

ISG Construction Ltd

Blackley Fire Station

Surface Water Management Report

Compiled by:

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On behalf of:

ISG Construction Ltd



REVISION HISTORY

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Preliminary Note

This report has been produced by Mark Symonds who has over 20 years' experience in infrastructure engineering (in particular surface water management design) and has qualifications including: BSc (Hons) Civil Engineering (2003); HND Civil Engineering Studies (2002); and OND Construction Studies (2000).

1. Introduction

Bradshaw Gass & Hope LLP have prepared this surface water management report to support a detailed drainage design for the redevelopment of Blackley Fire Station, which is in Manchester City Council area.

The report describes and demonstrates how the surface water run-off rate and volume from the post development site will be managed to adhere to National and local planning policy, regulations, and relevant design guidance, which include:

- National Planning Policy Framework (NPPF), July 2021 Paragraphs 153-158 and 159-169;
- National Planning Practice Guidance (NPPG);
- Principles of Sustainable drainage systems (SuDS) set out by DEFRA (2011);
- CIRIA (2010) Planning for SuDS;
- CIRIA SuDS Manual C753 (2015);
- Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015);

And local policies including:

- Manchester City, Salford City and Trafford Councils Level 1 SFRA (May 2010);
- Manchester City, Salford City and Trafford Councils Level 2 SFRA (March 2011);
- Manchester City Council – Local Flood Risk Management Strategy (March 2014);
- Manchester Local Development Framework – Core Strategy Development Plan (July 2012).

Manchester City Council, acting as Lead Local Flood Authority (LLFA) need to be satisfied that the design and drainage principles of the proposed development will address the surface water management and risk of flooding within the site; will ensure that the drainage is managed and maintained for its lifetime to prevent flooding; and will ensure that the development will not increase the risk of flooding to neighbouring land and property.

2. National Policy and Water Management Guidance

2.1. National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG)

The NPPF (July 2021) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced. This document is used to form this surface water management report, with particular attention to Paragraphs 153 to 158 Planning for Climate Change, and Paragraphs 159 to 169 Planning for Flood Risk.

NPPG, Paragraph 051 states that sustainable drainage systems (SuDS) are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible, where they provide opportunities to reduce the causes and impacts of flooding; remove pollutants from urban run-off at source; and to combine water management with green space with benefits for amenity, recreation, and wildlife.

2.2. Flood and Water Management Act

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk, and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

2.3. Manchester Local Development Framework – Core Strategy Development Plan

Relevant Policy EN 08 states:

'All new development will be expected to be adaptable to climate change in terms of the design, layout, siting, and function of both buildings and associated external spaces. In achieving developments which are adaptable to climate change developers should minimise flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rainwater permeability, and will be permitted to use green infrastructure elements such as green roofs.'

Relevant Policy EN 14 states:

'All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required'.

Relevant Policy EN 17 states:

'Development should avoid any adverse impact on water quality, including during the construction phase, and wherever possible should seek to enhance water quality, both chemical and ecological; Development should minimise surface water run-off from development and associated roads, and maximise the use of appropriate sustainable drainage systems, to minimise groundwater contamination, and to avoid pollutants reaching watercourses; Development close to a watercourse should also ensure that waste or litter cannot enter the watercourse from the site; Development should, where feasible and appropriate, seek to open up any culverted or hidden watercourse beneath the site to improve the ecological status of that watercourse'.

3. Site Setting and Description

3.1. Site Location

Blackley Fire Station is in a residential area of Blackley, is approximately 10km north of Manchester city centre, and is bound by residential dwellings to the north, undeveloped land and a community building leading to White Moss Road to the south, and Rochdale Road to the west.

The address of the site is Blackley Fire Station, Rochdale Road, Manchester, M9 7EQ, with co-ordinates for the centre of the site being E: 386060; N: 403390.

3.2. Existing Site and Topography

As detailed on the topographical survey plan in Appendix A, the site consists of an existing fire station building along the southern boundary, with parking and yard areas to the north, and access to the west. The site has a general fall from north to south, with the High point along the northern boundary being approximately 81.64m AOD, and the low-point along the southern boundary being approximately 76.33m AOD.

3.3. Proposed Development

The proposed site plan is shown in Appendix B, with a full description of the works being stated by the Architect. However, in brief, and in relation to this report, the proposal is to demolish the existing fire station building, and to build a new building in its place. The parking and yard areas will be reconfigured, with a new training tower to the east, and soft-landscaping around the perimeter.

3.4. Ground Conditions

A Phase 2 Geo-Environmental Investigation Report was produced by IGE Consulting in March 2023, which describes the ground conditions and infiltration rates of the soils at the site.

The window sample logs (see Appendix C) show the ground to consist of bands of clay and sand over glacial till. Infiltration tests at window samples WS01 and WS02 (east of site) to depths 3.58m bgl and 3.87m bgl, shows the ground to have infiltrate rates of 1.70×10^{-4} m/s (**0.612 m/hr**) and 2.59×10^{-4} m/s (0.932 m/hr), respectively.

3.5. Waterbody / Rivers / Canals / Reservoirs

There are no known water bodies near the site, with the nearest being Boggart Hole Brook approximately 1 km to the south.

3.6. Existing Drainage Networks

The nearest public sewer to the site is a 525mm diameter combined water sewer in Rochdale Road (west of site), with the assumption that surface water run-off from the existing site discharges to this sewer.

3.7. Development Areas

The overall development boundary area is approximately 2,600m² / **0.260 ha**.

The proposed developed area of the site consists of the new fire station building, parking and yard areas, which equates to approximately 2,000m² / 0.200 ha, and soft-landscaping areas equating to approximately 600m² / 0.060 ha.

The surface water run-off from the developed areas of the site is discharged to a below ground drainage network, with the surface water run-off from the permeable (soft-landscaping) areas discharging off the site at a natural / greenfield rate. Therefore, the surface water management area is based on an area of **0.200 ha**.

4. Surface Water Management Principles

The surface water for the development areas of the site is to be managed so that it adheres to the current national regulations and local authority requirements.

4.1. Run-Off Destination

Surface water run-off is to discharge to one or more of the following in the order of priority shown:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer, highway drain or other drain;
- Discharge to combined sewer.

4.2. The Management Train

A concept fundamental to implementing a successful SuDS scheme is the management train. This is a sequence of SuDS components that serve to reduce run-off rates and volumes and reduce pollution. The hierarchy of techniques that are to be used for the surface water management of the development are:

- Prevention - Prevention of run-off by good site design and reduction of impermeable areas;
- Source Control - Dealing with water where and when it falls (e.g. infiltration techniques);
- Site Control - Management of water in the local area (e.g. swales, detention basins);
- Regional Control - Management of run-off from sites (e.g. balancing ponds, wetlands).

4.3. Design Principles

The design principles for the surface water management of the development will be to:

- Ensure that people, property, and critical infrastructure are protected from flooding;
- Ensure that the development does not increase flood risk off site;
- Ensure that SuDS can be economically maintained for the development.

4.4. Peak Surface Water Flow

The surface water run-off from the post development site will discharge to ground, and therefore will discharge off the Site at the equivalent natural / greenfield rates.

4.5. Volume Control

The surface water run-off volume from the Site will discharge to ground, and therefore will discharge off the Site at the equivalent natural / greenfield volume.

4.6. Flood Risk

The below ground attenuation and soakaway / infiltration structure will be designed so that, unless an area is designed to hold and/or convey water, flooding does not occur on any part of the site for a 1 in 30-year rainfall event.

The soakaway / infiltration structure will also be designed so that, unless an area is designed to hold and/or convey water, flooding does not occur during a 1 in 100-year rainfall event in any part of the Site.

5. Surface Water Run-Off Destination

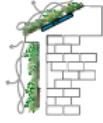
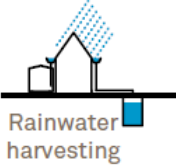
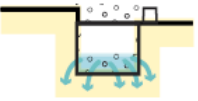
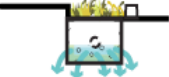
The destination of the surface water run-off from the post development site has been assessed against the prioritisation set by the Approved Document H (2010). The feasibility of the surface water run-off to the priority receptors are as follows:

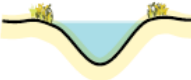
Run-Off Destination	Feasible	Description
Discharge to Ground	Yes	The Phase 2 Geo-Environmental Investigation Report (IGE Consulting - March 2023), shows the ground to consist of bands of clay and sand over glacial till. Infiltration tests at window samples WS01 and WS02 (east of site) to depths 3.58m bgl and 3.87m bgl, shows the ground to have infiltrate rates of 1.70×10^{-4} m/s (0.612 m/hr) and 2.59×10^{-4} m/s (0.932 m/hr), respectively. The proposed soakaway will be formed to the east of the site between WS01 and WS02, and therefore to ensure a suitable design the lower of the two test figures will be used. Therefore, the infiltration rate at the proposed soakaway location is deemed to be 0.612m/hr.
Discharge to Surface Water Body	No	There is no requirement to discharge the surface water to a waterbody, as discharge to ground is feasible.
Discharge to Surface Water Sewer	No	There is no requirement to discharge the surface water to a surface water sewer, as discharge to ground is feasible.
Discharge to Highway Drain or Other	No	There is no requirement to discharge the surface water to a highway or other drain, as discharge to ground is feasible.
Discharge to Combined Water Sewer	No	There is no requirement to discharge the surface water to a combined water sewer, as discharge to ground is feasible.

6. SuDS Feasibility

To reduce the surface water run-off to the greenfield rate, SuDS methods are to be introduced to the post development design.

SuDS methods as per the Sustainable Drainage System (SuDS) hierarchy, and the Non-Statutory Technical Standards for Sustainable Drainage Systems – March 2015, that can be used are detailed below:

	Description	Setting	Required area
 Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	 Building	Building integrated.
 Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an overground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	 Building	Water storage (underground or above ground).
 Soakaway	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	 Open space	Dependant on runoff volumes and soils.
 Filter Strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	 Open space	Minimum length 5 metres.
 Permeable paving	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	 Street/open space	Can typically drain double its area.
 Bioretention area	A vegetated area with gravel and sand layers below designed to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	 Street/open space	Typically surface area is 5-10% of drained area with storage below.

	Description	Setting	Required area
 Swale	Swales are vegetated shallow depressions designed to convey and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	 Street/open space	Account for width to allow safe maintenance typically 2-3 metres wide.
 Hardscape storage	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	 Open space	Could be above or below ground and sized to storage need.
 Pond / Basin	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	 Open space	Dependant on runoff volumes and soils.
 Wetland	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	 Open space	Typically 5-15% of drainage area to provide good treatment.
 Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	 Open space	Dependant on runoff volumes and soils.

The feasibility of the above SuDS methods for the post developed site are summarised in the table below:

SuDS Method	Potential Use	Description
Green Roofs	Yes	There is potential to have biodiverse roofs over parts of the new fire station building. Full details to be confirmed, but the biodiverse roof will reduce surface water run-off rates, act as a pollutant control, and add biodiversity to the development.
Rainwater Harvesting	Yes	Rainwater harvesting tanks could be installed for use with firefighting practices. Full details of the harvesting method / size / volume to be confirmed.
Soakaway	Yes	The Phase 2 Geo-Environmental Investigation Report (IGE Consulting - March 2023), shows the ground to consist of bands of clay and sand over glacial till. Infiltration tests at window samples WS01 and WS02 (east of site) to depths 3.58m bgl and 3.87m bgl, shows the ground to have infiltrate rates of 1.70×10^{-4} m/s (0.612 m/hr) and 2.59×10^{-4} m/s (0.932 m/hr).

		The proposed soakaway will be formed to the east of the site between WS01 and WS02, and therefore to ensure a suitable design the lower of the two test figures will be used. Therefore, the infiltration rate at the proposed soakaway location is deemed to be 0.612m/hr.
Filter Strips	No	There are limited areas within the site for filter drains, and therefore this is not a suitable SuDS method.
Permeable Paving	No	External parking and yard areas are used by heavy loads vehicles, where permeable paving will not have the structural integrity to withstand the loads. Therefore, it is deemed that this is not a suitable SuDS method.
Swale	No	There are limited areas within the site for swales, and therefore this is not a suitable SuDS method.
Pond / Basin	No	There are limited areas within the site for ponds/ basins, and therefore this is not a suitable SuDS method.
Underground Storage	Yes	The surface water run-off from the Site will be greater than the surface water percolation rate to ground. Therefore, there will be a requirement to have underground storage for storm events up to 1 in 30-year; and to suitably sized so that the volume of water during the 1 in 100-year storm event is kept a minimum at surface level, where it can be contained on the Site.

7. Surface Water Network and Management Calculations

7.1. Climate Change

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance summarised in Figure 1 below.

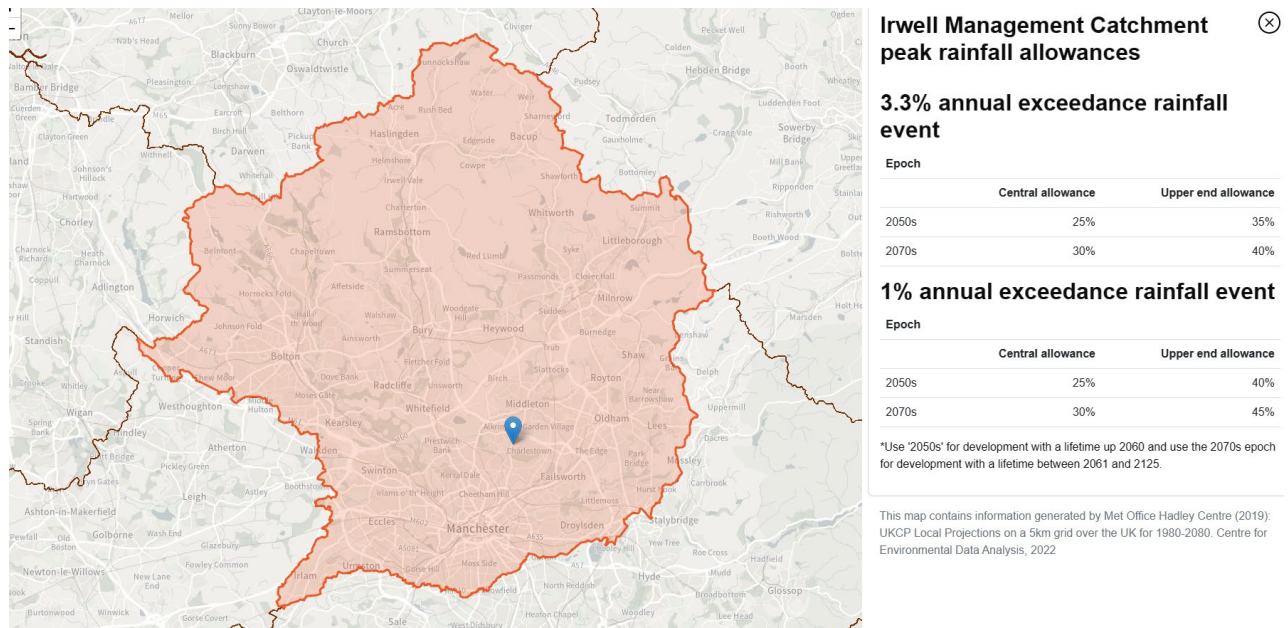


Figure 1 - Department for Environment Food & Rural Affairs – Climate Change Allowances

The lifetime of the Site is likely to be beyond 2061, and therefore the Epoch 2070's is to be used with Upper End Allowance (likelihood of increase rainfall). Therefore, the climate change allowance for the post development Site surface water run-off will be 40% and 45% for the 30-year and 100-year event, respectively.

7.2. Surface Water Network Calculations

The calculations to determine the post development surface water run-off rates and required infiltration structure volume, are based on the post development surface water run-off area of 0.122 ha, and the rainfall data given by the FEH 2013.

7.3. Surface Water Drainage Network

As shown on the below ground drainage layout in Appendix D, the proposed surface water network will consist of 150mm to 300mm diameter pipes; 460mm diameter inspection chambers, 1200mm diameter manholes; a by-pass separator, a 1500mm diameter soakaway manhole, and an attenuation tank in the form of cellular units.

The surface water network will flow to the central yard area, where the surface water will flow through the by-pass separator prior to discharge to the soakaway manhole, and subsequently to ground.

Surface water in soakaway manhole will overflow to attenuation tank in extreme storm events where water will be stored to prevent flooding. Post storm event, the surface water will flow from the tank, and back to the soakaway where the surface water will continue to discharge to ground.

7.4. Soakaway and Attenuation Design Calculations

The soakaway, in the form of a manhole with perforated rings, will be appropriately sized to infiltrate the surface water run-off to ground in an appropriate time period (half drain in 24 hours); and the attenuation tank, in the form of cellular units, will be approximately sized to prevent flooding for storm events up to and including the 1 in 30-year storm event (including 40% climate change); and for only minor flooding (which is controlled) to occur during the 1 in 100-year storm event (including 45% climate change). This is based on the following guidance where:

Ciria SuDS Manual 2015, Paragraph 10.2.4 states that: *'Exceedance flows (i.e. flows in excess of those for which the system is designed) should be managed safely in above-ground space such that risks to people and property are acceptable'*.

The required soakaway design to meet the required half drain time is detailed in the MicroDrainage calculations in Appendix E, and the required drainage network with attenuation tank to prevent flooding is detailed in the MicroDrainage calculations in Appendix F.

Details of the soakaway and attenuation tank are as follows:

Soakaway Design Criteria

SW Catchment Area	-	0.200 ha
Ground Infiltration Rate	-	0.612 m/hr
Soakaway Diameter	-	1.50m
Soakaway Depth	-	4.00m
Perforated Ring Depth	-	1.90m

Soakaway Calculation Results (Appendix

Critical Storm	-	100-year + 45% climate change, 720-minute
1 in 30-Year + CC Half Drain Time	-	750-Minutes
1 in 100-Year + CC Half Drain Time	-	1124-Minutes

Attenuation Tank Design

Tank Area	-	130.00m ²
Tank Depth	-	1.20m
Tank Volume	-	156.00m ³
Tank Porosity	-	0.95
Tank Attenuation Volume	-	148.20m ³

The MicroDrainage in Appendix E and F, shows that the soakaway and tank are adequately sized to for half the surface water volume to discharge to ground within a 24-hour period, with no flooding up to and including the 100-year + 45% climate change storm event.

8. Maintenance Requirements

The extent of the drainage network and SuDS features for the development site are shown on the below ground drainage layout drawings in Appendix D.

The management and maintenance of the surface water drainage networks and SuDS features will be by contractors appointed by Blackley Fire Station, which will form part of the overall site management and maintenance schedule. Details of which are as follows:

8.1. Surface Water Drainage Network, Cellular Units and Soakaway

Operation	Frequency
Inspect and identify any areas that are not operating correctly, if required, take remedial actions	Monthly for 3 months, then six monthlies
Debris removal from manholes (where may cause risk performance)	Monthly
Where rainfall into network from above, check surface or filter for blockage or silt, algae, or other matter by jetting	As required, but at least twice a year
Remove sediment from pipework by jetting.	Annually or as required
Repair/check all inlets, outlets, and overflow pipes	As required
Inspect/check all inlets, outlets, and overflow pipes to ensure that they are in good condition and operating as designed	Annually and after large storms

8.2. Linked and Further Maintenance Activities

The maintenance of the drainage network and SuDS features are to be linked with the wider site maintenance for the new fire station

A log of all maintenance activities is to be kept and made available to the local planning authority (LPA) and / or the Lead Local Flood Authority (LLFA) on request.

9. Conclusion / Summary

9.1. Discharge Destination

The suitable surface water destination is to ground.

9.2. SuDS Methods

The feasible SuDS methods used to manage the surface water will include biodiverse roofs, rainwater harvesting, a soakaway manhole, and an attenuation tank in the form of cellular units.

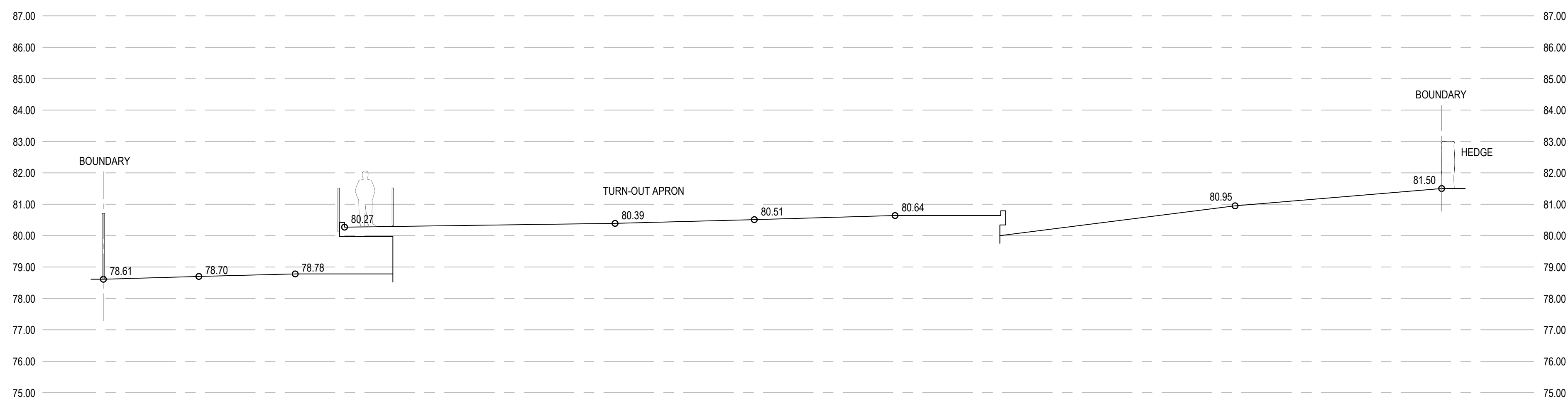
9.3. Soakaway and Attenuation Tank

The soakaway manhole and attenuation tank are adequately sized to for half the surface water volume to discharge to ground within a 24-hour period, with no flooding up to and including the 100-year + 45% climate change storm event.

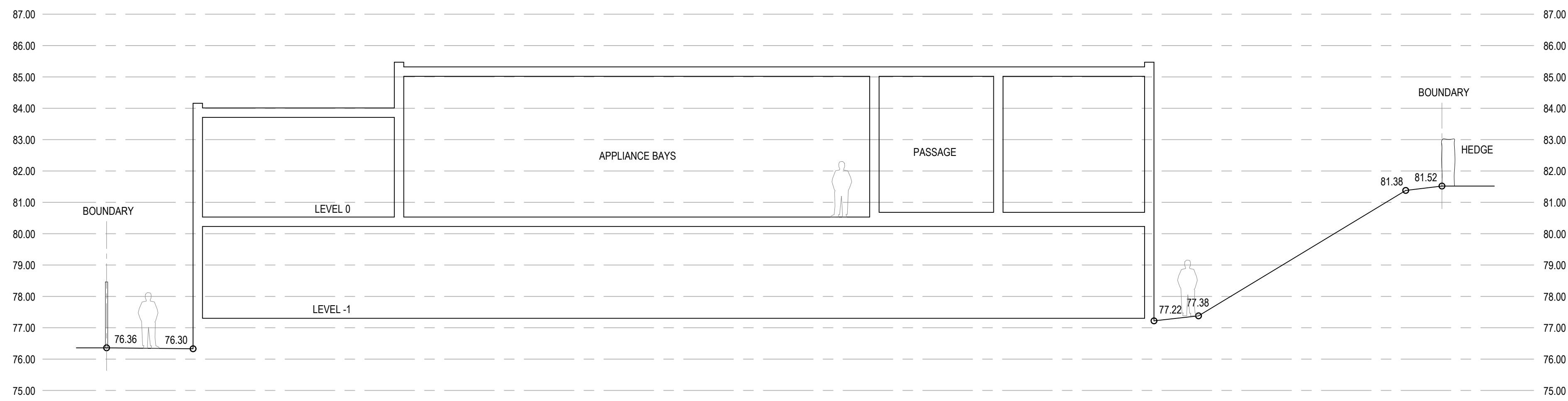
9.4. Maintenance

The management and maintenance of the surface water drainage networks and SuDS features will be by contractors appointed by Blackley Fire Station, which will form part of the overall site management and maintenance schedule.

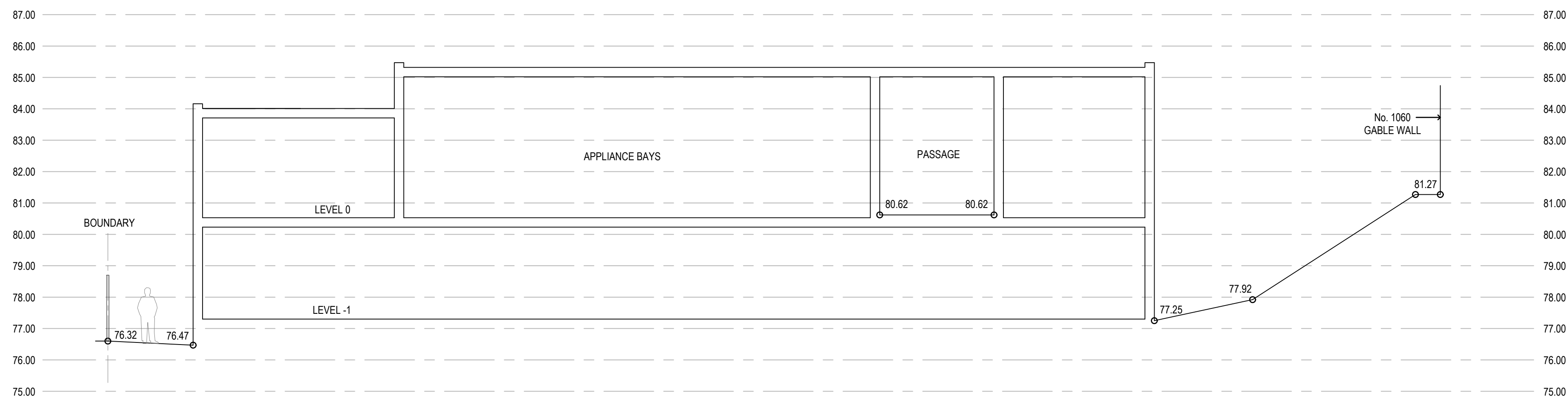
Appendix A - Topographical Survey



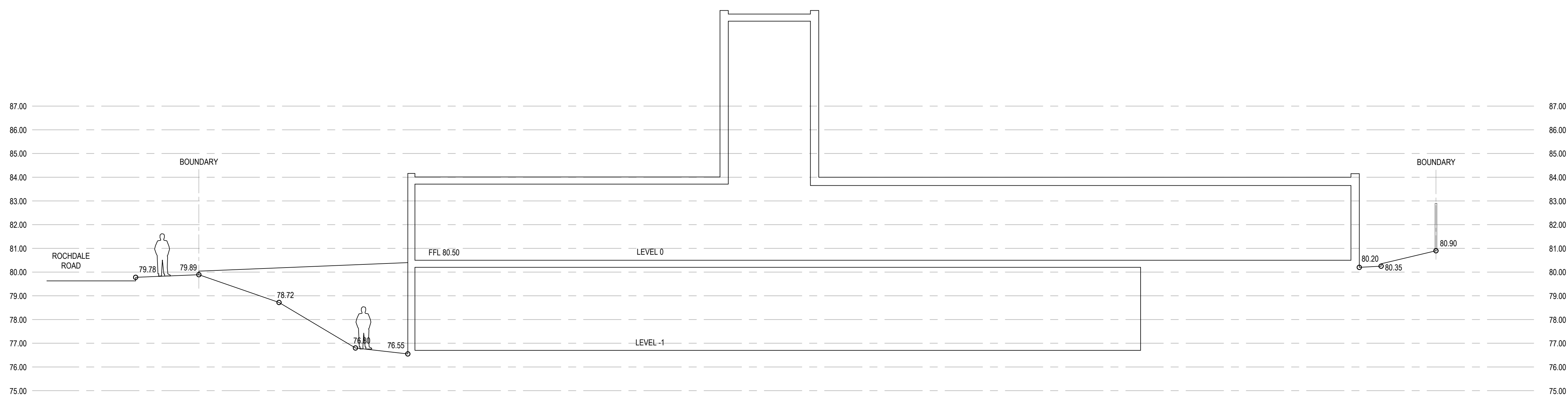
SECTION A1



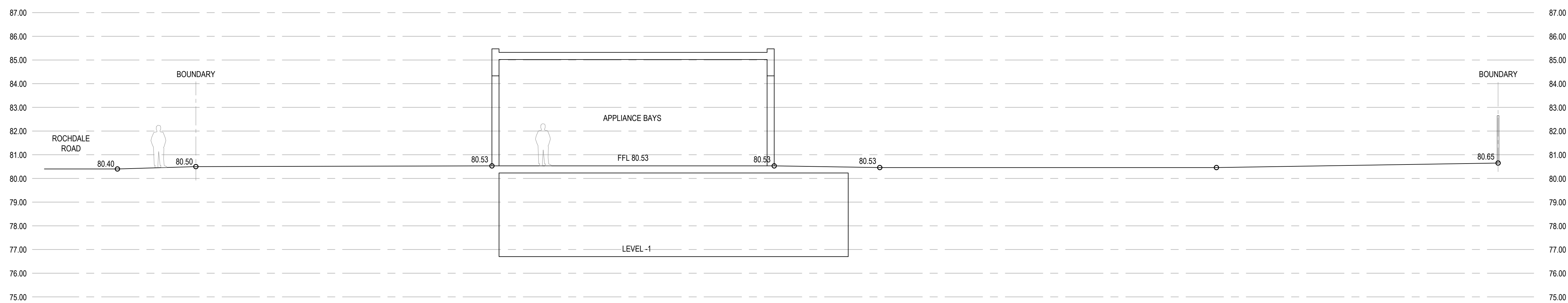
SECTION A2



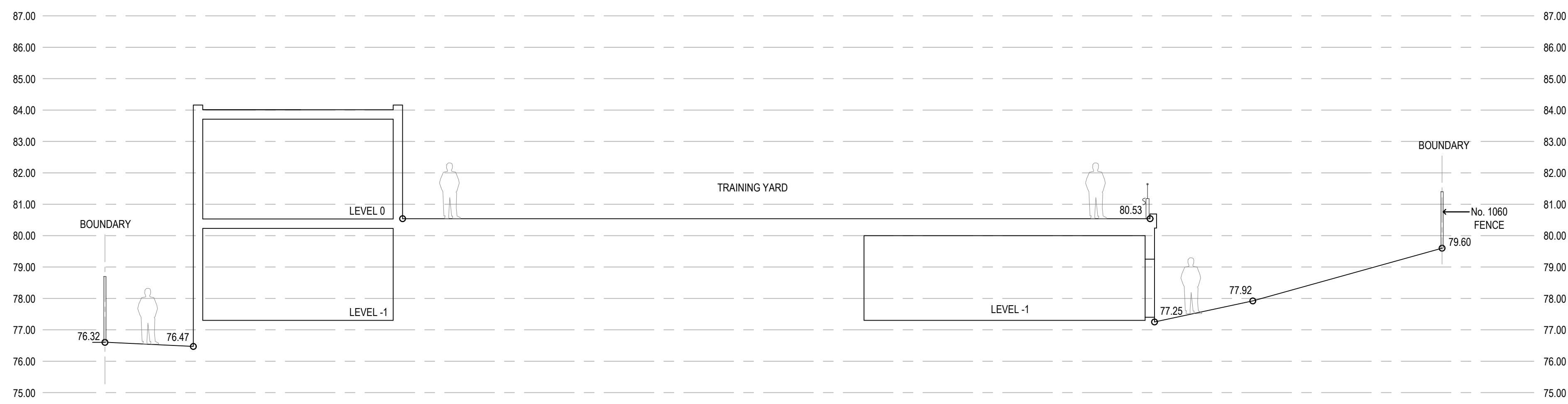
SECTION A3



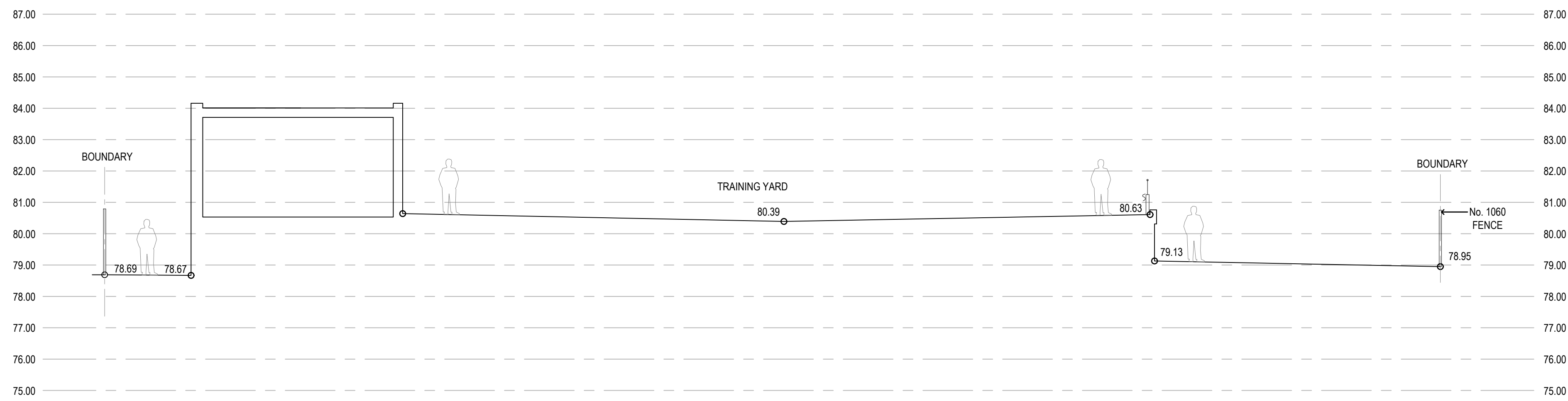
SECTION B1



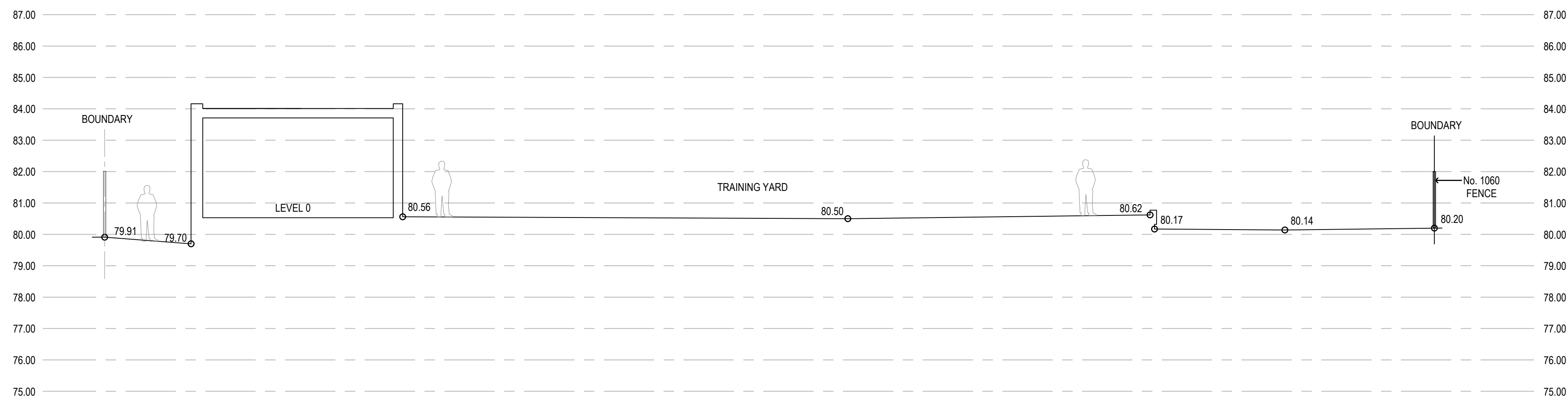
SECTION B2



SECTION A4



SECTION A5



SECTION A6



KEY PLAN
1:200



Status		STAGE 3	
This drawing is ©Bradshaw Gass & Hope LLP and is not to be copied, reproduced or its disclosure either in whole or in part without the prior written permission of the originator.			
The originator shall have no responsibility for any liability, loss, cost, damage or expense arising from its reliance by any user of this document other than for its intended purpose in this project.			
This drawing shall be used in conjunction with all other relevant drawings, specifications and associated documentation. Any discrepancies, errors or omissions are to be reported to the originator before proceeding with work. All dimensions are to be checked on site by the contractor prior to proceeding with the work.			
Hazard Identification			
ref	hazard	date	
P1	FIRST ISSUE	ST	17.03.23
ref	revision	by	date
 Architects Consulting Engineers Quantity Surveyors		21 Skewton Street B20 6LW T 01204 320321 enquiries@gristaker.co.uk www.bghlondon.co.uk	
Bradshaw Gass & Hope LLP			
client GREATER MANCHESTER COMBINED AUTHORITY			
project NEW FIRE STATIONS FEASIBILITY STUDIES			
drawing BLACKLEY FIRE STATION EXISTING SITE SECTIONS			
drawing by scale	ST 1:100	date MAR 23	A0
day no 1978.35.1551	rev P1		

Appendix B - Proposed Site Plans



- ⓧ Designed for Safety
- ⓧ Designed for Maintenance
- ⚠ Construction Hazard
- ⚠ Residual Hazard

Designed for Safety
The following elements have been included in the design to allow for safe use of the building and installed plant / equipment.

The Principal Designer is to be advised of any changes to the design which affects these elements.

Designed for Maintenance
The following elements have been included in the design to assist safe maintenance and access.

The Principal Designer is to be advised of any changes to the design which affects these elements.

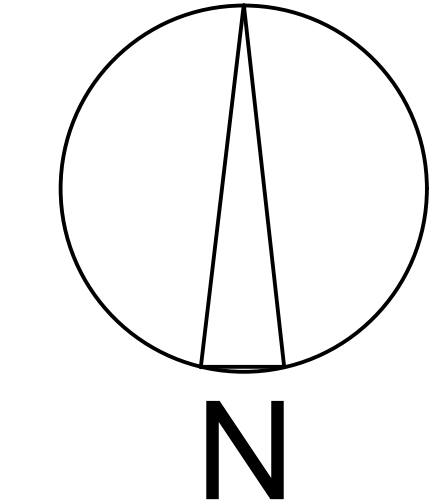
- | | |
|---|---|
| 1 | Plant area located at ground level for ease of access / maintenance |
| 2 | Access pathway & handrail to provide access for window cleaning |
| 3 | Access pathway to provide access for maintenance in connection with residential domestic property |

Construction Hazard
The following significant or unusual hazards have been identified by the designer and must be managed during the construction phase.

- | | |
|---|--|
| 1 | Significant level difference. High retaining walls |
| 2 | Working in close proximity to existing domestic residential property / foundations |

Residual Hazard
The following significant or unusual hazards have been identified by the designer and must be managed by the Client during the use of the building / site.

1	Deep water pit
2	Maintenance of Biodiverse Roof



● TREE TO BE RETAINED

○ TREE TO BE REMOVED

■ NEW SOFT LANDSCAPING

00.00 EXISTING LEVEL

00.00 PROPOSED LEVEL

▨ WORKS WITHIN THE PUBLIC HIGHWAY

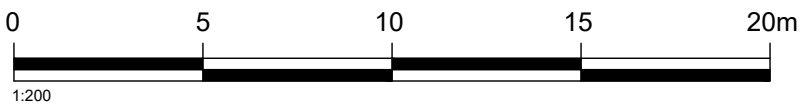
P3	PLANT ENCLOSURE SHOWN AT GROUND LEVEL. BUILDING FOOTPRINT UPDATED	ST	12.04.23
P2	MAINTENANCE PATHWAY ADDED FOR No. 1060 ROCHDALE ROAD	ST	23.03.23
P1	FIRST ISSUE	ST	17.03.23
ref	revision	by	date

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Bradshaw Gass & Hope LLP

client	GREATER MANCHESTER COMBINED AUTHORITY		
project	NEW FIRE STATIONS FEASIBILITY STUDIES		
drawing	BLACKLEY FIRE STATION PROPOSED SITE PLAN		
drawn by	ST	date	MAR 23
checked by		date	
scale	1:200		A1
dwg no	1978.35.1253	rev	P3



Appendix C - Ground Investigation Data



ROCH

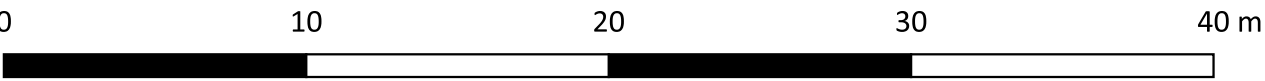
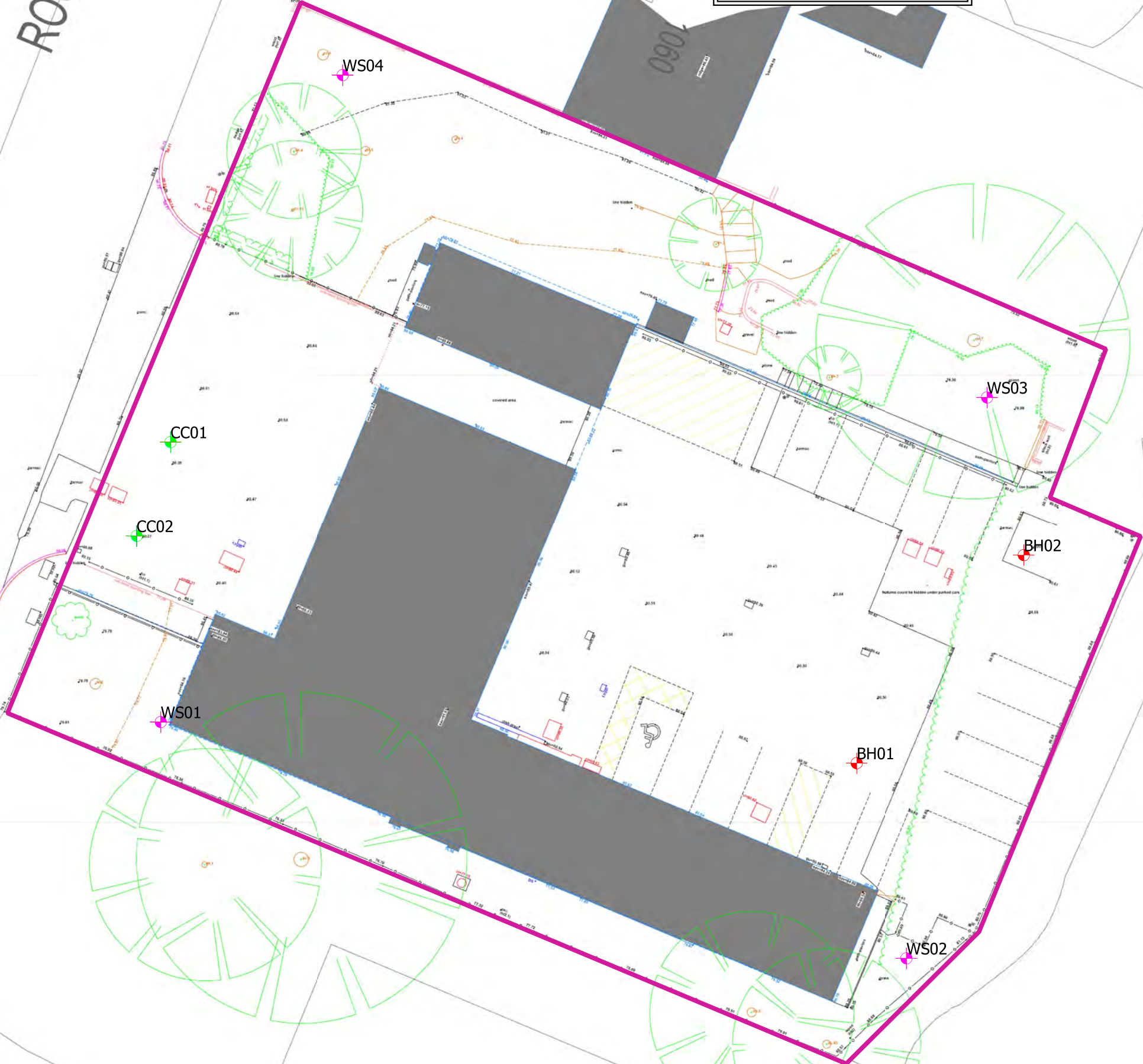
FOR GUIDANCE PURPOSES ONLY

IGE SI

Dynamic Sample Boreholes

Cable Percussion Boreholes

Concrete Core Locations

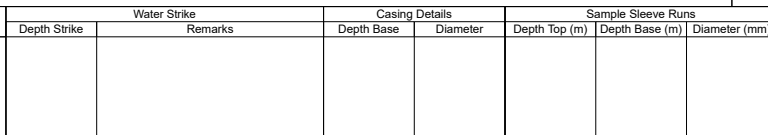


Rev	Drawn	Date	Description
Drawing Status: Information			
Contract: Blackley Fire Station			
For: Greater Manchester Combined Authority (GMCA)			
Drawing Title: Exploratory Hole Location Plan			
IGE consulting			
Office 16, Bartle House, Manchester, M2 3WQ Email: contact@igeconsulting.co.uk Web: www.igeconsulting.co.uk Tel: 0161 914 9170			
Scale: 1:250 @A3		Date: Feb 2023	
Drawn: AJ		Checked: AE	
Contract No. 3866B		Drawing No. SI - 05	P1

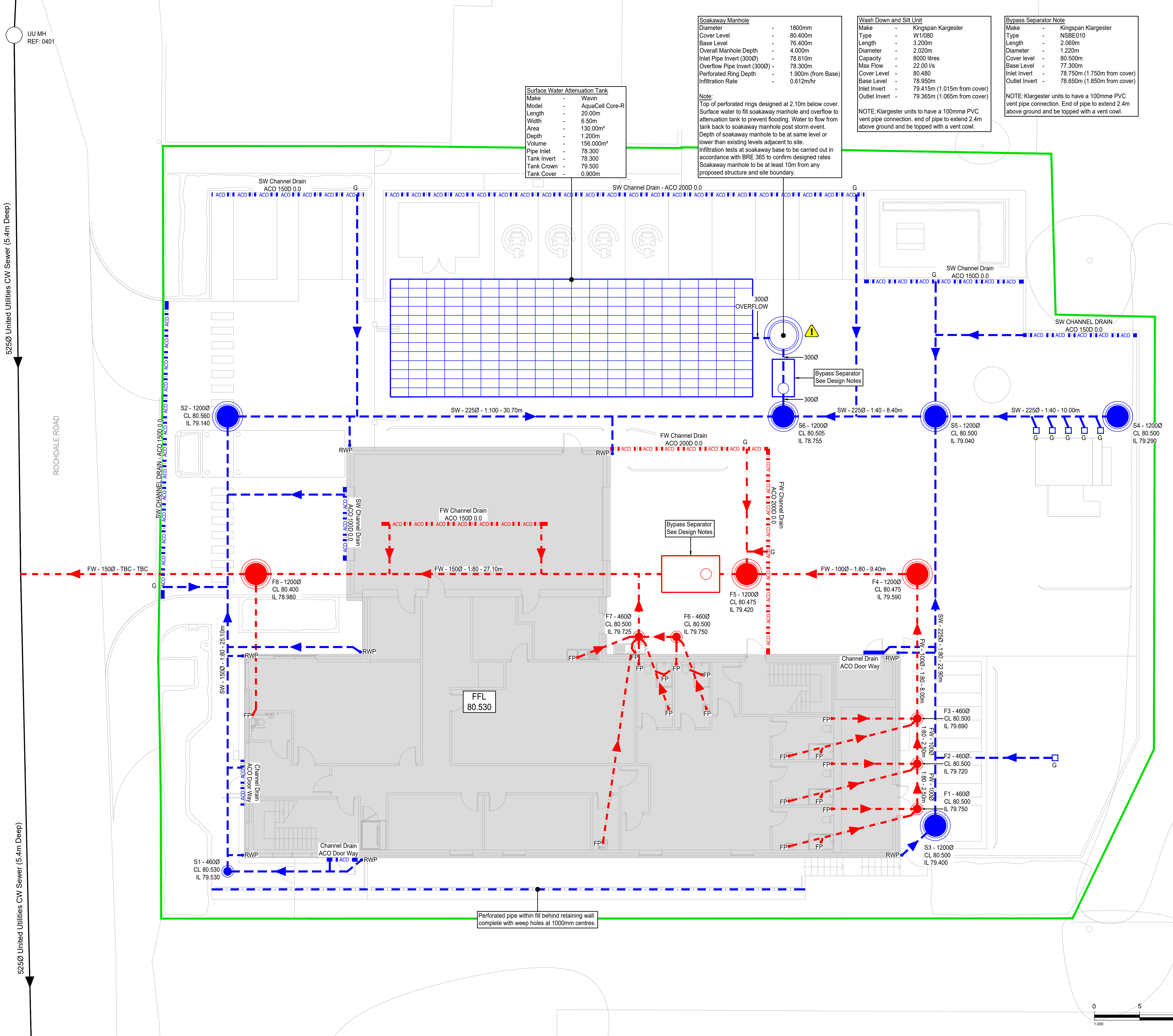
IGE consulting		Office 16, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Dynamic Sample Borehole Log ver. 1.5			Dynamic Sample No. WS01 Sheet 1 of 1			
Project Name: Blackley Fire Station				Co-ords: 386038E - 403381N		Project No. 3866b				
Location: Blackley, Greater Manchester				Level (m AOD): 76.60		Logged By LM				
Client: Greater Manchester Combined Authority				Date: 23/01/2023		Checked By				
Weather: Clear										
Well / Backfill	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Stratum Description			
		Depth(m)	Type	Results						
		0.30	ES		0.40	76.20	Soft to firm dark brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to medium of mudstone, sandstone and brick fragments. MADE GROUND			
		0.80	ES					Light orangish brown mottled light grey very clayey very gravelly fine to coarse SAND with low cobble content. Gravel is angular to subrounded fine to coarse of sandstone, mudstone and brick fragments. Cobbles are angular of whole and half bricks. MADE GROUND		
		1.00	D		1.00	75.60	Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mudstone and sandstone. GLACIAL TILL	1		
		1.20	SPT	N=11 (1,2/2,3,3,3)						
		2.00	D						2	
		2.00	SPT	N=10 (2,2/2,2,3,3)						
		3.00	D						3	
		3.00	SPT	N=12 (1,2/2,3,3,4)						
		4.00	D		3.80	72.80	Dark brown clayey sandy SILT. GLACIAL TILL	4		
		4.00	SPT	N=23 (3,4/5,6,6,6)						
5.00	D						5			
5.00	SPT	N=31 (5,6/7,8,8,8)								
			5.45	71.15	Dynamic Sample terminated at 5.45m.		6			
Remarks:				Water Strike		Casing Details		Sample Sleeve Runs		
				Depth Strike	Remarks	Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)

IGE consulting		Office 16, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Dynamic Sample Borehole Log ver. 1.5				Dynamic Sample No. WS02 Sheet 1 of 1	
Project Name: Blackley Fire Station				Co-ords: 386079E - 403367N		Project No. 3866b			
Location: Blackley, Greater Manchester				Level (m AOD): 80.60		Logged By LM			
Client: Greater Manchester Combined Authority				Date: 23/01/2023		Checked By			
Well / Backfill		Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Stratum Description	
			Depth(m)	Type	Results				
			0.20	ES		0.25	80.35	Soft to firm dark brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone, sandstone and brick fragments with rare plastic. MADE GROUND	
			0.70	ES				Light orangish brown slightly gravelly very silty fine to coarse SAND. Gravel is subrounded fine of sandstone and mudstone. GLACIAL TILL	
			1.00	D		1.10	79.50	Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subrounded fine of mudstone and sandstone. GLACIAL TILL	
			1.00	SPT	N=10 (1,2/2,3,2,3)				
			2.00	D		1.80	78.80	Medium dense light orangish brown slightly gravelly sandy SILT. Gravel is subrounded fine of mudstone and sandstone. GLACIAL TILL	
			2.00	SPT	N=14 (2,2/3,3,4,4)				
			3.00	D					
			3.00	SPT	N=15 (2,3/4,3,4,4)				
			4.00	D					
			4.00	SPT	N=14 (2,3/3,4,3,4)				
			5.00	D					
			5.00	SPT	N=20 (3,4/4,5,5,6)	5.45	75.15	Dynamic Sample terminated at 5.45m.	
Remarks:		Water Strike		Casing Details		Sample Sleeve Runs			
		Depth Strike	Remarks		Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)

IGE consulting		Office 16, Bartle House, Oxford Court Manchester M2 3WQ email: contact@igeconsulting.co.uk web: www.igeconsulting.co.uk tel: 0161 914 9170		Dynamic Sample Borehole Log ver. 1.5			Dynamic Sample No. WS03 Sheet 1 of 1			
Project Name: Blackley Fire Station				Co-ords: 386084E - 403399N		Project No. 3866b				
Location: Blackley, Greater Manchester				Level (m AOD): 79.74		Logged By LM				
Client: Greater Manchester Combined Authority				Date: 23/01/2023		Checked By				
Well / Backfill		Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Stratum Description		
			Depth(m)	Type	Results					
			0.40	ES	N=4 (1,1/1,1,1,1)	0.50	79.24	Soft to firm dark brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of mudstone, sandstone and brick fragments with rare ceramic and glass. MADE GROUND	1	
			0.90	ES		1.20	78.54	Light orangish brown slightly gravelly very silty fine to coarse SAND. Gravel is subrounded fine of sandstone and mudstone. GLACIAL TILL		
			1.00 1.00	D SPT				Firm dark brown slightly sandy slightly gravelly CLAY. Gravel is subrounded fine of mudstone and sandstone. GLACIAL TILL		
			2.00 2.00	D SPT	5 (1,2/1,2,2)	1.80	77.94	Medium dense light orangish brown slightly gravelly sandy SILT. Gravel is subrounded fine of mudstone and sandstone. GLACIAL TILL	2	
			3.00 3.00	D SPT	N=11 (2,3/3,3,2,3)				3	
			4.00 4.00	D SPT	N=10 (2,2/2,2,3,3)				4	
			5.00 5.00	D SPT	N=13 (3,2/3,3,3,4)				5	
						5.45	74.29	Dynamic Sample terminated at 5.45m.	6	
Remarks:				Water Strike		Casing Details		Sample Sleeve Runs		
				Depth Strike	Remarks	Depth Base	Diameter	Depth Top (m)	Depth Base (m)	Diameter (mm)



Appendix D - Below Ground Drainage Layout and Details



General Drainage Notes:

Existing details shown on this drawing including kerblines, existing drains, chambers, sewers, pipework, stub connections where new connections, diversions or abandonment are shown, invert levels and pipe sizes shall be checked and confirmed to the engineer prior to the commencement of any works. Any discrepancies shall be reported to the engineer for action prior to any new construction.

All existing drainage depths, size and conditions, to which the proposed drainage is to connect, are to be confirmed prior to the commencement of any drainage works.

All drainage works shall be carried out in accordance with the requirements of the local authority and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and addendums as appropriate.

All drainage shall comply with the typical drainage construction details and the requirements of BS EN 752.

Access covers and frames shall comply with the loadings specified and to BS EN 124 and kitemarked or if recessed covers are specified then in accordance with FACTA association equivalent.

All underslab drainage shall be clear of foundations unless shown otherwise with long radius bends kept to a minimum and used where unavoidable.

At least one soil pipe at the head of each foul run shall be vented to the atmosphere.

All private drainage pipework for foul and surface water systems have been designed on the basis of UPVC to BS EN 1401-1, unless noted otherwise.

Where new drainage is situated within 5 metres of new or existing trees the pipework shall be encased in concrete to reduce the risk of root ingress.

Concrete encasement of the pipework shall be required where the vertical clearance between two pipes crossing is less than 300mm.

All existing drainage shall be assumed to be 'live' and shall be maintained at all times during the works. Existing drainage shall be reconnected to the new drainage system unless proven to be redundant for abandonment. All existing drainage to be abandoned shall be sealed by appropriate means.

Upon completion all new drainage installation together with any existing drainage retained shall be jetted and CCTV surveyed upon completion. Contractor to ensure that the drainage system is fully operational, free of excess debris/silt and all identified faults rectified.

HEALTH & SAFETY: The works shall be carried out by specialist competent and experienced contractors. All operatives shall have received full and appropriate training with appropriate qualifications for the operations they are required to undertake. All work shall be carried out in accordance with the relevant Health & Safety Regulations.

Hazard Identification

ref	hazard	date
1	DEEP SOAKAWAY MANHOLE	20.04.23

Site Specific Drainage Notes:

Infiltration tests at base of soakaway manhole required to confirm rates. Soakaway size, depth and attenuation tank size / volume subject to change once known.

Rainwater pipe and foul down pipe locations to be confirmed by Architect prior to the commencement of drainage works. Design subject to change once known.

Final external levels to be confirmed. Manhole and inspection cover levels subject to change once final external levels are known.

Existing combined network (to which the foul water is connecting / discharging) location, size and depth to be confirmed prior to the commencement of any drainage works. Design subject to change once known.

All foul water pipes to be 100Ø, and all surface water pipes to be 150Ø unless shown otherwise.

Foul water down pipes to have rest bend invert of 450mm below finished floor level, unless stated otherwise.

Rainwater pipe to have rest bend invert of 600mm below finished floor level unless stated otherwise.

Surface and foul water discharge to sewer subject to Section 106 agreement with United Utilities. No drainage work to commence until approval has been received.

All existing drainage found on-site to remain live unless proven to be redundant. Survey of existing drainage to establish network to be carried out prior to the commencement of work on site.

Drainage Specifications

Foul water pipes to be Polypipe to BS EN 1401-1 or similar.

Surface water pipes to be Polypipe Ridgidrain or similar.

Manhole and soakaway manhole to be Precast Concrete by FP McCann or similar

Inspection chambers to be Polypipe or similar.

Channel and Threshold Drains by ACO or similar.

Attenuation tank to be WAVIN AquaCell Core-R or similar.

Drainage Key:

- Proposed Surface Water
- Proposed Foul Water
- Existing CW Sewer
- RWP Rainwater Pipe
- FP Foul Down Pipe
- Surface Water Channel Drain
- Foul Water Channel Drain
- External Surface Water Gully
- Development Boundary

0 5 10 15 20m

1:200

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Architects
Consulting Engineers
Quantity Surveyors

Bradshaw Gass & Hope LLP

client	
GREATER MANCHESTER COMBINED AUTHORITY	

project	
BLACKLEY FIRE STATION	

drawing	
PROPOSED DRAINAGE LAYOUT	

drawn by	MDS	date	20.04.23
checked by	BH	date	

scale	1:100	A1	
dwg no	1978.35.400	rev	P1

status

PRELIMINARY

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Hazard Identification

ref

hazard

date

P1

FIRST ISSUE

MDS

21.04.23

ref

revision

by

date

BGH

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Bradshaw Gass & Hope LLP

client

GREATER MANCHESTER
COMBINED AUTHORITY

project

BLACKLEY FIRE STATION

drawing

MANHOLE AND PIPE SCHEDULE

drawn by

MDS

date

20.04.23

checked by

BH

date

scale

N.T.S

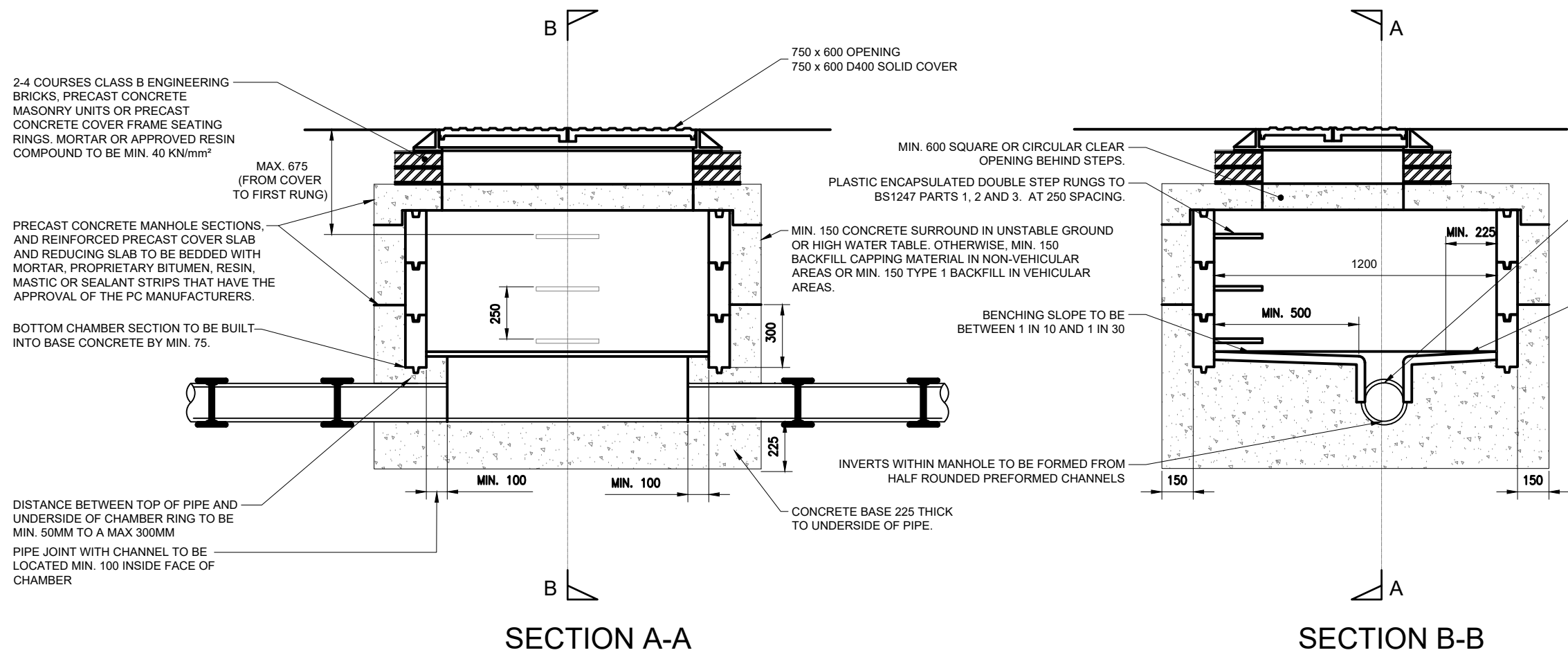
A1

dwg no

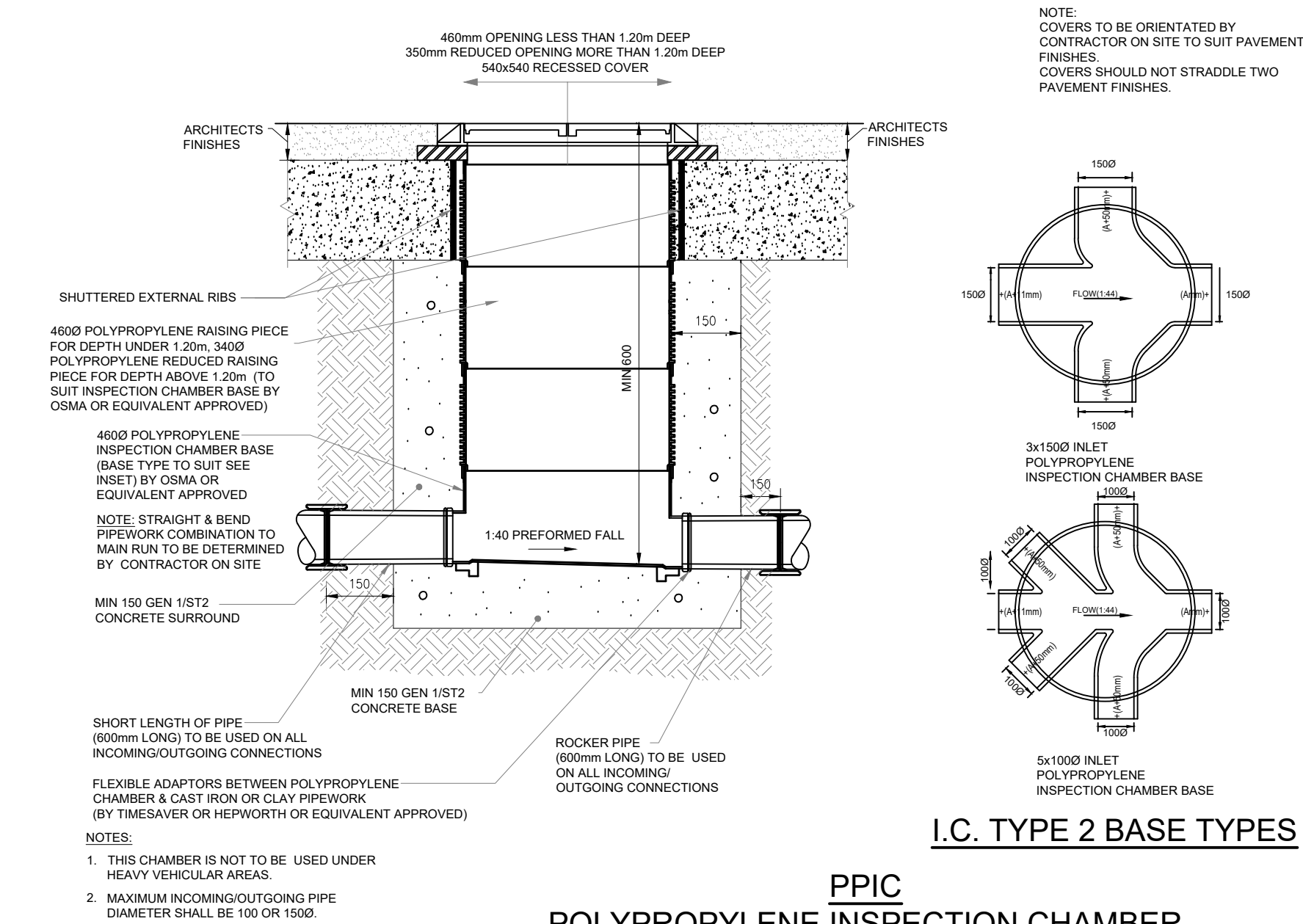
1978.35.401

rev

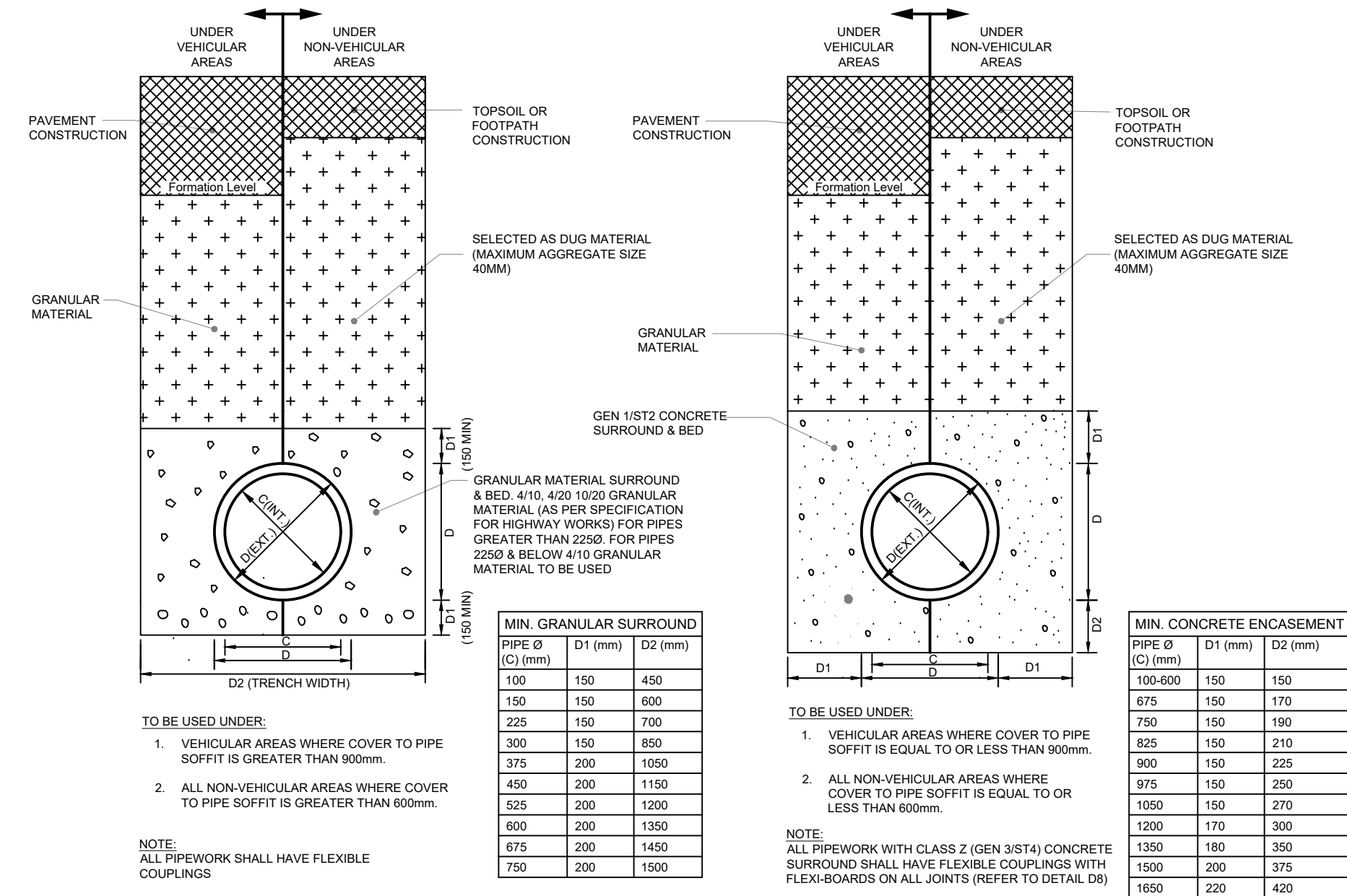
P1



MANHOLE TYPE E
CIRCULAR PRECAST CONCRETE MANHOLE DETAIL
(DEPTH LESS THAN 1.50m TO TOP OF PIPE)

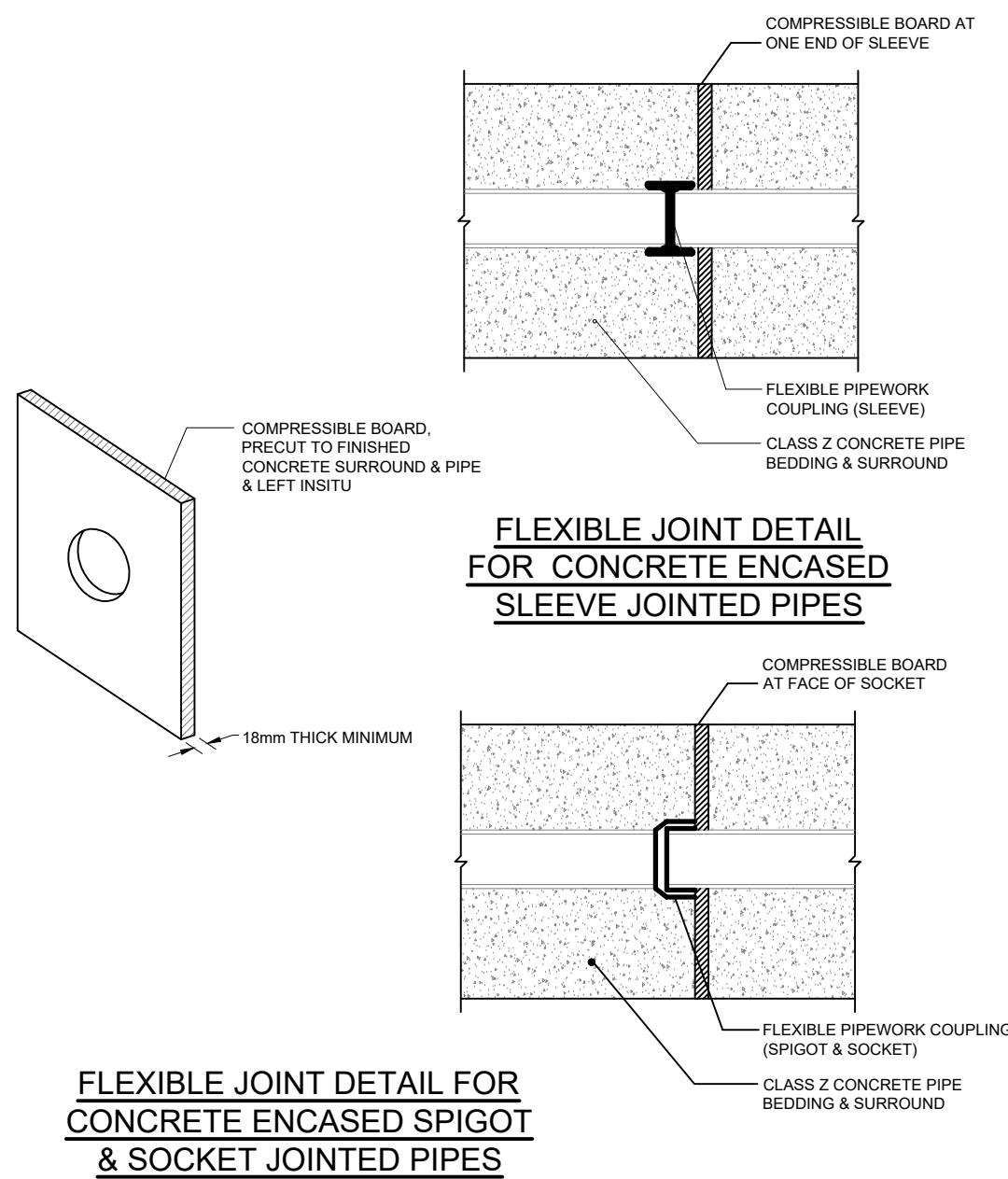


PPIC
POLYPROPYLENE INSPECTION CHAMBER

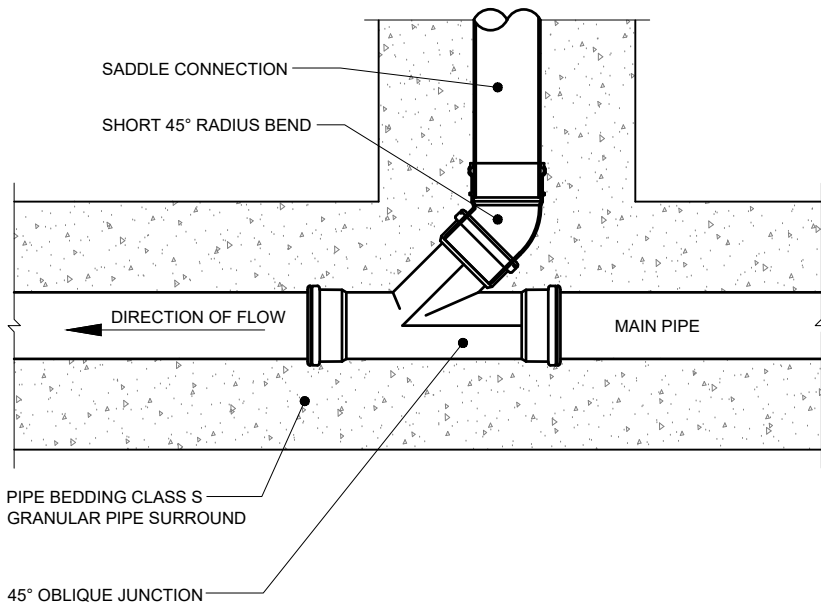


CLASS S PIPE BEDDING & SURROUND
(TO BE USED FOR PLASTIC, VITRIFIED
CLAY & CONCRETE PIPEWORK)

CLASS Z PIPE BEDDING & SURROUND
(TO BE USED FOR PLASTIC, VITRIFIED
CLAY & CONCRETE PIPEWORK)



FLEXIBLE JOINT DETAIL FOR
CONCRETE ENCASED PIPES
(TO B.S. 1142)



TYPICAL 45° PIPE JUNCTION
CONNECTION DETAIL

status PRELIMINARY

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Hazard Identification		
ref	hazard	date

P1		FIRST ISSUE	MDS	21.04.23
ref	revision	by	date	

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Consulting Engineers
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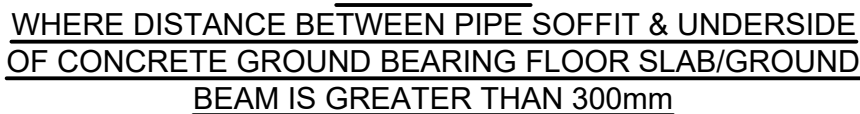
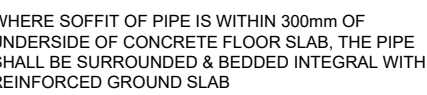
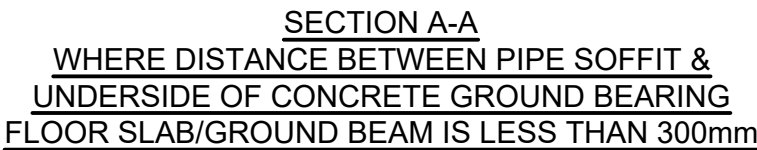
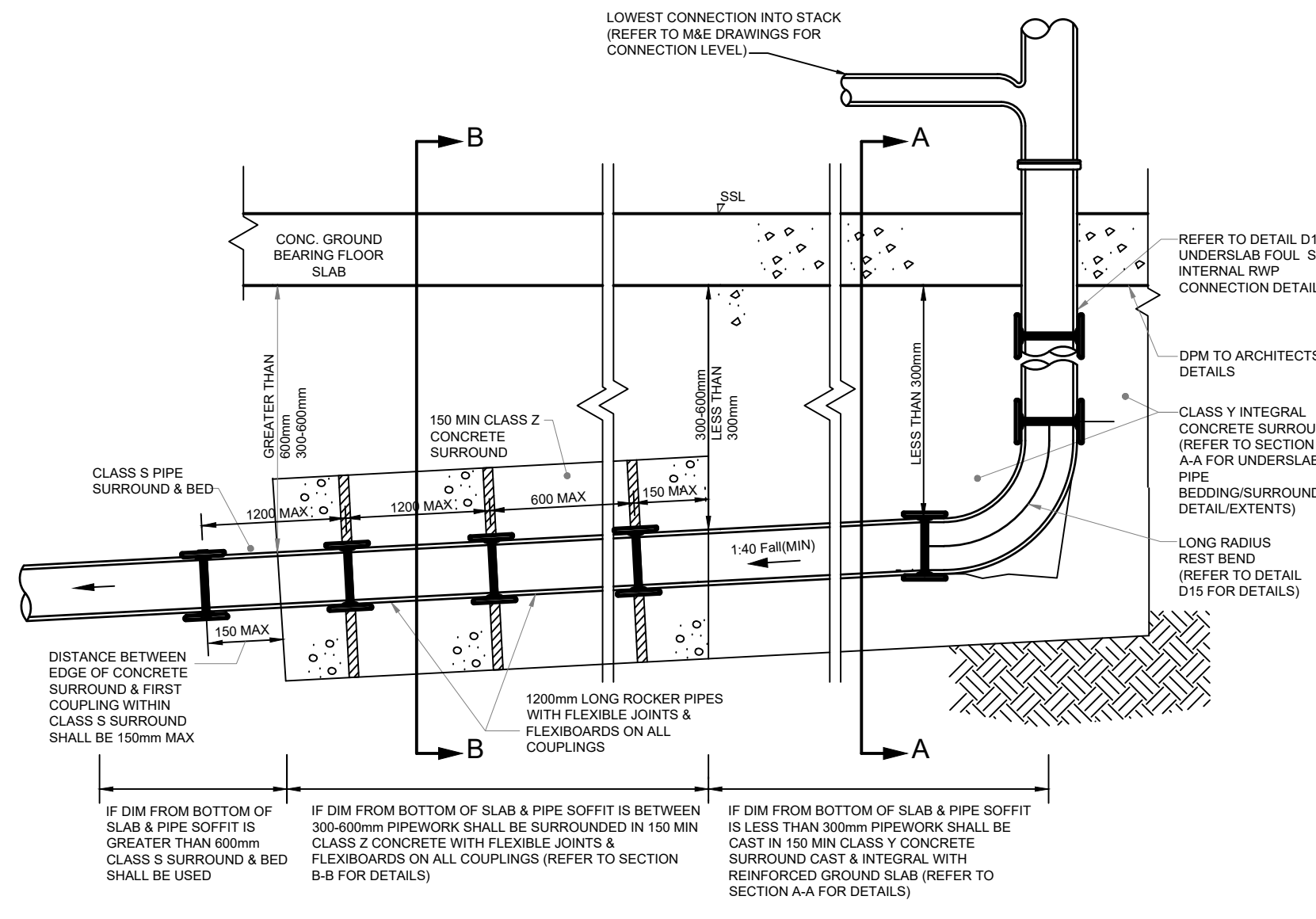
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client
GREATER MANCHESTER
COMBINED AUTHORITY

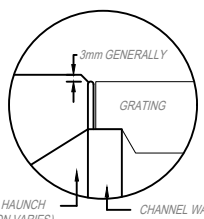
project
BLACKLEY FIRE STATION

drawing
DRAINAGE DETAILS
SHEET 1

drawn by	MDS	date	20.04.23
checked by	BH	date	
N.T.S		A1	
dwg no	1978.35.402	rev	P1



TYPICAL UNDERSLAB PIPE BEDDING
DETAILS FOR PIPEWORK UNDER
GROUND BEARING SLAB
(FOR ALL UNDER SLAB PIPE DEPTHS)





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client

GREATER MANCHESTER

COMBINED AUTHORITY

project

BOLTON FIRE STATION

drawing

DRAWING DETAILS

SHEET 2

drawn by	MDS	date	20.04.23
checked by	BH	date	
scale	N.T.S		A1
dwg no	1978.35.403		rev P1

Appendix E - Soakaway and Half Drain Time Calculations

Flo Consult UK Ltd				Page 1																																																																																																																																																																																					
4 Market Square Old Amersham Buckinghamshire, HP7 0DQ		Blackley Fire Station Soakaway Calculation + Half Drain Time																																																																																																																																																																																							
Date 21/04/2023		Designed by MDS																																																																																																																																																																																							
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Date 21/04/2023		Designed by MDS			
File SOAKAWAY CALCULATIONS.SRCX		Checked by MDS			
Innovyze		Source Control 2020.1.3			
<u>Summary of Results for 2 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
8640 min Summer	77.787	1.387	0.9	3.1	O K
10080 min Summer	77.649	1.249	0.8	2.8	O K
15 min Winter	78.365	1.965	1.2	12.4	O K
30 min Winter	78.393	1.993	1.2	16.0	O K
60 min Winter	78.420	2.020	1.2	19.3	O K
120 min Winter	78.451	2.051	1.2	23.2	O K
180 min Winter	78.464	2.064	1.2	24.8	O K
240 min Winter	78.468	2.068	1.2	25.3	O K
360 min Winter	78.470	2.070	1.2	25.6	O K
480 min Winter	78.467	2.067	1.2	25.2	O K
600 min Winter	78.461	2.061	1.2	24.4	O K
720 min Winter	78.453	2.053	1.2	23.5	O K
960 min Winter	78.436	2.036	1.2	21.3	O K
1440 min Winter	78.398	1.998	1.2	16.5	O K
2160 min Winter	78.347	1.947	1.2	10.2	O K
2880 min Winter	78.311	1.911	1.2	5.7	O K
4320 min Winter	77.965	1.565	1.0	3.5	O K
5760 min Winter	77.655	1.255	0.8	2.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
8640 min Summer	0.557	0.0	4408		
10080 min Summer	0.512	0.0	5136		
15 min Winter	32.945	0.0	28		
30 min Winter	21.572	0.0	41		
60 min Winter	13.672	0.0	68		
120 min Winter	8.959	0.0	122		
180 min Winter	6.922	0.0	176		
240 min Winter	5.746	0.0	224		
360 min Winter	4.404	0.0	284		
480 min Winter	3.643	0.0	362		
600 min Winter	3.143	0.0	440		
720 min Winter	2.785	0.0	514		
960 min Winter	2.301	0.0	660		
1440 min Winter	1.755	0.0	932		
2160 min Winter	1.338	0.0	1300		
2880 min Winter	1.106	0.0	1600		
4320 min Winter	0.850	0.0	2220		
5760 min Winter	0.709	0.0	2944		
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ		Blackley Fire Station Soakaway Calculation + Half Drain Time			
Date 21/04/2023		Designed by MDS			
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Innovyze		Source Control 2020.1.3			
<u>Summary of Results for 2 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	77.453	1.053	0.7	2.4	O K
8640 min Winter	77.312	0.912	0.7	2.1	O K
10080 min Winter	77.207	0.807	0.6	1.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
7200 min Winter	0.620	0.0	3680		
8640 min Winter	0.557	0.0	4408		
10080 min Winter	0.512	0.0	5144		
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Innovyze	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 80.400

Complex Structure

Lined Soakaway

Infiltration Coefficient Base (m/hr) 0.61200	Ring Diameter (m) 1.50
Infiltration Coefficient Side (m/hr) 0.61200	Pit Multiplier 1.0
Safety Factor 2.0	Number Required 1
Porosity 1.00	Cap Volume Depth (m) 0.000
Invert Level (m) 76.400	Cap Infiltration Depth (m) 1.900

Cellular Storage

Invert Level (m) 78.300	Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000	Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000	

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	130.0	0.0	2.600	0.0	0.0
0.200	130.0	0.0	2.800	0.0	0.0
0.400	130.0	0.0	3.000	0.0	0.0
0.600	130.0	0.0	3.200	0.0	0.0
0.800	130.0	0.0	3.400	0.0	0.0
1.000	130.0	0.0	3.600	0.0	0.0
1.200	130.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

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Date 21/04/2023		Designed by MDS			
File SOAKAWAY CALCULATIONS.SRCX		Checked by MDS			
Innovyze		Source Control 2020.1.3			
<u>Summary of Results for 30 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
8640 min Summer	78.528	2.128	1.2	32.9	O K
10080 min Summer	78.480	2.080	1.2	26.8	O K
15 min Winter	78.598	2.198	1.2	41.6	O K
30 min Winter	78.707	2.307	1.2	55.2	O K
60 min Winter	78.821	2.421	1.2	69.5	O K
120 min Winter	78.918	2.518	1.2	81.6	O K
180 min Winter	78.974	2.574	1.2	88.8	O K
240 min Winter	79.012	2.612	1.2	93.5	O K
360 min Winter	79.057	2.657	1.2	99.0	O K
480 min Winter	79.077	2.677	1.2	101.6	O K
600 min Winter	79.084	2.684	1.2	102.5	O K
720 min Winter	79.082	2.682	1.2	102.2	O K
960 min Winter	79.062	2.662	1.2	99.7	O K
1440 min Winter	79.019	2.619	1.2	94.3	O K
2160 min Winter	78.947	2.547	1.2	85.3	O K
2880 min Winter	78.871	2.471	1.2	75.8	O K
4320 min Winter	78.729	2.329	1.2	58.0	O K
5760 min Winter	78.604	2.204	1.2	42.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
8640 min Summer	1.228	0.0	4920		
10080 min Summer	1.115	0.0	5640		
15 min Winter	103.254	0.0	30		
30 min Winter	68.762	0.0	44		
60 min Winter	43.945	0.0	72		
120 min Winter	26.690	0.0	130		
180 min Winter	19.951	0.0	186		
240 min Winter	16.227	0.0	244		
360 min Winter	12.116	0.0	358		
480 min Winter	9.837	0.0	472		
600 min Winter	8.361	0.0	584		
720 min Winter	7.317	0.0	692		
960 min Winter	5.916	0.0	892		
1440 min Winter	4.380	0.0	1110		
2160 min Winter	3.239	0.0	1568		
2880 min Winter	2.621	0.0	2016		
4320 min Winter	1.959	0.0	2856		
5760 min Winter	1.604	0.0	3632		
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<u>Summary of Results for 30 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	78.499	2.099	1.2	29.2	O K
8640 min Winter	78.415	2.015	1.2	18.7	O K
10080 min Winter	78.352	1.952	1.2	10.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
7200 min Winter	1.382	0.0	4336		
8640 min Winter	1.228	0.0	5016		
10080 min Winter	1.115	0.0	5648		
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 386063 403387 SD 86063 03387
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.200

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:	From:	To:
0	4 0.050	4	8 0.050	8	12 0.050	12	16 0.050

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Model Details

Storage is Online Cover Level (m) 80.400

Complex Structure

Lined Soakaway

Infiltration Coefficient Base (m/hr) 0.61200	Ring Diameter (m) 1.50
Infiltration Coefficient Side (m/hr) 0.61200	Pit Multiplier 1.0
Safety Factor 2.0	Number Required 1
Porosity 1.00	Cap Volume Depth (m) 0.000
Invert Level (m) 76.400	Cap Infiltration Depth (m) 1.900

Cellular Storage

Invert Level (m) 78.300	Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000	Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000	

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	130.0	0.0	2.600	0.0	0.0
0.200	130.0	0.0	2.800	0.0	0.0
0.400	130.0	0.0	3.000	0.0	0.0
0.600	130.0	0.0	3.200	0.0	0.0
0.800	130.0	0.0	3.400	0.0	0.0
1.000	130.0	0.0	3.600	0.0	0.0
1.200	130.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ		Blackley Fire Station Soakaway Calculation + Half Drain Time			
Date 21/04/2023		Designed by MDS			
File SOAKAWAY CALCULATIONS.SRCX		Checked by MDS			
Innovyze		Source Control 2020.1.3			
<u>Summary of Results for 100 year Return Period (+45%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
8640 min Summer	78.776	2.376	1.2	63.9	O K
10080 min Summer	78.710	2.310	1.2	55.6	O K
15 min Winter	78.737	2.337	1.2	59.0	O K
30 min Winter	78.900	2.500	1.2	79.4	O K
60 min Winter	79.073	2.673	1.2	101.1	O K
120 min Winter	79.221	2.821	1.2	119.6	O K
180 min Winter	79.309	2.909	1.2	130.7	O K
240 min Winter	79.369	2.969	1.2	138.2	O K
360 min Winter	79.445	3.045	1.2	147.6	O K
480 min Winter	79.484	3.084	1.2	152.6	O K
600 min Winter	79.504	3.104	1.2	155.1	O K
720 min Winter	79.512	3.112	1.2	156.0	O K
960 min Winter	79.500	3.100	1.2	154.6	O K
1440 min Winter	79.433	3.033	1.2	146.2	O K
2160 min Winter	79.341	2.941	1.2	134.7	O K
2880 min Winter	79.256	2.856	1.2	124.0	O K
4320 min Winter	79.093	2.693	1.2	103.6	O K
5760 min Winter	78.942	2.542	1.2	84.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
8640 min Summer	1.541	0.0	5104		
10080 min Summer	1.391	0.0	5856		
15 min Winter	144.818	0.0	30		
30 min Winter	97.642	0.0	44		
60 min Winter	62.886	0.0	72		
120 min Winter	38.055	0.0	130		
180 min Winter	28.324	0.0	188		
240 min Winter	22.940	0.0	246		
360 min Winter	16.993	0.0	362		
480 min Winter	13.689	0.0	478		
600 min Winter	11.556	0.0	592		
720 min Winter	10.051	0.0	706		
960 min Winter	8.049	0.0	926		
1440 min Winter	5.871	0.0	1330		
2160 min Winter	4.278	0.0	1652		
2880 min Winter	3.425	0.0	2112		
4320 min Winter	2.523	0.0	2992		
5760 min Winter	2.044	0.0	3816		
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ		Blackley Fire Station Soakaway Calculation + Half Drain Time			
Date 21/04/2023		Designed by MDS			
File SOAKAWAY CALCULATIONS.SRCX		Checked by MDS			
Innovyze		Source Control 2020.1.3			
<u>Summary of Results for 100 year Return Period (+45%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
7200 min Winter	78.809	2.409	1.2	68.1	O K
8640 min Winter	78.692	2.292	1.2	53.3	O K
10080 min Winter	78.589	2.189	1.2	40.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
7200 min Winter	1.746	0.0	4616		
8640 min Winter	1.541	0.0	5368		
10080 min Winter	1.391	0.0	6064		
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Blackley Fire Station Soakaway Calculation + Half Drain Time	
Date 21/04/2023	Designed by MDS	
File SOAKAWAY CALCULATIONS.SRCX	Checked by MDS	
Innovyze		Source Control 2020.1.3

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386063 403387 SD 86063 03387
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.200

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:	From:	To:
0	4 0.050	4	8 0.050	8	12 0.050	12	16 0.050

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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Blackley Fire Station Soakaway Calculation + Half Drain Time	
Date 21/04/2023	Designed by MDS	
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Innovyze	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 80.400

Complex Structure

Lined Soakaway

Infiltration Coefficient Base (m/hr) 0.61200	Ring Diameter (m) 1.50
Infiltration Coefficient Side (m/hr) 0.61200	Pit Multiplier 1.0
Safety Factor 2.0	Number Required 1
Porosity 1.00	Cap Volume Depth (m) 0.000
Invert Level (m) 76.400	Cap Infiltration Depth (m) 1.900

Cellular Storage

Invert Level (m) 78.300	Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000	Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000	

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	130.0	0.0	2.600	0.0	0.0
0.200	130.0	0.0	2.800	0.0	0.0
0.400	130.0	0.0	3.000	0.0	0.0
0.600	130.0	0.0	3.200	0.0	0.0
0.800	130.0	0.0	3.400	0.0	0.0
1.000	130.0	0.0	3.600	0.0	0.0
1.200	130.0	0.0	3.800	0.0	0.0
1.400	0.0	0.0	4.000	0.0	0.0
1.600	0.0	0.0	4.200	0.0	0.0
1.800	0.0	0.0	4.400	0.0	0.0
2.000	0.0	0.0	4.600	0.0	0.0
2.200	0.0	0.0	4.800	0.0	0.0
2.400	0.0	0.0	5.000	0.0	0.0

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Appendix F - Surface Water Netork Calculations

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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Blackley Fire Station Surface Water Network Calculations	
Date 21/04/2023	Designed by MDS	
File SW Network Calculations.MDX	Checked by MDS	
Innovyze		Network 2020.1.3

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 386063 403387 SD 86063 03387
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 (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
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

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.171	4-8	0.029

Total Area Contributing (ha) = 0.200

Total Pipe Volume (m³) = 3.660

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
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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)
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Blackley Fire Station Surface Water Network Calculations	
Date 21/04/2023	Designed by MDS	
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Innovyze	Network 2020.1.3	
<u>Simulation Criteria for Storm</u> Volumetric Runoff Coeff 1.000 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/ha Storage 2.000 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 Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FEH Return Period (years) 2 FEH Rainfall Version 2013 Site Location GB 386063 403387 SD 86063 03387 Data Type Point Summer Storms No Winter Storms Yes Cv (Summer) 0.750 Cv (Winter) 1.000 Storm Duration (mins) 15		
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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Blackley Fire Station Surface Water Network Calculations	
Date 21/04/2023	Designed by MDS	
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Innovyze	Network 2020.1.3	
Online Controls for Storm Orifice Manhole: Soakaway, DS/PN: 1.003, Volume (m³): 14.9 Diameter (m) 0.001 Discharge Coefficient 0.600 Invert Level (m) 74.600		
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<u>Storage Structures for Storm</u> <u>Complex Manhole: Soakaway, DS/PN: 1.003</u> <u>Lined Soakaway</u> <table><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.61200</td><td>Ring Diameter (m)</td><td>1.50</td></tr><tr><td>Infiltration Coefficient Side (m/hr)</td><td>0.61200</td><td>Pit Multiplier</td><td>1.0</td></tr><tr><td>Safety Factor</td><td>2.0</td><td>Number Required</td><td>1</td></tr><tr><td>Porosity</td><td>1.00</td><td>Cap Volume Depth (m)</td><td>0.000</td></tr><tr><td>Invert Level (m)</td><td>74.600</td><td>Cap Infiltration Depth (m)</td><td>1.900</td></tr></table> <u>Cellular Storage</u> <table><tr><td>Invert Level (m)</td><td>78.300</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>130.0</td><td>0.0</td><td>2.600</td><td>0.0</td><td>0.0</td></tr><tr><td>0.200</td><td>130.0</td><td>0.0</td><td>2.800</td><td>0.0</td><td>0.0</td></tr><tr><td>0.400</td><td>130.0</td><td>0.0</td><td>3.000</td><td>0.0</td><td>0.0</td></tr><tr><td>0.600</td><td>130.0</td><td>0.0</td><td>3.200</td><td>0.0</td><td>0.0</td></tr><tr><td>0.800</td><td>130.0</td><td>0.0</td><td>3.400</td><td>0.0</td><td>0.0</td></tr><tr><td>1.000</td><td>130.0</td><td>0.0</td><td>3.600</td><td>0.0</td><td>0.0</td></tr><tr><td>1.200</td><td>130.0</td><td>0.0</td><td>3.800</td><td>0.0</td><td>0.0</td></tr><tr><td>1.400</td><td>0.0</td><td>0.0</td><td>4.000</td><td>0.0</td><td>0.0</td></tr><tr><td>1.600</td><td>0.0</td><td>0.0</td><td>4.200</td><td>0.0</td><td>0.0</td></tr><tr><td>1.800</td><td>0.0</td><td>0.0</td><td>4.400</td><td>0.0</td><td>0.0</td></tr><tr><td>2.000</td><td>0.0</td><td>0.0</td><td>4.600</td><td>0.0</td><td>0.0</td></tr><tr><td>2.200</td><td>0.0</td><td>0.0</td><td>4.800</td><td>0.0</td><td>0.0</td></tr><tr><td>2.400</td><td>0.0</td><td>0.0</td><td>5.000</td><td>0.0</td><td>0.0</td></tr></table>			Infiltration Coefficient Base (m/hr)	0.61200	Ring Diameter (m)	1.50	Infiltration Coefficient Side (m/hr)	0.61200	Pit Multiplier	1.0	Safety Factor	2.0	Number Required	1	Porosity	1.00	Cap Volume Depth (m)	0.000	Invert Level (m)	74.600	Cap Infiltration Depth (m)	1.900	Invert Level (m)	78.300	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	130.0	0.0	2.600	0.0	0.0	0.200	130.0	0.0	2.800	0.0	0.0	0.400	130.0	0.0	3.000	0.0	0.0	0.600	130.0	0.0	3.200	0.0	0.0	0.800	130.0	0.0	3.400	0.0	0.0	1.000	130.0	0.0	3.600	0.0	0.0	1.200	130.0	0.0	3.800	0.0	0.0	1.400	0.0	0.0	4.000	0.0	0.0	1.600	0.0	0.0	4.200	0.0	0.0	1.800	0.0	0.0	4.400	0.0	0.0	2.000	0.0	0.0	4.600	0.0	0.0	2.200	0.0	0.0	4.800	0.0	0.0	2.400	0.0	0.0	5.000	0.0	0.0
Infiltration Coefficient Base (m/hr)	0.61200	Ring Diameter (m)	1.50																																																																																																																			
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0.000	130.0	0.0	2.600	0.0	0.0																																																																																																																	
0.200	130.0	0.0	2.800	0.0	0.0																																																																																																																	
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1.000	130.0	0.0	3.600	0.0	0.0																																																																																																																	
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1.600	0.0	0.0	4.200	0.0	0.0																																																																																																																	
1.800	0.0	0.0	4.400	0.0	0.0																																																																																																																	
2.000	0.0	0.0	4.600	0.0	0.0																																																																																																																	
2.200	0.0	0.0	4.800	0.0	0.0																																																																																																																	
2.400	0.0	0.0	5.000	0.0	0.0																																																																																																																	
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Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF
      Analysis Timestep   Fine Inertia Status OFF
      DTS Status         ON
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WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status	
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)		Flow (l/s)
1.000	S1	79.575	-0.105	0.000	0.20			3.7	OK
1.001	S2	79.204	-0.161	0.000	0.18			8.8	OK
2.000	S3	79.368	-0.182	0.000	0.08			4.4	OK
3.000	S4	79.316	-0.199	0.000	0.03			2.2	OK
2.001	S5	79.119	-0.146	0.000	0.27			17.4	OK
1.002	S6	78.862	-0.193	0.000	0.27			26.2	OK
1.003	Soakaway	78.323	3.423	0.000	0.00			0.0	SURCHARGED

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Summary of Results for 60 minute 2 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status	
		Level	Depth	Volume	Flow /	Overflow	Time		Flow
		(m)	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	
1.000	S1	79.566	-0.114	0.000	0.13			2.5	OK
1.001	S2	79.192	-0.173	0.000	0.12			6.1	OK
2.000	S3	79.359	-0.191	0.000	0.06			2.9	OK
3.000	S4	79.313	-0.202	0.000	0.02			1.5	OK
2.001	S5	79.105	-0.160	0.000	0.19			12.1	OK
1.002	S6	78.843	-0.212	0.000	0.19			18.2	OK
1.003	Soakaway	78.357	3.457	0.000	0.00			0.0	SURCHARGED



Micro
Drainage

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Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF
      Analysis Timestep   Fine Inertia Status OFF
      DTS Status         ON
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WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
1.000	S1	79.560	-0.120	0.000	0.09		1.7	OK
1.001	S2	79.184	-0.181	0.000	0.08		4.1	OK
2.000	S3	79.353	-0.197	0.000	0.04		2.0	OK
3.000	S4	79.305	-0.210	0.000	0.01		1.0	OK
2.001	S5	79.093	-0.172	0.000	0.13		8.2	OK
1.002	S6	78.826	-0.229	0.000	0.13		12.3	OK
1.003	Soakaway	78.399	3.499	0.000	0.00		0.0	SURCHARGED



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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 386063 403387 SD 86063 03387
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 (%)	40
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
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

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	40.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 386063 403387 SD 86063 03387
Data Type	Point
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	1.000

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Innovyze	Network 2020.1.3	
Synthetic Rainfall Details Storm Duration (mins) 15		
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Micro
Drainage

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Margin for Flood Risk Warning (mm) 300.0      DVD Status OFF
      Analysis Timestep    Fine Inertia Status OFF
      DTS Status          ON
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WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status	
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)		Flow (l/s)
1.000	S1	79.616	-0.064	0.000	0.63			11.9	OK
1.001	S2	79.268	-0.097	0.000	0.61			29.6	OK
2.000	S3	79.403	-0.147	0.000	0.26			14.1	OK
3.000	S4	79.338	-0.177	0.000	0.10			7.0	OK
2.001	S5	79.210	-0.055	0.000	0.91			59.0	OK
1.002	S6	78.983	-0.072	0.000	0.93			88.9	OK
1.003	Soakaway	78.690	3.790	0.000	0.00			0.0	SURCHARGED

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Summary of Results for 60 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF

Analysis Timestep Fine Inertia Status OFF

DTS Status ON

WARNING: Half Drain Time has not been calculated as the structure is too full.

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)	
1.000	S1	79.598	-0.082	0.000	0.42		7.9		OK
1.001	S2	79.240	-0.125	0.000	0.41		19.8		OK
2.000	S3	79.389	-0.161	0.000	0.18		9.5		OK
3.000	S4	79.329	-0.186	0.000	0.07		4.7		OK
2.001	S5	79.168	-0.097	0.000	0.61		39.6		OK
1.002	S6	78.928	-0.127	0.000	0.62		59.0		OK
1.003	Soakaway	78.825	3.925	0.000	0.00		0.0		SURCHARGED

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Drainage

Summary of Results for 120 minute 30 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status	
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)		Flow (l/s)
1.000	S1	79.582	-0.098	0.000	0.26			5.0	OK
1.001	S2	79.216	-0.149	0.000	0.25			12.3	OK
2.000	S3	79.375	-0.175	0.000	0.11			5.9	OK
3.000	S4	79.320	-0.195	0.000	0.04			2.9	OK
2.001	S5	79.136	-0.129	0.000	0.38			24.4	OK
1.002	S6	78.941	-0.114	0.000	0.39			36.7	OK
1.003	Soakaway	78.941	4.041	0.000	0.00			0.0	SURCHARGED



Summary of Results for 360 minute 30 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
1.000	S1	79.564	-0.116	0.000	0.12		2.3	OK
1.001	S2	79.191	-0.174	0.000	0.12		5.7	OK
2.000	S3	79.357	-0.193	0.000	0.05		2.7	OK
3.000	S4	79.311	-0.204	0.000	0.02		1.4	OK
2.001	S5	79.119	-0.146	0.000	0.17		11.3	OK
1.002	S6	79.118	0.063	0.000	0.18		16.9	SURCHARGED
1.003	Soakaway	79.118	4.218	0.000	0.00		0.0	SURCHARGED

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Summary of Results for 720 minute 30 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status	
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)		Flow (l/s)
1.000	S1	79.557	-0.123	0.000	0.07			1.4	OK
1.001	S2	79.179	-0.186	0.000	0.07			3.4	OK
2.000	S3	79.351	-0.199	0.000	0.03			1.6	OK
3.000	S4	79.303	-0.212	0.000	0.01			0.8	OK
2.001	S5	79.178	-0.087	0.000	0.11			6.8	OK
1.002	S6	79.177	0.122	0.000	0.11			10.2	SURCHARGED
1.003	Soakaway	79.177	4.277	0.000	0.00			0.0	SURCHARGED



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

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386063 403387 SD 86063 03387
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 (%)	45
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
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

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	45.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 386063 403387 SD 86063 03387
Data Type	Point
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	1.000

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Synthetic Rainfall Details Storm Duration (mins) 15		
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Micro
Drainage

Summary of Results for 15 minute 100 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

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)	
1.000	S1	79.874	0.194	0.000	1.04			19.8	SURCHARGED
1.001	S2	79.527	0.162	0.000	0.98			48.0	SURCHARGED
2.000	S3	79.749	0.199	0.000	0.46			24.5	SURCHARGED
3.000	S4	79.715	0.200	0.000	0.20			13.5	SURCHARGED
2.001	S5	79.701	0.436	0.000	1.49			96.1	SURCHARGED
1.002	S6	79.225	0.170	0.000	1.50			142.9	SURCHARGED
1.003	Soakaway	78.725	3.825	0.000	0.00			0.0	SURCHARGED



Micro
Drainage

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded			Half Drain	Pipe	Status
		Level	Depth	Volume	Flow /	Overflow	Time	Flow	
		(m)	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	
1.000	S1	79.640	-0.040	0.000	0.89			16.8	OK
1.001	S2	79.349	-0.016	0.000	0.84			41.1	OK
2.000	S3	79.494	-0.056	0.000	0.37			19.4	OK
3.000	S4	79.465	-0.050	0.000	0.14			9.9	OK
2.001	S5	79.452	0.187	0.000	1.23			79.4	SURCHARGED
1.002	S6	79.127	0.072	0.000	1.26			120.5	SURCHARGED
1.003	Soakaway	78.913	4.013	0.000	0.00			0.0	SURCHARGED



Summary of Results for 120 minute 100 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Half Drain		Pipe	Status	
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)		Flow (l/s)
1.000	S1	79.593	-0.087	0.000	0.37			7.1	OK
1.001	S2	79.274	-0.091	0.000	0.36			17.5	OK
2.000	S3	79.384	-0.166	0.000	0.16			8.4	OK
3.000	S4	79.326	-0.189	0.000	0.06			4.2	OK
2.001	S5	79.274	0.009	0.000	0.54			34.8	SURCHARGED
1.002	S6	79.272	0.217	0.000	0.55			52.4	SURCHARGED
1.003	Soakaway	79.271	4.371	0.000	0.00			0.0	SURCHARGED



Summary of Results for 360 minute 100 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

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)	
1.000	S1	79.571	-0.109	0.000	0.17			3.2	OK
1.001	S2	79.538	0.173	0.000	0.16			8.0	SURCHARGED
2.000	S3	79.538	-0.012	0.000	0.07			3.8	OK
3.000	S4	79.538	0.023	0.000	0.03			1.9	SURCHARGED
2.001	S5	79.538	0.273	0.000	0.24			15.8	SURCHARGED
1.002	S6	79.536	0.481	0.000	0.25			23.5	SURCHARGED
1.003	Soakaway	79.536	4.636	0.000	0.00			0.0	SURCHARGED

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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ	Blackley Fire Station Surface Water Network Calculations	
Date 21/04/2023	Designed by MDS	
File SW Network Calculations.MDX	Checked by MDS	
Innovyze	Network 2020.1.3	

Summary of Results for 720 minute 100 year Winter (Storm)

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

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
1.000	S1	80.236	0.556	0.000	0.10			1.9	FLOOD RISK
1.001	S2	80.235	0.870	0.000	0.10			4.7	SURCHARGED
2.000	S3	80.234	0.684	0.000	0.04			2.2	FLOOD RISK
3.000	S4	80.234	0.719	0.000	0.02			1.1	FLOOD RISK
2.001	S5	80.234	0.969	0.000	0.14			9.3	FLOOD RISK
1.002	S6	80.233	1.178	0.000	0.14			13.8	FLOOD RISK
1.003	Soakaway	80.233	5.333	0.000	0.00			0.0	FLOOD RISK

