

Huddersfield Royal Infirmary - New Accident & Emergency Department

Drainage Design Commentary

Project:	100102983		
Our reference:	HG0052-MMD-00-XX-RP-D-0001 C01		
Prepared by:	J Lea-Wilson	Date:	28/01/2022
Approved by:	K Bos	Checked by:	A Precious
Subject:	HRI ED Drainage Design Commentary		

1 Introduction

Mott MacDonald has been appointed by IHP to provide the Civil & Structural consultancy services to a RIBA Stage 4 design for the proposed new Accident & Emergency Department at Huddersfield Royal Infirmary.

The proposed development involves the demolition of the existing Saville Court buildings and construction of a new single storey A&E department. The single storey is being designed with a plant room on the roof.

The purpose of this design commentary is to identify the methodology adopted in the design of the surface water and foul water drainage.

1.1 Site Description

The development site has a total area of approximately 6520m² within the red line boundary.

Of this area, approximately 4970m² consists of existing drained impermeable buildings/landscaping. The remaining area consists of approximately 1550m² of existing soft landscaping.

Topographical data, obtained in July 2020 (included in Appendix A for reference), shows that the site generally slopes west to east. With a high spot in the northwest of the site on the access road at approximately 191.75mAOD, and a low spot at approximately 185.75mAOD in the southeast of the site.

1.2 Existing Site Drainage

The existing site drainage has been surveyed (see Appendix B). The utilities survey confirms that there is a sitewide combined drainage network, as well as a separate surface water drainage network that collects runoff from the site before discharging into the sitewide combined system at a number of locations.

Pipe diameters for the combined network are 150mm from the existing Saville Court buildings. The combined drainage from the Saville Court buildings connects to a 225mm diameter combined drain that flows west to east. This 225mm diameter drain has both foul, surface water and combined connections from the existing hospital buildings to the north.

Existing surface water drainage is recorded to be 100mm to 150mm diameter across the majority of the site, with the exception of the outlet pipe from MH45 (as noted in Appendix B) which is 225mm diameter. This

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225mm diameter surface water pipe flows west to east, before turning north and connecting into the existing sitewide combined drainage network.

2 Drainage Design

2.1 Surface Water Drainage

2.1.1 Design Criteria and Requirements

All new surface water drainage shall be developed in accordance with BS EN 752, Sewerage Sector Guidance (SSG) Appendix C, and Building Regulations Part H. Any appropriate Environment Agency (EA) requirements shall also apply.

The design life of any new drainage shall reflect the design life of the building.

Drainage features have been sized based on current known information and are briefly summarised within this report.

It is expected that the development has a design life in excess of 50-years. EA guidance gives a central allowance for climate change (CC) of 20%, and an upper end allowance for CC of 40%. Given the sensitivity of the site use, the surface water has been robustly designed to attenuate rainfall from a 1 in 100yr + 40% CC storm.

2.1.2 Design Parameters and Assumptions

The below design parameters have been used for the purpose of design.

- Return Period = 1 in 100 years
- Climate Change = 40%
- M5-60 (mm) = 19.000
- Ratio R = 0.316
- $C_v = 1.0$

The following assumptions have been made in the development of the surface water drainage strategy to date:

- It has been assumed that the landscaped areas will not generate runoff into the drained system;
- Rainwater pipe locations have been shown in the locations provided by the MEP engineers, and these have been designed as a gravity-based system as specified by the architect. The positions are subject to change following final coordination.

2.1.3 Allowable Discharge Rate

The allowable discharge rate has been calculated by applying a 50% betterment to the existing surface water discharge rate from the development site area. 50% has been used to provide betterment in the surface water runoff but also to create headroom in the downstream system for the foul drainage from the new development.

The allowable runoff rate has been calculated as follows:

- The existing drained impermeable area is approximately 4970m² (see section 1.1).
- The runoff rate for a 50mm/hr event is approximately 69.1l/s.
- Applying a 50% betterment to this figure gives a runoff rate of 34.5l/s.

A portion of the site area has been designed to drain to the combined drainage network or existing drainage rather than the new surface water network due to site constraints and as such will not pass through a flow restriction or the proposed attenuation features. These include runoff from the following areas, totalling 480m²:

- The new link corridor (120m²). This area is proposed to drain to the diverted combined drainage run within the link corridor. A new surface water network cannot be built in this area due to the difficulty achieving a gravity connection to the west, as well as the lack of space between the northeast of the new Emergency Department and the existing buildings to the north for a connection to the east.
- A portion of hard landscaping to the northwest of the new Emergency Department (95m²). A connection to the surface water network cannot be achieved due to the difficulty achieving a gravity connection to the west, as well as the lack of space between the northeast of the new Emergency Department and the existing buildings to the north for a connection to the east.
- A portion of car park areas/hard landscaping to the east of the development (265m²). The car park in this area is predominantly remaining as existing and the car park has its own private drainage network. It is proposed that these areas drain to existing gullies.

Runoff from the areas draining unattenuated equals 6.7l/s.

As such, the allowable runoff rate for the remainder of the site that is to be drained by a separate surface water network is 27.8l/s. Flows from the new surface water network should be designed to not exceed 27.8l/s up to the 1 in 100yr + 40% CC event.

2.1.4 Proposed Design

The application of a SuDS based system has been considered as the primary measure for dealing with surface water for the proposals.

Roof drainage will connect to a new sitewide surface water network (with the exception of the link corridor roof as noted in section 2.1.3). The roof is proposed to drain using a gravity-based system, the downpipe locations are subject to further coordination and optimisation with internal MEP and internal layouts.

It is proposed that runoff from hard landscaped areas will be collected through a combination of permeable paving, linear drains and gullies.

Attenuation is to be provided using geocellular storage and permeable paving. The flow will be controlled using vortex flow control structures such as a Hydro-brake, in two locations of the site.

It is proposed that the upstream flow control (at MH S11) will limit flows to 11.8l/s, with geocellular storage (103m³ attenuation volume) and permeable paving (25m³ attenuation volume) providing attenuation. It is proposed that the downstream flow control (at MH S24) will limit flows to 27.8l/s, with geocellular storage (68m³ attenuation volume) providing attenuation. The surface water system will outfall into the existing surface water network, on which manhole S29 is proposed to be located.

The majority of runoff from the access roads will be treated using permeable paving and a Class II interceptor (interceptor to be sized and located) to improve the water quality prior to discharge to the combined sewer in accordance with the C753 Simplified Index Approach.

Surface water drainage has been designed with gradients that will ensure self-cleansing velocities are achieved.

The proposed drainage masterplan and accompanying calculations are included in Appendices CA and D respectively.

2.2 Foul Water Drainage

2.2.1 Design Criteria and Requirements

All new foul water drainage shall be developed in accordance with BS EN 752, Sewerage Sector Guidance (SSG) Appendix C, and Building Regulations Part H. Any appropriate Environment Agency (EA) requirements shall also apply.

The design life of any new drainage shall reflect the design life of the building.

2.2.2 Design Parameters and Assumptions

The system has been designed using BS EN 12056 DU Unit Method. SVP locations have been proposed by the mechanical engineers and are to be confirmed following final coordination.

The sum of DU units leaving the building is calculated to be 92.3. A frequency factor of 0.7 has been applied throughout the network. This results in a peak foul flow leaving the building of 6.7l/s.

2.2.3 Proposed Design

The majority of the foul drainage is proposed to be collected using a new foul water network that will discharge to the existing combined sewer to the northeast of the new hospital building.

The other foul connections will be made with new manholes built on the line of the existing combined sewer towards the northwest of the new building as this will reduce the amount of new pipework required.

The existing combined sewer towards the north of the building is to be diverted as this would clash with the foundations of the new link structure.

Buried under slab foul drainage has been designed with minimum gradients of 1v:40h and are designed such that only low-flow connections branch on the high-flow (typically WC's) to mitigate the risk of blockage.

The external foul drainage has been designed in accordance with Building Regulation Part H minimum gradients.

Foul pipework is to be 100mm diameter below the slab and 150mm diameter elsewhere. Using 150mm diameter external pipework gives additional capacity should the building be extended one floor upwards.

A. Topographical Survey



Survey Notes

Grid: Local plane metric related to OS grid at SC1
Levels: OS datum from GNSS positioning, converted using the National Grid model OSGM15

Notes

Topographical Survey Legend

BUILDINGS AND STRUCTURES		GENERAL INFORMATION	
Building	[Symbol]	Petrol Pump	[Symbol]
Building Base	[Symbol]	Street Light	[Symbol]
Run	[Symbol]	Footbridge	[Symbol]
Passage	[Symbol]	End Type Channel	[Symbol]
Wall with height	[Symbol]	End Type Channel	[Symbol]
Retaining Wall	[Symbol]	End Type Channel	[Symbol]
FENCE STYLES AND DESCRIPTIONS		OVERHEAD FEATURES	
Close Boarded	[Symbol]	Electric Pylon	[Symbol]
Corrugated Iron	[Symbol]	Electricity	[Symbol]
Overhead Piling	[Symbol]	Telephone	[Symbol]
Chainlink	[Symbol]	Water Features	[Symbol]
Wattle	[Symbol]	Canal	[Symbol]
Intersect	[Symbol]	Stream	[Symbol]
Iron Piling	[Symbol]	Drain	[Symbol]
Leisure	[Symbol]	Paved Footway	[Symbol]
Maintenance	[Symbol]	Track	[Symbol]
Pedestrian	[Symbol]	Footpath	[Symbol]
Post & Chain	[Symbol]	Street Furniture	[Symbol]
Post & Rail	[Symbol]	Relief and Vegetation	[Symbol]
Post & Wire	[Symbol]	Level and Height Information	[Symbol]
Post & Wire Mesh	[Symbol]	Survey Information Signs	[Symbol]
Rigid Mesh	[Symbol]	Geotechnical Information	[Symbol]
Site	[Symbol]		
Fence Height	[Symbol]		

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55810_02_01	55810_02_02	55810_02_03	55810_02_04	55810_02_05
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Rev.	Date	Description

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Didsbury, M20 2EY

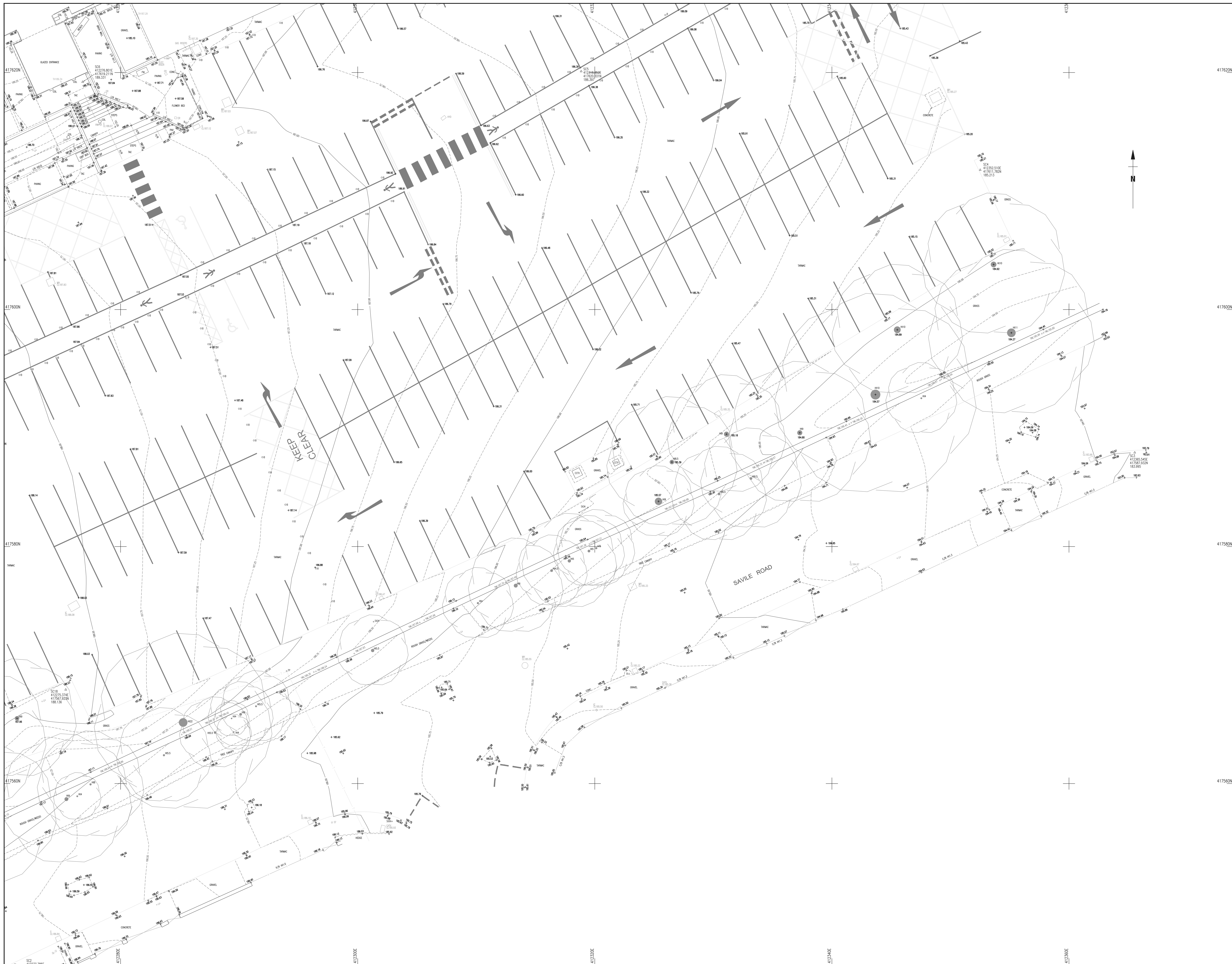
Project

Huddersfield Royal Infirmary
Acre St, Lindley
Huddersfield, HD3 3EA

Drawing Title

Topographical Survey

Drawn by	YW	21/07/20	Survey Date	July 2020
Checked by	NC	22/07/20	Scale	A0 @ 1:100
Drawing No	55810_02_01			Revision



Survey Notes	
Grid:	Local plane metric related to OS grid at SC1
Levels:	OS datum from GNSS positioning, converted using the National Geoid model OSGM15

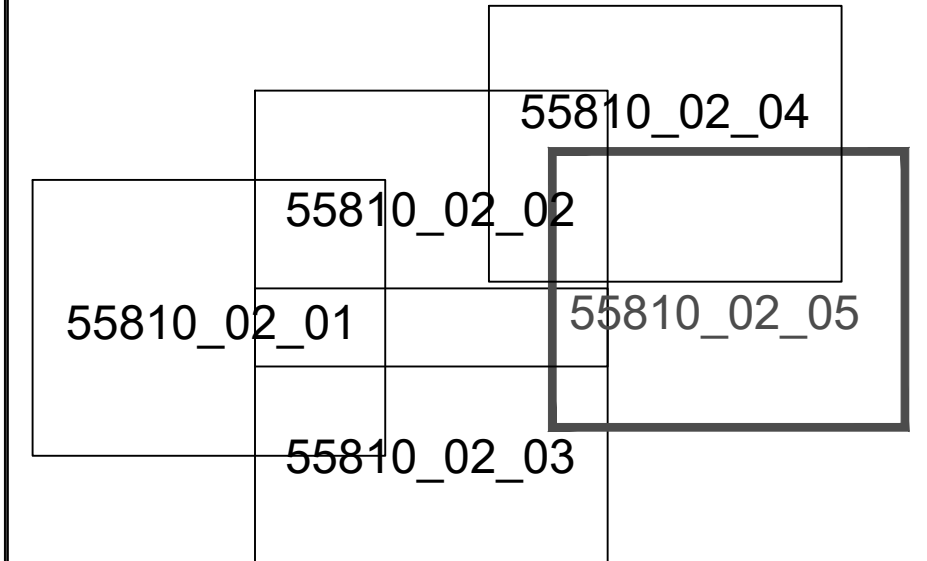
Notes

417620N

Topographical Survey Legend

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Sheet Index

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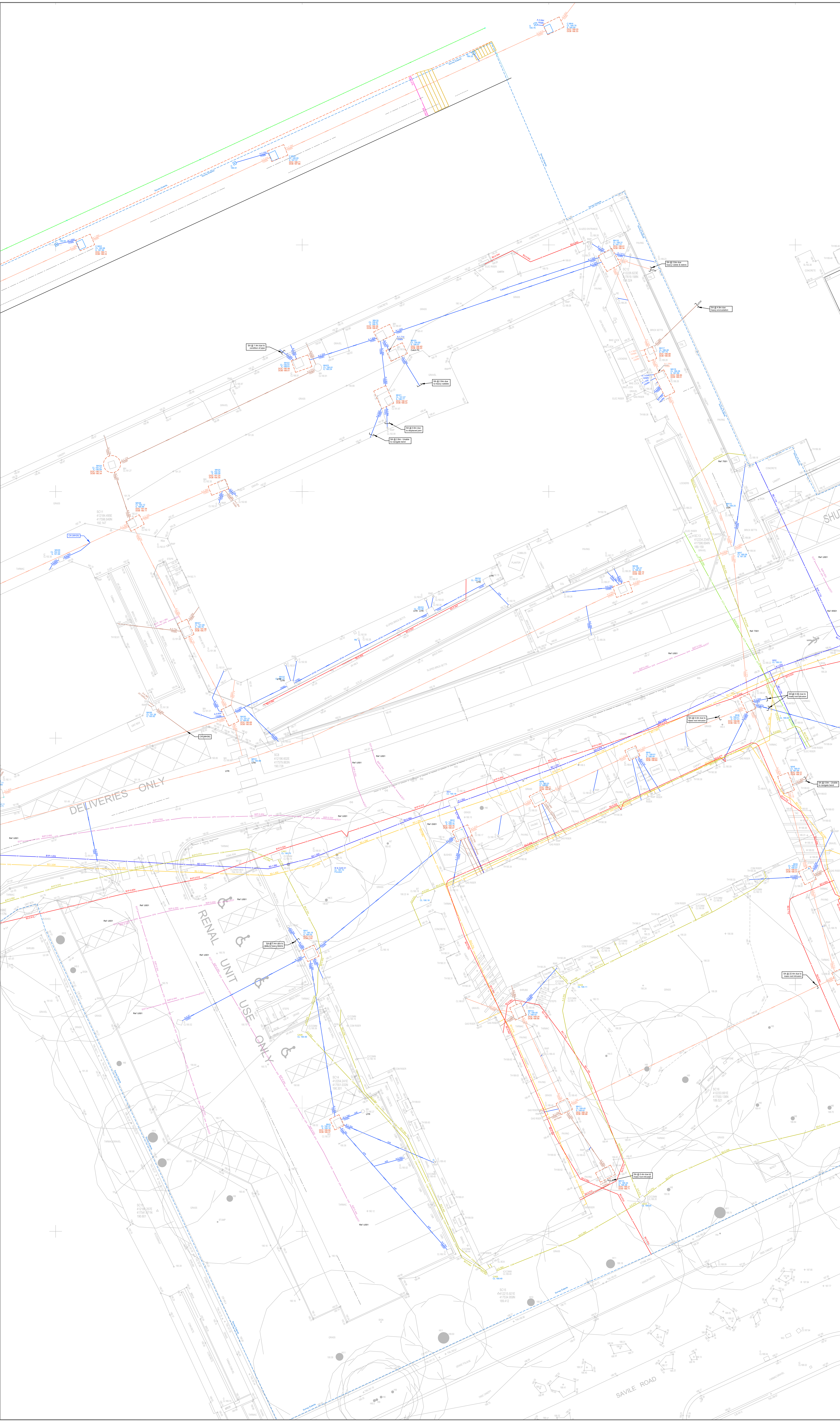
Huddersfield Royal Infirmary
Acre St, Lindley
Huddersfield, HD3 3EA

Drawing Title

Topographical Survey

Drawn by	YW	21/07/20	Survey Date	July 2020
Checked by	NC	22/07/20	Scale	A0 @ 1:100
Drawing No			Revision	
55810_02_05				

B. Existing Utilities Survey



Quality Levels (PAS128)					Detection Clarification
Quality Level	Accuracy	Horizontal	Vertical	Assurance	
Desktop Records Search	D	N/A	N/A	N/A	Service shown on records only not found on site.
Site Reconnaissance	C	N/A	N/A	N/A	A segment of utility whose location is demonstrated by visual reference to street furniture, topographical features or evidence of previous street works (reinstatement scar).
Detection	B4	Undefined	Undefined	Undefined	A utility segment which is suspected to exist but has not been detected and is therefore shown as an assumed route.
Detection	B3	+ 500mm	Undefined	No reliable depth	Horizontal location only of the utility detected by one of the geophysical techniques used.
Detection	B2	+ 250mm	+ 40%	Detected Depth	Horizontal and vertical location of the utility detected by one of the geophysical techniques used.
Detection	B1	+ 150mm	+ 15%	Detected Depth	Horizontal and vertical location of the utility detected by multiple geophysical techniques used.
Verification	A	+ 50mm	+ 25mm		Horizontal and vertical location of the top and/or bottom of the utility.

Disclaimer
All services shown on this plan have been surveyed using approved detectors and the connections between manholes, if not traced, are assumed to be direct.
Should the background, or topographical, information for the survey area be based on an Ordnance Survey file we are not liable for any loss that may arise due to a lack of accuracy in that digital data.
Location accuracy detected by EML methods are determined by referring to manufacturer's guidelines for the equipment used. In ideal conditions the accuracies for the underground utilities located and mapped are +/-10% of the depth. Whilst this technique has proven to be successful, it is not 100% reliable and is affected by ground conditions. The depths obtained are for the centre of the conductor and do not necessarily the depth to a duct or pipe.
Although all reasonable effort is made during site detection, the completeness of the underground services information cannot be guaranteed. An electric current will flow along the path of least resistance. This means that when a current is induced into a feature it will 'jump' to adjacent features if they offer a better conducting pathway. It is possible, therefore, that features that are detected by connecting to one type of apparatus may not in fact be that type of utility. The identification of apparatus cannot be assumed to be totally accurate. It should be noted that the technique is limited to detecting features that either generate an electromagnetic field, such as power cables, or around which an electromagnetic field can be induced, such as some water pipes and some communications cables, and it cannot therefore be guaranteed to reveal the exact routes of all buried services or to detect their presence.
GPR is only useful on flat relatively smooth surfaces free from obstructions. Areas of vegetation, waterlogged areas or uneven ground will often not be scanned using GPR as the data is too unreliable.
GPR is affected by below ground conditions. Saturated ground or concrete reinforcement bars are examples of below ground conditions that can have effects on the results of scans.
Service information can also be shown on the drawings taken from statutory undertakers record plans. This information is shown for the sake of completeness and Subscan Ltd can take no responsibility for the positional accuracy of such information as this may be digitised directly from service plans provided. Information shown as still plan information may duplicate traced routes but may be of other than the same accuracy. The service records from which the information has been digitised.

Sub Surface Key	
Orange line	CATV Cable
Green line	CCTV Cable
Blue line	Comms Cable
Purple line	Duct
Red line	Earthing Rod
Yellow line	Electric Cable
Dark blue line	Electric HV Cable
Light blue line	Electric LV Cable
Light green line	Fibre Optic
Light orange line	Gas Pipe
Light purple line	GPR Anomaly
Light yellow line	GPR Linear
Light pink line	Heating Rod
Light brown line	Rising Main
Light grey line	Surface Sewer
Light tan line	Foul Sewer
Light olive line	Combined Sewer
Light magenta line	Trade Effluent
Light cyan line	Traffic Signal Cable
Light blue line	Undetected
Light green line	Water Main
Light yellow line	Vent Pipe
Light orange line	Fuel Pipe
Light purple line	Oil Pipe Line
Light pink line	Survey Extents
Light brown line	Assume Route
Light grey line	Taken From Records

Warning
Water & Gas utilities entering the properties are generally of a size that cannot be detected by the detectors used. The user of these services should be aware that the data shown on this plan is not intended to be used as a guide only and any digging operations should be carried out with caution. Safe digging practices should be used to verify the position and depth of any utilities. The user of this plan should be aware that the data shown on this plan is not intended to be used as a guide only and any digging operations should be carried out with caution. Safe digging practices should be used to verify the position and depth of any utilities. The user of this plan should be aware that the data shown on this plan is not intended to be used as a guide only and any digging operations should be carried out with caution. Safe digging practices should be used to verify the position and depth of any utilities.

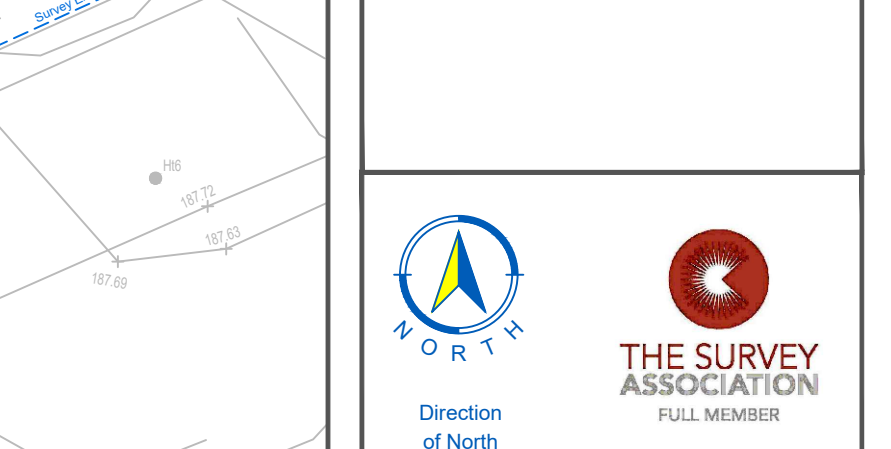
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Topographic & Utility Key	
AV	Air Valve
BN	Boundary
BN	Bus Stop
CSBM	Benchmark
BO	Bollard
MAU	Manhole
BUS	Bus Stop
UT	Utility
CU	Column
GL	Gravel
EL	Electric Point
EP	Electric Pole
ER	Earth Rod
FH	Fire Hydrant
FL	Floor Level
FP	Flag Pole
FV	Fuel Valve
GP	Gate Post
GV	Gas Valve
I	Induced
IL	Inset Level
GL	Gravel
LP	Lamp Post
MH	Manhole
MR	Marker
RE	Road Edge
RWP	Rain Water Pipe
SC	Stop Sign
SV	Stop Valve
SVP	Soil Vent Pipe
TAP	Tap
TO	Top of France
TOV	Top of Wall
TEL	Telecom Cover
TL	Threshold Level
TL	Traffic Light
TP	Telegraph Pole

General
This survey has been carried out in accordance with the standards of accuracy band E, as described in RICS guidance note Assured survey of land, buildings and utilities (3rd Ed).
Drawing units are meters, quoted units are metres.
Grid ticks should be used to check for plotting distortions.
Details or services hidden or obscured by vegetation, details or vehicles at survey time may be omitted. Hedge & Vegetation details are outline.
Any assumed details are shown in DASHDOT.
All arrows point up unless otherwise stated.

Control & Datum Information
All bench shown on this drawing are related to Ordnance Survey datum by means of multiple network OSB3 (Ordnance Survey Bench Mark).
The grid shown on this survey is based on Ordnance Survey datum by means of multiple network OSB3 (Ordnance Survey Bench Mark).
All other stations are related to this in plane projection and Grid North coordinate is true (G.N. is true) and location with a scale factor equal to 1.

Layout	
Sheet 1	Sheet 2
Sheet 3	Sheet 4



REV	DATE	BY	DESCRIPTION	REVISION
1	01/01/2025	GR12551	3D Underground Utilities Survey	0

CLIENT
Mott MacDonald

SITE
Hudsonfield Royal Infirmary
Ainslie Street, Hudsonfield H3 3EA
H3 3EA

DRAWING TITLE
3D Underground Utilities Survey

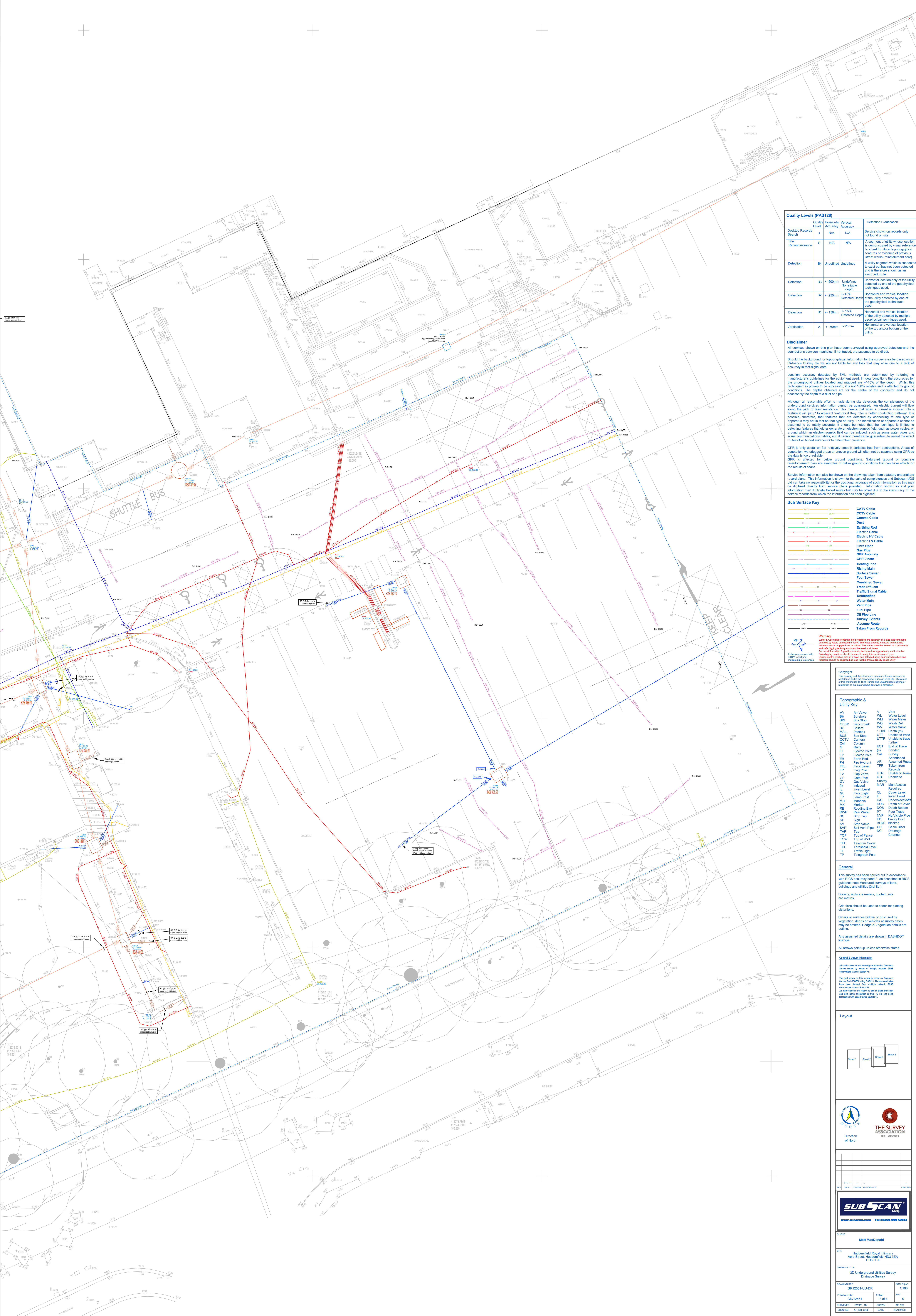
DRAWING REF
GR12551-JU-GR

PROJECT REF
GR12551

SHEET
2 of 4

REV
0

DATE
30/03/2025



Quality Levels (PAS128)				
	Quality Level	Horizontal Accuracy	Vertical Accuracy	Detection Clarification
Desktop Records Search	D	N/A	N/A	Service shown on records only not found on site.
Site Reconnaissance	C	N/A	N/A	A segment of utility whose location is demonstrated by visual reference to street furniture, topographical features or evidence of previous street works (reinstatement scar).
Detection	B4	Undefined	Undefined	A utility segment which is suspected to exist but has not been detected and is therefore shown as an assumed route.
Detection	B3	+ 500mm	Undefined No reliable depth	Horizontal location only of the utility detected by one of the geophysical techniques used.
Detection	B2	+ 250mm	+ 40% Detected Depth	Horizontal and vertical location of the utility detected by one of the geophysical techniques used.
Detection	B1	+ 150mm	+ 15% Detected Depth	Horizontal and vertical location of the utility detected by multiple geophysical techniques used.
Verification	A	+ 50mm	+ 25mm	Horizontal and vertical location of the top and/or bottom of the utility.

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All services shown on this plan have been surveyed using approved detectors and the connections between manholes, if not traced, are assumed to be direct.

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Location accuracy detected by EML methods are determined by referring to manufacturer's guidelines for the equipment used. In ideal conditions the accuracies for the underground utilities located and mapped are +/-10% of the depth. Whilst this technique has proven to be successful, it is not 100% reliable and is affected by ground conditions. The depths obtained are for the centre of the conductor and do not necessarily the depth to a duct or pipe.

Although all reasonable effort is made during site detection, the completeness of the underground services information cannot be guaranteed. An electric current will flow along the path of least resistance. This means that other not be scanned using GPR as the data is too unreliable.

GPR is affected by below ground conditions. Saturated ground or concrete reinforcement bars are examples of below ground conditions that can have effects on the results of scans.

Service information can also be shown on the drawings taken from statutory undertakers record plans. This information is shown for the sake of completeness and Subcan UDS Ltd can take no responsibility for the positional accuracy of such information as this may be digitised directly from service plans provided. Information shown as still plan information may duplicate traced service plans provided. Information shown as still plan information may duplicate traced service plans provided.

Sub Surface Key	
0.00m	CATV Cable
0.00m	CCTV Cable
0.00m	Comms Cable
0.00m	Duct
0.00m	Earthing Rod
0.00m	Electric Cable
0.00m	Electric HV Cable
0.00m	Electric LV Cable
0.00m	Fibre Optic
0.00m	Gas Pipe
0.00m	GPR Anomaly
0.00m	GPR Linear
0.00m	Heating Pipe
0.00m	Rising Main
0.00m	Surface Sewer
0.00m	Foul Sewer
0.00m	Combined Sewer
0.00m	Trade Effluent
0.00m	Traffic Signal Cable
0.00m	Unidentified
0.00m	Water Main
0.00m	Vent Pipe
0.00m	Fuel Pipe
0.00m	Oil Pipe Line
0.00m	Survey Extents
0.00m	Assume Route
0.00m	Taken From Records

Warning
Water & Gas utilities entering properties are generally of a size that cannot be detected by GPR. The data shown on this plan is based on a visual inspection of the site and is not a substitute for a visual inspection. The data shown on this plan is based on a visual inspection of the site and is not a substitute for a visual inspection. The data shown on this plan is based on a visual inspection of the site and is not a substitute for a visual inspection.

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Topographic & Utility Key			
AV	Air Valve	V	Vent
BH	Borehole	VM	Water Meter
BN	Bus Stop	WM	Water Meter
BSM	Benchmark	WO	Wash Out
BO	Bolt	WV	Water Valve
MA	Manhole	1.00	Depth (m)
BUS	Bus Stop	UTT	Unable to Trace
CCTV	Camera	UTR	Unable to Trace
CU	Column	UTR	Unable to Trace
G	Gully	EDT	End of Trace
EL	Electric Point	(S)	Sonded
EP	Electric Pole	BA	Survey
ER	Earth Rod	AK	Assumed Route
FH	Fire Hydrant	TFR	Taken from
FL	Flag Pole	UTR	Unable to Trace
FP	Flag Pole	UTR	Unable to Trace
GP	Gate Post	UTR	Unable to Trace
GV	Gas Valve	UTR	Unable to Trace
I	Induced	MAR	Man Access
IL	Inset Level	CL	Cover Level
GL	Ground Level	IL	Inset Level
LP	Lamp Post	US	Under/Suff
MH	Manhole	DO	Depth of Cover
MR	Marker	DB	Depth Bottom
RE	Road Edge	PT	Pipe Top
RWP	Road Water	ED	End of Duct
SC	Stop Sign	NVP	No Visible Pipe
SV	Stop Valve	BLKD	Blocked
SVP	Soil Vent Pipe	CR	Cable Riser
TAP	Tap	DC	Drainage
TOF	Top of Fence		
TCW	Top of Wall		
TEL	Telecom Cover		
TL	Threshold Level		
TP	Traffic Light		
TP	Telegraph Pole		

General
This survey has been carried out in accordance with the accuracy band E, as described in BS5936:2008. The survey was carried out in accordance with the accuracy band E, as described in BS5936:2008. The survey was carried out in accordance with the accuracy band E, as described in BS5936:2008.

Drawing units are meters, quoted units are metres.

Grid ticks should be used to check for plotting distortions.

Details or services hidden or obscured by vegetation, debris or vehicles at survey dates may be omitted. Hedge & Vegetation details are outline.

Any assumed details are shown in DASHDOT (dotted).

All arrows point up unless otherwise stated.

Control & Datum Information
All work shown on this drawing is related to Ordnance Survey datum. The datum is based on the datum of the Ordnance Survey datum. The datum is based on the datum of the Ordnance Survey datum. The datum is based on the datum of the Ordnance Survey datum.

The grid shown on this survey is based on Ordnance Survey datum. The datum is based on the datum of the Ordnance Survey datum. The datum is based on the datum of the Ordnance Survey datum. The datum is based on the datum of the Ordnance Survey datum.

All other stations are related to this in plan projection and are not shown unless they are shown in plan projection and are not shown unless they are shown in plan projection.

Layout			
Sheet 1	Sheet 2	Sheet 3	Sheet 4



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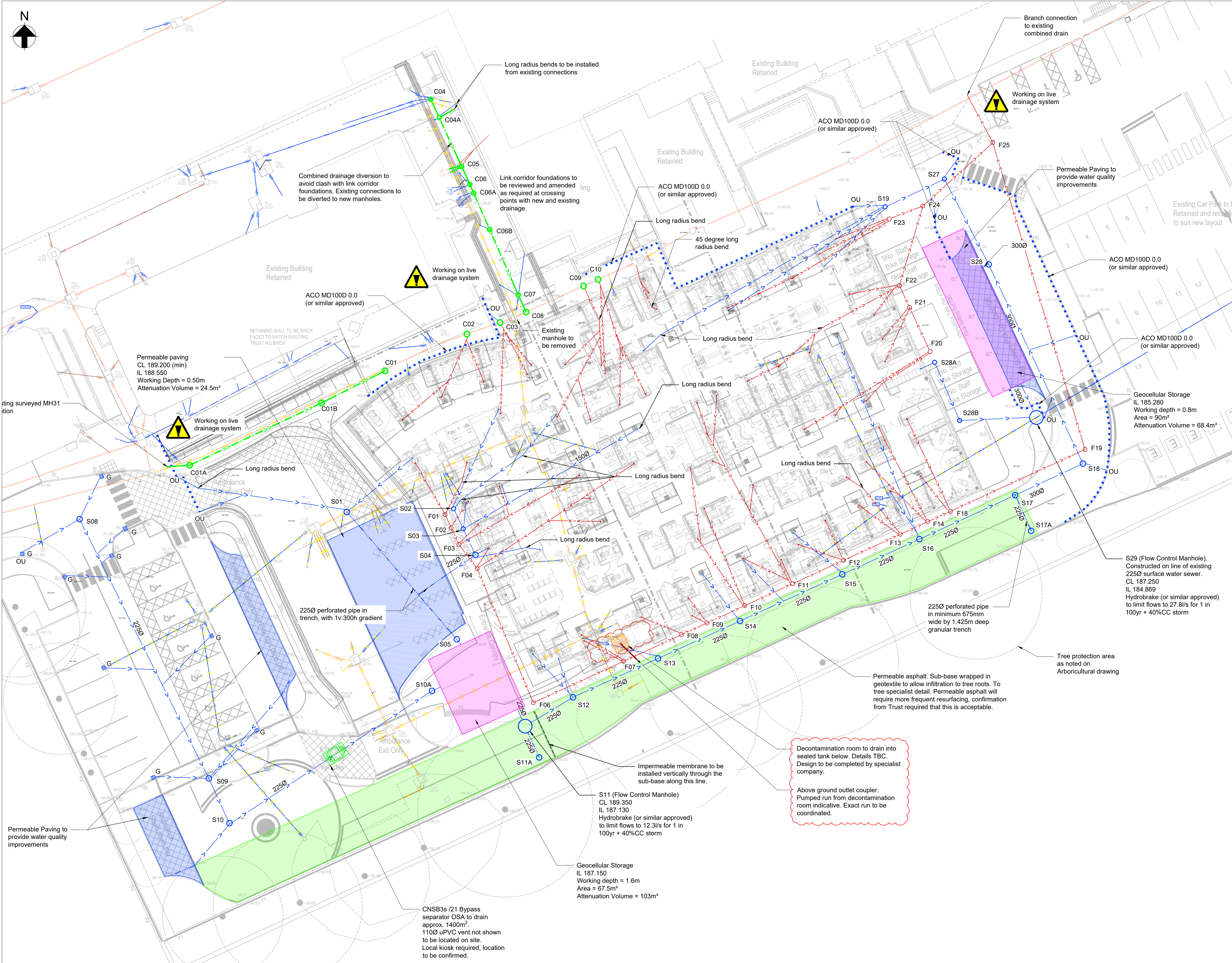
CLIENT
Mott MacDonald

SITE
Hudsonfield Royal Infirmary
Ainslie Street, Hudsonfield HDS 3EA
HDS 3EA

Drawn Title
3D Underground Utilities Survey
Drainage Survey

Drawn By	GR12551-JU-GR	Scale	1:100
Product Ref	GR12551	Sheet	3 of 4
Drawn By	GR12551	Drawn By	GR12551
Checked By	GR12551	Checked By	GR12551

C. Drainage Masterplan



- Notes
1. Do not scale from this drawing. If in doubt, please ask.
 2. Levels in metres above ordnance datum (mAOD).
 3. Proposed drainage designed in accordance with Building Regulations Part H and Sewerage Sector Guidance (SSG) Appendix C.
 4. Existing services based on GR12551-UU-DR Underground Utilities Survey Drainage Survey
 5. Pipe bedding to be Type 'S' unless pipe cover is less than 1.2m; whereupon concrete surround shall be used.
 6. Minimum buried under slab foul gradients to be 1v:40h.
 7. Foul and surface water branch connection require final coordination with foundations. Invert levels of pipework may need minor amendments. Top of foundation levels may also need to be dropped in places.
 8. Class II interceptor or additional SuDS features required to treat runoff from access road.
 9. Refer to manhole schedule for further manhole details including invert levels and cover levels.
 10. RWP & SVP locations based on HG0052-MMD-ED-GF-DR-M-520000 and HG0052-MMD-ED-GF-DR-M-520001. SVP and RWP positions subject to change following final coordination.
 11. Roof drainage to be a gravity based system.
 12. Existing topographical survey not shown for clarity.
 13. All underslab foul pipes 1000Ø, all other foul pipe diameters to be 1500Ø. Surface water pipe diameters 1000Ø below slab, 1500Ø elsewhere unless noted otherwise.

Key to symbols

	Existing Surface Water
	Existing Foul Water
	Existing Combined Water
	Proposed Foul Water
	Proposed Surface Water
	Proposed Combined Water Diversion
	Proposed Linear Drainage
	Proposed Perforated Pipe
	Drainage to be Abandoned
	Linear Drainage Outlet Unit
	Rainwater Pipe (position l.b.c.)
	SVP (position l.b.c.)
	Proposed Geocellular Storage
	Proposed Permeable Paving
	Proposed Permeable Asphalt
	Proposed Surface Water Manhole
	Proposed Foul Water Manhole
	Proposed Combined Water Manhole
	Proposed decontamination tank (details TBC)
	Proposed pumped pipework from decontamination tank (details TBC)
	Proposed Road Gully

Reference drawings

HG0052-IBI-ED-XX-PL-L-700001 IBI External Works Plan
HG0052-MMD-ED-FN-DR-S-000230 Foundation General Arrangement Sheet 1 of 2
HG0052-MMD-ED-FN-DR-S-000231 Foundation General Arrangement Sheet 2 of 2
HG0052-MMD-ED-ZZ-DR-S-001002 Link Corridor General Arrangement
HG0052-MMD-ED-GF-DR-M-520000 Above Ground Drainage Sheet 1 of 2
HG0052-MMD-ED-GF-DR-M-520001 Above Ground Drainage Sheet 2 of 2
GR12551-UU-DR Underground Utilities Survey Drainage Survey
55810_02 Topographical Survey
HG0052-MMD-ED-XX-DR-D-000011 - Drainage Construction Details Sheet 1 of 3
HG0052-MMD-ED-XX-DR-D-000012 - Drainage Construction Details Sheet 2 of 3
HG0052-MMD-ED-XX-DR-D-000013 - Drainage Construction Details Sheet 3 of 3
16285e ME Rev 2 Arboricultural Implications Plan

C02	28/01/2022	JLW	Discharge of Planning Conditions	AJP	YH
C01	22/10/2021	JLW	Enabling Works	AJP	YH
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

FOR CONSTRUCTION

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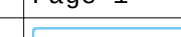
Calderdale and Huddersfield NHS Foundation Trust

Title

Huddersfield Royal Infirmary
Emergency Department
Drainage Masterplan

Designed	J Lea-Wilson	JLW	Eng check	A Precious	AJP
Drawn	J Lea-Wilson	JLW	Coordination	A Precious	AJP
Dwg check	A Precious	AJP	Approved	A Dhorat	AD
MMD Project Number	102983	Scale at A1	1:200	Security	STD
Suitability Description	For Review			Suit. Code	S3
Drawing Number	HG0052-MMD-ED-XX-DR-D-000001			Revision	C02

D. MicroDrainage Calculations

Mott MacDonald		Page 1
Mott MacDonalds House 8-10 Sydenham Road Croydon CR0 2EE, United	HRI ED SW Calcs	
Date 27/01/2022	Designed by J Lea-Wilson	
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Innovyze	Network 2020.1.3	

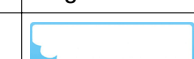
STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

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	1.428	0.047	30.4	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit		
S2.000	19.020	0.795	23.9	0.023	4.00	0.0	0.600	o	100	Pipe/Conduit		
S3.000	16.074	0.785	20.5	0.005	4.00	0.0	0.600	o	100	Pipe/Conduit		
S4.000	9.296	0.093	100.0	0.014	4.00	0.0	0.600	o	100	Pipe/Conduit		
S2.001	11.917	0.036	331.0	0.060	0.00	0.0	0.600	o	225	Pipe/Conduit		
S5.000	11.904	0.119	100.0	0.008	4.00	0.0	0.600	o	100	Pipe/Conduit		

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.01	187.600	0.000	0.0	0.0	0.0	1.83	32.4	0.0
S2.000	50.00	4.20	189.220	0.023	0.0	0.0	0.0	1.58	12.4	4.1
S3.000	50.00	4.16	189.210	0.005	0.0	0.0	0.0	1.71	13.5	0.9
S4.000	50.00	4.20	188.518	0.014	0.0	0.0	0.0	0.77	6.0	2.6
S2.001	50.00	4.48	188.300	0.102	0.0	0.0	0.0	0.71	28.4	18.4
S5.000	50.00	4.26	188.599	0.008	0.0	0.0	0.0	0.77	6.0	1.4

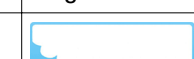
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Mott MacDonalds House 8-10 Sydenham Road Croydon CR0 2EE, United	HRI ED SW Calcs	
Date 27/01/2022 File Huddersfield ED_5.09.MDX	Designed by J Lea-Wilson Checked by A Precious	
Innovyze	Network 2020.1.3	

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
S6.000	15.191	0.152	99.9	0.011	4.00	0.0	0.600	o	100	Pipe/Conduit	
S5.001	2.425	0.024	101.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	2.889	0.023	125.6	0.003	4.00	0.0	0.600	o	100	Pipe/Conduit	
S8.000	0.500	0.008	62.5	0.025	4.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	16.695	0.281	59.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.000	2.055	0.035	58.7	0.006	4.00	0.0	0.600	o	100	Pipe/Conduit	
S8.002	5.626	0.095	59.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S5.002	3.153	0.032	98.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S10.000	7.072	0.071	99.6	0.011	4.00	0.0	0.600	o	100	Pipe/Conduit	
S11.000	1.466	0.015	97.7	0.002	4.00	0.0	0.600	o	100	Pipe/Conduit	
S5.003	7.596	0.035	217.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.002	6.463	0.026	253.0	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)	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)
S6.000	50.00	4.33	188.632	0.011	0.0	0.0	0.0	0.77	6.0	2.0
S5.001	50.00	4.37	188.430	0.019	0.0	0.0	0.0	1.00	17.7	3.4
S7.000	50.00	4.07	188.485	0.003	0.0	0.0	0.0	0.68	5.4	0.5
S8.000	50.00	4.01	188.790	0.025	0.0	0.0	0.0	1.27	22.5	4.5
S8.001	50.00	4.22	188.782	0.025	0.0	0.0	0.0	1.31	23.1	4.5
S9.000	50.00	4.03	188.586	0.006	0.0	0.0	0.0	1.01	7.9	1.0
S8.002	50.00	4.29	188.501	0.030	0.0	0.0	0.0	1.31	23.1	5.5
S5.002	50.00	4.42	188.406	0.052	0.0	0.0	0.0	1.01	17.9	9.3
S10.000	50.00	4.15	188.495	0.011	0.0	0.0	0.0	0.77	6.1	2.0
S11.000	50.00	4.03	188.439	0.002	0.0	0.0	0.0	0.78	6.1	0.4
S5.003	50.00	4.56	188.299	0.065	0.0	0.0	0.0	0.88	35.1	11.8
S2.002	50.00	4.70	188.264	0.167	0.0	0.0	0.0	0.82	32.5	30.2

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Innovyze	Network 2020.1.3	

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
S17.000	7.654	0.765	10.0	0.019	4.00	0.0	0.600	o	100	Pipe/Conduit	
S16.001	0.638	0.064	10.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
S2.007	8.660	0.133	65.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S18.000	7.002	0.500	14.0	0.012	4.00	0.0	0.600	o	100	Pipe/Conduit	
S2.008	9.266	0.183	50.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S19.000	23.050	0.806	28.6	0.017	4.00	0.0	0.600	o	100	Pipe/Conduit	
S20.000	5.261	0.184	28.6	0.013	4.00	0.0	0.600	o	100	Pipe/Conduit	
S19.001	0.747	0.026	28.7	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
S2.009	11.490	0.297	38.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.010	8.186	0.762	10.7	0.044	0.00	0.0	0.600	o	300	Pipe/Conduit	
S21.000	10.740	1.074	10.0	0.000	15.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S17.000	50.00	4.05	188.279	0.019	0.0	0.0	0.0	2.46	19.3	3.5
S16.001	50.00	4.06	187.514	0.026	0.0	0.0	0.0	2.46	19.3	4.7
S2.007	50.00	4.60	186.931	0.038	12.3	0.0	0.0	1.62	64.5	19.1
S18.000	50.00	4.06	187.800	0.012	0.0	0.0	0.0	2.08	16.3	2.2
S2.008	50.00	4.68	186.798	0.049	12.3	0.0	0.0	1.84	73.3	21.2
S19.000	50.00	4.27	187.572	0.017	0.0	0.0	0.0	1.45	11.4	3.1
S20.000	50.00	4.06	186.950	0.013	0.0	0.0	0.0	1.45	11.4	2.4
S19.001	50.00	4.27	186.766	0.031	0.0	0.0	0.0	1.44	11.3	5.5
S2.009	50.00	4.77	186.615	0.080	12.3	0.0	0.0	2.11	83.9	26.8
S2.010	50.00	4.80	186.243	0.124	12.3	0.0	0.0	4.82	340.9	34.8
S21.000	50.00	15.04	186.600	0.000	0.0	0.0	0.0	5.00	353.4	0.0

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HRI ED
SW Calcs

Date 27/01/2022
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Designed by J Lea-Wilson
Checked by A Precious

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Micro Drainage

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
2.000	As Zoned	Default	100	0.010	0.010	0.010
	As Zoned	Default	100	0.013	0.013	0.023
3.000	As Zoned	Default	100	0.005	0.005	0.005
4.000	As Zoned	Default	100	0.014	0.014	0.014
2.001	As Zoned	Default	100	0.060	0.060	0.060
5.000	As Zoned	Default	100	0.008	0.008	0.008
6.000	As Zoned	Default	100	0.011	0.011	0.011
5.001	-	-	100	0.000	0.000	0.000
7.000	As Zoned	Default	100	0.003	0.003	0.003
8.000	As Zoned	Default	100	0.025	0.025	0.025
8.001	-	-	100	0.000	0.000	0.000
9.000	As Zoned	Default	100	0.006	0.006	0.006
8.002	-	-	100	0.000	0.000	0.000
5.002	-	-	100	0.000	0.000	0.000
10.000	As Zoned	Default	100	0.011	0.011	0.011
11.000	As Zoned	Default	100	0.002	0.002	0.002
5.003	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.000	0.000	0.000
12.000	As Zoned	Default	100	0.015	0.015	0.015
	As Zoned	Default	100	0.009	0.009	0.009
	As Zoned	Default	100	0.002	0.002	0.002
	As Zoned	Default	100	0.006	0.006	0.006
	As Zoned	Default	100	0.002	0.002	0.002
	As Zoned	Default	100	0.010	0.010	0.010
	As Zoned	Default	100	0.012	0.012	0.055
12.001	As Zoned	Default	100	0.011	0.011	0.011
	As Zoned	Default	100	0.015	0.015	0.027
12.002	As Zoned	Default	100	0.004	0.004	0.004
12.003	-	-	100	0.000	0.000	0.000
2.004	As Zoned	Default	100	0.037	0.037	0.037
	As Zoned	Default	100	0.009	0.009	0.009
	As Zoned	Default	100	0.012	0.012	0.057
13.000	As Zoned	Default	100	0.002	0.002	0.002
14.000	As Zoned	Default	100	0.002	0.002	0.002
13.001	-	-	100	0.000	0.000	0.000
2.005	-	-	100	0.000	0.000	0.000
15.000	As Zoned	Default	100	0.007	0.007	0.007
2.006	-	-	100	0.000	0.000	0.000
16.000	As Zoned	Default	100	0.007	0.007	0.007
17.000	As Zoned	Default	100	0.019	0.019	0.019
16.001	-	-	100	0.000	0.000	0.000
2.007	-	-	100	0.000	0.000	0.000
18.000	As Zoned	Default	100	0.012	0.012	0.012
2.008	-	-	100	0.000	0.000	0.000
19.000	As Zoned	Default	100	0.017	0.017	0.017
20.000	As Zoned	Default	100	0.013	0.013	0.013
19.001	-	-	100	0.000	0.000	0.000
2.009	-	-	100	0.000	0.000	0.000

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Innovyze		Network 2020.1.3

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
2.010	As Zoned	Default	100	0.010	0.010	0.010
	As Zoned	Default	100	0.034	0.034	0.044
21.000	-	-	100	0.000	0.000	0.000
2.011	As Zoned	Default	100	0.017	0.017	0.017
	As Zoned	Default	100	0.004	0.004	0.004
	As Zoned	Default	100	0.011	0.011	0.031
22.000	As Zoned	Default	100	0.016	0.016	0.016
22.001	-	-	100	0.000	0.000	0.000
23.000	As Zoned	Default	100	0.008	0.008	0.008
24.000	As Zoned	Default	100	0.007	0.007	0.007
22.002	As Zoned	Default	100	0.010	0.010	0.010
	As Zoned	Default	100	0.005	0.005	0.015
22.003	As Zoned	Default	100	0.007	0.007	0.007
2.012	As Zoned	Default	100	0.015	0.015	0.015
25.000	As Zoned	Default	100	0.014	0.014	0.014
25.001	-	-	100	0.000	0.000	0.000
25.002	-	-	100	0.000	0.000	0.000
2.013	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.547	0.547	0.547

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Innovyze		Network 2020.1.3

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S11, DS/PN: S2.004, Volume (m³): 4.8

Unit Reference	MD-SHE-0144-1230-2050-1230
Design Head (m)	2.050
Design Flow (l/s)	12.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	144
Invert Level (m)	187.130
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.050	12.3	Kick-Flo®	1.233	9.7
Flush-Flo™	0.600	12.2	Mean Flow over Head Range	-	10.7

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	5.2	1.200	10.0	3.000	14.7	7.000	22.1
0.200	10.1	1.400	10.3	3.500	15.8	7.500	22.8
0.300	11.3	1.600	10.9	4.000	16.9	8.000	23.5
0.400	11.9	1.800	11.6	4.500	17.9	8.500	24.2
0.500	12.1	2.000	12.1	5.000	18.8	9.000	24.9
0.600	12.2	2.200	12.7	5.500	19.7	9.500	25.6
0.800	12.0	2.400	13.2	6.000	20.5		
1.000	11.4	2.600	13.8	6.500	21.3		

Hydro-Brake® Optimum Manhole: S29, DS/PN: S2.013, Volume (m³): 4.0

Unit Reference	MD-SHE-0225-2750-1211-2750
Design Head (m)	1.211
Design Flow (l/s)	27.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	225
Invert Level (m)	184.869
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

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Innovyze		Network 2020.1.3			
<u>Hydro-Brake® Optimum Manhole: S29, DS/PN: S2.013, Volume (m³): 4.0</u>					
Control Points		Head (m)	Flow (l/s)	Control Points	
Design Point (Calculated)		1.211	27.5	Kick-Flo®	0.861 23.4
Flush-Flo™		0.403	27.5	Mean Flow over Head Range	- 23.3
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)
0.100	7.5	1.200	27.4	3.000	42.5
0.200	22.4	1.400	29.5	3.500	45.8
0.300	27.1	1.600	31.4	4.000	48.9
0.400	27.5	1.800	33.2	4.500	51.7
0.500	27.3	2.000	35.0	5.000	54.4
0.600	26.8	2.200	36.6	5.500	57.0
0.800	24.9	2.400	38.2	6.000	59.5
1.000	25.1	2.600	39.7	6.500	61.8
				7.000	64.1
				7.500	66.3
				8.000	68.4
				8.500	70.4
				9.000	72.4
				9.500	74.4
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Storage Structures for Storm

Porous Car Park Manhole: SSub-base, DS/PN: S2.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	16.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.2
Max Percolation (l/s)	45.3	Slope (1:X)	300.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	188.550	Cap Volume Depth (m)	0.500

Cellular Storage Manhole: S11, DS/PN: S2.004

Invert Level (m)	187.150	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	67.5	0.0	1.601	0.0	0.0
1.600	67.5	0.0			

Cellular Storage Manhole: S29, DS/PN: S2.013

Invert Level (m)	185.280	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	90.0	0.0	0.801	0.0	0.0
0.800	90.0	0.0			

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Synthetic Rainfall Details

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

PN	US/MH	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
	Name							
S1.000	SLinearDrain1	15	Summer	1	+0%			
S2.000	SLinearDrain2	15	Winter	100	+40%			
S3.000	SLinearDrain3	15	Summer	100	+40%			
S4.000	SRWP1	15	Winter	100	+40%			
S2.001	S01	120	Winter	100	+40%	30/15	Summer	
S5.000	SRWP2	15	Winter	100	+40%			
S6.000	SRWP3	15	Winter	100	+40%			
S5.001	S02	120	Winter	100	+40%	30/15	Summer	
S7.000	SRWP4	15	Winter	100	+40%			
S8.000	SRWP5	15	Winter	100	+40%			
S8.001	SB1	15	Winter	100	+40%			
S9.000	SRWP6	15	Winter	100	+40%			
S8.002	SJ2	15	Winter	100	+40%			
S5.002	S03	120	Winter	100	+40%	30/15	Summer	
S10.000	SRWP7	15	Winter	100	+40%			
S11.000	SRWP8	15	Winter	100	+40%			
S5.003	S04	120	Winter	100	+40%	30/15	Summer	
S2.002	SSub-base	120	Winter	100	+40%	30/15	Summer	
S2.003	S05	120	Winter	100	+40%	100/15	Summer	
S12.000	S08	15	Summer	100	+40%			
S12.001	S09	120	Winter	100	+40%	100/120	Summer	

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
S1.000	SLinearDrain1	187.600	-0.150	0.000	0.00			0.0
S2.000	SLinearDrain2	189.320	0.000	0.000	1.05			13.0
S3.000	SLinearDrain3	189.248	-0.062	0.000	0.30			4.1
S4.000	SRWP1	188.618	0.000	0.000	1.43			8.6
S2.001	S01	189.022	0.497	0.000	1.02			23.6
S5.000	SRWP2	188.699	0.000	0.000	0.59			3.6
S6.000	SRWP3	188.732	0.000	0.000	0.93			5.6
S5.001	S02	189.022	0.442	0.000	0.40			4.3
S7.000	SRWP4	188.585	0.000	0.000	0.39			1.6
S8.000	SRWP5	188.940	0.000	0.000	1.47			15.9
S8.001	SB1	188.932	0.000	0.000	0.62			14.2
S9.000	SRWP6	188.686	0.000	0.000	0.46			2.4
S8.002	SJ2	188.651	0.000	0.000	0.78			15.0
S5.002	S03	189.023	0.467	0.000	1.06			11.9
S10.000	SRWP7	188.595	0.000	0.000	1.09			6.6
S11.000	SRWP8	188.539	0.000	0.000	0.53			2.1
S5.003	S04	189.021	0.497	0.000	0.54			15.0
S2.002	SSub-base	189.019	0.530	0.000	1.29		40	38.6
S2.003	S05	189.170	0.707	0.000	0.28			37.8
S12.000	S08	189.814	-0.111	0.000	0.51			42.8
S12.001	S09	189.139	0.154	0.000	0.26			19.0

PN	US/MH Name	Status	Level Exceeded
S1.000	SLinearDrain1	OK*	
S2.000	SLinearDrain2	SURCHARGED*	
S3.000	SLinearDrain3	OK*	
S4.000	SRWP1	SURCHARGED*	
S2.001	S01	SURCHARGED	
S5.000	SRWP2	SURCHARGED*	
S6.000	SRWP3	SURCHARGED*	
S5.001	S02	FLOOD RISK	
S7.000	SRWP4	SURCHARGED*	
S8.000	SRWP5	SURCHARGED*	
S8.001	SB1	SURCHARGED*	
S9.000	SRWP6	SURCHARGED*	
S8.002	SJ2	SURCHARGED*	
S5.002	S03	FLOOD RISK	
S10.000	SRWP7	SURCHARGED*	
S11.000	SRWP8	SURCHARGED*	
S5.003	S04	FLOOD RISK	
S2.002	SSub-base	FLOOD RISK*	
S2.003	S05	FLOOD RISK	
S12.000	S08	OK	

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<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>			
PN	US/MH Name	Status	Level Exceeded
S12.001	S09	SURCHARGED	
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S16.000	SRWP13	188.073	-0.064	0.000	0.28		5.5	OK*
S17.000	SRWP14	188.379	0.000	0.000	0.72		13.9	SURCHARGED*
S16.001	SJ4	187.614	0.000	0.000	2.49		17.5	SURCHARGED*
S2.007	S14	187.079	-0.077	0.000	0.77		39.4	OK
S18.000	SRWP15	187.854	-0.046	0.000	0.57		9.3	OK*
S2.008	S15	186.951	-0.072	0.000	0.79		47.7	OK
S19.000	SRWP16	187.672	0.000	0.000	0.89		10.1	SURCHARGED*
S20.000	SRWP17	187.050	0.000	0.000	0.69		7.9	SURCHARGED*
S19.001	SJ5	186.866	0.000	0.000	1.18		5.3	SURCHARGED*
S2.009	S16	186.786	-0.054	0.000	0.93		66.3	OK
S2.010	S17	186.476	-0.067	0.000	0.43		94.2	OK
S21.000	SSub-base2	186.600	-0.300	0.000	0.00		0.0	OK*
S2.011	S18	186.341	0.560	0.000	1.39		112.0	SURCHARGED
S22.000	SRWP18	187.222	0.000	0.000	2.02		9.1	SURCHARGED*
S22.001	SB2	187.196	0.000	0.000	1.38		8.3	SURCHARGED*
S23.000	SRWP19	187.188	-0.032	0.000	0.80		5.9	OK*
S24.000	SRWP20	186.981	-0.027	0.000	0.88		5.3	OK*
S22.002	S19	186.698	0.448	0.000	1.70		28.5	SURCHARGED
S22.003	S27	186.449	0.286	0.000	0.91		33.0	SURCHARGED
S2.012	S28	186.149	0.529	0.000	0.55		83.5	SURCHARGED
S25.000	SRWP21	186.769	-0.023	0.000	0.95		10.8	OK*
S25.001	S28A	186.523	-0.102	0.000	0.22		10.8	OK
S25.002	S28B	186.112	0.178	0.000	0.10		5.1	SURCHARGED
S2.013	S29	186.109	1.015	0.000	0.84	56	27.8	SURCHARGED

PN	US/MH Name	Level Exceeded
S12.002	S10	
S12.003	S10A	
S2.004	S11	
S13.000	SRWP9	
S14.000	SRWP10	
S13.001	SJ3	
S2.005	S12	
S15.000	SRWP12	
S2.006	S13	
S16.000	SRWP13	
S17.000	SRWP14	
S16.001	SJ4	
S2.007	S14	
S18.000	SRWP15	
S2.008	S15	
S19.000	SRWP16	
S20.000	SRWP17	
S19.001	SJ5	

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<p><u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u></p>		
PN	US/MH Name	Level Exceeded
S2.009	S16	
S2.010	S17	
S21.000	SSub-base2	
S2.011	S18	
S22.000	SRWP18	
S22.001	SB2	
S23.000	SRWP19	
S24.000	SRWP20	
S22.002	S19	
S22.003	S27	
S2.012	S28	
S25.000	SRWP21	
S25.001	S28A	
S25.002	S28B	
S2.013	S29	
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FOUL SEWERAGE DESIGN

Design Criteria for Foul - Unit

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Calculation Method	EN 752	Maximum Backdrop Height (m)	1.500
Frequency Factor	0.70	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

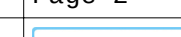
Designed with Level Soffits

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	6.498	0.163	39.9	0.000	4.0	0.0	1.500	o	100	Pipe/Conduit	
F2.000	6.165	0.154	40.0	0.000	1.6	0.0	1.500	o	100	Pipe/Conduit	
F1.001	1.590	0.040	39.8	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F3.000	3.411	0.085	40.1	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F4.000	6.943	0.174	39.9	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F1.002	2.027	0.051	39.7	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F5.000	3.031	0.076	39.9	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	188.463	0.000	0.0	4.0	0.0	28	0.78	1.06	8.3	1.4
F2.000	188.454	0.000	0.0	1.6	0.0	22	0.68	1.05	8.3	0.9
F1.001	188.250	0.000	0.0	5.6	0.0	27	0.78	1.39	24.6	1.7
F3.000	188.345	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F4.000	188.434	0.000	0.0	0.3	0.0	15	0.52	1.06	8.3	0.4
F1.002	188.210	0.000	0.0	6.2	0.0	27	0.80	1.39	24.6	1.7
F5.000	188.285	0.000	0.0	0.3	0.0	15	0.52	1.06	8.3	0.4

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Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F6.000	15.164	0.379	40.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F1.003	3.277	0.081	40.5	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F7.000	2.571	0.064	40.2	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F8.000	6.856	0.171	40.1	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F9.000	0.888	0.022	40.4	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F8.001	4.326	0.108	40.1	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F10.000	5.640	0.141	40.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F8.002	9.418	0.235	40.1	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F1.004	15.900	0.321	49.5	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F1.005	10.856	0.217	50.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F11.000	4.855	0.135	36.0	0.000	2.0	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F6.000	188.588	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F1.003	188.159	0.000	0.0	6.8	0.0	28	0.80	1.38	24.4	1.8
F7.000	188.192	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F8.000	188.643	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F9.000	188.494	0.000	0.0	0.3	0.0	15	0.52	1.05	8.2	0.4
F8.001	188.472	0.000	0.0	0.6	0.0	18	0.58	1.05	8.3	0.5
F10.000	188.505	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F8.002	188.364	0.000	0.0	0.9	0.0	19	0.62	1.05	8.3	0.7
F1.004	188.078	0.000	0.0	8.0	0.0	31	0.77	1.25	22.0	2.0
F1.005	187.757	0.000	0.0	8.0	0.0	31	0.76	1.24	21.9	2.0
F11.000	188.300	0.000	0.0	2.0	0.0	23	0.73	1.11	8.7	1.0

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Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F12.000	5.419	0.135	40.1	0.000	2.0	0.0	1.500	o	100	Pipe/Conduit	
F1.006	6.953	0.193	36.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F13.000	4.806	0.120	40.1	0.000	2.3	0.0	1.500	o	100	Pipe/Conduit	
F1.007	3.058	0.153	20.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F14.000	1.794	0.045	39.9	0.000	2.0	0.0	1.500	o	100	Pipe/Conduit	
F15.000	3.427	0.086	39.8	0.000	3.6	0.0	1.500	o	100	Pipe/Conduit	
F1.008	4.566	0.147	31.1	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F16.000	8.321	0.208	40.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F17.000	0.631	0.016	39.4	0.000	2.0	0.0	1.500	o	100	Pipe/Conduit	
F16.001	8.294	0.207	40.1	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F18.000	11.502	0.288	39.9	0.000	1.6	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F12.000	188.300	0.000	0.0	2.0	0.0	24	0.70	1.05	8.3	1.0
F1.006	187.540	0.000	0.0	12.0	0.0	31	0.91	1.46	25.8	2.4
F13.000	187.517	0.000	0.0	2.3	0.0	24	0.72	1.05	8.3	1.1
F1.007	187.347	0.000	0.0	14.3	0.0	28	1.15	1.97	34.7	2.6
F14.000	187.289	0.000	0.0	2.0	0.0	24	0.70	1.06	8.3	1.0
F15.000	187.330	0.000	0.0	3.6	0.0	27	0.77	1.06	8.3	1.3
F1.008	187.194	0.000	0.0	19.9	0.0	34	1.04	1.58	27.8	3.1
F16.000	187.512	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F17.000	187.320	0.000	0.0	2.0	0.0	23	0.70	1.06	8.3	1.0
F16.001	187.304	0.000	0.0	2.3	0.0	24	0.72	1.05	8.3	1.1
F18.000	187.385	0.000	0.0	1.6	0.0	22	0.68	1.06	8.3	0.9

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Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.009	5.704	0.197	29.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F19.000	0.500	0.013	38.5	0.000	6.0	0.0	1.500	o	100	Pipe/Conduit	
F20.000	3.849	0.096	40.1	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F19.001	1.142	0.029	39.4	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F21.000	5.487	0.137	40.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F19.002	2.659	0.066	40.3	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F22.000	1.521	0.038	40.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F19.003	5.551	0.139	39.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F23.000	2.840	0.071	40.0	0.000	4.3	0.0	1.500	o	100	Pipe/Conduit	
F19.004	8.646	0.215	40.2	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F24.000	5.504	0.138	39.9	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.009	187.047	0.000	0.0	23.8	0.0	35	1.09	1.63	28.8	3.4
F19.000	187.977	0.000	0.0	6.0	0.0	31	0.84	1.08	8.4	1.7
F20.000	188.060	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F19.001	187.964	0.000	0.0	6.3	0.0	31	0.84	1.06	8.3	1.8
F21.000	188.072	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F19.002	187.935	0.000	0.0	6.6	0.0	32	0.84	1.05	8.3	1.8
F22.000	187.907	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
F19.003	187.869	0.000	0.0	6.9	0.0	32	0.84	1.06	8.3	1.8
F23.000	187.801	0.000	0.0	4.3	0.0	29	0.79	1.05	8.3	1.5
F19.004	187.730	0.000	0.0	11.2	0.0	37	0.90	1.05	8.3	2.3
F24.000	187.653	0.000	0.0	0.3	0.0	15	0.52	1.06	8.3	0.4

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Mott MacDonalds House 8-10 Sydenham Road Croydon CR0 2EE, United	HRI ED SW Calcs	
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Innovyze		Network 2020.1.3

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F19.005	0.591	0.015	39.4	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F25.000	2.904	0.073	39.8	0.000	2.0	0.0	1.500	o	100	Pipe/Conduit	
F1.010	6.135	0.227	27.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F26.000	5.188	0.130	39.9	0.000	2.0	0.0	1.500	o	100	Pipe/Conduit	
F27.000	4.771	0.119	40.1	0.000	0.6	0.0	1.500	o	100	Pipe/Conduit	
F1.011	6.829	0.085	80.3	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F28.000	5.523	0.368	15.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F29.000	8.565	0.571	15.0	0.000	0.6	0.0	1.500	o	100	Pipe/Conduit	
F1.012	3.287	0.041	80.2	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F30.000	4.891	0.122	40.1	0.000	3.7	0.0	1.500	o	100	Pipe/Conduit	
F31.000	0.942	0.024	39.3	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F19.005	187.515	0.000	0.0	11.5	0.0	37	0.91	1.06	8.3	2.4
F25.000	187.573	0.000	0.0	2.0	0.0	24	0.70	1.06	8.3	1.0
F1.010	186.850	0.000	0.0	37.3	0.0	38	1.19	1.69	29.9	4.3
F26.000	186.803	0.000	0.0	2.0	0.0	24	0.70	1.06	8.3	1.0
F27.000	186.792	0.000	0.0	0.6	0.0	18	0.58	1.05	8.3	0.5
F1.011	186.623	0.000	0.0	39.9	0.0	52	0.82	0.98	17.3	4.4
F28.000	187.326	0.000	0.0	0.3	0.0	12	0.73	1.72	13.5	0.4
F29.000	187.529	0.000	0.0	0.6	0.0	14	0.82	1.72	13.5	0.5
F1.012	186.538	0.000	0.0	40.8	0.0	52	0.82	0.98	17.3	4.5
F30.000	186.780	0.000	0.0	3.7	0.0	27	0.77	1.05	8.3	1.3
F31.000	186.682	0.000	0.0	0.3	0.0	15	0.53	1.06	8.4	0.4

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Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F30.001	4.450	0.111	40.1	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F32.000	1.647	0.041	40.2	0.000	2.3	0.0	1.500	o	100	Pipe/Conduit	
F32.001	9.901	0.248	39.9	0.000	4.6	0.0	1.500	o	100	Pipe/Conduit	
F1.013	2.732	0.072	37.9	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F33.000	5.029	0.503	10.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F34.000	11.154	1.115	10.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F1.014	16.179	0.468	34.6	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F1.015	34.992	0.257	136.2	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F35.000	2.636	0.264	10.0	0.000	2.3	0.0	1.500	o	100	Pipe/Conduit	
F35.001	6.236	0.624	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F36.000	4.902	0.409	12.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F37.000	1.291	0.108	12.0	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
F36.001	11.242	0.937	12.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F30.001	186.658	0.000	0.0	4.0	0.0	28	0.78	1.05	8.3	1.4
F32.000	186.836	0.000	0.0	2.3	0.0	24	0.72	1.05	8.3	1.1
F32.001	186.795	0.000	0.0	6.9	0.0	32	0.84	1.06	8.3	1.8
F1.013	186.497	0.000	0.0	51.7	0.0	46	1.11	1.43	25.2	5.0
F33.000	186.978	0.000	0.0	0.3	0.0	11	0.84	2.11	16.6	0.4
F34.000	187.590	0.000	0.0	0.3	0.0	11	0.84	2.11	16.6	0.4
F1.014	186.425	0.000	0.0	52.3	0.0	45	1.15	1.49	26.4	5.1
F1.015	185.957	0.000	0.0	52.3	0.0	64	0.70	0.75	13.3	5.1
F35.000	187.288	0.000	0.0	2.3	0.0	17	1.16	2.12	16.6	1.1
F35.001	187.024	0.000	0.0	2.3	0.0	17	1.16	2.11	16.6	1.1
F36.000	187.746	0.000	0.0	0.3	0.0	11	0.79	1.93	15.2	0.4
F37.000	187.445	0.000	0.0	0.3	0.0	11	0.79	1.93	15.2	0.4
F36.001	187.337	0.000	0.0	0.6	0.0	13	0.88	1.93	15.2	0.5

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Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F35.002	5.319	0.133	40.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F38.000	6.531	0.553	11.8	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F39.000	4.524	0.414	10.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F35.003	2.634	0.066	40.0	0.000	7.0	0.0	1.500	o	150	Pipe/Conduit	
F40.000	4.108	0.411	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F41.000	0.500	0.050	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F40.001	4.952	0.495	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F42.000	2.086	0.209	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F40.002	1.102	0.110	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F40.003	8.947	0.895	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F43.000	3.661	0.366	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F35.002	186.350	0.000	0.0	2.9	0.0	23	0.71	1.39	24.5	1.2
F38.000	186.820	0.000	0.0	0.0	0.0	0	0.00	1.94	15.3	0.0
F39.000	186.681	0.000	0.0	0.0	0.0	0	0.00	2.02	15.9	0.0
F35.003	186.217	0.000	0.0	9.9	0.0	31	0.85	1.39	24.5	2.2
F40.000	188.174	0.000	0.0	0.0	0.0	0	0.00	2.11	16.6	0.0
F41.000	187.813	0.000	0.0	0.0	0.0	0	0.00	2.11	16.6	0.0
F40.001	187.763	0.000	0.0	0.0	0.0	0	0.00	2.11	16.6	0.0
F42.000	187.477	0.000	0.0	0.0	0.0	0	0.00	2.12	16.6	0.0
F40.002	187.268	0.000	0.0	0.0	0.0	0	0.00	2.11	16.6	0.0
F40.003	187.158	0.000	0.0	0.0	0.0	0	0.00	2.11	16.6	0.0
F43.000	186.629	0.000	0.0	0.0	0.0	0	0.00	2.11	16.6	0.0

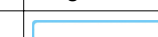
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Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F40.004	0.619	0.062	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F44.000	5.567	0.557	10.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F35.004	9.055	0.322	28.1	0.000	1.8	0.0	1.500	o	150	Pipe/Conduit	
F45.000	6.189	0.155	39.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F46.000	8.566	0.214	40.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F47.000	4.138	0.103	40.2	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F47.001	4.453	0.111	40.1	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F47.002	11.564	0.289	40.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
F45.001	3.929	0.311	12.6	0.000	5.2	0.0	1.500	o	150	Pipe/Conduit	
F35.005	10.313	0.129	79.9	0.000	9.9	0.0	1.500	o	150	Pipe/Conduit	
F1.016	5.978	0.040	149.5	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F40.004	186.263	0.000	0.0	0.0	0.0	0	0.00	2.12	16.6	0.0
F44.000	186.758	0.000	0.0	0.0	0.0	0	0.00	2.11	16.6	0.0
F35.004	186.151	0.000	0.0	11.7	0.0	29	0.99	1.66	29.3	2.4
F45.000	186.649	0.000	0.0	0.0	0.0	0	0.00	1.06	8.3	0.0
F46.000	186.708	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
F47.000	186.996	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
F47.001	186.893	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
F47.002	186.782	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
F45.001	186.140	0.000	0.0	5.2	0.0	20	1.15	2.47	43.7	1.6
F35.005	185.829	0.000	0.0	26.8	0.0	47	0.77	0.98	17.3	3.6
F1.016	185.700	0.000	0.0	79.1	0.0	74	0.71	0.72	12.6	6.2

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FOUL SEWERAGE DESIGN

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
C1.000	3.871	0.097	40.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C1.001	15.927	0.400	39.8	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C1.002	7.868	0.198	39.7	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C1.003	5.816	0.146	39.8	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C1.004	3.905	0.474	8.2	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C2.000	1.857	0.050	37.1	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
C3.000	6.496	0.175	37.1	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
C2.001	4.963	0.133	37.3	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C4.000	4.952	0.133	37.2	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

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Network Design Table for Combined

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
C2.002	0.641	0.017	37.7	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C1.005	3.835	0.468	8.2	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C5.000	4.884	0.122	40.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C6.000	4.268	0.107	39.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C5.001	0.705	0.018	39.2	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C7.000	9.255	0.236	39.2	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C5.002	0.798	0.020	39.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C1.006	3.060	0.218	14.0	0.009	0.0	0.0	1.500	o	225	Pipe/Conduit	
C8.000	2.197	0.011	199.7	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
C8.001	5.879	0.029	202.7	0.003	0.0	0.0	1.500	o	150	Pipe/Conduit	
C8.002	2.154	0.040	53.9	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
C8.003	1.042	0.024	43.4	0.002	0.0	0.0	1.500	o	150	Pipe/Conduit	
C8.004	4.329	0.101	42.9	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
C2.002	188.367	0.000	0.0	0.9	0.0	19	0.63	1.09	8.5	0.7
C1.005	187.946	0.000	0.0	0.9	0.0	11	0.95	4.02	160.0	0.7
C5.000	187.763	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
C6.000	187.748	0.000	0.0	0.0	0.0	0	0.00	1.06	8.3	0.0
C5.001	187.641	0.000	0.0	0.0	0.0	0	0.00	1.07	8.4	0.0
C7.000	187.859	0.000	0.0	0.0	0.0	0	0.00	1.06	8.4	0.0
C5.002	187.623	0.000	0.0	0.0	0.0	0	0.00	1.06	8.3	0.0
C1.006	187.478	0.009	0.0	0.9	0.0	12	0.79	3.07	122.2	0.7
C8.000	187.770	0.000	0.0	0.0	0.0	0	0.00	0.62	10.9	0.0
C8.001	187.759	0.003	0.0	0.0	0.0	0	0.00	0.61	10.8	0.0
C8.002	187.730	0.003	0.0	0.0	0.0	0	0.00	1.20	21.1	0.0
C8.003	187.690	0.005	0.0	0.0	0.0	0	0.00	1.33	23.5	0.0
C8.004	187.666	0.005	0.0	0.0	0.0	0	0.00	1.34	23.7	0.0

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Innovyze		Network 2020.1.3

Network Design Table for Combined

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
C8.005	7.817	0.182	42.9	0.003	0.0	0.0	1.500	o	150	Pipe/Conduit	
C8.006	2.037	0.048	42.4	0.004	0.0	0.0	1.500	o	150	Pipe/Conduit	
C1.007	6.897	0.257	26.8	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C9.000	1.350	0.034	39.7	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C10.000	7.338	0.183	40.1	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C9.001	0.644	0.017	37.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C11.000	8.740	0.219	39.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C9.002	1.336	0.033	40.5	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C12.000	4.518	0.113	40.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C9.003	5.558	0.139	40.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C1.008	1.742	0.071	24.5	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C13.000	4.546	0.379	12.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
C8.005	187.565	0.008	0.0	0.0	0.0	0	0.00	1.34	23.7	0.0
C8.006	187.383	0.012	0.0	0.0	0.0	0	0.00	1.35	23.8	0.0
C1.007	187.260	0.022	0.0	0.9	0.0	14	0.64	2.22	88.3	0.7
C9.000	188.641	0.000	0.0	0.0	0.0	0	0.00	1.06	8.3	0.0
C10.000	188.790	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
C9.001	188.607	0.000	0.0	0.0	0.0	0	0.00	1.08	8.5	0.0
C11.000	188.808	0.000	0.0	0.0	0.0	0	0.00	1.06	8.3	0.0
C9.002	188.590	0.000	0.0	0.0	0.0	0	0.00	1.05	8.2	0.0
C12.000	188.670	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
C9.003	188.557	0.000	0.0	0.0	0.0	0	0.00	1.05	8.3	0.0
C1.008	187.003	0.022	0.0	0.9	0.0	14	0.66	2.32	92.4	0.7
C13.000	188.298	0.000	0.0	0.0	0.0	0	0.00	1.93	15.2	0.0

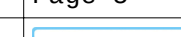
Mott MacDonald		Page 4
Mott MacDonalds House 8-10 Sydenham Road Croydon CR0 2EE, United	HRI ED SW Calcs	
Date 27/01/2022 File Huddersfield ED_5.09.MDX	Designed by J Lea-Wilson Checked by A Precious	
Innovyze		Network 2020.1.3

Network Design Table for Combined

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
C14.000	8.173	0.752	10.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C13.001	4.994	0.416	12.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C15.000	2.368	0.197	12.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C16.000	7.275	0.606	12.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C15.001	5.617	0.467	12.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C13.002	0.762	0.064	11.9	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C1.009	4.866	0.172	28.3	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
C17.000	0.553	0.014	39.5	0.000	0.3	0.0	1.500	o	100	Pipe/Conduit	
C17.001	3.082	0.077	40.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	
C18.000	1.506	0.038	39.6	0.000	1.3	0.0	1.500	o	100	Pipe/Conduit	
C17.002	2.406	0.060	40.0	0.000	0.0	0.0	1.500	o	100	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
C14.000	188.600	0.000	0.0	0.0	0.0	0	0.00	2.03	15.9	0.0
C13.001	187.919	0.000	0.0	0.0	0.0	0	0.00	1.93	15.1	0.0
C15.000	188.167	0.000	0.0	0.0	0.0	0	0.00	1.93	15.1	0.0
C16.000	188.576	0.000	0.0	0.0	0.0	0	0.00	1.93	15.1	0.0
C15.001	187.970	0.000	0.0	0.0	0.0	0	0.00	1.93	15.1	0.0
C13.002	187.503	0.000	0.0	0.0	0.0	0	0.00	1.94	15.2	0.0
C1.009	186.932	0.022	0.0	0.9	0.0	14	0.62	2.16	86.0	0.7
C17.000	187.732	0.000	0.0	0.3	0.0	15	0.53	1.06	8.3	0.4
C17.001	187.718	0.000	0.0	0.3	0.0	15	0.52	1.05	8.3	0.4
C18.000	187.679	0.000	0.0	1.3	0.0	21	0.66	1.06	8.3	0.8
C17.002	187.641	0.000	0.0	1.6	0.0	22	0.68	1.05	8.3	0.9

Mott MacDonald		Page 5
Mott MacDonalds House 8-10 Sydenham Road Croydon CR0 2EE, United	HRI ED SW Calcs	
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Network Design Table for Combined

Network Results Table

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<div>Area Summary for Combined</div> <table><thead><tr><th>Pipe Number</th><th>Gross Area (ha)</th><th>Pipe Total (ha)</th></tr></thead><tbody><tr><td>1.000</td><td>0.000</td><td>0.000</td></tr><tr><td>1.001</td><td>0.000</td><td>0.000</td></tr><tr><td>1.002</td><td>0.000</td><td>0.000</td></tr><tr><td>1.003</td><td>0.000</td><td>0.000</td></tr><tr><td>1.004</td><td>0.000</td><td>0.000</td></tr><tr><td>2.000</td><td>0.000</td><td>0.000</td></tr><tr><td>3.000</td><td>0.000</td><td>0.000</td></tr><tr><td>2.001</td><td>0.000</td><td>0.000</td></tr><tr><td>4.000</td><td>0.000</td><td>0.000</td></tr><tr><td>2.002</td><td>0.000</td><td>0.000</td></tr><tr><td>1.005</td><td>0.000</td><td>0.000</td></tr><tr><td>5.000</td><td>0.000</td><td>0.000</td></tr><tr><td>6.000</td><td>0.000</td><td>0.000</td></tr><tr><td>5.001</td><td>0.000</td><td>0.000</td></tr><tr><td>7.000</td><td>0.000</td><td>0.000</td></tr><tr><td>5.002</td><td>0.000</td><td>0.000</td></tr><tr><td>1.006</td><td>0.009</td><td>0.009</td></tr><tr><td>8.000</td><td>0.000</td><td>0.000</td></tr><tr><td>8.001</td><td>0.003</td><td>0.003</td></tr><tr><td>8.002</td><td>0.000</td><td>0.000</td></tr><tr><td>8.003</td><td>0.002</td><td>0.002</td></tr><tr><td>8.004</td><td>0.000</td><td>0.000</td></tr><tr><td>8.005</td><td>0.003</td><td>0.003</td></tr><tr><td>8.006</td><td>0.004</td><td>0.004</td></tr><tr><td>1.007</td><td>0.000</td><td>0.000</td></tr><tr><td>9.000</td><td>0.000</td><td>0.000</td></tr><tr><td>10.000</td><td>0.000</td><td>0.000</td></tr><tr><td>9.001</td><td>0.000</td><td>0.000</td></tr><tr><td>11.000</td><td>0.000</td><td>0.000</td></tr><tr><td>9.002</td><td>0.000</td><td>0.000</td></tr><tr><td>12.000</td><td>0.000</td><td>0.000</td></tr><tr><td>9.003</td><td>0.000</td><td>0.000</td></tr><tr><td>1.008</td><td>0.000</td><td>0.000</td></tr><tr><td>13.000</td><td>0.000</td><td>0.000</td></tr><tr><td>14.000</td><td>0.000</td><td>0.000</td></tr><tr><td>13.001</td><td>0.000</td><td>0.000</td></tr><tr><td>15.000</td><td>0.000</td><td>0.000</td></tr><tr><td>16.000</td><td>0.000</td><td>0.000</td></tr><tr><td>15.001</td><td>0.000</td><td>0.000</td></tr><tr><td>13.002</td><td>0.000</td><td>0.000</td></tr><tr><td>1.009</td><td>0.000</td><td>0.000</td></tr><tr><td>17.000</td><td>0.000</td><td>0.000</td></tr><tr><td>17.001</td><td>0.000</td><td>0.000</td></tr><tr><td>18.000</td><td>0.000</td><td>0.000</td></tr><tr><td>17.002</td><td>0.000</td><td>0.000</td></tr><tr><td>1.010</td><td>0.000</td><td>0.000</td></tr><tr><td></td><td>Total</td><td>Total</td></tr><tr><td></td><td>0.022</td><td>0.022</td></tr></tbody></table>			Pipe Number	Gross Area (ha)	Pipe Total (ha)	1.000	0.000	0.000	1.001	0.000	0.000	1.002	0.000	0.000	1.003	0.000	0.000	1.004	0.000	0.000	2.000	0.000	0.000	3.000	0.000	0.000	2.001	0.000	0.000	4.000	0.000	0.000	2.002	0.000	0.000	1.005	0.000	0.000	5.000	0.000	0.000	6.000	0.000	0.000	5.001	0.000	0.000	7.000	0.000	0.000	5.002	0.000	0.000	1.006	0.009	0.009	8.000	0.000	0.000	8.001	0.003	0.003	8.002	0.000	0.000	8.003	0.002	0.002	8.004	0.000	0.000	8.005	0.003	0.003	8.006	0.004	0.004	1.007	0.000	0.000	9.000	0.000	0.000	10.000	0.000	0.000	9.001	0.000	0.000	11.000	0.000	0.000	9.002	0.000	0.000	12.000	0.000	0.000	9.003	0.000	0.000	1.008	0.000	0.000	13.000	0.000	0.000	14.000	0.000	0.000	13.001	0.000	0.000	15.000	0.000	0.000	16.000	0.000	0.000	15.001	0.000	0.000	13.002	0.000	0.000	1.009	0.000	0.000	17.000	0.000	0.000	17.001	0.000	0.000	18.000	0.000	0.000	17.002	0.000	0.000	1.010	0.000	0.000		Total	Total		0.022	0.022
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