

FLOOD RISK & DRAINAGE IMPACT ASSESSMENT

FOR

PROPOSED RETIREMENT LIVING
DEVELOPMENT

AT

LAND OFF HUYTON LANE, HUYTON,
LIVERPOOL.

ON BEHALF OF

McCARTHY STONE
Life, well lived

Project ref:	29652/DIA/WOB
Date First Issued:	07 th February 2023
Issue:	01
Revision Date:	N/A
Prepared by:	W. Brown
Checked by:	J. Collins BSc. (Hons), MCIWEM.

GGP Consult
2 Hallam Road
Priory Park East
Hull
HU4 7DY
United Kingdom

Tel:	+44 (0) 1482 627963
Fax:	+44 (0) 1482 641736
Email:	willbrown@ggpconsult.co.uk
Website:	www.ggpconsult.co.uk

CONTENTS

1. Introduction
2. Description of Existing Site
 - 2.1 Description of Existing Drainage
3. Proposed Site
 - 3.1 Development Flood Risk Vulnerability
4. Design Philosophy
5. Proposed Site Drainage
6. Point of Discharge
 - 6.1 Interception Storage
 - 6.2 Water Quality
 - 6.3 Peak Flow Rate & Volume Control
 - 6.3.1 Brownfield Site
7. Construction Design Elements
 - 7.1 Water Quality Treatment
 - 7.2 Functionality of the Design
8. Maintenance
9. Attenuation Summary

APPENDICES

- I Existing Site Location Plan
- II Existing Impermeable Area
- III Existing Drainage Plan
- IV Topographical Survey
- V Proposed Site Plan
- VI Proposed Landscaping Plan
- VII Proposed Surface Water Drainage Layout
- VIII Proposed Foul Water Drainage Layout
- IX Proposed Impermeable Area Layout
- X 1:100 Year Storm Event +40% CC (5l/s)
- XI 1:30 Year Storm Event +40% CC (5l/s)
- XII 1:1 Year Storm Event +40% CC (5l/s)

Document Revision Box			
Revision	Date	Description	Author
01	6 th February '23	First issued	WOB

1.0 Introduction

GGP Consult has been instructed by McCarthy Stone to prepare a flood risk & drainage impact assessment for the proposed retirement living development on land off Huyton Lane, Huyton, Liverpool.

The following assessment will detail how the proposed development will drain surface and foul water from the site with consideration to the National Planning Policy Framework (NPPF).

2.0 Description of Existing Site

The site is located within Huyton, east of the city of Liverpool. The site is on the boundary of a Jobcentre, Asda Supercentre & residential developments.

The site has an area of 3,717m² and is mostly impermeable. The site is partly occupied, with 'Huyton Ambulance Station' which is due to be demolished. The site is bound to the north by Huyton Lane, to the east by a Residential housing, to the west by Lathom Road & Huyton Jobcentre and to the south by an Asda superstore.

Approximately, the grid reference for the site is SJ 44385 91111.

Refer to Appendix I for the Existing Site Location Plan.

Refer to Appendix II for the Existing Impermeable Area.

The site has an average existing level of 36.000m.

2.1 Description of Existing Site Drainage

The existing site is positively drained; a full understanding of the site's existing drainage is known and understood.

A topographical survey was carried out at the site within July 2022, from this a combined manhole has been located to the east.

Refer to Appendix III for the Existing Drainage Plan.

Refer to Appendix IV for the Topographical Survey.

Further looking into the location of the existing manhole further CCTV surveys were carried out to confirm that the existing manhole is a private combined chamber which forms a connection into the existing adoptable system within Huyton Lane. This pipe has been confirmed to be at a diameter of 150mm..

Additionally, a United Utilities Combined system is located to the northwest of the site within Huyton Lane.

3.0 Proposed Site

It is proposed to develop a McCarthy Stone Retirement Living Development. This is to be accompanied by a car park which includes 22 spaces 2 of these being disabled bays. All of these bays are to be dual EV charging points.

Refer to Appendix V for the Proposed Site Plan.

Refer to Appendix VI for the Proposed Landscaping Plan.

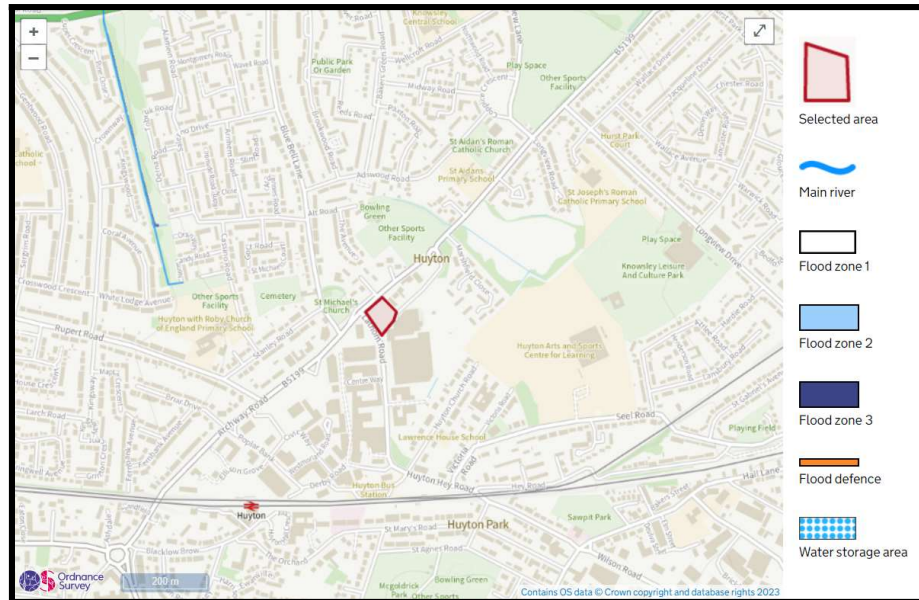
The living complex will have a FFL of 35.850m AOD.

The Buggy Store & Bin Store will have a FFL of 35.800m AOD

3.1 Development Flood Risk Vulnerability

In accordance with the NPPF flood risk vulnerability classification, the proposed development is classified as a 'more vulnerable' development.

The site is entirely located within flood zone 1, as shown in the below Environment Agency flood risk map. This means the site has a less than 1:1000 annual probability of river and sea flooding.

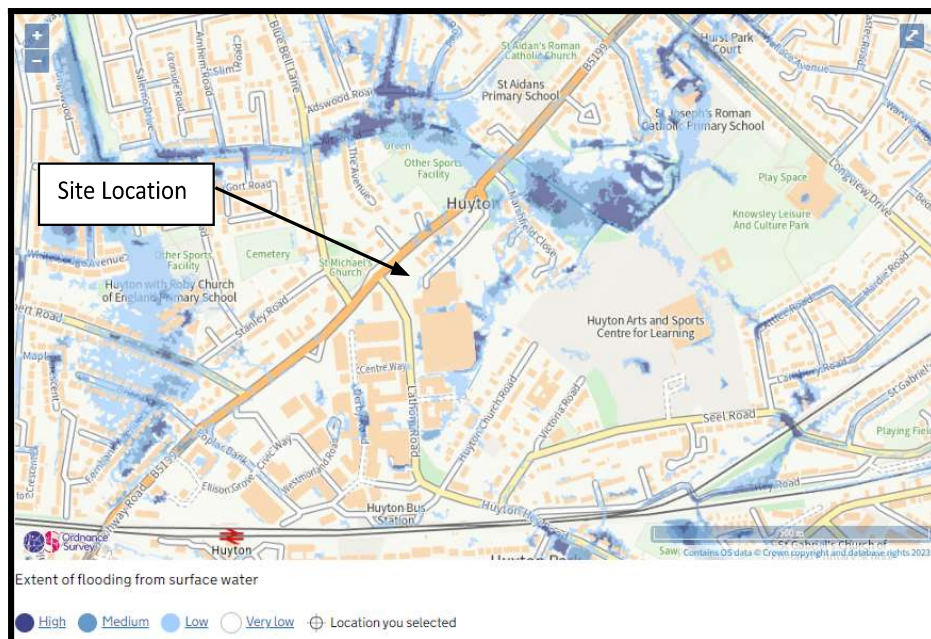


Environment Agency Flood Risk Zone Map

As per table 3 of the NPPF, all developments with a 'more vulnerable' classification proposed within flood zone 1 are acceptable.

Additionally, as shown in the below Environment Agency flood risk map, the entire site is at 'low' risk of surface water flooding, meaning the site has between a 0.1% & 1% annual probability of surface water flooding.

Therefore, flood risk to the site is considered negligible and the proposal is deemed acceptable.



Environment Agency Surface Water Flood Risk Map

4.0 Design Philosophy

Part H of the Building Regulations details a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to infiltration system, watercourse, surface water sewer & combined sewer in that priority order.

Ground investigation has been carried out for the development site by engineering consultant Patrick Parson, which confirm soakaways will be unsuitable

'Based on the extent of cohesive natural strata across the site, as well as the shallow groundwater encountered, it is considered that a soakaway drainage strategy will not be suitable for the proposed development.'

The closest watercourse is located 0.3km to the northeast of the site; this has been identified as 'River Alt'.

As the connection into the river located to the northeast of the site is unfeasible, it is proposed that the drainage systems be discharged into the private combined system within the site which discharges into Huyton Lane.

Therefore, it is proposed to discharge into the existing private combined water system.

5.0 Proposed Site Drainage

As mentioned within section 4.0, it is proposed to discharge into the existing private combined water system within the site located to the north, where the existing system forms a connection into the Adoptable sewer with Huyton Road.

It is proposed to discharge through a HydroBrake from the development at a rate of 5l/s.

In accordance with local drainage standards, a 40% climate change allowance will be applied to the calculations.

The existing site has an impermeable area of 3,115m² and is discharged at an unknown rate, note that the following discharge route has been finalised and fully understood, further CCTV surveys were undertaken within the site in regards to the private combined sewer.

Surface water from the development is to be collected by a series of chambers, gullies, ACO's and pipes where it will be brought into the car park area and discharged into a cellular storage system.

Surface water runoff from the carpark will be collected by several ACO channels and a gully located in the carpark and discharged into a Klargestor NSBP003 Bypass Separator before discharging into the proposed attenuation tank.

A Wavin AquaCell Core-R cellular storage system is to be used. This will be designed to contain 88.7m³ of runoff at 95% voids. This has been designed to contain the 1:100 year + 40% CC below ground. Refer to section 6.0 for calculation details.

The tank will discharge into a Hydro-Brake flow control chamber located to the southeast of the tank where the site runoff will be restricted to 5l/s. This is to have a design head of 1.050m AOD and to be fitted with a catchpit.

This is to discharge into an existing combined manhole within the site. A connection will be formed within the existing manhole where the existing pipe runs to the north into the existing adoptable 225mm diameter sewer within Huyton Lane.

Refer to Appendix VII for the Proposed Surface Water Drainage Layout.

Foul water from the development is to be collected through a series of soil vent pipes, sewers and manhole chambers. This will be brought to the southeast of the site where it will discharge into the existing combined manhole located to the north of the site.

Refer to Appendix VIII for the Proposed Foul Water Drainage Layout.

6.0 Point of Discharge

6.1 Interception Storage

- a) Preliminary calculations have been undertaken in accordance with “SUDS Manual 2015, Section 24.8, simple approaches to interception delivery and compliance assessment”.

The proposed site does not incorporate rainwater harvesting, infiltration, permeable paving, or other suitable SUDS components.

6.2 Water Quality

Define pollution hazard indices – see below tables

TABLE 4.3 Minimum water quality management requirements for discharges to receiving surface waters and groundwater			
Land use	Pollution hazard level	Requirements for discharge to surface waters, including coasts and estuaries ²	Requirements for discharge to groundwater
Residential roofs	Very low	Removal of gross solids and sediments only	
Individual property driveways, roofs (excluding residential), residential car parks, low traffic roads (eg cul de sacs, home zones, general access roads), non-residential car parking with infrequent change (eg schools, offices)	Low	Simple index approach ³ Note: extra measures may be required for discharges to protected resources ⁴	
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	Simple index approach ³ Note: extra measures may be required for discharges to protected resources ⁴	Simple index approach ³ Note: extra measures may be required for discharges to protected resources ⁴ In England and Wales, Risk Screening ⁴ must be undertaken first to determine whether consultation with the environmental regulator is required. In Northern Ireland, the need for risk screening should be agreed with the environmental regulator.
Trunk roads and motorways	High	Follow the guidance and risk assessment process set out in HA (2009)	
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured, industrial sites	High	Discharges may require an environmental licence or permit ⁵ . Obtain pre-permitting advice from the environmental regulator. Risk assessment is likely to be required ⁶ .	

Pollution Hazard Level is ‘Low’.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ²	High	0.8 ³	0.8 ³	0.9 ³

Pollution Hazard Level is 'Low'.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Mitigation indices ¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

As the site hardstanding is over 800m², mitigation measures are required. Therefore, the site will use a 'Proprietary treatment system'.

6.3 **Peak Flow Rate & Volume Control**

6.3.1 **Brownfield Site**

- a) As existing the site is entirely brownfield.

Catchment areas can be defined as follows,

Catchment Areas

Existing

Total Existing Impermeable Area	= 3,115m ²
Total Existing Permeable Area	= 602m ²
Total Site Area	= 3,717m²

Proposed

Proposed Impermeable Car Park Aisle Area	= 602m ²
Proposed Impermeable Building Area	= 963m ²
Proposed Impermeable Path Area	= 227m ²
Proposed Impermeable Patio Area	= 90m ²
Proposed Impermeable Hardstanding Area	= 35m ²
Total Impermeable Area	= 1,926m²
Proposed Permeable Ground Area	= 1,791m ²
Total Permeable Area	= 1,791m²

Refer to Appendix IX for the Proposed Impermeable Area Layout

- b) The following MicroDrainage output are based on a hydrobrake set to 5.0l/s at 1.050m Head and an attenuation volume of 86.1m³

Additional parameter within the model are;

Ground Level	= 35.220m AOD
Tank Invert Level	= 33.700m AOD
Area	= 116m ²
Length	= 22m
Depth	= 0.80m
Void Ratio	= 0.95%
Total Impermeable Area	= 0.193ha

Tank or Pond Structure

Cover Level (m)	95.220	Storage is	Online
		Dividing Weir Level (m)	0.000

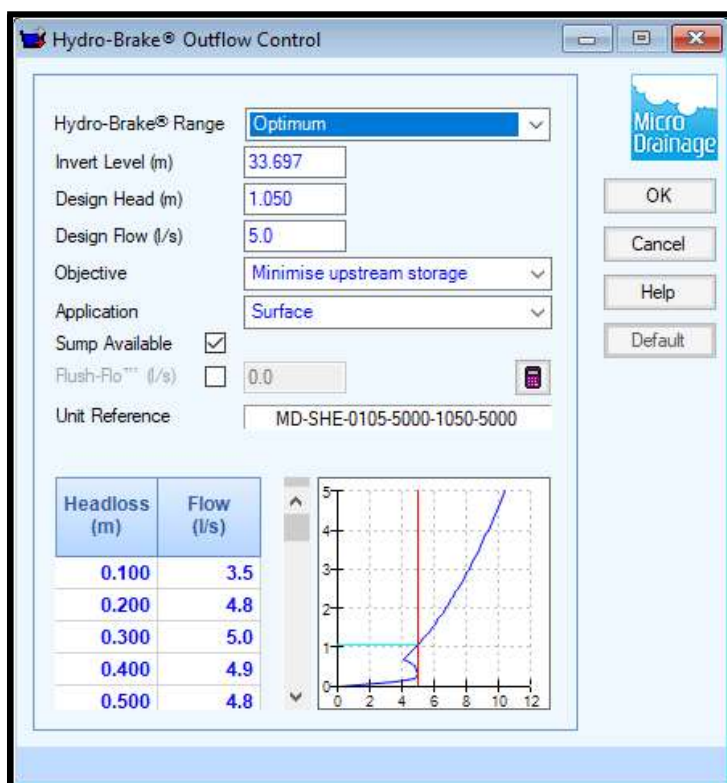
Invert Level (m)	33.700	
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Depth (m)	Area (m^2)
0.000	160.0
0.800	160.0
0.801	1.0
1.520	1.0

Scale Factor (%)	
0.1m	0 ▾
0.2m	Scale
0.4m	⌵
Clear	Repeat

Enter Cover Level between -9999.999 and 9999.999

Extract from Source Control – Showing Model Tank Parameters



Extract from Source Control – Showing Model Flow Control Parameters

- c) The below table identifies the storage structure along with drain downtime for the 1:100 yr. 6hr event + 40% CC.

The below results are a summary taken from the MicroDrainage Model.

Structure Name	Cover Level	Max Water Level	Peak Discharge Rate (l/s)	Above Ground Flooding	Flooding Depth
SW Tank	35.220m AOD	34.238m AOD (360 Winter)	5.0l/s	0.0m ³	0mm

See Appendix X for full MicroDrainage calculations for the above.

- d) The below table identifies the storage structure along with drain downtime for the 1:1 yr. event + 40% CC.

The below results are a summary taken from the MicroDrainage Model.

Structure Name	Cover Level	Max Water Level	Peak Discharge Rate (l/s)	Above Ground Flooding	Flooding Depth
SW Tank	35.220m AOD	33.837m AOD (120 Winter)	4.5l/s	0.0m ³	0mm

As shown above, all flows up to and including the 1:1-year storm event can be contained below ground. See Appendix XII for full MicroDrainage calculations for the above.

- e) The below table identifies the storage structure along with drain downtime for the 1:30 yr. event + 40% CC.

The below results are a summary taken from the MicroDrainage Model.

Structure Name	Cover Level	Max Water Level	Peak Discharge Rate (l/s)	Above Ground Flooding	Flooding Depth
SW Tank	35.220m AOD	34.080m AOD (120 Winter)	5.0l/s	0.0m ³	0mm

As shown above, all flows up to and including the 1:30-year storm event can be contained below ground. See Appendix XI for full MicroDrainage calculations for the above.

- f) The below table identifies the storage structure along with drain downtime for the 1:100 yr. event + 40% CC.

The below results are a summary taken from the MicroDrainage Model.

Structure Name	Cover Level	Max Water Level	Peak Discharge Rate (l/s)	Above Ground Flooding	Flooding Depth
SW Tank	35.220m AOD	34.238m AOD (120 Winter)	5.0l/s	0.0m ³	0mm

As shown above, no above-ground flooding occurs during the 1:100 year storm event +40 CC.

Refer to Appendix X for full MicroDrainage calculations for the above.

As shown above, all flows up to and including the 1:100 year storm event +40% CC can be contained below ground.

7.0 Construction Design Elements

- All chambers discharging directly to attenuation structures should be preceded by a catchpit manhole to help remove sediment prior to discharge.
- Channel drains are to have sump units to help remove sediment prior to discharge.
- All SUDs structures are to be lined with an impermeable geomembrane due to local ground conditions

7.1 Water Quality Treatment



As shown on the Environment Agency map below, the site is not located within a source protection zone.

7.2 Functionality of the Design

- The client has full ownership on the land within the redline boundary. Along with the obligation to construct new access for the site.
- Pipework is to be maintained as per manufacturer's instructions.

8.0 Maintenance

Recommendations for inspection and maintenance can be seen in the table overleaf. It is worth noting that both the drainage and highway elements of the design will remain under the ownership of the landowner who will be solely responsible for the maintenance and upkeep of these elements of the proposal.

The landowner will perform a thorough site inspection biannually and as a minimum the following maintenance item should be actioned without fail.

- Lifting of manhole lids to check flows.
- Catchpits to be emptied.
- Rodding of external pipework.

Where defects exist, maintenance will be carried out in accordance with the below maintenance schedule. In addition to this a CCTV survey of the full drainage system will be undertaken every 5 years to check the condition of the pipework

ITEM		DEFECT CHECK	DETAILED INSPECTION VISUAL INSPECTION	ACTION REQUIRED	REPLACEMENT	ADDITIONAL COMMENTS
FLOW CHECK		Surface water ponding	6months. Lifting of manhole lids to check flows.	Check downstream for blockages. Clean system and undertake CCTV survey if issues are identified	N/A	Under the maintenance responsibility of the landowner.
	MANHOLE COVERS	Broken lids.	6 months.	Replace.	When broken.	Under the maintenance responsibility of the landowner.
MANHOLE		Blockages, surcharging.	6months. Lifting of manhole lids to check flows.	Check downstream for blockages. Clean system and undertake CCTV survey if issues are identified	N/A	Under the maintenance responsibility of the landowner.
INSPECTION CHAMBER		Blockages, surcharging.	6months. Lifting of manhole lids to check flows.	Check downstream for blockages. Clean system and undertake CCTV survey if issues are identified	N/A	Under the maintenance responsibility of the landowner.
SILT TRAPS/ CATCHPITS		Blockages, silt build up	6months. Lifting of manhole to check for silt.	Empty and clean sump	N/A	Under the maintenance responsibility of the landowner.
PIPEWORK		Blockages, Cracking	6 months.	Rodding required	When damaged.	Under the maintenance responsibility of the landowner.
GUTTERING		Blockages	6 months.	Cleaning and removal of debris	N/A	Under the maintenance responsibility of the landowner.
ACCESS ROAD		Surface damage	6 months.	Pressure washing of surface Surface Patching when required	When damaged. (Surfacing to be patched to original specification.)	Under the maintenance responsibility of the landowner.
GULLIES		Blockages, silt removal	Yearly	Gullies to be inspected and emptied to reduce sediment entry to the tank.	N/A	Under the maintenance responsibility of the landowner.

9.0 Attenuation Summary

Within section 6.3.1, various storm periods have been modelled based on outline parameters. This has resulted in a required attenuation volume to satisfy the storm events up to and including the 1:100yr storm.

From the calculations undertaken, it has been established that 86.1m³ of attenuation is required to be contained up to the 1:100yr event while maintaining a peak discharge rate no greater than 5.0l/s

APPENDIX I

Existing Site Location Plan



- NOTES:-
1. All dimensions must be checked on site and not scaled from this drawing.
 2. The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
 3. All levels shown on this drawing are relative to Agreed Datum
 4. This drawing is to be read in conjunction with 29652/100 Series Drawings.
 5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.
- Denotes Site Boundary Area – 3,717m²

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Rev	Date	Description	DR	CH

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CONSULTING ENGINEERS
PROJECT MANAGEMENT
2 Hallam Road
Priory Park East
HULL HU4 7DY
United Kingdom
Telephone(+44) 01482 627963
Fax (+44) 01482 641736
Email info@ggpconsult.co.uk

Client **McCARTHY STONE**
Life, well lived

Job Title
Huyton Lane,
Huyton,
Liverpool

Drawing Title
Site Location Plan

Status APPROVAL

Scale 1:250 @ A1 Date Jan' 23

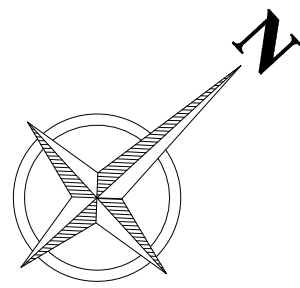
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Dwg. No.	Rev
29652 / 100	A

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APPENDIX II

Existing Impermeable Area



HUYTON LANE

9E

ESS

NOTES:-

1. All dimensions must be checked on site and not scaled from this drawing.
2. The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
3. All levels shown on this drawing are relative to Agreed Datum
4. This drawing is to be read in conjunction with 29652/100 Series Drawings.
5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.

Denotes Site Boundary Area - 3,717m²

Denotes Existing Impermeable Building Area - 287m²

Denotes Existing Impermeable Hardstanding Area - 2,819m²

Denotes Existing Impermeable Retaining Wall Area - 9m²

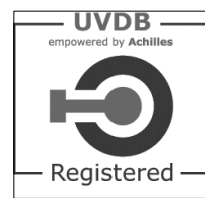
Denotes Existing Permeable Grassed Area - 602m²

Existing Total Impermeable Area - 3,115m²

Existing Total Permeable Area - 602m²

A	02/03/23	ISSUED FOR APPROVAL	JIT	WP
Rev	Date	Description	DR	CH

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GGP
CONSULT

CONSULTING ENGINEERS
PROJECT MANAGEMENT

2 Hallam Road
Priory Park East
HULL HU4 7DY
United Kingdom

Telephone(+44) 01482 627963
Fax (+44) 01482 641736
Email info@ggpconsult.co.uk

Client
McCARTHY STONE
Life, well lived

Job Title
Huyton Lane,
Huyton,
Liverpool

Drawing Title
Existing Impermeable Area

Status
APPROVAL

Scale
1:150 @ A1

Date
Dec' 22

Drawn By
W. Brown

Checked
W.B

Approved
J.H.C

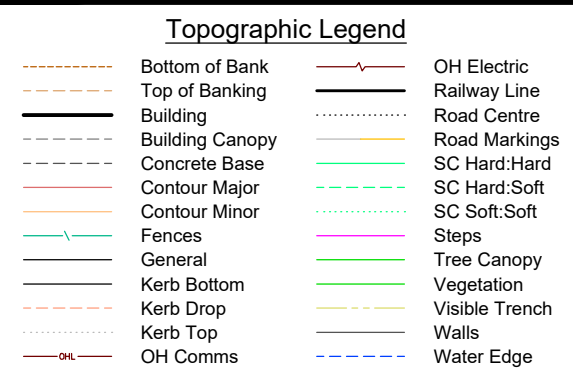
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APPENDIX III

Existing Drainage Plan



Topographic Abbreviations			
AV	Air Valve	PB	Pedestrian Beacon
BH	Borehole	PBX	Post Box
BO(L)	Bolt (Rusted)	PCR	Perimeter Guard Rail
BS	Bull Stop	PK	Parking Meter
CB	Cabinets	PO	Post
CL	Clear Level	RE	Reeding Eye
CS	Concrete	RS(L)	Right Sign (Riminated)
Conc	Concrete	RWP	Right Sign (Rimmed)
CO	Drainage Channel	SP(L)	Sign Post (Rimmed)
CP	Chain	SP	Sign Post (Rimmed) Camera
DP	Down Pipe	ST	Stop Tap
EP	Electricity Pole	SV	Sluice Valve
ET	Earth Road	SV	Sluice Vent Pipe
FFL	Finished Floor Level	TBox	Telephone Box
FH	Fire Hydrant	TL	Top of Level
FG	Flag Pole	TOF	Top of Fence Level
GV	Gate Post	TOW	Top of Wall Level
GP	Gravel	TP	Top of Pave Level
GV	Gully	VP	Vent Pipe
CS	Inspection Cover	WB	Waste Bin
KO	Kerbs Outlet	WB	Waste Bottom Level
LP	Lamp Post	WM	Water Meter
LM	Lamp	W	Wash Out
MR	Marker	WT	Window Top Level
MP	Marker Post	WV	Water Valve

Utility Legend

	Air Line		SWD Sewer
	Alarm Cable		Survey Extents
	BT Cable		Heating Pipe
	CATV Cable		HV Electric Cable
	Chamber Extent		Kingston Comms
	Comms Cable		Oil Pipe
	CWD Sewer		Rising Main
	Earth Wire/Tape		Traffic Control
	Electric Cable		Unknown Utility
	Fibre Optic Cable		Vent Pipe
	Fuel Line		Water
	FWD Sewer		GPR Detection
	Gas Pipe		Assumed Route
			Records Route
			Drainage
			Backdrop
	Band of Cuts		
	Empty Service Duct		

Utility Abbreviations			
CP	Cathodic Protection	LoS	Loss of Signal
Cut	Disconnected Utility	MDPE	Middle Density PE
DI	Ductile Iron	SI	Spun Iron
DoB	Depth of Bottom	TLC	Traffic Light Control
DoC	Depth of Cover	UDI	Unreliable Depth Info
ED	Empty Duct	uPVC	Unplasticized
EoT	End of Trace	UPVC	Polyvinyl Chloride
PE	Polyethylene	UTR	Unable to Raise
HDPE	High Density PE	UTT	Unable to Trace

Manufacturer Stated Depths

- Detected Using Electromagnetic Location Methods
e.g. Any metallic pipe/cable. Accuracy $\pm 2.5\%$ of depth reading.
- Detected Using Electromagnetic Location Methods
e.g. Using a Sonde to locate drainage pipework
Accuracy $\pm 2.5\%$ of depth reading.
- Detected Using Ground Penetrating Radar
e.g. A plastic pipe or service not located by other means.
Accuracy depends on ground conditions.

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Rev.	Date	Comments

Rev.	Date	Comments

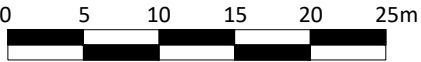
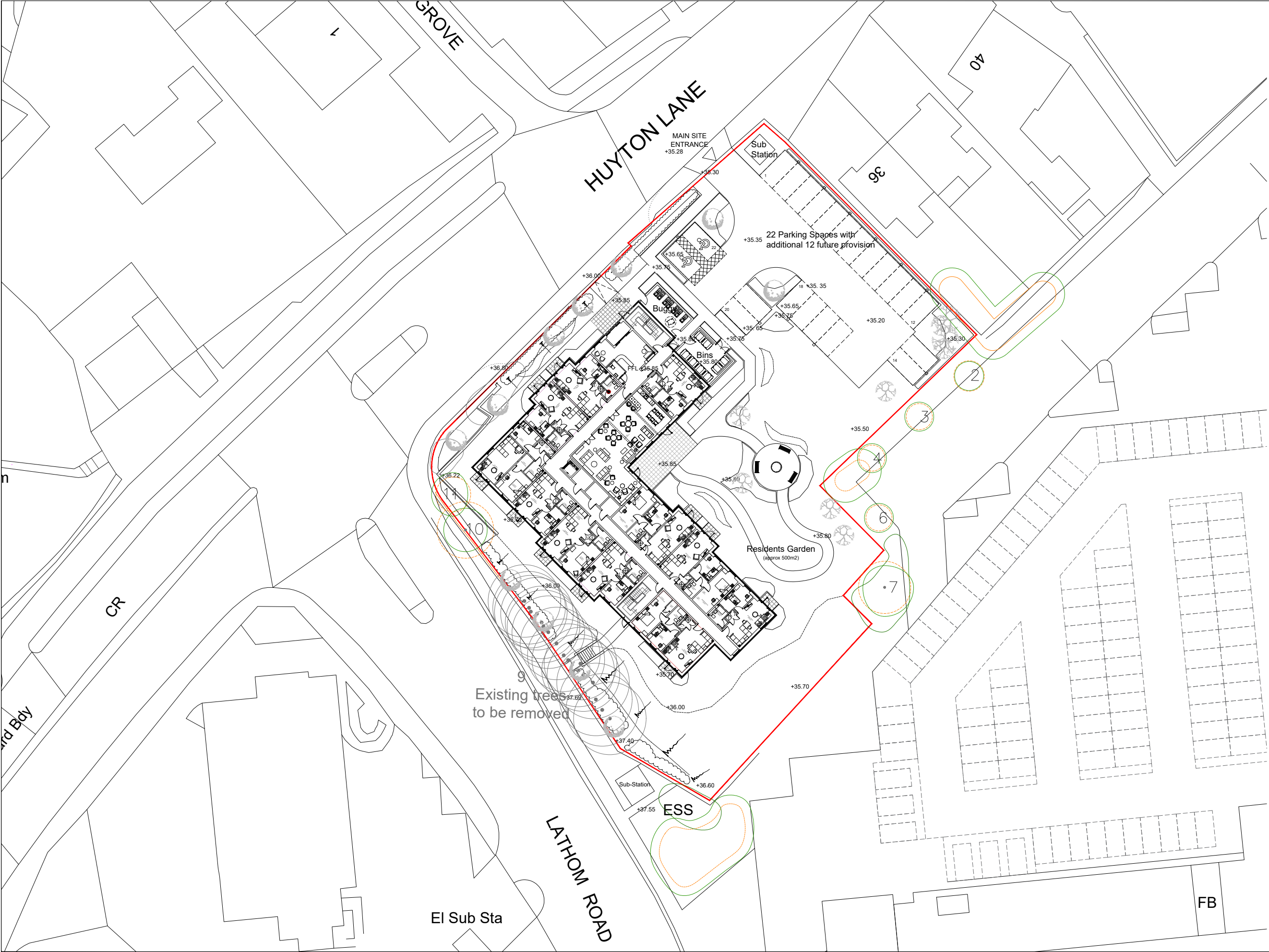
Client	MCCARTHY AND STONE		
Site Location:	HUYTON LANE, HUYTON, KNOWSLEY, L36 9XS		
Purpose of Drawing	GPR UTILITY MAPPING SURVEY PRESENTED ON A TOPOGRAPHICAL SURVEY		
Surveyed: AC ND TR PR	Drawn:	RSI	
Checked: RC	Authorised:	DM	
Date: 09-01-20	Scale:	1:200@A1	
Office 10, Ripley Drive, Normanton Business Park, Wakefield, WF6 1QT. info@centara-ttd.com			
Project No	108286	Revision Status	00
Sheet Number:	Layout 1		

APPENDIX IV

Topographical Survey

APPENDIX V

Proposed Site Plan



Scale 1:500

Notes:

- All drawings are subject to Planning and Building Control consent.
- The details shown are for design intent purposes only and are subject to further design development with suppliers and sub-contractors
- Proposals subject to consultation and approval from Local Authority Building Control or an Approved Inspector
- All setting out dimensions should be checked on-site prior to construction and any discrepancies and/or omissions should be reported to the Architect immediately

Rev.	Date	Details	Drawn	Checked
E	03.02.23	Revised levels	AL	MA
D	31.01.23	Revised Landscape layout	AL	MA
C	25.01.23	Amendment to staircase location and units arrangement	AL	MA
B	23.01.23	Amendments to car park layout	AL	MA
A	20.01.23	Building re-designed to accommodate 5m water easement	MA	MA
Rev.	Date	Details	Drawn	Checked

Drawn By:
AL

Date:
Dec22

Checked By:
MA

Date:

Project No:
22053

Scale:
1:500 @A3

Dwg No:
1002

Rev: E

Issued for:

PLANNING

Project/Client:
22053
Huyton Lane, Huyton
McCarthy & Stone

Drawing:
Proposed Site Plan

APPENDIX VI

Proposed Landscaping Plan



KEY

- Existing tree to be retained (RPA in orange)
- Proposed heavy standard (12-14cm girth) tree
- Proposed select standard (10-12cm girth) tree
- Proposed Hornbeam hedge
- Proposed turf
- Proposed species rich flowering lawn
- Proposed swathes of bulb planting
- Proposed 450 x 450 x 50mm concrete flag paving
- Proposed pedestrian tarmacadam
- Proposed vehicular tarmacadam
- Proposed resin bonded gravel
- Indicative seats
- Proposed 1500mm high metal railing
- Proposed 1800mm timber close boarded fence
- Existing retaining wall
- Existing metal bow top railing retained and painted
- Existing metal bow top railing retained and painted

NOTES

CONCEPT

The communal open spaces form an integral part of the development, which includes an areas for sitting and socialising with interest provided through the use of different paving materials and planting styles. Planting will maximise biodiversity enhancement. Individual patio areas will look out onto a garden of mixed planting with all year round seasonal interest.

TREE PLANTING

Planting of heavy standard and select standard trees around the entrance and frontage to the site will give early structure and maturity to the scheme. Specimen garden trees will provide year round colour and interest in the garden areas. Foundation design of new buildings shall accommodate proposed tree planting in accordance with NHBC guidelines.

Species to be chosen from suggested species such as:
Acer campestre (Ac) Prunus padus 'Albertii' (Pp)
Betula utilis jaquemontii (Buj) Sorbus aucuparia 'Asplenifolia' (SaA)
Liquidamber styraciflua 'Worplesdon' (LsW)

SHRUB PLANTING

A mix of evergreen and deciduous shrubs as well as herbaceous perennials will be planted throughout the site to give enclosure and structure to the development and to provide year round interest through form, foliage and colour. Medium/large species will be planted against screen fences and walls and medium/low species will be planted around paths and entrance areas.

Species to be selected from a range of species including: () density/m2

Berberis frikartii 'Amstelveen'(5), Berberis cordifolia 'Silberlicht'(6), Ceanothus thrysiflorus repens(4), Chaenomeles superba 'Jet Trail'(4), Cornus alba 'Spaethii'(2), Cornus stolonifera 'Flaviramea'(2), Cytisus 'Allgold'(4), Elaeagnus pungens 'Maculata'(3), Escallonia 'Apple Blossom'(4), Euonymus fortunei 'Emerald Gaiety'(6), Euphorbia griffithii 'Fireglow'(5), Festuca spp(6), Geranium 'Johnson's Blue'(4), Hebe albicans 'Red Edge'(4), Hebe 'Autumn Glory'(4), Hypericum x moserianum(4), Juniperus sabina 'Tamariscifolia' (3), Lavandula 'Hidcote'(6), Lonicera 'Maygreen'(4), Nepeta faassenii(4), Perovskia 'Blue Spire'(6), Phormium var, Potentilla 'Red Ace'(5), Prunus laurocerasus 'Zabeliana'(3), Pyracantha 'Orange Charm'(3), Rubus x 'Betty Ashburner'(4), Spiraea 'Gold Flame'(4), Spiraea 'Shirobana'(4), Viburnum tinus 'Eve Price'(3)

HARD LANDSCAPE

Footpaths around the building to be surfaced with tarmac with a non slip paving unit used for the sitting areas and patios to create a more intimate character. Resin bonded gravel to circular seating area will provide contrast.

GRASS AREAS

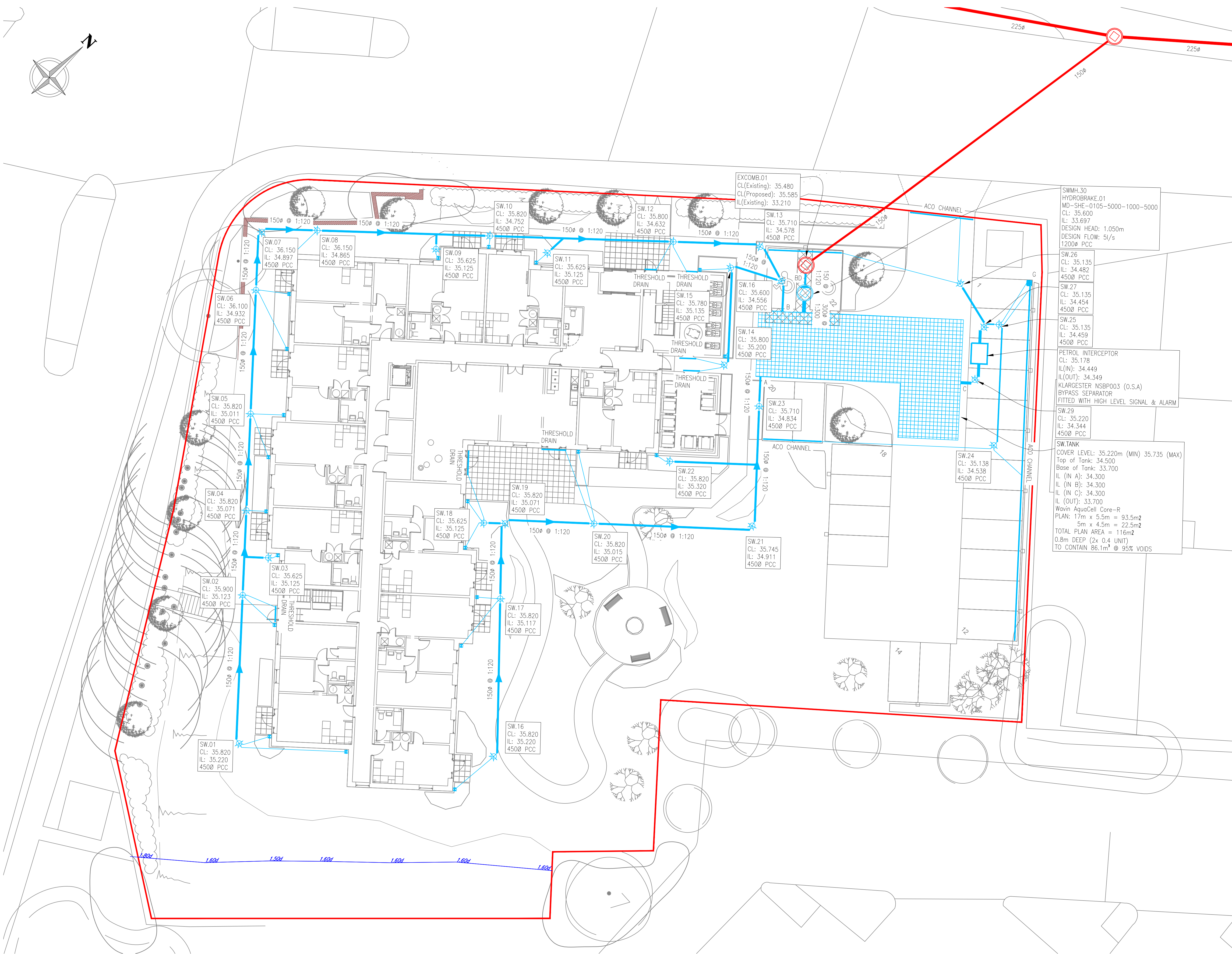
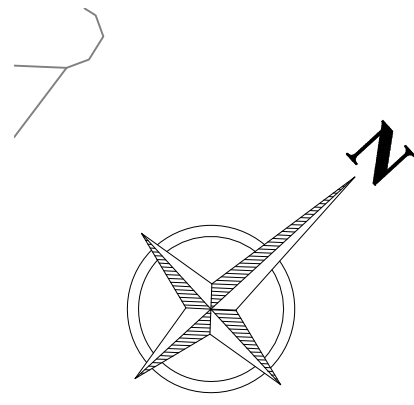
Lawned areas will provide a more highly maintained area to the Resident's Garden with more irregularly mown species rich flowering lawn areas to enhance biodiversity and provide interest over areas that cannot be planted due to drainage easement.

Rev.A: Addition of easement to key and update to Layout Rev.E (SF) February 2023

Sue Farmer BA MA MAI Landscape Architect fdalandscape Westleigh Hall Wakefield Road Denby Dale Huddersfield HD8 8QJ telephone 01484 861611 fax 01484 861616 isdn 01484 866900 email info@fdalandscape.co.uk www.fdalandscape.co.uk	client McCarthy Stone	
	project Proposed Residential Development	
	HUYTON LANE, HUYTON	
	drawing title LANDSCAPE MASTERPLAN	
scale 1:200 @A1	date Jan 23	drwn by SF
		drawing no R/2671/1A

APPENDIX VII

Proposed Surface Water Drainage Layout



- NOTES:-
1. All dimensions must be checked on site and not scaled from this drawing.
 2. The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
 3. All levels shown on this drawing are relative to Agreed Datum
 4. This drawing is to be read in conjunction with 29652/100 Series Drawings.
 5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.
- Denotes Site Boundary
 - Denotes Proposed Surface Water Sewer
 - Denotes Proposed Surface Water 4500 PCC
 - Denotes Proposed Cellular Storage Tank
 - Denotes Proposed Rainwater Pipe
 - Denotes Proposed HydroBrake Chamber
 - Denotes Existing Combined Water Sewer
 - Denotes Existing Combined Water Manhole Chamber
 - Denotes Existing Retaining Wall

B	07/02/23	ISSUED FOR APPROVAL	WP	WP
A	03/02/23	ISSUED FOR APPROVAL	WP	WP
Rev	Date	Description	DR	CH

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CONSULTING ENGINEERS
PROJECT MANAGEMENT

2 Hallam Road
Priory Park East
HULL HU4 7DY
United Kingdom

Telephone(+44) 01482 627963
Fax (+44) 01482 641736
Email info@ggpconsult.co.uk

Client **MCCARTHY STONE**
Life, we'll lived

Job Title
Huyton Lane,
Huyton,
Liverpool

Drawing Title
Surface Water Drainage
Layout

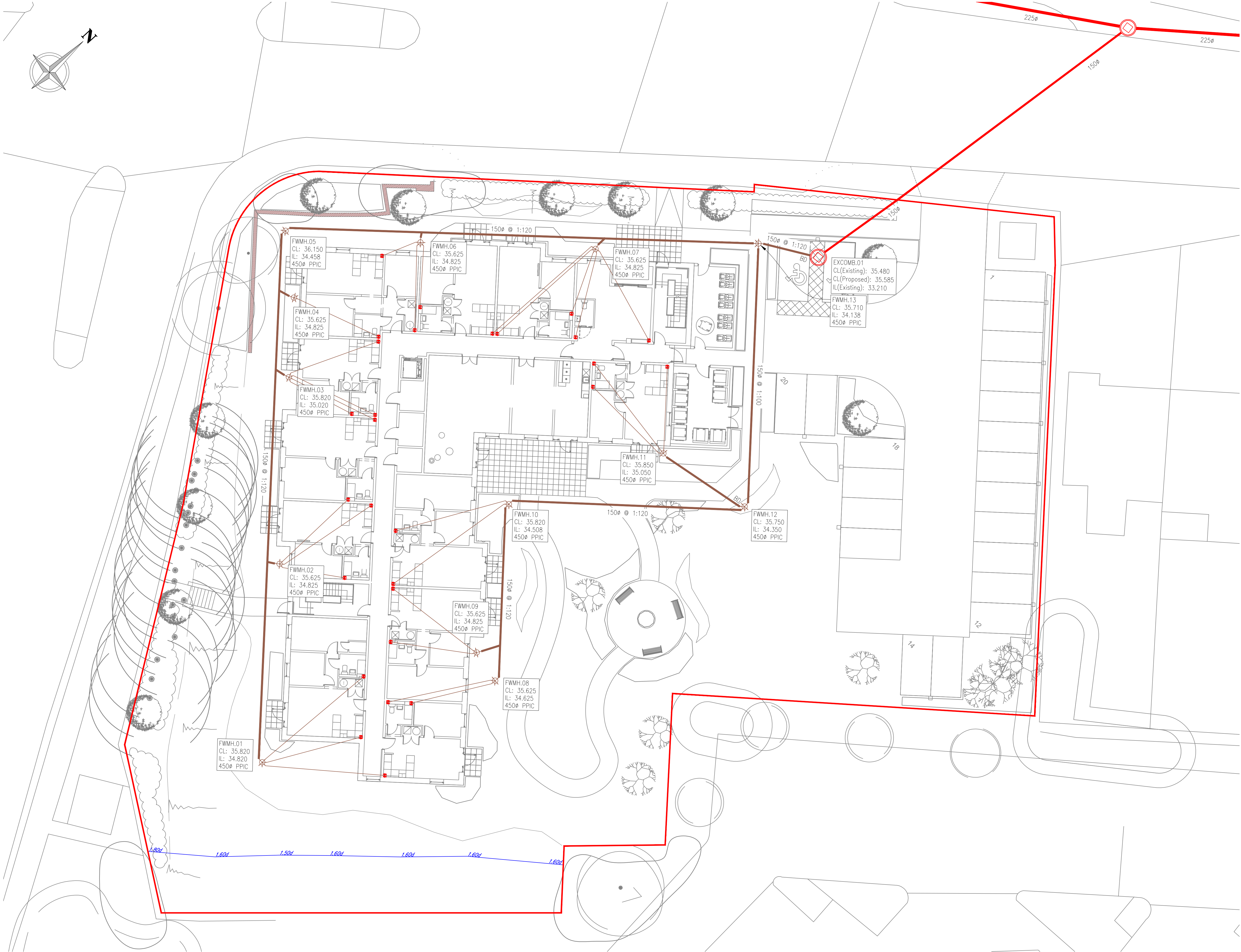
Status	APPROVAL		
Scale	1:150 @ A1	Date	Dec' 22
Drawn By	W. Brown	Checked	W.B
		Approved	J.H.C

Dwg. No.	29652 / 105	Rev	B
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NOT FOR CONSTRUCTION

APPENDIX VIII

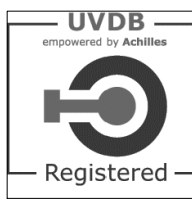
Proposed Foul Water Drainage Layout



- NOTES:-
1. All dimensions must be checked on site and not scaled from this drawing.
 2. The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
 3. All levels shown on this drawing are relative to Agreed Datum
 4. This drawing is to be read in conjunction with 29652/100 Series Drawings.
 5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.
- Denotes Site Boundary
 - Proposed Foul Water Sewer
 - Proposed Soil Vent Pipe
 - Denotes Proposed Foul Water 450Ø PPIC
 - Denotes Existing Combined Water Sewer
 - Denotes Existing Combined Water Manhole Chamber
 - Denotes Existing Retaining Wall

Rev	Date	Description	WP	CH
A	03/02/23	ISSUED FOR APPROVAL	WP	CH

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CONSULTING ENGINEERS
PROJECT MANAGEMENT

2 Hallam Road
Priory Park East
HULL HU4 7DY
United Kingdom

Telephone(+44) 01482 627963
Fax (+44) 01482 641736
Email info@ggpconsult.co.uk

Client **McCARTHY STONE**
Life, well lived

Job Title
Huyton Lane,
Huyton,
Liverpool

Drawing Title
Foul Water Drainage
Layout

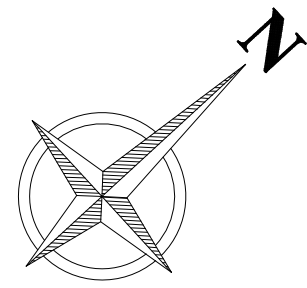
Status	APPROVAL		
Scale	1:150 @ A1	Date	Dec' 22
Drawn By	W. Brown	Checked	W.B
		Approved	J.H.C

Orig. No.	29652 / 106	Rev	A
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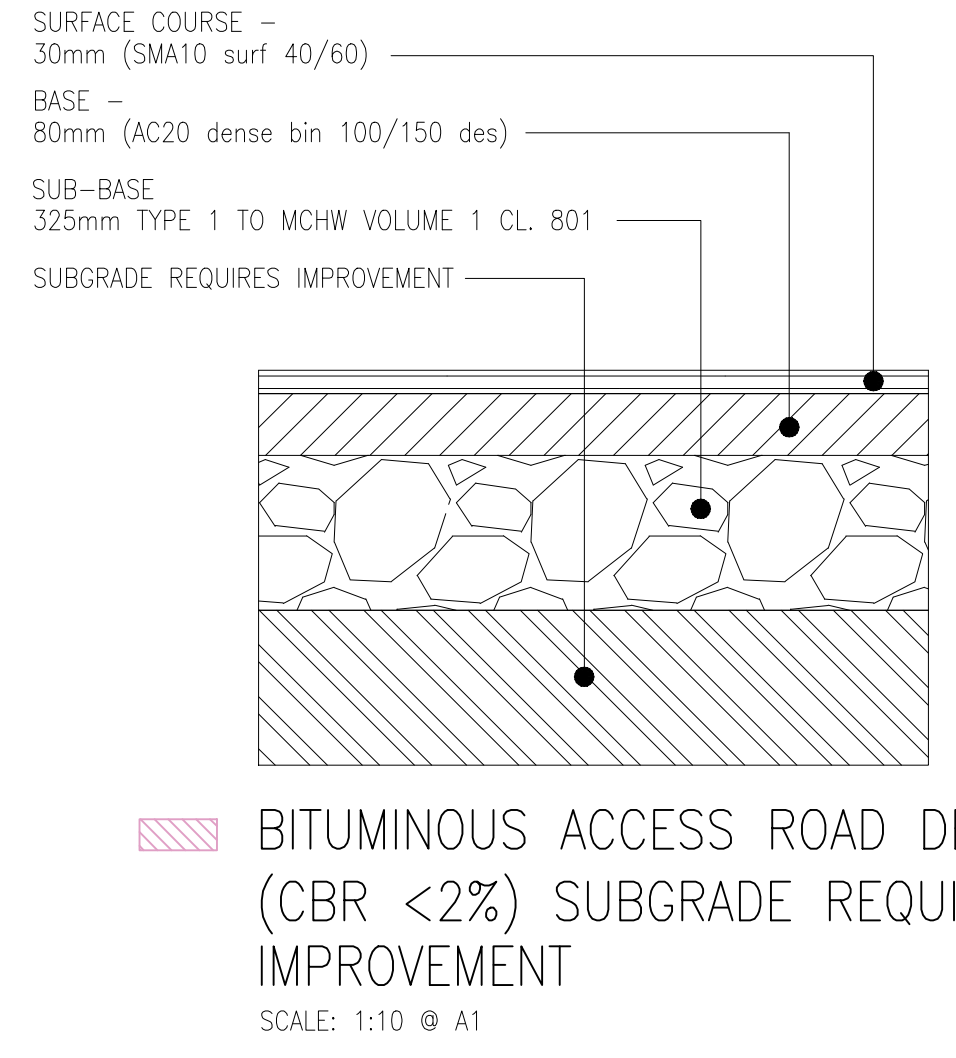
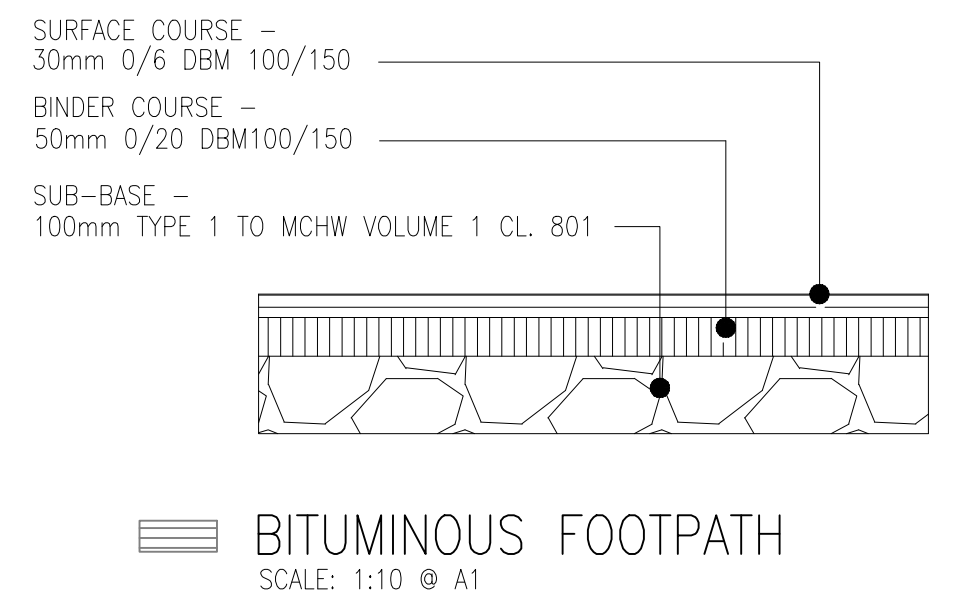
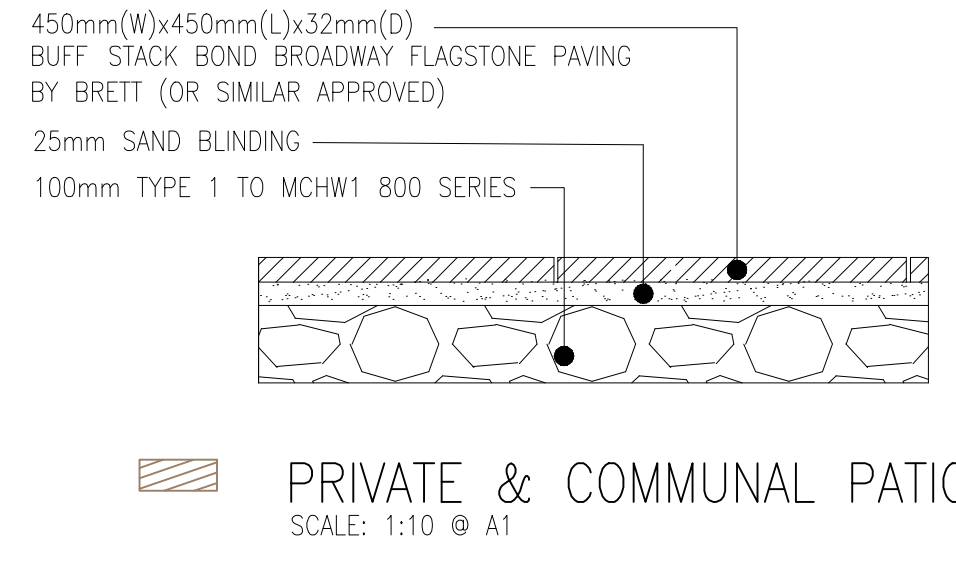
APPENDIX IX

Proposed Impermeable Area Layout



NHBC STANDARDS 2022: TABLE 3	
CBR VALUE	TYPE 1 ONLY
<2%	Subgrade requires improvement
2%-3%	325
3%-5%	250
5%-7%	150
7%-20%	100

- NOTES:
- 1) ACCESS ROAD & CAR PARK FORMATION TO BE PROOF ROLLED & ADDITIONAL CBR TESTS UNDERTAKEN
- 2) SUBBASE CAN BE REDUCED IN ACCORDANCE WITH TABLE 3 (NHBC 2020: CHAPTER 10) DEPENDENT ON RESULTS.



- NOTES:-
- All dimensions must be checked on site and not scaled from this drawing.
 - The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
 - All levels shown on this drawing are relative to Agreed Datum
 - This drawing is to be read in conjunction with 29652/100 Series Drawings.
 - All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.
- Denotes Site Boundary Area - 3,717m²
 - Denotes Proposed Impermeable Car Park Aisle Area - 602m²
 - Denotes Proposed Impermeable Building Area - 963m²
 - Denotes Proposed Impermeable Hardstanding Area - 35m²
 - Denotes Proposed Impermeable Path Area - 227m²
 - Denotes Proposed Impermeable Patio Area - 90m²
 - Denotes Existing Impermeable Retaining Wall Area - 9m²
 - Denotes Proposed Permeable Grassed Area - 1,852m²
 - Proposed Total Impermeable Area - 1,926m²
 - Proposed Total Permeable Area - 1,791m²

A	03/02/23	ISSUED FOR APPROVAL	JT	WP
Rev	Date	Description	DR	CH

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GGP CONSULT
CONSULTING ENGINEERS
PROJECT MANAGEMENT
2 Hallam Road
Priory Park East
HULL HU4 7DY
United Kingdom
Telephone(+44) 01482 627963
Fax (+44) 01482 641736
Email info@ggpconsult.co.uk

Client **McCARTHY STONE**
Life, well lived

Job Title
Huyton Lane,
Huyton,
Liverpool

Drawing Title
Proposed Impermeable
Area

Status
APPROVAL

Scale 1:150 @ A1 Date Dec' 22

Drawn By *J. Hattersley* Checked W.B Approved J.H.C

Dwg. No. 29652 / 102 Rev A

NOT FOR CONSTRUCTION

APPENDIX X

1:100 Year Storm Event +40% CC (5l/s)

GGP Consult				Page 1	
2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY					
Date 07/02/2023 08:02 File Huyton - 5 ls.SRCX		Designed by GGPAeecOne Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	33.986	0.286	5.0	45.7	O K
30 min Summer	34.066	0.366	5.0	58.6	O K
60 min Summer	34.133	0.433	5.0	69.3	O K
120 min Summer	34.165	0.465	5.0	74.5	O K
180 min Summer	34.164	0.464	5.0	74.2	O K
240 min Summer	34.153	0.453	5.0	72.5	O K
360 min Summer	34.126	0.426	5.0	68.1	O K
480 min Summer	34.096	0.396	5.0	63.3	O K
600 min Summer	34.066	0.366	5.0	58.5	O K
720 min Summer	34.037	0.337	5.0	53.9	O K
960 min Summer	33.985	0.285	5.0	45.7	O K
1440 min Summer	33.907	0.207	4.9	33.2	O K
2160 min Summer	33.840	0.140	4.5	22.4	O K
2880 min Summer	33.811	0.111	4.0	17.7	O K
4320 min Summer	33.786	0.086	3.1	13.7	O K
5760 min Summer	33.773	0.073	2.5	11.7	O K
7200 min Summer	33.765	0.065	2.1	10.4	O K
8640 min Summer	33.759	0.059	1.8	9.4	O K
10080 min Summer	33.755	0.055	1.6	8.7	O K
15 min Winter	34.022	0.322	5.0	51.6	O K
30 min Winter	34.115	0.415	5.0	66.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	137.181	0.0	49.6	21	
30 min Summer	90.378	0.0	65.3	35	
60 min Summer	56.713	0.0	82.0	62	
120 min Summer	34.360	0.0	99.4	116	
180 min Summer	25.274	0.0	109.7	146	
240 min Summer	20.196	0.0	116.9	176	
360 min Summer	14.701	0.0	127.6	244	
480 min Summer	11.729	0.0	135.7	312	
600 min Summer	9.837	0.0	142.3	378	
720 min Summer	8.516	0.0	147.8	442	
960 min Summer	6.777	0.0	156.9	568	
1440 min Summer	4.904	0.0	170.3	808	
2160 min Summer	3.543	0.0	184.5	1148	
2880 min Summer	2.810	0.0	195.2	1496	
4320 min Summer	2.024	0.0	210.9	2208	
5760 min Summer	1.602	0.0	222.5	2936	
7200 min Summer	1.335	0.0	231.9	3672	
8640 min Summer	1.151	0.0	239.7	4408	
10080 min Summer	1.014	0.0	246.5	5112	
15 min Winter	137.181	0.0	55.5	21	
30 min Winter	90.378	0.0	73.2	35	
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2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY					
Date 07/02/2023 08:02 File Huyton - 5 ls.SRCX		Designed by GGPAeecOne Checked by			
Innovyze		Source Control 2019.1			
Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	34.193	0.493	5.0	78.9	O K
120 min Winter	34.238	0.538	5.0	86.1	O K
180 min Winter	34.234	0.534	5.0	85.4	O K
240 min Winter	34.217	0.517	5.0	82.8	O K
360 min Winter	34.177	0.477	5.0	76.3	O K
480 min Winter	34.131	0.431	5.0	69.0	O K
600 min Winter	34.085	0.385	5.0	61.6	O K
720 min Winter	34.041	0.341	5.0	54.5	O K
960 min Winter	33.965	0.265	5.0	42.4	O K
1440 min Winter	33.863	0.163	4.7	26.1	O K
2160 min Winter	33.807	0.107	3.9	17.1	O K
2880 min Winter	33.787	0.087	3.1	13.9	O K
4320 min Winter	33.769	0.069	2.3	11.0	O K
5760 min Winter	33.759	0.059	1.8	9.5	O K
7200 min Winter	33.753	0.053	1.5	8.5	O K
8640 min Winter	33.748	0.048	1.3	7.7	O K
10080 min Winter	33.745	0.045	1.2	7.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	56.713	0.0	91.9	62	
120 min Winter	34.360	0.0	111.3	118	
180 min Winter	25.274	0.0	122.8	170	
240 min Winter	20.196	0.0	130.9	192	
360 min Winter	14.701	0.0	142.9	266	
480 min Winter	11.729	0.0	152.0	340	
600 min Winter	9.837	0.0	159.4	408	
720 min Winter	8.516	0.0	165.6	476	
960 min Winter	6.777	0.0	175.7	600	
1440 min Winter	4.904	0.0	190.7	824	
2160 min Winter	3.543	0.0	206.7	1144	
2880 min Winter	2.810	0.0	218.6	1496	
4320 min Winter	2.024	0.0	236.2	2208	
5760 min Winter	1.602	0.0	249.2	2936	
7200 min Winter	1.335	0.0	259.7	3672	
8640 min Winter	1.151	0.0	268.5	4408	
10080 min Winter	1.014	0.0	276.1	5144	
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2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY		
Date 07/02/2023 08:02 File Huyton - 5 ls.SRCX	Designed by GGPAeecOne Checked by	
Innovyze Source Control 2019.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.392	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.193

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.096	4 8	0.097

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GGP Consult		Page 4
2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY		
Date 07/02/2023 08:02 File Huyton - 5 ls.SRCX	Designed by GGPAeecOne Checked by	
Innovyze Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 35.220

Tank or Pond Structure

Invert Level (m) 33.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	160.0	0.800	160.0	0.801	1.0	1.520	1.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1050-5000
Design Head (m)	1.050
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	33.697
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	5.0
Flush-Flo™	0.313	5.0
Kick-Flo®	0.667	4.1
Mean Flow over Head Range	-	4.3

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)	Depth (m)	Flow (l/s)
0.100	3.5	1.200	5.3	3.000	8.2	7.000	12.2
0.200	4.8	1.400	5.7	3.500	8.8	7.500	12.6
0.300	5.0	1.600	6.1	4.000	9.4	8.000	13.0
0.400	4.9	1.800	6.4	4.500	9.9	8.500	13.4
0.500	4.8	2.000	6.7	5.000	10.4	9.000	13.8
0.600	4.5	2.200	7.1	5.500	10.9	9.500	14.1
0.800	4.4	2.400	7.3	6.000	11.3		
1.000	4.9	2.600	7.6	6.500	11.8		

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APPENDIX XI

1:30 Year Storm Event +40% CC (5l/s)

GGP Consult				Page 1		
2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY						
Date 07/02/2023 08:03 File Huyton - 5 ls.SRCX		Designed by GGPAeecOne Checked by				
Innovyze		Source Control 2019.1				
<u>Summary of Results for 30 year Return Period (+40%)</u>						
Storm Event		Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer		33.917	0.217	4.9	34.7	O K
30 min Summer		33.973	0.273	5.0	43.7	O K
60 min Summer		34.016	0.316	5.0	50.6	O K
120 min Summer		34.033	0.333	5.0	53.3	O K
180 min Summer		34.031	0.331	5.0	53.0	O K
240 min Summer		34.023	0.323	5.0	51.7	O K
360 min Summer		34.000	0.300	5.0	48.0	O K
480 min Summer		33.975	0.275	5.0	44.1	O K
600 min Summer		33.952	0.252	4.9	40.2	O K
720 min Summer		33.930	0.230	4.9	36.7	O K
960 min Summer		33.892	0.192	4.8	30.8	O K
1440 min Summer		33.841	0.141	4.5	22.6	O K
2160 min Summer		33.807	0.107	3.9	17.1	O K
2880 min Summer		33.790	0.090	3.3	14.4	O K
4320 min Summer		33.773	0.073	2.5	11.7	O K
5760 min Summer		33.763	0.063	2.0	10.1	O K
7200 min Summer		33.757	0.057	1.7	9.1	O K
8640 min Summer		33.752	0.052	1.5	8.3	O K
10080 min Summer		33.748	0.048	1.3	7.7	O K
15 min Winter		33.945	0.245	4.9	39.2	O K
30 min Winter		34.009	0.309	5.0	49.5	O K
Storm Event		Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer		105.725	0.0	38.2	21	
30 min Summer		69.056	0.0	49.9	34	
60 min Summer		43.136	0.0	62.4	62	
120 min Summer		26.149	0.0	75.6	98	
180 min Summer		19.302	0.0	83.7	132	
240 min Summer		15.490	0.0	89.6	166	
360 min Summer		11.343	0.0	98.4	234	
480 min Summer		9.087	0.0	105.2	300	
600 min Summer		7.647	0.0	110.6	364	
720 min Summer		6.639	0.0	115.2	426	
960 min Summer		5.308	0.0	122.9	548	
1440 min Summer		3.869	0.0	134.3	780	
2160 min Summer		2.816	0.0	146.7	1128	
2880 min Summer		2.246	0.0	156.0	1476	
4320 min Summer		1.632	0.0	170.0	2204	
5760 min Summer		1.300	0.0	180.6	2936	
7200 min Summer		1.090	0.0	189.2	3672	
8640 min Summer		0.943	0.0	196.4	4400	
10080 min Summer		0.834	0.0	202.8	5136	
15 min Winter		105.725	0.0	42.8	21	
30 min Winter		69.056	0.0	55.9	34	
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GGP Consult				Page 2	
2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY					
Date 07/02/2023 08:03 File Huyton - 5 ls.SRCX		Designed by GGPAeecOne Checked by			
Innovyze		Source Control 2019.1			
<u>Summary of Results for 30 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	34.061	0.361	5.0	57.7	O K
120 min Winter	34.080	0.380	5.0	60.8	O K
180 min Winter	34.074	0.374	5.0	59.9	O K
240 min Winter	34.060	0.360	5.0	57.7	O K
360 min Winter	34.024	0.324	5.0	51.8	O K
480 min Winter	33.985	0.285	5.0	45.6	O K
600 min Winter	33.949	0.249	4.9	39.8	O K
720 min Winter	33.916	0.216	4.9	34.6	O K
960 min Winter	33.866	0.166	4.7	26.5	O K
1440 min Winter	33.813	0.113	4.1	18.1	O K
2160 min Winter	33.786	0.086	3.1	13.8	O K
2880 min Winter	33.774	0.074	2.5	11.8	O K
4320 min Winter	33.760	0.060	1.8	9.6	O K
5760 min Winter	33.752	0.052	1.5	8.3	O K
7200 min Winter	33.747	0.047	1.2	7.5	O K
8640 min Winter	33.743	0.043	1.1	6.9	O K
10080 min Winter	33.740	0.040	0.9	6.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	43.136	0.0	69.9	62	
120 min Winter	26.149	0.0	84.7	114	
180 min Winter	19.302	0.0	93.8	142	
240 min Winter	15.490	0.0	100.4	180	
360 min Winter	11.343	0.0	110.3	254	
480 min Winter	9.087	0.0	117.8	322	
600 min Winter	7.647	0.0	123.9	388	
720 min Winter	6.639	0.0	129.1	450	
960 min Winter	5.308	0.0	137.6	568	
1440 min Winter	3.869	0.0	150.4	782	
2160 min Winter	2.816	0.0	164.3	1132	
2880 min Winter	2.246	0.0	174.7	1476	
4320 min Winter	1.632	0.0	190.4	2208	
5760 min Winter	1.300	0.0	202.3	2936	
7200 min Winter	1.090	0.0	211.9	3672	
8640 min Winter	0.943	0.0	220.0	4400	
10080 min Winter	0.834	0.0	227.1	5144	
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2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY		
Date 07/02/2023 08:03 File Huyton - 5 ls.SRCX	Designed by GGPAeecOne Checked by	
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.392	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.193

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.096	4 8	0.097

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GGP Consult		Page 4
2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY		
Date 07/02/2023 08:03 File Huyton - 5 ls.SRCX	Designed by GGPAeecOne Checked by	
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Model Details

Storage is Online Cover Level (m) 35.220

Tank or Pond Structure

Invert Level (m) 33.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	160.0	0.800	160.0	0.801	1.0	1.520	1.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1050-5000
Design Head (m)	1.050
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	33.697
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	5.0
Flush-Flo™	0.313	5.0
Kick-Flo®	0.667	4.1
Mean Flow over Head Range	-	4.3

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)	Depth (m)	Flow (l/s)
0.100	3.5	1.200	5.3	3.000	8.2	7.000	12.2
0.200	4.8	1.400	5.7	3.500	8.8	7.500	12.6
0.300	5.0	1.600	6.1	4.000	9.4	8.000	13.0
0.400	4.9	1.800	6.4	4.500	9.9	8.500	13.4
0.500	4.8	2.000	6.7	5.000	10.4	9.000	13.8
0.600	4.5	2.200	7.1	5.500	10.9	9.500	14.1
0.800	4.4	2.400	7.3	6.000	11.3		
1.000	4.9	2.600	7.6	6.500	11.8		

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APPENDIX XII

1:1 Year Storm Event +40% CC (5l/s)

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Date 07/02/2023 08:04 File Huyton - 5 ls.SRCX						
Innovyze			Designed by GGPAeecOne Checked by			
Source Control 2019.1						
Summary of Results for 1 year Return Period (+40%)						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
15 min Summer	33.787	0.087	3.1	13.9	O K	
30 min Summer	33.805	0.105	3.8	16.8	O K	
60 min Summer	33.818	0.118	4.3	18.9	O K	
120 min Summer	33.826	0.126	4.4	20.2	O K	
180 min Summer	33.826	0.126	4.4	20.2	O K	
240 min Summer	33.823	0.123	4.4	19.7	O K	
360 min Summer	33.815	0.115	4.2	18.4	O K	
480 min Summer	33.807	0.107	3.9	17.1	O K	
600 min Summer	33.800	0.100	3.7	16.0	O K	
720 min Summer	33.794	0.094	3.4	15.1	O K	
960 min Summer	33.785	0.085	3.1	13.6	O K	
1440 min Summer	33.774	0.074	2.5	11.8	O K	
2160 min Summer	33.763	0.063	2.0	10.1	O K	
2880 min Summer	33.756	0.056	1.7	9.0	O K	
4320 min Summer	33.748	0.048	1.3	7.7	O K	
5760 min Summer	33.743	0.043	1.1	6.8	O K	
7200 min Summer	33.739	0.039	0.9	6.2	O K	
8640 min Summer	33.736	0.036	0.8	5.8	O K	
10080 min Summer	33.734	0.034	0.7	5.4	O K	
15 min Winter	33.797	0.097	3.5	15.5	O K	
30 min Winter	33.818	0.118	4.3	18.9	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer	43.097	0.0	15.5	19		
30 min Summer	28.196	0.0	20.3	31		
60 min Summer	17.920	0.0	25.9	48		
120 min Summer	11.164	0.0	32.2	82		
180 min Summer	8.425	0.0	36.5	116		
240 min Summer	6.892	0.0	39.8	148		
360 min Summer	5.156	0.0	44.7	212		
480 min Summer	4.187	0.0	48.4	274		
600 min Summer	3.563	0.0	51.5	336		
720 min Summer	3.122	0.0	54.2	396		
960 min Summer	2.536	0.0	58.6	518		
1440 min Summer	1.892	0.0	65.6	756		
2160 min Summer	1.412	0.0	73.5	1124		
2880 min Summer	1.146	0.0	79.5	1476		
4320 min Summer	0.854	0.0	89.0	2208		
5760 min Summer	0.694	0.0	96.4	2936		
7200 min Summer	0.591	0.0	102.6	3672		
8640 min Summer	0.519	0.0	108.0	4408		
10080 min Summer	0.464	0.0	112.8	5112		
15 min Winter	43.097	0.0	17.4	19		
30 min Winter	28.196	0.0	22.8	31		
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GGP Consult				Page 2	
2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY					
Date 07/02/2023 08:04 File Huyton - 5 ls.SRCX		Designed by GGPAeecOne Checked by			
Innovyze		Source Control 2019.1			
<u>Summary of Results for 1 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	33.832	0.132	4.5	21.2	O K
120 min Winter	33.837	0.137	4.5	22.0	O K
180 min Winter	33.833	0.133	4.5	21.3	O K
240 min Winter	33.826	0.126	4.4	20.2	O K
360 min Winter	33.813	0.113	4.1	18.1	O K
480 min Winter	33.802	0.102	3.7	16.3	O K
600 min Winter	33.793	0.093	3.4	14.8	O K
720 min Winter	33.786	0.086	3.1	13.7	O K
960 min Winter	33.776	0.076	2.6	12.2	O K
1440 min Winter	33.764	0.064	2.1	10.2	O K
2160 min Winter	33.754	0.054	1.6	8.6	O K
2880 min Winter	33.748	0.048	1.3	7.6	O K
4320 min Winter	33.740	0.040	1.0	6.4	O K
5760 min Winter	33.736	0.036	0.8	5.7	O K
7200 min Winter	33.733	0.033	0.7	5.2	O K
8640 min Winter	33.730	0.030	0.6	4.8	O K
10080 min Winter	33.728	0.028	0.5	4.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	17.920	0.0	29.0	52	
120 min Winter	11.164	0.0	36.1	88	
180 min Winter	8.425	0.0	40.9	124	
240 min Winter	6.892	0.0	44.6	158	
360 min Winter	5.156	0.0	50.1	222	
480 min Winter	4.187	0.0	54.2	286	
600 min Winter	3.563	0.0	57.7	346	
720 min Winter	3.122	0.0	60.7	408	
960 min Winter	2.536	0.0	65.7	528	
1440 min Winter	1.892	0.0	73.5	768	
2160 min Winter	1.412	0.0	82.3	1144	
2880 min Winter	1.146	0.0	89.1	1500	
4320 min Winter	0.854	0.0	99.7	2208	
5760 min Winter	0.694	0.0	108.0	2936	
7200 min Winter	0.591	0.0	114.9	3664	
8640 min Winter	0.519	0.0	121.0	4352	
10080 min Winter	0.464	0.0	126.4	5136	
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GGP Consult		Page 3
2 Hallam Road, Priory Park East Hull, Humberside HU4 7DY		
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.392	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.193

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	0.096	4 8	0.097

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Date 07/02/2023 08:04 File Huyton - 5 ls.SRCX	Designed by GGPAeecOne Checked by	
Innovyze Source Control 2019.1		

Model Details

Storage is Online Cover Level (m) 35.220

Tank or Pond Structure

Invert Level (m) 33.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	160.0	0.800	160.0	0.801	1.0	1.520	1.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1050-5000
Design Head (m)	1.050
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	33.697
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	5.0
Flush-Flo™	0.313	5.0
Kick-Flo®	0.667	4.1
Mean Flow over Head Range	-	4.3

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)	Depth (m)	Flow (l/s)
0.100	3.5	1.200	5.3	3.000	8.2	7.000	12.2
0.200	4.8	1.400	5.7	3.500	8.8	7.500	12.6
0.300	5.0	1.600	6.1	4.000	9.4	8.000	13.0
0.400	4.9	1.800	6.4	4.500	9.9	8.500	13.4
0.500	4.8	2.000	6.7	5.000	10.4	9.000	13.8
0.600	4.5	2.200	7.1	5.500	10.9	9.500	14.1
0.800	4.4	2.400	7.3	6.000	11.3		
1.000	4.9	2.600	7.6	6.500	11.8		

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