

GWK STRUCTURAL SOLUTIONS LTD **CONSULTING ENGINEERS**

Proposed Drainage Strategy to Discharge Planning Condition 3 of Application Ref:22/00066/FUL

PROJECT REFERENCE:

- **Project No:** GK4571
- **Project Location:** 57 & 59 Mount Road, Middleton, Manchester, M24 1DY.
- **Project Title:** Mount Road.
- **Client:** Mrs Margarita Pankovych

				APPROVALS	
Issue	Date	Pages	Issue Description	By	Check
A	22/08/24		Issued to discharge planning condition	PG	GWK
☒ Entire Report Issued this Revision		Report Issued for:			
☐ Revised Pages Only Issued this Revision		☐ In-house Review	☐ Purchase		
		☐ Client Approval	☐ Construction		
		☐ Inquiry	☒ Planning		

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1.0 Introduction

1.1 Summary

In February 2022 an outline planning application was submitted to Rochdale Borough Council for the erection of two detached dwellings with associated landscaping, parking and boundary treatments with the associated infrastructure.

Planning approval was granted (ref: 22/00066/FUL) in May 2022.

This report has been prepared to discharge the drainage related planning condition; Number 3.

2.0 Drainage Strategy

2.1 Existing Drainage

The United Utilities sewer records have been reviewed and identify both a 75 and 600mm diameter combined water public sewer flowing east within Mount Road before turning north easterly and flow beneath Kirkway. No surface water sewers have been identified in close proximity. Refer to Figure 1 below.

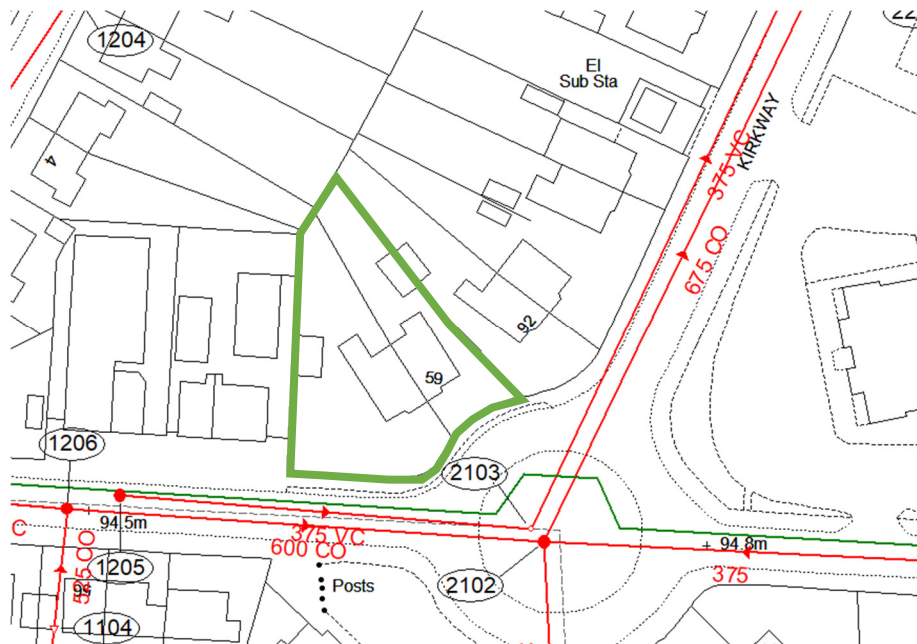


Figure 1: UU Sewer Plans (from 2006)

The area of the proposed development previously encompassed two dwellings that were demolished circa 10 years ago. Thus, the site is currently classed as unmade. A review of the historic private drainage plan indicates that the site drained into the front driveway of 92 Kirkway. Trial pit investigations have confirmed the route and depth of this existing drain.

2.2 Existing Geology

At this time a Phase 2 ground investigation has not been completed at the site. A review of the BGS dataset has indicated the superficial geology to encompass Till/Devensian – Silts and clays with the Bedrock geology comprising the Pennine Lower Coal Measures Formation – Mudstone.

In light of these findings' infiltration and the underlying cohesive ground, infiltration as a means of draining the site has been discounted.

2.3 Hydrology

The closest identified watercourse is the Wince Brook, located 325m to the north of the proposed site flowing in a westerly direction.

2.4 Sustainable Drainage

Sustainable Drainage Systems (SuDS) are utilised in line with the CIRIA 753 guidance with the aim to minimise the development's impact on the runoff quantity and quality and maximise amenity and biodiversity opportunities.

The management train approach is a fundamental principle of SuDS systems, it aims to primarily reduce pollution, flow rates and volume of runoff from the site. The main objective is to treat the runoff as close to the source as possible and where possible for at least two of the following should be included within the drainage strategy.

- **Prevention** – The use of good site design and rainwater re-use measures to prevent runoff.
- **Source Control** – Controlling the runoff as close to source as possible by using green roofs, porous pavements and soakaways.
- **Site Control** – Use of water management techniques within local area, i.e., detention basins and geocellular storage.
- **Regional Control** – Management of water from a number of sites in a specific location, i.e., balancing ponds and wetlands.

The drainage strategy for this development will incorporate prevention measures in the form of water butts, source control in the form of permeable driveways and site control methods in the form of a flow control device to retain the peak flows.

2.5 SuDS Hierarchal Approach

Based on the existing drainage configuration, plus an assessment of the local site conditions, the SuDS hierarchal approach for discharge of surface water at the development site is considered in detail below:

Method	Suitability	Suitability for Development
Infiltration to Ground	No	Investigations have identified the underlying ground to be cohesive and so infiltration is discounted.
Connection to Watercourse	No	No watercourse in close proximity.
Connection to Surface Water Sewer	No	No surface water sewer in close proximity.
Connection to Combined Water Sewer	Yes	Reuse existing offsite connection to the combined sewer in Kirkway at a peak rate of 5l/s.

Figure 2: SuDS Hierarchal Approach

2.6 Surface Water Drainage Strategy

The general principal of the surface water drainage strategy is to collect the runoff from the roof configuration of the new residential properties and direct it to a number of RWPs that will drop down via the rear water butts to a new below surface water drainage network. This will flow around the properties in a south easterly direction before outfalling to the existing offsite combined drain. The outflow will be restricted to 5.0l/s via a flow control chamber.

The front driveways will be constructed in permeable surfacing.

Full details of this strategy can be found on the GWK Drainage GA drawing in Appendix A and the hydraulic calculations in Appendix B.

2.7 Water Quality

Water quality has been considered and the following measures have been included within the surface water drainage proposals:

- Runoff from roofs is generally considered to be clean and will be discharged directly into the combined water network.

- All drainage from the driveway will pass through the permeable surfacing and so treated at source.

2.8 Maintenance

The drainage network encompasses standard pipework and manholes, geocellular tank and flow control. As long as the gullies at the base of the rainwater pipes are kept clear of leaves and detritus by regular inspection by the property owners then this should negate it passing into the network.

All management and maintenance of the drainage within each of the units and access road will be with the property owners to maintain the gullies, manholes, flows controls and attenuation tank. This will involve general maintenance of the drainage network in accordance with best practice, which is covered in Ciria guidance C753. Annual inspections will need to be carried out and clearing of gullies, channel drains and catchpits constructed.

Typically, the maintenance regime will be in line with the table below.

Future Maintenance of the Drainage System			
Responsibility	Feature	Maintenance	Frequency
Management company	Rainwater gutters, downpipes and above ground drainage.	Regular maintenance and inspections.	Ad-hoc sweeping and emptying of silt and debris required. Annual visual inspections to check for damage/leaks.
	Flow control chambers.	Regular maintenance / removal of blockages and debris.	Annual inspection and following significant rainfall events.
	Permeable Surfacing	Regular maintenance / removal of excess grasses and debris from voids.	Annual inspection and following significant rainfall events.
	Pipes, sewers, manholes	Regular maintenance / removal of blockages and debris.	Annual inspection and removal of silts if required.

Figure 3: Outline Management & Maintenance Plan

3.0 Drainage Related Planning Condition and Responses

3.1 Planning Conditions

Detailed below are the drainage condition Number 3 is in italics with the GWK response in Blue beneath each point.

Condition

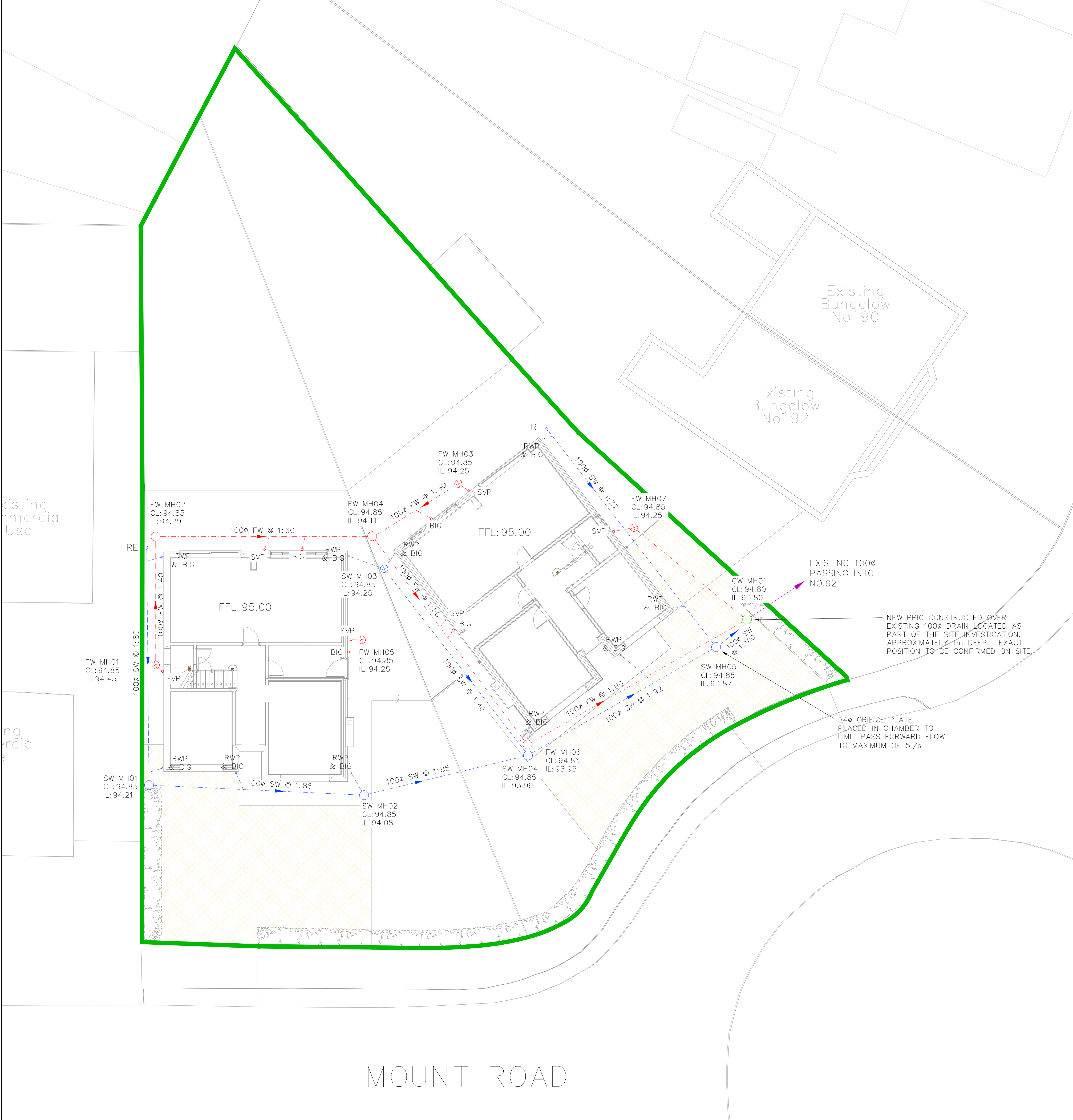
No development shall take place until a scheme for the disposal of foul and surface waters from the site has been submitted to and approved in writing by the Local Planning Authority. For the avoidance of doubt, surface water must drain separately from foul water. The surface water drainage scheme should be based on the hierarchy of drainage options in the National Planning Practice Guidance with evidence of an assessment of the site conditions, and include details of how the scheme shall be managed after completion. The development shall be completed, maintained and managed in accordance with the approved details.

As described in the earlier sections, the hierarchal approach has been considered for the draining of surface water from the development site. The underlying ground is cohesive and so a connection is to be made to the adjacent combined water sewer via the existing offsite connection at a restricted peak rate of 5l/s.

Refer to Appendix A for details of the surface water drainage network and Hydraulic calculations in Appendix B have been simulated for all events up to the 100 years plus 45% climate change event. This confirms no flooding for all events.

An outline maintenance and management plan can be found in section 2.8.

Appendix A - GWK Design Drawings



DRAINAGE NOTES & SPECIFICATIONS

- THE CONTRACTOR IS RESPONSIBLE FOR THE CONFIRMATION OF ALL POSITIONS AND LEVELS OF EXISTING DRAINS, SEWERS AND MANHOLES PRIOR TO THE COMMENCEMENT OF THE PROPOSED WORKS AND ANY DISCREPANCIES REPORTED IMMEDIATELY TO GWK.
- ALL PRIVATE DRAINAGE WITHIN THE SITE IS TO COMPLY WITH THE REQUIREMENTS OF BS EN 752 AND BUILDING REGULATIONS PART H.
- NO DEVIATION FROM THE CONTENT OF THIS DRAWING IS ALLOWED WITHOUT PERMISSION OF GWK.
- FOR DETAILS OF WORKMANSHIP AND MATERIALS REFER TO THE SPECIFICATION, BUILDING REGULATIONS AND BRITISH STANDARDS CURRENT AT THE TIME OF THE WORK.
- ADEQUATE PROTECTION IS TO BE PROVIDED TO MAINTAIN INTEGRITY OF THE EXISTING SERVICES AND PROPOSED WORKS DURING CONSTRUCTION.
- COVER LEVELS ARE PROVISIONAL AND THE FINAL LEVEL SHOULD BE ADJUSTED AND SET TO SUIT THE PROPOSED FINISHED LEVELS AS CONFIRMED BY THE ARCHITECT.
- CONCRETE SURROUND IS TO BE PROVIDED TO ALL DRAINS WITH A COVER OF LESS THAN 1.2m OF THE FINISHED GROUND LEVEL IN HIGHWAY AREAS OR WITHIN 0.6m IF WITHIN LANDSCAPED AREAS. AN EXPANSION JOINT IS TO BE PROVIDED AT EACH AND EVERY PIPE JOINT.
- ANY GRADIENTS OF DRAINS INDICATED ARE INDICATIVE ONLY AND THE CONTRACTOR SHALL INSTALL THE DRAINS TO THE SPECIFIED LEVELS SHOWN FOR EACH MANHOLE (U.O.N). CATCHPIT INVERT LEVELS ARE FOR THE OUTGOING PIPE WITH THE SUMP LEVEL SPECIFIED SEPARATELY.
- ALL PIPEWORK WITHIN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT (U.O.N). ALL CHAMBER INVERT LEVELS ARE FOR THE OUTGOING PIPE LEVELS. BACKDROP PIPEWORK SHALL BE CONNECTED AT SOFFIT TO SOFFIT WITH THE RODDING ACCESS LEVEL SPECIFIED.
- ALL INVERT LEVELS PROVIDED FOR 475mm PPIC CHAMBER ARE TO THE LOWEST PIPE WITHIN THE BENCHING ARRANGEMENT.
- DRAINAGE CHANNELS ARE TO BE ACO MD SYSTEM C/W 'HEELGUARD' GRATES OR 'BRICKSLOT' TO LANDSCAPE ARCHITECT APPROVAL.
- MANHOLE COVERS AND FRAMES ARE TO BE IN ACCORDANCE WITH BS EN 124 AND THE FOLLOWING:
 - VEHICULAR AREAS: CLASS D400 (E600 IN SERVICE YARD LOCATIONS), DOUBLE TRIANGULAR, 150mm DEEP DUCTILE IRON COVER AND FRAME WITH THREE POINT COVER SEATING, (NON-ROCK DESIGN) BADGED FW OR SW FOR FOUL OR SURFACE WATER DRAINAGE.
 - PEDESTRIAN AREAS: CLASS B125, 100mm DEEP, BADGED FW OR SW FOR FOUL OR SURFACE WATER DRAINAGE.
 - IF COVERS ARE REQUIRED TO BE RECESSED A HOWE GREEN 1050 HEAVY DUTY, STAINLESS STEEL EDGE, EXTERNAL USE, 100mm RECESS OR SIMILAR APPROVED SHALL BE USED.
- REFER TO ARCHITECT'S DRAWING FOR RWP'S/WPC'S POP UP SIZES. ALL REST BENDS ARE ASSUMED TO BE 1000, SET 600mm BELOW SSL, UNLESS OTHER SPECIFIED. THE CONTRACTOR SHALL ALLOW FOR SUITABLE VIKING JOHNSON ADAPTORS/COUPLINGS FOR JOINTING THE DIFFERENT PIPE MATERIALS/PIPE SIZES.
- ALL BRICKWORK IN CONNECTION WITH DRAINAGE IS BE SOLID ENGINEERING BRICK CLASS B TO BS 3921.
- ALL INSITU CONCRETE TO BE GEN3 UNLESS SPECIFIED OTHERWISE.
- ALL PRECAST CONCRETE PIPES, CHAMBER PRODUCTS AND ROAD GULLIES SHALL BE TO BS 5911 AND BE KITEMARKED.
- VITRIFIED CLAY PIPES TO CONFORM TO BS EN 295 MANUFACTURER: HEPWORTH SUPERSLEEVE;
 - 100/150mmØ -40 kN/m
 - 225mmØ -45 kN/m
 - 300mmØ -72 kN/mAND BE SUPPLIED WITH EPDM SEALING RINGS AS STANDARD.
- PLASTIC PIPEWORK IS ACCEPTABLE AND SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS.
- UPON COMPLETION OF THE WORKS, ALL THE DRAINS SHALL BE CLEANED BY JETTING, REMOVING ALL DEBRIS FROM SITE. NO DEBRIS SHALL BE PERMITTED TO ENTER THE EXISTING DRAINAGE SYSTEM.
- UPON COMPLETION OF THE WORKS THE CONTRACTOR SHALL SURVEY THE WORKS AND PROVIDE A SUITABLY 'MARKED-UP' DRAWINGS FOR 'RECORD' PURPOSES'.

NOTES: —

- ALL LEVELS ARE IN METRES.
- ALL DIMENSIONS ARE IN MILLIMETRES.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCURACY OF ALL DIMENSIONS AND LEVELS AND FOR THE CORRECT SETTING OUT OF THE WORK ON SITE UNLESS NOTED OTHERWISE.
- THE CONTRACTOR SHALL ENSURE ALL NECESSARY PRECAUTIONS ARE TAKEN TO PROTECT EXISTING SERVICES DURING THE WORKS.

KEY

- EXISTING COMBINED WATER DRAINAGE
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED PERMEABLE SURFACING
- PROPOSED 450Ø PPIC
- PROPOSED 300Ø MINI PPIC (MAX 600 DP)
- RWP RAINWATER PIPE
- SVP SOIL VENT PIPE
- BIG BACK INLET GULLY
- RE RODDING EYE
- SITE BOUNDARY

NOTE ALL RWP AND SVP LOCATIONS TO BE CONFIRMED BY OTHERS

EXTERNAL LEVELS TO BE AGREED BY OTHERS

ALL PIPEWORK TO BE 100Ø UNLESS NOTED OTHERWISE

A	22.08.24	PG	GWK	ISSUED FOR INFORMATION
No	DATE	DRAWN	REV'D ENG.	AMENDMENT

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PROJECT	57/59 MOUNT ROAD, MIDDLETON, MANCHESTER		
DRAFTER	PG	ENGINEER	GWK
TITLE	DRAINAGE GA		
SCALE	DRAWING No	DATE	AMOT
1:100	GK4571-C-001	22.08.24	A

Appendix B - GWK Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	10	Maximum Rainfall (mm/hr)	100.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RE	0.004	4.00	94.850	100	0.500
SW01	0.003	4.00	94.850	450	0.640
SW02	0.002	4.00	94.850	450	0.770
SW03	0.005	4.00	94.850	300	0.600
SW04	0.002	4.00	94.850	450	0.860
re02	0.004	4.00	94.850	100	0.600
SW05			94.850	450	0.980
CW01			94.850	450	1.010

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	RE	SW01	12.000	0.600	94.350	94.210	0.140	85.7	100	4.24	100.0
1.001	SW01	SW02	11.000	0.600	94.210	94.080	0.130	84.6	100	4.46	100.0
1.002	SW02	SW04	8.000	0.600	94.080	93.990	0.090	88.9	100	4.62	100.0
2.000	SW03	SW04	12.000	0.600	94.250	93.990	0.260	46.2	100	4.18	100.0
1.003	SW04	SW05	11.000	0.600	93.990	93.870	0.120	91.7	100	4.85	100.0
3.000	re02	SW05	14.000	0.600	94.250	93.870	0.380	36.8	100	4.18	100.0
1.004	SW05	CW01	3.000	0.600	93.870	93.840	0.030	100.0	100	4.92	100.0

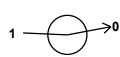
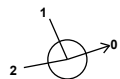
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.831	6.5	1.1	0.400	0.540	0.004	0.0	28	0.616
1.001	0.837	6.6	1.9	0.540	0.670	0.007	0.0	37	0.727
1.002	0.816	6.4	2.4	0.670	0.760	0.009	0.0	43	0.759
2.000	1.137	8.9	1.4	0.500	0.760	0.005	0.0	26	0.816
1.003	0.803	6.3	4.3	0.760	0.880	0.016	0.0	61	0.864
3.000	1.274	10.0	1.1	0.500	0.880	0.004	0.0	22	0.832
1.004	0.769	6.0	5.4	0.880	0.910	0.020	0.0	74	0.869

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	12.000	85.7	100	Circular	94.850	94.350	0.400	94.850	94.210	0.540
1.001	11.000	84.6	100	Circular	94.850	94.210	0.540	94.850	94.080	0.670
1.002	8.000	88.9	100	Circular	94.850	94.080	0.670	94.850	93.990	0.760
2.000	12.000	46.2	100	Circular	94.850	94.250	0.500	94.850	93.990	0.760
1.003	11.000	91.7	100	Circular	94.850	93.990	0.760	94.850	93.870	0.880
3.000	14.000	36.8	100	Circular	94.850	94.250	0.500	94.850	93.870	0.880
1.004	3.000	100.0	100	Circular	94.850	93.870	0.880	94.850	93.840	0.910

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	RE	100	Manhole	Adoptable	SW01	450	Manhole	Adoptable
1.001	SW01	450	Manhole	Adoptable	SW02	450	Manhole	Adoptable
1.002	SW02	450	Manhole	Adoptable	SW04	450	Manhole	Adoptable
2.000	SW03	300	Manhole	Adoptable	SW04	450	Manhole	Adoptable
1.003	SW04	450	Manhole	Adoptable	SW05	450	Manhole	Adoptable
3.000	re02	100	Manhole	Adoptable	SW05	450	Manhole	Adoptable
1.004	SW05	450	Manhole	Adoptable	CW01	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
RE	-15.243	71.356	94.850	0.500	100		0	1.000	94.350	100
SW01	-14.565	41.017	94.850	0.640	450		1	1.000	94.210	100
							0	1.001	94.210	100
SW02	16.282	39.661	94.850	0.770	450		1	1.001	94.080	100
							0	1.002	94.080	100
SW03	31.537	73.898	94.850	0.600	300		0	2.000	94.250	100
SW04	44.249	44.915	94.850	0.860	450		1	2.000	93.990	100
							2	1.002	93.990	100
							0	1.003	93.990	100
re02	63.910	85.085	94.850	0.600	100		0	3.000	94.250	100
SW05	76.791	55.593	94.850	0.980	450		1	3.000	93.870	100
							2	1.003	93.870	100
							0	1.004	93.870	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
CW01	88.486	63.729	94.850	1.010	450	1	1.004	93.840	100



Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Node SW05 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.700	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	5.0		
Invert Level (m)	93.870	Diameter (m)	0.054		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	1 year 720 minute winter	5.513	2.199
1 year 15 minute winter	76.857	30.991	1 year 960 minute summer	6.768	1.782
1 year 30 minute summer	71.439	20.215	1 year 960 minute winter	4.483	1.782
1 year 30 minute winter	50.133	20.215	1 year 1440 minute summer	4.949	1.326
1 year 60 minute summer	48.435	12.800	1 year 1440 minute winter	3.326	1.326
1 year 60 minute winter	32.179	12.800	30 year 15 minute summer	268.706	76.035
1 year 120 minute summer	30.053	7.942	30 year 15 minute winter	188.566	76.035
1 year 120 minute winter	19.966	7.942	30 year 30 minute summer	174.929	49.499
1 year 180 minute summer	23.233	5.979	30 year 30 minute winter	122.757	49.499
1 year 180 minute winter	15.102	5.979	30 year 60 minute summer	116.589	30.811
1 year 240 minute summer	18.475	4.882	30 year 60 minute winter	77.459	30.811
1 year 240 minute winter	12.274	4.882	30 year 120 minute summer	70.438	18.615
1 year 360 minute summer	14.169	3.646	30 year 120 minute winter	46.797	18.615
1 year 360 minute winter	9.210	3.646	30 year 180 minute summer	53.298	13.715
1 year 480 minute summer	11.185	2.956	30 year 180 minute winter	34.645	13.715
1 year 480 minute winter	7.431	2.956	30 year 240 minute summer	41.604	10.995
1 year 600 minute summer	9.182	2.511	30 year 240 minute winter	27.641	10.995
1 year 600 minute winter	6.274	2.511	30 year 360 minute summer	31.221	8.034
1 year 720 minute summer	8.203	2.199	30 year 360 minute winter	20.295	8.034

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 480 minute summer	24.324	6.428	100 year +45% CC 120 minute winter	89.169	35.469
30 year 480 minute winter	16.160	6.428	100 year +45% CC 180 minute summer	101.219	26.047
30 year 600 minute summer	19.756	5.404	100 year +45% CC 180 minute winter	65.795	26.047
30 year 600 minute winter	13.498	5.404	100 year +45% CC 240 minute summer	78.690	20.795
30 year 720 minute summer	17.490	4.687	100 year +45% CC 240 minute winter	52.280	20.795
30 year 720 minute winter	11.754	4.687	100 year +45% CC 360 minute summer	58.701	15.106
30 year 960 minute summer	14.215	3.743	100 year +45% CC 360 minute winter	38.157	15.106
30 year 960 minute winter	9.416	3.743	100 year +45% CC 480 minute summer	45.550	12.038
30 year 1440 minute summer	10.161	2.723	100 year +45% CC 480 minute winter	30.262	12.038
30 year 1440 minute winter	6.829	2.723	100 year +45% CC 600 minute summer	36.875	10.086
100 year +45% CC 15 minute summer	505.670	143.087	100 year +45% CC 600 minute winter	25.195	10.086
100 year +45% CC 15 minute winter	354.856	143.087	100 year +45% CC 720 minute summer	32.556	8.725
100 year +45% CC 30 minute summer	332.000	93.944	100 year +45% CC 720 minute winter	21.879	8.725
100 year +45% CC 30 minute winter	232.982	93.944	100 year +45% CC 960 minute summer	26.340	6.936
100 year +45% CC 60 minute summer	222.268	58.739	100 year +45% CC 960 minute winter	17.448	6.936
100 year +45% CC 60 minute winter	147.669	58.739	100 year +45% CC 1440 minute summer	18.700	5.012
100 year +45% CC 120 minute summer	134.215	35.469	100 year +45% CC 1440 minute winter	12.567	5.012

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE	10	94.370	0.020	0.6	0.0034	0.0000	OK
15 minute summer	SW01	10	94.236	0.026	1.0	0.0066	0.0000	OK
15 minute winter	SW02	11	94.110	0.030	1.3	0.0064	0.0000	OK
15 minute winter	SW03	10	94.269	0.019	0.7	0.0045	0.0000	OK
15 minute winter	SW04	12	94.036	0.046	2.3	0.0094	0.0000	OK
15 minute winter	re02	10	94.267	0.017	0.6	0.0023	0.0000	OK
15 minute winter	SW05	12	94.027	0.157	2.8	0.0250	0.0000	SURCHARGED
15 minute summer	CW01	1	93.840	0.000	2.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE	1.000	SW01	0.6	0.432	0.091	0.0167	
15 minute summer	SW01	1.001	SW02	1.0	0.548	0.150	0.0199	
15 minute winter	SW02	1.002	SW04	1.3	0.510	0.200	0.0211	
15 minute winter	SW03	2.000	SW04	0.7	0.492	0.078	0.0259	
15 minute winter	SW04	1.003	SW05	2.2	0.440	0.353	0.0621	
15 minute winter	re02	3.000	SW05	0.6	0.518	0.060	0.0607	
15 minute winter	SW05	Orifice	CW01	2.2				1.3

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	RE	10	94.383	0.033	1.5	0.0055	0.0000	OK
15 minute winter	SW01	13	94.281	0.071	2.6	0.0180	0.0000	OK
15 minute winter	SW02	13	94.277	0.197	3.3	0.0415	0.0000	SURCHARGED
15 minute winter	SW03	10	94.281	0.031	1.8	0.0072	0.0000	OK
15 minute winter	SW04	13	94.269	0.279	4.7	0.0575	0.0000	SURCHARGED
15 minute summer	re02	10	94.276	0.026	1.5	0.0037	0.0000	OK
15 minute winter	SW05	13	94.240	0.370	4.4	0.0588	0.0000	SURCHARGED
15 minute summer	CW01	1	93.840	0.000	3.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	RE	1.000	SW01	1.5	0.545	0.229	0.0331	
15 minute winter	SW01	1.001	SW02	2.6	0.678	0.394	0.0757	
15 minute winter	SW02	1.002	SW04	2.3	0.555	0.353	0.0626	
15 minute winter	SW03	2.000	SW04	1.8	0.439	0.201	0.0591	
15 minute winter	SW04	1.003	SW05	3.1	0.467	0.497	0.0861	
15 minute summer	re02	3.000	SW05	1.5	0.572	0.150	0.0662	
15 minute winter	SW05	Orifice	CW01	3.6				3.2

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE	13	94.575	0.225	2.8	0.0378	0.0000	FLOOD RISK
15 minute winter	SW01	14	94.571	0.361	4.8	0.0913	0.0000	FLOOD RISK
15 minute winter	SW02	14	94.561	0.481	4.8	0.1014	0.0000	FLOOD RISK
15 minute winter	SW03	14	94.552	0.302	3.4	0.0715	0.0000	FLOOD RISK
15 minute winter	SW04	14	94.547	0.557	6.1	0.1148	0.0000	SURCHARGED
15 minute winter	re02	14	94.497	0.247	2.8	0.0348	0.0000	SURCHARGED
15 minute winter	SW05	14	94.494	0.624	5.4	0.0992	0.0000	SURCHARGED
15 minute summer	CW01	1	93.840	0.000	4.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE	1.000	SW01	2.7	0.607	0.414	0.0939	
15 minute winter	SW01	1.001	SW02	3.6	0.699	0.551	0.0861	
15 minute winter	SW02	1.002	SW04	3.1	0.569	0.477	0.0626	
15 minute winter	SW03	2.000	SW04	2.7	0.557	0.308	0.0939	
15 minute winter	SW04	1.003	SW05	4.2	0.537	0.666	0.0861	
15 minute winter	re02	3.000	SW05	2.3	0.642	0.227	0.1095	
15 minute winter	SW05	Orifice	CW01	4.7				6.1