



Norden, Rochdale

Outline Drainage Strategy

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1.0 INTRODUCTION

1.1 Purpose of this report

This Outline Surface Water Drainage Strategy has been prepared to support the planning application for the proposed development for Norden, Rochdale.

The assessment includes: a summary of the site, an estimate of the existing and proposed surface water discharge rates, infiltration assessment, SUDs assessment, and outline drainage proposals and performance criteria.

This report should be read in conjunction with the Flood Risk Assessment, renaissance, December 2019.

The proposals within this report are intended to demonstrate the feasibility of the overarching drainage strategy to support the planning proposal.

2.0 THE SITE

2.1 Site Location

The proposed development site is located off Greenbooth Road in Rochdale.

The site location is described below:

- Post Code OL12 7TD
- OS X (Easting) 385736
- OS Y (Northing) 414705
- Nat. Grid SD857147

The site location is illustrated in Figure 2.1 below.



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Figure 2.1: Site Location

2.2 Site Description

The developed site area is circa 2.020 hectares and is located within a partially developed area, with the surrounding land being used for residential purposes.

The site forms an irregular shaped parcel of land, which can be divided into three distinct areas. The site includes: the remnants of the Tack Lea Works, occupying the central and northern portion of the site, the former Tenterhouse Mill, located in the western portion of the site and Shepherd Mill in the south eastern part of the site.

The topographical survey (Appendix A) indicates that the site slopes towards the south and south east.



2.3 Existing Site Drainage

The site is 50% impermeable, with associated existing drainage. The remaining area comprises permeable grassed or landscaped areas. The existing site drainage is understood to discharge into the existing foul water systems, with the site discharging to the United Utility sewer along Greenbooth Road. Surface water is assumed to discharge to the existing surface water sewer that also runs along Greenbooth Road.

Two sections of culvert have been identified on the site (refer to Appendix B). One exists beneath the main Tack Lea Works Mill building, with the other beneath the Shepherd Mill building. It is recommended that these culverts be inspected and traced as part of any future measured/topographical site surveys.

In accordance with EA and government policy, with regards to a watercourse which passes through private land, the land owner has riparian responsibilities under law which include:- to pass on water flow without obstruction, pollution or diversion which would affect the rights of others; to maintain the banks and bed of the watercourse, including any trees and shrubs growing on the banks, and any flood defences that exist on it; to maintain and manage any culverted sections of the watercourse, including carrying out all necessary maintenance and repairs; leave the development edge free on the banks next to the watercourse in case of EA or other maintenance or inspection is required.

In addition to the above, a well/spring was identified beneath the dye house in the central site area. The precise location of the well (and also the onsite existing sewers) will need to be established prior to the commencement of the proposed development works.

It is recommended, that a detailed drainage survey should be undertaken as the design develops, in order to verify the existing on-site drainage and connections to the surrounding sewer system. It should also be noted that diversion and re-connection may be required if any damage to the existing land drainage system is caused by foundation or sewer excavations.

2.4 Geology

British Geological Survey (BGS) maps indicate the site to be superficial deposits of Till, Devensian - Diamicton. The bedrock underlying the site is shown to be Rough Rock – Sandstone.

In the Shepherd Mill and Tack Lea areas, drift deposits were found to be absent in some locations. Where drift strata was encountered, it is stated to typically comprise gravelly clay with cobbles or sandstone and saturated, fine to coarse sand and gravel, extending vertically to depths of approximately 2.0m to 4.0m.

Drift deposits are shown to be more extensive, both laterally and vertically to the south and west of the Naden Brook (in the Tenterhouse Mill area). In this area, the drift strata appears to comprise interbedded gravelly clay with sandstone cobbles and medium dense saturated fine to coarse sand and gravel overlying “stiff” to “very stiff” sandy gravelly clay (Glacial Till). In this part of the site, the drift deposits are shown to extend to depths in excess of 15.0m.

It should be noted that a basement is located beneath part of the dye house in the north western part of the site. As such, strip/trench fill foundations will not be suitable in this part of the site. Instead, it is recommended that the basement could be backfilled using engineered fill, in order that raft or piled foundations can be adopted. In addition, it should be re-iterated that a culvert runs beneath this part of the site, which may also significantly influence foundation options.



Given the heritage of the site, contamination is anticipated. It is, therefore recommended that for all garden and landscaped areas a 600mm thick surface cover of “clean” soil comprising 150mm subsoil and 450mm topsoil be provided in order to eliminate any potential link between the underlying contaminated fill and future end-users of the site.

2.5 Hydrology

The site is located approximately 30m north of the Naden Brook that flows south.

Historically, there has been one Surface Water Abstraction recorded on site. The licence relates to industrial/commercial processes at Tack Lea Works. One surface water abstraction point for potable water supply has been recorded at Greenbooth Reservoir 474m to the north west (upstream) from the site.

Aquifer – Drift strata (Glacial Till) are classified by the Environmental Agency as ‘*low permeability non-aquifer*’. Solid strata are classified as a minor aquifer.

2.6 Proposed Development

The proposed redevelopment is for residential end use, comprising a combination of two and three storey townhouses (with and without separate garage/internal garages) with associated gardens, Public Open Space (P.O.S.), adoptable roads and sewers. Refer to the architects planning drawings for the proposed Site Layout Plan.

The proposals are to work within the existing site levels following complete demolition of existing buildings on the site.

3.0 EXISTING & PROPOSED SURFACE WATER DISCHARGE RATES

3.1 Pre-Development Surface Water Run-Off Rates

The existing development site area is 20,203m² (2.020ha) and is considered 50% impermeable in its current condition. The brownfield areas consist of positively drained hard-standing and with areas of vegetation throughout the other area of the site.

3.1.1 Existing Brownfield Run-Off Rates

To estimate the pre-development surface water discharge into the existing drainage system a mock network has been simulated in industry approved Micro Drainage Software (Appendix E) which is presented in the Table 3.1. The system is based on a single 225 dia connection to the existing surface water system. A critical 60-minute duration has been assumed to obtain the predevelopment rates.

A 50% betterment to brownfield run-off rates is proposed. The pre-development run-off rates for the 1, 2, 30 and 100 year events are therefore: -

Return Period	Q _{Brownfield} (l/s)	Q _{50% Brownfield} (l/s)
1 in 1 year	86.6	43.3
1 in 2 year	110.0	55.0
1 in 30 year	202.5	101.3
1 in 100 year	261.2	130.6

Table 3.1 – Brownfield Run-off Rates

3.1.2 Existing Greenfield Run-Off Rates

A remaining permeable area of 1.012 ha (10,121m²) is to be considered as greenfield run-off rates. The greenfield run-off rates for this portion of the development have been calculated using Microdrainage ICP SUDS method. The rates presented below are what would be typical of a site with an equivalent surface area which remains undeveloped / covered in grass or vegetation. A partly urbanised catchment ratio of 0.75, Q_{bar} has a return period of 2.3 years.

The equivalent greenfield run-off rate is tabled below: -

Return Period	Q _{Greenfield} (l/s)
1 in 1 year	15.8
1 in 2 year	18.6
1 in 30 year	26.3
1 in 100 year	28.3

Table 3.2 – Greenfield Run-off Rates

3.2 Proposed Surface Water Discharge Rates & Attenuation Requirements

Peak discharge rates will therefore be restricted to 50% of the pre-development brownfield run-off rate, plus greenfield run-off rates for the remaining area.

Restricting discharge rates to Greenfield run-off rates for the whole site is not considered practicable given the site constraints including size of site, limitations on infiltration. However, practical measures in addition to the 50% reduction in pre-development discharge are presented below, including allowance for climate change in post-development rates and use of SUDs to reduce runoff.

The total proposed run-off rates for the development site has been presented in the table below.

Return Period	Q _{50% Brownfield} (l/s)	Q _{Greenfield} (l/s)	Q _{total} (l/s)
1 in 1 year	43.3	15.8	59.1
1 in 30 year	101.3	26.3	127.6
1 in 100 year	130.6	28.3	158.9

Table 3.3 – Proposed Surface Water Run-off Rates

The proposed development results in circa 11,041m² of building footprint or external hard paved areas or highways.

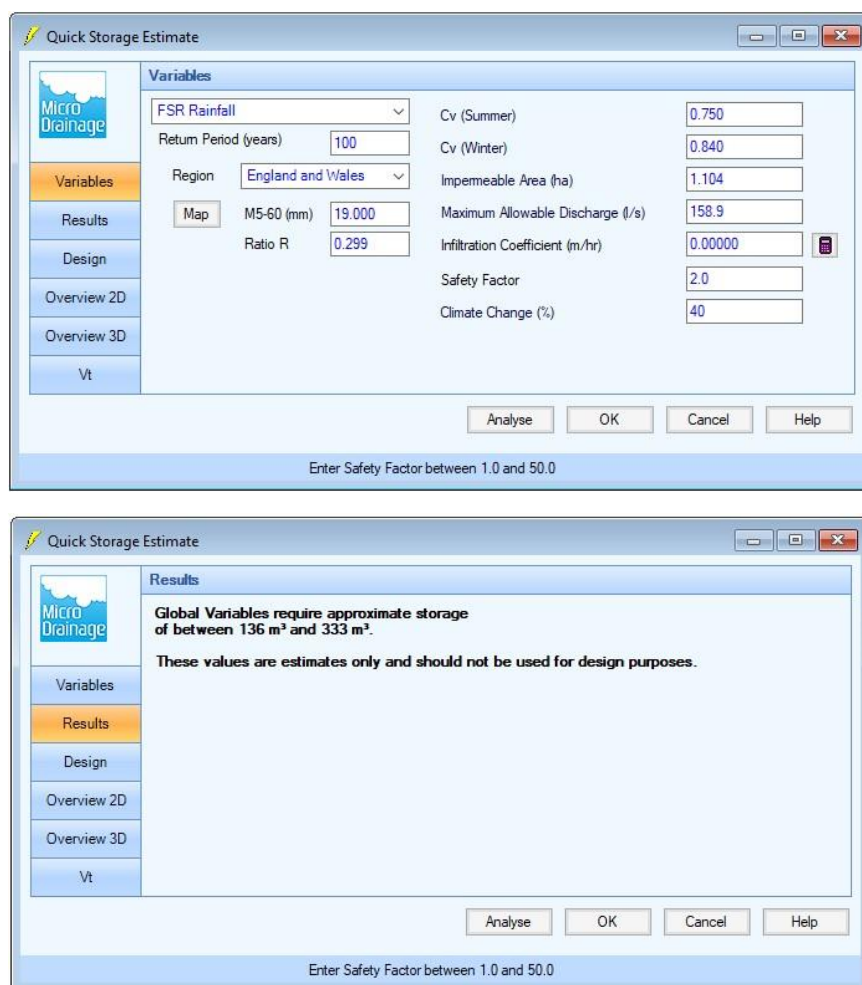
The provision of pervious surfaces is being proposed and further examination of the site conditions is recommended to determine the viability of infiltration and whether the system is required to have a permeable or impermeable liner. At this stage, an impermeable liner is proposed.

The post development discharge rates will include for an increase in the rainfall intensity of 40% to allow for climate change as is consistent with a design life of the development of 100 years, as outlined in NPPF.

To comply with the Non-Statutory Technical Standards for Sustainable Drainage: Practice Guidance the runoff volume for the post development 1 in 100 year 6 hour rainfall event will not exceed the pre-development runoff volume as the Brownfield runoff rates have been reduced by 50%.

The total allowable discharge from the site is 158.9 l/s.

A quick storage estimate for the 1 in 100 year storm event, plus 40% for climate change, using Micro Drainage, indicates that the total of circa 136-333m³ of attenuation across the site is required to limit the peak surface water discharge to 50% of the pre-development brownfield plus greenfield, with the discharge limits as presented in Table 3.3. However, as the site is within a Flood Zone 2 the drainage system is to be designed to account for the receiving water course being surcharged. The attenuation volumes should therefore be reviewed as part of the detailed design to allow for any surcharged outfall scenarios.



Quick Storage Estimate

Variables

FSR Rainfall: [Dropdown]
Return Period (years): [100]
Region: [England and Wales]
Map: [M5-60 (mm) 19.000]
Ratio R: [0.299]
Cv (Summer): [0.750]
Cv (Winter): [0.840]
Impermeable Area (ha): [1.104]
Maximum Allowable Discharge (l/s): [158.9]
Infiltration Coefficient (m/hr): [0.00000]
Safety Factor: [2.0]
Climate Change (%): [40]

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Quick Storage Estimate

Results

Global Variables require approximate storage of between 136 m³ and 333 m³.
These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Figure 3.4 – Quick Storage Estimate for Proposed Development Impermeable Areas

Refer to Appendix C for Existing Impermeable Areas and Discharge Rates, Appendix D for Proposed Impermeable Areas and Discharge Rates with micro-drainage outputs provided in Appendix E.

55% of the site area will be developed with the proposed residential buildings and associated hard landscape for pedestrian and vehicle use. At this stage, the proposal is to provide the following areas of attenuation: -

Pervious Paving within the front driveway area of each property. The area will be lined until further infiltration testing can demonstrate the potential for a permeable system. An allowance for a lined system, (as referenced above,) adopting a 150mm depth of coarse graded aggregate with a 30% void ratio, providing a storage volume to each property. The final build up is subject to further CBR testing.

Oversized Drainage Network through the development, consisting of 900mm diameter surface water drainage with associated large diameter.

The two combined attenuation systems will provide the required attenuation volume to meet the requirements of the storage estimate for the site. The system will discharge into the Naden Brook and associated tributary via a flow control, limiting the discharge to the rate as noted above. The two areas of the site will have two separate discharge points, each size of flow control device is based on their respective area of development.

4.0 SURFACE WATER DISCHARGE & SUDS ASSESSMENT

4.1 Surface Water Discharge Assessment

In accordance with NPPF, the following hierarchy of surface water drainage options has been considered:

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

Infiltration direct to the ground has been considered, however, examination of the site conditions is recommended to determine the viability of infiltration due to variable underlying ground conditions. The provision of pervious surfaces is being proposed and an impermeable liner is to be provided at this stage.

Opportunities for discharge to watercourse have been considered. The nearest named watercourse is Naden Brook skirting the south western boundary and a tributary which runs through the site. The proposals consider direct discharge to the watercourse with the rate of discharge to be agreed with the LLFA and EA.

There are no surface water drains within the highway around the site, therefore, discharge to the public surface water sewer, as the current situation, has been discounted.

The surface water system will accommodate flows on-site up to and including the 1 in 100-year critical duration event, with an allowance for climate change. The surface water will be collected on site, via various SUDs features and collected by a dedicated gravity system designed in accordance with BS EN 752 before discharging to the water course, subject to agreement with the LLFA and EA as noted previously.

Surface water discharge rate from the site is to be restricted to a combination of greenfield run-off plus a 50% betterment of existing Brownfield run-off. For calculations of onsite storage and discharge rates refer to Appendix C for Existing Impermeable Areas and Discharge Rates, Appendix D for Proposed Impermeable Areas and Discharge Rates with micro-drainage outputs provided in Appendix E.

The surface water system will be collected on site, via various SUDs features and collected by a dedicated gravity system designed in accordance with BS EN 752 before discharging to the sewer network, subject to agreement under S106 of the water industry act.

Foul water flows will be collected by a dedicated gravity network designed in accordance with BS EN 752 before discharging to the existing combined sewer in two locations. The North Western portion of the site into Greenbooth Road and the South Eastern portion of the site into Edenfield Road, both subject to agreement under Section 106 of the water industry Act.

4.2 Sustainable Urban Drainage

Table 4.1 below provides a summary of typical SUDs techniques outlined within CIRIA guide 753 SUDs manual. Based on a review of the suitability of the SUDs techniques it is proposed that the Derwent Street development incorporated the following:

- Adopt lined permeable paving to each property's front driveway in order to provide a level of treatment and local storage

- Provide underground storage & flow control to limit runoff to acceptable limits.

SUDs Technique	Description	Suitability for Development Site	
Soft Landscaping	Grassed areas that allow direct infiltration of rainwater	Not suitable due to no provision of grassed area.	?
Filter Drains	Granular filled Linear drains / soakaway with either granular fill and perforated pipe, or dense vegetation that treat runoff from adjacent impermeable areas	Not suitable due to ground conditions, contamination risk and proximity of buildings.	✗
Swales	Shallow landscape channel that can infiltrate or convey runoff.	Not suitable due to ground conditions, contamination risk and proximity of buildings.	✗
Infiltration Basins	Depressions in the ground designed to store and infiltration runoff to the ground. Can be landscaped to provide amenity value.	Not suitable due to ground conditions, contamination risk and proximity of buildings.	✗
Wet Ponds	Basins with permanent pool of water providing water quality treatment, wildlife and amenity benefit. Designed to provide temporary storage for additional runoff.	Not suitable due to ground conditions, contamination risk and proximity of buildings.	✗
Extended Detention Basins	Dry basins that are designed to temporarily store runoff providing water quality treatment.	Not suitable due to ground conditions, contamination risk and proximity of buildings.	✗
Constructed Wetland	Ponds and shallow wetland areas with vegetation to improve pollution removal and enhance wildlife habitat.	Not suitable due to ground conditions, contamination risk and proximity of buildings.	✗
Porous Paving	Granular build-up beneath permeable paving systems that can be used to either store runoff (lined system) and increase time of concentration or allow percolation into the ground.	Potential suitable in localised areas subject to confirm of infiltration rates and contamination risk assessment to groundwater and adjacent watercourse.	✓
Trees Pits	Managed permeable paving systems around tree pits that can be used to either store runoff (lined system) and increase time of concentration or allow percolation into the ground.	Incompatibility of levels of active SUDs facilitated tree pits and adjacent pervious paving SUDs system	✗
Soakaways	Infiltration device to temporarily store runoff and allow it to percolate into the ground.	Not suitable due to ground conditions and contamination risk.	✗
Green Roof	Vegetated roof area that reduce runoff and increase time of concentration.	Not viable due to plant and access.	✗
Blue Roof	Roof area designed to store and reduce peak runoff rates during intense storms.	Suitable to the roof area.	✗
Underground Storage	Attenuation structures installed below ground to provide runoff storage.	Suitable beneath car park area at grade	✓

✗ Not suitable

? Potentially suitable subject to further investigation

✓ Suitable

Table 4.1 – SUDs Techniques & Suitability for Development Site

4.3 Water Quality Assessment

The drainage from the site is from the roof to the buildings and areas of hardstanding for pedestrian and vehicular use. Water quality is generally affected by frequent rainfall events, 1 in 1-year events or less, which is circa 5mm/hr for the proposed development site. To assess the water quality consideration will be given to the guidance with the National Standard for Sustainable Urban Drainage (NSSUD) and CIRIA Guide C753. The pollution



hazard levels for difference land uses are presented in table 4.2 and are based on the definitions in the NSSUD and C753.

Pollution Hazard Level	Land Use
Very Low	Residential roofs
Low	Individual property driveways, non-residential roofs, residential car parks, low traffic roads, non-residential car parking with infrequent change (e.g. Schools, offices)
Medium	Commercial yards and delivery areas, non-residential car parking with frequent change (e.g. hospital, retail), minor roads
High	Site with heavy pollution (e.g. Haulage yards, lorry parks, waste sites, sites with chemical and fuels are delivered, handled, stored etc.)

Table 4.2 – Pollution Hazard Levels

As the area is to be used for residential access the Pollution Hazard Level is considered as very low to low with the primary consideration given to removal of gross solids and sediment.

The following tables indicate the minimum number of treatment stages required before surface runoff should reach the infiltration or receiving water body and are extracted from the NSSUD.

Pollution Hazard Level	Land Use	Low	Med	High
G1	Source Protection Zone 1, within 50m of a well, spring or borehole that supplies potable water.	1	3	Consult the EA
G2	Into or immediately adjacent to a sensitive receptor that could be influenced by infiltrated water. Includes designated nature conservation, heritage and landscape sites – including Biodiversity Action Plan (BAP) habitats and Protected Species.	1	3	
G3	Source Protection Zone II and III or Principal Aquifer	1	3	
G4	Secondary Aquifer	1	2	
G5	Unproductive strata	1	2	

Table 4.3 – Groundwater Minimum Treatment Stages

Pollution Hazard Level	Normal surface water	Sensitive surface water
Low	0	1
Med	2	3
High	Consult the EA	

Table 4.4 – Surface Water Body Minimum Treatment Stages

Surface water discharging by infiltration is subject to further detailed assessment of the localised ground conditions. The provision of pervious surfaces is being proposed to each property's front driveway and further examination of the local site conditions is recommended to conclude on the viability of infiltration and whether the system is required to have a permeable or impermeable liner. At this stage, an allowance for an impermeable liner has been made.

Discharge of surface water to the water course requires one treatment stages due to the low pollution hazard level. The adoption of SUDs as noted and good practice will provide inherent treatment. The proposed pervious paving, dependant on detailing, will act to absorb most frequent rainfall events and filter out solids and sediment. Sumps will also be provided to gullies and channels within the hardstanding areas prior to connecting to the silt traps. The silt traps and sumps will allow most of the sediment and solids to settle out under low flows, prior to discharging into the oversized pipe network which will store the surface water prior to discharge via a flow control device into the water course.

4.4 SUDS Management Plan

The adopted Sustainable Urban Drainage systems are to be maintained by the Building Management Company selected by the client. The building management company will be required to maintain the SUDs features in line with the following recommendations and suppliers' requirements of the various features.

The following operation and maintenance requirements for the SUDs features incorporated into the development are to be adopted by the Building Management Company. These requirements are general and have been extracted from the CIRA Guide C753.

Table 20.15 - Operation and maintenance requirement for pervious paving

The Main Contractor delivering each phase of development will update the general requirements to reflect the product specific requirements of the as installed proprietary SUDs and incorporate these into the Operation & Maintenance manual for the building.

TABLE 20.15 Operation and maintenance requirements for pervious pavements

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

5.0 OUTLINE DRAINAGE STRATEGY

5.1 Surface Water System

The surface water drainage is to collect the rainwater from the proposed building and areas of hard standing within a dedicated surface water network. The system is to then discharge under gravity to the Naden Brook watercourse, subject to agreement of the LLFA and EA. An outline drainage strategy is presented in Appendix E.

The surface water discharge from the site is to be limited 50% of the existing brownfield plus greenfield run-off rates using flow control devices at each SUDs feature as well as within the final manhole on site prior to discharge into the water course.

Attenuation will be provided using pervious paving driveway of each property combined with large diameter drainage pipework within the highway.

The surface water discharging from the site will be from the building roofs and an amount of hard-standing for private car and pedestrian use at grade. To ensure water quality to the water course is acceptable all rainwater to the public realm area is to be collected in gullies and channels with sumps. In addition all rainwater from the building and at-grade private areas is to pass through the pervious paving and silt trap manholes prior to discharging to allow silt to be intercepted and settle out under normal rainfall conditions.

The surface water drainage network is to be designed in accordance with Building Regulation Part H, BS EN 752 and 'Sewers for Adoption' 7th edition. In addition, the following requirements will also be adopted in accordance with the Non-Statutory Technical Standards for Sustainable Drainage: Practice Guidance and Rochdale Core Strategy – Policy G8 – Managing water resources and flood risk requirements for new developments:

- No surcharging of drainage network for design storm of 1 in 2 years.
- The drainage system will be designed to capture and contain on site surface water on site for both the 1 in 30 year and 1 in 100-year rainfall events
- 1:100 year + 40% model reviewed, and flood routing plans prepared as part of detailed site design
- No flooding inside buildings in a 1 in 100 year plus climate change event. Refer to EA data assessment discussed in detail in the aforementioned FRA.

Refer to Appendix E for Micro Drainage calculations showing pre-development discharge on which the proposed system has been based. surface water system will work for the 1, 2, 30 and 100 year return events with 40% climate change and free flow outfall, together with the 1 in 100 + CC Storm duration up to 6hr and 40% climate change for the surcharge outfall with the 1 in 100 year flood level.

5.2 Exceedance Events

The levels on site are relatively flat and within the external public realm area, the levels are to be set to form a natural channel along the central highway through the site, with road linkages down to the existing roads adjacent. This natural channel maintains the overland flood routing from the site to the watercourse and improves the overland flood routing from exceedance events on site ensuring that the risk to people and property are minimised.

Assessing the site levels and the EA flood data, all finished floor levels at ground floor are all above the 1 in 100 year flood event plus climate change and 1 in 1000 year event.



5.3 Foul Water System

The foul water drainage from the properties will be collected by a dedicated gravity foul network. The system is to be connected to the existing combined sewer in Greenbooth Road and Edenfield Road, via a new connections.

The extent of the existing UU combined sewer drain in both existing roads is indicated on the United Utility map in Appendix B - Existing Combined / Foul Network Surrounding the site.

The drainage system is to be designed in accordance with Building Regulations Part H, BS EN 752 and 'sewers for adoption' 7th edition.

5.4 Phasing & Surface Water Management During Construction

It is assumed that given the scale of the development that it will be delivered in a single phase.

The management of surface water management during construction will be addressed by the Main Contractor as part of their 'Construction Management Plan'.

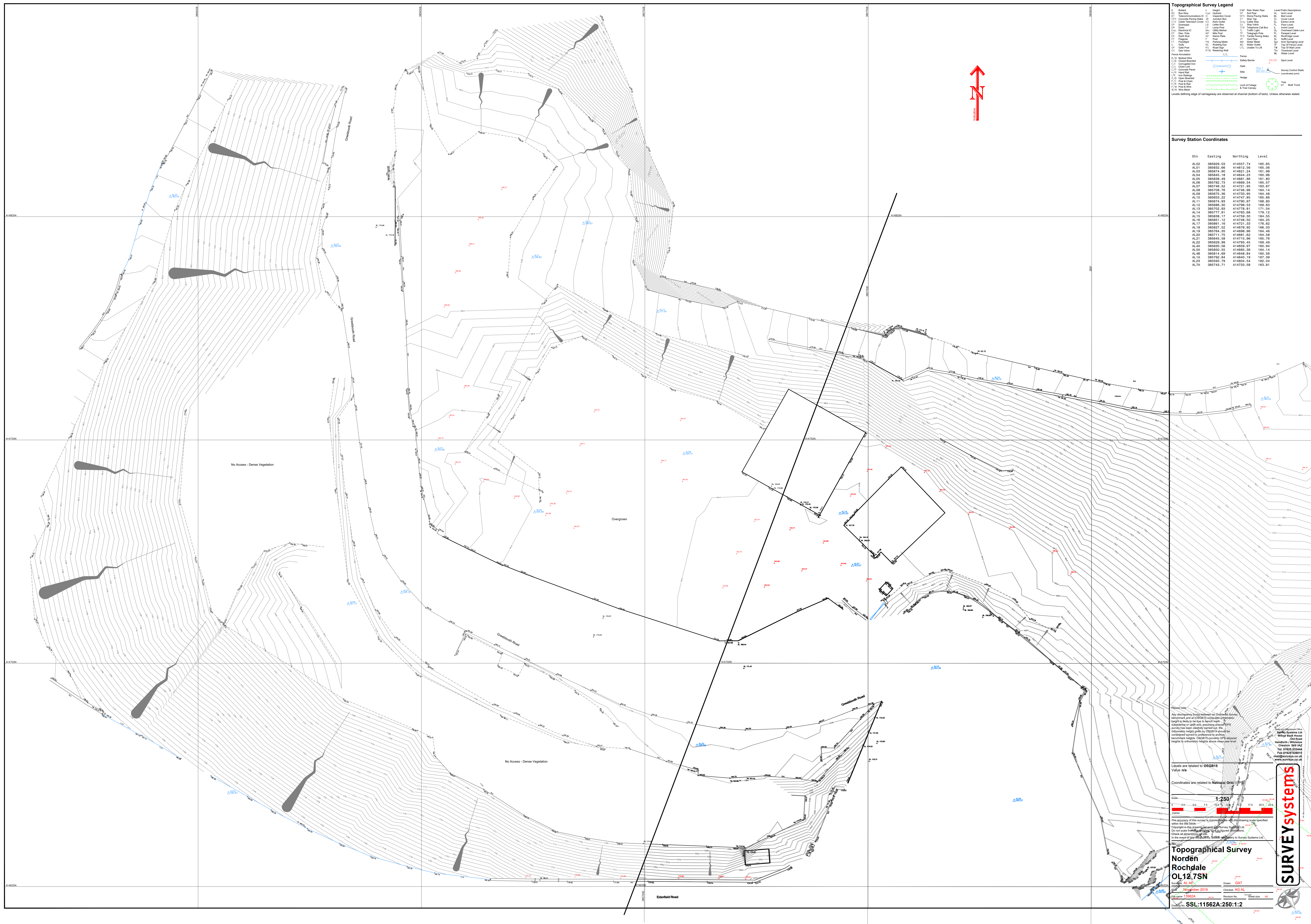
A brief overview of the key consideration relating to surface water management and flood risk that will need to be incorporated into the Main Contractors construction methodology include:

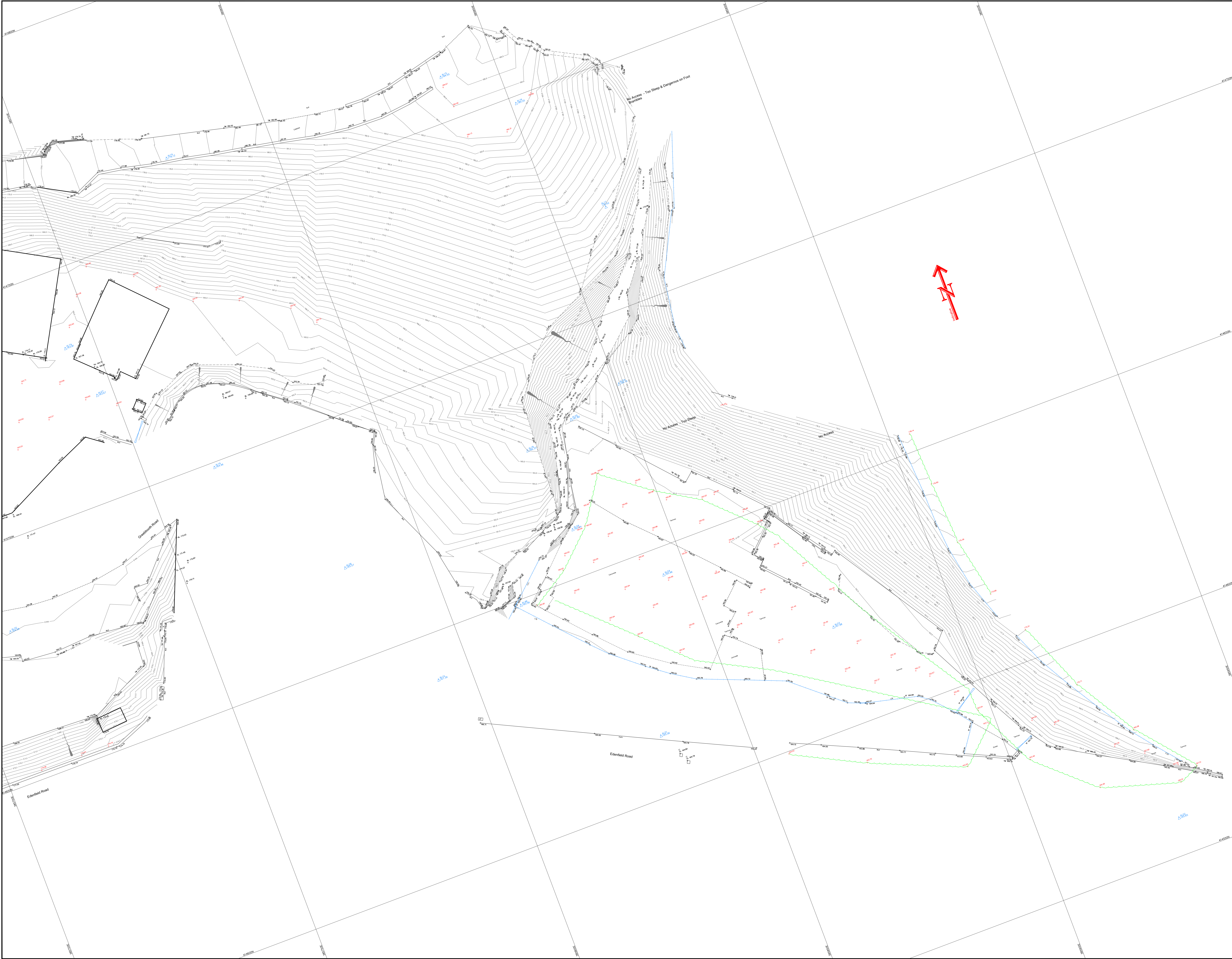
- The existing site is to be cleared of existing hard standing and other site features. Stockpiling of material on site is to be minimised to ensure that the flood storage capacity for the 1 in 1000-year (0.1% AEP) event is not compromised.
- Intrusive site investigations to date indicate localised evidence of contamination, (refer to WSP Ground Investigation Report Dated March 2019) and it is anticipated that ground remediation may be required. A working platform will also be required during construction to allow for formation of piled foundations etc. The top of the working platform is to be located at or lower than existing site levels to ensure that the flood storage capacity for the 1 in 1000-year (0.1% AEP) event is not compromised.
- Subject to the development of the remediation strategy, level of site remediation, and quality of working platform compaction to reduce infiltration, consideration should be given to the risk of residual contamination on site affecting groundwaters and the adjacent watercourse.
- The risk of spillage of diesel and other contamination risk during construction activities are to be assessed and measures implemented to ensure they do not cause a risk to groundwaters and the adjacent watercourse.



APPENDIX A

Topographical Survey





Topographical Survey Legend

Symbol	Description	Symbol	Description	Symbol	Description		
BS	Bullseye	h	Height	RRP	Rain Water Pipe	Level	Level Description
BS1	Bullseye 1	h1	Height 1	SP	Spot	AL	Asch Level
BS2	Bullseye 2	h2	Height 2	ST	Stop	CL	Cliff Level
BS3	Bullseye 3	h3	Height 3	ST1	Stop 1	CL1	Cliff Level 1
BS4	Bullseye 4	h4	Height 4	ST2	Stop 2	CL2	Cliff Level 2
BS5	Bullseye 5	h5	Height 5	ST3	Stop 3	CL3	Cliff Level 3
BS6	Bullseye 6	h6	Height 6	ST4	Stop 4	CL4	Cliff Level 4
BS7	Bullseye 7	h7	Height 7	ST5	Stop 5	CL5	Cliff Level 5
BS8	Bullseye 8	h8	Height 8	ST6	Stop 6	CL6	Cliff Level 6
BS9	Bullseye 9	h9	Height 9	ST7	Stop 7	CL7	Cliff Level 7
BS10	Bullseye 10	h10	Height 10	ST8	Stop 8	CL8	Cliff Level 8
BS11	Bullseye 11	h11	Height 11	ST9	Stop 9	CL9	Cliff Level 9
BS12	Bullseye 12	h12	Height 12	ST10	Stop 10	CL10	Cliff Level 10
BS13	Bullseye 13	h13	Height 13	ST11	Stop 11	CL11	Cliff Level 11
BS14	Bullseye 14	h14	Height 14	ST12	Stop 12	CL12	Cliff Level 12
BS15	Bullseye 15	h15	Height 15	ST13	Stop 13	CL13	Cliff Level 13
BS16	Bullseye 16	h16	Height 16	ST14	Stop 14	CL14	Cliff Level 14
BS17	Bullseye 17	h17	Height 17	ST15	Stop 15	CL15	Cliff Level 15
BS18	Bullseye 18	h18	Height 18	ST16	Stop 16	CL16	Cliff Level 16
BS19	Bullseye 19	h19	Height 19	ST17	Stop 17	CL17	Cliff Level 17
BS20	Bullseye 20	h20	Height 20	ST18	Stop 18	CL18	Cliff Level 18
BS21	Bullseye 21	h21	Height 21	ST19	Stop 19	CL19	Cliff Level 19
BS22	Bullseye 22	h22	Height 22	ST20	Stop 20	CL20	Cliff Level 20
BS23	Bullseye 23	h23	Height 23	ST21	Stop 21	CL21	Cliff Level 21
BS24	Bullseye 24	h24	Height 24	ST22	Stop 22	CL22	Cliff Level 22
BS25	Bullseye 25	h25	Height 25	ST23	Stop 23	CL23	Cliff Level 23
BS26	Bullseye 26	h26	Height 26	ST24	Stop 24	CL24	Cliff Level 24
BS27	Bullseye 27	h27	Height 27	ST25	Stop 25	CL25	Cliff Level 25
BS28	Bullseye 28	h28	Height 28	ST26	Stop 26	CL26	Cliff Level 26
BS29	Bullseye 29	h29	Height 29	ST27	Stop 27	CL27	Cliff Level 27
BS30	Bullseye 30	h30	Height 30	ST28	Stop 28	CL28	Cliff Level 28
BS31	Bullseye 31	h31	Height 31	ST29	Stop 29	CL29	Cliff Level 29
BS32	Bullseye 32	h32	Height 32	ST30	Stop 30	CL30	Cliff Level 30
BS33	Bullseye 33	h33	Height 33	ST31	Stop 31	CL31	Cliff Level 31
BS34	Bullseye 34	h34	Height 34	ST32	Stop 32	CL32	Cliff Level 32
BS35	Bullseye 35	h35	Height 35	ST33	Stop 33	CL33	Cliff Level 33
BS36	Bullseye 36	h36	Height 36	ST34	Stop 34	CL34	Cliff Level 34
BS37	Bullseye 37	h37	Height 37	ST35	Stop 35	CL35	Cliff Level 35
BS38	Bullseye 38	h38	Height 38	ST36	Stop 36	CL36	Cliff Level 36
BS39	Bullseye 39	h39	Height 39	ST37	Stop 37	CL37	Cliff Level 37
BS40	Bullseye 40	h40	Height 40	ST38	Stop 38	CL38	Cliff Level 38
BS41	Bullseye 41	h41	Height 41	ST39	Stop 39	CL39	Cliff Level 39
BS42	Bullseye 42	h42	Height 42	ST40	Stop 40	CL40	Cliff Level 40
BS43	Bullseye 43	h43	Height 43	ST41	Stop 41	CL41	Cliff Level 41
BS44	Bullseye 44	h44	Height 44	ST42	Stop 42	CL42	Cliff Level 42
BS45	Bullseye 45	h45	Height 45	ST43	Stop 43	CL43	Cliff Level 43
BS46	Bullseye 46	h46	Height 46	ST44	Stop 44	CL44	Cliff Level 44
BS47	Bullseye 47	h47	Height 47	ST45	Stop 45	CL45	Cliff Level 45
BS48	Bullseye 48	h48	Height 48	ST46	Stop 46	CL46	Cliff Level 46
BS49	Bullseye 49	h49	Height 49	ST47	Stop 47	CL47	Cliff Level 47
BS50	Bullseye 50	h50	Height 50	ST48	Stop 48	CL48	Cliff Level 48
BS51	Bullseye 51	h51	Height 51	ST49	Stop 49	CL49	Cliff Level 49
BS52	Bullseye 52	h52	Height 52	ST50	Stop 50	CL50	Cliff Level 50
BS53	Bullseye 53	h53	Height 53	ST51	Stop 51	CL51	Cliff Level 51
BS54	Bullseye 54	h54	Height 54	ST52	Stop 52	CL52	Cliff Level 52
BS55	Bullseye 55	h55	Height 55	ST53	Stop 53	CL53	Cliff Level 53
BS56	Bullseye 56	h56	Height 56	ST54	Stop 54	CL54	Cliff Level 54
BS57	Bullseye 57	h57	Height 57	ST55	Stop 55	CL55	Cliff Level 55
BS58	Bullseye 58	h58	Height 58	ST56	Stop 56	CL56	Cliff Level 56
BS59	Bullseye 59	h59	Height 59	ST57	Stop 57	CL57	Cliff Level 57
BS60	Bullseye 60	h60	Height 60	ST58	Stop 58	CL58	Cliff Level 58
BS61	Bullseye 61	h61	Height 61	ST59	Stop 59	CL59	Cliff Level 59
BS62	Bullseye 62	h62	Height 62	ST60	Stop 60	CL60	Cliff Level 60
BS63	Bullseye 63	h63	Height 63	ST61	Stop 61	CL61	Cliff Level 61
BS64	Bullseye 64	h64	Height 64	ST62	Stop 62	CL62	Cliff Level 62
BS65	Bullseye 65	h65	Height 65	ST63	Stop 63	CL63	Cliff Level 63
BS66	Bullseye 66	h66	Height 66	ST64	Stop 64	CL64	Cliff Level 64
BS67	Bullseye 67	h67	Height 67	ST65	Stop 65	CL65	Cliff Level 65
BS68	Bullseye 68	h68	Height 68	ST66	Stop 66	CL66	Cliff Level 66
BS69	Bullseye 69	h69	Height 69	ST67	Stop 67	CL67	Cliff Level 67
BS70	Bullseye 70	h70	Height 70	ST68	Stop 68	CL68	Cliff Level 68
BS71	Bullseye 71	h71	Height 71	ST69	Stop 69	CL69	Cliff Level 69
BS72	Bullseye 72	h72	Height 72	ST70	Stop 70	CL70	Cliff Level 70
BS73	Bullseye 73	h73	Height 73	ST71	Stop 71	CL71	Cliff Level 71
BS74	Bullseye 74	h74	Height 74	ST72	Stop 72	CL72	Cliff Level 72
BS75	Bullseye 75	h75	Height 75	ST73	Stop 73	CL73	Cliff Level 73
BS76	Bullseye 76	h76	Height 76	ST74	Stop 74	CL74	Cliff Level 74
BS77	Bullseye 77	h77	Height 77	ST75	Stop 75	CL75	Cliff Level 75
BS78	Bullseye 78	h78	Height 78	ST76	Stop 76	CL76	Cliff Level 76
BS79	Bullseye 79	h79	Height 79	ST77	Stop 77	CL77	Cliff Level 77
BS80	Bullseye 80	h80	Height 80	ST78	Stop 78	CL78	Cliff Level 78
BS81	Bullseye 81	h81	Height 81	ST79	Stop 79	CL79	Cliff Level 79
BS82	Bullseye 82	h82	Height 82	ST80	Stop 80	CL80	Cliff Level 80
BS83	Bullseye 83	h83	Height 83	ST81	Stop 81	CL81	Cliff Level 81
BS84	Bullseye 84	h84	Height 84	ST82	Stop 82	CL82	Cliff Level 82
BS85	Bullseye 85	h85	Height 85	ST83	Stop 83	CL83	Cliff Level 83
BS86	Bullseye 86	h86	Height 86	ST84	Stop 84	CL84	Cliff Level 84
BS87	Bullseye 87	h87	Height 87	ST85	Stop 85	CL85	Cliff Level 85
BS88	Bullseye 88	h88	Height 88	ST86	Stop 86	CL86	Cliff Level 86
BS89	Bullseye 89	h89	Height 89	ST87	Stop 87	CL87	Cliff Level 87
BS90	Bullseye 90	h90	Height 90	ST88	Stop 88	CL88	Cliff Level 88
BS91	Bullseye 91	h91	Height 91	ST89	Stop 89	CL89	Cliff Level 89
BS92	Bullseye 92	h92	Height 92	ST90	Stop 90	CL90	Cliff Level 90
BS93	Bullseye 93	h93	Height 93	ST91	Stop 91	CL91	Cliff Level 91
BS94	Bullseye 94	h94	Height 94	ST92	Stop 92	CL92	Cliff Level 92
BS95	Bullseye 95	h95	Height 95	ST93	Stop 93	CL93	Cliff Level 93
BS96	Bullseye 96	h96	Height 96	ST94	Stop 94	CL94	Cliff Level 94
BS97	Bullseye 97	h97	Height 97	ST95	Stop 95	CL95	Cliff Level 95
BS98	Bullseye 98	h98	Height 98	ST96	Stop 96	CL96	Cliff Level 96
BS99	Bullseye 99	h99	Height 99	ST97	Stop 97	CL97	Cliff Level 97
BS100	Bullseye 100	h100	Height 100	ST98	Stop 98	CL98	Cliff Level 98
BS101	Bullseye 101	h101	Height 101	ST99	Stop 99	CL99	Cliff Level 99
BS102	Bullseye 102	h102	Height 102	ST100	Stop 100	CL100	Cliff Level 100

Survey Station Coordinates

Stn	Easting	Northing	Level
AL02	385929.03	414557.74	165.65
AL01	385932.66	414612.56	165.06
AL03	385874.00	414621.24	161.98
AL04	385845.18	414644.23	160.96
AL05	385839.49	414681.86	161.80
AL06	385782.73	414669.34	165.57
AL07	385746.52	414727.95	163.67
AL08	385758.76	414745.96	164.14
AL09	385675.36	414733.95	164.48
AL10	385653.22	414747.85	165.66
AL11	385674.93	414730.97	168.80
AL12	385686.20	414791.53	169.63
AL13	385702.93	414778.81	171.04
AL14	385777.91	414763.68	173.12
AL15	385838.17	414759.30	184.55
AL16	385851.12	414745.50	184.25
AL17	385861.16	414721.33	176.62
AL18	385827.52	414676.52	166.33
AL19	385764.35	414698.96	164.45
AL20	385711.75	414691.62	164.58
AL21	385645.58	414715.96	165.76
AL22	385629.99	414703.45	169.49
AL4A	385830.56	414659.97	160.94
AL4B	385814.89	414648.84	160.56
AL1A	385792.84	414640.19	167.39
AL23	385593.79	414804.54	182.04
AL7A	385743.71	414733.58	163.81

Please note:
Any discrepancy found between an Ordnance Survey benchmark and an OSGB15 computed orthometric height is likely to be due to bench mark adjustment or uplift and, assuming precise GPS survey has been carefully carried out, the orthometric height given by OSGB15 should be considered correct in preference to archive benchmark heights. OSGB15 converts GPS ellipsoid heights to orthometric heights above mean sea level.

Levels are related to **OSGB15**
Value: n/a

Coordinates are related to **National Grid (GPS)**

Scale: **1:250**
0 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5
metres

The accuracy of this survey is commensurate with the drawing scale specified within the title block.
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Check all dimensions on-site.
In the event of any discrepancy, please refer query to Survey Systems Ltd.

Topographical Survey
Norden
Rochdale
OL12 7SN

Surveyed: AL AF
Date: November 2019
Site name: 11562A
Drawing No: SSL:11562A:250:1:2

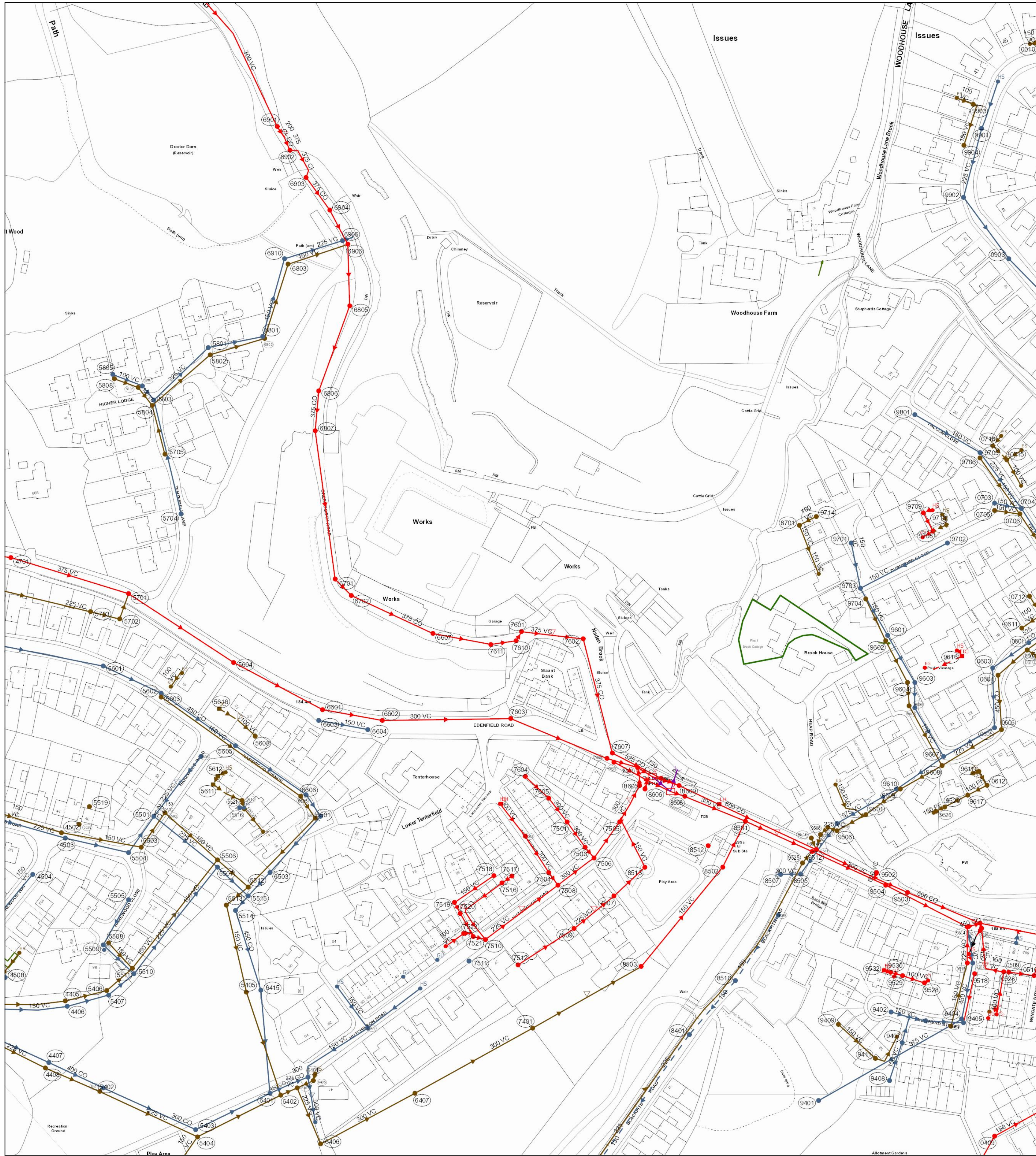
Drawn: GAT
Checked: AG AL
Revised: N/A
Sheet size: A0

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SURVEY systems



APPENDIX B
United Utilities Water Sewer Records



Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
7501	172.29	CO	170.23	300		VC	17.20485	1 in 13	
7507	170.38	CO		150		VC	23.26108		
8401		SW		225		VC	90.43255		
7706	187.82	FO	185.87	150		VC	28.84441	1 in 21	
7516		CO		150		VC	24.74104		
7604	176.79	CO		300		VC	17.69181		
7518		CO		150		VC	26.39586		
5905		SW		100		VC	17.38895		
9526		FO		150		VC	1.437221		
6001	189.37	FO	177.78	150		VC	53.53772	1 in 12	
6007	164.29	CO	163.15	375		VC	35.55754	1 in 181	
9507	167.6	FO	164.75	225		VC	5.69884	1 in 35	
5605	184.87	SW	182.45	450		VC	47.43417	1 in 35	
6403	166.31	FO	164.8	225		VC	33.61547	1 in 280	
5404	169.04	FO	165.63	225		VC	61.42966	1 in 70	
7502	174.82	CO	171.92	300		VC	23.85372	1 in 66	
9512	163.58	VC	161.34	300		VC	44.77941	1 in 560	
6404	166.3	SW	161.33	580		BR	12.16553		
9407	167.28	SW	165.12	150		VC	14.50022		
5504	160.88	SW	161.28	225		VC	24.41311	1 in 43	
5807		SW		100		VC	10.14251		
5512	175.52	FO	173.12	100		VC	15.5205	1 in 38	
0512	170.68	FO	168.6	450		VC	57.21888	1 in 13	
7512		CO		225		VC	36.89174		
7519		CO		150		VC	6.8583		
5506		FO		150		VC	22.87157		
4701	197.58	CO	194.69	375		VC	68.00735	1 in 14	
5508	179.68	FO	177.54	150		VC	18.15857	1 in 11	
5703	194.21	FO		225		VC	16.46242		
0010		FO		150		VC	3.80396		
9528		CO		100		VC	2.396281		
9408	168.34	FO	164.79	150		VC	36.13862	1 in 74	
9402	167.57	SW	165.25	150		VC	10.44031		
0903	195.85	SW	194.34	225		VC	67.52235	1 in 32	
5405	170.98	FO	168.76	150		VC	60.68327	1 in 17	
5808		FO		100		VC	14.04738		
5402	172.14	FO	167.62	225		VC	59.5903	1 in 36	
6702	165.74	CO	163.33	375		VC	49.65884	1 in 292	
5902	168.34	SW	165.33	450		VC	50.21952	1 in 23	
9504	166.75	CO	161.23	300		VC	50.53711	1 in 1011	
4502	168.98	FO	163.51	150		VC	44.72196	1 in 22	
8806	165.69	FO	163.21	225		VC	3.162278		
8808	164.71	CO	161.76	300		VC	36.23953	1 in 134	
7517		VC		150		VC	6.596634		
9704	185.72	FO	184.32	150		VC	25.4951	1 in 22	
7510	172.44	CO	170.29	225		VC	25	1 in 119	
6904	175.59	CO	173.89	375		VC	21.47091	1 in 24	
0510	168.38	CO	165.88	150		VC	19.94885		
0510		VC		150		VC	6.405368		
4504	186.52	SW	184.52	150		VC	55.15903	1 in 41	
0601	184.19	SW	180.75	450		VC	24.41311	1 in 21	
5514	174.21	SW	172.67	450		VC	46.17358	1 in 11	
4407		VC		150		VC	172.29		
6807	170.25	CO	165.55	375		VC	33.59591	1 in 26	
7509	172.38	VC	165.67	225		VC	62.74551	1 in 39	
7608	166.86	CO	164.7	300		VC	14.21687	1 in 84	
4508		VC		150		VC	17.72005	1 in 25	
7401	164.68	FO	163.48	300		VC	19.94882		
9605	181.29	SW	178.83	150		VC	34.48188	1 in 80	
9520		VC		100		VC	31.38471	1 in 15	
6910		SW		225		VC	6.430944		
9502	163.13	VC	161.84	150		VC	33.52811		
9515	168.4	CO	164.25	225		VC	28.29538	1 in 91	
7506	170.41	CO	168.04	300		VC	20	1 in 118	
5513	174.49	FO	172.66	150		VC	24.41311	1 in 21	
0705	188.25	FO	186.53	150		VC	49.24429	1 in 13	
0715		VC		100		VC	14.14274	1 in 22	
9714		VC		100		VC	16.51155		
7508	172.38	CO	168.63	300		VC	10.46829	1 in 32	
8513		CO		150		VC	25.05448		
8805	173.59	CO	171.87	375		VC	29.4523		
7521		VC		150		VC	45.99	1 in 25	
0606	181.41	FO	178.53	225		VC	6.875795		
9510	163.53	FO	161.78	150		VC	38.58756	1 in 58	
9022	184	FO	182.35	150		VC	6.917702	1 in 29	
7503		VC		100		VC	25.94224	1 in 29	
6905		SW		225		VC	4.116108		
5704	187.05	SW	185.52	225		VC	6.324555		
9529		CO		100		VC	64.7611	1 in 175	
4408	177.3	FO	172.08	225		VC	12.74715		
6802	180.08	CO	177.79	300		VC	32.69596	1 in 23	
7605	175.52	CO	172.66	300		VC	71.00794	1 in 10	
9516	168.37	FO	166.96	150		VC	16.40122	1 in 19	
9609	177.21	SW	173.08	450		VC	27.65863	1 in 10	
5403	168.04	SW	165.95	300		VC	18.35758	1 in 7	
6407	166.21	FO	164.19	300		VC	45.01798	1 in 27	
5407	176.97	SW	174.58	225		VC	74.30343	1 in 103	
9503	167.88	SW	164.68	150		VC	23.34524	1 in 16	
9615		FO		225		VC	21.9238	1 in 27	
5615		VC		100		VC	26.1999		
7610	164.18	CO	162.74	375		VC	4.801324		
9606	168.8	FO	166.72	225		VC	5.830952		
8509		SW		150		VC	5.385165	1 in 77	
7601	163.57	CO	163.01	375		VC	43.1064		
9409	164.45	FO	163.01	150		VC	17.1724	1 in 43	
9701	186.96	SW	185.87	150		VC	27.81698		
8501	163.57	CO	161.49	150		VC	25.4951	1 in 30	
5502	182	FO	179.95	150		VC	19.13281	1 in 159	
6906	174.82	CO	172.96	375		VC	38.94885		
9502	166.67	CO	163.17	600		VC	34.0147	1 in 26	
8609	184.74	CO	161.99	600		VC	3.162278		
7611	164.25	CO	162.97	375		VC	83.51915	1 in 303	
5509	176.81	SW	177.34	150		VC	14.14214	1 in 61	
8503	164.79	FO	162.64	150		VC	23.34524	1 in 13	
7504		VC		300		VC	71.06335	1 in 85	
9513	168.44	CO	160.78	600		VC	73.34848	1 in 183	
9503	167.45	CO	161.14	600		VC	6.860325	1 in 8	
0602	184.14	FO	181	225		VC	21.26029	1 in 20	
9502	167.45	CO	161.14	600		VC	42.46233	1 in 124	
5702	193.33	FO	191.53	225		VC	14.86607	1 in 20	
6402	166.36	FO	165.06	225		VC	9.84888	1 in 76	
5705	186.96	FO	185.35	150		VC	27.86925	1 in 72	
6806	171.58	CO	169.68	375		VC	22.50072	1 in 5	
6503	175.52	SW	171.81	450		VC	17.69181	1 in 22	
5801	186.5	SW	184.32	225		VC	30.59412	1 in 16	
6405	165.59	FO	164.35	150		VC	9.848885		
4406	180.55	SW		150		VC	23.70428		
0701	181.63	SW	186.12	225		VC	31.6445	1 in 18	
6902	176.7	CO	175.53	375		VC	20.91554	1 in 28	
4503	187.1	SW	183.89	225		VC	35.90265	1 in 15	
7607	166.83	CO	161.88	525		VC	30.41381	1 in 1014	
5803	188.51	SW	185.1	225		VC	41.72529	1 in 55	
0604	163.52	FO	178.3	225		VC	30.66659	1 in 22	
9530		CO		100		VC	6.818562		
9601	184.98	SW	182.15	225		VC	44.84933		
9517	168.39	SW	162.45	450		VC	31.57331	1 in 77	
8510		VC		150		VC	29.29634		
9508	166.14	FO	162.03	150		VC	6.712688	1 in 46	
9617		VC		150		VC	14.36033		
0508	188.27	FO	166.17	150		VC	10.33493		
7602	165.05	CO	162.2	375		VC	65	1 in 382	
8502	183.27	SW	177.95	450		VC	41.7732	1 in 13	
0605	181.45	SW	178.04	450		VC	32.24903	1 in 19	
8601		VC		150		VC	11.7732	1 in 13	
5501	181.81	SW	180.12	225		VC	44.82187	1 in 24	
9603	182.17	SW	179.26	150		VC	14	1 in 35	
9706	189.64	FO	187.38	150		VC	38.01316	1 in 25	
0409		CO		150		VC	27.82		
0703	189.29	SW	186.84	150		VC	15.20796	1 in 23	
4405	180.67	FO		150		VC	23.69696		
5701	182.9	FO	189.84	300		VC	69.53974	1 in 14	
9702	167.62	SW	166.37	150		VC	54.12024	1 in 37	
6802	184.82	FO		150		VC	43.01163	1 in 13	
0509	168.34	CO	166.64	150		VC	14.14214	1 in 13	
5516		VC		100		VC	16.30092		
6601	183.08	CO	180.47	100		VC	33.54102	1 in 13	
9511	163.61	CO	161.4	600		VC	35.91928	1 in 4	
9501	175.22	FO	171.91	225		VC	18.35758	1 in 4	
8505	162.35	SW	160.17	300		VC	10.98117	1 in 3	
8701		VC		150		VC	28.92888		
6605	182.62	SW	179.79	450		VC	14.4221	1 in 9	
5503	182.45	FO	181.34	150		VC	23.02173	1 in 18	
9401	166.49	SW	164.19	450		VC	12.06305	1 in 58	</



APPENDIX C

Existing Site Permeable Areas & Discharge Rates



KEY

SITE BOUNDARY
TOTAL AREA: 26,554m² (2.655 ha)

DEVELOPED AREAS
PLOT 1 AREA: 6,043m² (0.604 ha)
PLOT 2 AREA: 14,160m² (1.416 ha)
TOTAL AREA: 20,203m² (2.020 ha)

SOFT LANDSCAPED & PERMEABLE AREAS

AREA: 10,121m² (1.012 ha)

BUILDING IMPERMEABLE AREAS

AREA: 790m² (0.079 ha)

HARD PAVED IMPERMEABLE AREAS

AREA: 9,386m² (0.939 ha)

EXISTING MAXIMUM DISCHARGE RATES			
RAINFALL EVENT	GREENFIELD ¹ Q _{GREENFIELD}	BROWNFIELD ² Q _{BROWNFIELD}	TOTAL DISCHARGE ³ Q _{TOTAL}
1 IN 1 YEAR	15.8 l/s	86.6 l/s	102.4 l/s
1 IN 2 YEAR	18.6 l/s	110.0 l/s	128.6 l/s
1 IN 30 YEAR	26.3 l/s	202.5 l/s	228.8 l/s
1 IN 100 YEAR	28.3 l/s	261.2 l/s	289.5 l/s

¹ GREENFIELD CALCULATIONS IN ACCORDANCE WITH ICP SUDS MEAN ANNUAL METHOD WITHIN MICRODRAINAGE
² BROWNFIELD RUN-OFF CALCULATED USING A 2 PIPE MODEL IN MICRODRAINAGE
³ TOTAL DISCHARGE IS THE SUMMATION OF EXISTING GREENFIELD AND BROWNFIELD RUN-OFF RATES

- NOTES:**
1. THE DRAWING IS INTENDED TO INDICATE THE EXISTING DRAINED AREAS FROM THE SITE AND MAXIMUM DISCHARGE RATES UNDER VARIOUS RETURN PERIODS. IT IS BASED UPON A REVIEW OF THE TOPOGRAPHICAL SURVEY, AERIAL IMAGES OF THE SITE AND OS MAPPING.
 2. FOR PROPOSED DRAINED AREA AND DISCHARGE RATES REFER TO RENAISSANCE DRAWING NOR-REN-00-ZZ- DR-C-01051.
 3. FOR THE OUTLINE DRAINAGE STRATEGY REFER TO RENAISSANCE DRAWING NOR-REN-00-ZZ- DR-C-01100.

P01

PRELIMINARY

Rev.

Description:

22.01.21

Date:

JB

By:

HG

Chkd:



Renaissance Associates Ltd
Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project:
**NORDEN,
ROCHDALE**

Drawing Title:
**EXISTING IMPERMEABLE
AREAS AND DISCHARGE
RATES**

Status:
PRELIMINARY

Size:
A1

Date:
JAN'21

Drawn by:
JB

Designed by:
JB

Checked by:
HG

Scale:
1:500

Project No:
1906-21

Project: Originator: Volume: Level: Type: Role: Category/Number: Rev:

NOR-REN-00-ZZ- DR-C-01050-P01



APPENDIX D
Proposed Site Permeable Areas & Discharge Rates

- NOTES:
1. THE DRAWING IS INTENDED TO INDICATE THE PROPOSED DRAINED AREAS FROM THE SITE AND MAXIMUM DISCHARGE RATES UNDER VARIOUS RETURN PERIODS. IT IS BASED UPON ECCLESTON HOMES PLANNING LAYOUT DRAWING NO. 102.
 2. FOR EXISTING DRAINED AREA AND DISCHARGE RATES REFER TO RENAISSANCE DRAWING NOR-REN-00-ZZ- DR- C-01050.
 3. FOR THE OUTLINE DRAINAGE STRATEGY REFER TO RENAISSANCE DRAWING NOR-REN-00-ZZ- DR- C-01100.

KEY

SITE BOUNDARY
TOTAL AREA: 26,554m² (2.655 ha)

DEVELOPED AREAS
PLOT 1 AREA: 6,043m² (0.604 ha)
PLOT 2 AREA: 14,160m² (1.416 ha)
TOTAL AREA: 20,203 (2.020 ha)

SOFT LANDSCAPED &
PERMEABLE AREAS

AREA: 9,162 (0.916 ha)

BUILDING
IMPERMEABLE AREAS

AREA: 4,178m² (0.418 ha)

HARD PAVED
IMPERMEABLE AREAS

AREA: 3,368m² (0.337 ha)

HIGHWAYS
IMPERMEABLE AREAS

AREA: 3,495m² (0.350 ha)

PROPOSED MAXIMUM DISCHARGE RATES			
RAINFALL EVENT	GREENFIELD ¹ Q _{GREENFIELD}	50% BROWNFIELD ² Q _{BROWNFIELD}	PROPOSED DISCHARGE ³ Q _{TOTAL}
1 IN 1 YEAR	15.8 l/s	43.3 l/s	59.1 l/s
1 IN 2 YEAR	18.6 l/s	55.0 l/s	73.6 l/s
1 IN 30 YEAR	26.3 l/s	101.3 l/s	127.6 l/s
1 IN 100 YEAR	28.3 l/s	130.6 l/s	158.9 l/s

¹ GREENFIELD CALCULATIONS IN ACCORDANCE WITH ICP SUDS MEAN ANNUAL METHOD WITHIN MICRODRAINAGE
² BROWNFIELD RUN-OFF CALCULATED USING A 2 PIPE MODEL IN MICRODRAINAGE
³ PROPOSED RUN-OFF IS BASED ON GREENFIELD RUN-OFF + 50% BROWNFIELD RUN-OFF AS SITE IS LOCATED IN A CRITICAL DRAINAGE AREA.

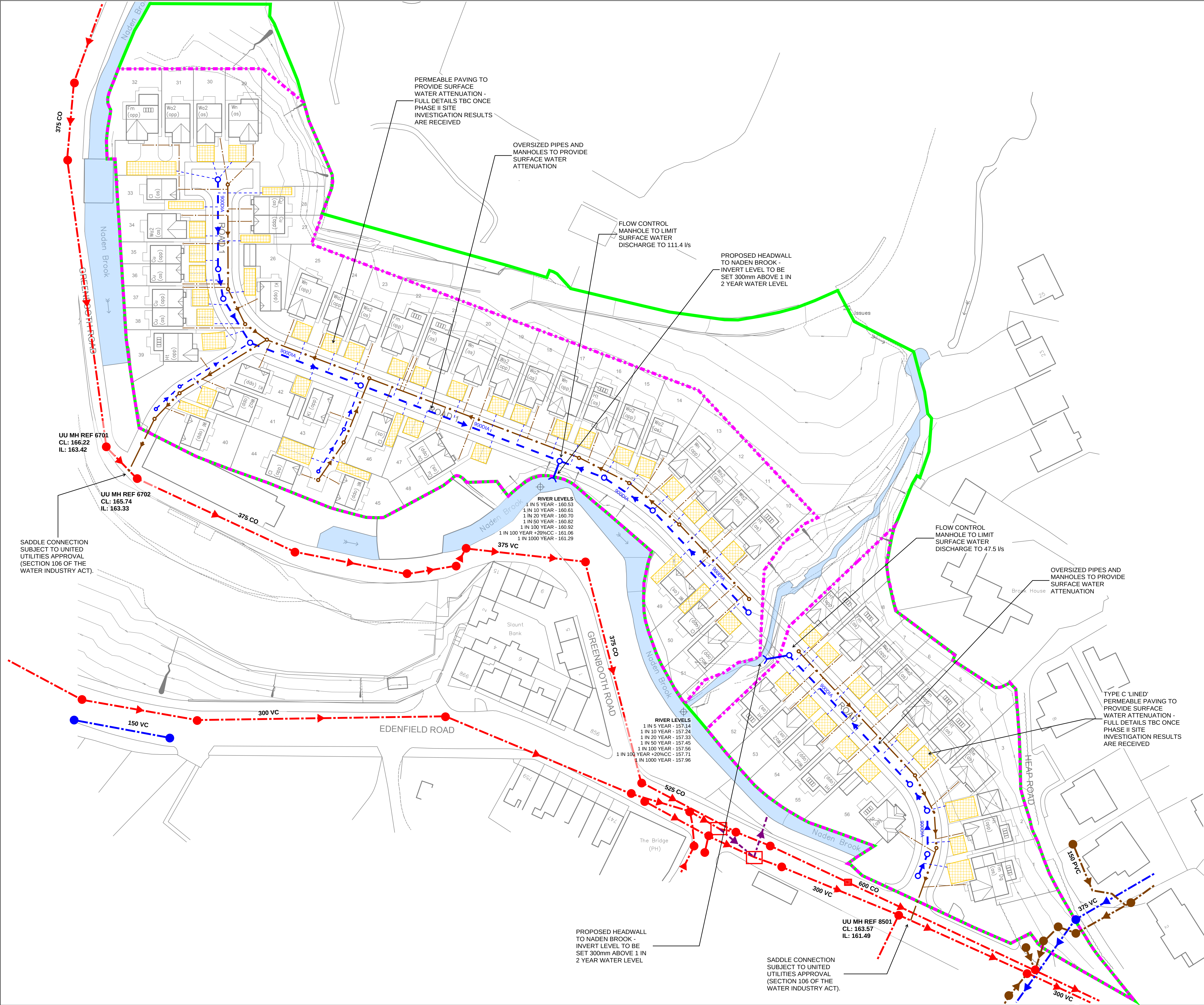
P01	PRELIMINARY	22.01.21	JB	HG
Rev:	Description:	Date:	By:	Chkd:
		Renaissance Associates Ltd Carvers Warehouse 77 Dale Street Manchester M1 2HG		
Project:				
NORDEN, ROCHDALE				
Drawing Title:				
PROPOSED IMPERMEABLE AREAS AND DISCHARGE RATES				
Status:				
PRELIMINARY				
Size:	Date:	Drawn by:	Designed by:	Checked by:
A1	JAN'21	JB	JB	HG
Scale:	1:500	Project No:	1906-21	
Project:	Originator:	Volume:	Level:	Type:
Role:		Category/Number:	Rev:	

NOR-REN-00-ZZ- DR-C-01051-P01



APPENDIX E

Outline Drainage Strategy



- NOTES:**
1. THE DRAWING IS INTENDED TO COMMUNICATE THE OUTLINE DRAINAGE STATELY TO SUPPORT THE PLANNING APPLICATION FOR THE PROPOSED NORDEN, ROCHDALE DEVELOPMENT.
 2. THIS DRAINAGE IS TO BE READ IN CONJUNCTION WITH THE 'FLOOD RISK ASSESSMENT' AND 'SITE WIDE DRAINAGE STRATEGY' REPORTS, RENAISSANCE, DEC 2019 & JAN 2021.
 3. THE LAYOUT OF THE PRIMARY DRAINAGE RUNS IS INDICATIVE AT THIS STAGE AND SUBJECT TO COORDINATION WITH THE DESIGN TEAM AND REVIEW AS THE DESIGN DEVELOPS.
 4. SUDS REQUIREMENTS ARE TO BE REVIEWED FOLLOWING THE FINDINGS OF THE PHASE II SITE INVESTIGATION AND ASSOCIATED CONTAMINATION TESTING.
 5. ALL CONNECTIONS TO THE PUBLIC SEWER ARE SUBJECT TO APPROVAL BY UNITED UTILITIES AND WILL REQUIRE SECTION 106 APPLICATIONS.
 6. ALL HEADWALL DETAILS ARE SUBJECT TO AGREEMENT AND APPROVAL BY THE ENVIRONMENT AGENCY
 7. THE DRAINAGE STRATEGY IS SUBJECT TO APPROVAL BY ROCHDALE CITY COUNCIL.

INTERNAL DRAINAGE

ALL SVP AND RWP STACK LOCATIONS ARE INDICATIVE AND ARE TO BE CONFIRMED AND SET OUT BY THE ARCHITECT AND M&E CONSULTANT

EXTERNAL DRAINAGE

ALL EXTERNAL LEVELS, CHANNELS, GULLIES, ETC. ARE INDICATIVE AND ARE TO BE CONFIRMED AND SET OUT BY THE ARCHITECT.

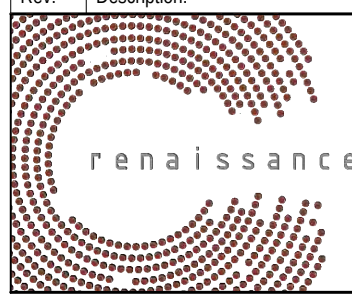
EXISTING ONSITE DRAINAGE

A FULL SURVEY OF THE EXISTING ONSITE NETWORK IS TO BE UNDERTAKEN TO ESTABLISH LOCATION. ALL ONSITE DRAINAGE IS EXPECTED TO BE ABANDONED AND REMOVED OR CAPPED WHERE NECESSARY

KEY

	SITE BOUNDARY
	DEVELOPED AREAS
	EXISTING COMBINED SEWER
	EXISTING FOUL SEWER
	EXISTING SURFACE WATER SEWER
	PROPOSED FOUL SEWER TYPICALLY 150 DIA
	PROPOSED SURFACE WATER SEWER
	PROPOSED HEADWALL
	TYPE 'C' 'LINED' PERMEABLE PAVING

P01	PRELIMINARY	22.01.21	JB	HG
Rev:	Description:	Date:	By:	Chkd:



Renaissance Associates Ltd
Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project:

**NORDEN,
ROCHDALE**

Drawing Title:

**OUTLINE DRAINAGE
STRATEGY**

Status:

PRELIMINARY

Size:	Date:	Drawn by:	Designed by:	Checked by:
A1	JAN'21	JB	JB	HG

Scale:	1:500	Project No:	1906-21				
Project:	Originator:	Volume:	Level:	Type:	Role:	Category/Number:	Rev:

NOR-REN-00-ZZ- DR-C-01100-P01



APPENDIX F
Micro Drainage Pre-Development Surface Water Run-Off

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Carvers Warehouse 77 Dale Street Manchester M1 2HG	1906-06 Norden, Rochdale Brownfield Run-Off	
Date 21/01/2021 17:27 File	Designed by JB Checked by HG	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.299	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.781	4-8	0.237

Total Area Contributing (ha) = 1.018

Total Pipe Volume (m³) = 2.209

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
1.000	10.000	0.125	80.0	1.018	5.00	0.0	0.600	o	375	Pipe/Conduit	
1.001	10.000	0.125	80.0	0.000	0.00	0.0	0.600	o	375	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)
1.000	50.00	5.08	159.350	1.018	0.0	0.0	0.0	2.03	223.9	137.8
1.001	50.00	5.16	159.225	1.018	0.0	0.0	0.0	2.03	223.9	137.8

Renaissance Assoc.		Page 2
Carvers Warehouse 77 Dale Street Manchester M1 2HG	1906-06 Norden, Rochdale Brownfield Run-Off	
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Innovyze	Network 2020.1	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	1.018	1.018	1.018
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.018	1.018	1.018

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.001		161.000	159.100	0.000	0	0

Simulation Criteria for Storm

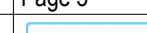
Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.299		

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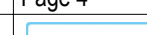
Renaissance Assoc.		Page 3
Carvers Warehouse 77 Dale Street Manchester M1 2HG	1906-06 Norden, Rochdale Brownfield Run-Off	
Date 21/01/2021 17:27 File	Designed by JB Checked by HG	
Innovyze	Network 2020.1	

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

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Synthetic Rainfall Details

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	1	+0%	30/60 Summer				159.566
1.001	2	60 Summer	1	+0%	30/60 Summer				159.441

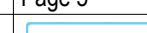
Renaissance Assoc.		Page 4
Carvers Warehouse 77 Dale Street Manchester M1 2HG	1906-06 Norden, Rochdale Brownfield Run-Off	
Date 21/01/2021 17:27 File	Designed by JB Checked by HG	
Innovyze	Network 2020.1	

2 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Synthetic Rainfall Details

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	2	+0%	30/60 Summer				159.605
1.001	2	60 Summer	2	+0%	30/60 Summer				159.488

Renaissance Assoc.		Page 5
Carvers Warehouse 77 Dale Street Manchester M1 2HG	1906-06 Norden, Rochdale Brownfield Run-Off	
Date 21/01/2021 17:27 File	Designed by JB Checked by HG	
Innovyze	Network 2020.1	

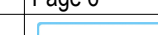
30 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Synthetic Rainfall Details

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Summer	30	+0%	30/60 Summer				159.996
1.001	2	60 Summer	30	+0%	30/60 Summer				159.725

Renaissance Assoc.		Page 6
Carvers Warehouse 77 Dale Street Manchester M1 2HG	1906-06 Norden, Rochdale Brownfield Run-Off	
Date 21/01/2021 17:27 File	Designed by JB Checked by HG	
Innovyze	Network 2020.1	

100 year Return Period Summary of Critical Results by Maximum Outflow (Rank 1) for Storm

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Synthetic Rainfall Details

Renaissance Assoc.		Page 1
Carvers Warehouse 77 Dale Street Manchester M1 2HG	1906-06 Norden, Rochdale Greenfield Run-Off	
Date 21/01/2021 17:25 File Plot 1 Attenuation Tank.SRCX	Designed by JB Checked by HG	
Innovyze	Source Control 2020.1	
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 2 SAAR (mm) 1071 Urban 0.750 Area (ha) 1.012 Soil 0.450 Region Number Region 10 Results l/s QBAR Rural 7.3 QBAR Urban 17.2 Q2 years 17.6 Q1 year 15.0 Q30 years 24.9 Q100 years 27.1		
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