FIRST STREET SOUTH, MANCHESTER

05/06/2020

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY REPORT

The Alan Johnston Partnership LLP

Ref: FSS-AJP-ZZ-XX-RP-C-3000

Prepared By

Document Owner(s)	Project/Organization Role
Danny Sinclair	Partner
John Speers	Senior Civil Engineer

Project Closure Report Version Control

Version	Date	Author	Change Description
P01	20/11/2019	J.Speers	First Issue
P02	30/04/2020	J.Speers	Updated to suit United Utilities requirements
P03	05/06/2020	J.Speers	Updated to suit latest

Record of Approval

Originator	Approved	Date
J.Speers	D.Sinclair	20/11/2019
J.Speers	D.Sinclair	30/04/2020
J.Speers	D.Sinclair	05/06/2020

Contents

1.0 INTRODUCTION 4

2.0 SITE DESCRIPTION 4

2.1 Geology 5

2.2 Hydrogeology 5

2.3 Hydrology 5

3.0 PROPOSED DEVELOPMENT 5

4.0 PLANNING POLICY 6

4.1 Sequential Test 6

4.2 Exception Test 6

5.0 FORMS OF FLOODING 6

5.1 Flooding from Rivers 6

5.2 Flooding from the Sea 6

5.3 Flooding from Land 6

5.4 Flooding from Groundwater 6

5.5 Flooding from Sewers 7

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources 7

6.0 DEVELOPMENT AND DRAINAGE STRATEGY 7

6.1 Effect of Development on Flood Risk 7

6.2 Existing Drainage Systems 8

6.3 Proposed Drainage Strategy 9

6.3.1 Surface Water Drainage 9

6.3.2 Foul Water Drainage 12

7.0 FUTURE MANAGEMENT & MAINTENANCE 13

7.1 General Maintenance & Inspection Requirements 14

7.2 Inspection Chambers, Manholes and Catchpits 14

7.3 Pipes 14

7.4 Drainage Channels and Gullies 15

7.5 Vortex Flow Control Devices 16

7.6 Cellular Attenuation Tanks 16

7.7 Green Roofs 17

7.8 Permeable Paving 18

8.0 CONCLUSIONS 19

9.0 RECOMMENDATIONS 20

Appendix A Site Location Plan 21

Appendix B Aerial Photo 22

Appendix C Topographic & Utility Survey 23

Appendix D Proposed Site Plan 24

Appendix E Flood Risk Maps 25

Appendix F United Utilities Map 26

Appendix G Pre & Post Development Impermeable Areas Drawing 27

Appendix H Existing Brownfield Discharge Rate 28

Appendix I Preliminary Storage Estimates 29

Appendix J Drainage Strategy Drawing & SW Calculations 30

1.0 INTRODUCTION

This Flood Risk Assessment (FRA) and Drainage Strategy Report has been prepared on behalf of Downing in connection with a planning application for the construction of a proposed mixed-use development. The proposed site is located to the south of Hulme Street, Manchester. This FRA is required as even though the site is located within Flood Zone 1, the total area of the proposed development site is over 1.0ha in area.

This FRA has been prepared in accordance with the general requirements of the National Planning Policy Framework and the Technical Guidance to the National Planning Policy Framework, both published by the Department for Communities and Local Government. This involves the identification of flood risk to new development(s) on the site, the possible effect of this development on flood risk elsewhere and the investigation of the impact on the development as a result of increased sea levels, fluvial flows and larger pluvial events due to increased impermeable areas and climate change.

The purpose of this report is to present a site-specific assessment of flood risk based on available information, to identify relevant flood levels affecting the site with respect to a particular probability of flooding. The flood levels identified are dependent on the correctness of the current conditions, as stated in this report and the prediction of future climatic conditions implicit in the National Planning Policy Framework.

For any size of storm event, the procedure will always yield a probability that the event will occur in any year, albeit the probability is smaller for larger events. The predicted storm event has a probability of occurrence in any year and the derived flood level has an associated probability of exceedance. This means that there is always a risk that property flooding could occur one or more times in any year.

Therefore, this report should not be interpreted or relied upon as providing a guarantee against flooding. There is always a residual risk that flooding will occur and it is not possible to predict a zero risk of flooding.

In accordance with National Planning Policy Framework (NPPF) and the associated Technical Guidance document, flood risk must be assessed for all sources including tidal (from the sea), fluvial (from rivers), pluvial (from land), groundwater, sewer and artificial water bodies (e.g. reservoirs, canals, major water supply infrastructure etc.).

More specifically, the development of any site must be carried out in such a way as to mitigate any potential flood risk, both on and off site from all sources of flooding.

The other purpose of this report is to present the surface water and foul water outline drainage strategies for the site which have been developed by the Alan Johnston Partnership. To demonstrate how the specific drainage requirements are to be met, the report should be read in conjunction with the relevant drawings and supporting information, included within the appendices.

The drainage strategies outlined within this report, have been prepared in accordance with BS EN 752:2008 (Drain and sewer systems outside buildings), Sewers for Adoption, Building Regulations Approved Document H (Drainage and waste disposal) and the Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).

2.0 SITE DESCRIPTION

The existing site is situated to the south of Hulme Street and north of Chester Street, Manchester and is located at National Grid reference SJ 83814 97172. The location of the existing site is illustrated in Appendix A and the extent of the area to which the application relates is shown on the enclosed aerial photo, attached in Appendix B.

The existing site covers a total area of 1.22ha and is a brownfield site. The site currently consists of an existing highway, Newcastle Street through the centre of the site and two areas on either side of the highway, both of which consist of areas of hardstanding associated with the demolition of previous developments.

The site is bounded on all four sides by existing highways, with Hulme Street to the north, Wilmott Street to the east, Medlock Street to the west and Chester Street to the south. The site slopes from south-west to north-east with levels

sloping from approximately 35.00mAOD in the south-west corner to approximately 33.00mAOD in the north-east corner. A topographical and utility survey of the existing site is attached in Appendix C and an aerial photo is included in Appendix B to illustrate the site at the present day.

2.1 Geology

An intrusive site investigation was completed in June 2016 by Cundall and is contained within the Cundall Geotechnical and Geoenvironmental Assessment Report, 1011906.RPT.GL.004. The site investigation report indicates that the underlying strata consists of made ground to a maximum recorded depth of 3.75mbgl, which is underlain by Glaciofluvial and Glacial Till deposits comprising mainly of clayey sands and gravels and firm to stiff clays with a maximum recorded stratum thickness of 7.80m. This is then underlain by bedrock, comprising mainly of sandstone, to a maximum recorded depth of 30.00mbgl.

This is supported by the information taken from the British Geological Survey (BGS) 1:50,000 Bedrock geology maps. These show that the site has superficial deposits comprising of both Glaciofluvial Sheet Deposits and Till, Devensian deposits, with the bedrock reported to be of the Chester Formation comprising of sandstone.

The intrusive site investigation report is also supported by the Cundall Supplementary Ground Investigation Report, 1011906.RPT.GL.007, dated October 2016. This supplementary report outlines the likely extents of the buried obstructions across the site, which include numerous basements and an air raid shelter.

2.2 Hydrogeology

The Environment Agency groundwater maps show that the superficial deposits are classified as both Secondary A and Secondary undifferentiated strata. These are defined as areas with permeable layers capable of supporting water supplies at a local rather than strategic scale and areas where it has not been possible to attribute either category A or B to a rock type, respectively. In most cases this is due to the variable characteristics of the rock type.

The bedrock is classified as a Principal Aquifer, defined as an area that exhibits high permeability and/or provides a high level of water storage. These areas may also support water supply and/or river base flow on a strategic scale.

The Environment Agency groundwater maps also indicate that the majority of the development site is not situated within a groundwater Source Protection Zone (SPZ) with only the eastern edge of the site located within a Source Protection Zone III.

The Cundall Supplementary Ground Investigation Report includes groundwater strikes were recorded as shallow as 2.60mbgl but monitoring has indicated that the groundwater level is actually at around 3.92mbgl.

2.3 Hydrology

The development site is situated in the direct catchment of the River Medlock, which is located approximately 145m north of the site. The site is located is located within Flood Zone 1 which is categorized by the Environment Agency as land assessed as having less than a 1 in 1,000 annual probability of river flooding (1% – 0.1%). Therefore, the site is an area identified by the Environment Agency as at low risk of flooding from rivers and streams.

3.0 PROPOSED DEVELOPMENT

The proposed development will occupy the entire 1.22ha site and will consist of 4no. mixed-use development buildings (Blocks A – D) and associated landscaped/pedestrian courtyard areas. The buildings will consist of mainly residential units with numerous commercial and leisure units and also associated car parking.

To enable a viable scheme, the proposed site levels are constrained by the existing highways surrounding the site, therefore the site levels are likely to remain similar to the existing. The proposed site plan is attached in Appendix D.

4.0 PLANNING POLICY

The National Planning Policy Framework (NPPF) sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. The NPPF states that:

"Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impact of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change taking full account of flood risk, coastal change and water supply and demand consideration."

This Flood Risk Assessment proposes recommendations to facilitate the proposed development so that it takes into account flood risk at all stages of the development.

4.1 Sequential Test

Based on the sites location, within Flood Zone 1, the Sequential Test is not required. Therefore, the development is deemed appropriate, in Flood Zone 1 and a sequential test is not required.

4.2 Exception Test

NPPF classifies the development (Residential) as a 'More vulnerable development' but as the site is located within Flood Zone 1, the development is deemed appropriate according to NPPF and therefore the Exception Test is not required.

5.0 FORMS OF FLOODING

The Technical Guidance to the National Planning Policy Framework requires all forms of flooding to be considered.

5.1 Flooding from Rivers

The Flood Risk map is included as Appendix E.
As can be seen from the Flood Risk map, the entire site is located within Flood Zone 1 and therefore, the site is located in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000).

The nearest river is the River Medlock, which is located approximately 145m north of the site. Despite this, the risk of flooding to the new development from rivers is considered to be low.

5.2 Flooding from the Sea

The site is not at risk of flooding from the sea. The lowest level of the site is approximately 33.00mAOD, i.e. well above tidal flood levels.

5.3 Flooding from Land

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding.

The Surface Water Flooding map is included in Appendix E. It can be seen from the map that the entire site is classified as having a very low risk of surface water flooding. As such, the risk of flooding from overland flows due to surface water flooding is considered to be low.

Therefore, the risk of flooding from overland flows due to surface water flooding is considered to be low and as such the overall site is considered to be at low risk of flooding from surface water/surrounding land.

5.4 Flooding from Groundwater

The Groundwater Flooding Map contained within the Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) Report indicates that the site is in an area which is at risk of groundwater flooding.

As outlined in Section 2.2, the Cundall Supplementary Ground Investigation Report has indicated that groundwater strikes as shallow as 2.60mbgl were encountered during the site investigation. However, subsequent groundwater monitoring has indicated that the shallowest groundwater level is 3.92mbgl, with the majority of groundwater levels being reported as between 4.00mbgl – 5.00mbgl.

As such, due to the depths of the groundwater encountered by the site investigation it is envisaged that the site has a negligible risk of groundwater flooding. Therefore, due to the depths of the groundwater encountered by the site investigation, the site is considered to be at low risk of flooding from groundwater.

5.5 Flooding from Sewers

A record of Public Sewers surrounding and serving the development site has been obtained from United Utilities and this is included in Appendix F. As can be seen from the United Utilities map, there is an existing combined water public sewer which runs south to north along Newcastle Street, through the centre of the site. There are also a number of other public combined water sewers located within the surrounding highways.

The intention for the proposed development is to 'stop up' Newcastle Street and as such it is envisaged that the existing combined water public sewer which runs along Newcastle Street will also be abandoned. However, as per the correspondence from United Utilities, also attached in Appendix F, the sewer along Newcastle Street is already abandoned. As such, the only sewers within the proposed site boundary will likely be private sewers used to drain the proposed development, which will have been suitably designed.

Therefore, due to the lack of public sewers within the proposed site, the proposed drainage networks for the site being suitably designed and the fact that the surrounding public sewers are maintained by United Utilities, leads to the conclusion that the site itself is considered to have a low risk of flooding from sewers.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

The Reservoir Flood Risk map is included in Appendix E and the closest artificial waterbody or reservoir is Audenshaw Reservoir which is located approximately 7.5km east of the site. As such, it can be seen from the map that the site is not at risk of flooding from reservoirs, canals or other artificial sources.

Therefore, the proposed development has a low risk of flooding from reservoirs, canals and other artificial sources.

6.0 DEVELOPMENT AND DRAINAGE STRATEGY

6.1 Effect of Development on Flood Risk

As previously outlined in Section 2.0, the existing site covers an area of 1.22ha and currently consists of an existing highway, Newcastle Street through the centre of the site and two areas on either side of the highway, both of which consist of areas of hardstanding associated with the demolition of previous developments.

As the buildings on either side of the highway have been demolished for a number of years it is envisaged that any existing drainage within these areas will now be redundant. Also, as United utilities have indicated that the sewer within the existing highway, Newcastle Street is abandoned it is anticipated that the highway drainage will also be redundant.

As such, it is envisaged that only the footpath and hardstanding areas (which drain to the highways) currently have an active drainage system. This has been confirmed via the existing levels within the Topo and Utility survey which is attached in Appendix C. Therefore, only the footpath and hardstanding areas have been considered during the pre-development impermeable areas calculation.

The pre and post development impermeable areas have been assessed and are indicated on the attached drawing in Appendix G. The comparison between the pre and post development impermeable areas is also summarised below;

Total Development Site Area (ha)	Existing Impermeable Area (ha)	Proposed Impermeable Area (ha)
1.220	0.171	0.992

As can be seen from the summary table above, the introduction of the proposed buildings and associated hard-standing areas will increase the impermeable area across the site. This increase in the impervious area within the proposed site will lead to an increase in the;

- Volume of surface water ponding on the site.
- Volume of surface water runoff leaving the site or discharging into surrounding areas.
- Peak discharge rate from the site.

Accordingly, drainage systems are needed to drain the foul and surface water flows arising from the proposed development. Where possible, any existing drainage networks should be utilised. Appropriate design and construction of these systems as set out in Section 6.3 should ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.2 Existing Drainage Systems

As can be seen from the United Utilities map, attached in Appendix F, there is an existing public combined water sewer which runs south to north along Newcastle Street, through the centre of the site, however subsequent correspondence from United Utilities, also attached in Appendix F, indicates that this sewer is now abandoned.

There is also an existing 660mm x 460mm public combined water sewer which runs in an easterly direction from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street. There are also a number of other public combined water sewers located within the surrounding highways.

To the north of the site on Hulme Street, there is an existing manhole located at the junction of Hulme Street and Newcastle Street, UU MH 7201, into which three existing public combined sewers discharge. The first is a 600mm x 500mm combined water sewer which runs from the western end of Hulme Street into UU MH 7201. The second is also a 600mm x 500mm combined water sewer but this sewer runs from the eastern end of Hulme Street, starting just east of the junction of Hulme Street and Wilmott Street before discharging into UU MH 7201.

The third is a 610mm x 660mm public combined water sewer running north along Newcastle Street, through the centre of the site itself and this public sewer also discharges into UU MH 7201 at the junction of Hulme Street and Newcastle Street, to the north of the site.

There are also two combined water sewers on Wilmott Street, to the east of the site. The first is an existing 560mm x 760mm public combined water sewer, which runs south to north along Wilmott Street and the second is a 300mm diameter public combined water sewer, which runs north to south along Wilmott Street. There is also an existing public combined water sewer which runs in an easterly direction from within the site and discharges into the 560mm x 760mm brick public combined water sewer on Wilmott Street.

Also, there is an existing 600mm x 900mm public combined water sewer, which runs east to west along Chester Street to the south of the site and finally there are two public combined water sewers on Newcastle Street to the south of the site. The first of these sewers is a 920mm x 590mm public combined water sewer which runs north to south, away from the site along Newcastle Street and the second is a 550mm x 560mm public combined water sewer which runs south to north along Newcastle Street prior to discharging into UU MH 8102 at the southern boundary of the site.

To enable the construction of the proposed development it is envisaged that the existing 610mm x 660mm public combined water sewer which runs along Newcastle Street, through the centre of the site will need to be grouted up or grubbed up. It is also envisaged that the existing 660mm x 460mm public combined water sewer which runs in an easterly direction from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street, will be abandoned. As such, a Section 116 agreement with United Utilities will be required to abandon this public sewer.

A CCTV survey of the existing public and private sewers should be undertaken to confirm the location, details, levels and condition of the public and private sewers both within and surrounding the proposed site. This will help identify if there are any existing private connections to the surrounding public sewers which can be re-used and also identify if invert levels are such to avoid the need for pumping the proposed drainage.

The surveys should also identify if the previous surveys are correct and that the existing public combined water sewer which runs through the centre of the site has been intentionally blocked up, immediately downstream of UU MH 8102 and the flow from the south diverted back into the public combined water sewer which flows in a southerly direction along Newcastle Street, away from the site.

6.3 Proposed Drainage Strategy

As outlined above in section 6.1, where required drainage systems are needed to drain the foul and surface water flows arising from the proposed development. The proposed drainage systems must ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.3.1 Surface Water Drainage

The Building Regulations - Approved Document H (2002) details a hierarchy of potential methods for disposing of surface water as shown below in order of preference:

- Discharge via infiltration
- Discharge to watercourse
- Discharge to sewer

Considering the hierarchy above, the surface water network for the proposed development should infiltrate where possible. The Cundall Geotechnical and Geoenvironmental Assessment Report, 1011906.RPT.GL.004, did not undertake any BRE365 complaint infiltration tests but it has indicated that the site is underlain by large depths of made ground, up to 3.75mbgl and also a number of buried obstructions. The made ground and glaciofluvial deposits are then underlain by a substrate of firm to stiff clays.

Even though no BRE 365 compliant soakaway tests were completed as part of the intrusive site investigation, it is envisaged that infiltration is not suitable across the proposed site. This is due to the potential for inundation settlement resulting from infiltration through the large depths of made ground and buried obstructions and also due to the low permeability of firm to stiff clays.

As such, it is envisaged that infiltration is not viable across the site and therefore soakaway tests are not required. This has been confirmed via detailed discussions with United Utilities, with the correspondence attached in Appendix F.

As the large depths of made ground and underlying impermeable clay strata has ruled out the use of infiltration, the intention for the development would be to discharge to watercourse. The nearest watercourse is the River Medlock, which is located approximately 145m north of the site. However, due to the distance through developed third-party land, discharging to watercourse has been deemed impractical.

As such, the only practical solution for discharge of the surface water is discharge to public sewer. As indicated within Section 6.2, the only nearby public sewers are the combined water sewers located within the highways surrounding the proposed site. As such, it is envisaged that the surface water runoff from the proposed development will discharge to the surrounding public combined water sewers.

While every effort to utilise any suitable existing systems should be made, the drainage systems should be designed to suit the proposed site layout and topography which aims to provide an efficient design.

In line with Sewers for Adoption (6th Edition), the requirements for the design of a new surface water drainage systems are as follows:

- Below ground piped drainage to be sized to accommodate the 1 in 2 year (50% AEP) design storm without surcharge.
- System to be designed not to flood any part of the site in a 1 in 30 year (3% AEP) design storm.
- For events in exceedance of the 1 in 30 year design storm and up to and including the 1 in 100 year event, site drainage and topography should be designed where practicable to route surface water run-off away from buildings to safe above-ground storage areas on site, thereby preventing this run-off from leaving the site and increasing flood risk elsewhere.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100 year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst case impacts of climate change. This is in accordance with new advice, issued by the Environment Agency, which updates previous climate change allowances outlined in the National Planning Policy Framework.

Therefore, suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30 year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100 year (+40%) event, will be retained on-site in safe storage areas.

As the site area consists mainly of pedestrianised areas and roof areas and there is only one car park, which is less than 800m^2 in area and has less than 50no. spaces, the risk of pollution has been deemed to be minimal and therefore in line with the requirements of Pollution Prevention Guidelines 3 (PPG3), no measures to prevent oil and other contaminants being passed forward to the existing combined water sewer are required.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

It is envisaged that a minimum 50% betterment on the existing surface water brownfield runoff rate is to be applied, in line with Section 3.4.1 of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide.

Therefore, an assessment of the existing surface water run-off from the brownfield site has been completed using a simple three pipe network modelled in Micro Drainage. For the existing 1.22ha site, using an existing impermeable area of 0.171ha, an existing 2-year return period brownfield discharge rate of 26.7 L/s was generated. The brownfield runoff assessment is attached in Appendix H.

As such, applying a 50% reduction to comply with the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide, the maximum surface water discharge rate for the entire site is **13.4 L/s**.

Manchester City Council (Lead Local Flood Authority) and United Utilities have been contacted regarding the maximum surface water discharge rate from the proposed development and the proposed discharge locations. To date no response has been received from the LLFA but United Utilities have indicated their acceptance of the proposed discharge rate via the correspondence attached in Appendix F. Detailed discussions must be undertaken with the LLFA to confirm their acceptance of the proposed drainage strategy.

Due to the size of the proposed development and the separate blocks, it is envisaged that the proposed development will have separate surface water networks. It is anticipated that Blocks A and B will be served by one surface water network and Blocks C and D will be served by another separate network. As such, it is anticipated that the total proposed discharge rate of 13.4 L/s will be split between the two networks, with Blocks A & B having a maximum discharge rate of 8.4 L/s and Blocks C & D a maximum discharge rate of 5.0 L/s. This is summarised in the below table.

Site Area	Post-Development Impermeable Area (ha)	Proposed Maximum Discharge Rate (L/s)	Required Storage Volume for 1 in 100 Year +40% CC storm (m^3)
Blocks A & B	0.611	8.4	298.0
Blocks C & D	0.381	5.0	187.1

Using the total post development impermeable areas and the maximum discharge rates for each block, the storage volumes required for each block to contain the 1 in 100 year + 40% return period design storm without any flooding, have been calculated. The attenuation storage assessments are attached in Appendix I and also summarised in the table above.

It should be noted that the calculated storage volumes are estimates only and therefore the actual storage volume required is likely to change during the detailed design of the proposed surface water drainage system. As such, the actual storage volumes required are subject to change and are dependent upon the detailed drainage design.

As can be seen from the Drainage Strategy Drawing, attached in Appendix J, it is anticipated that the surface water runoff from the proposed Blocks A and B area, will be collected and conveyed to the east of the proposed Block A & B buildings. Here it will be restricted to the maximum discharge rate of 8.4 L/s via a vortex flow control device, prior to it combining with the proposed foul water runoff from Blocks A and B.

The combined discharge will then discharge into a new combined water manhole which is to be constructed on the line of the existing 660mm x 460mm public combined water sewer which runs from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street. The existing 660mm x 460mm public combined water sewer which runs from within the site is to be abandoned upstream of the new combined manhole.

As the surface water discharge is to be restricted, the surface water runoff will surcharge the proposed drainage network. Therefore, attenuation storage will be provided in the form of a 400mm deep granular drainage blanket below the proposed areas of permeable paving and also a below ground cellular attenuation tank to supplement the required storage.

The depth of the granular drainage blanket cannot be increased to accommodate all of the attenuation storage due the potential impact or potential clashes with the existing gas main running through the centre of the site. Due to the lack of available open space in the Blocks A and B area, it is envisaged that a below ground cellular attenuation tank, located in the courtyard area to the west of the building would be the best option to supplement the storage.

The surface water runoff from the proposed Block C & D areas, will be collected and conveyed to the east of the proposed Block C building. Here it will be restricted to the maximum discharge rate of 5.0 L/s via a vortex flow control device, prior to it combining with the proposed foul water runoff from Blocks C & D.

The combined runoff from the Blocks C & D areas will then discharge into the existing United Utilities Manhole UU MH 8102 which discharges along the existing 920mm x 590mm public combined water sewer running north to south along Newcastle Street, away from the site.

Again, as the surface water discharge is to be restricted, the surface water runoff will surcharge the proposed drainage network. Therefore, attenuation storage will be provided in the form of a below ground cellular attenuation tank. Due to the depth of the surface water drainage from the undercroft area in Block D and the lack of available public open space, it is envisaged that a below ground cellular attenuation tank located under public open space will be used to store the surcharged runoff.

The proposed attenuation storage should prevent any flooding for all rainfall events up to and including the 1 in 100 year + 40% climate change event.

The proposed maximum discharge rates and discharge locations should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority (Manchester City Council) prior to the commencement of any works.

As outlined below, all SuDS techniques have been considered and comments made on their suitability for this proposed development;

SuDS Technique	Suitable?	Reasoning
Green Roof	✓	Suitable and incorporated, where possible.
Rainwater Harvesting	×	Impractical due to minimal roof area available and high-rise buildings.
Basins, Ponds or Swales	×	Suitable and incorporated, where possible.
Filter Strips	×	Unsuitable due to impermeable strata.
Infiltration Techniques	×	Unsuitable due to impermeable strata.
Permeable Surfaces	✓	Suitable and incorporated where possible but non-infiltration techniques to be used.
Tank / Oversized Pipe Systems	✓	Suitable and incorporated.

As can be seen from the Drainage Strategy Drawing, attached in Appendix J, where possible SuDS solutions have been incorporated throughout the site. Where feasible these will include; green roofs, non-infiltration permeable paving and also below ground cellular attenuation tanks.

The surface water drainage calculations have also been included within Appendix J and as can be seen the proposed surface water drainage and attenuation storage prevents any flooding for all rainfall events up to and including the 1 in 100 year + 40% climate change event and also meets the maximum discharge restrictions of 8.4 L/s and 5.0 L/s.

As can be seen from the surface water drainage calculations attached in Appendix J, the green roof areas and permeable paving have been modelled within the system.

The surface water drainage strategy and SuDS solutions outlined above are all subject to detailed drainage design and LLFA and United Utilities approvals. It is also subject to change, dependent upon the final site layout and levels. The surface water drainage proposals and discharge rates should be confirmed via detailed discussions with the Lead Local Flood Authority and United Utilities prior to the commencement of any works.

6.3.2 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

1. Public sewer
2. Septic tank
3. Cesspool.

The foul water system shall be designed in accordance with;

- BS EN 752:2008 (Drain and sewer systems outside buildings)
- Sewers for Adoption (6th Edition)
- Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).
- BS EN 12056-2:2000 (Drainage systems inside buildings)
- Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2010).

As seen in the Drainage Strategy Drawing, attached in Appendix J, it is anticipated that the proposed foul water drainage will mimic the proposed surface water drainage and will therefore also have separate foul water networks. It is anticipated that Blocks A and B will be served by the same foul water network, while Blocks C and D will be served by their own separate networks.

It is anticipated that the foul water runoff from Blocks A and B, will be collected and conveyed to the east of the proposed Block A & B buildings. Here it will combine with the restricted surface water runoff from the Blocks A and B area. The combined discharge will then discharge into a new combined water manhole which is to be constructed on the line of the existing 660mm x 460mm public combined water sewer which runs from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street.

The foul water runoff from the proposed Blocks C & D, will be collected and conveyed to the east of the proposed Block C building. Here it will combine with the restricted surface water runoff from the Blocks C & D areas, prior to discharging into the existing United Utilities Manhole UU MH 8102 which discharges along the existing 920mm x 590mm public combined water sewer, running north to south along Newcastle Street, away from the site.

It is anticipated that the foul water from all areas will discharge at an unrestricted rate into the surrounding public combined water sewers.

As with the surface water drainage strategy, the foul water drainage strategy outlined above is subject to change and is dependent upon detailed drainage design and LLFA and United Utilities approvals, in addition to the finalised site layout and levels.

The foul water drainage strategy and unrestricted discharge rates should also be confirmed via detailed discussions with the Lead Local Flood Authority and United Utilities prior to the commencement of any works.

7.0 FUTURE MANAGEMENT & MAINTENANCE

The proposed drainage solution uses SUDS techniques in accordance with the CIRIA SUDS Manual C753. The surface water run-off from the proposed development is restricted using a vortex flow control device and the attenuated run-off is stored using a granular drainage blanket below the area of permeable paving and also cellular attenuation tanks.

It is envisaged that the following components have been or will be included within the drainage strategy for the proposed development:

- Inspection chambers, manholes and catchpits.
- Pipes.
- Drainage channels and gullies.
- Vortex flow control device.
- Cellular attenuation tanks.
- Green roofs.
- Permeable paving.

A suitable maintenance strategy should be adopted to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented. It is assumed that the proposed drainage will remain private and therefore maintenance of the surface and foul water drainage systems will be the responsibility of an on-site facilities management team or the end user.

As such, the maintenance of the specified SuDS should be included within the developments Operation and Maintenance Manual and should be detailed in accordance with the CIRIA SuDS Manual C753, as per the operation and maintenance guidance outlined below.

7.1 General Maintenance & Inspection Requirements

- No work shall be carried out on the drainage system without permission from a nominated person, who has access to information/a working knowledge of the system.
- Maintenance/inspection work shall be carried out in a safe/planned manner.
- All work is to be carried out by competent persons suitably trained and equipped in accordance with current statutory safe working policies.
- Entry into confined spaces shall be kept to a minimum and be restricted to suitably qualified/equipped persons working in accordance with current statutory safe working policies.
- Drainage systems shall be inspected on a regular basis or should any problems be suspected. Any debris/defects discovered shall be recorded and a programme of cleaning/ repair initiated. Urgent repairs/cleaning shall be actioned as soon as practicable.
- It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event.
- Clearing of the drainage system can be achieved by a number of methods depending on the nature of the work;
    - Rodding – Manual/Mechanical with flexible rods.
    - Jetting – High pressure water jetting.
    - Plunging.

7.2 Inspection Chambers, Manholes and Catchpits

The appropriate health and safety equipment must be used when accessing manholes/catchpits. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access. The following operations should be carried out annually.

- Covers of inspection chambers and manholes shall be removed and the sides, benchings and channels cleared.
- Accumulated deposits of silt in inspection chambers, catchpits and manholes shall be removed. Any traps shall then be plunged and thoroughly flushed out with clean water. This should be completed in Autumn, after leaf fall.
- Main and branch drains shall be cleared as required and afterwards be flushed with clean water. Any obstructions found shall be removed and not flushed down the system.
- Covers of inspection chambers, manholes and catchpits shall be replaced, bedded in suitable grease or other sealing material as required and bolted/locked down as appropriate. Missing bolts and broken items shall be replaced in accordance with the manufacturer's details.

7.3 Pipes

Regular inspection and maintenance is important to identify areas which may have become obstructed/clogged and may not be draining correctly, as failure to do so would expose the development to a greater level of flood risk.

Pipes are proprietary products and therefore the materials used can vary across the site. As such, where used the manufacturer's recommendations should be followed. Access for maintenance of the pipes is provided through inspection chambers and manholes. The below table sets out the maintenace schedule for the pipe components of the proposed drianage systems.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect for evidence of poor operation via water levels. If required take remedial action.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.
	Check and remove large debris and/or vegetation growth near pipe runs.	Monthly or as required.
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue.	As required, if above actions do not improve performance.
Monitoring	Initial Inspection should be provided as post construction CCTV survey.	N/A
	Inspect/check all inlets, outlets and overflows to ensure they are in good condition and operating as designed.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.

7.4 Drainage Channels and Gullies

Channels and gullies should be inspected and cleaned in accordance with the manufacturer's details. Channel units can be cleaned through the use of a high-pressure hose; this can be fed into the channel system through access units strategically placed along the channel run. The throat section of channel units should be kept clear at all times to ensure uninterrupted flow of surface water into the drainage channel and any debris within the throat should be removed.

Locking bolts should be replaced and sufficiently tightened, taking care that the bolt heads do not stand above the top surface of the cover or grate. If covers are allowed to move within their frame, this may cause damage to the frame or seating. The below stable sets out the maintenace schedule for the drainage channel and gullies components of the proposed drianage systems.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Litter and debris removal.	Monthly or as required.
	Check and remove large debris and/or vegetation growth near pipe runs.	Monthly or as required.
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.
Remedial Actions	Inspect access/outlet boxes and rod through poorly performing channels and outlets as initial remediation.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue.	As required, if above actions do not improve performance.
Monitoring	Initial Inspection including channel outlet boxes and gully sumps.	Monthly for 3 months, then six-monthly intervals. Also, 48 hours after large storms.

7.5 Vortex Flow Control Devices

Regular inspection and maintenance is important to identify if the vortex flow control device has become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk.

Vortex flow control devices are proprietary products and therefore can vary from manufacturer to manufacturer. As such, where used the manufacturer's recommendations should be followed.

- Normally, little maintenance is required as there are generally a vortex flow control device has no moving parts.
- If blockages occur they tend to do so at the intake of the vortex flow control device.
- Vortex flow control devices are generally fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.
- The smaller type conical units, below the minimum recommended size, are also supplied with roding facilities or vortex suppressor pipes as standard.
- Following installation of the vortex flow control device it is vitally important that any extraneous material i.e. Building materials are removed from the unit and the chamber.
- After the system is made live, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required. Units should also be inspected within 48 hours after large storms.

7.6 Cellular Attenuation Tanks

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk. The maintenance requirements for cellular attenuation tanks are outlined within Table 21.3 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenace schedule for the cellular attenuation tank component of the proposed drianage systems.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

7.7 Green Roofs

Regular inspection and maintenance is important to identify if the inlets/outlets have become obstructed/clogged and may not be functioning correctly, as failure to do so would expose the development to a greater level of flood risk. The maintenance requirements for green roofs are outlined within Table 12.5 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenace schedule for the green roof components of the proposed drianage systems.

TABLE 12.5 Operation and maintenance requirements for green roofs

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

7.8 Permeable Paving

Regular inspection and maintenance is important to identify areas which may have become obstructed/clogged and may not be draining correctly, as failure to do so would expose the development to a greater level of flood risk.

Permeable paving is aproprietary product and therefore the materials used can vary. As such, where used the manufacturer's recommendations should be followed. The maintenance requirements for permebale paving are outlined within Table 20.15 of the CIRIA SUDS Manual C753. An extract of that table is given below to set out the maintenace schedule for the permebale paving component of the proposed drianage systems.

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 glyphospate 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

It should be noted that the Main Contractor should provide a Verification Report, including photographic evidence, to demonstrate that the drainage has been constructed as per the design drawings. As-built drawings should as be supplied by the Main Contractor, where the construction of the drainage varies from the design construction status drawings.

8.0 CONCLUSIONS

- The site is located within Flood Zone 1 and therefore is classified as having a low probability of flooding from rivers or sea. The site is also at a low risk of flooding from surface water flows and all other sources.

- An intrusive site investigation has been completed but this does not include BRE365 compliant infiltration tests. However, the site investigation has indicated that the site is underlain by large depths of made ground and buried obstructions and also firm to stiff clays. Therefore, due to the potential for inundations settlement of the made ground and buried obstructions and also the likely low permeability of the clay stratum, infiltration is not considered to be viable across the site and therefore these tests are not required. United Utilities have confirmed their acceptance of this but it should be confirmed via discussions with the LLFA.

- The nearest watercourse is the River Medlock, which is located approximately 145m north of the site. However, due to the distance through developed third-party land, discharging to watercourse has been deemed impractical. Therefore, the only practical solution for the discharge of the surface water is discharge to public sewer.

- There are no public surface water sewers within close vicinity of the site and as such the only viable option for the disposal of the surface water runoff from the proposed development is to the surrounding public combined water sewers.

- It is envisaged that a minimum 50% betterment on the existing surface water brownfield runoff rate is to be applied, in line with Section 3.4.1 of the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide.

- Therefore, an assessment of the existing surface water run-off from the brownfield site has been completed using a simple three pipe network modelled in Micro Drainage. For the existing 1.22ha site, using an existing impermeable area of 0.171ha, an existing 2-year return period brownfield discharge rate of 26.7 L/s was generated.

- As such, applying a 50% reduction to offer improvement and comply with the Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide, the maximum surface water discharge rate for the site as a whole is 13.4 L/s.

- It is anticipated that Blocks A and B will be served by the same surface water network, while Blocks C and D will be served by another separate network. As such, it is anticipated that the total proposed discharge rate of 13.4 L/s will be split between the two networks, with Blocks A & B having a maximum discharge rate of 8.4 L/s and Blocks C & D a maximum discharge rate of 5.0 L/s, for all rainfall events up to and including the 1 in 100 year +40% climate change event.

- The surface water runoff from the Blocks A and B area, will be collected and conveyed to the east of the proposed Block A & B buildings. Here it will be restricted to the maximum discharge rate of 8.4 L/s via a vortex flow control device, prior to it combining with the proposed foul water runoff from Blocks A and B. This will then discharge into a new combined water manhole which is to be constructed on the line of the existing 660mm x 460mm public combined water sewer which runs from within the site and discharges into the 560mm x 760mm public combined water sewer on Wilmott Street.

- As the surface water discharge is to be restricted, the surface water runoff will surcharge the proposed drainage network. Therefore, attenuation storage will be provided in the form of a granular drainage blanket below the areas of permeable paving and also a below ground cellular attenuation tank. Due to the lack of available open space in the Blocks A and B area, it is envisaged that the below ground cellular attenuation tank, will be located in the courtyard area to the west of the building.

- The surface water runoff from the proposed Block C & D areas, will be collected and conveyed to the east of the proposed Block C building. Here it will be restricted to the maximum discharge rate of 5.0 L/s via a vortex flow control device, prior to it combining with the proposed foul water runoff from Blocks C & D. This will then discharge into the existing United Utilities Manhole UU MH 8102 which discharges along the existing 920mm x 590mm public combined water sewer running north to south along Newcastle Street, away from the site.

- Again, as the surface water discharge is to be restricted, the surface water runoff will surcharge the proposed drainage network. Therefore, attenuation storage will be provided in the form of a below ground cellular attenuation tank below the public open space between Blocks C and D.

- The surface water calculations indicate that with the proposed green roof areas and areas of permeable paving, the proposed surface water drainage network and attenuation storage prevents any flooding for all rainfall events up to and including the 1 in 100 year + 40% climate change event.

- The proposed surface water drainage strategy, where possible, has incorporated SuDS solutions throughout the site. The proposed surface water drainage strategy for the site currently includes; green roofs, non-infiltration permeable paving and also below ground cellular attenuation tanks. However, the use of these SuDS solutions is subject to final site levels and also detailed drainage design. As such, the use of these SuDS components should be confirmed once the detailed drainage design has been completed.

- It is anticipated that the foul water from all areas will combine with the restricted surface water runoff from each Block and discharge at an unrestricted rate into the surrounding public combined water sewers.

- Manchester City Council (Lead Local Flood Authority) and United Utilities have been contacted regarding the maximum surface water discharge rates from the proposed development and also the overall drainage strategies. To date no response has been received from the LLFA but United Utilities have indicated their acceptance of the proposed discharge rate. Detailed discussions must be undertaken with the LLFA to confirm their acceptance of the proposed drainage strategy.

- The surface water drainage strategy is subject to detailed drainage design and LLFA and United Utilities approvals. It is also subject to change, dependent upon the finalised site layout and levels. The surface water drainage proposals and discharge rates should be confirmed via detailed discussions with the Lead Local Flood Authority and United Utilities prior to the commencement of any works.

- The foul water drainage strategy is also subject to detailed drainage design and LLFA and United Utilities approvals. It is also subject to change, dependent upon the finalised site layout and levels. The foul water drainage proposals and unrestricted discharge rates should be confirmed via detailed discussions with the Lead Local Flood Authority and United Utilities prior to the commencement of any works.

9.0 RECOMMENDATIONS

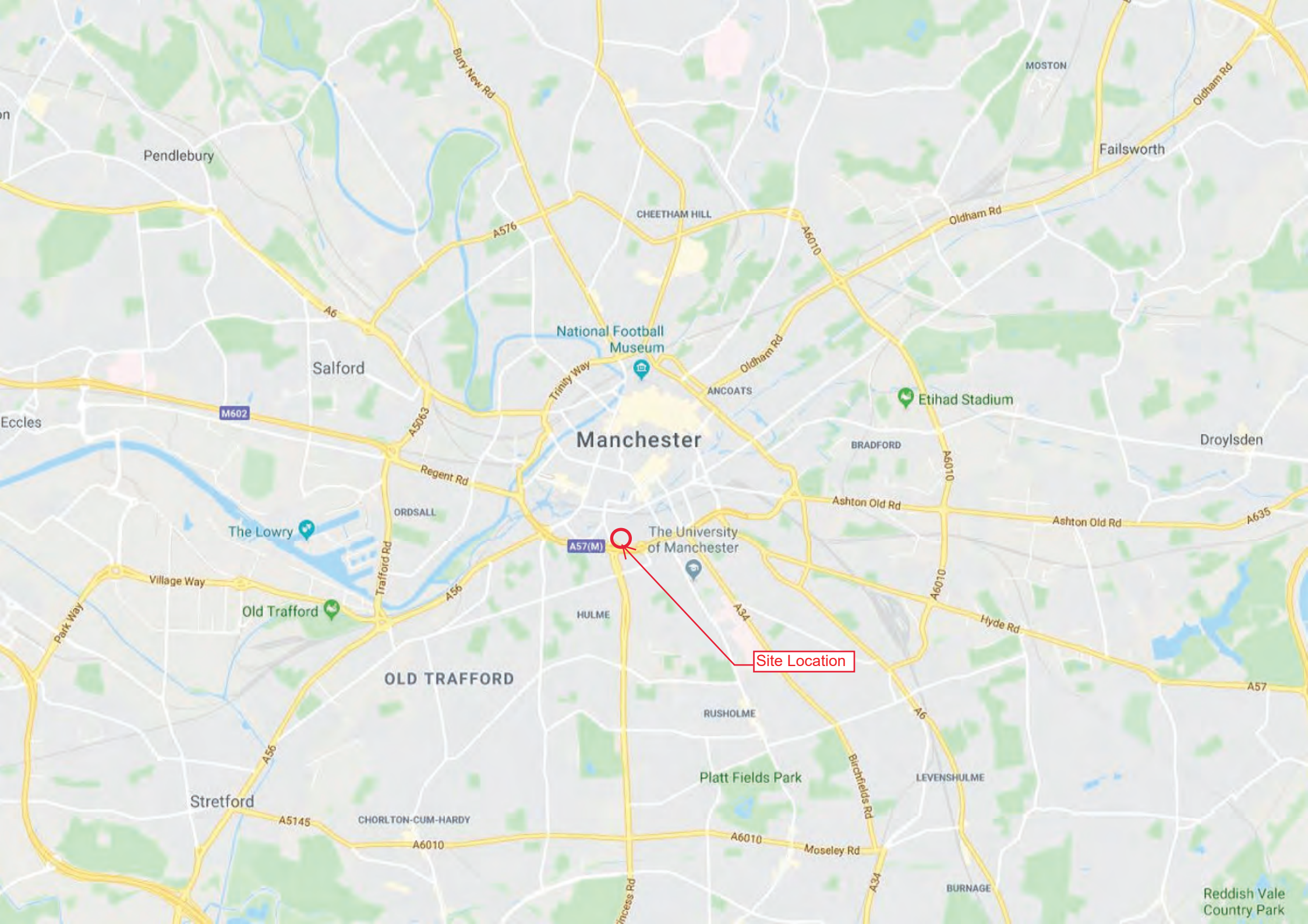
- A CCTV survey of the existing public and private sewers should be undertaken to confirm the location, details, levels and condition of the public and private sewers both within and surrounding the proposed site. This will help identify if there are any existing private connections to the surrounding public sewers which can be re-used and also identify if invert levels are such to avoid the need for pumping the proposed drainage.

- The surveys should also identify if the previous surveys are correct and that the existing public combined water sewer which runs through the centre of the site has been intentionally blocked up, immediately downstream of UU MH 8102 and the flow from the south diverted back into the public combined water sewer which flows in a southerly direction along Newcastle Street, away from the site.

- It is envisaged that the existing public combined water sewer which runs in an easterly direction from within the site and discharges into the 560mm x 760mm brick public combined water sewer on Wilmott Street will need to be abandoned/partially abandoned. As such, a Section 116 agreement with United Utilities will be required to abandon these public sewers.

- Detailed discussions with Lead Local Flood Authority and United Utilities should be completed to ensure agreement of the surface water and foul water drainage strategies, the proposed discharge rates and the overall approach.

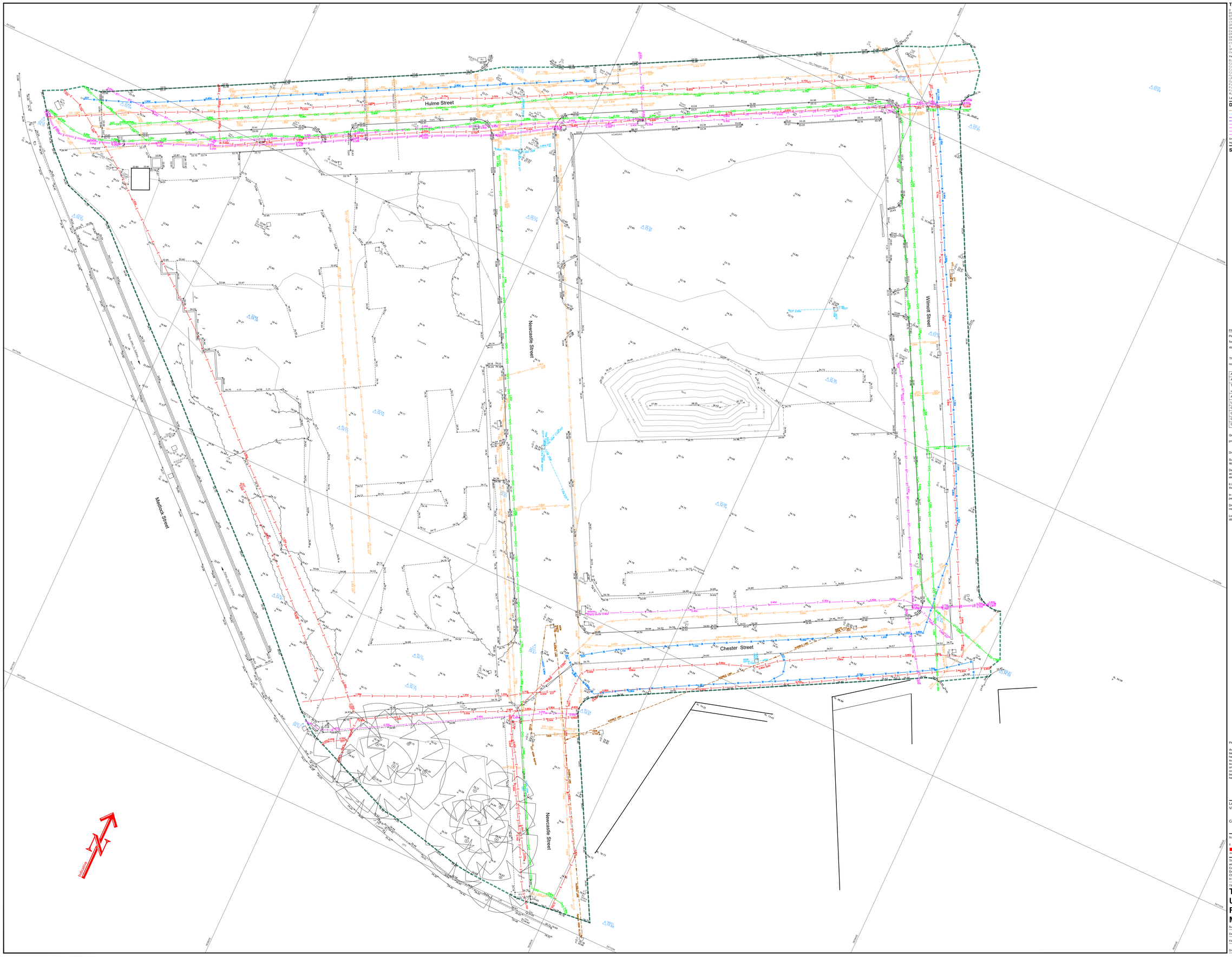
Appendix A Site Location Plan



Site Location
Manchester
Pendlebury
Salford
Eccles
Failsworth
MOSTON
CHEETHAM HILL
National Football Museum
ANCOATS
Etihad Stadium
BRADFORD
Droylsden
ORDSALL
The Lowry
The University of Manchester
Old Trafford
HULME
OLD TRAFFORD
RUSHOLME
Platt Fields Park
LEVENSHULME
Stretford
CHORLTON-CUM-HARDY
BURNAGE
Reddish Vale Country Park
Bury New Rd
Oldham Rd
A576
A6010
A6
Trinity Way
M602
A5063
Regent Rd
Ashton Old Rd
A635
A57(M)
Trafford Rd
Village Way
Park Way
A56
A34
Hyde Rd
A57
Birchfields Rd
A5145
Moseley Rd

Appendix B Aerial Photo

Appendix C Topographic & Utility Survey



Topographical Survey Legend

B Bollard
BS Bus stop
BT British telecom u
CPS Car parking stalls
CTV Cable television cover
DP Downpipe
DR Drain
Elec Electrical u
EM Elec meter
ER Earth rod
FP Flagpole
FT Floodlight
G Gully
GP Guard post
GV Gas valve
H Height
Hyd Hydrant
IC Inspection cover
KO Kerb outlet
KO Kerb outlet
LB Letter box
LP Lamp post
Utr Utility marker
M Manhole
NP Name plate
P Post
PM Parking meter
RS Rodding eye
RS Road sign
rwp Rain water pipe
SP Soil pipe
ST Stop tap
Stay Cable stay
TC Telephone cabinet
TCB Telephone call box
TL Traffic light
TP Telegraph pole
TPS Tactile paving slabs
VM Vent meter
WM Water meter
WO Water outlet
UTL Unable to lift

Level prefix descriptions
AL Arch level
BL Bed level
CL Cill level
EL Eaves level
FL Floor level
IL Invert level
PL Parapet level
SL Soffit level
SpL Soffit level
Spr Arch springing level
TF Top of fence level
TW Top of wall level
WL Water level
WL Water level

Fence annotation
B/B Barbed wire
C/B Closed boarded
C/I Corrugated iron
C/L Chain link
M/P Metal panel
H/R Hand rail
I/R Iron railings
O/B Open boarded
P/C Post & chain
P/R Post & rail
P/W Post & wire
W/M Wire mesh

Fence
Safety barrier
Gate
Stile
Hedge
Limit of foliage & tree canopy

Spot level
SSL1 50.00
Survey control station (Coordinated point)
Tree
MT Multi trunk

Levels defining edge of carriageway are observed at channel (bottom of kerb). Unless otherwise stated.

Drainage/Services Legend

Foul
Surface
Combined
Drainage (unspecified)
BT British telecom
T Telecom
FO Fibre optics
CATV
CCTV CCTV
E Electric
SL Street lighting
TM Traffic management
GAS Gas
W Water
F Fuel
Unknown / misc
Ducting
d Service depth (m)
ø Pipe diameter (mm)
EOT End of trace
UTT Unable to trace
Utility Survey Boundary

Drainage pipe size data has been determined from the surface, in order to comply with confined spaces health and safety legislation. Please regard this data as approximate.

Survey Station Coordinates

STN	EASTING	NORTHING	LEVEL
JS01	383798.78	397112.93	34.52
JS02	383727.05	397175.47	34.53
JS03	383715.43	397188.33	34.31
JS04	383784.81	397229.75	33.15
JS05	383884.74	397272.28	32.64
JS4A	383726.55	397196.24	33.54
JS4B	383844.46	397255.74	32.84
JS4C	383868.11	397218.38	33.70
RL01	383811.19	397131.64	34.70
S2A1	383761.34	397172.35	34.36
SE01	383829.11	397141.66	34.67
SE02	383812.75	397164.06	34.60
SE03	383797.47	397207.70	33.74
SE1A	383812.20	397126.52	34.75
SE1B	383889.58	397175.49	34.44
SE2A	383787.62	397166.65	34.14
SE3A	383815.96	397214.32	33.81
SSL01	383903.21	397171.06	34.51
SE3B	383855.42	397203.90	34.77
SSL2	383859.54	397253.33	32.96
RL02	383783.22	397161.58	34.13
NB01	383859.72	397103.81	34.88
S1A1	383785.11	397130.94	34.81
SE2B	383847.26	397176.81	34.74
S21A	383761.34	397172.36	34.36
RC04	383841.03	397135.01	34.81
SSL1	383903.21	397171.06	34.53

PAS128 Quality Levels

Please refer to PAS128:2014 Table 1 - "Quality level of survey outputs (normative)"

for in anticipated accuracy of quality levels.

All utilities are located to PAS128 QL-B2 unless otherwise stated.

The following table identifies the PAS128 quality level based on the text notes shown on the drawing:

Annotation found on drawing	PAS128 Quality Level
Added from records	PAS128 QL-D
Trench scar, street furniture, visual note/reference to utility	PAS128 QL-C
Assumed route	PAS128 QL-B4
Unable to obtain depth	PAS128 QL-B3
QL-B1	PAS128 QL-B1
QL-B3P	PAS128 QL-B3P
QL-B2P	PAS128 QL-B2P
QL-B1P	PAS128 QL-B1P

Quality levels ending with a "P" refer to a utility that has been located with post processed Ground Penetrating Radar (GPR).

Drawing caveats, please note:

Survey Systems Ltd carry out surveys in accordance with site procedures using approved detectors.

Depth data is limited by the accuracy of the detection equipment. Average accuracy is +/- 10% of depth with GPR and +/- 5% of the depth with electromagnetic technologies.

It is SSL's procedure to use statutory undertakers plans prior to and during the survey as a guide for the survey team.

In accordance with British Telecom's national policy survey companies are not permitted to raise BT inspection chamber covers.

Drainage routes between manholes, if not able to be traced by Locate's survey methodologies, are assumed to be direct lines between manholes.

Locate advise that excavations in the vicinity of services are carried out with due diligence, please refer to HSG47.

Please note:

Any discrepancy found between an Ordnance Survey benchmark and an OSGB15 computed orthometric height is likely to be due to bench mark displacement. If an OS benchmark where a 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.

Head and Registered Office
Survey Systems Ltd
Willow Farm Barn
Old Road
Handforth • Wilmslow
Cheshire SK9 3AZ
Tel. 01625 533444
Fax 01625 526815
mail@surveys.co.uk
www.surveys.co.uk

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

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

Scale **1:200**
0 2 4 6 8 10 12 14 16 18
metres

The accuracy of this survey is commensurate with the drawing scale specified within the title block.
Copyright in this drawing remains with Survey Systems Ltd.
Do not scale from this drawing, work to figured dimensions.
Check all dimensions on-site.
In the event of any discrepancy, please refer query to Survey Systems Ltd.

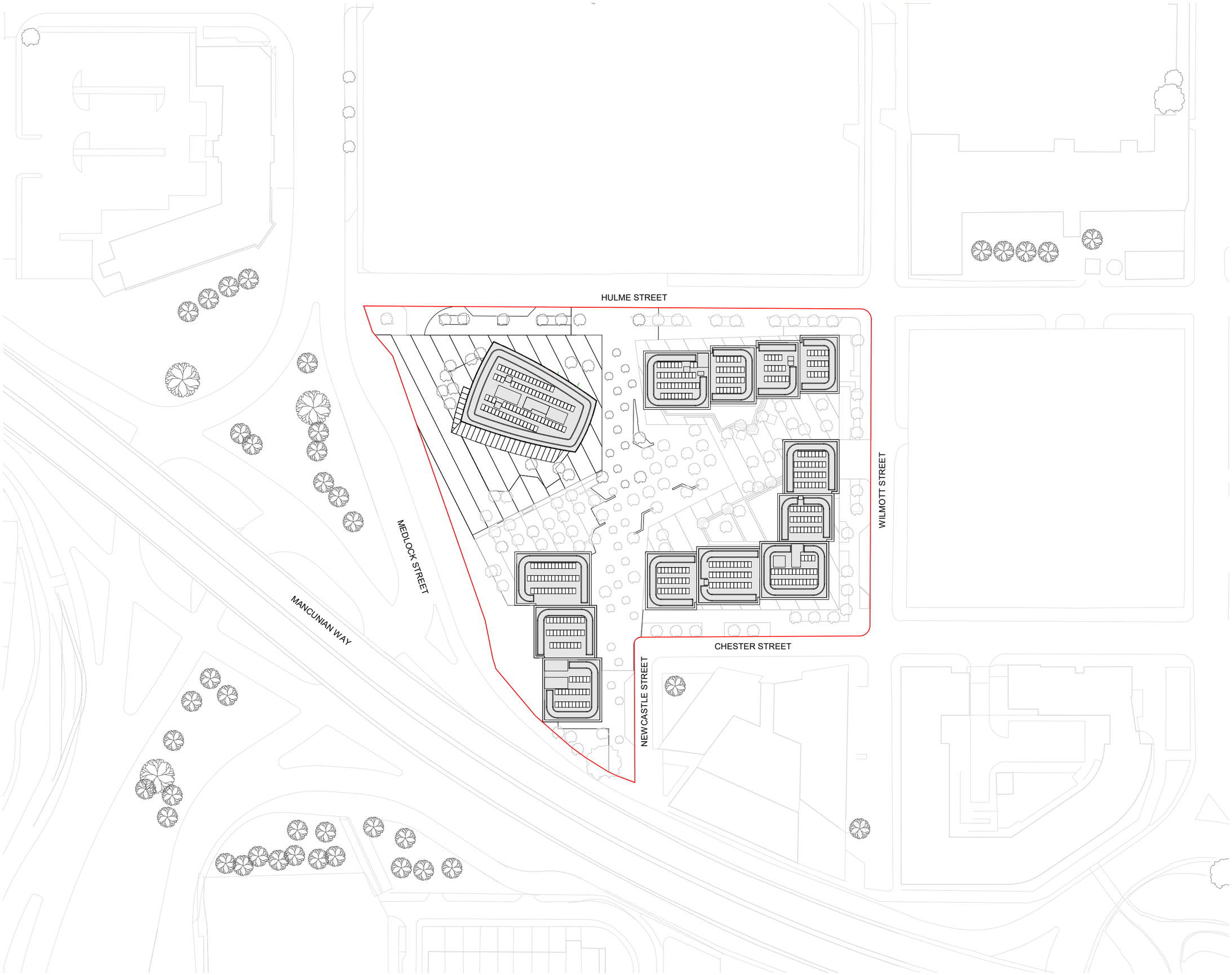
Title
Topographical & Utility Survey
First Street South
Manchester M15 6HF

Surveyed SE JS AD DB RL NB CM Drawn AG
Date October 2019 Checked MT
File name 19700 Revision No. Sheet size A0
Drawing No. **SSL:19700:200:1:1**

SURVEYsystems

© Copyright Survey Systems Ltd. Registered No. 4175874

Appendix D Proposed Site Plan



This drawing is copyright
Do not scale off dimensions.
All dimensions to be checked on site by contractor.
Contractor to report any dimensional discrepancies, errors or omissions prior to commencing on site.

NOTE:
DO NOT SCALE OFF DRAWING REFER TO INDICATED DIMENSIONS ONLY.

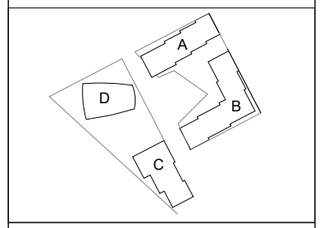
DRAWING TO BE READ IN CONJUNCTION WITH SHP SPECIFICATION.

INDICATIVE DETAILS TO ILLUSTRATE VISUAL INTENT ONLY. ALL TO CONTRACTORS DESIGN.

ALL DETAILS TO BE COORDINATED WITH ADJACENT TRADES AND SE AND M+E ENGINEER DETAILS.

THE CONTRACTOR IS RESPONSIBLE FOR MEETING THE SPECIFIED PERFORMANCE CRITERIA.

EXTERNAL WALL THICKNESS INDICATIVE ONLY AND SUBJECT TO DETAIL DESIGN



North

Rev	Date	Description
-	28-06-2019	FIRST ISSUE
P01	31-07-2019	DESIGN DEVELOPMENT
P02	23-08-2019	DESIGN DEVELOPMENT
P03	11-09-2019	DESIGN DEVELOPMENT
P04	20-09-2019	DESIGN DEVELOPMENT
P05	24-09-2019	DESIGN DEVELOPMENT
P06	30-09-2019	BUILDING A/B/C DESIGN UPDATED
P07	21-10-2019	DESIGN DEVELOPMENT
P08	01-11-2019	DESIGN DEVELOPMENT
P09	04-11-2019	DESIGN DEVELOPMENT
P10	10-01-2020	DESIGN DEVELOPMENT

Project Title
10266
Plot 11, First Street South
Manchester

Drawing Title
General Arrangement
Site Wide
Roof Level

Status
PRELIMINARY

Job No
10266

Scale
1 : 1000@A3

SHP Drawing Code
10266- Z0- A - G200- PL -RF-001
Project Zone Role Uniclass 1.4 Type Location Series

Revision
P10

simpsonhaugh

Manchester
+44 (0)161 835 2345

London
+44 (0)20 7549 4000

© SimpsonHaugh and Partners 2019

Appendix E Flood Risk Maps

Basic view Detailed view

Location Enter a place or postcode in England

Flood risk from rivers or the sea

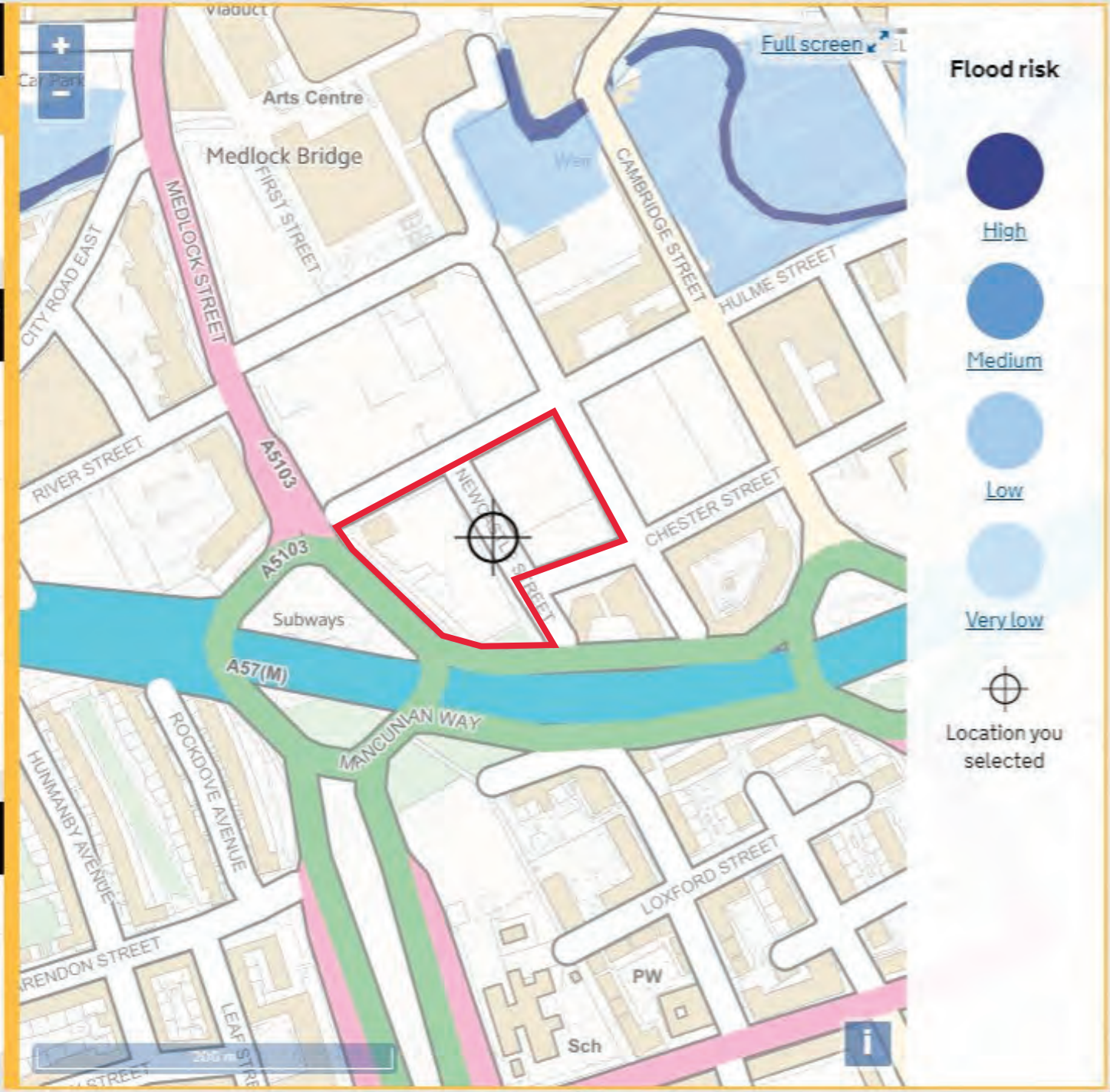
- Extent of flooding
- Depth and flow estimates at monitoring stations

Flood risk from surface water

- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Basic view Detailed view

Location Enter a place or postcode in England

Flood risk from rivers or the sea

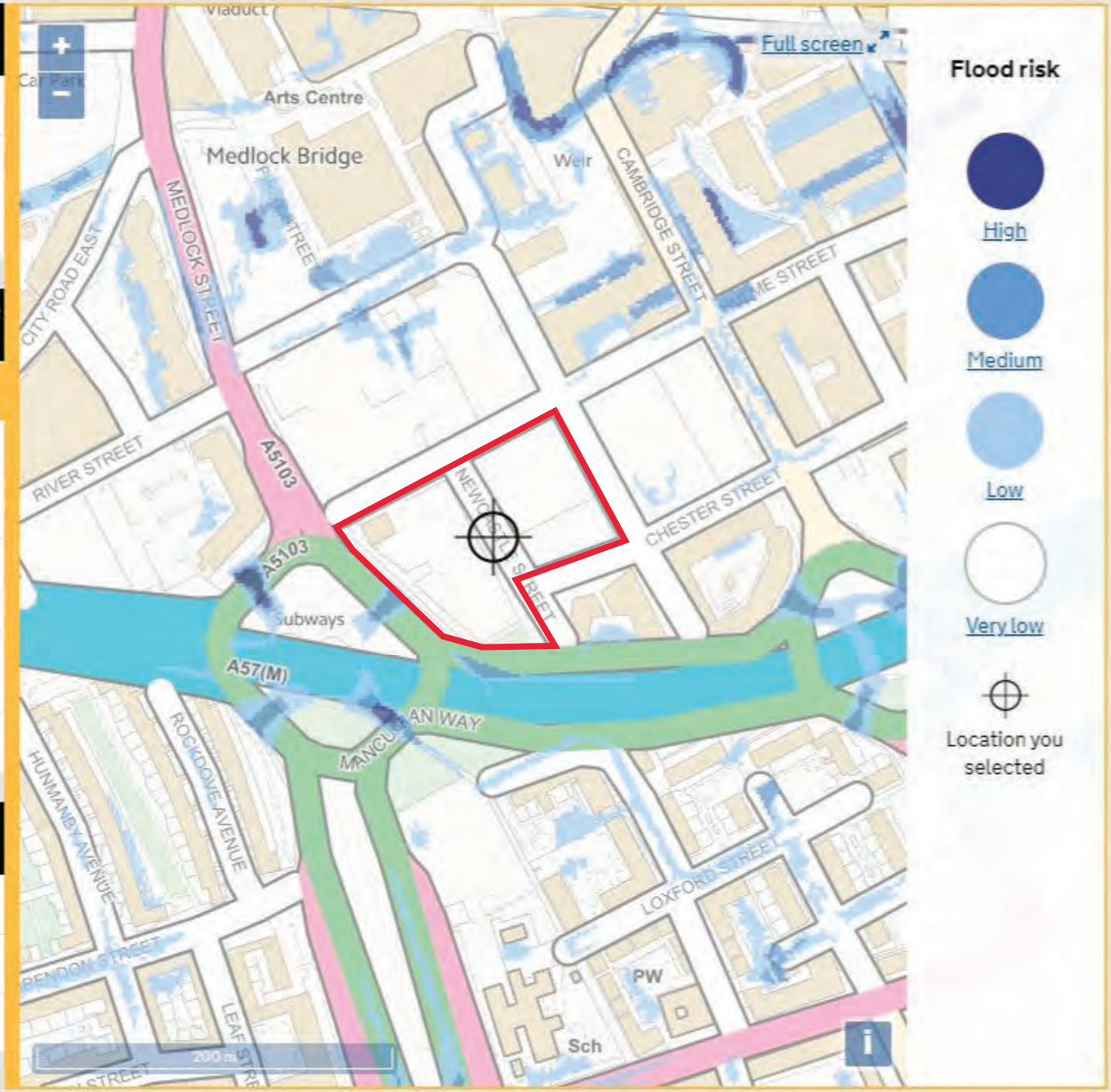
- Extent of flooding
- Depth and flow estimates at monitoring stations

Flood risk from surface water

- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Basic view Detailed view

Location Enter a place or postcode in England

Flood risk from rivers or the sea

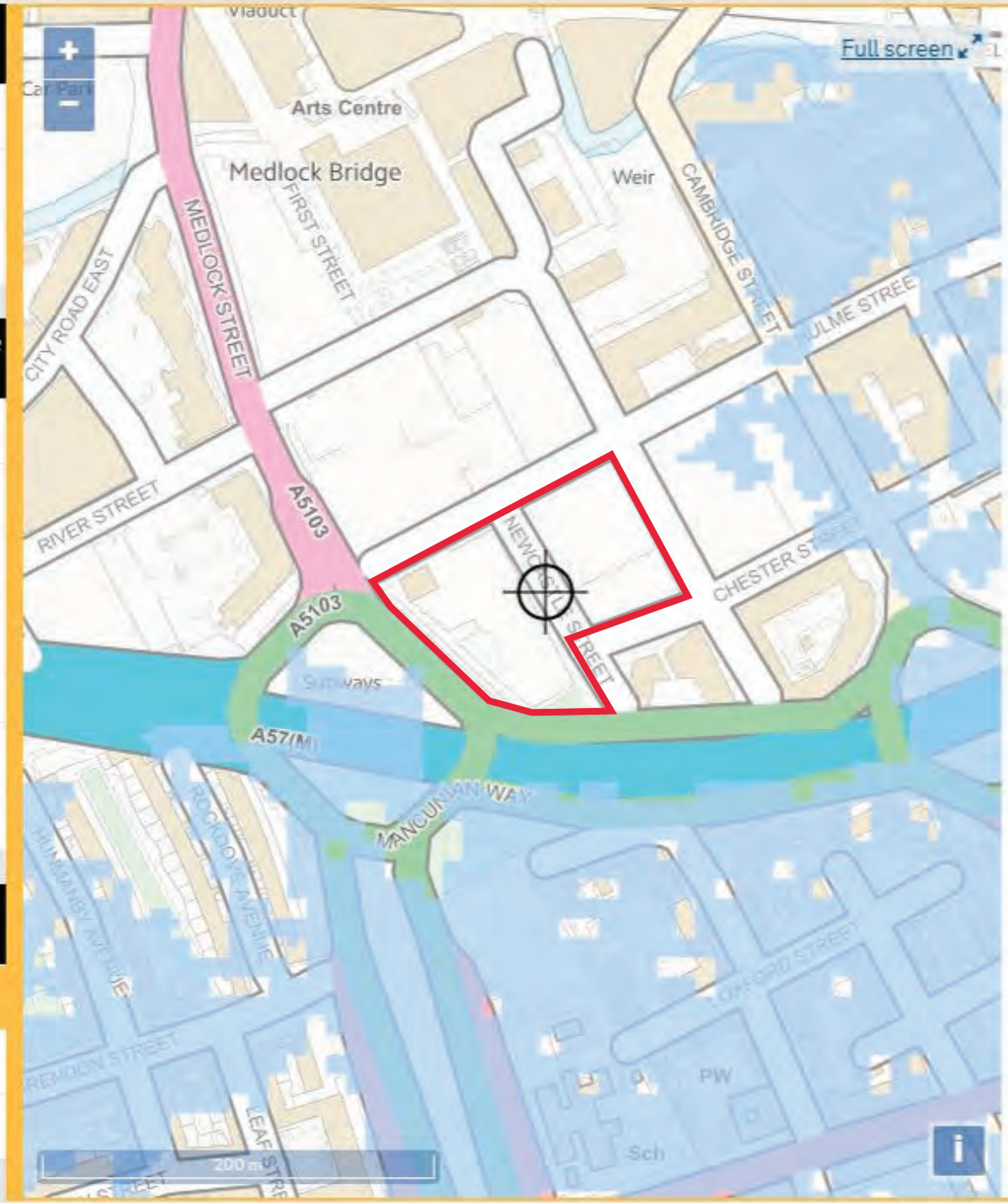
- Extent of flooding
- Depth and flow estimates at monitoring stations

Flood risk from surface water

- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Flood risk

Maximum extent of flooding

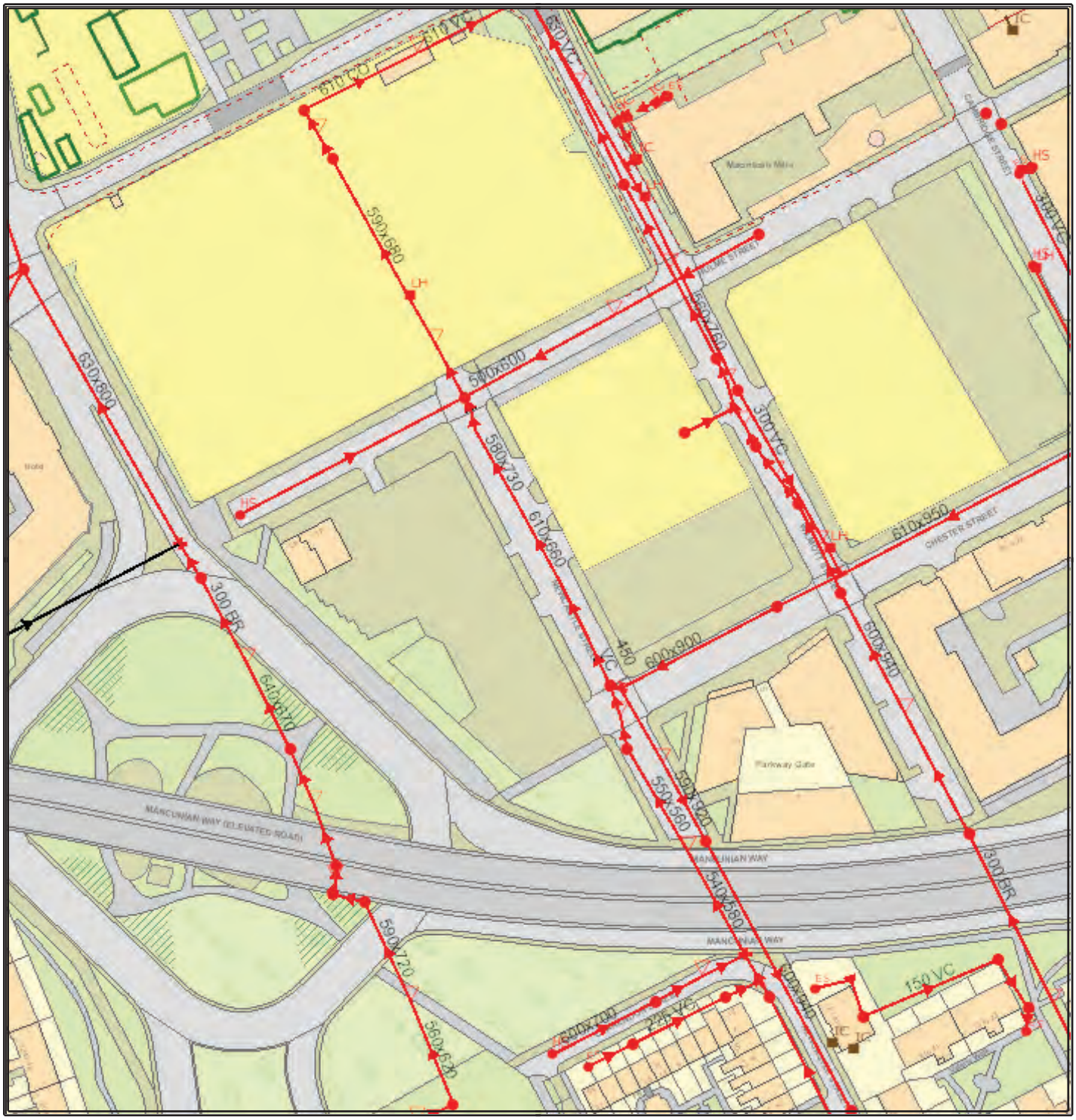
Location you selected

Appendix F United Utilities Map

United Utilities

COMMERCIALDW
DRAINAGE AND WATER ENQUIRY

SEWER RECORD LAND ON THE NORTH SIDE OF HULME STREET MANCHESTER



The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded. United Utilities Water Limited will not accept any liability for any damage caused by the actual positions being different from those shown.

© United Utilities Water Limited 2016.The plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M. Stationery Office, Crown copyright 100022432 and United Utilities Water Limited copyrights are reserved. Unauthorised reproduction will infringe these copyrights.

Waste Water Symbology

Combined	Foul	Surface	Overflow	
				Manhole
				Manhole, side entry
				Public sewer
				Private sewer
				S104 sewer
				Rising main, public
				Rising main, private
				Rising main, S104
				Highway drain, private
				Screen chamber
DP	DP	DP	DP	Discharge point
				Outfall

CK Control kiosk

Sludge main

Abandoned pipe	
	Public sewer
	Rising main
	Private sewer
	Sludge main

Manhole function	
FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

Sewer shape			
CI	Circular	U	Unspecified
EG	Egg	SQ	Square
OV	Oval	TR	Trapezoidal
FT	Flat top	AR	Arch
RE	Rectangular	BA	Barrel
		HO	Horse shoe

Sewer material			
AC	Asbestos cement	DI	Ductile iron
BR	Brick	VC	Vitrified clay
CO	Concrete	PP	Polypropylene
CSB	Concrete segment	PF	Pitched fibre
CSU	Concrete segment	MA	Masonary, coursed
CC	Concrete box culverted	MA	Masonary, random
PSC	Plastic	RP	Reinforced plastic
GR	Glass reinforced	CI	Cast iron
GRP	Glass reinforced	SI	Spun iron
PVC	Polyvinyl chloride	ST	Steel
PE	Polyethelene	U	Unspecified

			WW pumping station
IC	IC	IC	Inspection chamber
ES	ES	ES	Extent of survey
HS	HS	HS	Head of system
SO		SO	Soakaway
RE	RE	RE	Rodding eye
LH	LH	LH	Lamp hole
			T junction/saddle
GU	GU	GU	Gulley
AV	AV	AV	Air valve
NRV	NRV	NRV	Non return valve
V			Sewer overflow
CA	CA	CA	Cascade
FM	FM	FM	Flow meter
HA	HA	HA	Hatch box
HY	HY	HY	Hydrobrake
IN	IN	IN	Inlet
			Bifurcation
CA	CA	CA	Catchpit
OI	OI	OI	Oil interceptor
PE	PE	PE	Penstock
SM	SM	SM	Summit
VA	VA	VA	Valve
VC	VC	VC	Valve chamber
WO	WO	WO	Washout chamber
DS	DS	DS	Drop shaft
WwTW	WwTW		WW treatment works
ST	ST		Septic tank
			Vent column
			Network storage tank
OP	OP	OP	Orifice plate
			Vortex chamber
			Penstock chamber

John Speers

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 14 April 2020 14:33
To: John Speers
Cc: Wastewater Developer Services
Subject: FW: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Categories: 219-215 - First Street Manchester

Good Afternoon John,

Many thanks for your comments.

In light of these, I confirm United Utilities will be happy for surface water to connect to the public combined sewer network at total maximum pass-forward flow rate of 13.4 l/s (the brownfield rate stated in your previous email).

Should you have any further queries please do not hesitate to get in touch (note I am now contactable on the mobile number below whilst working from home).

Kind regards,

Tom

Did you know we now have a live chat facility available to you Mon to Friday 8 -5pm. You just click on the orange live chat box on our webpage and one of our advisors will be ready to chat to you and help you with your enquiry https://www.unitedutilities.com/builders-developers/ or you can email us at WastewaterDeveloperServices@uuplc.co.uk

United Utilities
Water for the North West

Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
M: 07880 339 195
unitedutilities.com

If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

From: John Speers [mailto:johnSpeers@ajpstructeng.com]
Sent: 02 April 2020 10:31
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Cc: Danny Sinclair <DannySinclair@ajpstructeng.com>
Subject: RE: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Morning Tom,

Thanks for the below response. Please see AJP comments below in red.

If you want to discuss this over the phone please contact me using my mobile number below.

Many Thanks

John

John Speers CEng MICE
Senior Civil Engineer

Alan Johnston Partnership LLP

Tel: 0151 227 1462 | Mobile: 07841832409
4th Floor, 1 Dale Street | Liverpool, L2 2ET | johnspeers@ajpstructeng.com | www.ajpstructeng.com

Certificate No. 7917
ISO 9001
ISO 14001

KM 674098

Alan Johnston Partnership LLP is a Limited Liability Partnership registered in England and Wales, number OC394381
A list of members' names is available for inspection at our registered office: 1 Dale Street, Liverpool, L2 2ET

The information contained in this communication is confidential, may be privileged and is intended for the exclusive use of the individual or entity to which it is addressed. If you are not the intended recipient, you are expressly prohibited from copying, distributing, disseminating, or in any other way using any information contained within this communication. We have taken precautions to minimise the risk of transmitting software viruses, but we advise you to carry out your own virus checks on any attachment to this message. We cannot accept liability for any loss or damage caused by software viruses. The Alan Johnston Partnership reserves the right to monitor all email communications through their internal and external networks. If you have received this communication in error, please notify us immediately by returning the original message to the sender and delete the material from any computer. Thank you.

Please do not print this email unless absolutely necessary

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 17 March 2020 15:51
To: John Speers <johnSpeers@ajpstructeng.com>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FW: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Good Afternoon John,

I have discussed the scheme with Neil and have the following comments:

Infiltration:

If 3.5m of ground is being replaced as part of the remediation strategy, could ground that is suitable for infiltration not be used? This would sit above the Glaciofluvial Sheet Deposits and could allow the site to infiltrate all surface water.
The remediation strategy is a 3.5m site turnover, so the ground will simply be reworked and remain on site. Given this and the restrictions imposed by the gas main easements and also the 5m restrictions on soakaways near buildings and highways from Building Regulations Part-H, the areas in which soakaways could be located are minimal. Also, the 3.5m of reworked made ground would limit the use of infiltration as it would still carry the potential for inundation settlement across the site.

Discharge rate (if infiltration not possible):

I note the most recent calculations have not included the highway. However, the remaining impermeable areas are not positively drained and the simulation therefore does not match the existing situation.

Since there is no positive drainage, the site must be classed as greenfield, resulting in the 6 l/s stated in the initial response below. I appreciate that surface water falling on the paving areas (around the perimeter of the site) may well run into the highway drainage, but will this not continue to be the case post-development?
As per the previously attached drainage strategy drawing the footpaths are to be drained via a series of linear drains (aco's) and will therefore not continue to drain onto the positively drained highways. With this is mind will UU accept that the site is brownfield and therefore the previous brownfield runoff calcs are suitable?
If not and UU are insisting that the site is greenfield, as per the previously attached drainage strategy, due to the phases in constructing the proposed development we will require 2no. outlets to the public sewers and as such a total of 6 L/s would only allow us 3 L/s per outfall. As this is less than the minimum 5 L/s discharge rate (to achieve a 100mm diameter orifice) would a total discharge rate of 10 L/s (5 L/s per outfall) be acceptable to UU?

Abandoned pipe:

Since the sewer is on our records as not live, there will not be a need for a S116 application. United Utilities would have no objection to this sewer being formerly grubbed up or grouted up, if investigations find this is required. Unfortunately our records do not have any information on if the sewer has already been grubbed up/grouted – apologies.
Noted.

Kind regards,

Tom

Thomas Bethell
Assistant Engineer
Developer Services & Metering
Customer Services
T: 01925 679 308
unitedutilities.com

If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

From: John Speers [mailto:johnSpeers@ajpstructeng.com]
Sent: 09 March 2020 17:20
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Cc: Danny Sinclair <DannySinclair@ajpstructeng.com>
Subject: RE: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Tom,

Apologies in the delay in getting back to you on this. I believe Neil O'Brien has now also commented on the planning application for the site, so if possible could you please liaise with Neil regarding the below information.

Due to the extent of the known buried structures across the site, the likelihood of more unknown buried structures and also to ensure a thorough UXO survey is completed, a 3.5m deep turnover of the site is proposed as a remediation strategy. This will therefore result in the majority of the site (excluding the gas main easements) having a minimum depth of 3.5m of made ground. Considering the remediation strategy and also constraints resulting from the numerous gas main easements (see attached drainage strategy drawing with easements in yellow hatching), **can you please confirm that UU are happy that infiltration is not suitable across the site?**

Also, with regards to the surface water discharge rates from the proposed site, you indicated that the sewer in Newcastle Street is shown as abandoned on your maps and therefore I have revised the pre & post development impermeable areas plan and also the existing brownfield runoff rates, see attached. The updated pre & post development impermeable areas plan shows that the pre development impermeable areas total is 1,703m^2, which results in the existing brownfield runoff rates indicated on the attached. Therefore, the required 50% betterment to comply with LLFA requirements, would be applied to these existing discharge rates for all rainfall events up to and including the 1 in 100 year +40% climate change rainfall event. For the 2 year rainfall event this would result in a maximum surface water discharge rate of 13.4 L/s. This will therefore be split across the 2no. separate outfalls, with 5.0 L/s from the Blocks C&D network and 8.4 L/s from the Blocks A & B network. Given the updated brownfield runoff rates and information above, **can you please confirm that UU are happy with the above surface water discharge rates?**

Finally, as the sewer along Newcastle Street is shown as abandoned **can you please confirm what actions, if any, (such as Section 116 application) need to be taken on our part?** Considering the depth of the remediation across the site, **would UU have any restrictions on the abandoned sewer, in terms of the sewer being removed/'grubbed up' as part of the enabling works? Can you also confirm if the sewer has been completely grouted or simply blocked up, as this will have an impact on whether or not it would be practical to remove the abandoned sewer or simply leave it in place?**

If you need any additional information or want to talk through anything, please do not hesitate to contact me using the details below.

Regards

John

John Speers CEng MICE
Senior Civil Engineer

Alan Johnston Partnership LLP

4th Floor, 1 Dale Street | Liverpool, L2 2ET | Tel: 0151 227 1462 | johnspeers@ajpstructeng.com | www.ajpstructeng.com

Certificate No. 7917
ISO 9001
ISO 14001

KM 674098

Alan Johnston Partnership LLP is a Limited Liability Partnership registered in England and Wales, number OC394381
A list of members' names is available for inspection at our registered office: 1 Dale Street, Liverpool, L2 2ET

The information contained in this communication is confidential, may be privileged and is intended for the exclusive use of the individual or entity to which it is addressed. If you are not the intended recipient, you are expressly prohibited from copying, distributing, disseminating, or in any other way using any information contained within this communication. We have taken precautions to minimise the risk of transmitting software viruses, but we advise you to carry out your own virus checks on any attachment to this message. We cannot accept liability for any loss or damage caused by software viruses. The Alan Johnston Partnership reserves the right to monitor all email communications through their internal and external networks. If you have received this communication in error, please notify us immediately by returning the original message to the sender and delete the material from any computer. Thank you.

Please do not print this email unless absolutely necessary

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 25 November 2019 16:42
To: John Speers <johnSpeers@ajpstructeng.com>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FW: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

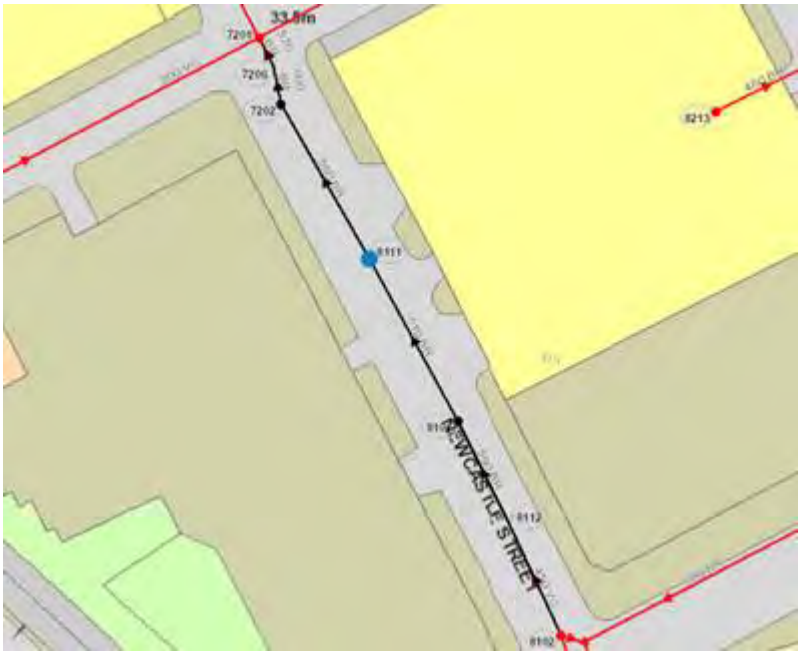
Good Afternoon John,

I am unsure why the sewers on the plans you have received are showing as live. We can only go off the records we have which (as shown below) are showing the sewers to have been abandoned.

Thank you for sending the SI report. Looking at the sectional drawings, I agree that in some areas the made ground is quite deep and does not leave much room for an infiltration system to be in the Glaciofluvial sheet deposits.

However, in some areas there appears to be several meters between the groundwater level and the shallow made ground level. The piped drainage arrangement taking water to any infiltration system will likely be deeper than the made ground levels. Therefore, we would argue further investigation into the potential for infiltration should be done.

Will there be any ground remediation taking place on this site? Please confirm the remediation strategy.



Kind regards,

Tom

If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

Thomas Bethell
Assistant Developer Engineer
Developer Services & Metering (Wastewater)
Customer Services
United Utilities
01925 679 308

From: John Speers [mailto:johnSpeers@ajpstructeng.com]
Sent: 13 November 2019 09:17

To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: RE: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Tom,

Thanks for the response.

The map which we have from United Utilities (see attached) shows that all the sewers in this area are live? Also, regarding the site investigation (extracts attached), it indicates that the site is underlain by large depths of made ground, up to 3.75mbgl and also a number of buried obstructions such as air raid shelters and basements. The made ground and glaciofluvial deposits are then underlain by a substrate of firm to stiff clays (Glacial Till). It is envisaged that BRE365 testing is not required as infiltration into the large depths of made ground and buried obstructions would result in the potential for inundation settlement and also this is underlain by firm to stiff clays (Glacial Till), which as shown within the Drawings section of the SI report seems to fairly impermeable, as what is assumed to be perched groundwater was consistently found just above the Glacial Till strata.

Can you please confirm that the sewer on Newcastle Street is abandoned? Also, given the SI information provided can you please confirm if you still believe BRE365 testing would be required?

Kind Regards

John

John Speers CEng MICE
Senior Civil Engineer

Alan Johnston Partnership LLP

4th Floor, 1 Dale Street | Liverpool, L2 2ET | Tel: 0151 227 1462 | johnspeers@ajpstructeng.com | www.ajpstructeng.com

Certificate No. 7917
ISO 9001
ISO 14001

KM 674098

Alan Johnston Partnership LLP is a Limited Liability Partnership registered in England and Wales, number OC394381
A list of members' names is available for inspection at our registered office: 1 Dale Street, Liverpool, L2 2ET

The information contained in this communication is confidential, may be privileged and is intended for the exclusive use of the individual or entity to which it is addressed. If you are not the intended recipient, you are expressly prohibited from copying, distributing, disseminating, or in any other way using any information contained within this communication. We have taken precautions to minimise the risk of transmitting software viruses, but we advise you to carry out your own virus checks on any attachment to this message. We cannot accept liability for any loss or damage caused by software viruses. The Alan Johnston Partnership reserves the right to monitor all email communications through their internal and external networks. If you have received this communication in error, please notify us immediately by returning the original message to the sender and delete the material from any computer. Thank you.

Please do not print this email unless absolutely necessary

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 10 November 2019 14:33
To: John Speers <johnSpeers@ajpstructeng.com>
Cc: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: FW: 219-215 - First Street South, Manchester - Pre-Development Enquiry 4200028919

Dear John,

Our reference for this pre-development enquiry: 4200028919

We have carried out an assessment of your application which is based on the information provided; this pre development advice will be valid for 12 months

Foul

Foul will be allowed to drain to the public combined sewer network at an unrestricted rate, and at any conveniant point.

Surface Water

I note your comments regarding infiltration, however the British Geological Survey (BGS) website indicates the area compries of sand and gravel over sandstone, suggesting infiltration is likely feasible. We would therefore expect to see BRE 365 percolation test results that give a good representation of the site (i.e. numerous tests done around the site). In the first instance, please could you provide the site investigation report to support the below?

If infiltration is proven to be infeasible, we would allow surface water to connect to the public combined sewer network. However unfortunately we would stipulate that discharge rates must be restricted to greenfield runoff rates as the sewer which gullies are shown to connect to in Newcastle Road are showing as abandoned sewers on our sewer records suggesting any highway drainage is redundent.

Therefore, in the event that a surface water connection is proven to be required, surface water must be restricted to a maximum pass-forward flow rate of 6 l/s.

General Information:

Please be aware that on site drainage must be designed in accordance with Building Regulations, National Planning Policy, and local flood authority guidelines, we would recommend that you speak and make suitable agreements with the relevant statutory bodies.

Connection Application

Although we may discuss and agree discharge points & rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below

http://www.unitedutilities.com/connecting-public-sewer.aspx

Many thanks and kind regards,

Tom

If you have received a great service today why not tell us?
Visit: unitedutilities.com/wow

Thomas Bethell
Assistant Developer Engineer
Developer Services & Metering (Wastewater)
Customer Services
United Utilities
01925 679 308

From: John Speers [mailto:johnSpeers@ajpstructeng.com]
Sent: 29 October 2019 16:06
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: 219-215 - First Street South, Manchester - Pre-Development Enquiry

Please find attached a pre-development form and associated information for your consideration.

The total site covers an area of approximately 1.22ha and is currently a brownfield site. The site currently consists of an existing highway, Newcastle Street through the centre of the site and two areas on either side of the highway, both of which consist of areas of hardstanding associated with the demolition of previous developments. See aerial view attached.

As the buildings on either side of the highway have been demolished for a number of years it is envisaged that any existing drainage within these areas will now be redundant. As such, it is envisaged that only the existing highway areas and associated footpath areas (which drain to the highways) currently have an active drainage system. This has been confirmed via the existing Topo and Utility survey which is attached, which indicates that the existing highway has a number of gullies which drain to the public combined sewer along Newcastle Street. Therefore, only the highway area has been considered during the pre-development impermeable areas calculation.

The Cundall Geotechnical and Geoenvironmental Assessment Report, 1011906.RPT.GL.004, did not undertake any BRE365 complaint infiltration tests but it has indicated that the site is underlain by large depths of made ground, up to 3.75mbgl and also a number of buried obstructions. The made ground and glaciofluvial deposits are then underlain by a substrate of firm to stiff clays.
Even though no BRE 365 compliant soakaway tests were completed as part of the intrusive site investigation, it is envisaged that infiltration is not suitable across the proposed site. This is due to the potential for inundation settlement resulting from infiltration through the large depths of made ground and buried obstructions and also due to the low permeability of firm to stiff clays.
As such, it is envisaged that infiltration is not viable across the site and therefore soakaway tests are not required.

Therefore, discharge to the surrounding pubic sewer network will be the only option for the discharge of the surface water runoff. Discharge to watercourse would be impractical as the nearest watercourse is the River Medlock which is located approximately 145m north of the site, through various plots of developed third party land. As there are no existing surface water sewers within close vicinity of the site, the only viable option would be to discharge to the existing public combined water sewers, surrounding the site.

It is envisaged that the surface water discharge will be restricted to 50% of the existing brownfield run off rates, in line with the Manchester, Salford and Trafford SFRA User Guide. The attached brownfield runoff calculations indicate that the existing brownfield run off rate for the 2-year return period is 48.3 L/s and therefore the proposed discharge from the entire site will be restricted to a rate of 24.2 L/s to achieve the minimum 50% betterment. This discharge rate will be applicable for all rainfall events up to and including the 1 in 100 year + 40% climate change event.

The intention is to drain Blocks A & B together on the same drainage network, with Block C and Block D drained via their own separate networks, therefore totalling 3no. separate drainage networks. The foul and surface water for each network will also be separate networks and then combined adjacent to the site boundary, prior to connecting to the surrounding UU combined sewers. If feasible, any existing drainage systems shall be utilised to connect the proposed drainage systems to the existing UU combined sewers.

Can you confirm that United Utilities are happy with this drainage arrangement and as such have no objections to the drainage strategy or discharge restrictions proposed above?

Please contact me immediately to discuss any matters further.

Regards

John

John Speers CEng MICE
Senior Civil Engineer

Alan Johnston Partnership LLP

4th Floor, 1 Dale Street | Liverpool, L2 2ET | Tel: 0151 227 1462 | johnspeers@ajpstructeng.com | www.ajpstructeng.com

Certificate No. 7917
ISO 9001
ISO 14001

KM 674098

Alan Johnston Partnership LLP is a Limited Liability Partnership registered in England and Wales, number OC394381
A list of members' names is available for inspection at our registered office: 1 Dale Street, Liverpool, L2 2ET

The information contained in this communication is confidential, may be privileged and is intended for the exclusive use of the individual or entity to which it is addressed. If you are not the intended recipient, you are expressly prohibited from copying, distributing, disseminating, or in any other way using any information contained within this communication. We have taken precautions to minimise the risk of transmitting software viruses, but we advise you to carry out your own virus checks on any attachment to this message. We cannot accept liability for any loss or damage caused by software viruses. The Alan Johnston Partnership reserves the right to monitor all email communications through their internal and external networks. If you have received this communication in error, please notify us immediately by returning the original message to the sender and delete the material from any computer. Thank you.

Please do not print this email unless absolutely necessary

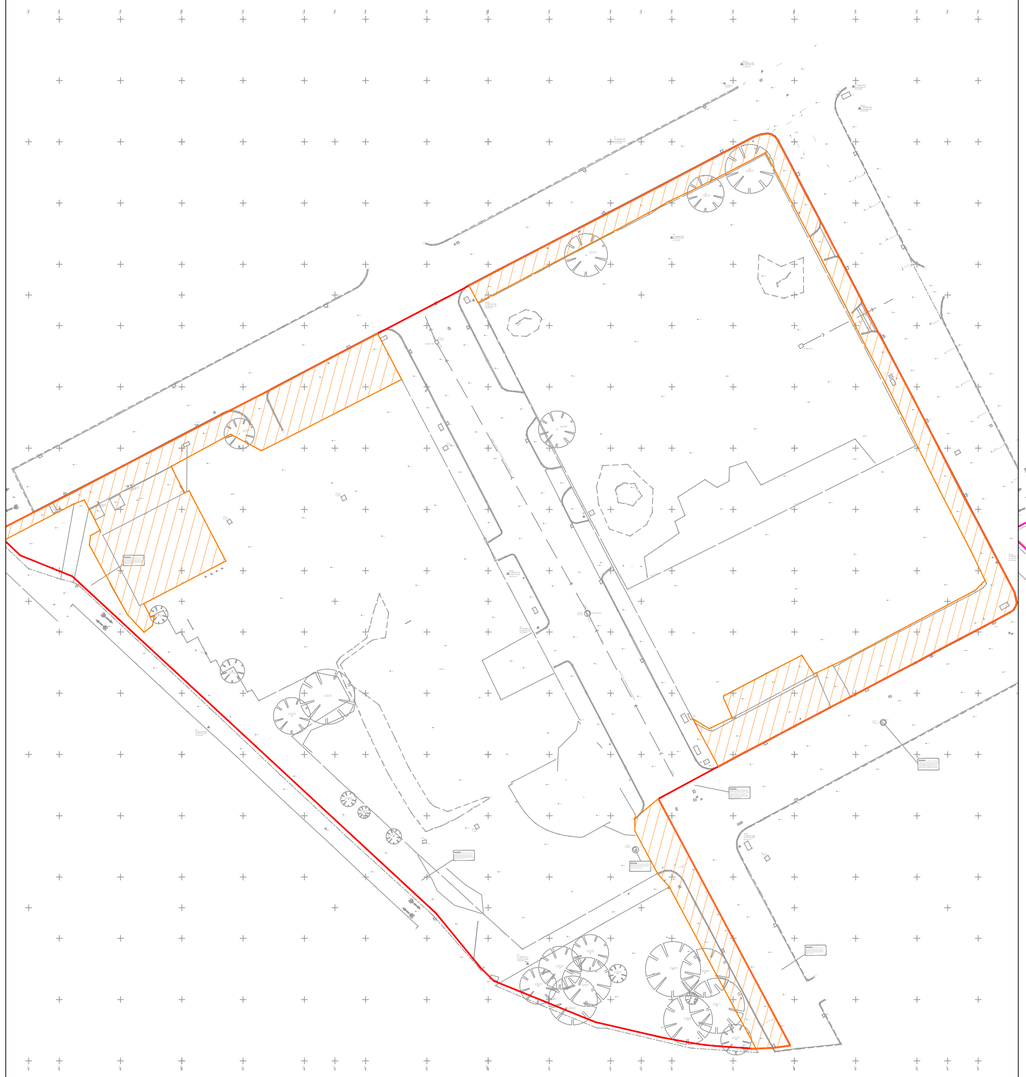
EMGateway3.uuplc.co.uk made the following annotations

The information contained in this e-mail is intended only for the individual to whom it is addressed. It may contain legally privileged or confidential information or otherwise be exempt from disclosure. If you have received this Message in error or there are any problems, please notify the sender immediately and delete the message from your computer. You must not use, disclose, copy or alter this message for any unauthorised purpose. Neither United Utilities Group PLC nor any of its subsidiaries will be liable for any direct, special, indirect or consequential damages as a result of any virus being passed on, or arising from the alteration of the contents of this message by a third party.

United Utilities Group PLC, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP
Registered in England and Wales. Registered No 6559020

www.unitedutilities.com
www.unitedutilities.com/subsidiaries

Appendix G Pre & Post Development Impermeable Areas Drawing



PRE-DEVELOPMENT
IMPERMEABLE AREAS = 1,707m²

POST-DEVELOPMENT
IMPERMEABLE AREAS = 9,918m²
(INCLUDES GREEN ROOF &
PERMEABLE PAVING AREAS)

REV	DATE	DESCRIPTION	BY	CHK	APP
P02	09.03.2020	FOR INFORMATION ONLY - UPDATED TO SUIT ABANDONED SEWER ON NEWCASTLE STREET	JRS	DJS	DJS
P01	25.10.2019	FOR INFORMATION ONLY	JRS	DJS	DJS

DRAWING STATUS:

INFORMATION

CLIENT:

DOWNING

ARCHITECT:

SIMPSON HAUGH & PARTNERS

PROJECT:

FIRST STREET SOUTH
MANCHESTER

TITLE:

PRE & POST DEVELOPMENT
IMPERMEABLE AREAS

STATUS:	PROJECT No.	PROJECT	ORIGINATOR	VOL/SYS	LEVEL	TYPE	ROLE	DRAWING No.	REV:
S2	219-215	FSS -	AJP -	XX -	00 -	DR -		**SK - 0001**	**P02**

SCALE @ A1:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
1:500	JRS	JRS	DJS	DJS	OCT 2019

alan johnston partnership LLP
CONSULTING STRUCTURAL & CIVIL ENGINEERS
1 Dale Street,
Liverpool L2 2ET
Tel: 0151 227 1462
Fax: 0151 225 1187
E-Mail: Mail@ajpstructeng.com

Appendix H Existing Brownfield Discharge Rate

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)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	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

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	0.171	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	10.000	0.125	80.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	10.000	0.125	80.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.11	32.875	0.171	0.0	0.0	0.0	1.46	58.2	23.2
1.001	50.00	5.23	32.750	0.171	0.0	0.0	0.0	1.46	58.2	23.2
1.002	50.00	5.34	32.625	0.171	0.0	0.0	0.0	1.46	58.2	23.2

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)
1.002		34.000	32.500	30.000	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 * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	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	M5-60 (mm)	18.000
Return Period (years)	30	Ratio R	0.360
Region	England and Wales	Profile Type	Summer

©1982-2019 Innovyze

Synthetic Rainfall Details

Cv (Summer) 0.750 Storm Duration (mins) 30
Cv (Winter) 0.840

©1982-2019 Innovyze

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

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 M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	SW01	15 Winter	2	+0%	100/15 Summer				32.995	-0.105	0.000
1.001	SW02	15 Winter	2	+0%	100/15 Summer				32.870	-0.105	0.000
1.002	SW03	15 Winter	2	+0%	100/15 Summer				32.745	-0.105	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.55		26.5	OK	
1.001	SW02	0.55		26.5	OK	
1.002	SW03	0.55		26.7	OK	

©1982-2019 Innovyze

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

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 M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	SW01	15 Winter	30	+0%	100/15 Summer				33.086	-0.014	0.000
1.001	SW02	15 Winter	30	+0%	100/15 Summer				32.932	-0.043	0.000
1.002	SW03	15 Winter	30	+0%	100/15 Summer				32.807	-0.043	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	1.00		48.5	OK	
1.001	SW02	1.00		48.5	OK	
1.002	SW03	1.00		48.4	OK	

©1982-2019 Innovyze

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

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 M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.000	SW01	15 Winter	100	+0%	100/15 Summer				33.291	0.191	0.000
1.001	SW02	15 Winter	100	+0%	100/15 Summer				33.096	0.121	0.000
1.002	SW03	15 Winter	100	+0%	100/15 Summer				32.904	0.054	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	1.24		59.9	SURCHARGED	
1.001	SW02	1.22		59.2	SURCHARGED	
1.002	SW03	1.23		59.6	SURCHARGED	

©1982-2019 Innovyze

Appendix I Preliminary Storage Estimates

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 310 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	32.428	0.428	0.0	8.3	8.3	127.6	O K
30 min Summer	32.567	0.567	0.0	8.3	8.3	169.1	O K
60 min Summer	32.706	0.706	0.0	8.3	8.3	210.7	O K
120 min Summer	32.821	0.821	0.0	8.3	8.3	244.8	O K
180 min Summer	32.861	0.861	0.0	8.3	8.3	256.9	O K
240 min Summer	32.870	0.870	0.0	8.3	8.3	259.4	O K
360 min Summer	32.855	0.855	0.0	8.3	8.3	255.2	O K
480 min Summer	32.837	0.837	0.0	8.3	8.3	249.6	O K
600 min Summer	32.815	0.815	0.0	8.3	8.3	243.0	O K
720 min Summer	32.790	0.790	0.0	8.3	8.3	235.8	O K
960 min Summer	32.739	0.739	0.0	8.3	8.3	220.5	O K
1440 min Summer	32.623	0.623	0.0	8.3	8.3	185.7	O K
2160 min Summer	32.464	0.464	0.0	8.3	8.3	138.5	O K
2880 min Summer	32.344	0.344	0.0	8.3	8.3	102.6	O K
4320 min Summer	32.202	0.202	0.0	8.1	8.1	60.4	O K
5760 min Summer	32.146	0.146	0.0	7.6	7.6	43.7	O K
7200 min Summer	32.126	0.126	0.0	6.5	6.5	37.5	O K
8640 min Summer	32.112	0.112	0.0	5.7	5.7	33.5	O K
10080 min Summer	32.103	0.103	0.0	5.1	5.1	30.7	O K
15 min Winter	32.482	0.482	0.0	8.3	8.3	143.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.613	0.0	134.1	25
30 min Summer	79.413	0.0	180.0	39
60 min Summer	50.812	0.0	232.0	68
120 min Summer	31.468	0.0	287.5	126
180 min Summer	23.466	0.0	321.6	182
240 min Summer	18.940	0.0	346.1	240
360 min Summer	13.882	0.0	380.6	298
480 min Summer	11.143	0.0	407.4	362
600 min Summer	9.389	0.0	429.1	430
720 min Summer	8.158	0.0	447.4	500
960 min Summer	6.531	0.0	477.5	640
1440 min Summer	4.764	0.0	522.4	908
2160 min Summer	3.468	0.0	571.6	1276
2880 min Summer	2.766	0.0	607.6	1620
4320 min Summer	2.007	0.0	660.7	2292
5760 min Summer	1.596	0.0	701.9	2944
7200 min Summer	1.336	0.0	734.1	3672
8640 min Summer	1.154	0.0	761.0	4408
10080 min Summer	1.020	0.0	783.9	5136
15 min Winter	118.613	0.0	150.4	25

©1982-2020 Innovyze

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	32.640	0.640	0.0	8.3	8.3	191.0	O K
60 min Winter	32.798	0.798	0.0	8.3	8.3	238.0	O K
120 min Winter	32.932	0.932	0.0	8.3	8.3	277.9	O K
180 min Winter	32.983	0.983	0.0	8.3	8.3	293.3	O K
240 min Winter	32.999	0.999	0.0	8.4	8.4	298.0	O K
360 min Winter	32.982	0.982	0.0	8.3	8.3	292.9	O K
480 min Winter	32.957	0.957	0.0	8.3	8.3	285.4	O K
600 min Winter	32.927	0.927	0.0	8.3	8.3	276.4	O K
720 min Winter	32.892	0.892	0.0	8.3	8.3	266.2	O K
960 min Winter	32.817	0.817	0.0	8.3	8.3	243.8	O K
1440 min Winter	32.646	0.646	0.0	8.3	8.3	192.7	O K
2160 min Winter	32.400	0.400	0.0	8.3	8.3	119.4	O K
2880 min Winter	32.245	0.245	0.0	8.3	8.3	73.1	O K
4320 min Winter	32.137	0.137	0.0	7.1	7.1	40.9	O K
5760 min Winter	32.113	0.113	0.0	5.7	5.7	33.6	O K
7200 min Winter	32.099	0.099	0.0	4.8	4.8	29.7	O K
8640 min Winter	32.090	0.090	0.0	4.1	4.1	27.0	O K
10080 min Winter	32.084	0.084	0.0	3.7	3.7	24.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	79.413	0.0	201.8	39
60 min Winter	50.812	0.0	259.9	68
120 min Winter	31.468	0.0	322.0	124
180 min Winter	23.466	0.0	360.3	180
240 min Winter	18.940	0.0	387.8	236
360 min Winter	13.882	0.0	426.4	336
480 min Winter	11.143	0.0	456.4	382
600 min Winter	9.389	0.0	480.7	460
720 min Winter	8.158	0.0	501.2	536
960 min Winter	6.531	0.0	534.9	692
1440 min Winter	4.764	0.0	585.2	988
2160 min Winter	3.468	0.0	640.3	1340
2880 min Winter	2.766	0.0	680.6	1648
4320 min Winter	2.007	0.0	740.2	2248
5760 min Winter	1.596	0.0	786.1	2944
7200 min Winter	1.336	0.0	822.2	3680
8640 min Winter	1.154	0.0	852.4	4408
10080 min Winter	1.020	0.0	878.2	5064

©1982-2020 Innovyze

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)	18.000	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.611

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.204	4	8	0.204	8	12	0.203

©1982-2020 Innovyze

Model Details

Storage is Online Cover Level (m) 34.000

Cellular Storage Structure

Invert Level (m) 32.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	314.0	0.0	1.001	0.0	0.0
1.000	314.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0134-8400-1000-8400
Design Head (m)	1.000
Design Flow (l/s)	8.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	134
Invert Level (m)	32.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	8.4
Flush-Flo™	0.301	8.3
Kick-Flo®	0.662	6.9
Mean Flow over Head Range	-	7.2

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	4.8	1.200	9.1	3.000	14.1	7.000	21.2
0.200	8.1	1.400	9.8	3.500	15.2	7.500	21.9
0.300	8.3	1.600	10.5	4.000	16.2	8.000	22.6
0.400	8.2	1.800	11.1	4.500	17.1	8.500	23.2
0.500	8.0	2.000	11.6	5.000	18.0	9.000	23.9
0.600	7.5	2.200	12.2	5.500	18.8	9.500	24.5
0.800	7.6	2.400	12.7	6.000	19.6		
1.000	8.4	2.600	13.2	6.500	20.4		

©1982-2020 Innovyze

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 331 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	32.426	0.426	0.0	5.0	5.0	79.7	O K
30 min Summer	32.564	0.564	0.0	5.0	5.0	105.6	O K
60 min Summer	32.704	0.704	0.0	5.0	5.0	131.7	O K
120 min Summer	32.818	0.818	0.0	5.0	5.0	153.1	O K
180 min Summer	32.860	0.860	0.0	5.0	5.0	160.9	O K
240 min Summer	32.870	0.870	0.0	5.0	5.0	162.7	O K
360 min Summer	32.855	0.855	0.0	5.0	5.0	160.0	O K
480 min Summer	32.836	0.836	0.0	5.0	5.0	156.5	O K
600 min Summer	32.815	0.815	0.0	5.0	5.0	152.4	O K
720 min Summer	32.791	0.791	0.0	5.0	5.0	148.1	O K
960 min Summer	32.743	0.743	0.0	5.0	5.0	139.0	O K
1440 min Summer	32.638	0.638	0.0	5.0	5.0	119.4	O K
2160 min Summer	32.476	0.476	0.0	5.0	5.0	89.1	O K
2880 min Summer	32.354	0.354	0.0	5.0	5.0	66.3	O K
4320 min Summer	32.206	0.206	0.0	4.9	4.9	38.5	O K
5760 min Summer	32.137	0.137	0.0	4.5	4.5	25.7	O K
7200 min Summer	32.113	0.113	0.0	4.0	4.0	21.1	O K
8640 min Summer	32.099	0.099	0.0	3.5	3.5	18.6	O K
10080 min Summer	32.090	0.090	0.0	3.2	3.2	16.8	O K
15 min Winter	32.480	0.480	0.0	5.0	5.0	89.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	118.613	0.0	83.9	25
30 min Summer	79.413	0.0	112.6	39
60 min Summer	50.812	0.0	144.8	68
120 min Summer	31.468	0.0	179.4	126
180 min Summer	23.466	0.0	200.7	182
240 min Summer	18.940	0.0	216.0	240
360 min Summer	13.882	0.0	237.5	306
480 min Summer	11.143	0.0	254.2	370
600 min Summer	9.389	0.0	267.7	436
720 min Summer	8.158	0.0	279.2	504
960 min Summer	6.531	0.0	298.0	644
1440 min Summer	4.764	0.0	326.0	924
2160 min Summer	3.468	0.0	356.5	1284
2880 min Summer	2.766	0.0	379.0	1644
4320 min Summer	2.007	0.0	412.2	2300
5760 min Summer	1.596	0.0	437.7	2992
7200 min Summer	1.336	0.0	457.8	3680
8640 min Summer	1.154	0.0	474.7	4408
10080 min Summer	1.020	0.0	489.0	5136
15 min Winter	118.613	0.0	94.1	25

©1982-2020 Innovyze

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	32.638	0.638	0.0	5.0	5.0	119.4	O K
60 min Winter	32.795	0.795	0.0	5.0	5.0	148.7	O K
120 min Winter	32.929	0.929	0.0	5.0	5.0	173.9	O K
180 min Winter	32.982	0.982	0.0	5.0	5.0	183.8	O K
240 min Winter	33.000	1.000	0.0	5.0	5.0	187.1	O K
360 min Winter	32.986	0.986	0.0	5.0	5.0	184.5	O K
480 min Winter	32.960	0.960	0.0	5.0	5.0	179.6	O K
600 min Winter	32.931	0.931	0.0	5.0	5.0	174.3	O K
720 min Winter	32.899	0.899	0.0	5.0	5.0	168.2	O K
960 min Winter	32.828	0.828	0.0	5.0	5.0	154.9	O K
1440 min Winter	32.675	0.675	0.0	5.0	5.0	126.3	O K
2160 min Winter	32.422	0.422	0.0	5.0	5.0	79.1	O K
2880 min Winter	32.261	0.261	0.0	5.0	5.0	48.8	O K
4320 min Winter	32.125	0.125	0.0	4.4	4.4	23.3	O K
5760 min Winter	32.100	0.100	0.0	3.6	3.6	18.6	O K
7200 min Winter	32.086	0.086	0.0	3.0	3.0	16.1	O K
8640 min Winter	32.078	0.078	0.0	2.6	2.6	14.5	O K
10080 min Winter	32.072	0.072	0.0	2.3	2.3	13.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	79.413	0.0	126.1	39
60 min Winter	50.812	0.0	162.2	68
120 min Winter	31.468	0.0	201.0	124
180 min Winter	23.466	0.0	224.8	180
240 min Winter	18.940	0.0	242.0	236
360 min Winter	13.882	0.0	266.1	340
480 min Winter	11.143	0.0	284.8	386
600 min Winter	9.389	0.0	299.9	464
720 min Winter	8.158	0.0	312.7	542
960 min Winter	6.531	0.0	333.8	696
1440 min Winter	4.764	0.0	365.2	1000
2160 min Winter	3.468	0.0	399.3	1352
2880 min Winter	2.766	0.0	424.5	1676
4320 min Winter	2.007	0.0	461.8	2252
5760 min Winter	1.596	0.0	490.3	2944
7200 min Winter	1.336	0.0	512.8	3672
8640 min Winter	1.154	0.0	531.7	4400
10080 min Winter	1.020	0.0	547.8	5136

©1982-2020 Innovyze

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)	18.000	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.381

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.127	4	8	0.127	8	12	0.127

©1982-2020 Innovyze

Model Details

Storage is Online Cover Level (m) 34.000

Cellular Storage Structure

Invert Level (m) 32.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	197.0	0.0	1.001	0.0	0.0
1.000	197.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	32.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	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	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

©1982-2020 Innovyze

Appendix J Drainage Strategy Drawing & SW Calculations

PRELIMINARY SUBJECT TO CONFIRMATION OF LANDSCAPE ARCHITECTS PROPOSED SITE LEVELS AND ALL FOUL WATER POP UP AND RAINWATER DOWNPIPE LOCATIONS AND FLOW RATES

PRELIMINARY SUBJECT TO CONFIRMATION OF UNITED UTILITIES AND MANCHESTER CITY COUNCIL ACCEPTANCE OF DISCHARGE CONNECTION LOCATIONS AND FLOW RATES

ALL PROPOSED DRAINAGE IS CURRENTLY PRELIMINARY SUBJECT TO DETAILED DRAINAGE DESIGN BEING COMPLETED.

IMPORTANT NOTES

1. SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN. DISTANCES SHOULD NOT BE SCALED FROM THIS DRAWING.
2. ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION AND UNITED UTILITIES DETAILS & GUIDELINES.
3. THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150mm
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION GIVEN WITH REGARDS TO EXISTING SERVICES AND DRAINAGE CONNECTIONS ETC. PRIOR TO COMMENCING THE WORKS. THE RATES SHALL INCLUDE FOR HAND DIG AROUND SERVICES WHERE NECESSARY. THE CONTRACTOR SHALL ADHERE TO THE CDM REGULATIONS AT ALL TIMES
5. THE OUTSIDES OF ALL SEWERS SHALL BE A MINIMUM OF 1.0m FROM KERB LINES AND THE OUTSIDE OF MANHOLES SHALL BE A MINIMUM OF 0.5m FROM KERB LINES
6. EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES
7. ONLY TRAINED PERSONNEL SHALL BE PERMITTED TO ENTER CONFINED SPACES
8. ALL MATERIALS TO BEAR THE RELEVANT B.S. KITEMARK AND COMPLY FULLY WITH THE SPECIFICATIONS. ALL CONCRETE & CONCRETE PRODUCTS MUST USE SULPHATE RESISTANT CEMENT UNLESS THE SITE INVESTIGATION REPORT PROVES THAT SULPHATE ATTACK FROM SOILS AND GROUNDWATER WILL NOT OCCUR TO WITHSTAND A CLASS
9. ALL OPENING NOTICES ETC. AS REQUIRED UNDER HIGHWAYS ACTS ETC. ARE TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORKS. ALL WORKS ARE TO BE INSPECTED BY L.A., NHBC OR THE NETWORK OPERATOR AS APPLICABLE.
10. WHERE "ULTRA RIB" UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND LAID IN ACCORDANCE WITH THE SPECIFICATION AND GUIDANCE ISSUED BY THE HIGH PERFORMANCE PIPE ASSOCIATION.
11. A CLASS S BED AND SURROUND MUST BE USED FOR SUCH PIPES. TRENCH BACKFILL IN HIGHWAYS TO WITHIN 1M OF HIGHWAY SHALL AS DIRECTED BY THE HIGHWAY AUTHORITY BE A SUITABLE GRANULAR MATERIAL ALL IN ACCORDANCE WITH SEWERS FOR ADOPTION CL. 4.3.4.
12. SLAB LEVELS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE ENGINEER FOR GUIDANCE
13. DOMESTIC DRAINAGE SHALL BE TO BUILDING REGULATIONS APPROVED DOCUMENT H. 110mm U.P.V.C. PIPES LAID TO THE FOLLOWING MINIMUM FALLS UNLESS OTHERWISE SHOWN.

	FOUL	S.W.
HEAD RUN	1 IN 40	1 IN 60
ELSEWHERE	1 IN 80	1 IN 100

14. ALL GULLY CONNECTIONS TO BE 150mm VITRIFIED CLAY UNLESS NOTED OTHERWISE
15. ALL MANHOLE COVERS TO BE RECESSED TO ACCEPT FINISH AS DETAILED BY LANDSCAPE ARCHITECT
16. SLOW REST BENDS TO BE USED IN ALL LOCATIONS MADE UP FROM 2No. 45 DEG BENDS (600mm TO INVERT FROM FFL)
17. MANHOLE POSITIONS AND ACCESS COVERS TO BE ACCURATELY SET-OUT BY LANDSCAPE ARCHITECT TO SUIT EXTERNAL FINISHES
18. ALL DRAINS CAST THROUGH FOUNDATIONS TO HAVE ROCKER PIPES ON BOTH SIDES OF FOUNDATION
19. ALL POP UP POSITIONS TO BE CONFIRMED SET OUT DIMENSIONS TO BE AGREED & PROVIDED BY OTHERS
20. ALL DISCHARGE RATES TO BE CONFIRMED BY M&E DESIGNER
21. ALL SURFACE WATER COLLECTION FEATURES TO BE CONFIRMED BY THE LANDSCAPE ARCHITECT
22. STORAGE HAS BEEN PROVIDED IN A CELLULAR STORAGE TANK AND UP-SIZED MANHOLES AND PIPES.
23. EXISTING SEWER DEPTHS HAVE BEEN APPROXIMATED FROM LIMITED INFORMATION, NEW CONNECTIONS TO BE CONFIRMED PRIOR TO CONSTRUCTION OF ANY DRAINAGE WORKS.
24. LANDSCAPE ARCHITECT TO CONFIRM GULLY AND DRAINAGE CHANNEL LOCATIONS TO LANDSCAPED AREAS.
25. FOUL NETWORK TO BE CONFIRMED FOLLOWING CONFIRMATION OF BRANCH CONNECTION POINTS FROM BUILDING M&E DESIGNER
26. CCTV SURVEY OF EXISTING SITE DRAINAGE REQUIRED PRIOR TO THE COMMENCEMENT OF ANY WORKS STARTING ON SITE

LEGEND

- PROPOSED SURFACE WATER MANHOLE
- PROPOSED FOUL WATER MANHOLE
- PROPOSED COMBINED WATER MANHOLE
- PROPOSED SURFACE WATER PPIC
- PROPOSED FOUL WATER PPIC
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED COMBINED WATER DRAINAGE
- AREAS OF NON-INFILTRATION (TANKED) PERMEABLE PAVING
- RE — PROPOSED PERFORATED UNDERDRAIN FOR NON-INFILTRATION PERMEABLE PAVING WITH RODDING EYE
- ACO — PROPOSED ACO DRAIN
- G — PROPOSED GULLY
- EXISTING UNITED UTILITIES COMBINED WATER SEWER
- EXISTING UNITED UTILITIES COMBINED WATER SEWERS TO BE ABANDONED
- EXISTING UNITED UTILITIES COMBINED WATER SEWERS ALREADY ABANDONED
- REQUIRED EASEMENT FOR EXISTING GAS MAINS

REV	DATE	DESCRIPTION	BY	CHK	APP
P03	05.06.2020	RIBA STAGE 3 ISSUE (DEVELOPED DESIGN)	JRS	DJS	DJS
P02	30.04.2020	RIBA STAGE 2 (CONCEPT DESIGN) - UPDATED TO SUIT UNITED UTILITIES REQUIREMENTS	JRS	DJS	DJS
P01	12.12.2019	RIBA STAGE 2 (CONCEPT DESIGN)	JRS	DJS	DJS

DRAWING STATUS:

PRELIMINARY

CLIENT:

DOWNING

ARCHITECT:

SIMPSON HAUGH & PARTNERS

PROJECT:

FIRST STREET SOUTH
MANCHESTER

TITLE:

BELOW GROUND DRAINAGE
DRAINAGE STRATEGY

STATUS:	PROJECT No.	PROJECT	ORIGINATOR	VOLUME	LEVEL	TYPE	ROLE	DRAWING No.	REV
S2	219-215	FSS	AJP	XX	00	DR	C	0001	P03

SCALE @ A0	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
1:200	JRS	JRS	DJS	DJS	NOV 2019

alan johnston partnership LLP
CONSULTING STRUCTURAL & CIVIL ENGINEERS
1 Dale Street, Liverpool L2 2ET
Tel: 0151 227 1462
Fax: 0151 225 1187
E-Mail: Mail@ajpstructeng.com

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Blocks A&B

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.360	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 Blocks A&B

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.256	4-8	0.120

Total Area Contributing (ha) = 0.376

Total Pipe Volume (m³) = 8.875

Network Design Table for Blocks A&B

« - Indicates pipe capacity < flow

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	30.797	0.310	99.3	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	30.936	0.309	100.1	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	2.551	0.130	19.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	10.323	0.100	103.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	10.323	0.099	104.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	8.388	0.081	104.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	11.203	0.110	102.0	0.029	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	4.722	0.270	17.5	0.000	0.00	0.0	0.600	o	150	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	5.51	33.250	0.000	0.0	0.0	0.0	1.01	17.8	0.0
2.000	50.00	5.51	33.650	0.000	0.0	0.0	0.0	1.00	17.7	0.0
1.001	50.00	5.53	31.940	0.000	0.0	0.0	0.0	2.29	40.4	0.0
1.002	50.00	5.71	31.810	0.000	0.0	0.0	0.0	0.99	17.5	0.0
1.003	50.00	5.88	31.710	0.000	0.0	0.0	0.0	0.99	17.4	0.0
1.004	50.00	6.02	31.610	0.000	0.0	0.0	0.0	0.99	17.4	0.0
1.005	50.00	6.21	31.530	0.029	0.0	0.0	0.0	0.99	17.6	3.9
1.006	50.00	6.24	31.420	0.029	0.0	0.0	0.0	2.42	42.8	3.9

©1982-2020 Innovyze

Network Design Table for Blocks A&B

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
3.000	25.078	0.250	100.3	0.013	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	14.862	0.150	99.4	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	4.464	0.100	44.6	0.044	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	9.329	0.091	102.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.000	42.488	0.425	100.0	0.013	5.00	0.0	0.600	o	150	Pipe/Conduit	
5.001	12.838	0.125	102.7	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.002	9.691	0.100	97.0	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.003	11.503	0.120	95.9	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.003	23.927	0.161	149.0	0.041	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	4.443	0.030	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.000	20.092	0.200	100.5	0.016	5.00	0.0	0.600	o	150	Pipe/Conduit	
6.001	8.235	0.082	100.4	0.016	0.00	0.0	0.600	o	150	Pipe/Conduit	
7.000	5.803	0.107	54.2	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit	
8.000	2.476	0.107	23.1	0.038	5.00	0.0	0.600	o	150	Pipe/Conduit	
7.001	15.855	0.295	53.7	0.000	0.00	0.0	0.600	o	150	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)
3.000	50.00	5.42	32.950	0.013	0.0	0.0	0.0	1.00	17.7	1.8
3.001	50.00	5.66	32.700	0.018	0.0	0.0	0.0	1.01	17.8	2.4
4.000	50.00	5.05	33.650	0.044	0.0	0.0	0.0	1.51	26.7	6.0
3.002	50.00	5.82	32.550	0.062	0.0	0.0	0.0	0.99	17.5	8.4
5.000	50.00	5.70	32.080	0.013	0.0	0.0	0.0	1.00	17.8	1.8
5.001	50.00	5.92	31.655	0.026	0.0	0.0	0.0	0.99	17.5	3.5
5.002	50.00	6.08	31.530	0.037	0.0	0.0	0.0	1.02	18.0	5.0
5.003	50.00	6.27	31.430	0.042	0.0	0.0	0.0	1.03	18.1	5.7
3.003	50.00	6.64	31.235	0.145	0.0	0.0	0.0	1.07	42.5	19.6
1.007	50.00	6.71	31.075	0.174	0.0	0.0	0.0	1.07	42.4	23.6
6.000	50.00	5.33	33.530	0.016	0.0	0.0	0.0	1.00	17.7	2.2
6.001	50.00	5.47	33.330	0.032	0.0	0.0	0.0	1.00	17.7	4.3
7.000	50.00	5.07	33.650	0.007	0.0	0.0	0.0	1.37	24.2	0.9
8.000	50.00	5.02	33.650	0.038	0.0	0.0	0.0	2.10	37.2	5.1
7.001	50.00	5.26	33.543	0.045	0.0	0.0	0.0	1.38	24.3	6.1

©1982-2020 Innovyze

Network Design Table for Blocks A&B

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
6.002	6.679	0.123	54.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
9.000	9.280	0.424	21.9	0.016	5.00	0.0	0.600	o	150	Pipe/Conduit	
6.003	16.347	0.165	99.2	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	
10.000	9.721	0.440	22.1	0.050	5.00	0.0	0.600	o	150	Pipe/Conduit	
6.004	8.017	0.053	150.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.005	12.253	0.082	150.0	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	8.706	0.040	215.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.009	10.661	0.050	213.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
6.002	50.00	5.55	33.248	0.077	0.0	0.0	0.0	1.37	24.2	10.4
9.000	50.00	5.07	33.550	0.016	0.0	0.0	0.0	2.16	38.2	2.2
6.003	50.00	5.82	33.125	0.110	0.0	0.0	0.0	1.01	17.8	14.9
10.000	50.00	5.08	33.400	0.050	0.0	0.0	0.0	2.15	38.0	6.8
6.004	50.00	5.95	32.885	0.160	0.0	0.0	0.0	1.07	42.4	21.7
6.005	50.00	6.14	32.832	0.194	0.0	0.0	0.0	1.07	42.4	26.3
1.008	50.00	6.84	30.970	0.376	0.0	0.0	0.0	1.07	75.5	50.9
1.009	50.00	7.04	30.930	0.376	0.0	0.0	0.0	0.89	35.4«	50.9

©1982-2020 Innovyze

Manhole Schedules for Blocks A&B

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SW01	34.000	0.750	Open Manhole	1200	1.000	33.250	150				
SW02	34.400	0.750	Open Manhole	1200	2.000	33.650	150				
SW03	34.100	2.160	Open Manhole	1200	1.001	31.940	150	1.000	32.940	150	1000
								2.000	33.341	150	1401
SW04	34.100	2.290	Open Manhole	1200	1.002	31.810	150	1.001	31.810	150	
A&B TANK	34.100	2.390	Open Manhole	1200	1.003	31.710	150	1.002	31.710	150	
SW05	34.400	2.790	Open Manhole	1200	1.004	31.610	150	1.003	31.610	150	
SW06	34.400	2.870	Open Manhole	1200	1.005	31.530	150	1.004	31.530	150	
SW07	34.400	2.980	Open Manhole	1200	1.006	31.420	150	1.005	31.420	150	
SW08	34.000	1.050	Open Manhole	600	3.000	32.950	150				
SW09	34.400	1.700	Open Manhole	1200	3.001	32.700	150	3.000	32.700	150	
SW10	34.400	0.750	Open Manhole	600	4.000	33.650	150				
SW11	34.400	1.850	Open Manhole	1200	3.002	32.550	150	3.001	32.550	150	
								4.000	33.550	150	1000
SW12	33.280	1.200	Open Manhole	600	5.000	32.080	150				
SW13	33.300	1.645	Open Manhole	600	5.001	31.655	150	5.000	31.655	150	
SW14	33.500	1.970	Open Manhole	1200	5.002	31.530	150	5.001	31.530	150	
SW15	34.400	2.970	Open Manhole	1200	5.003	31.430	150	5.002	31.430	150	
SW16	34.400	3.165	Open Manhole	1200	3.003	31.235	225	3.002	32.459	150	1149
								5.003	31.310	150	
SW17	34.400	3.325	Open Manhole	1200	1.007	31.075	225	1.006	31.150	150	
								3.003	31.075	225	
SW18	34.580	1.050	Open Manhole	600	6.000	33.530	150				
SW19	34.480	1.150	Open Manhole	600	6.001	33.330	150	6.000	33.330	150	
SW20	34.400	0.750	Open Manhole	600	7.000	33.650	150				
SW21	34.400	0.750	Open Manhole	600	8.000	33.650	150				
JUNCTION01	34.400	0.857	Junction		7.001	33.543	150	7.000	33.543	150	
								8.000	33.543	150	
JUNCTION02	34.400	1.152	Junction		6.002	33.248	150	6.001	33.248	150	
								7.001	33.248	150	
SW22	34.600	1.050	Open Manhole	600	9.000	33.550	150				
SW23	34.600	1.475	Open Manhole	1200	6.003	33.125	150	6.002	33.125	150	
								9.000	33.126	150	1
SW24	34.450	1.050	Open Manhole	600	10.000	33.400	150				
SW25	34.600	1.715	Open Manhole	1200	6.004	32.885	225	6.003	32.960	150	
								10.000	32.960	150	
SW26	34.600	1.768	Open Manhole	1200	6.005	32.832	225	6.004	32.832	225	
SW27	34.400	3.430	Open Manhole	1200	1.008	30.970	300	1.007	31.045	225	
								6.005	32.750	225	1705
SW28	33.980	3.051	Open Manhole	1500	1.009	30.930	225	1.008	30.929	300	
CW01	33.900	3.020	Open Manhole	1500		OUTFALL		1.009	30.880	225	

No coordinates have been specified, layout information cannot be produced.

©1982-2020 Innovyze

PIPELINE SCHEDULES for Blocks A&B

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	SW01	34.000	33.250	0.600	Open Manhole	1200
2.000	o	150	SW02	34.400	33.650	0.600	Open Manhole	1200
1.001	o	150	SW03	34.100	31.940	2.010	Open Manhole	1200
1.002	o	150	SW04	34.100	31.810	2.140	Open Manhole	1200
1.003	o	150	A&B TANK	34.100	31.710	2.240	Open Manhole	1200
1.004	o	150	SW05	34.400	31.610	2.640	Open Manhole	1200
1.005	o	150	SW06	34.400	31.530	2.720	Open Manhole	1200
1.006	o	150	SW07	34.400	31.420	2.830	Open Manhole	1200
3.000	o	150	SW08	34.000	32.950	0.900	Open Manhole	600
3.001	o	150	SW09	34.400	32.700	1.550	Open Manhole	1200
4.000	o	150	SW10	34.400	33.650	0.600	Open Manhole	600
3.002	o	150	SW11	34.400	32.550	1.700	Open Manhole	1200
5.000	o	150	SW12	33.280	32.080	1.050	Open Manhole	600
5.001	o	150	SW13	33.300	31.655	1.495	Open Manhole	600
5.002	o	150	SW14	33.500	31.530	1.820	Open Manhole	1200
5.003	o	150	SW15	34.400	31.430	2.820	Open Manhole	1200
3.003	o	225	SW16	34.400	31.235	2.940	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	30.797	99.3	SW03	34.100	32.940	1.010	Open Manhole	1200
2.000	30.936	100.1	SW03	34.100	33.341	0.609	Open Manhole	1200
1.001	2.551	19.6	SW04	34.100	31.810	2.140	Open Manhole	1200
1.002	10.323	103.0	A&B TANK	34.100	31.710	2.240	Open Manhole	1200
1.003	10.323	104.0	SW05	34.400	31.610	2.640	Open Manhole	1200
1.004	8.388	104.0	SW06	34.400	31.530	2.720	Open Manhole	1200
1.005	11.203	102.0	SW07	34.400	31.420	2.830	Open Manhole	1200
1.006	4.722	17.5	SW17	34.400	31.150	3.100	Open Manhole	1200
3.000	25.078	100.3	SW09	34.400	32.700	1.550	Open Manhole	1200
3.001	14.862	99.4	SW11	34.400	32.550	1.700	Open Manhole	1200
4.000	4.464	44.6	SW11	34.400	33.550	0.700	Open Manhole	1200
3.002	9.329	102.5	SW16	34.400	32.459	1.791	Open Manhole	1200
5.000	42.488	100.0	SW13	33.300	31.655	1.495	Open Manhole	600
5.001	12.838	102.7	SW14	33.500	31.530	1.820	Open Manhole	1200
5.002	9.691	97.0	SW15	34.400	31.430	2.820	Open Manhole	1200
5.003	11.503	95.9	SW16	34.400	31.310	2.940	Open Manhole	1200
3.003	23.927	149.0	SW17	34.400	31.075	3.100	Open Manhole	1200

©1982-2020 Innovyze

PIPELINE SCHEDULES for Blocks A&B

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.007	o	225	SW17	34.400	31.075	3.100	Open Manhole	1200
6.000	o	150	SW18	34.580	33.530	0.900	Open Manhole	600
6.001	o	150	SW19	34.480	33.330	1.000	Open Manhole	600
7.000	o	150	SW20	34.400	33.650	0.600	Open Manhole	600
8.000	o	150	SW21	34.400	33.650	0.600	Open Manhole	600
7.001	o	150	JUNCTION01	34.400	33.543	0.707	Junction	
6.002	o	150	JUNCTION02	34.400	33.248	1.002	Junction	
9.000	o	150	SW22	34.600	33.550	0.900	Open Manhole	600
6.003	o	150	SW23	34.600	33.125	1.325	Open Manhole	1200
10.000	o	150	SW24	34.450	33.400	0.900	Open Manhole	600
6.004	o	225	SW25	34.600	32.885	1.490	Open Manhole	1200
6.005	o	225	SW26	34.600	32.832	1.543	Open Manhole	1200
1.008	o	300	SW27	34.400	30.970	3.130	Open Manhole	1200
1.009	o	225	SW28	33.980	30.930	2.825	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.007	4.443	150.0	SW27	34.400	31.045	3.130	Open Manhole	1200
6.000	20.092	100.5	SW19	34.480	33.330	1.000	Open Manhole	600
6.001	8.235	100.4	JUNCTION02	34.400	33.248	1.002	Junction	
7.000	5.803	54.2	JUNCTION01	34.400	33.543	0.707	Junction	
8.000	2.476	23.1	JUNCTION01	34.400	33.543	0.707	Junction	
7.001	15.855	53.7	JUNCTION02	34.400	33.248	1.002	Junction	
6.002	6.679	54.3	SW23	34.600	33.125	1.325	Open Manhole	1200
9.000	9.280	21.9	SW23	34.600	33.126	1.324	Open Manhole	1200
6.003	16.347	99.2	SW25	34.600	32.960	1.490	Open Manhole	1200
10.000	9.721	22.1	SW25	34.600	32.960	1.490	Open Manhole	1200
6.004	8.017	150.0	SW26	34.600	32.832	1.543	Open Manhole	1200
6.005	12.253	150.0	SW27	34.400	32.750	1.425	Open Manhole	1200
1.008	8.706	215.0	SW28	33.980	30.929	2.751	Open Manhole	1500
1.009	10.661	213.2	CW01	33.900	30.880	2.795	Open Manhole	1500

©1982-2020 Innovyze

Free Flowing Outfall Details for Blocks A&B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	CW01	33.900	30.880	29.000	1500	0

Simulation Criteria for Blocks A&B

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	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	15
Number of Online Controls	1	Number of Storage Structures	3	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

©1982-2020 Innovyze

Online Controls for Blocks A&B

Hydro-Brake® Optimum Manhole: SW28, DS/PN: 1.009, Volume (m³): 5.9

Unit Reference	MD-SHE-0116-8400-2300-8400
Design Head (m)	2.300
Design Flow (l/s)	8.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	116
Invert Level (m)	30.930
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.300	8.4	Kick-Flo®	1.034	5.8
Flush-Flo™	0.507	7.3	Mean Flow over Head Range	-	6.8

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)	Depth (m)	Flow (l/s)
0.100	4.1	0.800	6.9	2.000	7.9	4.000	10.9	7.000	14.2
0.200	6.3	1.000	6.0	2.200	8.2	4.500	11.5	7.500	14.7
0.300	6.9	1.200	6.2	2.400	8.6	5.000	12.1	8.000	15.2
0.400	7.2	1.400	6.7	2.600	8.9	5.500	12.7	8.500	15.6
0.500	7.3	1.600	7.1	3.000	9.5	6.000	13.2	9.000	16.1
0.600	7.2	1.800	7.5	3.500	10.2	6.500	13.7	9.500	16.5

©1982-2020 Innovyze

Storage Structures for Blocks A&B

Porous Car Park Manhole: SW01, DS/PN: 1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	31.7
Membrane Percolation (mm/hr)	1000	Length (m)	31.7
Max Percolation (l/s)	279.1	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	33.400	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: SW02, DS/PN: 2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	25.4
Membrane Percolation (mm/hr)	1000	Length (m)	25.4
Max Percolation (l/s)	179.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	33.800	Cap Volume Depth (m)	0.400

Tank or Pond Manhole: A&B TANK, DS/PN: 1.003

Invert Level (m) 31.710

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	102.0	1.200	102.0	1.201	0.0

Time Area Diagram for Green Roof at Pipe Number 1.000 (Blocks A&B)

Area (m³) 1005 Evaporation (mm/day) 0
Depression Storage (mm) 0 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.018263	32	36	0.003687	64	68	0.000744	96	100	0.000150
4	8	0.014952	36	40	0.003019	68	72	0.000609	100	104	0.000123
8	12	0.012242	40	44	0.002472	72	76	0.000499	104	108	0.000101
12	16	0.010023	44	48	0.002024	76	80	0.000409	108	112	0.000082
16	20	0.008206	48	52	0.001657	80	84	0.000334	112	116	0.000068
20	24	0.006719	52	56	0.001356	84	88	0.000274	116	120	0.000055
24	28	0.005501	56	60	0.001111	88	92	0.000224			
28	32	0.004504	60	64	0.000909	92	96	0.000184			

Time Area Diagram for Green Roof at Pipe Number 2.000 (Blocks A&B)

Area (m³) 645 Evaporation (mm/day) 0
Depression Storage (mm) 0 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.011721	28	32	0.002890	56	60	0.000713	84	88	0.000176
4	8	0.009596	32	36	0.002366	60	64	0.000584	88	92	0.000144
8	12	0.007857	36	40	0.001937	64	68	0.000478	92	96	0.000118
12	16	0.006433	40	44	0.001586	68	72	0.000391	96	100	0.000096
16	20	0.005267	44	48	0.001299	72	76	0.000320	100	104	0.000079
20	24	0.004312	48	52	0.001063	76	80	0.000262	104	108	0.000065
24	28	0.003530	52	56	0.000871	80	84	0.000215	108	112	0.000053

©1982-2020 Innovyze

Time Area Diagram for Green Roof at Pipe Number 2.000 (Blocks A&B)

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
112	116	0.000043	116	120	0.000035						

Time Area Diagram for Green Roof at Pipe Number 1.005 (Blocks A&B)

Area (m³) 39 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000709	32	36	0.000143	64	68	0.000029	96	100	0.000006
4	8	0.000580	36	40	0.000117	68	72	0.000024	100	104	0.000005
8	12	0.000475	40	44	0.000096	72	76	0.000019	104	108	0.000004
12	16	0.000389	44	48	0.000079	76	80	0.000016	108	112	0.000003
16	20	0.000318	48	52	0.000064	80	84	0.000013	112	116	0.000003
20	24	0.000261	52	56	0.000053	84	88	0.000011	116	120	0.000002
24	28	0.000213	56	60	0.000043	88	92	0.000009			
28	32	0.000175	60	64	0.000035	92	96	0.000007			

Time Area Diagram for Green Roof at Pipe Number 1.006 (Blocks A&B)

Area (m³) 260 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004725	32	36	0.000954	64	68	0.000193	96	100	0.000039
4	8	0.003868	36	40	0.000781	68	72	0.000158	100	104	0.000032
8	12	0.003167	40	44	0.000639	72	76	0.000129	104	108	0.000026
12	16	0.002593	44	48	0.000524	76	80	0.000106	108	112	0.000021
16	20	0.002123	48	52	0.000429	80	84	0.000087	112	116	0.000017
20	24	0.001738	52	56	0.000351	84	88	0.000071	116	120	0.000014
24	28	0.001423	56	60	0.000287	88	92	0.000058			
28	32	0.001165	60	64	0.000235	92	96	0.000047			

Time Area Diagram for Green Roof at Pipe Number 3.000 (Blocks A&B)

Area (m³) 204 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003707	32	36	0.000748	64	68	0.000151	96	100	0.000031
4	8	0.003035	36	40	0.000613	68	72	0.000124	100	104	0.000025
8	12	0.002485	40	44	0.000502	72	76	0.000101	104	108	0.000020
12	16	0.002034	44	48	0.000411	76	80	0.000083	108	112	0.000017
16	20	0.001666	48	52	0.000336	80	84	0.000068	112	116	0.000014
20	24	0.001364	52	56	0.000275	84	88	0.000056	116	120	0.000011
24	28	0.001117	56	60	0.000225	88	92	0.000046			
28	32	0.000914	60	64	0.000185	92	96	0.000037			

©1982-2020 Innovyze

Time Area Diagram for Green Roof at Pipe Number 3.001 (Blocks A&B)

Area (m³) 49 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000890	32	36	0.000180	64	68	0.000036	96	100	0.000007
4	8	0.000729	36	40	0.000147	68	72	0.000030	100	104	0.000006
8	12	0.000597	40	44	0.000121	72	76	0.000024	104	108	0.000005
12	16	0.000489	44	48	0.000099	76	80	0.000020	108	112	0.000004
16	20	0.000400	48	52	0.000081	80	84	0.000016	112	116	0.000003
20	24	0.000328	52	56	0.000066	84	88	0.000013	116	120	0.000003
24	28	0.000268	56	60	0.000054	88	92	0.000011			
28	32	0.000220	60	64	0.000044	92	96	0.000009			

Time Area Diagram for Green Roof at Pipe Number 4.000 (Blocks A&B)

Area (m³) 145 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002635	32	36	0.000532	64	68	0.000107	96	100	0.000022
4	8	0.002157	36	40	0.000436	68	72	0.000088	100	104	0.000018
8	12	0.001766	40	44	0.000357	72	76	0.000072	104	108	0.000015
12	16	0.001446	44	48	0.000292	76	80	0.000059	108	112	0.000012
16	20	0.001184	48	52	0.000239	80	84	0.000048	112	116	0.000010
20	24	0.000969	52	56	0.000196	84	88	0.000040	116	120	0.000008
24	28	0.000794	56	60	0.000160	88	92	0.000032			
28	32	0.000650	60	64	0.000131	92	96	0.000026			

Time Area Diagram for Green Roof at Pipe Number 5.003 (Blocks A&B)

Area (m³) 232 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004216	32	36	0.000851	64	68	0.000172	96	100	0.000035
4	8	0.003452	36	40	0.000697	68	72	0.000141	100	104	0.000028
8	12	0.002826	40	44	0.000571	72	76	0.000115	104	108	0.000023
12	16	0.002314	44	48	0.000467	76	80	0.000094	108	112	0.000019
16	20	0.001894	48	52	0.000382	80	84	0.000077	112	116	0.000016
20	24	0.001551	52	56	0.000313	84	88	0.000063	116	120	0.000013
24	28	0.001270	56	60	0.000256	88	92	0.000052			
28	32	0.001040	60	64	0.000210	92	96	0.000042			

Time Area Diagram for Green Roof at Pipe Number 6.000 (Blocks A&B)

Area (m³) 116 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.002108	12	16	0.001157	24	28	0.000635	36	40	0.000348
4	8	0.001726	16	20	0.000947	28	32	0.000520	40	44	0.000285
8	12	0.001413	20	24	0.000775	32	36	0.000426	44	48	0.000234

©1982-2020 Innovyze

Time Area Diagram for Green Roof at Pipe Number 6.000 (Blocks A&B)

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
48	52	0.000191	68	72	0.000070	88	92	0.000026	108	112	0.000010
52	56	0.000157	72	76	0.000058	92	96	0.000021	112	116	0.000008
56	60	0.000128	76	80	0.000047	96	100	0.000017	116	120	0.000006
60	64	0.000105	80	84	0.000039	100	104	0.000014			
64	68	0.000086	84	88	0.000032	104	108	0.000012			

Time Area Diagram for Green Roof at Pipe Number 7.000 (Blocks A&B)

Area (m³) 200 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.003634	32	36	0.000734	64	68	0.000148	96	100	0.000030
4	8	0.002976	36	40	0.000601	68	72	0.000121	100	104	0.000024
8	12	0.002436	40	44	0.000492	72	76	0.000099	104	108	0.000020
12	16	0.001995	44	48	0.000403	76	80	0.000081	108	112	0.000016
16	20	0.001633	48	52	0.000330	80	84	0.000067	112	116	0.000013
20	24	0.001337	52	56	0.000270	84	88	0.000054	116	120	0.000011
24	28	0.001095	56	60	0.000221	88	92	0.000045			
28	32	0.000896	60	64	0.000181	92	96	0.000037			

Time Area Diagram for Green Roof at Pipe Number 8.000 (Blocks A&B)

Area (m³) 21 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000382	32	36	0.000077	64	68	0.000016	96	100	0.000003
4	8	0.000312	36	40	0.000063	68	72	0.000013	100	104	0.000003
8	12	0.000256	40	44	0.000052	72	76	0.000010	104	108	0.000002
12	16	0.000209	44	48	0.000042	76	80	0.000009	108	112	0.000002
16	20	0.000171	48	52	0.000035	80	84	0.000007	112	116	0.000001
20	24	0.000140	52	56	0.000028	84	88	0.000006	116	120	0.000001
24	28	0.000115	56	60	0.000023	88	92	0.000005			
28	32	0.000094	60	64	0.000019	92	96	0.000004			

Time Area Diagram for Green Roof at Pipe Number 6.003 (Blocks A&B)

Area (m³) 60 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.001090	32	36	0.000220	64	68	0.000044	96	100	0.000009
4	8	0.000893	36	40	0.000180	68	72	0.000036	100	104	0.000007
8	12	0.000731	40	44	0.000148	72	76	0.000030	104	108	0.000006
12	16	0.000598	44	48	0.000121	76	80	0.000024	108	112	0.000005
16	20	0.000490	48	52	0.000099	80	84	0.000020	112	116	0.000004
20	24	0.000401	52	56	0.000081	84	88	0.000016	116	120	0.000003
24	28	0.000328	56	60	0.000066	88	92	0.000013			
28	32	0.000269	60	64	0.000054	92	96	0.000011			

©1982-2020 Innovyze

Time Area Diagram for Green Roof at Pipe Number 10.000 (Blocks A&B)

Area (m³) 21 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000382	32	36	0.000077	64	68	0.000016	96	100	0.000003
4	8	0.000312	36	40	0.000063	68	72	0.000013	100	104	0.000003
8	12	0.000256	40	44	0.000052	72	76	0.000010	104	108	0.000002
12	16	0.000209	44	48	0.000042	76	80	0.000009	108	112	0.000002
16	20	0.000171	48	52	0.000035	80	84	0.000007	112	116	0.000001
20	24	0.000140	52	56	0.000028	84	88	0.000006	116	120	0.000001
24	28	0.000115	56	60	0.000023	88	92	0.000005			
28	32	0.000094	60	64	0.000019	92	96	0.000004			

Time Area Diagram for Green Roof at Pipe Number 6.005 (Blocks A&B)

Area (m³) 25 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000454	32	36	0.000092	64	68	0.000019	96	100	0.000004
4	8	0.000372	36	40	0.000075	68	72	0.000015	100	104	0.000003
8	12	0.000305	40	44	0.000061	72	76	0.000012	104	108	0.000003
12	16	0.000249	44	48	0.000050	76	80	0.000010	108	112	0.000002
16	20	0.000204	48	52	0.000041	80	84	0.000008	112	116	0.000002
20	24	0.000167	52	56	0.000034	84	88	0.000007	116	120	0.000001
24	28	0.000137	56	60	0.000028	88	92	0.000006			
28	32	0.000112	60	64	0.000023	92	96	0.000005			

Time Area Diagram for Green Roof at Pipe Number 1.008 (Blocks A&B)

Area (m³) 59 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.001072	32	36	0.000216	64	68	0.000044	96	100	0.000009
4	8	0.000878	36	40	0.000177	68	72	0.000036	100	104	0.000007
8	12	0.000719	40	44	0.000145	72	76	0.000029	104	108	0.000006
12	16	0.000588	44	48	0.000119	76	80	0.000024	108	112	0.000005
16	20	0.000482	48	52	0.000097	80	84	0.000020	112	116	0.000004
20	24	0.000394	52	56	0.000080	84	88	0.000016	116	120	0.000003
24	28	0.000323	56	60	0.000065	88	92	0.000013			
28	32	0.000264	60	64	0.000053	92	96	0.000011			

©1982-2020 Innovyze

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks A&B

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 15
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW01	60 Winter	2	+0%					33.301	-0.099
2.000	SW02	60 Winter	2	+0%					33.691	-0.109
1.001	SW03	60 Winter	2	+0%	30/120 Summer				31.999	-0.091
1.002	SW04	60 Winter	2	+0%	30/60 Summer				31.881	-0.079
1.003	A&B TANK	240 Winter	2	+0%	30/30 Summer				31.764	-0.095
1.004	SW05	240 Winter	2	+0%	30/15 Winter				31.751	-0.009
1.005	SW06	240 Winter	2	+0%	2/120 Winter				31.742	0.063
1.006	SW07	240 Winter	2	+0%	2/120 Winter				31.732	0.162
3.000	SW08	60 Winter	2	+0%	100/240 Winter				32.972	-0.128
3.001	SW09	60 Winter	2	+0%	100/30 Winter				32.726	-0.124
4.000	SW10	60 Winter	2	+0%					33.667	-0.133
3.002	SW11	60 Winter	2	+0%	100/30 Summer				32.584	-0.116
5.000	SW12	15 Winter	2	+0%	100/15 Summer				32.114	-0.116
5.001	SW13	240 Winter	2	+0%	30/15 Summer				31.737	-0.068
5.002	SW14	240 Winter	2	+0%	2/120 Winter				31.736	0.056
5.003	SW15	240 Winter	2	+0%	2/120 Winter				31.734	0.154
3.003	SW16	240 Winter	2	+0%	2/120 Winter				31.731	0.271
1.007	SW17	240 Winter	2	+0%	2/15 Summer				31.726	0.426
6.000	SW18	60 Winter	2	+0%					33.547	-0.133
6.001	SW19	15 Winter	2	+0%					33.367	-0.113
7.000	SW20	60 Winter	2	+0%					33.670	-0.130
8.000	SW21	60 Summer	2	+0%					33.653	-0.147
7.001	JUNCTION01	60 Winter	2	+0%					33.563	-0.130
6.002	JUNCTION02	15 Winter	2	+0%					33.279	-0.119
9.000	SW22	15 Winter	2	+0%					33.577	-0.123
6.003	SW23	15 Winter	2	+0%	100/15 Winter				33.179	-0.096
10.000	SW24	60 Summer	2	+0%					33.402	-0.148
6.004	SW25	15 Winter	2	+0%	100/240 Winter				32.941	-0.169
6.005	SW26	15 Winter	2	+0%	100/240 Winter				32.885	-0.172
1.008	SW27	240 Winter	2	+0%	2/15 Summer				31.722	0.452
1.009	SW28	240 Winter	2	+0%	2/15 Summer				31.718	0.563

©1982-2020 Innovyze

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks A&B

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.000	0.26		32	4.4	OK	
2.000	SW02	0.000	0.17		31	2.8	OK	
1.001	SW03	0.000	0.32			7.2	OK	
1.002	SW04	0.000	0.46			7.2	OK	
1.003	A&B TANK	0.000	0.26			4.1	OK	
1.004	SW05	0.000	0.27			4.0	OK	
1.005	SW06	0.000	0.25			3.9	SURCHARGED	
1.006	SW07	0.000	0.13			4.2	SURCHARGED	
3.000	SW08	0.000	0.05			0.9	OK	
3.001	SW09	0.000	0.07			1.2	OK	
4.000	SW10	0.000	0.03			0.6	OK	
3.002	SW11	0.000	0.11			1.8	OK	
5.000	SW12	0.000	0.11			2.0	OK	
5.001	SW13	0.000	0.05			0.9	OK	
5.002	SW14	0.000	0.08			1.2	SURCHARGED	
5.003	SW15	0.000	0.11			1.8	SURCHARGED	
3.003	SW16	0.000	0.11			4.2	SURCHARGED	
1.007	SW17	0.000	0.21			6.2	SURCHARGED	
6.000	SW18	0.000	0.03			0.5	OK	
6.001	SW19	0.000	0.14			2.1	OK	
7.000	SW20	0.000	0.04			0.9	OK	
8.000	SW21	0.000	0.00			0.1	OK	
7.001	JUNCTION01	0.000	0.04			1.0	OK*	
6.002	JUNCTION02	0.000	0.10			2.1	OK*	
9.000	SW22	0.000	0.07			2.5	OK	
6.003	SW23	0.000	0.28			4.6	OK	
10.000	SW24	0.000	0.00			0.1	OK	
6.004	SW25	0.000	0.14			4.6	OK	
6.005	SW26	0.000	0.13			4.6	OK	
1.008	SW27	0.000	0.14			8.0	SURCHARGED	
1.009	SW28	0.000	0.24			7.3	SURCHARGED	

©1982-2020 Innovyze

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks A&B

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 15
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW01	30 Winter	30	+0%					33.327	-0.073
2.000	SW02	30 Winter	30	+0%					33.710	-0.090
1.001	SW03	240 Winter	30	+0%	30/120 Summer				32.203	0.113
1.002	SW04	240 Winter	30	+0%	30/60 Summer				32.200	0.240
1.003	A&B TANK	240 Winter	30	+0%	30/30 Summer				32.190	0.330
1.004	SW05	240 Winter	30	+0%	30/15 Winter				32.181	0.420
1.005	SW06	240 Winter	30	+0%	2/120 Winter				32.173	0.493
1.006	SW07	240 Winter	30	+0%	2/120 Winter				32.164	0.594
3.000	SW08	30 Winter	30	+0%	100/240 Winter				32.983	-0.117
3.001	SW09	30 Winter	30	+0%	100/30 Winter				32.737	-0.113
4.000	SW10	30 Winter	30	+0%					33.676	-0.124
3.002	SW11	30 Winter	30	+0%	100/30 Summer				32.600	-0.101
5.000	SW12	60 Winter	30	+0%	100/15 Summer				32.230	0.000
5.001	SW13	60 Winter	30	+0%	30/15 Summer				32.223	0.418
5.002	SW14	60 Winter	30	+0%	2/120 Winter				32.217	0.537
5.003	SW15	60 Winter	30	+0%	2/120 Winter				32.210	0.630
3.003	SW16	120 Winter	30	+0%	2/120 Winter				32.195	0.735
1.007	SW17	120 Winter	30	+0%	2/15 Summer				32.178	0.878
6.000	SW18	30 Winter	30	+0%					33.554	-0.126
6.001	SW19	15 Summer	30	+0%					33.389	-0.091
7.000	SW20	30 Winter	30	+0%					33.681	-0.119
8.000	SW21	60 Winter	30	+0%					33.657	-0.143
7.001	JUNCTION01	30 Winter	30	+0%					33.572	-0.121
6.002	JUNCTION02	60 Winter	30	+0%					33.297	-0.101
9.000	SW22	15 Winter	30	+0%					33.587	-0.113
6.003	SW23	15 Winter	30	+0%	100/15 Winter				33.208	-0.067
10.000	SW24	60 Winter	30	+0%					33.404	-0.146
6.004	SW25	15 Winter	30	+0%	100/240 Winter				32.970	-0.140
6.005	SW26	15 Winter	30	+0%	100/240 Winter				32.911	-0.146
1.008	SW27	120 Winter	30	+0%	2/15 Summer				32.177	0.907
1.009	SW28	120 Winter	30	+0%	2/15 Summer				32.173	1.018

©1982-2020 Innovyze

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks A&B

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.000	0.52		28	8.9	OK	
2.000	SW02	0.000	0.34		28	5.8	OK	
1.001	SW03	0.000	0.39			8.7	SURCHARGED	
1.002	SW04	0.000	0.55			8.6	SURCHARGED	
1.003	A&B TANK	0.000	0.39			6.1	SURCHARGED	
1.004	SW05	0.000	0.41			6.2	SURCHARGED	
1.005	SW06	0.000	0.40			6.3	SURCHARGED	
1.006	SW07	0.000	0.20			6.4	SURCHARGED	
3.000	SW08	0.000	0.11			1.8	OK	
3.001	SW09	0.000	0.14			2.3	OK	
4.000	SW10	0.000	0.07			1.3	OK	
3.002	SW11	0.000	0.23			3.6	OK	
5.000	SW12	0.000	0.12			2.0	OK	
5.001	SW13	0.000	0.26			4.1	SURCHARGED	
5.002	SW14	0.000	0.36			5.8	SURCHARGED	
5.003	SW15	0.000	0.34			5.5	SURCHARGED	
3.003	SW16	0.000	0.25			9.6	SURCHARGED	
1.007	SW17	0.000	0.22			6.6	SURCHARGED	
6.000	SW18	0.000	0.06			1.0	OK	
6.001	SW19	0.000	0.33			5.1	OK	
7.000	SW20	0.000	0.09			1.8	OK	
8.000	SW21	0.000	0.01			0.2	OK	
7.001	JUNCTION01	0.000	0.08			2.0	OK*	
6.002	JUNCTION02	0.000	0.23			5.1	OK*	
9.000	SW22	0.000	0.14			4.7	OK	
6.003	SW23	0.000	0.59			9.7	OK	
10.000	SW24	0.000	0.01			0.2	OK	
6.004	SW25	0.000	0.30			9.7	OK	
6.005	SW26	0.000	0.27			9.8	OK	
1.008	SW27	0.000	0.17			9.9	SURCHARGED	
1.009	SW28	0.000	0.24			7.3	SURCHARGED	

©1982-2020 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks A&B

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 15
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW01	30 Winter	100	+40%					33.369	-0.031
2.000	SW02	30 Winter	100	+40%					33.737	-0.063
1.001	SW03	240 Winter	100	+40%	30/120 Summer				33.282	1.192
1.002	SW04	240 Winter	100	+40%	30/60 Summer				33.277	1.318
1.003	A&B TANK	240 Winter	100	+40%	30/30 Summer				33.265	1.405
1.004	SW05	240 Winter	100	+40%	30/15 Winter				33.252	1.492
1.005	SW06	240 Winter	100	+40%	2/120 Winter				33.241	1.561
1.006	SW07	240 Winter	100	+40%	2/120 Winter				33.227	1.657
3.000	SW08	240 Winter	100	+40%	100/240 Winter				33.232	0.132
3.001	SW09	240 Winter	100	+40%	100/30 Winter				33.230	0.380
4.000	SW10	15 Winter	100	+40%					33.685	-0.115
3.002	SW11	240 Winter	100	+40%	100/30 Summer				33.228	0.527
5.000	SW12	240 Winter	100	+40%	100/15 Summer				33.234	1.004
5.001	SW13	240 Winter	100	+40%	30/15 Summer				33.233	1.428
5.002	SW14	240 Winter	100	+40%	2/120 Winter				33.231	1.551
5.003	SW15	240 Winter	100	+40%	2/120 Winter				33.229	1.649
3.003	SW16	240 Winter	100	+40%	2/120 Winter				33.225	1.765
1.007	SW17	240 Winter	100	+40%	2/15 Summer				33.219	1.920
6.000	SW18	30 Winter	100	+40%					33.564	-0.116
6.001	SW19	15 Winter	100	+40%					33.413	-0.067
7.000	SW20	30 Winter	100	+40%					33.691	-0.109
8.000	SW21	30 Winter	100	+40%					33.662	-0.138
7.001	JUNCTION01	30 Winter	100	+40%					33.583	-0.110
6.002	JUNCTION02	30 Winter	100	+40%					33.330	-0.068
9.000	SW22	15 Winter	100	+40%					33.601	-0.099
6.003	SW23	30 Winter	100	+40%	100/15 Winter				33.300	0.025
10.000	SW24	15 Winter	100	+40%					33.408	-0.142
6.004	SW25	240 Winter	100	+40%	100/240 Winter				33.218	0.108
6.005	SW26	240 Winter	100	+40%	100/240 Winter				33.217	0.160

©1982-2020 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks A&B

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW01	0.000	0.99		27	16.9	OK	
2.000	SW02	0.000	0.64		29	10.8	OK	
1.001	SW03	0.000	0.69			15.7	SURCHARGED	
1.002	SW04	0.000	0.98			15.3	SURCHARGED	
1.003	A&B TANK	0.000	0.41			6.4	SURCHARGED	
1.004	SW05	0.000	0.43			6.5	SURCHARGED	
1.005	SW06	0.000	0.41			6.6	SURCHARGED	
1.006	SW07	0.000	0.20			6.7	SURCHARGED	
3.000	SW08	0.000	0.12			2.0	SURCHARGED	
3.001	SW09	0.000	0.15			2.4	SURCHARGED	
4.000	SW10	0.000	0.11			2.2	OK	
3.002	SW11	0.000	0.24			3.6	SURCHARGED	
5.000	SW12	0.000	0.07			1.3	FLOOD RISK	
5.001	SW13	0.000	0.16			2.5	FLOOD RISK	
5.002	SW14	0.000	0.21			3.4	FLOOD RISK	
5.003	SW15	0.000	0.32			5.2	SURCHARGED	
3.003	SW16	0.000	0.32			12.5	SURCHARGED	
1.007	SW17	0.000	0.24			7.3	SURCHARGED	
6.000	SW18	0.000	0.12			1.9	OK	
6.001	SW19	0.000	0.59			9.1	OK	
7.000	SW20	0.000	0.17			3.4	OK	
8.000	SW21	0.000	0.02			0.4	OK	
7.001	JUNCTION01	0.000	0.15			3.7	OK*	
6.002	JUNCTION02	0.000	0.52			11.5	OK*	
9.000	SW22	0.000	0.25			8.5	OK	
6.003	SW23	0.000	1.09			18.0	SURCHARGED	
10.000	SW24	0.000	0.01			0.3	OK	
6.004	SW25	0.000	0.23			7.4	SURCHARGED	
6.005	SW26	0.000	0.21			7.6	SURCHARGED	

©1982-2020 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks A&B

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.008	SW27	240 Winter	100	+40%	2/15 Summer				33.215	1.945	0.000
1.009	SW28	240 Winter	100	+40%	2/15 Summer				33.210	2.055	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.008	SW27	0.15			8.9	SURCHARGED	
1.009	SW28	0.28			8.4	SURCHARGED	

©1982-2020 Innovyze

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Blocks C&D

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.361	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 Blocks C&D

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.148	4-8	0.098

Total Area Contributing (ha) = 0.246

Total Pipe Volume (m³) = 5.482

Network Design Table for Blocks C&D

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	6.339	0.063	100.6	0.024	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	6.979	0.113	61.8	0.031	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	2.639	0.027	97.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	10.710	0.110	97.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	17.912	0.180	99.5	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	13.570	0.136	99.8	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	5.466	0.055	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	1.802	0.090	20.0	0.007	5.00	0.0	0.600	o	150	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	5.11	32.700	0.024	0.0	0.0	0.0	1.00	17.7	3.2
2.000	50.00	5.09	32.750	0.031	0.0	0.0	0.0	1.28	22.7	4.2
1.001	50.00	5.15	32.637	0.055	0.0	0.0	0.0	1.02	18.0	7.4
1.002	50.00	5.32	32.610	0.055	0.0	0.0	0.0	1.02	18.0	7.4
1.003	50.00	5.62	32.500	0.068	0.0	0.0	0.0	1.01	17.8	9.2
1.004	50.00	5.85	32.320	0.090	0.0	0.0	0.0	1.01	17.8	12.2
1.005	50.00	5.94	32.184	0.090	0.0	0.0	0.0	1.00	17.8	12.2
3.000	50.00	5.01	32.220	0.007	0.0	0.0	0.0	2.26	40.0	0.9

©1982-2020 Innovyze

Network Design Table for Blocks C&D

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
1.006	18.387	0.184	99.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	3.345	0.164	20.4	0.026	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.007	19.268	0.191	100.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.008	4.320	0.043	100.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
5.000	1.712	0.088	19.5	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.009	7.692	0.077	99.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.000	1.277	0.064	20.0	0.026	5.00	0.0	0.600	o	150	Pipe/Conduit	
7.000	8.841	0.444	19.9	0.003	5.00	0.0	0.600	o	150	Pipe/Conduit	
6.001	2.671	0.131	20.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.010	7.256	0.050	146.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
8.000	30.902	0.210	147.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
8.001	21.682	0.217	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.011	8.956	0.060	149.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.012	8.956	0.060	149.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.013	8.156	0.052	156.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.006	50.00	6.24	32.129	0.097	0.0	0.0	0.0	1.01	17.8	13.1
4.000	50.00	5.02	32.110	0.026	0.0	0.0	0.0	2.24	39.6	3.5
1.007	50.00	6.56	31.945	0.123	0.0	0.0	0.0	1.00	17.7	16.7
1.008	50.00	6.63	31.754	0.123	0.0	0.0	0.0	1.00	17.7	16.7
5.000	50.00	5.01	31.800	0.000	0.0	0.0	0.0	2.29	40.5	0.0
1.009	50.00	6.76	31.712	0.123	0.0	0.0	0.0	1.01	17.8	16.7
6.000	50.00	5.01	31.830	0.026	0.0	0.0	0.0	2.27	40.0	3.5
7.000	50.00	5.06	32.210	0.003	0.0	0.0	0.0	2.27	40.1	0.4
6.001	50.00	5.08	31.766	0.029	0.0	0.0	0.0	2.24	39.6	3.9
1.010	50.00	6.87	31.560	0.152	0.0	0.0	0.0	1.08	42.9	20.6
8.000	50.00	5.62	34.000	0.000	0.0	0.0	0.0	0.83	14.6	0.0
8.001	50.00	5.98	33.790	0.000	0.0	0.0	0.0	1.00	17.8	0.0
1.011	50.00	7.01	31.510	0.152	0.0	0.0	0.0	1.07	42.5	20.6
1.012	50.00	7.15	31.450	0.152	0.0	0.0	0.0	1.07	42.5	20.6
1.013	50.00	7.28	31.390	0.152	0.0	0.0	0.0	1.04	41.5	20.6

©1982-2020 Innovyze

Network Design Table for Blocks C&D

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
9.000	1.558	0.078	20.0	0.034	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.014	7.496	0.047	159.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
10.000	17.227	0.170	101.3	0.032	5.00	0.0	0.600	o	150	Pipe/Conduit	
10.001	9.468	0.095	100.0	0.028	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.015	2.035	0.020	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
9.000	50.00	5.01	33.150	0.034	0.0	0.0	0.0	2.26	40.0	4.6
1.014	50.00	7.40	31.337	0.186	0.0	0.0	0.0	1.03	41.1	25.2
10.000	50.00	5.29	34.200	0.032	0.0	0.0	0.0	1.00	17.6	4.3
10.001	50.00	5.44	34.030	0.060	0.0	0.0	0.0	1.00	17.8	8.1
1.015	50.00	7.43	31.290	0.246	0.0	0.0	0.0	1.31	52.0	33.3

©1982-2020 Innovyze

Manhole Schedules for Blocks C&D

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SW29	33.750	1.050	Open Manhole	600	1.000	32.700	150				
SW30	33.800	1.050	Open Manhole	600	2.000	32.750	150				
JUNCTION03	33.750	1.113	Junction		1.001	32.637	150	1.000	32.637	150	
								2.000	32.637	150	
SW31	33.750	1.140	Open Manhole	600	1.002	32.610	150	1.001	32.610	150	
SW32	33.750	1.250	Open Manhole	600	1.003	32.500	150	1.002	32.500	150	
SW33	33.750	1.430	Open Manhole	1200	1.004	32.320	150	1.003	32.320	150	
SW34	33.800	1.616	Open Manhole	1200	1.005	32.184	150	1.004	32.184	150	
SW35	33.800	1.580	Open Manhole	600	3.000	32.220	150				
JUNCTION04	33.800	1.671	Junction		1.006	32.129	150	1.005	32.129	150	
								3.000	32.130	150	1
SW36	33.800	1.690	Open Manhole	600	4.000	32.110	150				
JUNCTION05	33.800	1.855	Junction		1.007	31.945	150	1.006	31.945	150	
								4.000	31.946	150	1
SW37	33.800	2.046	Open Manhole	1200	1.008	31.754	150	1.007	31.754	150	
SW38	33.800	2.000	Open Manhole	600	5.000	31.800	150				
JUNCTION06	33.800	2.088	Junction		1.009	31.712	150	1.008	31.712	150	
								5.000	31.712	150	
SW39	33.800	1.970	Open Manhole	600	6.000	31.830	150				
SW40	33.800	1.590	Open Manhole	600	7.000	32.210	150				
JUNCTION07	33.800	2.034	Junction		6.001	31.766	150	6.000	31.766	150	
								7.000	31.766	150	
SW41	33.800	2.240	Open Manhole	1200	1.010	31.560	225	1.009	31.635	150	
								6.001	31.635	150	
SW42	34.700	0.700	Open Manhole	1200	8.000	34.000	150				
SW43	34.700	0.910	Open Manhole	1200	8.001	33.790	150	8.000	33.790	150	
SW44	34.700	3.190	Open Manhole	1200	1.011	31.510	225	1.010	31.510	225	
								8.001	33.573	150	1988
C&D TANK	34.400	2.950	Open Manhole	1200	1.012	31.450	225	1.011	31.450	225	
SW45	34.350	2.960	Open Manhole	1200	1.013	31.390	225	1.012	31.390	225	
SW46	34.500	1.350	Open Manhole	600	9.000	33.150	150				
JUNCTION08	34.500	3.163	Open Manhole	1200	1.014	31.337	225	1.013	31.337	225	
								9.000	33.072	150	1660
SW47	34.950	0.750	Open Manhole	1200	10.000	34.200	150				
SW48	34.900	0.870	Open Manhole	1200	10.001	34.030	150	10.000	34.030	150	
SW49	34.700	3.410	Open Manhole	1200	1.015	31.290	225	1.014	31.290	225	
								10.001	33.935	150	2570
CW02	34.600	3.330	Open Manhole	1500		OUTFALL		1.015	31.270	225	

No coordinates have been specified, layout information cannot be produced.

©1982-2020 Innovyze

PIPELINE SCHEDULES for Blocks C&D

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	SW29	33.750	32.700	0.900	Open Manhole	600
2.000	o	150	SW30	33.800	32.750	0.900	Open Manhole	600
1.001	o	150	JUNCTION03	33.750	32.637	0.963	Junction	
1.002	o	150	SW31	33.750	32.610	0.990	Open Manhole	600
1.003	o	150	SW32	33.750	32.500	1.100	Open Manhole	600
1.004	o	150	SW33	33.750	32.320	1.280	Open Manhole	1200
1.005	o	150	SW34	33.800	32.184	1.466	Open Manhole	1200
3.000	o	150	SW35	33.800	32.220	1.430	Open Manhole	600
1.006	o	150	JUNCTION04	33.800	32.129	1.521	Junction	
4.000	o	150	SW36	33.800	32.110	1.540	Open Manhole	600
1.007	o	150	JUNCTION05	33.800	31.945	1.705	Junction	
1.008	o	150	SW37	33.800	31.754	1.896	Open Manhole	1200
5.000	o	150	SW38	33.800	31.800	1.850	Open Manhole	600
1.009	o	150	JUNCTION06	33.800	31.712	1.938	Junction	
6.000	o	150	SW39	33.800	31.830	1.820	Open Manhole	600

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	6.339	100.6	JUNCTION03	33.750	32.637	0.963	Junction	
2.000	6.979	61.8	JUNCTION03	33.750	32.637	0.963	Junction	
1.001	2.639	97.7	SW31	33.750	32.610	0.990	Open Manhole	600
1.002	10.710	97.4	SW32	33.750	32.500	1.100	Open Manhole	600
1.003	17.912	99.5	SW33	33.750	32.320	1.280	Open Manhole	1200
1.004	13.570	99.8	SW34	33.800	32.184	1.466	Open Manhole	1200
1.005	5.466	100.0	JUNCTION04	33.800	32.129	1.521	Junction	
3.000	1.802	20.0	JUNCTION04	33.800	32.130	1.520	Junction	
1.006	18.387	99.9	JUNCTION05	33.800	31.945	1.705	Junction	
4.000	3.345	20.4	JUNCTION05	33.800	31.946	1.704	Junction	
1.007	19.268	100.9	SW37	33.800	31.754	1.896	Open Manhole	1200
1.008	4.320	100.9	JUNCTION06	33.800	31.712	1.938	Junction	
5.000	1.712	19.5	JUNCTION06	33.800	31.712	1.938	Junction	
1.009	7.692	99.9	SW41	33.800	31.635	2.015	Open Manhole	1200
6.000	1.277	20.0	JUNCTION07	33.800	31.766	1.884	Junction	

©1982-2020 Innovyze

PIPELINE SCHEDULES for Blocks C&D

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	o	150	SW40	33.800	32.210	1.440	Open Manhole	600
6.001	o	150	JUNCTION07	33.800	31.766	1.884	Junction	
1.010	o	225	SW41	33.800	31.560	2.015	Open Manhole	1200
8.000	o	150	SW42	34.700	34.000	0.550	Open Manhole	1200
8.001	o	150	SW43	34.700	33.790	0.760	Open Manhole	1200
1.011	o	225	SW44	34.700	31.510	2.965	Open Manhole	1200
1.012	o	225	C&D TANK	34.400	31.450	2.725	Open Manhole	1200
1.013	o	225	SW45	34.350	31.390	2.735	Open Manhole	1200
9.000	o	150	SW46	34.500	33.150	1.200	Open Manhole	600
1.014	o	225	JUNCTION08	34.500	31.337	2.938	Open Manhole	1200
10.000	o	150	SW47	34.950	34.200	0.600	Open Manhole	1200
10.001	o	150	SW48	34.900	34.030	0.720	Open Manhole	1200
1.015	o	225	SW49	34.700	31.290	3.185	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
7.000	8.841	19.9	JUNCTION07	33.800	31.766	1.884	Junction	
6.001	2.671	20.4	SW41	33.800	31.635	2.015	Open Manhole	1200
1.010	7.256	146.0	SW44	34.700	31.510	2.965	Open Manhole	1200
8.000	30.902	147.0	SW43	34.700	33.790	0.760	Open Manhole	1200
8.001	21.682	100.0	SW44	34.700	33.573	0.977	Open Manhole	1200
1.011	8.956	149.0	C&D TANK	34.400	31.450	2.725	Open Manhole	1200
1.012	8.956	149.3	SW45	34.350	31.390	2.735	Open Manhole	1200
1.013	8.156	156.0	JUNCTION08	34.500	31.337	2.938	Open Manhole	1200
9.000	1.558	20.0	JUNCTION08	34.500	33.072	1.278	Open Manhole	1200
1.014	7.496	159.0	SW49	34.700	31.290	3.185	Open Manhole	1200
10.000	17.227	101.3	SW48	34.900	34.030	0.720	Open Manhole	1200
10.001	9.468	100.0	SW49	34.700	33.935	0.615	Open Manhole	1200
1.015	2.035	100.0	CW02	34.600	31.270	3.105	Open Manhole	1500

Free Flowing Outfall Details for Blocks C&D

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.015	CW02	34.600	31.270	31.250	1500	0

©1982-2020 Innovyze

Simulation Criteria for Blocks C&D

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	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	10
Number of Online Controls	1	Number of Storage Structures	3	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.360		

©1982-2020 Innovyze

Online Controls for Blocks C&D

Hydro-Brake® Optimum Manhole: SW49, DS/PN: 1.015, Volume (m³): 4.3

Unit Reference	MD-SHE-0100-5000-1400-5000
Design Head (m)	1.400
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	31.290
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	5.0	Kick-Flo®	0.855	4.0
Flush-Flo™	0.416	5.0	Mean Flow over Head Range	-	4.4

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)	Depth (m)	Flow (l/s)
0.100	3.3	0.800	4.3	2.000	5.9	4.000	8.2	7.000	10.7
0.200	4.6	1.000	4.3	2.200	6.2	4.500	8.6	7.500	11.0
0.300	4.9	1.200	4.7	2.400	6.4	5.000	9.1	8.000	11.4
0.400	5.0	1.400	5.0	2.600	6.7	5.500	9.5	8.500	11.7
0.500	5.0	1.600	5.3	3.000	7.1	6.000	9.9	9.000	12.0
0.600	4.9	1.800	5.6	3.500	7.7	6.500	10.3	9.500	12.3

©1982-2020 Innovyze

Storage Structures for Blocks C&D

Cellular Storage Manhole: C&D TANK, DS/PN: 1.012

Invert Level (m) 31.450 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	55.0	0.0	1.600	55.0	0.0	1.601	0.0	0.0

Porous Car Park Manhole: SW47, DS/PN: 10.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	9.5
Membrane Percolation (mm/hr)	1000	Length (m)	21.5
Max Percolation (l/s)	56.7	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	34.350	Cap Volume Depth (m)	0.400

Porous Car Park Manhole: SW48, DS/PN: 10.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	9.5
Membrane Percolation (mm/hr)	1000	Length (m)	19.5
Max Percolation (l/s)	51.5	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	34.180	Cap Volume Depth (m)	0.400

Time Area Diagram for Green Roof at Pipe Number 1.000 (Blocks C&D)

Area (m³) 112 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002035	32	36	0.000411	64	68	0.000083	96	100	0.000017
4	8	0.001666	36	40	0.000336	68	72	0.000068	100	104	0.000014
8	12	0.001364	40	44	0.000275	72	76	0.000056	104	108	0.000011
12	16	0.001117	44	48	0.000226	76	80	0.000046	108	112	0.000009
16	20	0.000915	48	52	0.000185	80	84	0.000037	112	116	0.000008
20	24	0.000749	52	56	0.000151	84	88	0.000031	116	120	0.000006
24	28	0.000613	56	60	0.000124	88	92	0.000025			
28	32	0.000502	60	64	0.000101	92	96	0.000020			

Time Area Diagram for Green Roof at Pipe Number 2.000 (Blocks C&D)

Area (m³) 172 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.003126	20	24	0.001150	40	44	0.000423	60	64	0.000156
4	8	0.002559	24	28	0.000941	44	48	0.000346	64	68	0.000127
8	12	0.002095	28	32	0.000771	48	52	0.000284	68	72	0.000104
12	16	0.001715	32	36	0.000631	52	56	0.000232	72	76	0.000085
16	20	0.001404	36	40	0.000517	56	60	0.000190	76	80	0.000070

©1982-2020 Innovyze

Time Area Diagram for Green Roof at Pipe Number 2.000 (Blocks C&D)

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
80	84	0.000057	92	96	0.000031	104	108	0.000017	116	120	0.000009
84	88	0.000047	96	100	0.000026	108	112	0.000014			
88	92	0.000038	100	104	0.000021	112	116	0.000012			

Time Area Diagram for Green Roof at Pipe Number 1.002 (Blocks C&D)

Area (m³) 111 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.002017	32	36	0.000407	64	68	0.000082	96	100	0.000017
4	8	0.001651	36	40	0.000333	68	72	0.000067	100	104	0.000014
8	12	0.001352	40	44	0.000273	72	76	0.000055	104	108	0.000011
12	16	0.001107	44	48	0.000223	76	80	0.000045	108	112	0.000009
16	20	0.000906	48	52	0.000183	80	84	0.000037	112	116	0.000007
20	24	0.000742	52	56	0.000150	84	88	0.000030	116	120	0.000006
24	28	0.000608	56	60	0.000123	88	92	0.000025			
28	32	0.000497	60	64	0.000100	92	96	0.000020			

Time Area Diagram for Green Roof at Pipe Number 1.003 (Blocks C&D)

Area (m³) 107 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.001944	32	36	0.000393	64	68	0.000079	96	100	0.000016
4	8	0.001592	36	40	0.000321	68	72	0.000065	100	104	0.000013
8	12	0.001303	40	44	0.000263	72	76	0.000053	104	108	0.000011
12	16	0.001067	44	48	0.000215	76	80	0.000043	108	112	0.000009
16	20	0.000874	48	52	0.000176	80	84	0.000036	112	116	0.000007
20	24	0.000715	52	56	0.000144	84	88	0.000029	116	120	0.000006
24	28	0.000586	56	60	0.000118	88	92	0.000024			
28	32	0.000479	60	64	0.000097	92	96	0.000020			

Time Area Diagram for Green Roof at Pipe Number 3.000 (Blocks C&D)

Area (m³) 189 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.003435	32	36	0.000693	64	68	0.000140	96	100	0.000028
4	8	0.002812	36	40	0.000568	68	72	0.000115	100	104	0.000023
8	12	0.002302	40	44	0.000465	72	76	0.000094	104	108	0.000019
12	16	0.001885	44	48	0.000381	76	80	0.000077	108	112	0.000016
16	20	0.001543	48	52	0.000312	80	84	0.000063	112	116	0.000013
20	24	0.001263	52	56	0.000255	84	88	0.000052	116	120	0.000010
24	28	0.001034	56	60	0.000209	88	92	0.000042			
28	32	0.000847	60	64	0.000171	92	96	0.000035			

©1982-2020 Innovyze

Time Area Diagram for Green Roof at Pipe Number 4.000 (Blocks C&D)

Area (m³) 12 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000218	32	36	0.000044	64	68	0.000009	96	100	0.000002
4	8	0.000179	36	40	0.000036	68	72	0.000007	100	104	0.000001
8	12	0.000146	40	44	0.000030	72	76	0.000006	104	108	0.000001
12	16	0.000120	44	48	0.000024	76	80	0.000005	108	112	0.000001
16	20	0.000098	48	52	0.000020	80	84	0.000004	112	116	0.000001
20	24	0.000080	52	56	0.000016	84	88	0.000003	116	120	0.000001
24	28	0.000066	56	60	0.000013	88	92	0.000003			
28	32	0.000054	60	64	0.000011	92	96	0.000002			

Time Area Diagram for Green Roof at Pipe Number 5.000 (Blocks C&D)

Area (m³) 213 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003871	32	36	0.000781	64	68	0.000158	96	100	0.000032
4	8	0.003169	36	40	0.000640	68	72	0.000129	100	104	0.000026
8	12	0.002595	40	44	0.000524	72	76	0.000106	104	108	0.000021
12	16	0.002124	44	48	0.000429	76	80	0.000087	108	112	0.000017
16	20	0.001739	48	52	0.000351	80	84	0.000071	112	116	0.000014
20	24	0.001424	52	56	0.000287	84	88	0.000058	116	120	0.000012
24	28	0.001166	56	60	0.000235	88	92	0.000048			
28	32	0.000954	60	64	0.000193	92	96	0.000039			

Time Area Diagram for Green Roof at Pipe Number 7.000 (Blocks C&D)

Area (m³) 225 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004089	32	36	0.000825	64	68	0.000167	96	100	0.000034
4	8	0.003348	36	40	0.000676	68	72	0.000136	100	104	0.000028
8	12	0.002741	40	44	0.000553	72	76	0.000112	104	108	0.000023
12	16	0.002244	44	48	0.000453	76	80	0.000091	108	112	0.000018
16	20	0.001837	48	52	0.000371	80	84	0.000075	112	116	0.000015
20	24	0.001504	52	56	0.000304	84	88	0.000061	116	120	0.000012
24	28	0.001231	56	60	0.000249	88	92	0.000050			
28	32	0.001008	60	64	0.000204	92	96	0.000041			

Time Area Diagram for Green Roof at Pipe Number 10.000 (Blocks C&D)

Area (m³) 204 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.003707	12	16	0.002034	24	28	0.001117	36	40	0.000613
4	8	0.003035	16	20	0.001666	28	32	0.000914	40	44	0.000502
8	12	0.002485	20	24	0.001364	32	36	0.000748	44	48	0.000411

©1982-2020 Innovyze

Time Area Diagram for Green Roof at Pipe Number 10.000 (Blocks C&D)

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
48	52	0.000336	68	72	0.000124	88	92	0.000046	108	112	0.000017
52	56	0.000275	72	76	0.000101	92	96	0.000037	112	116	0.000014
56	60	0.000225	76	80	0.000083	96	100	0.000031	116	120	0.000011
60	64	0.000185	80	84	0.000068	100	104	0.000025			
64	68	0.000151	84	88	0.000056	104	108	0.000020			

Time Area Diagram for Green Roof at Pipe Number 10.001 (Blocks C&D)

Area (m³) 185 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.003362	32	36	0.000679	64	68	0.000137	96	100	0.000028
4	8	0.002752	36	40	0.000556	68	72	0.000112	100	104	0.000023
8	12	0.002253	40	44	0.000455	72	76	0.000092	104	108	0.000019
12	16	0.001845	44	48	0.000372	76	80	0.000075	108	112	0.000015
16	20	0.001511	48	52	0.000305	80	84	0.000062	112	116	0.000012
20	24	0.001237	52	56	0.000250	84	88	0.000050	116	120	0.000010
24	28	0.001013	56	60	0.000204	88	92	0.000041			
28	32	0.000829	60	64	0.000167	92	96	0.000034			

©1982-2020 Innovyze

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 10
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW29	60 Winter	2	+0%					32.718	-0.132
2.000	SW30	60 Winter	2	+0%					32.769	-0.131
1.001	JUNCTION03	60 Winter	2	+0%					32.671	-0.116
1.002	SW31	60 Winter	2	+0%					32.643	-0.117
1.003	SW32	60 Winter	2	+0%	100/120 Winter				32.536	-0.114
1.004	SW33	15 Winter	2	+0%	100/60 Winter				32.363	-0.107
1.005	SW34	15 Winter	2	+0%	100/60 Summer				32.230	-0.104
3.000	SW35	60 Winter	2	+0%	100/60 Winter				32.240	-0.130
1.006	JUNCTION04	120 Winter	2	+0%	100/30 Winter				32.175	-0.104
4.000	SW36	60 Summer	2	+0%	100/60 Summer				32.112	-0.148
1.007	JUNCTION05	120 Winter	2	+0%	100/30 Winter				31.992	-0.104
1.008	SW37	120 Winter	2	+0%	30/120 Winter				31.809	-0.096
5.000	SW38	60 Winter	2	+0%	100/30 Summer				31.821	-0.129
1.009	JUNCTION06	60 Winter	2	+0%					31.763	-0.098
6.000	SW39	15 Winter	2	+0%	100/30 Summer				31.882	-0.098
7.000	SW40	60 Summer	2	+0%	100/60 Winter				32.227	-0.133
6.001	JUNCTION07	15 Winter	2	+0%					31.809	-0.107
1.010	SW41	15 Winter	2	+0%	30/60 Winter				31.629	-0.156
8.000	SW42	15 Summer	2	+0%					34.000	-0.150
8.001	SW43	15 Summer	2	+0%					33.790	-0.150
1.011	SW44	15 Winter	2	+0%	30/60 Summer				31.576	-0.159
1.012	C&D TANK	120 Winter	2	+0%	30/30 Winter				31.531	-0.144
1.013	SW45	120 Winter	2	+0%	30/30 Summer				31.527	-0.088
9.000	SW46	15 Winter	2	+0%	100/15 Winter				33.207	-0.093
1.014	JUNCTION08	120 Winter	2	+0%	30/15 Summer				31.523	-0.039
10.000	SW47	120 Winter	2	+0%					34.218	-0.132
10.001	SW48	120 Winter	2	+0%					34.055	-0.125
1.015	SW49	120 Winter	2	+0%	2/120 Winter				31.519	0.004

©1982-2020 Innovyze

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW29	0.000	0.03			0.5	OK	
2.000	SW30	0.000	0.04			0.8	OK	
1.001	JUNCTION03	0.000	0.11			1.2	OK*	
1.002	SW31	0.000	0.11			1.7	OK	
1.003	SW32	0.000	0.13			2.1	OK	
1.004	SW33	0.000	0.18			2.9	OK	
1.005	SW34	0.000	0.20			2.9	OK	
3.000	SW35	0.000	0.05			0.9	OK	
1.006	JUNCTION04	0.000	0.20			3.6	OK*	
4.000	SW36	0.000	0.00			0.0	OK	
1.007	JUNCTION05	0.000	0.21			3.7	OK*	
1.008	SW37	0.000	0.28			3.7	OK	
5.000	SW38	0.000	0.05			1.0	OK	
1.009	JUNCTION06	0.000	0.26			4.5	OK*	
6.000	SW39	0.000	0.26			4.1	OK	
7.000	SW40	0.000	0.02			0.8	OK	
6.001	JUNCTION07	0.000	0.18			4.0	OK*	
1.010	SW41	0.000	0.21			6.5	OK	
8.000	SW42	0.000	0.00			0.0	OK	
8.001	SW43	0.000	0.00			0.0	OK	
1.011	SW44	0.000	0.19			6.5	OK	
1.012	C&D TANK	0.000	0.13		33	4.4	OK	
1.013	SW45	0.000	0.13			4.1	OK	
9.000	SW46	0.000	0.30			5.3	OK	
1.014	JUNCTION08	0.000	0.15			4.7	OK	
10.000	SW47	0.000	0.03		29	0.5	OK	
10.001	SW48	0.000	0.07		36	1.0	OK	
1.015	SW49	0.000	0.16			4.7	SURCHARGED	

©1982-2020 Innovyze

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 10
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW29	30 Winter	30	+0%					32.727	-0.123
2.000	SW30	30 Winter	30	+0%					32.779	-0.121
1.001	JUNCTION03	30 Winter	30	+0%					32.687	-0.100
1.002	SW31	30 Winter	30	+0%					32.658	-0.102
1.003	SW32	30 Winter	30	+0%	100/120 Winter				32.553	-0.097
1.004	SW33	60 Winter	30	+0%	100/60 Winter				32.390	-0.080
1.005	SW34	60 Winter	30	+0%	100/60 Summer				32.259	-0.075
3.000	SW35	60 Winter	30	+0%	100/60 Winter				32.251	-0.119
1.006	JUNCTION04	60 Winter	30	+0%	100/30 Winter				32.204	-0.075
4.000	SW36	60 Winter	30	+0%	100/60 Summer				32.113	-0.147
1.007	JUNCTION05	60 Winter	30	+0%	100/30 Winter				32.021	-0.074
1.008	SW37	120 Winter	30	+0%	30/120 Winter				31.915	0.011
5.000	SW38	120 Winter	30	+0%	100/30 Summer				31.911	-0.039
1.009	JUNCTION06	120 Winter	30	+0%					31.862	0.000
6.000	SW39	120 Winter	30	+0%	100/30 Summer				31.905	-0.075
7.000	SW40	60 Winter	30	+0%	100/60 Winter				32.234	-0.126
6.001	JUNCTION07	120 Winter	30	+0%					31.905	-0.011
1.010	SW41	120 Winter	30	+0%	30/60 Winter				31.904	0.119
8.000	SW42	15 Summer	30	+0%					34.000	-0.150
8.001	SW43	15 Summer	30	+0%					33.790	-0.150
1.011	SW44	120 Winter	30	+0%	30/60 Summer				31.901	0.166
1.012	C&D TANK	120 Winter	30	+0%	30/30 Winter				31.897	0.222
1.013	SW45	120 Winter	30	+0%	30/30 Summer				31.904	0.289
9.000	SW46	15 Winter	30	+0%	100/15 Winter				33.232	-0.068
1.014	JUNCTION08	120 Winter	30	+0%	30/15 Summer				31.907	0.344
10.000	SW47	60 Winter	30	+0%					34.232	-0.118
10.001	SW48	60 Winter	30	+0%					34.075	-0.105
1.015	SW49	120 Winter	30	+0%	2/120 Winter				31.905	0.390

©1982-2020 Innovyze

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW29	0.000	0.07			1.0	OK	
2.000	SW30	0.000	0.08			1.6	OK	
1.001	JUNCTION03	0.000	0.24			2.6	OK*	
1.002	SW31	0.000	0.22			3.6	OK	
1.003	SW32	0.000	0.27			4.4	OK	
1.004	SW33	0.000	0.44			7.2	OK	
1.005	SW34	0.000	0.49			7.2	OK	
3.000	SW35	0.000	0.09			1.7	OK	
1.006	JUNCTION04	0.000	0.50			8.8	OK*	
4.000	SW36	0.000	0.00			0.1	OK	
1.007	JUNCTION05	0.000	0.50			8.9	OK*	
1.008	SW37	0.000	0.54			7.0	SURCHARGED	
5.000	SW38	0.000	0.08			1.6	OK	
1.009	JUNCTION06	0.000	0.49			8.5	SURCHARGED*	
6.000	SW39	0.000	0.16			2.6	OK	
7.000	SW40	0.000	0.06			2.0	OK	
6.001	JUNCTION07	0.000	0.18			4.1	OK*	
1.010	SW41	0.000	0.40			12.5	SURCHARGED	
8.000	SW42	0.000	0.00			0.0	OK	
8.001	SW43	0.000	0.00			0.0	OK	
1.011	SW44	0.000	0.35			12.2	SURCHARGED	
1.012	C&D TANK	0.000	0.17		66	6.0	SURCHARGED	
1.013	SW45	0.000	0.18			5.7	SURCHARGED	
9.000	SW46	0.000	0.57			10.0	OK	
1.014	JUNCTION08	0.000	0.17			5.3	SURCHARGED	
10.000	SW47	0.000	0.10		29	1.7	OK	
10.001	SW48	0.000	0.20		30	3.1	OK	
1.015	SW49	0.000	0.17			5.0	SURCHARGED	

©1982-2020 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 10
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 18.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.360 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	SW29	240 Winter	100	+40%					32.745	-0.105
2.000	SW30	15 Winter	100	+40%					32.790	-0.110
1.001	JUNCTION03	240 Winter	100	+40%					32.744	-0.043
1.002	SW31	240 Winter	100	+40%					32.744	-0.016
1.003	SW32	240 Winter	100	+40%	100/120 Winter				32.740	0.090
1.004	SW33	240 Winter	100	+40%	100/60 Winter				32.735	0.265
1.005	SW34	240 Winter	100	+40%	100/60 Summer				32.728	0.394
3.000	SW35	240 Winter	100	+40%	100/60 Winter				32.725	0.355
1.006	JUNCTION04	60 Summer	100	+40%	100/30 Winter				32.280	0.001
4.000	SW36	240 Winter	100	+40%	100/60 Summer				32.716	0.456
1.007	JUNCTION05	60 Summer	100	+40%	100/30 Winter				32.096	0.001
1.008	SW37	240 Winter	100	+40%	30/120 Winter				32.707	0.802
5.000	SW38	240 Winter	100	+40%	100/30 Summer				32.703	0.753
1.009	JUNCTION06	1440 Summer	100	+40%					31.862	0.000
6.000	SW39	240 Winter	100	+40%	100/30 Summer				32.698	0.718
7.000	SW40	240 Winter	100	+40%	100/60 Winter				32.699	0.339
6.001	JUNCTION07	30 Summer	100	+40%					31.916	0.000
1.010	SW41	240 Winter	100	+40%	30/60 Winter				32.697	0.912
8.000	SW42	15 Summer	100	+40%					34.000	-0.150
8.001	SW43	15 Summer	100	+40%					33.790	-0.150
1.011	SW44	240 Winter	100	+40%	30/60 Summer				32.693	0.958
1.012	C&D TANK	240 Winter	100	+40%	30/30 Winter				32.689	1.015
1.013	SW45	240 Winter	100	+40%	30/30 Summer				32.695	1.080
9.000	SW46	15 Winter	100	+40%	100/15 Winter				33.301	0.001
1.014	JUNCTION08	240 Winter	100	+40%	30/15 Summer				32.698	1.135
10.000	SW47	60 Winter	100	+40%					34.245	-0.105
10.001	SW48	30 Winter	100	+40%					34.096	-0.084
1.015	SW49	240 Winter	100	+40%	2/120 Winter				32.695	1.180

©1982-2020 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Blocks C&D

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	SW29	0.000	0.07			1.1	OK	
2.000	SW30	0.000	0.13			2.6	OK	
1.001	JUNCTION03	0.000	0.25			2.7	OK*	
1.002	SW31	0.000	0.24			3.8	OK	
1.003	SW32	0.000	0.29			4.8	SURCHARGED	
1.004	SW33	0.000	0.44			7.1	SURCHARGED	
1.005	SW34	0.000	0.49			7.1	SURCHARGED	
3.000	SW35	0.000	0.10			1.8	SURCHARGED	
1.006	JUNCTION04	0.000	0.96			17.1	SURCHARGED*	
4.000	SW36	0.000	0.00			0.1	SURCHARGED	
1.007	JUNCTION05	0.000	0.93			16.4	SURCHARGED*	
1.008	SW37	0.000	0.61			7.9	SURCHARGED	
5.000	SW38	0.000	0.10			1.9	SURCHARGED	
1.009	JUNCTION06	0.000	0.24			4.2	SURCHARGED*	
6.000	SW39	0.000	0.18			2.8	SURCHARGED	
7.000	SW40	0.000	0.06			2.2	SURCHARGED	
6.001	JUNCTION07	0.000	0.64			14.6	SURCHARGED*	
1.010	SW41	0.000	0.43			13.5	SURCHARGED	
8.000	SW42	0.000	0.00			0.0	OK	
8.001	SW43	0.000	0.00			0.0	OK	
1.011	SW44	0.000	0.38			13.2	SURCHARGED	
1.012	C&D TANK	0.000	0.18		180	6.1	SURCHARGED	
1.013	SW45	0.000	0.18			5.8	SURCHARGED	
9.000	SW46	0.000	1.02			17.8	SURCHARGED	
1.014	JUNCTION08	0.000	0.18			5.4	SURCHARGED	
10.000	SW47	0.000	0.20		34	3.3	OK	
10.001	SW48	0.000	0.40		27	6.2	OK	
1.015	SW49	0.000	0.17			5.0	SURCHARGED	

©1982-2020 Innovyze