BURO HAPPOLD

NOMA, Angel Square Public Realm

Drainage Strategy

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Glossary

Term	Definition
Attenuation	A method to reduce a flood peak to prevent flooding, often utilising temporary storage, but increasing the duration of the flow.
Brownfield	Land previously developed that has potential to be regenerated.
Catchment	A surface water catchment is the area which water drains into a watercourse. A groundwater catchment is the area that consists of the groundwater river flow.
Design Flood Level	This is the level of flooding that flood defences or mitigation measures are designed against. This is typically the 1% (1 in 100) flood level.
Discharge	The rate of flow of water measured in terms of volume per unit time.
EA	Environment Agency.
Flood Defence	A natural or man-made infrastructure used to prevent certain areas from inundation from flooding, and / or the provision of flood warning systems.
Floodplain	Area of land adjacent to a water course which water flows or is stored during a flood event or would otherwise be flooded in the absence of flood defences.
Flood Resilience	Improving flood resistance, e.g. reducing the risk of properties against flooding events.
Flood Risk	The level of risk to personal safety and damage to property resulting from flooding due to the frequency or likelihood of flood events.
Flood Risk Assessment (FRA)	An assessment of the flood risks to the proposed development over its expected lifetime and the possible flood risks to the surrounding areas, assessing flood flows, flood storage capacity and runoff.
Flood Risk Management (FRM)	Managing and/or reducing flood risk to people, property and the environment.
Flood Zones	The statistical chance of a flood event occurring in any one year, stated as a percentage. PPS25 identifies three flood zones.
Fluvial Flooding	Related or connected to a watercourse (river or stream).
Greenfield	Land which has not been previously developed.
Groundwater	Water present within underground strata known as aquifers.
Inundation	Flooding of land with water.
m AOD	Metres Above Ordnance Datum.
Mitigation	Actions taken to reduce either the probability of flooding or the consequences of flooding or a combination of the two.
Previously Developed Land	Land which is or was occupied by a permanent structure (excluding agricultural or forestry buildings) and associated fixed surface infrastructure.
Red line boundary	Boundary drawn to indicate the site area on which the planning application is based.
Residual Risk	The risk that remains after risk management and mitigation measures have been implemented
Risk	Risk is the probability that an event will occur and the impact (or consequences) associated with that event.
Runoff	Water flow over surfaces to the drainage system. Runoff occurs if the ground is impermeable or if permeable ground is saturated.
Strategic Flood Risk Assessment (SFRA)	An SFRA is the assessment and 'categorisation' of flood risk on an area-wide basis in accordance with PPS25.
Surface Water Flooding	Surface water flooding occurs when the volume of water is unable to filtrate through the ground to enter drainage systems, and therefore runs quickly off land and results in localised flooding. This type of flooding is usually associated with intense rainfall.
Sustainable Drainage Systems (SuDS)	SuDS are used as a strategy to manage surface water in a sustainable manner or least damaging solution through management practices and physical structures.
Sustainable Development	Development which meets the needs of the present without compromising the ability of future generations to meet their own needs.
Water Table	The top surface of the saturated zone within the aquifer.

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1 Executive Summary

This drainage strategy has been prepared in support of the planning application and to set the principles for the drainage design to serve the Angel Square Public Realm development. The exact configuration and nature of the drainage is to be determined at the detailed design stage and dependent on any discharge of planning conditions.

The Site is located to the north of Manchester City Centre, approximately 200m east of Manchester Victoria Railway Station and is surrounded by the Co-operative Group headquarters to the north, an existing carpark to the west, Miller Street to the south and an existing carpark to the east which is the site of the proposed 2&3 Angel Square development.

The drainage strategy will be in accordance with Section H of the Building Regulations, the Manchester City Council Lead Local Flood Authority (LLFA) and United Utilities (UU) requirements.

To be in line with UU and the LLFA criteria, it is proposed to reduce the surface water runoff rate for the existing impermeable area by 50% and discharge the additional impermeable area at Q-bar greenfield runoff rates. It is therefore proposed to limit the discharge of surface water from the proposed development to 25.2l/s.

Attenuation storage will be required to facilitate the reduction of the proposed flows, and SuDS will be included wherever practicable. The surface water network will ultimately discharge to the public combined sewer located within Dantzic Street to the west of the site.

With regards to foul water, the development will be designed with separate systems for both foul and surface water drainage which will remain separate until the point of discharge to the public combined sewer located within the Dantzic Street. United Utilities confirmed that the foul water from this site can be discharged at an unrestricted rate to the public combined sewer network.

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2 Introduction

2.1 Appointment and Brief

This drainage strategy has been prepared in support of the planning application for the Angel Square public realm development (herein referred to as the proposed development).

2.2 Limitations

This report is based on the interpretation and assessment of data provided by third parties. It should be noted that the detailed design of the drainage and associated Sustainable Drainage Systems (SuDS) features is agreed in principal nd the assumptions and information presented herein is subject to design development. Operation and maintenance of all SuDS (including proprietary systems) will need to be considered once the proposed development has been finalised with all specific information presented to those responsible for the maintenance of the facility. Buro Happold cannot be held responsible for the accuracy of third-party data or the conclusions that come from this information or as a result of changes arising from the developing design. The conclusions and findings of this report may change if the proposed development is amended or updated after the date of publishing.

2.3 Review of Available Information

As-built drainage drawings of the Co-operative Group HQ building dated 11/12/12 were made available, some of this drainage is located within the north of the Angel Square public realm site. A multi utility infrastructure constraints plan showing all utilities within the surrounding highways was provided by WDA dated 21/12/2021. A CCTV survey of the on-site public realm drainage was undertaken by Drain Alert dated 23/08/2022 in addition to a GPR survey undertaken by Survey Operations dated October 2022. The findings of these surveys are discussed in Section 3.4.

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3 Site Description

3.1 Existing Site

The proposed development is located to the north of Manchester City Centre, approximately 200m east of Manchester Victoria Railway Station. The post code and grid reference of the site are M60 0AG and SJ 84312 99021. The site is bounded by the Co-operative Group headquarters (1 Angel Square) to the north, an existing carpark (Euro car parks) to the west, Miller Street to the south and an existing carpark to the east which is the site of the proposed 2&3 Angel Square development. Figure 1 shows the boundary of the site and its relative location.

The site area is currently occupied by existing public realm space with a combination of hard standing, soft landscaping and planting. The immediate surrounding area comprises urban development including residential, warehouses, offices, and manufacturing facilities. A recent site visit indicates that there is existing traditional gravity drainage capturing surface water within the site boundary. The site currently comprises off an area of public realm hard and soft landscaping with no buildings it therefore produces no foul water discharge. There is foul water discharge to a combined sewer serving 1 Angel Square to the north of the site.

Based on the Flood Map for Planning the site is located in Flood Zone 1; Flood Zone 1 is classified as land having a less than 0.1% annual probability of river (fluvial) or sea (tidal) flooding (1 in 1000 year return period event). The Manchester City, Salford City and Trafford SFRA identifies the site as being located within the Conurbation Core Critical Drainage Area. The site is not located within a groundwater Source Protection Zone (SPZ).



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Figure 1 - Indicative Angel Square Public Realm Site Plan (Map Data from Google Earth©2022)

3.2 Existing Topography

The highest point of the site is located to the north-east of the site at the threshold with the existing Co-operative Group building with an approximate level of +43.47mAOD. The levels generally fall in a south-western direction towards Miller Street. The lowest level of the site is located at the south-west boundary with an approximate level of +39.21mAOD. Refer to Appendix A for topographical survey.

3.3 Existing Waterbodies

There are no watercourses located within the site boundary. The nearest watercourses to the site are:

- The River Irk, a Main River managed by the Environment Agency located 200m north of the site
- The River Irwell, a Main River managed by the Environment Agency located 450m west of the site

3.4 Existing Drainage

3.4.1 Public Drainage

Record information obtained from United Utilities (UU) indicates that the site is surrounded by an extensive public sewer system. The following drainage systems are present in the vicinity of the site:

- 300 x 525mm combined sewer located within the site boundary to the west of the site within Dantzic Street.
- 300mm combined sewer located within the site boundary to the south-west corner of the site within Dantzic Street
- 1500 x 675mm brick combined sewer that conveys flows in a north-westerly direction beneath Miller Street.
- 1850mm diameter brick combined sewer beneath Angel Street which flows in a south-easterly direction.

In addition, a data screening was undertaken for the NOMA 2&3 Angel Square development by the LLFA to identify any culvert conduits that could be located within the site and not registered in the public records. The extent of this data screening includes the Angel Square public realm site. No culverts were identified within the site boundary, refer to Appendix B for data screening.

3.4.2 Private Drainage

As-built information of the Co-operative Group HQ building, see Appendix C, shows that foul and surface water drainage from the building is located within the site. It is noted that Tubosider oversized pipes that provide attenuation for the building are located within the site. This drainage and associated attenuation is therefore a constraint to the proposed development. The location of the attenuation associated with the Co-operative Group HQ could not be verified by the surveys undertaken due to dense vegetation and access to trace from ground to date therefore the exact location is to be confirmed by further intrusive surveys at a later design stage.

A CCTV survey undertaken by Drain Alert, see Appendix D, identified that the existing public realm site is drained via a series of drainage channels connected by below ground drainage. The water is conveyed to the 300 x 525mm public sewer within Dantzic Street to the west of the site. The connection to the public sewer takes drainage from both the Co-operative HQ building and the public realm area. The CCTV survey identified an existing geocellular attenuation tank between manholes MH3 and MH4 serving the existing public realm. Thee exact location, size and condition of the tank could not be confirmed therefore further surveys will be undertaken at a later design stage to determine this.

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As the suitability of the existing public realm attenuation tank is to be confirmed by further surveys, it is not currently proposed to reuse the tank. If the tank is found to be suitable at a later design stage, the existing tank could provide a proportion of the required attenuation for the site.

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4 Proposed Development

The proposed development comprises of improvements to Angel Square public realm, works to include: replacement of existing hard and soft landscaping; erection of structure for community use (Use Class F2); installation of new drainage scheme; installation of services, installation of lighting columns, wayfinding signage and other street furniture; provision of cycle parking; and, associated works.

Figure 2 illustrates the indicative site masterplan:



Figure 2 - Landscape Masterplan (Planit IE)

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5 Proposed Surface Water Drainage Strategy

5.1 General

A surface water drainage system will be provided to collect surface water runoff from hardstanding areas. Primary runoff from ground will be from hard impermeable surfaces such as roof and any exposed areas of hard standing. Allowance will be made to include green areas that may fall towards the buildings as infiltration is not viable in the proposed development.

5.2 Consultation

5.2.1 United Utilities

A Wastewater Pre-development Enquiry was submitted to United Utilities 16/08/2022 to determine the proposed surface water and foul water discharge rates and potential points of connections. United Utilities confirmed that foul water from the development can be discharged to the existing combined sewer to the west of the site at an unrestricted rate. United Utilities further confirmed to limit the discharge of surface water to 25.3l/s. Refer to Appendix E for correspondence with United Utilities.

5.2.2 Manchester City Council (Lead Local Flood Authority)

A meeting with the Manchester City Council Lead Local Flood Authority (LLFA) was held on 09/09/2022. The proposed drainage strategy and design criteria was outlined. The proposals were generally accepted by the LLFA representative, and no objections were made to the strategy.

5.3 Climate Change

Climate change allowances are based on the Irwell Management Catchment peak rainfall allowance table for the 1% annual exceedance rainfall event produced by the EA. For the proposed development, the design life is considered as more than 50 years and design is considered at the upper end.

Allowance category	Total potential change anticipated for the 2050's	Total potential change anticipated for the 2070's
Upper End	+40%	+45%
Central	+25%	+30%

Table 1 - Climate change allowances for peak rainfall in England (1981-2000 baseline)

5.4 Drainage Hierarchy

Surface water disposal should be in accordance with the drainage hierarchy in Building Regulations Part H 2010 (2015 Edition). This hierarchy is briefly described below:

- Step 1. Disposal on Site
  Disposal via infiltration SuDS (Sustainable Drainage Systems) methods should be considered as the first option. The SuDS Manual (CIRIA C753) provides descriptions of the various methods of providing infiltration

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SuDS including systems such as soakaways, basins and filter strips, together with swales, pervious pavements, detention basins, ponds and other wetland solutions.

Infiltration SuDS such as soakaways should be located, as a minimum, 5m away from any building footprints and title boundaries. The Ground Conditions Design Note shows that the site is underlain mostly by made ground and due to the proximity to the proposed buildings and surrounding developments, this option is therefore not considered to be viable. Refer to Appendix F for Ground Conditions Design Note.

- Step 2. Disposal to a Watercourse
  The nearest watercourses to the site are the River Irk 200m to the west of the site. Due to the significant distance between the river and the proposed development, any direct connection to the watercourses is not considered viable.

- Step 3. Disposal to a Public Sewer
  In the event that infiltration SuDS are deemed not suitable, surface water flows will need to be restricted and connected into the existing public sewers. The peak flow rates of surface water leaving the site shall be no greater than 25.3 l/s as per the pre-development response from UU. Attenuation must be provided to cater for the 1in 100 year plus 45% climate change rainfall event.

  It is envisaged to discharge surface water to the public sewer located within Dantzic Street to the west of the site via an existing connection associated with the Co-operative Group headquarters.

5.5 Sustainable Urban Drainage Systems (SuDS)

Sustainable Urban Drainage Systems are used to reduce the impact of surface water from storm events on the existing environment mimicking the natural run-off characteristics of the site and removing pollutants from the urban run-off at source. There are various solutions which are described in the SuDS Manual (CIRIA C753) and include ground level features including swales and ponds, below ground systems (such as tanks, and infiltration techniques like soakaways).

The proposed development considers the use of sustainable drainage techniques in accordance with local policy. The CIRIA SuDS Manual contains a hierarchy of sustainable methods of capturing and storing rainwater in a descending order: from drainage into the ground to recharging water resources. Where infiltration is not possible, surface water should be stored on site in open water features and then released at a controlled rate. The final option is to store surface water in tanks or cellular storage below ground.

Subject to the ground conditions and infiltration rates, SuDS features that could be considered through the detailed design stage include permeable paving, in ground geocellular storage tanks and rain gardens. Non-infiltration SuDS features will not reduce the amount of surface water discharged; however, it will significantly delay and mitigate the peak flood flows from the site.

The hierarchy of SuDS techniques is shown in Table 2:

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Table 2 - SuDS techniques

	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit	Suitability for the Proposed Development	Comments
Most Sustainable ↑	**Living roofs**	√	√	√	**No**	Green roofs are not considered for this scheme, as no suitable buildings are proposed on the site.
	Basins & ponds	√	√	√	**No**	Due to restricted outside space and its intended uses there is no location suitable to accommodate a basin or pond. Due to water quality and maintenance, the proposed water feature will be served by a separate system and is not considered within this category.
	-Constructed Wetlands				**No**	
	-Balancing ponds				**No**	
	-Detention basins				**No**	
	-Retention ponds				**No**	
	Filter strips & swales	√	√	√	**No**	
	Rain Gardens	√	√	√	**Yes**	Rain gardens are proposed within the landscaped areas to the south of the site
	Infiltration devices	√	√	√	**No**	The ground conditions are not suitable for infiltration.
	-Soakaways				**No**	
	-Infiltration trenches & basins				**No**	
	Permeable surfaces	√	√		**Yes**	Areas currently of hard standing can be replaced with permeable surfacing to allow for attenuation underneath subject to ground investigation results and coordination with landscape architect
↓	-Gravelled areas				**No**	Unsuited to landscape design
	-Solid paving blocks				**No**	Unsuited to landscape design
	-Porous pavers				**No**	Unsuited to landscape design
	Tanked systems	√			**Yes**	Underground attenuation tanks are proposed within hardstand areas subject to coordination of services and other constraints.
	-Over-sized pipes/tanks				**No**	Due to limited space and site constraints, oversized pipes are not considered suitable
Least Sustainable	-Attenuation cells				**Yes**	Attenuation cells are proposed under hardstand areas. Subject to further surveys, it may be possible to reuse the existing attenuation tank serving the public realm.

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5.6 Proposed SuDS Measures

5.6.1 Underground tanks/cellular crates

Tanks and/or cellular crates provide an underground storage structure with a high void ratio that is suitable for attenuating surface water flows. Depending on ground conditions, the flows can be released either into the ground through infiltration or into the public sewer drainage system via flow control devices.

Due to the restricted external space for other SuDS features, underground storage structures will form part of a series of attenuation features which will contribute to attenuating the 1 in 100 year storm events + 45% Climate Change.

5.6.2 Rain Gardens

Rain gardens are shallow landscaped depressions that are strategically located to capture runoff from impermeable surfaces. Through the use of engineered soils and vegetation, rain gardens reduce the intensity of runoff rates and volumes in addition to treating pollution. Runoff collected by the rain garden infiltrates through the filter media and depending on ground conditions, is either collected by a perforated pipe or allowed to infiltrate to the in-situ ground.

Rain gardens will not form part of the sites attenuation however will reduce the runoff rate and volume from the site as well as providing a water quality and biodiversity benefit.

5.7 SuDS Operation and Maintenance Plan

5.7.1 Details of the party responsible for each feature

Regular maintenance of the sustainable drainage system is essential to maintain its performance and avoid failure of the mechanical/electrical components. It is anticipated that the maintenance of the attenuation tanks will be undertaken by an experienced contractor, in cases where geocellular units are installed the suppliers will normally offer a maintenance contract for periodic inspections and flushing the system to remove any silt and debris that have been collected. An agreed maintenance programme will be prepared in accordance with the CIRIA guidance and supervised by the adopting authority. This will be included within the Building Manual for the development on completion. An outline maintenance plan is shown in Appendix G.

5.7.2 SuDS Adoption

It is currently understood that all drainage, including SuDS features will remain within the ownership of the developer.

5.7.3 Inspection and Maintenance

A specification for inspection and maintenance actions, including frequency of maintenance tasks required for each proposed SuDS, setting out a minimum standard to which the SuDS system must be maintained. This will include information relating to:

- Schedule of cleaning;
- Inspection;
- General repair and maintenance; and
- Replacement details and lifespan.

This information will include specific requirements of proprietary products. This information will need to be collated during the detailed design as part of the H&S File and O&M Manual for the building(s). Maintenance will be in accordance with the specific requirements of each feature and the chosen attenuation supplier, generally:

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- Geocellular tank – operation and maintenance in accordance with the tank manufacturers guidance and warranty requirements. This will be product specific.
- Rain Garden - operation and maintenance in accordance with landscape architect's specification which should be prepared in accordance with the manufacturer's guidance and warranty requirements. This will be product specific.

5.8 Maintenance Options, Risks and Safeguards

There are many options that will allow the successful operation and maintenance of a SuDS feature for the lifetime of the proposed development. With each maintenance option there may be associated risks for the onsite and surrounding land and property owners; LPA, LHA and LLFA should the chosen maintenance option become compromised.

The most appropriate maintenance option will be specific to the SuDS features employed.

5.9 Safety and Access

Consideration will be given to safety in design and appropriate consideration of access during the design of the SuDS features used.

CDM Regulations 2015 will be considered and applied to the planning, design and construction and long-term maintenance of the SuDS systems used.

5.10 Existing and Proposed Impermeable Areas

The site boundary has a total area of 0.49ha, the existing and proposed permeable/impermeable areas are summarised in Table 3. Refer to Appendix H for details of the existing and proposed impermeable areas.

	Existing Area (m^2)	Proposed Area (m^2)
Permeable	2177	1770
Impermeable	2747	3153

Table 3 - Existing and proposed permeable/impermeable areas

5.11 Proposed Discharge Rate

The as-built drawing C300 (see Appendix C) for the Co-operative Group HQ building drainage, shows that a drainage stub was constructed at manhole MHS1005 to serve the public realm area. The flow rate from the public realm area was limited at this manhole to 50l/s and ultimately discharges to the public combined sewer. A recent CCTV survey has confirmed that the existing public realm area wholly outfalls to the combined sewer via this manhole.

In line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, it is proposed to reduce the runoff rate for the existing impermeable area (2747m2) by 50% and discharge the additional impermeable area (406m2) at Q-bar greenfield runoff rates. Refer to Appendix I for the greenfield runoff rate calculation.

It is therefore proposed to limit the discharge of surface water from the proposed development to 25l/s (50% of existing 2747m2 that is currently limited to 50l/s) + 0.2l/s (Qbar of 532m2) = **25.2 l/s**.

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5.12 Proposed Strategy

The strategy for the surface water drainage of the scheme will be to collect the surface water runoff via surface water channels and discharge to a below ground network that connects to the existing 300x525mm public combined sewer located within Dantzic Street to the west of the site. It is anticipated that the connection to the public combined sewer will be via an existing connection associated with the Co-operative Group headquarters.

Where possible, some impermeable areas will drain into a series of rain gardens to the south of the proposed development. Due to the levels, the rain gardens will have check dams to reduce and slow down the runoff rate and volume and during extreme events, runoff will discharge to the below ground system via an overflow or bypass located within the rain gardens.

Drainage channels will be drained to an underground attenuation tank located at the central space, that will provide a storage volume of 92.7m^3. A flow control chamber will be located downstream the attenuation tank to restrict the flow to 25.2 l/s, as agreed with United Utilities, prior to discharging to the public sewer.

Attenuation is proposed in the form of an underground geocellular attenuation tank. As the location, size and condition of the existing public realm attenuation tank is to be confirmed by further surveys, it is not currently proposed to reuse the tank. If the tank is found to be suitable at a later design stage, the existing tank could provide a proportion of the required attenuation for the site. The location of the attenuation associated with 1 Angel Square is also to be confirmed by further surveys, therefore the location of the proposed attenuation tank is to be confirmed once this is understood.

Refer to Appendix J for proposed surface and foul water drainage general arrangement.

A hydraulic model of the drainage system using Microdrainage has been undertaken to assess the performance of the proposed drainage strategy against the 1 in 1, 1 in 30 and 1 in 100 year storm return period plus 45% climate change, to ensure building is protected against flooding.

Refer to Appendix K for full details of the network and hydraulic performance. Table 4presents a summary of the results:

Critical Storm Event	Return Period (year)	Flow (l/s)
30 min Winter	1	17.1
30 min Winter	30	22.4
60 min Winter	100+45% CC	25.2

Table 4 - Summary results

It should be noted that no flooding is expected for any of the storm events that have been analysed.

5.13 Designing for Exceedance

The proposed site levels are similar to the existing site levels, which means the proposed site will generally fall from northeast to the southwest corner. Any exceedance events will follow the flow paths to Miller Street to the south or Dantzic Street to the northwest. The main roads and public realm will act as the flow paths and divert flow away from buildings to less vulnerable areas.

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The exceedance routes are indicated by blue arrows in Figure 3.



Figure 3 – Exceedance Routes

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6 Foul Drainage Strategy

6.1 General Drainage Strategy

A separate foul drainage system will be provided to collect all foul water generated from site via gravitational flow from below ground floor level and discharge to the existing public sewer. Pumped solutions are not currently envisaged.

All foul water drainage above the ground slab will be designed by building services engineering. All foul water ground slab installation, slab penetrations, under slab drainage and the external foul drainage system is considered as civil infrastructure. Close coordination is required between the civil and building services engineers to connect the above and below ground slab drainage systems.

Under slab foul water drainage will be provided to collect foul water discharge from ground slab installations, and sewer vent pipes (SVPs) and convey by gravity to an external below ground foul drainage system.

External foul water drainage will be provided to collect foul water drainage and convey by gravity to the receiving public sewer. The external foul drainage systems will include pipe sewers, concrete and brick manholes, vent pipes, connector pipes and associated works.

6.2 Proposed Foul Water Drainage

Foul water disposal should be in accordance with the Part H “Drainage and Waste Disposal” of the Building Regulations.

Disposal will be to the public combined sewers in the vicinity of the site. Any new connections to the existing sewer system will require approval from the relevant authority. United Utilities confirmed that the foul water from this site can be drained at an unrestricted rate to the public combined sewer network.

Within the Pre-development Enquiry response from United Utilities, it was noted that the preferred point of discharge would be to the 300x525mm public combined sewer located within Dantzic Street to the west of the proposed development at an unrestricted rate. A new foul water connection is therefore proposed to this combined sewer to serve a potential future community structure and the water feature.

Foul drainage will need to make an allowance for grease traps/interceptors for kitchen areas in the above ground drainage systems. Refer to Appendix J for proposed surface and foul water drainage general arrangement.

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7 Conclusions

This drainage strategy has been prepared in support of the planning application to set the principles for the drainage design to serve the Angel Square public realm development. The exact configuration and nature of the drainage will be determined at the detailed design / discharge of planning conditions stage.

As a result of the existing conditions on site, surface water flows are anticipated to discharge to the existing combined public sewer located within the site boundary to the west of the site within Dantzic Street.

The strategy for the surface water drainage of the scheme will be to collect the surface water runoff generated and discharge to the existing combined public sewer located within Dantzic Street at a restricted flow rate.

Attenuation storage will be required to facilitate the reduction of the proposed flows, and SuDS will be included wherever practicable.

Proposed surface water discharge rate is 25.2l/s and the attenuation volume require will be 92.7m^3. This attenuation will be provided in the form of below ground geocellular tank.

A separate foul drainage system will be provided to collect all foul water generated from site via gravitational flow from below ground floor level and discharge to the existing public sewer. United Utilities confirmed that the foul water from this site can be drained at an unrestricted rate to the public combined sewer network.

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Appendix A Topographical Survey

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KEEP CLEAR
KEEP CLEAR
Munster Street
Temporary Building
Stairway
Area under construction
Asphalt carpark
Brick building
Crushed stone
Shrubs
Grass
CPS

Appendix B LLFA Data Screening

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MANCHESTER
CITY COUNCIL

Lead Local Flood Authority
Highways Service
Growth and Neighbourhoods Directorate
Manchester City Council
PO Box 532
Town Hall
Manchester
M60 2LA
Email: floodriskmanagement@manchester.gov.uk

DATE 10/05/2021

Dear Sir or Madam,

RE: Our Ref: MCC010/05/2022

We acknowledge with thanks your payment received on 09/05/2022 for our LLFA data screen service.

Please find enclosed plan showing the results of the data screen. The position of features shown on this plan is approximate only and is given in accordance with the best information currently available.

The enclosed plan cannot be used to substitute a competent site investigation.

The enclosed plan is being provided to you subject to Manchester City Council's terms and conditions which are shown attached.

I trust the above meets your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter, please do not hesitate to contact us.

Yours Faithfully,

Neil Bayliss-Rowe, Highways Development Control & Flood Risk Manager, Lead Local Flood Authority

MANCHESTER
CITY COUNCIL

TERMS AND CONDITIONS – LLFA DATA SCREEN

These provisions apply to LLFA data supplied by Manchester City Council ("MCC").

TERMS AND CONDITIONS:

- This data Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- MCC has taken all reasonable care to compile this data Map. This data Map and any information supplied with it is provided for general guidance only and MCC makes no representation, undertaking or warranty of any kind as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position of any culverted assets shown on the data Map are approximate only. MCC strongly recommends that a comprehensive site investigation is undertaken in addition to reviewing this data Map to determine and ensure the precise location of any assets. The exact location, positions and depths should be obtained by an appropriate survey which may include but shall not be limited to GPR and CCTV.
- The data screened may be modified over time without notice and therefore this data Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the data Map have been made subsequent to issue and prior to any works being carried out.
- This data Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) or for the purpose of determining the suitability of a point of connection to discharge.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising from damages of any kind caused to assets by reason of the actual position and/or existence of assets being different from those shown on the data Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent MCC from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

MANCHESTER
CITY COUNCIL

DATA SCREEN SYMBOLOGY

Bridge

- Good
- Fair
- Poor
- Very Poor
- Unknown

Trash Screen

- Good
- Fair
- Poor
- Very Poor
- Unknown

Culvert Orifice

- Very Good
- Good
- Fair
- Poor
- Very Poor
- Unknown

Culvert Conduit

- CCTV surveyed
- Not CCTV surveyed
- Ordinary Watercourse Conduit

- MCC SuDS
- MCC Flood Incident Points
- MCC Section 19 Report
- MCC Flood Incident Polygons
- MCC Local Authority Boundary

Supplementary Information where available:

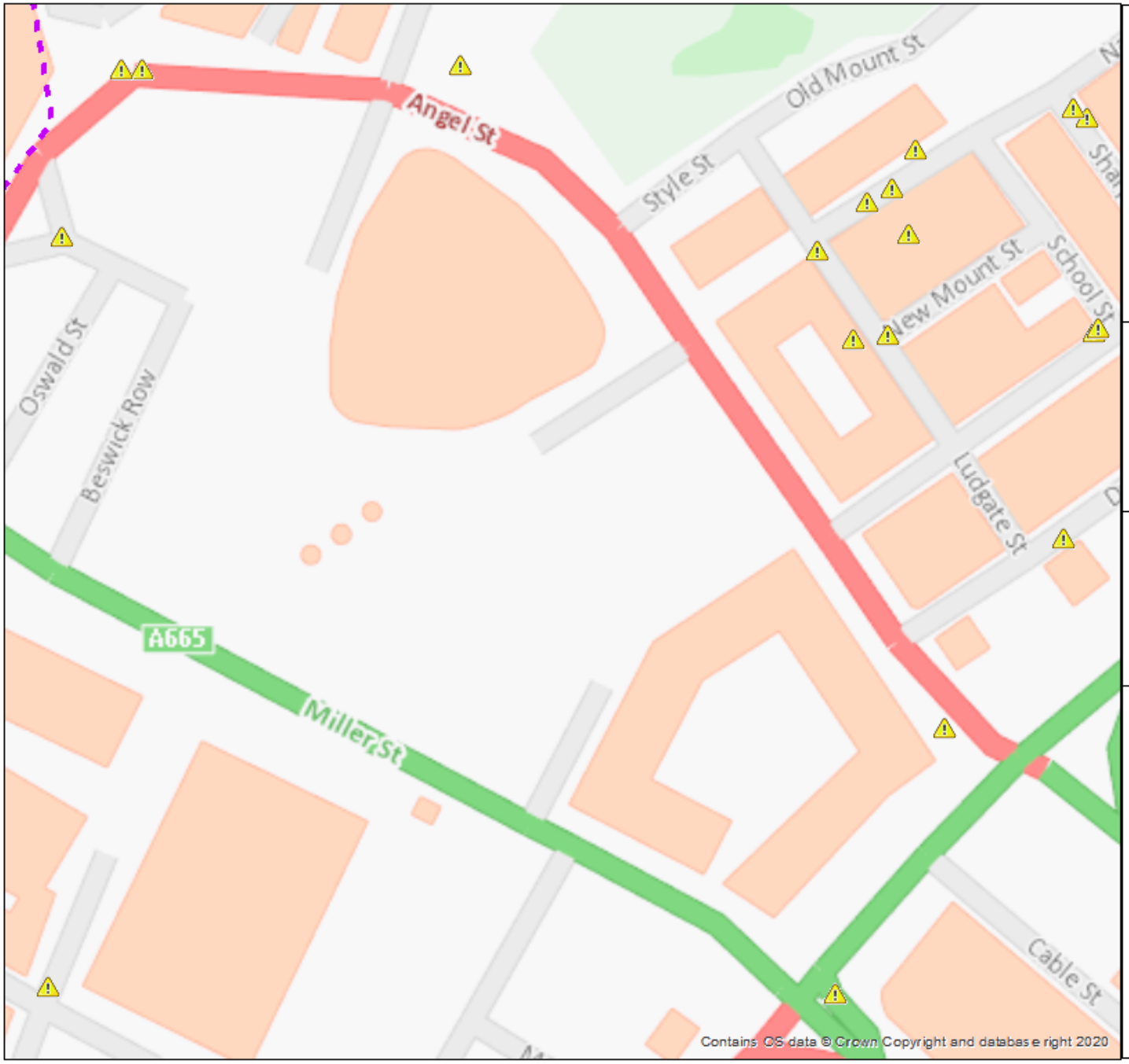
Critical Drainage Area – The site is within the Conurbation Core CDA.

Flood Incidents - There are no recorded flood incidents onsite. The nearest recorded (approximately 50m northeast of the Site) is 'flooding on the highway' dated 16/03/2022.

Culvert Conduits – The LLFA asset register does not record any known or indicative culverted ordinary watercourses within the site boundary. The closest indicative culverted ordinary watercourse is approximately 150m to the northwest.

Survey and Design Archive – The 1984 Manchester City Council drainage survey does not record any known or indicative ordinary watercourses within the site boundary. A georeferenced extract is enclosed.

Any other information identified by LLFA officer during screening – United Utilities records available to us indicate an abandoned combined sewer may cross the northern part of the site. We recommend United Utilities are consulted to confirm whether this asset exists onsite and whether it has been properly decommissioned.



MANCHESTER CITY COUNCIL

LLFA DATA SCREEN

Address/Site Ref:
Angel Square

Our Ref: **MCC010/05/2022**

Author: Manchester City Council LLFA
Date: 10/05/2022
Scale: 1:1,493

The position of features shown on this plan is approximate only and is given in accordance with the best information currently available. Manchester City Council will not accept liability for any loss or damage caused by the actual position being different from those shown.

N

0 10 20 40
Meters

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MANCHESTER CITY COUNCIL

LLFA DATA SCREEN

Address/Site Ref:
Angel Square

Our Ref: **MCC010/05/2022**

Author: Manchester City Council LLFA
Date: 10/05/2022
Scale: 1:1,493

The position of features shown on this plan is approximate only and is given in accordance with the best information currently available. Manchester City Council will not accept liability for any loss or damage caused by the actual position being different from those shown.

N

0 10 20 40
Meters

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Appendix C As-built Drawings

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LEGEND:

- PROPOSED FOUL WATER DRAIN
- PROPOSED SURFACE WATER DRAIN
- PROPOSED COMBINED SEWER
- PROPOSED ROOF WATER DRAIN
- PROPOSED DRAINAGE CHANNEL
- PROPOSED FOUL WATER MANHOLE
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED COMBINED MANHOLE
- PROPOSED OVERFLOW FROM LEAF FILTER
- PROPOSED GULLY
- EXISTING PUBLIC COMBINED SEWER DRAINAGE
- ABOVE GROUND FOUL SLAB PENETRATION / DRAIN POINT
- RWP — RAINWATER DOWNPIPE
- PROPOSED FRENCH DRAIN
- INDICATES PROPOSED SLOT DRAIN

SADDLE CONNECTION TO EXISTING UNITED UTILITIES COMBINED SEWER. SEE NOTE 21

MHF2000

MHF2001

GULLY (SEE DETAIL ON SK-L-081) TO COLLECT DISHED CHANNELS (LOCATION OF CHANNELS BY OTHERS.)

SOAK AWAY (SEE DETAIL ON SK-L-081) MIN 4mx1mx3m DEEP

PPIC (SEE DETAIL ON SK-L-081)

SURFACE WATER MANHOLE TO COLLECT CHANNEL DRAINAGE IN PUBLIC REALM ADJACENT TO DANTZIC STREET. CONNECTION FROM LINEAR CHANNEL TO MANHOLE TO BE MADE VIA EXTERNAL BACKDROP. SEE NOTE 21

EXISTING HIGHWAY GULLIES TO BE RELOCATED TO SUIT PROPOSED ACCESS ROAD LEVELS

EXISTING UNITED UTILITIES MANHOLE:
CL: 38.80m AOD
IL: 34.464m AOD
PIPE DIA.: (ASSUMED FROM BAM SITE SURVEY, TBC. SEE NOTE 14)

CARRIER LAND DRAIN REFER TO SK-L-081 FOR DETAILS

SOAK AWAY (SEE DETAIL ON SK-L-081) MIN 1mx0.5mx3m DEEP

GULLY (SEE DETAIL ON SK-L-081) TO COLLECT DISHED CHANNELS (LOCATION OF CHANNELS BY OTHERS.)

SOAK AWAY (SEE DETAIL ON SK-L-081) MIN 4mx1mx3m DEEP

BIRCO 100 5/0 CHANNEL UNIT WITH OUTFALL. DETAILS TO BE CONFIRMED FOLLOWING RE-DESIGN OF DANTZIC STREET - BY OTHERS

4m EASEMENT BOUNDARY FROM PUBLIC SEWER (SEE NOTE 22)

4m EASEMENT BOUNDARY FROM PUBLIC SEWER (SEE NOTE 22)

SURVEY DONE BY LANES FOR DRAINS

SURVEY DONE BY GRISEDALE 2000

8.5m EASEMENT BOUNDARY FROM PUBLIC SEWER (SEE NOTE 22)

CONNECTION BY NEW MANHOLE TO EXISTING UNITED UTILITIES PUBLIC SEWER (SEE NOTE 9)

NEW PUBLIC MANHOLE:
CL: 39.73m AOD
EASTING=384288.952
NORTHING=399036.778
SEE NOTE 14 & 21

SITE SURVEY OF PUBLIC DRAINAGE BY CONTRACTOR. SEE NOTE 14

MHS1005

MHF1005

MHS4000

225mm DIAMETER DRAINAGE STUB LAID AT 1:50 TO SERVE PUBLIC REALM CONTRACT BY OTHERS: FLOW TO BE LIMITED TO A MAXIMUM OF 50l/s
IL (END OF STUB) = 36.732m. AOD
EASTING =384293.104
NORTHING =399030.595

MHF1004

MHS1004

WATER FLOW CONTROL DEVICE LIMITING FLOW TO 14l/s AT A HEAD OF 1.4m

FW RUN COMES FROM INSIDE THE BUILDING AT LOW LEVEL
FW OUTLET
IL: 42.7 AOD

NON RETURN VALVE TO BE FITTED ON FOUL PIPE

RISING MAIN FROM BASEMENT SURFACE WATER PUMP. MAX DISCHARGE 5 L/S.

RWP RUNS COME FROM INSIDE THE BUILDING AT LOW LEVEL

SEE NOTE 13

8 X 200mmØ RWP'S. 5 X SYPHONIC & 3 X GRAVITY. SEE NOTE 7

MHF1003

MHS1003

MHS3000

MHS2000

MHF1002

MHS2001

MHS2002

MHS1002

LEAF FILTER CHAMBER. SEE NOTES 15, 16 & 17

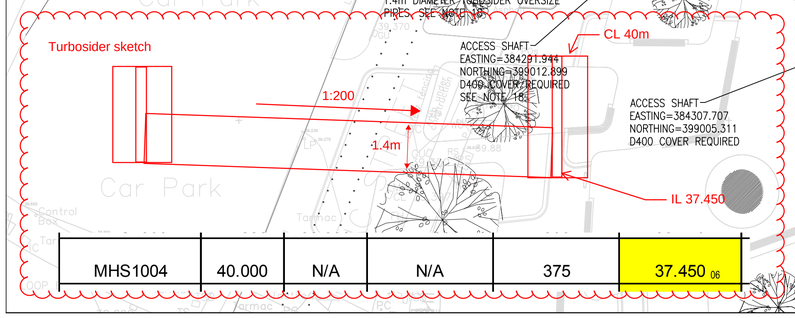
STORM WATER ATTENUATION TANK. MINIMUM CAPACITY OF 55m³. 2 X 1.4m DIAMETER TUBOSIDER OVERSIZE PIPES. SEE NOTE 18

RAINWATER HARVESTING TANK. REFER TO M&E DETAILS.

ACCESS SHAFT
EASTING=384291.944
NORTHING=399012.899
D400 COVER REQUIRED
SEE NOTE 18

ACCESS SHAFT
EASTING=384307.707
NORTHING=399005.311
D400 COVER REQUIRED

Turbosider sketch



MHS1004	40.000	N/A	N/A	375	37.450 06

MHF1000

MHF1001

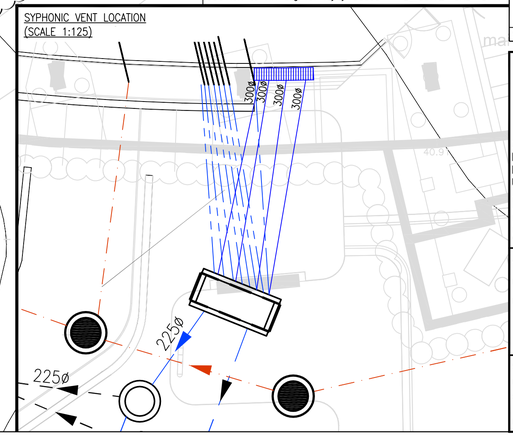
MHS1001

MH-TD1

SEE DRAWING 9W2827-TD-050001 (BH) FOR LAYBY/TURNING HEAD ARRANGEMENT AND LAND DRAINAGE REQUIREMENTS.

SLOT DRAIN POSITIONS TAKEN FROM DRAWING PW2827-TD-050001

SYPHONIC VENT LOCATION (SCALE 1:125)



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DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

- DEEP MANHOLE / DRAINAGE FEATURES -UP TO 4m
- POTENTIAL IN-SITU MANHOLE - MHS2000
- WORKS IN CLOSE PROXIMITY TO PILE WALL: STRUCTURE
- CLOSE TO STRUCTURAL FOUNDATION SOLUTION
- CLOSE TO DEEP BASEMENT EXCAVATION

MAINTENANCE/CLEANING/OPERATION.

- DEEP MANHOLE / DRAINAGE FEATURES - UP TO 4m
- HIGH FLOW RATE DURING PEAK STORMS
- COMBINED SEWER
- CLOSE PROXIMITY TO STEPS

DECOMMISSIONING/DEMOLITION.

- DEEP MANHOLE / DRAINAGE FEATURES - UP TO 4m
- HIGH FLOW RATE DURING PEAK STORMS
- COMBINED SEWER
- CLOSE PROXIMITY TO STEPS
- POTENTIAL WORKS TO PUBLIC SEWER ON PUBLIC HIGHWAY

Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. DRAWING TO BE READ IN CONJUNCTION WITH BH BELOW GROUND SPECIFICATION.
3. SEE BH DRAWINGS C320 - C322 FOR DRAINAGE DETAILS.
4. REFER TO BH DRAWING C140 FOR CONSTRUCTION MANHOLE SCHEDULES.
5. RAIN WATER DOWNPIPE FLOW RATES HAVE BEEN CONFIRMED BY ROTARY / S. L SEALY 25.10.10. A WORST CASE VALUE OF 160L/S HAS BEEN PROVIDED FOR THE ENTIRE ROOF AREA. INDIVIDUAL DOWNPIPE FLOW RATES AND TO BE CONFIRMED BY ROTARY.
6. PUBLIC REALM DRAINAGE TO BE CONFIRMED.
7. LOCATION OF FOUL AND SURFACE WATER DOWNPIPES, ROUTES THROUGH BUILDING, PIPE SIZES & SET OUT BY M & E ENGINEER AND ARCHITECT.
8. EXTERNAL PIPE DIAMETERS SHOWN ARE SIZED BASED ON BUILDING DRAINAGE ONLY. INTERNAL PIPE SIZES ARE TO BE CONFIRMED BY THE PUBLIC HEALTH ENGINEER.
9. FOUL AND SURFACE WATER CONNECTIONS TO THE PUBLIC SEWER NETWORK HAVE BEEN AGREED WITH UNITED UTILITIES 25.10.10.
10. PUBLIC REALM DRAINAGE DESIGN. TO BE CONFIRMED FOLLOWING APPOINTMENT OF PUBLIC REALM ARCHITECT.
11. SURFACE WATER DISCHARGE RATE FOR THE ENTIRE DEVELOPMENT (INCLUDING PUBLIC REALM AREA) TO BE 200L/S. AGREED WITH UNITED UTILITIES 27/8/10. THE PUBLIC REALM AREA IS TO BE LIMITED TO A DISCHARGE RATE OF 50L/S AND THE MAIN BUILDING DRAINAGE TO 150L/S
12. ALL PIPE SIZES TO BE 150mmØ UNLESS OTHERWISE STATED.
13. VENTILATION FOR THE SYPHONIC BREAK MANHOLE VIA 4 x 300mmØ VITRIFIED CLAY PIPES CONNECTED TO A BESPOKE FLOOR GRILLE. EXACT LOCATION AND DETAIL OF FLOOR GRILLE TO BE SET OUT BY THE ARCHITECT. SYPHONIC MANHOLE DETAIL TO BE CHECKED BY SYPHONIC DRAINAGE SPECIALIST PRIOR TO CONSTRUCTION. REGULAR INSPECTION/CLEANING OF VENTED GRILL E AND VENT PIPES REQUIRED TO ENSURE SYSTEM OPERATES DURING PEAK STORMS.
14. SURVEY OF PUBLIC SEWER IN DANTZIC STREET PROVIDED BY BAM 03,11,10. DUES TO SURVEY TOLERANCES (SONIC TRACING), THE INVERT LEVEL LEVEL OF THE NEW ADOPTABLE PUBLIC MANHOLE HAS BEEN SET TO 36.000m AOD. INVERT LEVEL OF NEW PUBLIC MANHOLE TO BE CONFIRMED BY CONTRACTOR DURING CONSTRUCTION.
15. SEE M&E AND AQUACO MANUFACTURERS SPECIFICATIONS FOR LEAF FILTER DETAILS AND MANHOLE CONSTRUCTION INFORMATION. A DROP OF 325mm FROM THE INLET TO THE FILTERED WATER OUTLET HAS BEEN ACCOUNTED FOR IN THE SYSTEM DESIGN AND ON THE MANHOLE SCHEDULE.
16. THE INVERT LEVEL OF THE OVERFLOW OUTLET FROM THE LEAF FILTER CHAMBERS ARE 175mm BELOW THE OULETS TO THE RAINWATER HARVESTING TANK.
17. LEAF FILTER OVERFLOW INVERT LEVELS:
    MHS2001 = 40,141m AOD
    MHS3000 = 40,141m AOD
18. TUBOSIDER TO PROVIDE ATTENUATION TANK CONSTRUCTION DETAILS, LAYOUT AND SIZE PROVIDED BY TUBOSIDER 05,11,10. TANK REQUIRES A MINIMUM OF 650mm OF COVER.
19. INVERT LEVEL OF MHS1005 CURRENTLY 36,613m AOD. THIS IS TO BE CONFIRMED UPON RECEIPT OF THE INVERT LEVEL OF THE NEW PUBLIC MANHOLE IN DANTZIC STREET.
20. ALL MANHOLES (EXCLUDING THE ADOPTABLE MANHOLE IN DANTZIC STREET) ARE TO HAVE RECESSED COVERS.
21. CONNECTION DETAILS (X3) TO UNITED UTILITIES SEWER IN DANTZIC STREET CONFIRMED BY UNITED UTILITIES 12.10.10.
22. SEWER EASEMENT CONFIRMED BY UNITED UTILITIES 15/12/10.

Rev	Description	Date	Drn	Ch'd
C05	MHF2001 Added	31.08.11	LM	VB
C04	Easement Boundary Text Amended	16.02.11	PP	VB
C03	Easement Boundary Amended Floor Grille Relocated	28.01.11	SG	VB
C02	RWH Tank Co-ordinates Updated	23.11.10	PP	MH
C01	Layout Amended. Notes Added	12.11.10	PP	MH
C00	Construction	05.11.10	PP	VC
E	Contract	11.06.10	LM	RAM
D	Stage E	31.03.10	LM	RAM
C	Stage D+	22.02.10	LM	RAM
B	Issued for Planning	18.11.09	LM	RAM
A	Stage D	19.10.09	LM	RAM
C07	FINAL CONSTRUCTION ISSUE LAND DRAINAGE ADDED	11.12.12	SAB	DPN
C07	FINAL CONSTRUCTION ISSUE.	11.10.12	SAB	DPN
C06	Ref. to RH drg for layby added	22.03.12	SAB	DPN

FINAL CONSTRUCTION

Status of drawing

2 Brewery Place
Brewery Wharf
Leeds LS10 1NE
UK
Tel: +44 (0)113 204 2200
Fax: +44 (0)870 787 4144
Email: 023842@burohappold.com
Web: www.burohappold.com

Buro Happold
Consulting Engineers

Architect: 3D Reid Architects
Project: Co-operative Group New Head Office
Drg Title: External Drainage Layout

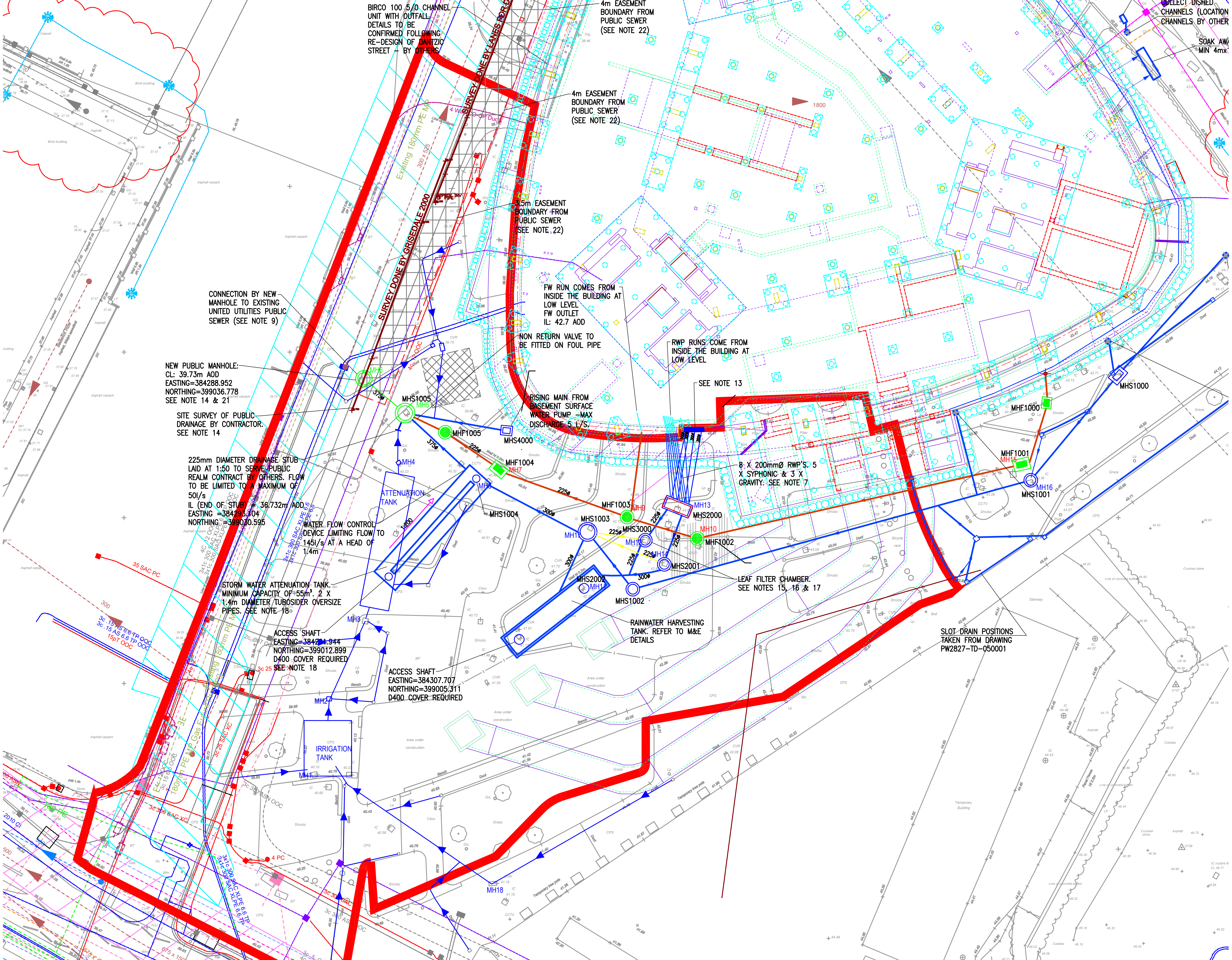
Scales@A1 1:250
Drawn by LM
Checked by RAM
Date October 2009

Job No. 023842
Drawing No. C300
Rev C07

Admin Local \\arc-prospero\vgpa-global-hert\BH-Tools\Title_Sheets\Borders\A1.dwg 28/02/2008 DWF6 ePlot.pc3

Appendix D CCTV Drainage Survey

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BIRCO 100 5/0 CHANNEL UNIT WITH OUTFALL. DETAILS TO BE CONFIRMED FOLLOWING RE-DESIGN OF DANTZIC STREET - BY OTHERS
4m EASEMENT BOUNDARY FROM PUBLIC SEWER (SEE NOTE 22)
4m EASEMENT BOUNDARY FROM PUBLIC SEWER (SEE NOTE 22)
3.5m EASEMENT BOUNDARY FROM PUBLIC SEWER (SEE NOTE 22)
SOAK AWAY MIN 4mx
SURVEY DONE BY LANES FOR DUCTS
SURVEY DONE BY GRISEDALE 2000
Existing 180mm PE MP
300 x 525
1800
FW RUN COMES FROM INSIDE THE BUILDING AT LOW LEVEL FW OUTLET IL: 42.7 AOD
NON RETURN VALVE TO BE FITTED ON FOUL PIPE
RWP RUNS COME FROM INSIDE THE BUILDING AT LOW LEVEL
SEE NOTE 13
CONNECTION BY NEW MANHOLE TO EXISTING UNITED UTILITIES PUBLIC SEWER (SEE NOTE 9)
NEW PUBLIC MANHOLE: CL: 39.73m AOD EASTING=384288.952 NORTHING=399036.778 SEE NOTE 14 & 21
SITE SURVEY OF PUBLIC DRAINAGE BY CONTRACTOR. SEE NOTE 14
RISING MAIN FROM BASEMENT SURFACE WATER PUMP -MAX DISCHARGE 5 L/S.
MHS1005
MH5
MH6
MHF1005
MHS4000
MHF1004
MH7
MH4
MH8
MHS1004
225mm DIAMETER DRAINAGE STUB LAID AT 1:50 TO SERVE PUBLIC REALM CONTRACT BY OTHERS. FLOW TO BE LIMITED TO A MAXIMUM OF 50l/s IL (END OF STUB) = 36.732m AOD EASTING =384293.104 NORTHING =399030.595
ATTENUATION TANK
WATER FLOW CONTROL DEVICE LIMITING FLOW TO 145l/s AT A HEAD OF 1.4m
8 X 200mmØ RWP'S. 5 X SYPHONIC & 3 X GRAVITY. SEE NOTE 7
MHF1003
MH9
MHS1003
MH11
MHS3000
MH12
MH13
MHS2000
MH10
MHF1002
MH14
MHS2001
MHS2002
MH17
MHS1002
LEAF FILTER CHAMBER. SEE NOTES 15, 16 & 17
MHS1000
MHF1000
MHF1001
MH15
MH16
MHS1001
STORM WATER ATTENUATION TANK. MINIMUM CAPACITY OF 55m³. 2 X 1.4m DIAMETER TUBOSIDER OVERSIZE PIPES. SEE NOTE 18
ACCESS SHAFT EASTING=384294.944 NORTHING=399012.899 D400 COVER REQUIRED SEE NOTE 18
ACCESS SHAFT EASTING=384307.707 NORTHING=399005.311 D400 COVER REQUIRED
RAINWATER HARVESTING TANK. REFER TO M&E DETAILS
SLOT DRAIN POSITIONS TAKEN FROM DRAWING PW2827-TD-050001
MH3
MH2
MH1
IRRIGATION TANK
MH18
35 SAC PC
4 PC

Appendix E United Utilities Correspondence

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Daniel Carroll

From: wastewaterdeveloperservices@uuplc.co.uk
Sent: 26 August 2022 11:55
To: Daniel Carroll
Cc: Paul Thomson
Subject: PDE for: Angel Square UU Ref : 02673405

External Email. This email originated from outside Buro Happold.

Good morning Daniel,

Pre Development Enquiry for: Angel Square UU Reference Number : 02673405

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

https://www.unitedutilities.com/builders-developers/working-near-our-assets/

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 300*525mm public combined sewer located to the West of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

Please ensure all proposed manhole chambers cover levels and finished floor levels are higher than the receiving public sewer.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.
This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**

2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The **North West SuDS Pro-Forma** provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

https://www.gov.uk/government/publications/groundwater-protection-position-statements

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

United Utilities acknowledge that the nearest watercourse is a significant distance off-site.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 300*525mm public combined sewer located West of the proposed site at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 25.3l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the pubic sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

According to our public sewer records there are public sewers located within your site boundary. We will require unrestricted access to the sewer for maintenance purposes, we would ask that you maintain a minimum clearance of 6m which is measured 3m from the centre line of the pipe unless there happens to be a formal easement agreement in place, in which case the specified easement width would apply. If you cannot achieve this then you may wish to consider diverting and or abandoning the public sewer.

Please be aware that any proposed diversion may require modelling. This process may take up to 6 months in order to reach an acceptable design.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/

Please refer to the link below to obtain full details of the processes involved with sewer closure:

https://www.unitedutilities.com/builders-developers/wastewater-services/close-a-sewer/sewer-closures/

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address: DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/

Connection Application

Although we may discuss and agree discharge points and 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:

https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

Many thanks and kind regards,

United Utilities
Water for the North West

Mohammed Aljafarawi (He/Him)
Developer Engineer
Developer Services & Metering
Customer Services
M: 07950474499
unitedutilities.com

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www.unitedutilities.com/subsidiaries

Daniel Carroll

From: Daniel Carroll
Sent: 16 August 2022 10:05
To: wastewaterdeveloperservices@uuplc.co.uk
Cc: Paul Thomson
Subject: Angel Square - Wastewater Pre-development Enquiry
Attachments: Angel Square - Site Location Plan.pdf; Angel Square - Topographical Survey.pdf; C300.pdf; Angel Square - Greenfield Runoff Rate.pdf; Angel Square - Wastewater Pre-development Enquiry.pdf

Dear Sir/Madam,

Please find the wastewater pre-development enquiry attached for Angle Square, Manchester.

The existing site is occupied by public realm with a combination of hard landscaping and planting. The existing impermeable area is drained via a network of traditional slot drains and channels. The proposed development involves the regeneration of this public realm area. The existing and proposed permeable/impermeable areas are summarised in the table below:

	Existing Area (m^2)	Proposed Area (m^2)
Permeable	2177	1644
Impermeable	2747	3279

Referring to the attached as-built drawing (C300) for the Co-operative Group HQ building drainage, it is evident that a drainage stub was constructed at manhole MHS1005 to serve the public realm area. The flow rate from the public realm area was limited at this manhole to 50l/s and ultimately discharges to the public combined sewer. A recent CCTV survey has confirmed that the existing public realm area wholly outfalls to the combined sewer via this manhole..

In line with the Manchester Trafford and Salford Strategic Flood Risk Assessment, it is proposed to reduce the runoff rate for the existing impermeable area (2747m^2) by 50% and discharge the additional impermeable area (532m^2) at Q-bar greenfield runoff rates. We therefore propose the discharge rate of 25.3 l/s (greenfield calculation attached). Please advise whether this strategy is acceptable.

It is currently proposed that a foul connection to the combined sewer will also be required for a maintenance shed. Please confirm whether this is acceptable in principle.

We would welcome your comments on any additional issues or concerns you may have involving the site. If you require any further information to assist with the enquiry, please do not hesitate to contact me.

Kind regards,
Daniel

Daniel Carroll
Infrastructure Engineer
Buro Happold | Cities - Infrastructure
Tel: +44 (0)161 819 3426
www.burohappold.com | Twitter | Instagram

Wastewater pre-development enquiry

United Utilities
Water for the North West

Please complete this form for enquiring about drainage strategies and points of connection for new developments.

You can fill in this form, just save a copy, complete it and email it to **WastewaterDeveloperServices@uuplc.co.uk** alternatively you can print the form and post it to us at this address **United Utilities Developer Services, Second Floor, Grasmere House, Lingley Mere Business Park, Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP**

All fields are required unless otherwise stated. Please note incomplete information may cause delays to your application. When answering the yes/no questions please tick in the appropriate box. Please keep a copy of the completed application for your records.

If you need any help completing the form please call us on **0345 072 6067** and we'll be happy to help.

We aim to respond to enquiries within 15 working days from receipt of your completed enquiry form.

Section 1: Your details			
Are you (please tick)	Developer ☐ Consultant ☑ Land owner ☐ Other (please state) ☐		
Name	Daniel Carroll		
Company Name (if applicable)	Buro Happold		
Address (including post code)	Buro Happold 2nd Floor Eastgate 2 Castle Street Manchester M3 4LZ		
Telephone number	0161 819 3426		
Email address	Daniel.Carroll@BuroHappold.com		
Section 2: Development details			
Do you intend to offer any of the sewers for adoption by United Utilities under S104?		Yes ☐ No ☑	
Please provide as much of the site address that is available. This address must contain a road name, town/city.			
Address (including nearest postcode)	Public Realm Area to the South of Co-operative HQ, 1 Angel Sq, Manchester. Postcode: M60 0AG		
Site name	Angel Square		
The grid reference is a 12 digit grid reference split into two 6 digit numbers (X and Y).			
Grid reference number	Easting: 384298 Northing: 399004		
Development type	Commercial ☑ Residential ☐		
Approx. number units	0		
Total site area (hectares)	0.49		
Does this site have planning permission?		Yes ☐ No ☑	
Planning reference number			
Council area	Manchester City Council		
Have you approached us about this site previously?	Yes ☐ No ☑	If yes, please provide reference number	
Is the development part of a larger site that will be developed in phases?		Yes ☐ No ☑	

Section 3: Previous land use			
Please confirm what the land was previously used for and provide the following information:			
Greenfield	☐	**Brownfield** Evidence of positive drainage to the public sewer must be provided (Drawings showing connecting pipe sizes, permeable/impermeable areas)	☑

Section 4: Drainage strategy			
Foul connection: How are you proposing to drain foul flows from the site?			
Via an existing connection to the public sewer?	☐	Via a new connection to the public sewer?	☑
Do your drainage proposals involve pumping to the public sewer network?		Yes ☐ No ☑	
Surface water connection: How are you proposing to drain your site, following the surface water hierarchy, as outlined in National Planning Policy Guidance? Please indicate below and provide evidence to support your strategy			
Infiltration ☐ Surface water body ☐ Surface water sewer/Highway Drain ☐ Combined sewer ☑			
SuDS: Have SuDS features been considered in the surface water drainage strategy?		Yes ☑ No ☐	

Section 5: Supporting Information	
Please confirm that the following list of information has been provided to support with your enquiry:	
• Site location plan including site boundary and road/street names	Yes ☑ No ☐
• Preferred drainage outfall route(s) and point(s) of access etc.	Yes ☑ No ☐
• Topographical survey	Yes ☑ No ☐
• Ground investigation report	Yes ☐ No ☑
• Evidence of existing drainage connections and estimated rates of discharge (for Brownfield sites)	Yes ☑ N/A ☐
• Full calculations to show pre-development surface water rates for Greenfield sites	Yes ☐ N/A ☑

Section 6 : Declaration			
I understand that the submission of this form is to be treated as a preliminary enquiry and the information may be subject to change. In particular, I understand that the information United Utilities Water Limited provides in response is only valid in conjunction with the information provided in relation to this enquiry, any changes to regulation or development layout will invalidate our response.			
Signature		Date	15/08/2022
Print Name	Daniel Carroll	Position	Engineer

United Utilities
Water for the North West

About us

United Utilities is the North West s water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

United Utilities Water Limited, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington WA5 3LP.
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Appendix F Ground Investigation Report

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Design Note

BURO HAPPOLD

Project	NOMA Angel Square
Subject	Summary of Ground Conditions and Planning Status
Project no	0052681
Date	3 October 2022

Revision	Description	Issued by	Date	Approved (signature)
00	For Planning	LR	22/9/22	PH
01	Review of historic ground engineering documents and planning responses	LR	3/10/22	PH

1.1 Introduction

Buro Happold have been appointed by MEPC to provide technical planning support and advice for the proposed NOMA Angel Square. The site is located to the south of the existing 1 Angel Square site (Figure 1 refers). The proposals comprise the redevelopment of the area of public realm. This design note provides a high level summary of the ground conditions, historical planning documentation and an analysis of existing / proposed levels.

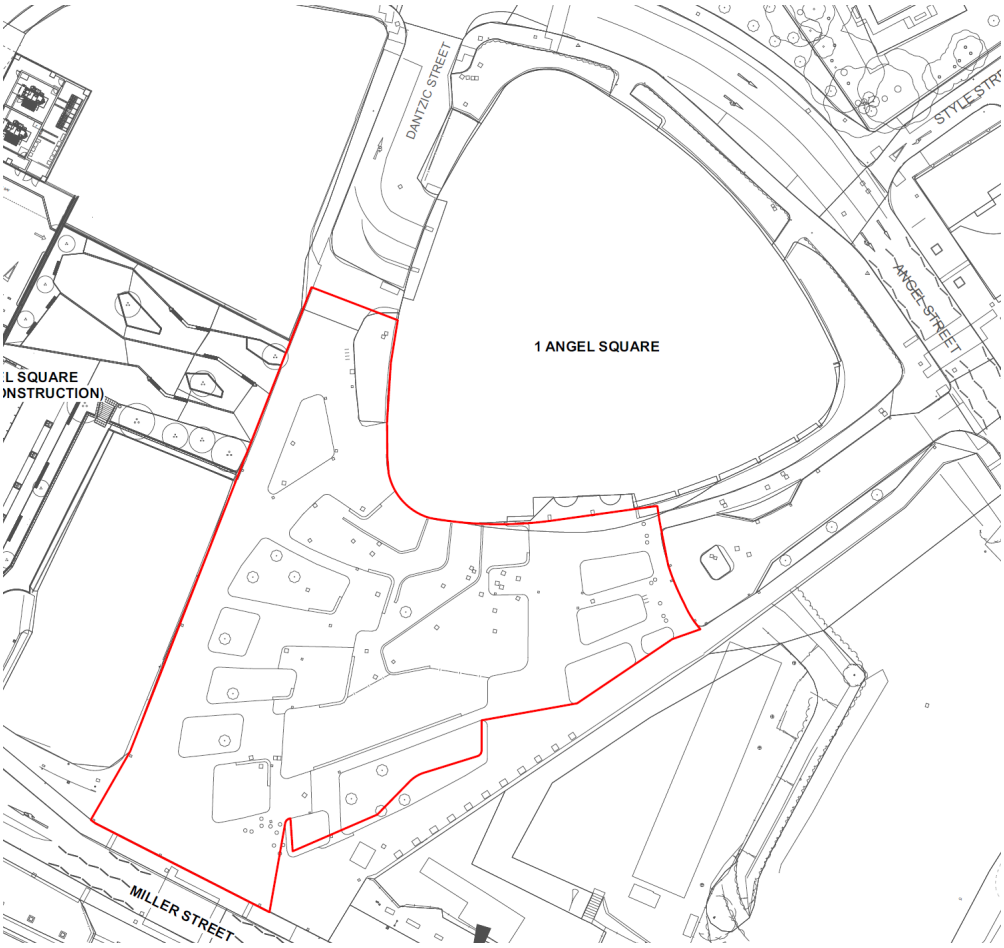


Figure 1: Extract of Planit I.E Limited drawing ref: 2962-PLA-XX-XX-DR-L-0004-Existing site plan

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1.2 Ground conditions and risk from historical contamination

All available historical documentation has been reviewed:

- The ground conditions comprise Made Ground, overlying Glacial Till, overlying Chester Formation bedrock.
- Based on the historical chemical testing undertaken, the chemical concentrations in the soils beneath the site are not likely to pose a significant risk to the end users of the development.
- Given the concentrations of determinands generally encountered across the proposed development site, the risk to construction workers due to direct contact with soils is considered to be low and it is envisaged that nominal safety precautions will be acceptable (the adoption of good hygiene and the use of overalls, gloves and dust masks if necessary).
- UXO detection / clearance was undertaken at the time of the construction of 1 Angel Square and its public realm, therefore the risk is considered to be low for any future works.

1.3 Planning conditions

All available historical planning documentation has been reviewed:

- Planning condition 25 a – BH are in receipt of documentation that considers all sections of planning condition 25a to be 'Adequate' (Appendix A refers).
- Remediation Strategy – Whilst BH are not in receipt of the Remediation Strategy document, the planning response dated 27/11/2009 provides a summary of the works (Appendix A refers, extract below for ease of reference). Relevant sections of the BH Excavation and Filling Specification (S090911_EW Spec_T1_fnl) and Updated Rem Clauses (023842_Rem_Clauses_fnl) should also have been referred to by the Main Contractor for managing the 'contaminated land' aspects of the construction works.

Remedial measures are to include:

  - *Areas of contaminated ground are likely to be removed during basement excavations. Materials to be removed off site shall be fully audited.*
  - *All imported materials to be suitable for use. The report states that a sampling ratio of 1:50m3 is to be applied to imported materials from unknown, mixed or brownfield sources.*
  - *Provision of a final layout detailing all areas within the planning boundary has been supplied*
  - *Gas control measures compliant with CS2 to include:*
    - *ventilation of confined spaces*
    - *well constructed ground slab*
    - *low permeability gas membrane*
    - *min penetration of ground slab by services*
    - *two levels of tanked and ventilated basement*

- Planning Condition 25b - BH are not in receipt of the verification report for the works. It is assumed that the verification report was 'Adequate' as the development was built.

1.4 Existing and proposed levels

The existing and proposed levels are provided in Appendix B and C. When comparing the existing to proposed, the levels are very similar to existing in order to tie in with 1 Angel Square and the site boundary. Where they differ, the amount is approximately 0.50 m. Therefore, the majority of the works will be working within the existing 'clean' build up zone.

It is possible that localised areas may reach the Made Ground beneath the build up zone. However, following analysis of the historical chemical results, no gross contamination was observed within this material and the risk to future users was and still is considered to be low.

1.5 Conclusions and recommendations

We understand that all the conditions on 1 Angel Square, including those relevant to ground conditions, have either been discharged or complied with.

The historical chemical concentrations in the soils beneath the site are not likely to pose a significant risk to the end users of the development. Provided the construction workers use good working practice and wear appropriate personal protective equipment, the risk to them is also considered to be low.

In addition, based on the supplied existing and proposed levels (Appendix B & C refer), the majority of the works will be working within the existing 'clean' build up zone. As the detailed design progresses, it is recommended that a cut/fill analysis and 3d isopachyte drawing is produced to clearly show the differences in level across the site.

It is recommended that all works within the proposed NOMA Angel Square are completed in accordance with an approved earthworks specification. Within the document there should be a section which sets out the protocol if unexpected contamination is recorded during the works.

The Main Contractor who completes the works will also have to keep detailed records of materials movement in and out of site and ultimately produce a verification report for the works to prove that they have been completed in accordance with the approved earthworks specification.

Appendix G SuDS Maintenance Plan

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The table below is based on the CIRIA C753 SuDs Manual, 2015.

SUDS COMPONENTS MAINTENANCE REQUIREMENTS		
SUDS COMPONENT	**Geocellular Attenuation Tanks**	
MAINTENANCE	**ACTION**	**FREQUENCY**
Regular maintenance	Check inlets, outlets, control structures and overflows	Monthly or annually, as required
Occasional tasks	Jetting and suction where silt has settled	As required
Remedial work	Reinstate	As required
SUDS COMPONENT	**Rain Garden**	
MAINTENANCE	**ACTION**	**FREQUENCY**
Regular maintenance	Litter and debris removal	Monthly
	Check inlets, outlets, control structures and overflows	Quarterly
	Inspect plants for diseases, poor growth and invatsive species	Quarterly
	Inspect infiltration surfaces for silting and ponding	Quarterly
	Check operation of underdrains after rain	Annually
Occasional tasks	Infill any holes or scour in the filter medium	As required
Remedial work	Remove and replace filter medium and vegetation	As required

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Appendix H Existing and Proposed Impermeable Areas

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CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

Rev.	Description	Date	Iss'd	Rev'd	App'd
B	FOR INFORMATION	22.09.2023	DC	PT	PT
A	FOR INFORMATION	08/11/2022	DC	PT	PT

PRELIMINARY DESIGN

Project Stage

FOR INFORMATION

Status of Drawing

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Client: *MEPC*

Architect: *PLANIT-IE*

Project: **ANGEL SQUARE**

Drg Title: PERMEABLE / IMPERMEABLE AREAS PROPOSED

Job No.: 0052681

Scale@A1: 1:200

Drawn/Designed By.: DC

Checked By.: PT

Approved By.: PT

Drawing No.: 0052681-SK02

Revision: B

Daniel Carroll P:\0052681\HOM\Angel Square\Public Realm\08 Cities + Infra\01_Sheet\0052681-SK02_Permeable Areas.dwg

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CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

KEY

EXISTING PERMEABLE AREA = 2177m²

EXISTING IMPERMEABLE AREA = 2747m²

Rev	Description	Date	Iss'd	Rev'd	App'd
B	FOR INFORMATION	22.09.2023	DC	PT	PT
A	FOR INFORMATION	08/11/2022	DC	PT	PT

PRELIMINARY DESIGN

Project Stage

FOR INFORMATION

Status of Drawing

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Architect *PLANIT-IE*

Project **ANGEL SQUARE**

Drg Title PERMEABLE / IMPERMEABLE AREAS EXISTING

Job No.	Scale@A1
0052681	1:200

Drawn/Designed By.	Checked By.	Approved By.
DC	PT	PT

Drawing No.	Revision
0052681-SK03	B

Dated: Cloud P:\0052681\MDM\Angel Square\Public Realm\03 Cities - Intro\01_Sheets\0052681-SK03 - [WIP]_Impermeable Areas.dwg

Appendix I Greenfield runoff calculation

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ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.041	Urban	0.000
SAAR (mm)	868	Region Number	Region 10

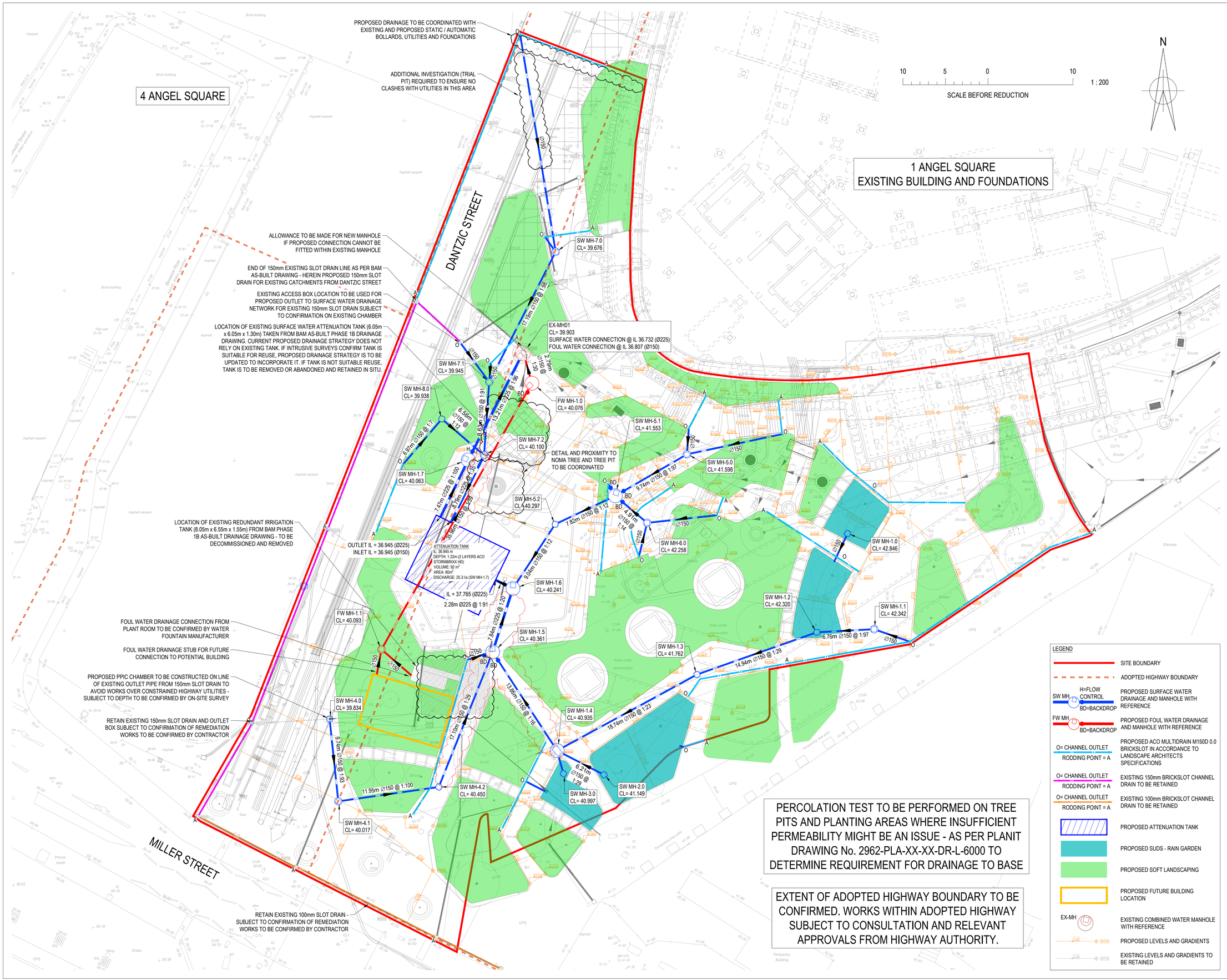
Results l/s

QBAR Rural	0.2
QBAR Urban	0.2
Q100 years	0.5
Q1 year	0.2
Q30 years	0.4
Q100 years	0.5

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Appendix J Proposed Drainage Strategy

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PERCOLATION TEST TO BE PERFORMED ON TREE PITS AND PLANTING AREAS WHERE INSUFFICIENT PERMEABILITY MIGHT BE AN ISSUE - AS PER PLANIT DRAWING No. 2962-PLA-XX-XX-DR-L-6000 TO DETERMINE REQUIREMENT FOR DRAINAGE TO BASE

EXTENT OF ADOPTED HIGHWAY BOUNDARY TO BE CONFIRMED. WORKS WITHIN ADOPTED HIGHWAY SUBJECT TO CONSULTATION AND RELEVANT APPROVALS FROM HIGHWAY AUTHORITY.

LEGEND

- SITE BOUNDARY
- ADOPTED HIGHWAY BOUNDARY
- SW MH — H=FLOW CONTROL, BD=BACKDROP — PROPOSED SURFACE WATER DRAINAGE AND MANHOLE WITH REFERENCE
- FW MH — BD=BACKDROP — PROPOSED FOUL WATER DRAINAGE AND MANHOLE WITH REFERENCE
- O= CHANNEL OUTLET, RODDING POINT = A — PROPOSED ACO MULTIDRAIN M150D 0.0 BRICKSLOT IN ACCORDANCE TO LANDSCAPE ARCHITECTS SPECIFICATIONS
- O= CHANNEL OUTLET, RODDING POINT = A — EXISTING 150mm BRICKSLOT CHANNEL DRAIN TO BE RETAINED
- O= CHANNEL OUTLET, RODDING POINT = A — EXISTING 100mm BRICKSLOT CHANNEL DRAIN TO BE RETAINED
- PROPOSED ATTENUATION TANK
- PROPOSED SUDS - RAIN GARDEN
- PROPOSED SOFT LANDSCAPING
- PROPOSED FUTURE BUILDING LOCATION
- EX-MH — EXISTING COMBINED WATER MANHOLE WITH REFERENCE
- PROPOSED LEVELS AND GRADIENTS
- EXISTING LEVELS AND GRADIENTS TO BE RETAINED

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- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS INTERFACE WITH THE PUBLIC ON MILLER STREET

MAINTENANCE/CLEANING/OPERATION.
- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS INTERFACE WITH THE PUBLIC ON MILLER STREET

DECOMMISSIONING/DEMOLITION.
- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS INTERFACE WITH THE PUBLIC ON MILLER STREET

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, DETAILS AND SPECIFICATIONS.
3. THIS DESIGN HAS BEEN BASE ON THE FOLLOWING DRAWINGS AND INFORMATION:
   - ARCHITECT'S PLAN 2962-PLA-XX-XX-DR-L-3000 RECEIVED FROM PLANIT ON 13/07/2023
   - TOPOGRAPHICAL SURVEY RECEIVED 13/07/2022
   - 1 ANGEL SQUARE AS BUILT DRAINAGE DRAWING C300 PRODUCED BY BURO HAPPOLD DATED 31/08/2011
   - PHASE 1B / 2 SERVICES AS-BUILT INFORMATION RECIEVED FROM BAM ON 26/06/2023
4. PRIOR TO THE COMMENCEMENT OF WORK THE LOCATION, SIZE AND DEPTH OF ALL EXISTING DRAINAGE AND SERVICES SHALL BE ESTABLISHED BY THE CONTRACTOR. ANY DISCREPANCIED FROM THE INFORMATION SHOWN ON THESE DRAWINGS SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
5. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT AND DIVERSION WORKS AS NECESSARY, TO ALL EXISTING SERVICES TO THE SATISFACTION OF PUBLIC UTIITIES.
6. REFER TO DRAWING 0052681-BHE-XX-XX-DR-C-3800 FOR PROPOSED DRAINAGE MANHOLE SCHEDULES.
7. REFER TO DRAWING SERIES 0052681-BHE-XX-XX-DR-C-3700 FOR PROPOSED DRAINAGE DETAILS.

Rev	Description	Date	Iss'd	Rev'd	App'd
P03	ISSUED FOR PLANNING	22.09.2023	DC	FR	PT
P02	ISSUED FOR STAGE 3+	25.08.2023	CR	DC	PT
P01	ISSUED FOR STAGE 3 COSTING	27.06.2023	CR	PT	PT

STAGE 3

Project Stage

INFORMATION

Status of Drawing

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Client	MEPC
Architect	PLANIT-IE
Project	ANGEL SQUARE PUBLIC REALM
Drg Title	PROPOSED DRAINAGE GENERAL ARRANGEMENT

Job No.	Scale@A1
0052681	1:200

Drawn/Designed By.	Checked By.	Approved By.
CR	PT	PT

Drawing No. 0052681-BHE-XX-XX-DR-C-3100 — Revision P03

Dated Cannot P 0052681 HOM Angel Square Public Realm\08 Cities - Infra\01 Sheet\0052681-BHE-XX-XX-DR-C-3100_Drainage Layout.dwg

MANHOLE SCHEDULE - PH-SW-PR

MANHOLE REF.	EASTING [m]	NORTHING [m]	COVER LEVEL [m]	INVERT LEVEL [m]	DEPTH TO INVERT [m]	MANHOLE TYPE	INNER DIAMETER [mm]	CLEAR OPENING DIMENSIONS [mm]	COVER TYPE	COVER GRADE	INCOMING PIPE INVERT LEVEL [mm]	OUTGOING PIPE INVERT LEVEL [m]	COMMENTS
SW MH-1.0	384332.150	399011.426	42.85	41.80	1.05	TYPE D	450 DIA.	450 x 450	ST	B125		42.500 (150Ø)	SHALLOW PIPEWORK TO ALLOW FOR CONNECTION TO CASCADING RAIN GARDEN
SW MH-1.1	384335.273	399000.169	42.34	41.28	1.06	TYPE D	600 DIA.	600 x 600	RE	B125	41.285 (150Ø)	41.285 (150Ø)	
SW MH-1.2	384328.520	398999.808	42.32	41.22	1.10	TYPE D	450 DIA.	450 x 450	ST	B125	41.215 (150Ø)	41.215 (150Ø)	
SW MH-1.3	384314.430	398994.839	41.76	40.70	1.06	TYPE D	450 DIA.	450 x 450	RE	B125	40.705 (150Ø)	40.705 (150Ø)	
SW MH-1.4	384297.967	398985.887	40.94	39.88	1.05	TYPE C	1350 DIA.	1220 x 685	RE	B125	39.885 (150Ø) 39.885 (150Ø) 39.885 (150Ø)	39.885 (150Ø)	
SW MH-1.5	384290.391	398997.492	40.36	38.62	1.74	TYPE B	1200 DIA.	600 x 600	RE	B125	38.255 (150Ø) 39.000 (150Ø) 39.000 (150Ø)	38.180 (225Ø)	
SW MH-1.6	384292.774	399004.961	40.24	37.79	2.45	TYPE B	1200 DIA.	600 x 600	RE	D400	37.865 (150Ø) 37.790 (225Ø)	37.790 (225Ø)	CATCHPIT MANHOLE, REFER TO DRAWING No. 0052681-BHE-XX-XX-DR-C-3301 FOR DETAILS
SW MH-1.7	384287.513	399020.073	40.06	36.87	3.19	TYPE A2	1200 DIA.	600 x 600	RE	D400	36.870 (225Ø)	36.870 (225Ø)	FLOW CONTROL UNIT RATED AT 25.3l/s, REFER TO DRAWING No. 0052681-BHE-XX-XX-DR-C-3305 FOR DETAILS
SW MH-2.0	384303.487	398983.046	41.15	40.10	1.05	TYPE D	450 DIA.	450 x 450	ST	B125		40.100 (150Ø)	
SW MH-3.0	384298.724	398983.177	41.00	39.96	1.03	TYPE D	450 DIA.	450 x 450	ST	B125		39.965 (150Ø)	
SW MH-4.0	384271.208	398989.606	39.83	39.07	0.76	TYPE D	450 DIA.	??? x ???	RE	D400		39.070 (150Ø)	
SW MH-4.1	384272.230	398979.921	40.02	38.96	1.05	TYPE D	600 DIA.	600 x 600	RE	D400	38.965 (150Ø)	38.965 (150Ø)	
SW MH-4.2	384284.055	398981.611	40.45	38.84	1.61	TYPE D	450 DIA.	450 x 450	RE	B125	38.845 (150Ø)	38.845 (150Ø)	
SW MH-5.0	384313.242	399020.743	41.60	40.55	1.05	TYPE D	600 DIA.	450 x 450	RE	B125	40.550 (150Ø) 40.550 (150Ø)	40.550 (150Ø)	
SW MH-5.1	384304.817	399015.855	41.55	39.30	2.25	TYPE B	1200 DIA.	600 x 600	RE	B125	40.450 (150Ø) 40.450 (150Ø) 40.450 (150Ø)	39.300 (150Ø)	
SW MH-5.2	384297.744	399012.517	40.30	38.64	1.66	TYPE D	450 DIA.	450 x 450	RE	D400	38.635 (150Ø)	38.635 (150Ø)	
SW MH-6.0	384308.561	399012.680	42.26	40.80	1.46	TYPE D	600 DIA.	600 x 600	RE	B125	40.800 (150Ø) 40.800 (150Ø)	40.800 (150Ø)	
SW MH-7.0	384297.804	399044.562	39.68	37.54	2.14	TYPE D	600 DIA.	600 x 600	RE	B125	37.540 (150Ø) 37.540 (150Ø)	37.540 (150Ø)	
SW MH-7.1	384289.987	399029.249	39.95	37.45	2.50	TYPE D	600 DIA.	600 x 600	ST	B125	37.365 (150Ø) 37.365 (150Ø) 37.365 (150Ø)	37.365 (150Ø)	
SW MH-7.2	384289.381	399020.637	40.10	37.60	2.50	TYPE D	600 DIA.	600 x 600	RE	D400	37.270 (150Ø) 37.270 (150Ø)	37.195 (225Ø)	
SW MH-7.2 (1)	384268.183	399005.275	40.10	37.60	2.50	TYPE D	600 DIA.	600 x 600	RE	D400			
SW MH-8.0	384284.407	399024.907	39.94	38.10	1.84	TYPE D	450 DIA.	450 x 450	ST	B125	38.100 (150Ø)	37.800 (150Ø)	

MANHOLE SCHEDULE - PH-FW-PR

MANHOLE REF.	EASTING [m]	NORTHING [m]	COVER LEVEL [m]	INVERT LEVEL [m]	DEPTH TO INVERT [m]	MANHOLE TYPE	INNER DIAMETER [mm]	CLEAR OPENING DIMENSIONS [mm]	COVER TYPE	COVER GRADE	INCOMING PIPE INVERT LEVEL [mm]	OUTGOING PIPE INVERT LEVEL [m]	COMMENTS
FW MH-1.0	384295.003	399029.108	40.08	36.90	3.18	TYPE A2	1200 DIA.	600 x 600	RE	B125	38.400 (150Ø)	36.900 (150Ø)	
FW MH-1.1	384277.311	398997.795	40.09	39.33	0.76	TYPE D	600 DIA.	650 x 650	ST	B125	39.329 (150Ø) 39.329 (150Ø)	39.329 (150Ø)	

ANNOTATIONS

ST - SOLID TOP DUCTILE IRON
RE - RECESSED
GR - GRATED DOME TOP (AS SPECIFIED BY LANDSCAPE ARCHITECT)
BD - BACKDROP

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HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS INTERFACE WITH THE PUBLIC ON MILLER STREET

MAINTENANCE/CLEANING/OPERATION.

- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS INTERFACE WITH THE PUBLIC ON MILLER STREET

DECOMMISSIONING/DEMOLITION.

- WORKS WITHIN POTENTIAL CONFINED SPACE CONDITIONS
- WORKS IN PROXIMITY TO LIVE SERVICES
- WORKS INTERFACE WITH THE PUBLIC ON MILLER STREET

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS, DETAILS AND SPECIFICATIONS.
3. WHERE INFILL MANHOLE COVERS ARE SPECIFIED, THE LOCATION OF MANHOLES AND ORIENTATION OF THE COVERS SHALL BE COORDINATED ON SITE TO SUIT THE SURFACING MATERIAL AND PAVING ARRANGMENT WHEREVER POSSIBLE.
4. REFER TO DRAWING 0052681-BHE-XX-XX-DR-C-3100 FOR PROPOSED DRAINAGE LAYOUT.

Rev	Description	Date	Iss'd	Rev'd	App'd
P03	ISSUED FOR PLANNING	22.09.2023	DC	FR	PT
P02	ISSUED FOR STAGE 3+	25.08.2023	CR	DC	PT
P01	ISSUED FOR STAGE 3 COSTING	27.06.2023	CR	PT	PT

STAGE 3

Project Stage

INFORMATION

Status of Drawing

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Client *MEPC*
Architect *PLANIT-IE*
Project **ANGEL SQUARE PUBLIC REALM**
Drg Title PROPOSED DRAINAGE MANHOLE SCHEDULE

Job No. 0052681
Scale@A1 1:200
Drawn/Designed By. CR
Checked By. PT
Approved By. PT
Drawing No. 0052681-BHE-XX-XX-DR-C-3800
Revision P03

Dated Cprod P:\0052681\ROMA Angel Square Public Realm\3 Cities - Ireland\0052681-BHE-XX-XX-DR-C-3800_Manhole Schedule.dwg

Appendix K Hydraulic calculation results

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.356	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
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

- Indicates pipe length does not match coordinates

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	6.773	0.070	96.8	0.017	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	12.187	1.285	9.5	0.039	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	14.928	0.510	29.3	0.011	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	18.758	0.820	22.9	0.012	0.00	0.0	0.600	o	150	Pipe/Conduit	
S3.000	6.190	0.215	28.8	0.016	5.00	0.0	0.600	o	150	Pipe/Conduit	
S4.000	3.770	0.210	18.0	0.012	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)
S1.000	50.00	5.11	41.285	0.017	0.0	0.0	0.0	1.02	18.1	2.3
S2.000	50.00	5.06	42.500	0.039	0.0	0.0	0.0	3.29	58.2	5.3
S1.001	50.00	5.24	41.215	0.067	0.0	0.0	0.0	1.87	33.0	9.1
S1.002	50.00	5.39	40.705	0.079	0.0	0.0	0.0	2.11	37.4	10.7
S3.000	50.00	5.05	40.100	0.016	0.0	0.0	0.0	1.88	33.3	2.2
S4.000	50.00	5.03	40.095	0.012	0.0	0.0	0.0	2.39	42.2	1.7

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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
S1.003	13.925	0.885	15.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S5.000	9.735	0.105	93.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S5.001	11.959	0.120	99.7	0.070	0.00	0.0	0.600	o	150	Pipe/Conduit	
S5.002	17.147	0.590	29.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	7.772	0.390	19.9	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	9.785	0.100	97.9	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S7.000	4.894	0.350	14.0	0.006	5.00	0.0	0.600	o	150	Pipe/Conduit	
S6.001	7.776	0.665	11.7	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S6.002	9.061	0.770	11.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	2.276#	0.025	91.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	17.198	0.175	98.3	0.071	5.00	0.0	0.600	o	150	Pipe/Conduit	
S8.001	8.627	0.095	90.8	0.010	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.000	6.556	0.530	12.4	0.053	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)
S1.003	50.00	5.48	39.885	0.108	0.0	0.0	0.0	2.55	45.1	14.6
S5.000	50.00	5.16	39.070	0.000	0.0	0.0	0.0	1.04	18.4	0.0
S5.001	50.00	5.35	38.965	0.070	0.0	0.0	0.0	1.01	17.8	9.5
S5.002	50.00	5.51	38.845	0.070	0.0	0.0	0.0	1.87	33.1	9.5
S1.004	50.00	5.55	38.180	0.193	0.0	0.0	0.0	2.94	117.1	26.1
S6.000	50.00	5.16	40.550	0.008	0.0	0.0	0.0	1.02	18.0	1.0
S7.000	50.00	5.03	40.800	0.006	0.0	0.0	0.0	2.71	47.9	0.9
S6.001	50.00	5.20	39.300	0.022	0.0	0.0	0.0	2.96	52.4	2.9
S6.002	50.00	5.26	38.635	0.022	0.0	0.0	0.0	2.95	52.2	2.9
S1.005	50.00	5.58	37.790	0.215	0.0	0.0	0.0	1.37	54.5	29.1
S8.000	50.00	5.28	37.540	0.071	0.0	0.0	0.0	1.01	17.9	9.7
S8.001	50.00	5.42	37.365	0.081	0.0	0.0	0.0	1.06	18.6	11.0
S9.000	50.00	5.04	37.800	0.053	0.0	0.0	0.0	2.88	50.9	7.1

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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
S8.002	8.793	0.250	35.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	7.454	0.075	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	14.119	0.138	102.3	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)
S8.002	50.00	5.49	37.195	0.134	0.0	0.0	0.0	2.21	88.0	18.1
S1.006	50.00	5.67	36.945	0.349	0.0	0.0	0.0	1.31	52.0	47.2
S1.007	50.00	5.85	36.870	0.349	0.0	0.0	0.0	1.29	51.4	47.2

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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.356		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: SSW MH-1.7, DS/PN: S1.007, Volume (m³): 3.9

Unit Reference	MD-CHE-0205-2530-1200-2530
Design Head (m)	1.200
Design Flow (l/s)	25.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	No
Diameter (mm)	205
Invert Level (m)	36.870
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	25.3
Flush-Flo™	0.372	25.3
Kick-Flo®	0.501	16.8
Mean Flow over Head Range	-	18.8

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)
0.100	5.8	1.200	25.3	3.000	39.7	7.000	60.1
0.200	16.0	1.400	27.3	3.500	42.8	7.500	62.2
0.300	22.8	1.600	29.1	4.000	45.7	8.000	64.2
0.400	24.5	1.800	30.9	4.500	48.4	8.500	66.2
0.500	16.8	2.000	32.5	5.000	51.0	9.000	68.0
0.600	18.0	2.200	34.1	5.500	53.4	9.500	69.9
0.800	20.7	2.400	35.6	6.000	55.8		
1.000	23.1	2.600	37.0	6.500	58.0		

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Storage Structures for Storm

Cellular Storage Manhole: SATT TANK, DS/PN: S1.006

Invert Level (m) 36.945 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	80.0	0.0	1.221	0.0	0.0
1.220	80.0	0.0			

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1 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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.356
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SSW MH-1.1	15 Winter	1	+0%	100/15 Summer			
S2.000	SSW MH-1.0	15 Winter	1	+0%				
S1.001	SSW MH-1.2	15 Winter	1	+0%	100/15 Summer			
S1.002	SSW MH-1.3	15 Winter	1	+0%	100/15 Summer			
S3.000	SSW MH-2.0	15 Winter	1	+0%	100/15 Summer			
S4.000	SSW MH-3.0	15 Winter	1	+0%	100/15 Summer			
S1.003	SSW MH-1.4	15 Winter	1	+0%	100/15 Summer			
S5.000	SSW MH-4.0	15 Summer	1	+0%	100/15 Summer			
S5.001	SSW MH-4.1	15 Winter	1	+0%	30/15 Summer			
S5.002	SSW MH-4.2	15 Winter	1	+0%	100/15 Summer			
S1.004	SSW MH-1.5	15 Winter	1	+0%	100/15 Summer			
S6.000	SSW MH-5.0	15 Winter	1	+0%				
S7.000	SSW MH-6.0	15 Winter	1	+0%				
S6.001	SSW MH-5.1	15 Winter	1	+0%				
S6.002	SSW MH-5.2	15 Winter	1	+0%				
S1.005	SSW MH-1.6	15 Winter	1	+0%	30/15 Summer			
S8.000	SSW MH-7.0	15 Winter	1	+0%	30/15 Summer			
S8.001	SSW MH-7.1	15 Winter	1	+0%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SSW MH-1.1	41.321	-0.114	0.000	0.13			2.0	OK
S2.000	SSW MH-1.0	42.530	-0.120	0.000	0.09			4.7	OK
S1.001	SSW MH-1.2	41.267	-0.098	0.000	0.26			7.8	OK
S1.002	SSW MH-1.3	40.757	-0.098	0.000	0.26			9.0	OK
S3.000	SSW MH-2.0	40.126	-0.124	0.000	0.07			2.0	OK
S4.000	SSW MH-3.0	40.117	-0.128	0.000	0.05			1.5	OK
S1.003	SSW MH-1.4	39.942	-0.093	0.000	0.30			12.4	OK
S5.000	SSW MH-4.0	39.070	-0.150	0.000	0.00			0.0	OK
S5.001	SSW MH-4.1	39.036	-0.080	0.000	0.44			7.1	OK
S5.002	SSW MH-4.2	38.894	-0.101	0.000	0.23			7.1	OK
S1.004	SSW MH-1.5	38.255	-0.150	0.000	0.24			21.2	OK
S6.000	SSW MH-5.0	40.573	-0.127	0.000	0.06			0.9	OK
S7.000	SSW MH-6.0	40.815	-0.135	0.000	0.02			0.8	OK
S6.001	SSW MH-5.1	39.323	-0.127	0.000	0.05			2.4	OK
S6.002	SSW MH-5.2	38.657	-0.128	0.000	0.05			2.5	OK
S1.005	SSW MH-1.6	37.942	-0.073	0.000	0.79			23.7	OK
S8.000	SSW MH-7.0	37.617	-0.073	0.000	0.51			8.5	OK
S8.001	SSW MH-7.1	37.448	-0.067	0.000	0.58			9.5	OK

PN	US/MH Name	Level Exceeded
S1.000	SSW MH-1.1	
S2.000	SSW MH-1.0	
S1.001	SSW MH-1.2	
S1.002	SSW MH-1.3	
S3.000	SSW MH-2.0	
S4.000	SSW MH-3.0	
S1.003	SSW MH-1.4	
S5.000	SSW MH-4.0	
S5.001	SSW MH-4.1	
S5.002	SSW MH-4.2	
S1.004	SSW MH-1.5	
S6.000	SSW MH-5.0	
S7.000	SSW MH-6.0	
S6.001	SSW MH-5.1	
S6.002	SSW MH-5.2	
S1.005	SSW MH-1.6	
S8.000	SSW MH-7.0	
S8.001	SSW MH-7.1	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.000	SSW MH-8.0	15 Winter	1	+0%	100/30 Winter			
S8.002	SSW MH-7.2	15 Winter	1	+0%	30/30 Winter			
S1.006	SATT TANK	30 Winter	1	+0%	30/15 Summer			
S1.007	SSW MH-1.7	30 Winter	1	+0%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S9.000	SSW MH-8.0	37.838	-0.112	0.000	0.15			6.3	OK
S8.002	SSW MH-7.2	37.268	-0.152	0.000	0.22			15.7	OK
S1.006	SATT TANK	37.101	-0.069	0.000	0.44		15	17.1	OK
S1.007	SSW MH-1.7	37.083	-0.012	0.000	0.38			17.1	OK

PN	US/MH Name	Level Exceeded
S9.000	SSW MH-8.0	
S8.002	SSW MH-7.2	
S1.006	SATT TANK	
S1.007	SSW MH-1.7	

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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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.356
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SSW MH-1.1	15 Winter	30	+0%	100/15 Summer			
S2.000	SSW MH-1.0	15 Winter	30	+0%				
S1.001	SSW MH-1.2	15 Winter	30	+0%	100/15 Summer			
S1.002	SSW MH-1.3	15 Winter	30	+0%	100/15 Summer			
S3.000	SSW MH-2.0	15 Winter	30	+0%	100/15 Summer			
S4.000	SSW MH-3.0	15 Winter	30	+0%	100/15 Summer			
S1.003	SSW MH-1.4	15 Winter	30	+0%	100/15 Summer			
S5.000	SSW MH-4.0	15 Winter	30	+0%	100/15 Summer			
S5.001	SSW MH-4.1	15 Winter	30	+0%	30/15 Summer			
S5.002	SSW MH-4.2	15 Winter	30	+0%	100/15 Summer			
S1.004	SSW MH-1.5	15 Winter	30	+0%	100/15 Summer			
S6.000	SSW MH-5.0	15 Winter	30	+0%				
S7.000	SSW MH-6.0	15 Winter	30	+0%				
S6.001	SSW MH-5.1	15 Winter	30	+0%				
S6.002	SSW MH-5.2	15 Winter	30	+0%				
S1.005	SSW MH-1.6	15 Winter	30	+0%	30/15 Summer			
S8.000	SSW MH-7.0	15 Winter	30	+0%	30/15 Summer			
S8.001	SSW MH-7.1	15 Winter	30	+0%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SSW MH-1.1	41.343	-0.092	0.000	0.32			4.9	OK
S2.000	SSW MH-1.0	42.548	-0.102	0.000	0.22			11.5	FLOOD RISK
S1.001	SSW MH-1.2	41.305	-0.060	0.000	0.65			19.8	OK
S1.002	SSW MH-1.3	40.796	-0.059	0.000	0.67			23.3	OK
S3.000	SSW MH-2.0	40.142	-0.108	0.000	0.17			4.8	OK
S4.000	SSW MH-3.0	40.130	-0.115	0.000	0.13			3.6	OK
S1.003	SSW MH-1.4	39.986	-0.049	0.000	0.76			31.4	OK
S5.000	SSW MH-4.0	39.211	-0.009	0.000	0.01			0.2	OK
S5.001	SSW MH-4.1	39.211	0.096	0.000	1.31			21.2	SURCHARGED
S5.002	SSW MH-4.2	38.939	-0.057	0.000	0.69			21.3	OK
S1.004	SSW MH-1.5	38.355	-0.050	0.000	0.65			57.6	OK
S6.000	SSW MH-5.0	40.587	-0.113	0.000	0.14			2.2	OK
S7.000	SSW MH-6.0	40.822	-0.128	0.000	0.05			1.9	OK
S6.001	SSW MH-5.1	39.338	-0.112	0.000	0.14			6.5	OK
S6.002	SSW MH-5.2	38.673	-0.112	0.000	0.14			6.5	OK
S1.005	SSW MH-1.6	38.184	0.169	0.000	2.14			63.9	SURCHARGED
S8.000	SSW MH-7.0	37.869	0.179	0.000	1.22			20.3	SURCHARGED
S8.001	SSW MH-7.1	37.604	0.089	0.000	1.41			23.0	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	SSW MH-1.1	
S2.000	SSW MH-1.0	
S1.001	SSW MH-1.2	
S1.002	SSW MH-1.3	
S3.000	SSW MH-2.0	
S4.000	SSW MH-3.0	
S1.003	SSW MH-1.4	
S5.000	SSW MH-4.0	
S5.001	SSW MH-4.1	
S5.002	SSW MH-4.2	
S1.004	SSW MH-1.5	
S6.000	SSW MH-5.0	
S7.000	SSW MH-6.0	
S6.001	SSW MH-5.1	
S6.002	SSW MH-5.2	
S1.005	SSW MH-1.6	
S8.000	SSW MH-7.0	
S8.001	SSW MH-7.1	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.000	SSW MH-8.0	15 Winter	30	+0%	100/30 Winter			
S8.002	SSW MH-7.2	30 Winter	30	+0%	30/30 Winter			
S1.006	SATT TANK	30 Winter	30	+0%	30/15 Summer			
S1.007	SSW MH-1.7	30 Winter	30	+0%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S9.000	SSW MH-8.0	37.862	-0.088	0.000	0.36			15.5	OK
S8.002	SSW MH-7.2	37.464	0.044	0.000	0.43			30.6	SURCHARGED
S1.006	SATT TANK	37.457	0.287	0.000	0.59		25	22.9	SURCHARGED
S1.007	SSW MH-1.7	37.438	0.343	0.000	0.50			22.4	SURCHARGED

PN	US/MH Name	Level Exceeded
S9.000	SSW MH-8.0	
S8.002	SSW MH-7.2	
S1.006	SATT TANK	
S1.007	SSW MH-1.7	

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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 Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.356
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SSW MH-1.1	15 Winter	100	+45%	100/15 Summer			
S2.000	SSW MH-1.0	15 Winter	100	+45%				
S1.001	SSW MH-1.2	15 Winter	100	+45%	100/15 Summer			
S1.002	SSW MH-1.3	15 Winter	100	+45%	100/15 Summer			
S3.000	SSW MH-2.0	15 Winter	100	+45%	100/15 Summer			
S4.000	SSW MH-3.0	15 Winter	100	+45%	100/15 Summer			
S1.003	SSW MH-1.4	15 Winter	100	+45%	100/15 Summer			
S5.000	SSW MH-4.0	15 Winter	100	+45%	100/15 Summer			
S5.001	SSW MH-4.1	15 Winter	100	+45%	30/15 Summer			
S5.002	SSW MH-4.2	15 Winter	100	+45%	100/15 Summer			
S1.004	SSW MH-1.5	15 Winter	100	+45%	100/15 Summer			
S6.000	SSW MH-5.0	15 Winter	100	+45%				
S7.000	SSW MH-6.0	15 Winter	100	+45%				
S6.001	SSW MH-5.1	15 Winter	100	+45%				
S6.002	SSW MH-5.2	15 Winter	100	+45%				
S1.005	SSW MH-1.6	15 Winter	100	+45%	30/15 Summer			
S8.000	SSW MH-7.0	15 Winter	100	+45%	30/15 Summer			
S8.001	SSW MH-7.1	15 Winter	100	+45%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	SSW MH-1.1	41.946	0.511	0.000	0.59			9.1	SURCHARGED
S2.000	SSW MH-1.0	42.567	-0.083	0.000	0.41			21.6	FLOOD RISK
S1.001	SSW MH-1.2	41.927	0.562	0.000	1.08			32.9	SURCHARGED
S1.002	SSW MH-1.3	41.342	0.487	0.000	1.06			37.3	SURCHARGED
S3.000	SSW MH-2.0	40.417	0.167	0.000	0.29			8.0	SURCHARGED
S4.000	SSW MH-3.0	40.409	0.164	0.000	0.21			5.9	SURCHARGED
S1.003	SSW MH-1.4	40.400	0.365	0.000	1.19			49.1	SURCHARGED
S5.000	SSW MH-4.0	39.831	0.611	0.000	0.45			7.4	FLOOD RISK
S5.001	SSW MH-4.1	39.930	0.814	0.000	1.98			31.8	FLOOD RISK
S5.002	SSW MH-4.2	39.460	0.465	0.000	1.02			31.4	SURCHARGED
S1.004	SSW MH-1.5	38.842	0.437	0.000	0.98			86.3	SURCHARGED
S6.000	SSW MH-5.0	40.602	-0.098	0.000	0.26			4.2	OK
S7.000	SSW MH-6.0	40.831	-0.119	0.000	0.09			3.5	OK
S6.001	SSW MH-5.1	39.353	-0.097	0.000	0.27			12.2	OK
S6.002	SSW MH-5.2	38.688	-0.097	0.000	0.26			12.1	OK
S1.005	SSW MH-1.6	38.462	0.447	0.000	3.25			97.2	SURCHARGED
S8.000	SSW MH-7.0	39.023	1.333	0.000	2.10			35.1	SURCHARGED
S8.001	SSW MH-7.1	38.241	0.726	0.000	2.40			39.3	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	SSW MH-1.1	
S2.000	SSW MH-1.0	
S1.001	SSW MH-1.2	
S1.002	SSW MH-1.3	
S3.000	SSW MH-2.0	
S4.000	SSW MH-3.0	
S1.003	SSW MH-1.4	
S5.000	SSW MH-4.0	
S5.001	SSW MH-4.1	
S5.002	SSW MH-4.2	
S1.004	SSW MH-1.5	
S6.000	SSW MH-5.0	
S7.000	SSW MH-6.0	
S6.001	SSW MH-5.1	
S6.002	SSW MH-5.2	
S1.005	SSW MH-1.6	
S8.000	SSW MH-7.0	
S8.001	SSW MH-7.1	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S9.000	SSW MH-8.0	60 Winter	100	+45%	100/30 Winter			
S8.002	SSW MH-7.2	60 Winter	100	+45%	30/30 Winter			
S1.006	SATT TANK	60 Winter	100	+45%	30/15 Summer			
S1.007	SSW MH-1.7	60 Winter	100	+45%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S9.000	SSW MH-8.0	38.135	0.185	0.000	0.37			15.9	SURCHARGED
S8.002	SSW MH-7.2	38.125	0.705	0.000	0.54			37.9	SURCHARGED
S1.006	SATT TANK	38.114	0.944	0.000	0.66		48	25.4	SURCHARGED
S1.007	SSW MH-1.7	38.057	0.962	0.000	0.56			25.2	SURCHARGED

PN	US/MH Name	Level Exceeded
S9.000	SSW MH-8.0	
S8.002	SSW MH-7.2	
S1.006	SATT TANK	
S1.007	SSW MH-1.7	

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