
Proposed Development, Hangar 4 Manchester Airport

Flood Risk and Drainage Assessment

784-B041631

[Revision 1]

Threadneedle Curtis Limited

Date of first Issue [19/04/2022]

Document prepared on behalf of Tetra Tech Limited. Registered in England number: 01959704



Document Control

Document:	Flood Risk and Drainage Assessment
Project:	Proposed Development, Hangar 4 Manchester Airport
Client:	Threadneedle Curtis Limited
Project Number:	784-B041631
File Origin:	Y:\784-B041631 Hangar 4, Manchester Airport\60. Project Output\61. Work In Progress\Flood Risk\FRA

Revision:	P01	Prepared by: Charlie Hadden	
Date:	19.04.2023	Checked by: Graham Mawdsley	
Status:	19.04.2023	Approved By: Neil Mason	
Description of Revision:	First Issue		

Revision:		Prepared by:	
Date:		Checked by:	
Status:		Approved By:	
Description of Revision:			

TABLE OF CONTENTS

1.0 INTRODUCTION.....	4
1.1 Purpose of this Report.....	4
1.2 Proposed Development	4
1.3 Scope of this Report	4
1.4 Requirement for this report	4
1.5 Limitations of this Report.....	4
2.0 SITE DESCRIPTION.....	6
2.1 Site Location	6
2.2 Site Topography	6
2.3 Watercourses	6
2.4 Drainage.....	7
2.5 Ground Conditions	7
2.5.1 Soil	7
2.5.2 Geology.....	7
2.5.3 Hydrogeology.....	7
3.0 FLOOD RISK	7
3.1 Fluvial Risk	7
3.2 Surface Water & Overland Flows.....	9
3.3 Groundwater Flooding	10
3.4 Sewer Flooding.....	10
3.5 Reservoir Flooding.....	10
3.6 Canal Flooding.....	11
3.7 Summary of Flood Risk	11
4.0 SEQUENTIAL AND EXCEPTION TESTS	11
5.0 SURFACE WATER MANAGEMENT	12
5.1 Drainage Hierarchy.....	12
5.2 Impermeable Areas	12
5.3 Discharge Rates	13

5.4 Required Attenuation	13
5.5 Sustainable Drainage	13
5.5.1 Review of SuDS Options.....	13
5.5.2 The SuDS Management Train	13
5.6 Proposed Surface Water Drainage Strategy	15
5.6.1 Drainage Strategy	15
5.6.2 Water Quality and Treatment.....	16
5.6.3 SUDS & Drainage Systems Maintenance.....	17
5.7 Exceedance Flow Routes.....	18
6.0 FOUL DRAINAGE	19
6.1 Existing Drainage	19
6.2 Proposed Foul Drainage.....	19
7.0 CONCLUSIONS & RECOMMENDATIONS.....	20
7.1 Conclusions	20

LIST OF TABLES

Table 1 - Existing and Proposed Permeable Areas	13
Table 2 - Estimated Attenuation Volume	13
Table 3 – Review of suitability of SuDS features to the developed site.....	14
Table 4 – Pollution Hazard Indices.....	17
Table 5 – SuDS Mitigation Indices	17
Table 6 – SuDS maintenance tasks and frequency required	18

LIST OF

Figure 1: Site Location	6
Figure 2: Environment Agency Flood Map for Planning	8
Figure 3: Environment Agency Flood Map for Planning	9
Figure 4: SuDS Management Train	14

APPENDICES

Appendix A: Proposed Site Plan	
Appendix B: Topographical Survey	
Appendix C: Groundwater Susceptibility Map	
Appendix D: Microdrainge - Quick Storage Estimates	
Appendix E: Microdrainage Calculations - Hangar 4	

Appendix F: Drainage General Arrangement Drawing

1.0 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

Tetra Tech Ltd has been commissioned by Threadneedle Curtis Ltd to undertake a Flood Risk Assessment and drainage strategy with regards to a proposed development at Manchester Airport.

This report has been produced in support of full planning application for the proposed development as outlined in Section 1.2.

1.2 PROPOSED DEVELOPMENT

A full planning application is being submitted for approval of a new logistics facility, office, yard and car park within the confines of the former Hangar 4 site, Manchester Airport. The proposed layout of the new building, yard and car park are included in Appendix A.

1.3 SCOPE OF THIS REPORT

The FRA will consider all potential sources of flooding including Main Rivers, Ordinary Watercourses, surface water and overland flow routes, groundwater, sewers and reservoirs. It will identify the level of risk and, where necessary, proposed mitigation to manage flood risk.

The assessment will be undertaken in accordance with the NPPF (Chapter 14), Planning Practice Guidance (PPG) (Flood Risk and Coastal Change), Environment Agency guidance and the Manchester City Council Strategic Flood Risk Assessment (SFRA) and Manchester City Council Local Flood Risk Management Strategy (LFRMS).

1.4 REQUIREMENT FOR THIS REPORT

The application site covers an area of 1.96 ha and therefore, in line with the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG) (Flood Risk and Coastal Change), a Flood Risk Assessment is required to support the planning application.

1.5 LIMITATIONS OF THIS REPORT

This report has been prepared by Tetra Tech Ltd on behalf of the Client in connection with the scope of the report as described in Section 1.2 above and taking into account the particular instructions and requirements set out in Tetra Tech's fee proposal and the Client's acceptance. It is not intended for and should not be relied on by any third party and no responsibility is undertaken to any third party.

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2.0 SITE DESCRIPTION

2.1 SITE LOCATION

The Hangar 4 site is located at Manchester Airport, as shown in Figure 1. The full planning application site boundary is included in Appendix A.



Figure 1: Site Location

2.2 SITE TOPOGRAPHY

A topographical survey was conducted by Survey Operations in February 2023, indicating the site elevation ranges from 67 m to 68.6 m Above Ordnance Datum (AOD) and the site falls from north west to south east. Topographical survey extent and details are shown in Appendix B.

2.3 WATERCOURSES

The Cotteril Clough Brook is located approximately 55 m south of the site and is a tributary of the nearest main river, River Bollin.

2.4 DRAINAGE

The site is currently served by a surface water network which discharges to the Cotteril Clough Brook outfall. Cotteril Clough Brook is a designated SSSI and is thus determined a sensitive receptor. At the request of Manchester Airport all drainage to this outfall will be removed and abandoned as part of this proposed development.

The existing Hangar which is located on site and is scheduled for demolition discharges foul drainage via a gravity network to the existing airport owned Pumping Station 1. The existing outfall from the site is to be re-used for the proposed development at the request of Manchester Airport.

2.5 GROUND CONDITIONS

2.5.1 Soil

A review of British Geological Survey (BGS) online geological mapping indicated the superficial deposits are Till, Devensian – Diamicton.

2.5.2 Geology

The BGS online geological mapping indicated the bedrock geology below the site is Bollin Mudstone – Mudstone. The nearest BGS borehole records, located approximately 200 m north west of the site, indicates clay based strata to a depth of 4 m below ground level and no water was encountered.

2.5.3 Hydrogeology

A review of Defra's online 'Magic' mapping indicates that the superficial and bedrock aquifers are both classified as unproductive which have negligible significance for water supply or baseflow to river and lakes. The site is not located within a groundwater Source Protection Zone.

3.0 FLOOD RISK

3.1 FLUVIAL RISK

A floodplain is the area that would naturally be affected by flooding if a river rises above its banks or is inundated by the sea (coastal or tidal flooding). In England, floodplains are divided into flood zones for planning purposes. These show the extent of the natural floodplain area at risk of inundation if there were no flood defences or certain other manmade structures and channel improvements. They are divided as follows:

- Flood Zone 1 is land assessed as having an annual probability of flooding of less than 1 in 1000 (<0.1%).

- Flood Zone 2 is land assessed as having an annual probability of flooding of between a 1 in 1000 (0.1%) and 1 in 100 (1%).
- Flood Zone 3 is land assessed as having an annual probability of flooding of 1 in 100 or greater (>1%).

As outlined within Section 2.3, the nearest watercourse, Cotteril Clough Brook, is located 55 m south of the site and flows southwest away from the site.

The Environment Agency's Flood Map for Planning (Figure 2) indicates that the site is located entirely within Flood Zone 1 and therefore at low risk from fluvial flooding. The EA historical flood map shows the site has not been flooded previously.

The elevation of the Cotteril Clough Brook is approximately 63 m AOD, based on the latest available LiDAR data (2022 1m resolution), the nearest site boundary is approximately 4 m above the Cotteril Clough Brook, therefore in the event of a flood, it is considered unlikely the site would be affected. It is noted that the upstream inflows would be limited by the capacity (i.e. size) at the upstream end of the culvert, therefore with the exception of any drainage flows that may enter along its route, the upstream face would create a constriction to the upstream catchment inflows.

The fluvial flood risk to the site is considered to be low.

The site is located at an inland location in excess of 60 m AOD, and therefore the risk of tidal flooding is considered to be negligible.

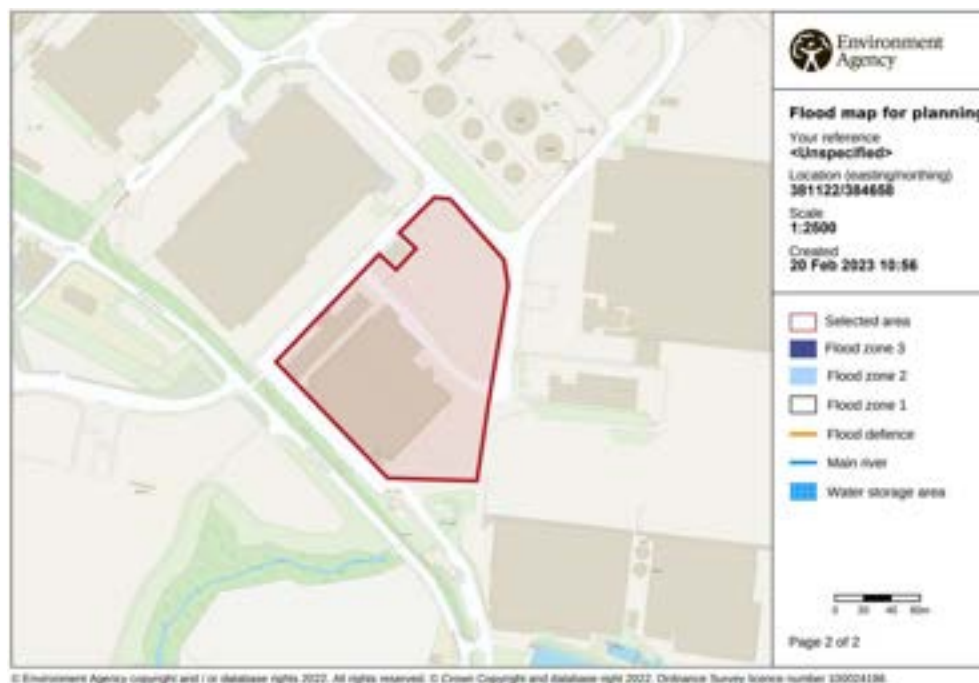


Figure 2: Environment Agency Flood Map for Planning

3.2 SURFACE WATER & OVERLAND FLOWS

Surface water flooding can occur during high intensity rainfall events as sheet runoff from fields or hard paved areas. It is particularly prevalent in areas with significant hardstanding or poorly permeable soils (i.e. clay). This is because the grounds capacity for infiltration is reduced. In addition, the inability to enter local drainage systems also contributes to risk from this source. The risk of surface water flooding is divided as follows, as defined by the Environment Agency:

- Very low risk means that the annual probability of flooding is less than 1 in 1000 (<0.1%).
- Low risk means that the annual probability of flooding is between 1 in 1000 (0.1%) and 1 in 100 (1%).
- Medium risk means that the annual probability of flooding is between 1 in 100 (1%) and 1 in 30 (3.3%).
- High risk means that the annual probability of flooding is greater than 1 in 30 (>3.3%).

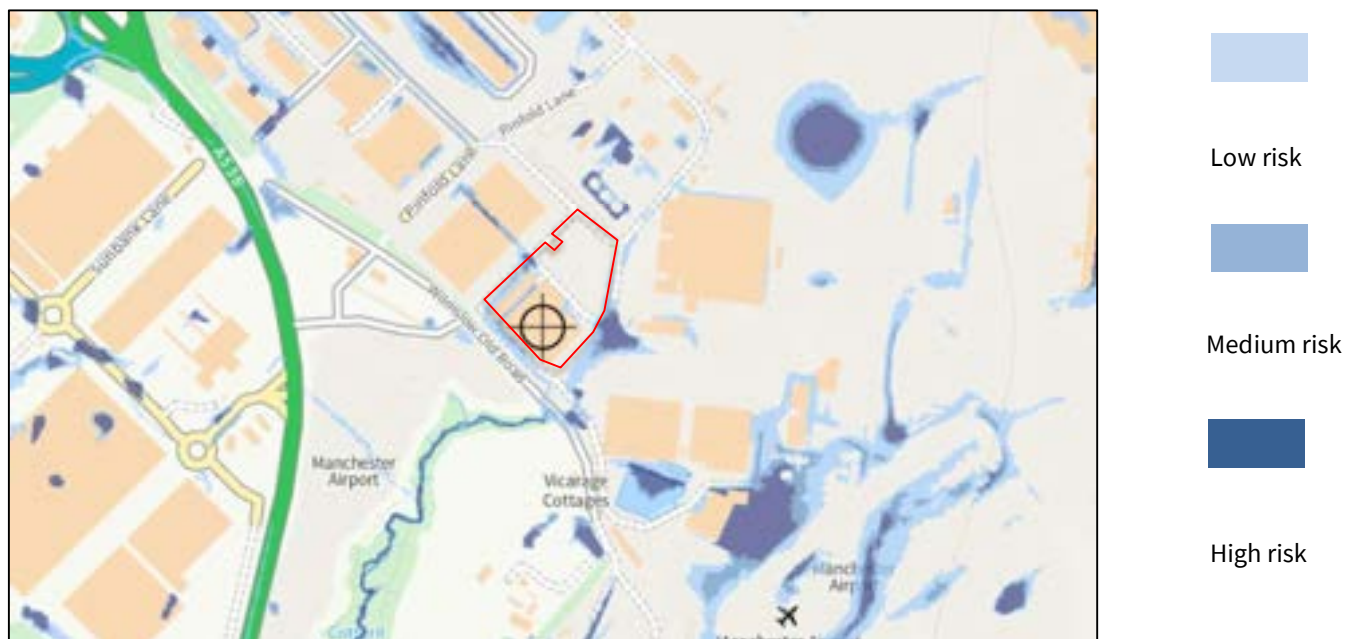


Figure 3: Environment Agency Flood Map for Planning

The EA surface water mapping identifies the majority of the site is at very low risk of surface water flooding, with small areas of high risk associated with the internal airport roads to the west and east of the site.

A drainage strategy for the site has been developed to manage the 100-year plus 45 % climate change event and therefore any runoff generated from the site will be captured, attenuated and discharged to Bollin outfall tunnel. Further details on the drainage strategy are outlined in Section 5.

The external ground level is proposed slope away from the building to reduce the potential for ingress of localised surface water flooding in the vicinity of the site.

Therefore, the surface water flood risk to the site is considered to be low.

3.3 GROUNDWATER FLOODING

Groundwater flooding occurs when groundwater emerges at the surface under conditions where the 'normal' range of groundwater levels and groundwater flows is exceeded.

The site is located on impermeable ground limiting the risk of groundwater flooding. In addition, the clay-based strata located between ground level and the groundwater table at the Site will limit the potential for groundwater to inundate the Site.

A review of the MCC SFRA groundwater flooding map, Appendix C, indicates the risks from groundwater flooding is very low.

Overall, the risk of groundwater flooding is considered to be low.

3.4 SEWER FLOODING

Sewer flooding occurs when intense rainfall overloads the sewer system capacity and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system.

A review of the MCC SFRA and LFRMS indicates there is no history of sewer flooding at the site or within the vicinity of the site.

It is proposed that the external ground levels slope away from the building to reduce the potential for ingress of flooding from the private sewer networks that are likely to be located in the vicinity of the site.

Based on the above, the risk of flooding from this source is considered to be low to negligible.

3.5 RESERVOIR FLOODING

The probability of a catastrophic dam failure is considered to be extremely low. All large reservoirs must be regularly inspected and supervised by reservoir panel engineers under the Environment Agency's enforcement of the Reservoirs Act 1975 in England.

A review of the Environment Agency's online Extent of Flooding from Reservoirs (Figure x) indicates that the site is not located within the reservoir flood extents 'when river levels are normal' and 'when there is also flooding from rivers'.

The risk from reservoir flooding is considered to be negligible.

3.6 CANAL FLOODING

There are no canals on or in proximity to the site and so the risk of flooding from this source is considered to be negligible.

3.7 SUMMARY OF FLOOD RISK

The flood risk for the site is summarised below:

- The site is located within Flood Zone 1, the Cotteril Clough Brook is the nearest watercourse located 55m south of the site flowing away from the Site. The site is at a greater elevation than the watercourse and therefore in the event of flooding it is considered unlikely that the site would be affected. The fluvial flood risk to the site is considered to be low.
- Due to the sites inland location the risk of tidal flooding is considered to be negligible.
- The site will have a drainage strategy for the site designed to a 100 year plus 45% climate change and therefore the surface water flood risk is considered to be low.
- The site is located on impermeable ground underlaid by clay-based strata reducing the likelihood of ground water flooding. The groundwater flood risk for the site is considered to be low.
- The MCC SFRA and LFRMS identifies no previous sewer flooding at the site. The sewer flood risk for the site is considered to be low to negligible.
- The site is not located with the EA reservoir flood extents and therefore the risk is considered to be negligible.
- There are no canals located within the vicinity of the site and therefore the risk is considered to be negligible.

4.0 SEQUENTIAL AND EXCEPTION TESTS

The site is located within Flood Zone 1 and is considered to be at a low risk of flooding from all sources and therefore meets the requirements of the sequential test. Therefore the exception test is not required as per the EA and DEFRA's 'Flood risk assessment: the sequential test for applicants' guidance.

5.0 SURFACE WATER MANAGEMENT

5.1 DRAINAGE HIERARCHY

In order to ensure that surface water runoff from the developed site does not increase the risk of flooding, in accordance with national and local policy, the management of runoff should be considered via a sequential approach. The following options for the disposal of surface water runoff have been considered at a high level, in order of preference:

- Discharge to ground;
- Discharge to a surface water body;
- Discharge to a surface water system, highway drain, or another drainage system, or;
- To a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewerage undertaker.

5.1.1.1 Discharge to Ground

Initial geotechnical investigations have indicated that the site is underlain by made ground over natural strata. Evidence of contamination has been observed from previous site uses. To facilitate the redevelopment of the site it is likely ground improvement works will be needed.

On the above basis discharge via infiltration is not considered to be viable.

5.1.1.2 Discharge to Surface Water Body

The nearest surface water body is Cotteril Clough. This watercourse is a designed SSSI and sensitive receptor. At the request of the Manchester Airport Group who manage the discharge permit and liaise regularly with the Environment Agency this outfall will not be utilised.

There are no other nearby waterbodies deemed viable for discharge.

5.1.1.3 Discharge to Surface Water System or Combined Sewer

The site will discharge to a nearby airport owned surface water drain. This existing drain conveys flows to the Bollin Outfall Tunnel which in turn conveys flows directly to the River Bollin.

5.2 IMPERMEABLE AREAS

Table 1 - Existing and Proposed Permeable Areas

Situation	Impermeable Area (ha)	Permeable Area (ha)
Existing	1.96	0
Proposed	1.96	0

5.3 DISCHARGE RATES

The discharge rate for the existing site area has been calculated as uncontrolled at 272 l/s. The new development will cover the same area and the impermeable area of the site will remain the same. The discharge rate for the new development will provide a 50% reduction in the rate of discharge (betterment) from the site and will discharge at a rate of 136 l/s, which is based upon the calculated current uncontrolled discharge rate.

5.4 REQUIRED ATTENUATION

Table 2 - Estimated Attenuation Volume

refer to appendix D for the microdrainage QSE calculations

Impermeable area (ha)	Discharge Rate (l/s)	1 in 100 year + 45% CC (m ³)
1.96	136	616

5.5 SUSTAINABLE DRAINAGE

5.5.1 Review of SuDS Options

The site redevelopment will comprise of an area that will remain 100% impermeable with nominal areas of feature landscaping. Betterment will be provided by reducing surface water discharge rates to 50% of its calculated brownfield rate.

A Class 1 bypass interceptor will be provided to reduce the risk from fuel oils. The drainage system will also include the introduction of catchpit manhole chambers to capture silt and debris from the sites paved surfaces and also from the building's roof prior to flows entering the attenuation tank. The use of permeable paving systems appropriate for the class of vehicle loading should be considered.

Car parking is proposed to the north of the site. The car park is proposed to be delivered as permeable paving system. Due to the lack of viable infiltration and potential contaminants in the ground this will be designed as a lined permeable paving system.

5.5.2 The SuDS Management Train

The main purpose of SuDS is to manage surface water runoff generated by a development within the development site, attenuating additional flows generated by the introduction of impermeable areas whilst providing water quality treatment to the runoff and amenity and landscape benefits to the community. SuDS features can be categorised as follows:

1. Source Control: manage runoff at its source
 - Water butts, green/brown roofs, permeable pavements, rainwater harvesting systems, bio-retention systems.
2. Site Control: manage runoff generated by a wider area
 - Swales, ponds, infiltration devices, filter strip, French drains.
3. Regional Control: manage runoff generated by several sites
 - Basins, ponds and wetlands

The following is an illustration of the SuDS principles and how they may be applied to a development via a SuDS Management Train.

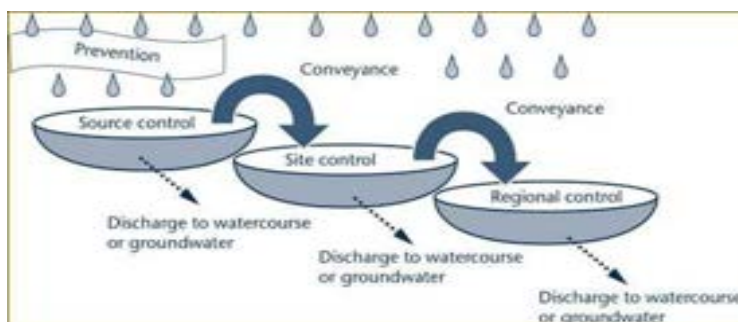


Figure 4: SuDS Management Train

Table 3 below summarises the suitability of the different SuDS features to the developed site.

Table 3 – Review of suitability of SuDS features to the developed site

Type of SuDS	Description	Suitability for the Site
Source Control		
Water butts	Small storage tanks on each individual housing plot.	Not appropriate for this development.
Rainwater harvesting	Recycling of water from roofs and impermeable areas.	

Green roofs	Vegetated roofs that reduce runoff and remove pollutants.	
Pervious surfaces	Pavements that allow surface water to flow into underlying layers of the pavement and either infiltrate or drain to an on-site drainage network.	These may be appropriate for some areas within the development such as car parking areas.
Rain gardens & bioretention systems	Shallow depressions with free draining soil and planted with vegetation that withstands occasional flooding.	Not appropriate for ground conditions.
Site & Regional Control		
Filter drains	Linear drains or trenches filled with granular material that allow infiltration to the surrounding ground.	Not appropriate for this development due to ground conditions.
Swales	Vegetated channels to convey store and treat runoff.	Not appropriate for this development.
Detention basins & ponds	Shallow areas of open space that temporarily hold water and collect silt.	Not appropriate for this development.
Infiltration basins	Shallow depression that stores runoff before it infiltrates into the subsoil.	Not appropriate for this development.
Infiltration devices	Generally granular trenches or soakaways that store water and allow infiltration to the surrounding ground.	Not appropriate for ground conditions.

Table 3 identifies that there is only one SuDS Type that may be appropriate for use within the development site, subject to detailed design. All SuDS should be designed in accordance with The SuDS Manual (Ciria C753) and Defra's Non-technical standards for sustainable drainage systems.

5.6 PROPOSED SURFACE WATER DRAINAGE STRATEGY

5.6.1 Drainage Strategy

The proposed drainage strategy is to provide a gravity surface water system to that will discharge at a reduced rate to the existing MAG owned drainage system located to the north of the site. The flows will be restricted to a 50% betterment of the existing calculated brownfield rate from the existing site.

The original site catchment drains towards the southern end of the site and discharges to the Cotteril Clough Brook, however, this is a sensitive watercourse and it has been requested by MAG to discharge flows to the MAG drainage system located to the north of the site. This system ultimately discharges to the River Bollin. MAG have agreed the capacity this system to be able to accept this restricted flow from the development.

The new system starts at the eastern side of the building and works around the building in a clockwise direction picking up the service yards, loading docks and vehicular entrances via channel drains. The car parking to the north end of the site will be drained via a lined system 3 permeable paving and connect to the attenuation tank. These flows will be treated with a class 1 bypass interceptor based on the catchment area size. The roof water will be collected via syphonic system and drain to the north end of the building and will pass through a catch pit manhole before entering into an attenuation tank.

The attenuation is estimated to be a 616 m³ underground geocellular tank located under the car park to the north, with a 136 l/s vortex flow control located to the north side of the tank. The outfall will be towards the existing MAG drainage located to the north of the site. Refer to appendix F for the Drainage General Arrangement.

The design will cater for a 100 year rainfall events plus climate change with no flooding to cater for the airports request for no flooding to occur during these events. The microdrainage calculation are within appendix E

Exceedance flows above the 100 year plus climate change would initially hold within the eastern loading dock then exceed the site from the southern and eastern sides from the service yard vehicular entrances.

Two existing surface water pipes entering the site from the east will require a 93 m division, this will remove the runs from the development while maintaining their flow to the original outfalls.

The existing drainage to the substation, located on the west side of the site, will also need to be diverted to the existing drainage in the road just to the west of the development.

Car parking is proposed to the north of the site. The car park is proposed to be delivered as permeable paving system. Due to the lack of viable infiltration and potential contaminants in the ground this will be designed as a lined permeable paving system. Flows will be collected from the permeable paving system via a filter drain and connected to the main site drainage network via catchpit for silt capture.

5.6.2 Water Quality and Treatment

In accordance with Table 26.2 of The SuDS Manual CIRIA C753, pollution hazard indices are attributed to the areas serviced by SuDS. The area being developed can be considered to have a 'medium-low' pollution hazard level. The requirements for discharge to surface waters state that the 'simple index approach' should be used.

Step 1 of the 'Simple index approach' outlined in The SuDS Manual is to identify the pollution hazard indices for the proposed land uses. These are set out in Table 4 below, which is an extract of Table 26.2 of The SuDS Manual.

Table 4 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-carbons
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways.	Medium	0.7	0.6	0.7

Step 2 of the Simple index approach is to select SuDS features with a total pollution mitigation index that equals or exceeds the pollution hazard index. Appropriate SuDS should be considered during development of the drainage strategy for the new build(s). As an example, SuDS mitigation indices for the SuDS applicable to the site, outlined in Table 5 above, are shown in Table 6 below. These are taken from Table 26.3 of The SuDS Manual.

Table 5 – SuDS Mitigation Indices

SuDS Feature	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable paving	0.7	0.6	0.7

Provided that the mitigation indices of the treatment techniques are equal to the hazard indices for the proposed development then there should be no reduction in the overall water quality within the receiving system.

As stated in 5.5.1, a Class 1 bypass interceptor will be provided to reduce the risk from spilt or leaking fuel oils contaminating surface water flows and discharging from site. The drainage system will also include the introduction of catchpit manhole chambers to capture silt and debris from the sites paved surfaces and also from the building's roof prior to flows entering the attenuation tank. Permeable paving will also be provided in the asphalt car parking area.

5.6.3 SUDS & Drainage Systems Maintenance

SuDS require regular maintenance to keep them working effectively. It is assumed that drainage and SuDS on the site will be non-adoptable and therefore the responsibility of the Client or a delegated management company. Table 7 below shows the maintenance requirements for each of the proposed SuDS features for the scheme.

Table 6 – SuDS maintenance tasks and frequency required

SuDS Feature	Maintenance Task	Recommended Frequency
Permeable Paving	- Cleaning the surface by brush or sweeping - Removal or management of weeds - Remediation of any broken paving, rutting or lost jointing material. - Rehabilitation of the upper surface and substructure by remedial sweeping	- Annually or as required if more frequently required - Annually - As required 10 to 15 years or when significant clogging.
Pipe drainage System	- Remove debris from catchment surface - Remove sediment from pre-treatment structures - Inspect inlets and outlets - Survey inside of the pipes	- Every 12 months - Every 12 months - Every 12 months - Every 5 years
Geocellular Attenuation Tank	- Remove debris from catchment surface - Remove sediment from pre-treatment structures - Inspect inlets and outlets - Survey inside of the tank	- Every 12 months - Every 12 months - Every 12 months - Every 5 years
By-pass Separator	- Remove litter and debris - Inspect for oil and silt accumulation remove as necessary - Service electrical systems - General Inspection - Replace filter media	- Every 6 months - Every 6 months - Every 5 years - As specified by manufacturer - As specified by manufacturer

5.7 EXCEEDANCE FLOW ROUTES

All site levels are profiled to fall away from the proposed building to the external permitter of the site. In an exceedance event flow will convey from the site to the external airport owned perimeter roads where existing drainage networks are in place which will suitably capture exceedance flows and convey them to existing airport outfalls.

6.0 FOUL DRAINAGE

6.1 EXISTING DRAINAGE

The existing Hangar which is located on site and is scheduled for demolition, discharges foul drainage via a gravity network to the existing airport owned Pumping Station 1. The existing outfall from the site is to be re-used for the proposed development at the request of Manchester Airport.

6.2 PROPOSED FOUL DRAINAGE

The proposed unit will drain via a gravity foul network emanating in the north wrapping around the building serving the proposed office and welfare areas.

Flows will discharge to the existing MAG owned network to the South with flows conveyed to the Airport Pumping Station 1. MAG have confirmed there is suitable capacity for this discharge.

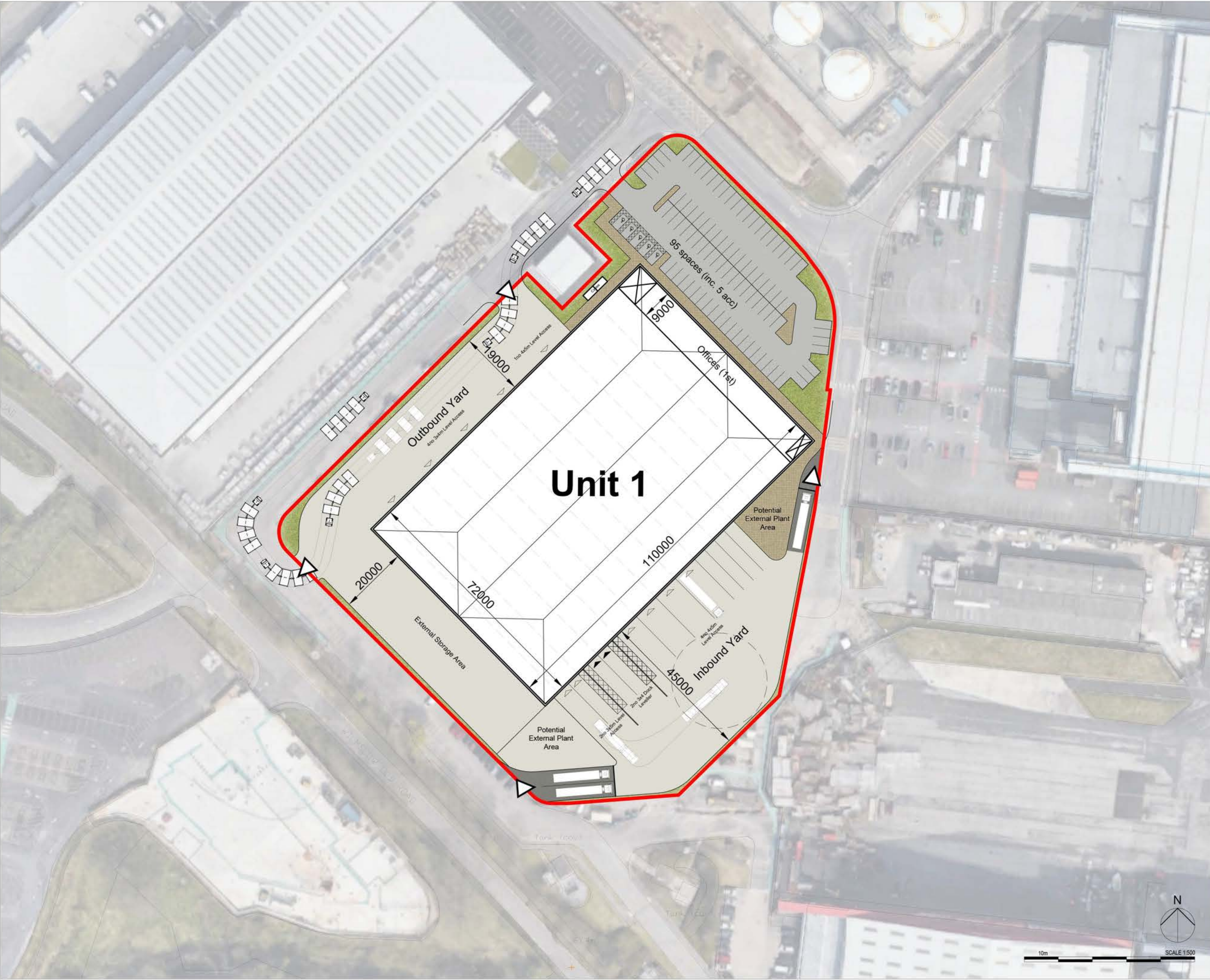
Foul flows from pumping station 1 are conveyed by a series of pumping stations and rising mains across the airfield and outfall to a United Utilities sewer at an agreed discharge rate. The final discharge rate will remain as existing.

7.0 CONCLUSIONS & RECOMMENDATIONS

7.1 CONCLUSIONS

- The site is located within Flood Zone 1 and is considered to be at low risk from all other sources of flooding with the exception of surface water flooding.
- Existing surface water flood mapping indicates surface water flow paths along the north west side, and south west sides of the existing building.
- At the request of Manchester Airport Group (MAG) the outfall of for the system is to be change from the existing, heading to the Cotterial Clough Brook, a SSSI designated watercourse, to the river Bollin via the existing MAG drainage system
- Proposed surface water drainage scheme to be is to be restricted to a 50% betterment of the existing flow to 136 l/s
- No flooding to occur for the 100year plus climate change events.
- Geocellular underground attenuation to be used, and a vortex flow control.
- The car park to the north is to have a lined system C permeable paving.
- Flows for the service yards are to pass through a by-pass interceptor.
- Exceedance flows, above the 100 year plus climate change events, will pass off the site generally to the southern side to wider existing MAG drainage system.

APPENDIX A: PROPOSED SITE PLAN



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Notes

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SCHEDULE OF ACCOMMODATION

Unit 1 GIA	m²	sq ft
Warehouse Footprint	7,272	78,276
Office Undercroft	561	6,038
Grd Floor Rec.+ FE	87	936
1st Floor Office	648	6,975
TOTAL GIA	8,568	92,225
Site Area	1.958Ha	4.89acres
Site Density	43.75%	
Haunch Height	12.5m	
Dock Levellers	2	
Level Access	11	
HGV Parking	12 (inc. 8 Loading)	
Cycles	9	
Car Parking	95 (inc. 5 Accessible)	

P01	First Issue	LL	MJH	21/02/23
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Project

Hangar 4, Manchester Airport

Title

Proposed Masterplan
Option 6b

RPS Project Number	Scale @ A1	Date Created
NK020993	1:500	16/02/23
Task Team Manager	Information Author	Task Information Manager
KRP	LL	MJH

Status

S2 (Suitable for Information)

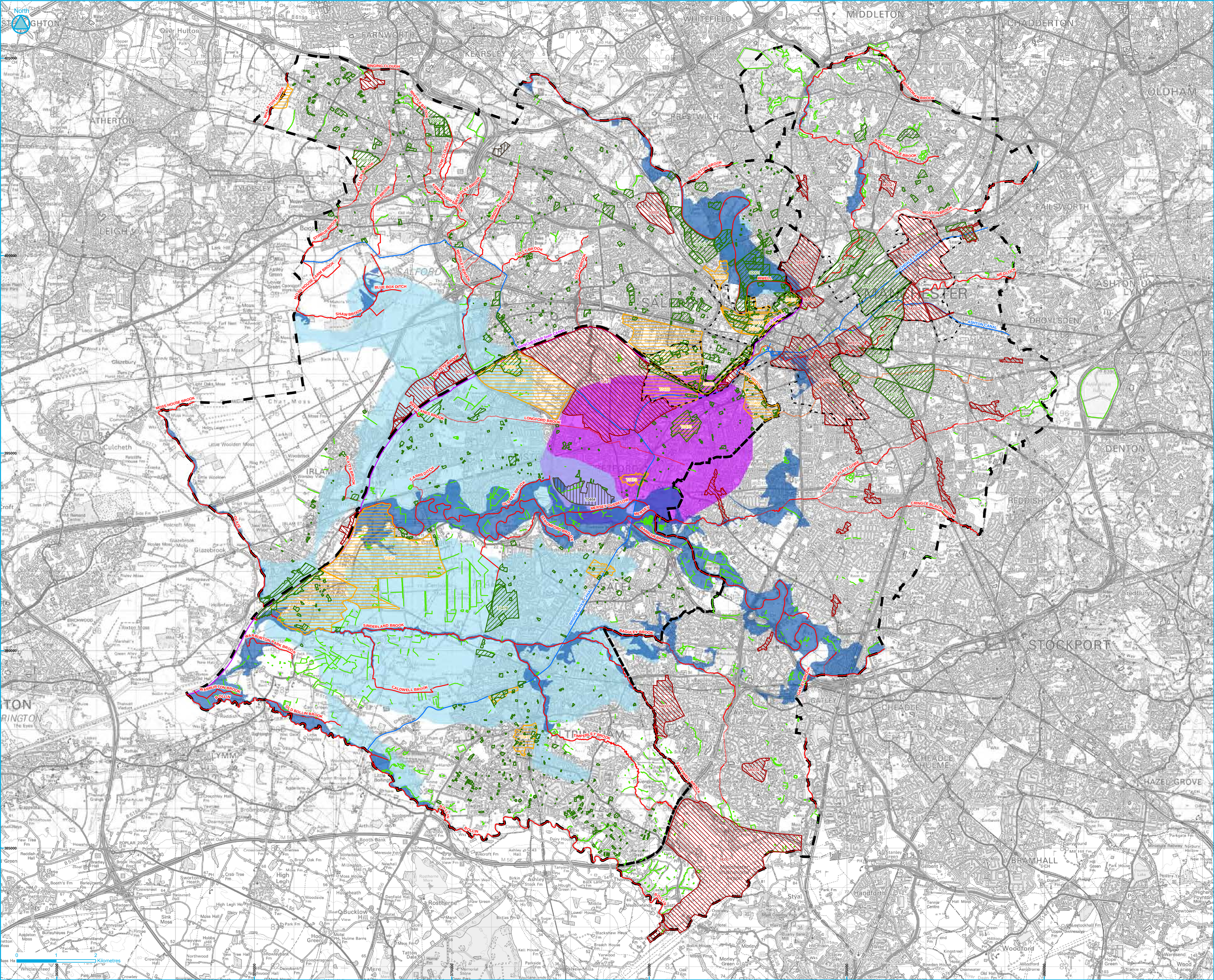
Document Number	Revision
020993-RPS-SI-XX-DR-A-9029	P01

Project Code - Originator - Functional - Spatial - Type - Discipline - Number

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APPENDIX B: TOPOGRAPHICAL SURVEY

APPENDIX C: GROUNDWATER SUSCEPTIBILITY MAP



- Council Boundary
- Areas at risk of GW Flooding
- Areas of shallow GW
- Areas at risk of GW rebound
- Employment
- Housing
- Mixed Use
- Other
- Regional Centre Boundary
- Ashton, Bridgewater and Rochdale Canals
- Manchester Ship Canal / Grey Irwell
- Other Waterbodies
- Main Rivers (V8.0)**
 - Culverted
 - Open
- Digitised River Lines**
 - Culverted
 - Open

The map has been produced in accordance with PPS25: Development and Flood Risk and its Practice Guide. This map shows areas that are potentially at risk from groundwater flooding and should be used to scope suitable mitigation measures in a site specific Flood Risk Assessment.

The Main River information shown in the SFRA is provided by the Environment Agency; the centreline data may deviate from that shown on basemapping due to inherent differences in data resolution. Further information on Main Rivers is provided on the Environment Agency's website. The mapping of culverted sections of watercourse is a strategic screening only based upon Ordnance Survey 1:10,000 mapping and should be confirmed for more detailed studies such as site specific Flood Risk Assessment. The canals layer does not necessarily cover all the canal arms, but the modelled overtopping/breaching and hydraulic interactions with rivers and other waterbodies is complete and accurate as appropriate for a Strategic Flood Risk Assessment.

The information on the map is based on Environment Agency potential groundwater rebound areas, data from the Coal Authority, BGS drift geology mapping and Defra Groundwater Emergence Maps.

The River Irwell between Victoria Station and Pomona Island is not shown as a Main River on the Environment Agency's Flood Map although Flood Zones related to the river are. The same approach has been taken in this SFRA.

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Other offices at: Atherstone, Doncaster, Edinburgh, Haywards Heath, Limerick, Newcastle upon Tyne, Newport, Northallerton, Salford, Skipton, Tadcaster & Wellingford

for

Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

Groundwater Flooding

Drawn by: J Cheetham	Date: 08/03/2011	This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationary Office. Crown copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence number: 100015658 2011.
Checked by: J Dimelow	Date: 01/02/2011	
Approved by: J Cooper	Date: 01/02/2011	
File Name: ArcViewMapping\Level1\MS1_GroundwaterFlooding_V1.3.mxd		
Drawing Number:	Status:	Scale:
GW_2.1	FINAL	1:45,000
		Original @ A1

APPENDIX D: MICRODRAINAGE - QUICK STORAGE ESTIMATES



Variables

Results

Design

Overview 2D

Overview 3D

Vt

Variables

FSR Rainfall

Return Period (years)

100

Region

England and Wales

Map

M5-60 (mm)

18.300

Ratio R

0.397

Cv (Summer)

0.750

Cv (Winter)

0.840

Impervious Area (ha)

1.960

Maximum Allowable Discharge (l/s)

136.0

Infiltration Coefficient (m/hr)

0.00000

Safety Factor

2.0

Climate Change (%)

45

Analyse

OK

Cancel

Help

Enter Climate Change between -100 and 600



Variables

Results

Design

Overview 2D

Overview 3D

Vt

Results

Global Variables require approximate storage of between 450 m³ and 783 m³.

These values are estimates only and should not be used for design purposes.

Analyse

OK

Cancel

Help

APPENDIX E: MICRODRAINAGE CALCULATIONS - HANGAR 4

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Designed by DOUG.HYSLOP
Checked by

Network 2020.1

Page 2



STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.012	22.045	0.010	2204.5	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	4.849	0.083	58.4	0.203	4.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	4.849	0.083	58.4	0.103	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.002	16.308	0.190	85.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.000	29.832	0.299	99.8	0.202	4.00	0.0	0.600	o	300	Pipe/Conduit	
6.000	9.569	0.164	58.3	0.405	4.00	0.0	0.600	o	375	Pipe/Conduit	
5.001	8.667	0.083	104.4	0.103	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.002	13.702	1.669	8.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.013	2.725	0.009	302.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.014	22.530	0.055	409.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.012	0.00	10.31	64.009	0.940	0.0	0.0	0.0	0.42	67.4	0.0
4.000	0.00	4.04	65.500	0.203	0.0	0.0	0.0	2.06	145.7	0.0
4.001	0.00	4.08	65.417	0.306	0.0	0.0	0.0	2.06	145.7	0.0
4.002	0.00	4.24	65.334	0.306	0.0	0.0	0.0	1.70	120.0	0.0
5.000	0.00	4.32	66.200	0.202	0.0	0.0	0.0	1.57	111.3	0.0
6.000	0.00	4.07	66.000	0.405	0.0	0.0	0.0	2.38	262.4	0.0
5.001	0.00	4.40	65.826	0.710	0.0	0.0	0.0	1.77	195.8	0.0
5.002	0.00	4.43	65.743	0.710	0.0	0.0	0.0	6.36	702.0	0.0
1.013	0.00	10.35	63.999	1.956	0.0	0.0	0.0	1.16	185.0	0.0
1.014	0.00	10.73	63.990	1.956	0.0	0.0	0.0	1.00	158.8	0.0

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Innovyze					Network 2020.1						
Manhole Schedules for Storm											
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Invert Level (m)	Diameter (mm)	Pipes In PN	Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	67.360	1.281	Open Manhole	1500	1.000	66.079	300				
2	67.380	1.987	Open Manhole	2100	1.001	65.393	375	1.000	65.468	300	
3dock	66.800	0.919	Open Manhole	2100	2.000	65.881	225				
4	67.420	2.439	Open Manhole	2400	1.002	64.981	450	1.001	65.056	375	
								2.000	65.206	225	
5	67.580	2.646	Open Manhole	2400	1.003	64.934	450	1.002	64.934	450	
6a CD	67.230	1.180	Open Manhole	200	3.000	66.050	150				
6	67.580	2.733	Open Manhole	2100	1.004	64.847	450	1.003	64.847	450	
								3.000	65.814	150	667
59	67.580	2.988	Open Manhole	1500	1.005	64.592	450	1.004	64.592	450	
8	67.600	3.022	Open Manhole	1350	1.006	64.578	450	1.005	64.578	450	
9	67.800	3.453	Open Manhole	1350	1.007	64.347	450	1.006	64.347	450	
10	68.040	3.754	Open Manhole	1350	1.008	64.286	450	1.007	64.286	450	
12	67.980	3.771	Open Manhole	1350	1.009	64.209	450	1.008	64.209	450	
13 int	67.980	3.880	Open Manhole	1350	1.010	64.100	450	1.009	64.200	450	100
14	67.760	3.742	Open Manhole	1350	1.011	64.018	450	1.010	64.018	450	
14a TI	67.760	3.751	Open Manhole	1350	1.012	64.009	450	1.011	64.009	450	
15 SY	67.240	1.740	Open Manhole	1800	4.000	65.500	300				
16	67.440	2.023	Open Manhole	1200	4.001	65.417	300	4.000	65.417	300	
16 TI	67.640	2.306	Open Manhole	1200	4.002	65.334	300	4.001	65.334	300	
17 SY	68.040	1.840	Open Manhole	1800	5.000	66.200	300				
18 SY	67.820	1.820	Open Manhole	1800	6.000	66.000	375				
19 CP	67.740	1.914	Open Manhole	1350	5.001	65.826	375	5.000	65.901	300	
								6.000	65.836	375	10
19a TI	67.620	1.877	Open Manhole	1350	5.002	65.743	375	5.001	65.743	375	
20a TO	67.880	3.881	Open Manhole	1350	1.013	63.999	450	1.012	63.999	450	
								4.002	65.144	300	995
								5.002	64.074	375	
20 HYDRO	67.980	3.990	Open Manhole	1350	1.014	63.990	450	1.013	63.990	450	
	68.400	4.465	Open Manhole	0		OUTFALL		1.014	63.935	450	
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Simulation Criteria for Storm

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

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

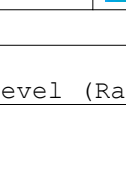
Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.400	Storm Duration (mins)	30
Ratio R	0.400		

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Online Controls for Storm																																																																										
Hydro-Brake® Optimum Manhole: 20 HYDRO, DS/PN: 1.014, Volume (m³): 5.9																																																																										
Unit Reference		MD-SHE-0419-1360-3250-1360																																																																								
Design Head (m)		3.250																																																																								
Design Flow (l/s)		136.0																																																																								
Flush-Flo™		Calculated																																																																								
Objective		Minimise upstream storage																																																																								
Application		Surface																																																																								
Sump Available		Yes																																																																								
Diameter (mm)		419																																																																								
Invert Level (m)		63.990																																																																								
Minimum Outlet Pipe Diameter (mm)		Site Specific Design (Contact Hydro International)																																																																								
Suggested Manhole Diameter (mm)		Site Specific Design (Contact Hydro International)																																																																								
<table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>3.250</td><td>136.0</td><td>Kick-Flo®</td><td>2.107</td><td>110.2</td></tr><tr><td>Flush-Flo™</td><td>0.968</td><td>136.0</td><td>Mean Flow over Head Range</td><td>-</td><td>117.4</td></tr></table>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	3.250	136.0	Kick-Flo®	2.107	110.2	Flush-Flo™	0.968	136.0	Mean Flow over Head Range	-	117.4																																																						
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Flush-Flo™	0.968	136.0	Mean Flow over Head Range	-	117.4																																																																					
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated																																																																										
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>11.3</td><td>1.200</td><td>135.0</td><td>3.000</td><td>130.8</td><td>7.000</td><td>197.8</td></tr><tr><td>0.200</td><td>40.8</td><td>1.400</td><td>133.0</td><td>3.500</td><td>141.0</td><td>7.500</td><td>204.6</td></tr><tr><td>0.300</td><td>79.8</td><td>1.600</td><td>130.0</td><td>4.000</td><td>150.5</td><td>8.000</td><td>211.2</td></tr><tr><td>0.400</td><td>115.6</td><td>1.800</td><td>125.2</td><td>4.500</td><td>159.4</td><td>8.500</td><td>217.5</td></tr><tr><td>0.500</td><td>126.5</td><td>2.000</td><td>116.9</td><td>5.000</td><td>167.8</td><td>9.000</td><td>223.7</td></tr><tr><td>0.600</td><td>130.8</td><td>2.200</td><td>112.5</td><td>5.500</td><td>175.8</td><td>9.500</td><td>229.7</td></tr><tr><td>0.800</td><td>135.1</td><td>2.400</td><td>117.3</td><td>6.000</td><td>183.4</td><td></td><td></td></tr><tr><td>1.000</td><td>136.0</td><td>2.600</td><td>122.0</td><td>6.500</td><td>190.8</td><td></td><td></td></tr></table>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	11.3	1.200	135.0	3.000	130.8	7.000	197.8	0.200	40.8	1.400	133.0	3.500	141.0	7.500	204.6	0.300	79.8	1.600	130.0	4.000	150.5	8.000	211.2	0.400	115.6	1.800	125.2	4.500	159.4	8.500	217.5	0.500	126.5	2.000	116.9	5.000	167.8	9.000	223.7	0.600	130.8	2.200	112.5	5.500	175.8	9.500	229.7	0.800	135.1	2.400	117.3	6.000	183.4			1.000	136.0	2.600	122.0	6.500	190.8		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																			
0.100	11.3	1.200	135.0	3.000	130.8	7.000	197.8																																																																			
0.200	40.8	1.400	133.0	3.500	141.0	7.500	204.6																																																																			
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Innovyze Network 2020.1																		
Storage Structures for Storm Tank or Pond Manhole: 20a TO, DS/PN: 1.013 Invert Level (m) 64.000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>306.0</td><td>1.000</td><td>306.0</td><td>2.000</td><td>306.0</td><td>2.001</td><td>0.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	306.0	1.000	306.0	2.000	306.0	2.001	0.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)											
0.000	306.0	1.000	306.0	2.000	306.0	2.001	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 Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.393
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.200	Cv (Winter)	0.840

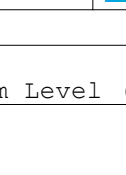
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 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) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Summer	1	+0%	100/15 Winter				66.121
1.001	2	15 Winter	1	+0%	100/15 Summer				65.488
2.000	3dock	15 Summer	1	+0%	100/15 Summer				65.913
1.002	4	15 Winter	1	+0%	100/15 Summer				65.117
1.003	5	15 Winter	1	+0%	100/15 Summer				65.092
3.000	6a CD	15 Winter	1	+0%	100/15 Summer				66.098
1.004	6	15 Winter	1	+0%	100/15 Summer				65.011
1.005	59	15 Winter	1	+0%	30/15 Winter				64.819
1.006	8	15 Winter	1	+0%	100/15 Summer				64.764
1.007	9	30 Winter	1	+0%	30/15 Winter				64.575
1.008	10	15 Winter	1	+0%	30/15 Winter				64.535
1.009	12	30 Winter	1	+0%	30/15 Winter				64.496
1.010	13 int	30 Winter	1	+0%	30/15 Summer				64.490
1.011	14	30 Winter	1	+0%	30/15 Summer				64.466

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Innovyze				Network 2020.1					
1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for <u>Storm</u>									
PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.258	0.000	0.05			6.7	OK	
1.001	2	-0.280	0.000	0.14			19.5	OK	
2.000	3dock	-0.193	0.000	0.05			4.0	OK	
1.002	4	-0.314	0.000	0.20			32.1	OK	
1.003	5	-0.292	0.000	0.25			36.4	OK	
3.000	6a CD	-0.102	0.000	0.22			6.7	OK	
1.004	6	-0.286	0.000	0.27			43.2	OK	
1.005	59	-0.223	0.000	0.51			58.3	OK	
1.006	8	-0.264	0.000	0.35			56.3	OK	
1.007	9	-0.221	0.000	0.42			59.1	OK	
1.008	10	-0.201	0.000	0.43			63.4	OK	
1.009	12	-0.162	0.000	0.45			56.4	OK	
1.010	13 int	-0.060	0.000	0.40			62.0	OK	
1.011	14	-0.002	0.000	0.48			60.0	OK	
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3 Sovereign Square Sovereign Street Leeds LS1 4ER		
Date 18/04/2023 17:15 File Hangar 4 Model 3 17.04.2...	Designed by DOUG.HYSLOP Checked by	
Innovyze Network 2020.1		

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 Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.393
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.200	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 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) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	30	+0%	100/15 Winter				66.147
1.001	2	15 Winter	30	+0%	100/15 Summer				65.561
2.000	3dock	15 Summer	30	+0%	100/15 Summer				65.932
1.002	4	15 Winter	30	+0%	100/15 Summer				65.260
1.003	5	15 Winter	30	+0%	100/15 Summer				65.242
3.000	6a CD	15 Winter	30	+0%	100/15 Summer				66.129
1.004	6	15 Winter	30	+0%	100/15 Summer				65.185
1.005	59	15 Winter	30	+0%	30/15 Winter				65.049
1.006	8	15 Winter	30	+0%	100/15 Summer				64.971
1.007	9	30 Winter	30	+0%	30/15 Winter				64.851
1.008	10	30 Winter	30	+0%	30/15 Winter				64.805
1.009	12	30 Winter	30	+0%	30/15 Winter				64.754
1.010	13 int	30 Winter	30	+0%	30/15 Summer				64.736
1.011	14	60 Winter	30	+0%	30/15 Summer				64.694

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Page 17



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Network 2020.1

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

Simulation Criteria

Areal Reduction Factor 1.000

Hot Start (mins) 0

Hot Start Level (mm) 0

Manhole Headloss Coeff (Global) 0.500

Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000

MADD Factor * 10m³/ha Storage 2.000

Inlet Coefficient 0.800

Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0

Number of Offline Controls 0

Number of Time/Area Diagrams 0

Number of Online Controls 1

Number of Storage Structures 1

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Region England and Wales

M5-60 (mm) 18.200

Ratio R 0.393

Cv (Summer) 0.750

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second

DTS Status ON

DVD Status OFF

Inertia Status OFF

Increment (Extended)

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

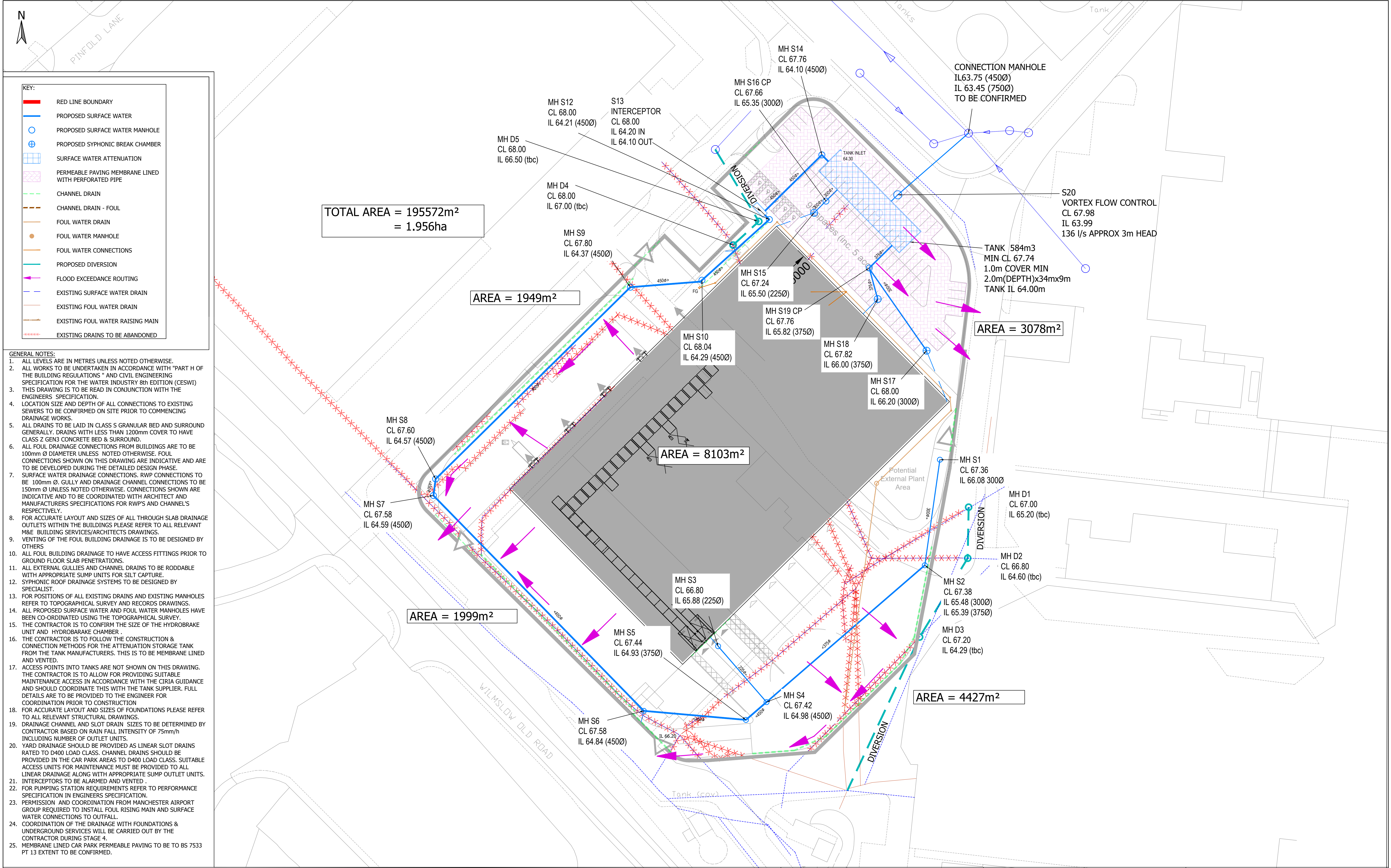
Return Period(s) (years) 1, 30, 100

Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+45%	100/15 Winter				66.447
1.001	2	15 Winter	100	+45%	100/15 Summer				66.433
2.000	3dock	30 Winter	100	+45%	100/15 Summer				66.390
1.002	4	15 Winter	100	+45%	100/15 Summer				66.389
1.003	5	15 Winter	100	+45%	100/15 Summer				66.375
3.000	6a CD	15 Winter	100	+45%	100/15 Summer				66.406
1.004	6	15 Winter	100	+45%	100/15 Summer				66.342
1.005	59	15 Winter	100	+45%	30/15 Winter				66.250
1.006	8	30 Winter	100	+45%	100/15 Summer				66.177
1.007	9	30 Winter	100	+45%	30/15 Winter				65.967
1.008	10	30 Winter	100	+45%	30/15 Winter				65.845
1.009	12	30 Winter	100	+45%	30/15 Winter				65.699
1.010	13 int	60 Winter	100	+45%	30/15 Summer				65.600
1.011	14	60 Winter	100	+45%	30/15 Summer				65.546

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APPENDIX F: DRAINAGE GENERAL ARRANGEMENT DRAWING



0 5 10 15 20 25m

SCALE 1:500

PRELIMINARY ISSUE

Client

MANCHESTER AIRPORT GROUP,
MAG

Project Name

HANGAR 4 DEMOLITION

Issuing Office

Tetra Tech Leeds
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TTE Project Number

Drawn By

Date

Checked By

Date

Approved By

Date

Scale

@ A1

Suitability

B041631

MA

MAR 23

DH

MAR 23

NM

MAR 23

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S0

Client Project Number

Originator

Volume/System

Level/Location

Type/Code

Role

Number

Revision

B041631

- TTE

- 00

- ZZ

- DR

- C

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P03

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P03	CAR PARK DRAINAGE AMENDED FOR PERMEABLE PAVING AND FLOOD ROUTING ARROWS SHOWN	18.04.2023	DJH	DJH	NM
P02	REVISED LEVELS	03.04.2023	MA	DJH	NM
P01	PRELIMINARY ISSUE	20.03.2023	MA	DJH	NM
Rev	Description	Date	Drn / Chk / App		
	Document Control				