

Stage 4 Drainage Strategy

Mayfield Park

0042912

1 March 2021

Revision P07

Revision	Description	Issued by	Date	Checked
P01	Drainage Strategy	JS	02/09/2019	AG
P02	Drainage Strategy Amendments	JS	13/09/2019	AG
P03	For Planning	JF	15/10/2020	CB
P04	Stage 4	JF	18/12/2020	CB
P05	Stage 4 Updates	JF	29/01/2021	CB
P06	Incorporating Planning Comments	JF	17/02/2021	CB
P07	Incorporating Planning Comments	JF	01/03/2021	CB

[https://burohappold.sharepoint.com/sites/046688/02_Documents/03_Reports/Drainage Strategy Report/210301 JF 004912 Drainage Strategy P07.docx](https://burohappold.sharepoint.com/sites/046688/02_Documents/03_Reports/Drainage%20Strategy%20Report/210301%20JF%20004912%20Drainage%20Strategy%20P07.docx)

This report has been prepared for the sole benefit, use and information of Mayfield Partnership for the purposes set out in the report or instructions commissioning it. The liability of Buro Happold in respect of the information contained in the report will not extend to any third party.

author

James Forsey

date

01 March 2021

approved

Colin Byrne

signature



date

01 March 2021

..

[Click here to enter text.](#)

Contents

1 Introduction	7
2 Legislation, Policy and Guidelines	8
Planning Context	8
Planning Policies and the Guidance	8
3 Consultation with Manchester City Council and the Environment Agency	9
Manchester City Council (MCC)	9
Environment Agency (EA)	9
Scoping Opinion Response	9
Further Consultation with MCC	9
4 Existing Site	10
Existing Flood Zones	10
5 Existing Surface Water Drainage	11
Existing Drainage and Outfalls	11
6 Existing Foul Water Drainage	12
7 Proposed Surface Water Drainage	13
Proposed Strategy	13
Design Parameters	14
Contaminated Ground and Infiltration	15
Existing vs Proposed Runoff Rates	15
Catchment Areas	16
Proposed Outfalls	18
Outfall 1a and 1b	19
Proposed Layout	19
Overland Flow and Exceedance Events	20
8 Proposed Foul Water Drainage	21
Appendix A Existing Foul/Combined Sewer Network	22
Appendix B Proposed Foul Network	23
Appendix C Proposed Catchment Areas	24
Appendix D Proposed Storm Water Layouts	25
Appendix E Proposed Storm Water Manhole Schedule and Details	26
Appendix F MicroDrainage Results	27
Appendix G Drainage Plans from Plot Teams of Building Plots O, N	28
Appendix H MCC Correspondence	29
Appendix I Soakaway Testing and Contamination Report	30

Table of Tables

Table 7-1 Existing vs Proposed Peak Discharge Requirement (* = Flow Control on this catchment, see Table 7-2)	15
Table 7-2 Summary of peak flow at the outfall from MicroDrainage	15
Table 7-3 Summary of Flow Control devices within the full site build out	16
Table 7-4 Proposed Catchment Areas (See Figure 7-3 or location plan)	16
Table 7-5 Existing Catchment Areas	17

Table of Figures

Figure 1-1 Proposed Mayfield Park.....	7
Figure 4-1 Existing Site with the Phase 1 Site Boundary.....	10
Figure 4-2 Mayfield 2019 Flood Map extract from the Flood Risk Assessment.....	10
Figure 5-1 Existing Outfall Observed During Site Visit	11
Figure 5-2 Existing river wall outfalls observed in culvert conveyance survey	11
Figure 5-3 Debris build up within culvert.....	11
Figure 6-1 United Utilities Sewer Asset Record. (Image courtesy of United Utilities © United Utilities Water PLC 2017).....	12
Figure 6-2 Known private site sewerage (Image courtesy of the United Utilities © United Utilities Water PLC 2017).....	12
Figure 7-1 Designed wildscape area within the site, highlighted in red	14
Figure 7-2 Areas drained via overland flow/infiltration.....	14
Figure 7-3 Catchment Areas Plan (park boundary shown in red dashed).....	17
Figure 7-4: MircoDrainage Model, Detailing Future Network Outside of Phase 1 Boundary.....	17
Figure 7-5 Surface Water Plot Connection Points into proposed surface water sewer.....	18
Figure 7-6 1 in 5, 25, 100+cc Year fluvial flood levels and Average Water Levels near proposed outfalls	19
Figure 7-7 Outfall 1a and 1b in the wildscape area	19
Figure 7-8 1 in 100 + 35%cc Fluvial Flood Extents.....	19
Figure 7-9 Proposed Surface Water Drainage Layout Plan.....	19
Figure 7-10 Overland flow diagram	20
Figure 8-1 Proposed Foul Network.....	21

1 Introduction

BuroHappold Engineering has been appointed by U+I Group PLC on behalf of the Mayfield Development Partnership LP to prepare a drainage strategy for Mayfield Phase 1 Development, including two commercial office blocks, a multi-storey car park and creation of a city centre park. The Phase 1 site is 7 Ha and is bounded by the Mayfield Depot building to the north, Hoyle Street to the east, the Mancunian Way ring road (A635) to the south and Baring Street (inclusive) to the west. The Site boundary also extends to the London Road junction and access to Baring Street to facilitate road improvements proposed ("the Site").

This report has been prepared to describe the proposed surface water and foul water drainage strategy for the new development, a high-quality urban neighbourhood with residential buildings and public spaces just south of the Manchester Piccadilly Railway Station.

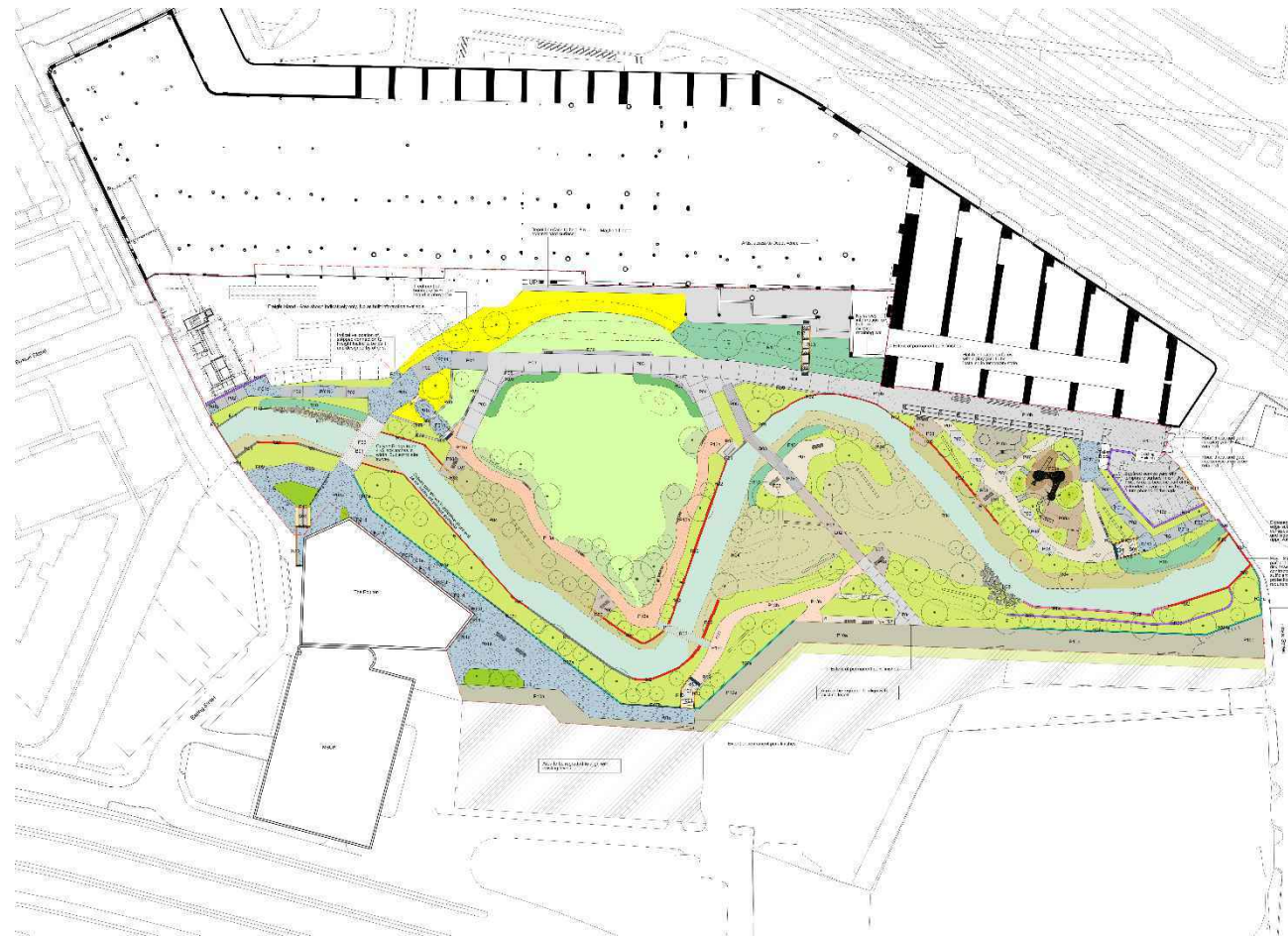


Figure 1-1 Proposed Mayfield Park

2 Legislation, Policy and Guidelines

Planning Context

The management of water resources is governed by a range of legislative guidance set out within international, national and regional policies and plans. The stormwater strategy has been prepared with due regard to the plans and policies set out in this section.

Planning Policies and the Guidance

The Drainage Strategy has been developed in accordance with the following policies and guidelines:

- National Planning Policy Framework – March 2012
- Water Resources Act 1991 – December 1991
- Flooding and Water Management Act 2010 – April 2010
- Non-statutory Technical Standards for Sustainable Drainage Systems
- Guide to Development in Manchester Supplementary Planning Document and Planning Guidance Adopted - April 2007
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide Final – May 2010
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA Level 2 SFRA Final – March 2011
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA Canal Hazard Zones, Drawing Number MM_3.2B, Final – March 2011
- Manchester City, Salford City and Trafford Councils (March 2011) Level 2 Hybrid SFRA Critical Drainage Areas, Drawing Number SS_4.5, Final – March 2011
- Manchester City, Salford City and Trafford Councils (March 2011) Level 2 Hybrid SFRA Flood Risk Management, Drawing Number FL_1.1 F, Final – March 2011
- Manchester City Council SuDS Requirements for New Developments
- Manchester Green and Blue Strategy – July 2015
- Manchester Green and Blue Action Plan – July 2015
- Northwest River Basin Management Plan – February 2015
- Environment Agency (EA) Guidelines

3 Consultation with Manchester City Council and the Environment Agency

Manchester City Council (MCC)

An application has been made with the Manchester City Council (MCC) Drainage team, the LLFA for the area.

Application Number:	CDN/20/0691
Proposal:	Discharge of Conditions 10
Location:	Mayfield Phase 1, Manchester, 1 2AD

Following conversations and meetings with MCC the below parameters were agreed:

- Proposed discharge rate is to be restricted to 50% of the existing brownfield runoff rate with 2l/s/ha to be subtracted from this peak 50% discharge rate.
- Climate change allowance is to be 30%, however, attenuation volumes should also be checked against a 40% allowance.
- No flooding of buildings occurs in 1 in 100-year rainfall event plus climate change allowance. Plot designers will need to accommodate all the necessary surface water attenuation within the plot demise. The attenuation will need to be designed to accommodate the 1 in 100-year storm events plus climate change allowance based on a 50% brownfield rate with a further reduction of 2l/s/ha for long-term storage.
- Surface flooding of open spaces is acceptable for short periods in events over 1 in 30-year return period rainfall events.
- Overland flow routes for extreme events are diverted away from buildings.
- As the existing site is brownfield the 1 in 100-year, 6-hour rainfall runoff volume shall be constrained to a maximum of the existing brownfield runoff volume for the same event.
- For surface car parks (>50 spaces) and areas of unusual pollution risk pollution control measures will be provided (likely to be a combination of petrol interceptors and SuDS features where applicable).

Environment Agency (EA)

After consultation with the EA it was agreed that discharge of surface water into the Medlock River would be acceptable.

Scoping Opinion Response

A scoping opinion was submitted to MCC in July 2019 the comments returned highlighted two key issues for the drainage strategy to address:

The area is situated within the Conurbation Core Critical Drainage Area and in accordance with the Manchester City Council SFRA at least a 50% reduction in surface water runoff should be provided through SUDS as part of any brownfield development with the aim of reducing to the Greenfield runoff rates.

Surface water should be managed to ensure there is no increased surface water from the proposed development and runoff from extreme events should be retained within the site such that the adjacent third-party land is not affected.

And;

The suitability of sustainable drainage systems should be assessed in accordance with paragraphs 051, 079 and 080 of the revised NPPF Planning Practice Guidance for Flood Risk and Coastal Change Sustainable drainage systems should be designed in line with national Non-Statutory Technical Standards for SuDS and local policies EN08, EN14 and EN17 of the Core Strategy.

Hydraulic calculations and drawings to support the design need to be provided along with proposed standards of operation and maintenance in accordance with paragraph 081 of NPPF Planning Practice Guidance.

Both points are addressed as part of the proposed surface water strategy.

Further Consultation with MCC

Following changes to the landscape design and layout of the Phase 1 park the surface water strategy has been updated to reflect this and take the opportunity to further maximise Sustainable Drainage Systems on the site. A meeting was attended on the 09.10.2020 between Buro Happold and MCC to discuss these changes. This meeting was met positively by MCC, with the updated strategy well received for its increased take-up of SuDS. See Appendix H for meeting minutes.

Following this the drainage strategy was issued to MCC on 21st of December 2020. MCC Requested that further information is needed to confirm that the proposed drainage design is adequate to manage flood risk. Full comment: *“Hydraulic model refers to manholes and pipes which don’t appear on the drainage layout and some pipe sizes on drainage layout do not correlate with those shown on the drainage layout. This needs to be updated accordingly for review.”* Following this the report has been updated and this has been reflected in Section 7

4 Existing Site

The Mayfield Phase 1 Development Site is 7ha and is in Manchester City Centre to the immediate south/southeast of Piccadilly Railway Station, centred at NGR 385006 397717. The River Medlock meanders through the central area of the Site, flowing from east to west within a deep rectangular brick/stone walled channel. It is culverted beneath Hoyle Street and a central section of the site.

The Site is currently occupied by existing and historical urban development comprising the former (now abandoned) Mayfield Railway Station and associated railway lines, numerous works/factories, a scrap yard, a depot, Hoyle Street Industrial Estate, derelict land and car parking. The immediate surrounding area comprises urban development including residential (student accommodation/private rental), offices, commercial and industrial facilities.

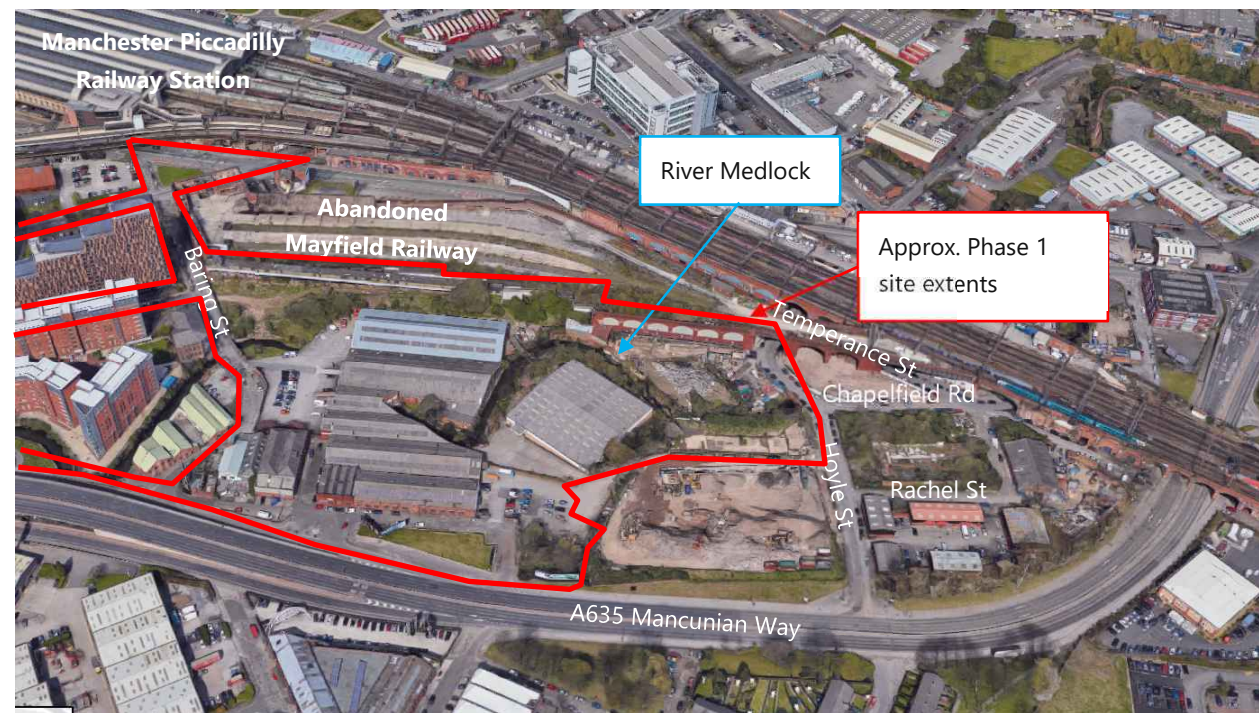


Figure 4-1 Existing Site with the Phase 1 Site Boundary

The condition of the river varies. The river walls are generally in a poor derelict state of repair with parts collapsed into the river. It is assumed that some stormwater is seeping through cracks into the River Medlock. In many locations, siltation has built up on one or both sides of the riverbank. The silt deposits have enabled the dense growth of vegetation along almost the entire corridor. Japanese Knotweed is currently present along the riparian corridor within the site.

The site is heavily overgrown in areas and is largely covered in impermeable hardstanding and buildings in various states of condition with hardscaping in areas being cracked and deteriorated.

Existing Flood Zones

Extract from River Strategy Report and water chapter of Strategic Regeneration Framework dated 12/10/2017:

"The Environment Agency's flood risk mapping shows parts of the existing site to be highly susceptible to flooding with the River Medlock canalised between the high walls and under industrial buildings. Flooding of the site is concentrated around the Medlock in the central area (Flood Zone 3 High risk) with some Flood Zone 2 (Medium risk) on the margins. However, most of the site is situated within Flood Zone 1 (Low risk) with a flood risk less than 0.1% (on average one occurrence in 1000 years). Flood risk from ground water, surface water and artificial sources is currently considered low to very low at the site.

The regeneration of Mayfield will allow the river corridor and floodplain to be carefully reprofiled using the results of detailed hydraulic modelling, that will ensure the park can reduce the risk of flooding and mitigate for the effects of climate change. The well-considered design will ensure that there will be no detrimental effects upstream or downstream, with finished floor levels for property set well above design flood levels as recommended by the Environment Agency (EA). This will ensure the development is safe, with appropriate pedestrian and vehicular access, even during the 0.1% AEP event for maintenance or improvements works."

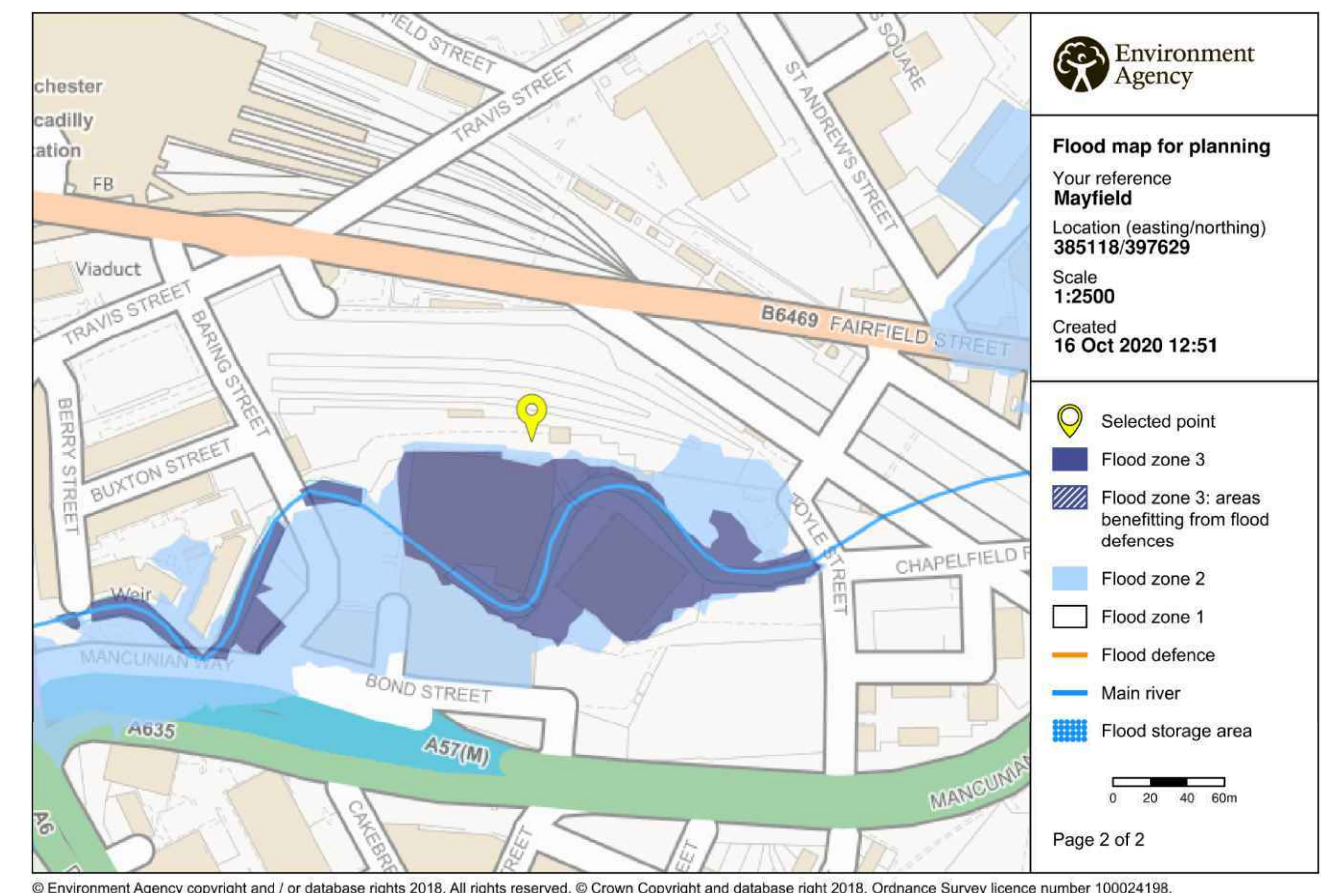


Figure 4-2 Mayfield 2019 Flood Map extract from the Flood Risk Assessment

5 Existing Surface Water Drainage

Existing Drainage and Outfalls

It is unclear from public sewer records how the current site is drained however the lack of available information would suggest that most of the site is served by private drainage networks. It is likely that the buildings are served by a combination of individual connections to the United Utilities combined sewers that surround the site and direct outfalls into the River Medlock through the river wall.

The site generally slopes towards the River Medlock and it is assumed that it drains into the river. One outfall is shown on the topographic survey conducted by Malcolm Hughes. Visual inspection of the riverbank indicates that there are numerous existing outfalls to the River Medlock (example Figure 5-1).



Figure 5-1 Existing Outfall Observed During Site Visit

A culvert conveyance report was conducted following an inspection on 23/03/2018. The report detailed the location of the existing outfalls through the river wall that were observed in the length within the culvert, these have been summarised in Figure 5-2.

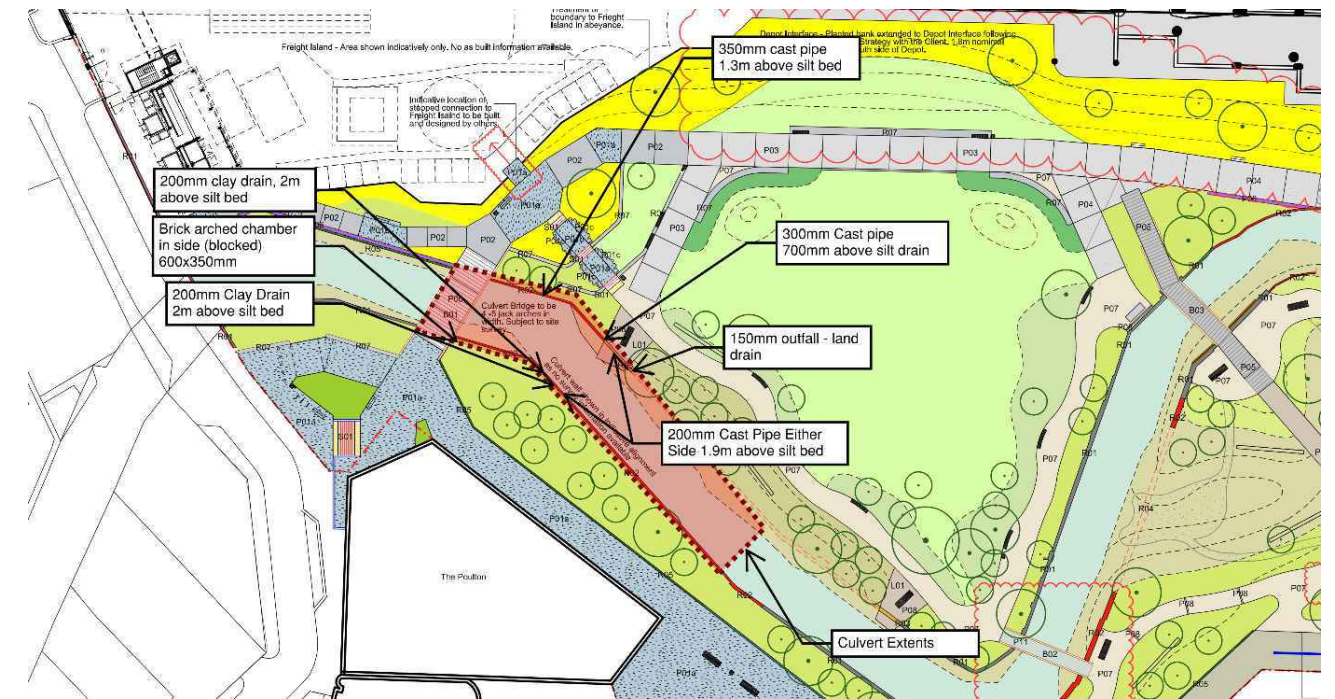


Figure 5-2 Existing river wall outfalls observed in culvert conveyance survey



Figure 5-3 Debris build up within culvert

The existing drainage is assumed to have been designed and installed in accordance with national standards. It is assumed that the existing below ground stormwater drainage system discharges at an uncontrolled rate and no on-site storage exists.

Existing topographic surveys show gullies within Hoyle Street, Baring Street, Temperance Street and Chapelfield Road however the condition and exact layout of these stormwater drains are unknown. It is proposed to retain these drains throughout the resurfacing of these roads.

6 Existing Foul Water Drainage

Mayfield is served by a network of public combined sewers (conveying both foul and surface water together) situated beneath the principal roads both within the masterplan (Hoyle Street, Baring Street and Chapelfield Road) and immediately beyond its perimeter (Mancunian Way, Fairfield Street and Temperance Street). United Utilities (UU) records show one number site sewer as having been adopted, situated in Amory Street, site of the proposed park.

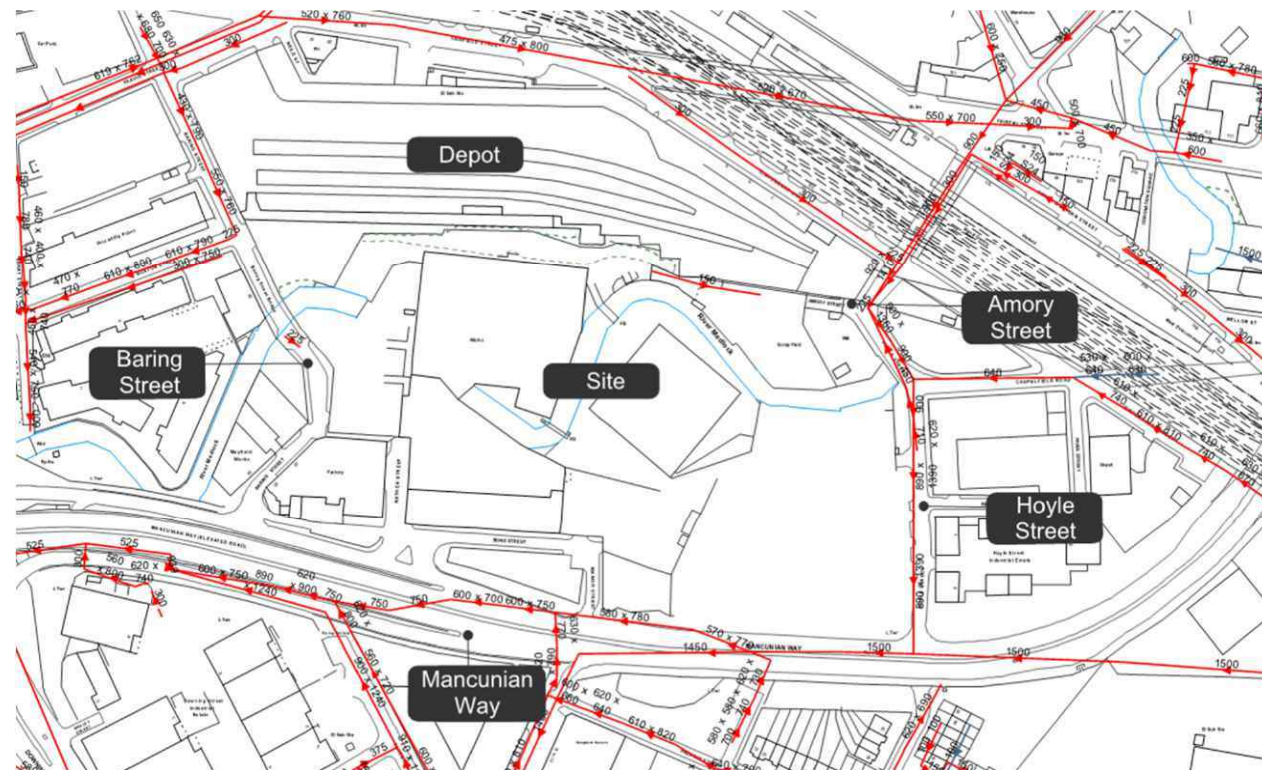


Figure 6-1 United Utilities Sewer Asset Record. (Image courtesy of the United Utilities © United Utilities Water PLC 2017)

UU network pipes sizes vary from 150mm diameter to 1500mm in Mancunian Way. Pipe materials are a mix of vitrified clay and brick and sewer shape varies from circular to egg. Sewer depths appear significant, up to 10m in places, suggesting that they have excavated in rock or possibly constructed within a tunnel heading. UU sewer levels and exact manhole locations are unknown in most cases. A line and level survey at probable points of connection will be required at the next stage.

Information pertaining to the private site foul drainage is limited, and no as-built data is available. UU asset records show a length north of the river serving the Depot, does not appear to drain to an obvious discharge point on the sewer records, however, it is assumed to connect to the public sewer in Amory Street. A known private combined sewer is connected to this run.

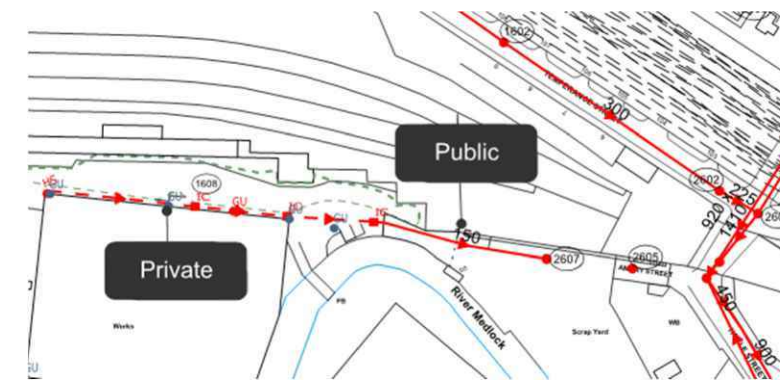


Figure 6-2 Known private site sewerage (Image courtesy of the United Utilities © United Utilities Water PLC 2017)

The sewers that run underneath Chapelfield Road and Hoyle Street are both assumed to be Victorian era, egg-shaped brick combined sewers of unknown condition and are owned by UU. The sewer that runs beneath Chapelfield Road is buried approximately 2-3m deep based on incomplete UU sewer records and is recorded as a 640mm "diameter". There are two sewers that run-down Hoyle Street in opposite directions. There is a 450mm diameter combined sewer draining northwards at approximately 5m depth that runs for roughly a third of the length of the section of Hoyle Street that is within the site boundary. A much larger and deeper 900mm "diameter" combined sewer flows southwards beneath this sewer at a depth of between 8-14m. It is assumed based on limited ground information that this deep sewer is within rock. The other two sewers may be partly within rock but are likely to be buried within the made ground on site.

All surface water which falls on the surrounding and future buildings will be attenuated on plot with peak flows restricted. The outfalls within the park have been designed to account for these external flows, no additional outfalls into the river Medlock are envisaged as part of future development works. This surface water from the plots will be discharged via a series pipes outside of the park boundary connecting into the park drainage system before discharging into the River Medlock.

As part of the design process we have approached the discharge strategy in accordance with the hierarchy set out in building regulations and as recommended in the CIRIS SuDS manual. A SuDS appraisal for the site has been undertaken and developed in line with best practise to improve water quality, reduce runoff quantity, provide bio-diversity benefits and amenity space.

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

- Step 1. Disposal on Site - via infiltration SuDS (Sustainable Drainage Systems)
A site investigation is ongoing and will determine the suitability for infiltration features across the site. At present the drainage system has been designed without infiltration due to the potential for contaminants in the ground to be mobilised by infiltration techniques.
- Step 2. Disposal to a Watercourse
The site is located adjacent to the River Medlock and all surface water is currently proposed to discharge to the watercourse.
- Step 3. Disposal to a Public Sewer
This is not envisaged for the park and plot elements of the scheme.

The following table indicates the SuDS techniques considered for this scheme.

	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit	Suitability for the Proposed Development	Provision in Scheme
Most Sustainable ↑ ↓	Living roofs	√	√	√	Yes	Not considered for the infrastructure areas, however, could be considered when proposed plots are developed.
	Basins & ponds	√	√	√	Yes	A wetland area is proposed as part of the scheme
	-Constructed Wetlands				Yes	
	-Balancing ponds				No	
	-Detention basins				No	
	-Retention ponds				No	
	Filter drains & swales	√	√	√	Yes	Included in scheme
	Rain Gardens	√	√	√	Yes	Included in scheme
	Infiltration devices	√	√	√	No	Not considered due to potential for contaminated ground.
	-soakaways					
	-infiltration trenches & basins					
	Permeable surfaces	√	√		Yes	Majority of park area is designed to drain to permeable areas
	-gravelled areas				Yes	Not required
	-solid paving blocks				Yes	Not required
	-porous pavers				Yes	Not required

Least Sustainable	Tanked systems	√			Yes	Only used in areas with minimal space to serve plot drainage
	-over-sized pipes/tanks				Yes	Not required
	-attenuation cells				Yes	

Wetlands

A wildscape area has been incorporated into the park design as indicated in pink below. This area will flood during high river flow events and a river flow flood model is being developed to help the detailed design of this area. Due to the variable nature of the river flooding, an outfall from the drainage system has also been incorporated into the landscape to provide natural irrigation to the vegetation in this area.



Figure 7-1 Designed wildscape area within the site, highlighted in red

Filter Drains

In the park there are several filter drains provided to drain hardscape and areas of steep slopes. The filter drains will consist of a gravel section with perforated pipe to convey the flow to the drainage system.

Rain Gardens

Three rain gardens have been included within the surface water design, as online storage to manage the 1 in 30 and 1 in 100-year storm events. As the information on ground contamination is unknown at this point these have been sized with zero infiltration, however, if it is found to be that the ground conditions are suitable to accept infiltration the design be updated to suit.

Permeable Surfaces

Paving along the footpaths that are within the park and the flood zones are proposed to be resin bound material, these hardscape areas are designed to discharge onto the into the surrounding soft landscaping, infiltrating through the proposed panting and grassed areas. The surrounding clay pavers and concrete slabs outside of the flood zones are for the most part proposed to be drained by the same SuDS mechanism with a few strategic formal drainage points where levels do not permit.

All soft landscape areas of the park will use a mixture of overland flow to the River Medlock and filter drains connected to the drainage system via filter drains. The areas highlighted in blue below all discharge to permeable surfaces.



Figure 7-2 Areas drained via overland flow/infiltration

Tanked Systems

Plots 'The Poulton' and 'MSCP' have designed below ground tanks within their boundary in order to restrict their flows to a surface water runoff of 50% of the 1 in 100-year storm brownfield runoff rate minus 2l/s/ha as agreed with MCC.

The discharge of all the plot designers' attenuation will be discharged into the proposed surface water network within the park that transfers surface water to the River Medlock.

Design Parameters

We propose that all new buried drainage provides the following levels of service:

- No surcharge within the pipe network up to and including a 1:2-year storm event;
- No flooding of the drainage system up to and including a 1:30 year storm event;
- Management of flood water up to the 1:100-year storm event.
- Climate change allowance included in the infrastructure design shall be 30%; and
- Proposed discharge rate for plot attenuation shall be restricted to 50% of the existing peak brownfield runoff rate with 2l/s/ha subtracted from this 50% peak discharge rate (1 in 100 year) as per discussions with MCC and the EA.

Contaminated Ground and Infiltration

Appendix I Soakaway Testing and Contamination Report, highlights the summary of the soakaway testing and leachate testing that was carried out on the site to determine the feasibility of infiltrating on the site. Soakaway results were found in the locations of all rain gardens, this was incorporated into the hydraulic drainage model and it was updated to suit. This was done following the results of the leachate testing. The results of the leachate testing in Rain Garden 3 confirmed that no contamination was present, and infiltrating would be safe. In the instance of Rain Garden 1 and 2 there was some contamination present. To ensure that no contaminants were mobilised into the ground water the design was updated to ensure that at the base of each rain garden the existing ground would be excavated and disposed of, until the existing bedrock material was hit, which was proven to be clean sandstone. The pit would then be backfilled with clean stone and Rain Garden 1 & 2 will infiltrate into this.

Existing vs Proposed Runoff Rates

To ensure the overall surface water runoff rates meet the requirements set out by MCC the following comparison has been presented in Table 7-1. This highlights the existing peak discharge rates as calculated by an analysis of the existing land usage and FEH rainfall data, this has been compared against the new layouts and green space uplift with the engineered flow controls on buildings and some future phases.

It has been calculated that the overall site peak brownfield peak discharge for the full site would have been **1756.13 l/s**. Applying the **50% of brownfield – 2l/s/ha** arrives at an overall target peak discharge of **862.87 l/s**.

Table 7-1 Existing vs Proposed Peak Discharge Requirement (* = Flow Control on this catchment, see Table 7-3)

Outfall	Associated Catchments	Brownfield Peak Discharge (l/s)	Proposed Peak Discharge (l/s)
1a & 1b	C15 C16 B3 B4 B5	C15 = 171.00 C16 = 146.11 B3 = 49.80 B4 = 193.35 B5 = 163.03 Total = 750.33	C15 = 83.94* C16= 71.92* B3 = 17.52* B4 = 63.43* B5 = 57.12* Total = 293.92
2	C1 C2 C3 Phase 4	C1 = 66.16 C2 = 18.49 C3 = 79.38 Phase 4 = 315.63 Total = 479.66	C1 = 34.72 C2 = 17.17 C3 = 62.94 Phase 4 = 151.49* Total = 266.32
3	C5 C10 C12 C13 C14 B1a B1b B2	C5 = 9.39 C10 = 17.23 C12 = 59.20 C13 = 12.59 C14 = 7.73 B1a = 34.01 B1b = 47.21 B2 = 64.40 Total = 479.66	C5 = 8.63 C10 = 15.11 C12 = 54.16 C13 = 10.57 C14 = 9.05 B1a = 7.5* B1b = 10.7* B2 = 22.96* Total = 138.68
Overland Flow to River	C4 C6 C7 C8 C9 C11	C4 = 1.82 C6 = 40.40 C7 = 96.50 C8 = 89.12 C9 = 46.56 C11 = 27.04 Total = 274.40	C4 = 1.38 C6 = 23.81 C7 = 41.20 C8 = 58.05 C9 = 21.71 C11 = 17.79 Total = 163.94
Total	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, B1a, B1b, B2, B3, B4, B5, Phase 4	Total = 1756.13	Total = 862.87

The above calculated peak discharge rates has been compared against the results from the MicroDrainage model for the network, these are summarised in Table 7-2.

Table 7-2 Summary of peak flow at the outfall from MicroDrainage

Outfall	Peak Flow from MicroDrainage	Flow Controls?
Outfall 1a & 1b	285.3 l/s	Yes, upstream control and attenuation of the future buildings and public realm areas outside of phase 1.
Outfall 2	251.4 l/s	Yes, upstream controls are present within the upgraded Depot building (Phase 4). Furthermore, the outfall pipe has been intentionally downsized to a 375mm pipe to restrict the flow into the river.
Outfall 3	135.5 l/s	Yes, upstream controls and attenuation are present within the future buildings in this area.
Overland Flow to River	163.94 l/s	No.
Total	836.14 l/s	Note – Total calculated in MicroDrainage is below the discharge requirement of 50% Brownfield – 2l/s/ha.

The below table summarises the planned flow control devices within the scheme in order to achieve the sites drainage and discharge aims.

Table 7-3 Summary of Flow Control devices within the full site build out

Corresponding Outfall	Upstream Catchment Name	Flow Control (Hydrobrake)
Outfall 1a & 1b	C15	83.94 l/s
	C16	17.92 l/s
	B3	17.52 l/s
	B4	63.43 l/s (split over 2 outfalls restricted to 31.72 l/s each)
	B5	57.12 l/s (split over 2 outfalls restricted to 28.56 l/s each)
Outfall 2	Phase 4	151.49 l/s (split over 10 outfalls restricted to 15.15l/s each)
Outfall 3	B1a	7.5 l/a
	B1b	10.7 l/s
	B2	22.96 l/s

Catchment Areas

Catchment areas have been created based on the landscaping layout. Catchment areas are shown in Table 7-4. The effective areas for each catchment have been calculated using the runoff coefficients of 0.95 for hardscaping and buildings and 0.3 for softscape landscaped areas. The locations of the catchment areas can be seen in Figure 7-3.

Future development phases have been considered as part of the design process for the delivery of the first phase in relation to SuDS and attenuation. Whilst no detailed designs are available at this stage, which will come forward as part of any future application, the methods of managing surface water runoff will be delivered in line with CIRIA SuDS Guidance.

Table 7-4 Proposed Catchment Areas (See Figure 7-3 or location plan)

Catchment Ref.	Catchment Type	Catchment Area (ha)	Hardscape (%)	Softscape (%)	Effective Hardscape Area (ha)	Effective Softscape Area (ha)	Total Effective Area (ha)
C1	Landscape	0.39	0%	100%	0.12	0.00	0.12
C2	Landscape	0.09	50%	50%	0.04	0.01	0.06
C3	Landscape	0.34	50%	50%	0.16	0.05	0.21
C4	Landscape	0.02	0%	100%	0.00	0.00	0.00
C5	Landscape	0.04	80%	20%	0.03	0.00	0.03
C6	Landscape	0.14	40%	60%	0.05	0.03	0.08
C7	Landscape	0.36	14%	86%	0.05	0.09	0.14
C8	Landscape	0.39	32%	68%	0.12	0.08	0.20
C9	Landscape	0.17	22%	78%	0.03	0.04	0.07
C10	Landscape	0.06	82%	18%	0.05	0.00	0.05
C11	Landscape	0.10	50%	50%	0.05	0.01	0.06
C12	Landscape	0.22	80%	20%	0.17	0.01	0.18
C13	Landscape	0.05	55%	45%	0.03	0.01	0.04
C14	Landscape	0.03	100%	0%	0.03	0.00	0.03
C15	Landscape	0.78	70%	30%	0.52	0.07	0.59
C16	Landscape	0.57	85%	15%	0.46	0.03	0.48
B1a	Building	0.12	100%	0%	0.12	0.00	0.12
B1b	Building	0.17	100%	0%	0.16	0.00	0.16
B2	Building	0.26	100%	0%	0.25	0.00	0.25
B3	Building	0.20	100%	0%	0.19	0.00	0.19
B4	Building	0.72	98%	2%	0.67	0.00	0.68
B5	Building	0.65	100%	0%	0.62	0.00	0.62
Phase 4	Building	1.72	100%	0%	1.64	0.00	1.64
Total		7.59			5.56	0.43	6.00

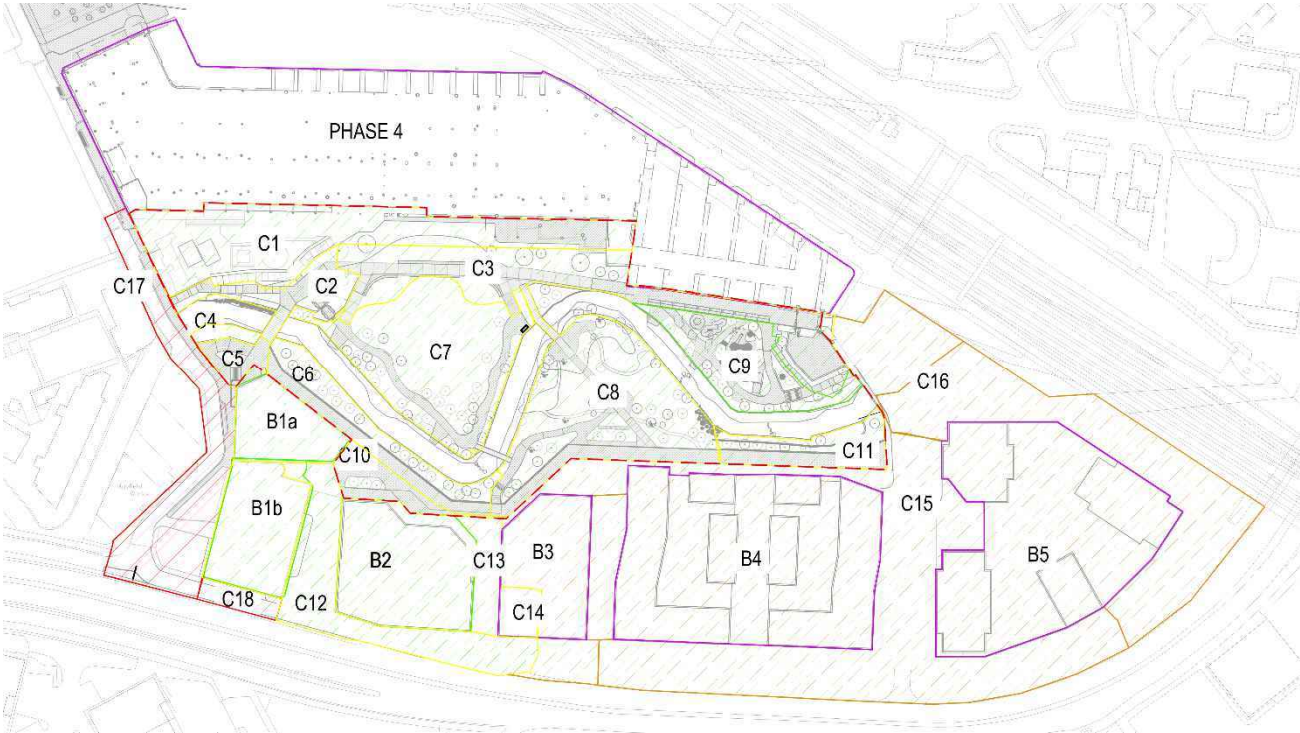


Figure 7-3 Catchment Areas Plan (park boundary shown in red dashed)

All runoff from catchments shown outside of the dashed black boundary in Figure 7-3 will outfall through the park in one of the three discharge points to the River Medlock. However, they must have peak flows restricted to a minimum of 50% brownfield runoff – 2l/s/ha, achieved through a selection of on plot SuDS features and discharge controls on plot. An Exception to this is Catchment C17, which is understood to discharge via the existing highway sewer drainage system in Baring Street, the delivery of this package of works has been pushed back so there is no design available at this stage.

The existing runoff rates within these catchments have been calculated using the topographical survey. The difference between the existing and proposed effective areas within each catchment can be seen in the table below. The proposed scheme has an effective area **0.54ha less than existing**. Due to the reduced effective area the 1 in 100yr 6hr volumetric discharge will be less for the proposed scheme than in the existing brownfield condition. Calculating this as a volume against the rainfall data for the 6-hour storm leaves a deficit of **359.6m³**.

Following MCC comments received on 5th January 2021, full comments in Section 3 , the following clarification has been provided. The MicroDrainage model has been assembled to include Surface Water catchments outside of the Phase 1 boundary, this is because in the full build out of the site they will outfall through Outfall 1 located within the Phase 1 boundary. The affected catchments are: C1, C12, C13, C14, C15, C16, C18, B1a, B1b, B2, B3, B4, B5 and the full Phase 4 Catchment. Attenuation structures, flow controls, manholes and pipes have also been modelled and sized for these areas and these are highlighted in the summary results of the MicroDrainage model. The below screenshots highlight the pipes in these areas for clarity. Full results are shown in Appendix F.

When reviewing the MicroDrainage results within the appendix it should be noted that the Manhole prefix 'F' = Future and represents a manhole that is in the future phases of the project and has not been fully detailed but modelled for conveyance purposes. The 'B' prefix is for manholes located on future buildings to capture their roof areas. The 'D' prefix is there to represent the rain water downpipes from the depot.



Figure 7-4: MicroDrainage Model, Detailing Future Network Outside of Phase 1 Boundary

Table 7-5 Existing Catchment Areas

Catchment Ref.	Hardscape (ha)	Softscape (ha)	Effective Hardscape Area (ha)	Effective Softscape Area (ha)	Total Effective Area (ha)
C1	0.16	0.23	0.16	0.07	0.22
C2	0.05	0.04	0.05	0.01	0.06
C3	0.26	0.09	0.24	0.03	0.27
C4	0.00	0.01	0.00	0.00	0.01
C5	0.03	0.00	0.03	0.00	0.03
C6	0.14	0.00	0.14	0.00	0.14
C7	0.34	0.02	0.32	0.01	0.33
C8	0.29	0.10	0.27	0.03	0.30
C9	0.17	0.00	0.16	0.00	0.16
C10	0.06	0.00	0.06	0.00	0.06
C11	0.10	0.00	0.09	0.00	0.09
C12	0.21	0.02	0.20	0.01	0.20
C13	0.04	0.01	0.04	0.00	0.04
C14	0.03	0.01	0.02	0.00	0.03
C15	0.53	0.25	0.50	0.08	0.58
C16	0.50	0.07	0.47	0.02	0.50
B1a	0.12	0.00	0.12	0.00	0.12
B1b	0.17	0.00	0.16	0.00	0.16
B2	0.22	0.05	0.20	0.01	0.22
B3	0.17	0.03	0.16	0.01	0.17
B4	0.68	0.04	0.64	0.01	0.66
B5	0.55	0.10	0.52	0.03	0.55
Phase 4	1.72	0.00	1.64	0.00	1.64
Total					6.54

Summary of Building Runoff Rates and Discharge Points

The MCC has stipulated that the surface water discharge from the plots will need to be restricted to 50% of the peak brownfield discharge rate (1 in 100-year storm event) minus 2l/s/ha. Brownfield runoff has been calculated based on the catchment areas of the buildings using the Modified Rational Method. Where the design of the plots is developed the plot, teams have provided flow rates with further reductions for discharging the buildings’ surface water into the proposed surface water sewer. These rates have been used in the hydraulic model, in the absence of plot team values the calculated rate has been used.

The surface water system has been designed to consider future runoff from the proposed buildings around the site. Points of connection to the proposed external surface water system for the on-plot attenuation tanks at the required maximum discharge rates are shown in the figure below. See Appendix G for drainage strategies from the plot teams.

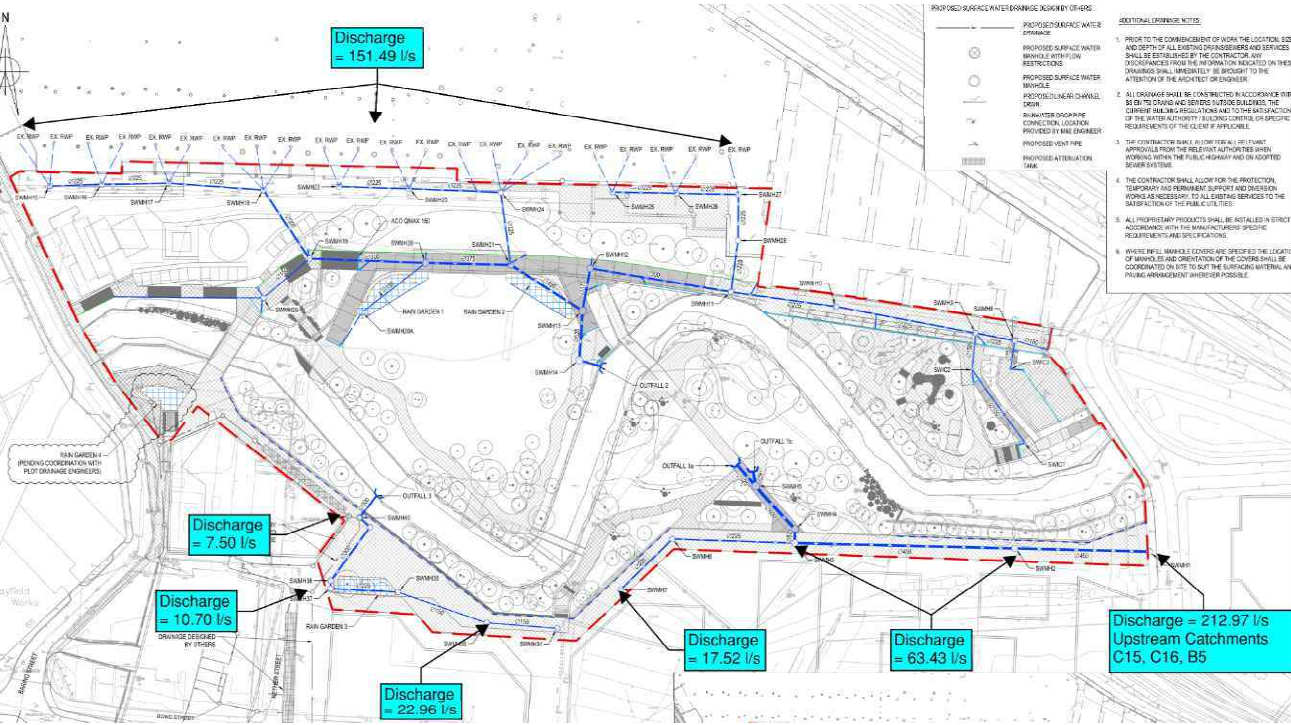


Figure 7-5 Surface Water Plot Connection Points into proposed surface water sewer

Proposed Outfalls

The outfalls are all located within the flood extents of the River Medlock, meaning that they will be submerged during the extreme fluvial events. In order to accurately model this hydraulically an analysis comparing the rainfall flood events probability and the fluvial flood events probability has been undertaken. As the two events are not directly linked the probabilities of different storm and fluvial return periods coinciding was analysed using a Joint Probability analysis, the results of this are below.

Joint Probability Assessment

The below list summarises the parameters used in the joint probability assessment.

Parameters	
River critical duration (hours)	10
Drainage critical duration (hours)	0.25
Level of dependency (CF100)	75 (modestly correlated)

The below table summarises the outputs of the joint probability assessment, in 1 in X terms, for example the likelihood of a 1 in 2-year drainage event and 1 in 5-year fluvial event occurring together is 1 in 95.9.

All values are 1 in X		Drainage return period (years)		
		2	30	100
River return period (years)	1 in X event			
	5	95.9	641.3	1492.2
	25	296.7	1983.1	4614.8
	100	784.6	5244.4	12203.6

In order to determine the design condition for the system the joint probability assessment summarised below was carried out. This highlighted the extreme unlikelihood of our 1 in 100 storm occurring alongside our 1 in 100 fluvial water level (a probability of 1 in 12203.6, equivalent to 0.008%), which was deemed unsuitable for our analysis. It was therefore selected that the 1 in 5 event for the river water level was used for all drainage return periods, to provide a conservative design.

The flood levels compared against the outfall inverts has been summarised in Figure 7-6, this shows that due to the high river flood levels during high return-period river events stormwater outfalls 1, 2 & 3 will become submerged. For this reason, all outfalls have been fitted with non-return valves to prevent river water backing up into the surface water system.

Submerged Outfalls

The below diagram summarises the outfalls within Phase 1 with their invert levels against the Fluvial Flood levels for various fluvial events.

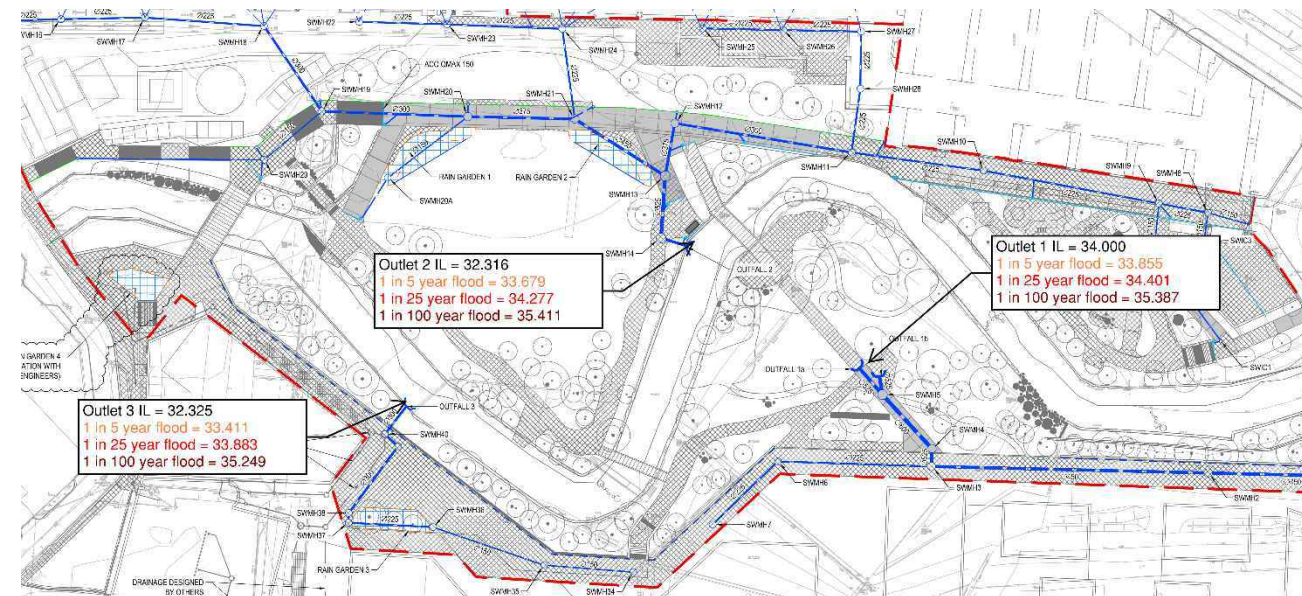


Figure 7-6 1 in 5, 25, 100+cc Year fluvial flood levels and Average Water Levels near proposed outfalls

Outfall 1a and 1b

Outfall 1a and 1b is located within the wildscape wetland area at the low point of the site. This has been designed in this location intentionally to further the SuDS benefits on the site through infiltration and re-use of rainwater from roof drainage in the public realm, further providing cleaning and amenity benefits to the site. Due to this location significant volumes of Surface Water will outfall onto the surface of the wildscape before either infiltrating or percolating overland into the river at the base of the slope. This has meant additional detailing has been provided to ensure the area is resilient to damage and maintenance issues during its operation. This has been fully detailed on drawing 0042912-BHE-XX-XX-DR-C-3300 and plan 0042912-BHE-XX-XX-DR-C-3120. This is also in response to EA and MCC comments received requesting further detail on how Outfall 1 will discharge into the wildscape area. Except shown below in Figure 7-7.

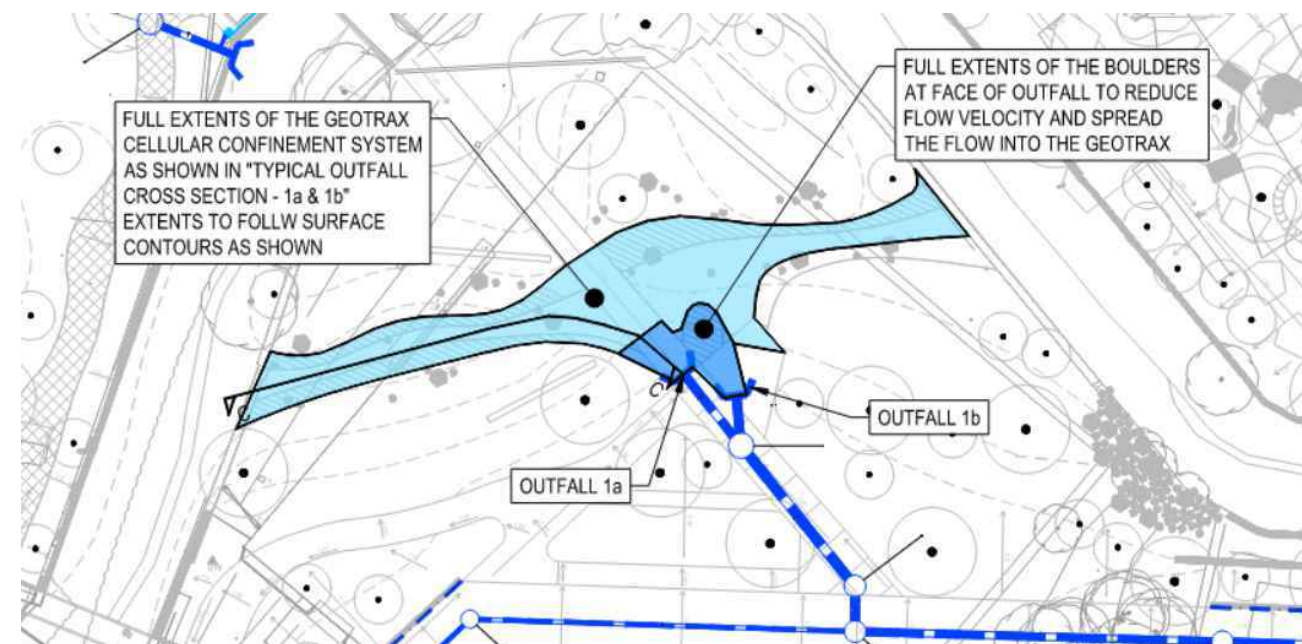


Figure 7-7 Outfall 1a and 1b in the wildscape area

Fluvial Flood Extents

The below figure highlights the extents of the 1 in 100 +35% climate change fluvial flood extent. The flooding has been designed to flood the soft landscaping and wildscape areas, whilst avoiding the hardstanding around the edge of the site.

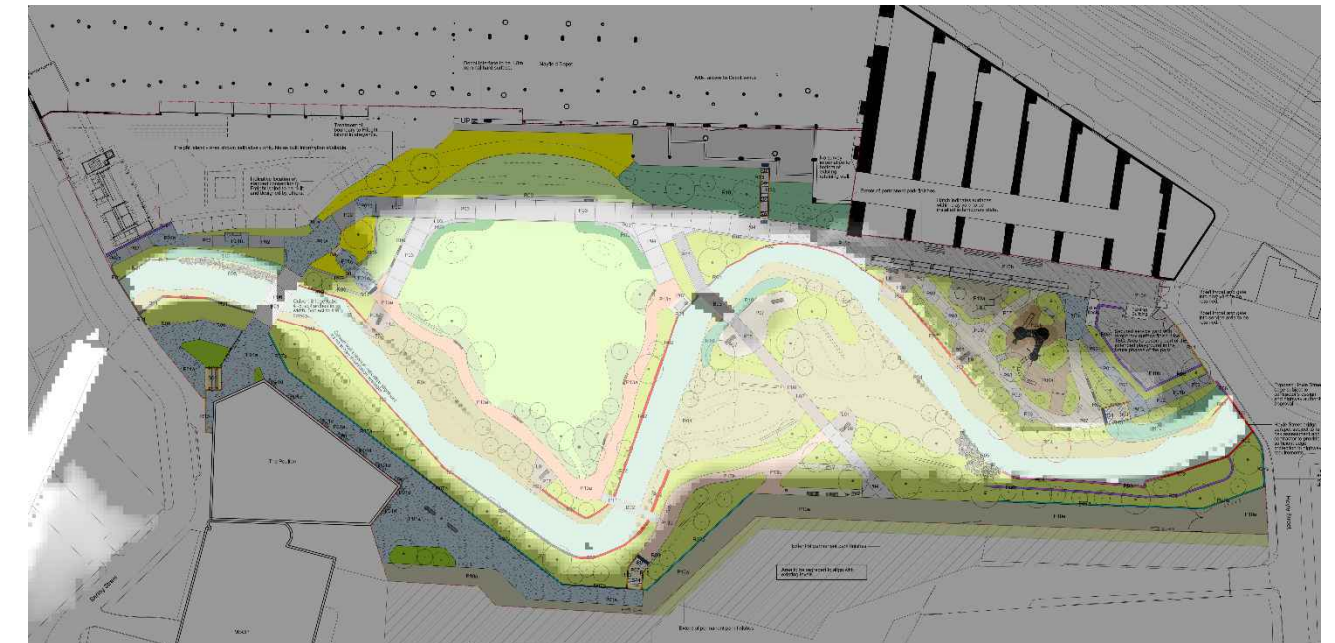


Figure 7-8 1 in 100 + 35%cc Fluvial Flood Extents

Proposed Layout

A hydraulic analysis was completed using the catchment areas and brownfield runoff rates for the full site to determine pipe sizes, gradients and storage volumes. Based on the site topography, building locations and landscape design, the network has been developed to discharge to three locations into the River Medlock. This is a rationalised approach to reduce the number of outfalls into the river. For more detail on the network layout, pipe sizes/gradients, manhole sizes and storage volumes see Appendix D.

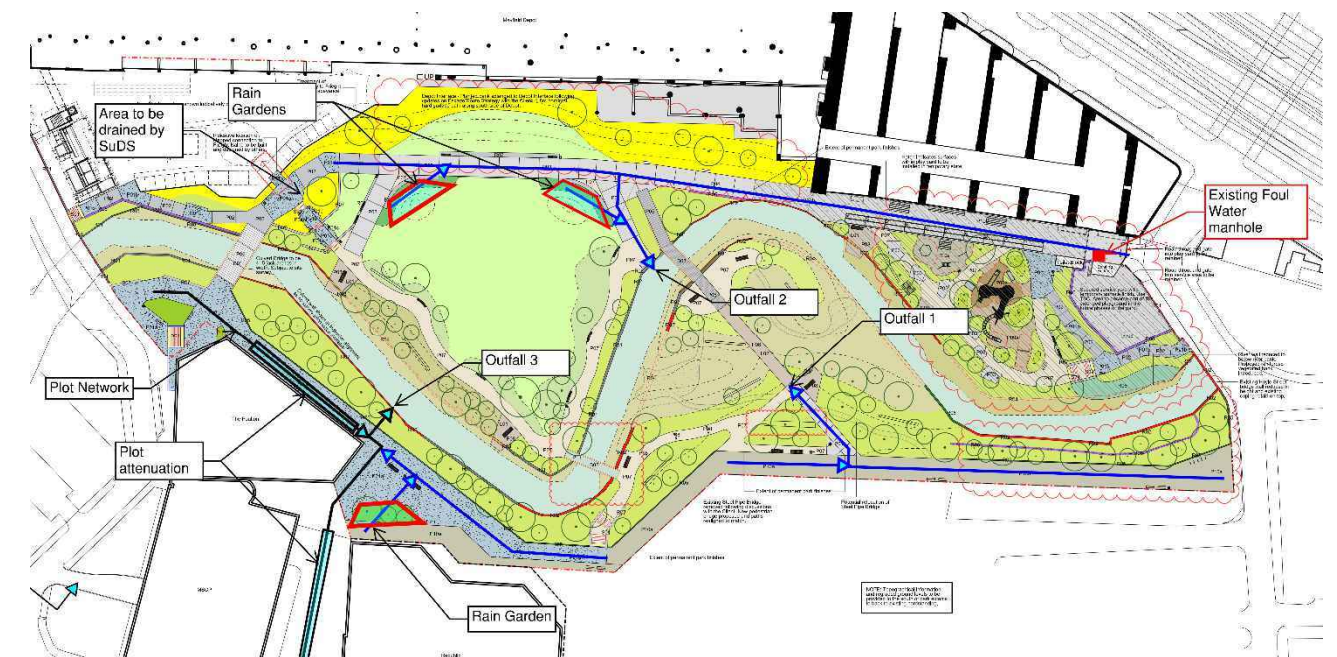


Figure 7-9 Proposed Surface Water Drainage Layout Plan

Overland Flow and Exceedance Events

The levels of the park are designed so that the park and public realm areas within it all drain towards to River Medlock. In the event of an exceedance event the below graphic summarises the overland flow that would occur.

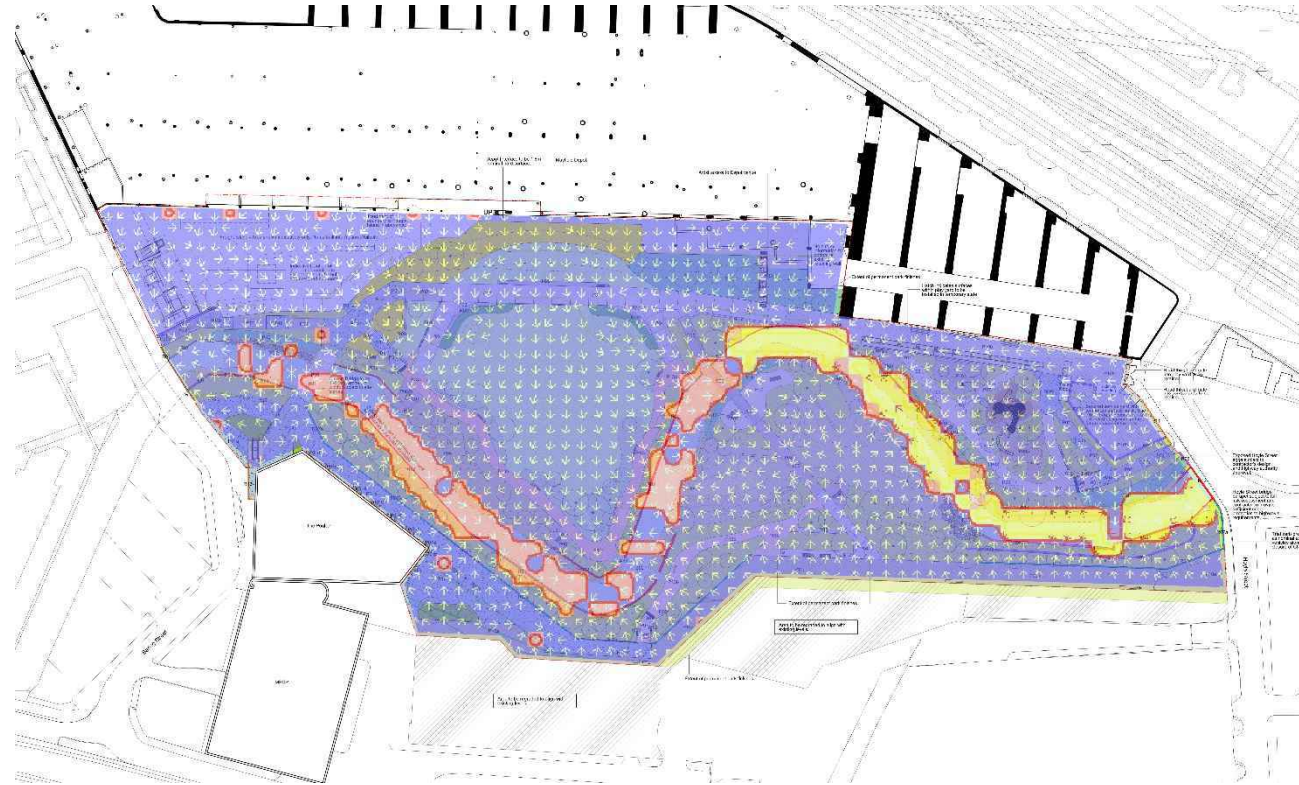


Figure 7-10 Overland flow diagram

8 Proposed Foul Water Drainage

A proposed foul network has been developed to provide connection for the MSCP and The Poulton. In addition, a connection has been provided in the north-east corner of the park for a toilet block within the park. The proposed network will then connect into the existing UU combined sewer network to the south and east of the site. Plot connections to the proposed foul water sewer are shown below.

A description of the individual plot drainage strategies and details for plot foul water networks can be found in Appendix G.

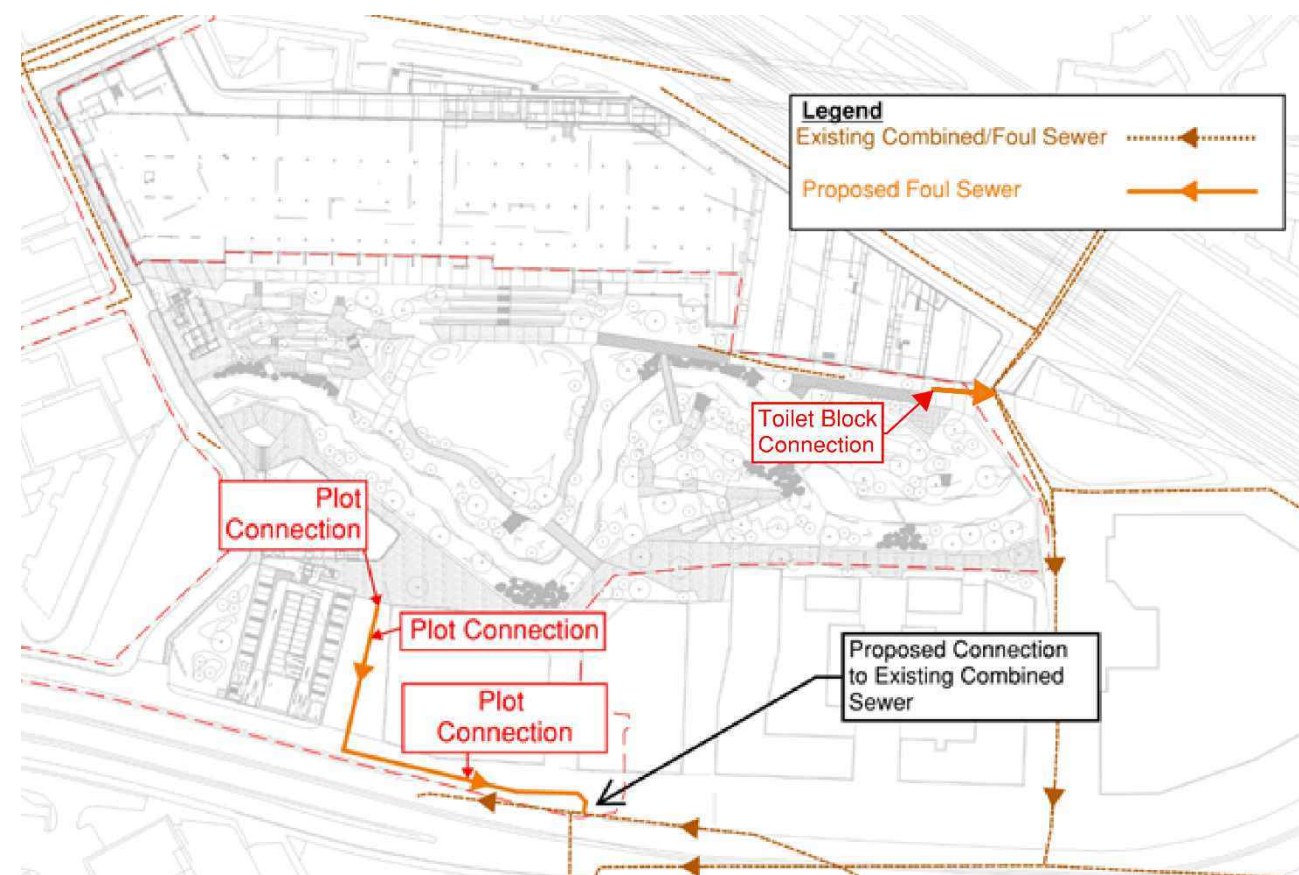


Figure 8-1 Proposed Foul Network

Appendix A Existing Foul/Combined Sewer Network

James Forsey
Buro Happold
17 Newman Street
London
W1T 1PD
UK

M: +44 7894 419810
T: +44 207 927 9700

Email: James.Forsey@BuroHappold.com