

OVG Manchester:

Appendix 13.2 – Drainage Strategy

OVG MANCHESTER

BRA-BHE-XX-XX-RP-CI-0132 Drainage Strategy to support FRA

0042841

17 January 2020

Revision 02

Revision	Description	Issued by	Date	Checked
00	Draft Issue for FRA	SVR	22.11.19	
01	Issue for inclusion in EIA	SVR	12.12.12	
02	Strategy updated with CCTV survey results	SVR	17.01.20	NH

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author **Siddhesh Raute**

date **17.01.2020**

approved **Nick Hall**

signature 

date **17.01.2020**

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1 Introduction

1.1 Site Setting

The site is located north of the Ashton Canal adjacent to Alan Turing Way with the culverted River Medlock running approximately 100m north of the site (Figure 1-1).

The existing site is brownfield with historic site uses comprising a gas works, hosting sporting events for the Commonwealth Games in 2002 and currently being used as a car park for events hosted within the Etihad Campus. A site walkover undertaken in June 2019, indicated the majority of the site to be compacted made ground with a capping layer isolating contaminated fill below.

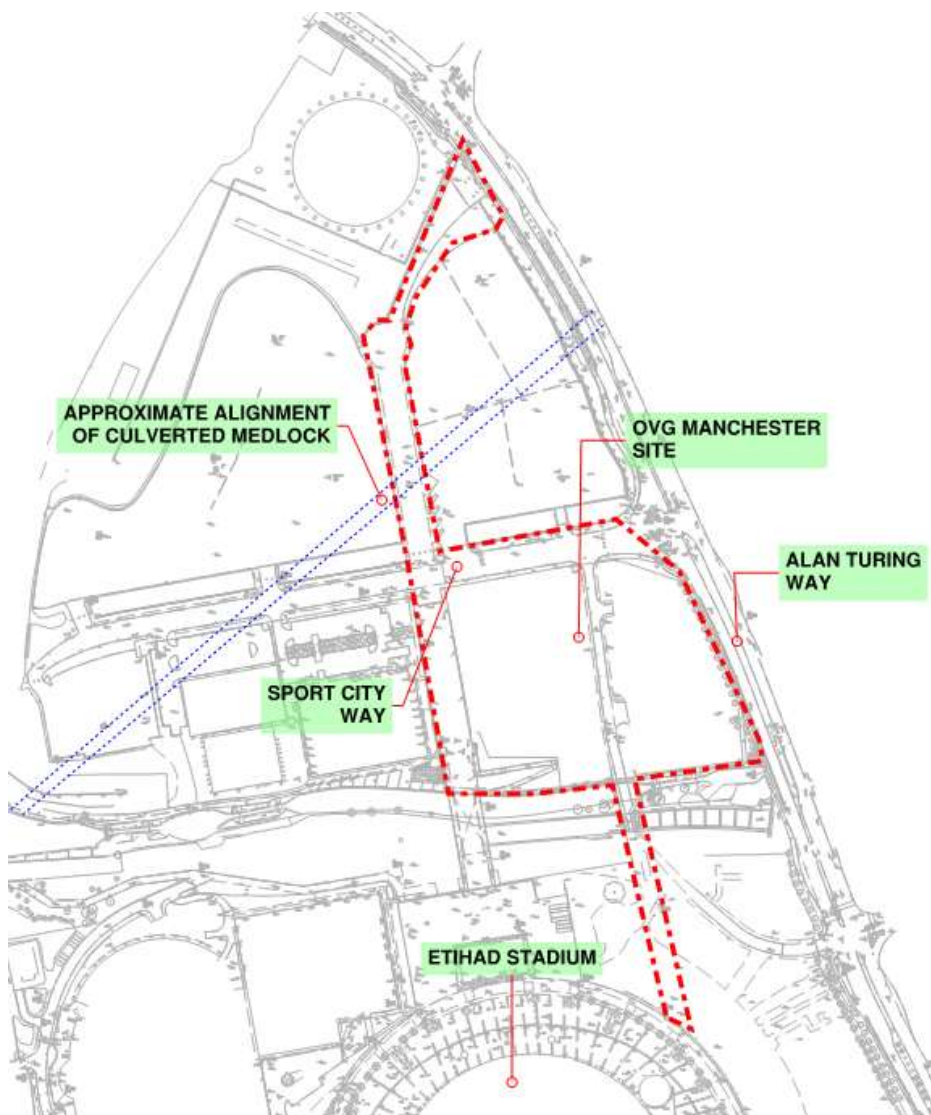


Figure 1-1: Location plan

1.2 Existing Infrastructure

The following sources of data have been provided which identify existing infrastructure in the vicinity:

1.2.1 Statutory Utility Records (Groundsure Premier Utilities Report, May 2019)

United Utilities Asset maps indicate three main combined sewers running under the site, flowing from south to north. Initial investigation of these sewers indicates they are very deep (almost 12m at the southern manhole). These sewers are shown on the constraints plan in Figure 1-2. The upstream flows to these sewers appear to have been abandoned and detailed CCTV drainage survey undertaken in December 2019 ascertained that this sewer can be classed as being abandoned.

The sewers ultimately combine to the north of the site, and discharge to a large culvert flowing from north-east to south-west. Discussions held with United Utilities on 17 Oct 2019 has confirmed that foul water flows will be allowed to connect into foul water sewer at the north east connection manhole (Refer to email correspondence in Appendix A).

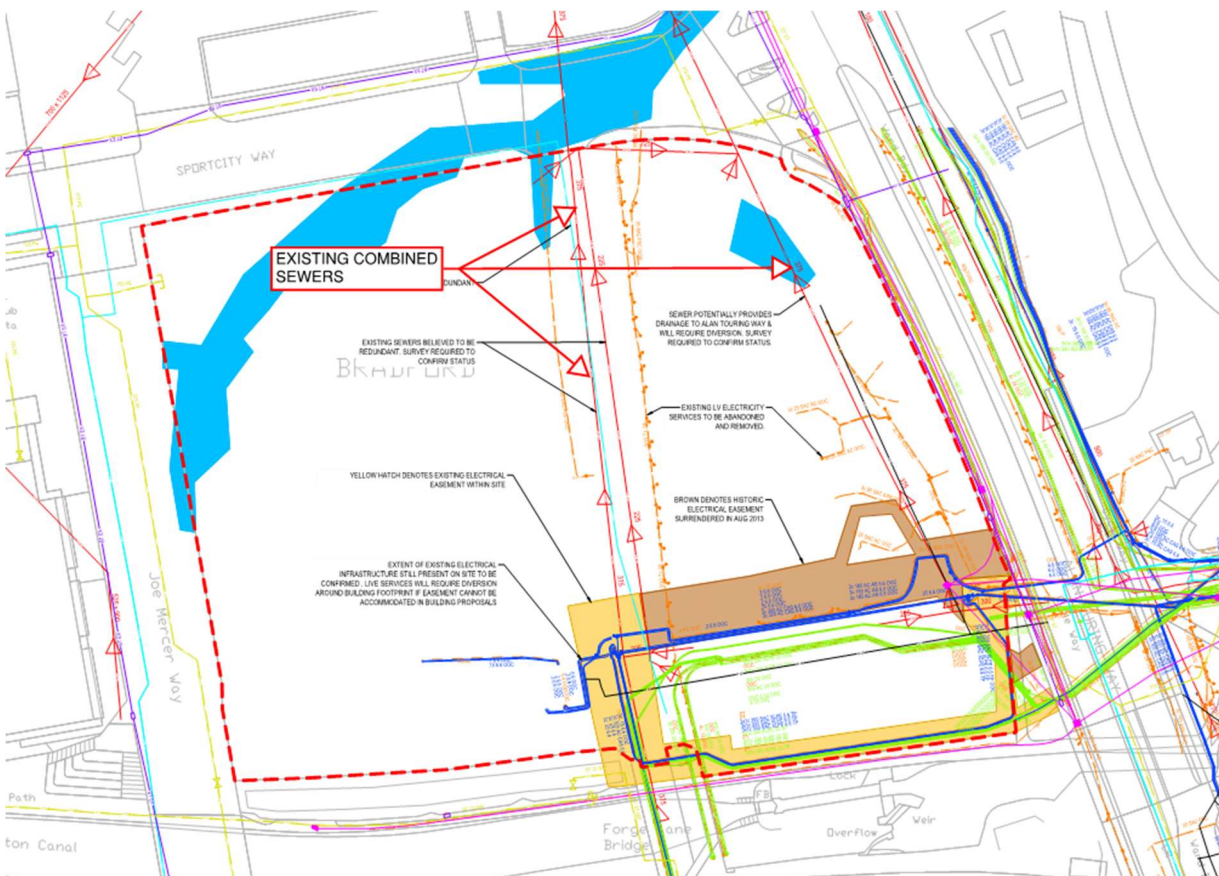


Figure 1-2: Extract of constraints plan drawing 0042841_BHE_XX_XX_DR_C_0020 showing abandoned sewers

1.2.2 Sport City Constraints Establishment Context Report (ARUP, October 2008)

The 2008 Context Report identifies the presence of surface water drainage underneath Sportcity Way. CCTV surveys that have since been undertaken have confirmed that this drainage serves Sport City Way and connects to the car park drainage network north of Sport City Way to subsequently outfall into the culverted River Medlock via a hydrocarbon interceptor.

2 Surface Water Strategy

2.1 Proposed Strategy

The surface water management strategy for the arena aims to protect the site from extreme storm events to maintain business continuity and deliver visitor comfort in the most adverse weather conditions. The strategy is developed to ensure flood events up to the 1 in 100 year event with 40% increase due to climate change are dealt within the site boundary.

In order to determine the permissible discharge rates off site, discussions have been undertaken with Manchester City Council as the Lead Local Flood Authority (LLFA) for the area. In discussions with the LLFA, historical site use has been considered with proposed discharge rates aligned to brownfield rates of runoff whilst providing 50% betterment on existing rates of runoff.

The proposed surface water drainage strategy is based on the initial correspondence with the LLFA confirmed that surface water flows from the site will have to provide a min. 50% betterment over the capacity of the existing pipework serving the site (Refer to email correspondence in Appendix B). Attenuation tanks will be utilised to provide this betterment in offsite rate. Surface water storage tanks are positioned below the ground floor slab in the service yard area and sized to store the 1 in 100 year rainfall event with 40% increase in rainfall intensities due to climate change. CCTV survey data has verified that the existing site drains to the highway network in Sportcity Way.

For ease of access and maintenance the attenuation tank has been positioned in the service yard. To maximise water re-use, the surface water attenuation tanks will be combined to function as rainwater harvesting tanks to allow collected surface water to be utilised for non-potable uses such as toilet flushing within the arena building.

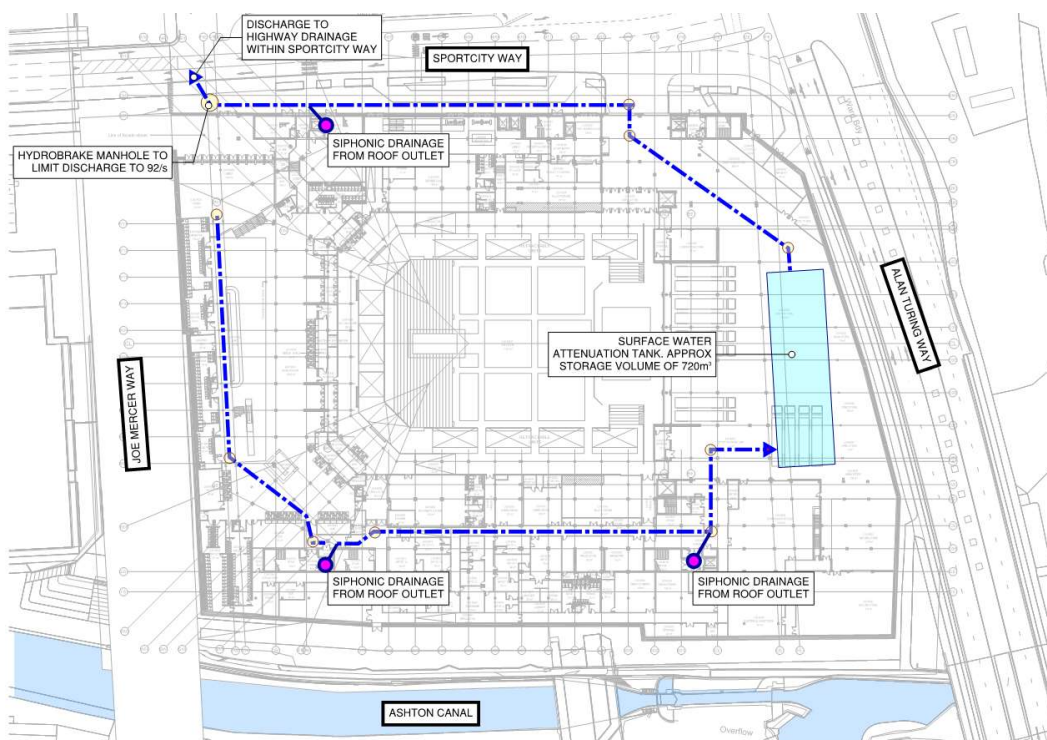


Figure 2-1: Surface water drainage strategy with tanks positioned to the east and west of the arena floor

The surface water system will provide measures to improve the quality of runoff where appropriate. Guidance is provided in The SuDS Manual (2015) reproduced in Table 1 below, with risk of pollution presented as 'Pollution Hazard Indices'. Areas of the site discharging to the surface water drainage network are assessed as having a low pollution hazard level, applicable to:

- Commercial Roofs
- Low traffic roads

The site incorporates permeable paving, catchpit manholes and an attenuation tank which should all provide an improvement in the quality of surface water discharge from the site. A hydrocarbon interceptor is not deemed appropriate for the arena site as it does not accommodate any open car parking areas.

Table 1 • Pollution Hazard Indices from CIRIA C753 (2015), 'The SuDS Manual'.

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

2.2 Selection of SuDS

Sustainable Drainage Systems (SuDS) seek to achieve one or more of three main aims:

- Reduce the quantity and rate of water discharging from a site;
- Improve the quality of runoff; and,

- Promote biodiversity and amenity.

SuDS features can be arranged into a hierarchy, ranked for their performance as a hydraulic control or their ability to improve water quality. The suitability of a number of features ranked for water quality has been assessed to establish those that may be appropriate for use at the site, shown in Table 2.

The viability and inclusion of features has been considered as part of the wider external works and landscape design. Where suitable these measures have now been incorporated within the surface water management strategy.

Table 2 - SuDS Features: Assessment of Suitability

SuDS Device	Suitable on Site	Comments
Permeable Pavement	High Potential	Level 1 podium paving will be designed as permeable where practical. In order to tie with existing boundary levels, where surface falls are mandated at the podium level, permeable paving has been excluded.
Infiltration Trench	No	Infiltration not considered viable at this stage due to proximity to building footprint and presence of contaminated ground.
Infiltration Basin	No	Infiltration not considered viable at this stage due to presence of contaminated ground.
Soakaway	No	Infiltration not considered viable at this stage due to presence of contaminated ground.
Bio-retention/filter strips	No	Non-infiltrating arrangements suitable for use in any landscape buffers.
Filter Trench	No	Infiltration not considered viable at this stage due to presence of contaminated ground.
Enhanced Dry Swale	No	No suitable landscape corridors identified due to presence of contaminated ground.
Enhanced Wet Swale	No	Open water bodies not considered appropriate for an arena setting.
Shallow Wetland	No	Insufficient external space available for open water bodies unlikely to be considered appropriate for an arena building.
Extended Detention Wetland	No	Insufficient green space available
Pond/wetland	No	Insufficient external space available and open water bodies unlikely to be considered appropriate for an arena building.
Pocket Wetland	No	Insufficient external space available
Submerged Gravel Wetland	No	Insufficient external space available
Wetland Channel	No	Insufficient external space available
Retention Pond	No	Insufficient external space available
Conveyance Swale	No	Insufficient space to accommodate conveyance swale.
Detention Basin	No	Insufficient external space available
Sub-surface Storage	High Potential	Below ground tanks provided for surface water attenuation
Rainwater Harvesting	High Potential	Rainwater harvesting utilised to maximise water reuse.
Green/Brown Roof	No	The provision of large spaces that are clear of columns to facilitate unobstructed sightlines within the arena result in long structural spans. A heavy green roof build-up does not lend itself to this functional requirement and has hence been excluded. A lighter (or shallower) green roof build-up is not expected to provide the required benefits and the cost of such a provision would override the benefits achievable. Green roofs have therefore been discounted from the project scheme.

2.3 Conclusion and Recommendations

Based on the assessment completed, the widespread implementation of natural systems of sustainable drainage are not suitable for the site. The use of more engineered physical methods like permeable paving and below ground tanks to improve water quality and quantity of runoff will therefore be implemented to address the pollution hazard indices noted in Table 1.

Appendix A

Email correspondence with United Utilities

Nick Hall

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 07 November 2019 17:16
To: Nick Hall
Cc: Edwards, Stuart; O'Brien, Neil; Wastewater Developer Services
Subject: PDE 4200028804 Project Bradford, Sportcity Way, Manchester, M11 3U
Attachments: RE: Etihad Campus - general predevelopment enquiry - 4200028724

**** External Email ****

Good afternoon,

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

Foul

The foul water flows emanating from this site will be allowed to drain freely in to the nearest available public foul/combined sewerage system located within a public highway. Our preference would be to discharge into the 375mm diameter public combined sewer located within Sport City Way to the northeast of the proposed development.

Surface Water

Surface water from the site is proposed to drain into a private drainage network which ultimately discharges into the River Medlock. As a result, United Utilities cannot comment further but suggest that you discuss the matter with the relevant risk management authority.

Existing Sewers Crossing the Site

There are public sewers crossing the site of which, we will require unrestricted access to the sewer for maintenance purposes, we would ask that you maintain a minimum clearance of (6m refer to table 2.1 SFA) which is measured 3m from the centre line of the pipe unless there happens to be a formal easement agreement in place, in which case the specified detail would apply, assuming that they will remain in situ. However, it is understood that you are considering abandonment of the on-site sewers. If this is the case we suggest that you submit a sewer closure application along with all supporting information as outlined within the guidance document available on our website via the following link:

<https://www.unitedutilities.com/builders-developers/wastewater/sewer-closures/>

The information provided should determine that there are no live flows within the length of sewers which are being proposed to be abandoned or upstream of this location, as identified on the attachment my colleagues have recently provided to you. As discussed on our telephone conversation, as a minimum we request the plan which allows us to cross reference the CCTV drainage survey provided.

It may be possible to divert the flows upstream into a different network which could be assessed as part of a diversion application.

Should abandonment of the on-site public sewer not be possible, United Utilities would encourage the investigation of potential diversion of these sewers as we would not accept building over at this time due to the potential post development access restrictions resulting from the site. We understand you may have evidence of a build over agreement which we did not have on record, if you are able to provide this, we will take it under consideration.

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

<https://www.unitedutilities.com/builders-developers/wastewater-services-and-connections/sewer-diversions/>

Connection Application

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

<https://www.unitedutilities.com/builders-developers/wastewater-services-and-connections/sewer-connections/>

Sewer Adoption Agreement

You may wish to offer the proposed new sewers for adoption. United Utilities assess adoption application based on Sewers adoption 6th Edition and for any pumping stations our company addenda document. Please refer to link below to obtain further guidance and application pack:

<https://www.unitedutilities.com/builders-developers/wastewater-services-and-connections/sewer-adoptions/>

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

Please note, if you intend to put forward your wastewater assets for adoption by United Utilities, the proposed detail design will be subject to a technical appraisal by an Adoption Engineer as we need to be sure that the proposals meets the requirements of Sewers for adoption and United Utilities Asset Standards. The proposed design should give consideration to long term operability and give United Utilities a cost effective proposal for the life of the assets. Therefore, further to this enquiry should you wish to progress a Section 104 agreement, we strongly recommend that no construction commences until the detailed drainage design, submitted as part of the Section 104 agreement, has been assessed and accepted in writing by United Utilities. Any works carried out prior to the technical assessment being approved is done entirely at the developers own risk and could be subject to change.

If I can be of any further assistance please don't hesitate to contact us further.

Kind regards,

Robert Brenton
Developer Engineer
Developer Services and Planning
Network Delivery
United Utilities

T: 01925 537400
[unitedutilities.com](https://www.unitedutilities.com)

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From: Nick Hall [<mailto:Nick.Hall@BuroHappold.com>]

Sent: 22 October 2019 21:14

To: Edwards, Stuart ; Wastewater Developer Services

Cc: Ross Cuming ; Richard.hattan ; Ben Luffman ; Andrew Pottinger ; 042841 Project Bradford

Subject: Etihad Campus - general predevelopment enquiry

Dear Stuart

Many thanks for making time to meet us last week to discuss the Bradford site at the Etihad Campus. I have attached a set of meeting minutes, I'd be grateful if you could let me know if there are any errors or omissions.

As promised, the report attachment to this email presents the information we have obtained about the site to date and presents the current proposals relating to existing foul water sewers and the disposal of foul water from the proposed new development. There is a mark-up summarising the sewer survey info obtained to date contained in Appendix F at the very end of the report.

I have also attached a pre-development enquiry form, completed as far as is possible at this stage.

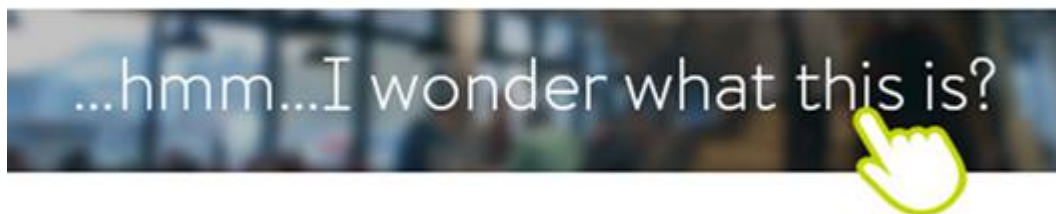
Surface water from the site is to discharge into the culverted River Medlock within the campus boundary, via an existing private campus SW drainage system. I have therefore not presented SW proposals within this email.

I have also not discussed potable water supply within this email. This is being by a different consultant within the design team so we shall progress this element separately.

Please don't hesitate to call should you have any queries or require any further information from us.

Kind regards,

Nick Hall BEng (Hons) CEng MICE
Associate
BuroHappold Engineering | Infrastructure
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Appendix B

Email correspondence with Lead Local Flood Authority

Nick Hall

From: z.todorovic@manchester.gov.uk on behalf of floodriskmanagement@manchester.gov.uk
Sent: 22 October 2019 13:46
To: Siddhesh Raute
Cc: 042841 Project Bradford; floodriskmanagement@manchester.gov.uk; Nick Hall; Rodoula Gregoriou
Subject: RE: Project Bradford: LLFA consultation
Attachments: NTH 185 420 A.pdf

**** External Email ****

Siddhesh

Thank you for the email.

We have noted that you mentioned that the site is currently draining by positive drainage into the v-ditch and into the highway drain. The assessment of the existing flows should not be based on the rational method as they are suggesting unrealistic high flows that are drained through the existing drainage system. Instead, the existing flows need to be estimated based on the capacity of the existing drainage system to convey peak flows based on the diameter of the outfall pipe into the ditch. These much smaller flows are in line with reported regular ponding on site after each rainfall event which indicate that a lot of runoff does not drain straight into the drainage system.

With regards to the next steps, we have already sent you the guidance for developing the design and we trust that it provide sufficient guidance. We would recommend that you send us the fully developed proposal for review and comments and not send developed proposal in steps.

Kind regards

Flood Risk Management
Highways Service, Growth and Neighbourhoods Directorate
Manchester City Council
Tel: 0161 219 6295
Email: floodriskmanagement@manchester.gov.uk
Web: <http://www.manchester.gov.uk/>

POSTAL ADDRESS: Manchester City Council, Public Realm, The Neighbourhood Service, PO Box 532, Town Hall, Manchester M60 2LA

From: Siddhesh Raute <Siddhesh.Raute@BuroHappold.com>
To: "floodriskmanagement@manchester.gov.uk" <floodriskmanagement@manchester.gov.uk>,
Cc: 042841 Project Bradford <042841ProjectBradford@BuroHappold.com>, Nick Hall <Nick.Hall@BuroHappold.com>, Rodoula Gregoriou <Rodoula.Gregoriou@BuroHappold.com>
Date: 09/10/2019 22:29
Subject: RE: Project Bradford: LLFA consultation

Dear Zorica

Many thanks for your email. Having reviewed the document attached within your email, I have outlined our design philosophy for managing surface water runoff from the site and we welcome your comments.

Existing site:

The existing site is brownfield with historic site uses comprising a gas works, hosting sporting events for the Commonwealth Games in 2002 and currently being used as a car park for events hosted within the Etihad Campus. Historic reports detailing the soil characteristics of the site indicate a mixture of demolition rubble, ash, colliery spoil, refuse and reworked natural material. Ongoing site investigations are confirming these observations and are revealing contaminated ground conditions at the site. The existing site covers an area of approximately 2ha.

Existing Drainage:

The existing site is currently drained positively to its northern boundary. Drawing NTH/185/420 received from our client (and attached here) illustrates that existing drainage is conveyed to a V-ditch along the northern perimeter from where it is discharged to the highway drainage network. The highway network subsequently drains to the culverted River Medlock north of the site via a hydrocarbon interceptor.

The drainage strategy drawing identifies a 75% run-off rate for surface water and we believe that the lime stabilised material that sits close to surface could be the key reason for impermeable conditions resulting in this assumption. Regular ponding has been reported on site after rainfall events.

Proposed Strategy:

The proposed building footprint occupies approx. 90% of the site area, with external landscaped and hardscaped spaces making up the remaining 10%. In order to improve the quality and quantity of surface water runoff, design proposals currently aim to provide permeable paved areas wherever possible. Additionally an active rainwater harvesting system is being investigated to maximise rainwater capture and re-use. The presence of contaminated ground will make using infiltration techniques unsuitable, however, permeable pavements combined with active rainwater harvesting should capture pollutants from the first flush thus helping improve quality of offsite discharge.

Using the Modified Rational Method and assuming 75% impermeability of existing ground, a resultant discharge rate of 508.6l/s is expected from a 1 in 100 year storm event. The design will aim to provide a min. of 50% betterment on this rate of runoff, but we will aim to extend this to 70% betterment assuming this can be successfully achieved within the building constraints. The betterment in rate of runoff will be provided by a below ground attenuation tank comprising cellular units. Whilst the intention will be to minimise excavations in contaminated ground and offsite transfer of such material the design team will endeavour to maximise the storage that can be provided to reduce the offsite discharge rate.

Next Steps:

- Agree with the Manchester City Council proposed surface water drainage strategy
- Develop drainage proposals in further detail to provide attenuation storage volume and final flow rates being adopted.

We look forward to receiving your feedback.

Thanks and kind regards

Siddhesh

Siddhesh Raute IEng MICE

Senior Engineer

BuroHappold Engineering | Cities

T: +44 (0)1225 320600

Please note: My normal working days are Monday to Thursday

From: z.todorovic@manchester.gov.uk <z.todorovic@manchester.gov.uk> **On Behalf Of** floodriskmanagement@manchester.gov.uk

Sent: 17 September 2019 09:07

To: Siddhesh Raute <Siddhesh.Raute@BuroHappold.com>

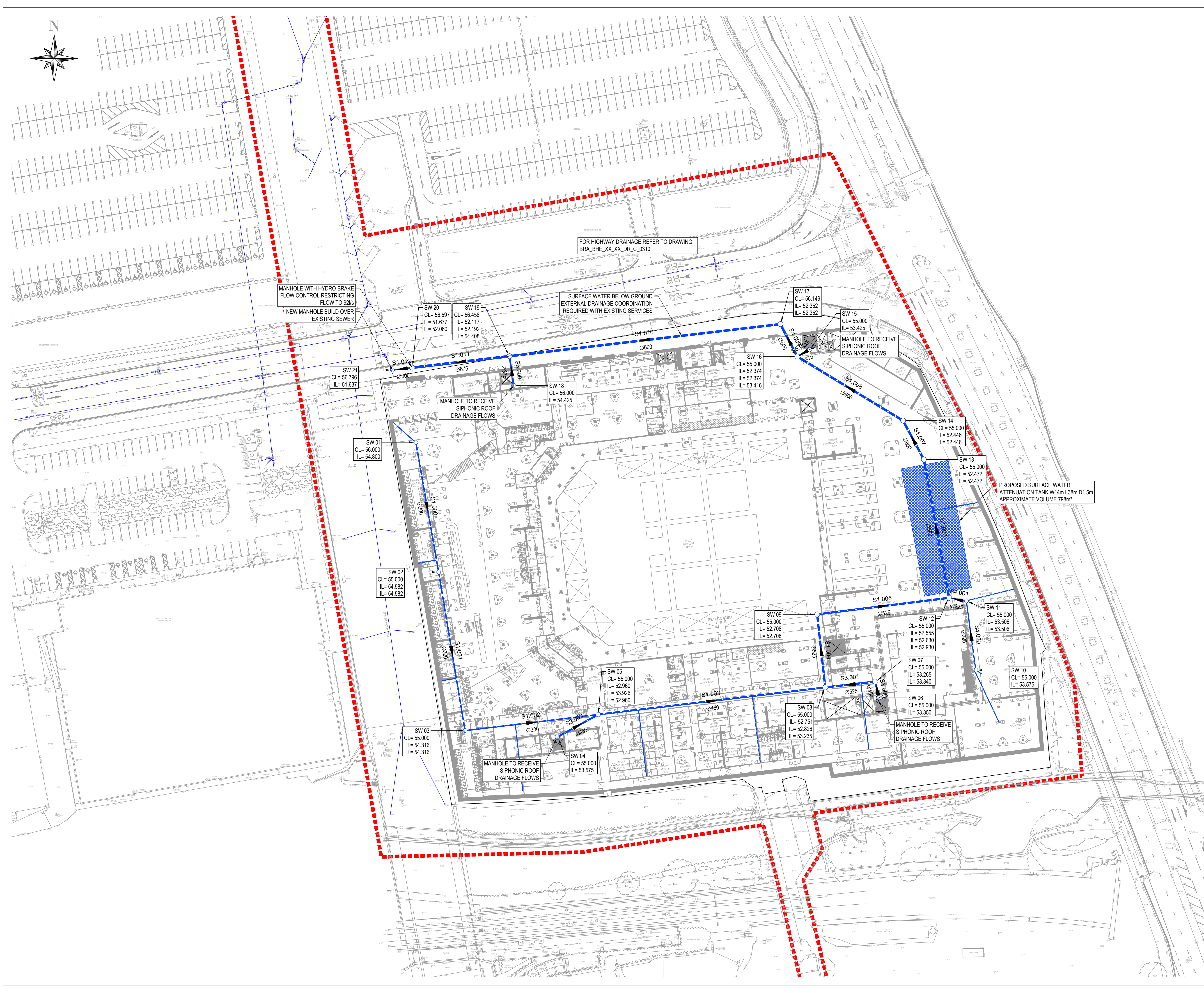
Cc: 042841 Project Bradford <042841ProjectBradford@BuroHappold.com>; floodriskmanagement@manchester.gov.uk; Nick Hall <Nick.Hall@BuroHappold.com>; Rodoula Gregoriou <Rodoula.Gregoriou@BuroHappold.com>

Subject: RE: Project Bradford: LLFA consultation

**** External Email ****

Appendix C Drawings

0042841_BHE_XX_XX_DR_C_0300 – Surface Water Drainage General Arrangement



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IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING		
CONSTRUCTION		
EXCAVATIONS IN CONTAMINATED GROUND FINAL CONNECTION TO LIVE SEWER IS Xm DEEP AND WILL REQUIRE AN EXTERNAL BACKDROP		
MAINTENANCE/CLEANING/OPERATION		
HYDRO-BRAKE FLOW CONTROL DEVICE ATTENUATION TANK		
DECOMMISSIONING/DEMOLITION		
N/A		

- Notes
- THIS DRAWING REFERENCE FOLLOWING INFORMATION:
 - POPULUS (ARCHITECT) - LEVEL 00 RECEIVED ON THE 22.10.2019
 - TOPO SURVEY FROM SURVEY OPERATIONS REFERENCE 19D065 A RECEIVED ON THE 12.09.2019
 - ALL INTERNAL MANHOLES TO HAVE DOUBLE SEALED COVERS
 - ALL PIPES TO BE Ø150mm UNLESS SHOWN OTHERWISE ON THE DRAWING.
 - FOR HIGHWAY DRAINAGE REFER TO DRAWING BRA_BHE_XX_XX_DR_C_0310
 - FOR ABOVE GROUND DRAINAGE REFER TO ME ENGINEERING DRAWINGS
 - FOR MANHOLE & PIPE SCHEDULE REFER TO DRAWING: BRE_BHE_XX_XX_DR_C_0391
 - ALL PIPE WORK TO BE CLEANED PRIOR TO HANDOVER INCLUDING SLOT DRAINS AND GULLIES

- LEGEND
- PROPOSED SCHEME BOUNDARY
 - PROPOSED SURFACE WATER DRAINAGE & MANHOLE
 - PROPOSED SURFACE WATER ATTENUATION TANK
 - EXISTING SURFACE WATER DRAINAGE

00 DRAFT ISSUE FOR COSTING	01.11.2019	JZ	SR
Rev	Description	Date	Drm

Rev	Description	Date	Drm	Chd
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INFORMATION

Status of drawing

BUROHAPPOLD ENGINEERING

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Architect **POPULOUS**
Project **PROJECT BRADFORD**
Drg Title **GENERAL ARRANGEMENT
PROPOSED BELOW GROUND
SURFACE WATER DRAINAGE**

Scales@A1 1:500
Drawn by JZ
Checked by NJH

Job No. **0042841**
Date NOV 2019
Rev 00

Drawing No. BRA-BHE-XX-XX-DR-C-0300

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