



THE GOODSYARD

Outline Drainage Strategy

September 2019



ballymore.



PREFACE

This is an Outline Drainage Strategy prepared by WSP.

It is submitted in relation to amendments ("Proposed Amendments") that are being made to the planning applications and applications for listed building consent (the "Applications") for the redevelopment of Bishopsgate Goodsyrd. The Applications as amended by the Proposed Amendments form the "Revised Scheme".

On 21st July 2014 Bishopsgate Goodsyrd Regeneration Limited (the "Applicant") submitted the Applications to the London Borough of Hackney and the London Borough of Tower Hamlets (the "Boroughs").

On 23rd September 2015 the then Mayor of London directed that he would act as local planning authority for the purposes of determining the Applications.

On 12th April 2016 the then Mayor deferred the determination of the Applications to allow the Applicant to address the issues raised in the Stage III Report.

The Applicant has carefully reviewed the issues raised in the Stage III Report and has liaised closely with the Mayor of London, the Boroughs and other stakeholders and consultees and is now submitting amendments to the Applications to address their feedback.

In broad terms, the Applicant is making the following Proposed Amendments to the Applications:

PLOT 1 (FORMERLY PLOTS A AND B)

The Proposed Amendments maintain the height of the building and the type of uses, as currently proposed and retains the bridging over the East London Line box. The building massing is proposed to be revised to include setbacks at the upper levels as a result of feedback from the GLA and the Boroughs to address the relationship with adjacent buildings.

PLOT 2 (FORMERLY PLOTS F AND G)

The Proposed Amendments replace the two tallest residential buildings with a commercial building with retail at the ground floor. The building would extend up to 17 - 29 storeys and would be the tallest building proposed. This building is being submitted with all matters in detail.

The reduction in height of Plot 2 means that no part of the scheme is now visible in views from the South Bastion of Tower Bridge.

PLOT 3 (FORMERLY PLOT K)

The Proposed Amendments maintain the height and footprint of the building and the type of uses, as currently proposed. The Proposed Amendments address design comments in respect of the treatment to Phoenix Street and the listed Oriel Wall along Commercial Street.

PLOT 4 (FORMERLY PLOT C)

The Proposed Amendments maintain the uses within this building and comprise retail at ground floor with residential above. The height of the building is proposed to be reduced to 19 storeys.

PLOT 5 (FORMERLY PLOT D)

The Proposed Amendments maintain the uses within this building and comprise retail at ground floor with residential above. The height of the building is proposed to be reduced to between 6 -13 storeys.

PLOT 6 (FORMERLY PLOT E)

The Proposed Amendments change the use of this building to a cultural type use with retail use. The height of the building is proposed to be reduced to up to 5 storeys in order to address comments raised by the GLA in respect of daylight and sunlight impacts along Sclater Street and the massing in the north-east part of the site.

PLOTS 7, (FORMERLY PLOTS H, I, J), 8A, 8B, 8C, 10 AND 11 (THE PAVILION)

The Proposed Amendments maintain the mix of retail uses within the Oriel as well as the potential for Class D1/D2 uses within the Braithwaite arches with public open space above, as currently proposed (Plot 7). Plot 8 introduces hotel and residential uses with access at ground floor level within a 25 storey building to the west of Braithwaite Street, plus 4 storey buildings on top of the existing arches. The Proposed Amendments introduce residential within Plot 10 with retail at ground floor. The Proposed Amendments introduce retail use within a single storey building in Plot 11.

PUBLIC OPEN SPACE

The overall amount of public space as part of the Proposed Amendments would increase at platform level, including an area of consolidated open space at the eastern end of the platform.

The Proposed Amendments, and the rationale for them, are explained fully in the Planning Statement prepared by DP9 Ltd.

The Proposed Amendments to the Applications have required some changes to be made to the Outline Drainage Strategy and other documentation originally submitted with the Applications.

Rather than issuing tracked changed documents, the Applicant has issued this revised Outline Drainage Strategy which replaces in its entirety that submitted previously.

CONTENTS

1.	INTRODUCTION	7
1.1	APPOINTMENT AND BRIEF	7
1.2	OBJECTIVE OF STUDY	7
2.	EXISTING SITE	9
2.1	SITE LOCATION	9
2.2	SITE DESCRIPTION	9
2.3	GEOLOGY AND HYDRO-GEOLOGY	10
2.4	EXISTING WATERCOURSES	10
2.5	EXISTING SURFACE AND FOUL WATER DRAINAGE	10
3.	PROPOSED DEVELOPMENT	12
3.1	DEVELOPMENT PROPOSALS	12
4.	CLIMATE CHANGE	14
4.1	BACKGROUND INFORMATION	14
4.2	DEVELOPMENT LIFESPAN	14
4.3	IMPACT OF CLIMATE CHANGE ON THE DEVELOPMENT	14
5.	OUTLINE DRAINAGE STRATEGY	16
5.1	SURFACE WATER	16
5.2	MAINTENANCE STRATEGY	24
5.3	FOUL WATER	26
6.	CONCLUSIONS	28

FIGURES

Figure 1: Indicative Proposed Development Area	9
--	---

TABLES

Table 1 - Thames Water Sewer Summary	10
Table 2 - Existing Runoff Rates	17
Table 3 - Proposed Runoff Rates	17
Table 4 -Summary of Catchment Areas and Proposed Attenuation On-site	18
Table 5 – 1in2 Year Discharge/Attenuation Summary	19
Table 6 – 1in30 Year Discharge/Attenuation Summary	20
Table 7 – 1in100 Year Discharge/Attenuation Summary	21
Table 8 – 1in100+40% cc Discharge/Attenuation Summary	21
Table 9 – Site Wide Discharge/Attenuation Summary	22
Table 10 - Maintenance Strategy	24

APPENDICES

APPENDIX A - SITE LOCATION PLAN
APPENDIX B - TOPOGRAPHICAL SURVEY AND THAMES WATER RECORDS
APPENDIX C - PROPOSED ARCHITECTS PLANS
APPENDIX D - OUTLINE DRAINAGE STRATEGY PLAN AND CALCULATIONS

1.0 INTRODUCTION

1. INTRODUCTION

1.1 APPOINTMENT AND BRIEF

- 1.1.1 WSP have undertaken this Outline Surface Water and Foul Water Drainage Strategy (DS) to support a planning application for Bishopsgate Goodsyards, Shoreditch, London ('the Site').
- 1.1.2 Under an Appointment dated May 2018 between WSP and Bishopsgate Goodsyards Regeneration Limited, WSP were employed as Consultant to provide the below Report and in doing so has exercised reasonable skill and care. This report relates solely to the Bishopsgate Goodsyards site.
- 1.1.3 This report is intended for the sole benefit of the parties named above and shall not be capable of assignment. WSP shall not be liable for any use of the Report for any reasons other than that for which the report was originally prepared and provided.
- 1.1.4 Although this report was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances, please note that WSP cannot take responsibility for errors in the information provided by third parties.

1.2 OBJECTIVE OF STUDY

- 1.2.1 This report outlines the management of foul and surface water for the Proposed Development prior to discharge off-site, in accordance with Local Policy.
- 1.2.2 The appraisal process consisted of a Site visit (undertaken in June 2018), a desk study, and consultation with regulatory bodies and third parties. Thames Water (TW) and the Great London Authority (GLA) have provided background information to inform the production of this DS. Consultation with these regulatory bodies and third parties have been undertaken as part of the design of the Proposed Development
- 1.2.3 The DS has been produced taking into consideration the following London Borough of Tower Hamlets (LBTH) and London Borough of Hackney (LBH) local policy documents:
 - LBTH – Core Strategy Development Plan Document 2025 (September 2010);
 - LBTH – Local Flood Risk Management Strategy 2016-2022 (2016);
 - LBTH – SuDS Guidance (undated)
 - LBTH – Surface Water Management Plan (July 2011);
 - LBH – Core Strategy Hackney's Strategic planning policies for 2010-2025 (November 2010);
 - LBH – Development Management Local Plan (July 2015);
 - LBH – Surface Water Management Plan (July 2011);
 - LBH – Interim SuDS and SAB Guidance (January 2014);
- 1.2.4 This Report makes partial use of third party information and contains Environment Agency information ©.

2.0 EXISTING SITE

2. EXISTING SITE

2.1 SITE LOCATION

- 2.1.1 The Site is located at Shoreditch High Street within the Shoreditch area of London. The Site is bounded by Bethnal Green Road (A1209) and Sclater Street to the north and Brick Lane to the east. Commercial Street crosses the south west corner of the site and Shoreditch High Street (A10) runs along the western side. Braithwaite street/Wheler Street bisects from the north to south, across the centre of the Site.

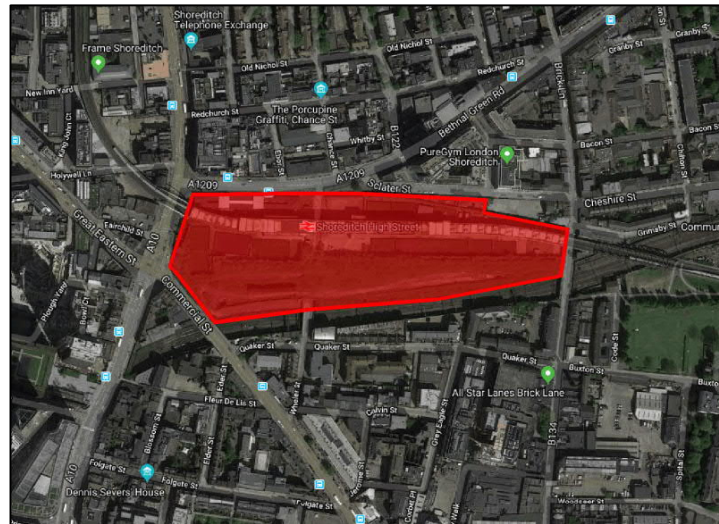


Figure 1: Indicative Proposed Development Area

- 2.1.2 Refer to **Error! Reference source not found.** above and Appendix A for the area applicable to this planning application.

2.2 SITE DESCRIPTION

- 2.2.1 The Planning Application Site boundary is approximately 4.4 hectares (ha) in size and currently comprises the Shoreditch High Street Overground station, retail units, sports pitches, a number of commercial units fronting Sclater Street and historical rail arches across the southern side of the site.
- 2.2.2 Based on the Plowman Craven topographical survey (undertaken in 2007), the levels on top of the listed structures to the eastern side generally slope from west to east with levels ranging from 18.5mAOD to 17.9mAOD. The lower level areas, where the sports pitches are located have levels from 14.6mAOD 13.9mAOD and generally slope towards the centre. No levels have been provided within the topographical survey for the western side of the site.
- 2.2.3 Levels at Shoreditch High Street are 14.7-14.8mAOD and 14.9mAOD at Commercial Street, compared to 13.9mAOD at Brick Lane, suggesting that there is approximately a 1 metre drop in external levels from the western and eastern sides of the site.
- 2.2.4 An additional Plowman Craven topographical survey (undertaken in 2019) indicates that the levels at the base of the listed structures to the eastern side of Braithwaite Street generally slope from west to east with levels ranging from 13.9mAOD to 12.3mAOD. To the west of Braithwaite Street, levels range from 15.2mAOD to the west to 14.6mAOD to the east.
- 2.2.5 In consistency with the 2007 topographical survey, levels at Shoreditch High Street are 14.7-14.8mAOD and 14.7-15.4mAOD at Commercial Street, compared to 13.2-14.4mAOD at Brick Lane.
- 2.2.6 Refer to Appendix B for the further details of the topographical surveys.

2.3 GEOLOGY AND HYDRO-GEOLOGY

- 2.3.1 Based on online British Geological Society (BGS) records, the Site's underlying bedrock geology is identified to be London Clay Formation – Clay, Silt and Sand. The EA classify this bedrock geology as 'Unproductive Strata' (i.e. rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.) Superficial deposits are present on site and consist of Taplow Gravel Member – sand.
- 2.3.2 Based on the online DEFRA Groundwater Vulnerability and Aquifer Designation Maps, the site is located within a Secondary A Aquifer/Minor Aquifer High Zone.

2.4 EXISTING WATERCOURSES

- 2.4.1 No watercourses exist within proximity of the site. The Regents Canal is located approximately 1.4km north of the site and the River Thames at approximately 1.7 km south.

2.5 EXISTING SURFACE AND FOUL WATER DRAINAGE

- 2.5.1 Based on TW Asset Records (2018), included in Appendix B, there are combined sewers surrounding the Site. Table 1 below summarises the Thames Water public sewers that surround the site.

Table 1 - Thames Water Sewer Summary

Location	Type	Size (mm)	Depth (mbgl)
Sclater Street	Foul/Surface Water/Combined	305	n/a
Braithwaite Street	Foul/Surface Water/Combined	305	n/a
Bethnal Green Road	Foul/Surface Water/Combined	1219x813	n/a
Brick Lane	Foul/Surface Water/Combined	305	n/a
Commercial Street	Foul/Surface Water/Combined	1219x813 -> 1219x762	n/a
Shoreditch High Street	Foul/Surface Water/Combined	1676x1118	8.7
Wheeler Street	Foul/Surface Water/Combined	1143x813	n/a

- 2.5.2 Refer to Appendix B for further details related to TW public sewer information.

3.0 PROPOSED DEVELOPMENT

3. PROPOSED DEVELOPMENT

3.1 DEVELOPMENT PROPOSALS

3.1.1 This DS has been produced for the following Proposed Planning Submission:

“An OUTLINE application for the comprehensive mixed use redevelopment of the site comprising:

- *Residential (Class C3) comprising up to 500 residential units;*
- *Business Use (Class B1) – up to 130,940 m² (GIA);*
- *Hotel (Class C1) – up to 11,013 m² (GIA)*
- *Retail, financial and professional services, restaurants and cafes and hot food takeaways (Class A1, A2, A3 and A5) – up to 18,390 m² (GIA) of which only 3,678 m² (GIA) can be used as Class A5;*
- *Non-residential Institutions (Class D1) / Assembly and Leisure (Class D2) – up to 6,363 m² (GIA);*
- *Public conveniences (sui generis) – up to 298 m² (GIA);*
- *Basement, ancillary and plant space – up to 21,216 m² (GIA);*
- *Formation of new pedestrian and vehicular access; means of access and circulation and car parking within the site; and*
- *Provision of new public open space and landscaping.*

The application proposes a total of 10 buildings that range in height, with the highest being 142.4m AOD and the lowest being 19.0m AOD.

With all matters reserved save that FULL DETAILS for Plot 2 are submitted for alterations to, and the partial removal of, existing structures on the site and the erection of a building for office (Class B1) and retail use (Class A1, A2, A3, A5) comprising a part 17 / part 29 storey building; and Plot 7 A, B, C and D comprising the use of the ground level of the Braithwaite Viaduct for retail and food and drink uses (A1, A2, A3, A5) and works to and use of the Oriel and adjoining structures for retail and food and drink uses (A1, A2, A3, A5).”

3.1.2 A proposed ground floor plan, produced by FaulknerBrowns architects (Drawing 3465-FBA-00-XX-M3-A-GOODSYARD MASTERPLAN) is attached in Appendix C.

3.1.3 The Proposed Development will be constructed over a number of phases. For details on each phase please refer to Faulkner Browns Phasing drawing BGY-FBA-00-00-DR-A-00-0039, attached in Appendix C.

4.0 CLIMATE CHANGE

4. CLIMATE CHANGE

4.1 BACKGROUND INFORMATION

- 4.1.1 As explained in the Climate Change Adaptation Sub-Committee Progress Report 2014, increased flood risk is the greatest threat to the UK from climate change. Models of the climate system suggest floods of the type experienced in England and Wales in autumn 2000, and between December 2013 and February 2014, have become more likely as a consequence of increased concentrations of greenhouse gases in the atmosphere.
- 4.1.2 More frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall could be expected. Sea levels are also expected to continue to rise.
- 4.1.3 EA guidance “Flood risk assessments: climate change allowances” issued on the 19th February 2016, updated in April 2016 and February 2017, provides up to date information on expected changes in rainfall, river flows and sea level rise as a consequence of climate change.
- 4.1.4 For peak rainfall the EA Guidance provides an upper end and central allowance depending on epoch; the guidance recommends assessing both the central and upper end allowances to understand the range of possible impacts.

4.2 DEVELOPMENT LIFESPAN

- 4.2.1 A typical lifespan for more vulnerable uses is 100 years and on this basis, the contingency allowances for climate change that are potentially applicable to this Site are:

Peak Rainfall;

- Upper End – 40% by 2115
- Central – 20% by 2115

4.3 IMPACT OF CLIMATE CHANGE ON THE DEVELOPMENT

- 4.3.1 The impact of climate change is negligible with regards to river flows and sea level rise as the Site is not located within or in proximity of any fluvial or tidal floodplain.
- 4.3.2 The EA guidance indicates that developers should assess both the central and upper end allowances to understand the range of impact, the DS will therefore assess the impact of 40% climate change and will detail the risk associated with any flooding that may occur during this event.

5.0 OUTLINE DRAINAGE STRATEGY

5. OUTLINE DRAINAGE STRATEGY

5.1 SURFACE WATER

SUDS OPTIONS APPRAISAL

- 5.1.1 Policy 5.13 Sustainable Drainage, indicates developers should utilise Sustainable Drainage Systems (SuDS) in line with the following drainage hierarchy:
- store rainwater for later use;
 - use infiltration techniques, such as porous surfaces in non-clay areas;
 - attenuate rainwater in ponds or open water features for gradual release;
 - attenuate rainwater by storing in tanks or sealed water features for gradual release;
 - discharge rainwater direct to a watercourse;
 - discharge rainwater to a surface water sewer/drain;
 - discharge rainwater to the combined sewer.
- 5.1.2 Storing rainwater for later use is not proposed to be incorporated as part of the Proposed Development, due to the limited space to occupy such system, when considering the massing required, amount of soft landscaping proposed at podium level i.e. unsuitable for rainwater harvesting, and building height constraints.
- 5.1.3 Based on a review of the ground conditions of the site (via BSG Mapping), the site is underlain by London Clay bedrock geology, which suggests infiltration is not feasible. Any permeable layers that exist from superficial deposits overlying the bedrock geology is likely to be limited in thickness because of the significant subterranean development in this heavily urbanised area of the site.
- 5.1.4 In addition, using infiltration via SuDS, for example a soakaway, is unfeasible given that best practice advocates a 5m easement buffer between any building envelope and an infiltration SuDS system. Therefore, infiltration methods have been discounted for this site.
- 5.1.5 Furthermore, porous surface systems (such as permeable paving) are not considered to be viable due to the limited external areas for locating such systems i.e. the Site's boundary is largely taken up by the building envelope. The public realm areas are heavily congested with utility infrastructure, and as a result there is insufficient build-up to incorporate porous surfaces at lower ground level. Additionally, the existing heritage cobbled paving within the lower ground areas of the site is to be restored and retained, which would not allow space for the incorporation of permeable paving.
- 5.1.6 The use of open water features such as ponds as a design feature is considered to be impractical given the small amount of external area at lower ground, relative to building envelope areas.
- 5.1.7 It is proposed to include SuDS in the form of blue roofs located on a number of plot roofs, geo-cellular tanks at platform deck levels, and below ground storage to provide the level of surface water attenuation required, in accordance with the London Plan. Through the use of these SuDS systems, the attenuated water will be restricted by incorporating a flow control device (i.e. hydro-brake or similar) to allow for a gradual release to the public sewer network.
- 5.1.8 As described in the Section 2.4, the option to discharge into a nearby watercourse is unachievable, as there are no watercourses in proximity to the site that would allow for a surface water discharge.
- 5.1.9 There are no surface water sewers located adjacent or in close proximity to the development, therefore it is unfeasible to discharge rainwater into surface water sewers.
- 5.1.10 It is therefore proposed that the site will discharge both surface and foul water into the public combined sewer network within the vicinity of the site.
- 5.1.11 As part of the DS, a capacity check enquiry has been submitted to TW (December 2018) to ensure that the local sewer network can accommodate the proposed discharge of the development. A response has not yet received and is currently being awaited.

5.1.12 In favour of sustainability, the Proposed Development will aim to reduce surface water discharge to greenfield runoff rates, in accordance with LBTH and LBH local policy and best practice. To achieve the surface water reduction, the Proposed Development will utilise SuDS in the form of blue roof attenuation systems located at roof level, below slab attenuation tanks and geocellular attenuation tanks located in ground and platform level areas of the site. The DS has been designed to ensure surface water on-site drains via gravity, to avoid a pumped solution.

5.1.13 The following subsection will detail the amount of reduction achieved with the SuDS when compared to the existing scenario, as well as outline the location of drainage features on-site.

EXISTING SURFACE WATER RUNOFF CALCULATIONS

5.1.14 Based upon the Wallingford Procedure's Rational Method and rainfall intensity from FEH rainfall (obtained using point data and MicroDrainage), for a storm duration of 15 minutes, the existing brownfield runoff rates have been calculated, as follows in Table 2:

$$Q = 2.78 \times \text{Rainfall Intensity (mm/hour)} \times \text{Area (ha)}$$

Table 2 - Existing Runoff Rates

Drainage Catchment	Storm Event	Rainfall Intensity (15min Duration) (mm/hr)	Q - Existing Flow Rate (l/s) using Wallingford Procedure
Impermeable Site Area = 4.4 ha	1 in 2	37.028	452.9
	1 in 30	94.051	1150.4
	1 in 100	124.337	1520.9

5.1.15 The site is currently estimated to discharge 1520.9 l/s during the existing 1 in 100 year storm event.

5.1.16 Please refer to Appendix D for a copy of the rainfall intensities generated using FEH rainfall data.

PROPOSED SURFACE WATER RUNOFF CALCULATIONS

5.1.17 Based on the Proposed Development, the drainage strategy is to target a reduction to greenfield runoff rates. The greenfield runoff rates have been calculated using the latest FEH data and HR Wallingford's online SuDS Greenfield runoff estimation tool. The results are as follows in Table 3:

Table 3 - Proposed Runoff Rates

Drainage Catchment	Storm Event	Greenfield Runoff Rate from HR Wallingford Greenfield Runoff Estimation Tool (l/s)
Site Area = 3.91 ha	1 in 1*	5.91
	1 in 30	15.99
	1 in 100	22.18

*1in1 runoff rate used as a conservative measure from UKSUDS.com, 1in2 runoff rate is not provided from online tool, which is the lowest storm period that can be applied with MicroDrainage software.

5.1.18 The area considered for the proposed surface water calculations is less than the total site area, at 3.91ha compared to the 4.4ha site extent. The catchment reduction is due to a 0.49ha area of the existing site intending to remain unchanged during development. The Shoreditch high street station section of track to the north of the site is owned by London Overground and Shoreditch High Street station and is anticipated to drain as existing. Furthermore, Braithwaite/Wheler Street running north to south through the centre of the site is publicly owned and will also be draining as existing. Therefore, the total catchment area for the site is reduced totalling at 3.91ha.

5.1.19 Based on the above, hydraulic modelling has been undertaken using MicroDrainage to calculate attenuation requirements for the Site with the following parameters and assumptions:

- MicroDrainage software has been used for all hydraulic design;
- FEH 2013 point rainfall data has been used;
- CV values are set at 0.95 (95%) within Micro-Drainage, for conservative measures at this stage to account for 95% impermeable coefficient and with the remaining 5% accounting for losses on the surfaces/soft planters on top of arch structures. See paragraph 5.1.20.
- The proposed drainage network has been designed to accommodate the 1 in 100 year return period plus 40% climate change (cc) event;
- The Total Draining Area of the Site is 3.91ha;
- Each drainage catchment will target a limiting discharge rate no less than 2.0 l/s to minimise blockages (excluding Catchment A – 2.8 l/s, refer to paragraph 5.1.25);
- Flow control to be used: Hydrobrake;
- Storm Events to be modelled:
 - 1 in 2 year return period event;
 - 1 in 30 year return period event;
 - 1 in 100 year return period event; and
 - 1 in 100 year return period plus 40% cc event.

5.1.20 This DS has assumed the Site is 100% impermeable (as a worst-case scenario) to ensure sufficient attenuation volume space is allocated within the Site. However, during detailed design stages, when landscaped areas extents are confirmed, the draining areas positively draining to the attenuation systems may be reduced as a result, and therefore provide further reductions in the attenuation required on site.

5.1.21 Due to the nature of the Proposed Development comprising of numerous building plots and external areas, the Site has been split into drainage catchment areas, and are summarised in Table 4 below. Please refer to Appendix D for the Surface Water Runoff Catchment Area Plan (Drawing Ref: 24710919-WSP-D-D001) which shows below catchment areas, and attenuation required for each plot.

Table 4 -Summary of Catchment Areas and Proposed Attenuation On-site

Catchment	Plot	Total Catchment Area (m ²)	Total Attenuation Provided on Site (m ³) ¹	Proposed Attenuation Storage Location
A	Plot 1	5019	559	Below Ground Attenuation Tank
B	Plot 2, 3, 8, 11 and Platform Level	20674	2994	Geo-cellular tank at platform level
C	Plot 4	1105	171	Blue roof storage
D	Plot 5	1594	182	Blue roof storage

¹ Attenuation provided is indicative and subject to change following further design iterations.

E	Plot 6	660	76	Blue roof storage
F	Plot 10	2176	325	Blue roof storage
G	Lower Level	3896	507	Geo-cellular tank at Lower Level
H	Unrestricted Hardstanding Areas	3979	0	n/a
	Total	39103	4814	

5.1.22 As shown in

5.1.23 Table 4, it is proposed that surface water catchments from buildings 4, 5, 6 and 10 will be attenuated via blue roof systems at roof level. Building 1 will be attenuated locally within a below ground storage tank towards the northern side of the building. Building 2, 3, 7 and 8 catchments will drain into the attenuation tank situated at platform level. The platform tank spans a large area of the platform deck, to ensure there is sufficient volume available for the proposed catchments. Additionally, a tank located below the lower ground level will be utilised to store a surface water catchment at lower level. It should be noted that the attenuation solutions will be reassessed within future design phases as the site wide design develops.

5.1.24 Please note, specific areas are restricted spatially at the lower ground level, due to the extent of basement underlying a large proportion of the western side of the site, and the building envelope around the perimeter of the Site. In addition, a section of the platform level to the west of the site is constrained due to the levels design in that area i.e. a drop within the Site exists in this area, which does not provide the necessary depth required for an attenuation layer. As a result, storing attenuation tanks in these areas is considered unfeasible. Therefore, a total catchment area of 3979m² is proposed to drain freely and without attenuation on site, thus discharging into the public sewer network at an unrestricted flow rate. The remaining attenuated areas will target further reductions to compensate these unrestricted catchment H.

5.1.25 A series of rainfall events have been hydraulically modelled to ensure that for all storm events, the blue roof storage systems and attenuation tanks for the site will provide a reduction to the existing runoff rates, as close to greenfield runoff rates as reasonably possible.

5.1.26 Please note, that Catchment A (building 1) has a proposed rate higher than the other attenuated catchments. The total attenuation volume provided on site is 559m³ in the form of a below ground attenuation tank. Modelling for this catchment has been undertaken and confirms that with a restricted rate of 2.0 l/s, the tank floods and therefore a higher rate is required to ensure the total catchment can be attenuated without flooding. Through iteration, a rate of 2.8 l/s has been calculated to be required to ensure that no flooding occurs on site.

5.1.27 It should be noted that at detailed design stage, the inclusion of blue roofs may be reconsidered across the site following confirmation of space available at higher levels.

5.1.28 The following Summary Tables outline the amount of attenuation required, the Micro-Drainage outflow results, and the amount of reduction achieved for the 1:2, 1:30, 1:100, and 1:100+40%CC storm period events. Full calculations can be found in Appendix D.

Table 5 – 1in2 Year Discharge/Attenuation Summary

Catchment	1in2 Storm Period Event - Attenuation Requirement (m ³)	MicroDrainage Flow Rate Output (l/s)
A	127.9	1.4
B	934.4	1.2

C	25.5	0.7
D	36.2	0.9
E	12.6	0.8
F	51.3	1.0
G	100.9	1.0
H	n/a	41.0
TOTAL	1288.8	48.0

* Proposed Rate as per existing, due to constraints detailed in Paragraph 5.1.24.

Table 6 – 1in30 Year Discharge/Attenuation Summary

Catchment	1in30 Storm Period Event - Attenuation Requirement (m ³)	MicroDrainage Flow Rate Output (l/s)
A	271.7	2.0
B	1572.4	1.5
C	51.1	1.2
D	76.3	1.4
E	26.1	1.2
F	109.5	1.4
G	213.6	1.4
H	n/a	104.0
TOTAL	2320.7	114.1

* Proposed Rate as per existing, due to constraints detailed in Paragraph 5.1.24.

Table 7 – 1in100 Year Discharge/Attenuation Summary

Catchment	1in100 Storm Period Event - Attenuation Requirement (m ³)	MicroDrainage Flow Rate Output (l/s)
A	388.8	2.4
B	1986.3	1.7
C	72.9	1.4
D	108.5	1.6
E	36.9	1.5
F	156.7	1.7
G	305.7	1.7
H	n/a	137.5
TOTAL	3055.8	149.5

* Proposed Rate as per existing, due to constraints detailed in Paragraph 5.1.24.

Table 8 – 1in100+40% cc Discharge/Attenuation Summary

Catchment	1in100 +40% cc Storm Period Event - Attenuation Requirement (m ³)	MicroDrainage Flow Rate Output (l/s)
A	558.0	2.8
B	2875.2	2.0
C	104.9	1.6
D	156.8	1.9
E	53.3	1.7
F	225.4	2.0
G	438.1	2.0

H	n/a	192.6 ²
TOTAL	4411.7	206.6

* Proposed Rate as per existing, due to constraints detailed in Paragraph 5.1.24

5.1.29 Based on the hydraulic modelling undertaken, a site-wide summary of results is outlined in Table 9 below:

Table 9 – Site Wide Discharge/Attenuation Summary

Storm Period Event	Existing Flow (l/s)	Proposed Flow (l/s)	Reduction Achieved (%)
1in2	452.9	48.0	89
1in30	1150.4	114.1	90
1in100	1520.9	149.5	90
1in100+40% CC	n/a	206.6	n/a

* Proposed Rate as per existing, due to constraints detailed in Paragraph 5.1.24.

5.1.30 Table 9 above shows that the design achieves at least an 89% reduction for all storm events up to and including the 1 in 100 + 40% cc allowance event.

5.1.31 Please refer to Appendix D for the Outline Surface Water Drainage Strategy Plan (Drawing No. 24710919-WSP-D-D002), which indicatively outlines the proposed attenuation details.

5.1.32 Constraints on site have been outlined for areas where runoff will be unrestricted (Paragraph 5.1.24), and a limiting discharge of 2.0l/s have been utilised across all catchments (excluding Catchment A – 2.8l/s) to ensure that the discharge is reduced to as reasonable possible to greenfield runoff rates.

5.1.33 Please note, during Phase 1 works, a limited amount of attenuation will be constructed (371m³) for the platform level, due to the limited space available within the Phase 1 boundary. Therefore, Building 1 will discharge at a increased rate of 17.5 l/s until the remainder of the proposed attenuation tank at platform level is constructed in Phase 2. Once the Phase 1 attenuation tank is connected to the remaining storage units in Phase 2 works, the proposed flow rate from the attenuation tank at platform level will reduce to 2.0 l/s in total. At completion of the Proposed Development, the total proposed rate will total to the flow rate of 206.6 l/s, outlined as part of this DS.

² The total discharge rate for Catchment H for the 1 in 100 + 40% cc storm event has been calculated by considering a 40% increase of the 1 in 100 rainfall intensity. Therefore, the calculation is $Q = 2.78 \times 0.3979 \times (124.337 \times 1.4)$

SUMMARY

- 5.1.34 Based on the design results and associated hydraulic modelling, the DS achieves a significant decrease in surface water runoff, when compared to the existing situation. Therefore, it is proposed that the Site will discharge at a rate of 206.6 l/s for a 1 in 100 year + 40% cc extreme storm event, achieving a betterment of up to 90% across the Site.
- 5.1.35 It is proposed that the site will discharge into the TW combined public sewer network at a number of connection points, due to the large scale of the development. A demarcation chamber will be installed upstream of the new proposed connections.
- 5.1.36 Based on a limiting discharge rate of 206.6 l/s for the Proposed Development, and a total attenuation storage volume of 4814m³ across the Site, the Site achieves a 90% reduction for up to the 1 in 100 year + 40% cc storm event.
- 5.1.37 The proposed locations of the attenuation storage systems will be at roof level in the form of blue roofs, below platform level and external lower ground areas, and below the ground slab for Building 1.
- 5.1.38 Hydraulic modelling has been undertaken, and the attenuation requirements required are achieved by the Site provisions outlined in Table 4.
- 5.1.39 Please refer to Appendix D for the Outline Surface Water Drainage Strategy Plan (Drawing No. 24710919-WSP-D-D002), which indicatively outlines the proposed attenuation details.
- 5.1.40 All permits and applications for connections to the public sewer network will be made post planning when detailed drainage requirements are confirmed and approved following planning submission.
- 5.1.41 Further discussion with Thames Water will be undertaken for the connection to the public surface water sewer network via a S106 sewer connection application.

5.2 MAINTENANCE STRATEGY

5.2.1 The following drainage maintenance and management strategy (Table 10) has been produced; it is expected that the maintenance for the entire scheme will be managed by the Managing Agent/Management Company, in which a suitably qualified maintenance specialist will undertake the work.

Table 10 - Maintenance Strategy

Drainage Feature	Regular Maintenance	Occasional/Remedial Maintenance	Monitoring
Drainage channels/Gullies	- Inspections will include gratings; covers including their locking bolts; sumps and sump buckets; exposed concrete surround and adjacent surfacing. - Check for accumulation of debris and silt and cleaned as necessary - Gratings, frames and all associated locking parts to be checked for damage. - Exposed concrete and adjacent surfacing to be checked for cracking and general damage. - Check condition of inlet and outlet pipes, flow controls, baffles and isolation structures	- Channel cleaning will be by flushing with water or high pressure jetting (no boiling water or cleaning agent will be used). All silt buckets and sumps will be cleaned out replaced back into the units ensuring they are correctly fitted. - All channel surfaces and joints will be checked and repaired as necessary. - Repair/rehabilitation of inlets, outlet, overflows and vents, as required.	Inspect every 4 months or after large storm.
Catchpit Manholes/Inspection Chambers	- Check for accumulation of debris and silt and cleaned as necessary. - Covers and frames to be checked for damage. - Exposed concrete and adjacent surfacing to be checked for cracking and general damage. - Check condition of inlet and outlet pipes, flow controls, baffles and isolation structures	- Clean as necessary. - All manhole and inspection chamber covers and frames to be replaced as necessary. - Repair exposed concrete and surfacing as necessary - Repair/rehabilitation of inlets, outlet, overflows and vents, as required.	Inspect every 6 months or after large storm.

Above/Below Ground Attenuation Tank	• Check for accumulation of debris and silt and cleaned as necessary. • Covers and frames to be checked for damage. • Exposed concrete and adjacent surfacing to be checked for cracking and general damage. • Check condition of inlet and outlet pipes, flow controls, baffles and isolation structures	• Clean as necessary. • All manhole and inspection chamber covers and frames to be replaced as necessary. • Repair exposed concrete and surfacing as necessary. • Repair/rehabilitation of inlets, outlet, overflows and vents, as required.	• Inspect every 6 months or after large storm.
Flow Control (Hydrobrake / Orifice)	• Check for accumulation of debris and silt and cleaned as necessary. • Check condition and test alarm probe. • Other regular maintenance to be undertaken as per manufacturer's guidelines.	• Clean as necessary. • Repair/rehabilitation of inlets, outlets, alarms and vents as required. • Other remedial maintenance to be undertaken as per manufacturers guidelines	• Frequency of monitoring to be undertaken as per manufacturers guidelines.

5.3 FOUL WATER

- 5.3.1 Foul water flows from the development will be conveyed to the boundaries of each building, before routing to a demarcation manhole(s) via soil and vent pipes. All demarcation manholes will subsequently discharge to the public combined sewers located around the Site.
- 5.3.2 Confirmation of the demarcation manhole locations will be sought at detailed design stage.
- 5.3.3 To prevent any internal flooding as a result of overloaded public sewers, non-return valves/flap valves will be utilised to prevent sewer flooding entering the Site.
- 5.3.4 A capacity check enquiry has been undertaken with TW (December 2018) to confirm that there is adequate capacity of the receiving public sewers, in relation to the site's foul water discharge. A response is awaited to confirm the receiving foul sewer has adequate capacity to cater for the proposed development.
- 5.3.5 In the case of inadequate capacity for the public sewer systems, due to changes to infrastructure charges since April 201, TW will now undertake impact studies and any remedial infrastructure works required to cater to Proposed Developments, subject to planning approval (to avoid abortive works).

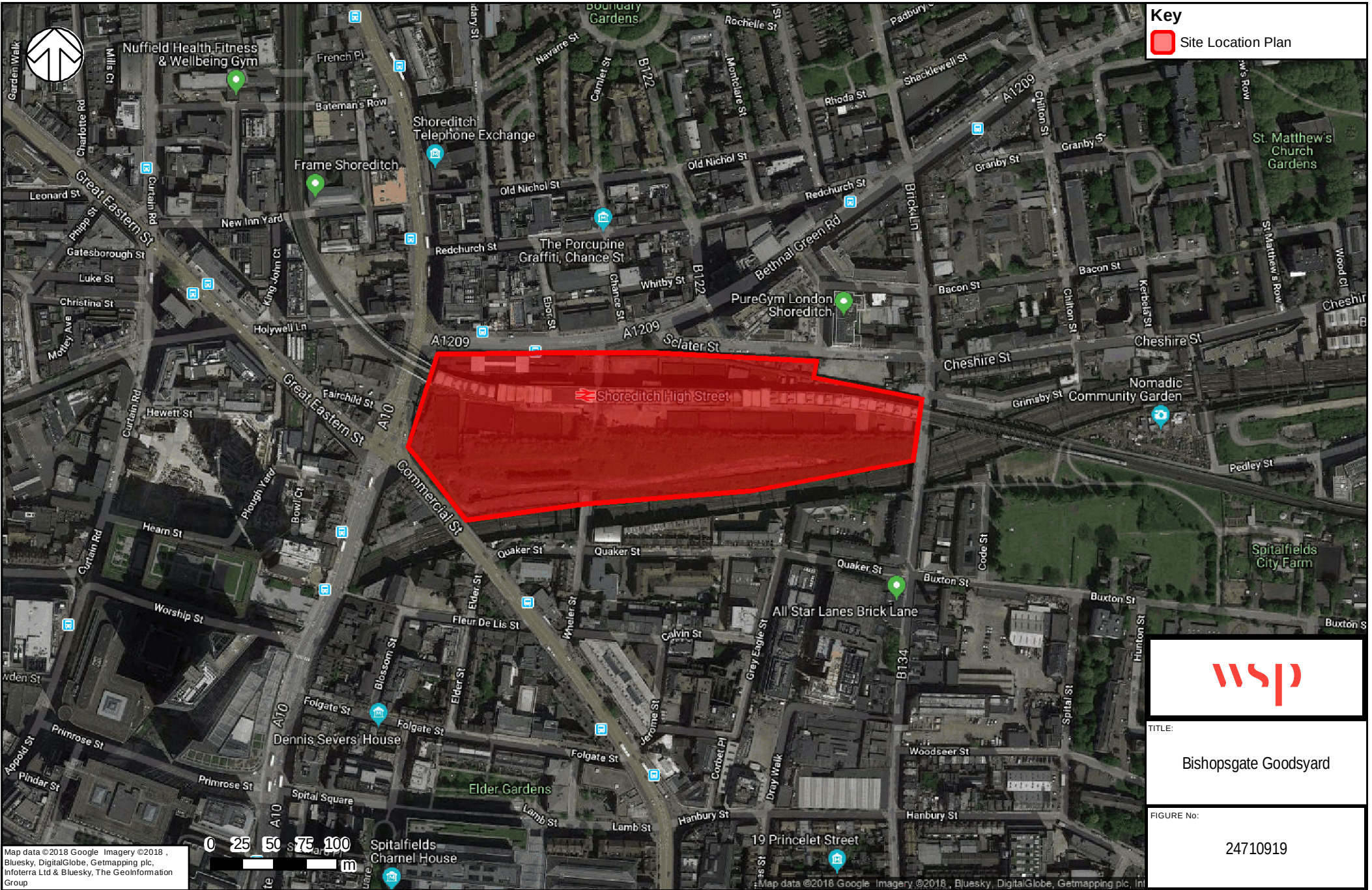
6.0 CONCLUSIONS

6. CONCLUSIONS

- 6.1.1 This DS supports the proposed planning application for the development at Bishopsgate Goodsyard.
- 6.1.2 The Proposed Development will restrict surface water flows to a total runoff rate of 206.6l/s, for up to the 1 in 100 + 40% cc allowance event and acceptance from TW is awaited following a capacity check enquiry submitted in December 2018.
- 6.1.3 The hydraulic modelling results undertaken for the Site shows that the drainage proposals can potentially achieve a reduction of up to 90% in surface water discharge runoff when compared to the existing brownfield runoff rate of the site.
- 6.1.4 In order to achieve the required attenuation for the 1 in 100 year + 40% cc event, attenuation storage will be provided within tanks located at platform and lower ground levels, with the provision of SuDS in the form of blue roof systems at roof level across the majority of the plots.
- 6.1.5 This outline drainage strategy has considered a worst-case scenario i.e. assuming the Site is 100% impermeable to ensure sufficient attenuation volume space is allocated within the Site. However, during detailed design stages, when landscaped areas extents are confirmed, there may be a possibility for reducing the draining areas positively draining to the attenuation systems and therefore, a possible reduction in the spaces required for attenuation volumes, to achieve a reduction from the existing rates.

APPENDIX A

SITE LOCATION PLAN



TITLE:
 Bishopsgate Goodsyard

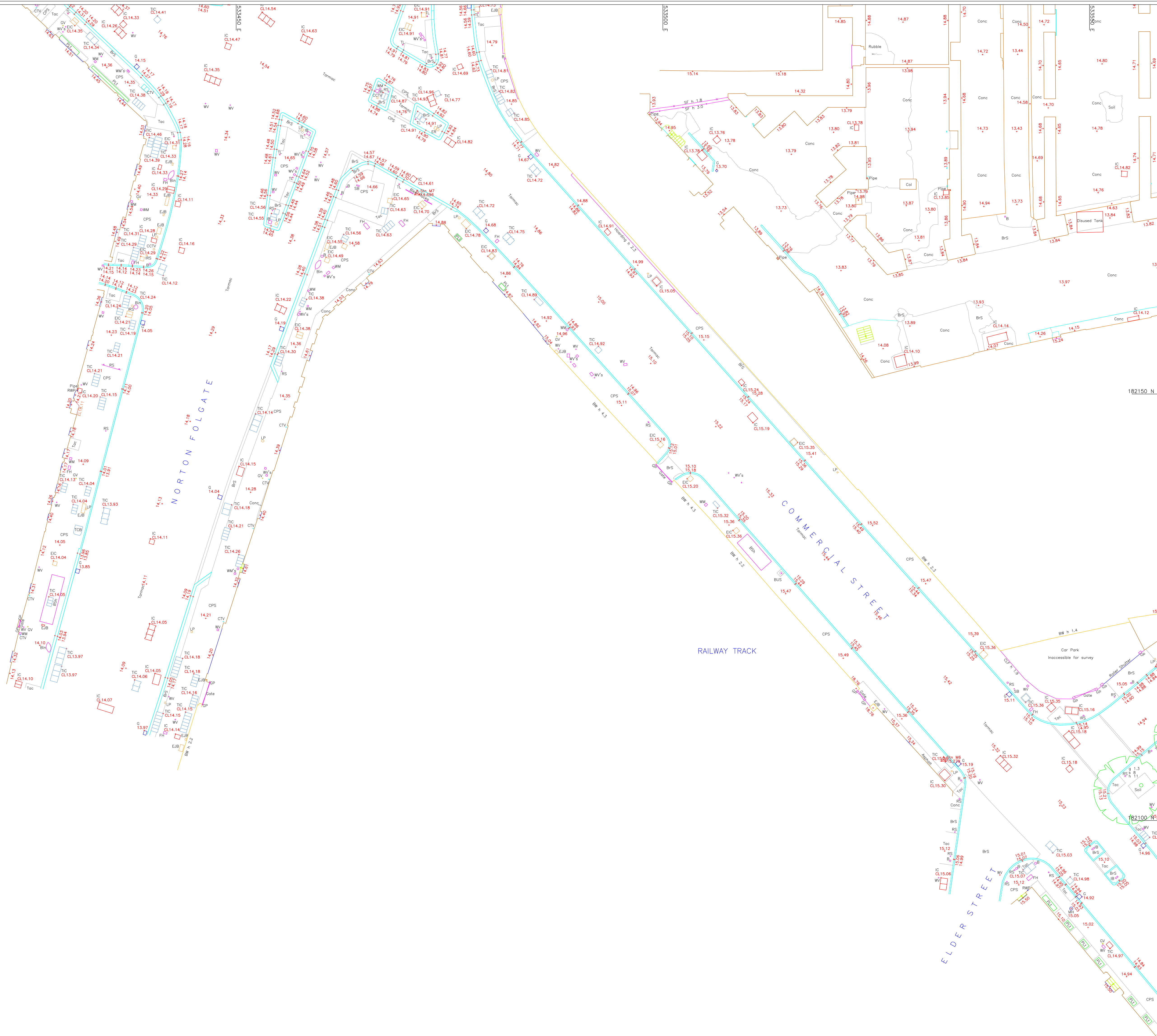
FIGURE No:
 24710919

APPENDIX B

TOPOGRAPHICAL SURVEY, THAMES WATER ASSET RECORDS

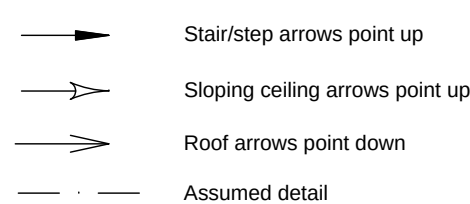


SURVEY STATIONS			
Name	Easting	Northing	Height
PONEW	1020893.838	1012200.803	12.734
M2073B1	1021122.253	1012125.253	13.562
M1	1020899.666	102215.300	13.802
M1	1020893.473	102279.812	14.471
M2080A1	1021227.698	1012200.803	13.565
L005	1020834.150	102208.776	14.780
M2080B1	1021227.698	1012200.803	13.562
U1	1020862.609	102216.476	15.041
L04	1020832.786	102211.700	13.829
M2073B2	1021122.253	1012200.803	13.562
M5	1020558.056	1022118.170	14.957
M8	1020552.889	1022107.115	15.279
M2081A1	1021122.253	1012200.803	13.562
M5	1020444.666	102221.084	14.734
M2081B1	1021122.253	1012200.803	13.562
M30	1020553.272	1022118.170	14.972

[illegible]

SURVEY STATIONS			
Name	Easting	Northing	Height
PNEW	555873.638	982108.038	12.734
P3	557043.628	982122.363	12.962
N5008	557043.628	982122.363	12.962
P4	555880.473	982270.812	14.471
N5089	555880.473	982270.812	14.471
M06	555824.150	982098.770	15.395
P5	556231.434	982294.476	13.829
N5101	556231.434	982294.476	13.829
M3	556323.786	982111.790	15.983
N5127	556323.786	982111.790	15.983
M5	555666.026	982118.170	14.997
N5056	555666.026	982118.170	14.997
M6	555632.806	982107.115	16.279
N5071	555632.806	982107.115	16.279
M5	555464.966	982117.084	14.734
N5074	555464.966	982117.084	14.734
M20	555721.272	982271.200	14.872
N5075	555721.272	982271.200	14.872

LEGEND



The identification of service covers has been made by a surface inspection only. Critical identifications should be verified by the lifting of covers or a full utilities survey.

Due to the inherent instability of paper materials, drawings plotted on paper may stretch and distort - dimensions scaled from paper plots should therefore be treated with caution.

This drawing has been produced for the purpose of the original commissioning agent. Plewman Craven Limited will accept no responsibility for details that are subsequently found to be consequence of undisclosed facts or that were obscured from view at the time of survey or that have been altered since the survey.

See www.plewmancraven.co.uk for full terms and conditions of contract.

SHEET LAYOUT

15532-018T-01	15532-018T-02	15532-018T-03
15532-018T-04	15532-018T-05	15532-018T-06

ISSUES & REVISIONS

Issue	Details	By	Date
A	Final Issue	MS	27/0
B prov 1	Arches areas added. Provisional Issue.	PCL	23/0
B	Final Issue	MS	26/0

This survey is commensurate with band F accuracy, as outlined in the RICS survey detail accuracy banding table

All levels are in metres and are above Ordnance Survey Newlyn Datum
derived by multiple network RTK GPS observations

The survey grid shown on this drawing is positioned on Ordnance Survey (OS) National Grid, obtained by multiple network RTK GPS observation.

Unless otherwise stated, levels have been taken to finished floor surface.

Drawing units are metres

CLIENT

Kings Place
90 York Way
LONDON
N1 9GE

PROJECT TITLE

Bishopsgate
Goods Yard

Topographical Survey

PRESENTATION SCALE 1:200 @ A0

DATE OF ORIGINAL SURVEY February 2019

PC PROJECT No.15532-018
DRAWING No. 15532-018-001
CHECKED
ISSUED

15532 018T 01 4 B

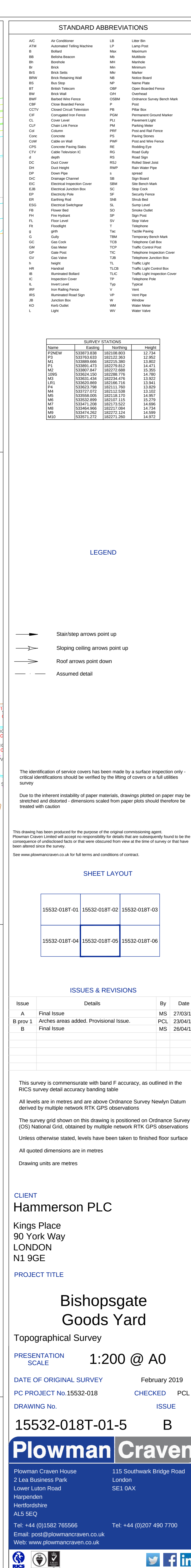
Plausibilis | 0

Florian Craver

Plowman Craven House
2 Lea Business Park
London

Lower Euton Road
Harpden
Staffordshire

Email: post@plowmancraven.co.uk
Web: www.plowmancraven.co.uk





The width of the displayed area is 500m and the centre of the map is located at OS coordinates 533750,182250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
9010	n/a	n/a
9012	n/a	n/a
9009	n/a	n/a
9001	n/a	n/a
9002	n/a	n/a
9003	n/a	n/a
9101	n/a	n/a
9102	n/a	n/a
9103	n/a	n/a
9104	n/a	n/a
9106	n/a	n/a
9105	n/a	n/a
9011	n/a	n/a
641C	n/a	n/a
6401	n/a	n/a
6402	n/a	n/a
7420	n/a	n/a
7413	n/a	n/a
74CG	n/a	n/a
7410	n/a	n/a
74CH	n/a	n/a
74CI	n/a	n/a
74CF	n/a	n/a
74FB	n/a	n/a
74CJ	n/a	n/a
741C	n/a	n/a
74DA	n/a	n/a
74FC	n/a	n/a
74DB	n/a	n/a
74DC	n/a	n/a
741B	n/a	n/a
74DD	n/a	n/a
74DE	n/a	n/a
74DF	n/a	n/a
741A	n/a	n/a
7412	n/a	n/a
74FD	n/a	n/a
641B	n/a	n/a
641A	n/a	n/a
831B	n/a	n/a
83EI	n/a	n/a
84DJ	n/a	n/a
83DJ	n/a	n/a
84DI	n/a	n/a
9303	n/a	n/a
941F	n/a	n/a
9401	n/a	n/a
931A	n/a	n/a
9304	n/a	n/a
941A	n/a	n/a
94EJ	n/a	n/a
94BJ	n/a	n/a
941E	n/a	n/a
941C	n/a	n/a
941B	n/a	n/a
94CD	n/a	n/a
9403	n/a	n/a
9402	n/a	n/a
9302B	15.03	10.29
941G	n/a	n/a
9307	n/a	n/a
941H	n/a	n/a
9306	n/a	n/a
9209	n/a	n/a
9208	n/a	n/a
9207	n/a	n/a
8216	n/a	n/a
92EA	n/a	n/a
8223	n/a	n/a
9205	n/a	n/a
8219	n/a	n/a
9206	n/a	n/a
92EF	n/a	n/a
92EG	n/a	n/a
92EH	n/a	n/a
92EI	n/a	n/a
93BC	n/a	n/a
93BB	n/a	n/a
93BD	n/a	n/a
9309	n/a	n/a
9308	n/a	n/a
9301	14.97	10.01
9302A	n/a	n/a
7409	n/a	n/a
8222	n/a	n/a
8301	15.82	12.57
8303	15.17	9.59
8221	n/a	n/a
84CC	n/a	n/a
8421	n/a	n/a
831A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
83FB	n/a	n/a
83FJ	n/a	n/a
83FA	n/a	n/a
8406	n/a	n/a
83FE	n/a	n/a
831C	n/a	n/a
831D	n/a	n/a
82EB	n/a	n/a
82EC	n/a	n/a
83EG	n/a	n/a
84EB	n/a	n/a
8220	n/a	n/a
8314	n/a	n/a
831E	n/a	n/a
84EA	n/a	n/a
841B	n/a	n/a
841C	n/a	n/a
8215	n/a	n/a
841A	n/a	n/a
6210	n/a	n/a
6209	n/a	n/a
6208	n/a	n/a
7201	n/a	n/a
6215	n/a	n/a
6206	n/a	n/a
6207	n/a	n/a
7306A	n/a	n/a
6305	n/a	n/a
7312	n/a	n/a
7311	n/a	n/a
6315	n/a	n/a
7305B	n/a	n/a
6314	n/a	n/a
63CE	n/a	n/a
63EA	n/a	n/a
7301A	15.74	n/a
7310	n/a	n/a
6316	n/a	n/a
6312	n/a	n/a
63GA	n/a	n/a
731A	n/a	n/a
73BI	n/a	n/a
731B	n/a	n/a
73BJ	n/a	n/a
6313	n/a	n/a
741D	n/a	n/a
8018	n/a	n/a
801B	n/a	n/a
8019	n/a	n/a
8016	n/a	n/a
8101	n/a	n/a
8102	n/a	n/a
8114	n/a	n/a
8115	n/a	n/a
811B	n/a	n/a
911A	n/a	n/a
911B	n/a	n/a
7112	n/a	n/a
8127	n/a	n/a
8128	n/a	n/a
8116	n/a	n/a
7104	n/a	n/a
7103	n/a	n/a
8117	n/a	n/a
81EI	n/a	n/a
811A	n/a	n/a
91CB	n/a	n/a
81DH	n/a	n/a
8129	n/a	n/a
81DJ	n/a	n/a
8103	n/a	n/a
8118	n/a	n/a
8104	n/a	n/a
7001	n/a	n/a
8005	n/a	n/a
8004	n/a	n/a
8007	n/a	n/a
7002	n/a	n/a
8008	n/a	n/a
801A	n/a	n/a
7003	n/a	n/a
8015	n/a	n/a
6004	n/a	n/a
6105	13.69	11.99
61CD	n/a	n/a
60DG	n/a	n/a
60DH	n/a	n/a
61CF	n/a	n/a
61CE	n/a	n/a
601A	n/a	n/a
61CA	n/a	n/a
6101	13.38	11.72
61CB	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
601B	n/a	n/a
701D	n/a	n/a
71BH	n/a	n/a
71BG	n/a	n/a
70CH	n/a	n/a
7015	n/a	n/a
701B	n/a	n/a
701A	n/a	n/a
7108	n/a	n/a
71BJ	n/a	n/a
7014	n/a	n/a
7013	n/a	n/a
7011	n/a	n/a
71CB	n/a	n/a
71CC	n/a	n/a
7012	n/a	n/a
6003	n/a	n/a
7009	n/a	n/a
60CF	n/a	n/a
60CE	n/a	n/a
60CD	n/a	n/a
701E	n/a	n/a
7010	n/a	n/a
6002	n/a	n/a
601D	n/a	n/a
601C	n/a	n/a
601E	n/a	n/a
60CC	n/a	n/a
701C	n/a	n/a
6001	n/a	n/a
5021	n/a	n/a
5022	n/a	n/a
50EA	n/a	n/a
50DF	n/a	n/a
5103	n/a	n/a
5001	n/a	n/a
5002	n/a	n/a
6013	n/a	n/a
6113	n/a	n/a
60DE	n/a	n/a
6005	n/a	n/a
60DD	n/a	n/a
6106	n/a	n/a
5016	n/a	n/a
5015	n/a	n/a
53YR	n/a	n/a
5312	n/a	n/a
5313	16.16	n/a
5405	n/a	n/a
5403	n/a	n/a
5402	n/a	n/a
5404	n/a	n/a
5304	n/a	n/a
5305A	n/a	n/a
53WZ	n/a	n/a
63BI	n/a	n/a
53XW	n/a	n/a
531A	n/a	n/a
53XT	n/a	n/a
53XS	n/a	n/a
5305	15.93	11.62
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		



The width of the displayed area is 500m and the centre of the map is located at OS coordinates 533250,182250

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
40BI	n/a	n/a
40CA	n/a	n/a
40BJ	n/a	n/a
4001B	14	10.57
411E	n/a	n/a
40CJ	n/a	n/a
411B	n/a	n/a
411A	n/a	n/a
4101	14.13	5.44
4102	14.41	10.15
41YR	n/a	n/a
41YT	n/a	n/a
41YU	n/a	n/a
41YV	n/a	n/a
4003A	n/a	n/a
4002A	n/a	n/a
411D	n/a	n/a
4001A	n/a	n/a
4103	15.02	n/a
2003	14.26	10.24
21YQ	n/a	n/a
2001	14.64	10.31
21YZ	n/a	n/a
21XZ	n/a	n/a
2002	14.42	10.16
21XY	n/a	n/a
201B	n/a	n/a
2102	n/a	n/a
2101	15	11.23
2004	14.33	9.91
201A	n/a	n/a
3104	14.25	11.83
3004	14.39	9.12
3006	14.38	n/a
3103	14.39	12.19
301A	n/a	n/a
3102	15.04	13.09
3001	13.9	n/a
3101	14.71	10.43
4002B	13.82	5.24
401A	n/a	n/a
40BE	n/a	n/a
40CB	n/a	n/a
1003	15.43	10.96
00XR	n/a	n/a
00XS	n/a	n/a
1002	14.73	10.68
1001	14.85	10.87
0002	15.6	11.06
11ZV	n/a	n/a
21ZR	n/a	n/a
11YQ	n/a	n/a
11YR	n/a	n/a
11YS	n/a	n/a
11YY	n/a	n/a
11XW	n/a	n/a
1101A	14.75	12.4
111B	n/a	n/a
0102	16.17	12.31
111A	n/a	n/a
00YR	n/a	n/a
00XU	n/a	n/a
00YT	n/a	n/a
00YS	n/a	n/a
0004	15.98	n/a
0003	16.09	10.96
0001	16.19	12.35
00WZ	n/a	n/a
01YU	n/a	n/a
01YT	n/a	n/a
01YV	n/a	n/a
01YW	n/a	n/a
0103	15.91	12.56
24XY	n/a	n/a
14XQ	n/a	n/a
4301	15.56	11.72
3304	14.34	9.69
431B	n/a	n/a
441A	n/a	n/a
4406	15.56	10.88
3401	14.7	12.23
4403	14.77	11.6
4405	15.19	11.25
4404	15.27	n/a
44YU	n/a	n/a
341B	n/a	n/a
34YS	n/a	n/a
34YU	n/a	n/a
44YV	n/a	n/a
341A	n/a	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
44YW	n/a	n/a
3402	14.68	n/a
4401	15.7	12.3
04YQ	n/a	n/a
04YR	n/a	n/a
04XQ	n/a	n/a
04WY	n/a	n/a
031A	n/a	n/a
041C	n/a	n/a
03YX	n/a	n/a
0406	15.57	11.83
041B	n/a	n/a
041A	n/a	n/a
1404	15.19	n/a
1403	15.01	n/a
1405	15.06	12.41
1402	15.55	10.05
141A	n/a	n/a
14WZ	n/a	n/a
131B	n/a	n/a
1305	15.46	n/a
1406	n/a	n/a
141C	n/a	n/a
14UX	n/a	n/a
14UW	n/a	n/a
1408	15.39	n/a
131A	n/a	n/a
121B	n/a	n/a
02YT	n/a	n/a
02YQ	n/a	n/a
121C	n/a	n/a
121D	n/a	n/a
121A	n/a	n/a
021B	n/a	n/a
1201	15.21	11.93
02YS	n/a	n/a
02XZ	n/a	n/a
0205	16.18	11.58
0204	16.85	11.18
0203	17.19	10.72
021A	n/a	n/a
021C	n/a	n/a
121E	n/a	n/a
0208	16.24	13.88
0207	16.23	12.34
1301B	16.36	12.79
1302	15.95	n/a
1306	16.84	12.83
1303	16.72	n/a
0301	16.62	n/a
1304	16.11	12.46
1202	15.39	n/a
13XW	n/a	n/a
13XX	n/a	n/a
1203	15.48	12.17
12ZR	n/a	n/a
22YV	n/a	n/a
241A	n/a	n/a
241B	n/a	n/a
21ZS	n/a	n/a
2303	16.04	13.42
23WZ	n/a	n/a
24XW	n/a	n/a
2201	15.93	11.74
2304	16.02	n/a
2302	15.32	n/a
2305	15.94	13.22
2202	15.77	n/a
241D	n/a	n/a
2203	15.04	11.29
2204	15.26	11.12
2401	15.27	11.6
2205	15.55	10.87
2306	15.45	10.46
2402	15.28	11.23
2301	15.35	n/a
24ZV	n/a	n/a
24RS	n/a	n/a
411F	n/a	n/a
4205	14.43	n/a
3201	15.99	n/a
4206	14.29	11.79
3202	14.98	n/a
2206	15.34	11.26
4201	14.71	n/a
4204	15.54	n/a
43WS	n/a	n/a
43WR	n/a	n/a
3306	14.98	10.57
3305	15.11	10.36
33XX	n/a	n/a
43WT	n/a	n/a
4316	15.56	n/a

Manhole Reference	Manhole Cover Level	Manhole Invert Level
3301	14.65	n/a
4315	15.22	n/a
431A	n/a	n/a
The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.		

APPENDIX C

PROPOSED ARCHITECTS PLANS

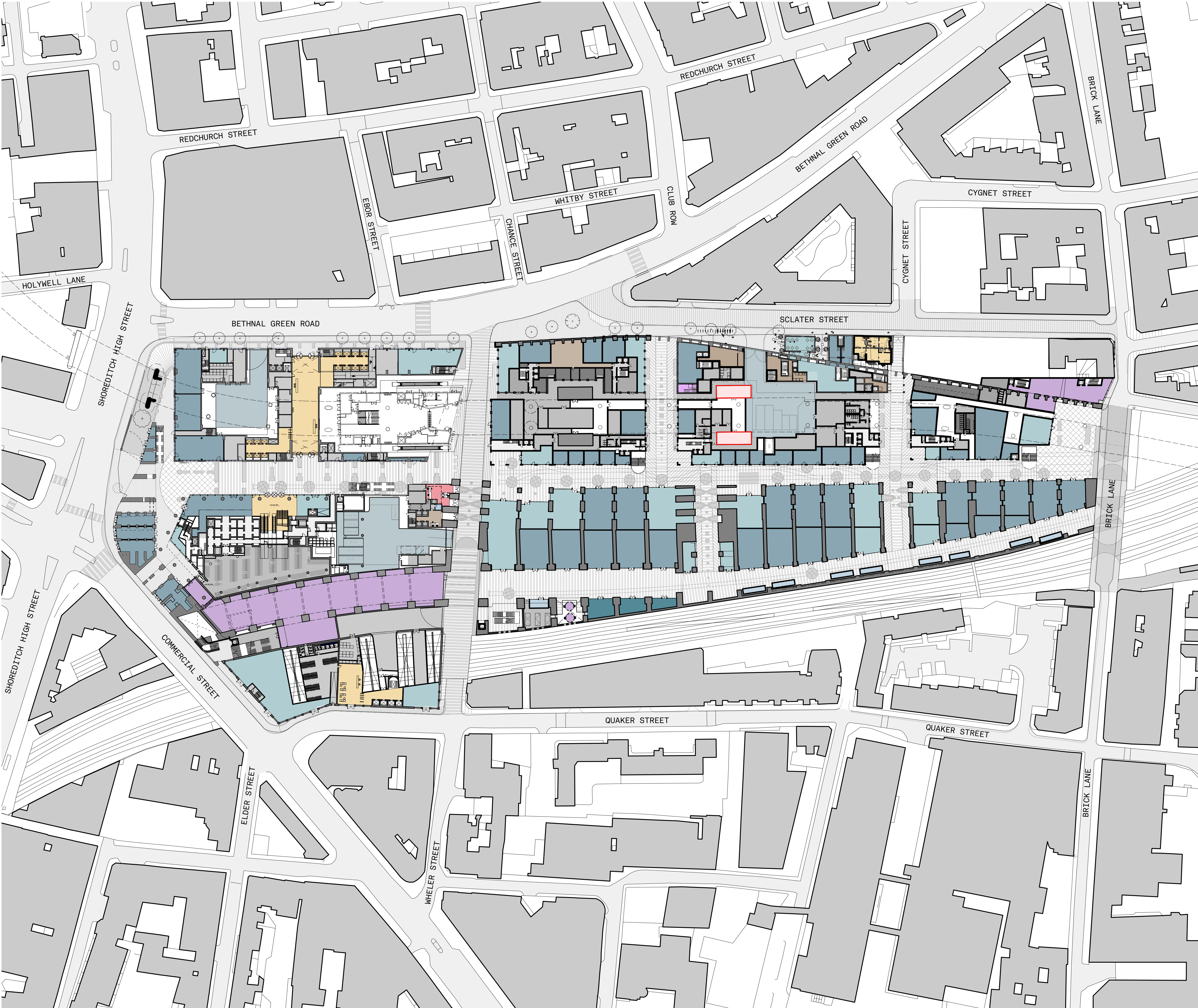


DIAGRAM KEY:

- RETAIL A3
- RETAIL A1
- OFFICE
- HOTEL
- CULTURAL
- RESIDENTIAL
- GP SURGERY
- SERVICE
- EXHIBITION SPACE
- ELL ESCAPE
- SERVICE YARD
- FITNESS

notes:

rev	date	by

drawing and design copyright of:

FAULKNERBROWNS
ARCHITECTS

client:

Hammerston

ballymore.

project:
BISHOPGATE GOODSYARD

north:

site address:
BRAITHWAITE ST
LONDON
E1 6GJ

plot key:

do not scale this drawing
do not derive measurements from digital media

drawing status:
PRELIMINARY

title:
MASTERPLAN - GROUND

scale:
1 : 750

size:
A1

scale bar:

0m 10m 20m 30m 40m 50m 60m

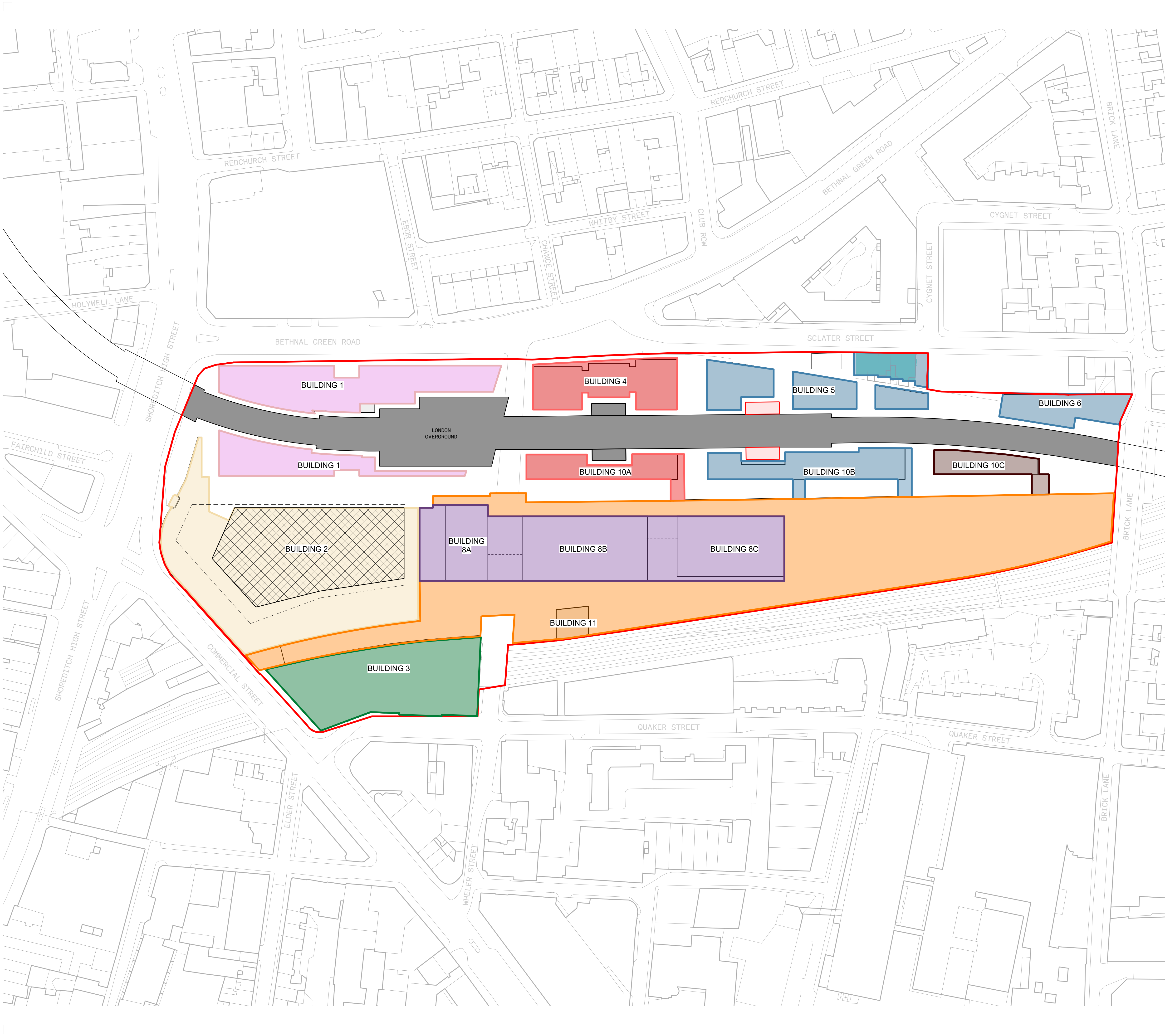
drawing no:
3465-FBA-00-00-DR- A-00-000

rev:

suit:

drawn by:
KF

checked by:
PR



- DIAGRAM KEY:
- EXTENTS ABOVE (PROJECTION)
 - EXISTING BUILDINGS RETAINED
 - EXISTING RETAINED STRUCTURE
 - FULL DETAILS SUBMITTED
 - ZONE RESERVED FOR EXPANSION
 - PHASE 1
 - PHASE 2
 - PHASE 3
 - PHASE 4
 - PHASE 5
 - PHASE 6
 - PHASE 7
 - PHASE 8

notes:

rev	date	by

drawing and design copyright of:

FAULKNERBROWNS ARCHITECTS

client:

ballymore.

Hammerson

project:

BISHOPGATE GOODSYARD

north:

site address:

BRAITHWAITE ST
LONDON
E1 6GJ

plot key:

do not scale this drawing
do no derive measurements from digital media

drawing status:

PLANNING : FOR APPROVAL

title:

PARAMETER - PHASING
(PLATFORM LEVEL)

scale:

1 : 750

size:

A1

scale bar:

0m

10m

20m

30m

40m

50m

60m

drawing no:

BGY-FBA-00-00-DR-A-00-0039

rev:

P1

suit:

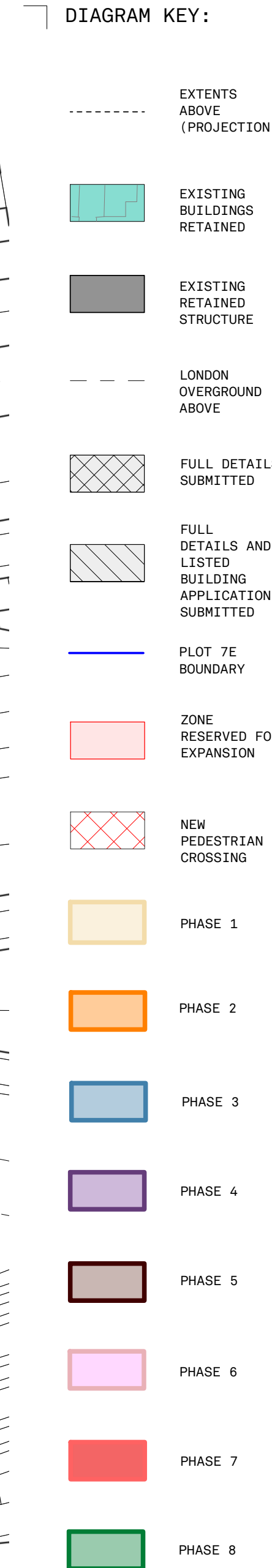
S0

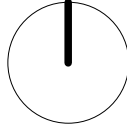
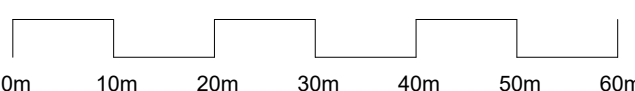
drawn by:

CE

checked by:

PR

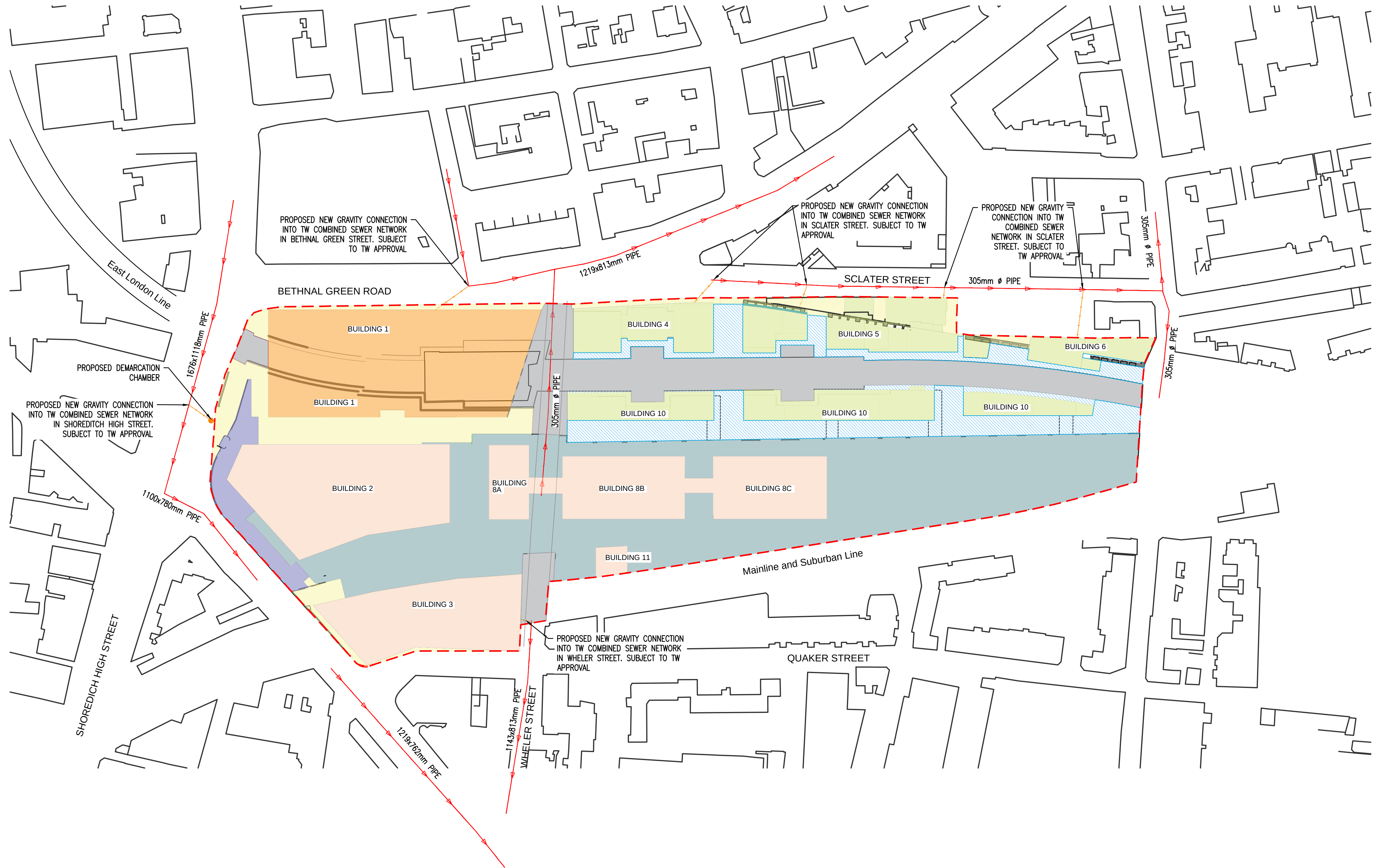


notes:			
rev	date		by
drawing and design copyright of: FAULKNERBROWNS ARCHITECTS			
client:		 Hammerston	
project: BISHOPGATE GOODSYARD			
north: 	site address: BRAITHWAITE ST LONDON E1 6GJ		
			
do not scale this drawing do no derive measurements from digital media			
drawing status: PLANNING - FOR APPROVAL			
title: PARAMETER - PHASING (GROUND)			
scale: 1 : 750		size: A1	
scale bar: 			
drawing no: BGY-FBA-00-00-DR-A-00-0038			
rev: P1	suit: S0	drawn by: CE	checked by: PR

APPENDIX D

OUTLINE DRAINAGE STRATEGY PLAN AND CALCULATIONS

File name: \\UK-WSPGROUP\COM\UKCENTRAL\BUILDINGS\CS LONDON\PROJECTS\247110919 - BGY MASTERPLAN & PHASE 1H DWG\DEVELOPMENT\DRAWINGS\247110919-WSP-D-D001.DWG, printed on 29 April 2019 14:45:19 by Tiber, Phoebe



DO NOT SCALE

NOTES:

- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE GOODSYARD OUTLINE DRAINAGE STRATEGY, PREPARED BY WSP (APRIL 2019).
- PLEASE REFER TO WSP DRAWING NO. 24710919-WSP-D-D002 FOR INDICATIVE LOCATION OF ATTENUATION STORAGE SYSTEMS.
- ALL PROPOSED CONNECTIONS INTO PUBLIC SEWER, SUBJECT TO S106 CONNECTION APPROVAL.

CATCHMENT KEY:

- BUILDING CATCHMENT TO DRAIN INTO LOCALISED ATTENUATION TANK WITHIN BUILDING – A
- BUILDING CATCHMENT TO DRAIN INTO ATTENUATION TANK AT PLATFORM LEVEL – B
- PLATFORM LEVEL CATCHMENT TO DRAIN INTO ATTENUATION TANK AT PLATFORM LEVEL – B
- TOTAL CATCHMENT STORED IN BLUE ROOF – C,D,E,F
- LOWER GROUND LEVEL CATCHMENT TO DRAIN IN GEOCELLULAR ATTENUATION BELOW PAVING – G
- PLATFORM LEVEL CATCHMENT TO DRAIN UNRESTRICTED – H
- LOWER LEVEL CATCHMENT TO DRAIN UNRESTRICTED – H
- CATCHMENT TO DRAIN AS EXISTING

SITE-WIDE ATTENUATION REQUIREMENTS			
CATCHMENT	PLOTS	TOTAL CATCHMENT (m²)	TOTAL ATTENUATION PROVIDED (m²)
A	1	5019	559
B	2, 3, 8, 11, PLATFORM LEVEL	20674	2994
C	4	1105	171
D	5	1594	182
E	6	660	76
F	10	2176	325
G	LOWER LEVEL	3896	507
H	UNRESTRICTED HARDSTANDING AREAS	3979	0
TOTAL		39103	4814

KEY:

- PLANNING APPLICATION BOUNDARY
- EXISTING THAMES WATER COMBINED SEWER NETWORK (BASED ON TW ASSET RECORDS, 2019)
- NEW PROPOSED COMBINED SEWER
- NEW PROPOSED DEMARCATION CHAMBER

A	29/04/2019	PT	FIRST ISSUE	WK	GB
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS: **S2 - FOR INFORMATION**

wsp

WSP House, 70 Chancery Lane, London, WC2A 1AF, UK
T+ 44 (0) 207 314 5000, F+ 44 (0) 207 314 5111
wsp.com

CLIENT: **HAMMERSON & BALLYMORE**

ARCHITECT: **FAULKNER BROWNS**

SITE/PROJECT: **BISHOPSGATE GOODSYARD**

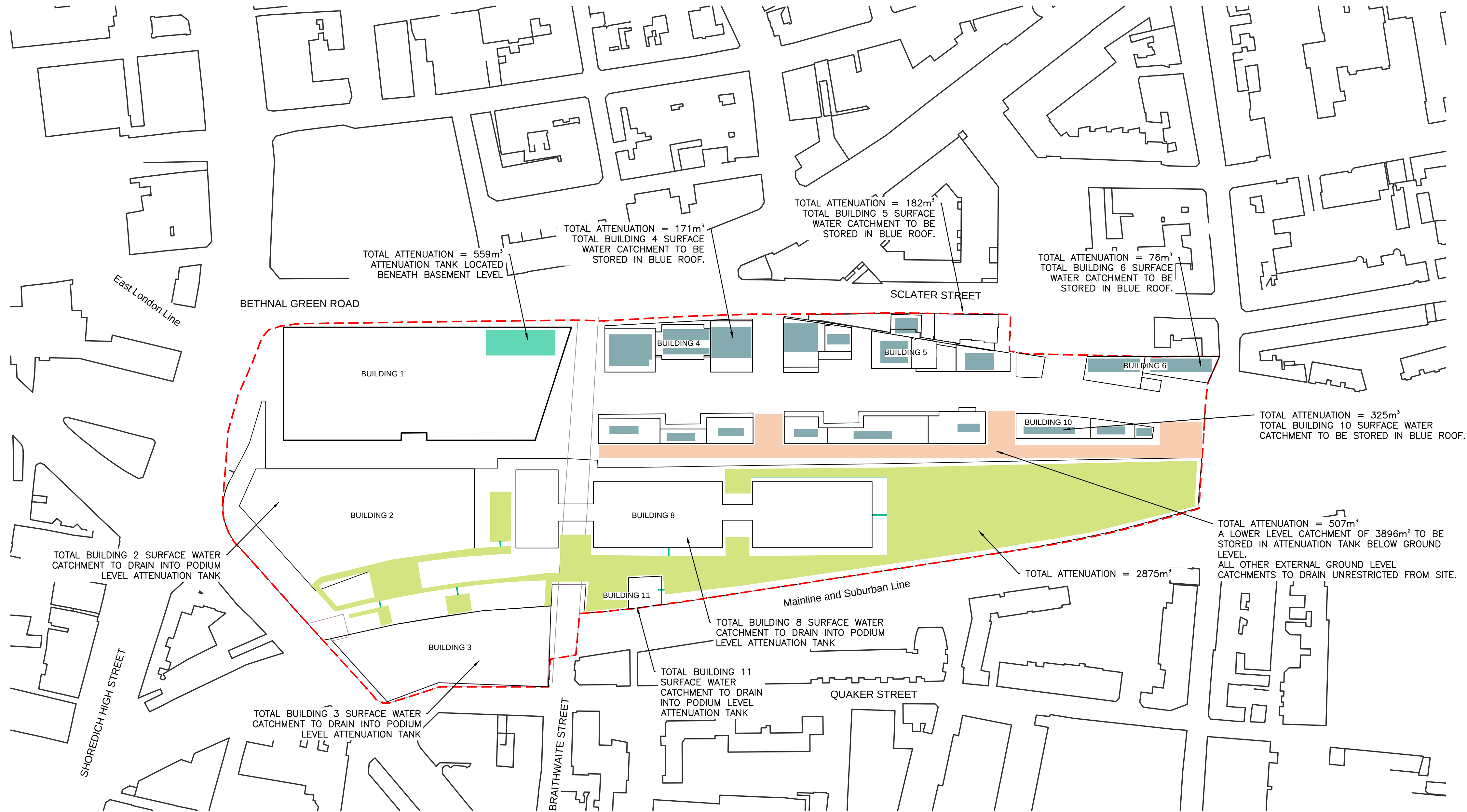
TITLE: **SURFACE WATER RUNOFF CATCHMENT AREA PLAN**

SCALE @ A1: 1:1000	CHECKED: WK	APPROVED: GB
PROJECT NO: 24710919	DESIGNED: PT	DRAWN: PT
		DATE: April 19

DRAWING No: 24710919-WSP-D-D001	REV: A
---------------------------------	--------

© WSP UK Ltd

File name: \\UK-WSPGROUP\COM\UKCENTRAL\BUILDINGS\CS\LONDON\PROJECTS\247124710919 - SCY MASTERPLAN & PHASE 1\H DWS\DEVELOPMENT\DRAWINGS\24710919-WSP-D-0002.DWG, printed on 29 April 2019 14:41:19 by Tiber, Phoebe



DO NOT SCALE

NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE GOODSYARD OUTLINE DRAINAGE STRATEGY, PREPARED BY WSP (APRIL 2019).
2. PLEASE REFER TO WSP DRAWING NO. 24710919-WSP-D-0001 FOR SURFACE WATER RUNOFF CATCHMENT AREAS.
3. ALL PROPOSED SURFACE WATER DRAINAGE SYSTEMS ARE SHOWN INDICATIVELY AND ARE SUBJECT TO DETAILED DESIGN.

KEY:

PLANNING APPLICATION BOUNDARY

PROPOSED SURFACE WATER ATTENUATION SYSTEMS

- PROPOSED BLUE ROOF ATTENUATION TANK. EXACT LOCATIONS TBC.
- PROPOSED PLATFORM LEVEL ATTENUATION TANK
- PROPOSED ATTENUATION TANK BELOW GROUND LEVEL
- PROPOSED LOWER GROUND LEVEL ATTENUATION TANK

SITE-WIDE ATTENUATION REQUIREMENTS

CATCHMENT	PLOTS	TOTAL ATTENUATION PROVIDED (m ³)	PROPOSED ATTENUATION STORAGE LOCATION
A	1	559	BELOW GROUND TANK
B	2, 3, 8, 11, PLATFORM LEVEL	2994	PLATFORM LEVEL TANK
C	4	171	BLUE ROOF
D	5	182	BLUE ROOF
E	6	76	BLUE ROOF
F	10	325	BLUE ROOF
G	LOWER LEVEL	507	BELOW GROUND TANK
H	UNRESTRICTED HARDSTANDING AREAS	0	N/A
TOTAL		4814	

A	29/04/2019	PT	FIRST ISSUE	WK	GB
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS:



WSP House, 70 Chancery Lane, London, WC2A 1AF, UK
T+ 44 (0) 207 314 5000, F+ 44 (0) 207 314 5111
wsp.com

CLIENT: HAMMERSON & BALLYMORE

ARCHITECT: FAULKNER BROWNS

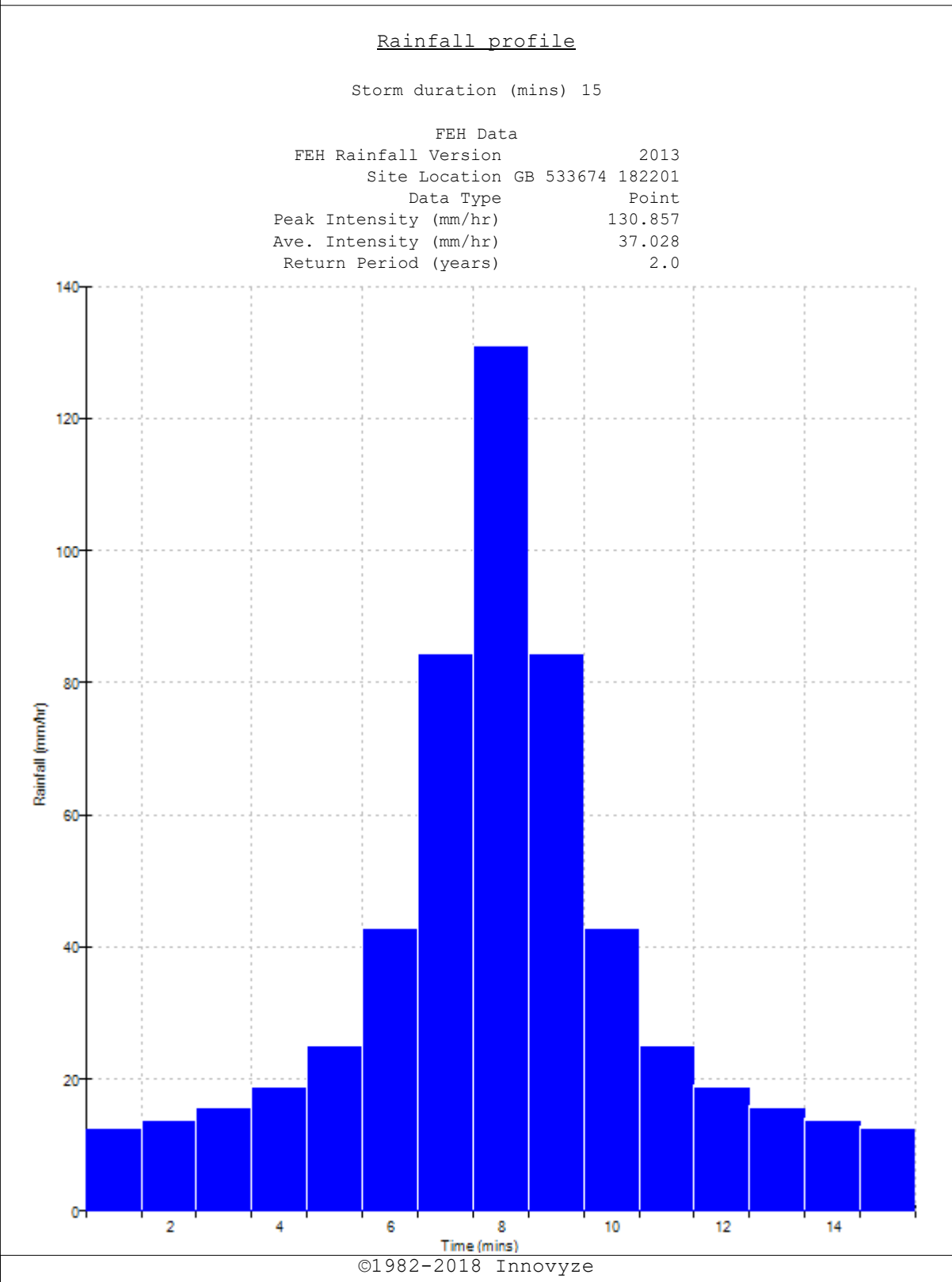
SITE/PROJECT: BISHOPSGATE GOODSYARD

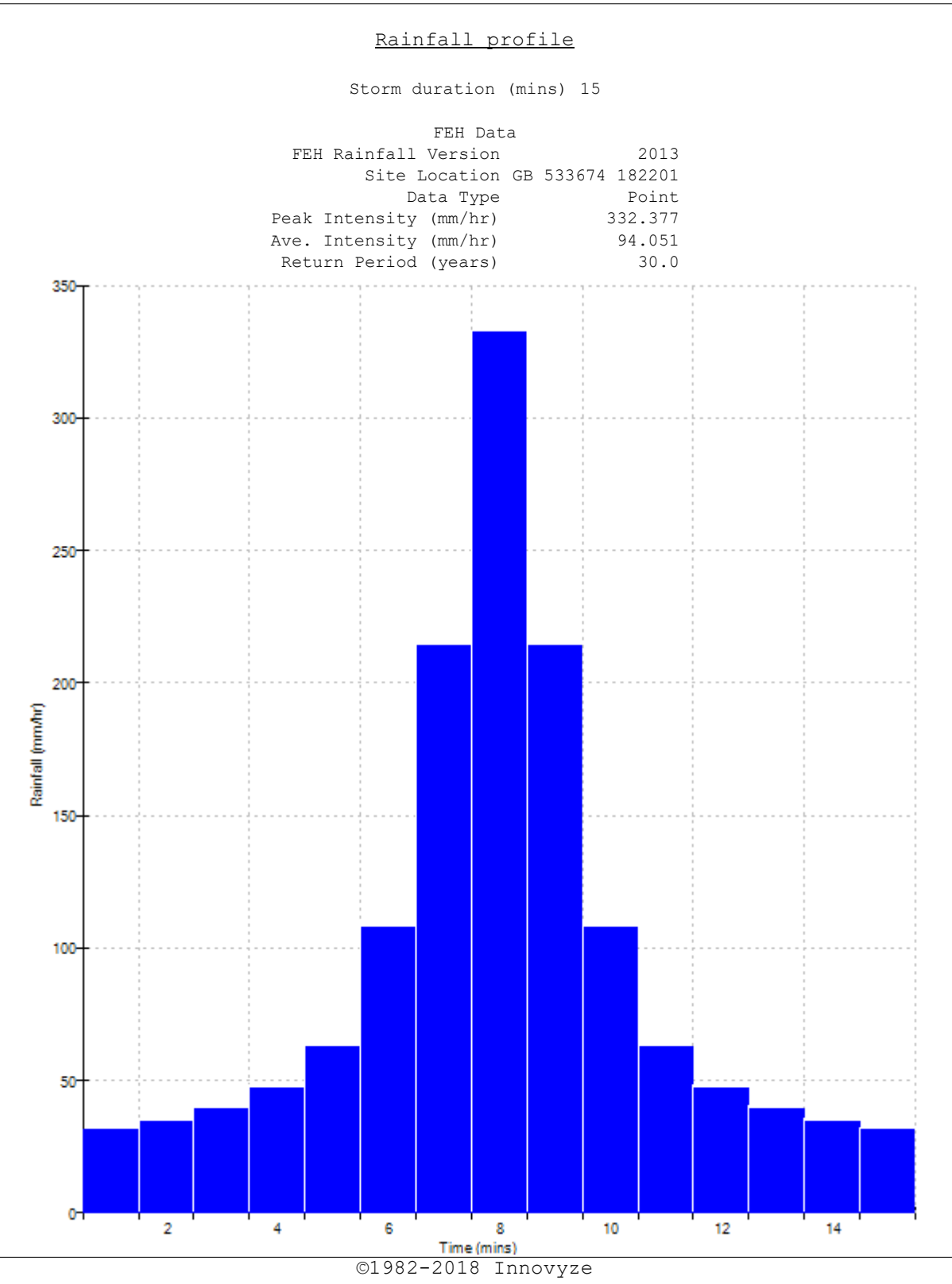
TITLE: OUTLINE SURFACE WATER DRAINAGE ATTENUATION STRATEGY PLAN

SCALE @ A1: 1:1000	CHECKED: WK	APPROVED: GB
PROJECT NO: 24710919	DESIGNED: PT	DRAWN: PT
		DATE: April 19

DRAWING No: 24710919-WSP-D-0002	REV: A
---------------------------------	--------

© WSP UK Ltd





.
.

.

Date 15/10/2018 17:37

File AreaI.SRCX

XP Solutions

Designed by UKPAT005

Checked by

Source Control 2018.1

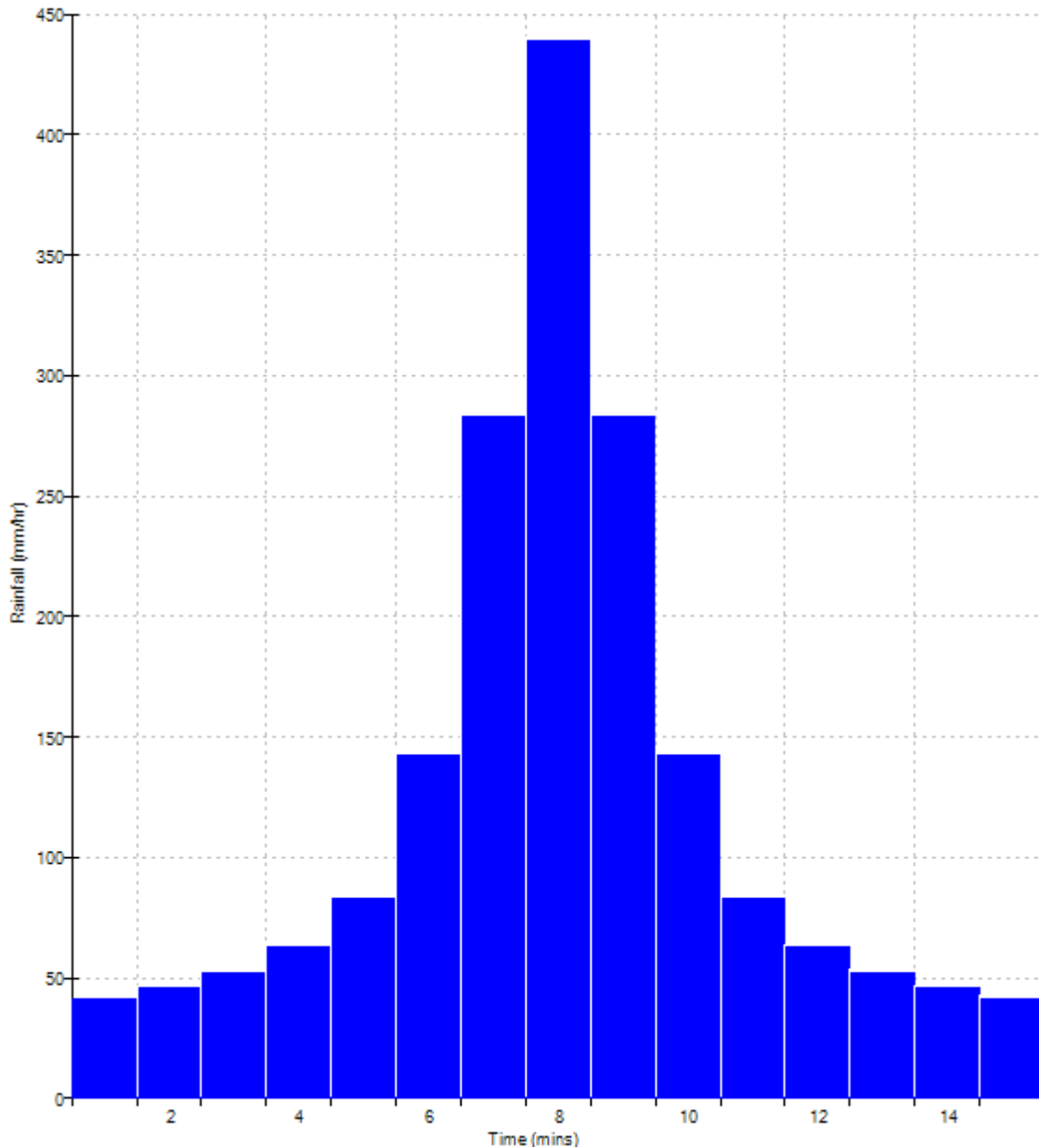


Rainfall profile

Storm duration (mins) 15

FEH Data

FEH Rainfall Version	2013
Site Location GB 533674	182201
Data Type	Point
Peak Intensity (mm/hr)	439.409
Ave. Intensity (mm/hr)	124.337
Return Period (years)	100.0



WSP Group Ltd				Page 1	
.		BISHOPSGATE GOODSYARD			
.					
.					
Date 24/04/2019		Designed by PT			
File lin2.SRCX		Checked by WK			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 2 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.078	0.078	0.9	43.6	O K
30 min Summer	9.097	0.097	1.0	54.5	O K
60 min Summer	9.117	0.117	1.1	65.2	O K
120 min Summer	9.165	0.165	1.2	92.3	O K
180 min Summer	9.191	0.191	1.3	106.6	O K
240 min Summer	9.206	0.206	1.4	115.2	O K
360 min Summer	9.221	0.221	1.4	123.8	O K
480 min Summer	9.227	0.227	1.4	126.8	O K
600 min Summer	9.228	0.228	1.4	127.2	O K
720 min Summer	9.227	0.227	1.4	126.7	O K
960 min Summer	9.224	0.224	1.4	125.1	O K
1440 min Summer	9.217	0.217	1.4	121.2	O K
2160 min Summer	9.207	0.207	1.4	115.5	O K
2880 min Summer	9.197	0.197	1.3	110.3	O K
4320 min Summer	9.182	0.182	1.3	101.8	O K
5760 min Summer	9.170	0.170	1.3	95.0	O K
7200 min Summer	9.161	0.161	1.2	89.7	O K
8640 min Summer	9.153	0.153	1.2	85.5	O K
10080 min Summer	9.147	0.147	1.2	82.0	O K
15 min Winter	9.078	0.078	0.9	43.6	O K
30 min Winter	9.098	0.098	1.0	54.5	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	37.028	0.0	35.3	19	
30 min Summer	23.293	0.0	45.2	34	
60 min Summer	14.142	0.0	62.3	64	
120 min Summer	10.220	0.0	91.2	122	
180 min Summer	8.038	0.0	107.8	182	
240 min Summer	6.652	0.0	118.9	242	
360 min Summer	4.969	0.0	132.9	362	
480 min Summer	3.980	0.0	141.4	480	
600 min Summer	3.332	0.0	147.3	596	
720 min Summer	2.873	0.0	151.7	642	
960 min Summer	2.266	0.0	157.5	760	
1440 min Summer	1.620	0.0	162.1	1010	
2160 min Summer	1.166	0.0	195.8	1428	
2880 min Summer	0.930	0.0	207.7	1844	
4320 min Summer	0.689	0.0	228.0	2640	
5760 min Summer	0.564	0.0	256.5	3456	
7200 min Summer	0.489	0.0	277.4	4184	
8640 min Summer	0.438	0.0	297.4	5008	
10080 min Summer	0.401	0.0	316.3	5744	
15 min Winter	37.028	0.0	35.3	19	
30 min Winter	23.293	0.0	45.2	33	
©1982-2018 Innovyze					

WSP Group Ltd			Page 2		
.		BISHOPSGATE GOODSYARD			
.					
.					
Date 24/04/2019		Designed by PT			
File lin2.SRCX		Checked by WK			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 2 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.117	0.117	1.1	65.2	O K
120 min Winter	9.165	0.165	1.2	92.3	O K
180 min Winter	9.191	0.191	1.3	106.6	O K
240 min Winter	9.206	0.206	1.4	115.3	O K
360 min Winter	9.222	0.222	1.4	124.0	O K
480 min Winter	9.228	0.228	1.4	127.2	O K
600 min Winter	9.229	0.229	1.4	127.9	O K
720 min Winter	9.228	0.228	1.4	127.3	O K
960 min Winter	9.223	0.223	1.4	124.6	O K
1440 min Winter	9.214	0.214	1.4	119.5	O K
2160 min Winter	9.199	0.199	1.3	111.3	O K
2880 min Winter	9.185	0.185	1.3	103.6	O K
4320 min Winter	9.163	0.163	1.2	91.0	O K
5760 min Winter	9.145	0.145	1.2	81.0	O K
7200 min Winter	9.131	0.131	1.1	73.2	O K
8640 min Winter	9.120	0.120	1.1	67.0	O K
10080 min Winter	9.111	0.111	1.0	61.9	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	14.142	0.0	62.3	62	
120 min Winter	10.220	0.0	91.2	120	
180 min Winter	8.038	0.0	107.8	180	
240 min Winter	6.652	0.0	118.9	238	
360 min Winter	4.969	0.0	132.9	352	
480 min Winter	3.980	0.0	141.4	466	
600 min Winter	3.332	0.0	147.4	574	
720 min Winter	2.873	0.0	151.7	680	
960 min Winter	2.266	0.0	157.6	776	
1440 min Winter	1.620	0.0	162.4	1080	
2160 min Winter	1.166	0.0	195.8	1532	
2880 min Winter	0.930	0.0	207.7	1960	
4320 min Winter	0.689	0.0	228.2	2808	
5760 min Winter	0.564	0.0	256.5	3624	
7200 min Winter	0.489	0.0	277.4	4400	
8640 min Winter	0.438	0.0	297.5	5184	
10080 min Winter	0.401	0.0	316.6	5944	
©1982-2018 Innovyze					

WSP Group Ltd		Page 3
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019	Designed by PT	
File lin2.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.950
FEH Rainfall Version	2013	Cv (Winter)	0.950
Site Location	GB 533674 182201	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.502

Time (mins)	Area
From:	To: (ha)
0	4 0.502

©1982-2018 Innovyze

WSP Group Ltd		Page 4																																																																																															
. . .	BISHOPSGATE GOODSYARD	Micro Drainage																																																																																															
Date 24/04/2019	Designed by PT																																																																																																
File lin2.SRCX	Checked by WK																																																																																																
XP Solutions	Source Control 2018.1																																																																																																
Model Details Storage is Online Cover Level (m) 10.000 Tank or Pond Structure Invert Level (m) 9.000 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>559.0</td><td>1.000</td><td>559.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SCU-0051-2800-1000-2800 Design Head (m) 1.000 Design Flow (l/s) 2.8 Flush-Flo™ Calculated Objective Linear discharge profile Application Surface Sump Available Yes Diameter (mm) 51 Invert Level (m) 9.000 Minimum Outlet Pipe Diameter (mm) 75 Suggested Manhole Diameter (mm) 1200 <table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.000</td><td>2.8</td></tr><tr><td>Flush-Flo™</td><td>0.076</td><td>0.9</td></tr><tr><td>Kick-Flo®</td><td>0.076</td><td>0.9</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>1.9</td></tr></table> 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>1.0</td><td>1.200</td><td>3.0</td><td>3.000</td><td>4.7</td><td>7.000</td><td>7.0</td></tr><tr><td>0.200</td><td>1.3</td><td>1.400</td><td>3.3</td><td>3.500</td><td>5.0</td><td>7.500</td><td>7.2</td></tr><tr><td>0.300</td><td>1.6</td><td>1.600</td><td>3.5</td><td>4.000</td><td>5.4</td><td>8.000</td><td>7.4</td></tr><tr><td>0.400</td><td>1.8</td><td>1.800</td><td>3.7</td><td>4.500</td><td>5.7</td><td>8.500</td><td>7.7</td></tr><tr><td>0.500</td><td>2.0</td><td>2.000</td><td>3.9</td><td>5.000</td><td>5.9</td><td>9.000</td><td>7.9</td></tr><tr><td>0.600</td><td>2.2</td><td>2.200</td><td>4.0</td><td>5.500</td><td>6.2</td><td>9.500</td><td>8.1</td></tr><tr><td>0.800</td><td>2.5</td><td>2.400</td><td>4.2</td><td>6.000</td><td>6.5</td><td></td><td></td></tr><tr><td>1.000</td><td>2.8</td><td>2.600</td><td>4.4</td><td>6.500</td><td>6.7</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	559.0	1.000	559.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.000	2.8	Flush-Flo™	0.076	0.9	Kick-Flo®	0.076	0.9	Mean Flow over Head Range	-	1.9	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	1.0	1.200	3.0	3.000	4.7	7.000	7.0	0.200	1.3	1.400	3.3	3.500	5.0	7.500	7.2	0.300	1.6	1.600	3.5	4.000	5.4	8.000	7.4	0.400	1.8	1.800	3.7	4.500	5.7	8.500	7.7	0.500	2.0	2.000	3.9	5.000	5.9	9.000	7.9	0.600	2.2	2.200	4.0	5.500	6.2	9.500	8.1	0.800	2.5	2.400	4.2	6.000	6.5			1.000	2.8	2.600	4.4	6.500	6.7		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
0.000	559.0	1.000	559.0																																																																																														
Control Points	Head (m)	Flow (l/s)																																																																																															
Design Point (Calculated)	1.000	2.8																																																																																															
Flush-Flo™	0.076	0.9																																																																																															
Kick-Flo®	0.076	0.9																																																																																															
Mean Flow over Head Range	-	1.9																																																																																															
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																										
0.100	1.0	1.200	3.0	3.000	4.7	7.000	7.0																																																																																										
0.200	1.3	1.400	3.3	3.500	5.0	7.500	7.2																																																																																										
0.300	1.6	1.600	3.5	4.000	5.4	8.000	7.4																																																																																										
0.400	1.8	1.800	3.7	4.500	5.7	8.500	7.7																																																																																										
0.500	2.0	2.000	3.9	5.000	5.9	9.000	7.9																																																																																										
0.600	2.2	2.200	4.0	5.500	6.2	9.500	8.1																																																																																										
0.800	2.5	2.400	4.2	6.000	6.5																																																																																												
1.000	2.8	2.600	4.4	6.500	6.7																																																																																												
©1982-2018 Innovyze																																																																																																	

WSP Group Ltd				Page 1	
.		BISHOPSGATE GOODSYARD			
.					
.					
Date 26/04/2019 11:24		Designed by PT			
File lin30.SRCX		Checked by WK			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.199	0.199	1.3	111.3	O K
30 min Summer	9.253	0.253	1.5	141.4	O K
60 min Summer	9.305	0.305	1.6	170.4	O K
120 min Summer	9.384	0.384	1.8	214.6	O K
180 min Summer	9.425	0.425	1.9	237.8	O K
240 min Summer	9.450	0.450	1.9	251.6	O K
360 min Summer	9.475	0.475	2.0	265.3	O K
480 min Summer	9.483	0.483	2.0	270.0	O K
600 min Summer	9.484	0.484	2.0	270.8	O K
720 min Summer	9.482	0.482	2.0	269.3	O K
960 min Summer	9.470	0.470	2.0	262.8	O K
1440 min Summer	9.448	0.448	1.9	250.5	O K
2160 min Summer	9.422	0.422	1.9	236.0	O K
2880 min Summer	9.400	0.400	1.8	223.8	O K
4320 min Summer	9.366	0.366	1.8	204.5	O K
5760 min Summer	9.339	0.339	1.7	189.4	O K
7200 min Summer	9.317	0.317	1.7	177.3	O K
8640 min Summer	9.299	0.299	1.6	167.2	O K
10080 min Summer	9.284	0.284	1.6	158.9	O K
15 min Winter	9.199	0.199	1.3	111.3	O K
30 min Winter	9.253	0.253	1.5	141.4	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	94.051	0.0	87.6	19	
30 min Summer	60.059	0.0	102.2	34	
60 min Summer	36.505	0.0	163.2	64	
120 min Summer	23.359	0.0	205.0	124	
180 min Summer	17.523	0.0	225.3	182	
240 min Summer	14.116	0.0	236.5	242	
360 min Summer	10.224	0.0	247.7	362	
480 min Summer	8.044	0.0	253.0	482	
600 min Summer	6.650	0.0	255.7	602	
720 min Summer	5.680	0.0	256.7	720	
960 min Summer	4.415	0.0	256.1	932	
1440 min Summer	3.089	0.0	249.3	1138	
2160 min Summer	2.168	0.0	363.9	1516	
2880 min Summer	1.694	0.0	376.5	1932	
4320 min Summer	1.213	0.0	385.0	2728	
5760 min Summer	0.966	0.0	440.1	3568	
7200 min Summer	0.817	0.0	464.4	4328	
8640 min Summer	0.716	0.0	487.6	5112	
10080 min Summer	0.643	0.0	509.1	5944	
15 min Winter	94.051	0.0	87.6	19	
30 min Winter	60.059	0.0	102.2	33	
©1982-2018 Innovyze					

WSP Group Ltd			Page 2		
.		BISHOPSGATE GOODSYARD			
.					
.					
Date 26/04/2019 11:24		Designed by PT			
File lin30.SRCX		Checked by WK			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 30 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.305	0.305	1.6	170.3	O K
120 min Winter	9.384	0.384	1.8	214.7	O K
180 min Winter	9.426	0.426	1.9	238.0	O K
240 min Winter	9.451	0.451	1.9	251.8	O K
360 min Winter	9.475	0.475	2.0	265.7	O K
480 min Winter	9.484	0.484	2.0	270.7	O K
600 min Winter	9.486	0.486	2.0	271.7	O K
720 min Winter	9.484	0.484	2.0	270.6	O K
960 min Winter	9.474	0.474	2.0	264.9	O K
1440 min Winter	9.448	0.448	1.9	250.2	O K
2160 min Winter	9.417	0.417	1.9	233.3	O K
2880 min Winter	9.390	0.390	1.8	217.9	O K
4320 min Winter	9.344	0.344	1.7	192.4	O K
5760 min Winter	9.307	0.307	1.6	171.8	O K
7200 min Winter	9.278	0.278	1.6	155.2	O K
8640 min Winter	9.253	0.253	1.5	141.5	O K
10080 min Winter	9.233	0.233	1.4	130.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	36.505	0.0	163.2	64	
120 min Winter	23.359	0.0	205.0	122	
180 min Winter	17.523	0.0	225.3	180	
240 min Winter	14.116	0.0	236.6	240	
360 min Winter	10.224	0.0	247.8	356	
480 min Winter	8.044	0.0	253.1	472	
600 min Winter	6.650	0.0	255.7	584	
720 min Winter	5.680	0.0	256.8	698	
960 min Winter	4.415	0.0	256.3	914	
1440 min Winter	3.089	0.0	249.5	1156	
2160 min Winter	2.168	0.0	364.0	1604	
2880 min Winter	1.694	0.0	376.6	2072	
4320 min Winter	1.213	0.0	385.6	2940	
5760 min Winter	0.966	0.0	440.1	3800	
7200 min Winter	0.817	0.0	464.4	4608	
8640 min Winter	0.716	0.0	487.6	5368	
10080 min Winter	0.643	0.0	509.4	6160	
©1982-2018 Innovyze					

WSP Group Ltd		Page 3
. . .	BISHOPSGATE GOODSYARD	
Date 26/04/2019 11:24	Designed by PT	
File lin30.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.950
FEH Rainfall Version	2013	Cv (Winter)	0.950
Site Location	GB 533674 182201	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.502

Time (mins)	Area
From:	To: (ha)
0	4 0.502

©1982-2018 Innovyze

WSP Group Ltd		Page 4
. . .	BISHOPSGATE GOODSYARD	
Date 26/04/2019 11:24 File lin30.SRCX	Designed by PT Checked by WK	
XP Solutions Source Control 2018.1		

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	559.0	1.000	559.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0051-2800-1000-2800
Design Head (m)	1.000
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	51
Invert Level (m)	9.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.8
Flush-Flo™	0.076	0.9
Kick-Flo®	0.076	0.9
Mean Flow over Head Range	-	1.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	3.0	3.000	4.7	7.000	7.0
0.200	1.3	1.400	3.3	3.500	5.0	7.500	7.2
0.300	1.6	1.600	3.5	4.000	5.4	8.000	7.4
0.400	1.8	1.800	3.7	4.500	5.7	8.500	7.7
0.500	2.0	2.000	3.9	5.000	5.9	9.000	7.9
0.600	2.2	2.200	4.0	5.500	6.2	9.500	8.1
0.800	2.5	2.400	4.2	6.000	6.5		
1.000	2.8	2.600	4.4	6.500	6.7		

©1982-2018 Innovyze

WSP Group Ltd				Page 1	
.		BISHOPSGATE GOODSYARD			
.					
.					
Date 24/04/2019		Designed by PT			
File lin100.SRCX		Checked by WK			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.263	0.263	1.5	147.2	O K
30 min Summer	9.338	0.338	1.7	188.8	O K
60 min Summer	9.410	0.410	1.9	229.0	O K
120 min Summer	9.518	0.518	2.1	289.7	O K
180 min Summer	9.581	0.581	2.2	324.8	O K
240 min Summer	9.621	0.621	2.2	347.3	O K
360 min Summer	9.665	0.665	2.3	372.0	O K
480 min Summer	9.685	0.685	2.4	383.0	O K
600 min Summer	9.693	0.693	2.4	387.1	O K
720 min Summer	9.693	0.693	2.4	387.4	O K
960 min Summer	9.682	0.682	2.3	381.3	O K
1440 min Summer	9.648	0.648	2.3	362.3	O K
2160 min Summer	9.605	0.605	2.2	338.0	O K
2880 min Summer	9.569	0.569	2.2	318.0	O K
4320 min Summer	9.510	0.510	2.1	285.3	O K
5760 min Summer	9.464	0.464	2.0	259.5	O K
7200 min Summer	9.428	0.428	1.9	239.2	O K
8640 min Summer	9.398	0.398	1.8	222.6	O K
10080 min Summer	9.374	0.374	1.8	208.9	O K
15 min Winter	9.263	0.263	1.5	147.2	O K
30 min Winter	9.338	0.338	1.7	188.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	124.337	0.0	104.6	19	
30 min Summer	80.062	0.0	120.7	34	
60 min Summer	48.931	0.0	213.9	64	
120 min Summer	31.379	0.0	256.5	124	
180 min Summer	23.760	0.0	277.8	184	
240 min Summer	19.294	0.0	290.9	242	
360 min Summer	14.126	0.0	305.3	362	
480 min Summer	11.183	0.0	312.0	482	
600 min Summer	9.272	0.0	315.0	602	
720 min Summer	7.929	0.0	316.0	722	
960 min Summer	6.157	0.0	314.1	960	
1440 min Summer	4.282	0.0	303.3	1226	
2160 min Summer	2.963	0.0	490.4	1580	
2880 min Summer	2.284	0.0	491.6	1988	
4320 min Summer	1.591	0.0	469.7	2808	
5760 min Summer	1.238	0.0	564.2	3632	
7200 min Summer	1.026	0.0	583.9	4400	
8640 min Summer	0.885	0.0	602.9	5192	
10080 min Summer	0.784	0.0	620.6	5960	
15 min Winter	124.337	0.0	104.6	19	
30 min Winter	80.062	0.0	120.7	34	
©1982-2018 Innovyze					

WSP Group Ltd			Page 2		
.		BISHOPSGATE GOODSYARD			
.					
.					
Date 24/04/2019		Designed by PT			
File lin100.SRCX		Checked by WK			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.410	0.410	1.9	229.0	O K
120 min Winter	9.518	0.518	2.1	289.8	O K
180 min Winter	9.581	0.581	2.2	325.0	O K
240 min Winter	9.622	0.622	2.2	347.6	O K
360 min Winter	9.666	0.666	2.3	372.5	O K
480 min Winter	9.686	0.686	2.4	383.7	O K
600 min Winter	9.694	0.694	2.4	388.1	O K
720 min Winter	9.695	0.695	2.4	388.8	O K
960 min Winter	9.686	0.686	2.4	383.6	O K
1440 min Winter	9.651	0.651	2.3	364.1	O K
2160 min Winter	9.602	0.602	2.2	336.6	O K
2880 min Winter	9.560	0.560	2.1	313.1	O K
4320 min Winter	9.488	0.488	2.0	273.1	O K
5760 min Winter	9.431	0.431	1.9	240.7	O K
7200 min Winter	9.384	0.384	1.8	214.8	O K
8640 min Winter	9.347	0.347	1.7	193.7	O K
10080 min Winter	9.315	0.315	1.7	176.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	48.931	0.0	213.9	64	
120 min Winter	31.379	0.0	256.5	122	
180 min Winter	23.760	0.0	277.8	180	
240 min Winter	19.294	0.0	290.9	240	
360 min Winter	14.126	0.0	305.3	356	
480 min Winter	11.183	0.0	312.0	472	
600 min Winter	9.272	0.0	315.1	588	
720 min Winter	7.929	0.0	316.0	702	
960 min Winter	6.157	0.0	314.2	924	
1440 min Winter	4.282	0.0	303.5	1340	
2160 min Winter	2.963	0.0	490.5	1660	
2880 min Winter	2.284	0.0	491.8	2108	
4320 min Winter	1.591	0.0	470.5	2988	
5760 min Winter	1.238	0.0	564.2	3864	
7200 min Winter	1.026	0.0	583.9	4688	
8640 min Winter	0.885	0.0	603.0	5528	
10080 min Winter	0.784	0.0	620.7	6256	
©1982-2018 Innovyze					

WSP Group Ltd		Page 3
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019	Designed by PT	
File lin100.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
FEH Rainfall Version	2013	Cv (Winter)	0.950
Site Location	GB 533674 182201	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.502

Time (mins)		Area
From:	To:	(ha)
0	4	0.502

©1982-2018 Innovyze

WSP Group Ltd		Page 4
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019 File lin100.SRCX	Designed by PT Checked by WK	
XP Solutions Source Control 2018.1		

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	559.0	1.000	559.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0051-2800-1000-2800
Design Head (m)	1.000
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	51
Invert Level (m)	9.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.8
Flush-Flo™	0.076	0.9
Kick-Flo®	0.076	0.9
Mean Flow over Head Range	-	1.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	3.0	3.000	4.7	7.000	7.0
0.200	1.3	1.400	3.3	3.500	5.0	7.500	7.2
0.300	1.6	1.600	3.5	4.000	5.4	8.000	7.4
0.400	1.8	1.800	3.7	4.500	5.7	8.500	7.7
0.500	2.0	2.000	3.9	5.000	5.9	9.000	7.9
0.600	2.2	2.200	4.0	5.500	6.2	9.500	8.1
0.800	2.5	2.400	4.2	6.000	6.5		
1.000	2.8	2.600	4.4	6.500	6.7		

©1982-2018 Innovyze

WSP Group Ltd				Page 1	
.		BISHOPSGATE GOODSYARD			
.					
.					
Date 24/04/2019		Designed by PT			
File lin100 +40.SRCX		Checked by WK			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.369	0.369	1.8	206.3	O K
30 min Summer	9.474	0.474	2.0	264.8	O K
60 min Summer	9.575	0.575	2.2	321.5	O K
120 min Summer	9.729	0.729	2.4	407.6	Flood Risk
180 min Summer	9.819	0.819	2.6	458.0	Flood Risk
240 min Summer	9.878	0.878	2.6	490.7	Flood Risk
360 min Summer	9.944	0.944	2.7	527.8	Flood Risk
480 min Summer	9.976	0.976	2.8	545.6	Flood Risk
600 min Summer	9.991	0.991	2.8	553.8	Flood Risk
720 min Summer	9.996	0.996	2.8	556.6	Flood Risk
960 min Summer	9.988	0.988	2.8	552.6	Flood Risk
1440 min Summer	9.948	0.948	2.7	530.0	Flood Risk
2160 min Summer	9.890	0.890	2.7	497.3	Flood Risk
2880 min Summer	9.843	0.843	2.6	471.3	Flood Risk
4320 min Summer	9.769	0.769	2.5	429.6	Flood Risk
5760 min Summer	9.709	0.709	2.4	396.2	Flood Risk
7200 min Summer	9.661	0.661	2.3	369.5	O K
8640 min Summer	9.622	0.622	2.2	347.7	O K
10080 min Summer	9.590	0.590	2.2	329.7	O K
15 min Winter	9.369	0.369	1.8	206.3	O K
30 min Winter	9.474	0.474	2.0	264.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	174.072	0.0	127.0	19	
30 min Summer	112.087	0.0	145.6	34	
60 min Summer	68.504	0.0	273.3	64	
120 min Summer	43.930	0.0	319.2	124	
180 min Summer	33.264	0.0	343.4	184	
240 min Summer	27.012	0.0	358.3	244	
360 min Summer	19.777	0.0	374.4	362	
480 min Summer	15.656	0.0	381.7	482	
600 min Summer	12.980	0.0	384.7	602	
720 min Summer	11.100	0.0	385.3	722	
960 min Summer	8.620	0.0	382.2	960	
1440 min Summer	5.995	0.0	367.9	1370	
2160 min Summer	4.148	0.0	637.6	1688	
2880 min Summer	3.197	0.0	628.0	2052	
4320 min Summer	2.227	0.0	590.7	2856	
5760 min Summer	1.734	0.0	789.9	3688	
7200 min Summer	1.437	0.0	817.1	4536	
8640 min Summer	1.239	0.0	842.4	5280	
10080 min Summer	1.097	0.0	860.3	6144	
15 min Winter	174.072	0.0	127.0	19	
30 min Winter	112.087	0.0	145.7	34	
©1982-2018 Innovyze					

WSP Group Ltd				Page 2	
.		BISHOPSGATE GOODSYARD			
.					
.					
Date 24/04/2019		Designed by PT			
File lin100 +40.SRCX		Checked by WK			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.575	0.575	2.2	321.5	O K
120 min Winter	9.730	0.730	2.4	407.8	Flood Risk
180 min Winter	9.820	0.820	2.6	458.2	Flood Risk
240 min Winter	9.878	0.878	2.6	491.1	Flood Risk
360 min Winter	9.945	0.945	2.7	528.3	Flood Risk
480 min Winter	9.977	0.977	2.8	546.4	Flood Risk
600 min Winter	9.993	0.993	2.8	554.9	Flood Risk
720 min Winter	9.998	0.998	2.8	558.0	Flood Risk
960 min Winter	9.993	0.993	2.8	555.0	Flood Risk
1440 min Winter	9.956	0.956	2.7	534.6	Flood Risk
2160 min Winter	9.889	0.889	2.7	497.1	Flood Risk
2880 min Winter	9.837	0.837	2.6	468.1	Flood Risk
4320 min Winter	9.748	0.748	2.4	418.0	Flood Risk
5760 min Winter	9.673	0.673	2.3	376.1	O K
7200 min Winter	9.612	0.612	2.2	342.1	O K
8640 min Winter	9.561	0.561	2.1	313.8	O K
10080 min Winter	9.519	0.519	2.1	290.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	68.504	0.0	273.3	64	
120 min Winter	43.930	0.0	319.2	122	
180 min Winter	33.264	0.0	343.4	180	
240 min Winter	27.012	0.0	358.3	240	
360 min Winter	19.777	0.0	374.4	358	
480 min Winter	15.656	0.0	381.7	474	
600 min Winter	12.980	0.0	384.8	590	
720 min Winter	11.100	0.0	385.3	706	
960 min Winter	8.620	0.0	382.2	932	
1440 min Winter	5.995	0.0	368.0	1370	
2160 min Winter	4.148	0.0	637.7	1728	
2880 min Winter	3.197	0.0	628.3	2164	
4320 min Winter	2.227	0.0	591.5	3072	
5760 min Winter	1.734	0.0	789.9	3976	
7200 min Winter	1.437	0.0	817.2	4824	
8640 min Winter	1.239	0.0	842.5	5624	
10080 min Winter	1.097	0.0	861.0	6456	
©1982-2018 Innovyze					

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin100 +40.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.502 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.502</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.502
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+40																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.502																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4																																																																																															
. . .	BISHOPSGATE GOODSYARD	Micro Drainage																																																																																															
Date 24/04/2019	Designed by PT																																																																																																
File lin100 +40.SRCX	Checked by WK																																																																																																
XP Solutions	Source Control 2018.1																																																																																																
Model Details Storage is Online Cover Level (m) 10.000 Tank or Pond Structure Invert Level (m) 9.000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr><tr><td>0.000</td><td>559.0</td><td>1.000</td><td>559.0</td></tr></table> Hydro-Brake® Optimum Outflow Control Unit Reference MD-SCU-0051-2800-1000-2800 Design Head (m) 1.000 Design Flow (l/s) 2.8 Flush-Flo™ Calculated Objective Linear discharge profile Application Surface Sump Available Yes Diameter (mm) 51 Invert Level (m) 9.000 Minimum Outlet Pipe Diameter (mm) 75 Suggested Manhole Diameter (mm) 1200 <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.000</td><td>2.8</td></tr><tr><td>Flush-Flo™</td><td>0.076</td><td>0.9</td></tr><tr><td>Kick-Flo®</td><td>0.076</td><td>0.9</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>1.9</td></tr></table> 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><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>1.0</td><td>1.200</td><td>3.0</td><td>3.000</td><td>4.7</td><td>7.000</td><td>7.0</td></tr><tr><td>0.200</td><td>1.3</td><td>1.400</td><td>3.3</td><td>3.500</td><td>5.0</td><td>7.500</td><td>7.2</td></tr><tr><td>0.300</td><td>1.6</td><td>1.600</td><td>3.5</td><td>4.000</td><td>5.4</td><td>8.000</td><td>7.4</td></tr><tr><td>0.400</td><td>1.8</td><td>1.800</td><td>3.7</td><td>4.500</td><td>5.7</td><td>8.500</td><td>7.7</td></tr><tr><td>0.500</td><td>2.0</td><td>2.000</td><td>3.9</td><td>5.000</td><td>5.9</td><td>9.000</td><td>7.9</td></tr><tr><td>0.600</td><td>2.2</td><td>2.200</td><td>4.0</td><td>5.500</td><td>6.2</td><td>9.500</td><td>8.1</td></tr><tr><td>0.800</td><td>2.5</td><td>2.400</td><td>4.2</td><td>6.000</td><td>6.5</td><td></td><td></td></tr><tr><td>1.000</td><td>2.8</td><td>2.600</td><td>4.4</td><td>6.500</td><td>6.7</td><td></td><td></td></tr></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	559.0	1.000	559.0	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.000	2.8	Flush-Flo™	0.076	0.9	Kick-Flo®	0.076	0.9	Mean Flow over Head Range	-	1.9	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	1.0	1.200	3.0	3.000	4.7	7.000	7.0	0.200	1.3	1.400	3.3	3.500	5.0	7.500	7.2	0.300	1.6	1.600	3.5	4.000	5.4	8.000	7.4	0.400	1.8	1.800	3.7	4.500	5.7	8.500	7.7	0.500	2.0	2.000	3.9	5.000	5.9	9.000	7.9	0.600	2.2	2.200	4.0	5.500	6.2	9.500	8.1	0.800	2.5	2.400	4.2	6.000	6.5			1.000	2.8	2.600	4.4	6.500	6.7		
Depth (m)	Area (m²)	Depth (m)	Area (m²)																																																																																														
0.000	559.0	1.000	559.0																																																																																														
Control Points	Head (m)	Flow (l/s)																																																																																															
Design Point (Calculated)	1.000	2.8																																																																																															
Flush-Flo™	0.076	0.9																																																																																															
Kick-Flo®	0.076	0.9																																																																																															
Mean Flow over Head Range	-	1.9																																																																																															
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																																										
0.100	1.0	1.200	3.0	3.000	4.7	7.000	7.0																																																																																										
0.200	1.3	1.400	3.3	3.500	5.0	7.500	7.2																																																																																										
0.300	1.6	1.600	3.5	4.000	5.4	8.000	7.4																																																																																										
0.400	1.8	1.800	3.7	4.500	5.7	8.500	7.7																																																																																										
0.500	2.0	2.000	3.9	5.000	5.9	9.000	7.9																																																																																										
0.600	2.2	2.200	4.0	5.500	6.2	9.500	8.1																																																																																										
0.800	2.5	2.400	4.2	6.000	6.5																																																																																												
1.000	2.8	2.600	4.4	6.500	6.7																																																																																												
©1982-2018 Innovyze																																																																																																	

WSP Group Ltd		Page 3
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019	Designed by PT	
File lin2.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	2	Cv (Summer)	0.950
FEH Rainfall Version	2013	Cv (Winter)	0.950
Site Location	GB 533674 182201	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.068

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	1.034	4 8	1.034

©1982-2018 Innovyze

WSP Group Ltd		Page 4
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019 File lin2.SRCX	Designed by PT Checked by WK	
XP Solutions Source Control 2018.1		

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.500 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	6303.0	0.0	0.500	6303.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0051-2000-0500-2000
 Design Head (m) 0.500
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Linear discharge profile
 Application Surface
 Sump Available Yes
 Diameter (mm) 51
 Invert Level (m) 9.500
 Minimum Outlet Pipe Diameter (mm) 75
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	2.0
Flush-Flo™	0.076	0.9
Kick-Flo®	0.076	0.9
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	3.0	3.000	4.6	7.000	6.9
0.200	1.3	1.400	3.2	3.500	4.9	7.500	7.1
0.300	1.6	1.600	3.4	4.000	5.3	8.000	7.4
0.400	1.8	1.800	3.6	4.500	5.6	8.500	7.6
0.500	2.0	2.000	3.8	5.000	5.8	9.000	7.8
0.600	2.2	2.200	4.0	5.500	6.1	9.500	8.0
0.800	2.5	2.400	4.1	6.000	6.4		
1.000	2.7	2.600	4.3	6.500	6.6		

©1982-2018 Innovyze

WSP Group Ltd		Page 3
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019	Designed by PT	
File lin30.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.950
FEH Rainfall Version	2013	Cv (Winter)	0.950
Site Location	GB 533674 182201	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 2.068

Time (mins)	Area	Time (mins)	Area
From: To:	(ha)	From: To:	(ha)
0 4	1.034	4 8	1.034

©1982-2018 Innovyze

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin30.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.500 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	6303.0	0.0	0.500	6303.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0051-2000-0500-2000

Design Head (m) 0.500

Design Flow (l/s) 2.0

Flush-Flo™ Calculated

Objective Linear discharge profile

Application Surface

Sump Available Yes

Diameter (mm) 51

Invert Level (m) 9.500

Minimum Outlet Pipe Diameter (mm) 75

Suggested Manhole Diameter (mm) 1200

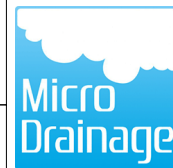
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	2.0
Flush-Flo™	0.076	0.9
Kick-Flo®	0.076	0.9
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	3.0	3.000	4.6	7.000	6.9
0.200	1.3	1.400	3.2	3.500	4.9	7.500	7.1
0.300	1.6	1.600	3.4	4.000	5.3	8.000	7.4
0.400	1.8	1.800	3.6	4.500	5.6	8.500	7.6
0.500	2.0	2.000	3.8	5.000	5.8	9.000	7.8
0.600	2.2	2.200	4.0	5.500	6.1	9.500	8.0
0.800	2.5	2.400	4.1	6.000	6.4		
1.000	2.7	2.600	4.3	6.500	6.6		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																				
. . .	BISHOPSGATE GOODSYARD																																					
Date 24/04/2019 File lin100.SRCX		Designed by PT Checked by WK																																				
XP Solutions		Source Control 2018.1																																				
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 2.068 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>1.034</td> <td>4 8</td> <td>1.034</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	1.034	4 8	1.034
Rainfall Model	FEH	Winter Storms	Yes																																			
Return Period (years)	100	Cv (Summer)	0.950																																			
FEH Rainfall Version	2013	Cv (Winter)	0.950																																			
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																			
Data Type	Point	Longest Storm (mins)	10080																																			
Summer Storms	Yes	Climate Change %	+0																																			
Time (mins)	Area	Time (mins)	Area																																			
From: To:	(ha)	From: To:	(ha)																																			
0 4	1.034	4 8	1.034																																			
©1982-2018 Innovyze																																						



WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin100.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.500 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	6303.0	0.0	0.500	6303.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0051-2000-0500-2000

Design Head (m) 0.500

Design Flow (l/s) 2.0

Flush-Flo™ Calculated

Objective Linear discharge profile

Application Surface

Sump Available Yes

Diameter (mm) 51

Invert Level (m) 9.500

Minimum Outlet Pipe Diameter (mm) 75

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	2.0
Flush-Flo™	0.076	0.9
Kick-Flo®	0.076	0.9
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	3.0	3.000	4.6	7.000	6.9
0.200	1.3	1.400	3.2	3.500	4.9	7.500	7.1
0.300	1.6	1.600	3.4	4.000	5.3	8.000	7.4
0.400	1.8	1.800	3.6	4.500	5.6	8.500	7.6
0.500	2.0	2.000	3.8	5.000	5.8	9.000	7.8
0.600	2.2	2.200	4.0	5.500	6.1	9.500	8.0
0.800	2.5	2.400	4.1	6.000	6.4		
1.000	2.7	2.600	4.3	6.500	6.6		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																				
. . .	BISHOPSGATE GOODSYARD																																					
Date 24/04/2019 File lin100+40.SRCX	Designed by PT Checked by WK																																					
XP Solutions Source Control 2018.1																																						
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 2.068 <table> <thead> <tr> <th>Time (mins)</th> <th>Area</th> <th>Time (mins)</th> <th>Area</th> </tr> <tr> <th>From: To:</th> <th>(ha)</th> <th>From: To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0 4</td> <td>1.034</td> <td>4 8</td> <td>1.034</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	From: To:	(ha)	From: To:	(ha)	0 4	1.034	4 8	1.034
Rainfall Model	FEH	Winter Storms	Yes																																			
Return Period (years)	100	Cv (Summer)	0.950																																			
FEH Rainfall Version	2013	Cv (Winter)	0.950																																			
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																			
Data Type	Point	Longest Storm (mins)	10080																																			
Summer Storms	Yes	Climate Change %	+40																																			
Time (mins)	Area	Time (mins)	Area																																			
From: To:	(ha)	From: To:	(ha)																																			
0 4	1.034	4 8	1.034																																			
©1982-2018 Innovyze																																						

WSP Group Ltd		Page 4
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019	Designed by PT	
File lin100+40.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.500 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	6303.0	0.0	0.500	6303.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0051-2000-0500-2000
 Design Head (m) 0.500
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Linear discharge profile
 Application Surface
 Sump Available Yes
 Diameter (mm) 51
 Invert Level (m) 9.500
 Minimum Outlet Pipe Diameter (mm) 75
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	2.0
Flush-Flo™	0.076	0.9
Kick-Flo®	0.076	0.9
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	3.0	3.000	4.6	7.000	6.9
0.200	1.3	1.400	3.2	3.500	4.9	7.500	7.1
0.300	1.6	1.600	3.4	4.000	5.3	8.000	7.4
0.400	1.8	1.800	3.6	4.500	5.6	8.500	7.6
0.500	2.0	2.000	3.8	5.000	5.8	9.000	7.8
0.600	2.2	2.200	4.0	5.500	6.1	9.500	8.0
0.800	2.5	2.400	4.1	6.000	6.4		
1.000	2.7	2.600	4.3	6.500	6.6		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin2.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.111 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.111</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	2	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.111
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	2	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.111																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .		
BISHOPSGATE GOODSYARD		
Date 24/04/2019 File lin2.SRCX		
Designed by PT		
Checked by WK		
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	600.0	0.0	0.300	600.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0057-2000-0300-2000
 Design Head (m) 0.300
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Linear discharge profile
 Application Surface
 Sump Available Yes
 Diameter (mm) 57
 Invert Level (m) 9.700
 Minimum Outlet Pipe Diameter (mm) 75
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin30.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.111 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.111</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.111
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	30	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.111																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019 File lin30.SRCX	Designed by PT Checked by WK	
XP Solutions Source Control 2018.1		

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	600.0	0.0	0.300	600.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin100.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.111 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.111</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.111
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.111																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .		
Date 24/04/2019 File lin100.SRCX		
BISHOPSGATE GOODSYARD Designed by PT Checked by WK		
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	600.0	0.0	0.300	600.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0057-2000-0300-2000
 Design Head (m) 0.300
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Linear discharge profile
 Application Surface
 Sump Available Yes
 Diameter (mm) 57
 Invert Level (m) 9.700
 Minimum Outlet Pipe Diameter (mm) 75
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin100+40.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.111 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.111</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.111
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+40																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.111																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .		
Date 24/04/2019 File lin100+40.SRCX		
BISHOPSGATE GOODSYARD Designed by PT Checked by WK		
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	600.0	0.0	0.300	600.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin2.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.159 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.159</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	2	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.159
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	2	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.159																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .		
BISHOPSGATE GOODSYARD		
Date 24/04/2019 File lin2.SRCX	Designed by PT Checked by WK	
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	638.0	0.0	0.300	638.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd

.

.

.

Date 24/04/2019

File lin30.SRCX

BISHOPSGATE GOODSYARD

Designed by PT

Checked by WK

XP Solutions

Source Control 2018.1

Page 1



Summary of Results for 30 year Return Period

Half Drain Time : 554 minutes.

Storm Event

Max Level

Max Depth

Max Infiltration

Max Control

Max Σ Outflow

Max Volume

Status

(m)

(m)

(l/s)

(l/s)

(l/s)

(m³)

15 min Summer

30 min Summer

60 min Summer

120 min Summer

180 min Summer

240 min Summer

360 min Summer

480 min Summer

600 min Summer

720 min Summer

960 min Summer

1440 min Summer

2160 min Summer

2880 min Summer

4320 min Summer

5760 min Summer

7200 min Summer

8640 min Summer

10080 min Summer

15 min Winter

9.758

9.773

9.787

9.808

9.818

9.823

9.825

9.824

9.823

9.821

9.817

9.809

9.799

9.790

9.776

9.767

9.762

9.757

9.754

9.758

0.058

0.073

0.087

0.108

0.118

0.123

0.125

0.124

0.123

0.121

0.117

0.109

0.099

0.090

0.076

0.067

0.062

0.057

0.054

0.058

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.9

1.1

1.2

1.3

1.3

1.3

1.4

1.3

1.3

1.3

1.3

1.3

1.2

1.2

1.1

1.0

1.0

0.9

0.8

0.9

0.9

1.1

1.2

1.3

1.3

1.3

1.4

1.3

1.3

1.3

1.3

1.3

1.2

1.2

1.1

1.0

1.0

0.9

0.8

0.9

35.0

44.3

52.8

65.5

71.5

74.5

76.0

75.4

74.5

73.4

71.1

66.3

59.8

54.3

45.8

40.9

37.4

34.7

32.8

35.0

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Flood Risk

Storm Event

Rain (mm/hr)

Flooded Volume (m³)

Discharge Volume (m³)

Time-Peak (mins)

15 min Summer

30 min Summer

60 min Summer

120 min Summer

180 min Summer

240 min Summer

360 min Summer

480 min Summer

600 min Summer

720 min Summer

960 min Summer

1440 min Summer

2160 min Summer

2880 min Summer

4320 min Summer

5760 min Summer

7200 min Summer

8640 min Summer

10080 min Summer

15 min Winter

94.051

60.059

36.505

23.359

17.523

14.116

10.224

8.044

6.650

5.680

4.415

3.089

2.168

1.694

1.213

0.966

0.817

0.716

0.643

94.051

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

0.0

27.3

36.2

50.3

65.2

73.7

79.4

86.4

90.6

93.5

95.7

98.9

102.7

114.5

118.9

126.1

138.2

145.6

152.5

158.6

27.3

19

33

64

122

182

242

360

412

472

532

664

936

1340

1728

2464

3176

3896

4664

5344

19

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin30.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.159 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.159</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.159
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	30	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.159																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin30.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	638.0	0.0	0.300	638.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin100.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.159 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.159</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.159
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.159																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin100.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	638.0	0.0	0.300	638.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin100+40.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.159 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.159</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.159
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+40																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.159																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin100+40.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	638.0	0.0	0.300	638.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0057-2000-0300-2000
Design Head (m) 0.300
Design Flow (l/s) 2.0
Flush-Flo™ Calculated
Objective Linear discharge profile
Application Surface
Sump Available Yes
Diameter (mm) 57
Invert Level (m) 9.700
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin2.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.066 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.066</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	2	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.066
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	2	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.066																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .		
BISHOPSGATE GOODSYARD		
Date 24/04/2019 File lin2.SRCX		
Designed by PT		
Checked by WK		
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	265.0	0.0	0.300	265.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0057-2000-0300-2000
 Design Head (m) 0.300
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Linear discharge profile
 Application Surface
 Sump Available Yes
 Diameter (mm) 57
 Invert Level (m) 9.700
 Minimum Outlet Pipe Diameter (mm) 75
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin30.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.066 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.066</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.066
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	30	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.066																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019 File lin30.SRCX	Designed by PT Checked by WK	
XP Solutions Source Control 2018.1		

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	265.0	0.0	0.300	265.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019	Designed by PT	
File lin100.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
FEH Rainfall Version	2013	Cv (Winter)	0.950
Site Location	GB 533674 182201	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.066

Time (mins)	Area
From:	To: (ha)
0	4 0.066

©1982-2018 Innovyze

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin100.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	265.0	0.0	0.300	265.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0057-2000-0300-2000

Design Head (m) 0.300

Design Flow (l/s) 2.0

Flush-Flo™ Calculated

Objective Linear discharge profile

Application Surface

Sump Available Yes

Diameter (mm) 57

Invert Level (m) 9.700

Minimum Outlet Pipe Diameter (mm) 75

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019	Designed by PT	
File lin100+40%.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
FEH Rainfall Version	2013	Cv (Winter)	0.950
Site Location	GB 533674 182201	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.066

Time (mins)		Area
From:	To:	(ha)
0	4	0.066

©1982-2018 Innovyze

WSP Group Ltd		Page 4
. . .		
Date 24/04/2019 File lin100+40%.SRCX		
BISHOPSGATE GOODSYARD Designed by PT Checked by WK		
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	265.0	0.0	0.300	265.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin2.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.218 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.218</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	2	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.218
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	2	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.218																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin2.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	800.0	0.0	0.300	800.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin30.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.218 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.218</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.218
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	30	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.218																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin30.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0

Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95

Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	800.0	0.0	0.300	800.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0057-2000-0300-2000

Design Head (m) 0.300

Design Flow (l/s) 2.0

Flush-Flo™ Calculated

Objective Linear discharge profile

Application Surface

Sump Available Yes

Diameter (mm) 57

Invert Level (m) 9.700

Minimum Outlet Pipe Diameter (mm) 75

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019	Designed by PT	
File lin100.SRCX	Checked by WK	
XP Solutions		Source Control 2018.1

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.950
FEH Rainfall Version	2013	Cv (Winter)	0.950
Site Location	GB 533674 182201	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.218

Time (mins)	Area
From:	To: (ha)
0	4 0.218

©1982-2018 Innovyze

WSP Group Ltd		Page 4
. . .		
Date 24/04/2019 File lin100.SRCX		
BISHOPSGATE GOODSYARD Designed by PT Checked by WK		
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	800.0	0.0	0.300	800.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCU-0057-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	57
Invert Level (m)	9.700
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin100+40.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.218 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.218</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.218
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+40																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.218																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin100+40.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	800.0	0.0	0.300	800.0	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0057-2000-0300-2000
Design Head (m) 0.300
Design Flow (l/s) 2.0
Flush-Flo™ Calculated
Objective Linear discharge profile
Application Surface
Sump Available Yes
Diameter (mm) 57
Invert Level (m) 9.700
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.085	1.1
Kick-Flo®	0.085	1.1
Mean Flow over Head Range	-	1.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.2	1.200	3.8	3.000	5.8	7.000	8.9
0.200	1.7	1.400	4.1	3.500	6.2	7.500	9.2
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.5
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.8
0.500	2.5	2.000	4.8	5.000	7.5	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin2.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>2</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.390 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.390</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	2	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.390
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	2	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.390																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin2.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	461.5	0.0	1.000	461.5	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0043-2000-1000-2000
Design Head (m) 1.000
Design Flow (l/s) 2.0
Flush-Flo™ Calculated
Objective Linear discharge profile
Application Surface
Sump Available Yes
Diameter (mm) 43
Invert Level (m) 9.000
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.065	0.6
Kick-Flo®	0.065	0.6
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	2.2	3.000	3.3	7.000	5.0
0.200	1.0	1.400	2.3	3.500	3.6	7.500	5.1
0.300	1.2	1.600	2.5	4.000	3.8	8.000	5.3
0.400	1.3	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.5	2.000	2.8	5.000	4.2	9.000	5.6
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.7
0.800	1.8	2.400	3.0	6.000	4.6		
1.000	2.0	2.600	3.1	6.500	4.8		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin30.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>30</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.390 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.390</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	30	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.390
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	30	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.390																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .	BISHOPSGATE GOODSYARD	
Date 24/04/2019 File lin30.SRCX	Designed by PT Checked by WK	
XP Solutions Source Control 2018.1		

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.000 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	461.5	0.0	1.000	461.5	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0043-2000-1000-2000
 Design Head (m) 1.000
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Linear discharge profile
 Application Surface
 Sump Available Yes
 Diameter (mm) 43
 Invert Level (m) 9.000
 Minimum Outlet Pipe Diameter (mm) 75
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.065	0.6
Kick-Flo®	0.065	0.6
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	2.2	3.000	3.3	7.000	5.0
0.200	1.0	1.400	2.3	3.500	3.6	7.500	5.1
0.300	1.2	1.600	2.5	4.000	3.8	8.000	5.3
0.400	1.3	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.5	2.000	2.8	5.000	4.2	9.000	5.6
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.7
0.800	1.8	2.400	3.0	6.000	4.6		
1.000	2.0	2.600	3.1	6.500	4.8		

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin100.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+0</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.390 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.390</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+0	Time (mins)		Area	From:	To:	(ha)	0	4	0.390
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+0																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.390																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
. . .		
BISHOPSGATE GOODSYARD		
Date 24/04/2019 File lin100.SRCX		
Designed by PT		
Checked by WK		
XP Solutions		Source Control 2018.1

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.000 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	461.5	0.0	1.000	461.5	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0043-2000-1000-2000
 Design Head (m) 1.000
 Design Flow (l/s) 2.0
 Flush-Flo™ Calculated
 Objective Linear discharge profile
 Application Surface
 Sump Available Yes
 Diameter (mm) 43
 Invert Level (m) 9.000
 Minimum Outlet Pipe Diameter (mm) 75
 Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.065	0.6
Kick-Flo®	0.065	0.6
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	2.2	3.000	3.3	7.000	5.0
0.200	1.0	1.400	2.3	3.500	3.6	7.500	5.1
0.300	1.2	1.600	2.5	4.000	3.8	8.000	5.3
0.400	1.3	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.5	2.000	2.8	5.000	4.2	9.000	5.6
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.7
0.800	1.8	2.400	3.0	6.000	4.6		
1.000	2.0	2.600	3.1	6.500	4.8		

©1982-2018 Innovyze

WSP Group Ltd

.

.

.

Date 24/04/2019

File lin100+40.SRCX

XP Solutions

Source Control 2018.1

BISHOPSGATE GOODSYARD

Designed by PT

Checked by WK

Page 1

Micro Drainage

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

Half Drain Time : 2126 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Outflow (1/s)	Max Volume (m³)	Status
15 min Summer	9.366	0.366	0.0	1.3	1.3	160.4	O K
30 min Summer	9.470	0.470	0.0	1.4	1.4	205.9	O K
60 min Summer	9.570	0.570	0.0	1.5	1.5	250.1	O K
120 min Summer	9.724	0.724	0.0	1.7	1.7	317.4	Flood Risk
180 min Summer	9.814	0.814	0.0	1.8	1.8	356.9	Flood Risk
240 min Summer	9.873	0.873	0.0	1.9	1.9	382.7	Flood Risk
360 min Summer	9.940	0.940	0.0	1.9	1.9	412.3	Flood Risk
480 min Summer	9.974	0.974	0.0	2.0	2.0	427.0	Flood Risk
600 min Summer	9.990	0.990	0.0	2.0	2.0	434.2	Flood Risk
720 min Summer	9.997	0.997	0.0	2.0	2.0	437.1	Flood Risk
960 min Summer	9.993	0.993	0.0	2.0	2.0	435.5	Flood Risk
1440 min Summer	9.959	0.959	0.0	2.0	2.0	420.5	Flood Risk
2160 min Summer	9.902	0.902	0.0	1.9	1.9	395.3	Flood Risk
2880 min Summer	9.857	0.857	0.0	1.9	1.9	375.6	Flood Risk
4320 min Summer	9.786	0.786	0.0	1.8	1.8	344.7	Flood Risk
5760 min Summer	9.729	0.729	0.0	1.7	1.7	319.8	Flood Risk
7200 min Summer	9.684	0.684	0.0	1.7	1.7	300.0	O K
8640 min Summer	9.647	0.647	0.0	1.6	1.6	283.5	O K
10080 min Summer	9.616	0.616	0.0	1.6	1.6	270.0	O K
15 min Winter	9.366	0.366	0.0	1.3	1.3	160.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	174.072	0.0	92.3	19
30 min Summer	112.087	0.0	105.5	34
60 min Summer	68.504	0.0	201.4	64
120 min Summer	43.930	0.0	233.6	124
180 min Summer	33.264	0.0	250.6	184
240 min Summer	27.012	0.0	261.1	244
360 min Summer	19.777	0.0	272.2	362
480 min Summer	15.656	0.0	277.2	482
600 min Summer	12.980	0.0	279.1	602
720 min Summer	11.100	0.0	279.4	722
960 min Summer	8.620	0.0	276.8	962
1440 min Summer	5.995	0.0	266.2	1440
2160 min Summer	4.148	0.0	472.7	1752
2880 min Summer	3.197	0.0	463.8	2104
4320 min Summer	2.227	0.0	433.9	2900
5760 min Summer	1.734	0.0	613.4	3744
7200 min Summer	1.437	0.0	634.1	4544
8640 min Summer	1.239	0.0	651.8	5360
10080 min Summer	1.097	0.0	654.8	6152
15 min Winter	174.072	0.0	92.3	19

©1982-2018 Innovyze

WSP Group Ltd		Page 3																																	
. . .	BISHOPSGATE GOODSYARD																																		
Date 24/04/2019	Designed by PT																																		
File lin100+40.SRCX	Checked by WK																																		
XP Solutions		Source Control 2018.1																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FEH</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.950</td> </tr> <tr> <td>FEH Rainfall Version</td> <td>2013</td> <td>Cv (Winter)</td> <td>0.950</td> </tr> <tr> <td>Site Location</td> <td>GB 533674 182201</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Data Type</td> <td>Point</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.390 <table> <thead> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>4</td> <td>0.390</td> </tr> </tbody> </table>			Rainfall Model	FEH	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.950	FEH Rainfall Version	2013	Cv (Winter)	0.950	Site Location	GB 533674 182201	Shortest Storm (mins)	15	Data Type	Point	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.390
Rainfall Model	FEH	Winter Storms	Yes																																
Return Period (years)	100	Cv (Summer)	0.950																																
FEH Rainfall Version	2013	Cv (Winter)	0.950																																
Site Location	GB 533674 182201	Shortest Storm (mins)	15																																
Data Type	Point	Longest Storm (mins)	10080																																
Summer Storms	Yes	Climate Change %	+40																																
Time (mins)		Area																																	
From:	To:	(ha)																																	
0	4	0.390																																	
©1982-2018 Innovyze																																			

WSP Group Ltd		Page 4
.	BISHOPSGATE GOODSYARD	
.		
.		
Date 24/04/2019	Designed by PT	
File lin100+40.SRCX	Checked by WK	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	461.5	0.0	1.000	461.5	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference MD-SCU-0043-2000-1000-2000
Design Head (m) 1.000
Design Flow (l/s) 2.0
Flush-Flo™ Calculated
Objective Linear discharge profile
Application Surface
Sump Available Yes
Diameter (mm) 43
Invert Level (m) 9.000
Minimum Outlet Pipe Diameter (mm) 75
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.065	0.6
Kick-Flo®	0.065	0.6
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	1.200	2.2	3.000	3.3	7.000	5.0
0.200	1.0	1.400	2.3	3.500	3.6	7.500	5.1
0.300	1.2	1.600	2.5	4.000	3.8	8.000	5.3
0.400	1.3	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.5	2.000	2.8	5.000	4.2	9.000	5.6
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.7
0.800	1.8	2.400	3.0	6.000	4.6		
1.000	2.0	2.600	3.1	6.500	4.8		

©1982-2018 Innovyze

ballymore.



Hammerson