
Highgate School Science Building, North Road

Flood Risk Assessment & Drainage Strategy Report

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Job Number: 26574

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Acronyms	
AOD	Above Ordnance Datum
BGS	British Geological Survey
CIRIA	Construction Industry Research and Information Association
CDA	Critical Drainage Area
EA	Environment Agency
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
SFRA	Strategic Flood Risk Assessment
SPZ	Source Protection Zones
SuDS	Sustainable Drainage Systems
SWMP	Surface Water Management Plan
TW	Thames Water

1 Introduction

Price & Myers have been commissioned to undertake a Flood Risk Assessment (FRA) for the proposed redevelopment at Highgate School.

This FRA has been carried out in accordance with the National Planning Policy Framework (NPPF) and the accompanying Planning Practice Guidance (PPG) “Flood Risk and Coastal Change”. This FRA also incorporates advice and guidance from the Environment Agency (EA), Haringey Strategic Flood Risk Assessment (SFRA, 2015), CIRIA documents and Non-Statutory Technical Standards.

The NPPF states that an appropriate FRA will be required for all development proposals of 1 ha or greater in Flood Zone 1 and for any development within Flood Zones 2 or 3.

The EA’s indicative floodplain map shows that the site is in Flood Zone 1, however the Local Authority has identified the area as a Critical Drainage Area (CDA) and the proposals include a new basement. This assessment will therefore focus on the flood risk to the basement from overland flows and groundwater.

This report will outline the proposed drainage strategy for the site including a detailed SuDS assessment.

2 Site Description and Location

The site is located within Highgate Schools' campus between North Road and Southwood Lane. Refer to Figure 2.1 below.

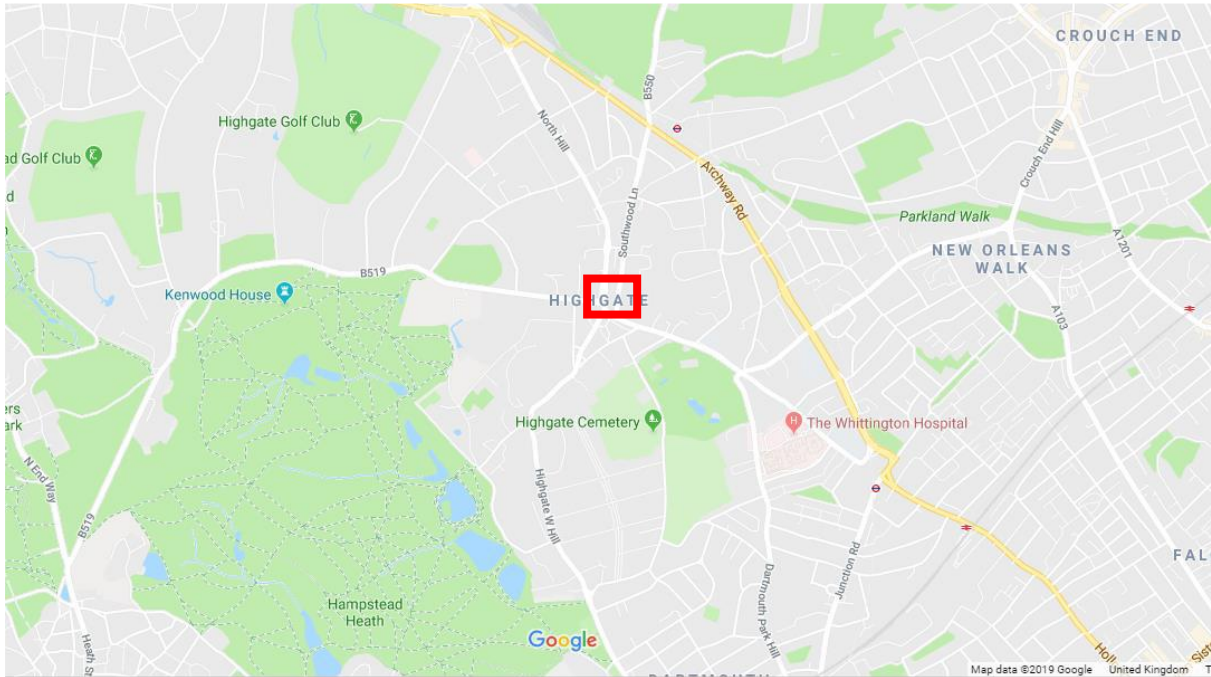


Figure 2.1: Site Location. Source: Google Maps

2.1 Existing Drainage

The existing science block has a combined drainage system and this outfalls into the 229 mm diameter combined water sewer located in Southwood Lane. The science quad courtyard has a separate surface water drainage system which appears to outfall into the 229 mm diameter surface water sewer; this is also located in Southwood Lane.

The garner quad is drained via a network of shallow gullies before discharging into the 225 mm diameter combined sewer located in North Road.

Refer to the CCTV surveys in Appendix A and Thames Water Sewer maps in Appendix B.

3 Development Proposal

The development proposal is to refurbish the existing science and administrative buildings on the North Road campus.

An extension is proposed in the science quad courtyard, adjacent to the science building's east wing. This comprises a 4-storey building with a basement.

An extension is also proposed on the north side of the science block, adjacent to the garner quad. This comprises a 2-storey building with an open colonnade at ground level. The garner quad extension is an extension of the upper levels only, increasing the size of the 1st floor and 2nd-floor science laboratories.

Both the science quad and garner quads are proposed to be relandscaped as part of the works.

4 Flood Risk Assessment

4.1 Flood Risk from Watercourses

The EA's indicative floodplain map shows that the site is located in Flood Zone 1 and is not at risk of fluvial and/or tidal flooding. Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.

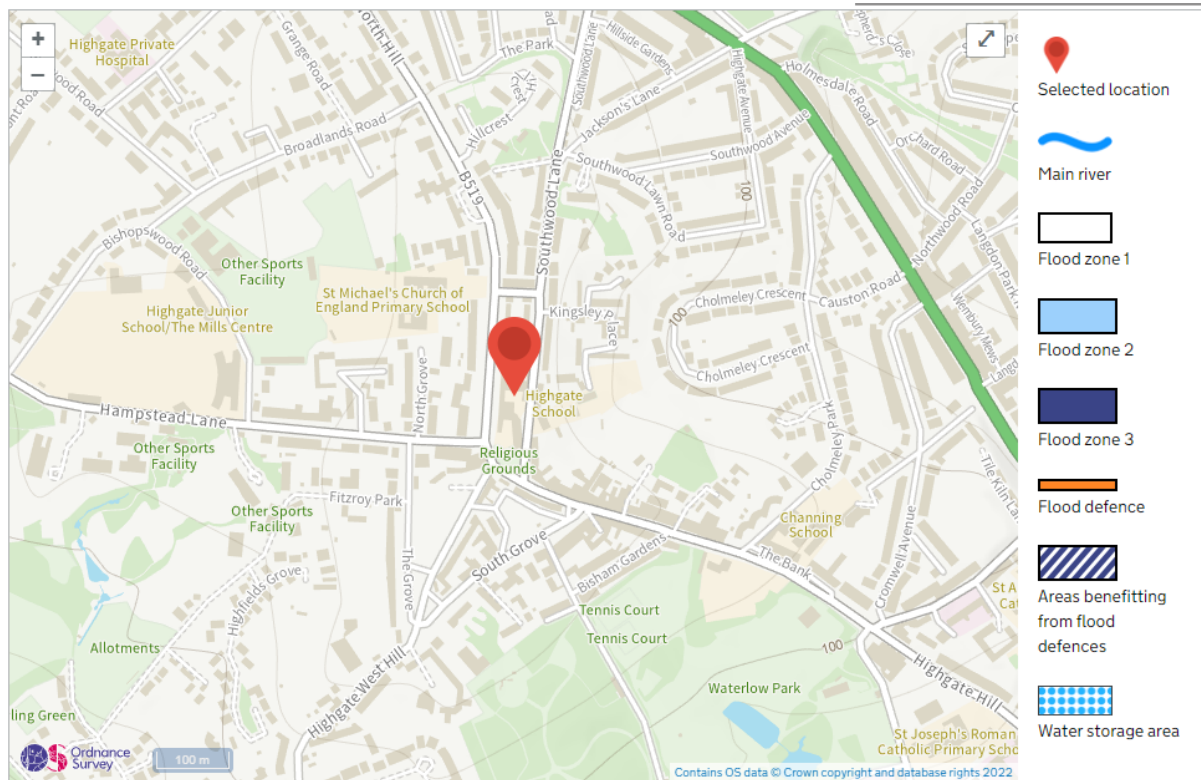


Figure 4.1: Flood risk zone from EA Flood Map for Planning

4.2 Flood Risk from Groundwater

Groundwater flooding occurs when water originating from sub-surface permeable strata emerges from the ground, typically after prolonged rainfall.

The 'Increased Potential for Elevated Groundwater' map in Haringey Council's Surface Water Management Plan (SWMP) indicates that the proposed site is in an area with no recorded historic groundwater flooding and is not susceptible to elevated groundwater levels. An extract from the map is included in Figure 4.2 below.

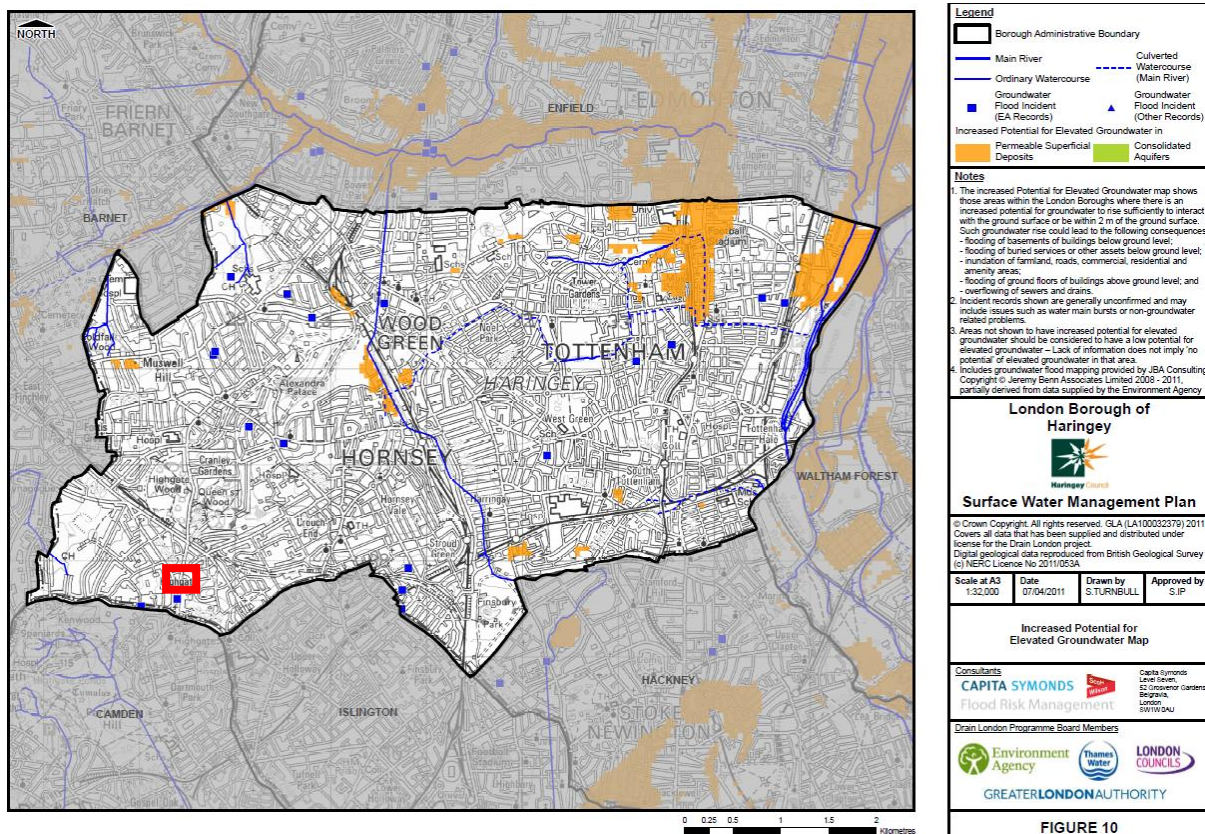


Figure 4.2: Increased Potential for Elevated Groundwater Map (Extract from SWMP)

The British Geological Survey (BGS) map for this area shows that the site is underlain by Bagshot Formation – Sand, as shown in Figure 4.3 below.

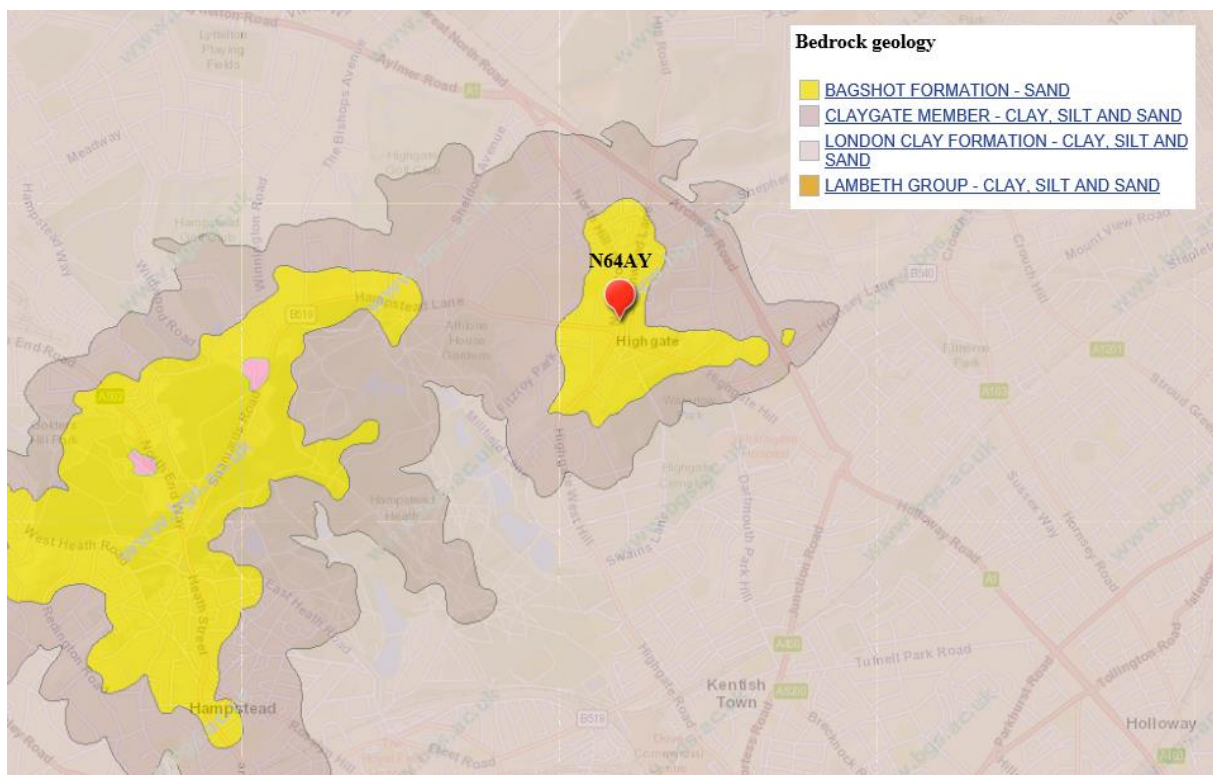


Figure 4.3: Local Geology (Map data British Geological Survey © NERC 2019)

The North London SFRA concludes that "groundwater flooding was found to be a relatively low risk. However, the local geology does increase the risk of groundwater flooding and these risk zones were highlighted" for Haringey.

Listers Geo have carried out a geotechnical site investigation and prepared an accompanying report (reference no: 18.07.019) The investigation revealed that a layer of engineered fill and Made Ground is above Bagshot Formation, extending to depths of 11.50 m bgl, over the Claygate Member to a full depth of 15.1 m.

Groundwater was encountered during intrusive works between 8.0 m and 12.5 m bgl and Claygate Member between 2.5m and 11.5m proven a maximum depth of 15.1 m bgl. Although groundwater was found to be deep and is likely to be below the base of the basement excavation, the proposed basements will be designed to be fully waterproof for the lifetime of the development, further reducing the residual risk of groundwater flooding.

The EA have defined Source Protection Zones (SPZ) for 2000 groundwater sources such as wells, boreholes and springs used for public drinking water supply. The closer the activity, the greater the risk. The EA maps confirm that the site is not located within any groundwater SPZ, as shown in the Figure 4.4. Therefore, it can be concluded that the groundwater flood risk to the site is low.



Figure 4.4: Source Protection Zones (Map data © 2019 OS 100022861)

The underlying Bagshot Formation is classified as a Secondary A aquifer, corresponding with the information shown in Figure 4.5 below. The Claygate Member is classified as Unproductive Strata. According to the site investigation, no significantly elevated concentrations of contaminants were detected in soils at this site, it is considered unlikely that significant contamination will migrate from soils into the groundwater of the Secondary A aquifer. Subsequent migration of contamination to surface water is also considered unlikely, particularly given their proximity from the site.

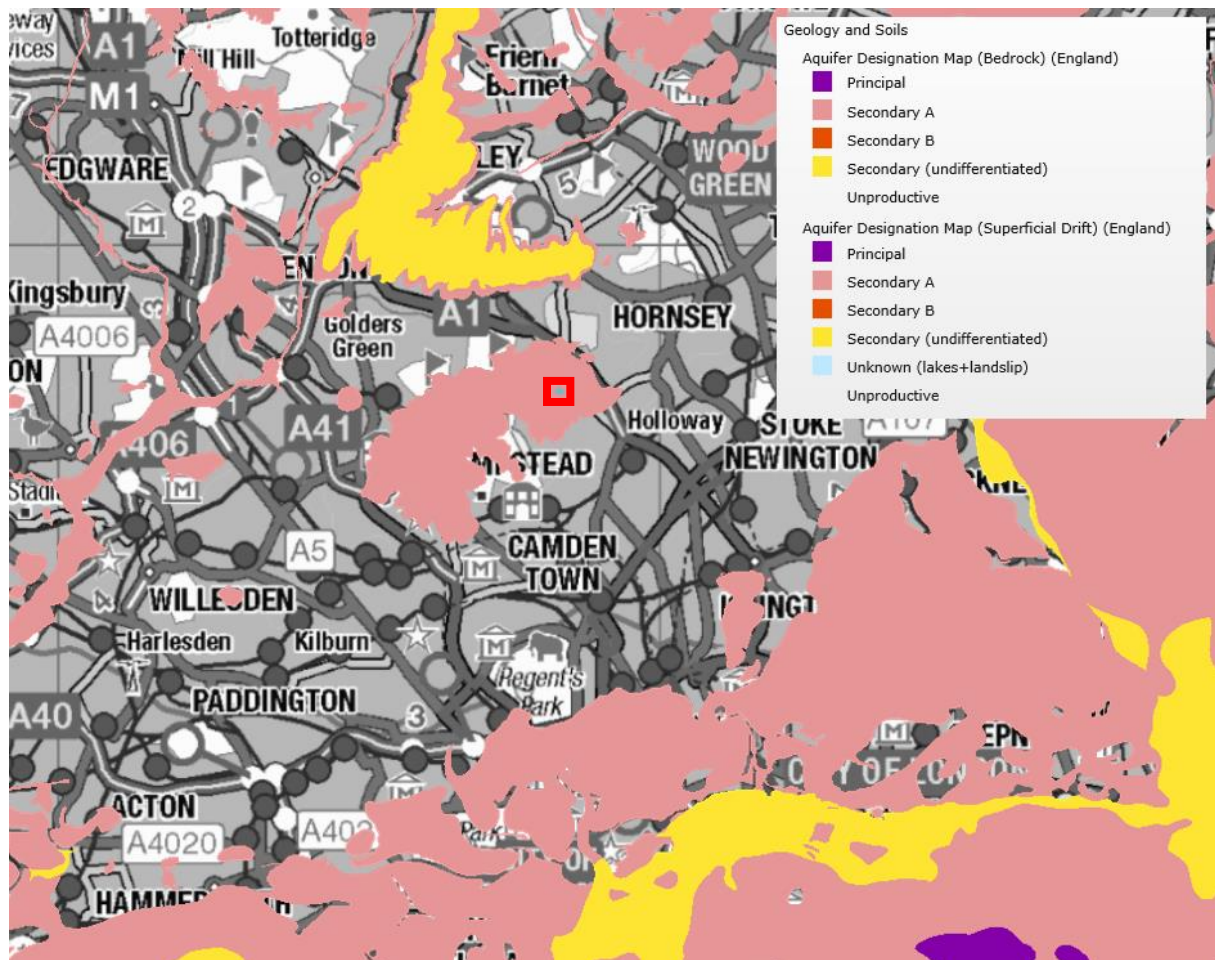


Figure 4.5: Aquifer Designation Map (Map data © 2019 OS 100022861)

4.3 Flood Risk from Surface Water and Overland Flows

Surface water flooding occurs when intense rainfall is unable to soak into the ground or enter a drainage system due to blockages or the capacity of the system being exceeded. Overland flows can also be generated by burst water mains, failed dams and any failure in a system storing or transferring water.

The EA's indicative Surface Water Flooding Map, Figure 4.6, shows that the site is at very low risk of surface water flooding.

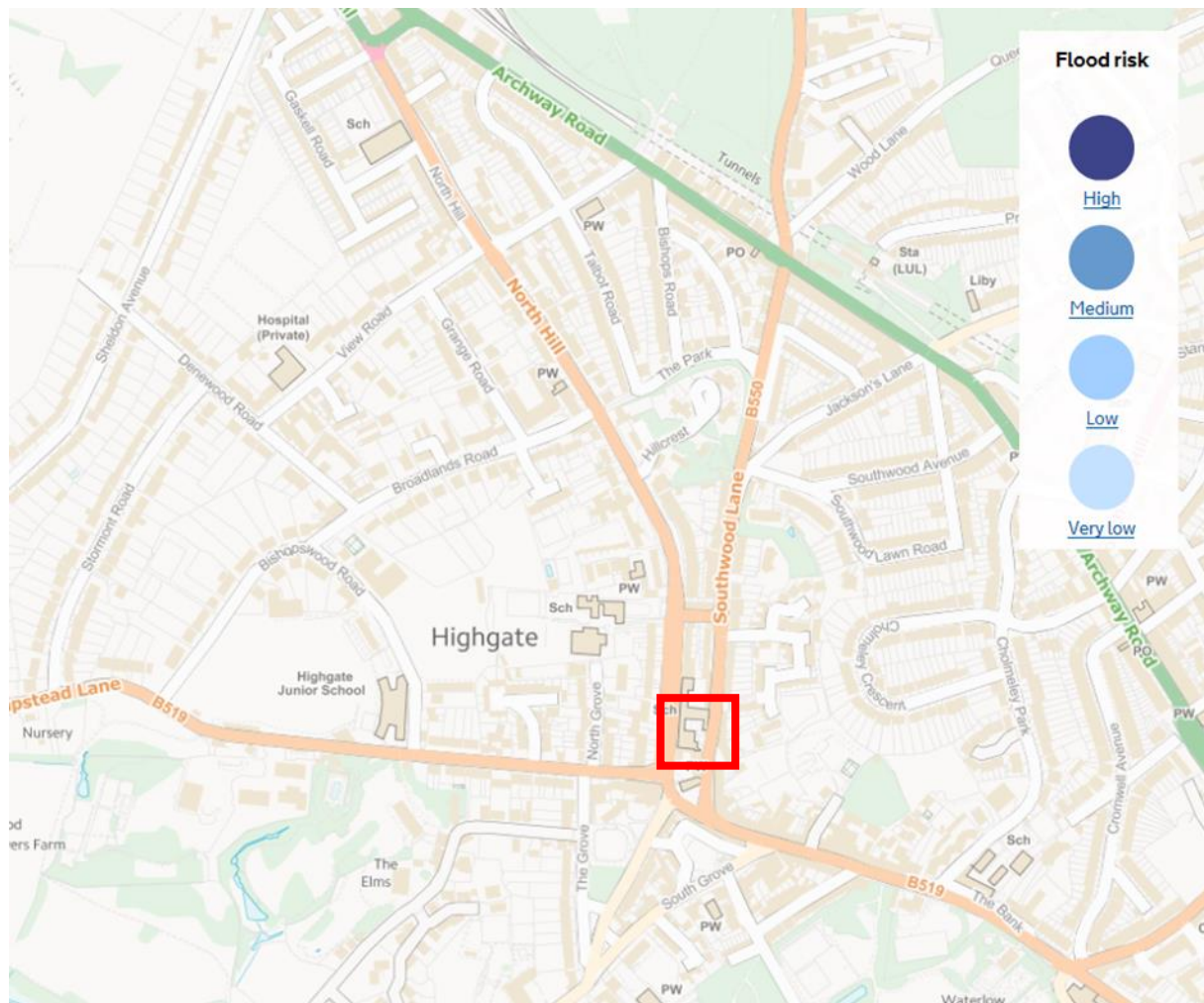


Figure 4.6 Environment Agency Surface Water Flood Risk Map (Map data © 2019 OS 100022861)

The site is located in a Critical Drainage Area (CDA) Group4_062, however, the site is at low risk of surface water flooding. The surface water flood risk identified in this CDA refers to Milton Park and Causton Road, which are located 500 m + away from the site location.

Therefore, the flood risk from surface water and overland flows is considered low.

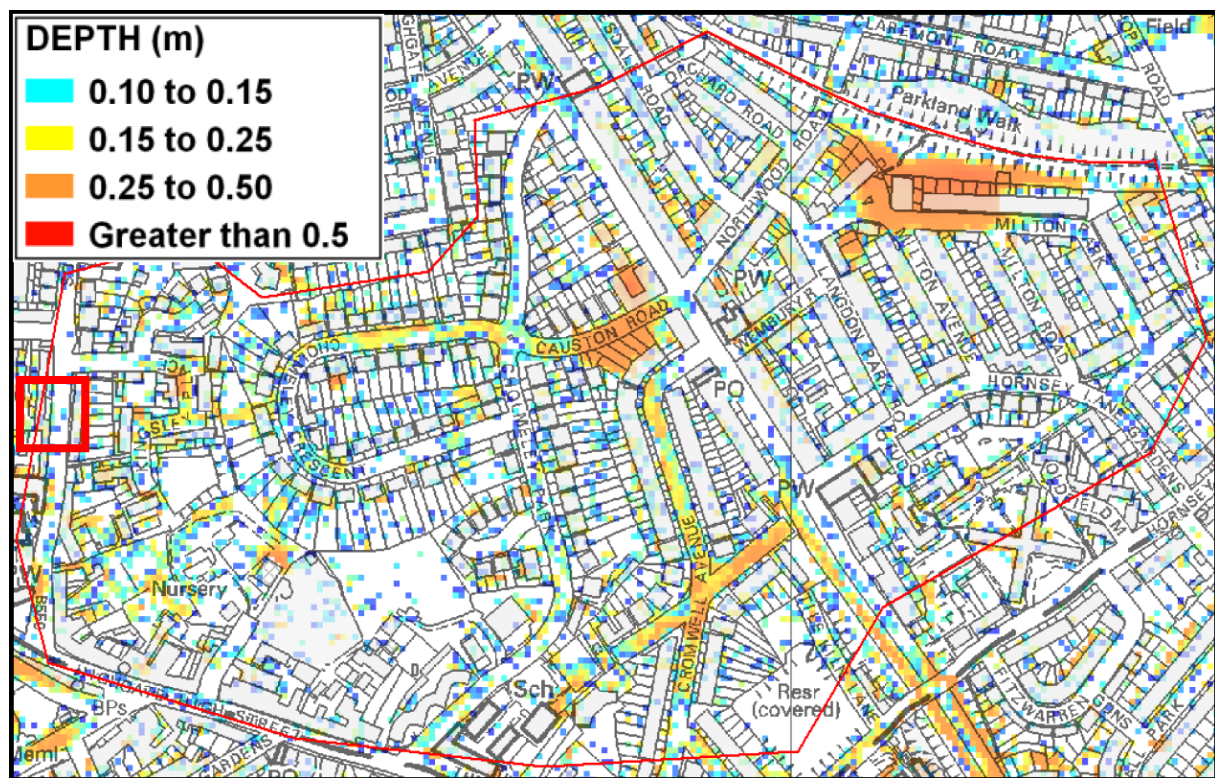


Figure 4.7 Critical Drainage Areas (Extract from SWMP)

4.4 Flood Risk from Reservoirs

The EA provides information on flood risk from reservoirs. The figure below shows that the site is not at risk of reservoir flooding.

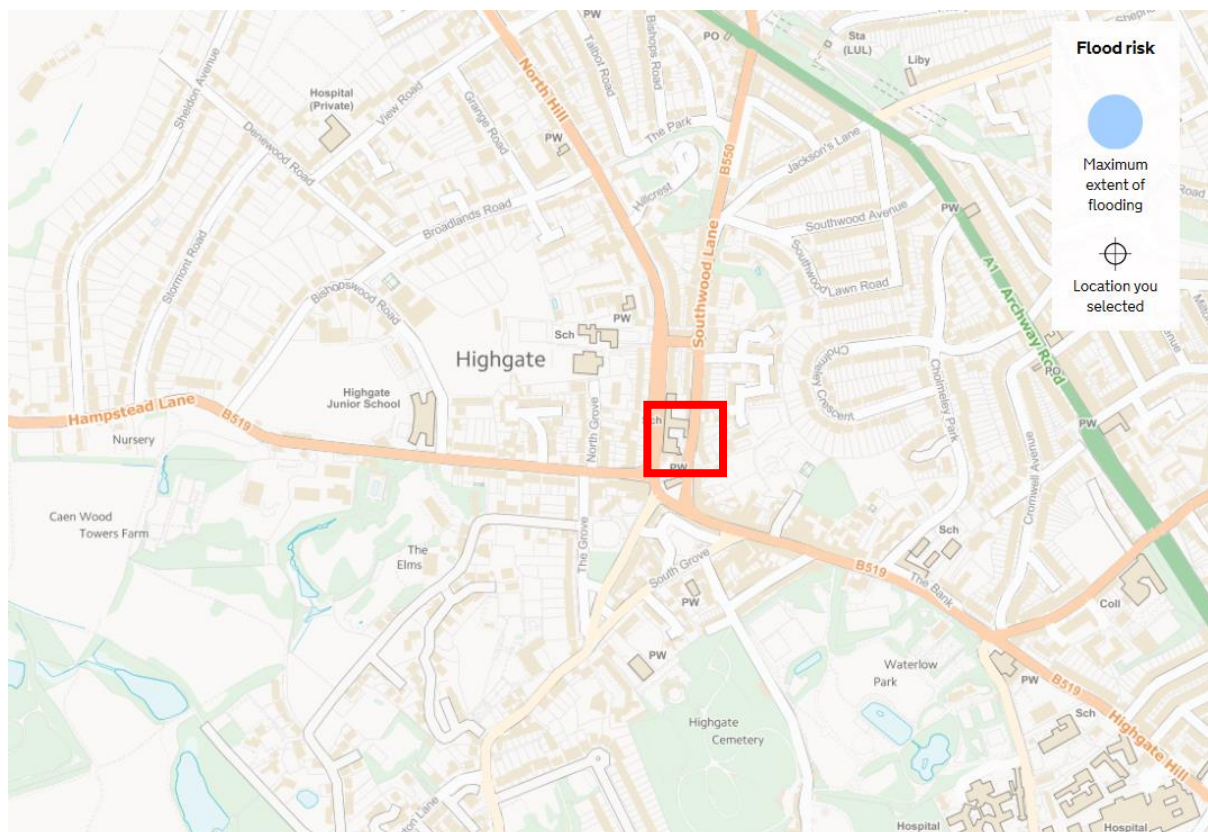


Figure 4.8 Environment Agency Risk of Reservoir Flooding Map (Map data © 2019 OS 100022861)

The EA's information states that reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The Reservoir Act of 1975 ensures that reservoirs are inspected regularly, and essential safety work is carried out.

5 Surface Water Run-Off Assessment

5.1 Existing Run-off

The science building and quad area is approximately 1714 m², of which 1602 m² is impermeable. The existing run-off rate for the design storm events was calculated using the modified rational method as shown below:

$$Q_x = 2.78 \times i \times A$$

Where 'x' is the return period in years, 'A' is the catchment area in ha and 'i' is the rainfall intensity in mm/hr as estimated from MicroDrainage software, using the Flood Studies Report method.

$$Q_1 = 2.78 \times 33.683 \times 0.160 = 14.982 \text{ l/s}$$

$$Q_{30} = 2.78 \times 82.739 \times 0.160 = 36.802 \text{ l/s}$$

$$Q_{100} = 2.78 \times 107.695 \times 0.160 = 47.903 \text{ l/s}$$

5.2 Proposed Run-off

A 15 m² increase in soft landscaped area is proposed within the science quad courtyard.

The courtyard will positively drain into a new surface water drainage system. It is also proposed to reroute the science building rainwater downpipes into this. However, it is not practical or sustainable to reroute the entirety of this roof area due to the existing drainage system's configuration.

Therefore, the contributing area into the new drainage network is 1336 m², of which 1224 m² is impermeable. This area is outlined in Figure 5.1. The existing run-off rates for the design storm events are calculated below:

$$Q_1 = 2.78 \times 33.683 \times 0.122 = 11.424 \text{ l/s}$$

$$Q_{30} = 2.78 \times 82.739 \times 0.122 = 28.062 \text{ l/s}$$

$$Q_{100} = 2.78 \times 107.695 \times 0.122 = 36.526 \text{ l/s}$$

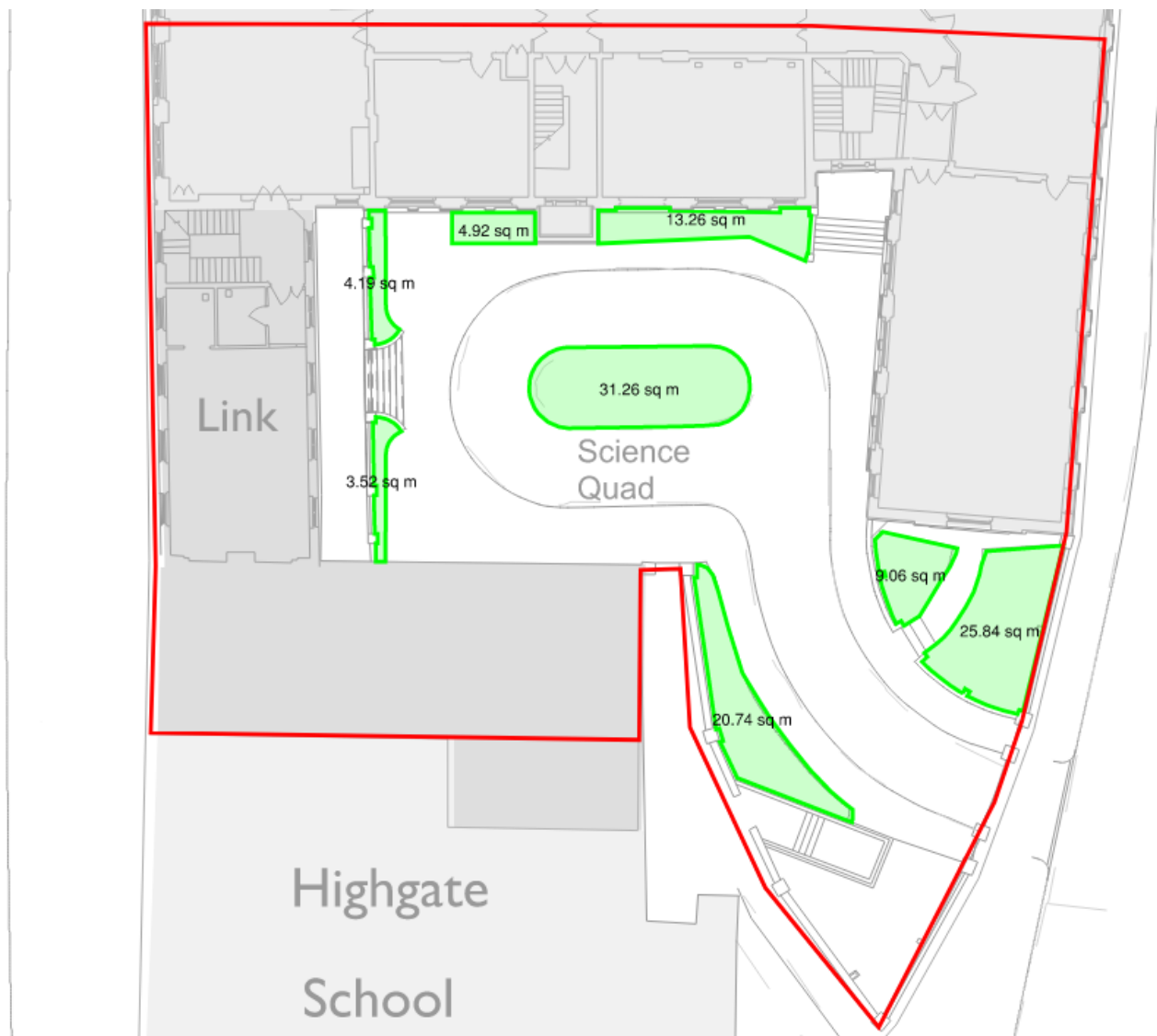


Figure 5.1 Proposed Contributing Area

The greenfield run-off rates for storm events of several different return periods were calculated using the IH124 method and are summarised below. Supporting documentation is contained in Appendix C.

Q_{1GF}	= 0.47 l/s
Q_{30GF}	= 1.27 l/s
Q_{100GF}	= 1.76 l/s

Haringey's SuDS design guidance notes that *"for brownfield sites, where reasonably practical, greenfield rates should be adopted"*. As shown above, the greenfield run-off rates are low. Surface water attenuation to greenfield rates is deemed impractical and would increase flood risk, as a small diameter flow control device will be required to achieve such flow rates. This will fail to meet the Building Regulation Part H requirements for a minimum outlet diameter of 75 mm.

The discharge rate for the proposed development shall be restricted using a 75mm orifice outlet, in compliance with Building Regulations part H. The discharge rates for a number of return periods are given below. Supporting calculations are provided in Appendix D.

Q2 _{pr}	= 4.9 l/s
Q30 _{pr}	= 8.5 l/s
Q100 _{pr}	= 10.2 l/s
Q100+CC _{pr}	= 12.5 l/s

Therefore, a minimum 50% betterment of the existing run-off rates is achieved, which is in accordance with Haringey's SuDS guidance.

5.2.1 Climate Change

The current EA guidance on climate change allowance states that new drainage systems must be designed to ensure that there is no increase in the rate of run-off discharged from the site for the 'Upper End' allowance. The expected lifetime of this development is 100-years; therefore a 40% allowance must be used in the design.

6 SuDS Assessment

In accordance with the EA guidelines, the SFRA, SWMP and CIRIA documents, surface water run-off should be managed as close to its source as possible. The possibility of implementing SuDS at the site was assessed using a hierarchy of preferred surface water management methods. The following paragraphs discuss the various methods in order of that hierarchy and evaluate the site's suitability for each method.

6.1 Store Rainwater for Later Use

Rainwater harvesting promotes the storage and re-use of rainwater collected from roofs and hard-surfaced areas. This type of system contributes to the reduction of run-off rates and volumes within a development. However, storing rainwater for later use is not feasible on the site due to spatial constraints.

6.2 Green Roofs

Green or blue roofs are not appropriate as the existing roofs are difficult to access, which will restrict maintenance accessibility. Also, it is not possible to retrofit a green roof in this instance as the existing structure would not be able to accommodate the additional loading.

6.3 Infiltration

Infiltration testing at four locations approximately 100m east of the site was conducted by Listers Geo consultants in 2018 to BRE 365 standards. Three of the locations failed the infiltration test with only one passing. The only successful test completed was tested in the made ground layer of the ground profile. The results suggest that on average, the ground is not suitably permeable. The layout of the science quad is also such that it is not possible to locate an infiltration system 5 m away from foundations. It is therefore concluded that infiltration techniques are not feasible.

6.4 Attenuation

The courtyard hardstanding and a portion of the existing science building's roof area will drain into a below ground attenuation tank located within the courtyard. 64.8 m³ attenuation storage is required to accommodate the 1 in 100-year storm event plus 40% allowance for climate change.

7 Surface Water Maintenance

The successful implementation and operation of a SuDS system depends on a robust and clear maintenance strategy being implemented. The following measures should form part of the site's proposed management plan.

The SuDS will be maintained by Highgate School and will form part of the overall maintenance regime for the site.

SuDS Element	Maintenance		
	Activity	Required Action	Typical Frequency
Attenuation Tank		Pump repairs	
	Monitoring / Inspections	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are working as they should	Annually or after severe storms
		Inspect and identify any elements that are not operating correctly.	Monthly for three months, then half yearly or as required.
	Regular Maintenance	Remove sediments / debris from catch pits / gullies and control structures	Annually, after severe storms or as required
	Remedial Actions	Repair inlets, outlets, vents, overflows and control structures.	As required
		Realignment of rip-rap	
		Repair/rehabilitation of inlets, outlets and overflows	
		Relevel uneven surfaces and reinstate design levels	
		Replant, where necessary	
		Aerate pond when signs of eutrophication are detected	
		Realign rip-rap or repair other damage	
		Repair / rehabilitate inlets, outlets and overflows.	

Table 7.1 SuDS Maintenance Strategy as taken from The SuDS Manual

8 Foul Water Assessment

The developed design includes two extensions and refurbishment of the existing facilities. The Garner Quad extension is an extension of the upper levels only, increasing the size of the 1st floor and 2nd-floor science laboratories. The Science Quad extension will accommodate a lift and stairs. At basement level, an additional sink, toilet and four showers are proposed.

Foul water appliances in the basement will require pumping due to the proposed levels relative to the sewer. Pumping also minimises the potential flood risk from surcharged sewers.

The number of pupils and staff post-development will remain as existing. Therefore, it is proposed to reuse the existing drainage connections on site and connection to the Thames Water public sewer.

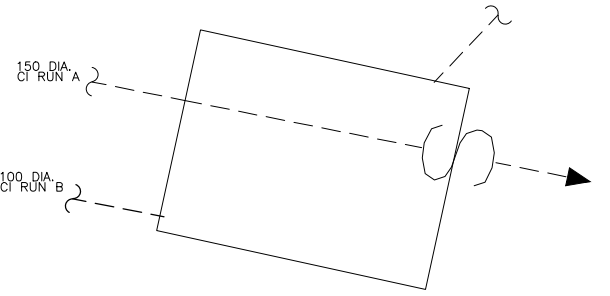
9 Conclusions

- This FRA and drainage strategy report has been produced to accompany the Basement Impact Assessment for Highgate School, North Road, Highgate, London, N6 4AY.
- The site falls within Flood Zone 1 “areas with little or no potential risk of flooding” from watercourses.
- The site is located within a CDA (Group 4_062); however, the site is at low risk of flooding from all sources, including surface water, groundwater, public sewers or reservoirs.
- Therefore, the proposed development has an acceptable flood risk within the terms and requirements of the NPPF.
- It is proposed to attenuate flows from the science quad courtyard and a portion of the existing roof via a below ground cellular tank.
- Surface water runoff will be restricted using an orifice and this will achieve a minimum 50% reduction in runoff.

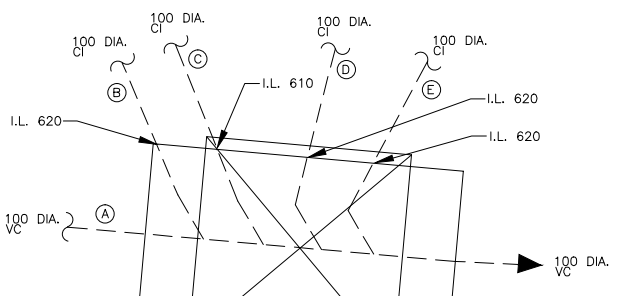
Appendix A

CCTV Drainage Surveys

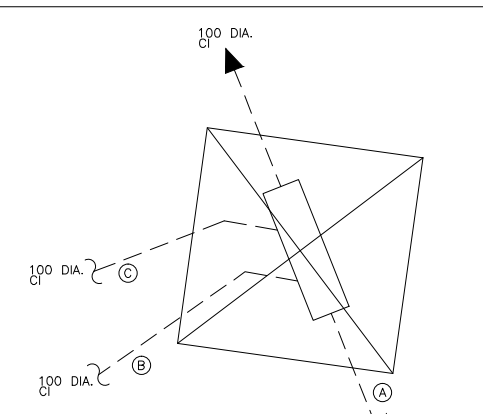
C/S	-
C/O	-
CH/S	-
C.L.	-
INLET	-
OUTLET	-
CONST	-
COND	-
SEAL	-
NOTES	N



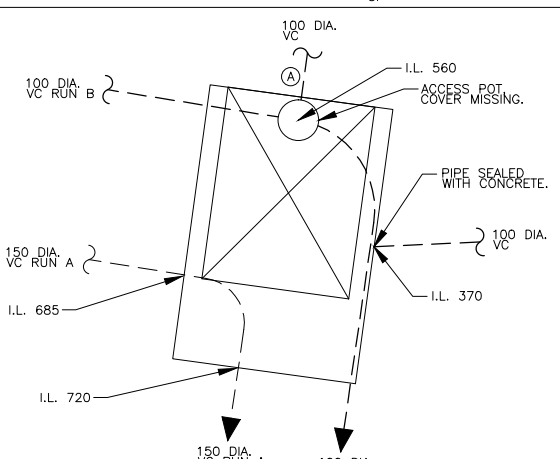
C/S	680 x 680 C.I.
C/O	600 x 600
CH/S	1030 x 600
C.I.	-
INLET	700
OUTLET	720
CONST	BRICK.
COND	REASONABLE
SEAL	SINGLE
NOTES	-



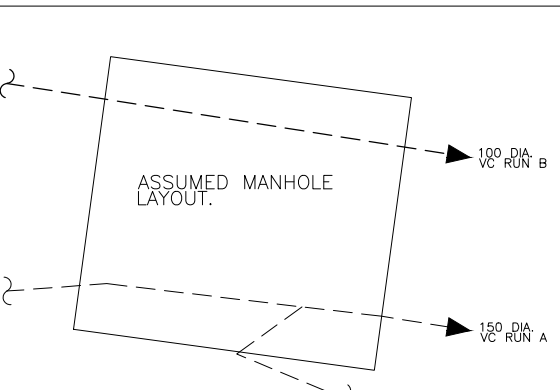
C/S	720 x 720 GALV. MS INFILL
C/O	600 x 600
CH/S	600 x 600
C.L.	—
INLET	460
OUTLET	470
CONST	BRICK.
COND	GOOD
SEAL	DOUBLE
NOTES	—



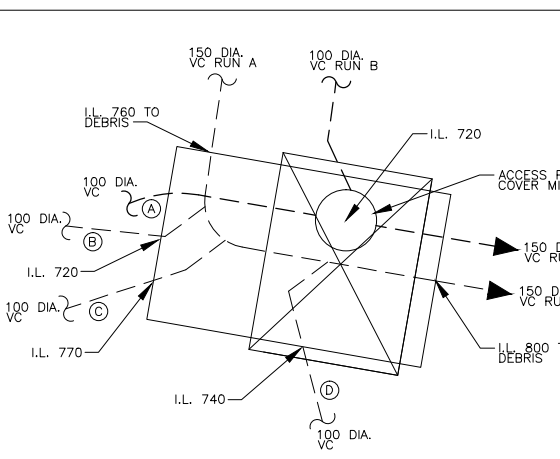
C/S	640 x 490 C.I. (OUTER)
C/S	600 x 440 C.I. (INNER)
C/O	525 x 370
CH/S	915 x 610
C.I.L.	—
INLET	—
OUTLET	—
CONST	BRICK.
COND	REASONABLE
SEAL	SINGLE
NOTES	INNER COVER CORNER BROKEN



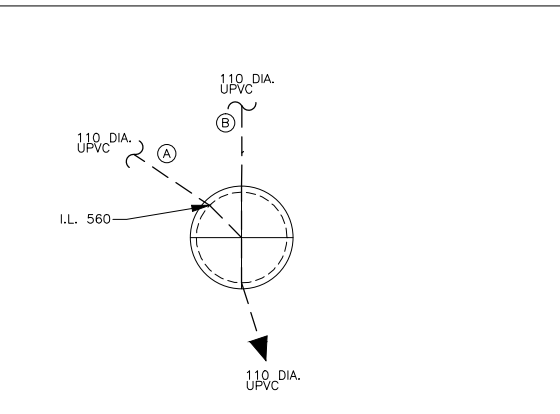
C/S	-
C/O	-
CH/S	-
C.L.	-
INLET	-
OUTLET	-
CONST	-
COND	-
SEAL	-



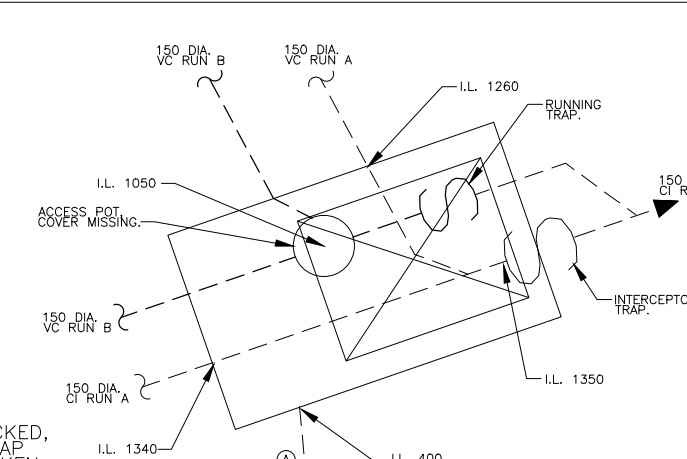
C/S	660 x 500 C.I. (OUTER)
C/S	600 x 450 C.I. (INNER)
C/O	525 x 370
CH/S	920 x 580
C.L.	—
INLET	—
OUTLET	—
CONST	BRICK.
COND	REASONABLE
SEAL	SINGLE
NOTES	INNER COVER BROKEN, 1 COVER CRACKED, 1 SP



C/S	340 DIA. C.I.
C/O	300 DIA.
CH/S	300 DIA.
C.L.	—
INLET	620
OUTLET	625
CONST	PLASTIC
COND	REASONABLE
SEAL	SINGLE
NOTES	—



C/S	645 x 490 C.I. (OUTER)
C/S	600 x 430 C.I. (INNER)
C/O	525 x 370
CH/S	1140 x 680
C.L.	-
INLET	-
OUTLET	-
CONST	BRICK.
COND	REASONABLE
SEAL	SINGLE
NOTES	INTERCEPTOR TRAP BLOC RECAP MISSING, SW TR



SYSTEM 5

ASSUMED ROUTE

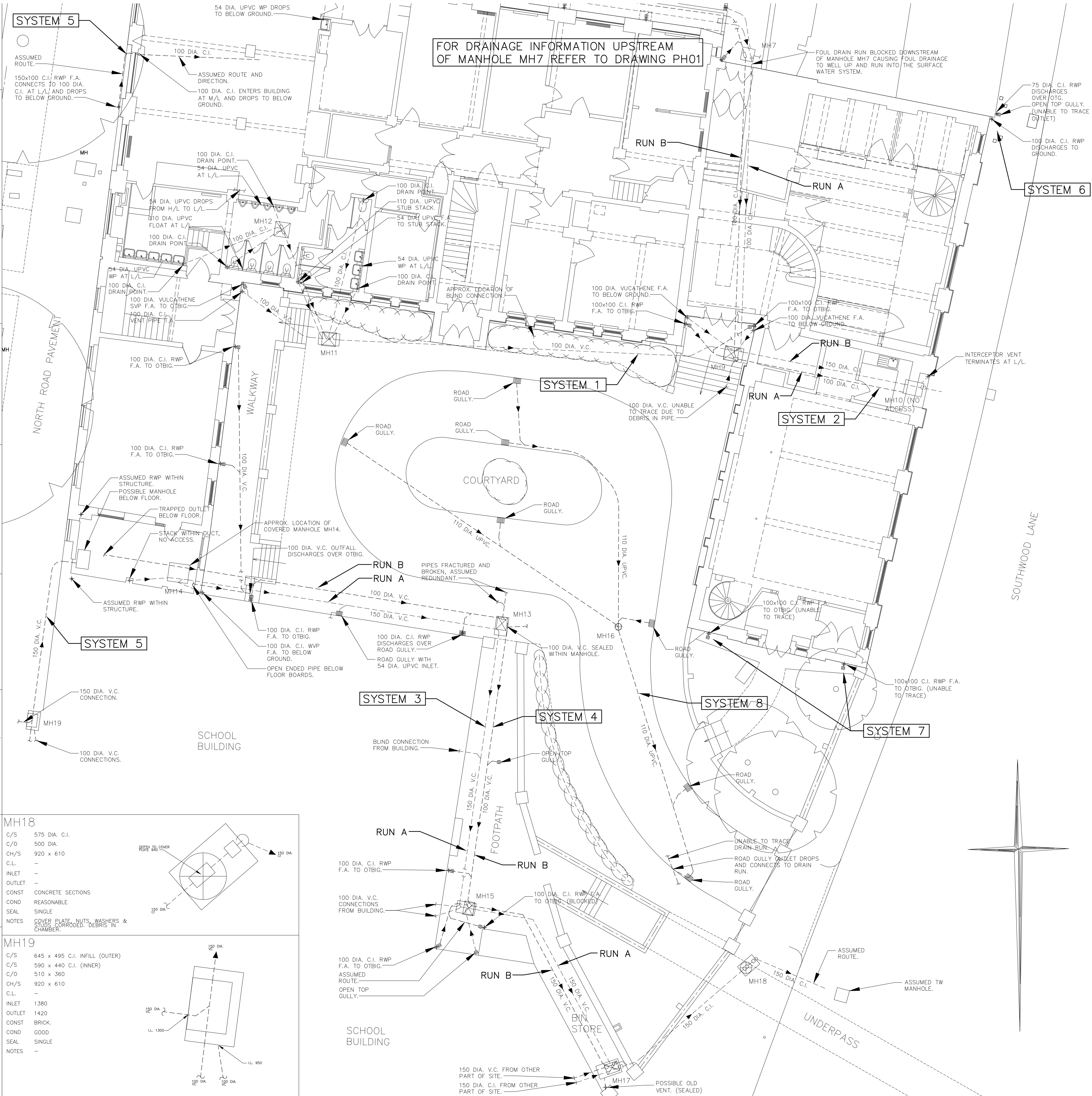
150x100 C.I. RWP F.A. CONNECTS TO 100 DIA. C.I. AT M/L AND DROPS TO BELOW GROUND.

100 DIA. C.I.

ASSUMED ROUTE AND DIRECTION

100 DIA. C.I. ENTERS BUILDING AT M/L AND DROPS TO BELOW GROUND.

54 DIA. UPVC WP DROPS TO BELOW GROUND.

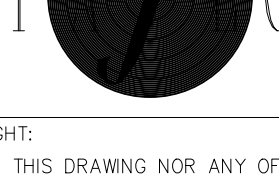


FOR DRAINAGE INFORMATION UPSTREAM
OF MANHOLE MH7 REFER TO DRAWING PH01

SYSTEM 6

THE SPACFLOW (UTILITIES) LTD REPORT DATED APRIL 2012.			
<u>LEGEND:</u>			
-----	BELOW GROUND (SURFACE WATER)		
-----	BELOW GROUND (FOUL WATER)		
=====	ABOVE GROUND (SURFACE WATER)		
=====	ABOVE GROUND (FOUL WATER)		
FH	FIRE HYDRANT	F.A.	FROM ABOVE
IV	ISOLATION VALVE	T.A.	TO ABOVE
WMT	WATER METER	T.B.	TO BELOW
GMT	GAS METER	RWP	RAINWATER PIPE
WM	RIISING WATER MAIN	G	GULLY
GM	RIISING GAS MAIN	RG	ROAD GULLY
GT	GREASE TRAP	OTG	OPEN TOP GULLY
CBP	CABLE PIT	L/L	LOW LEVEL
RE	RODDING EYE	MH	MANHOLE
SVP	SOIL VENT PIPE	FWP	FOUL WATER PIPE
RED	REDUNDANT	BIG.	BACK INLET GULLY
WHB	WASH HAND BASIN	VP	VENT PIPE
CP	CATCHPIT	C.I.	CAST IRON

REV.	DATE	DESCRIPTION	BY	APP.

			Spaflo (Utilities) Limited Watmough House The Parade Meopham Kent DA15 0JL Tel: 01474 814 700 Fax: 01474 815 800		
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HEYNE TILLETTS STEEL					
on behalf of					
HIGHGATE SCHOOL					
PROJECT: HIGHGATE SCHOOL HIGHGATE					
TITLE: RECORD OF CCTV SURVEY OF DRAINAGE					
PROJECT REF:				REV:	
DRAWN: SWW		DATE: APRIL 12		SCALES: NTS	
CHECKED: DWH		APPROVED: DWH			
CLIENT DRG. No:		CAD Q.A.:		PLOT SIZE:	
MICROFILM REF:		SHEET:		DRG. No: PH02	

Appendix B

Thames Water Asset Location Map

Asset Location Search Sewer Map - ALS/ALS Standard/2015 2989764



The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 528436,187538
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.

Appendix C

Greenfield Run-Off Rates

Calculated by:

Site name:

Site location:

Site Details

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

Default

Edited

SOIL type:

HOST class:

SPR/SPRHOST:

Hydrological characteristics

Default

Edited

SAAR (mm):

Hydrological region:

Growth curve factor 1 year:

Growth curve factor 30 years:

Growth curve factor 100 years:

Growth curve factor 200 years:

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default

Edited

Q_{BAR} (l/s):

1 in 1 year (l/s):

1 in 30 years (l/s):

1 in 100 year (l/s):

1 in 200 years (l/s):

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Appendix D

MicroDrainage Calculations

Price & Myers		Page 1
37 Alfred Place London WC1E 7DP		
Date 08/05/2023 18:28 File Attenuation Tank 1 in 2.SRCX	Designed by SRe Checked by	
Innovyze	Source Control 2018.1.1	

Summary of Results for 2 year Return Period

Half Drain Time : 26 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.160	0.160	0.0	4.1	4.1	8.2	O K
30 min Summer	0.183	0.183	0.0	4.5	4.5	9.4	O K
60 min Summer	0.188	0.188	0.0	4.6	4.6	9.7	O K
120 min Summer	0.215	0.215	0.0	4.9	4.9	11.0	O K
180 min Summer	0.210	0.210	0.0	4.9	4.9	10.8	O K
240 min Summer	0.197	0.197	0.0	4.7	4.7	10.1	O K
360 min Summer	0.169	0.169	0.0	4.3	4.3	8.6	O K
480 min Summer	0.145	0.145	0.0	3.9	3.9	7.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	36.866	0.0	10.7	21
30 min Summer	23.320	0.0	13.6	30
60 min Summer	14.149	0.0	16.5	46
120 min Summer	10.207	0.0	23.8	80
180 min Summer	8.076	0.0	28.3	112
240 min Summer	6.722	0.0	31.4	144
360 min Summer	5.065	0.0	35.5	204
480 min Summer	4.084	0.0	38.2	264

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37 Alfred Place																				
London																				
WC1E 7DP																				
Date 08/05/2023 18:28	Designed by SRe																			
File Attenuation Tank 1 in 2.SRCX	Checked by																			
Innovyze	Source Control 2018.1.1																			
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Price & Myers		Page 1
37 Alfred Place London WC1E 7DP		
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Innovyze	Source Control 2018.1.1	

Summary of Results for 30 year Return Period

Half Drain Time : 38 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.441	0.441	0.0	7.5	7.5	22.6	O K
30 min Summer	0.519	0.519	0.0	8.1	8.1	26.6	O K
60 min Summer	0.542	0.542	0.0	8.3	8.3	27.8	O K
120 min Summer	0.560	0.560	0.0	8.5	8.5	28.7	O K
180 min Summer	0.534	0.534	0.0	8.3	8.3	27.4	O K
240 min Summer	0.496	0.496	0.0	7.9	7.9	25.4	O K
360 min Summer	0.419	0.419	0.0	7.3	7.3	21.5	O K
480 min Summer	0.356	0.356	0.0	6.6	6.6	18.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	96.499	0.0	28.1	22
30 min Summer	61.214	0.0	35.7	32
60 min Summer	37.268	0.0	43.5	50
120 min Summer	23.827	0.0	55.7	84
180 min Summer	17.979	0.0	63.0	116
240 min Summer	14.567	0.0	68.1	150
360 min Summer	10.643	0.0	74.6	212
480 min Summer	8.430	0.0	78.8	274

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37 Alfred Place London WC1E 7DP		
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Summary of Results for 100 year Return Period

Half Drain Time : 40 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.596	0.596	0.0	8.8	8.8	30.6	O K
30 min Summer	0.712	0.712	0.0	9.6	9.6	36.5	O K
60 min Summer	0.750	0.750	0.0	9.9	9.9	38.5	O K
120 min Summer	0.792	0.792	0.0	10.2	10.2	40.6	O K
180 min Summer	0.772	0.772	0.0	10.1	10.1	39.6	O K
240 min Summer	0.731	0.731	0.0	9.8	9.8	37.5	O K
360 min Summer	0.639	0.639	0.0	9.1	9.1	32.8	O K
480 min Summer	0.553	0.553	0.0	8.4	8.4	28.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	127.795	0.0	37.3	22
30 min Summer	81.846	0.0	47.8	32
60 min Summer	49.871	0.0	58.2	50
120 min Summer	32.072	0.0	74.9	84
180 min Summer	24.417	0.0	85.6	118
240 min Summer	19.935	0.0	93.1	152
360 min Summer	14.730	0.0	103.2	216
480 min Summer	11.743	0.0	109.8	278

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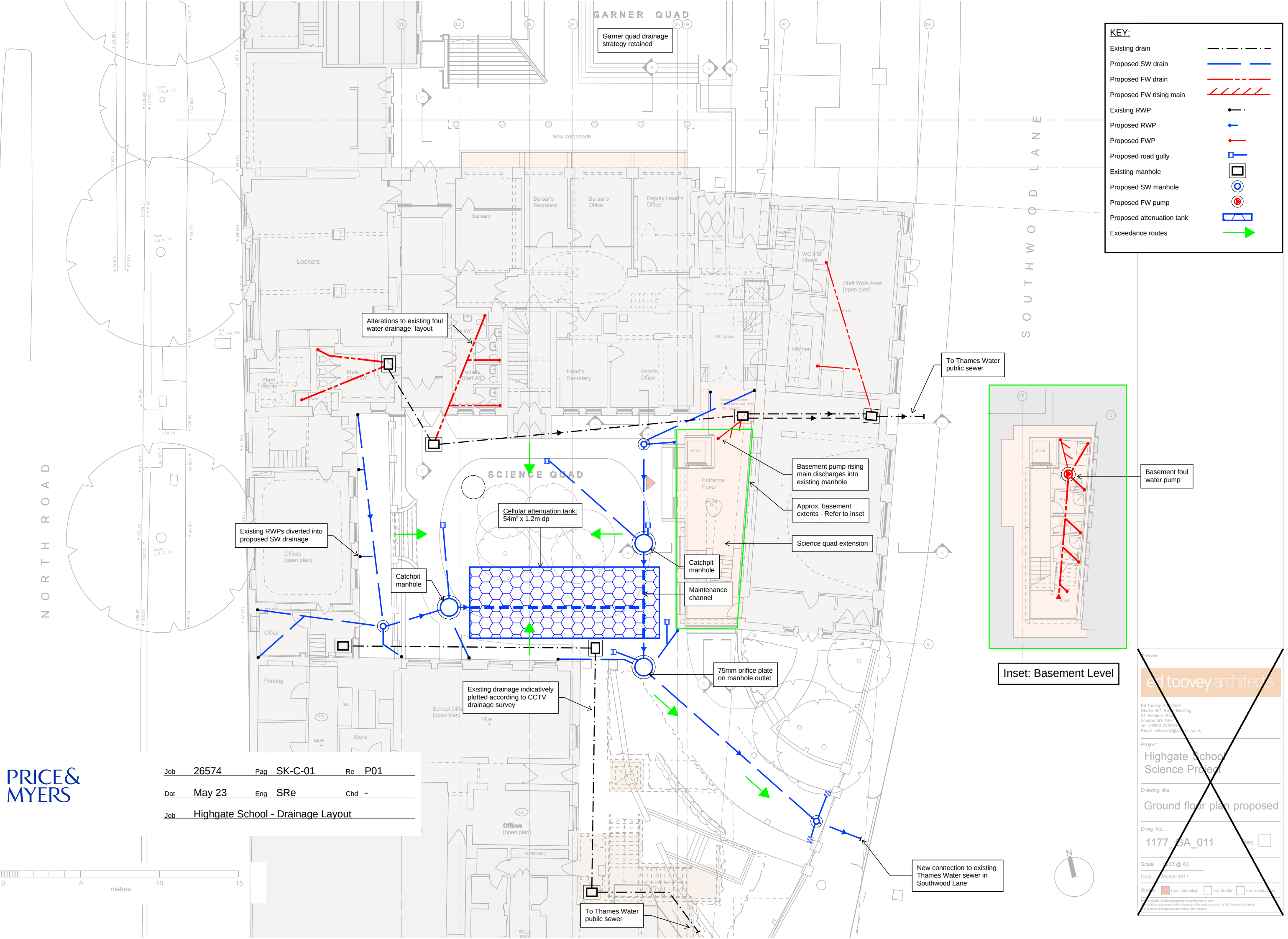
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Appendix E

Proposed Drainage Strategy



KEY:

- Existing drain
- Proposed SW drain
- Proposed FW drain
- Proposed FW rising main
- Existing RWP
- Proposed RWP
- Proposed FWP
- Proposed road gully
- Existing manhole
- Proposed SW manhole
- Proposed FW pump
- Proposed attenuation tank
- Exceedance routes

PRICE & MYERS

Job	26574	Pag	SK-C-01	Re	P01
Dat	May 23	Eng	SRe	Chd	-
Job	Highgate School - Drainage Layout				

Division:

ed toovey architects

Ed Toovey Architects
Studio 401 Rye Building
31 Wentlock Road
London N1 7SH
Tel: 07860 725755
Email: edtoovey@ryebld.co.uk

Project

Highgate School Science Project

Drawing title

Ground floor plan proposed

Drwg. No.

1177_SA_011

Scale

1:200 @ A3

Date

March 2017

Stages

☒ For information ☐ For tender ☐ For construction

Drawn to scale. All dimensions to be confirmed on site.
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