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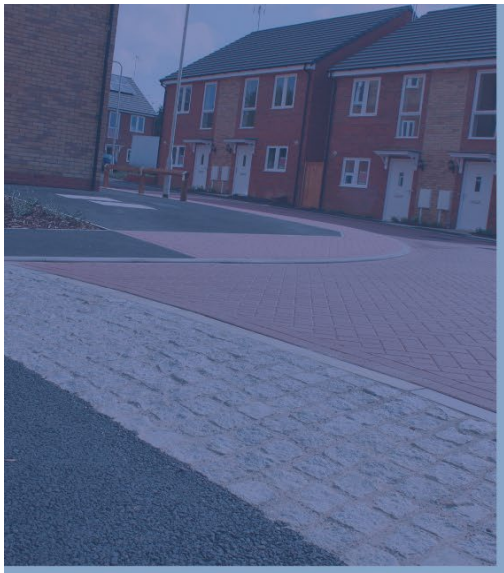

Proposed Synthetic Turf Pitch
Philips High School
Higher Lane
Whitefield
Manchester

Drainage Strategy

Revision 0: March 2026
R-DS-31553-01-0

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1.0 Introduction

1.1 Background

1.1.1 This report is a Drainage Strategy which has been prepared by JPP Consulting Limited for the benefit of our Client, Labosport Ltd (to be utilised in conjunction with the Football Foundation AGP Framework) for a proposed Synthetic Turf Pitch (STP) with associated building and parking provision. The benefit of this report is to our instructing client.

1.1.2 The proposed synthetic turf pitch is located at Philips High School, Higher Lane, Whitefield, as shown in Figure 1.1 below. Whitefield is located in the north of Manchester, approximately 8.6km north of Manchester City Centre, and to the south-east of Bolton. The National Grid Reference for the site is E380150 N405470.

Figure 1.1 Site Location Plan
Source: OpenStreetMap – 10/03/2026

1.2 Objectives

1.2.1 The objective of this report is to advise interested parties regarding the management of surface water run-off arising from the proposals.

1.2.2 This report has been prepared to support a detailed planning application.

2.0 Policy review

2.1 Introduction

2.1.1 The following section of the report details key national and local polices relating to flood risk and drainage, which will inform the assessment of the proposed development.

2.2 Reference documents

2.2.1 This report has been prepared with reference to the following publications:-

- Department for Environment, Food and Rural Affairs (updated July 2025), National standards for sustainable drainage systems (SuDS)
- Ministry of Housing, Communities and Local Government (March 2012, updated December 2024), National Planning Policy Framework
- Ministry of Housing, Communities and Local Government (March 2014, updated September 2025), Planning Practice Guidance 'Flood Risk and Coastal Change'
- Environment Agency (March 2014, updated April 2025), Planning Practice Guidance 'Flood risk assessments: applying for planning permission'
- Environment Agency (February 2016, updated May 2022), Planning Practice Guidance 'Flood risk assessments: climate change allowances'
- Environment Agency (October 2013), Delivering benefits through evidence: Rainfall runoff management for developments
- HM Government (2010), The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, The NBS, Newcastle Upon Tyne
- Wilson, Bray, Cooper (2004), Sustainable drainage systems: Hydraulic, structural and water quality advice, C609, CIRIA, London
- Woods-Ballard et al (2015), The SUDS Manual, C753, CIRIA, London
- CIRIA Report C624 Development and flood risk
- National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage Systems,
- Institute of Hydrology (1999), Flood Estimation Handbook, Institute of Hydrology, Wallingford
- BS EN 752:2008 Drain and sewer systems outside buildings. Hydraulic design and environmental considerations
- BS 8533:2011 Assessing and managing flood risk in development – Code of Practice
- CIRIA Report C635 Designing for exceedance in urban drainage – good practice
- Bury Local Plan (March 2025)

2.3 National policy

2.3.3 National Planning Policy Framework (NPPF)

2.3.3.1 The revised NPPF was published in December 2024, superseding all previous versions, however the presumption in favour of sustainable development remains as the core objective of the document. The document sets out the Government's planning policies for England and details how they are expected to be applied.

2.3.3.2 The paragraphs of most relevance to flood risk and drainage are captured within Chapter 14: Meeting the challenge of climate change, flooding and coastal change. The paragraphs presented within Chapter 14 are categorised as follows:

- 161: introductory paragraph
- 162 to 169: Planning for climate change
- 170 to 182: Planning and flood risk
- 183 to 186: Coastal

2.3.4 Planning Practice Guidance (PPG)

2.3.4.1 In 2016, the Government published the PPG, which provides further information and guidance to support the NPPF. Sections of the PPG relevant to the preparation of this report include:

- Flood risk assessments: applying for planning permission;
- Flood risk and climate change; and.
- Flood risk assessments: climate change allowances.

2.3.5 National standards for sustainable drainage systems

2.3.5.1 The National standards for sustainable drainage systems (SuDS), as published by DEFRA and updated in July 2025, set out the following Standards:

1. Runoff destinations
2. Management of everyday rainfall (interception)
3. Management of extreme rainfall and flooding
4. Water quality
5. Amenity
6. Biodiversity
7. Design of drainage for construction, operation, maintenance, decommissioning and structural integrity.

2.3.5.2 The above standards are underpinned by eleven principles, categorised as follows:

- Natural approach to managing water (1, 2, 3)
- Early and integrated design (4, 5, 6, 7, 8)
- Links with development planning (9, 10, 11)

2.4 Local policy

2.4.1 Bury Local Plan March 2025

2.4.1.1 The Local Plan sets out a long-term framework to manage future growth and development in the Borough up to 2043. Together with the adopted Places for Everyone Joint Plan, Bury's new Local Plan will form a key part of Bury's overall development plan and the policies within them will be used as the basis for determining future planning applications.

2.4.1.2 Policy LP-W1 relates to New Development and Flood Risk. Regarding development proposals for sites that are at flood risk will only be approved where a site-specific FRA confirms:

- The effects of climate change have been taken into account;
- The development will not increase flood risk elsewhere;
- The development will be safe and pass the exception test, if applicable
- There is no adverse impact on the impact of the operation of existing flood defence infrastructure.
- Proposed flood resilience/resistance measures designed to deal with current and future risks are appropriate; and
- Where appropriate, proportionate Sustainable Drainage Systems (SuDS) techniques have been incorporated into the design of the site, in line with Policy LP-W2

3.0 Description and history of the site and development proposals

3.1 Location and description of the site

3.1.1 The proposed synthetic turf pitch is located at Philips High School, Higher Lane, Whitefield, as shown in Figure 1.1 above. The site is bound by the Philips High School Sports Centre building to the north-east, grass playing fields to the south-east and south-west, with Whitefield Golf Course beyond, and Park Lane to the north-west with residential areas beyond.

3.2 History of the site

3.2.1 The proposed location of the synthetic turf pitch currently consists of an existing grass playing field associated with Philips High School.

3.2.2 Aerial imagery dating back to December 2000 is shown in Figure 3.1 below, with the most recent aerial imagery (dated March 2025) shown in Figure 3.2 below. It can be seen that the site has remained comparable during this time.

Figure 3.1 Aerial Imagery dated December 2000
Source: Google Earth Pro – 10/03/2026

Figure 3.2 Aerial Imagery dated March 2025
Source: Google Earth Pro – 10/03/2026

3.3 Site topography

3.3.1 The topographical survey indicates that site levels fall from north-west (at approximately 111.5m) towards south-east (lowest point of approximately 107.2m). The topographical survey is shown on the plan enclosed in **Appendix A**.

3.4 Existing drainage infrastructure

3.4.1 United Utilities' asset plan is enclosed in **Appendix B**. The asset plan identifies no adopted drainage infrastructure within the site boundary. A combined water sewer is shown along Park Lane, to the north-west of the site.

3.4.2 The topographical survey, enclosed in **Appendix A**, does not identify any private drainage associated with the location of the proposed pitch.

3.4.3 Private drainage will be associated with the school buildings located to the north-east of the proposed pitch location. Details of the existing drainage network associated with the school will be confirmed subject to a CCTV survey.

3.5 Geology of the site and ground investigation data

3.5.1 Inspection of the geological maps show that the superficial deposits at the site are Till, Devensian – Diamicton. The bedrock geology which underlies the site is Pennine Middle Coal Measures Formation – Mudstone, siltstone and sandstone.

3.5.2 JPP Geotechnical & Environmental have completed a geotechnical investigation on the site, see report extract enclosed in **Appendix C**. This investigation included a site investigation in November 2025. This investigation found Topsoil, overlying Made Ground, which overlies Devensian Till. Details of the encountered ground conditions are summarised in Table 3.1 below.

Summary of Ground Investigation Information								
Ground Conditions	Depth (m)							
	WS01	WS01A	WS02	WS03	WS04	WS05	WS06	WS07
Topsoil	0.20	0.20	0.20	0.41	0.34	0.10	0.20	0.20
Made Ground	0.90	1.00	0.75	N/A	N/A	N/A	N/A	1.00
Devensian Till	5.00	N/A	5.00	5.00	5.00	4.00	3.00	N/A
Source: JPP G&E report ref. R-SI-30447-01-00								

Table 3.1 Ground Investigation Information

3.5.3 Water strikes were encountered within the majority of locations, between 1.00m to 4.00m bgl, with water levels recorded between 0.68m to 3.61m bgl after 10-15 minutes of observation.

3.5.4 The site investigation included two indicative infiltration tests within WS01A and WS01, at 1.00m bgl and 1.80m bgl respectively. Regarding infiltration the following was summarised:

> *"Indicative infiltration testing was carried out within WS01A at 0.81m bgl (drilled to 1.00m bgl but collapsed upon completion) from groundwater seepage at the base of the borehole within the potential relic Topsoil, and within WS01 at 1.73m (drilled to 5.00m bgl but collapsed upon completion) where a groundwater strike was observed to be rising quickly after completion within the Devensian Till/Glaciofluvial Deposits. Within both WS01 and WS01A, water levels rose roughly 0.02m and 1.10m respectively after more than 200 minutes of observation. Based on the testing and ground conditions encountered, soakaways are not considered to be a viable option for surface water drainage and an alternative positive outfall is considered to be appropriate."*

3.5.5 The Ground Investigation concludes that soakaways are not suitable for the development proposals.

3.6 Proposed development

3.6.1 The proposed development will comprise of a synthetic turf pitch. The proposed development layout is shown on the plan enclosed in **Appendix D**.

4.0 Management of surface water

4.1 Current conditions

4.1.1 The proposed location of the synthetic turf pitch consists of an existing grass playing field, with no existing drainage.

4.2 Surface water drainage outfalls

4.2.1 It is a requirement of The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, to dispose of surface water collected by a development in accordance with the following, listed in order of priority:-

1. Infiltration systems where ground condition permit
2. To watercourses
3. To sewers

4.2.2 Further, Standard 1 of the National standards for SuDS requires runoff to be managed in accordance with the below hierarchy:

- Priority 1: collected for non-potable use
- Priority 2: infiltrated to ground
- Priority 3: discharge to an above ground surface water body
- Priority 4: discharged to a surface water sewer, or another piped surface water drainage system
- Priority 5: discharged to a combined sewer.

4.2.3 Each of these is considered separately below:

4.2.4 Non-potable use

4.2.4.1 Rainwater butts are not considered suitable for the development proposals.

4.2.5 Infiltration systems

4.2.5.1 The geology of the site is described in Section 3.5 above. Infiltration test results show that soakaways are not a viable method for managing surface water at the site.

4.2.6 Watercourses / Main River

4.2.6.1 There are no watercourse located within or adjacent to the boundary of the proposed development.

4.2.7 Sewers

4.2.7.1 As shown on the United Utilities asset plan enclosed in Appendix B, there are no adopted sewers located within the site.

4.2.7.2 Private drainage is associated to the school buildings located to the north-east of the proposed pitch location. It is proposed to connect surface water associated with the pitch to the existing surface water drainage associated with the school site. Details of the existing drainage will be confirmed subject to a CCTV survey.

4.3 Surface water drainage strategy

4.3.1 Surface water discharge rates will be restricted to greenfield equivalent run-off rates to ensure that the rate of surface water run-off from the site does not increase as a result of the proposed development.

4.3.2 The proposed drainage strategy will centre around the permeable sub-base of the synthetic turf pitch, which will offer interception, treatment and attenuation of surface water.

4.3.3 Surface water attenuated on site will outfall to the private drainage network associated with the school buildings to the north-east of the pitch. The direct connection point will be confirmed, subject to further investigation that includes a CCTV survey.

4.3.4 An indicative surface water layout plan is enclosed in **Appendix E**. The drawing shows that surface water attenuation can be accommodated on the site and the method of discharge on the basis that infiltration techniques are not viable. The detailed design parameters of the drainage are described below.

4.4 SUDS assessment

4.4.1 We have considered the suitability of SUDS for use on the development site. The review is set out in below Table 4.1.

SUDS Assessment		
SUDS Technique	**Suitability**	**Justification**
Rain Water Harvesting	No	Not applicable for the development type.
Green Roofs	No	Not applicable for the development type.
Infiltration	No	Underlying geology unviable.
Filter Strips / Filter Drains	No	A sufficient level of water treatment will be provided through the permeable sub-base of the proposed STP.
Swales	No	A sufficient level of water treatment will be provided through the permeable sub-base of the proposed STP.
Bioretention Systems	No	A sufficient level of water treatment will be provided through the permeable sub-base of the proposed STP.
Trees	No	The development proposals simply comprise the proposed STP and car park – no new tress will be planted.

Pervious Pavements	Yes	Surface water attenuation will primarily be provided within the sub-base for the pitch.
Attenuation Tanks	No	Surface water attenuation will be provided within the permeable sub-base of the proposed STP, supplemented by geocellular storage.
Detention Basin	No	Surface water attenuation will be provided within the permeable sub-base of the proposed STP.
Ponds and Wetlands	No	No open spaces.
Trapped Drainage	No	Water treatment will be achieved via the permeable sub-base of the proposed STP.

Table 4.1 SUDS Assessment

4.5 Water quality

4.5.1 Chapter 26 of The SuDS Manual 2015 (CIRIA 753) provides guidance on the methods that should be used to design SuDS to meet the water quality design criteria and good practice design standards. Based on the simple index approach, the pollution hazard indices for different land use classifications are listed in Table 26.2, Chapter 26 of the SuDS Manual. Table 4.2 below summarises the pollution hazard indices that are applicable for residential land use development.

Pollution Hazard Indices for Different Land Use Classifications				
Land Use	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydro-carbons**
Residential Roofs	Very low	0.2	0.2	0.05
Source: Table 26.2 of The SuDS Manual				

Table 4.2 Pollution Hazard Indices for Different Land Use Classifications

4.5.2 'Residential Roofs' is considered to be the most appropriate category for the proposed pitch, due to minimal pollution hazard associated with the proposed synthetic turf pitch, which will have no vehicle movements within its extent.

4.5.3 Table 26.3 of The SuDS Manual shows the mitigation indices for a range of SuDS components for discharges to surface waters. An extract of this is provided in Table 4.3 below for the components relevant to the proposed development.

Indicative SuDS Mitigation Indices for Discharges to Surface Waters			
Type of SuDS Component	**Mitigation Indices**		
	TSS	**Metals**	**Hydro-carbons**
Permeable pavement	0.7	0.6	0.7
Source: Table 26.3 of The SuDS Manual			

Table 4.3 Indicative SuDS Mitigation Indices for Discharges to Surface Waters

4.5.4 As set out in The SuDS Manual, where two or more components are utilised, *"a factor of 0.5 is used to account for the reduced performance of the secondary or tertiary components"*. This will therefore need to be considered where multiple SUDS components are proposed.

4.5.5 Based on the information and assessment set out above, the proposed SuDS features are considered to provide sufficient water treatment for the development proposals.

4.6 Surface water drainage design and management

4.6.1 Proposals are to design the surface water drainage system to accommodate storms up to the 1 in 100 year event plus an allowance of 45% for climate change. The Planning Practice Guidance 'Flood risk assessments: climate change allowances' to the National Planning Policy Framework defines the climate change allowances per catchment area, as set out on DEFRA map of 'climate change allowances for peak rainfall in England'. Table 4.4 below sets out the peak rainfall allowances for the Irwell Management Catchment which the site is located within.

Peak Rainfall Intensity Allowance: Irwell Management Catchment			
Rainfall Event	**Epoch**	**Central Allowance**	**Upper End Allowance**
3.3%	2050s	+25%	+35%
	2070s	+30%	+40%
1%	2050s	+25%	+40%
	2070s	+30%	+45%
Source: Planning Practice Guidance - 2022			

Table 4.4 Peak Rainfall Intensity Allowance

4.7 Existing run-off rates

4.7.1 To reflect the changes in the near surface geology across the site the greenfield run-off rates have been calculated. The method used to calculate the greenfield run off rates is the ICP SUDS and the calculations are presented in **Appendix F**.

4.7.2 The greenfield run off rate, for the application site, is:

Soil type	= 0.450 – obtained from the FEH parameters
SAAR	= 986mm – obtained from the FEH parameters
Urban	= 0.000
Region number	= 10
Proposed drained area	= 0.651ha
Q_1	= 3.7 l/s
Q_{bar}	= 4.3 l/s
Q_{30}	= 7.2 l/s
Q_{100}	= 8.9 l/s

4.7.3 Surface water run-off from the proposed development will be limited to the greenfield equivalent rate of 4.3 l/s via a vortex flow control device.

4.8 Attenuation requirements

4.8.1 Surface water will discharge into the private drainage network associated with the school buildings to the north-east of the pitch location and will be attenuation to a Q_{bar} greenfield run-off rate of 4.3 l/s. To achieve this, surface water will be attenuated within the permeable sub-base of the pitch.

4.8.2 The proposed drained area of the development is 0.659ha, as shown on the plan enclosed in **Appendix G**. Based on the proposed drained area and discharge rate of 4.3 l/s, the storage requirement has been calculated utilising the following parameters.

Rainfall profile	= Flood Estimation Handbook
Drained area	= 0.659ha (6,514m^2)
Pitch length	= 91m
Pitch width	= 67m
Fall across pitch	= 1:100
Depth of permeable sub-base	= 250mm
Porosity of permeable sub-base	= 30%
Control	= Hydrobrake

4.8.3 Due to the proposed gradient of the pitch, check dams have been incorporated into the design, splitting the pitch area into quadrants. Each check dam will be fitted with an orifice plate to restrict flows and ensure efficient use of the storage available within the permeable sub-base of each quadrant of the pitch.

4.8.4 Storage calculations for the 1 in 30 year event have been undertaken based on the parameters set out above and below. Full calculations are enclosed in **Appendix H**. The results confirm that the permeable sub-base of the pitch, with the inclusion of check dams, is sufficient to accommodate all the storage required for the 1 in 30 year event.

Return period	= 1 in 30 year
Climate change	= 0%
Durations	= 60 to 10080 minutes
Max volume of flooding triggered	= 0m^3

4.8.5 Storage calculations for the 1 in 100 year event have been undertaken based on the parameters set out above and below. Full calculations are enclosed in **Appendix I**. The results confirm that the permeable sub-base of the pitch, with inclusion of check dams, is not sufficient to accommodate all the storage required for the 1 in 100 year event.

Return period	= 1 in 100 year
Climate change	= 0%
Durations	= 60 to 10080 minutes
Total volume of flooding triggered	= 45.7m^3

4.8.6 Storage calculations for the 1 in 100 year plus 45% climate change event have been undertaken based on the parameters set out above and below. Full calculations are enclosed in **Appendix J**. The results confirm that the permeable sub-base of the pitch, with inclusion of check dams, is not sufficient to accommodate all the storage required for the 1 in 100 year plus 45% climate change event.

Return period	= 1 in 100 year
Climate change	= 45%
Durations	= 60 to 10080 minutes
Max volume of flooding triggered	= 172m^3

4.8.7 The presented surface water drainage strategy includes check dams to optimise the capacity of the permeable sub-base to attenuate surface water. Geocellular attenuation is also shown, such to accommodate the total flooded volume identified in the 1 in 100 year plus 45% climate change event. A combination of methods for achieving this attenuation can be reviewed and confirmed at detailed design stage.

4.8.8 The indicative surface water drainage layout is shown on the plan enclosed in **Appendix E**.

4.9 Overland flows

4.9.1 Proposals are to design the surface water drainage to accommodate the 1 in 100 year storm event taking into account the predicted future effects of climate. Clearly there is a risk of this storm event being exceeded, albeit this risk is considered very low. In such an event the proposed drainage systems will become overwhelmed and overland flows could occur. Overland flows will be directed to follow the path that overland flows currently follow.

4.9.2 Predicted overland flow routes are shown on the plan enclosed in **Appendix K**.

5.0 Foul water drainage strategy

5.1 There is no foul water drainage associated with the proposal.

6.0 Maintenance

6.1 Surface water drainage maintenance

6.1.1 The proposed surface water drainage infrastructure will comprise a private SuDS system which will be maintained accordingly.

6.2 Foul water drainage maintenance

6.2.1 There is no foul water drainage associated with the proposal.

7.0 Summary and conclusions

7.1 The proposed synthetic turf pitch is located at Philips High School, Higher Lane, Whitefield. The site is bound by the Philips High School Sports Centre building to the north-east, grass playing fields to the south-east and south-west, with Whitefield Golf Course beyond, and Park Lane to the north-west with residential areas beyond.

7.2 The proposed development will comprise of a new Synthetic Turf Pitch (STP), replacing the existing grass pitch within the northern extent of the grass playing fields associated with Philips High School.

7.3 JPP Geotechnical & Environmental have completed a geotechnical investigation at the site. The investigation found Topsoil, overlying Made Ground which overlies Devensian Till. The report concluded that infiltration is not a viable form of drainage for the proposed development, and other methods should therefore be investigated.

7.4 The proposed drainage strategy will centre around the permeable sub-base of the STP, which will offer interception, treatment and attenuation of surface water. Surface water will outfall to the private drainage network associated with the school buildings to the north-east of the pitch location. A direct connection point will be confirmed subject to a CCTV survey.

7.5 Calculations have been based on a flow restriction rate of Q_{bar} 4.3 l/s. Check dams have been incorporated into the design, splitting the pitch area into quadrants. Each check dam will be fitted with an orifice plate to restrict flows and ensure efficient use of the storage available within the permeable sub-base of each quadrant of the pitch.

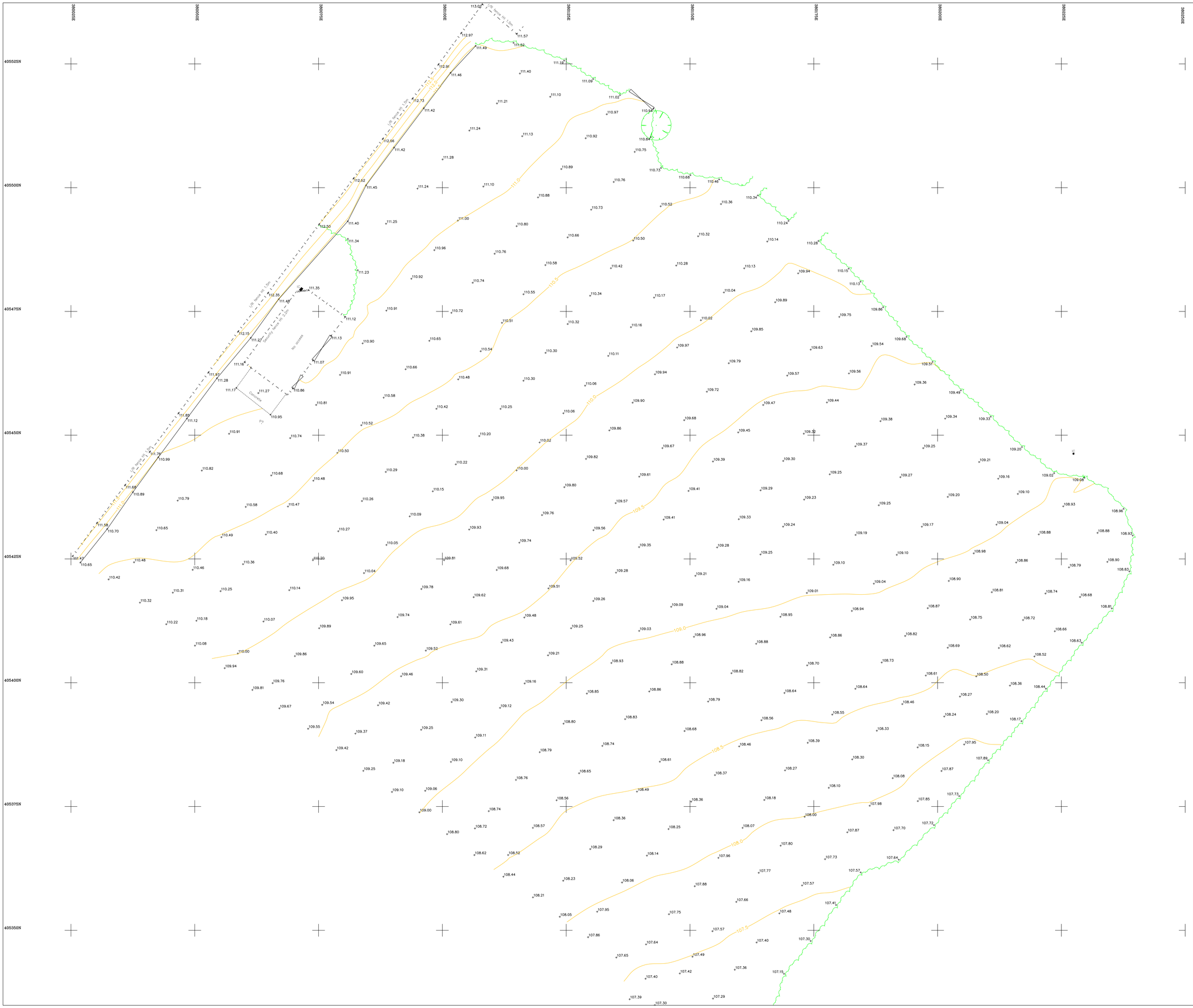
7.6 Geocellular attenuation is also shown, such to accommodate the 172m^3 total flooded volume identified in the 1 in 100 year plus 45% climate change event. A combination of methods for achieving this attenuation can be reviewed and confirmed at detailed design stage.

7.7 Sufficient attenuation will be provided for up to and including the 1 in 100 year plus 45% climate change event.

7.8 There is no foul water drainage associated with the proposal.

Appendix A

Topographical Survey
JPP Surveying drawing no. 30586Y_01



General notes

Grid and levels have been aligned with OS National Grid OSGB36 (15).
All dimensions and levels are in metres unless noted otherwise.

This plan should only be used for its original purpose. JPP accepts no responsibility if supplied to any other party than the original client.

Key

AV	Air Valve	Fl.	Flood Light	P/R	Post & Rail Fence
Bol	Bollard	FW	Foul Water	P/W	Post & Wire Fence
BH	Borehole	g	Gully	RE	Rodding Eye
BL	Bed Level	GV	Gas Valve	RS	Road Sign
BT	BT Cover	Ht.	Height	rwp	Rainwater Pipe
CATV	Cable TV Cover	IC	Inspection Chamber	SV	Stop Valve
C/B	Close Boarded Fence	IL	Invert Level	svp	Soil & Vent Pipe
C/L	Chain Link Fence	I/R	Iron Railing	SW	Surface Water
CL	Cover Level	ko	Kerb Outlet	TL	Traffic Light
Col	Column	LC	Lighting column	TP	Telegraph Pole
El	Elec	LU	Light unit	TW	Top of wall
ER	Earth Rod	MH	Manhole	utl	Unable To Lift
EP	Electricity Pole	Mkr	Marker Post	VP	Vent Pipe
FH	Fire Hydrant	O/H	Overhead	WL	Water Level
FL	Floor Level	PB	Post Box	WM	Water Meter
		Po	Post	wo	Wash Out

Building
Control Station
Tree
Bore Hole
Gate

Bottom of Bank
Top of Bank
Vegetation
Change of surface
Fence
Contours (65.0)
OH Telecom
OH Electric

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- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

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Client	Labosport
Project	Philips High School
Title	Topographical Survey

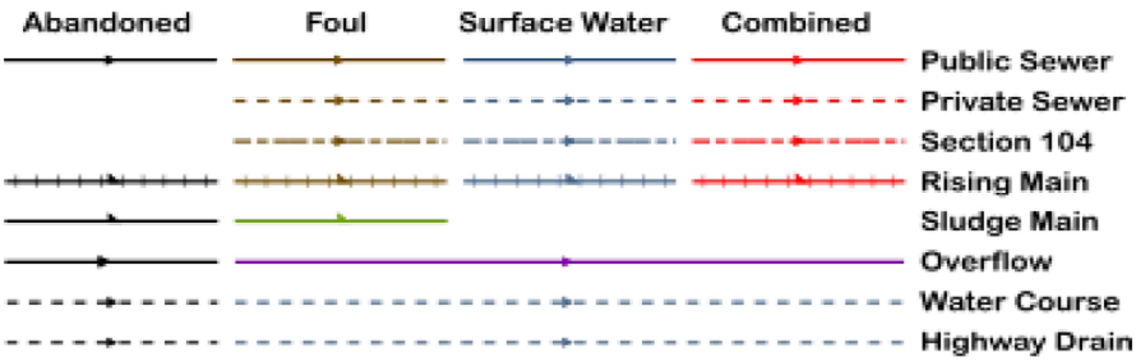
Scale at A0	1:250	Drawn by	JG	Checked by	TB	Date	5/8/25
Status		Project ref	30586Y	Drawing no.	01	Revision	

Appendix B

United Utilities Asset Plan

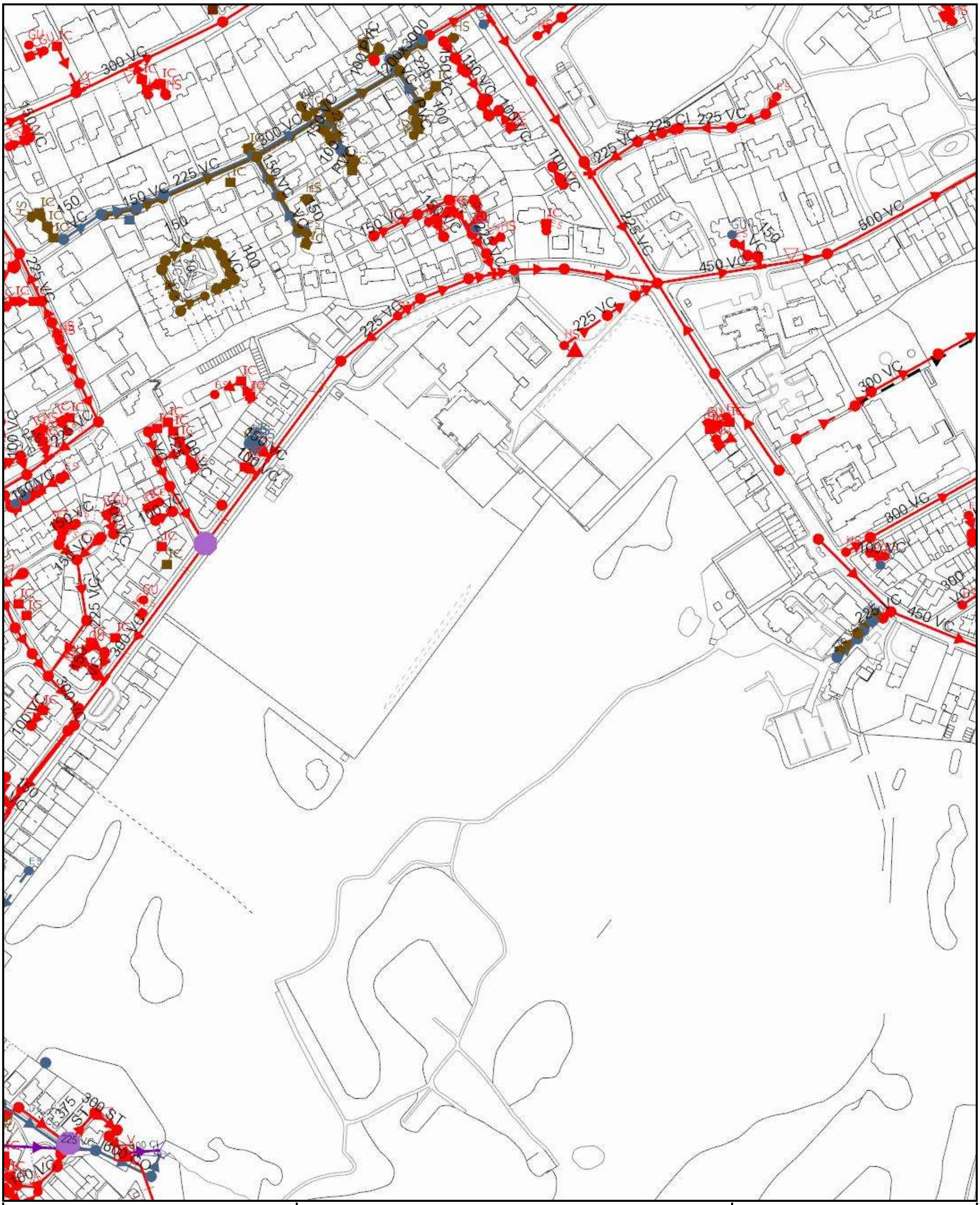
United Utilities
Water for the North West

Wastewater Symbology



All point assets follow the standard colour convention:	red – combined	brown - foul
	blue – surface water	purple - overflow

- Manhole
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- DS Drop Shaft
- OP Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- IC Inspection Chamber
- Bifurcation Chamber
- LH Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- T Network Storage Tank
- V Sewer Overflow
- WwTW Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- DNM Network Monitoring Point
- Change of Characteristic



Scale:	1:4005	**SEWER RECORDS**	United Utilities Water for the North West
Date:	17/07/2025		

Address or Site Reference: Philips High School

Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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United Utilities
Water for the North West

Clean Water Symbology

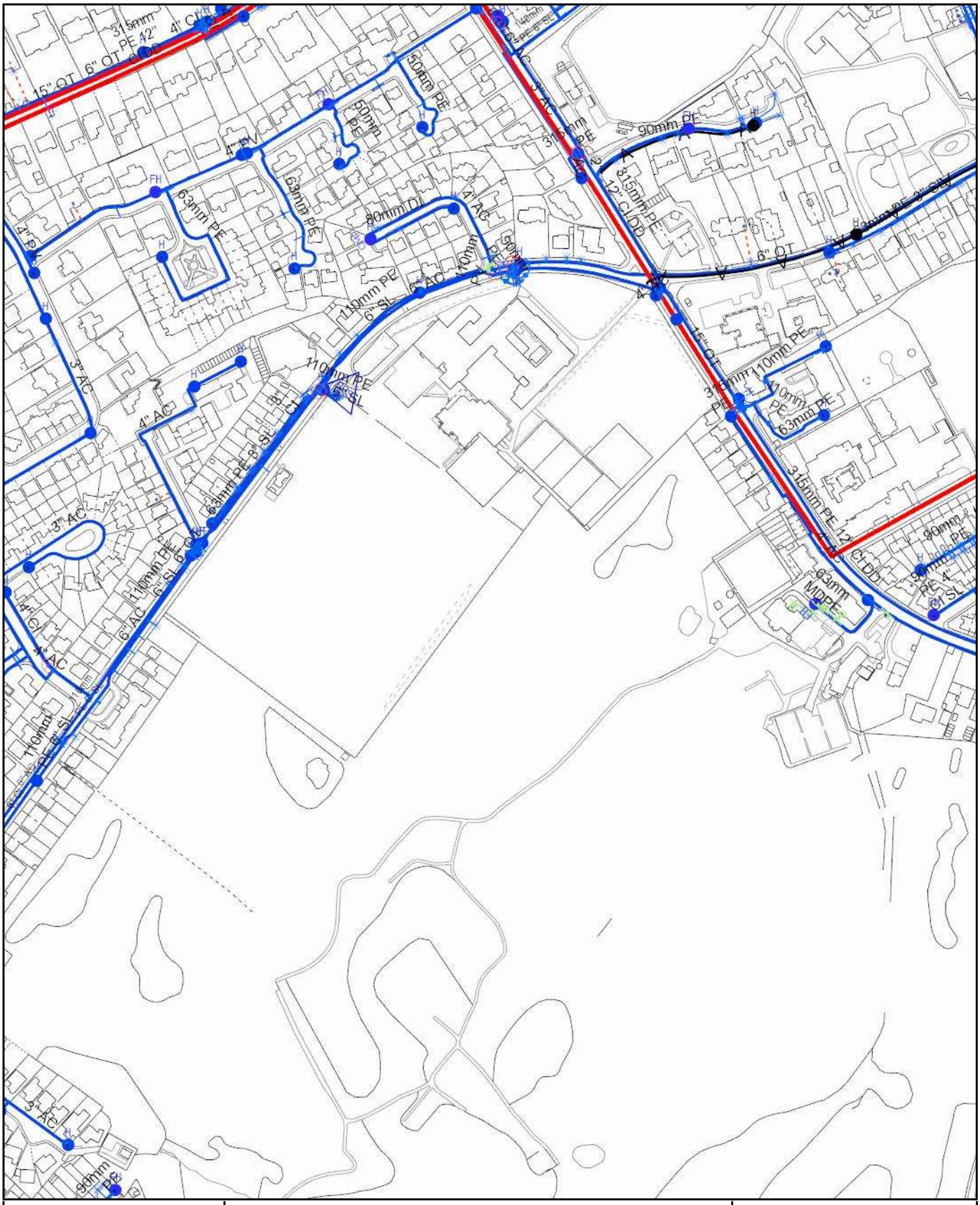
Proposed	Abandoned	Live	
			Distribution Main
			Trunk Main
			Comms Pipe
			Private Pipe
			Concessionary Service
			Raw Water
			LDTM Raw Water
			LDTM Treated Water

- Air Valve
- AC Valve, open
- AC Valve, closed
- CC Valve, open
- CC Valve, closed
- Non Return Valve
- Pressure Management Valve
- OMS Valve
- Stop Tap
- Flow Meter
- Domestic Meter
- Commercial Meter
- Pump
- Hydrant
- Fire Hydrant
- Anode
- Chlorination Point
- De-chlorination Point
- Strainer Point
- Access Point
- Hatch Box
- IP Point
- Sampling Station
- Logger Box
- Bore Hole
- Inlet Point
- Bulk Supply Point
- End Cap
- Site Termination
- Change of Characteristic
- Condition Report

Property Types

- Water Tower
- Valve House
- Booster Pumping Station
- Intake Pumping Station
- Water Treatment Works
- Supply Reservoir
- Service Reservoir
- Impounding Reservoir
- Pipe Bridge

Symbology for proposed assets is the same as above, but shown in green
Symbology for abandoned assets is the same as above, but shown in black



Scale: 1:4005 **Date:** 17/07/2025	**WATER MAINS RECORDS**	United Utilities Water for the North West
Address or Site Reference: Philips High School **Printed by:** Property Searches		

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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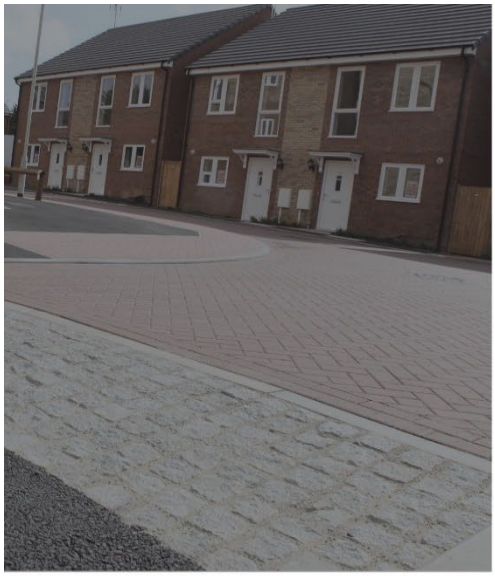
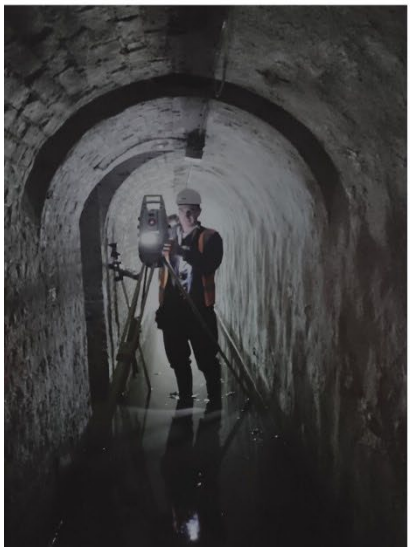
Appendix C

Extract of Ground Investigation
JPP G&E report no. R-SI-30447-01-00

- Structural Engineering
- Infrastructure Design
- Professional Advice
- Development Planning
- Geotechnical & Environmental
- Surveying



Proposed Artificial Grass Pitch
Philips High School
Higher Lane, Whitefield
Manchester
M45 7PH



Site Investigation Report

Revision 00: January 2026
R-SI-30447-01-00

Registered office

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T01-4

1.0 Executive Summary

1.1.1 The following is provided as an overview and should not be relied upon in isolation to the main report.

Summary overview	
Existing site	The proposed pitch is located in the north east of the main playing field, with the school buildings located to the north of the proposed pitch, including a recently constructed (circa 2012) sports hall building immediately adjacent to the north. Adjacent to the north east side of the proposed pitch are trees and hedgerow, the RPZ and influence of these may dictate the positioning of the pitch.
Proposals	Construction of a 3G Artificial Grass Pitch (AGP) with associated fencing, floodlights and infrastructure.
History	Historical OS mapping and aerial images shows the proposed pitch location appears to remain undeveloped fields prior to being playing fields for the school. There was formerly a pond located centrally within the proposed pitch footprint and therefore a potential for Made Ground and possible adverse settlement. There was also a field boundary adjacent to or potentially inline with the south west edge of the proposed pitch. There were slopes recorded down into the playing fields along the south west boundary which could suggest past excavations. The sports hall appears to have been constructed adjacent to the north east of the proposed pitch circa 2012.
UXO	Low risk of encountering buried UXO.
Buried Services	Statutory undertaker's assets show no services recorded to extend within or close to the proposed pitch. These records exclude any private services which could be present. Aerial images indicate the presence of land drainage in the form of a herringbone system, which is fairly distinctive adjacent to the north west of the proposed pitch, with carrier drains directed towards the south eastern boundary of the playing fields. A survey of the existing drainage is recommended both for avoidance purposes and in order to determine a connection, onward connectivity and ultimate outfall for the proposed pitch drainage.
Geology	BGS mapping of the site records superficial deposits of Devensian Till with Glaciofluvial Deposits to the north and north west of the school site. Bedrock geology beneath the proposed pitch and majority of the site is recorded as the Pennine Middle Coal Measures Formation, with an outcrop/intrusion of Nob End Rock across the north east end of the school site and of Newton Heath Sandstone to the south west, coinciding with geological fault lines.
Coal Mining	The site is mapped within a coal mining reporting area and is in close proximity to a development high risk area to the south. We produced a separate Coal Mining Risk Assessment which should be referred to for more details. This assessment was carried out to inform the pitch position, which has now been located as far as possible from the recorded extent of the development high risk zone.
Fieldwork	8 windowless sample boreholes to a maximum depth of 5.00m bgl with indicative infiltration testing within 2 positions, 2 dynamic probes to a maximum depth of 6.00m bgl and 5 TRL Dynamic cone penetration tests to measure insitu CBR values.
Ground Conditions	Each borehole encountered grass over a generally dark brown silty very sandy clayey or very clayey sandy Topsoil with frequent roots and rootlets to depths of between 0.10m – 0.41m bgl. Underlying the Topsoil in WS01/WS01A, WS02 and WS07, Made Ground soils were encountered to depths of between 0.75m to 1.00m bgl, and not penetrated at 1.00m bgl in WS07 located centrally within the location of a infilled former pond, and comprised a firm very sandy slightly gravelly Clay with occasional roots and rootlets with gravels consisting of fine to medium subrounded to subangular brick and sandstone. Borehole WS07 was carried out to target the likely position of a former pond recorded on historical OS mapping and encountered Made Ground soils to beyond the base of the excavation of 1.0m bgl and water in the base causing collapse of the borehole. Beneath the initial Made Ground layer, a potential relic Topsoil layer was encountered at WS01, WS01A and WS02, which comprised a very soft dark brown very sandy slightly gravelly Clay with rare roots and rootlets and rare pockets of fine to coarse sand.

Summary overview	
	Underlying the Made Ground/Topsoil in each of the borehole locations around the outside of the proposed pitch (excluding WS07 located centrally targeting the historic pond, which did not penetrate the Made Ground at 1.00m depth bgl) to the base of each borehole (3.0m to 5.0m bgl) were variable deposits considered to be representative of mapped natural Devensian Till. The soils generally comprised a very soft to firm very sandy slightly silty gravelly Clay with occasional pockets/laminations of fine to coarse sand. Gravels, where encountered, generally comprised fine to coarse subrounded to subangular flint and sandstone. Within the variable clay dominated natural Devensian Till, layers of granular soils were encountered at WS02 (0.75m to 1.68m bgl), WS03 (2.82m to 3.0m bgl) and WS04 (2.93m to 3.46m and 4.00m to 4.63m bgl). These soils were described as a silty to very silty occasionally clayey fine to medium Sand.
Groundwater	Water strikes were encountered within the majority of locations, between 1.00m to 4.00m bgl and standing water levels recorded between 0.68m to 3.61m bgl after 10-15 minutes of observation. Water levels recorded across the site were noted to be highly variable between locations and is likely associated with the variable nature of the Devensian Till and associated granular layers which may hold isolated perched water strikes of varying volume. This correlates with the findings in the ground investigation report undertaken to the north of the site which also report shallow perched water strikes.
Floodlight Foundations	Where soft/loose or variable ground conditions are encountered at founding level, then foundations should be deepened to locate consistent and more competent founding ground conditions and fully penetrating any Made Ground or reworked deposits, to minimise the risk of differential settlement or higher total settlement. This could require deepened foundations based on the ground conditions encountered and more significant following levelling earthworks where levels are increased, particularly where Made ground was encountered at the lowest point in the south east of the site. In addition, shallow groundwater inflows and instability could prevent the construction of successful pad foundations. It is recommended that such excavations are carried out during seasonally drier conditions. An alternative foundation solution may need to be considered such as piling. Pad foundations will require a minimum founding depth of 0.75m (below existing or proposed site levels, where the deepest should apply following any levelling earthworks) and at least 0.3m penetration into the natural firm clays of the Devensian Till and deepening through any Made Ground (encountered to depths of between 0.45 and 1.0m bgl along the south east side of the pitch) and deepened where required for the influence of trees and hedgerow based on low volume change potential. Foundations should also be deepened to locate consistent soils at formation level and through any potentially loose or soft/low strength deposits, as evident at the location of WS01, WS02, WS03 and WS04, where the ground conditions were found to be much softer in comparison to the other borehole locations.
Concrete Classification	DS-1 ACEC AC-1 for the Made Ground. DS-1 ACEC AC-2z for the Devensian Till.
Pitch Construction	For formation onto natural Devensian Till clay deposits, a CBR of 3% is recommended for design and to be reassessed during construction and <2% where any Made Ground/reworked soils are encountered and remains at formation level, encountered during our investigations within the south east of the pitch and centrally associated with the former pond, to depths of between 0.45m and in excess of 1.0m bgl (not penetrated in the presumed former backfilled pond) and ground improvement required to improve the CBR and reduce the potential for adverse settlement. There is potential for variability in formation soils between granular deposits and clays and also for softened clays. Ground improvement such as lime/cement stabilisation and introduction of geogrid reinforcement is likely to be appropriate to improve the CBR and reduce the potential for adverse settlement where the pitch spans between natural and Made Ground soils and between variable clay and granular deposits, particularly following any levelling earthworks. The formation soils are susceptible to softening and it is recommended that earthworks are carried out during seasonal drier conditions and adequate protection of excavated and exposed soils during earthworks. Some trenching excavation may be prudent to establish the full extent, depth and composition of this possible backfilled pond to assess whether the soils may need to be removed and replaced or whether a ground improvement near surface such as geogrid or lime stabilisation may be sufficient.

Summary overview	
	There is also potential for near surface soils close to trees to be affected by seasonal shrinkage and swelling. Root ingress beneath the pitch could result in uplift and damage to the surfacing and therefore root barriers may need to be installed around the perimeter of the pitch, close to trees. This will be subject to advice from a tree specialist to confirm any root protection zones and influence.
Infiltration Potential/ Surface Water Drainage	Infiltration testing indicates that near surface cohesive soils of the Devensian Till are not considered viable for the use of infiltration systems due to the low permeability of the soils encountered. It should also be noted that shallow groundwater was encountered across the site which is likely to restrict the effective depth of any soakaways and potentially precluding their use. Herringbone drains are understood to be present beneath the existing playing field, with carrier drains shown to flow down slope to the east towards the golf course. It may be possible to connect into the existing outfall or provide a new outfall for the proposed pitch drainage. Enquiries, inspection and potentially surveys would be recommended to establish any existing drainage routes close to the proposed pitch, including land drainage, and ultimate outfall, with a view to connecting into for the proposed pitch. Any outfall will be subject to seeking necessary approvals and a detailed drainage strategy.

Table 1.1

3.4.2 Bedrock geology beneath the proposed pitch and majority of the site is recorded as the Pennine Middle Coal Measures Formation (mudstone, siltstone and sandstone), with an outcrop/intrusion of Nob End Rock (sandstone) across the north east end of the school site and of Newton Heath Sandstone to the south west.

3.4.3 To the north and to the south of the site two fault lines are mapped which converge to the northwest. These are shown to be faults within the rockhead and have displaced the coal seam on the north of the fault to deeper depths.

3.5 Land and Historic Feature Designations

3.5.1 There are no listed buildings, scheduled monuments or heritage sites within close proximity to the site.

3.5.2 The site is within an SSSI impact zone for the Rochdale Canal (SSSI) to the east and on the edge of the impact zone for Nob End (SSSI) and Ashdough (SSSI) to the west.

3.5.3 The site is recorded to be within a Nitrate Vulnerable Zone for surface water.

3.6 Hydrology and Hydrogeology

3.6.1 The Devensian Till deposits are designated as a Secondary (undifferentiated) Aquifer, with the nearby Glaciofluvial Deposits designated as a Secondary A Aquifer. The underlying bedrock Pennine Middle Coal Measures Formation, Nob End Rock and Newton Heath Sandstone are designated as Secondary A Aquifers. The site is recorded to have medium groundwater vulnerability.

3.6.2 The site is not recorded within a groundwater Source Protection Zone (SPZ).

3.6.3 Groundwater is considered likely to be fairly deep within the underlying bedrock deposits, however there were shallow perched water strikes encountered within the granular Glacial Deposits of the boreholes carried out adjacent to the north east of the proposed pitch for the sports hall building, which suggest that similar conditions maybe encountered on the subject site.

3.6.4 There are no obvious watercourses or drains within or in close proximity to the site, with the closest features appearing to be a pond within the Golf Course adjacent to the south east corner of the playing field. The nearest watercourse is mapped as the Bradley Brook, recorded to originate to the south of the M60.

3.7 Flood Risk

3.7.1 According to Environment Agency mapping, the site is within a Flood Zone 1 with a low risk of fluvial flooding.

3.7.2 There is recorded to be no chance/very low risk of surface water flooding across and around the proposed pitch location. With some areas of low to high chance around the school buildings to the north. A Flood Risk Assessment is unlikely to be required.

4.0 Fieldwork

4.1.1 Our fieldwork was carried out on the 20th November 2025 and comprised the following:

- 8 windowless sample boreholes to a maximum depth of 5.00m bgl.
- 2 indicative infiltration tests within WS01A at 1.00m bgl, and within WS01 at 1.80m bgl.
- 2 dynamic probes to a maximum depth of 6.00m bgl.
- 5 TRL Dynamic Cone Penetration tests to measure insitu CBR values.

4.1.2 Each position was scanned using a cable avoidance tool and signal generator prior to positioning and proceeding. Utilities searches were also obtained prior to the fieldwork to confirm the position of potential underground services (excluding private services). These are presented in Appendix E.

4.1.3 The approximate location of each exploratory hole position is shown on the plan (Drawing 01) and included within Appendix A.

5.0 Ground Conditions

5.1 Soils

Topsoil

5.1.1 Each borehole encountered grass over a generally dark brown silty very sandy clayey or very clayey sandy Topsoil with frequent roots and rootlets to depths of between 0.10m – 0.41m bgl (average thickness of 0.23m).

Made Ground

5.1.2 Underlying the Topsoil in WS01, WS01A, WS02 and WS07, Made Ground soils were encountered to depths of between 0.75m to 1.00m bgl (average thickness of 0.41m) The initial/only layer in all locations where encountered generally comprised a firm very sandy slightly gravelly Clay with occasional roots and rootlets with gravels consisting of fine to medium subrounded to subangular brick and sandstone.

5.1.3 A potential relic Topsoil layer was encountered underlying the initial Made Ground layer in WS01, WS01A, located in the south east corner, and WS02, located centrally along the south west side of the pitch, where levels are lowest and considered likely to be a result of past levelling earthworks. Such deposits generally comprised a very soft dark brown very sandy slightly gravelly Clay with rare roots and rootlets and rare pockets of fine to coarse sand. Gravels consisted of fine to medium rounded to subrounded flint. Borehole WS07 was an additional position carried out in an attempt to target the likely position of a former pond recorded on historical OS mapping and encountered Made Ground soils to beyond the base of the excavation of 1.0m bgl and water in the base causing collapse of the borehole.

5.1.4 Hand pocket penetrometer measurements converted to kPa within the clayey Made Ground soils returned values of between 15kPa to 40kPa, indicating generally very low strength soils.

Devensian Till

5.1.5 Underlying the Made Ground or Topsoil in each of the boreholes positioned around the outside of the proposed pitch (excluding WS07 located centrally to target the historic pond, which did not penetrate the Made Ground at 1.00m depth bgl), to the base of each borehole (3.0m to 5.0m bgl) were variable deposits considered to be representative of mapped natural Devensian Till. However, there is a possibility that in some areas of the site this could initially represent reworked deposits given the potential for historical cut and fill to have taken place on site.

5.1.6 The soils were variable in nature but generally comprised a very soft to firm very sandy slightly silty gravelly Clay with occasional pockets/laminations of fine to coarse sand. Gravels, where encountered, generally comprised fine to coarse subrounded to subangular flint and sandstone.

5.1.7 Within the variable clay dominated natural Devensian Till, layers of granular soils were encountered at WS02 (0.75m to 1.68m bgl), WS03 (2.82m to 3.0m bgl) and WS04 (2.93m to 3.46m and 4.00m to 4.63m bgl). These soils were described as a silty to very silty occasionally clayey fine to medium Sand.

5.1.8 Within WS01 to WS04, hand pocket penetrometer measurements converted to kPa within the cohesive Devensian Till ranged from 0kPa to 90kPa, with sporadic outliers of 115kPa and 135kPa removed from the data set, indicating variable extremely low to high strength soils. **These soils were highly varied in nature and may potentially have been reworked, giving rise to the observed low strength.**

5.1.9 At the locations of WS05 and WS06, which were situated in the north west of the proposed AGP, hand pocket penetrometer measurements converted to kPa where possible within the cohesive Devensian Till ranged from 65kPa to 190kPa, , indicating medium to very high strength soils. **The nature of the soils and recorded strengths at the locations of WS05 and WS06 were significantly different from those recorded elsewhere on site, indicating that these soils could be insitu natural.**

5.1.10 SPT 'N' values recorded within the natural Devensian Till ranged between 3 to 14 from 1.00m to 4.00m bgl indicating highly variable soils with low to medium strength. Below 4.00m, SPT values increased to between 37 to 40 at 5.00m bgl, indicating very high strength/dense soils at 5.00m bgl. At the locations of WS05 and WS06 at 4.00m and 3.00m respectively, SPT 'N' values were recorded as refusals, with 50 blows for less than the full test penetration of 300mm.

Dynamic Probes

5.1.11 Dynamic probe DP1 was carried out adjacent to WS01 and WS01A in the south eastern corner of the proposed AGP. Blow counts were initially recorded as between 0 to 1 per 100mm penetration to 2.80m bgl, with 2 blows recorded at 1.90m bgl. Below 2.8m bgl, blow counts increased to 2 to 3 blows per 100mm down to 4.40m bgl, which broadly correlates with the recorded shear strengths and SPT results within WS01. Below 4.4m to the base of the probe at 6.0m bgl, blow counts steadily increased to between 4 to 8 blows per 100mm.

5.1.12 Dynamic probe DP2 was carried out adjacent to WS06 in the north east corner of the proposed pitch. Blow counts were initially between 0 to 2 blows per 100mm penetration to 0.80m bgl before increasing slightly to 3 to 5 blows per 100mm down to 2.90m bgl. Below 2.90m blow counts increased sharply to 13 blows per 100mm down to 3.10m bgl before increasing further to blow counts of 16, 19, 22, 21 and 27 consecutively down to 3.60m bgl, before refusal at 3.7m bgl. WS06 encountered a very dense Sand from 2.95m bgl, which is considered to be a granular layer within the Devensian Till and broadly correlates with the results from the dynamic probe.

5.2 Groundwater

5.2.1 Water strikes were encountered within the majority of positions with a summary of the strikes provided in the following table.

Summary of Groundwater Observations			
Location	**Depth of Strike (m bgl)**	**Water Level upon Completion (m bgl)**	**Observations**
WS01	3.00	1.73	Collapsed to 1.80m bgl upon completion.
WS01A	1.00	0.81	Groundwater seepage at the base of the borehole. Collapsed to 0.80m bgl upon completion.
WS02	3.00	0.83	Collapsed to 1.10m bgl upon completion.
WS03	4.00	0.72	Collapsed to 0.80m bgl 5 minutes after completion.
WS04	3.00	2.62	Recovered as damp from 2.59m bgl.
WS05	4.00	3.61	No groundwater strikes during drilling, presumed seepage at the base of the borehole.
WS07	1.00	0.68	Groundwater seepage at the base of the borehole. Collapsed to 0.84m bgl upon completion.

Table 5.2.1

5.2.2 Groundwater levels recorded across the site were noted to be highly variable between locations and is likely associated with the variable nature of the Devensian Till and associated granular layers which may hold isolated perched water strikes of varying volume. This correlates with the findings in the ground investigation report undertaken to the north of the site which also report shallow perched water strikes.

5.2.3 The volume of water and speed of ingress within the shallow perched water strikes is likely to vary seasonally and during periods of persistent rainfall which may impact excavations and dewatering requirements depending on the time of year construction works commence.

7.5.11 There is also potential for near surface soils close to trees and major vegetation to be affected by shrinkage and swelling. A root barrier may be appropriate to reduce the potential for root ingress beneath the pitch footprint. The position of the pitch may be subject to the Root Protection Zones and influence of nearby trees and hedgerow adjacent to the north east. Consultation with a tree specialist is recommended in this regard and to determine the Root Protection Zone and influence. Future overhang should also be considered for ongoing maintenance requirements.

7.5.12 All topsoil or organic material should be removed from the proposed footprint of the AGP and any obvious soft or loose spots excavated and backfilled with a suitable fill. Reference should be made to the compaction requirements outlined in Highways England Volume 1: Specification for Highway Works Series 600: Earthworks.

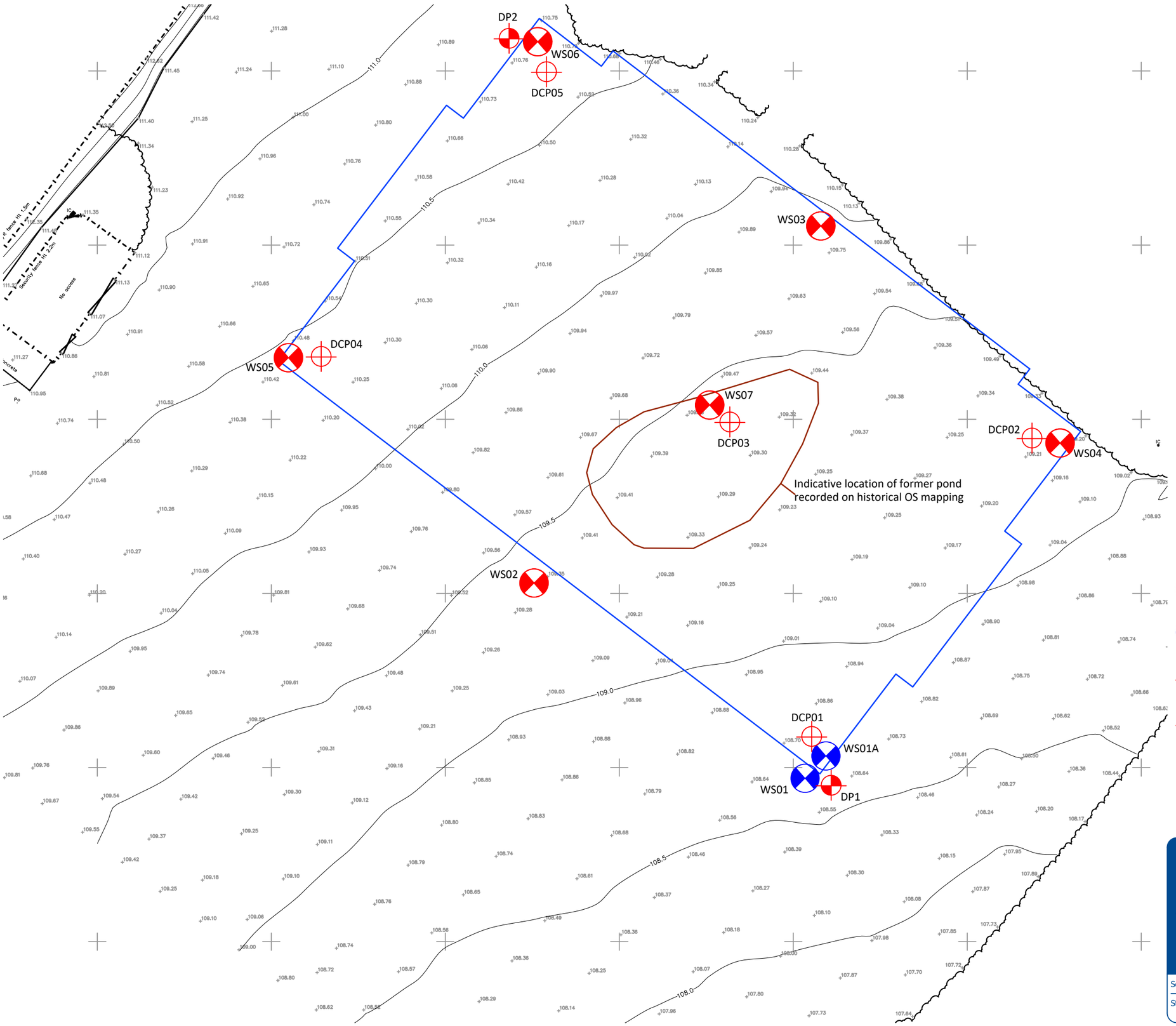
7.6 Infiltration Potential and Surface Water Drainage

7.6.1 Indicative infiltration testing was carried out within WS01A at 0.81m bgl (drilled to 1.00m bgl but collapsed upon completion) from groundwater seepage at the base of borehole within the potential relic Topsoil, and within WS01 at 1.73m (drilled to 5.00m bgl but collapsed upon completion) where a groundwater strike was observed to be rising quickly after completion within the Devensian Till/Glaciofluvial Deposits. Within both WS01 and WS01A, water levels rose roughly 0.02m and 1.10m respectively after more than 200 minutes of observation. Based on the testing and ground conditions encountered, soakaways are not considered to be a viable option for surface water drainage and an alternative positive outfall is considered to be appropriate.

7.6.2 There are no obvious watercourses or drains within or in close proximity to the site, with the closest features appearing to be a pond within the Golf Course adjacent to the south east corner of the playing field. Aerial imagery suggests that the existing grassed playing field is underlain by land drainage in the form of a herringbone system, which is fairly distinctive adjacent to the north west of the proposed pitch, with carrier drains directed towards the south eastern boundary of the playing fields. There is also likely private drainage in place for the nearby pavilion adjacent to the north west corner of the proposed pitch location and for the sports building to the north, as well as for the golf course to the east.

7.6.3 United Utilities records show a pumping station recorded within the school site to the north east of the buildings, with a private combined sewer from this connecting to the public combined sewer at the junction of Higher Lane, Park Lane and Pinfold Lane to the north east of the school. This could provide a potential outfall and there may be an existing private network closer to the pitch that connects into this.

7.6.4 Enquiries, inspection and potentially surveys would be recommended to establish any existing drainage routes close to the proposed pitch, including land drainage, and ultimate outfall, with a view to connecting into for the proposed pitch. Any outfall will be subject to seeking necessary approvals and a detailed drainage strategy.



Base drawing:
Topographical survey by JPP Surveying
drawing number: 30586Y, dated 05/08/2025

KEY

- WS — Windowless sample borehole
- WS — Windowless sample borehole with infiltration test
- DP — Dynamic probe
- DCP — TRL - Dynamic cone penetration test
- Approximate outline of proposed 3G AGP taken from Labosport layout plan.

jpp
- Infrastructure Design
- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

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Client	Labosport
Project	Philips High School, Whitefield
Title	Investigation positions and proposed pitch extent onto topographical survey

Scale at A3	NTS	Drawn by	LC	Checked by	DK	Date	December 2025
Status		Project ref 30447		Drawing no. 01		Revision	

Key to Exploratory Hole Logs

General

Descriptions for soils and rocks generally following:

BS 5930:2015+A1:2020

BS EN ISO 14688-2:2004

BS EN ISO 14689-1:2003

Sampling

ES	Environmental Sample (taken in appropriate sampling container)
D	Disturbed Sample
B	Bulk Sample
C	Core Sample
U	Undisturbed Sample (number of blows indicated in results column)
UT	Thinwalled Undisturbed (number of blows indicated in results column)
W	Water Sample

Insitu Tests

SPT	Standard Penetration Test
SPT (C)	Cone Penetration Test
PID	Photo Ionisation Detector Results (ppm)
PP	Pocket Penetrometer reading converted to shear strength kPa
HV	Converted Shear Vane measurement kPa

Drilling Records

▼	Depth to standing water level
▽	Depth to water strike
TCR	Total Core Recovery (%)
SCR	Solid Core Recovery (%)
RQD	Rock Quality Designation (%)

Backfill Symbols

Arisings

Concrete

Blacktop

Bentonite Seal

Gravel Filter

Sand Filter

Pipe Symbols

Plain Pipe

Slotted Pipe

Filter Tip

Principal Soil Types

Topsoil

Made Ground

Clay

Silt

Sand

Gravel

Peat

Principal Rock Types

Mudstone

Siltstone

Sandstone

Limestone

Chalk

Windowless Sampling Log

Project Name: Philips High School	Client: Labosport	Date: 20/11/2025
Location: Manchester	Contractor:	
Project No. : 30447	Crew Name:	Drilling Equipment: Premier 110

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS01	WLS		AH	1:30	Sheet 1 of 1

Sample and In Situ Testing						
Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
0.10	ES					Grass over dark brown silty very sandy clayey TOPSOIL with frequent roots and rootlets.
			0.20			Firm dark brown and beige very sandy slightly gravelly CLAY with occasional roots and rootlets. Gravel consists of fine to medium subrounded to subangular brick and sandstone. (MADE GROUND)
0.30	D					
0.30	PP	25.00				
			0.45			Very soft dark brown very sandy slightly gravelly CLAY with rare roots and rootlets and rare pockets of fine to coarse sand and gravel. Gravel consists of fine to medium rounded to subrounded flint. (RELIC TOPSOIL/MADE GROUND?)
0.60	PP	40.00				
0.70	D					
0.80	PP	15.00				
			0.90			Very soft becoming firm orange brown and beige very sandy gravelly CLAY. Gravel consists of fine to coarse subrounded to subangular flint. (DEVENSIAN TILL)
1.00	PP	15.00				
1.00		N=4 (1,2/1,1,1,1)				
1.30	PP	0.00				
1.50	D					
1.60	PP	135.00				
1.90	PP	90.00				
2.00		N=8 (1,1/3,2,2,1)				*No recovery from 2.00m - 3.00m bgl.*
3.00		N=7 (2,2/1,2,2,2)				*Becoming very soft from 3.00m bgl.*
3.50	D					
3.80	PP	25.00				*Becoming silty from 3.70m bgl.*
4.00		N=7 (2,1/1,2,2,2)				
4.50	D					*Becoming very silty from 4.50m bgl.*
4.80	PP	75.00				
5.00		N=39 (6,8/10,9,10,10)	5.00			End of Borehole at 5.000m

Water Strikes: 1.60, 3.80

Well: 1, 2, 3, 4, 5, 6

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater strike at 3.00m bgl. Collapsed to 1.80m bgl upon completion. Standing water level at 1.73m bgl after 15 minutes.

Windowless Sampling Log

Project Name: Philips High School	Client: Labosport	Date: 20/11/2025
Location: Manchester	Contractor:	
Project No. : 30447	Crew Name:	Drilling Equipment: Premier 110

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS01A	WLS		AH	1:30	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.20			Grass over dark brown silty very sandy clayey TOPSOIL with frequent roots and rootlets.
					0.60			Firm dark brown and beige very sandy slightly gravelly CLAY with occasional roots and rootlets. Gravel consists of fine to medium subrounded to subangular brick and sandstone. (MADE GROUND)
	▼				1.00			Very soft dark brown very sandy slightly gravelly CLAY with rare roots and rootlets and rare pockets of fine to coarse sand and gravel. Gravel consists of fine to medium rounded to subrounded flint. (RELIC TOPSOIL/MADE GROUND?)

End of Borehole at 1.000m

1 2 3 4 5 6

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Borehole drilled for indicative infiltration testing. Groundwater seepage at the base of the borehole upon completion. Collapsed to 0.80m bgl during infiltration testing. Standing water level at 0.81m bgl after 10 minutes.

Windowless Sampling Log

Project Name: Philips High School	Client: Labosport	Date: 20/11/2025
Location: Manchester	Contractor:	
Project No. : 30447	Crew Name:	Drilling Equipment: Premier 110

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS02	WLS		AH	1:30	Sheet 1 of 1

Sample and In Situ Testing					
Depth (m)	Type	Results	Depth (m)	Level (m)	Stratum Description
0.10	ES				Grass over dark brown silty very sandy clayey TOPSOIL with frequent roots and rootlets.
			0.20		Firm orange brown and beige very sandy slightly gravelly CLAY with occasional roots and rootlets. Gravel consists of fine to medium subrounded to subangular brick sandstone and flint. (MADE GROUND)
0.40	D				
0.40	PP	25.00			
0.60	PP	35.00	0.52		
			0.75		Very soft dark brown very sandy slightly gravelly CLAY with rare roots and rootlets and rare pockets of fine to coarse sand and Gravel. Gravel consists of fine to medium rounded to subrounded flint. (RELIC TOPSOIL/MADE GROUND?)
0.90	D				
1.00		N=4 (2,1/1,1,1,1)			
1.20	D				Very loose/loose light orange brown and beige clayey very silty fine to medium SAND. (DEVENSIAN TILL)
			1.68		Firm dark orange brown mottled grey with black speckling very sandy very silty slightly gravelly CLAY. Gravel consists of fine to medium subangular sandstone. (DEVENSIAN TILL)
1.75	D				
1.80	PP	45.00			
2.00	PP	65.00			
2.00		N=6 (2,1/1,1,2,2)			*No recovery from 2.00m - 3.00m bgl.*
3.00		N=4 (1,2/1,1,1,1)			*Becoming very soft from 3.10m bgl.*
3.30	PP	65.00			
3.50	PP	50.00			
			3.64		Soft to firm orange brown very sandy CLAY. (DEVENSIAN TILL)
3.80	PP	50.00			
4.00		N=8 (2,2/2,1,2,3)			
4.60	PP	25.00			
4.90	PP	15.00			
5.00		N=40 (4,7/10,11,10,9)	5.00		End of Borehole at 5.000m

Water Strikes: ▼ 0.90 ▽ 3.00

Legend: 1 2 3 4 5 6

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Recovered as damp from 1.00m bgl. Groundwater strike at 3.00m bgl. Collapsed to 1.10m bgl upon completion. Standing water level at 0.83m bgl after 15 minutes.

Windowless Sampling Log

Project Name: Philips High School	Client: Labosport	Date: 20/11/2025
Location: Manchester	Contractor:	
Project No. : 30447	Crew Name:	Drilling Equipment: Premier 110

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS03	WLS		AH	1:30	Sheet 1 of 1

Sample and In Situ Testing						
Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
						Grass over dark brown silty very clayey sandy TOPSOIL with frequent roots and rootlets.
0.30	ES		0.41			
0.50	PP	25.00				Very soft dark orange brown and beige very sandy silty slightly gravelly CLAY. Gravel consists of fine to medium rounded to subrounded flint and sandstone. (DEVENSIAN TILL)
0.70	D					
0.70	PP	25.00				
0.90	PP	30.00				
1.00		N=5 (2,1/2,1,1,1)				*No recovery from 1.00m - 1.90m bgl.*
2.00		N=3 (1,1/1,1,0,1)				
2.20	D					
2.20	PP	20.00				
2.40	PP	15.00				
2.60	PP	15.00				
			2.82			Very loose (est) grey silty fine to coarse SAND. (DEVENSIAN TILL)
3.00		N=4 (1,2/1,1,1,1)	3.00			Very soft becoming firm dark orange brown and grey very sandy very silty slightly gravelly CLAY. Gravel consists of fine to medium subrounded to subangular flint. (DEVENSIAN TILL)
3.40	PP	60.00				
3.50	D					
3.70	PP	75.00				
4.00	PP	90.00				
4.00		N=14 (2,4/4,3,3,4)				
5.00		N=37 (7,9/10,8,9,10)	5.00			End of Borehole at 5.000m

Water Strikes: 0.70, 4.00

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater strike at 4.00m bgl. Collapsed to 0.80m bgl 5 minutes after completion. Standing water level at 0.72m bgl after 10 minutes.

Windowless Sampling Log

Project Name: Philips High School	Client: Labosport	Date: 20/11/2025
Location: Manchester	Contractor:	
Project No. : 30447	Crew Name:	Drilling Equipment: Premier 110

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS04	WLS		AH	1:30	Sheet 1 of 1

Sample and In Situ Testing			Depth (m)	Stratum Description
Depth (m)	Type	Results		
				Grass over dark brown silty very clayey sandy TOPSOIL with frequent roots and rootlets.
0.25	ES		0.34	
0.40	PP	40.00		Soft to firm very sandy slightly silty gravelly CLAY. Gravel consists of fine to medium subrounded to subangular flint and sandstone. (DEVENSIAN TILL)
0.50	D			
0.60	PP	25.00		
0.80	PP	65.00		
1.00		N=7 (1,2/2,1,2,2)		
1.10	D			
1.10	PP	35.00		
1.40	PP	115.00		
1.70	PP	105.00		
1.80	D			
2.00	PP	70.00		
2.00		N=5 (1,1/2,1,1,1)		
2.30	PP	30.00		
2.50	D			
2.60	PP	45.00		
2.90	PP	45.00	2.93	
3.00		N=11 (2,1/3,2,3,3)		Medium dense dark greyish silty fine to coarse SAND. (DEVENSIAN TILL)
3.10	D			
			3.46	
3.60	PP	40.00		Soft very sandy slightly silty gravelly CLAY. Gravel consists of fine to medium subrounded to subangular flint and sandstone. (DEVENSIAN TILL)
3.80	PP	25.00		
3.90	D			
4.00		N=8 (2,3/2,2,2,2)	4.00	Loose dark greyish silty fine to coarse SAND. (DEVENSIAN TILL)
			4.63	
4.80	PP	75.00		Soft very sandy slightly silty gravelly CLAY. Gravel consists of fine to coarse subrounded to subangular flint and sandstone. (DEVENSIAN TILL)
4.90	D			
5.00		N=37 (5,8/8,9,10,10)	5.00	End of Borehole at 5.000m

Water Strikes: 2.60m, 3.00m

Level (m): 1, 2, 3, 4, 5, 6

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Recovered as damp from 2.60m bgl. Groundwater strike at 3.00m bgl. Standing water level at 2.62m bgl after 20 minutes.

Windowless Sampling Log

Project Name: Philips High School	Client: Labosport	Date: 20/11/2025
Location: Manchester	Contractor:	
Project No. : 30447	Crew Name:	Drilling Equipment: Premier 110

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS05	WLS		AH	1:30	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
		0.05	ES		0.10			Grass over dark brown silty very sandy clayey TOPSOIL with frequent roots and rootlets.	
		0.25	PP	85.00				Soft to firm orange brown with black speckling very sandy slightly silty slightly gravelly CLAY. Gravel consists of fine to medium subrounded to subangular flint and sandstone. (DEVENSIAN TILL)	
		0.40	D						
		0.50	PP	180.00				*Orange brown fine to coarse SAND observed from 0.29m - 0.30m bgl.*	
		0.70	PP	145.00					
		0.80	D						
		0.90	PP	100.00					
		1.00		N=8 (2,3/2,2,2,2)					1
								Orange brown fine to coarse SAND observed from 1.05m - 1.14m bgl.	
		1.30	PP	75.00					
		1.40	D						
		1.60	PP	90.00					
		1.90	PP	95.00					
		2.00		N=8 (1,2/2,1,2,3)					2
		2.30	PP	75.00					
		2.40	D					*Thin to thick laminations of orange brown fine to coarse SAND observed from 2.40m - 2.8m bgl.*	
		2.60	PP	70.00					
					2.90			Medium dense becoming very dense orangish slightly silty slightly gravelly fine to coarse SAND. Gravel consists of fine rounded to subrounded flint. (DEVENSIAN TILL)	
		3.00		N=25 (4,6/7,6,6,6)					3
		3.40	D						
	▼								
		4.00		N=50 (10,13/50 for 240mm)	4.00			End of Borehole at 4.000m	4
									5
									6

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

No groundwater strikes during drilling. Standing water level at 3.61m bgl after 20 minutes. Borehole terminated at 4.00m bgl due ro refusal on very dense granular soils.

Windowless Sampling Log

Project Name: Philips High School	Client: Labosport	Date: 20/11/2025
Location: Manchester	Contractor:	
Project No. : 30447	Crew Name:	Drilling Equipment: Premier 110

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS06	WLS		AH	1:30	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.10	ES		0.20			Grass over dark brown silty very clayey sandy TOPSOIL with frequent roots and rootlets.
		0.40	PP	125.00				Soft to firm orange brown very sandy slightly silty gravelly CLAY. Gravel consists of fine to medium rounded to subangular flint and sandstone. (DEVENSIAN TILL)
		0.60	D					
		0.60	PP	150.00				
		0.80	PP	140.00				
		1.00		N=6 (1,2/2,1,2,1)				
		1.30	PP	145.00				
		1.50	PP	165.00				
		1.60	D					
		1.80	PP	190.00				
		2.00		N=17 (2,2/4,5,4,4)				
		2.10	PP	65.00				
		2.40	PP	65.00				
		2.60	D					
		2.70	PP	115.00				
		3.00	D		2.95			Very dense orangish slightly silty slightly gravelly fine to coarse SAND. Gravel consists of fine rounded to subrounded flint. (DEVENSIAN TILL)
		3.00		50 (10,13/50 for 205mm)	3.00			End of Borehole at 3.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

No groundwater strikes during or after drilling. Borehole terminated at 3.00m bgl due to refusal on very dense granular soils.

Windowless Sampling Log

Project Name: Philips High School	Client: Labosport	Date: 20/11/2025
Location: Manchester	Contractor:	
Project No. : 30447	Crew Name:	Drilling Equipment: Premier 110

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS07	WLS		AH	1:30	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.15	ES		0.20			Grass over dark brown silty very sandy clayey TOPSOIL with frequent roots and rootlets.
	▼	0.60	D					Firm dark brown and beige very sandy slightly gravelly CLAY with occasional roots and rootlets. Gravel consists of fine to medium subrounded to subangular brick and sandstone. (MADE GROUND)
	▽				1.00			End of Borehole at 1.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater seepage at the base of the borehole upon completion. Collapsed to 0.84m bgl upon completion. Standing water level at 0.68m bgl after 20 minutes.

Appendix D

Proposed Site Layout

Labosport Ltd drawing no. 25-0637(G-234812)-02P

SITE PLAN

CHECK ALL DIMENSIONS PRIOR TO COMMENCEMENT OF WORK

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REFERENCE SHOULD ALSO BE MADE TO HISTORICAL PLANS AND AS BUILT DRAWINGS

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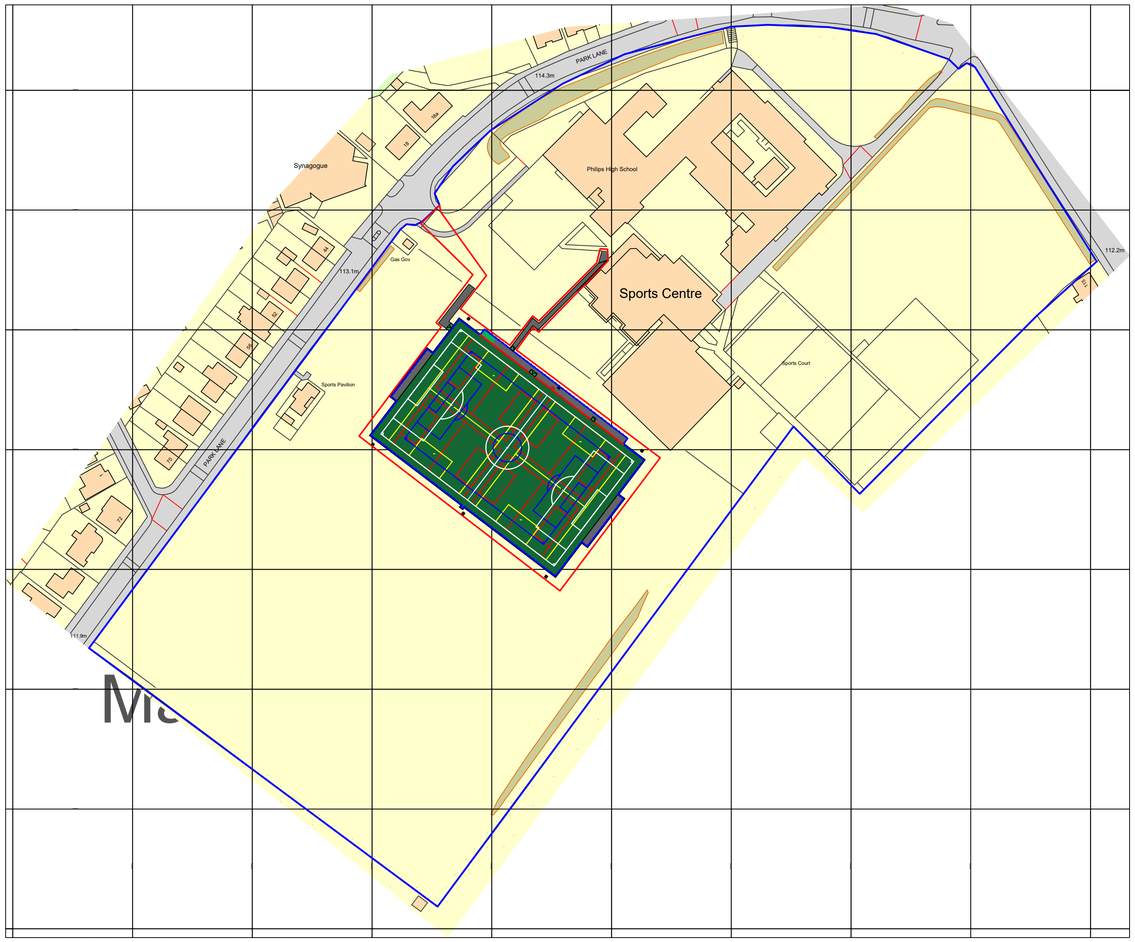
NOTES

APPLICATION SITE AREA REQUIRED

LAND AREA UNDER OWNERSHIP OF CLIENT



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0 25M 50M 100M 150M

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LEGEND / KEY

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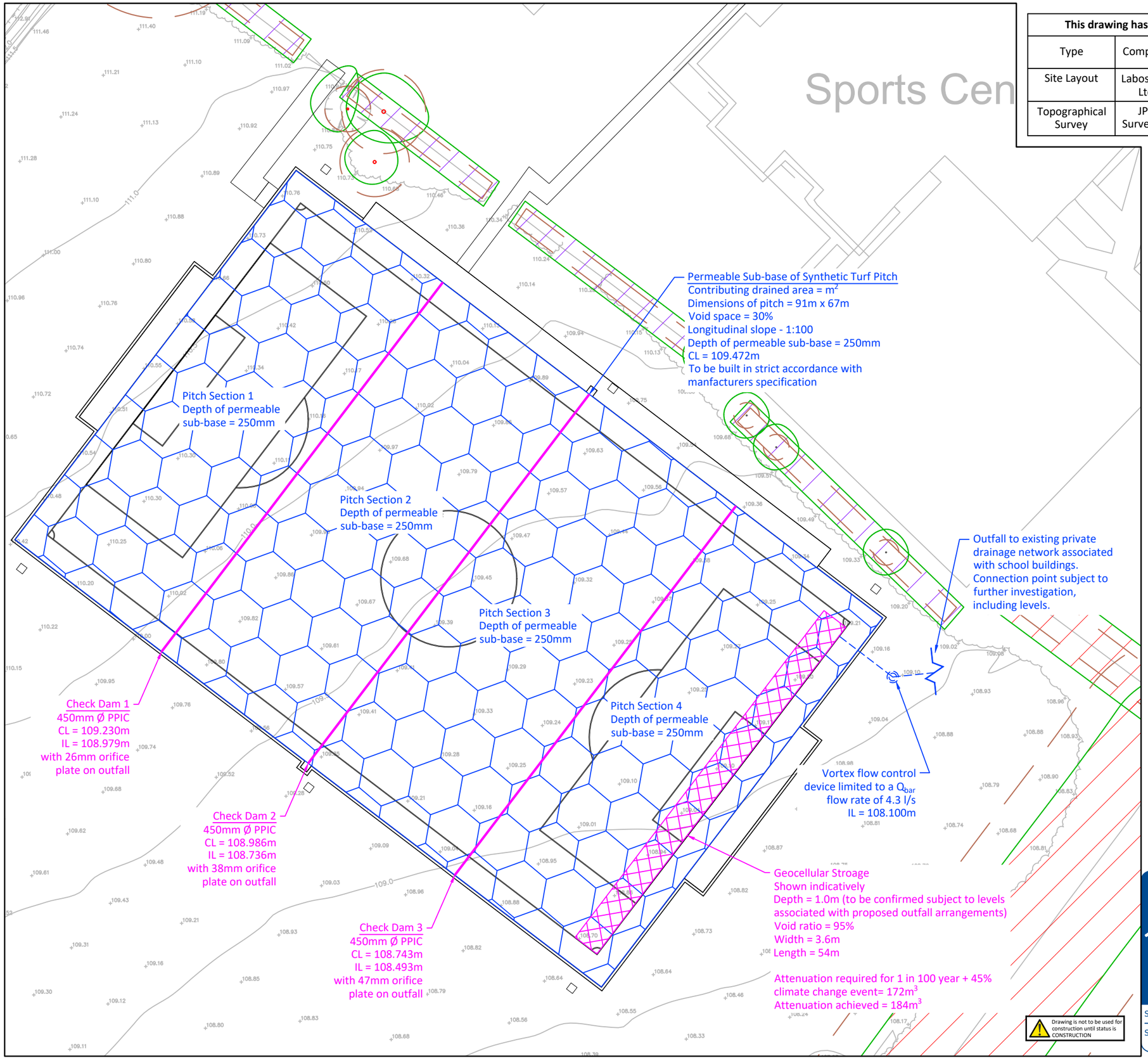
PROJECT
G-234812 PHILIPS HIGH SCHOOL
SYNTHETIC TURF PITCH (STP) DEVELOPMENT

DRAWING
SITE PLAN

STATUS: PLANNING		ISSUED BY: OG	VERSION: 02
PROJECT: G-234812 25-0637		ISSUE DATE: 18.03.26	DRAWING: 25-0637(G-234812) 02P
PAPER SIZE: A1		SCALE: 1:1250	

Appendix E

Proposed Drainage Strategy
JPP Consulting drawing no. 31553-FRA03



This drawing has been based/developed using the following external drawings					
Type	Company	Drawing date	Drawing title / File name	Date received	Rev
Site Layout	Labosport Ltd	-	Philips High School - FOR EXPORT	06.02.2026	-
Topographical Survey	JPP Surveying	05.06.2025	Topographical Survey	06.02.2026	-

General Notes

1. All dimensions are in metres unless otherwise stated.
2. All levels are in metres.
3. This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.
4. Do not scale from this drawing.

Drawing Key

- Proposed Permeable Sub-base
- Proposed Geocellular Storage
- Proposed Surface Water Drainage
- Check Dam
- Tree RPA (Category C)
- Tree RPA (Category B)

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Client: Labosport Ltd

Project: Proposed Synthetic Turf Pitch Philips High School, Higher Lane, Whitefield, Manchester

Title: Proposed Drainage Strategy

Scale at A3	Drawn by	Checked by	Date
1:500	JPB	KER	30.03.2026

Status	Project ref	Drawing no.	Revision
FOR PLANNING	31553	FRA03	-

Appendix F
Greenfield Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	0.659	Urban	0.000
SAAR (mm)	986	Region Number	Region 10

Results	**l/s**
QBAR Rural	4.3
QBAR Urban	4.3
Q1 year	3.8
Q1 year	3.8
Q30 years	7.3
Q100 years	9.0

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Appendix G

Proposed Drained Area

JPP Consulting drawing no. 31553-FRA02

This drawing has been based/developed using the following external drawings					
Type	Company	Drawing date	Drawing title / File name	Date received	Rev
Site Layout	Labosport Ltd	-	Philips High School - FOR EXPORT	06.02.2026	-
Topographical Survey	JPP Surveying	05.06.2025	Topographical Survey	06.02.2026	-

General Notes

1. All dimensions are in metres unless otherwise stated.
2. All levels are in metres.
3. This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.
4. Do not scale from this drawing.

Drawing Key

Proposed Drained Area = 6,590m^2

Drawing is not to be used for construction until status is CONSTRUCTION

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- Infrastructure Design
- Highways
- Structural Engineering
- Development Planning
- Geotechnical & Environmental
- Surveying
- Construction Management

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Client: Labosport Ltd

Project: Proposed Synthetic Turf Pitch Philips High School, Higher Lane, Whitefield, Manchester

Title: Proposed Drained Area

Scale at A3	Drawn by	Checked by	Date
1:500	JPB	KER	18.03.2026

Status	Project ref	Drawing no.	Revision
FOR PLANNING	31553	FRA02	-

Appendix H

Pitch Calculations – 1 in 30 year

Cascade Summary of Results for Pitch 1 - 1 in 30 year.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	Pitch 2 - 1 in 30 year.SRCX	(None)

Half Drain Time : 756 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	109.110	0.130	0.0	0.5	0.5	15.5	Flood Risk
30 min Summer	109.138	0.158	0.0	0.5	0.5	23.0	Flood Risk
60 min Summer	109.163	0.183	0.0	0.6	0.6	30.8	Flood Risk
120 min Summer	109.182	0.202	0.0	0.6	0.6	37.2	Flood Risk
180 min Summer	109.191	0.211	0.0	0.6	0.6	40.9	Flood Risk
240 min Summer	109.198	0.218	0.0	0.6	0.6	43.3	Flood Risk
360 min Summer	109.205	0.225	0.0	0.6	0.6	46.2	Flood Risk
480 min Summer	109.208	0.228	0.0	0.7	0.7	47.6	Flood Risk
600 min Summer	109.209	0.229	0.0	0.7	0.7	48.1	Flood Risk
720 min Summer	109.210	0.230	0.0	0.7	0.7	48.5	Flood Risk
960 min Summer	109.211	0.231	0.0	0.7	0.7	48.9	Flood Risk
1440 min Summer	109.210	0.230	0.0	0.7	0.7	48.5	Flood Risk
2160 min Summer	109.206	0.226	0.0	0.7	0.7	46.9	Flood Risk
2880 min Summer	109.201	0.221	0.0	0.6	0.6	44.9	Flood Risk
4320 min Summer	109.191	0.211	0.0	0.6	0.6	40.8	Flood Risk
5760 min Summer	109.182	0.202	0.0	0.6	0.6	37.2	Flood Risk
7200 min Summer	109.173	0.193	0.0	0.6	0.6	34.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.079	0.0	15.8	19
30 min Summer	50.218	0.0	23.6	34
60 min Summer	32.010	0.0	32.0	64
120 min Summer	19.186	0.0	39.7	122
180 min Summer	14.217	0.0	44.8	182
240 min Summer	11.489	0.0	48.7	242
360 min Summer	8.498	0.0	54.6	362
480 min Summer	6.853	0.0	59.0	480
600 min Summer	5.798	0.0	62.5	560
720 min Summer	5.058	0.0	65.5	612
960 min Summer	4.078	0.0	70.4	740
1440 min Summer	3.010	0.0	76.6	998
2160 min Summer	2.231	0.0	85.3	1408
2880 min Summer	1.812	0.0	91.4	1820
4320 min Summer	1.365	0.0	100.9	2636
5760 min Summer	1.126	0.0	108.6	3408
7200 min Summer	0.975	0.0	115.2	4184

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Cascade Summary of Results for Pitch 1 - 1 in 30 year.SRCX

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
8640 min Summer	109.166	0.186	0.0	0.6	0.6	31.5	Flood Risk
10080 min Summer	109.159	0.179	0.0	0.6	0.6	29.3	Flood Risk
15 min Winter	109.121	0.141	0.0	0.5	0.5	18.2	Flood Risk
30 min Winter	109.151	0.171	0.0	0.6	0.6	26.7	Flood Risk
60 min Winter	109.177	0.197	0.0	0.6	0.6	35.5	Flood Risk
120 min Winter	109.196	0.216	0.0	0.6	0.6	42.7	Flood Risk
180 min Winter	109.207	0.227	0.0	0.7	0.7	47.0	Flood Risk
240 min Winter	109.213	0.233	0.0	0.7	0.7	49.9	Flood Risk
360 min Winter	109.222	0.242	0.0	0.7	0.7	53.4	Flood Risk
480 min Winter	109.226	0.246	0.0	0.7	0.7	55.2	Flood Risk
600 min Winter	109.228	0.248	0.0	0.7	0.7	56.1	Flood Risk
720 min Winter	109.229	0.249	0.0	0.7	0.7	56.5	Flood Risk
960 min Winter	109.228	0.248	0.0	0.7	0.7	56.4	Flood Risk
1440 min Winter	109.226	0.246	0.0	0.7	0.7	55.6	Flood Risk
2160 min Winter	109.220	0.240	0.0	0.7	0.7	52.6	Flood Risk
2880 min Winter	109.212	0.232	0.0	0.7	0.7	49.2	Flood Risk
4320 min Winter	109.195	0.215	0.0	0.6	0.6	42.4	Flood Risk
5760 min Winter	109.180	0.200	0.0	0.6	0.6	36.6	Flood Risk
7200 min Winter	109.166	0.186	0.0	0.6	0.6	31.7	Flood Risk
8640 min Winter	109.154	0.174	0.0	0.6	0.6	27.6	Flood Risk
10080 min Winter	109.143	0.163	0.0	0.5	0.5	24.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.872	0.0	121.2	4936
10080 min Summer	0.796	0.0	126.9	5656
15 min Winter	75.079	0.0	18.6	19
30 min Winter	50.218	0.0	27.3	33
60 min Winter	32.010	0.0	36.8	62
120 min Winter	19.186	0.0	45.4	120
180 min Winter	14.217	0.0	51.1	180
240 min Winter	11.489	0.0	55.5	238
360 min Winter	8.498	0.0	62.1	352
480 min Winter	6.853	0.0	67.1	464
600 min Winter	5.798	0.0	71.1	574
720 min Winter	5.058	0.0	74.5	678
960 min Winter	4.078	0.0	80.0	778
1440 min Winter	3.010	0.0	84.0	1082
2160 min Winter	2.231	0.0	97.3	1536
2880 min Winter	1.812	0.0	104.4	1988
4320 min Winter	1.365	0.0	115.7	2812
5760 min Winter	1.126	0.0	124.9	3632
7200 min Winter	0.975	0.0	133.0	4400
8640 min Winter	0.872	0.0	140.4	5184
10080 min Winter	0.796	0.0	147.4	5944

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Cascade Rainfall Details for Pitch 1 - 1 in 30 year.SRCX

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 1 - 1 in 30 year.SRCX

Storage is Online Cover Level (m) 109.230

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.980	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 108.980

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Cascade Summary of Results for Pitch 2 - 1 in 30 year.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 1 - 1 in 30 year.SRCX	Pitch 3 - 1 in 30 year.SRCX	(None)

Half Drain Time : 358 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	108.866	0.130	0.0	1.0	1.0	15.5	Flood Risk
30 min Summer	108.894	0.158	0.0	1.1	1.1	22.9	Flood Risk
60 min Summer	108.919	0.183	0.0	1.2	1.2	30.7	Flood Risk
120 min Summer	108.937	0.201	0.0	1.3	1.3	37.0	Flood Risk
180 min Summer	108.947	0.211	0.0	1.3	1.3	40.6	Flood Risk
240 min Summer	108.953	0.217	0.0	1.3	1.3	42.9	Flood Risk
360 min Summer	108.959	0.223	0.0	1.4	1.4	45.5	Flood Risk
480 min Summer	108.962	0.226	0.0	1.4	1.4	46.6	Flood Risk
600 min Summer	108.963	0.227	0.0	1.4	1.4	47.2	Flood Risk
720 min Summer	108.964	0.228	0.0	1.4	1.4	47.6	Flood Risk
960 min Summer	108.965	0.229	0.0	1.4	1.4	47.9	Flood Risk
1440 min Summer	108.964	0.228	0.0	1.4	1.4	47.4	Flood Risk
2160 min Summer	108.959	0.223	0.0	1.4	1.4	45.5	Flood Risk
2880 min Summer	108.953	0.217	0.0	1.3	1.3	43.2	Flood Risk
4320 min Summer	108.942	0.206	0.0	1.3	1.3	38.9	Flood Risk
5760 min Summer	108.932	0.196	0.0	1.3	1.3	35.1	Flood Risk
7200 min Summer	108.923	0.187	0.0	1.2	1.2	32.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.079	0.0	31.5	19
30 min Summer	50.218	0.0	47.1	34
60 min Summer	32.010	0.0	64.0	64
120 min Summer	19.186	0.0	79.4	122
180 min Summer	14.217	0.0	89.6	182
240 min Summer	11.489	0.0	97.4	242
360 min Summer	8.498	0.0	109.2	360
480 min Summer	6.853	0.0	117.9	476
600 min Summer	5.798	0.0	125.0	524
720 min Summer	5.058	0.0	130.9	586
960 min Summer	4.078	0.0	140.7	712
1440 min Summer	3.010	0.0	153.1	982
2160 min Summer	2.231	0.0	170.6	1388
2880 min Summer	1.812	0.0	182.7	1816
4320 min Summer	1.365	0.0	201.8	2596
5760 min Summer	1.126	0.0	217.1	3400
7200 min Summer	0.975	0.0	230.4	4176

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Cascade Summary of Results for Pitch 2 - 1 in 30 year.SRCX

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
8640 min Summer	108.915	0.179	0.0	1.2	1.2	29.4	Flood Risk
10080 min Summer	108.908	0.172	0.0	1.2	1.2	27.2	Flood Risk
15 min Winter	108.877	0.141	0.0	1.1	1.1	18.2	Flood Risk
30 min Winter	108.907	0.171	0.0	1.2	1.2	26.6	Flood Risk
60 min Winter	108.933	0.197	0.0	1.3	1.3	35.4	Flood Risk
120 min Winter	108.951	0.215	0.0	1.3	1.3	42.5	Flood Risk
180 min Winter	108.962	0.226	0.0	1.4	1.4	46.6	Flood Risk
240 min Winter	108.968	0.232	0.0	1.4	1.4	49.4	Flood Risk
360 min Winter	108.976	0.240	0.0	1.4	1.4	52.7	Flood Risk
480 min Winter	108.980	0.244	0.0	1.4	1.4	54.3	Flood Risk
600 min Winter	108.981	0.245	0.0	1.4	1.4	55.0	Flood Risk
720 min Winter	108.981	0.245	0.0	1.4	1.4	55.1	Flood Risk
960 min Winter	108.981	0.245	0.0	1.4	1.4	55.1	Flood Risk
1440 min Winter	108.979	0.243	0.0	1.4	1.4	53.9	Flood Risk
2160 min Winter	108.971	0.235	0.0	1.4	1.4	50.5	Flood Risk
2880 min Winter	108.962	0.226	0.0	1.4	1.4	46.8	Flood Risk
4320 min Winter	108.944	0.208	0.0	1.3	1.3	39.7	Flood Risk
5760 min Winter	108.928	0.192	0.0	1.3	1.3	33.8	Flood Risk
7200 min Winter	108.914	0.178	0.0	1.2	1.2	29.0	Flood Risk
8640 min Winter	108.902	0.166	0.0	1.2	1.2	25.2	Flood Risk
10080 min Winter	108.891	0.155	0.0	1.1	1.1	22.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.872	0.0	242.5	4920
10080 min Summer	0.796	0.0	253.8	5648
15 min Winter	75.079	0.0	37.1	19
30 min Winter	50.218	0.0	54.6	33
60 min Winter	32.010	0.0	73.5	62
120 min Winter	19.186	0.0	90.8	120
180 min Winter	14.217	0.0	102.3	178
240 min Winter	11.489	0.0	111.1	236
360 min Winter	8.498	0.0	124.3	352
480 min Winter	6.853	0.0	134.2	462
600 min Winter	5.798	0.0	142.2	570
720 min Winter	5.058	0.0	149.0	670
960 min Winter	4.078	0.0	159.8	754
1440 min Winter	3.010	0.0	169.7	1066
2160 min Winter	2.231	0.0	194.6	1516
2880 min Winter	1.812	0.0	208.8	1960
4320 min Winter	1.365	0.0	231.3	2808
5760 min Winter	1.126	0.0	249.7	3576
7200 min Winter	0.975	0.0	265.9	4392
8640 min Winter	0.872	0.0	280.7	5104
10080 min Winter	0.796	0.0	294.7	5848

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Cascade Rainfall Details for Pitch 2 - 1 in 30 year.SRCX

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 2 - 1 in 30 year.SRCX

Storage is Online Cover Level (m) 108.986

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.736	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.038 Discharge Coefficient 0.600 Invert Level (m) 108.736

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Cascade Summary of Results for Pitch 3 - 1 in 30 year.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 2 - 1 in 30 year.SRCX Pitch 1 - 1 in 30 year.SRCX	Pitch 4 - 1 in 30 year.SRCX	(None)

Half Drain Time : 235 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	108.623	0.130	0.0	1.5	1.5	15.5	Flood Risk
30 min Summer	108.651	0.158	0.0	1.7	1.7	23.0	Flood Risk
60 min Summer	108.676	0.183	0.0	1.8	1.8	30.8	Flood Risk
120 min Summer	108.694	0.201	0.0	1.9	1.9	37.1	Flood Risk
180 min Summer	108.704	0.211	0.0	2.0	2.0	40.7	Flood Risk
240 min Summer	108.710	0.217	0.0	2.0	2.0	43.1	Flood Risk
360 min Summer	108.717	0.224	0.0	2.1	2.1	45.8	Flood Risk
480 min Summer	108.720	0.227	0.0	2.1	2.1	47.0	Flood Risk
600 min Summer	108.721	0.228	0.0	2.1	2.1	47.6	Flood Risk
720 min Summer	108.722	0.229	0.0	2.1	2.1	48.0	Flood Risk
960 min Summer	108.723	0.230	0.0	2.1	2.1	48.4	Flood Risk
1440 min Summer	108.722	0.229	0.0	2.1	2.1	48.0	Flood Risk
2160 min Summer	108.718	0.225	0.0	2.1	2.1	46.1	Flood Risk
2880 min Summer	108.712	0.219	0.0	2.0	2.0	43.9	Flood Risk
4320 min Summer	108.701	0.208	0.0	2.0	2.0	39.5	Flood Risk
5760 min Summer	108.691	0.198	0.0	1.9	1.9	35.7	Flood Risk
7200 min Summer	108.682	0.189	0.0	1.9	1.9	32.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.079	0.0	47.3	19
30 min Summer	50.218	0.0	70.7	34
60 min Summer	32.010	0.0	96.0	64
120 min Summer	19.186	0.0	119.1	122
180 min Summer	14.217	0.0	134.4	182
240 min Summer	11.489	0.0	146.2	242
360 min Summer	8.498	0.0	163.7	360
480 min Summer	6.853	0.0	176.9	478
600 min Summer	5.798	0.0	187.5	524
720 min Summer	5.058	0.0	196.4	588
960 min Summer	4.078	0.0	211.1	714
1440 min Summer	3.010	0.0	229.5	982
2160 min Summer	2.231	0.0	256.0	1388
2880 min Summer	1.812	0.0	274.1	1816
4320 min Summer	1.365	0.0	302.7	2596
5760 min Summer	1.126	0.0	325.7	3400
7200 min Summer	0.975	0.0	345.6	4176

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Cascade Summary of Results for Pitch 3 - 1 in 30 year.SRCX

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
8640 min Summer	108.674	0.181	0.0	1.8	1.8	29.9	Flood Risk
10080 min Summer	108.667	0.174	0.0	1.8	1.8	27.7	Flood Risk
15 min Winter	108.634	0.141	0.0	1.6	1.6	18.3	Flood Risk
30 min Winter	108.664	0.171	0.0	1.8	1.8	26.7	Flood Risk
60 min Winter	108.690	0.197	0.0	1.9	1.9	35.4	Flood Risk
120 min Winter	108.709	0.216	0.0	2.0	2.0	42.6	Flood Risk
180 min Winter	108.719	0.226	0.0	2.1	2.1	46.8	Flood Risk
240 min Winter	108.726	0.233	0.0	2.1	2.1	49.6	Flood Risk
360 min Winter	108.734	0.241	0.0	2.1	2.1	52.9	Flood Risk
480 min Winter	108.737	0.244	0.0	2.2	2.2	54.6	Flood Risk
600 min Winter	108.739	0.246	0.0	2.2	2.2	55.4	Flood Risk
720 min Winter	108.739	0.246	0.0	2.2	2.2	55.6	Flood Risk
960 min Winter	108.740	0.247	0.0	2.2	2.2	55.6	Flood Risk
1440 min Winter	108.737	0.244	0.0	2.2	2.2	54.5	Flood Risk
2160 min Winter	108.730	0.237	0.0	2.1	2.1	51.2	Flood Risk
2880 min Winter	108.721	0.228	0.0	2.1	2.1	47.4	Flood Risk
4320 min Winter	108.703	0.210	0.0	2.0	2.0	40.3	Flood Risk
5760 min Winter	108.687	0.194	0.0	1.9	1.9	34.3	Flood Risk
7200 min Winter	108.672	0.179	0.0	1.8	1.8	29.5	Flood Risk
8640 min Winter	108.660	0.167	0.0	1.7	1.7	25.6	Flood Risk
10080 min Winter	108.649	0.156	0.0	1.7	1.7	22.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	0.872	0.0	363.7	4920
10080 min Summer	0.796	0.0	380.6	5648
15 min Winter	75.079	0.0	55.7	19
30 min Winter	50.218	0.0	81.8	33
60 min Winter	32.010	0.0	110.3	62
120 min Winter	19.186	0.0	136.2	120
180 min Winter	14.217	0.0	153.4	180
240 min Winter	11.489	0.0	166.6	236
360 min Winter	8.498	0.0	186.4	352
480 min Winter	6.853	0.0	201.3	462
600 min Winter	5.798	0.0	213.3	570
720 min Winter	5.058	0.0	223.4	670
960 min Winter	4.078	0.0	239.5	758
1440 min Winter	3.010	0.0	255.2	1066
2160 min Winter	2.231	0.0	291.9	1516
2880 min Winter	1.812	0.0	313.1	1960
4320 min Winter	1.365	0.0	347.0	2772
5760 min Winter	1.126	0.0	374.6	3576
7200 min Winter	0.975	0.0	398.9	4328
8640 min Winter	0.872	0.0	421.1	5104
10080 min Winter	0.796	0.0	442.1	5848

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Cascade Rainfall Details for Pitch 3 - 1 in 30 year.SRCX

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 3 - 1 in 30 year.SRCX

Storage is Online Cover Level (m) 108.743

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.493	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.047 Discharge Coefficient 0.600 Invert Level (m) 108.493

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Cascade Summary of Results for Pitch 4 - 1 in 30 year.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 3 - 1 in 30 year.SRCX	(None)	(None)
Pitch 2 - 1 in 30 year.SRCX		
Pitch 1 - 1 in 30 year.SRCX		

Half Drain Time : 67 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	108.373	0.123	0.0	4.1	4.1	13.9	Flood Risk
30 min Summer	108.399	0.149	0.0	4.1	4.1	20.4	Flood Risk
60 min Summer	108.418	0.168	0.0	4.2	4.2	25.7	Flood Risk
120 min Summer	108.424	0.174	0.0	4.2	4.2	27.7	Flood Risk
180 min Summer	108.424	0.174	0.0	4.2	4.2	27.7	Flood Risk
240 min Summer	108.422	0.172	0.0	4.2	4.2	27.2	Flood Risk
360 min Summer	108.418	0.168	0.0	4.2	4.2	25.7	Flood Risk
480 min Summer	108.412	0.162	0.0	4.1	4.1	23.9	Flood Risk
600 min Summer	108.405	0.155	0.0	4.1	4.1	22.1	Flood Risk
720 min Summer	108.399	0.149	0.0	4.1	4.1	20.3	Flood Risk
960 min Summer	108.385	0.135	0.0	4.1	4.1	16.8	Flood Risk
1440 min Summer	108.359	0.109	0.0	4.1	4.1	10.8	Flood Risk
2160 min Summer	108.320	0.070	0.0	4.0	4.0	4.5	Flood Risk
2880 min Summer	108.284	0.034	0.0	3.9	3.9	1.1	Flood Risk
4320 min Summer	108.250	0.000	0.0	3.6	3.6	0.0	Flood Risk
5760 min Summer	108.250	0.000	0.0	3.2	3.2	0.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	75.079	0.0	63.0	18
30 min Summer	50.218	0.0	94.3	32
60 min Summer	32.010	0.0	127.9	62
120 min Summer	19.186	0.0	158.7	116
180 min Summer	14.217	0.0	179.3	146
240 min Summer	11.489	0.0	194.9	178
360 min Summer	8.498	0.0	218.4	246
480 min Summer	6.853	0.0	235.7	316
600 min Summer	5.798	0.0	250.0	384
720 min Summer	5.058	0.0	262.0	452
960 min Summer	4.078	0.0	281.4	586
1440 min Summer	3.010	0.0	307.0	836
2160 min Summer	2.231	0.0	341.3	1188
2880 min Summer	1.812	0.0	365.4	1500
4320 min Summer	1.365	0.0	403.5	0
5760 min Summer	1.126	0.0	434.3	0

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Cascade Summary of Results for Pitch 4 - 1 in 30 year.SRCX

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
7200 min Summer	108.250	0.000	0.0	3.0	3.0	0.0	Flood Risk
8640 min Summer	108.250	0.000	0.0	2.8	2.8	0.0	Flood Risk
10080 min Summer	108.250	0.000	0.0	2.7	2.7	0.0	Flood Risk
15 min Winter	108.385	0.135	0.0	4.1	4.1	16.8	Flood Risk
30 min Winter	108.412	0.162	0.0	4.2	4.2	24.1	Flood Risk
60 min Winter	108.433	0.183	0.0	4.2	4.2	30.5	Flood Risk
120 min Winter	108.440	0.190	0.0	4.2	4.2	33.2	Flood Risk
180 min Winter	108.440	0.190	0.0	4.2	4.2	33.1	Flood Risk
240 min Winter	108.438	0.188	0.0	4.2	4.2	32.2	Flood Risk
360 min Winter	108.431	0.181	0.0	4.2	4.2	29.9	Flood Risk
480 min Winter	108.422	0.172	0.0	4.2	4.2	27.1	Flood Risk
600 min Winter	108.413	0.163	0.0	4.2	4.2	24.3	Flood Risk
720 min Winter	108.403	0.153	0.0	4.1	4.1	21.5	Flood Risk
960 min Winter	108.383	0.133	0.0	4.1	4.1	16.2	Flood Risk
1440 min Winter	108.342	0.092	0.0	4.0	4.0	7.7	Flood Risk
2160 min Winter	108.273	0.023	0.0	3.9	3.9	0.5	Flood Risk
2880 min Winter	108.250	0.000	0.0	3.6	3.6	0.0	Flood Risk
4320 min Winter	108.250	0.000	0.0	3.1	3.1	0.0	Flood Risk
5760 min Winter	108.250	0.000	0.0	2.8	2.8	0.0	Flood Risk
7200 min Winter	108.250	0.000	0.0	2.6	2.6	0.0	Flood Risk
8640 min Winter	108.250	0.000	0.0	2.5	2.5	0.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Summer	0.975	0.0	460.8	0
8640 min Summer	0.872	0.0	484.9	0
10080 min Summer	0.796	0.0	507.5	0
15 min Winter	75.079	0.0	74.2	18
30 min Winter	50.218	0.0	109.2	32
60 min Winter	32.010	0.0	147.2	60
120 min Winter	19.186	0.0	181.7	116
180 min Winter	14.217	0.0	204.7	170
240 min Winter	11.489	0.0	222.1	192
360 min Winter	8.498	0.0	248.7	270
480 min Winter	6.853	0.0	268.3	348
600 min Winter	5.798	0.0	284.4	422
720 min Winter	5.058	0.0	297.9	492
960 min Winter	4.078	0.0	319.5	634
1440 min Winter	3.010	0.0	343.6	882
2160 min Winter	2.231	0.0	389.2	1188
2880 min Winter	1.812	0.0	417.5	0
4320 min Winter	1.365	0.0	462.6	0
5760 min Winter	1.126	0.0	499.5	0
7200 min Winter	0.975	0.0	531.8	0
8640 min Winter	0.872	0.0	561.5	0

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Cascade Summary of Results for Pitch 4 - 1 in 30 year.SRCX

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
10080 min Winter	108.250	0.000	0.0	2.3	2.3	0.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.796	0.0	589.5	0

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Cascade Rainfall Details for Pitch 4 - 1 in 30 year.SRCX

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 4 - 1 in 30 year.SRCX

Storage is Online Cover Level (m) 108.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.250	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0095-4300-1200-4300
Design Head (m)	1.200
Design Flow (l/s)	4.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	107.300
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.200	4.3
Flush-Flo™	0.356	4.3
Kick-Flo®	0.739	3.4
Mean Flow over Head Range	-	3.8

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	3.1	1.200	4.3	3.000	6.6	7.000	9.8
0.200	4.1	1.400	4.6	3.500	7.1	7.500	10.2
0.300	4.3	1.600	4.9	4.000	7.5	8.000	10.5
0.400	4.3	1.800	5.2	4.500	8.0	8.500	10.8
0.500	4.2	2.000	5.5	5.000	8.4	9.000	11.1
0.600	4.0	2.200	5.7	5.500	8.8	9.500	11.4
0.800	3.6	2.400	5.9	6.000	9.1		
1.000	4.0	2.600	6.2	6.500	9.5		

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Appendix I

Pitch Calculations – 1 in 100 year

Cascade Summary of Results for Pitch 1 - 1 in 100 year.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	Pitch 2 - 1 in 100 year.SRCX	(None)

Half Drain Time : 1004 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	109.139	0.159	0.0	0.5	0.5	23.2	Flood Risk
30 min Summer	109.171	0.191	0.0	0.6	0.6	33.5	Flood Risk
60 min Summer	109.201	0.221	0.0	0.6	0.6	44.6	Flood Risk
120 min Summer	109.221	0.241	0.0	0.7	0.7	53.1	Flood Risk
180 min Summer	109.231	0.251	0.0	0.7	0.7	58.1	FLOOD
240 min Summer	109.233	0.253	0.0	0.7	0.7	61.4	FLOOD
360 min Summer	109.236	0.256	0.0	0.7	0.7	65.5	FLOOD
480 min Summer	109.237	0.257	0.0	0.7	0.7	67.6	FLOOD
600 min Summer	109.238	0.258	0.0	0.7	0.7	68.6	FLOOD
720 min Summer	109.238	0.258	0.0	0.7	0.7	68.8	FLOOD
960 min Summer	109.238	0.258	0.0	0.7	0.7	68.7	FLOOD
1440 min Summer	109.237	0.257	0.0	0.7	0.7	67.6	FLOOD
2160 min Summer	109.235	0.255	0.0	0.7	0.7	65.0	FLOOD
2880 min Summer	109.233	0.253	0.0	0.7	0.7	62.1	FLOOD
4320 min Summer	109.229	0.249	0.0	0.7	0.7	56.8	Flood Risk
5760 min Summer	109.219	0.239	0.0	0.7	0.7	52.3	Flood Risk
7200 min Summer	109.210	0.230	0.0	0.7	0.7	48.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	100.095	0.0	23.5	19
30 min Summer	67.350	0.0	34.1	34
60 min Summer	43.321	0.0	46.0	64
120 min Summer	25.795	0.0	56.1	124
180 min Summer	19.024	0.6	62.7	182
240 min Summer	15.315	3.1	67.7	242
360 min Summer	11.257	5.9	75.1	362
480 min Summer	9.033	7.3	80.5	480
600 min Summer	7.607	8.1	84.8	600
720 min Summer	6.608	8.1	88.0	704
960 min Summer	5.285	7.9	90.9	810
1440 min Summer	3.855	7.3	91.0	1054
2160 min Summer	2.821	5.5	111.6	1468
2880 min Summer	2.270	3.5	118.6	1872
4320 min Summer	1.690	0.0	129.8	2680
5760 min Summer	1.382	0.0	139.1	3464
7200 min Summer	1.190	0.0	147.2	4256

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Cascade Summary of Results for Pitch 1 - 1 in 100 year.SRCX

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
8640 min Summer	109.202	0.222	0.0	0.6	0.6	45.2	Flood Risk
10080 min Summer	109.195	0.215	0.0	0.6	0.6	42.3	Flood Risk
15 min Winter	109.151	0.171	0.0	0.6	0.6	26.9	Flood Risk
30 min Winter	109.185	0.205	0.0	0.6	0.6	38.5	Flood Risk
60 min Winter	109.216	0.236	0.0	0.7	0.7	50.9	Flood Risk
120 min Winter	109.232	0.252	0.0	0.7	0.7	60.6	FLOOD
180 min Winter	109.236	0.256	0.0	0.7	0.7	66.4	FLOOD
240 min Winter	109.239	0.259	0.0	0.7	0.7	70.3	FLOOD
360 min Winter	109.243	0.263	0.0	0.7	0.7	75.3	FLOOD
480 min Winter	109.245	0.265	0.0	0.7	0.7	78.0	FLOOD
600 min Winter	109.246	0.266	0.0	0.7	0.7	79.5	FLOOD
720 min Winter	109.246	0.266	0.0	0.7	0.7	80.2	FLOOD
960 min Winter	109.246	0.266	0.0	0.7	0.7	80.1	FLOOD
1440 min Winter	109.245	0.265	0.0	0.7	0.7	78.0	FLOOD
2160 min Winter	109.242	0.262	0.0	0.7	0.7	74.2	FLOOD
2880 min Winter	109.239	0.259	0.0	0.7	0.7	69.7	FLOOD
4320 min Winter	109.233	0.253	0.0	0.7	0.7	61.1	FLOOD
5760 min Winter	109.222	0.242	0.0	0.7	0.7	53.7	Flood Risk
7200 min Winter	109.208	0.228	0.0	0.7	0.7	47.5	Flood Risk
8640 min Winter	109.195	0.215	0.0	0.6	0.6	42.2	Flood Risk
10080 min Winter	109.183	0.203	0.0	0.6	0.6	37.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.059	0.0	154.6	5024
10080 min Summer	0.962	0.0	161.5	5840
15 min Winter	100.095	0.0	27.2	19
30 min Winter	67.350	0.0	38.7	33
60 min Winter	43.321	0.0	52.4	62
120 min Winter	25.795	2.5	63.7	122
180 min Winter	19.024	6.5	71.1	180
240 min Winter	15.315	9.1	76.8	238
360 min Winter	11.257	12.6	85.1	354
480 min Winter	9.033	14.5	90.9	470
600 min Winter	7.607	15.6	94.4	582
720 min Winter	6.608	16.1	96.1	694
960 min Winter	5.285	16.0	97.6	904
1440 min Winter	3.855	14.5	96.6	1128
2160 min Winter	2.821	12.0	126.7	1596
2880 min Winter	2.270	8.8	134.8	2044
4320 min Winter	1.690	2.7	148.0	2896
5760 min Winter	1.382	0.0	159.0	3744
7200 min Winter	1.190	0.0	168.7	4536
8640 min Winter	1.059	0.0	177.6	5280
10080 min Winter	0.962	0.0	186.0	6056

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Cascade Rainfall Details for Pitch 1 - 1 in 100 year.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 1 - 1 in 100 year.SRCX

Storage is Online Cover Level (m) 109.230

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.980	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 108.980

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Cascade Summary of Results for Pitch 2 - 1 in 100 year.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 1 - 1 in 100 year.SRCX	Pitch 3 - 1 in 100 year.SRCX	(None)

Half Drain Time : 469 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	108.895	0.159	0.0	1.1	1.1	23.2	Flood Risk
30 min Summer	108.927	0.191	0.0	1.3	1.3	33.4	Flood Risk
60 min Summer	108.956	0.220	0.0	1.4	1.4	44.5	Flood Risk
120 min Summer	108.976	0.240	0.0	1.4	1.4	52.9	Flood Risk
180 min Summer	108.986	0.250	0.0	1.4	1.4	57.7	FLOOD
240 min Summer	108.989	0.253	0.0	1.5	1.5	60.9	FLOOD
360 min Summer	108.991	0.255	0.0	1.5	1.5	64.7	FLOOD
480 min Summer	108.993	0.257	0.0	1.5	1.5	66.5	FLOOD
600 min Summer	108.993	0.257	0.0	1.5	1.5	67.2	FLOOD
720 min Summer	108.993	0.257	0.0	1.5	1.5	67.3	FLOOD
960 min Summer	108.993	0.257	0.0	1.5	1.5	67.1	FLOOD
1440 min Summer	108.992	0.256	0.0	1.5	1.5	65.8	FLOOD
2160 min Summer	108.990	0.254	0.0	1.5	1.5	62.9	FLOOD
2880 min Summer	108.988	0.252	0.0	1.5	1.5	59.8	FLOOD
4320 min Summer	108.979	0.243	0.0	1.4	1.4	54.2	Flood Risk
5760 min Summer	108.968	0.232	0.0	1.4	1.4	49.5	Flood Risk
7200 min Summer	108.959	0.223	0.0	1.4	1.4	45.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	100.095	0.0	47.0	19
30 min Summer	67.350	0.0	68.1	34
60 min Summer	43.321	0.0	92.0	64
120 min Summer	25.795	0.0	112.1	122
180 min Summer	19.024	0.5	125.3	182
240 min Summer	15.315	2.6	135.3	242
360 min Summer	11.257	5.2	150.1	362
480 min Summer	9.033	6.4	161.0	480
600 min Summer	7.607	7.1	169.5	600
720 min Summer	6.608	7.0	175.8	658
960 min Summer	5.285	7.0	183.2	770
1440 min Summer	3.855	6.0	185.6	1026
2160 min Summer	2.821	3.9	223.2	1432
2880 min Summer	2.270	1.9	237.1	1844
4320 min Summer	1.690	0.0	259.6	2640
5760 min Summer	1.382	0.0	278.1	3456
7200 min Summer	1.190	0.0	294.3	4248

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Cascade Summary of Results for Pitch 2 - 1 in 100 year.SRCX

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
8640 min Summer	108.951	0.215	0.0	1.3	1.3	42.1	Flood Risk
10080 min Summer	108.943	0.207	0.0	1.3	1.3	39.2	Flood Risk
15 min Winter	108.907	0.171	0.0	1.2	1.2	26.8	Flood Risk
30 min Winter	108.941	0.205	0.0	1.3	1.3	38.4	Flood Risk
60 min Winter	108.972	0.236	0.0	1.4	1.4	50.8	Flood Risk
120 min Winter	108.988	0.252	0.0	1.5	1.5	60.3	FLOOD
180 min Winter	108.992	0.256	0.0	1.5	1.5	66.0	FLOOD
240 min Winter	108.995	0.259	0.0	1.5	1.5	69.8	FLOOD
360 min Winter	108.998	0.262	0.0	1.5	1.5	74.4	FLOOD
480 min Winter	109.000	0.264	0.0	1.5	1.5	76.8	FLOOD
600 min Winter	109.001	0.265	0.0	1.5	1.5	78.1	FLOOD
720 min Winter	109.001	0.265	0.0	1.5	1.5	78.5	FLOOD
960 min Winter	109.001	0.265	0.0	1.5	1.5	77.9	FLOOD
1440 min Winter	108.999	0.263	0.0	1.5	1.5	75.7	FLOOD
2160 min Winter	108.996	0.260	0.0	1.5	1.5	71.3	FLOOD
2880 min Winter	108.992	0.256	0.0	1.5	1.5	66.3	FLOOD
4320 min Winter	108.986	0.250	0.0	1.4	1.4	57.2	FLOOD
5760 min Winter	108.969	0.233	0.0	1.4	1.4	49.8	Flood Risk
7200 min Winter	108.954	0.218	0.0	1.3	1.3	43.6	Flood Risk
8640 min Winter	108.941	0.205	0.0	1.3	1.3	38.4	Flood Risk
10080 min Winter	108.929	0.193	0.0	1.3	1.3	34.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.059	0.0	309.1	5008
10080 min Summer	0.962	0.0	323.0	5752
15 min Winter	100.095	0.0	54.4	19
30 min Winter	67.350	0.0	77.2	33
60 min Winter	43.321	0.0	104.9	62
120 min Winter	25.795	2.2	127.4	122
180 min Winter	19.024	6.1	142.3	180
240 min Winter	15.315	8.8	153.5	238
360 min Winter	11.257	11.9	170.1	354
480 min Winter	9.033	13.8	181.7	468
600 min Winter	7.607	14.6	189.2	578
720 min Winter	6.608	15.0	194.1	688
960 min Winter	5.285	14.4	198.6	894
1440 min Winter	3.855	13.1	198.5	1110
2160 min Winter	2.821	9.9	253.4	1560
2880 min Winter	2.270	6.4	269.6	2016
4320 min Winter	1.690	-0.1	296.1	2852
5760 min Winter	1.382	0.0	318.0	3688
7200 min Winter	1.190	0.0	337.4	4472
8640 min Winter	1.059	0.0	355.2	5272
10080 min Winter	0.962	0.0	372.0	6048

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Cascade Rainfall Details for Pitch 2 - 1 in 100 year.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 2 - 1 in 100 year.SRCX

Storage is Online Cover Level (m) 108.986

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.736	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.038 Discharge Coefficient 0.600 Invert Level (m) 108.736

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Cascade Summary of Results for Pitch 3 - 1 in 100 year.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 2 - 1 in 100 year.SRCX Pitch 1 - 1 in 100 year.SRCX	Pitch 4 - 1 in 100 year.SRCX	(None)

Half Drain Time : 316 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	108.652	0.159	0.0	1.7	1.7	23.2	Flood Risk
30 min Summer	108.684	0.191	0.0	1.9	1.9	33.5	Flood Risk
60 min Summer	108.714	0.221	0.0	2.0	2.0	44.5	Flood Risk
120 min Summer	108.734	0.241	0.0	2.1	2.1	53.0	Flood Risk
180 min Summer	108.744	0.251	0.0	2.2	2.2	57.9	FLOOD
240 min Summer	108.746	0.253	0.0	2.2	2.2	61.1	FLOOD
360 min Summer	108.748	0.255	0.0	2.2	2.2	65.0	FLOOD
480 min Summer	108.750	0.257	0.0	2.2	2.2	66.9	FLOOD
600 min Summer	108.750	0.257	0.0	2.2	2.2	67.7	FLOOD
720 min Summer	108.750	0.257	0.0	2.2	2.2	67.8	FLOOD
960 min Summer	108.750	0.257	0.0	2.2	2.2	67.7	FLOOD
1440 min Summer	108.750	0.257	0.0	2.2	2.2	66.6	FLOOD
2160 min Summer	108.748	0.255	0.0	2.2	2.2	63.7	FLOOD
2880 min Summer	108.745	0.252	0.0	2.2	2.2	60.6	FLOOD
4320 min Summer	108.738	0.245	0.0	2.2	2.2	54.8	Flood Risk
5760 min Summer	108.727	0.234	0.0	2.1	2.1	50.1	Flood Risk
7200 min Summer	108.717	0.224	0.0	2.1	2.1	46.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	100.095	0.0	70.5	19
30 min Summer	67.350	0.0	102.0	34
60 min Summer	43.321	0.0	138.0	64
120 min Summer	25.795	0.0	168.2	122
180 min Summer	19.024	0.4	188.0	182
240 min Summer	15.315	2.8	203.0	242
360 min Summer	11.257	5.6	225.2	362
480 min Summer	9.033	6.8	241.5	480
600 min Summer	7.607	7.4	254.1	600
720 min Summer	6.608	7.5	263.5	672
960 min Summer	5.285	7.4	275.3	780
1440 min Summer	3.855	6.4	280.5	1028
2160 min Summer	2.821	4.5	334.8	1448
2880 min Summer	2.270	2.4	355.7	1848
4320 min Summer	1.690	0.0	389.5	2640
5760 min Summer	1.382	0.0	417.2	3456
7200 min Summer	1.190	0.0	441.5	4248

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Cascade Summary of Results for Pitch 3 - 1 in 100 year.SRCX

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
8640 min Summer	108.709	0.216	0.0	2.0	2.0	42.6	Flood Risk
10080 min Summer	108.701	0.208	0.0	2.0	2.0	39.7	Flood Risk
15 min Winter	108.664	0.171	0.0	1.8	1.8	26.9	Flood Risk
30 min Winter	108.698	0.205	0.0	2.0	2.0	38.4	Flood Risk
60 min Winter	108.729	0.236	0.0	2.1	2.1	50.9	Flood Risk
120 min Winter	108.745	0.252	0.0	2.2	2.2	60.5	FLOOD
180 min Winter	108.749	0.256	0.0	2.2	2.2	66.1	FLOOD
240 min Winter	108.752	0.259	0.0	2.2	2.2	70.0	FLOOD
360 min Winter	108.755	0.262	0.0	2.3	2.3	74.7	FLOOD
480 min Winter	108.757	0.264	0.0	2.3	2.3	77.3	FLOOD
600 min Winter	108.758	0.265	0.0	2.3	2.3	78.6	FLOOD
720 min Winter	108.758	0.265	0.0	2.3	2.3	79.1	FLOOD
960 min Winter	108.758	0.265	0.0	2.3	2.3	78.6	FLOOD
1440 min Winter	108.757	0.264	0.0	2.3	2.3	76.5	FLOOD
2160 min Winter	108.753	0.260	0.0	2.2	2.2	72.1	FLOOD
2880 min Winter	108.750	0.257	0.0	2.2	2.2	67.2	FLOOD
4320 min Winter	108.744	0.251	0.0	2.2	2.2	57.9	FLOOD
5760 min Winter	108.727	0.234	0.0	2.1	2.1	50.3	Flood Risk
7200 min Winter	108.712	0.219	0.0	2.0	2.0	44.0	Flood Risk
8640 min Winter	108.699	0.206	0.0	2.0	2.0	38.8	Flood Risk
10080 min Winter	108.687	0.194	0.0	1.9	1.9	34.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.059	0.0	463.7	5008
10080 min Summer	0.962	0.0	484.5	5752
15 min Winter	100.095	0.0	81.6	19
30 min Winter	67.350	0.0	115.4	33
60 min Winter	43.321	0.0	157.3	62
120 min Winter	25.795	2.3	191.2	122
180 min Winter	19.024	6.3	213.4	180
240 min Winter	15.315	9.0	230.2	238
360 min Winter	11.257	12.3	255.1	354
480 min Winter	9.033	14.0	272.3	468
600 min Winter	7.607	15.1	283.9	580
720 min Winter	6.608	15.3	291.9	688
960 min Winter	5.285	15.1	300.0	894
1440 min Winter	3.855	13.4	300.4	1110
2160 min Winter	2.821	10.5	380.1	1576
2880 min Winter	2.270	7.1	404.4	2016
4320 min Winter	1.690	0.4	444.1	2856
5760 min Winter	1.382	0.0	477.0	3688
7200 min Winter	1.190	0.0	506.1	4472
8640 min Winter	1.059	0.0	532.8	5272
10080 min Winter	0.962	0.0	558.0	5960

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Cascade Rainfall Details for Pitch 3 - 1 in 100 year.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 3 - 1 in 100 year.SRCX

Storage is Online Cover Level (m) 108.743

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.493	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.047 Discharge Coefficient 0.600 Invert Level (m) 108.493

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Cascade Summary of Results for Pitch 4 - 1 in 100 year.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 3 - 1 in 100 year.SRCX Pitch 2 - 1 in 100 year.SRCX Pitch 1 - 1 in 100 year.SRCX	(None)	(None)

Half Drain Time : 104 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	108.404	0.154	0.0	4.1	4.1	21.8	Flood Risk
30 min Summer	108.434	0.184	0.0	4.2	4.2	31.0	Flood Risk
60 min Summer	108.458	0.208	0.0	4.2	4.2	39.7	Flood Risk
120 min Summer	108.468	0.218	0.0	4.2	4.2	43.4	Flood Risk
180 min Summer	108.469	0.219	0.0	4.2	4.2	43.8	Flood Risk
240 min Summer	108.467	0.217	0.0	4.2	4.2	43.1	Flood Risk
360 min Summer	108.463	0.213	0.0	4.2	4.2	41.5	Flood Risk
480 min Summer	108.458	0.208	0.0	4.2	4.2	39.7	Flood Risk
600 min Summer	108.453	0.203	0.0	4.2	4.2	37.7	Flood Risk
720 min Summer	108.448	0.198	0.0	4.2	4.2	35.7	Flood Risk
960 min Summer	108.436	0.186	0.0	4.2	4.2	31.7	Flood Risk
1440 min Summer	108.413	0.163	0.0	4.2	4.2	24.2	Flood Risk
2160 min Summer	108.378	0.128	0.0	4.1	4.1	15.1	Flood Risk
2880 min Summer	108.346	0.096	0.0	4.0	4.0	8.4	Flood Risk
4320 min Summer	108.288	0.038	0.0	3.9	3.9	1.3	Flood Risk
5760 min Summer	108.250	0.000	0.0	3.7	3.7	0.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	100.095	0.0	94.0	18
30 min Summer	67.350	0.0	136.2	33
60 min Summer	43.321	0.0	184.0	62
120 min Summer	25.795	0.0	224.2	122
180 min Summer	19.024	0.0	250.6	180
240 min Summer	15.315	0.0	270.6	208
360 min Summer	11.257	0.0	300.2	270
480 min Summer	9.033	0.0	322.1	338
600 min Summer	7.607	0.0	338.9	406
720 min Summer	6.608	0.0	351.9	476
960 min Summer	5.285	0.0	369.5	608
1440 min Summer	3.855	0.0	383.2	878
2160 min Summer	2.821	0.0	446.5	1252
2880 min Summer	2.270	0.0	474.1	1612
4320 min Summer	1.690	0.0	519.3	2248
5760 min Summer	1.382	0.0	556.2	0

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Cascade Summary of Results for Pitch 4 - 1 in 100 year.SRCX

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
7200 min Summer	108.250	0.000	0.0	3.4	3.4	0.0	Flood Risk
8640 min Summer	108.250	0.000	0.0	3.2	3.2	0.0	Flood Risk
10080 min Summer	108.250	0.000	0.0	3.1	3.1	0.0	Flood Risk
15 min Winter	108.416	0.166	0.0	4.2	4.2	25.3	Flood Risk
30 min Winter	108.448	0.198	0.0	4.2	4.2	35.8	Flood Risk
60 min Winter	108.474	0.224	0.0	4.3	4.3	46.0	Flood Risk
120 min Winter	108.486	0.236	0.0	4.3	4.3	51.1	Flood Risk
180 min Winter	108.489	0.239	0.0	4.3	4.3	52.2	Flood Risk
240 min Winter	108.488	0.238	0.0	4.3	4.3	51.7	Flood Risk
360 min Winter	108.482	0.232	0.0	4.3	4.3	49.1	Flood Risk
480 min Winter	108.475	0.225	0.0	4.3	4.3	46.5	Flood Risk
600 min Winter	108.468	0.218	0.0	4.2	4.2	43.5	Flood Risk
720 min Winter	108.460	0.210	0.0	4.2	4.2	40.5	Flood Risk
960 min Winter	108.444	0.194	0.0	4.2	4.2	34.4	Flood Risk
1440 min Winter	108.410	0.160	0.0	4.1	4.1	23.4	Flood Risk
2160 min Winter	108.359	0.109	0.0	4.1	4.1	10.9	Flood Risk
2880 min Winter	108.306	0.056	0.0	4.0	4.0	2.9	Flood Risk
4320 min Winter	108.250	0.000	0.0	3.6	3.6	0.0	Flood Risk
5760 min Winter	108.250	0.000	0.0	3.2	3.2	0.0	Flood Risk
7200 min Winter	108.250	0.000	0.0	3.0	3.0	0.0	Flood Risk
8640 min Winter	108.250	0.000	0.0	2.8	2.8	0.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Summer	1.190	0.0	588.7	0
8640 min Summer	1.059	0.0	618.2	0
10080 min Summer	0.962	0.0	646.0	0
15 min Winter	100.095	0.0	108.8	18
30 min Winter	67.350	0.0	154.6	32
60 min Winter	43.321	0.0	209.9	62
120 min Winter	25.795	0.0	254.9	118
180 min Winter	19.024	0.0	284.6	176
240 min Winter	15.315	0.0	306.9	230
360 min Winter	11.257	0.0	340.2	290
480 min Winter	9.033	0.0	363.4	366
600 min Winter	7.607	0.0	380.0	442
720 min Winter	6.608	0.0	392.2	520
960 min Winter	5.285	0.0	406.7	664
1440 min Winter	3.855	0.0	416.8	938
2160 min Winter	2.821	0.0	506.7	1320
2880 min Winter	2.270	0.0	539.2	1644
4320 min Winter	1.690	0.0	592.1	0
5760 min Winter	1.382	0.0	636.0	0
7200 min Winter	1.190	0.0	674.8	0
8640 min Winter	1.059	0.0	710.4	0

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Cascade Summary of Results for Pitch 4 - 1 in 100 year.SRCX

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
10080 min Winter	108.250	0.000	0.0	2.7	2.7	0.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.962	0.0	744.0	0

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Cascade Rainfall Details for Pitch 4 - 1 in 100 year.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 4 - 1 in 100 year.SRCX

Storage is Online Cover Level (m) 108.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.250	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0095-4300-1200-4300
Design Head (m)	1.200
Design Flow (l/s)	4.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	107.300
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	4.3
Flush-Flo™	0.356	4.3
Kick-Flo®	0.739	3.4
Mean Flow over Head Range	-	3.8

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	3.1	1.200	4.3	3.000	6.6	7.000	9.8
0.200	4.1	1.400	4.6	3.500	7.1	7.500	10.2
0.300	4.3	1.600	4.9	4.000	7.5	8.000	10.5
0.400	4.3	1.800	5.2	4.500	8.0	8.500	10.8
0.500	4.2	2.000	5.5	5.000	8.4	9.000	11.1
0.600	4.0	2.200	5.7	5.500	8.8	9.500	11.4
0.800	3.6	2.400	5.9	6.000	9.1		
1.000	4.0	2.600	6.2	6.500	9.5		

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Appendix J

Pitch Calculations – 1 in 100 year + 45 climate change

Cascade Summary of Results for Pitch 1 - 1 in 100 year + 45% CC.SRCX

Upstream Structures	Outflow To	Overflow To
(None)	Pitch 2 - 1 in 100 year + 45% CC.SRCX	(None)

Half Drain Time : 1488 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	109.181	0.201	0.0	0.6	0.6	37.0	Flood Risk
30 min Summer	109.219	0.239	0.0	0.7	0.7	52.1	Flood Risk
60 min Summer	109.238	0.258	0.0	0.7	0.7	68.5	FLOOD
120 min Summer	109.247	0.267	0.0	0.7	0.7	81.4	FLOOD
180 min Summer	109.253	0.273	0.0	0.7	0.7	89.2	FLOOD
240 min Summer	109.256	0.276	0.0	0.7	0.7	94.7	FLOOD
360 min Summer	109.262	0.282	0.0	0.7	0.7	101.9	FLOOD
480 min Summer	109.265	0.285	0.0	0.7	0.7	106.2	FLOOD
600 min Summer	109.267	0.287	0.0	0.7	0.7	108.8	FLOOD
720 min Summer	109.268	0.288	0.0	0.7	0.7	110.4	FLOOD
960 min Summer	109.269	0.289	0.0	0.7	0.7	111.4	FLOOD
1440 min Summer	109.268	0.288	0.0	0.7	0.7	110.4	FLOOD
2160 min Summer	109.266	0.286	0.0	0.7	0.7	108.0	FLOOD
2880 min Summer	109.264	0.284	0.0	0.7	0.7	105.3	FLOOD
4320 min Summer	109.260	0.280	0.0	0.7	0.7	100.0	FLOOD
5760 min Summer	109.257	0.277	0.0	0.7	0.7	95.2	FLOOD
7200 min Summer	109.254	0.274	0.0	0.7	0.7	91.0	FLOOD

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	145.138	0.0	37.2	19
30 min Summer	97.657	0.0	46.8	34
60 min Summer	62.815	7.9	70.1	64
120 min Summer	37.402	17.0	84.8	124
180 min Summer	27.585	22.4	94.2	184
240 min Summer	22.206	26.5	99.9	242
360 min Summer	16.323	31.5	105.1	362
480 min Summer	13.097	34.7	107.6	482
600 min Summer	11.031	36.6	108.9	602
720 min Summer	9.581	37.8	109.4	720
960 min Summer	7.663	38.4	109.2	960
1440 min Summer	5.590	37.8	106.1	1214
2160 min Summer	4.090	35.9	168.1	1584
2880 min Summer	3.292	34.0	179.2	1992
4320 min Summer	2.450	30.3	183.0	2812
5760 min Summer	2.005	26.8	213.0	3640
7200 min Summer	1.726	23.8	226.7	4464

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Cascade Summary of Results for Pitch 1 - 1 in 100 year + 45% CC.SRCX

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
8640 min Summer	109.251	0.271	0.0	0.7	0.7	87.2	FLOOD
10080 min Summer	109.249	0.269	0.0	0.7	0.7	83.9	FLOOD
15 min Winter	109.195	0.215	0.0	0.6	0.6	42.4	Flood Risk
30 min Winter	109.232	0.252	0.0	0.7	0.7	59.3	FLOOD
60 min Winter	109.244	0.264	0.0	0.7	0.7	77.7	FLOOD
120 min Winter	109.255	0.275	0.0	0.7	0.7	92.4	FLOOD
180 min Winter	109.261	0.281	0.0	0.7	0.7	101.4	FLOOD
240 min Winter	109.266	0.286	0.0	0.7	0.7	107.7	FLOOD
360 min Winter	109.272	0.292	0.0	0.7	0.7	116.1	FLOOD
480 min Winter	109.276	0.296	0.0	0.8	0.8	121.3	FLOOD
600 min Winter	109.278	0.298	0.0	0.8	0.8	124.7	FLOOD
720 min Winter	109.280	0.300	0.0	0.8	0.8	126.9	FLOOD
960 min Winter	109.281	0.301	0.0	0.8	0.8	129.1	FLOOD
1440 min Winter	109.281	0.301	0.0	0.8	0.8	128.6	FLOOD
2160 min Winter	109.278	0.298	0.0	0.8	0.8	124.8	FLOOD
2880 min Winter	109.276	0.296	0.0	0.8	0.8	121.0	FLOOD
4320 min Winter	109.269	0.289	0.0	0.7	0.7	112.6	FLOOD
5760 min Winter	109.263	0.283	0.0	0.7	0.7	104.3	FLOOD
7200 min Winter	109.258	0.278	0.0	0.7	0.7	96.7	FLOOD
8640 min Winter	109.253	0.273	0.0	0.7	0.7	89.8	FLOOD
10080 min Winter	109.249	0.269	0.0	0.7	0.7	83.6	FLOOD

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.535	21.0	239.4	5272
10080 min Summer	1.395	18.7	251.5	6056
15 min Winter	145.138	0.0	41.6	19
30 min Winter	97.657	1.4	49.9	33
60 min Winter	62.815	14.4	79.5	64
120 min Winter	37.402	24.8	95.7	122
180 min Winter	27.585	31.2	103.3	180
240 min Winter	22.206	35.8	107.2	240
360 min Winter	16.323	42.0	111.3	356
480 min Winter	13.097	45.7	113.1	472
600 min Winter	11.031	48.3	114.0	588
720 min Winter	9.581	49.9	114.2	702
960 min Winter	7.663	51.5	113.5	926
1440 min Winter	5.590	51.0	109.8	1356
2160 min Winter	4.090	48.3	190.0	1692
2880 min Winter	3.292	45.4	199.5	2160
4320 min Winter	2.450	39.4	195.4	3072
5760 min Winter	2.005	33.4	241.7	3976
7200 min Winter	1.726	27.9	257.7	4824
8640 min Winter	1.535	23.0	272.6	5624
10080 min Winter	1.395	18.4	286.7	6456

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Cascade Rainfall Details for Pitch 1 - 1 in 100 year + 45% CC.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 1 - 1 in 100 year + 45% CC.SRCX

Storage is Online Cover Level (m) 109.230

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.980	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 108.980

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Cascade Summary of Results for Pitch 2 - 1 in 100 year + 45% CC.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 1 - 1 in 100 year + 45% CC.SRCX	Pitch 3 - 1 in 100 year + 45% CC.SRCX	(None)

Half Drain Time : 697 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	108.937	0.201	0.0	1.3	1.3	37.0	Flood Risk
30 min Summer	108.975	0.239	0.0	1.4	1.4	52.1	Flood Risk
60 min Summer	108.994	0.258	0.0	1.5	1.5	68.3	FLOOD
120 min Summer	109.003	0.267	0.0	1.5	1.5	81.1	FLOOD
180 min Summer	109.008	0.272	0.0	1.5	1.5	88.7	FLOOD
240 min Summer	109.012	0.276	0.0	1.5	1.5	94.1	FLOOD
360 min Summer	109.017	0.281	0.0	1.5	1.5	100.9	FLOOD
480 min Summer	109.020	0.284	0.0	1.6	1.6	104.8	FLOOD
600 min Summer	109.021	0.285	0.0	1.6	1.6	107.1	FLOOD
720 min Summer	109.022	0.286	0.0	1.6	1.6	108.4	FLOOD
960 min Summer	109.023	0.287	0.0	1.6	1.6	108.7	FLOOD
1440 min Summer	109.022	0.286	0.0	1.6	1.6	107.5	FLOOD
2160 min Summer	109.020	0.284	0.0	1.6	1.6	104.7	FLOOD
2880 min Summer	109.017	0.281	0.0	1.5	1.5	101.6	FLOOD
4320 min Summer	109.013	0.277	0.0	1.5	1.5	95.6	FLOOD
5760 min Summer	109.009	0.273	0.0	1.5	1.5	90.2	FLOOD
7200 min Summer	109.006	0.270	0.0	1.5	1.5	85.5	FLOOD

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	145.138	0.0	74.3	19
30 min Summer	97.657	0.0	95.3	34
60 min Summer	62.815	7.8	140.3	64
120 min Summer	37.402	16.7	169.6	124
180 min Summer	27.585	22.2	188.3	182
240 min Summer	22.206	26.1	200.3	242
360 min Summer	16.323	30.9	213.5	362
480 min Summer	13.097	33.7	220.0	482
600 min Summer	11.031	35.4	223.5	602
720 min Summer	9.581	36.3	225.3	720
960 min Summer	7.663	36.5	225.9	936
1440 min Summer	5.590	35.6	220.7	1156
2160 min Summer	4.090	33.6	336.3	1540
2880 min Summer	3.292	31.5	358.4	1960
4320 min Summer	2.450	27.0	372.6	2768
5760 min Summer	2.005	23.2	425.9	3624
7200 min Summer	1.726	19.9	453.4	4400

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Cascade Summary of Results for Pitch 2 - 1 in 100 year + 45% CC.SRCX

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
8640 min Summer	109.003	0.267	0.0	1.5	1.5	81.3	FLOOD
10080 min Summer	109.000	0.264	0.0	1.5	1.5	77.6	FLOOD
15 min Winter	108.951	0.215	0.0	1.3	1.3	42.4	Flood Risk
30 min Winter	108.987	0.251	0.0	1.5	1.5	59.3	FLOOD
60 min Winter	109.000	0.264	0.0	1.5	1.5	77.6	FLOOD
120 min Winter	109.011	0.275	0.0	1.5	1.5	92.1	FLOOD
180 min Winter	109.017	0.281	0.0	1.5	1.5	100.9	FLOOD
240 min Winter	109.021	0.285	0.0	1.6	1.6	107.0	FLOOD
360 min Winter	109.027	0.291	0.0	1.6	1.6	115.1	FLOOD
480 min Winter	109.031	0.295	0.0	1.6	1.6	119.9	FLOOD
600 min Winter	109.033	0.297	0.0	1.6	1.6	123.0	FLOOD
720 min Winter	109.034	0.298	0.0	1.6	1.6	124.8	FLOOD
960 min Winter	109.035	0.299	0.0	1.6	1.6	126.3	FLOOD
1440 min Winter	109.034	0.298	0.0	1.6	1.6	124.6	FLOOD
2160 min Winter	109.031	0.295	0.0	1.6	1.6	120.6	FLOOD
2880 min Winter	109.028	0.292	0.0	1.6	1.6	116.0	FLOOD
4320 min Winter	109.021	0.285	0.0	1.6	1.6	106.4	FLOOD
5760 min Winter	109.014	0.278	0.0	1.5	1.5	97.2	FLOOD
7200 min Winter	109.008	0.272	0.0	1.5	1.5	89.0	FLOOD
8640 min Winter	109.003	0.267	0.0	1.5	1.5	81.6	FLOOD
10080 min Winter	108.999	0.263	0.0	1.5	1.5	75.1	FLOOD

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.535	17.0	478.9	5192
10080 min Summer	1.395	14.3	503.0	5960
15 min Winter	145.138	0.0	83.1	19
30 min Winter	97.657	1.6	102.1	33
60 min Winter	62.815	14.3	158.9	64
120 min Winter	37.402	24.5	191.1	122
180 min Winter	27.585	30.9	208.2	180
240 min Winter	22.206	35.3	217.7	240
360 min Winter	16.323	41.1	227.9	356
480 min Winter	13.097	44.7	233.0	472
600 min Winter	11.031	47.0	235.5	586
720 min Winter	9.581	48.4	236.6	700
960 min Winter	7.663	49.5	236.1	924
1440 min Winter	5.590	48.2	229.6	1340
2160 min Winter	4.090	45.2	380.0	1664
2880 min Winter	3.292	41.9	400.6	2132
4320 min Winter	2.450	34.9	401.1	3028
5760 min Winter	2.005	28.2	483.4	3912
7200 min Winter	1.726	22.4	515.5	4752
8640 min Winter	1.535	17.1	545.2	5536
10080 min Winter	1.395	12.5	573.4	6352

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Cascade Rainfall Details for Pitch 2 - 1 in 100 year + 45% CC.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 2 - 1 in 100 year + 45% CC.SRCX

Storage is Online Cover Level (m) 108.986

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.736	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.038 Discharge Coefficient 0.600 Invert Level (m) 108.736

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Cascade Summary of Results for Pitch 3 - 1 in 100 year + 45% CC.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 2 - 1 in 100 year + 45% CC.SRCX Pitch 1 - 1 in 100 year + 45% CC.SRCX	Pitch 4 - 1 in 100 year + 45% CC.SRCX	(None)

Half Drain Time : 462 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	108.694	0.201	0.0	1.9	1.9	37.0	Flood Risk
30 min Summer	108.732	0.239	0.0	2.1	2.1	52.1	Flood Risk
60 min Summer	108.751	0.258	0.0	2.2	2.2	68.4	FLOOD
120 min Summer	108.760	0.267	0.0	2.3	2.3	81.2	FLOOD
180 min Summer	108.765	0.272	0.0	2.3	2.3	88.9	FLOOD
240 min Summer	108.769	0.276	0.0	2.3	2.3	94.3	FLOOD
360 min Summer	108.774	0.281	0.0	2.3	2.3	101.2	FLOOD
480 min Summer	108.777	0.284	0.0	2.4	2.4	105.3	FLOOD
600 min Summer	108.779	0.286	0.0	2.4	2.4	107.7	FLOOD
720 min Summer	108.780	0.287	0.0	2.4	2.4	109.0	FLOOD
960 min Summer	108.780	0.287	0.0	2.4	2.4	109.5	FLOOD
1440 min Summer	108.779	0.286	0.0	2.4	2.4	108.3	FLOOD
2160 min Summer	108.777	0.284	0.0	2.4	2.4	105.6	FLOOD
2880 min Summer	108.775	0.282	0.0	2.3	2.3	102.6	FLOOD
4320 min Summer	108.771	0.278	0.0	2.3	2.3	96.6	FLOOD
5760 min Summer	108.767	0.274	0.0	2.3	2.3	91.2	FLOOD
7200 min Summer	108.764	0.271	0.0	2.3	2.3	86.5	FLOOD

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	145.138	0.0	111.1	19
30 min Summer	97.657	0.0	143.7	34
60 min Summer	62.815	7.9	210.4	64
120 min Summer	37.402	16.9	254.3	124
180 min Summer	27.585	22.3	282.2	182
240 min Summer	22.206	26.1	300.6	242
360 min Summer	16.323	31.1	322.2	362
480 min Summer	13.097	34.0	332.7	482
600 min Summer	11.031	35.8	338.4	602
720 min Summer	9.581	36.7	341.4	720
960 min Summer	7.663	37.0	342.5	952
1440 min Summer	5.590	36.3	334.6	1168
2160 min Summer	4.090	34.3	504.4	1552
2880 min Summer	3.292	32.0	537.5	1960
4320 min Summer	2.450	27.8	563.1	2768
5760 min Summer	2.005	24.0	638.9	3624
7200 min Summer	1.726	20.5	680.1	4400

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Cascade Summary of Results for Pitch 3 - 1 in 100 year + 45% CC.SRCX

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
8640 min Summer	108.761	0.268	0.0	2.3	2.3	82.3	FLOOD
10080 min Summer	108.758	0.265	0.0	2.3	2.3	78.6	FLOOD
15 min Winter	108.708	0.215	0.0	2.0	2.0	42.4	Flood Risk
30 min Winter	108.744	0.251	0.0	2.2	2.2	59.3	FLOOD
60 min Winter	108.757	0.264	0.0	2.3	2.3	77.6	FLOOD
120 min Winter	108.768	0.275	0.0	2.3	2.3	92.2	FLOOD
180 min Winter	108.774	0.281	0.0	2.3	2.3	101.0	FLOOD
240 min Winter	108.778	0.285	0.0	2.4	2.4	107.2	FLOOD
360 min Winter	108.784	0.291	0.0	2.4	2.4	115.4	FLOOD
480 min Winter	108.788	0.295	0.0	2.4	2.4	120.4	FLOOD
600 min Winter	108.790	0.297	0.0	2.4	2.4	123.5	FLOOD
720 min Winter	108.792	0.299	0.0	2.4	2.4	125.4	FLOOD
960 min Winter	108.793	0.300	0.0	2.4	2.4	127.0	FLOOD
1440 min Winter	108.792	0.299	0.0	2.4	2.4	125.6	FLOOD
2160 min Winter	108.789	0.296	0.0	2.4	2.4	121.6	FLOOD
2880 min Winter	108.786	0.293	0.0	2.4	2.4	117.1	FLOOD
4320 min Winter	108.779	0.286	0.0	2.4	2.4	107.5	FLOOD
5760 min Winter	108.772	0.279	0.0	2.3	2.3	98.3	FLOOD
7200 min Winter	108.766	0.273	0.0	2.3	2.3	90.0	FLOOD
8640 min Winter	108.761	0.268	0.0	2.3	2.3	82.6	FLOOD
10080 min Winter	108.756	0.263	0.0	2.3	2.3	76.1	FLOOD

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
8640 min Summer	1.535	17.6	718.3	5192
10080 min Summer	1.395	15.0	754.5	5960
15 min Winter	145.138	0.0	124.4	19
30 min Winter	97.657	1.6	154.2	33
60 min Winter	62.815	14.3	238.4	64
120 min Winter	37.402	24.6	286.4	122
180 min Winter	27.585	31.1	312.9	180
240 min Winter	22.206	35.6	328.7	240
360 min Winter	16.323	41.5	345.0	356
480 min Winter	13.097	45.0	353.1	472
600 min Winter	11.031	47.4	357.1	588
720 min Winter	9.581	48.8	358.9	700
960 min Winter	7.663	50.0	358.2	924
1440 min Winter	5.590	48.9	348.1	1340
2160 min Winter	4.090	46.0	569.9	1664
2880 min Winter	3.292	42.6	601.8	2132
4320 min Winter	2.450	35.6	607.4	3028
5760 min Winter	2.005	28.9	725.1	3912
7200 min Winter	1.726	23.1	773.2	4752
8640 min Winter	1.535	17.9	817.8	5536
10080 min Winter	1.395	13.2	860.1	6352

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Cascade Rainfall Details for Pitch 3 - 1 in 100 year + 45% CC.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 3 - 1 in 100 year + 45% CC.SRCX

Storage is Online Cover Level (m) 108.743

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.493	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.047 Discharge Coefficient 0.600 Invert Level (m) 108.493

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Cascade Summary of Results for Pitch 4 - 1 in 100 year + 45% CC.SRCX

Upstream Structures	Outflow To	Overflow To
Pitch 3 - 1 in 100 year + 45% CC.SRCX	(None)	(None)
Pitch 2 - 1 in 100 year + 45% CC.SRCX		
Pitch 1 - 1 in 100 year + 45% CC.SRCX		

Half Drain Time : 175 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	108.447	0.197	0.0	4.2	4.2	35.6	Flood Risk
30 min Summer	108.483	0.233	0.0	4.3	4.3	49.6	Flood Risk
60 min Summer	108.504	0.254	0.0	4.3	4.3	63.2	FLOOD
120 min Summer	108.510	0.260	0.0	4.3	4.3	71.2	FLOOD
180 min Summer	108.512	0.262	0.0	4.3	4.3	74.1	FLOOD
240 min Summer	108.512	0.262	0.0	4.3	4.3	74.7	FLOOD
360 min Summer	108.511	0.261	0.0	4.3	4.3	73.3	FLOOD
480 min Summer	108.510	0.260	0.0	4.3	4.3	71.5	FLOOD
600 min Summer	108.509	0.259	0.0	4.3	4.3	69.6	FLOOD
720 min Summer	108.507	0.257	0.0	4.3	4.3	67.7	FLOOD
960 min Summer	108.505	0.255	0.0	4.3	4.3	63.7	FLOOD
1440 min Summer	108.497	0.247	0.0	4.3	4.3	55.8	Flood Risk
2160 min Summer	108.472	0.222	0.0	4.3	4.3	45.0	Flood Risk
2880 min Summer	108.448	0.198	0.0	4.2	4.2	35.8	Flood Risk
4320 min Summer	108.405	0.155	0.0	4.1	4.1	21.9	Flood Risk
5760 min Summer	108.367	0.117	0.0	4.1	4.1	12.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	145.138	0.0	148.6	18
30 min Summer	97.657	0.0	196.6	33
60 min Summer	62.815	4.2	280.6	62
120 min Summer	37.402	9.8	339.0	122
180 min Summer	27.585	11.9	376.7	182
240 min Summer	22.206	12.3	402.4	240
360 min Summer	16.323	11.3	434.9	330
480 min Summer	13.097	10.1	453.5	388
600 min Summer	11.031	8.6	465.6	452
720 min Summer	9.581	7.4	474.0	516
960 min Summer	7.663	4.5	483.8	654
1440 min Summer	5.590	0.0	488.8	924
2160 min Summer	4.090	0.0	672.6	1320
2880 min Summer	3.292	0.0	716.6	1704
4320 min Summer	2.450	0.0	760.6	2460
5760 min Summer	2.005	0.0	851.7	3168

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Cascade Summary of Results for Pitch 4 - 1 in 100 year + 45% CC.SRCX

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
7200 min Summer	108.334	0.084	0.0	4.0	4.0	6.5	Flood Risk
8640 min Summer	108.305	0.055	0.0	4.0	4.0	2.7	Flood Risk
10080 min Summer	108.276	0.026	0.0	3.9	3.9	0.6	Flood Risk
15 min Winter	108.461	0.211	0.0	4.2	4.2	40.8	Flood Risk
30 min Winter	108.499	0.249	0.0	4.3	4.3	56.8	Flood Risk
60 min Winter	108.511	0.261	0.0	4.3	4.3	72.7	FLOOD
120 min Winter	108.518	0.268	0.0	4.3	4.3	82.4	FLOOD
180 min Winter	108.521	0.271	0.0	4.3	4.3	86.6	FLOOD
240 min Winter	108.522	0.272	0.0	4.3	4.3	88.2	FLOOD
360 min Winter	108.522	0.272	0.0	4.3	4.3	88.0	FLOOD
480 min Winter	108.520	0.270	0.0	4.3	4.3	85.6	FLOOD
600 min Winter	108.518	0.268	0.0	4.3	4.3	82.6	FLOOD
720 min Winter	108.516	0.266	0.0	4.3	4.3	80.0	FLOOD
960 min Winter	108.512	0.262	0.0	4.3	4.3	74.2	FLOOD
1440 min Winter	108.504	0.254	0.0	4.3	4.3	62.2	FLOOD
2160 min Winter	108.474	0.224	0.0	4.3	4.3	46.0	Flood Risk
2880 min Winter	108.439	0.189	0.0	4.2	4.2	32.6	Flood Risk
4320 min Winter	108.372	0.122	0.0	4.1	4.1	13.7	Flood Risk
5760 min Winter	108.308	0.058	0.0	4.0	4.0	3.1	Flood Risk
7200 min Winter	108.250	0.000	0.0	3.8	3.8	0.0	Flood Risk
8640 min Winter	108.250	0.000	0.0	3.6	3.6	0.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
7200 min Summer	1.726	0.0	906.8	3824
8640 min Summer	1.535	0.0	957.8	4496
10080 min Summer	1.395	0.0	1006.0	5144
15 min Winter	145.138	0.0	167.3	18
30 min Winter	97.657	0.0	214.4	33
60 min Winter	62.815	10.9	317.9	62
120 min Winter	37.402	17.6	382.1	120
180 min Winter	27.585	20.6	419.4	178
240 min Winter	22.206	21.8	443.6	234
360 min Winter	16.323	21.6	472.2	346
480 min Winter	13.097	20.0	489.4	450
600 min Winter	11.031	17.8	500.8	488
720 min Winter	9.581	16.0	508.5	560
960 min Winter	7.663	11.9	517.8	712
1440 min Winter	5.590	3.4	522.2	1010
2160 min Winter	4.090	0.0	760.0	1428
2880 min Winter	3.292	0.0	804.5	1820
4320 min Winter	2.450	0.0	831.3	2552
5760 min Winter	2.005	0.0	966.8	3176
7200 min Winter	1.726	0.0	1030.9	0
8640 min Winter	1.535	0.0	1090.4	0

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Cascade Summary of Results for Pitch 4 - 1 in 100 year + 45% CC.SRCX

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
10080 min Winter	108.250	0.000	0.0	3.5	3.5	0.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.395	0.0	1146.8	0

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Cascade Rainfall Details for Pitch 4 - 1 in 100 year + 45% CC.SRCX

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 380141 405477 SD 80141 05477
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.165

Time (mins) From:	To:	Area (ha)
0	4	0.165

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Cascade Model Details for Pitch 4 - 1 in 100 year + 45% CC.SRCX

Storage is Online Cover Level (m) 108.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	61.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.3
Max Percolation (l/s)	411.8	Slope (1:X)	100.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	108.250	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0095-4300-1200-4300
Design Head (m)	1.200
Design Flow (l/s)	4.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	107.300
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.200	4.3
Flush-Flo™	0.356	4.3
Kick-Flo®	0.739	3.4
Mean Flow over Head Range	-	3.8

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	3.1	1.200	4.3	3.000	6.6	7.000	9.8
0.200	4.1	1.400	4.6	3.500	7.1	7.500	10.2
0.300	4.3	1.600	4.9	4.000	7.5	8.000	10.5
0.400	4.3	1.800	5.2	4.500	8.0	8.500	10.8
0.500	4.2	2.000	5.5	5.000	8.4	9.000	11.1
0.600	4.0	2.200	5.7	5.500	8.8	9.500	11.4
0.800	3.6	2.400	5.9	6.000	9.1		
1.000	4.0	2.600	6.2	6.500	9.5		

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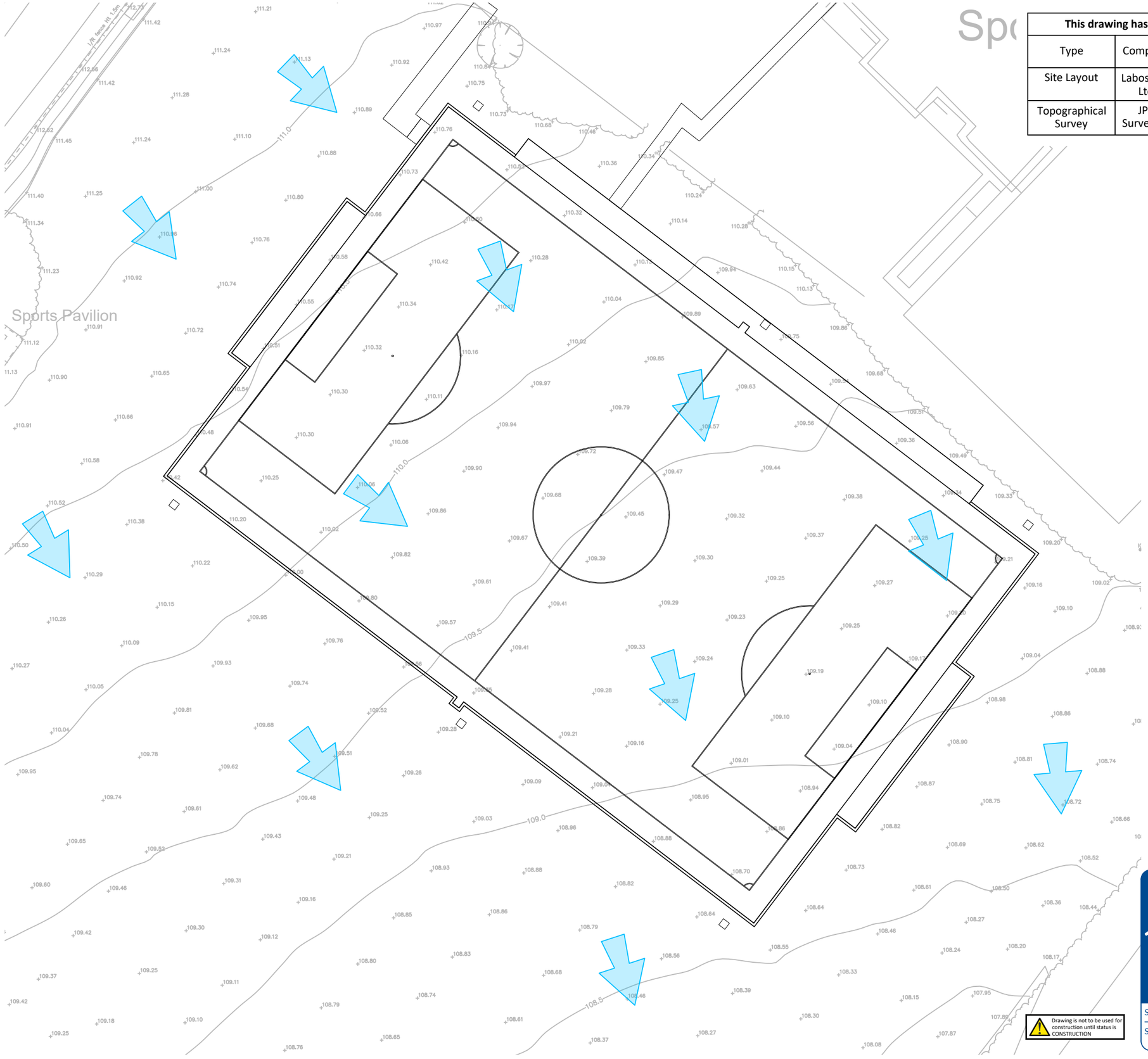
Appendix K

Overland Flows

JPP Consulting drawing no. 31553-FRA04



This drawing has been based/developed using the following external drawings					
Type	Company	Drawing date	Drawing title / File name	Date received	Rev
Site Layout	Labosport Ltd	-	Philips High School - FOR EXPORT	06.02.2026	-
Topographical Survey	JPP Surveying	05.06.2025	Topographical Survey	06.02.2026	-

General Notes

1. All dimensions are in metres unless otherwise stated.
2. All levels are in metres.
3. This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.
4. Do not scale from this drawing.

Drawing Key

Overland Flows

Drawing is not to be used for construction until status is CONSTRUCTION

jpp The JPP Group

- Infrastructure Design
- Highways
- Structural Engineering
- Development Planning
- Geotechnical & Environmental
- Surveying
- Construction Management

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Client: Labosport Ltd

Project: Proposed Synthetic Turf Pitch Philips High School, Higher Lane, Whitefield, Manchester

Title: Overland Flows

Scale at A3 1:500	Drawn by JPB	Checked by KER	Date 18.03.2026
Status **FOR PLANNING**	Project ref 31553	Drawing no. FRA04	Revision -