Vincentian Presbytery

Mill Hill, London

Drainage Strategy and Surface Water Management Plan

April 2021

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Document Revision Control

Revisions	Date	Reason for Issue	By	Approved
00	20.04.21	Planning	CB	BL
01	22.04.21	Planning	CB	BL

Contents

1.0 Introduction

Harley Haddow Ltd were appointed to act as civil engineers for the proposed redevelopment of a church site in Mill Hill, London. The scope comprises demolition of an existing presbytery and construction of a 3 storey building to provide a new presbytery and single storey extension to an existing church. This report will outline the surface water management plan and drainage requirements of the development design proposal and the drainage strategies that are to be employed.

The site comprises an existing church, car park and presbytery and is considered 'Brownfield'. The calculations within this report will assess the existing surface water runoff against the proposed discharge rates and state what attenuation is required.

The site is located in the Mill Hill area of Barnet, London. It is bounded to the west by The Broadway, Flower Lane to the east and residential properties to the south.

2.0 Site Information

2.1 Existing Site

The site area is approximately 2750m^2 and comprises a church, an asphalt car park and a presbytery. The presbytery contains six bedrooms, and the car park comprises vehicle parking for 34no. vehicles.

The site contains some areas of vegetation and planting but is mainly hardstanding. The church area is 763m^2, car park area is 1007m^2 and the presbytery and associated garages is 198m^2. The western section of the car park is dished so that the levels fall from the outer edge inwards towards gullies located in the central area. Towards the eastern side of the car park the levels generally fall to the north to a gully located at the parking bays. A location plan is shown in Appendix A.

Review of the Thames Water asset map shows existing 375mm foul sewers running down both The Broadway and Flower Lane flowing roughly from north to south. There is an existing 900mm surface water sewer running from north to south down The Broadway.

The site drainage survey found that the foul drainage runs along the rear of the presbytery and into ex. FWMH11 before connecting to the existing foul sewer on Flower Lane. It was noted on the survey that the outgoing pipe from ex. FWMH11 is trapped, with the invert level being +67.73m AOD.

The surface water drainage runs along both gables of the presbytery then west along the front before joining into the main church surface water network. This then continues around the south west of the church where it runs into ex. SWMH4. This manhole was unable to be surveyed due to vegetation, however, it is assumed that this connects into the 900mm surface water sewer that runs along The Broadway to the west of the site.

It was noted in the CCTV survey report that there were numerous grade 4 and 5 defects within the existing drainage network. These comprised displaced joints, holes / broken sections of pipe and fractures. Remedial work such as high-pressure jetting, drain lining and drain repair are recommended.

2.2 Proposed Works

The proposals are to demolish the existing presbytery and associated single story garages. A new replacement presbytery is to be erected comprising 6no. bedroom suites, 1no. guest room, communal living and dining areas, a kitchen, and the construction of a basement.

In addition, a single-story extension of approximately 42m^2 is to be constructed to the existing church building which will house the offices that are being relocated from the presbytery.

Due to the increase in building footprint of the presbytery and the extension to the church the car park is being reconfigured to provide 30no. spaces, reduced from 34no.

3.0 Drainage Strategy

3.1 Foul Drainage

The proposed development comprises the demolition of the existing building and construction of a new presbytery in its place. As part of the demolition works the existing foul drainage should be abandoned or grubbed up with a new foul drainage system installed in its place.

The pre development peak foul flow from the presbytery was calculated to be 0.042 litres per second. This will increase to 0.047 litres per second following the addition of 1no. guest bedroom. The calculations for this can be found in Appendix B.

Generally, the proposal for the foul drainage is to drain by gravity and then tie into ex. FWMH11 where the existing connection to the main foul sewer on Flower Lane will be utilised. A sump pump will be located in the basement which will take drainage from floor gullies and pop-ups. Specification for the pump will be confirmed at detailed design.

The drainage proposals can be found in Appendix A.

All foul drainage runs are anticipated to be constructed of 100mm and 150mm diameter uPVC pipework with pea gravel surround. All access / manhole construction is anticipated to be constructed of uPVC, polypropylene or precast concrete.

3.2 Surface Water Drainage

The proposal for capturing the surface water drainage from roof areas is a conventional system of guttering and rainwater downpipes connecting to a private underground gravity surface water drain. This will then connect to the surface water network for the church where it will discharge to the 900mm surface water sewer that runs along The Broadway road to the west of the site.

In addition to standard downpipes, a 35m^2 sedum grass roof is proposed for a section of roof at the south western corner of the proposed presbytery.

The existing surface water discharge for the whole site was calculated to be 21.9 litres per second for a 1 in 2 year event.

The post development impermeable area is as per existing, however, in accordance with Barnet Council guidance the discharge rate is to be reduced by at least 50%. Therefore, a flow control is to be fitted to MHS1 to limit the discharge rate to a maximum of 11 litres per second for up to and including the 1 in 100 year event + 30% allowance for climate change. This is shown in the supporting surface water calculations found in Appendix C.

The surface water system is proposed to run separately from the foul system for their entirety.

4.0 SuDS Strategy

SuDS are a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than “conventional” techniques. The requirement for SuDS to account for the quantity and quality of surface water is an intrinsic part of the planning process and all new developments.

The SuDS proposal for this site involve conveying the surface water run-off from roofs to the proposed outfall via down pipes and gravity surface water drainage. Surface water flows from hardstanding areas will be conveyed via permeable paving.

SuDS proposals for this development have been designed in accordance with the SuDS Manual C753, utilising the Simple Index approach. The Pollution Hazard characteristic has been identified as *Very Low* for residential roofs and *Low* for Residential car park / low traffic roads using Table 26.2 within the SUDS Manual, with pollution indices as shown below.

Land Use	TTS (Total Suspended Solids)	Metals	Hydrocarbons
Residential development, driveways, low traffic roads	0.5	0.4	0.4

Suitable SuDS measures have therefore been chosen utilising the mitigation indices noted within table 26.3. The SuDS measures proposed for the development are permeable paving and a bioretention area, with mitigation indices as shown below.

Type of SUDS Component	TTS (Total Suspended Solids)	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7
Bioretention System	0.8	0.8	0.8

Maintenance of SuDS systems should be carried out in accordance with manufacturer’s guidelines and the SuDS Manual C753. A long-term SuDS operation and maintenance strategy for the sedum roof, permeable paving and bioretention system have been proposed within Appendix D. This should be implemented by the client through a suitable maintenance contact or factoring agreement.

5.0 Conclusion

This report and the drawings and calculations contained within the appendices confirm that the design strategy as noted below:

- Detailed levels and drainage designs should remove all lows points subject to surface water ponding where possible and provide adequate surface drainage to remove any potential risk of surface water ponding.
- The surface water volume generated from the proposed works will align with the volume from the existing site as the hard standing area is the same.
- SuDS for the development will be provided through permeable paving, bioretention and a section of sedum roof. Attenuation will be provided via cellular storage and a flow control device to limit discharge to a maximum of 11 litres per second for the 1 in 100 year events including a 30% allowance for climate change
- It is recommended that remedial works are carried to the existing drainage network as there were numerous defects noted in the drainage survey report carried out by UtiliMap in February 2021.

Appendix A
Drawings

Notes:

1. Do not scale from this drawing other than for planning purposes.
2. All dimensions to be verified prior to the commencement of any work or the production of any shop drawings.
3. Matthew Lloyd Architects (MLA) shall be notified in writing of any discrepancies.
4. Survey and boundaries indicative only.
5. Proposals are subject to utilities surveys and specialist consultants' input & coordination.
6. Any areas indicated are approximate and indicative only.
7. Where an item is covered by drawings in different scales the larger scale drawing is to be worked to.
8. Drawing to be read in conjunction with relevant consultant's drawings and specifications.
9. Where MLA services on a project do not include for site inspections and work surveys, MLA do not warrent that 'as built' issue drawings are a complete and accurate record of what has been built.

KEY

APPLICATION BOUNDARY

OWNERSHIP BOUNDARY

Revisions:

PLANNING

Client:

THE VINCENTIANS

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Original Sheet Size A3

N

Date:	Scale:	Drawn by:
Apr-21	1:1250 @ A3	ASp

Project:
VINCENTIAN PRESBYTERY
MILL HILL

Drawing title:
EXISTING
SITE LOCATION PLAN

Reference:	Dwg. No:	Rev.
VP	001	P01

NOTES:

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT AND ENGINEER DRAWINGS & SPECIFICATION NOTES.

HARLEY HADDOW DRAWINGS ARE FOR STRUCTURAL INFORMATION. FOR ALL SETTING OUT DIMENSIONS AND DETAILS REFER TO ARCHITECTS DRAWINGS.

DRAINAGE KEY:

- EXISTING THAMES WATER SURFACE WATER SEWER
- EXISTING THAMES WATER FOUL SEWER
- EXISTING PRIVATE SURFACE WATER DRAINAGE
- EXISTING PRIVATAE FOUL DRAINAGE
- DRAINAGE TO BE GRUBBED UP / REMOVED

REV	DESCRIPTION	BY	ENG	DATE

Project Status:

PLANNING

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Project: 307117

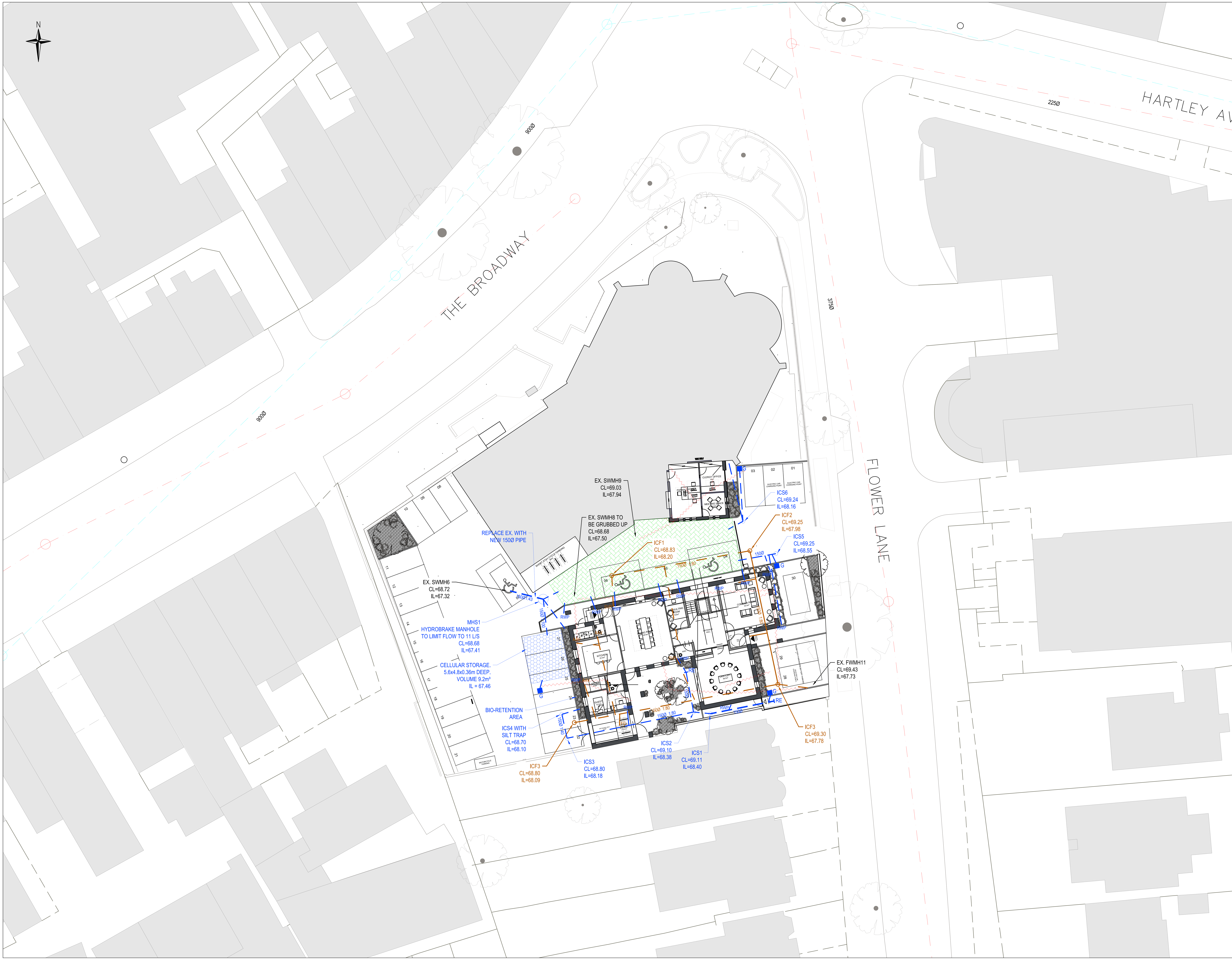
VINCENTIAN PRESBYTERY
MILL HILL, LONDON

Drawing Title:

EXISTING DRAINAGE LAYOUT

Scale at A1:	Date:	Technician:	Engineer:
As Noted	Mar 2021	CB	CB

Drawing No.	Revision
307117-HAH-XX-XX-DR-C-00200	-



NOTES:

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DRAINAGE KEY:

- EXISTING THAMES WATER SURFACE WATER SEWER
- EXISTING THAMES WATER FOUL SEWER
- EXISTING PRIVATE SURFACE WATER DRAINAGE
- EXISTING PRIVATAE FOUL DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED FOUL DRAINAGE
- PROPOSED CELLULAR STORAGE
- PROPOSED PERMEABLE PAVING
- DRAINAGE TO BE ABANDONED / GRUBBED UP

REV	DESCRIPTION	BY	ENG	DATE
A	UPDATED AS PER ARCHITECT'S COMMENTS	CB	CB	22.04.21

Project Status:

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Project: 307117

VINCENTIAN PRESBYTERY
MILL HILL, LONDON

Drawing Title:

PROPOSED DRAINAGE LAYOUT

Scale at A1:	Date:	Technician:	Engineer:
1:200	Mar 2021	CB	CB

Drawing No.	Revision
307117-HAH-XX-XX-DR-C-00201	A

NOTES:

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DRAINAGE KEY:

- PROPOSED BELOW GROUND FOUL DRAINAGE
- PROPOSED FOUL BASEMENT DRAINAGE
- FLOOR GULLY
- PROPOSED BELOW GROUND SURFACE WATER DRAINAGE
- PROPOSED SURFACE WATER BASEMENT DRAINAGE

REV	DESCRIPTION	BY	ENG	DATE
A	UPDATED AS PER ARCHITECT'S COMMENTS	CB	XX	22.04.21

Project Status:

PLANNING

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Project: 307117

VINCENTIAN PRESBYTERY
MILL HILL, LONDON

Drawing Title:

BASEMENT DRAINAGE LAYOUT

Scale at A1:	Date:	Technician:	Engineer:
1:50	Mar 2021	CB	CB

Drawing No.	Revision
307117-HAH-XX-B1-DR-C-00202	A

Appendix B
Foul Flow Calculations

Contract/project:	Vincentian Presbytery, Mill Hill, London		
Job Ref:	307117	Part of structure/element	Foul Flow Calcs
Calc sheet no:	1 of 1	Drawing Ref:	
Calculations by:	CB	Checked By:	Date:

HARLEY HADDOW

Ref:	Calculations	Output:
	Pre Development Discharge	
	The existing arrangement comprises a presbytery with 6no. bedrooms. As per Flows and Loads 4, assume a PE of 8 with flows of 150 litres per person per day for a standard residential dwelling.	
	Average foul flow:	
	8 x 150 = 1200 l / day	
	1200 / 86400 (24hrs/60mins/60secs) = 0.014 l / sec	
	Average foul flow =	0.014 l / sec
	Peak Foul Discharge	
	Peak foul discharge = average foul discharge x 3	
	0.014 x 3 = 0.042 l / sec	
	Peak foul flow =	0.042 l / sec
	Post Development Discharge	
	The proposed development comprises the demolition of the existing presbytery and the erection of a new, 7 bedroom presbytery built in its place. As per Flows and Loads 4, assume a PE of 9 with flows of 150 litres per person per day for a standard residential dwelling.	
	Average foul flow:	
	9 x 150 = 1350 l / day	
	1350 / 86400 (24hrs/60mins/60secs) = 0.016 l / sec	
	Average foul flow =	0.016 l / sec
	Peak Foul Discharge	
	Peak foul discharge = average foul discharge x 3	
	0.016 x 3 = 0.047 l / sec	
	Peak foul flow =	0.047 l / sec

Appendix C
Storm Water Calculations

Contract/project:	Vincentian Presbytery, Mill Hill, London		
Job Ref: 307117	Part of structure/element	Surface Water Calcs	
Calc sheet no: 1 of 1	Drawing Ref:		
Calculations by: CB	Checked By:	Date:	

HARLEY HADDOW

Ref:	Calculations	Output:

Pre Development Surface Water Discharge

The site is currently brownfield and comprises a church, car park and presbytery.

Assume 40mm/hr intensity rainfall

Site hard standing = 0.2 Ha
= 1970 m^2

40 x 1970 / 3600 (60mins/60secs) = 21.9 l/sec

Pre Development Discharge = 21.9 l/sec

Post Development Surface Water Discharge

The post development impermeable area is as per the existing arrangement. In accordance with Barnet Council guidance, the discharge rate from the redeveloped Presbytery will be reduced by at least 50%.

This will be achieved by using a flow control device and installing cellular storage below an area of the car park.

Full microdrainage calculations are included within Appendix C.

Post Development Discharge (from redeveloped presbytery) = 11.0 l/sec

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for DRAINAGE NETWORK.SWS

Pipe Sizes DRAINAGE NETWORK Manhole Sizes DRAINAGE NETWORK

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	20.700	Add Flow / Climate Change (%)	30
Ratio R	0.438	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for DRAINAGE NETWORK.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	3.068	0.077	39.8	0.026	5.00	0.0	0.600	o	150	Pipe/Conduit	🔒
1.001	3.093	0.031	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
1.002	9.589	0.096	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
1.003	4.391	0.274	16.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
2.000	4.598	0.046	100.0	0.009	5.00	0.0	0.600	o	150	Pipe/Conduit	🔒
2.001	19.037	0.304	62.7	0.044	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
2.002	5.066	0.422	12.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
3.000	5.073	0.010	507.3	0.011	5.00	0.0	0.600	o	150	Pipe/Conduit	🔒
3.001	4.368	0.044	99.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
1.004	4.096	0.095	43.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.03	68.180	0.026	0.0	0.0	1.1	1.60	28.3	4.6
1.001	50.00	5.08	68.103	0.026	0.0	0.0	1.1	1.00	17.8	4.6
1.002	50.00	5.24	68.072	0.026	0.0	0.0	1.1	1.00	17.8	4.6
1.003	50.00	5.27	67.976	0.026	0.0	0.0	1.1	2.53	44.7	4.6
2.000	50.00	5.08	68.550	0.009	0.0	0.0	0.4	1.00	17.8	1.6
2.001	50.00	5.33	68.504	0.053	0.0	0.0	2.2	1.27	22.5	9.3
2.002	50.00	5.35	68.200	0.053	0.0	0.0	2.2	2.92	51.7	9.3
3.000	50.00	5.19	67.660	0.011	0.0	0.0	0.4	0.44	7.8	1.9
3.001	50.00	5.26	67.456	0.011	0.0	0.0	0.4	1.01	17.8	1.9
1.004	50.00	5.40	67.412	0.090	0.0	0.0	3.7	1.54	27.2	15.8

Free Flowing Outfall Details for DRAINAGE NETWORK.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004	6	68.720	67.317	67.317	0	0

Simulation Criteria for DRAINAGE NETWORK.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	5.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.700	Storm Duration (mins)	30
Ratio R	0.438		

Online Controls for DRAINAGE NETWORK.SWS

Hydro-Brake® Optimum Manhole: MHS1, DS/PN: 1.004, Volume (m^3): 1.6

Unit Reference	MD-SHE-0149-1100-1200-1100
Design Head (m)	1.200
Design Flow (l/s)	11.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	149
Invert Level (m)	67.412
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.200	11.0
Flush-Flo™	0.357	11.0
Kick-Flo®	0.782	9.0
Mean Flow over Head Range	-	9.5

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	5.4	1.200	11.0	3.000	17.0	7.000	25.5
0.200	10.4	1.400	11.8	3.500	18.3	7.500	26.4
0.300	10.9	1.600	12.6	4.000	19.5	8.000	27.2
0.400	11.0	1.800	13.3	4.500	20.6	8.500	28.0
0.500	10.8	2.000	14.0	5.000	21.7	9.000	28.8
0.600	10.5	2.200	14.7	5.500	22.7	9.500	29.5
0.800	9.1	2.400	15.3	6.000	23.7		
1.000	10.1	2.600	15.9	6.500	24.6		

Storage Structures for DRAINAGE NETWORK.SWS

Porous Car Park Manhole: Porous Paving 2, DS/PN: 2.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.5
Membrane Percolation (mm/hr)	1000	Length (m)	22.0
Max Percolation (l/s)	39.7	Slope (1:X)	70.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	68.200	Membrane Depth (mm)	350

Cellular Storage Manhole: Storage 2, DS/PN: 3.001

Invert Level (m)	67.456	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	**Area (m²)**	**Inf. Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf. Area (m²)**
0.000	26.9	26.9	0.500	0.0	35.2
0.400	26.9	35.2			

Summary of Critical Results by Maximum Level (Rank 1) for DRAINAGE NETWORK.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	5.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.438
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.700	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	100
Climate Change (%)	30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	ICS3	30 Winter	100	+30%	100/15 Summer			
1.001	ICS4	30 Winter	100	+30%	100/15 Summer			
1.002	Bio-Retention 1	15 Summer	100	+30%				
1.003	Bio-Retention 2	15 Summer	100	+30%				
2.000	ICS5	15 Winter	100	+30%	100/15 Summer			
2.001	Porous Paving 1	15 Summer	100	+30%				
2.002	Porous Paving 2	15 Winter	100	+30%				
3.000	Storage 1	30 Winter	100	+30%	100/15 Summer			
3.001	Storage 2	30 Winter	100	+30%	100/15 Summer			
1.004	MHS1	30 Winter	100	+30%	100/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
1.000	ICS3	68.414	0.084	0.000	0.71			12.4
1.001	ICS4	68.409	0.156	0.000	1.12			12.3

Summary of Critical Results by Maximum Level (Rank 1) for DRAINAGE NETWORK.SWS

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
1.002	Bio-Retention 1	68.222	0.000	0.000	0.85			15.1
1.003	Bio-Retention 2	68.126	0.000	0.000	0.46			15.0
2.000	ICS5	68.867	0.167	0.000	0.39			5.3
2.001	Porous Paving 1	68.654	0.000	0.000	1.27			28.5
2.002	Porous Paving 2	68.350	0.000	0.000	0.71		6	28.9
3.000	Storage 1	68.395	0.585	0.000	0.57			5.1
3.001	Storage 2	68.392	0.786	0.000	0.80		26	10.5
1.004	MHS1	68.390	0.828	0.000	0.57			11.0

PN	US/MH Name	Status	Level Exceeded
1.000	ICS3	SURCHARGED	
1.001	ICS4	FLOOD RISK	
1.002	Bio-Retention 1	SURCHARGED*	
1.003	Bio-Retention 2	SURCHARGED*	
2.000	ICS5	SURCHARGED	
2.001	Porous Paving 1	SURCHARGED*	
2.002	Porous Paving 2	SURCHARGED*	
3.000	Storage 1	FLOOD RISK	
3.001	Storage 2	FLOOD RISK	
1.004	MHS1	FLOOD RISK	

Appendix D
SuDS Maintenance Schedules

Permeable Pavement

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/ or weed growth - if required, take remedial action	Three-monthly, 48h after large storms, in fix six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually

Bioretention System

Maintenance Schedule	Required Action	Typical Frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in under (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Sedum Roof

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all the components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of water proofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to insure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e. year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where >5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate), as required - clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources or erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

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