

Document Title: Drainage Strategy and Maintenance Schedule

Project Title: Dining Room Extension,
Withington Girls' School,
Wellington Road,
Fallowfield,
Manchester.

Project Ref.: 219/060/GJW

Date: 17 March 2021

Revision: 0

Revision Description: -

Engineer: G J Wilkinson BSc (Hons) MSc CEng MStructE

1.0 Introduction

- 1.1 Withington Girls' School propose to extend their existing dining room facilities situated towards the North-East side of the school land.
- 1.2 The project has been subject to a formal Planning Application and the permission notice is referenced 126199/FO/2020 dated 8 April 2020.
- 1.3 This document has been prepared to summarise the existing on-site drainage circumstances and the proposed drainage strategy and has been carried out from a review of available information listed below;
- G7 Geotech Limited's Phase 1 & Phase 2 Ground Investigation Report ref. 1226 dated 21 April 2020.
 - United Utilities sewer records accessed 10 March 2020.
 - Survey Operations GPR Utility Survey – drawing number 20L001/001 dated December 2020.
 - Sleater & Watson drawing number 219/060/100.

2.0 Review

- 2.1 Existing site drainage circumstances;
- 2.2 The existing on-site underground foul and surface water drainage networks within the vicinity of the extension ultimately converge into a combined water system whilst on site, the details of which are illustrated on the following drawings;
- Survey Operations GPR Utility Survey – drawing number 20L001/001 dated December 2020.
 - Sleater & Watson drawing number 219/060/100.
- 2.3 The existing combined water drainage network ultimately discharges into the United Utilities public sewers within Wellington Road and Victoria Road to the East and South of site, respectively.
- 2.4 Existing site ground conditions;

2.5 A review of G7 Geotech's Ground Investigation Report indicates the site ground profile generally comprises of clay soil with limited permeability characteristics which do not present the opportunity to use ground infiltration surface water disposal solutions.

3.0 Assessment

3.1 Foul Water Drainage;

3.2 There are no foul water drainage requirements from the proposed extension

3.3 Surface Water Drainage;

3.4 The proposed development drainage design will consider the requirements and recommendations contained in the National Planning Policy Framework (NPPF), DEFRA Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) and the Building Regulations Approved Document H.

3.5 The NPPF advises 'Developers and Local Authorities should seek opportunities to reduce overall flood risk in the area and beyond through the layout and form of the development, and the application of sustainable drainage system'.

3.6 Building Regulations Approved Document H requires rainwater from the site is discharged via one of the following receptors listed in order of priority;

- a. An adequate soakaway or other infiltration system; or where not reasonably practicable;
- b. A watercourse; or where that is not reasonably practicable;
- c. A surface water sewer.
- d. A combined water sewer.

3.7 Appraisal of the surface water drainage in accordance with NPPF and Building Regulation protocol is shown below;

SW Drainage Option	Suitability	Reasons
Ground infiltration system	No	The ground conditions in the locality of the development have low permeability characteristics and offer limited opportunity to utilise ground infiltration methods to discharge surface water run-off.
To a surface water body	No	There are no nearby watercourses or surface water bodies to accommodate a surface water connection.
Into a surface water sewer	No	There are no nearby surface water sewers to accommodate a surface water connection.
Into a combined water sewer	Yes	There is an existing off-site combined water connection within Wellington Road and Victoria Road which the school drainage currently connects into. the new development drainage systems will be designed to accommodate surface water runoff resultant from 1 in 1 year, 1 in 30 year, 1 in 100 year and 1 in 100 year plus 40% climate change storm events.

4.0 Surface water drainage proposals

- 4.1 The surface water drainage proposals are illustrated on Sleater & Watson drawing number 219/060/100. The principle of the design is summarised below.
- 4.2 The existing area below the proposed extension are roof areas, which are positively drained, and hardstanding areas, which it is conservatively assumed are not positively drained.
- 4.3 The proposed extension creates a net increase in the catchment area to be positively drained of 82m².
- 4.4 It is therefore proposed to provide below ground stormwater attenuation to accommodate the additional catchment area and restrict the discharge rate via a flow control unit to 6l/s in accordance with the requirements included within the Planning Permission notice.
- 4.5 This has resulted in the requirement for a storage volume of 5.3m³ which is provided via an overall attenuation tank size of 14m long x 1.0m wide x 0.4m deep (5.6m³) which has a void ratio of 95% and hence the overall storage provided is 5.32m³.
- 4.6 Refer to Appendix B for the supporting calculation sheets.

5.0 Maintenance

- 5.1 The proposed drainage system will become an extended element of the overall site drainage system, the maintenance and care of which is and will remain the responsibility of Withington Girls' School.
- 5.2 A surface water drainage maintenance plan and manual are required to accompany the final drainage scheme and details and a draft manual is contained within Appendix A. This document is to be updated as the construction design progresses and will accompany the final drainage scheme and details.

Appendix B

Maintenance Procedures for Surface Water Drainage System

Document Title: Maintenance Procedures for Surface Water Drainage System

Project Title: Dining Room Extension,
Withington Girls' School,
Wellington Road,
Fallowfield,
Manchester.

Project Ref.: 219/060/GJW

Date: 17 March 2021

1. Overview of the system

- 1.1 The surface water drainage system for the site is a sustainable drainage system (SuDS) which is designed to attenuate extreme rainfall events from the impermeable surfaces and restrict the surface water flow rate to the receiving downstream drainage network.
- 1.2 The system comprises the following elements:
- 1.3 A conventional roof drainage system which collects the roof surface water discharging to the rainwater pipes on the North and South elevations and connects into a below ground attenuation tank via a conventional drainage pipe system.
- 1.4 Conventional drainage channels to impermeable hardstanding areas, fitted with removable gratings and sump units at the outlets.
- 1.5 A flow control manhole chamber is provided directly downstream of the attenuation tank – a manhole which includes a sump and housing a reduced diameter orifice plate to control the surface water flow rate to the receiving distribution pipe. Chambers are generally fitted with ground level heavy duty covers which require a two-person lifting operation using manhole keys.
- 1.6 Manhole inspection chambers are positioned at changes to the direction of drainage runs or where connections of multiple pipes are made. Chambers are generally fitted with ground level heavy duty covers which require a two-person lifting operation using manhole keys.
- 1.7 The drainage system and storage provisions have been designed assuming light vehicular loading due to restricted vehicular access around site. Separate detailed consideration on an individual case basis should be carried out by suitably qualified persons if other heavier loading conditions are required.

2. Location of surface water drainage system

- 2.1 The location and details of the surface water drainage system for this site is shown upon Sleater & Watson drawing number 216/060/100.

3. Avoiding damage to the system

- 3.1 The main cause of damage to the system is likely due to the presence of litter, excessive silt accumulation or physical damage to the system.
- 3.2 Litter should be frequently removed from the site and the drainage inlets to the drainage channels and rainwater pipe gullies should be routinely inspected for blockages. To avoid excessive silt build-up impermeable surfaces should be regularly swept clean.
- 3.3 During periods of cold weather, if site maintenance includes salt spreading to the impermeable surfaces, the salt application to surfaces should be kept to a minimum. Salt should not be stockpiled in areas that drain to the SUDS system.
- 3.4 If modifications to the site are proposed, Designers and Contractors should be made aware of the presence of the SUDS, so that due regard can be given to the system details and damage avoided.

4. Maintenance Plan - Routine maintenance

- 4.1 The following routine inspections and maintenance are required;
- 4.2 6 monthly inspections of drainage channels for signs of blockage.
- 4.3 Remove litter and blockages as required from all components.
- 4.4 Every 6 months inspect all chambers for silt build-up.
- 4.5 Every 6 months check the Flow Control Unit is clear and the over-ride mechanism is in good working order.
- 4.6 Every 6 months sweep external surfaces.
- 4.7 Remove silt from drainage channels as required but at least every 12 months.
- 4.8 Records of inspections and maintenance undertaken should be kept by the client (example attached).

Surface Water Drainage Routine Maintenance Record

Dining Room Extension, Withington Girls' School, Fallowfield, Manchester.

Person responsible for inspections and maintenance:				
Component	Inspections / maintenance item and action taken	Date undertaken	Next scheduled inspection	Initials
General	6 monthly inspections of all paved surfaces.			
	Every 6 months sweep all paved surfaces or more regularly if necessary.			
	Action Taken;			
Drainage Channels, Gullies, and storage tanks	Remove litter as required.			
	6 monthly inspections of drainage channels.			
	Every 12 months remove silt from channels if necessary.			
	Action Taken;			
Surface Water Manhole Chambers including Flow Control Manhole	Every 6 months inspect chambers for silt build up and remove silt if discovered.			
	Check Flow Control Unit is clear and over-ride mechanism is in good working order.			
	Action Taken;			

Appendix A

Calculations

ATTENUATION DESIGN

In accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.04

EA_Defra method

Site characteristics

Location	Manchester
Hydrological region	10
Soil type (Wallingford Procedure W.R.A.P map)	4
Standard percentage runoff	SPR = 0.47
Average annual rainfall	SAAR = 880 mm
5 year return period rainfall of 60 minute duration	M5_60min = 18.0 mm
Ratio 60-minute to 2 day rainfalls of 5 year return	r = 0.36
Rainfall intensity increase due to global warming	p _{climate} = 40%
Impervious area req. attenuation storage	α = 100.0 %

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%)	Impermeable. area (ha)
1;	Proposed Extension + Ext Works;	0.01;	100.0	0.01;
Total		0.01;	100.0	0.01;

Greenfield runoff rates

Catchment area	AREA = 50.00 hectare
Greenfield runoff rate (50 hectare site)	$\bar{Q}_{\text{rural}} = 0.00108 \text{ m}^3/\text{s} \times (\text{AREA}/1 \text{ km}^2)^{0.89} \times (\text{SAAR}/1 \text{ mm})^{1.17} \times \text{SPR}^{2.17} =$ 315.5 l / s
Greenfield runoff rate	$\bar{Q} = \bar{Q}_{\text{rural}} / \text{AREA} \times A =$ 0.1 l / s
Greenfield runoff rate per unit area	$\bar{Q}_A = \bar{Q} / A =$ 6.3 l / s / hectare

Estimated site discharges

FSR growth rate (1 year)	FSR _{1yr} = 0.87
Discharge (1 year)	Q _{1yr} = $\bar{Q} \times \text{FSR}_{1\text{yr}}$ = 0.0 l/s
FSR growth rate (30 year)	FSR _{30yr} = 1.70
Discharge (30 year)	Q _{30yr} = $\bar{Q} \times \text{FSR}_{30\text{yr}}$ = 0.1 l/s
FSR growth rate (100 year)	FSR _{100yr} = 2.08
Discharge (100 year)	Q _{100yr} = $\bar{Q} \times \text{FSR}_{100\text{yr}}$ = 0.1 l/s

Estimated attenuation volume - 1 year

Attenuation storage vol (fig A7.1 - A7.8)	Uvol _{1yr} = 124.3 m ³ / hectare
Basic storage volume	BSV _{1yr} = Uvol _{1yr} × α × A = 1.02 m ³
FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4)	FF _{1yr} = 1.00
Storage volume ratio (fig A8.1 - A8.8)	SVR _{1yr} = 1.57
Adjusted storage volume	ASV _{1yr} = SVR _{1yr} × BSV _{1yr} = 1.61 m ³
Hydrological regional volume ratio (fig A9.1)	HR _{1yr} = 1.00
Final estimated attenuation storage	Vol _{1yr} = HR _{1yr} × ASV _{1yr} = 1.61 m ³

Library item: Estimated attenuation output

Estimated attenuation volume - 30 year

Attenuation storage vol (fig A7.1 - A7.8)	Uvol _{30yr} = 284.7 m ³ / hectare
---	--

Project Dining Room Extension, Withington Girls' School, Fallowfield.				Job no. 219/060	
Calcs for Attenuation Tank				Start page no./Revision 2	
Calcs by GJW	Calcs date 17/03/2021	Checked by SAW	Checked date 17/03/2021	Approved by	Approved date

Basic storage volume

$$BSV_{30yr} = Uvol_{30yr} \times \alpha \times A = \mathbf{2.33 \text{ m}^3}$$

FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4)

$$FF_{30yr} = \mathbf{0.95}$$

Storage volume ratio (fig A8.1 - A8.8)

$$SVR_{30yr} = \mathbf{1.69}$$

Adjusted storage volume

$$ASV_{30yr} = SVR_{30yr} \times BSV_{30yr} = \mathbf{3.95 \text{ m}^3}$$

Hydrological regional volume ratio (fig A9.1)

$$HR_{30yr} = \mathbf{1.08}$$

Final estimated attenuation storage

$$Vol_{30yr} = HR_{30yr} \times ASV_{30yr} = \mathbf{4.26 \text{ m}^3}$$

Library item: Estimated attenuation output

Estimated attenuation volume - 100 year

Attenuation storage vol (fig A7.1 - A7.8)

$$Uvol_{100yr} = \mathbf{364.7 \text{ m}^3 / \text{hectare}}$$

Basic storage volume

$$BSV_{100yr} = Uvol_{100yr} \times \alpha \times A = \mathbf{2.99 \text{ m}^3}$$

FEH rainfall factor (figs A11.1, A6.1.1 - A6.3.4)

$$FF_{100yr} = \mathbf{0.90}$$

Storage volume ratio (fig A8.1 - A8.8)

$$SVR_{100yr} = \mathbf{1.73}$$

Adjusted storage volume

$$ASV_{100yr} = SVR_{100yr} \times BSV_{100yr} = \mathbf{5.18 \text{ m}^3}$$

Hydrological regional volume ratio (fig A9.1)

$$HR_{100yr} = \mathbf{1.12}$$

Final estimated attenuation storage

$$Vol_{100yr} = HR_{100yr} \times ASV_{100yr} = \mathbf{5.81 \text{ m}^3}$$

Library item: Estimated attenuation output

Attenuation storage required

Vol. increase due to head-discharge relationship

$$p_{hydro} = \mathbf{1.25}$$

Maximum attenuation storage required

$$V_{req_max} = Vol_{30yr} \times p_{hydro} = \mathbf{5.3 \text{ m}^3}$$

Interception storage

Interception rainfall depth

$$d_{int} = \mathbf{5 \text{ mm}}$$

Volume of interception storage required

$$V_{int_req} = 0.8 \times A_{imp} \times d_{int} = \mathbf{0.33 \text{ m}^3}$$

Long term storage

Proportion of paved area draining in to network

$$\alpha = \mathbf{1.0}$$

Proportion of pervious area draining in to network

$$\beta = \mathbf{0.5}$$

Rainfall depth for 100years, 6 hour event

$$RD = M100_360 = \mathbf{78.8 \text{ mm}}$$

Extra runoff vol of dev.runoff over greenfield runoff

$$Vol_{xs} = \max(RD \times A \times (PIMP \times \alpha \times 0.8 + ((1 - PIMP) \times \beta \times SPR) - SPR), 0 \text{ m}^3) = \mathbf{2.13 \text{ m}^3}$$

Treatment volume

Treatment volume (assume 80% runoff)

$$T_{vol} = 0.8 \times A \times 15 \text{ mm} \times PIMP = \mathbf{0.98 \text{ m}^3}$$