

WAAFER HOMES LTD

WARNINGLID PRIMARY SCHOOL, SLAUGHAM LANE,
WARNINGLID, WEST SUSSEX RH17 5TJ



Drainage Design Strategy – Surface and Foul

December 2025
(Revised May 2026, July 2026, September 2026)



EAS ltd

Environmental Assessment Services Ltd

REPORT DATA SHEET

Requirement	Data
Report Reference	862/GB/WaaferHomes/WarninglidSchool/DDS
Date	December 2025
Client	Waafer Homes Ltd
Report type	Drainage Design Strategy – Surface and Foul
Purpose	Planning
Revisions	May 2026, July 2026, September 2026
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1. INTRODUCTION

- 1.1 Environmental Assessment Services (EAS) Limited was instructed to prepare a Drainage Design Strategy – Surface and Foul for the proposed redevelopment of Warninglid Primary School into 2No. residential dwellings, as well as development of another 2No. residential dwellings on site.

2. EXISTING SITE & PROPOSED DEVELOPMENT

- 2.1 The site comprises of the existing school building (closed 2021), surrounding asphalt and synthetic playgrounds and grass field. The site area is approximately 0.55 ha. The Ordnance Survey (OS) map reference for the site is TQ 2504 2695. The site elevation is approximately +88 m OD. See Appendix A, Site Location.
- 2.2 According to the British Geological Survey (available online), the site lies on a bedrock of Cretaceous Weald Clay – Mudstone. Online Environment Agency (EA) groundwater mapping identifies the site to lie on unproductive strata. The site does not lie within a groundwater source protection zone.
- 2.3 The proposed development comprises converting the existing school building into 2No. 4-bedroom residential dwellings and developing 2No. additional 2-storey, 4-bedroom residential dwellings on the grass field with associated 2No. car garages. This will also include driveway access tracks connecting to Slaugham Road. Permeable surfacing will be utilised including block paving for patio areas and gravel for driveways.
- 2.4 The northern half of the site consists of the existing school building and surrounding playgrounds; the northern and southern playground surfaced with asphalt and the eastern playground consisting of a synthetic surface. The southern half of the site comprises entirely of the grass playing field. An oak tree stands at the centre of the site with a few saplings growing around it. A bench surrounded by a ring of young thorn bushes lies close to the southeastern corner of the site. An earthen bund runs from the midpoint of the western border to the southwestern corner with fully developed trees planted along it and continuing along the southern border.
- 2.5 The site is in a rural location, approximately 900 m north of Warninglid, predominantly surrounded by fields with few residences north of site. The site lies on/is accessed from Slaugham Lane, which lies west of the site boundary.

- 2.6 There are no nearby drainage ditches or watercourses. The site has a slight camber with the highest point at the northeastern corner of the site and lowest point in the southeastern corner.

3. FLOOD RISK ASSESSMENT

- 3.1 According to the EA online Flood Map for Planning, the site lies within Flood Zone 1, at low risk of flooding from rivers and the sea. The nearest area within Flood Zones 2 and 3 are located some 400 m north of the site. The EA online Risk of Flooding from Surface Water map shows that the site is not at risk of surface water flooding.
- 3.2 As the site is less than 1 ha in area and lies within Flood Zone 1, there is no requirement for a flood risk assessment under the National Planning Policy Framework (NPPF) and associated guidance documents.

4. EXISTING DRAINAGE

- 4.1 The site was visited on 28 November 2025 in order to examine the existing drainage (and carry out percolation testing). See Appendix B: Site Photographs.
- 4.2 Formal surface water drainage on the site is divided between two separate discharge points as existing:
- 4.2.1 Rainwater piping along the western side of the existing schoolhouse and two surface water gullies along the perimeter of the southern playground drain into an existing highways owned surface water sewer (Reference: A10836). Approximately 248 m² of the impervious area discharges via the highways owned surface water sewer.
- 4.2.2 Drain piping on the eastern and southern side of the schoolhouse, as well as the ancillary buildings south of the playground, discharge into combined sewer manholes that run from the eastern side of the building and southwards off site into a public combined sewer chamber (Reference: TQ25260801) owned by Southern Water. Foul water from the schoolhouse also discharges into the combined sewer via manholes near the eastern and southern sides of the schoolhouse. Approximately 363 m² of the impervious area discharges via the private combined sewer system.
- 4.3 As a general rule, the flow permitted to leave the developed site should not exceed the QBar Greenfield flow rate. The Greenfield runoff rate for the site has therefore been estimated using the UK Sustainable Drainage (UKSUDS) Greenfield Runoff Estimation Tool. Surface water from the impervious area that drains to the Southern Water public combined sewer will remain unchanged as part of the proposed development and as a result has been excluded from runoff calculation. The runoff rates are given for scenarios up to (and including) the 1 in 200-year storm event, as summarised in Table 4.1 below and provided in Appendix D.

TABLE 4.1
GREENFIELD RUNOFF RATES

Return period	Runoff rates (l/s)
QBar	3.6
1 in 1 year	3.0
1 in 2 years	3.1
1 in 10 years	5.8
1 in 30 years	8.2
1 in 100 years	11.4
1 in 200 years	13.3

- 4.4 The maximum discharge permitted to leave the whole site post development should not exceed the QBar rate of 3.6 l/s.
- 4.5 The foul sewage should also be allowed for in the permitted discharge flow rate. The peak foul sewage design flow has been calculated for the proposed site as 0.2 l/s (see Section 7 below) therefore the surface water discharge should not exceed 3.4 l/s.

5. PROPOSED DRAINAGE

- 5.1 The proposed residential development may increase the impermeable area of the site compared to its former use, which could increase the peak flow following a rainfall event. It has been estimated that, following development, 0.09 ha of the site will comprise hardstanding and the rest (0.46 ha) will comprise permeable surfacing and soft landscaping. The permeable surfacing and soft landscaping will still discharge informally as Greenfield (as existing) and surface water drained as existing to the Southern Water combined sewer will remain unchanged. Controlled drainage from all other impermeable areas will be subject to SuDS measures.
- 5.2 The drainage design of the developed site should retain onsite flows up to the 1 in 100 year return period event, including an allowance for climate change and an increase in impermeable area of 10% due to urban creep. The ways in which this can be achieved are discussed in 5.3 and 5.4 below.
- 5.3 **Drainage to Soakaway**
- 5.3.1 Drainage to soakaway (infiltration) is the preferred Sustainable Drainage System (SUDS) solution. The underlying Weald Clay is not considered a suitable medium for soakaway. Percolation testing was undertaken at the site on 28 November 2025 in order to investigate the practicality of soakaway as a method of disposal of surface water.

5.3.2 Percolation testing comprised the excavation of three trial pits to 1 m below ground level to examine the geology at different locations across the site. Trial pits were located near the eastern border of the site, one below the synthetic playground, one near the southeastern corner of the site and one in between. No groundwater was encountered during the excavation of the trial pits, however there was a small level of water in the trial pits due to recent heavy rainfall. The geology appeared to comprise of a thin layer of topsoil over Weald Clay with a shallow layer of made ground present at the northernmost trial pit.

5.3.3 Percolation testing was undertaken in all the trial pits. The holes were filled with water, and the water level drop relative to the time was recorded. An infiltration rate could not be gained as no drop in water level was observed. Drainage to soakaway is therefore not considered to be a feasible option for the site.

5.4 Attenuation Storage

5.4.1 The alternative to soakaway drainage would be attenuation storage onsite, with discharge limited to the QBar Greenfield flow rate for the impermeable areas subtracting peak foul sewage design flow (in this case 3.4 l/s), as stated in the Mid Sussex District Council Level 1 Strategic Flood Risk Assessment (2024).

5.4.2 This would require a discharge point, which in this case the only possible option would be the existing surface water sewer. A connection exists and is in use presently for the existing school building (Reference: A10836). Due to the slope of the site, the new residences would not be able to utilise the existing connection and would require a new connection to the surface water sewer, the closest being a manhole on Slaugham Lane (Reference: A10839). The West Sussex Highways team have agreed in principle for the formation of a new connection into the highway surface water drainage system further downstream, provided the existing connection higher up the system is removed or abandoned.

5.4.3 The Moody Sewage survey identified the surface water sewer on Slaugham Lane to be a Highway Authority asset with the existing pipework consisting of 9 inch pipes with discharge into the watercourse at the bottom of the hill, 200 m south of the site. The drainage infrastructure is in good condition with no significant defects identified and has sufficient capacity to accommodate the proposed discharge.

5.4.4 The total storage volume required for the site, for the 1 in 100 year plus climate change scenario, with a volumetric runoff coefficient (cv) of 1.0, has been calculated as 56.2 m³. See Appendix E.

5.4.5 Attenuation storage could be provided in the form of ponds, swales, a detention basin or an underground geocellular/modular system wrapped in a geomembrane. Due to the layout and slope of the site, an underground geocellular/modular system is considered to be the most appropriate for the site.

5.4.6 A suitable location for the geocellular/modular system would be the southwestern corner of the southernmost new build. This would allow for the outlet pipes for the storage system to discharge into the existing surface water sewer. Discharged surface water will be limited by vortex valve to a peak flow rate of 3.4 l/s.

5.4.7 Due to the slope of the site, it is considered most practicable that the underground geocellular/modular system is no more than 0.8 m in depth, allowing for 0.6 m of topsoil to lay above in order to provide suitable planting depth. In order to provide the required storage volume for the site, and with a depth of 0.8 m, the dimensions of the geocellular/modular system would need to be 6.4 m x 11.6 m x 0.8 m. See Appendix A, Figure 4 for the suggested drainage design.

5.5 Other Sustainable Urban Drainage System (SUDS) Options

5.5.1 Permeable paving is to be utilised in the driveway and any patio areas. Permeable paving will permit surface water to infiltrate into the underlying structure, delay discharge and reduce peak flows following a rainfall event. It is recommended that the permeable paving be underlain by a shallow drainage blanket connected to the surface water drainage system.

5.5.2 Rainwater harvesting could also be implemented. Rainwater could be used for irrigation purposes within the garden, via water butts connected to roof downpipes. Rain gardens could also be installed.

5.5.3 It may be possible to incorporate a green roof into the proposed design. Green roofs reduce the volume and rate of runoff and can be low maintenance, generally requiring bi-annual maintenance visits.

6. SURFACE WATER DRAINAGE DESIGN

6.1 Design Philosophy

6.1.1 The drainage strategy is for surface water to be drained into attenuation storage, comprising a geocellular/modular system, before being discharged into the public surface water sewer system, with discharge limited to the QBar flow rate for the site (in this case 3.4 l/s). See Figure 4 in Appendix A for the proposed drainage arrangement.

6.2 Design Storm

6.2.1 The surface water drainage system has been designed for the 30-year return period event with 10% urban creep, plus a 45% allowance for climate change and tested for surcharge for the 1 in 100-year return period event (1% Annual Exceedance Probability) plus a 45% allowance for climate change. See Appendix A, Figure 4 for the proposed drainage design and Appendix E for pipe and chamber layout and sizing of the attenuation storage from the MasterDrain model.

6.3 Drainage Design Model

- 6.3.1 The attenuation storage has been designed to accommodate the 1 in 100-year return period storm event plus a 45% allowance for climate change using the MasterDrain network model.
- 6.3.2 An appropriate attenuation storage size has been calculated as 11.6 m length, 6.4 m width and 0.8 m depth.

6.4 Hydrogeological Data

- 6.4.1 Hydrological data based on FEH22 rainfall data for the site and applied to the MasterDrain model is given in Appendix E. The chamber details, pipe sizes and levels are shown in Appendix E and summarised in Table 6.1 below:

TABLE 6.1
SURFACE WATER DRAINAGE

Ref.	Dia (mm)	Cover level (mAOD)	Invert level (mAOD)	Pipe dia in (mm)	Pipe dia out (mm)
EXSW1	600	89.78	89.28	-	150
EXSW2	600	89.42	88.92	150	150
EXSW3	600	89.17	88.67	150	225
SW1	450	89.00	88.50	225	225
SW2	450	88.50	88.00	225	225
SW3	450	88.15	87.65	225	225
SW4	450	87.84	87.34	225	225
SW5	450	87.20	86.70	225	300
SW6	450	87.40	86.52	300	225
STORAGE	-	87.30	85.90	225	100
SW7	450	87.30	85.73	100	100
A10839	600	85.20	84.70	100	150

6.5 Extreme event

- 6.5.1 If an extreme storm event overwhelmed the surface water drainage system at the site and/or if the drainage system were to fail, ground levels would indicate that surface water would discharge along the western site boundary, as existing, and into the south adjacent field as per the present situation.

7. PROPOSED FOUL SEWERAGE

- 7.1 There is existing foul sewerage at the site. A private sewer runs from the north adjacent Old School House dwelling, through the site (two chambers on site) and connects to an existing demarcation chamber at the southern boundary. This then discharges to the public foul sewer (Southern Water manhole reference: TQ25260801) in the south adjacent field. The invert levels for the private sewer chambers and public foul sewer chambers are unknown and have been estimated for drainage calculations. These levels will need to be determined at a later date.
- 7.2 The preferred foul sewerage disposal option would be to utilise the existing connections from the school to the combined sewer for the dwellings in the converted school building and connecting a chamber for each of the proposed houses to the existing combined sewer. As the proposed development consists of fewer than 10 No. properties, and there is an existing connection, neither permission nor a capacity check should be required from the relevant authority. Following consultation with Southern Water, sufficient capacity to accommodate the peak foul sewage flow for the site has been confirmed. See Appendix C: Southern Water Sewer Plans.
- 7.3 The proposed development will comprise of four dwellings. According to the WRc publication "Sewers for Adoption" (8th Edition), the design (peak) flow from a proposed residential development should be based on water use of 4000 l/dwelling/day. This gives the overall (peak) foul sewage design flow for the site as 0.2 l/s.
- 7.4 The flow of sewage is calculated by the MasterDrain Foul model based on "drainage units"; the number of facilities (basins, baths, showers, WCs, washing machines, dishwashers, etc.).
- 7.5 The results of the sewerage design from the MasterDrain Foul analysis given in Appendix E and illustrated in Figure 4 are summarised in Table 7.1 below:

TABLE 7.1
FOUL SEWERAGE

Ref.	Dia (mm)	Cover level (mAOD)	Invert level (mAOD)	Pipe dia in (mm)	Pipe dia out (mm)
PC1	450	90.00	89.00	-	100
EXC1	450	89.87	88.35	100	100
EXC2	450	89.55	88.84	-	100
EXC3	450	89.26	88.02	100	100
PC2	450	88.96	87.94	100, 100	100
FW1	450	88.28	87.78	-	100
PC3	450	88.54	87.64	100, 100	100
FW2	450	88.50	88.00	-	100
EDC	450	87.40	86.90	100, 100	100

EXC – Existing Combined PC – Private Chamber EDC – Existing Demarcation Chamber

- 7.6 It is advised that the peak foul sewage design flow (0.2 l/s) should be deducted from the maximum permitted discharge from the surface water attenuation storage.

8. OPERATION AND MAINTENANCE

- 8.1 The drainage system will generally require minimal operational input once construction has been completed. However, it will require some regular maintenance. The maintenance of the drainage systems will be the responsibility of the owners of the residences, overseen by either a residents committee or single freeholder to manage and charge where appropriate.
- 8.2 The chambers, gullies, gutters and channels will require regular removal of any silt or other debris. Maintenance should be carried out at the time of year after most leaf fall has occurred.
- 8.3 Required maintenance in accordance with the CIRIA SuDS Manual (C753) for attenuation storage is summarised in Table 8.1:

TABLE 8.1
OPERATION AND MAINTENANCE REQUIREMENTS FOR
ATTENUATION STORAGE

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter- remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays.	Annually, or as required
Remedial action	Repair/rehabilitate inlets, outlet, overflows and vents.	Annually, or as required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required

- 8.4 In accordance with the CIRIA SuDS Manual (C753) the pollution hazard level for the development is considered to be very low for the residential roofs and low for individual property driveways. For the roofs, it is advised to remove gross solids and sediments to satisfy requirements. For the driveways the simple index approach to determine pollution control measures should be applied. As such the proposed permeable pavement is considered an adequate control measure.

9. CONCLUSIONS

- 9.1 The site currently comprises of the existing school building (closed 2021), surrounding asphalt and synthetic playgrounds and grass field located to the west of Slaugham Lane, Warninglid. It is proposed to redevelop the existing school building into 2No. 4-bedroom residential dwellings with associated driveway as well as develop a further 2No. 4-bedroom dwellings with garages and driveways where the existing grass field lies.
- 9.2 All runoff for the 1 in 100 year flood event, plus allowance for climate change, will be managed on site, and the discharge from the proposed development will be restricted to QBar greenfield run-off rate, including peak foul drainage (3.4 l/s).
- 9.3 The site lies within Flood Zone 1, at low risk of tidal and fluvial flooding, and is also shown to not be at risk of surface water flooding.
- 9.4 Formal surface water drainage on site is divided between two separate discharge points as existing. Rainwater piping along the western side of the existing schoolhouse, and two surface water gullies along the perimeter of the southern playground, drain into an existing highways owned surface water sewer (Reference: A10836). Drain piping on the eastern and southern side of the schoolhouse, and rainwater piping on the ancillary buildings south of the playground, discharge into a private combined sewer that runs from the eastern side of the building and southwards off site into a public combined sewer chamber (Reference: TQ25260801) owned by Southern Water.
- 9.5 The total storage volume required to retain the 1 in 100 year plus climate change flood event on site has been calculated as 56.2m² based on the MasterDrain Model.
- 9.6 The underlying Weald Clay showed poor infiltration during percolation testing and as such drainage to soakaway would not be a practicable option for the site. The alternative SuDS preferred method of draining surface water is drainage to attenuation storage with outflow limited to QBar greenfield flow rate (3.4 l/s). This would require a discharge point, of which the only option would be the existing surface water sewer.

- 9.7 Due to the layout and slope of the site, a geocellular/modular system is considered to be the most appropriate for the site. A suitable location for the geocellular/modular system would be the southwestern corner of the site. The West Sussex Highways team have agreed in principle for the formation of a new connection into the highway surface water drainage system further downstream for the discharge of surface water from the site, provided the existing connection higher up the system is removed or abandoned. Suggested dimensions for the storage would be 11.6 m x 6.4 m x 0.8 m. Flow rate would be limited to 3.4 l/s by vortex flow valve.
- 9.8 Permeable surfacing is to be utilised for the driveway and patio areas. Additional SUDS options which could be incorporated into the development include rainwater harvesting for garden irrigation purposes via the provision of water butts, and a green roof on the dwelling.
- 9.9 Existing foul sewerage on site consists of a private combined sewer that runs through the site, past the eastern side of the school and southwards off site into a Southern Water public combined sewer (Reference: TQ25260801). Proposed foul sewerage would comprise utilising the existing sewer connections from the school to the combined sewer for the dwellings in the converted school building and connecting a chamber for each of the proposed houses to the existing combined sewer.

10. RECOMMENDATIONS

- 10.1 The invert levels for the surface water sewer along Slaugham Lane, private sewer on site and public foul sewer south of site, will need to be determined prior to development.
- 10.2 The drainage system will generally require minimal operational input once construction has been completed. However, it will require some regular maintenance.
- 10.3 The geocellular/modular system and all chambers are to be kept clear of debris and build ups of silt to ensure working order and prevent loss of storage capacity.

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APPENDIX A

Figures

- | | |
|-----------|---------------------------|
| Figure 1: | Site Location |
| Figure 2: | Site as Existing |
| Figure 3: | Proposed Development |
| Figure 4: | Suggested Drainage Design |



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Scale as shown

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Figure 1: Site Location

July 2026



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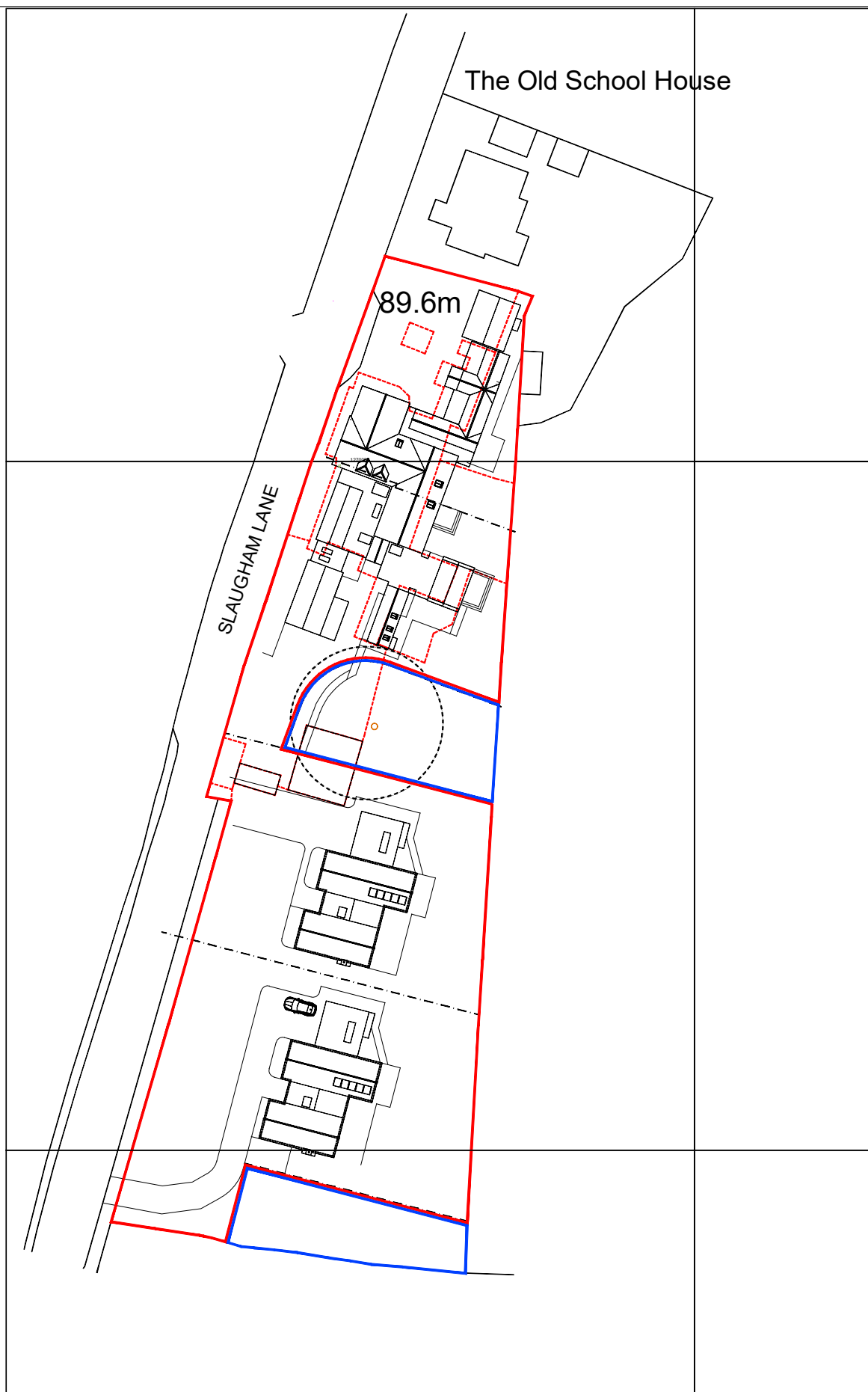
Scale as shown

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Figure 2: Site as Existing

July 2026





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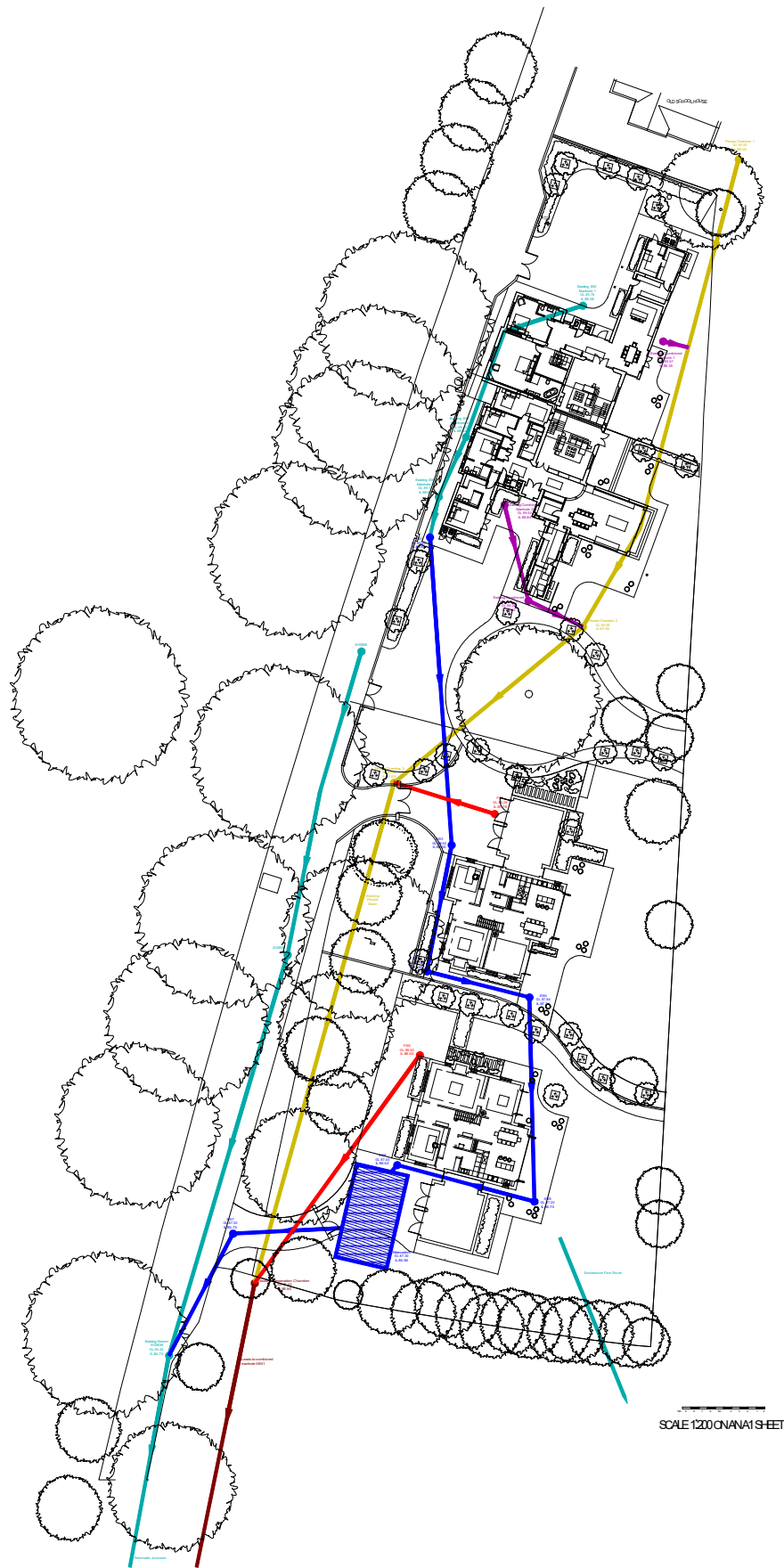
Scale as shown

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Figure 3: Proposed Development

July 2026



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Scale as shown

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WARNINGLID, WEST SUSSEX RH17 5TJ

Figure 4: Suggested Drainage Design

September 2026



APPENDIX B

Site Photographs

Percolation test pit 1



Percolation test pit 2



Percolation test pit 3



Eastern playground



Southwestern playground



Existing school



Grass field



Southern site boundary and adjacent field



Playground drains leading to road gully pots



Existing sewer gully pot



Side access manholes south of site



Existing drainpipes and downpipes

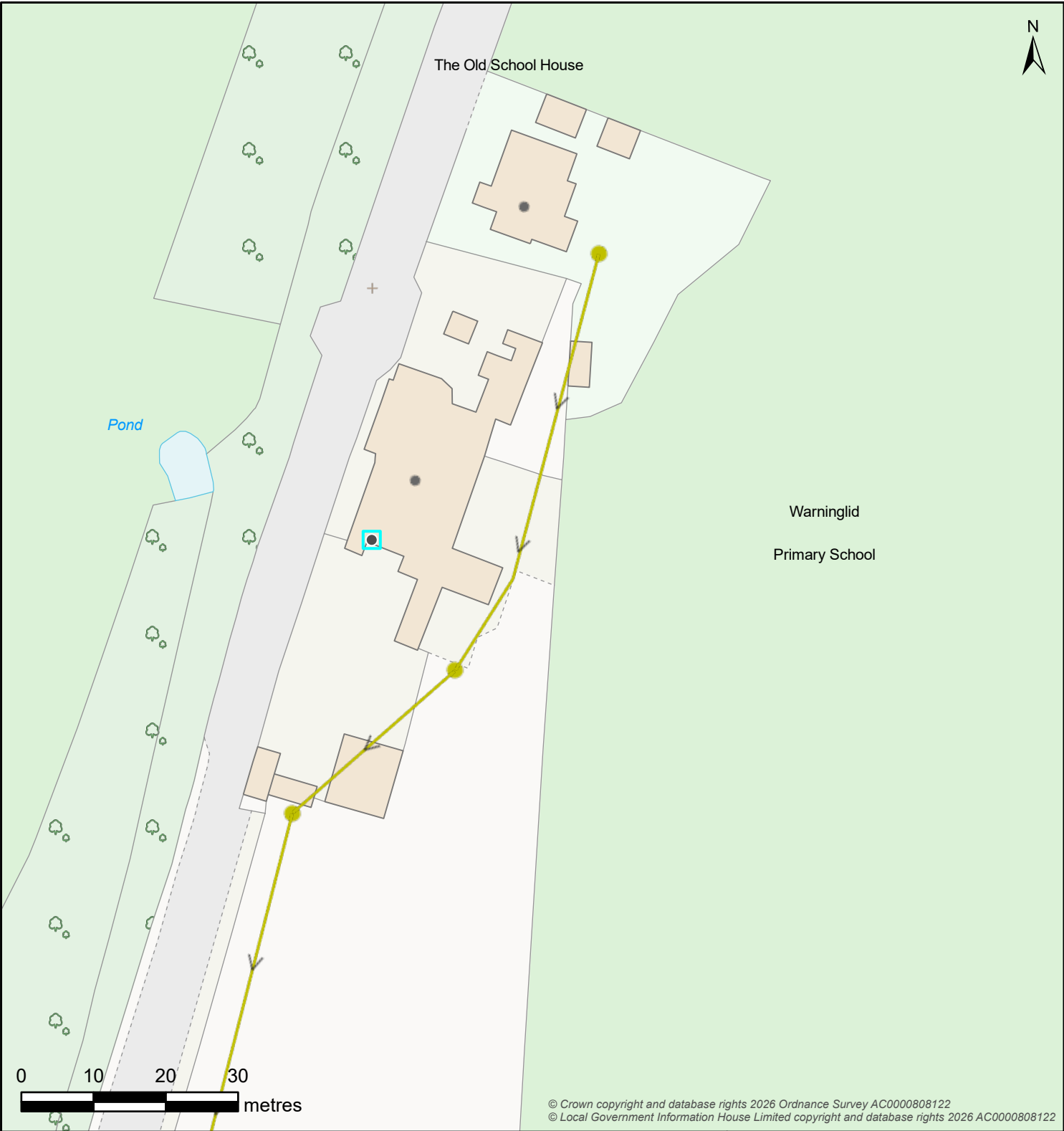


Private sewer manhole



APPENDIX C

Southern Water Sewer Plans



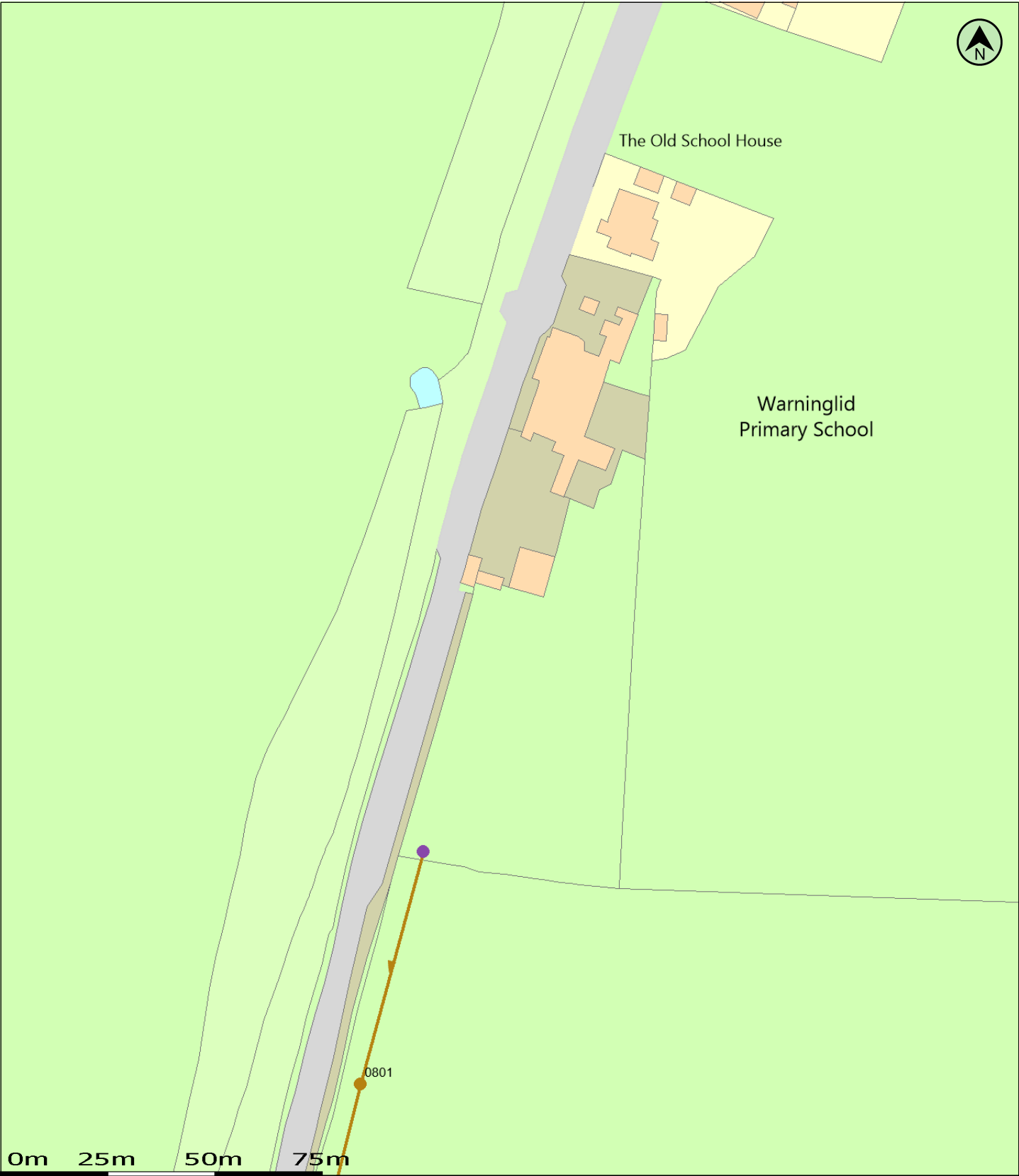
Controllable Valve			Flow Control			Inlet-Outfall	
Damboards	Penstock	Valve	Anti Flood Device	Pumped Anti Flood Device	Reflux Valve	Inlet	Outfall
Manhole							
BIF Bifurcation	Cascade	CP Catchpit	Head Of Public Sewer	IC Interceptor Chamber	Manhole	S Soakaway	WO Washout
Outfall Headworks		Overflow Chamber		Pipe Bridge		Pumping Station	
Outfall Headworks	CSO Combined Sewer Overflow	Emergency Overflow	EMO Emergency Overflow	Pipe Bridge	Micro Pumping Station	Pumping Station	
Sewer Level Monitor		Storage		Treatment Works		Weir	
Sewer Level Monitor	Storm Tank	Tidal Storage Tank		Treatment Works		Weir	Wastewater Site
Wastewater Pipe				Wastewater Use		Developer Services	
Culverted Water Course	Syphon	Tank Sewer	Trunk Sewer	Foul	Combined	Build Over Agreement	Section 104
Drain	Vacuum Main	Decommissioned Pipe		Sludge	Treated Effluent	Wastewater Area	
Outfall				Surface Water	Private	Catchment	Sub-Catchment
Overflow							
Rising Main							
Sewer							

Map Title: SW Print

Printed By: Anne.McFarlane2
Date Printed: 19/06/2026
Map Scale: 750

The information provided is believed to be correct but is provided on an 'as is' basis and without any warranty or condition express or implied, statutory or otherwise as to its quality or fitness for purpose. Actual positions of assets should always be determined on site.





(c) Crown copyright and database rights 2025 Ordnance Survey AC0000808122 Scale: 1:1250 Date: 10/12/25 Wastewater Plan A4
Data updated: 24/11/25 Map Centre: 525041,126952 Our Ref: 1966518 - 1 Powered by digdat

malcolm@easltd.co.uk
Warninglid Primary



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2025 Ordnance Survey AC0000808122. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

APPENDIX D

UK Sustainable Drainage Calculations (Greenfield Runoff Rate)

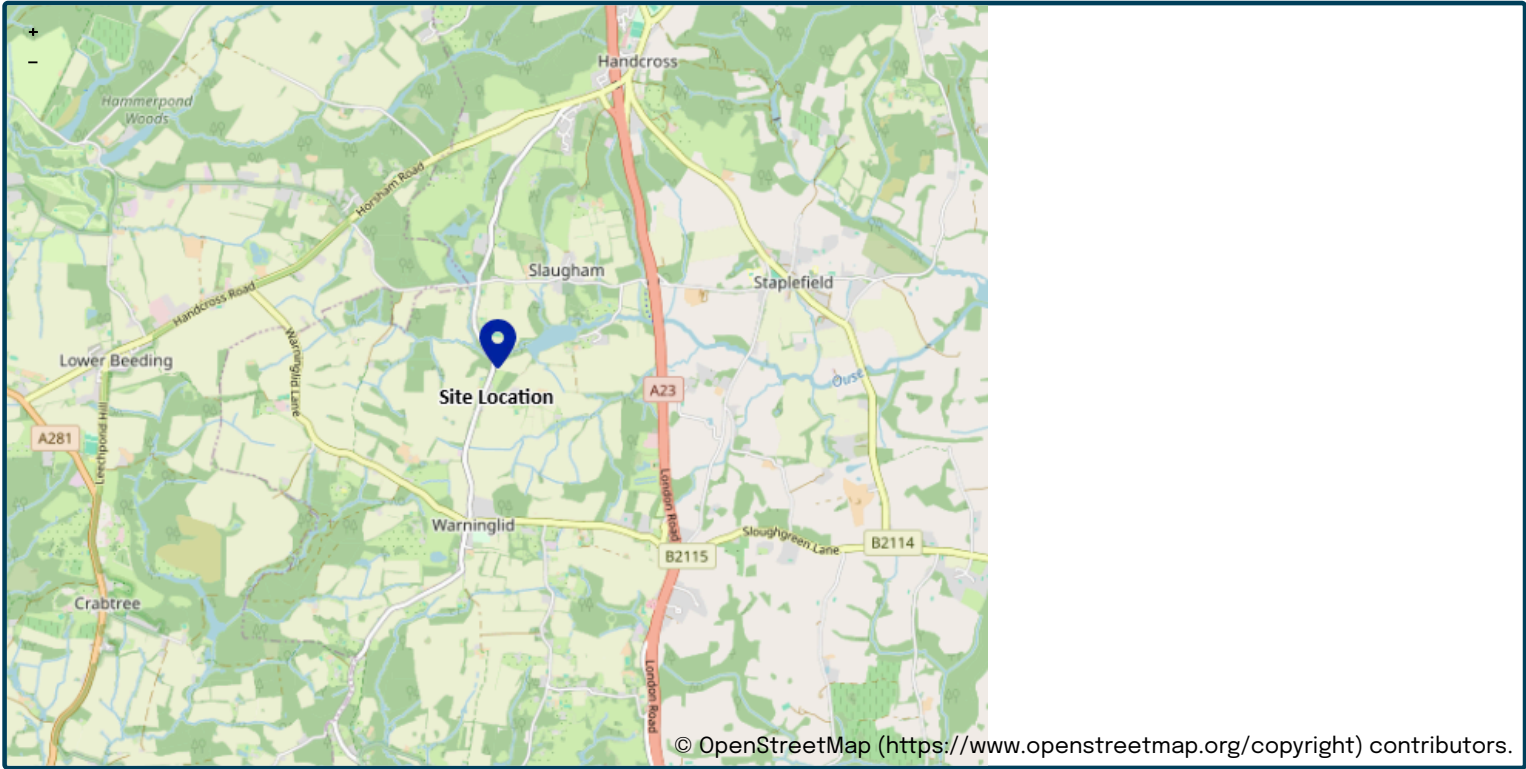
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

Project details

Date	24/09/2026
Calculated by	EAS
Reference	862
Model version	2.2.3

Location

Site name	Warninglid School
Site location	Warninglid



Site easting (British National Grid)	525209
Site northing (British National Grid)	127192

Site details

Total site area (ha)	0.4337	ha
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Greenfield runoff

Method

Method	FEH statistical (2025)
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FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	866	mm
BFIHOST19scaled	0.321	
QMed-QBar conversion	1.136	1.136
QMed (l/s)	3.1	l/s
QBar (FEH statistical 2025) (l/s)	3.6	l/s

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	7	7
1 year growth factor	0.85	
2 year growth factor	0.88	
10 year growth factor	1.62	
30 year growth factor	2.3	
100 year growth factor	3.19	
200 year growth factor	3.74	

Results

Method	FEH statistical (2025)
Flow rate 1 year (l/s)	3.0
Flow rate 2 year (l/s)	3.1
Flow rate 10 years (l/s)	5.8
Flow rate 30 years (l/s)	8.2
Flow rate 100 years (l/s)	11.4
Flow rate 200 years (l/s)	13.3

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

APPENDIX E

Output From Drainage Design Software and Attenuation Storage Calculations



MasterDrain
HY 11.0

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Job No. 862		
Sheet no. 1		
Date 11/03/26		
By EAS	Checked	Reviewed

Project **Warninglid School**

Title **Hydrological data for WARNINGLID**

Data:-

FSR values

Location = WARNINGLID

Grid reference = TQ2526

M5-60 (mm) = 19.8

SAAR (mm/yr) = 825

r = 0.34

Soil = 0.45

Long reference = 525126

Area = England and Wales

Hydrological area = 7

Hydrological zone = 7

Soil classification for WRAP type 4

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

FEH values

c = -0.027

d1 = 0.390

d2 = 0.306

d3 = 0.328

e = 0.319

f = 2.498



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HY 11.0

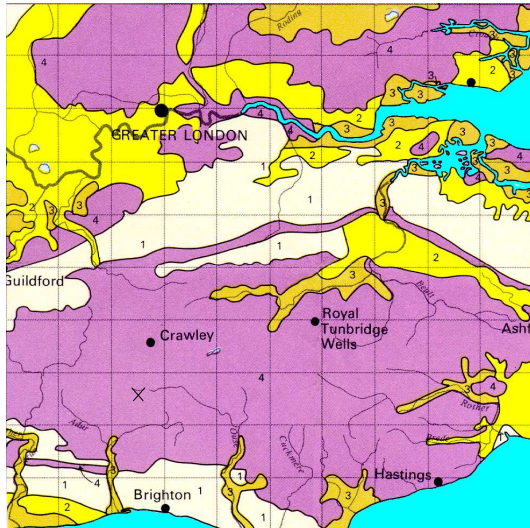
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Project **Warninglid School**
Title **Hydrological data for WARNINGLID**



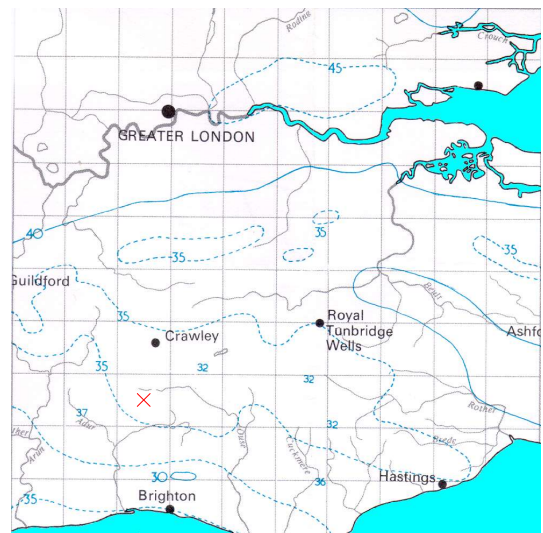
<- Soil

M5-60 ->



<- SAAR

r x 100 ->



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Job No. 862		
Sheet no. 1		
Date 24/09/26		
By	Checked	Reviewed

Project	Warninglid School
Title	Hydrograph storage analysis (Winter profile) for WARNINGLID

Data:-

FEH Hydrology:-

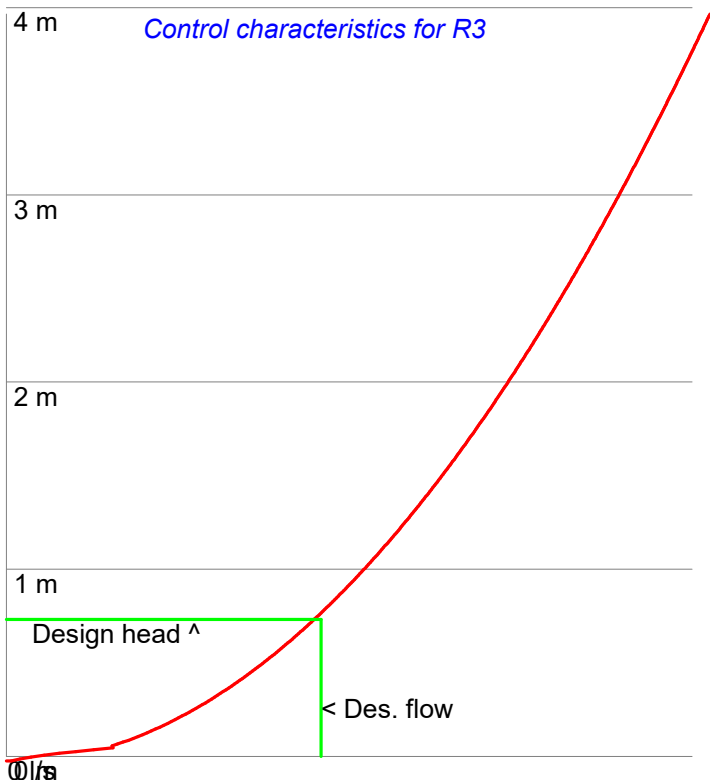
Location = WARNINGLID Grid reference = TQ2526
 c = -0.0270 d1 = 0.3904 d2 = 0.3064
 d3 = 0.3282 e = 0.3190 f = 2.4980
 Return period = 100 Climate change = 45%

Percentage runoff = 100.0% (manual setting)

Imperv. area = 723 m² Pervious area = 0 m²
 Total area = 723 m² Equiv area = 723 m² (Tot. area x % runoff).
 Total runoff = 80.0 m³ Discharge rate = 3.400 l/s

Design Head = 0.8m Peak flow = 3.38 l/s
 Control device = R3 Orifice diam = 54.5 mm
 Max. calc. depth = 0.8 m Available depth = 0.0 m³
 Mean discharge = 1.90 l/s

Available system storage = 0.00 m³ under a system plane at the design head level.
 Offline storage = 0.0 m³
 Total storage = 56.2 m³ Peak input flow = 13.88 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.05	2.01	5.39
0.05	0.57	2.05	5.44
0.10	1.20	2.10	5.51
0.15	1.47	2.15	5.57
0.20	1.70	2.20	5.64
0.25	1.90	2.25	5.70
0.30	2.08	2.30	5.76
0.35	2.25	2.35	5.83
0.40	2.40	2.40	5.89
0.45	2.55	2.45	5.95
0.50	2.69	2.50	6.01
0.55	2.82	2.55	6.07
0.60	2.94	2.60	6.13
0.65	3.06	2.65	6.19
0.70	3.18	2.70	6.25
0.75	3.29	2.75	6.30
0.80	3.40	2.80	6.36
0.85	3.50	2.85	6.42
0.90	3.61	2.90	6.47
0.95	3.71	2.95	6.53
1.00	3.80	3.00	6.58
1.05	3.90	3.05	6.64
1.10	3.99	3.10	6.69
1.15	4.08	3.15	6.75
1.20	4.16	3.20	6.80
1.25	4.25	3.25	6.85
1.30	4.33	3.30	6.91
1.35	4.42	3.35	6.96
1.40	4.50	3.40	7.01
1.45	4.58	3.45	7.06
1.50	4.66	3.50	7.11
1.55	4.73	3.55	7.16
1.60	4.81	3.60	7.21
1.65	4.88	3.65	7.26
1.70	4.96	3.70	7.31
1.75	5.03	3.75	7.36
1.80	5.10	3.80	7.41
1.85	5.17	3.85	7.46
1.90	5.24	3.90	7.51
1.95	5.31	3.95	7.55
2.00	5.38	4.00	7.60

Calculation data provided by Crown Water Ltd, SL5 7NT



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Sheet no. 2		
Date 24/09/26		
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Project **Warninglid School**
Title **Hydrograph storage analysis (Winter profile) for WARNINGLID**

Storage curves for a 4 hours storm.

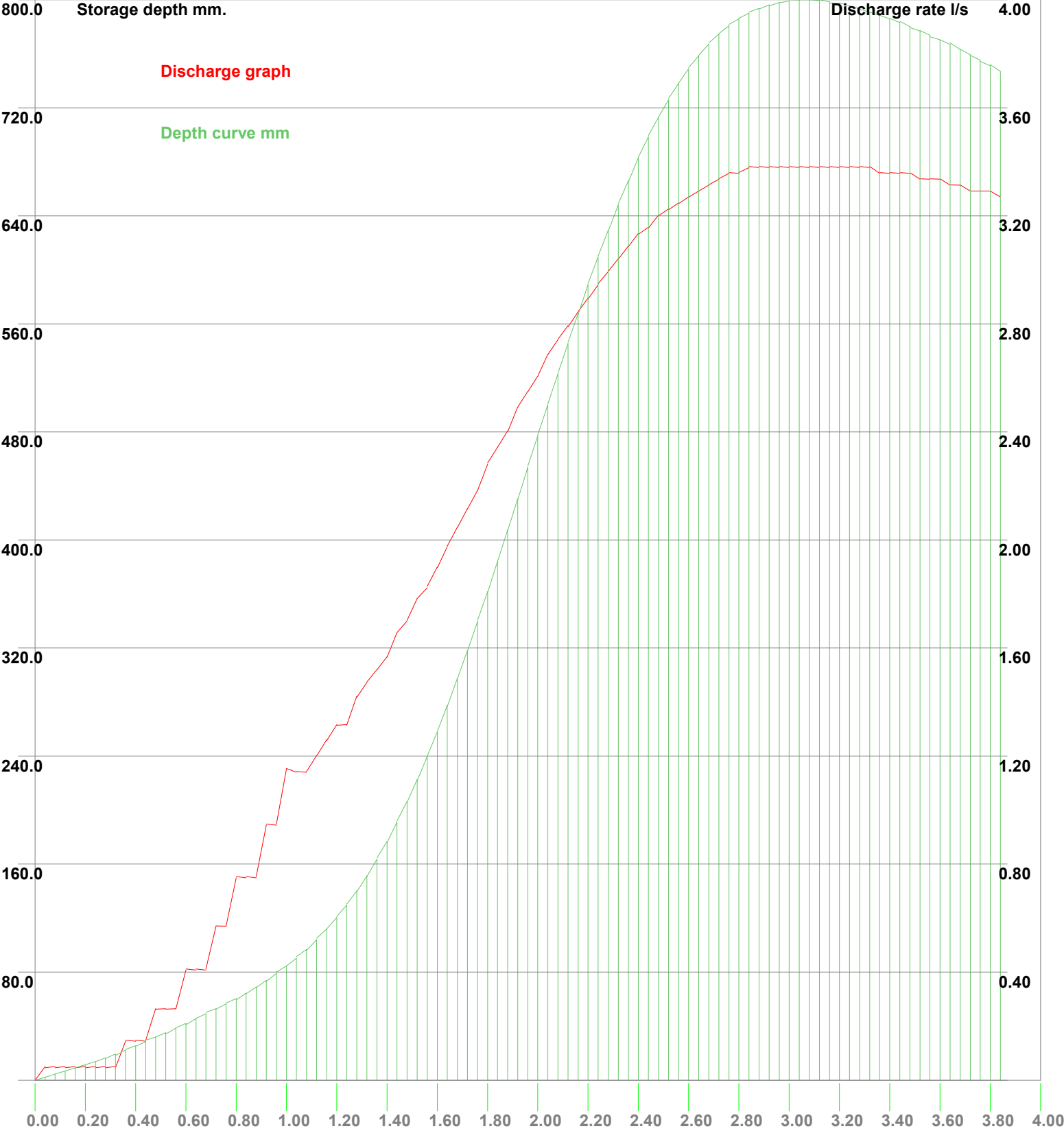
Storage depth mm.

Discharge rate l/s

4.00

Discharge graph

Depth curve mm





Project	Warninglid School
Title	Hydrograph storage analysis (Winter profile) for WARNINGLID

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
2.4	2.3	0.05	122.4	500.1	2.69
4.8	4.4	0.05	124.8	523.0	2.74
7.2	6.7	0.05	127.2	545.6	2.79
9.6	9.0	0.05	129.6	567.6	2.84
12.0	11.4	0.05	132.0	589.0	2.89
14.4	13.9	0.05	134.4	609.6	2.94
16.8	16.6	0.05	136.8	629.3	2.99
19.2	19.4	0.05	139.2	648.1	3.04
21.6	22.4	0.14	141.6	666.0	3.09
24.0	25.4	0.14	144.0	682.9	3.13
26.4	28.6	0.14	146.4	698.5	3.16
28.8	32.0	0.26	148.8	712.9	3.20
31.2	35.2	0.26	151.2	726.0	3.23
33.6	38.5	0.26	153.6	738.1	3.25
36.0	42.1	0.41	156.0	749.0	3.27
38.4	45.6	0.41	158.4	758.5	3.29
40.8	49.2	0.41	160.8	767.2	3.31
43.2	52.9	0.57	163.2	774.6	3.34
45.6	56.5	0.57	165.6	780.7	3.36
48.0	60.4	0.75	168.0	785.8	3.36
50.4	64.5	0.75	170.4	790.1	3.38
52.8	69.0	0.75	172.8	793.5	3.38
55.2	73.9	0.94	175.2	796.1	3.38
57.6	79.1	0.94	177.6	798.0	3.38
60.0	84.6	1.15	180.0	799.1	3.38
62.4	90.4	1.14	182.4	799.7	3.38
64.8	96.8	1.14	184.8	799.9	3.38
67.2	104.0	1.20	187.2	799.4	3.38
69.6	111.9	1.26	189.6	798.5	3.38
72.0	120.5	1.32	192.0	797.2	3.38
74.4	129.7	1.32	194.4	795.4	3.38
76.8	140.0	1.42	196.8	793.2	3.38
79.2	151.3	1.47	199.2	790.9	3.38
81.6	163.7	1.52	201.6	788.4	3.36
84.0	176.8	1.57	204.0	785.8	3.36
86.4	191.2	1.66	206.4	783.0	3.36
88.8	206.4	1.70	208.8	780.0	3.36
91.2	222.6	1.78	211.2	776.9	3.34
93.6	239.8	1.82	213.6	773.7	3.34
96.0	258.2	1.90	216.0	770.4	3.34
98.4	277.5	1.98	218.4	766.9	3.31
100.8	297.6	2.05	220.8	763.1	3.31
103.2	318.3	2.12	223.2	759.3	3.29
105.6	339.7	2.18	225.6	755.3	3.29
108.0	361.7	2.28	228.0	751.2	3.29
110.4	384.3	2.34	230.4	746.9	3.27
112.8	407.3	2.40	232.8	742.6	3.27
115.2	430.6	2.49	235.2	738.3	3.25
117.6	453.8	2.55	237.6	733.9	3.25
120.0	477.0	2.61	240.0	729.5	3.23

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.

Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.



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Sheet no.

4

Date

24/09/26

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SW

Project
Warninglid School

Title
Hydrograph storage analysis (Winter profile) for WARNINGLID

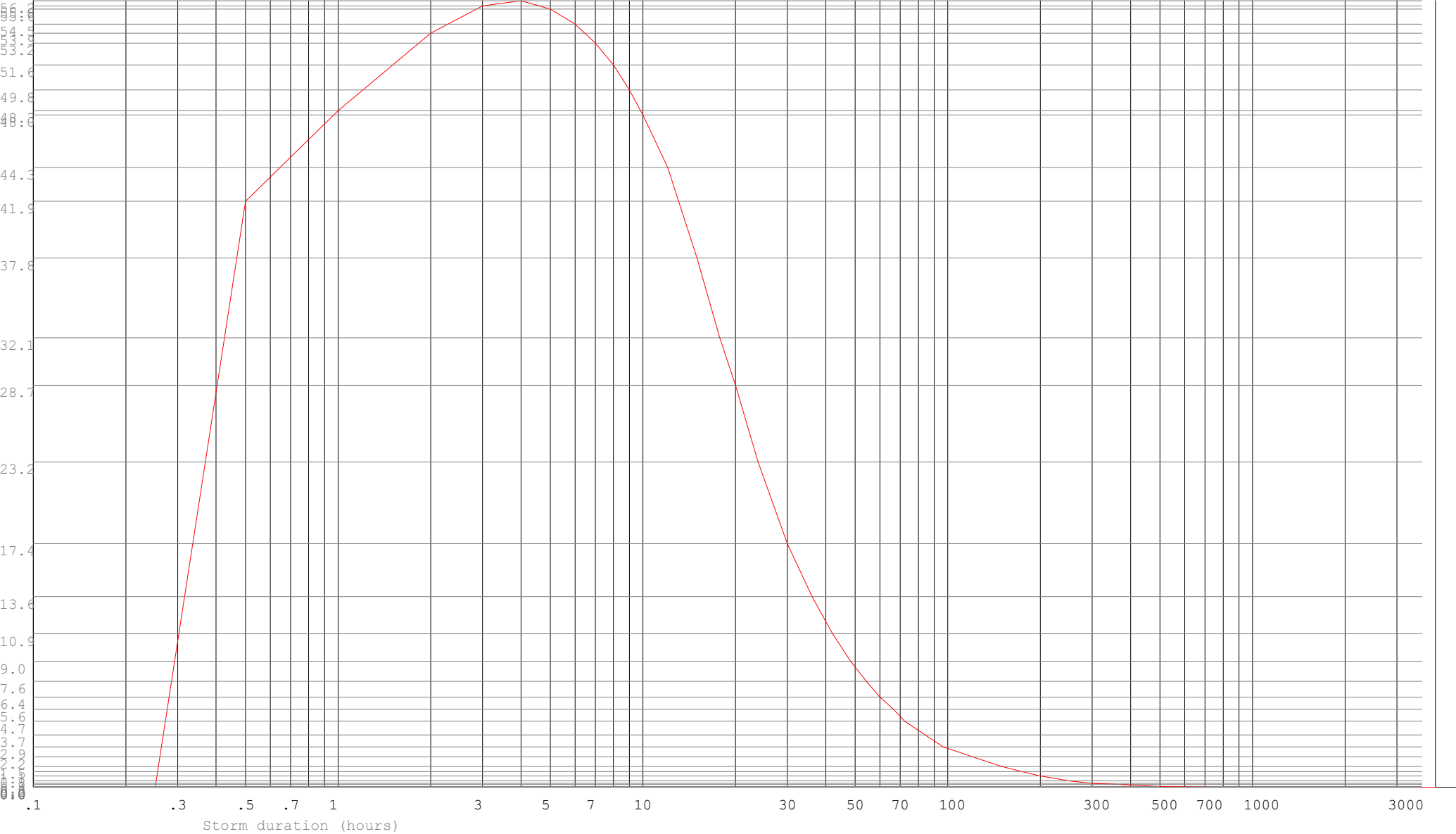
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Sequential storage volume at specific storm durations.

m³



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		Sheet no. 1		
		Date 24/09/26 13:20		
Project Warninglid School		By	Checked	Reviewed
Title Manhole printout for WARNINGLID SCHOOL				

Manhole ref.	X ref	Y ref	Form	Cham diam. or length	Rect. width	Chamb. height	Shaft height	MH Volume	Exit Diam	Exit Crown	Exit Invert	Chamb const	Slab level	Cover Level	Dwnstr MH
EXSW1	68.8	141.4	circ	600	N/A	0.50		0.14	150	89.455	89.280	N/A	89.230	89.780	EXSW2
EXSW2	54.5	125.5	circ	600	N/A	0.50		0.14	150	89.095	88.920	N/A	88.870	89.420	EXSW3
EXSW3	51.2	118.2	circ	600	N/A	0.50		0.14	225	88.920	88.670	N/A	88.620	89.170	SW1
SW1	50	113.3	circ	450	N/A	0.50		0.08	225	88.750	88.500	N/A	88.450	89.000	SW2
SW2	52.7	75.8	circ	450	N/A	0.50		0.08	225	88.250	88.000	N/A	87.950	88.500	SW3
SW3	49.7	60.4	circ	450	N/A	0.50		0.08	225	87.900	87.650	N/A	87.600	88.150	SW4
SW4	62.2	57.2	circ	450	N/A	0.50		0.08	225	87.590	87.340	N/A	87.290	87.840	SW5
SW5	62.8	32.3	circ	450	N/A	0.50		0.08	300	87.025	86.700	N/A	86.650	87.200	SW6
SW6	46	36.7	circ	450	N/A	0.88		0.14	225	86.770	86.520	N/A	86.470	87.400	STORAGE
STORAGE	42.8	30.5	circ	9458	N/A	1.40		98.36	100	86.025	85.900	N/A	85.850	87.300	SW7
SW7	26	28.4	circ	450	N/A	1.57		0.25	100	85.855	85.730	N/A	85.680	87.300	A10839
A10839	18.2	13.5	circ	600	N/A	0.50		0.14	150	84.875	84.700	N/A	84.650	85.200	STREAM

All manholes to be as per 'Sewers for Adoption'

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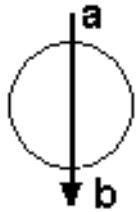
Sheet no.
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Date
24/09/26 13:21

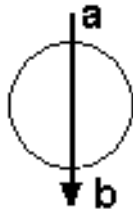
Project
Warninglid School

Title
Manhole printout for WARNINGLID SCHOOL

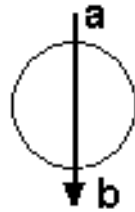
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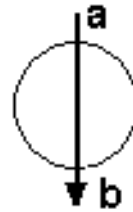
MH = EXSW1
a=head
b = 150



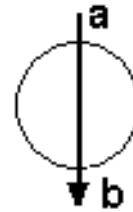
MH = EXSW2
a= 150
b = 150



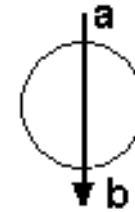
MH = EXSW3
a= 150
b = 225



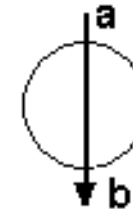
MH = SW1
a= 225
b = 225



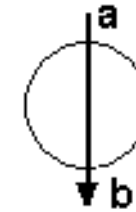
MH = SW2
a= 225
b = 225



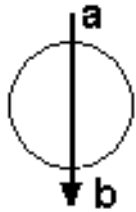
MH = SW3
a= 225
b = 225



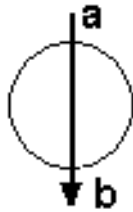
MH = SW4
a= 225
b = 225



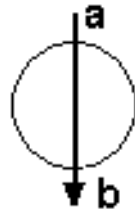
MH = SW5
a= 225
b = 300



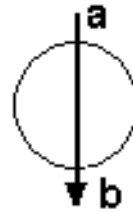
MH = SW6
a= 300
b = 225



MH = STORAGE
a= 225
b = 100



MH = SW7
a= 100
b = 100



MH = A10839
a= 100
b = 150

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				Sheet no. 3		
				Date 24/09/26 13:21		
Project	Warninglid School			By	Checked	Reviewed
Title	Manhole printout for WARNINGLID SCHOOL					

These explanatory notes should be read in conjunction with the Manhole printout

- 1) Manhole ref - the reference for the manhole in question
- 2) Form - either circular or rectangular
- 3) Chamber diam or length - diameter of chamber if circular, or length if rectangular - in metres
- 4) Rectangular width - if form is rectangular, this gives the width of the chamber
- 5) Chamber height - height of chamber from invert
- 6) Shaft height - height of access shaft if applicable, from top of chamber to ground level
- 7) Manhole volume - cubic capacity of manhole chamber
- 8) Exit diameter - diameter of pipe leaving this manhole
- 9) Exit crown - crown level of pipe leaving this manhole
- 10) Exit invert - invert level of pipe leaving this manhole
- 11) Chamb const - manhole construction :-
 - N/A - not specified
 - Conc - concrete rings
 - Poly - polypropylene rings surrounded by selected fill
 - Poly/conc - polypropylene rings surrounded by concrete
 - Brick - brick built with waterproof render
 - In situ - concrete cast in situ
- 12) Slab level - surface level of base slab (if no sump, this is placed at 50mm below exit invert to allow levels manipulation).
- 13) Manhole diameters of 9999 have exceeded the sizes available in SfA
- 14) Manhole diameters may have to be modified due to the number of branches



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Job No. 862		
Sheet no. 1		
Date 24/09/26		
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Project
Warninglid School

Title
Surcharge calcs for WARNINGLID SCHOOL CCF = 45%

Using in-line restrictors
Return period = 100 yrs
Climate change factor = 45

PEAK hydrograph values printed
Storm duration = 15 mins
No offline storage

Mean rain intens. 307.00 mm/hr
Storm profile = Summer
Using FEH data

Peak rain intens. 1203.44 mm/hr
Sample period = 7.5 secs.

Entry	SECT.:	MANHOLE	:	PIPE	:	RATE	:	PIPE	:	CHAMBER	:	INVERT:	WATER	:	GRND	:	SURCHARGE		:	EXCESS	:	FLOODED	:	DRAINED	:	STATUS		
No.	No.	REF	:	CAPACITY	:	FLOW	:	SIZE	:	DIAM/LxW	:	LEVEL	LEVEL	:	LEVEL	:	:	:	:	:	FLOW	:	VOL	:	AREA (m ²)	:		
			:	l/s	:	l/s	:	mm	:	mm	:	m	m	:	m	:	fract.	Depth	:	l/s	:	m ³	:	:x FACTOR	:			
1	I	1.01		EXSW1		23.2		17.6		150		600	89.28		89.39		89.78		0.76		0.11		0.00		0.000		121	OK
2	I	1.02		EXSW2		31.5		31.2		150		600	88.92		89.07		89.42		0.99		0.15		0.00		0.000		216	OK
3	I	1.03		EXSW3		95.3		37.2		225		600	88.67		88.76		89.17		0.39		0.09		0.00		0.000		257	OK
4	I	1.04		SW1		60.0		37.2		225		450	88.50		88.63		89.00		0.62		0.13		0.00		0.000		257	OK
5	I	1.05		SW2		77.7		39.6		225		450	88.00		88.11		88.50		0.51		0.11		0.00		0.000		274	OK
6	I	1.06		SW3		80.4		49.9		225		450	87.65		87.78		88.15		0.62		0.13		0.00		0.000		344	OK
7	I	1.07		SW4		83.5		62.6		225		450	87.34		87.50		87.84		0.75		0.16		0.00		0.000		432	OK
8	I	1.08		SW5		113.3		73.4		300		450	86.70		86.89		87.20		0.65		0.19		0.00		0.000		507	OK
9	I	1.09		SW6		157.7		89.2		225		450	86.52		86.64		87.40		0.57		0.12		0.00		0.000		616	OK
10	I	1.10		STORAGE#		6.0		3.4		100		9458	85.90		85.96		87.30		0.56		0.06		0.00		0.000		616	OK
11	I	1.11		SW7		15.2		0.0		100		450	85.73		85.73		87.30		0.00		0.00		0.00		0.000		0	OK
12	I	1.12		A10839		33.1		24.8		150		600	84.70		84.81		85.20		0.75		0.11		0.00		0.000		171	OK



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Job No. 862		
Sheet no. 2		
Date 24/09/26		
By	Checked	Reviewed

Project	Warninglid School
Title	Surcharge calcs for WARNINGLID SCHOOL CCF = 45%

Notes

Printout headings

- | | | |
|---|--|--|
| 1) Entry no - position in file | 2) Section no - pipe identifier | 3) Manhole ref - Manhole identifier |
| 4) Pipe cap - full bore capacity of that pipe | 5) Rate of flow - calculated flow rate (l/s) ‡ = flow restrictor. | 6) Pipe diam - outlet pipe diameter (mm) |
| 7) Chamber diam - chamber diam. at base of MH | 8) Invert level - invert level of manhole | 9) Water level - calculated peak water level. |
| 10) Grnd level - ground / cover level | 11) Surch. fract - calc.flow/pipe capacity | 12) Surch. depth - surcharge level above soffit |
| 13) Overflow - surcharged flow rate (l/s) | 14) Flooded vol - volume of water above cover | 15) Upstrm Vol - upstream pipe vol to previous manhole(s) |
| 16) Status - OK - outlet not surcharged | 17) Status - Surcharged - outlet surcharged | 18) Status - Warning - water level within 299mm of cover level |
| 19) Status - Flooded - cover over-topped | 20) § against diameter indicates throttle pipe used. | |

Title box

Hydrograph data

- | | | |
|---|--------------------------------------|--|
| 1) Ret. period - that used to calculate profile | 2) Duration - length of storm (mins) | 3) Profile - either Winter (75%) or Summer (50%) |
|---|--------------------------------------|--|

Flow restrictors

Manhole reference - STORAGE

Restrictor flowrate - 3.4 l/s

Flood volumes

Check that the upstream storage of the manhole is adequate to take the flood volume - see Upstrm Vol above.



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SW

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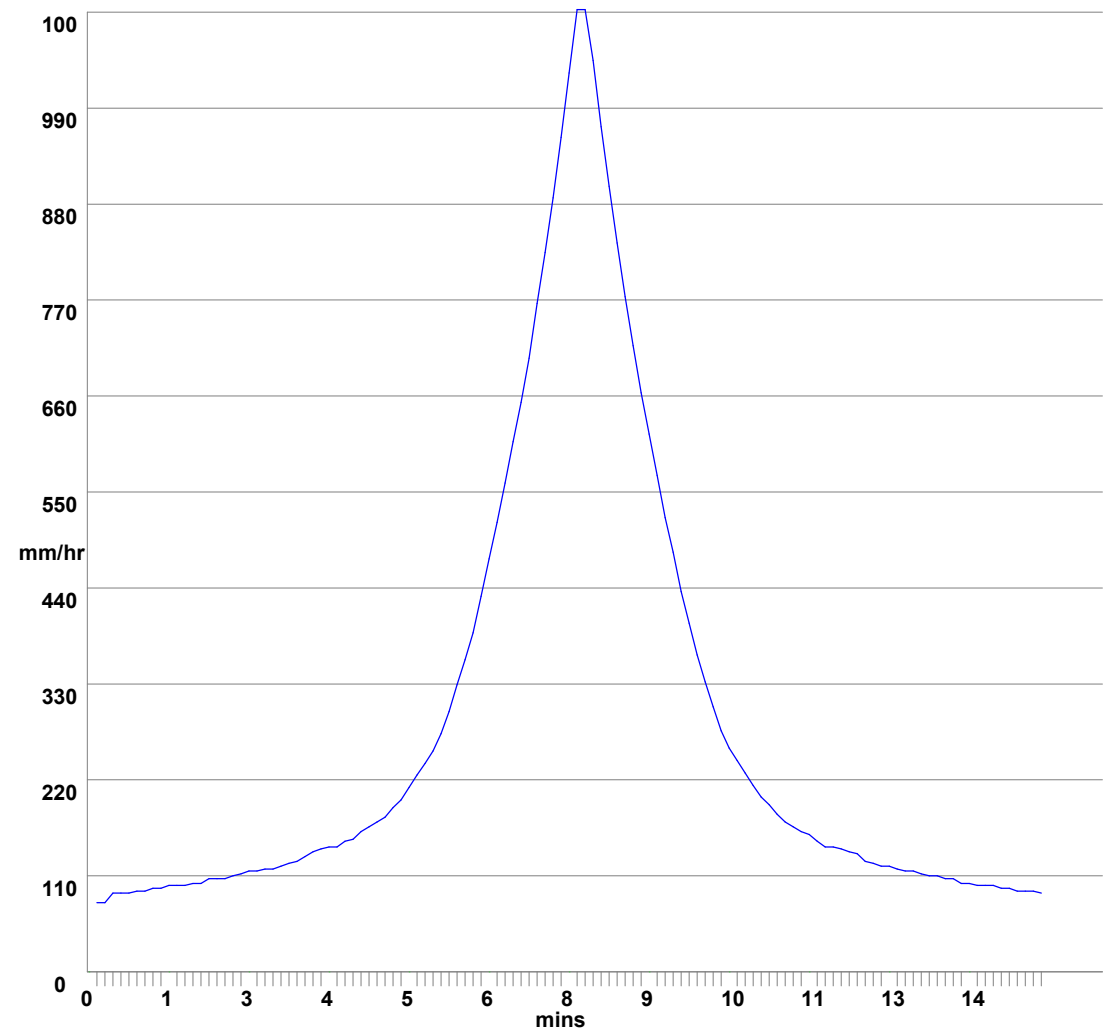
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Project Warninglid School
Title Surcharge calcs for WARNINGLID SCHOOL CCF = 45%

Time mins	Rain mm/hr	Time mins	Rain mm/hr	Time mins	Rain mm/hr
0:08	71.60	5:08	204.57	10:08	219.92
0:15	71.60	5:15	217.36	10:15	207.13
0:22	81.83	5:22	230.15	10:22	194.35
0:30	81.83	5:30	248.05	10:30	181.56
0:38	81.83	5:38	271.06	10:38	173.89
0:45	84.39	5:45	299.19	10:45	163.66
0:52	84.39	5:52	324.76	10:52	155.99
1:00	86.94	6:00	352.89	11:00	150.87
1:08	86.94	6:08	391.25	11:08	145.76
1:15	89.50	6:15	429.61	11:15	143.20
1:22	89.50	6:22	467.96	11:22	135.53
1:30	89.50	6:30	508.88	11:30	130.42
1:38	92.06	6:38	552.35	11:38	130.42
1:45	92.06	6:45	593.27	11:45	127.86
1:52	97.17	6:52	639.30	11:52	125.30
2:00	97.17	7:00	695.55	12:00	122.74
2:08	97.17	7:08	749.25	12:08	115.07
2:15	99.73	7:15	805.51	12:15	112.52
2:22	102.29	7:22	869.44	12:22	109.96
2:30	104.84	7:30	935.93	12:30	109.96
2:38	104.84	7:38	1002.42	12:38	107.40
2:45	107.40	7:45	1002.42	12:45	104.84
2:52	107.40	7:52	948.71	12:52	104.84
3:00	109.96	8:00	879.67	13:00	102.29
3:08	112.52	8:08	818.30	13:08	99.73
3:15	115.07	8:15	759.48	13:15	99.73
3:22	120.19	8:22	703.22	13:22	97.17
3:30	125.30	8:30	652.08	13:30	97.17
3:38	127.86	8:38	603.49	13:38	92.06
3:45	130.42	8:45	560.02	13:45	92.06
3:52	130.42	8:52	516.55	13:52	89.50
4:00	135.53	9:00	473.08	14:00	89.50
4:08	138.09	9:08	437.28	14:08	89.50
4:15	145.76	9:15	396.36	14:15	86.94
4:22	150.87	9:22	363.12	14:22	86.94
4:30	155.99	9:30	329.88	14:30	84.39
4:38	161.10	9:38	301.75	14:38	84.39
4:45	171.33	9:45	276.18	14:45	84.39
4:52	179.00	9:52	250.60	14:52	81.83
5:00	191.79	10:00	232.70	15:00	81.83

Hydrograph profile derived from data in the Flood Studies Report

Return period= 100 yrs Duration= 15 mins Profile - summer





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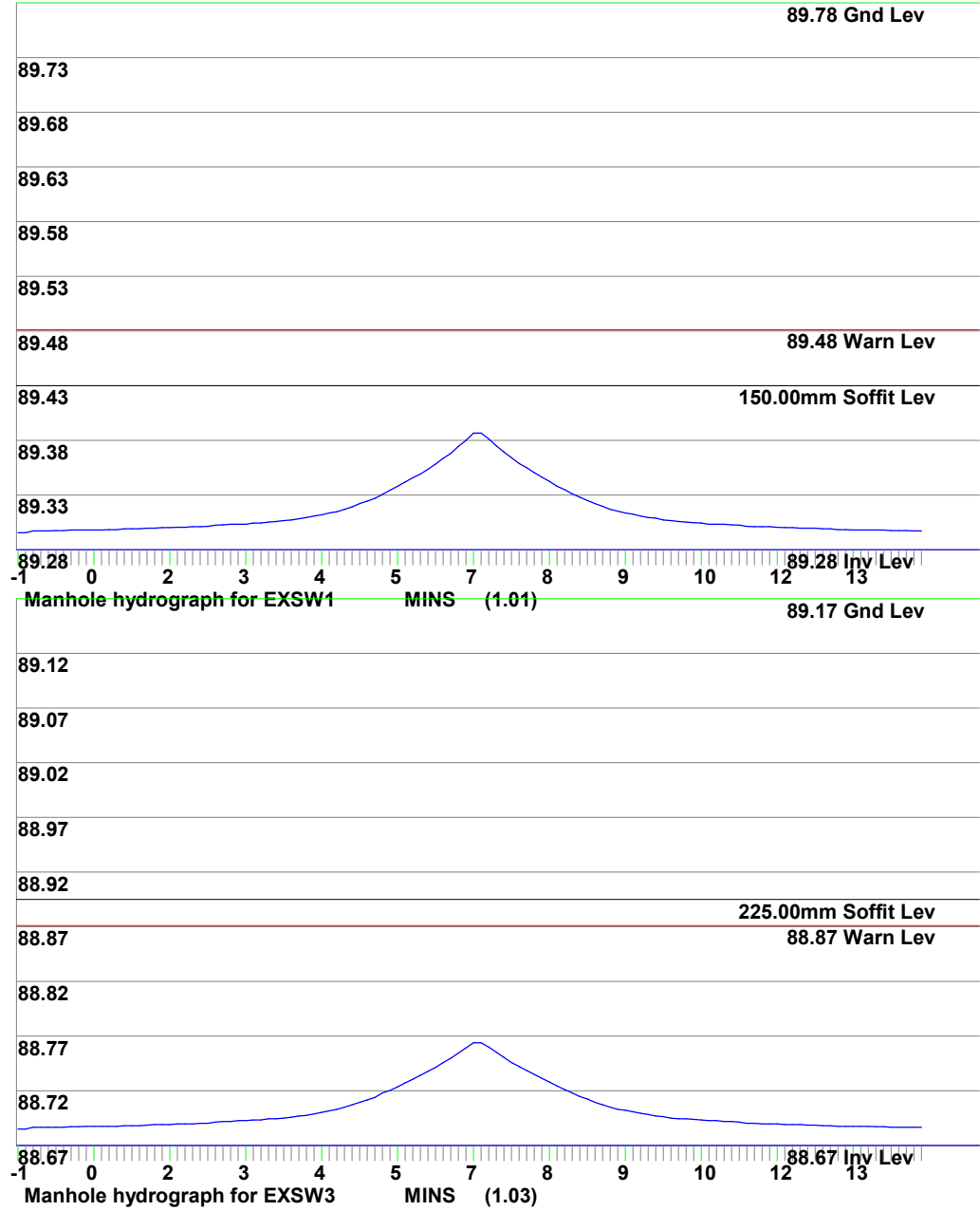
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Title Surcharge calcs for WARNINGLID SCHOOL CCF = 45%			





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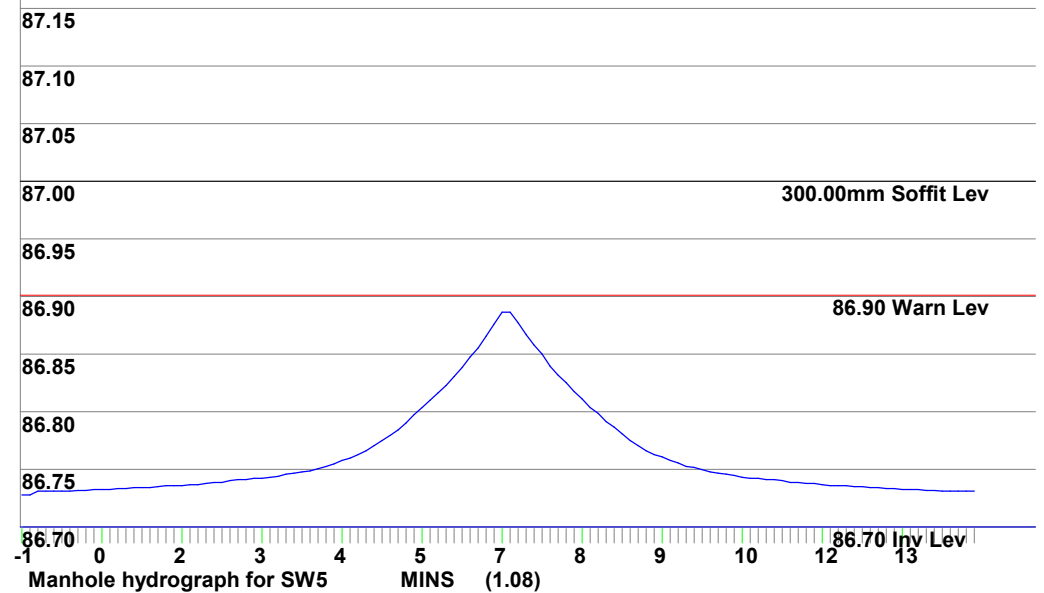
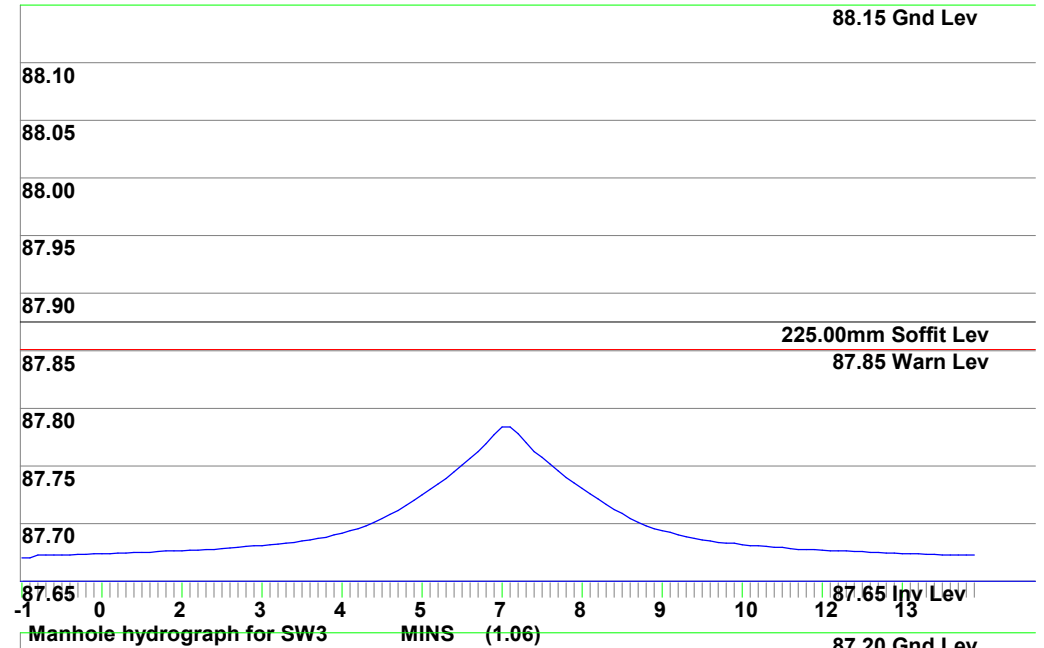
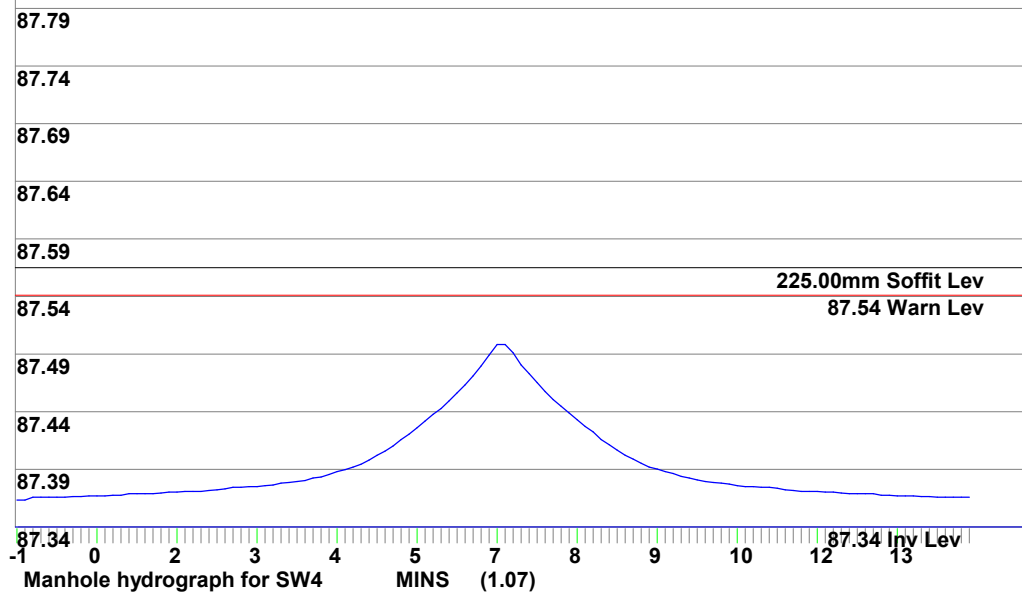
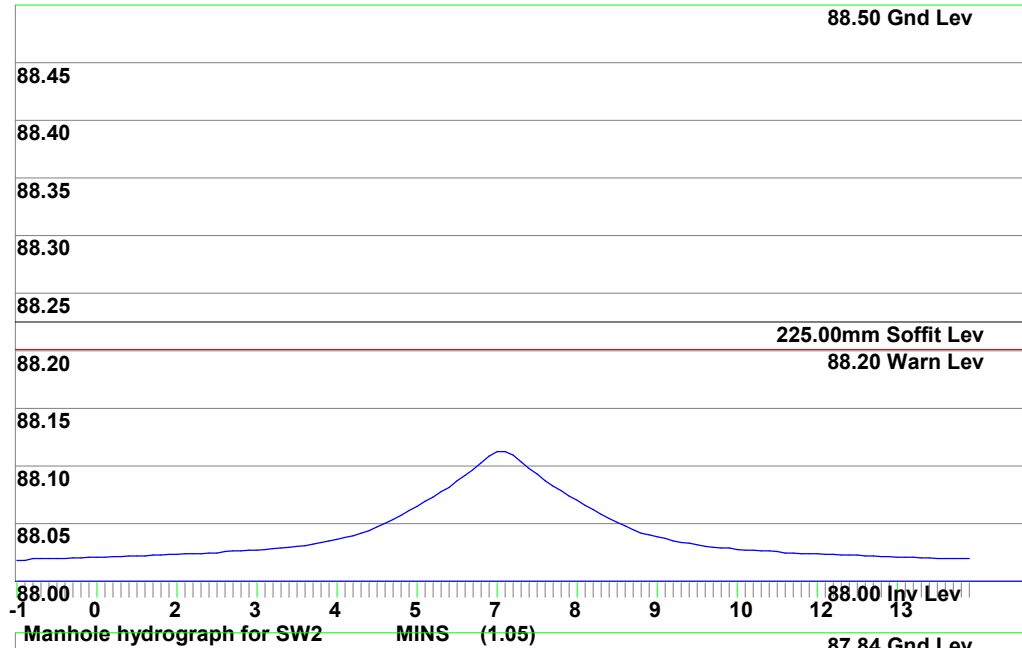
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Title **Surcharge calcs for WARNINGLID SCHOOL CCF = 45%**





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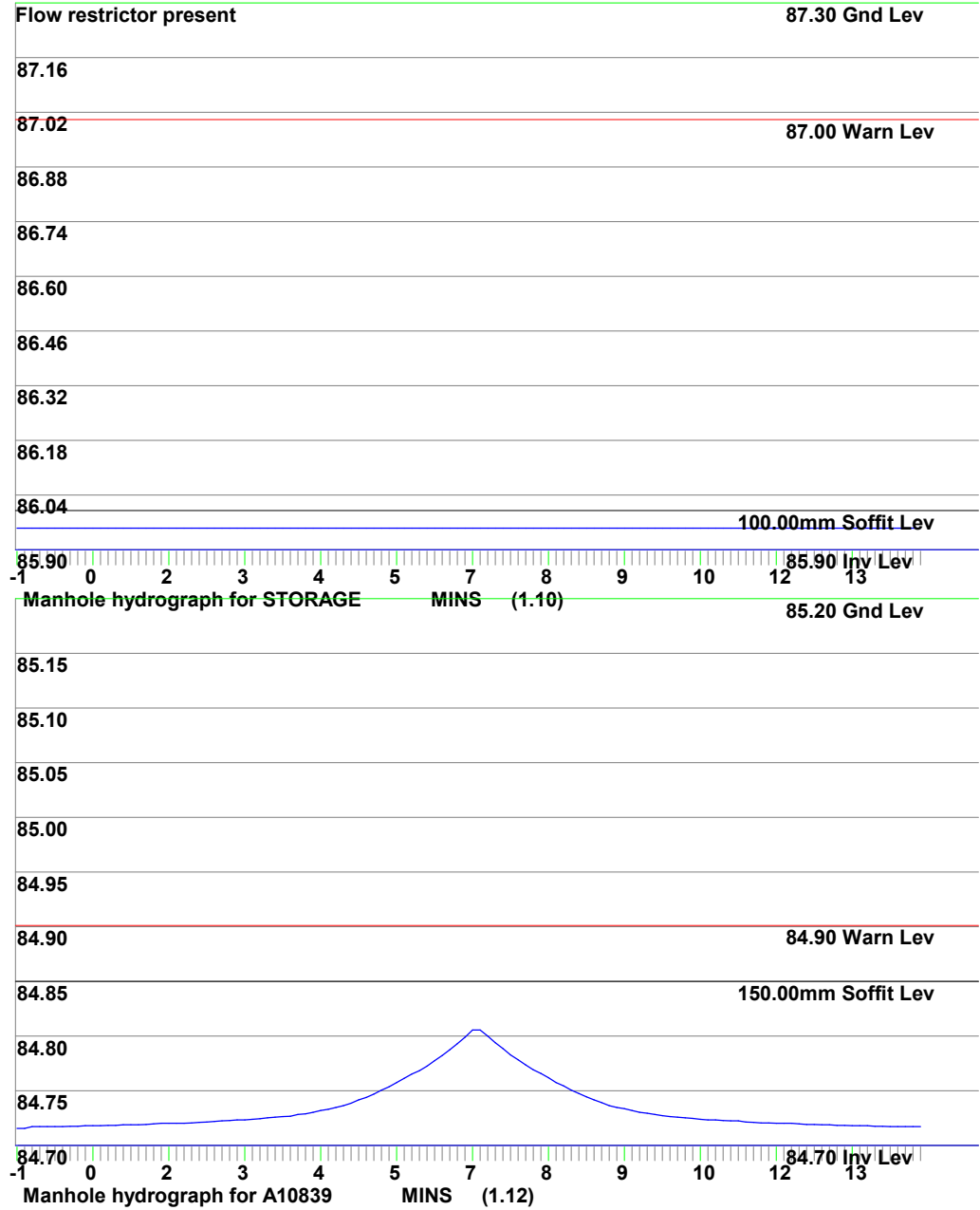
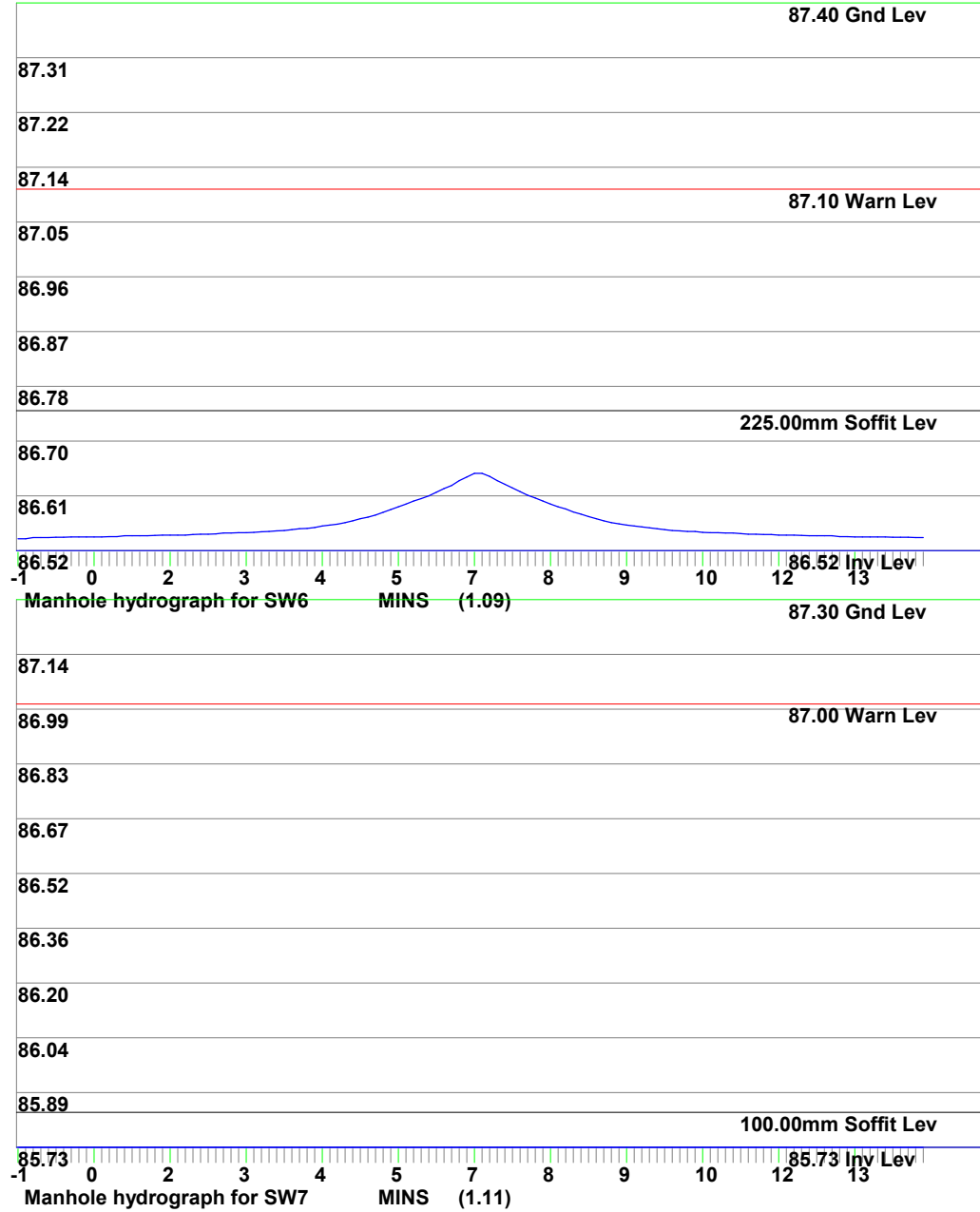
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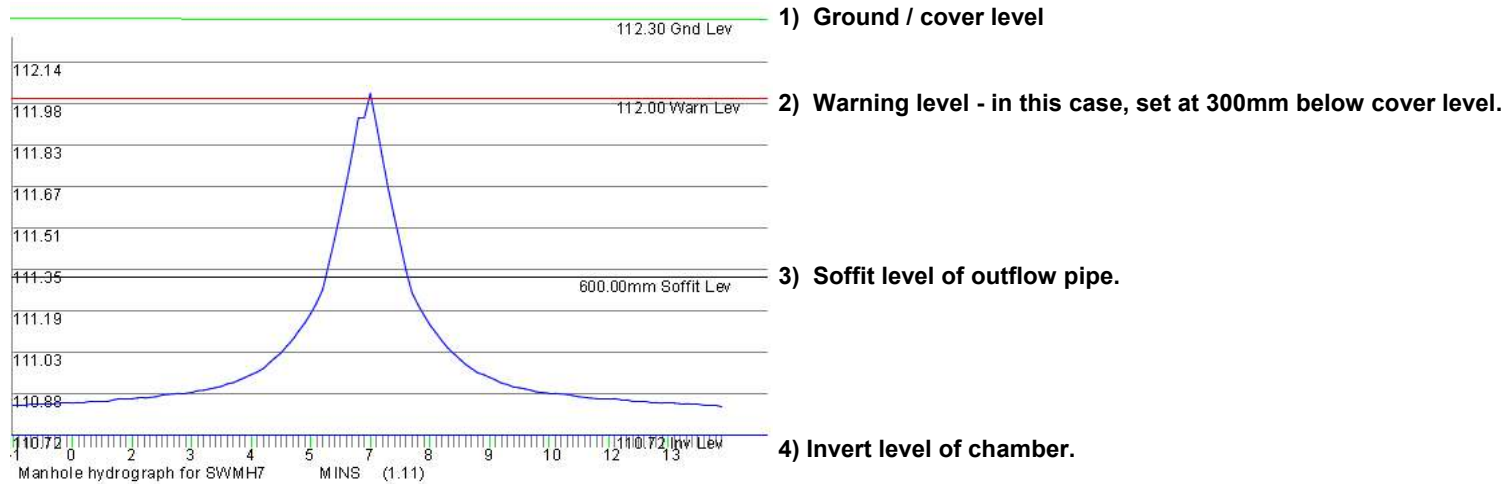
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Notes

- Lower section of the graph shows the water depth filling the channel. Channel is assumed to be a full pipe diameter in depth.
- Upper section of the graph shows the water depth filling the chamber. Chamber has a greater width/diameter than the channel, so increases in depth are proportionally less.
- The top of the graph clips the warning level and would be marked thus on the printout.
- In many cases the invert of the offline storage is required to enter at the channel soffit level, meaning that the pipe will still surcharge but flooding risk reduced.
- The diagram above is a general one and is not part of the current calculation.



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Foul 11.5

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Project
WARNINGLID SCHOOL

Title
Manhole printout for WARNINGLID SCHOOL

Manhole ref.	Form	Cham diam. or length	Rect. width	Chamb. height	Shaft height	MH Volume	Ent. Diam	Ent. Crown	Ent. Invert	Exit Diam	Exit Crown	Exit Invert	Chamb const	Cover Level	Dwnstr MH
PC1	circ	450	N/A	1.00		0.16	Head	----	----	100	89.125	89.000	N/A	90.000	EXC1
EXC1	circ	450	N/A	1.52		0.24	100	0.000	0.000	100	88.475	88.350	N/A	89.870	PC2
EXC2	circ	450	N/A	1.20		0.19	Head	----	----	100	88.475	88.350	N/A	89.550	EXC3
EXC3	circ	450	N/A	1.24		0.20	100	0.000	0.000	100	88.145	88.020	N/A	89.260	PC2
PC2	circ	450	N/A	1.02		0.16	100	0.000	0.000	100	88.065	87.940	N/A	88.960	PC3
FW1	circ	450	N/A	0.50		0.08	Head	----	----	100	87.905	87.780	N/A	88.280	PC3
PC3	circ	450	N/A	0.90		0.14	100	0.000	0.000	100	87.765	87.640	N/A	88.540	EDC
FW2	circ	450	N/A	0.50		0.08	Head	----	----	100	88.125	88.000	N/A	88.500	EDC

All manholes to be as per 'Sewers for Adoption'

Levels calculated for level inverts



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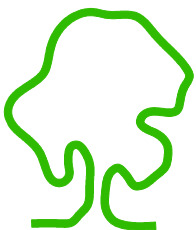
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Project
WARNINGLID SCHOOL

Title
Manhole printout for WARNINGLID SCHOOL

These explanatory notes should be read in conjunction with the Manhole printout

- 1) Manhole ref - the reference for the manhole in question
- 2) Form - either circular or rectangular
- 3) Chamber diam or length - diameter of chamber if circular, or length if rectangular - in metres
- 4) Rectangular width - if form is rectangular, this gives the width of the chamber
- 5) Chamber height - height of chamber from invert
- 6) Shaft height - height of access shaft if applicable, from top of chamber to ground level
- 7) Manhole volume - cubic capacity of manhole chamber
- 8) Exit diameter - diameter of pipe leaving this manhole
- 9) Exit crown - crown level of pipe leaving this manhole
- 10) Exit invert - invert level of pipe leaving this manhole
- 11) Manhole diameters of 9999 have exceeded the sizes available in Sfa
- 12) Manhole diameters may have to be modified due to the number of branches



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