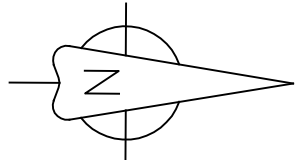


Appendix C - Proposed Drainage Strategy



FOUL AND SURFACE WATER DRAINAGE LAYOUT

SCALE : 1:500

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
In addition to the hazard/risk normally associated with the types of work detailed on this drawing, note the following :
CONSTRUCTION
- All buried services to be isolated/protected/ removed prior to start of works
- Contractor to maintain dedicated signed worker access routes
- Ensure temporary earthwork support for deep excavations
- Contractor to ensure any worker carrying out work in confined spaces has the required training and PPE
- Ensure washing facilities/PPE are available as breathing into existing voids / drainage may be required.
- Ensure all trenches / excavations are adequately supported and the sides of all trenches stepped/battered in accordance with up to date HSE legislation.
MAINTENANCE /CLEANING
- As constructed records of all underground sewers / drains and utilities are to be kept by the contractor and included in the project Health and Safety File.
- Do not enter excavations unless absolutely required and ensure adequate sealing of vehicle and pedestrian areas in time of cold weather
- Implement adequate maintenance regime in order to ensure the integrity and skid resistance of vehicle and pedestrian areas.
DECOMMISSIONING /DEMOLITION
- Consult project Building Maintenance Manual / Health and Safety File before carrying out excavation / site clearance next to building and retaining structures.
It is ensured that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement

Notes

1. To be read in conjunction with all relevant Architect's and Engineer's drawings and specifications.
2. All dimensions are in mm, (unless otherwise stated).
3. Drainage under buildings to be cast for socketless pipe and fittings to BS EN 877 and to have Class S granular bed unless within 300mm of the underside of the slab in which case to have Class Z concrete bed & surround. External below ground drainage to comprise of vitrified Clay pipe (up to and including 225mm dia). Strength class 120 to BS EN 295 or concrete pipes (over 225mm dia). Strength class H to BS5911.
4. Typically pipes under hard standing to have a class S bedding where cover is greater than 1200mm, where cover is less than 1200mm pipework is to have a class Z concrete surround. Concrete pipes with more than 1200mm cover to have class S bed.
5. Typically, pipes under non-trunked area to have a class S bedding.
6. Minimum cover 300mm.
7. Manholes to be constructed in accordance with BS EN 124, & the manhole schedule. Typically Grade D400 in trafficked areas and Grade B125 in non-trafficked areas.
8. Position, size and invert of existing drains taken from existing survey and CCTV information (if applicable).
9. This drawing to be read in conjunction with other drainage details.
10. All internal drainage chambers and manholes to be provided with double seal cover and frame.
11. All soilstack, soil and vent and internal rainwater pipes to be provided with rodding access points unless otherwise shown.
12. All rainwater gutters to be trapped unless otherwise shown.
13. All soil stack, soil and vent pipe connections to be 150mm internal diameter unless otherwise shown.
14. All abandoned drainage to be grubbed up or grouted unless otherwise shown.
15. All new drainage to be installed using 200mm GEN3 concrete plug and bedding chamber to be allowed for suit new internal arrangement (extent of abandonment to be agreed).
16. Backdrops to new or existing chambers to be external in accordance with the relevant standard details (if required).
17. All existing drainage to be maintained in working order unless otherwise shown.
18. All connections to existing adopted Welsh Water drainage system to be subject to a Section 106 application. No work to take place on the existing adopted system until this application has been agreed.
19. All existing manhole levels (foul & storm) that are to form part of the revised drainage apparatus must be confirmed prior to the commencement of any works. Any discrepancies are to be reported to the relevant authority.
20. Threshold drains to proposed downways subject to detailed design levels and proposals.
21. Above ground grease traps/enzyme dosing system to be provided to all kitchen areas.
22. All distribution pipes within soakaway to be 225mm internal diameter sloped pipes. Contractor to provide pipe details for approval. No works to the existing public sewer to be carried out until the completion of an Agreement. Any unauthorised works will be subject to legal proceedings taken by the sewer authority.

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12	16.02.16	NEW SITE LAYOUT AND RWP LOCATIONS	J.E	J.P.	J.P.	D.H
T1	30.11.15	TENDER ISSUE	J.E	J.P.	J.P.	D.H
Rev	Rev. Date	Purpose of revision	Drawn	Checked	Rev'd	Approved

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Client
POLICE AND CRIME COMMISSIONER OF NORTH WALES

Project
EASTERN COMMAND AND CUSTODY FACILITY

Drawing title
FOUL AND SURFACE WATER DRAINAGE LAYOUT

Drawing status
TENDER ISSUE

Scale	1:500 @ A1	DO NOT SCALE
Jacobs No.	B13055210	
Client no.		

Drawing number
B13055210/CE/170.001

Rev	T2
This drawing is not to be used in whole or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.	

Appendix D - Site Suds Evaluation

Site Drainage Evaluation for the use of SUDS

Site Name: Wrexham Police Eastern Command and Custody Facility.

Introduction

This is a site specific report to provide outline guidance on drainage and the use of SUDS. HR Wallingford Ltd, the Environment Agency and any local authority are not liable for the performance of any drainage scheme which is based upon these results. It is recommended that detailed design of any scheme is carried out before construction takes place.

The following site characteristics were entered.

- *Site Development Includes:* Commercial;
- *Drainage Ownership:* Private;
- *Site Size:* Between 4 ha and 5 ha.
- *Land Use:* Brownfield / Greenfield Development.
- *Other Characteristics:* None
- *Ground Water:* Greater than 2m below surface (assumed).

General

The general principle behind the use of SUDS for any site is to comply with the following:

- *runoff volumes should be minimised*
- *runoff rates should be minimised*
- *the stormwater effluent is treated appropriately before discharge from the site bearing in mind the requirements of the receiving watercourse*
- *groundwater must be protected*

in addition it is desirable to maximise the amenity potential and ecological benefits where there is an opportunity to provide this.

The various SUDS components should not be treated as individual options, but should be seen as providing a set of drainage features (a treatment train) which are appropriate at various scales. It is always desirable to have a mix of SUDS components across the site to take opportunity of their respective benefits.

SUDS Ownership

Due to institutional and legislative constraints it is possible that the most technically appropriate solution may not be suitable due to ownership and maintenance issues. It is essential that any drainage system will receive appropriate long-term maintenance.

The following table summarises the current position on vesting of SUDS systems in the UK. It should be noted that there will be occasional differences between some organisations, particularly Local Authorities.

Private Owner: Private owners have no constraints on the use of any SUDS component. Careful assessment should be made of the risk of a change to the SUDS component occurring in the property and the impact this might have on the whole system performance.

SUDS Ownership/Maintenance by Drainage Organisation - UK						
SUDS Component	Local Authority	Highways Authorities	Scottish Water	Sewerage Undertaker	NI Water	Service Private owner
Water butts, Stormwater Use Systems	No	No	No	No	No	Yes
Pervious Pavement	No	No	No	No	No	Yes
Filter drains	No	Yes	No	No	No	Yes
Filter Strips	Yes	Yes	No	No	No	Yes
Swales	Yes	Yes	No	No	No	Yes
Detention Ponds	Yes	No	Yes	No	No	Yes
Retention Ponds	Yes	No	No	No	No	Yes
Wetlands	Yes	No	No	No	No	Yes
Detention Basins	Yes	No	Yes	No	No	Yes
Soakaways	No	Yes	No	No	No	Yes
Infiltration Trenches	No	Yes	No	No	No	Yes
Infiltration Basins	Yes	Yes	No	No	No	Yes
Green Roofs	No	No	No	No	No	Yes
Bio-retention Areas	Yes	Yes	No	No	No	Yes
Underground Storage	No	Yes	Yes	Yes	Yes	Yes
Proprietary Drainage Units	No	Yes	Yes	Yes	Yes	Yes
Pipes	Yes	Yes	Yes	Yes	Yes	Yes

Design of SUDS

It is important to be aware of both the opportunities and constraints of using SUDS for providing the most appropriate drainage system for a development. For more in-depth guidance the most appropriate document is the SUDS manual by CIRIA and SUDS for High Density Developments by HR Wallingford. Other SUDS reference documents and manuals are to be found in the references section of this web site.

Construction of SUDS

SUDS are a combination of civil engineering structures and landscaping practice. Due to the limited experience of building SUDS in the water industry, there are a number of key issues which need to be particularly considered as their construction requires a change in approach to some standard construction practices. Detailed guidance on the construction related issues for SUDS is available in the SUDS Manual and the associated Construction Site handbook (CIRIA, 2007).

SUDS Components for Your Site

The following table summarises the SUDS components that might be used:

SuDS Component	Applicability
Ponds	Yes
Basins	no
Pervious Pavements	Yes (subject to infiltration testing)
Swales	Yes
Infiltration Trenches	No
Soakaways	Yes (subject to infiltration testing)
Green Roofs	Yes
Rainwater Harvesting	yes
Bio-retention	yes

The Use of SUDS for Infiltration

Infiltration options are may be possible with this soil type subject to other site considerations.

Treatment Train

In principle, the more SUDS used in a treatment train the better. Ponds and storage should preferably not be used as the first SUDS component for any paved runoff. Treatment will be more effective and hydraulic benefits will also be gained. Where commercial or industrial development is proposed, greater emphasis on the treatment train will be required. It would generally be desirable to separate the systems serving these areas from systems serving residential developments.

Suitable SUDS Components

The following SUDS might be suitable components of the drainage system for the following reasons:

- *Pervious Pavements*

Pervious pavements are suitable for this site but not used in the strategy.

- *Swales*

Swales are suitable for this site but not used in the strategy.

The land take of swales is significant except for mini-swales. Although these SUDS components are very effective, their use in high density developments may be precluded due to lack of space. In spite of this issue of land take and adoption difficulties, the use of these SUDS units is very desirable due to their effectiveness in addressing both hydraulic and water quality issues.

- *Green Roofs*

Green roofs are suitable for this site but not used in the strategy.

The use of green roofs provides a number of benefits including reducing runoff volumes for ordinary rainfall events. However they do not have a significant impact on the sizing of main drainage components unless the rainwater is harvested and used.

- *Rainwater Harvesting*

Rainwater harvesting is suitable for this site but not used in the strategy.
Warning: Rainwater harvesting for large roof areas may have a higher yield than the demand for the collect water. In this situation stormwater management benefits assumed for extreme storm event management will be limited and require careful analysis.

Rainwater harvesting has benefits in reducing potable water demand and also can have a significant impact in reducing the size of some main drainage components if rainfall storage tanks are large enough. Where water resources are particularly scarce, rainwater harvesting should be positively considered. Depending on proposed usage and yield, guidelines suggest that the volume of storage provided should be around 350 litres per person to ensure reasonable continuity of supply. However where rainwater harvesting is used to obtain stormwater management benefits, this figure should be multiplied by around 3 (1000 l/person). Detailed evaluation of the rainwater harvesting benefits requires the use of time series rainfall data.

- **Ponds**

Ponds are suitable for this site and are included within the strategy.

- **Soakaways**

Soakaways are suitable for this site and are used within the strategy – subject to infiltration testing.

- ***Bio-retention***

Bio-retention is suitable for this site but not used in the strategy.

Warning: The use of bio-retention in situations where the groundwater is less than 2m may not be feasible unless the percolation zone depth is kept to a minimum.

Unsuitable SUDS Components

The following SUDS have been excluded as suitable components of the drainage system for the following reasons:

- ***None***

Appendix E - Calculations

Quick Storage Estimate

Micro Drainage

Variables

FSR Rainfall Cv (Summer) 0.750

Return Period (years) 100 Cv (Winter) 0.840

Region England and Wales Impervious Area (ha) 1.370

Map M5-60 (mm) 18.000 Maximum Allowable Discharge (l/s) 100.0

Ratio R 0.325 Infiltration Coefficient (m/hr) 0.00000

Safety Factor 2.0

Climate Change (%) 30

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 244 m³ and 474 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

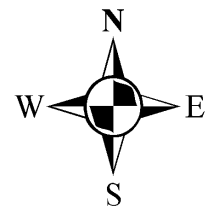
Enter Maximum Allowable Discharge between 0.0 and 999999.0

Following detailed design the proposed drainage strategy uses the maximum storage requirement of 250m³ for the western half of the site. This storage is located within an attenuation pond to the south west boundary.

The storage required for the soakaway to the east of the site has been designed in accordance with BRE Digest 365.

Appendix F - Welsh Water Sewer records

Wrexham



LEGEND(Representative of most common features)

Waste network:

	Foul chamber		Outfall
	Surface water chamber		Lamphole
	Combined chamber		Storm Overflow
	Combined sewer overflow		Rising main
	Special purpose chamber		Gravity sewer
	Treatment works		Private sewer
	Pumping station		Private sewer subject to Sect. 104 adoption agreement
			Private Sewer Transfer
			Lateral Drain
			Inspection Chamber

NB: Sewer symbol colour indicates the type.

- RED - Combined
- GREEN - Surface Water
- BROWN - Foul
- Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dwr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onset of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

**EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

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Map Ref: 332561, 356646
Map scale: 1:3,000
Printed by: MW
Printed on: 30.07.14