



Consulting Civil Engineers

SuDS Maintenance and Management Plan

Merry England, Dappers Lane, Angmering

For

GD Group

Rev – B

Planning Application No A/91/18/PL

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1. Introduction

CGS Civils Ltd have been appointed to undertake a detailed drainage design using sustainable techniques for a proposed development in Angmering, West Sussex.

The site will consist of the construction of 18 new dwellings. There are three private parking areas as well as individual driveways and an access road. Root protection zones run along the south of the site and in other areas. A drainage ditch runs south along the western flank of the site.

2. Sustainable Drainage Systems (SuDS)

The surface water management strategy has been developed using best practice Sustainable Drainage Systems (SuDS) techniques. Guidance on suitable techniques and methods has been obtained from the EA, and the SuDS manual (CIRIA C753).

The National Planning Policy Framework (NPPF) recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface runoff from development sites and recommends that priority is given to the use of Sustainable Drainage Systems (SuDS) in new development.

The overall philosophy of SuDS is to replicate, as closely as possible, the natural drainage process of a site prior to development to mitigate the adverse effect of storm water runoff on the environment. SuDS not only provide the ability to control surface water flows, but also improve water quality, amenity and bio-diversity within the development.

The Building Regulations Requirement H3 stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

- 1- Discharge into the ground
- 2- Discharge to a surface water body
- 3- Discharge to a surface water sewer

3. SuDS at Merry England

Soakage tests to the BRE 365 method were undertaken on site on 18th November 2019. Testing undertaken was terminated due to an effectively impermeable surface combined with exceptionally high groundwater in areas of the site.

Test ref	Test Depth (m)	Initial fill level (mbgl)	Elapsed Time (minutes)	Final Fill Level (mbgl)	K (m/s)
SA2 – Test 1	1.30	0.27	1500	0.38	N/A
SA3 – Test 2	1.40	0.33	1565	0.50	N/A

Tests were abandoned following approximately 1,500 minutes' observation period as the very poor infiltration rates suggested that for one test cycle a period of approximately 4-5 days would have been required. As a result the testing is invalid and it is considered that the soils should be considered to be practically impermeable.

Based on the above results the site will discharge all water into the adjacent drainage ditch via a flow control restricted to 2.3l/s which is the Qbar greenfield runoff rate for the existing site.

All driveways and private parking areas are to be constructed with a resin bound permeable surface that will be tanked with fin drains added to allow the water to enter into the main surface water drainage system. These areas will provide primary treatment of any pollutants whilst also providing a modest amount of storage.

The main SuDS feature itself will be in the form of two cellular storage attenuation tanks. Due to the high groundwater it has been necessary to have the tank manufacture design a system to counteract the effects of floatation. These details will be made available in the next revision.

All SuDS features have been designed to cater for and contain the 1 in 100-year storm + 40% below ground.

4. Managing SuDS

The SuDS have been designed for easy maintenance and comprise:

- Regular day-to-day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS feature
- Occasional tasks – checking the SUDS feature and removing any silt that builds up in the SuDS feature
- Remedial work – repairing damage where necessary

The client will, within the first 6-12 months of construction, form a maintenance company within the structure of the current company and funded by the client to facilitate the maintenance of the drainage system and common areas as per the requirements and specifications within this document. Once the dwellings become occupied, the occupants will pay a fixed annual fee towards this to cover the costs of the maintenance as detailed below.

Should the maintenance company fail to carry out its duties then the maintenance company will be obliged to refund any costs to the occupants and a new company is to be appointed by a representative of the occupants to carry out the maintenance duties. This will be written into the contract.

Once design life has been met on the SuDS features then these will be repaired or replaced in part in accordance with the SuDS maintenance specification in Section 6 or fully replaced in accordance with the respective manufacturer's specifications.

The existing drainage ditch will be maintained from site via the south western car park. Parking and safe access will be provided.

5. Water Quality

The new SuDS Manual (Ciria C753, November 2015) introduces slightly different approach compared to the previous version for the water quality management of surface water. The Manual describes risks posed by the surface water runoff to the receiving environment as a function of:

- The pollution hazard at a particular site (i.e. the pollution source)
- The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels
- The sensitivity of the receiving environment

The EA website indicates that the site does not lie within a Source Protection Zone.

The recommended approaches for water quality risk management are given in the SuDS Manual Table 26.1.

Figure 7 Approaches to Water Quality Risk Management

TABLE 26.1	Approaches to water quality risk management			
	Design method	Hazard characterisation	Risk reduction	
			For surface water	For groundwater
	Simple index approach	Simple pollution hazard indices based on land use (eg Table 26.2 or equivalent)	Simple SuDS hazard mitigation indices (eg Table 26.3 or equivalent)	Simple SuDS hazard mitigation indices (eg Table 26.4 or equivalent)
	Risk screening ¹	Factors characterising traffic density and extent of infiltration likely to occur (eg Table 26.5 or equivalent)	N/A	Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (eg Table 26.5 or equivalent)
	Detailed risk assessment	Site specific information used to define likely pollutants and their significance	More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels	
	Process-based treatment modelling	Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff	Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in event mean discharge concentrations and total annual load reductions delivered by the system	

As per Table 26.1 Simple Index approach will be used as a design method for this site.

Table 26.2 will provide hazard classification of different land uses. The land uses for the surface water drainage for this site are;

- Residential Roofs
- Individual Property driveways and residential car parks
- Low traffic roads

To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index for each contaminant type that equals or exceeds the pollution hazard index for each contaminant type. Therefore, the following must be achieved for the surface running off the site.

Total SuDS mitigation index $\geq$ pollution hazard index

Pollution Hazard Indices are given for different land uses in Table 26.2 of the SuDS manual;

Figure 8 Pollution Hazard Indices for Different Land Use Classifications

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

From Table 26.2 the following information is tabulated in Table 4

Table 4: Pollution hazard index and destination of runoff for the proposed site

Land Use	Destination of Runoff	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Roofs	Surface Waters	Very Low	0.2	0.2	0.05
Individual Driveways, Residential car parks and low traffic roads	Surface Waters	Low	0.5	0.4	0.4

The SuDS mitigation index will be obtained from Table 26.4 (for surface water) of the SuDS manual.

Figure 9 Indicative SuDS Mitigation Indices for discharges to surface waters

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters				
		Mitigation indices ¹		
Type of SuDS component	TSS	Metals	Hydrocarbons	
Filter strip	0.4	0.4	0.5	
Filter drain	0.4 ²	0.4	0.4	
Swale	0.5	0.6	0.6	
Bioretention system	0.8	0.8	0.8	
Permeable pavement	0.7	0.6	0.7	
Detention basin	0.5	0.5	0.6	
Pond ⁴	0.7 ³	0.7	0.5	
Wetland	0.8 ³	0.8	0.8	
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.			

SuDS mitigation index are tabulated in Table 5 as followed;

Runoff Source	Destination of Runoff	Mitigation Index Source	Mitigation Indices			
			Type of SuDS Component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Individual Driveways and Residential Car parks	Surface Waters	Table 26.3 (for surface waters)	Permeable Pavement	0.7	0.6	0.7

Table 5: SuDS mitigation index

The above analysis demonstrates that the SuDS devices within the design will mitigate any pollution present within the surface water system.

6. SuDS Drainage Maintenance Specification

6.1. Permeable Pavements

In order to maintain the functioning of the permeable paving, the following maintenance requirements should be adhered to:

TABLE 20.15	Operation and maintenance requirements for pervious pavements		
	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 50 mm 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, 48 h after large storms in first six months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually

6.2. Attenuation Tank

In order to maintain the functioning of the attenuation tanks, the following maintenance requirements should be adhered to:

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

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 actions	Repair/rehabilitate inlets, outlet, overflows and vents	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

6.3. Drainage Ditch

Watercourses and drainage ditches require correct maintenance in order to allow surface water to flow freely, this will also reduce the risks of flooding. Correctly maintained watercourses can also create an excellent habitat for wildlife. There are specific maintenance procedures that should be followed in order to correctly maintain the ditch.

In order to maintain the functioning of a drainage ditch, the following requirements should be adhered to:

Watercourse and Drainage Ditches	
Regular Maintenance	Frequency
<p>Keep Watercourse Free of Debris</p> <p>Remove any physical obstructions such as large rocks, rubble, fallen trees and branches and other waste materials (litter, grass cuttings etc) so that water can flow freely.</p> <p>All non-organic waste should be completely removed off site and disposed of in an appropriate manner.</p> <p>Any green waste resulting from the maintenance of ditches can be left a safe distance from the bank for a few days to allow any organisms to move back into the watercourse, after which the green waste should be removed so it doesn't wash back into the watercourse.</p> <p>Ensure that any disturbed debris does not end up flowing downstream and causing problems for other landowners.</p> <p>Do not store anything alongside the watercourse which may interfere with maintenance, affect the stability of the bank or get washed into the channel.</p>	Monthly
<p>Keep growth of vegetation under control</p> <p>When trimming vegetation, it is important to consider any impact on biodiversity. Mowing of banks around ditches should be minimised during the animal spawning season of March to mid-July.</p> <p>Some trees may have tree protection orders (TPOs) on them, so if in doubt check with local planning authority.</p> <p>It is recommended to cut only up to just above the water level on one side of the watercourse, leaving the fringe of the bank uncut, thereby maintaining</p>	As Required

<p>some habitat as well as enabling a free flow of water in the ditch.</p> <p>Cuttings from any clearance work should be removed from the channel to avoid it causing blockages downstream. Putting removed material too close to the top of the bank can lead to it falling back in during times of flooding.</p>	
<p>Remove excess Silt</p> <p>Silt should be removed along the length of the ditch to ensure it flows properly in the right direction.</p> <p>If there are any pipes into or out of the ditch you should remove silt to the same level or below the bottom of the pipe(s).</p> <p>Where possible, try to maintain the original slope and cross section of the ditch when de-silting. If the slope of the ditch is altered it can change the flow pattern, cause erosion or increase flood risk either upstream or downstream.</p> <p>As long as the silt is non-hazardous you can put it on the bank of the watercourse. Depositing silt on top of the banks of the watercourse allows for any organisms to move back into the ditch. However;</p> <ul style="list-style-type: none"> • It is essential that this material does not then block any other ditches or nearby roads, or stop water draining into the ditch if it would normally do so. • The silts must be as close as possible to where it was dredged from either: on the bank of the waters from where it was taken or on land directly next to the watercourse. <p>If you think a material may be hazardous. Contact the Environment Agency for advice.</p>	<p>As required.</p>

7. General Drainage Maintenance Specification

7.1. Inlet Structures and Inspection Chambers

- Inlet structures such as rain water downpipes, road gullies and channel drains should be free from obstruction at all times to allow free flow through the SuDS.
- Inspection Chambers and rodding eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

Inlet Structures and Inspection Chambers	
Regular Maintenance	Frequency
Inlet Structures Inspect rainwater downpipes, channel drains and road gullies, removing obstructions and silt as necessary. Check that there is no physical damage. Trim vegetation 1m min surround to structures and keep area free from silt and debris	Monthly
Inspections Chambers and below ground control chambers Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in Autumn	Annually
Catch pits Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in Autumn	Annually
Occasional Maintenance Check topsoil levels are 20mm above edges of chambers to avoid mower damage.	As necessary
Remedial Work Repair physical damage if necessary	As required

7.2. Below ground drainage pipes

- Below ground drainage pipes convey water to the SuDS system. They should always be free from obstruction to allow free flow.

Below Ground Drainage Pipes and Culverts	
Regular Maintenance	Frequency
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
Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks to avoid	Monthly or as required
Remedial Work	
Repair physical damage if necessary	As required
Monitoring	
Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed.	Annually
Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

7.3. Culvert and Headwalls

- Culverts allow the drainage ditch to flow freely under the access road. They should always be free from obstruction to allow free flow.
- Headwalls are used as an outlet to the drainage ditch from the surface water network; they are also used as an inlet and outlet for the culvert.

Culvert and Headwalls	
Regular Maintenance	Frequency
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
Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks to avoid	Monthly or as required
Remedial Work	
Repair physical damage if necessary	As required
Monitoring	
Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed.	Annually
Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

7.4. Hydro-Brake Flow Control Chamber

- See Appendix C

Appendix A

Drainage Strategy

Appendix B

Surface Water Drainage Calculations

Appendix C

Hydro-Brake Flow Control Chamber