



Alan Wood & Partners

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SuDS Operation and Maintenance Plan

M181 Southern Junction – Phase 2
B1450 Spur and East Roundabout for
North Lincolnshire Council

Project Number: 53335

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Suds Operation and Maintenance Plan

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1.0 Introduction

A new east termination roundabout and associated link roads is proposed to enable access from Burringham Road directly to the M181.

North Lincolnshire Council commissioned Alan Wood & Partners to undertake the drainage design for the scheme. This Technical Note stipulates the operation and maintenance requirements and responsibilities for the SuDS elements of the proposed drainage systems.

2.0 Proposed Drainage Components

The proposed drainage design consists of silt traps, trapped gullies, traditional manholes and pipes, hydro-brake[®] vortex flow control device, filter drains, fin drains, swales and a basin.

The drainage design is shown on Alan Wood & Partners' drawings; references SER-AWP-ZZ-05-D-C-3118 and SER-AWP-ZZ-05-D-C-3119.

3.0 Operation and Maintenance of Drainage Components

Operation and maintenance requirements of the drainage components, as listed above, should be undertaken in accordance with Chapter 32 of the CIRIA C753 SuDS Manual, along with the relevant tables as included below and any relevant manufacturer's recommendations. See also: BS 8582:2013 Code of Practice for Surface Water Management for Development Sites Section 11, and Susdrain Fact Sheet on SuDS Maintenance and Adoption Options (England) dated September 2015.

The responsibility for the operation and maintenance of the drainage and SuDS will lie with North Lincolnshire Council. An initial pre-handover inspection should be undertaken once construction is complete to ensure that it has been constructed as designed.

The staff undertaking the maintenance should have appropriate experience of SuDS and drainage maintenance and should be capable of keeping sufficiently detailed records of any inspections. An example of a checklist for SuDS maintenance can be found within Appendix B of the CIRIA C753 SuDS Manual v2. If staff do not have appropriate experience, then specific inspection visits may be necessary. During the first year of operations of SuDS, inspections should usually be carried out at least monthly (and after significant storm events).

4.0 Maintenance Schedules

Operation and Maintenance Requirements for Silt Traps/Trapped Gullies (Based on CIRIA C753 Table 14.2)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 months
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	6 months *
	Inspect filter media and establish appropriate replacement frequencies	6 months*
	Inspect sediment accumulation rates and establish appropriate removal frequencies	6 months*
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

Operation and Maintenance Requirements for Filter Drains (Based on CIRIA C753 Table 16.1)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Remove sediment from pre-treatment devices	6 months, or as required
Occasional maintenance	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	5 years, or as required
Remedial actions	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g. NJUG, 2007 or BS 3998:2010)	As required
	Clear perforated pipework of blockages	As required
Monitoring	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	6 months*
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate removal frequencies	6 months*
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

Operation and Maintenance Requirements for Swales (Based on CIRIA C753 Table 17.1)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris	Monthly (or as required)
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to suit better conditions, if required	As required, or if bare soil is exposed to over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Re-level uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly*
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for >48 hours	Monthly, or when required*
	Inspect vegetation coverage	Quarterly for first two years, then six monthly*
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Six monthly*

*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.

Operation and Maintenance Requirements for Vortex Type Flow Control (Hydro-brake®) Device (Based on Manufacturer's recommendations)

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	6 monthly
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Monthly during the first three months, then every 6 months
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every 6 months

Detention Basins Operation and Maintenance Requirements (Based on CIRIA C753 Table 22.1)

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal.	Monthly.
	Grass cutting – for spillways and access routes.	Monthly (during growing season), or as required.
	Grass cutting – meadow grass in and around basin.	Half yearly (spring – before nesting season, and autumn).
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
	Tidy all dead growth before start of growing season.	Annually.
	Remove sediment from inlets, outlet and forebay.	Annually (or as required).
	Manage wetland plants in outlet pool – where provided.	Annually.
Occasional Maintenance	Re-seed areas of poor vegetation growth.	Annually, or as required.
	Prune and trim trees and remove cuttings.	2 years, or as required.
	Remove sediment from forebay, when 50% full and from micropools if volume reduced by > 25%.	3–10 years (or as required).
Remedial Actions	Repair of erosion or other damage by re-seeding or re-turfing.	As required.
	Realignment of rip-rap.	As required.
	Repair/rehabilitation of inlets, outlets and overflows.	As required.
	Re-level uneven surfaces and reinstate design levels.	As required.
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly/after large storms.
	Inspect banksides, structures, pipework, etc. for evidence of physical damage.	Monthly/after large storms.
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.
	Check penstocks and other mechanical devices.	Half yearly.
*During the first year of operation, inspections should be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident.		

5.0 Treatment of Surface Water Run-off

Due to proposals for the surface water run-off to discharge into a watercourse, appropriate treatment of surface water run-off must be undertaken to aid the trapping, removal or breaking down naturally of silt, oils and other pollutants before being carried to the natural environment.

Gullies, filter drains, fin drains and swales intercept surface water flows and provide good removal of pollutants from the highway runoff. The sumps, geotextile wrap, granular surround and vegetation will trap organic and mineral particles which will then be incorporated into the soil, while the vegetation takes up nutrients. The detention basin can also be planted with vegetation to facilitate removal of pollutants using plant uptake.

Pollution Removal Mechanisms in SUDS (Section 1.3.4, CIRIA C697 SUDS Manual, adapted from Wilson et al, 2004):

<p>Sedimentation</p> <p>Sedimentation is one of the primary removal mechanisms in SUDS. Most pollution in runoff is attached to sediment particles and therefore removal of sediment results in a significant reduction in pollutant loads. Sedimentation is achieved by reducing flow velocities to a level at which the sediment particles fall out of suspension. Care has to be taken in design to minimise the risk of re-suspension when extreme rainfall events occur.</p>
<p>Filtration and Biofiltration</p> <p>Pollutants that are conveyed in association with sediment may be filtered from percolating waters. This may occur through trapping within the soil or aggregate matrix, on plants or on geotextile layers within the construction. The locations of any filtration will depend upon the internal structure of the particular SUDS technique, for example whether a geotextile layer is near the surface or at the subgrade in a pervious surface.</p>
<p>Adsorption</p> <p>Adsorption occurs when pollutants attach or bind to the surface of soil or aggregate particles. The actual process is complex but tends to be a combination of surface reactions grouped as sorption processes:</p> <p><i>Adsorption</i> – Pollutants bind to surface of soil/aggregate.</p> <p><i>Cation exchange</i> – Attraction between cations and clay minerals.</p> <p><i>Chemisorption</i> – Solute is incorporated in the structure of a soil/aggregate.</p> <p><i>Absorption</i> – The solute diffuses into the soil/aggregate/organic matter.</p> <p>Change in acidity of runoff can either increase or decrease the adsorption of pollutants by construction materials or soils. Eventually the materials onto which pollutants adsorb will become saturated and thus this method of treatment will stop.</p>
<p>Biodegradation</p> <p>In addition to the physical and chemical processes, which may occur on or within a SUDS technique, biological treatment may also occur. Microbial communities may be established within the ground, using the oxygen within the free-draining materials and the nutrients supplied with the inflows, to degrade organic pollutants such as oils and grease. The level of activity of such bioremediation will be affected by the environmental conditions such as temperature and the supply of oxygen and nutrients. It also depends on the physical conditions within the ground such as the suitability of the materials for colonisation.</p>

Volatilisation

Volatilisation comprises the transfer of a compound from solution in water to the soil atmosphere and then to the general atmosphere. The conversion to a gas or vapour occurs due to heat, reducing pressure, chemical reaction or a combination of these processes. The rate of volatilisation of a compound is controlled by a number of its properties and those of the surrounding soil. In SUDS schemes volatilisation is primarily concerned with organic compounds in petroleum products and pesticides.

Removal mechanisms for each pollutant category (Section 1.3.4, CIRIA C697 SUDS Manual, adapted from Wilson et al, 2004):

Pollutant	Removal Mechanisms in SUDS
Nutrients Phosphorous, nitrogen	Sedimentation, biodegradation, precipitation, de-nitrification.
Sediments Total suspended solids	Sedimentation, filtration.
Hydrocarbons TPH, PAH, VOC, MTBE	Biodegradation, photolysis, filtrations and adsorption.
Metals Lead, copper, cadmium, mercury, zinc, chromium, aluminium	Sedimentation, adsorption, filtration, precipitation, plant uptake.
Pesticides	Biodegradation, adsorption, volatilisation.
Chlorides	Prevention.
Cyanides	Volatilisation, photolysis.
Litter	Trapping, removal during routine maintenance.
Organic matter, BOD	Filtration, sedimentation, biodegradation.

Pollutant removal mechanisms available in SUDS methods:

Technique	Pollutant Removal Mechanisms
Pervious pavements/surfacing	Sedimentation, filtration, adsorption, biodegradation, volatilisation.
Swales	Sedimentation, filtration, adsorption, biodegradation.
Detention Basin	Sedimentation, filtration, adsorption, biodegradation, uptake by plants.
Silt removal devices (in manholes)	Sedimentation.

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