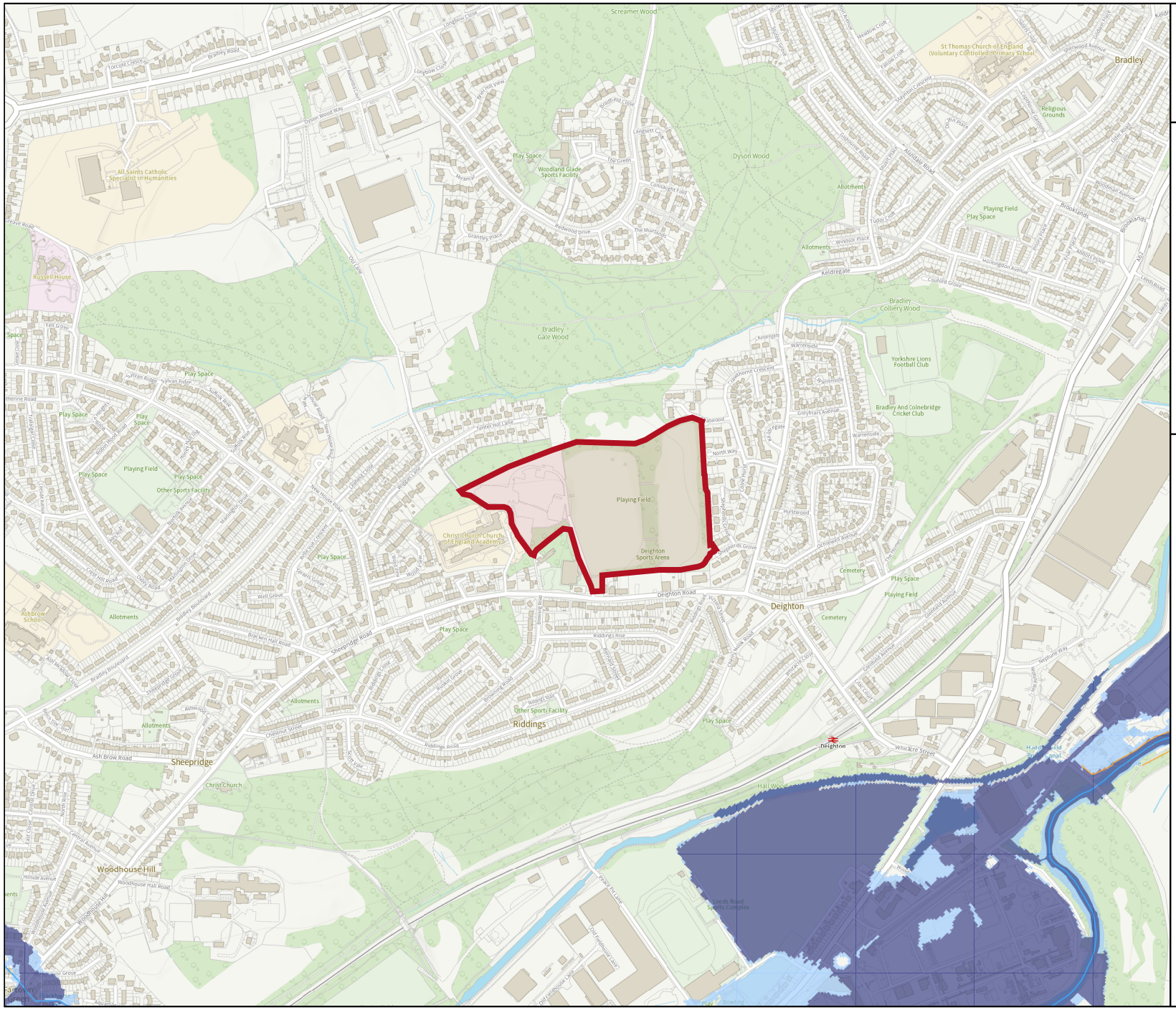

Environment Agency

Flood map for planning

Your reference
Joseph Norton SEMH School

Location (easting/northing)
416006/419551

Scale
1:10000

Created
25 Jan 2023 13:32

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 100 200 300m

Appendix 5

- Greenfield Runoff Calculations
- Quick Storage Estimates

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Callum Jeffrey
Site name:	Joseph Norton School
Site location:	C4164

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.

Site Details

Latitude:	53.67237° N
Longitude:	1.76053° W
Reference:	149795693
Date:	Mar 03 2023 12:34

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.52

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	840	840
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	3.11	3.11
1 in 1 year (l/s):	2.67	2.67
1 in 30 years (l/s):	5.44	5.44
1 in 100 year (l/s):	6.46	6.46
1 in 200 years (l/s):	7.36	7.36

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Callum Jeffrey
Site name:	Joseph Norton School
Site location:	C4164

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.

Site Details

Latitude:	53.67237° N
Longitude:	1.76053° W
Reference:	1417680140
Date:	Mar 03 2023 12:37

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.04

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	840	840
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	6.21	6.21
1 in 1 year (l/s):	5.34	5.34
1 in 30 years (l/s):	10.88	10.88
1 in 100 year (l/s):	12.93	12.93
1 in 200 years (l/s):	14.73	14.73

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Callum Jeffrey
Site name:	Joseph Norton School
Site location:	C4164

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.

Site Details

Latitude:	53.67237° N
Longitude:	1.76053° W
Reference:	2925315734
Date:	Mar 03 2023 12:39

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1.55

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	840	840
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	9.26	9.26
1 in 1 year (l/s):	7.97	7.97
1 in 30 years (l/s):	16.21	16.21
1 in 100 year (l/s):	19.27	19.27
1 in 200 years (l/s):	21.95	21.95

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Callum Jeffrey
Site name:	Joseph Norton School
Site location:	C4164

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.

Site Details

Latitude:	53.67237° N
Longitude:	1.76053° W
Reference:	2185194211
Date:	Mar 03 2023 12:30

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	840	840
Hydrological region:	3	3
Growth curve factor 1 year:	0.86	0.86
Growth curve factor 30 years:	1.75	1.75
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	5.98	5.98
1 in 1 year (l/s):	5.14	5.14
1 in 30 years (l/s):	10.46	10.46
1 in 100 year (l/s):	12.43	12.43
1 in 200 years (l/s):	14.16	14.16

Quick Storage Estimate

Quick Storage Estimate (25% Impermeable Area – 0.52ha)

100 year + 30% Attenuation

Storage Estimate

Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	0.520
Peak Discharge (l/s)	3.110
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	290
to	392
With infiltration (m³)	
from	
to	

100 year + 45% Attenuation

Storage Estimate

Return Period (years)	100
Climate Change (%)	45
Impermeable Area (ha)	0.520
Peak Discharge (l/s)	3.110
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	333
to	446
With infiltration (m³)	
from	
to	

Quick Storage Estimate

Quick Storage Estimate (50% Impermeable Area – 1.04ha)

100 year + 30% Attenuation

Storage Estimate

Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	1.040
Peak Discharge (l/s)	6.210
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	580
to	784
With infiltration (m³)	
from	
to	

100 year + 45% Attenuation

Storage Estimate

Return Period (years)	100
Climate Change (%)	45
Impermeable Area (ha)	1.040
Peak Discharge (l/s)	6.210
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	667
to	893
With infiltration (m³)	
from	
to	

Quick Storage Estimate

Quick Storage Estimate (75% Impermeable Area – 1.55ha)

100 year + 30% Attenuation

Storage Estimate

Return Period (years)	100
Climate Change (%)	30
Impermeable Area (ha)	1.550
Peak Discharge (l/s)	9.260
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	865
to	1169
With infiltration (m³)	
from	
to	

100 year + 45% Attenuation

Storage Estimate

Return Period (years)	100
Climate Change (%)	45
Impermeable Area (ha)	1.550
Peak Discharge (l/s)	9.260
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m³)	Calc
from	993
to	1330
With infiltration (m³)	
from	
to	

Appendix 6

- Draft Drainage Maintenance Schedule

Manholes and Inspection Chambers

Description

Manholes providing rodding and jetting access to pipe work.

Typically manholes, in distinction to inspection chambers, are designed to allow for operatives to access. Manholes should only be accessed following a risk assessment, and the specification of the safe system of work, paying regard to confined space risks.

Maintenance Issues

Manholes are unlikely to present maintenance issues in themselves. However, they provide access to the drainage infrastructure and allow visual inspection from the surface of any major maintenance issues.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Lift covers and ensure that there are no blockages. Inspect and identify any parts that are not operating correctly and remediate.	For 3 months following installation
	Ensure covers are in a good state of repair.	Monthly
	Inspect manholes, and inspection chambers, to ensure that the drainage is running freely.	Six Monthly and every autumn after leaf fall
Occasional maintenance	Suction sweeping and cleansing (to WRC Jetting Code of Practice) and CCTV where necessary.	Every 2 – 4 Years
Remedial maintenance	• Silt removal. • Inlet/outlet repair. • Erosion repairs. • System rehabilitation following a pollution event. • Manhole Cover Replacement. • Repairs to brickwork or concrete. • Chanel repair.	As required (tasks to repair problems due to wear, damage or vandalism).

Catchpits

Description

Catchpits are similar to manholes but include a sump to the base which is designed to capture silt and prevent it reaching other parts of the drainage network. Catchpits provide a convenient location to remove silt from drainage networks. Catchpits should only be accessed following a risk assessment, and the specification of the safe system of work, paying regard to confined space risks.

Maintenance Issues

If the silt captured in catchpits is not removed regularly it will cause silt to migrate downstream to other part of the drainage network, some of which may be less accessible, or inaccessible.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Lift manhole covers and ensure that there are no blockages. Inspect and identify any parts that are not operating correctly and remediate. Inspect silt storage in sump. Remove silt as required using subcontractor with vacuum extraction plant.	For 3 months following installation
	Ensure covers are in a good state of repair. Repair/replace as necessary.	Monthly
	Inspect catchpits to ensure that the drainage is running freely, and free of debris. Inspect silt storage in sump. Remove silt as required using subcontractor with vacuum extraction plant.	Six Monthly and every autumn after leaf fall
Occasional maintenance	Suction sweeping and cleansing (to WRC Jetting Code of Practice) and CCTV where necessary. Remediate any chamber structural defects, or any defects that may reduce the free flow of water.	Every 2 – 4 Years
Remedial maintenance	• Silt removal. • Inlet/outlet repair. • Erosion repairs. • System rehabilitation following a pollution event. • Manhole Cover Replacement. • Repairs to brickwork or concrete.	As required (tasks to repair problems due to wear, damage or vandalism).

Linear Drains

Description

Surface Water is drained over impermeable areas towards grated, or slot-type linear drains at low points and water is conveyed to below ground pipework.

Maintenance Issues

Linear drains can become blocked by silt or debris, causing flooding.

Linear drains often include silts traps at outlets which can cause siltation of downstream drainage infrastructure if not maintained adequality.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Inspect linear drains to ensure that there are no blockages at surface level. Lift covers to outflow boxes and check for blockages or siltation. Inspect and identify any parts that are not operating correctly and remediate.	For 3 months following installation
	Inspect linear drains to ensure that there are no blockages at surface level.	Monthly
	Lift covers to outflow boxes and check for blockages or siltation.	Six Monthly and every autumn after leaf fall
Occasional maintenance	Jetting of linear drains and suction vacuuming of outlet boxes (to WRC Jetting Code of Practice). CCTV where necessary.	Every 1 – 2 Years
Remedial maintenance	• Silt removal. • Inlet/outlet repair. • Erosion repairs. • System rehabilitation following a pollution event. • Linear drain cover replacement. • Chanel repair. • Ensure that impermeable surfaces surrounding linear drains have not settled below top of linear drain level, causing ponding.	As required (tasks to repair problems due to wear, damage or vandalism).

Gullies

Description

Surface Water is drained over impermeable areas towards grated gullies at low points, from where water is conveyed to below ground pipework.

Maintenance Issues

Gullies can become blocked by silt or debris, causing flooding.

Gullies include integral silt traps which can cause siltation of downstream drainage infrastructure if not adequality maintained.

Gullies often include a trapped outlet which prevents liquids lighter than water (ie oil and fuel) leaving the gully. If silt and light liquids are not removed regularly silt and oil will migrate downstream to other part of the drainage network, some of which may be less accessible, or inaccessible.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Inspect to ensure that there are no blockages at surface level, and that the outfall is operating effectively. Inspect and identify any parts that are not operating correctly and remediate.	For 3 months following installation
	Ensure that there are no blockages at surface level.	Monthly
	Lift covers to check for blockages or siltation.	Six Monthly and every autumn after leaf fall
Occasional maintenance	Remove oil and silt using specialist vacuum extraction plant.	Every 1 – 2 Years
Remedial maintenance	• Silt removal. • Inlet/outlet repair. • Erosion repairs. • System rehabilitation following a pollution event. • Cover replacement. • Structural failure of gully pot. • Ensure that impermeable surfaces surrounding linear drains have not settled below top of gully cover level, causing ponding.	As required (tasks to repair problems due to wear, damage or vandalism).

Pipework

Description

Below ground drainage pipework connects drainage inlets (gullies, linear drains etc) to manholes and also provides connections between manholes.

Maintenance Issues

Pipes can become blocked by silt, debris fat, grease, or suffer structural collapse. It is also possible for pipe joints to become displaced or for roots to grow from the surrounding ground into pipes.

These factors cause a reduction in, or loss of, the hydraulic capacity of the pipes which can in turn cause flooding to land and buildings.

Defects in pipes can also cause a reduction in stability to ground underlying foundations, which can cause settlement and damage to buildings and external surfaces.

The material of pipes and associated couplings can be degraded if aggressive liquids are passed through the pipes.

It is recommended that trees are not planted within 3m of pipes to minimise the risk of root ingress.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Inspect and identify any parts that are not operating correctly and remediate.	For 3 months following installation
	Monitor working of drainage at ground level. Evidence of damage to pipework my include localised flooding or emission of smells.	Monthly
	Lift manholes covers to check for blockages.	Six Monthly
Occasional maintenance	CCTV pipework, clean to WRC Sewer Jetting Code of Practice. Remediate as necessary.	Every 1 – 2 Years
Remedial maintenance	• Silt removal. • Fat and Grease removal. • Erosion repairs. • Joint displacement. • Structural failure, cracking or collapse. • System rehabilitation following a pollution event.	As required (tasks to repair problems due to wear, damage or vandalism).

Vortex Controls

Description

Vortex controls, often called Hydrobrakes, are installed in some manholes to restrict the rate of flow. Vortex controls are usually constructed in steel and are installed in a manhole with a sump.

Maintenance Issues

Vortex controls can become blocked by debris, plastic bags or other sheet material. If silt is allowed build up in the sump the operation of the device can be hampered causing flooding upstream.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Refer to manufacturer's specification. Inspect and identify any parts that are not operating correctly, consult supplier and remediate as required.	For 3 months following installation
	Monitor working of drainage at ground level. If there is localised flooding check the condition of all system elements.	Monthly
	Lift manholes covers to check for blockages. Remove sediment from pre-treatment structures, gullies, catchpits etc.	Six Monthly and every autumn after leaf fall
Occasional maintenance	Clean to WRC Sewer Jetting Code of Practice. Remediate as necessary.	Every 1 – 2 Years
Remedial maintenance	Inspect, and carry out remediation works to ensure that the features are in fully working order.	As required (tasks to repair problems due to wear, damage or vandalism).

Fat and Grease Separators

Description

Fat and Grease separators, separate fat and grease from oil emitting facilities such as kitchens and factories. This prevents fat and grease entering the public sewerage network. Preventing fat and grease is a requirement of Building Regulations (Part H) and The Water Industry Act (1991).

Maintenance Issues

For a fat and grease separator to operate effectively, and prevent pollutants leaving a site, it is necessary to remove the contained fat and grease on a regular basis. It is recommended that maintenance is proactive, rather than waiting for any installed alarm to highlight the need for emptying. The party responsible for maintenance, usually the owner or occupier, should consult the manufacturer to determine a suitable maintenance regime. Fat and Grease should only be removed by a licenced contractor.

Maintenance Regime

Schedule	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Refer to manufacturer's specification. Inspect and identify any parts that are not operating correctly and remediate.	For 3 months following installation
	Monitor working of drainage at ground level. If there is localised flooding check the condition of all system elements.	Monthly
	Check to determine the volume of fat and grease collected, and if necessary, arrange for removal by a licenced contractor.	Six Monthly or as recommended by supplier.
Occasional maintenance	Consult manufacturer to obtain details of an approved maintenance contractor. Remediate as necessary.	Every 1 – 2 Years
Remedial maintenance	Inspect, and carry out remediation works to ensure that the features are in fully working order.	As required (tasks to repair problems due to wear, damage or vandalism).

Geocellular Attenuation Storage

Description

Geocelluar storage systems are modular plastic units with a high porosity that can be used to efficiently create a below-ground structure for the temporary storage of surface water before being released.

Maintenance Issues

The main maintenance issue with geocellular attenuation storage is the prospective build up of silt within the units. It is imperative that the upstream and downstream catchpits are inspected and emptied regularly to prevent the ingress of silt into the system.

Maintenance Regime

Schedule	Action Required	Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	For 3 months following installation, then annually.
	Remove debris from the catchment surface (where it may cause a risk to performance)	Monthly
	For systems where rainfall infiltrate 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.	Annual, or as required
Remedial Actions	Repair/rehabilitate inlets, outlets, 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 five years or as required

Petrol Interceptors/Oil Separators

Description

Petrol interceptors, also called oil separators, separate out light liquids, such as oil or fuel, and silt and grit. The purpose of the separation is to prevent oil and silt (which may contain heavy metals) polluting watercourses downstream.

Maintenance Issues

For a separator to operate effectively, and prevent pollutants leaving a site, it is necessary to remove the contained oil and silt on a regular basis. It is recommended that maintenance is proactive, rather than waiting for any installed alarm to highlight the need for emptying. The party responsible for maintenance, usually the owner or occupier, should consult the manufacturer to determine a suitable maintenance regime. Oil and silt should only be removed by a licenced contractor.

Maintenance Regime

Activity	Action Required	Frequency
Routine/regular maintenance (including inspections and monitoring)	Refer to manufacturer's specification. Inspect and identify any parts that are not operating correctly and remediate.	For 3 months following installation
	Monitor working of drainage at ground level. If there is localised flooding check the condition of all system elements.	Monthly
Routine/regular maintenance (including inspections and monitoring)	• Check volume of sludge/silt. • Check thickness of light liquid. • Check function of automatic closure device. • Empty the separator, if required. • Check the coalescing material and clean or change if necessary (Class 1 only). • Check the function of the warning device (if fitted).	Six Monthly and every autumn after leaf fall
Occasional maintenance	• Consult manufacturer to obtain details of an approved separator maintenance contractor. • Check watertightness of system. • Check structural condition. • Check internal coatings. • Check built-in parts • Check electrical devices and installations. • Adjust automatic closure devices.	5 Yearly Maximum
Remedial maintenance	Inspect, and carry out remediation works to ensure that the features are in fully working order.	As required

Green Roofs

Description

Green roofs are areas of living vegetation, installed on the top of buildings. Green roofs provide visual, ecological and biodiversity benefits in addition to reducing surface water runoff.

Maintenance Issues

Intensive green roofs (ones that are similar to gardens) are likely to require regular maintenance, with grassed areas mowed, and plant beds weeded, on weekly or fortnightly basis during growing season.

Extensive green roofs (shallow with low maintenance planting) normally only accessed once or twice a year to remove litter, check fire breaks and drains, and in some cases remove unwanted invasive plants.

Maintenance during the green roof establishment period is normally undertaken by the green roof supplier.

Maintenance Regime

Activity	Action Required	Frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability.	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular Maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required

	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Infiltration Basins

Description

Infiltration basins are depressions formed in the ground. Infiltration basins are designed to temporarily attenuate surface water runoff volumes, as water infiltrates into the ground through the base and sides of the basin. Typically the basin is planted with grass, and sometimes with trees and shrubs.

Maintenance Issues

Infiltration basins have comparatively low maintenance requirements. They should be kept free from litter. Grass should be maintained at a length of between 75 – 150mm. All grass clippings should be removed from the filter strip. Sedimentation should be kept below a depth of 25mm.

Maintenance Regime

Activity	Action Required	Frequency
Regular Maintenance	Remove litter, debris and trash	Monthly
	Cut grass – for landscaped areas and access routes	Monthly (during growing season) or as required
	Cut grass – 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
Occasional maintenance	Reseed areas of poor vegetation growth	Annually, or as required
	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

Soakaways, Infiltration Trenches and Blankets

Description

There are many different types of drainage components that can be used to facilitate infiltration. These include soakaways, trenches, and blankets.

Maintenance Issues

Soakaways, Trenches and Blankets should include monitoring points where the water level in the system can be observed and monitored. The useful life and effective operation of an infiltration component is related to the frequency of the of maintenance and the risk of sediment being introduced into the system.

Maintenance Regime

Activity	Action Required	Frequency
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Half yearly: spring (before nesting season) and autumn
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings.	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year then annually
	Check soakaway to ensure emptying is occuring	Annually

Filter Strips

Description

Filter strips are uniformly graded and gently sloping strips of grass or dense vegetation that are designed to treat runoff from adjacent impermeable areas by promoting sedimentation, filtration and, where acceptable, infiltration.

Maintenance Issues

Filter strips have low maintenance requirements. They should be kept free from litter. Grass should be maintained at a length of between 75 – 150mm. All grass clippings should be removed from the filter strip. Sedimentation should be kept below a depth of 25mm.

Maintenance Regime

Activity	Action Required	Frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Cut the 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)
	Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination (eg oils)	Monthly (at start, then half yearly)
	Check flow spreader and filter strip surface for even gradients	Monthly (at start, then half yearly)
	Inspect gravel flow spreader upstream of filter strip for clogging	Monthly (at start, then half yearly)
	Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly (at start, then half yearly)
Occasional maintenance	Reseed areas of poor vegetation growth; alter plant types to better suit conditions, if required	As required or if bare soil is exposed over > 10% of the filter strip area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel 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

Filter Drains

Description

Filter drains are shallow trenches filled with stone/gravel that create temporary subsurface storage for the attenuation, conveyance and filtration of surface water. The stone may be contained in a simple trench lined with a geotextile, geomembrane or impermeable liner. Often filter drains have a 50mm-100mm depth of permeable material that is separated from the main gravel/stone trench by a permeable geotextile. This top layer is intended to be sacrificial, collecting silt over time and requiring replacement every 5 – 10 years, or as required if ponding is evident.

Maintenance Issues

Over time the top permeable material layer will trap silt and other materials. On a highway the trapped material may include heavy metals. The top layer, and associated geotextile, will become less permeable with time and should be replaced as set out below.

If the filter drain includes pipework it may become blocked over time. The pipe should be kept clear of silt and debris.

If the main filter material becomes silted up there may be a requirement to excavate and replace the entire filter drain.

Any material removed should be tested and may require disposal at landfill.

Maintenance Regime

Activity	Action Required	Frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium. This may also be necessary where there are high silt loads.	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Swales and Ditches

Description

Swales are shallow flat bottomed, vegetated open channels designed to convey, treat and often attenuate surface water runoff. Swales can include some planting, but this must be specified not in impede the flow in the channel.

Maintenance Issues

Sufficient access to the swales should be provided. The grass at the base of the swale should be cut to a length of between 75mm and 100mm. Grass clippings/cuttings should be removed to prevent nutrients/pollutants entering the drainage system.

Occasionally sediment will need to be removed (eg once deposits exceed 25mm in depth).

Maintenance Regime

Activity	Action Required	Frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range (typically 75-100mm)	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start then as required
	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	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel 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

Bioretention Systems

Description

Bioretention systems (including rain gardens) are shallow landscaped depressions that can reduce runoff rates and volumes, and treat pollution through the use of engineered soils and vegetation.

Maintenance Issues

Bioretention systems typically require 2-3 times more maintenance than ordinary landscape areas. Particular care should paid to any surface clogging which will reduce the hydraulic performance of the system. The surface should be subjected to a frequent litter picking regime. Plants should be maintained regularly. A detailed maintenance regime should be provided by the designer.

Maintenance Regime

Activity	Action Required	Frequency
Regular inspections	Inspect infiltration surfaces for sitting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Trees

Description

Trees can benefit surface water management through transpiration, interception, increased filtration and phytoremediation (the process of a tree taking up harmful chemicals). Trees are typically an addition to a SuDS component.

Maintenance Issues

Maintenance requirements of trees will be greatest during the first few years, when the tree is becoming established. Early maintenance should involve regular inspection, removal of invasive vegetation and irrigation, if required during long dry spells. Maintenance responsibility for a tree pit or planter should be placed with an appropriate organisation.

Maintenance Regime

Activity	Action Required	Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets and outlets	Inspect monthly
Occasional maintenance	Check tree health and manage tree appropriately	Annually
	Remove silt build-up from inlets and surface and replace mulch as necessary	Annually, or as required
	Water	As required (in periods of drought)
Monitoring	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Pervious Pavements

Description

Pervious pavements, together with their associated substructures, are an efficient means of managing surface water runoff close it its source – intercepting runoff, reducing the volume and frequency of runoff and providing a treatment medium.

Maintenance Issues

Pervious pavements need to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Typically sweeping once a year should be sufficient to maintain an acceptable infiltration rate on most sites. However, the frequency should be adjusted to suit site specific circumstances and should be informed by inspection reports.

Maintenance Regime

Activity	Action Required	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 50mm 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, 48hrs after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Detention Basins

Description

Detention basins are landscaped depressions that are normally dry except during, and immediately following, storm events. They can be on-line, where water is routed through the basin, or offline, where water is diverted into the basin on reaching a certain threshold.

Maintenance Issues

Detention basins have low maintenance requirements. They should be kept free from litter. Grass should be maintained at a length of between 75 – 150mm, where water is intended to run overland. All grass clippings should be removed from the detention basin. Sedimentation should be kept below a depth of 25mm.

Maintenance Regime

Activity	Action Required	Frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – 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)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly (for firs year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	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 (as set out in Chapter 23 of the Ciria SuDS Manual C753)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Ponds and Wetlands

Description

Ponds and wetlands are features with a permanent pool of water that provide both attenuation and treatment of surface water runoff. They can support emergent and submerged aquatic vegetation along their shoreline and in shallow marshy wetland zones.

Maintenance Issues

Ponds and wetlands will require regular maintenance to ensure continuing operation to design performance standards.

Litter and debris removal should be undertaken as part of general landscape maintenance. Any invasive maintenance, such as silt or vegetation removal should be planned to be sympathetic to the requirement of wildlife.

Maintenance Regime

Activity	Action Required	Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices eg penstocks	Hal yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include mas 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1-5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, eg every 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required

	Repair/rehabilitate inlets, outlets and overflows	As required

Flood Risk Assessment

Lawrence House | 6 Meadowbank Way | Nottingham | NG16 3SB
01773 535555 | design@hspconsulting.com | www.hspconsulting.com