Appendix J: Maintenance: field sheet

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Maintenance requirements for biofiltration systems

Biofiltration systems (also known as biofilters, bioretention systems and rain gardens) are designed with the primary intent of removing pollutants from stormwater before the water is discharged to the local waterway, infiltrated into surrounding soils or reused for other applications (e.g. irrigation). They are typically constructed as basins, trenches or tree pits (Figure 1). Stormwater runoff generally enters the biofiltration system through a break in a standard road kerb where it temporarily ponds on the surface before slowly filtering through the soil media. Treated stormwater is then collected at the base of the biofiltration system via perforated pipes located within a gravel drainage layer before being discharged to conventional stormwater pipes, infiltrated or collected for reuse. Note that, it is recommended that the outlet pipe is upturned to create a pool of water, or submerged zone, in the bottom of the biofiltration system. If unlined, this pool will be temporary, but will be longer-lasting in lined systems. Conventional stormwater pipes also act as an overflow in most designs, taking flows that exceed the design capacity of the biofiltration system.

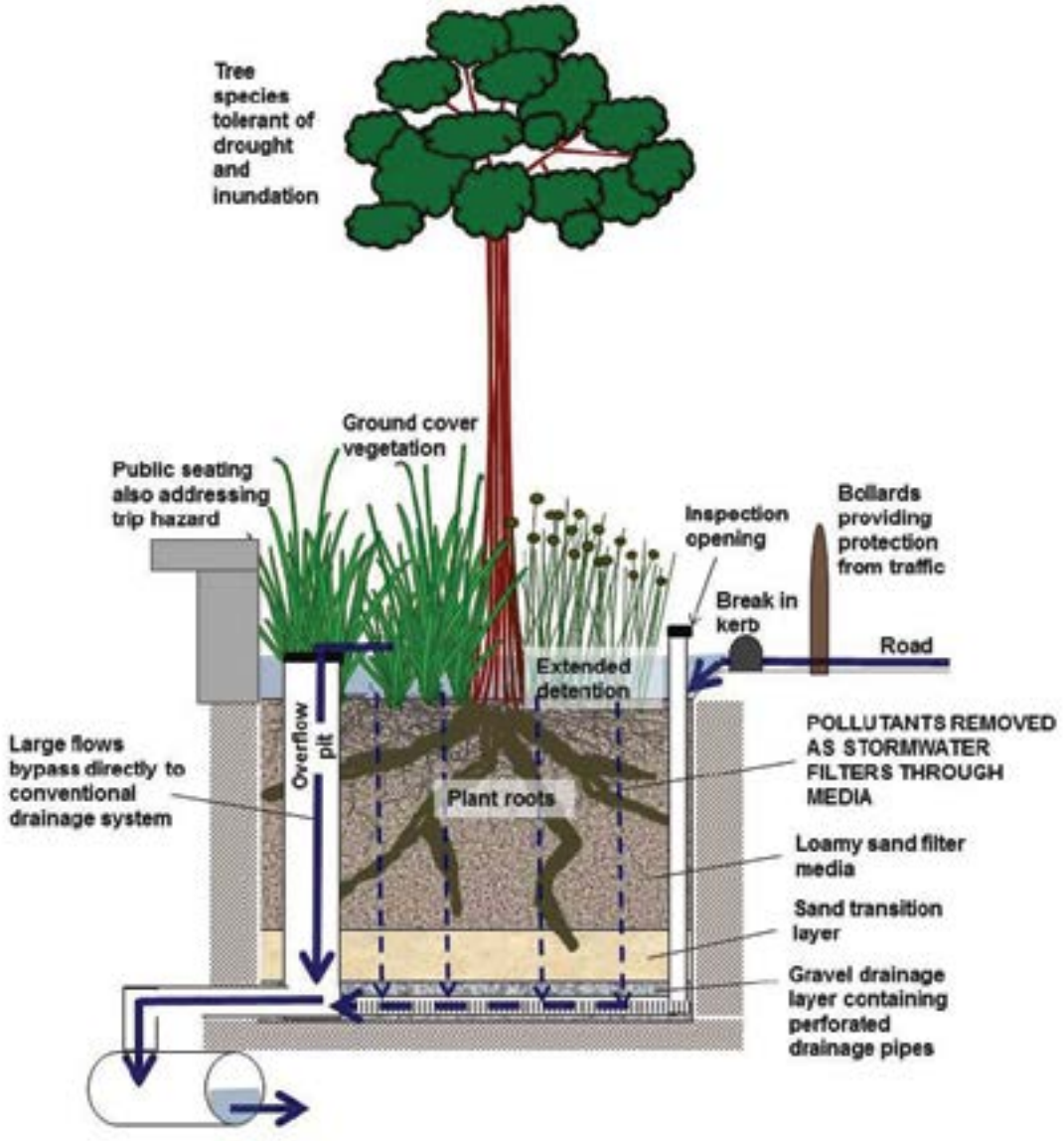

Figure 1. Conceptual drawing of a biofiltration system illustrating stormwater flow pathways and subsurface infrastructure.

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There are a number of maintenance activities that need to be carried out to ensure effective long-term function of biofiltration systems. Table 1 provides example illustrations of maintenance issues while Table 2 outlines inspection tasks, recommended frequencies and associated maintenance actions.

Table 1. Examples of issues requiring maintenance.

Build-up of fine sediments on the surface of the filter media reduces surface porosity and treatment capacity.		Holes, erosion and scour should be repaired and inflow controls provided or augmented.	
Anthropogenic and organic litter build-up is unsightly and can hinder flow paths and infiltration.		Anthropogenic and organic litter build-up is unsightly and can hinder flow paths and infiltration.	
Poor plant growth can be a sign of too much or too little water, or of poor filter function.		Vegetation die off can be a sign of too much or too little water, or of poor filter function.	
Weeds are unsightly and can reduce treatment capacity.		Blocked overflow grates can result in nuisance flooding.	
Overfilling of filters reduces the extended detention storage and treatment capacity.		Overflow levels that are set too low reduces the extended detention storage and treatment capacity.	

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Inspection Task	Frequency	Comment	Maintenance Action
Filter media			
Check for sediment deposition	3 monthly, after rain	Blocking of inlets and filter media reduces treatment capacity.	Remove sediment from inlets, forebays and other pre-treatment measures, and the surface of biofiltration street trees
Check for holes, erosion or scour	3 monthly, after rain	Holes, erosion and scour can be a sign of excessive inflow velocities due to poor inflow control or inadequate provision for bypass of high flows.	Infill any holes, repair erosion and scour Provide/augment energy dissipation (e.g. rocks and pebbles at inlet) Reconfigure inlet to bypass high flows Relocate inlet
Inspect for the build-up of oily or clayey sediment on the surface of the filter media, excessive moss growth, or evidence of prolonged ponding (i.e. clogging)	3 monthly, after rain	Reduced surface porosity reduces treatment capacity.	Clear away any mulch on the surface and lightly rake over the surface of the filter media between plants
Check for litter in and around treatment areas	3 monthly, after rain or as desired for aesthetics	Flow paths and infiltration through the filter media may be hindered.	Remove both litter/rubbish and excessive build-ups of plant litter
Damage	6 monthly	Check for damage to the surface from vehicles or pedestrians.	Repair using compatible filter media material.
Horticultural			
Additional checks of system health and function required during establishment	As required – weekly during initial establishment if during dry periods. May reduce to bimonthly later and in wetter periods.	The initial period after construction (up to the first 2 years) requires additional monitoring and maintenance works are required. Ensure a healthy and diverse vegetation cover is developing and that stormwater moves through the system as the design intended.	New seedlings will require regular watering and irrigation, protection from high sediment loads and high flows. If flows do not move through the system as intended, this requires further investigation. Works may be required to remedy the hydraulics (e.g. changing the invert level of the overflow, the surface gradient or removing mulch to reinstate the desired ponding depth). Refer to Water by Design's 'Construction and Establishment Guidelines' (2009).

Inspection Task	Frequency	Comment	Maintenance Action
Horticultural			
Assess plants for disease or pest infection	3 monthly, or as desired for aesthetics		• Treat or replace as necessary
Check plants for signs of stunted growth or die off	3 monthly, but more frequently during long dry spells	Poor plant health can be a sign of too much or too little water, or poor flow control.	• Check inlet and overflow levels are correct and reset as required • For too much water: • Replace plants with species more tolerant of wet conditions OR • Replace filter media with that of a higher infiltration capacity • For too little water: • Consider installing a choke on the outlet or retrofitting a submerged zone (i.e. raised outlet) OR • Replant with species more tolerant of dry conditions
Check that original plant densities are maintained	3 monthly, or as desired for aesthetics	Plants are essential for pollutant removal and maintaining drainage capacity. Plants should be close enough that their roots touch each other; 6 – 10 plants/m^2 is generally adequate. A high plant density also helps prevent ingress of weeds.	• Carry out infill planting as required – plants should be evenly spaced to help prevent scouring due to a concentration of flow
Check for presence of weeds	3 monthly, or as desired for aesthetics	Weeds can reduce aesthetics and treatment capacity because some plants are more effective at pollutant removal than others.	• Manually remove weeds where possible – where this is not feasible, spot spray weeds with a herbicide appropriate for use near waterways
Pruning and harvesting (if feasible)	Once or twice a year	It may be worth considering occasionally harvesting plants to permanently remove nutrients and heavy metals stored in aboveground tissues, and to promote new plant growth and further nutrient and metal uptake.	• If practical, cut back and remove above-ground biomass (but do not cut back so severely that plant health and survival is compromised) • Prune plants back as required to enhance aesthetics, but remove cuttings from the system.

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Inspection Task	Frequency	Comment	Maintenance Action
Drainage			
Check that inflow areas, weirs and grates over pits are clear of litter and debris and in good and safe condition.	Monthly, and occasionally after rain, but 6 monthly if no construction activity in the catchment	A blocked grate or inlet would cause nuisance flooding and may lead to plant death within the biofilter.	• Replace dislodged or damaged pit covers as required • Remove sediment from pits and entry sites (likely to be an irregular occurrence in mature catchments)
Check that the underdrain is not blocked with sediment or roots	6 monthly, after rain	Filter media and plants can become waterlogged if the underdrain is choked or blocked. Remote camera (CCTV) inspection of pipelines could be useful.	• Clear underdrain as required using a pipe snake or water jet • Water jets should be used with care in perforated pipes
Check the sediment forebay or pre-treatment zone (if present) is clear of high accumulations of sediment and debris	Twice a year (more frequently if accumulation is rapid)	Pre-treatment device may become full of sediment or debris, which stops it serving its function of protecting the biofilter. The biofilter will then be impacted by sediment and rectification will be more costly.	• Remove accumulated sediment and debris before it builds up to excessive levels
Check the water level within the submerged zone (if lined)	Monthly throughout the dry season or as required	Although the submerged zone helps to sustain the biofilter through dry periods and drawdown is expected, if drying persists for long enough it will become drawn down and require replenishment.	• Check that the water level in the submerged zone is at the design level and top this up as required.
Check that the elevated outlet for the submerged zone	6 monthly, after rain	Debris may block the outlet or the level of the raised pipe may not match the design, producing a different depth for the submerged zone.	• Check outflow level is correct and reset as required

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Other			
Observe biofiltration system after a rainfall event to check drainage	Twice a year, after rain	Ponding on the filter media surface for more than a few hours after rain is a sign of poor drainage	• Check catchment land use and assess whether it has altered from design capacity (e.g. unusually high sediment loads may require installation of a sediment forebay)

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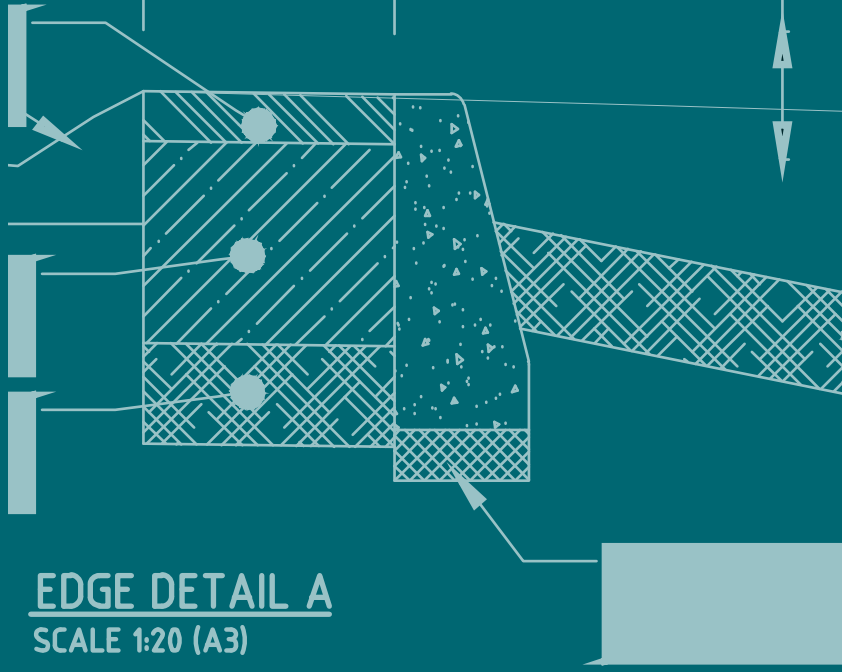

EDGE DETAIL A

SCALE 1:20 (A3)