

APPENDIX A. INSPECTION & MAINTENANCE RECOMMENDATIONS

Table 18. Inspection Recommendations for Municipal Stormwater Infrastructure

Stormwater Asset	Inspection Tasks	Inspection Frequency
Storm Sewers	<ul style="list-style-type: none"> Inspection by Close Circuit TV (CCTV) including Aqua Zooming Use Water Resource Centre (WRC) rating on a 1-5 scale 	<ul style="list-style-type: none"> CCTV inspection and rating of all storm sewer pipes every 10 years CCTV inspection every 3 years of pipes with WRC Rating 4-5
Culverts	<ul style="list-style-type: none"> Visual inspection for debris, sediment, or vegetation limiting capacity and any signs of caving, riprap deterioration or corrosion 	<ul style="list-style-type: none"> Inspect once every 2 years
Manholes	<ul style="list-style-type: none"> Visual inspection of manholes Record and monitor debris/sediment levels, blockage and salt accumulation Identify structural problems and assess manhole cover 	<ul style="list-style-type: none"> Inspect manholes every 5 years
Catchbasins	<ul style="list-style-type: none"> Visual inspection of catchbasins Record and monitor debris/sediment levels Identify structural problems and assess catchbasin cover 	<ul style="list-style-type: none"> Inspect once every 3 years
Outfalls	<ul style="list-style-type: none"> Visual inspection of outlets to assess structural integrity, obstructions 	<ul style="list-style-type: none"> Inspect annually
Ditches/open channels	<ul style="list-style-type: none"> Visual inspection to identify condition (e.g. erosion, vegetation overgrowth, soil exposure, etc.) Visual inspection to assess sediment deposition and change in design slope 	<ul style="list-style-type: none"> Inspect annually
Dry Ponds	<ul style="list-style-type: none"> Inspect for sediment accumulation, outlets operation and potential obstructions, emergent pond vegetation and embankment and spillway stability 	<ul style="list-style-type: none"> Inspect after storm events during first year after construction Once per year during growing season thereafter
Water Quality Unit (Oil and Grit Separator)	<ul style="list-style-type: none"> Inspect for sediment accumulation, trash, and oil depth using sludge judge and oil dip-stick Inspect for structural failures like leakage, corrosion, or displaced components Inspect downstream outfall for oil sheen 	<ul style="list-style-type: none"> Inspection twice in first year after installation and then once annually thereafter
Infiltration Trenches	<ul style="list-style-type: none"> Inspect for water levels, accumulated sediment, leaves and debris, clogged inlet/outlet pipes, and ponded water inside and outside the trench 	<ul style="list-style-type: none"> After every significant storm event during first year after construction Twice per year for subsequent years
Rain Gardens	<ul style="list-style-type: none"> Inspect for plant establishment, adequate soil moisture to support planting, eroded areas, litter and debris, ponded water, sediment deposition, and the integrity of check dams 	<ul style="list-style-type: none"> After every significant storm event during first year after construction Three times per year after vegetation establishment
Dry Swale	<ul style="list-style-type: none"> Inspect for grass cover establishment and density, trash and debris, and sediment build-up 	<ul style="list-style-type: none"> 2-3 times for the first 3-4 months Once per year after turf establishment
Tree Trenches	<ul style="list-style-type: none"> Inspect for: erosion, weeds, sediment/debris, standing water, outlet/overflow structure, need for irrigation, need for pruning and overall tree health 	<ul style="list-style-type: none"> Once per month and after major storm for first year Inspect twice per year after first year (Spring and Fall)
Permeable Pavers	<ul style="list-style-type: none"> Inspect for organic matter clogging, deterioration of pavers, and signs of long-term water ponding 	<ul style="list-style-type: none"> Twice per year immediately before and after winters

Table 19. Preventative Maintenance, Corrective Actions, and Replacement Recommendations

Stormwater Asset	Preventative Maintenance		Corrective Measures		Replacement (lifespan)
	Action	Frequency	Action	Frequency	
Storm Sewers	<ul style="list-style-type: none"> Flushing to remove/prevent blockages 	<ul style="list-style-type: none"> Year-round as identified by CCTV inspection or visual observation At a minimum, all pipes need to be flushed once every 10 years 	<ul style="list-style-type: none"> Planned and urgent (unplanned) repairs replacements like cured in place pipe lining methods, corrosion reduction, reaming and sealing and spot repairs of less than 10 m Emergency repairs as described above using either dig-up or trenchless methods. Action to be taken in less than 24 hours from notice 	<ul style="list-style-type: none"> Year round as identified by CCTV inspection and/or by functional emergency At a minimum, rehabilitation to be performed once every 10 years for all inspected sewers over 10 years old. Priorities are determined by the results of regularly scheduled CCTV inspection 	<ul style="list-style-type: none"> 100 years for concrete, brick, vitrified clay, and ductile iron pipes 100 years for HDPE and PVC pipes 50 years for CSP pipes 50 years for all laterals
Culverts	<ul style="list-style-type: none"> Remove debris and sediment Remove blockages Fix minor corrosion issues 	<ul style="list-style-type: none"> Once every 2-3 years for culverts 2,000 mm to 3,000 mm Once every 5 years for culverts under 2,000 mm 	<ul style="list-style-type: none"> Fix corrosion and misalignment Replace grates as needed Repair caving and partial breakdown either by sealing or replacing (open trench) Repair/replace riprap 	<ul style="list-style-type: none"> Year round as identified by visual inspection and/or by functional emergency At minimum, corrective measures need to be performed once every 20 years. Priorities are determined by regular inspection 	<ul style="list-style-type: none"> 100 years for concrete culverts 50 for CSP culverts
Manholes	<ul style="list-style-type: none"> Remove debris/sediment and other materials Remove obstructions Minor grouting 	<ul style="list-style-type: none"> 10% annually or once every 10 years. Priorities determined by the regular inspection program 	<ul style="list-style-type: none"> Structural rehabilitation Grouting cracks and connections to pipes Replacing covers and mechanical elements (e.g. weirs, splitters, restrictions, etc.) 	<ul style="list-style-type: none"> As needed determined by prioritization of inspection results At a minimum, corrective actions need to be performed every 10 years for manholes over 10 years old 	<ul style="list-style-type: none"> 100 years for brick and concrete manholes
Catchbasins	<ul style="list-style-type: none"> Remove debris/sediment Remove obstructions Minor grouting 	<ul style="list-style-type: none"> Once every 4 years. Priorities determined by the regular inspection program 	<ul style="list-style-type: none"> Structural rehabilitation Grouting cracks and pipe connections Replacing grates and other elements as needed 	<ul style="list-style-type: none"> As needed determined by prioritization of inspection results At a minimum, corrective actions need to be performed every 10 years for catch basins over 10 years old 	<ul style="list-style-type: none"> 50 years for brick and concrete catchbasins

Stormwater Asset	Preventative Maintenance		Corrective Measures		Replacement (lifespan)
	Action	Frequency	Action	Frequency	
Outfalls	<ul style="list-style-type: none"> Remove debris and sediment Remove blockages Fix minor corrosion issues 	<ul style="list-style-type: none"> Once annually or as required 	<ul style="list-style-type: none"> Fix corrosion, misalignment and/or overhanging Add aprons, grates and other flow control elements as needed Repair caving and partial breakdown Repair bank erosion and stabilize with rip rap or vegetation Track potential water quality discharge issues back in the system 	<ul style="list-style-type: none"> Year round as identified by inspection and/or by functional emergency At a minimum, corrective measurements should be performed every 10-15 years, with priorities being determined by regular inspections 	75 years
Ditches /open channels	<ul style="list-style-type: none"> Trash/debris removal Remove/cut overgrown vegetation Remove other minor blockages 	<ul style="list-style-type: none"> Once every 5 years 	<ul style="list-style-type: none"> Sediment removal and minor re-grading to preserve design slopes Re-vegetate exposed areas Fill and re-vegetate eroded areas 	<ul style="list-style-type: none"> Once every 20 years or as determined by regular ditch walk outs and inspections 	100 years
Dry Ponds	<ul style="list-style-type: none"> Minor repairs to the pilot channel: erosion and vegetation reestablishment 	<ul style="list-style-type: none"> Once every 5 years 	<ul style="list-style-type: none"> Major repairs to pilot channel 	<ul style="list-style-type: none"> As needed or every 20 years 	Outlet: 50 years Pond: 100 years
	<ul style="list-style-type: none"> Remove trash and debris from side slopes, embankment, spillways, outlet and trash gates 	<ul style="list-style-type: none"> Twice a year during growing season 	<ul style="list-style-type: none"> Repair control structure 	<ul style="list-style-type: none"> As needed or every 20 years 	
	<ul style="list-style-type: none"> Harvest vegetation 	<ul style="list-style-type: none"> Annually as needed 	<ul style="list-style-type: none"> Remove accumulated sediment from forebays or pre-treatment areas when 60% of the original volume has been lost 	<ul style="list-style-type: none"> Once every 5 years 	
	<ul style="list-style-type: none"> Minor repairs to embankment and side slopes 	<ul style="list-style-type: none"> Once every 5 years 	<ul style="list-style-type: none"> Remove accumulated sediment from main cells of pond once 50% of the original volume has been lost 	<ul style="list-style-type: none"> As needed or every 20 years 	
	<ul style="list-style-type: none"> Minor repairs to outlet structure and riprap 	<ul style="list-style-type: none"> Once every 5 years 	<ul style="list-style-type: none"> Major erosion repairs, vegetation reestablishment and embankment subsidence 	<ul style="list-style-type: none"> As needed or every 20 years 	

Stormwater Asset	Preventative Maintenance		Corrective Measures		Replacement (lifespan)
	Action	Frequency	Action	Frequency	
Infiltration Galleries & Tree Trenches*	<ul style="list-style-type: none"> Remove clogging in inlet/outlet pipes 	<ul style="list-style-type: none"> Twice a year during growing season 	<ul style="list-style-type: none"> Replace layers of stone aggregate, the filter fabric, drain tile (if present) and perform bottom scarification/tilled 	<ul style="list-style-type: none"> As needed or every 15-20 years 	30-50 years
	<ul style="list-style-type: none"> Remove leaves, grass clippings, debris and trash 	<ul style="list-style-type: none"> Twice a year during growing season 	<ul style="list-style-type: none"> Remove accumulated sediment from forebays or sediment storage areas when 50% of the original volume has been lost 	<ul style="list-style-type: none"> Every 10 years 	
	<ul style="list-style-type: none"> Clean pre-treatment devices 	<ul style="list-style-type: none"> Twice a year during growing season 	<ul style="list-style-type: none"> Remove accumulated sediment (only top layer) when standing water exceeds 72 hours 	<ul style="list-style-type: none"> Every 3-5 years 	
	<ul style="list-style-type: none"> Maintain and prune vegetation 	<ul style="list-style-type: none"> Annually and as needed 			
	<ul style="list-style-type: none"> Minor replanting on eroded or barren spots 	<ul style="list-style-type: none"> Annually as needed 			
Rain Gardens	<ul style="list-style-type: none"> Water plants 	<ul style="list-style-type: none"> As necessary during the first growing season 	<ul style="list-style-type: none"> Treat or remove and replace all diseased and dead vegetation 	<ul style="list-style-type: none"> As needed or every 2 years 	50+ years
	<ul style="list-style-type: none"> Water as necessary during dry periods 	<ul style="list-style-type: none"> As needed for the next 2 growing seasons 	<ul style="list-style-type: none"> Add mulch 	<ul style="list-style-type: none"> As needed or every 2 years 	
	<ul style="list-style-type: none"> Re-mulch void areas 	<ul style="list-style-type: none"> Annual 	<ul style="list-style-type: none"> Remove vegetation and mulch, and replace with new layer 	<ul style="list-style-type: none"> 3-5 year cycle 	
	<ul style="list-style-type: none"> Repair eroded areas 	<ul style="list-style-type: none"> Monthly until full vegetation establishment 	<ul style="list-style-type: none"> Repair check dams (if present) 	<ul style="list-style-type: none"> As needed or 5-10 year cycle 	
	<ul style="list-style-type: none"> Remove litter and debris 	<ul style="list-style-type: none"> Once a year or during inspections 			
	<ul style="list-style-type: none"> Manage nutrient and pesticide use Aerate soil on the filter strip 	<ul style="list-style-type: none"> Annual 2-3 year cycle 			
Dry Swale	<ul style="list-style-type: none"> Mow grasses (low pressure equipment) to about 10 cm high 	<ul style="list-style-type: none"> 3-4 times during growing season (only once in early Spring if native grasses are used) 	<ul style="list-style-type: none"> Stabilize eroded side slopes and bottom 	<ul style="list-style-type: none"> As needed 	100 years
	<ul style="list-style-type: none"> Trimming, removal of invasive species and replanting when necessary 	<ul style="list-style-type: none"> Annual 	<ul style="list-style-type: none"> Scrape swale bottom and remove sediment to restore original cross section and infiltration rate 	<ul style="list-style-type: none"> 5-10 year cycle 	
	<ul style="list-style-type: none"> Remove litter/debris 	<ul style="list-style-type: none"> Annual 	<ul style="list-style-type: none"> Re-seed or sod to restore ground cover 	<ul style="list-style-type: none"> As needed or every 5 years 	
	<ul style="list-style-type: none"> Manage nutrient and pesticide use 	<ul style="list-style-type: none"> Annual 			
	<ul style="list-style-type: none"> Aerate soil on the filter strip 	<ul style="list-style-type: none"> Every 2-3 years 			

Stormwater Asset	Preventative Maintenance		Corrective Measures		Replacement (lifespan)
	Action	Frequency	Action	Frequency	
Permeable Pavers	<ul style="list-style-type: none"> Vacuuming Keep the surrounding landscaped areas well maintained, pull out weeds and preventing soil from being washed onto the pavement 	<ul style="list-style-type: none"> As needed or twice per year (April and November) On going 	<ul style="list-style-type: none"> Potholes patching with standard patching mixes Replacing pavers 	<ul style="list-style-type: none"> As needed As needed 	20-60 years
Water Quality Unit	<ul style="list-style-type: none"> Remove sediment, grit, trash, organics and oil accumulation Remove flow obstructions 	<ul style="list-style-type: none"> At least once a year or as often as recommended by manufacturer or as determined by inspections 	<ul style="list-style-type: none"> Correct structural displacement and cracks Replace leaking or corroded components Grout as needed Replace filters 	<ul style="list-style-type: none"> Once every 20 years or as determined by inspections 	50 to 100 years depending upon OGS type

* Preventative maintenance and corrective action requirements and frequency for Tree Trenches vary significantly with the type of BMP (e.g. Structural cells/ suspended pavement, rock based structural soil, sand based structural soil, concrete boxes, etc.) and the type of trees.



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