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Stormwater Management Facility
Operation and Maintenance Manual

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Overall Facilities Map

O&M Site Plan, Stormwater Facilities Map

Stormwater Facilities Map

Extended Detention Pond

O&M Site Plans

O&M Plan (Plan and Profile) (1 page)

O&M Plan (Details) (1 page)

SOP’s for Inspection and Maintenance (18 pages)

Standard Operation Procedures (SOP)
For
Extended Detention Pond
Inspection and Maintenance

February 2016

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ACRONYMS

CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
CWA	Clean Water Act
EDP	Extended Detention Pond
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
GS	Grass Swale
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
PBMP	Permanent Best Management Practice
PLD	Porous Landscape Detention
SDECM	Storm Drainage and Environmental Criteria Manual
SOP	Standard Operating Procedure
WQCD	Water Quality Control Division of the CDPHE
WQCV	Water Quality Capture Volume

EDP-1 REGIONAL DETENTION BACKGROUND

Regional detention basins serve multiple property owners in watershed areas ranging from about 130 acres to one square mile.

Regional detention facilities may be constructed by a public entity such as a municipality, special district, or property owner but should always be based on a master plan or a detailed hydrologic model approved by the local jurisdiction that accounts for future development upstream and impacts downstream of the facility. Compared to on-site facilities, regional detention facilities typically require proportionally less total land area and are more cost effective to construct and maintain. Well-designed regional facilities may also provide more favorable riparian habitat and offer greater opportunities for achieving multi-use objectives, such as combining with park and open space resources and connecting shared use paths. There are limitations associated with the implementation of on-line regional detention facilities. To avoid excessive accumulation of sediment, it is not recommended that regional detention facilities be constructed on streams experiencing significant upstream bed or bank erosion unless stabilization improvements are constructed ahead of the basin. When an on-line regional facility is designed to provide water quality, storm water best management practices (BMPs) are still required in the tributary watershed to address water quality and channel stability for the reach upstream of the regional facility. In accordance with MS4 permits and regulations, areas of "New Development and Significant Redevelopment" must be treated with BMPs prior to discharging to a State Water.

An EDP is a sedimentation basin with a permanent pool designed to “extend” the runoff detention time, but to drain the runoff from the design storm completely sometime after stormwater runoff ends. The EDP’s drain time for the water quality portion of the facility is typically 40 hours.

EDPs are an adaptation of a detention pond used for flood control, with the primary difference is the addition of forebays, micro-pools and a slow release outlet design. Forebays are shallow concrete “pans” located at the inflow point to the basin and are provided to facilitate sediment removal within a contained area prior to releasing into the pond. These forebays collect and briefly hold stormwater runoff resulting in a process called sedimentation, dropping sediment out of the stormwater. The stormwater is then routed from the forebay into the pond. The EDP uses a much smaller outlet that extends the emptying time of the more frequently occurring runoff events to facilitate pollutant removal. An EDP should have a small micro-pool just upstream of the outlet. This micro-pool is designed to hold a small amount of water to keep sediment and floatables from blocking the outlet orifices.

EDP-2 INSPECTING EXTENDED DETENTION PONDS (EDPs)

EDP-2.1 ACCESS AND EASEMENTS

Inspection or maintenance personnel may utilize the stormwater facility map located in the Appendix containing the location(s) of the access points and maintenance easements of the EDP(s) within this development.

EDP-2.2 STORM WATER MANAGEMENT FACILITIES LOCATIONS

Inspection or maintenance personnel may utilize the stormwater facility map located in the Appendix containing the location(s) of the EDP(s) within this development.

EDP-2.3 EXTENDED DETENTION POND (EDP) FEATURES

EDPs have a number of features that are designed to serve a particular function. Many times the proper function of one feature depends on another. For example, if a forebay is not properly maintained, it could negatively affect the performance of a feature downstream (micro-pool, outlet structure, etc.). Therefore, it is critical that each feature of the EDP is properly inspected and maintained to ensure that the overall facility functions as it was intended. Below is a list and description of the most common features within an EDP and the corresponding maintenance inspection items that can be anticipated:

TABLE EDP-1
TYPICAL INSPECTION & MAINTENANCE REQUIREMENTS MATRIX

EDP Features	Sediment Removal	Mowing/ Weed control	Trash & Debris Removal	Erosion	Overgrown Vegetation Removal	Standing Water (mosquito/ algae control)	Structure Repair
Inflow Points (outfalls)	X		X				X
Forebay	X		X				X
Low-flow channel	X		X	X	X		X
Bottom Stage	X	X	X	X	X	X	
Micro-pool	X		X		X	X	X
Outlet Works	X		X				X
Emergency Spillway			X	X	X		X
Upper Stage			X	X			
Embankment		X		X	X		

EDP-2.3.1 Inflow Points

Inflow Points or Outfalls into EDPs are the point source of the stormwater discharge into the facility. An inflow point is commonly a storm sewer pipe with a flared end section that discharges into the EDP. In some instances, an inflow point could be a drainage channel or ditch that flows into the facility.

An energy dissipater (riprap or hard armor protection) is typically immediately downstream of the discharge point into the EDP to protect from erosion. In some cases, the storm sewer outfall can have a toe-wall or cut-off wall immediately below the structure to prevent undercutting of the outfall from erosion.

The typical maintenance items that are found with inflow points are as follows:

a) *Riprap Displaced.* Many times, because the repeated impact/force of water, the riprap can shift and settle. If any portion of the riprap apron appears to have settled, soil is present between the riprap, or the riprap has shifted, maintenance may be required to ensure future erosion is prevented.

b) *Erosion Present/Outfall Undercut*. In some situations, the energy dissipater may not have been sized, constructed, or maintained appropriately and erosion has occurred. Any erosion within the vicinity of the inflow point will require maintenance to prevent damage to the structure(s) and sediment transport within the facility.

c) *Sediment Accumulation.* Because of the turbulence in the water created by the energy dissipater, sediment often deposits immediately downstream of the inflow point. To prevent a loss in hydraulic performance of the upstream infrastructure, sediment that accumulates in this area must be removed in a timely manner.

d) *Structural Damage.* Structural damage can occur at any time during the life of the facility. Typically, for an inflow, the structural damage occurs to the pipe flared end section (concrete or steel). Structural damage can lead to additional operating problems with the facility, including loss of hydraulic performance.

e) *Woody Growth/Weeds Present*. Undesirable vegetation can grow in and around the inflow area to an EDP that can significantly affect the performance of the drainage facilities discharging into the facility. This type of vegetation includes trees (typically cottonwoods) and dense areas of shrubs (willows). If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, resulting in blockage of the discharge. Also, tree roots can cause damage to the structural components of the inflow. Routine maintenance is essential for trees (removing a small tree/sapling is much cheaper and "quieter" than a mature tree). In addition, noxious weeds growing in the facility can result in the loss of desirable native vegetation and impact adjacent open spaces/land.

EDP-2.3.2 Forebay

A forebay is a solid surface (pad), typically constructed of concrete, immediately downstream of the inflow point. The forebay is designed to capture larger particles and trash to prevent them from entering the main portion of the EDP. The solid surface is designed to facilitate mechanical sediment removal (skid steer). The forebay typically includes a small diameter discharge pipe or v-notch weir on the downstream end to drain the forebay in a specified period of time to promote sedimentation. The forebays vary in size and depth depending on the design and site constraints.

The typical maintenance items that are found with forebays are as follows:

a) *Sediment/Debris Accumulation.* Because this feature of the EDP is designed to provide the initial sedimentation, debris and sediment frequently accumulate in this area. If the sediment and debris are not removed from the forebay on a regular basis, it can significantly affect the function of other features within the EDP. Routine sediment removal from the forebay can significantly reduce the need for dredging of the main portion of the EDP using specialized equipment (long reach excavators). Routine removal of sediment from the forebay can substantially decrease the long-term sediment removal costs of an EDP.

b) *Concrete Cracking/Failing.* The forebay is primarily constructed of concrete, which cracks, spalls, and settles. Damage to the forebay can result in decreased performance and impact maintenance efforts.

c) *Drain Pipe/Weir Clogged.* Many times the drainpipe or weir can be clogged with debris, and prevent the forebay from draining properly. If standing water is present in the forebay (and there is not a base flow), the forebay is most likely not draining properly. This can result in a decrease in performance and create potential nuisances with stagnant water (mosquitoes).

d) *Weir/Drain Pipe Damaged.* Routine maintenance activities, vandalism, or age may cause the weir or drain pipe in the forebay to become damaged. Weirs are typically constructed of concrete, which cracks and spalls. The drainpipe is typically smaller in diameter and constructed with plastic, which can fracture.

EDP-2.3.3 Permanent Pool

The permanent pool is an area at least 5.0 feet deep and is the main area of the pond. This area enhances the facility's pollutant removal capabilities. This area of the EDP may develop wetland vegetation.

The typical maintenance items that are found with the permanent pool are as follows:

a) *Sediment/Debris Accumulation.* The edges of the permanent pool can frequently accumulate sediment and debris. This material must be removed to maintain pond volume and proper function of the outlet structure. Locate the source of the sediment and stabilize the area of erosion.

b) *Woody Growth/Weeds Present.* Because of the constant moisture in the soil surrounding the water surface, woody growth (cottonwoods/willows) can create operational problems for the EDP. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, which can cause problems with other EDP features. Also, tree roots can cause damage to the structural components of the pond banks. Routine management is essential for trees (removing a small tree/sapling is much cheaper and "quieter" than a mature tree).

c) *Bank Erosion.* Erosion can be caused by water flowing across the pond banks if adequate stabilization protection/armor is not present. Erosion in this area must be mitigated to prevent sediment transport and other EDP feature damage.

d) *Mosquitoes/Algae Treatment.* Nuisance created by stagnant water can result from improper maintenance/treatment of the permanent pool. Mosquito larvae can be laid by adult mosquitoes within the permanent pool. Also, aquatic vegetation that grows in shallow pools of water can decompose causing foul odors. Chemical/mechanical treatment of the permanent pool may be necessary to reduce these impacts to adjacent homeowners.

e) *Petroleum/Chemical Sheen.* Many indicators of illicit discharges into the storm sewer systems will be present in the permanent pool area of the EDP. These indicators can include sheens, odors, discolored soil, and dead vegetation. If it is suspected that an illicit discharge has occurred, contact the supervisor immediately. Proper removal/mitigation of contaminated soils and water in the EDP is necessary to minimize any environmental impacts downstream.

EDP-2.3.4 Micro-pool

The micro-pool is a concrete or grouted boulder walled structure directly in front of the outlet works. At a minimum, the micro-pool is 2.5 feet deep and is designed to hold water. The micro-pool is critical in the proper function of the EDP; it allows suspended sediment to be deposited at the bottom of the micro-pool and prevents these sediments from being deposited in front of the outlet works causing clogging of the outlet structure, which results in marshy areas within the top and bottom stages.

The typical maintenance items that are found with micro-pools are as follows:

a) *Sediment/Debris Accumulation.* The micro-pool can frequently accumulate sediment and debris. This material must be removed to maintain pond volume and proper function of the outlet structure.

b) *Woody Growth/Weeds Present*. Because of the constant moisture in the soil surrounding the micro-pool, woody growth (cottonwoods/willows) can create operational problems for the EDP. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate outside of the micro-pool, which can cause problems with other EDP features. Also, tree roots can cause damage to the structural components of the outlet works. Routine management is essential for trees (removing a small tree/sapling is much cheaper and "quieter" than a mature tree).

c) *Mosquitoes/Algae Treatment.* Nuisance created by stagnant water can result from improper maintenance/treatment of the micro-pool. Mosquito larvae can be laid by adult mosquitoes within the permanent pool. Also, aquatic vegetation that grows in shallow pools of water can decompose causing foul odors. Chemical/mechanical treatment of the micro-pool may be necessary to reduce these impacts to adjacent homeowners.

d) *Petroleum/Chemical Sheen.* Many indicators of illicit discharges into the storm sewer systems will be present in the micro-pool area of the EDP. These indicators can include sheens, odors, discolored soil, and dead vegetation. If it is suspected that an illicit discharge has occurred, contact the supervisor immediately. Proper removal/mitigation of contaminated soils and water in the EDP is necessary to minimize any environmental impacts downstream.

EDP-2.3.5 Outlet Works

The outlet works is the feature that drains the EDP in specified quantities and periods of time. The outlet works is typically constructed of reinforced concrete into the embankment of the EDP. The concrete structure typically has steel orifice plates anchored/embedded into it to control stormwater release rates. The larger openings (flood control) on the outlet structure typically have trash racks over them to prevent clogging. The water quality orifice plate (smaller diameter holes) will typically have a well screen covering it to prevent smaller materials from clogging it. The outlet structure is the single most important feature in the EDP operation. Proper inspection and maintenance of the outlet works is essential in ensuring the long-term operation of the EDP.

The typical maintenance items that are found with the outlet works are as follows:

a) *Trash Rack/Well Screen Clogged.* Floatable material that enters the EDP will most likely make its way to the outlet structure. This material is trapped against the trash racks and well screens on the outlet structure (which is why they are there). This material must be removed on a routine basis to ensure the outlet structure drains in the specified design period.

b) *Structural Damage.* The outlet structure is primarily constructed of concrete, which can crack, spall, and settle. The steel trash racks and well screens are also susceptible to damage.

c) *Orifice Plate Missing/Not Secure.* Many times residents, property owners, or maintenance personnel will remove or loosen orifice plates if they believe the pond is not draining properly. Any modification to the orifice plate(s) will significantly affect the designed discharge rates for water quality and/or flood control. Modification of the orifice plates is not allowed without approval from the Town of Parker.

d) *Manhole Access.* Access to the outlet structure is necessary to properly inspect and maintain the facility. If access is difficult or not available to inspect the structure, chances are it will be difficult to maintain as well.

e) *Woody Growth/Weeds Present.* Because of the constant moisture in the soil surrounding the outlet works, woody growth (cottonwoods/willows) can create operational problems for the EDP. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate around the outlet works, which can cause problems with other EDP features.

   Also, tree roots can cause damage to the structural components of the outlet works. Routine management is essential for trees (removing a small tree/sapling is much cheaper and "quieter" than a mature tree).

EDP-2.3.6 Emergency Spillway

An emergency spillway is typical of all EDPs and designed to serve as the overflow in the event the volume of the pond is exceeded. The emergency spillway is typically armored with riprap (or other hard armor) and is sometimes buried with soil. The emergency spillway is typically a weir (notch) in the pond embankment. Proper function of the emergency spillway is essential to ensure flooding does not affect adjacent properties.

The typical maintenance items that are found with emergency spillways are as follows:

a) *Riprap Displaced.* As mentioned before, the emergency spillway is typically armored with riprap to provide erosion protection. Over the life of an EDP, the riprap may shift or dislodge due to flow.

b) *Erosion Present.* Although the spillway is typically armored, stormwater flowing through the spillway can cause erosion damage. Erosion must be repaired to ensure the integrity of the basin embankment, and proper function of the spillway.

c) *Woody Growth/Weeds Present.* Management of woody vegetation is essential in the proper longterm function of the spillway. Larger trees or dense shrubs can capture larger debris entering the EDP and reduce the capacity of the spillway.

d) *Obstruction Debris.* The spillway must be cleared of any obstruction (manmade or natural) to ensure the proper design capacity.

EDP-2.3.7 Upper Stage (Dry Storage)

The upper stage of the EDP provides the majority of the water quality flood detention volume. This area of the EDP is higher than the permanent pool and typically stays dry, except during storm events. The upper stage is the largest feature/area of the basin.

The typical maintenance items that are found with upper stages are as follows:

a) *Vegetation Sparse.* The upper basin is the most visible part of the EDP, and therefore aesthetics is important. Adequate and properly maintained vegetation can greatly increase the overall appearance and acceptance of the EDP by the public. In addition, vegetation can reduce the potential for erosion and subsequent sediment transport to the other areas of the pond.

b) *Woody Growth/Undesirable Vegetation*. Although some trees and woody vegetation may be acceptable in the upper basin, some thinning of cottonwoods and willows may be necessary. Remember, the basin will have to be dredged to ensure volume, and large trees and shrubs will be difficult to protect during that operation.

c) *Standing Water/Boggy Areas.* Standing water or boggy areas in the upper stage is typically a sign that some other feature in the pond is not functioning properly. Routine maintenance (mowing, trash removal, etc) can be extremely difficult for the upper stage if the ground is saturated. If this inspection item is checked, make sure you have identified the root cause of the problem.

d) *Sediment Accumulation.* Although other features within the EDP are designed to capture sediment, the upper storage area will collect sediment over time. Excessive amounts of sedimentation will result in a loss of storage volume. It may be more difficult to determine if this area has accumulated sediment without conducting a field survey.

Below is a list of indicators:

1. Standing water or boggy areas in upper stage
2. Uneven grades or mounds
3. Micro-pool or Forebay has excessive amounts of sediment

e) *Erosion (banks).* Inadequate vegetative cover may result in erosion of the upper stage. Erosion that occurs in the upper stage can result in increased dredging/maintenance of the permanent pool.

f) *Trash/Debris.* Trash and debris can accumulate in the upper area after large events, or from illegal dumping. Over time, this material can accumulate and clog the EDP outlet works.

g) *Maintenance Access.* Most EDPs typically have a gravel/concrete maintenance access path to either the micro-pool or forebay. This access path should be inspected to ensure the surface is still drivable. Some of the smaller EDPs may not have maintenance access paths; however, the inspector should verify that access is available from adjacent properties.

EDP-2.3.8 Miscellaneous

There are a variety of inspection/maintenance issues that may not be attributed to a single feature within the EDP. This category on the inspection form is for maintenance items that are commonly found in the EDP, but may not be attributed to an individual feature.

a) *Encroachment in Easement Area.* Private lots/property can sometimes be located very close to the EDPs, even though they are required to be located in tracts with drainage easements. Property owners may place landscaping, trash, fencing, or other items within the easement area that may affect maintenance or the operation of the facility.

b) Graffiti/Vandalism. Damage to the EDP infrastructure can be caused by vandals. If criminal mischief is evident, the inspector should forward this information to the Town of Parker Police Department.

c) Public Hazards. Public hazards include items such as vertical drops of greater than 4-feet, containers of unknown/suspicious substances, exposed metal/jagged concrete on structures. **If any hazard is found within the facility area that poses an immediate threat to public safety, call 911 immediately!**

d) Burrowing Animals/Pests. Prairie dogs and other burrowing rodents may cause damage to the EDP features and negatively affect the vegetation within the EDP.

e) Other. Any miscellaneous inspection/maintenance items not contained on the form should be entered here.

EDP-2.4 INSPECTION FORMS

EDP Inspection forms are located in the Appendix. Inspection forms shall be completed by the person(s) conducting the inspection activities. Each form shall be reviewed and submitted by the property owner or property manager to the Town of Parker per the requirements of the Operations and Maintenance Manual. Copies of these inspections forms shall be kept indefinitely by the property owner or manager and made available to the Town of Parker upon request.

EDP-3 MAINTAINING EXTENDED DETENTION PONDS (EDPS)

EDP-3.1 MAINTENANCE PERSONNEL

Maintenance personnel must be qualified to properly maintain EDPs. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

EDP-3.2 EQUIPMENT

It is imperative that the appropriate equipment and tools are taken to the field with the operations crew. The types of equipment/tools will vary depending on the task at hand. Below is a list of tools, equipment, and material(s) that may be necessary to perform maintenance on an EDP:

1. Loppers/Tree Trimming Tools
2. Mowing Tractors
3. Trimmers (extra string)
4. Shovels
5. Rakes
6. All Surface Vehicle (ASVs)
7. Skid Steer
8. Back Hoe
9. Track Hoe/Long Reach Excavator
10. Dump Truck
11. Jet-Vac Machine
12. Engineers Level (laser)
13. Riprap (Minimum - Type M)
14. Filter Fabric
15. Erosion Control Blanket(s)
16. Seed Mix (Native - Foothills)
17. Illicit Discharge Cleanup Kits
18. Trash Bags
19. Tools (wrenches, screw drivers, hammers, etc)
20. Chain Saw
21. Confined Space Entry Equipment
22. Approved Stormwater Facility Operation and Maintenance Manual

Some of the items identified above may not be needed for every maintenance operation. However, this equipment should be available to the maintenance operations crews should the need arise.

EDP-3.3 SAFETY

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. If a vertical drop is identified within the EDP that is greater than 48" in height, make the appropriate note/comment on the maintenance inspection form.

EDP-3.4 MAINTENANCE FORMS

The EDP Maintenance Form provides a record of each maintenance operation performed by maintenance contractors. The EBD Maintenance Form shall be filled out in the field after the completion of the maintenance operation. Each form shall be reviewed and submitted by the property owner or property manager to the Town of Parker per the requirements of the Operations and Maintenance Manual. The EDP Maintenance form is located in the Appendix.

EDP-3.5 MAINTENANCE CATEGORIES AND ACTIVITIES

A typical EDP Maintenance Program will consist of three broad categories of work. Within each category of work, a variety of maintenance activities can be performed on an EDP. A maintenance activity can be specific to each feature within the EDP, or general to the overall facility. This section of the SOP explains each of the categories and briefly describes the typical maintenance activities for an EDP.

A variety of maintenance activities are typical of EDPs. The maintenance activities range in magnitude from routine trash pickup to the reconstruction of drainage infrastructure. Below is a description of each maintenance activity, the objectives, and frequency of actions:

EDP-3.6 ROUTINE MAINTENANCE ACTIVITIES

The majority of this work consists of regularly scheduled mowing and trash and debris pickups for stormwater management facilities during the growing season. This includes items such as the removal of debris/material that may be clogging the outlet structure well screens and trash racks. It also includes activities such as weed control, mosquito treatment, and algae treatment. These activities normally will be performed numerous times during the year. These items can be completed without any prior correspondence with the Town, however, completed inspection and maintenance forms shall be submitted to the Town for each inspection and maintenance activity.

The Maintenance Activities are summarized below, and further described in the following sections.

TABLE EDP-2
SUMMARY OF ROUTINE MAINTENANCE ACTIVITIES

Maintenance Activity	Minimum Frequency	Look For:	Maintenance Action
Mowing	Twice annually	Excessive grass height/aesthetics	Mow grass to a height of 4" to 6"
Trash/Debris Removal	Twice annually	Trash & debris in EDP	Remove and dispose of trash and debris
Outlet Works Cleaning	As needed - after significant rain events – twice annually min.	Clogged outlet structure; ponding water	Remove and dispose of debris/trash/sediment to allow outlet to function properly
Weed control	Minimum twice annually	Noxious weeds; Unwanted vegetation	Treat w/ herbicide or hand pull; Consult the local weed specialist
Mosquito Treatment	As needed	Standing water/mosquito habitat	Treat w/ EPA approved chemicals
Algae Treatment	As needed	Standing water/ Algae growth/green color	Treat w/ EPA approved chemicals

EDP-3.6.1 Mowing

Occasional mowing is necessary to limit unwanted vegetation and to improve the overall appearance of the EDP. Native vegetation should be mowed to a height of 4-to-6 inches tall. Grass clippings should be collected and disposed of properly.

Frequency: Routine - Minimum of twice annually or depending on aesthetics.

EDP-3.6.2 Trash/Debris Removal

Trash and debris must be removed from the entire EDP area to minimize outlet clogging and to improve aesthetics. This activity must be performed prior to mowing operations.

Frequency: Routine – Prior to mowing operations and minimum of twice annually.

EDP-3.6.3 Outlet Works Cleaning

Debris and other materials can clog the outlet work's well screen, orifice plate(s) and trash rack. This activity must be performed anytime other maintenance activities are conducted to ensure proper operation.

Frequency: Routine – After significant rainfall event or concurrently with other maintenance activities.

EDP-3.6.4 Weed Control

Noxious weeds and other unwanted vegetation must be treated as needed throughout the EDP. This activity can be performed either through mechanical means (mowing/pulling) or with herbicide. Consultation with the local Weed Inspector is highly recommended prior to the use of herbicide.

Frequency: Routine – As needed based on inspections.

EDP-3.6.5 Mosquito/Algae Treatment

Treatment of permanent pools is necessary to control mosquitoes and undesirable aquatic vegetation that can create nuisances. Only EPA approved chemicals/materials can be used in areas that are warranted.

Frequency: As needed.

EDP- 3.7 MINOR MAINTENANCE ACTIVITIES

This work consists of a variety of isolated or small-scale maintenance or operational problems. Most of this work can be completed by a small crew, tools, and small equipment. These items require prior approval from the Town of Parker. Completed inspection and maintenance forms shall be submitted to the Town for each inspection and maintenance period.

TABLE – EDP-3
SUMMARY OF MINOR MAINTENANCE ACTIVITIES

Maintenance Activity	Minimum Frequency	Look For:	Maintenance Action
Sediment Removal	As needed; typically every 1 –2 years	Sediment build-up; decrease in pond volume	Remove and dispose of sediment
Erosion Repair	As needed, based upon inspection	Rills/gullies forming on side slopes, trickle channel, other areas	Repair eroded areas Revegetate; address source of erosion
Vegetation Removal/ Tree Thinning	As needed, based upon inspection	Large trees/wood vegetation in lower chamber of pond	Remove vegetation; restore grade and surface
Drain Cleaning/Jet Vac	As needed, based upon inspection	Sediment build-up /non draining system	Clean drains; Jet Vac if needed

EDP-3.7.1 Sediment Removal

Sediment removal is necessary to maintain the original design volume of the EDP and to ensure proper function of the infrastructure. Regular sediment removal (minor) from the forebay, inflow(s) and drop structures can significantly reduce the frequency of major sediment removal activities (dredging) in the upper and lower pond stages. The minor sediment removal activities can typically be addressed with shovels and smaller equipment. Major sediment removal activities will require larger and more specialized equipment. The major sediment activities will also require surveying with an engineer's level, and consultation with the Town of Parker Staff to ensure design volumes/grades are achieved.

Stormwater sediments removed from EDPs do not meet the criteria of "hazardous waste". However, these sediments are contaminated with a wide array of organic and inorganic pollutants and handling must be done with care. Sediments from permanent pools must be carefully removed to minimize turbidity, further sedimentation, or other adverse water quality impacts. Sediments should be transported by motor vehicle only after they are dewatered. All sediments must be taken to a landfill for proper disposal. Prompt and thorough cleanup is important should a spill occur during transportation.

Frequency: Nonroutine – As necessary based upon inspections. Sediment removal in the forebay and drop structures may be necessary as frequently as every 1-2 years.

EDP-3.7.2 Erosion Repair

The repair of eroded areas is necessary to ensure the proper function of the EDP, minimize sediment transport, and to reduce potential impacts to other features. Erosion can vary in magnitude from minor repairs to energy dissipaters, and rilling to major gullies in the embankments and spillways. The repair of eroded areas may require the use of excavators, earthmoving equipment, riprap, concrete, erosion control blankets, and turf reinforcement mats. Major erosion repair to the pond embankments, spillways, and adjacent to structures will require consultation with the Town of Parker Staff.

Frequency: Nonroutine – As necessary based upon inspections.

EDP-3.7.3 Vegetation Removal/Tree Thinning

Dense stands of woody vegetation (willows, shrubs, etc) or trees can create maintenance problems for the infrastructure within an EDP. Tree roots can damage structures and invade pipes/channels thereby blocking flows. Also, trees growing in the upper and lower stages of the EDP will most likely have to be removed when sediment/dredging operations occur. A small tree is easier to remove than a large tree, therefore, regular removal/thinning is imperative. All trees and woody vegetation that is growing in the bottom of the EDP or near structures (inflows, outlet works, emergency spillways, etc) should be removed. Any trees or woody vegetation in the EDP should be limited to the upper portions of the pond banks.

Frequency: Nonroutine – As necessary based upon inspections.

EDP-3.7.4 Clearing Drains/Jet-Vac

An EDP contains many structures, openings, and pipes that can be frequently clogged with debris. These blockages can result in a decrease of hydraulic capacity and create standing water in areas outside of the permanent pool and micro-pool. Many times the blockage to this infrastructure can be difficult to access and/or clean. Specialized equipment (jet-vac machines) may be necessary to clear debris from these difficult areas.

Frequency: Nonroutine – As necessary based upon inspections.

EDP-3.8 MAJOR MAINTENANCE ACTIVITIES

This work consists of larger maintenance/operational problems and failures within the stormwater management facilities. All of this work requires consultation with the Town of Parker to ensure the proper maintenance is performed. This work requires that the Town Staff review the original design and construction drawings to assess the situation and assign the necessary maintenance. This work may also require more specialized maintenance equipment, design/details, surveying, or assistance through private contractors and consultants.

TABLE EDP-4
SUMMARY OF MAJOR MAINTENANCE ACTIVITIES

Maintenance Activity	Minimum Frequency	Look For:	Maintenance Action
Major Sediment Removal	As needed – based upon scheduled inspections	Large quantities of sediment; reduced pond capacity	Remove and dispose of sediment. Repair vegetation as needed
Major Erosion Repair	As needed – based upon scheduled inspections	Severe erosion including gullies, excessive soil displacement, areas of settlement, holes	Repair erosion – find cause of problem and address to avoid future erosion
Structural Repair	As needed – based upon scheduled inspections	Deterioration and/or damage to structural components – broken concrete, damaged pipes, outlet works	Structural repair to restore the structure to its original design

EDP-3.8.1 Major Sediment Removal

Major sediment removal consists of removal of large quantities of sediment or removal of sediment from vegetated areas. Care shall be given when removing large quantities of sediment and sediment deposited in vegetated areas. Large quantities of sediment need to be carefully removed, transported and disposed of. Vegetated areas need special care to ensure design volumes and grades are preserved.

Frequency: Nonroutine – Repair as needed based upon inspections.

EDP-3.8.2 Major Erosion Repair

Major erosion repair consist of filling and revegetating areas of severe erosion. Determining the cause of the erosion, as well as, correcting the condition that caused the erosion should also be part of the erosion repair. Care should be given to ensure design grades and volumes are preserved.

Frequency: Nonroutine – Repair as needed based upon inspections.

EDP-3.8.3 Structural Repair

An EDP includes a variety of structures that can deteriorate or be damaged during the course of routine maintenance. These structures are constructed of steel and concrete that can degrade or be damaged and may need to be repaired or re-constructed from time to time. These structures include items like outlet works, forebays, inflows and other features. In-house operations staff can perform some of the minor structural repairs. Major repairs to structures may require input from a structural engineer and specialized contractors. Consultation with the Town of Parker Staff should take place prior to all structural repairs.

Frequency: Nonroutine – Repair as needed based upon inspections.

Reference:

This manual is adapted from Town of Parker, Colorado, *Stormwater Permanent Best Management Practices (PBMP) Long-Term Operation and Maintenance Manual*, October 2004

Stormwater Management Facility Maintenance and Inspection Form

General Information:

Contractor Name: _____ Contractor Email: _____

Contractor Address: _____ Project Name: _____

Contractor Phone: _____ Project Location: _____

Maintenance Required from Inspection based on Standard Operating Procedure (SOP):

Routine Work		Minor Work*		Major Work**	
Mowing		Sediment Removal		Major Sediment Removal	
Trash/Debris Removal		Forebay		Main Basin	
Outlet Works Cleaning		Trickle Channel		Filter Media	
Weed Control		Inflow (s)		Major Erosion Repair	
Mosquito Treatment		Filter Media		Outlet Works	
Algae Treatment		Erosion Repair		Main Basin	
		Inflow Point		Spillway	
		Trickle Channel		Structural Repair	
		Filter Media		Inflow (s)	
		Vegetation Removal/Tree Thinning		Outlet Works	
		Inflow (s)		Forebay	
BMP Type		Trickle Channel		Trickle channel	
Extended Detention Basin		Main Basin		Facility Rebuild	
Porous Landscape Detention		Filter Media		OTHER:_____	
Sand Filter Basin		Revegetation		_____	
Grass Swale		Jet-Vac/Clearing Drains		_____	
Grass Buffer		Forebay			
Open Channel		Outlet Works			
Constructed Wetland Basin		Inflow (s)			
Constructed Wetland Channel		Underdrain (s)			

*Requires Approval From Douglas County **Requires Permitting From Douglas County

Inspection Notes:

_____

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_____

_____

_____

Attach any inspection photos from the inspection.

Inspector Sign Off: _____ **Date**: _____