

APPROVED

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**Stormwater Best Management Practices
Inspection and Maintenance Plan (IM Plan)**

for:

Located at:

**Prepared for and Party Responsible
for Maintenance and Inspection:**

Prepared by:

Reference:

This plan is adapted from various maintenance manuals developed in the Colorado Front Range

Appendix A

General Location and Description of Stormwater Best Management Practices

A. General Site Description

B. General Stormwater Management Description

C. Stormwater Facilities Site Plan

Inspection or maintenance personnel may utilize the documents in Appendix F for locating the stormwater facilities within this development.

D. On-Site Stormwater Management Facilities

Volume Reduction Facilities

Storage Facilities (Detention)

Water Quality Facilities

Source Control Best Management Practices

**Stormwater Best Management Practices
Inspection and Maintenance Plan (IM Plan) Procedures/Forms**

for:

Extended Detention Basins (EDBs)

Reference:

This plan is adapted from various maintenance manuals developed in the Colorado Front Range

**Stormwater Best Management Practices
Inspection and Maintenance Plan Procedures/Forms for
Extended Detention Basins (EDBs)**

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Stormwater Best Management Practices Inspection and Maintenance Plan Procedures/Forms for Extended Detention Basins (EDBs)

I. Compliance with Stormwater Best Management Practices Maintenance Requirements

All property owners are responsible for ensuring that stormwater best management practices (BMPs) or facilities installed on their property are properly maintained and that they function as designed. In some cases, this maintenance responsibility may be assigned to others through special agreements. The maintenance responsibility for a stormwater facility may be designated on the subdivision plat, the site development plan, and/or within a maintenance agreement for the property. Property owners should be aware of their responsibilities regarding stormwater facility maintenance and need to be familiar with the contents of this Inspection and Maintenance Plan (IM Plan). Maintenance agreement(s) associated with this property are provided.

In some cases, the City of Colorado Springs may agree to provide the required inspection and maintenance for some stormwater facilities that once the warranty period has ended will become public. In these cases, a City of Colorado Springs maintenance agreement will be included for those facilities that are agreed to be included in the City of Colorado Springs routine maintenance program.

II. Inspection & Maintenance – Annual Reporting

Requirements for the inspection and maintenance of stormwater facilities, as well as reporting requirements are included in this Stormwater Best Management Practices Inspection and Maintenance Plan.

Verification that the stormwater BMPs have been properly inspected and maintained and submittal of the required Inspection and Maintenance Forms shall be provided to the City on an annual basis. The annual reporting form shall be provided to the City prior to May 31st of each year.

Copies of the Inspection and Maintenance forms for each of the stormwater BMPs are located in Appendix C and D. A standard annual reporting form is provided in Appendix E. Each form shall be reviewed and submitted by the property owner or property manager to the City of Colorado Springs/Stormwater Team.

III. Preventative Measures to Reduce Maintenance Costs

The most effective way to maintain your water quality facility is to prevent the pollutants from entering the facility. Common pollutants include sediment, trash & debris, chemicals, pet wastes, runoff from stored materials, illicit discharges into the storm drainage system and many others. A thoughtful maintenance program will include measures to address these potential contaminants and will save money and time in the long run. Key points to consider in your maintenance program include:

- Educate property owners/residents to be aware of how their actions affect water quality and how they can help reduce maintenance costs.
- Keep properties, streets and gutters, and parking lots free of trash, debris, and lawn clippings.
- Ensure the proper use, storage, and disposal of hazardous wastes and chemicals. Promptly clean up any spilled materials and dispose of properly.

- Plan lawn care to minimize and properly use chemicals and pesticides.
- Sweep paved surfaces and put the sweepings back on the lawn.
- Be aware of automobiles leaking fluids. Use absorbents such as cat litter to soak up drippings – dispose of properly.
- Encourage pet owners to clean up pet wastes.
- Re-vegetate disturbed and bare areas to maintain vegetative stabilization.
- Clean any private storm drainage system components, including inlets, storm sewers, and outfalls.
- Do not store materials outdoors (including landscaping materials) unless properly protected from runoff.

IV. Access and Right to Enter

All stormwater management facilities located on the site should have both a designated access location and the City has the right to enter for the purpose of inspecting and for maintaining BMPs where the owner has failed to do so.

V. Safety

Keep safety considerations at the forefront of inspection procedures at all times. Likely hazards should be anticipated and avoided. Never enter a confined space (outlet structure, manhole, etc) without proper training, number of personal, and equipment.

Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas must be referred to emergency services at 911 (non-emergency number is 444-7000). If a toxic or flammable substance is discovered, leave the immediate area and contact the local emergency services at 911.

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 greater than 48” in height, make the appropriate note/comment on the maintenance inspection form.

If any hazard is found within the facility area that poses an immediate threat to public safety, contact emergency services at 911 immediately.

VI. Field Inspection Equipment

It is imperative that the appropriate equipment is taken to the field with the inspector(s). This is to ensure the safety of the inspector and allow the inspections to be performed as efficiently as possible. Below is a list of the equipment that may be necessary to perform the inspections of all Stormwater BMPs:

- Protective clothing and boots.
- Safety equipment (vest, hard hat, confined space entry equipment [if certified to perform confined space entry]).
- Communication equipment.
- IM Plan for the site.
- Clipboard.
- Stormwater BMP Inspection Forms (See Appendix C).
- Manhole Lid Remover
- Shovel.

Some of the items identified above need not be carried by the inspector (manhole lid remover, shovel, and confined space entry equipment), but should be available in the vehicle driven to the site. Specialized

equipment may require specific training related to that equipment and should only be used by trained individuals.

VII. Inspecting Stormwater BMPs

The quality of stormwater entering the waters of the state relies heavily on the proper operation and maintenance of permanent BMPs. Stormwater BMPs must be periodically inspected to ensure that they function as designed. The inspection will determine the appropriate maintenance that is required for the facility.

A. Inspection Procedures

All Stormwater BMPs are required to be inspected a minimum of once per year. Inspections should follow the inspection guidance found in the SOP for the specific type of facility. (Appendix B of this manual).

B. Inspection Report

The person(s) conducting the inspection activities shall complete the appropriate inspection report for the specific facility. Inspection reports are located in Appendix C. A copy of each inspection form shall be kept by the owner a minimum of 5 years.

The following information explains how to fill out the Inspection Forms:

General Information

This section identifies the facility location, person conducting the inspection, the date and time the facility was inspected, and approximate days since the last rainfall. Property classification is identified as single-family residential, multi-family residential, commercial, or other.

The reason for the inspection is also identified on the form depending on the nature of the inspection. All facilities must be inspected on an annual basis at a minimum. In addition, all facilities should be inspected after a significant precipitation event to ensure the facility is draining appropriately and to identify any damage that occurred as a result of the increased runoff.

Inspection Scoring

For each inspection item, a score must be given to identify the urgency of required maintenance. The scoring is as follows:

- 0 = No deficiencies identified.
- 1 = Monitor – Although maintenance may not be required at this time, a potential problem exists that will most likely need to be addressed in the future. This can include items like minor erosion, concrete cracks/spalling, or minor sediment accumulation. This item should be revisited at the next inspection.
- 2 = Routine Maintenance Required – Some inspection items can be addressed through the routine maintenance program. This can include items like vegetation management or debris/trash removal.
- 3 = Immediate Repair Necessary – This item needs immediate attention because failure is imminent or has already occurred. This could include items such as structural failure of a feature (outlet works, forebay, etc), significant erosion, or significant sediment accumulation. This score

should be given to an item that can significantly affect the function of the facility.

N/A This is checked by an item that may not exist in a facility. Not all facilities have all of the features identified on the form (forebay, micro-pool, etc.).

Inspection Summary/Additional Comments

Additional explanations to inspection items, and observations about the facility not covered by the form, are recorded in this section.

Overall Facility Rating

An overall rating must be given for each facility inspected. The overall facility rating should correspond with the highest score (0, 1, 2, 3) given to any feature on the inspection form.

C. Verification of Inspection and Form Submittal

The Stormwater BMP Inspection Form provides a record of inspection of the facility. Inspection Forms for each facility type are provided in Appendix C. Verification of the inspection of the stormwater facilities and the facility inspection form(s) shall be provided to the City of Colorado Springs/Stormwater Team on an annual basis. The verification and the inspection form(s) shall be reviewed and submitted by the property owner or property manager on behalf of the property owner.

Refer to Section II of this Manual regarding the annual reporting of inspections.

VIII. Maintaining Stormwater BMPs

Stormwater BMPs must be properly maintained to ensure that they operate correctly and provide the water quality treatment for which they were designed. Routine maintenance performed on a frequently scheduled basis, can help avoid more costly rehabilitative maintenance that results when facilities are not adequately maintained.

A. Maintenance Categories

Stormwater BMP maintenance programs are separated into three broad categories of work. The categories are separated based upon the magnitude and type of the maintenance activities performed. A description of each category follows:

Routine Work

The majority of this work consists of scheduled mowings 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 City of Colorado Springs/Stormwater Team; however, inspection and maintenance forms shall be completed with the information also being reported on the annual report forms that are submitted to the City.

Restoration Work

This work consists of a variety of isolated or small-scale maintenance and work needed to address operational problems. Most of this work can be completed by a small crew, with minor tools, and small equipment. These items do not require prior correspondence with City of Colorado Springs/Stormwater Team, but do require that completed maintenance forms be submitted to City of Colorado Springs/Stormwater Team with the annual report forms.

Rehabilitation Work

This work consists of large-scale maintenance and major improvements needed to address failures within the stormwater BMP. This work requires consultation with City of Colorado Springs/Stormwater Team and may require an engineering design with construction plans to be prepared for review and approval by the City. This work may also require more specialized maintenance equipment, surveying, construction permits or assistance through private contractors and consultants. These items require prior correspondence with City of Colorado Springs/Stormwater Team and require that completed maintenance forms be submitted to City of Colorado Springs/Stormwater Team with the annual report forms.

B. Maintenance Personnel

Maintenance personnel should be qualified to properly maintain stormwater BMPs, especially for restoration or rehabilitation work. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs. Periodic training will be offered by the City of Colorado Springs/Stormwater Team (fees apply).

C. Maintenance Forms

The Stormwater BMP Maintenance Form provides a record of maintenance activities and includes general cost information to assist property owners in budgeting for future maintenance. Maintenance Forms for each facility type are provided in Appendix D. Maintenance Forms shall be completed by the property owner, management company, or contractor completing the required maintenance items. The form shall then be reviewed by the property owner or an authorized agent of the property owner and submitted on an annual basis by May 31st to the following address:

City of Colorado Springs/Stormwater Team
Attn: Ensure O&M Program Inspector
PO Box 1575, MC 520
Colorado Springs, CO 80901-1575

Refer to Section II of this Manual regarding the annual reporting of inspections and maintenance activities performed



Appendix B

Standard Operation Procedures for Inspection and Maintenance Extended Detention Basins (EDBs)

May 2008

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EDB-1 BACKGROUND

Extended Detention Basins (EDBs) are one of the most common types of Stormwater BMPs utilized within the Front Range of Colorado. An EDB is a sedimentation basin designed to “extend” the runoff detention time, but to drain completely dry sometime after stormwater runoff ends. The EDB’s drain time for the water quality portion of the facility is typically 40 hours. The basins are considered to be “dry” because the majority of the basin is designed not to have a significant permanent pool of water remaining between runoff events.

EDBs are an adaptation of a detention basin used for flood control, with the primary difference is the addition of forebays, micropools 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 concrete trickle channel and upper basin, the large grassy portion of the basin. The EDB uses a much smaller outlet that extends the emptying time of the more frequently occurring runoff events to facilitate pollutant removal. An EDB should have a small micropool just upstream of the outlet. This micropool is designed to hold a small amount of water to keep sediment and floatables from blocking the outlet orifices.

EDB-2 INSPECTING EXTENDED DETENTION BASINS (EDBs)

EDB-2.1 Access and Easements

Inspection or maintenance personnel may utilize the figures located in Appendix E containing the location(s) of the access points and potential maintenance easements of the EDB(s) within this development.

EDB-2.2 Stormwater Best Management Practice (BMP) Locations

Inspection or maintenance personnel may utilize the figures located in Appendix E containing the location(s) of the EDB(s) within this development.

EDB-2.3 Extended Detention Basin (EDB) Features

EDBs 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 (trickle channel, micropool, etc.). Therefore, it is critical that each feature of the EDB 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 EDB and the corresponding maintenance inspection items that can be anticipated:

**Table EDB-1
Typical Inspection & Maintenance Requirements Matrix**

EDB 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	X		X
Forebay	X		X			X	X
Low-flow channel	X		X	X	X		X
Bottom Stage	X	X	X	X	X	X	
Micropool	X		X		X	X	X
Outlet Works	X		X			X	X
Emergency Spillway			X	X	X		X
Upper Stage		X	X	X	X		
Embankment		X	X	X	X		

EDB-2.3.1 Inflow Points

Inflow Points or Outfalls into EDBs 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 EDB. 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 EDB 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 anytime 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 EDB 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.

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

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.

EDB-2.3.3 Trickle Channel (Low-Flow)

The trickle channel conveys stormwater from the forebay to the micro-pool of the EDB. The trickle channel is typically made of concrete. However, grass lined (riprap sides protected) is also common and can provide for an additional means of water quality within the EDB. The trickle channel is typically 6-9 inches in depth and can vary in width.

The typical maintenance items that are found with trickle channels are as follows:

a. Sediment/Debris Accumulation – Trickle channels are typically designed with a relatively flat slope that can promote sedimentation and the collection of debris. Also, if a trickle channel is grass lined it can accumulate sediment and debris at a much quicker rate. Routine removal of accumulated sediment and debris is essential in preventing flows from circumventing the trickle channel and affecting the dry storage portion of the pond.

b. Concrete/Riprap Damage – Concrete can crack, spall, and settle and must be repaired to ensure proper function of the trickle channel. Riprap can also shift over time and must be replaced/repared as necessary.

c. Woody Growth/Weeds Present – Because of the constant moisture in the area surrounding the trickle channel, woody growth (cottonwoods/willows) can become a problem. Trees and dense shrub type vegetation can affect the capacity of the trickle channel and can allow flows to circumvent the feature.

d. Erosion Outside of Channel – In larger precipitation events, the trickle channel capacity will likely be exceeded. This can result in erosion immediately adjacent to the trickle channel and must be repaired to prevent further damage to the structural components of the EDB.

EDB-2.3.4 Bottom Stage

The bottom stage is at least 1.0 to 2.0 feet deeper than the upper stage and is located in front of the outlet works structure. The bottom stage is designed to store the smaller runoff events, assists in keeping the majority of the basin bottom dry resulting in easier maintenance operations, and enhances the facilities pollutant removal capabilities. This area of the EDB may develop wetland vegetation.

The typical maintenance items that are found with the bottom stage 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 EDB. 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 EDB 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. Bank Erosion – The micro-pool is usually a couple feet deeper than the other areas of the ponds. Erosion can be caused by water dropping into the micro-pool if adequate protection/armor is not present. Erosion in this area must be mitigated to prevent sediment transport and other EDB feature damage.

d. 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.

e. Petroleum/Chemical Sheen – Many indicators of illicit discharges into the storm sewer systems will be present in the micro-pool area of the EDB. 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 EDB is necessary to minimize any environmental impacts downstream.

EDB-2.3.5 Micro-pool

The micro-pool is a concrete or grouted boulder walled structure directly in front of the outlet works. At a minimum, the micropool is 2.5 feet deep and is designed to hold water. The micro-pool is critical in the proper function of the EDB; 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 EDB. 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 EDB 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 EDB. 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 EDB is necessary to minimize any environmental impacts downstream.

EDB-2.3.6 Outlet Works

The outlet works is the feature that drains the EDB in specified quantities and periods of time. The outlet works is typically constructed of reinforced concrete into the embankment of the EDB. 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 EDB operation. Proper inspection and maintenance of the outlet works is essential in ensuring the long-term operation of the EDB.

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 EDB 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 City.

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 EDB. 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 EDB 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).

EDB-2.3.7 Emergency Spillway

An emergency spillway is typical of all EDBs 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 EDB, 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 long-term function of the spillway. Larger trees or dense shrubs can capture larger debris entering the EDB and reduce the capacity of the spillway.

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

EDB-2.3.8 Upper Stage (Dry Storage)

The upper stage of the EDB provides the majority of the water quality flood detention volume. This area of the EDB is higher than the micro-pool and typically stays dry, except during storm events. The upper stage is the largest feature/area of the basin. Sometimes, the upper stage can be utilized for park space and other uses in larger EDBs. With proper maintenance of the micro-pool and forebay(s), the upper stage should not experience much sedimentation; however, bottom elevations should be monitored to ensure adequate volume.

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 EDB, and therefore aesthetics is important. Adequate and properly maintained vegetation can greatly increase the overall appearance and acceptance of the EDB 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 EDB 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. Ground adjacent to the trickle channel appears to be several inches higher than concrete/riprap
2. Standing water or boggy areas in upper stage
3. Uneven grades or mounds
4. Micro-pool or Forebay has excessive amounts of sediment

e. Erosion (banks and bottom) – The bottom grades of the dry storage are typically flat enough that erosion should not occur. However, 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 micro-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 EDB outlet works.

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

EDB-2.3.9 Miscellaneous

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

a. Access – Access needs to be maintained.

b. Graffiti/Vandalism – Damage to the EDB infrastructure can be caused by vandals. If criminal mischief is evident, the inspector should forward this information to the local enforcement agency.

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, contact the local emergency services at 911 immediately!**

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

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

EDB-2.4 Inspection Forms

EDB Inspection forms are located in Appendix C. 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 City of Colorado Springs/Stormwater Team per the requirements of the Inspection and Maintenance Plan. These inspection forms shall be kept a minimum of 5 years and made available to the City of Colorado Springs/Stormwater Team upon request.

EDB-3 MAINTAINING EXTENDED DETENTION BASINS (EDBs)

EDB-3.1 Maintenance Personnel

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

EDB-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 EDB:

- 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 Mix)
- 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 Inspection and Maintenance Plan

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.

EDB-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 EDB that is greater than 48" in height, make the appropriate note/comment on the maintenance inspection form.

EDB-3.4 Maintenance Forms

The EDB 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 City of Colorado Springs/Stormwater Team per the requirements of the Inspection and Maintenance Plan. The EDB Maintenance form is located in Appendix D.

EDB-3.5 Maintenance Categories and Activities

A typical EDB Maintenance Program will consist of three broad categories of work: Routine, Restoration (minor), and Rehabilitation (major). Within each category of work, a variety of maintenance activities can be performed on an EDB. A maintenance activity can be specific to each feature within the EDB, 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 EDB.

A variety of maintenance activities are typical of EDBs. 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:

EDB-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 includes 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 City of Colorado Springs/Stormwater Team; however, completed inspection and maintenance forms shall be submitted to the City of Colorado Springs/Stormwater Team for each inspection and maintenance activity.

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

**TABLE – EDB-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 EDB	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/ Algal growth/green color	Treat w/ EPA approved chemicals

EDB-3.6.1 Mowing

Occasional mowing is necessary to limit unwanted vegetation and to improve the overall appearance of the EDB. 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.

EDB-3.6.2 Trash/Debris Removal

Trash and debris must be removed from the entire EDB 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.

EDB-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.

EDB-3.6.4 Weed Control

Noxious weeds and other unwanted vegetation must be treated as needed throughout the EDB. 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.

EDB-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.

EDB- 3.7 Restoration 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 do not require prior correspondence with City of Colorado Springs/Stormwater Team and require completed inspection and maintenance forms to be submitted to City of Colorado Springs/Stormwater Team for each inspection and maintenance activity.

**Table – EDB-3
Summary of Restoration 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

EDB-3.7.1 Sediment Removal

Sediment removal is necessary to maintain the original design volume of the EDB and to ensure proper function of the infrastructure. Regular sediment removal (minor) from the forebay, inflow(s), and trickle channel can significantly reduce the frequency of major sediment removal activities (dredging) in the upper and lower 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 City’s Engineering staff to ensure design volumes/grades are achieved.

Stormwater sediments removed from EDBs 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 trickle channel may be necessary as frequently as every 1-2 years.

EDB-3.7.2 Erosion Repair

The repair of eroded areas is necessary to ensure the proper function of the EDB, minimize sediment transport, and to reduce potential impacts to other features. Erosion can vary in magnitude from minor repairs to trickle channels, 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 City’s Engineering staff.

Frequency – Nonroutine – As necessary based upon inspections.

EDB-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 EDB. Tree roots can damage structures and invade pipes/channels thereby blocking flows. Also, trees growing in the upper and lower stages of the EDB 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 EDB or near structures (inflows, trickle channels, outlet works, emergency spillways, etc) should be removed. Any trees or woody vegetation in the EDB should be limited to the upper portions of the pond banks.

Frequency – Nonroutine – As necessary based upon inspections.

EDB-3.7.4 Clearing Drains/Jet-Vac

An EDB 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 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.

EDB-3.8 Rehabilitation Maintenance Activities

This work consists of larger maintenance/operational problems and failures within the stormwater management facilities. All of this work requires consultation with City's Engineering staff to ensure the proper maintenance is performed. This work requires that the engineering 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. Any proper permits required for this activity must be obtained.

**Table – EDB-4
Summary of Rehabilitation 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

EDB-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.

EDB-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.

EDB-3.8.3 Structural Repair

An EDB 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, trickle channels, 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 City's Engineering staff should take place prior to all structural repairs.

Frequency – Nonroutine – Repair as needed based upon inspections.



CITY OF COLORADO SPRINGS

EXTENDED DETENTION BASIN (EDB) MAINTENANCE FORM

Subdivision/Business Name: _____ Completion Date: _____

Subdivision/Business Address: _____ Contact Name: _____

Maintenance Category: (Circle All That Apply)	Routine	Restoration	Rehabilitation
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MAINTENANCE ACTIVITIES PERFORMED

ROUTINE WORK

- MOWING
- TRASH/DEBRIS REMOVAL
- OUTLET WORKS CLEANING (TRASH RACK/WELL SCREEN)
- WEED CONTROL (HERBICIDE APPLICATION)
- MOSQUITO TREATMENT
- ALGAE TREATMENT

RESTORATION WORK

- SEDIMENT REMOVAL
 - FOREBAY
 - TRICKLE CHANNEL
 - INFLOW
- EROSION REPAIR
 - INFLOW POINT
 - TRICKLE CHANNEL
- VEGETATION REMOVAL/TREE THINNING
 - INFLOW(S)
 - TRICKLE CHANNEL
 - UPPER STAGE
 - BOTTOM STAGE
- REVEGETATION
- JET-VAC/CLEARING DRAINS
 - FOREBAY
 - OUTLET WORKS
 - INFLOWS

REHABILITATION WORK

- SEDIMENT REMOVAL (DREDGING)
 - BOTTOM STAGE
 - UPPER STAGE
- EROSION REPAIR
 - OUTLET WORKS
 - UPPER STAGE
 - BOTTOM STAGE
 - SPILLWAY
- STRUCTURAL REPAIR
 - INFLOW
 - OUTLET WORKS
 - FOREBAY
 - TRICKLE CHANNEL

OTHER _____

ESTIMATED TOTAL MANHOURS: _____

COSTS INCURRED (include description of costs): _____

EQUIPMENT/MATERIAL USED (include hours of equipment usage and quantity of material used):

COMMENTS/ADDITIONAL INFO:

Appendix E: Annual Inspection and Maintenance Submittal Form



CITY OF COLORADO SPRINGS

Annual Inspection and Maintenance Reporting Form
for
Stormwater BMPs

(This form to be submitted to City of Colorado Springs prior to May 31 of each year)

Date: _____

To: City of Colorado Springs/Stormwater Team
Attn: Ensure Operations and Maintenance Program Inspector
PO Box 1575, MC 520
Colorado Springs, CO 80901-1575

Re: Certification of Inspection and Maintenance; Submittal of forms

Property/Subdivision Name: _____

Property Address: _____

Contact Name: _____

Contact Phone #: _____

Contact Email Address: _____

I verify that the required stormwater facility inspections and required maintenance have been completed in accordance with the Stormwater BMP Maintenance Agreement and the Inspection and Maintenance Manual associated with the above referenced property.

The required Stormwater Facility Inspection and Maintenance forms are attached to this form.

Name of Party Responsible for Inspection
& Maintenance

Property Owner

Authorized Signature

Signature

Appendix F

As-Built Plans (When Complete)

Appendix G

BMP Maintenance Cost Estimates (2007)

Routine maintenance costs can usually be predicted for an annual budget and may range from four percent of original capital construction costs per year for an EDB to nine percent of original capital costs per year for an infiltration BMP.

A general rule of thumb is that annual maintenance costs may run from \$100 per acre for minor maintenance, such as mowing, to \$500 per acre for more intensive maintenance including weed control, debris removal, etc.

Non-routine maintenance costs, however, can be substantial over the long run, especially when considering the possibility of eventual BMP replacement. To lessen the immediate financial impact of non-routine costs, it is advised that a BMP maintenance fund, with annual contributions, be established.

As an example, for EDBs, which need to have sediment removed once every two to ten years, ten to 50 percent of anticipated dredging costs should be collected annually. In addition, the average EDBs has a life expectancy of 20 to 50 years. A separate fund that collects two to five percent a year should be established for replacement. Anticipated interest may be used to offset the effects of inflation.

Type of BMP	Sediment Removal Frequency	Facility Life Span*
Retention Pond	5 to 15 years	20 to 50 years
EDB	2 to 10 years	20 to 50 years
Sand Filter	Every 6 months or as required	20 to 50 years
PLD	5 to 10 years	10 to 25 years
Grass Swale/Grass Buffer	As needed	10 to 25 years
Porous Paving	3 to 4 times per year	25 years

*Assumes the facility is maintained on a regular basis.

Estimating and Planning for Non-routine Costs for BMPs

Costs for non-routine maintenance of BMPs are highly specific and will vary depending upon:

- the type, size, and depth of the facility;
- the volume of the sediment trapped in the BMP;
- the accessibility of the BMP; and
- whether or not on-site disposal of the sediment is possible.

Retention Pond and EDB Sediment Removal

The technique used to remove sediment from a retention pond or EDB is very site-specific. The information below provides an estimate of costs associated with the dredging process.

🔥 Mobilization and Demobilization of Machinery

Associated Costs: \$1,000 to \$10,000

Large retention ponds or regional facilities will often require a waterborne operation during which an excavator or a crane must be mounted to a floating barge and moved into position. For smaller ponds, larger ponds that can be drained or dredged from the shore, and extended detention basins, a perimeter or dry operation will usually suffice. In this case, a backhoe, truck equipment, or crane may be used to scoop out the sediment. Additional costs for the construction and restoration of access roads for trucks and heavy equipment may be accrued.

🔥 Dredging

Associated Costs: \$10 per cubic yard to \$20 per cubic yard

The cost of dredging a BMP depends on the volume of sediment removed. The cost (expressed by cubic yard) is largely influenced by the depth of the water and the distance between the excavation area and the “staging area” where sediment is transferred to trucks for removal. Another consideration is whether equipment can easily access the BMP bottom. The following equation can be used to estimate the volume of sediment in cubic yards.

Equation to Estimate the Volume of Sediment in a BMP (in cubic yards)

$$\text{surface area} \text{ ______ (acres) } \times \text{depth of sediment} \text{ ______ (feet) } \times 43,560 = \text{ ______ cubic feet}$$
$$\text{cubic feet} \text{ ______ } / 27 = \text{ ______ cubic yards}$$

🔥 Disposal

Associated Costs: \$5 per cubic yard - on-site to \$47 per cubic yard - off-site

The primary determinant of disposal costs is whether on-site disposal is an option. If on-site disposal is not available, then locating a landfill or large area to apply the spoils may prove challenging and transportation costs may increase considerably. Dredged materials will require special disposal if found to contain hazardous materials.

Adding the likely costs of the sediment removal components establishes a range in which an owner can expect to pay for sediment/pollutant removal. For a facility with a small surface area (0.25 acres) overall costs can range from \$4,000 to \$10,000+. For a large facility (10 acres) overall costs can range from \$170,000 to \$550,000+.

	Maintenance	Annual Associated Cost
PLD	Removal of sediments and replacement of some level of soil is required periodically. Mulch should be replaced annually, or as needed.	Between \$1,500 and \$2,000, depending upon the size and complexity of the facility.
Grass Swale/ Grass Buffer	Remove sediments, replace check dams (usually made of earth, riprap, or wood), reseed or sod (if grassed) or replace dead plants, every two years.	
Porous Paving	Vacuum sediments from surface, twice a year.	Between \$500 and \$1,000, depending on the size of the facility.
Sand Filter	Remove the top filter cloth and remove/replace the filter gravel, when a semiannual inspection reveals that it is necessary. Remove and replace the filter cloth and gravel every three to five years.	Between \$3,000 to \$10,000, depending on the type and size of the sand filter and the amount of impervious surface draining to it.

If an oil sheen is present in the facility, it should be removed by a qualified oil recycler, which increases costs. Other expenses, such as removal of trash and hydrocarbons from water traps may also be required.

Removing sediment from stormwater facilities can be a considerable expense. Look for opportunities to reduce the amount of sediment entering the pond from the surrounding drainage area.

Reference: Information adapted from “Maintaining Stormwater Systems, A Guidebook for Private Owners and Operators in Northern Virginia”, January 2007, Northern Virginia Regional Commission

Appendix H

Civil Engineer

Stormwater Best Management Practice (permanent) Certification Letter

(date)

City of Colorado Springs
City Engineering Division, Stormwater Enterprise
30 S. Nevada Avenue, Suite 502
PO Box 1575, MC 520
Colorado Springs, CO 80901-1575

Attn.: Lisa Ross, P.E.
Stormwater Engineering Interim Manager

Gentlemen:

The permanent stormwater Best Management Practices (BMPs) for *(Name of project & Subdivision Name (required) & address)* consist of *(description of the BMPs, e.g., type, WQCV, drainage area, etc.)*. *(Name of Civil Engineering Firm)* has reviewed the attached letter(s) from *(Name of Geotechnical Engineering Firm)* and from *(Name(s) Landscape Architect Firm and/or Other Involved Firms)*, as appropriate. Based upon this information and information gathered during periodic site visits to the project during significant/key phases of the stormwater BMP installation, *(Name of Engineering Firm)* is of the opinion that the stormwater BMPs have been constructed in general compliance with the approved Erosion and Stormwater Quality Control Plan, Construction Plans, and Specifications as filed with the City.

Statement Of Engineer In Responsible Charge:

I, _____ *(print name)*, a registered Professional Engineer in the State of Colorado, in accordance with Sections 5.2 and 5.3 of the Bylaws and Rules of the State Board of Registration for Professional Engineers and Professional Land Surveyors, do hereby certify that I or a person under my responsible charge periodically observed the construction of the above mentioned project. Based on the on-site field observations and review of pertinent documentation, it is my professional opinion that the required permanent BMPs have been installed and are in general compliance with the approved Erosion and Stormwater Quality Control Plan, Construction Plans, and Specifications as filed with the City of Colorado Springs. For BMPs with a Water Quality Capture Volume (WQCV), I have attached the post-construction As-Built drawings. The As-Built drawings accurately depict the final installation of the stormwater BMPs and verify the WQCV.

(Name of Engineer, P.E.)
Colorado No. XXXXX

Seal & Signature of P.E. Goes Here



Badger Hydrovac Service Proposal

United States

Prepared By:	Andrew Bruce
Email:	abruce@badgerinc.com
Date	2022/04/22



Badger Daylighting Corp
 2020 E. Kiowa Street
 Colorado Springs, CO 80909
 "An equal opportunity employer"

ESTIMATE	
DATE:	2022/04/22
Reference #:	QT-042222-97899
PREPARED BY:	Andrew Bruce

Customer Information			
Company:	THE EQUITY GROUP	Contact Name	Jeff Evans
Contact Phone #	(719) 669-9135	E-mail:	jeff@theequitygroup.net
Billing Address:		Title:	Construction Manager
Bill City/State		Account #	11111295
Service Address	E CHEYENNE RD & E SAINT ELMO AVE, Colorado Springs, CO, 80906		

Scope of Work
CCTV inspections twice a year. Flushing as needed.

Service Item	Item Description	Price	UOM	Qty	Amount
Badger Flusher With Operator		\$ 250.00	HR	8	\$ 2,000.00
Badger Flusher With Operator Overtime		\$ 275.00	HR	4	\$ 1,100.00
CCTV CAMERA UNIT 2 MAN CREW		\$ 250.00	HR	8	\$ 2,000.00
CCTV CAMERA UNIT 2 MAN CREW OVERTIME		\$ 275.00	HR	4	\$ 1,100.00
Consumable Materials		\$ 22.48	EA	1	\$ 22.48
Supply Water		\$ 55.00	EA	2	\$ 110.00
Fluctuating Fuel Recovery					\$ 733.93
Total:					\$ 7,066.41

*This proposal contains the budgetary estimate to complete the work as described above under the heading "Scope of Work".
 If any part of the work varies from that described in Scope of Work, or if unexpected digging conditions are encountered (eg rocks, rubble, roots, etc...), then additional charges shall apply. All work will be done on a time and material basis. All work will be done in accordance with the terms and conditions contained in Badger Daylighting Corp.'s standard terms and conditions (USA) attached hereto.*

Company: _____
 Name (please print): _____
 Signature: _____
I am authorized to bind the Company

PO#: _____
 Title: _____
 Date: _____



General Notes, Conditions, & Badger Responsibilities:

1. Travel rates apply when traveling from the closest Badger Operation to the client's project site.
2. Badger will off load material at contracted facility. Travel to and from a designated facility is considered part of the work day and charged at the hourly rate.
3. Any additional third party services provided by Badger Daylighting outside of our typical Hydrovac activities shall be charged out at cost + .
4. With any Hydrovac project, there are possible additional charges that are application and site specific. For example, items such as water trucks, specialized equipment and attachments (remote hose, etc.), crew trucks, and other items may be required. Rather than provide an extensive listing of all possible considerations, this is best implemented on a project-by-project basis and evaluated at the field operations level. The information presented in this document represents the complete proposal.
5. This proposal is valid for 30 days from the date posted on this proposal document.
6. Any and all quotes, offers and transactions are pending Credit Approval by Badger.
7. Terms of Payment - Net 30 days from date of invoice. Late invoices are subject to service fees.
8. Zero (0) % retainage is withheld
9. Taxes – tax will be added to quote pricing as required by State/Local governments.
10. All invoices will be assessed a Fluctuating Fuel Recover Fee on the entire amount of the invoice. This fee is reviewed regularly and is subject to change. Badger utilizes information from the US Department of Energy and the Canadian Department of Natural Resources when calculating the fee.

Client responsibilities include:

1. Access to the Hydrovac site, including permits and permission from property owners, utilities, and government agents.
2. Surface locates, survey marks and traffic control, if needed unless agreed to in writing prior.
3. Breaking, removal, and restoration of asphalt and or concrete unless agreed to in writing prior.
4. Establish, maintain and remediate accessible water source and disposal site.
5. Specific direction and locations for Hydrovac excavation.
6. Backfill and site restoration unless agreed to in writing prior to completing work.
7. Materials to secure and cover the excavation unless agreed to in writing prior.
8. Shoring, maintenance and barricading.
9. Ownership of the soil and debris removed by the Hydrovac including any soils or material contaminated or suspect.
10. Any project delays caused by others that result in downtime of Badger Hydrovac units will be billed at the hourly rates.
11. Pay for all specialized training that is required by contractor/owner/Badger to be on the site to work.
12. Notify Badger of all billing requirements and any appropriate purchase orders, job numbers, AFE, etc. that would be necessary to release payment to Badger. This must be done prior to the first day of work.
13. Notify Badger of any of the following: Certified payrolls, OCIP requirements, prevailing wages.
14. Additional insurance requirements over what Badger already has in place.

Client Representative

Printed Name: _____

Signature: _____

Date: _____

I am authorized to bind the Company

Badger Representative

Printed Name: _____

Signature: _____

Date: _____



BADGER DAYLIGHTING CORP. STANDARD TERMS AND CONDITIONS (USA)

1. Definitions. "Service Provider" shall mean Badger Daylighting Corp. "Buyer" shall mean any party who contracts to purchase Services from Service Provider, as indicated on a service agreement or a statement of work. "Services" shall mean those services and any related goods ordered by Buyer from Service Provider pursuant to a service agreement accepted by Service Provider. "Credit Application" shall mean Service Provider's form of credit application, as may be amended from time to time, the review and written approval of which is a pre-requisite to Service Provider entering into any type of binding agreement with Buyer to provide Services. "USA" shall mean the United States of America.

2. Terms of Service Agreement Acceptance and Complete Agreement

(a) Acceptance. Buyer's order for Services is binding only when accepted in writing by an authorized representative of Service Provider, and is accepted subject to all of Service Provider's Standard Terms and Conditions of Services, which constitute the complete agreement between the parties. Buyer's acceptance of delivery and performance of Services evidences Buyer's acceptance of all of Service Provider's Standard Terms and Conditions of Services.

(b) No Acceptance. Service Provider's performance under any Buyer service agreement or a statement of work does not constitute an acceptance of any provision of any Buyer service agreement that is different from or additional to Service Provider's Standard Terms and Conditions of Services, and any such different or additional provisions are hereby expressly rejected and are void.

3. Buyer's Obligations.

(a) Services. Buyer shall: (i) cooperate with Service Provider in all matters relating to Services and provide such access to Buyer's premises, and other facilities as may reasonably be requested by Service Provider, for the purposes of performing Services; (ii) respond promptly to any Service Provider request to provide direction, information, approvals, authorizations or decisions that are reasonably necessary for Service Provider to perform Services in accordance with the requirements of the service agreement; (iii) provide such Buyer materials or information as Service Provider may reasonably request and Buyer considers reasonably necessary to carry out Services in a timely manner and ensure that such Buyer materials or information are complete and accurate in all material respects; and (iv) obtain and maintain all necessary permits and consents and comply with all applicable laws in relation to Services before the date on which Services are to start.

(b) Shipment and Delivery. Any goods provided in relation to the Services are sold EXW Service Provider's Facility Incoterms 2010. The method and route of shipment shall be as mutually agreed in each accepted service agreement. Service Provider shall tender delivery of all such related goods to a carrier for transportation to Buyer's place of business. All costs of transportation, including, without limitation, taxes and standard insurance shall be assessed by Service Provider and borne by Buyer unless otherwise agreed to in writing by Service Provider. Service Provider shall invoice Buyer for all shipping related costs.

All risk of loss shall pass to Buyer when such related goods are made available to the carrier at Service Provider's facility, including, without limitation, all risks of loading, transportation, and shipment. Delivery and acceptance shall not be affected by a delay on the part of Buyer in accepting delivery. Shipment of such related goods held by reason of Buyer's request or inability to receive such related goods will be at the risk and expense of Buyer. Claims for shortages in shipment shall be deemed waived by Buyer unless made in writing to Seller within thirty (30) days from the date of invoice.

4. Buyer's Acts or Omissions. If Service Provider's performance of its obligations under this Agreement is prevented or delayed by any act or omission of Buyer or its agents, subcontractors, consultants or employees, Service Provider shall not be deemed in breach of its obligations under the service agreement or otherwise liable for any costs, charges or losses sustained or incurred by Buyer, in each case, to the extent arising directly or indirectly from such prevention or delay. breach of its obligations under the service agreement or otherwise liable for any costs, charges or losses sustained or incurred by Buyer, in each case, to the extent arising directly or indirectly from such prevention or delay.

5. Taxes and Fees. Unless expressly stated and agreed to in writing by Service Provider, quoted prices do not include any shipping and handling charges, sales, use, excise, or similar taxes or duties. Buyer shall pay these taxes directly if the law permits or shall reimburse Service Provider if Service Provider is required to collect and pay them.

6. Representations and Warranties; Limitation of Remedy.

(a) Service Provider represents and warrants to Buyer that it shall perform Services using personnel of required skill, experience and qualifications and in a professional and workmanlike manner in accordance with generally recognized industry standards for similar services and shall devote adequate resources to meet its obligations under the service agreement.

(b) Service Provider shall not be liable to a breach of the warranty set forth in Section 6(a) unless Buyer gives written notice of the defective Services, reasonably described, to Service Provider with three (3) days of the time when Buyer discovers or ought to have discovered that Services were defective.

(c) The sole and exclusive remedy of Buyer for any liability of Service Provider of any kind, including (i) warranty, express or implied, whether contained in the terms and conditions hereof or in any terms additional or supplemental hereto, (ii) contract, (iii) negligence, (iv) tort, or (v) otherwise, is limited to Service Provider's repair or re-performance of Services. The sole and exclusive remedy for goods related to Services shall be Service Provider's repair or replacement of those related goods the examination of which by Service Provider reveals material defects during the warranty period or, at Service Provider's option, a refund to Buyer of the money paid to Services Provider for such goods. The warranty period shall begin on the date of completion of Services on Service Provider's invoice and shall continue for a period of one (1) year therefrom for all Services. This limited warranty shall not extend to any Services that have been modified, disassembled, altered, changed, damaged, misused, repaired, misapplied or negligently maintained in any manner.

(d) EXCEPT FOR THE EXPRESS LIMITED WARRANTY SET FORTH IN SECTION 6(a) ABOVE, SERVICE PROVIDER MAKES NO WARRANTY WHATSOEVER WITH RESPECT TO SERVICES, EXPRESS OR IMPLIED, INCLUDING ANY (i) WARRANTY OF MERCHANTABILITY; OR (ii) WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE; OR (iii) WARRANTY OF TITLE; OR (iv) WARRANTY AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY; WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE.

Continued...



7. Limitation of Liability.

(a) SERVICE PROVIDER'S LIABILITY SHALL BE LIMITED TO THE COST OF REPAIR AND RE-PERFORMANCE OF SERVICES WITHIN A REASONABLE PERIOD OF TIME FOLLOWING PROPER AND TIMELY NOTICE BY BUYER. IN NO EVENT SHALL SERVICE PROVIDER BE LIABLE TO BUYER OR TO ANY THIRD PARTY FOR ANY LOSS OF USE, REVENUE, OR PROFIT; OR FOR ANY CONSEQUENTIAL, INCIDENTAL, INDIRECT, EXEMPLARY, SPECIAL OR PUNITIVE DAMAGES WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR OTHERWISE, REGARDLESS OF WHETHER SUCH DAMAGES WERE FORESEEABLE AND WHETHER OR NOT SERVICE PROVIDER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, AND NOTWITHSTANDING THE FAILURE OF ANY AGREED OR OTHER ESSENTIAL PURPOSE. IN NO EVENT SHALL SERVICE PROVIDER'S AGGREGATE

LIABILITY ARISING OUT OF OR RELATED TO THE SERVICE AGREEMENT, WHETHER ARISING OUT OF OR RELATED TO BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE) OR

OTHERWISE, EXCEED THE AGGREGATE AMOUNTS PAID OR PAYABLE TO SERVICE PROVIDER. Buyer agrees to indemnify and hold Service Provider harmless from and against all liabilities, claims, or demands of third parties of any kind relating to Services and the use of any related goods arising after performance of Services.

(b) The limitation of liability set forth in Section 7(a) above shall not apply to (i) liability resulting from Service Provider's gross negligence or willful misconduct and (ii) death or bodily injury resulting from Service Provider's negligent acts or omissions.

8. Rejection or Claims. A rejection of Services for non-conformity, or a claim of incomplete performance and/or damage by Buyer, shall not be effective unless it is made, and written notice thereof is given to Service Provider, within thirty (30) days after Services are provided to Buyer; or, with respect to any goods related to Services, within thirty (30) days after such related goods arrive at the destination specified in Service Provider's statement of work. Service Provider reserves the right to inspect the site of supposed non-conforming Services and to determine lack of conformity in its sole discretion.

9. Performance Dates. Service Provider shall use reasonable efforts to meet any performance dates specified in the service agreement, and any such dates shall be estimates only.

10. Failure to Take Delivery. If Buyer fails to take delivery of any goods related to Services, or any part thereof, such related goods not delivered shall be held at Buyer's sole risk in all respects. Service Provider, acting as Buyer's agent and at Buyer's expense, may thereafter store, insure and/or otherwise protect such related goods or may resell same for Buyer's account. The delivery date(s) quoted are based on Service Provider's best estimate of a realistic time when delivery to the carrier will be made, and are subject to confirmation at time of acceptance of any resulting Service Agreement. Service Provider reserves the right to make either early delivery or partial delivery upon prior notice to Buyer as provided in Section 23 hereof and to invoice Buyer accordingly.

11. Title and Risk of Loss or Damage. Title, risk of loss and/or damage shall pass to Buyer when any goods related to Services are made available to the carrier at Service Provider's facility.

12. Payment Terms.

All payments are due thirty (30) days from date of invoice in U.S. Dollars, unless otherwise specified by Service Provider. Buyer's failure to make payment when due will be a material breach of the service agreement and these Standard Terms and Conditions of Services. Subject to applicable law, amounts unpaid after such date may, at Service Provider's discretion, bear interest from the date of the invoice at a rate of one and one-half percent (1.5%) per month, or eighteen percent (18%) per annum. Service Provider shall be entitled to reimbursement from Buyer for all costs and fees, including reasonable attorneys' fees, incurred by Service Provider in the collection of any overdue amounts. Service Provider, at its sole option and without incurring any liability, may suspend its performance of Services until such time as any overdue payment is made or Service Provider receives assurances, adequate in Service Provider's opinion, that the payment will be promptly made. In the event of such suspension of performance of Services by Service Provider, there will be an equitable adjustment made to the remaining performance schedule and pricing to reflect the duration and cost resulting from such suspension. Buyer may only suspend performance upon Service Provider's written consent. In the event of such Buyer suspension, the performance time will be changed, taking into account the suspension, and Buyer will promptly pay Service Provider for all costs, including related overhead costs, resulting from such suspension. All terms of the Credit Application are incorporated into and are part of this Agreement.

13. Cancellation. Except as otherwise expressly provided in a statement of work, the service agreement shall be cancelled only by mutual written consent of the parties. Notice is hereby given that Service Provider shall not consent to cancellation if Buyer has bound itself to purchase Services. If Buyer is in default by failure to pay any previous invoice within credit terms at the expected date of performance of Services or any part thereof, has not otherwise performed or complied with any of the terms of the service agreement, in whole or in part, or becomes insolvent, files a petition for bankruptcy or commences or has commenced against it proceedings relating to bankruptcy, receivership, reorganization or assignment for the benefit of creditors, or if Service Provider has received any adverse credit information about Buyer, Service Provider may delay performance and/or cancel performance of Services without liability. In the event of U.S. or foreign government intervention, trade restrictions, and/or quotas, which may delay or prevent performance of Services or any part thereof, Service Provider, at Service Provider's option, may cancel the performance of Services without liability. In the event any Services shall become subject to any governmental fees or duties not presently in effect or to any increase in any existing fee or duty, including any antidumping duty or countervailing duty, Service Provider shall have the right to cancel performance of Services without liability.

14. Default. If Buyer breaches or is otherwise in default under the service agreement or under any other contract between the parties hereto, Service Provider at its sole option, may defer performance of Services until the default is cured, or may treat the default as a repudiation by Buyer of the service agreement in its entirety, and hold Buyer liable for such damages as Service Provider may incur, including consequential and incidental damages. For purposes hereof, Buyer's insolvency shall be a default.

15. Waiver. No waiver by Service Provider of any of the provisions of the service agreement is effective unless explicitly set forth in writing and signed by Service Provider. No failure to exercise, or delay in exercising, any rights, remedy, power or privilege arising from the service agreement operates or may be construed as a waiver thereof. No single or partial exercise of any right, remedy, power or privilege hereunder precludes any other or further exercise thereof or the exercise of any other right, remedy, power or privilege.

Continued...



16. Force Majeure. Service Provider shall be free from any liability for delay or failure in performance of Services arising from strikes, lockouts, labor troubles of any kind, accidents, perils of the sea, fire, earthquake, civil commotion, terrorist acts, war or consequences of war, government acts, restrictions or requisitions, failure of manufacturers or suppliers to deliver, bankruptcy or insolvency of manufacturers or suppliers, suspension of shipping facilities, act or default of carrier or any other contingency of whatsoever nature beyond Service Provider's control affecting production and performance of Services, including disturbances existing on the date of the service agreement or a statement of work. In such a situation, if performance is not made during the period contracted for, Buyer shall accept performance under the service agreement when performance is made; provided, however, Buyer shall not be obligated to accept performance if performance is not made within a reasonable time after the cessation of the aforementioned impediments or causes.

17. Intellectual Property. All the designs, know-how, innovations, inventions and discoveries related to Services provided under this transaction shall be and remain the property of Service Provider.

18. Confidential Information.

(a) All non-public, confidential or proprietary information of Service Provider, including, but not limited to, trade secrets, technology, information pertaining to business operations and strategies, and information pertaining to customers, pricing, and marketing (collectively, the "Confidential Information"), disclosed by Service Provider to Buyer, whether disclosed orally or disclosed or accessed in written, electronic or other form or media, and whether or not marked, designated or otherwise identified as "confidential," in connection with the provision of Services and the service agreement is confidential, and shall not be disclosed or copied by Buyer without the prior written consent of Service Provider. Confidential Information does not include information that is (i) in the public domain; (ii) known to Buyer at the time of the disclosure; or (iii) rightfully obtained by Buyer on a non-confidential basis from a third party.

(b) Buyer agrees to use the Confidential Information only to make use of Services, and deliverables.

(c) Service Provider shall be entitled to injunctive relief for any violation of this Section.

19. Integration. The service agreement, these Standard Terms and Conditions of Services, and a statement of work supersede all prior negotiations, representations, agreements, quotes and catalogues, whether written or oral, and shall not be modified, supplemented or interpreted by evidence of course of dealing, course of performance or usage of trade. To the extent the provisions hereof conflict with any prior or subsequent agreement of the parties, these Standard Terms and Conditions of Services will control. Any amendment to these Standard Terms and Conditions of Services must be in writing and signed by both parties.

20. Assignment. Buyer acknowledges that no service agreement or statement of work, nor the obligations represented thereby, may be assigned or delegated, in whole or in part by Buyer, without the prior written consent of Service Provider. Buyer's unauthorized attempt to assign or delegate any rights or obligations shall serve as grounds for termination of the service agreement.

21. Severability. Service Provider and Buyer agree that each and every paragraph, sentence, clause, term and provision of these Standard Terms and Conditions of Services is severable and that, in the event any portion hereof is adjudged to be invalid or unenforceable, the remaining portions shall remain in full force and effect to the fullest extent permitted by law.

22. Relationship of the Parties. The relationship between the parties is that of independent contractors. Nothing contained in these Standard Terms and Conditions of Services or the service agreement shall be construed as creating any agency, partnership, joint venture or other form of joint enterprise, employment or fiduciary relationship between the parties; and neither party shall have authority to contract for or bind the other party in any manner whatsoever.

23. Notices. All notices, requests, consents, claims, demands, waivers and other communications hereunder (each, a "Notice") shall be in writing and addressed to the parties at the addresses set forth in the service agreement or to such other address that may be designated by the receiving party in writing. All Notices shall be delivered by personal delivery, nationally recognized overnight courier (with all fees prepaid), facsimile (with confirmation of transmission) or certified or registered mail (in each case, return receipt requested, postage prepaid). Except as otherwise provided in the service agreement, a Notice is effective only (a) upon receipt of the receiving party, and (b) if the party giving the Notice has complied with the requirements of this Section.

24. Governing Law; Venue. All matters involving the validity, interpretation and application of these Standard Terms and Conditions of Services will be controlled by the laws of the State of Indiana, United States of America and Buyer and Service Provider hereby irrevocably consent to the jurisdiction of the state and federal courts located in Marion County, Indiana for the resolution of any disputes arising under these Standard Terms and Conditions of Services and the service agreement.

25. Collection, Use and Disclosure of Information.

Notwithstanding section 18, by submitting an application for the Services, Buyer consents to and authorizes Service Provider and its service providers to use the personal information, confidential information, financial information and other details (collectively "Information") about Buyer that Buyer has provided to:

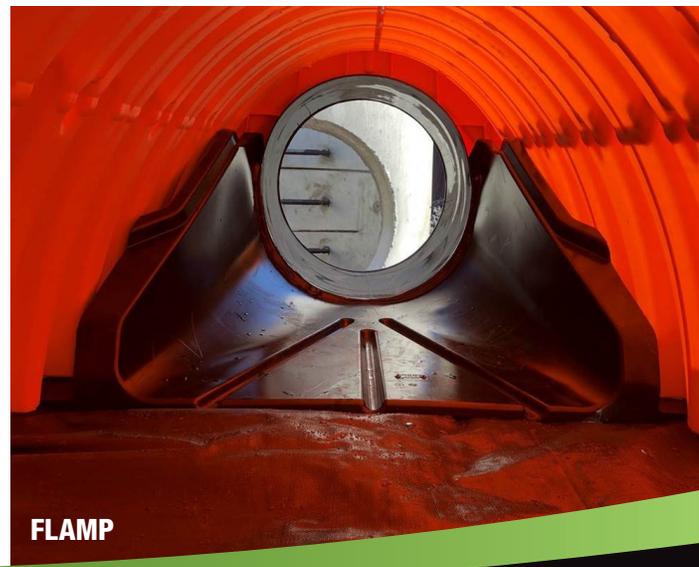
- (a) Exchange Information and reports about Buyer with credit reporting agencies, credit reporting services including Creditsafe USA Inc., and other lenders (collectively "Credit Agencies") prior to the commencement of Services for the purposes of Service Provider providing credit to Buyer, including in the form of an outstanding receivable with the Service Provider for Services to be performed pursuant to these Service Provider's Standard Terms and Conditions of Services;
- (b) Conduct, or arrange for a Credit Agency to conduct, "soft" or "hard" credit checks from time to time for up to one year after Buyer submits an application and Service Provider exchanges Information with Credit Agencies;
- (c) Conduct, or arrange for third parties to conduct, risk assessments and identity and payment verification checks from time to time;
- (d) Assess Buyer's application for the Services based on the results of the credit, risk assessment, and identity and payment verification checks;
- (e) Periodically review and verify Buyer creditworthiness, establish credit and hold limits, help Service Provider collect a debt or enforce an obligation owed to Service Provider by Buyer, and/or manage and assess risk; and
- (f) Issue a decision to grant or deny Buyer's application for credit.

Service Provider shall determine in its sole discretion whether to grant any credit to Buyer and, if so, the amount of any such credit. Service Provider has no obligation to grant any credit, and any granting of credit is without commitment to provide any future credit. Buyer shall be responsible for all credit it receives from Service Provider, whether or not such credit exceeds authorized credit limits. In the event that Service Provider grants credit to Buyer and for a reasonable period of time afterwards, Service Provider may from time to time disclose Buyer's Information to other lenders and credit reporting agencies requesting such Information. Service Provider may obtain Information and reports about Buyer from third party providers such as Creditsafe USA Inc., and other Credit Agencies. Once Buyer has applied for credit with Service Provider, Buyer may not withdraw their consent to this exchange of Information.

For more information about the Service Provider's privacy policy and our collection and use of personal information, please see: <https://www.badgerinc.com/learn-about-badger/privacy-antispam-web-policy/>.

End

Isolator[®] Row PLUS O&M Manual



THE ISOLATOR® ROW PLUS

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row PLUS is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

THE ISOLATOR ROW PLUS

The Isolator Row PLUS is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row PLUS and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row PLUS protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row PLUS chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row PLUS is designed to capture the “first flush” runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator Row PLUS but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row PLUS bypass through a manifold to the other chambers. This is achieved with either an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row PLUS row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row PLUS. After Stormwater flows through the Isolator Row PLUS and into the rest of the StormTech chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus that is attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by enhancing outflow of solid debris that would otherwise collect at an end of the chamber. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row PLUS may be part of a treatment train system. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row PLUS is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

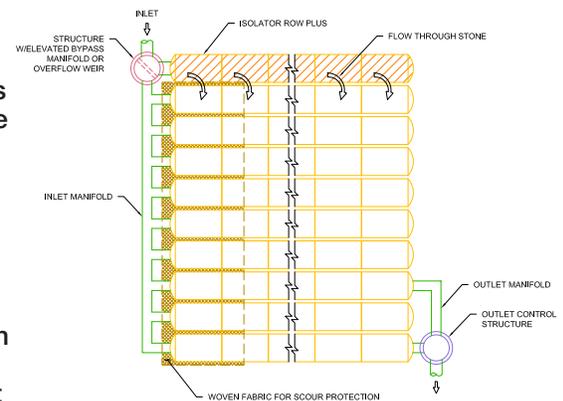
Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row PLUS.



Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.



StormTech Isolator Row PLUS with Overflow Spillway (not to scale)





ISOLATOR ROW PLUS INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row PLUS should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row PLUS incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row PLUS, clean-out should be performed.

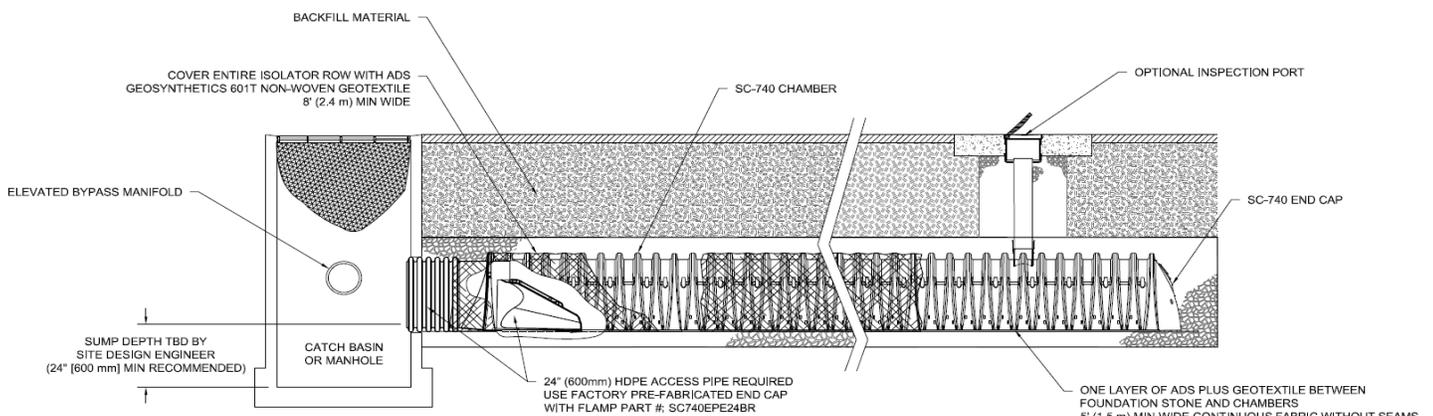
MAINTENANCE

The Isolator Row PLUS was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row PLUS while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45° are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row PLUS up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Row PLUS that have ADS PLUS Fabric (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row PLUS (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row PLUS.



ISOLATOR ROW PLUS STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row PLUS for sediment.

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Row PLUS
 - i. Remove cover from manhole at upstream end of Isolator Row PLUS
 - ii. Using a flashlight, inspect down Isolator Row PLUS through outlet pipe
 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 2. Follow OSHA regulations for confined space entry if entering manhole
 - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row PLUS using the JetVac process.

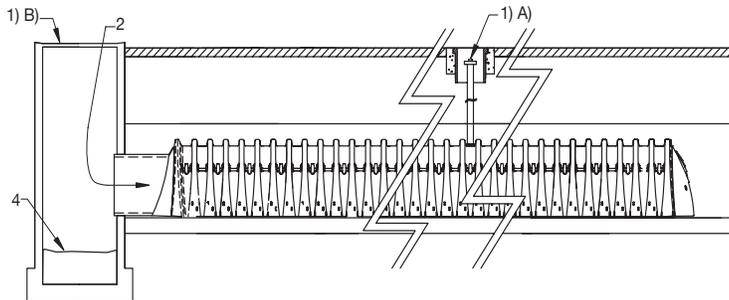
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3

Replace all caps, lids and covers, record observations and actions.

STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)-(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

BaySaver[®] Separation System Maintenance Manual



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1302 Rising Ridge Rd. Unit 1 • Mount Airy, Maryland 21771

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BaySeparator System Maintenance Manual

One of the advantages of the BaySaver Separation Systems is the ease of maintenance. Like any system that collects pollutants, the BaySaver Separation Systems must be maintained for continued effectiveness. Maintenance is a simple procedure performed using a vacuum truck or similar equipment. The systems were designed to minimize the volume of water removed during routine maintenance, reducing disposal costs.

Contractors can access the pollutants stored in the manholes through two 30" manhole covers. This allows them to gain unobstructed access to the bottom of the manholes. There is no confined space entry necessary for inspection or maintenance.

Vacuum hoses can reach the entire sump area of both manholes to remove sediments and trash. The entire maintenance procedure typically takes from 2 to 4 hours, depending on the size of the system and the capacity of the vacuum truck.

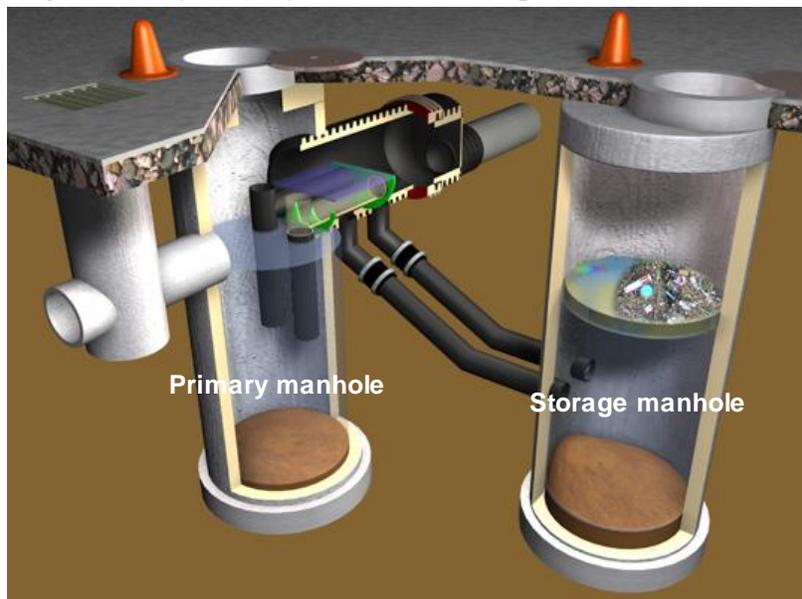
Local regulations may apply to the maintenance procedure. Safe and legal disposal of pollutants is the responsibility of the maintenance contractor. Maintenance should be performed only by a qualified contractor.

Inspection and Cleaning Cycle

Periodic inspection is needed to determine the need for and frequency of maintenance. You should begin inspecting as soon as construction is complete and thereafter on a quarterly basis. Typically, the system needs to be cleaned every 12 months.

The cycle may be less than 12 months if there is a chance that excessive oils, fuels or sediments will accumulate. That is why periodic inspection is important.

Figure 1: BaySaver System with stored pollutants in manholes



BaySeparator System Maintenance Manual

Determining When to Clean

The system needs to be cleaned when 2 feet (0.6 meters) of sediment is accumulated at the bottom of either structure or when visual inspection shows a large accumulation of debris or oil.

Measuring Sediment Depth

You can determine the sediment depth by lowering a pole into the manhole until it hits the sediment and measuring the distance from the bottom of the pole to the water line mark on the pole. If this is less than 6 feet (1.8 meters), the system needs to be cleaned.

Summary

- You can access the pollutants through the 2 manhole covers.
- You can see the entire floor/sump area of each manhole from the surface.
- There is no confined space entry for inspection or maintenance.
- During maintenance, you can transfer water from the primary to the storage manhole, minimizing the amount of water for disposal.

Finding Information

- For the **manhole capacities** for the BaySaver models, **American standards**, see page 3.
- For the **manhole capacities** for the BaySaver models, **metric standards**, see page 4.
- For the **maintenance procedure**, see page 6.
- To see an **animated maintenance procedure**, visit our web site at www.baysaver.com.

Figure 2: Storage manhole with floating debris and oils



BaySeparator System Maintenance Manual

**Table 1: BaySaver Separation System Manhole Storage Capacities
(American Standards)**

BaySeparator Manhole Size	Total System Capacity	Sediment Capacity	Floatable Capacity
Inches	Gallons / (ft ³)	Yards ³ / (ft ³)	Gallons / (ft ³)
1/2 K			
48 x 48	1128 / (151)	1.40 / (38)	226 / (30)
48 x 60	1445 / (193)	1.79 / (48)	353 / (47)
48 x 72	1833 / (245)	2.27 / (61)	509 / (68)
1K			
48 x 48	1504 / (201)	1.86 / (50)	320 / (43)
48 x 60	1927 / (258)	2.39 / (64)	500 / (67)
48 x 72	2444 / (327)	3.03 / (82)	720 / (96)
3K			
60 x 60	2350 / (314)	2.90 / (79)	456 / (61)
60 x 72	2867 / (383)	3.55 / (96)	657 / (88)
60 x 84	3478 / (465)	4.30 / (116)	894 / (119)
5K			
72 x 72	3384 / (452)	4.19 / (113)	621 / (83)
72 x 84	3995 / (534)	4.93 / (134)	846 / (113)
72 x 96	4700 / (628)	5.82 / (157)	1105 / (148)
84 x 96	5311 / (710)	6.57 / (177)	1105 / (148)
10K			
120 x 120	9400 / (1257)	11.64 / (314)	1567 / (209)

BaySeparator System Maintenance Manual

Table 2: BaySaver Separation System Manhole Storage Capacities (Metric Standards)

BaySaver Separation System Size	Total System Capacity	Sediment Capacity	Floatable Capacity
Millimeters	(m ³)	(m ³)	(m ³)
1/2 K			
1219.2 x 1219.2	4.27	1.07	0.86
1219.2 x 1524.0	5.47	1.37	1.34
1219.2 x 1828.8	6.94	1.73	1.93
1K			
1219.2 x 1219.2	5.69	1.42	1.21
1219.2 x 1524.0	7.29	1.82	1.89
1219.2 x 1828.8	9.23	2.31	2.73
3K			
1524.0 x 1524.0	8.90	2.22	1.73
1524.0 x 1828.8	10.85	2.71	2.49
1524.0 x 2133.6	13.17	3.29	3.38
5K			
1828.8 x 1828.8	12.81	3.20	2.35
1828.8 x 2133.6	15.12	3.78	3.20
1828.8 x 2438.4	17.78	4.45	4.18
2133.6 x 2438.4	20.10	5.03	4.18
10K			
3048.0 x 3048.0	35.57	8.89	5.93

BaySeparator System Maintenance Manual

Figure 3: Storage manhole containing diesel fuel before pollutant removal:



Figure 4: Primary manhole with BaySaver unit after pollutant removal



BaySeparator System Maintenance Manual

Maintenance Instructions

Note: For each BaySaver System, there are 2 manholes to clean: the **primary manhole** and **storage manhole**.

1. Remove the manhole covers to provide access to the pollutant storage.
2. **Storage manhole:** Use a vacuum truck or other similar equipment to remove all water, debris, oils and sediment.
3. **Storage manhole:** Use a high pressure hose to clean the manhole of all the remaining sediment and debris. Then, use the vacuum truck to remove the water.
4. **Primary manhole:** Use a submersible pump to pump the bulk of the water from the primary manhole into the clean storage manhole:
 - a. Keep the pump intake below the water surface.
 - b. Stop pumping when the water surface is one (1) foot above the accumulated sediments.
5. **Primary manhole:** Use a vacuum truck or other similar equipment to remove all water, debris, oils and sediment.
6. **Primary manhole:** Use a high pressure hose to clean the manhole of all the remaining sediment and debris. Then, use the vacuum truck to remove the water.
7. **Primary manhole:** Fill the cleaned primary manhole with water until you have a depth of 8 feet (or 2.44 meters).
8. **Storage manhole:** Top off the storage manhole with water until you have a depth of 8 feet (or 2.44 meters).
9. Replace the two manhole covers.
10. Dispose of the polluted water, oils, sediment and trash at an approved facility.
 - Local regulations prohibit the discharge of solid material into the sanitary system. Check with the local sewer authority for authority to discharge the liquid.
 - Many places treat the pollutants as leachate. Check with local regulators about disposal requirements.

Important: Additional local regulations may apply to the maintenance procedure.

Figure 5: Vacuum truck and high pressure hose



How can you tell the primary from the storage manhole?

The **primary manhole** has the BaySaver unit with the T-pipes (see Figure 4).

The other manhole is the **storage manhole** (see Figure 3).

If you need further assistance or have any questions, please call **1-800-229-7283** or visit

Baysaver.com



CITY OF COLORADO SPRINGS

EXTENDED DETENTION BASIN (EDB) INSPECTION FORM

Date: _____

Subdivision/Business Name: _____ Inspector: _____

Subdivision/Business Address: _____

Weather: _____

Date of Last Rainfall: _____ Amount: _____ Inches

Property Classification: Residential Multi Family Commercial Other: _____
(Circle One)

Reason for Inspection: Routine Complaint After Significant Rainfall Event
(Circle One)

INSPECTION SCORING - For each facility inspection item, insert one of the following scores:
0 = No deficiencies identified 2 = Routine maintenance required
1 = Monitor (potential for future problem) 3 = Immediate repair necessary
N/A = Not applicable

FEATURES

1.) Inflow Points

- Riprap Displaced
- Erosion Present/Outfall Undercut
- Sediment Accumulation
- Structural Damage (pipe, end-section, etc.)
- Woody Growth/Weeds Present

2.) Forebay

- Sediment/Debris Accumulation
- Concrete Cracking/Failing
- Drain Pipe/Wier Clogged (not draining)
- Wier/Drain Pipe Damage

3.) Trickle Channel (Low-flow)

- Sediment/Debris Accumulation
- Concrete/Riprap Damage
- Woody Growth/Weeds Present
- Erosion Outside Channel

4.) Bottom Stage (Micro-Pool)

- Sediment/Debris Accumulation
- Woody Growth/Weeds Present
- Bank Erosion
- Mosquitoes/Algae Treatment
- Petroleum/Chemical Sheen

5.) Outlet Works

- Trash Rack/Well Screen Clogged
- Structural Damage (concrete, steel, subgrade)
- Orifice Plate(s) Missing/Not Secure
- Manhole Access (cover, steps, etc.)
- Woody Growth/Weeds Present

6.) Emergency Spillway

- Riprap Displaced
- Erosion Present
- Woody Growth/Weeds Present
- Obstruction/Debris

7.) Upper Stage (Dry Storage)

- Vegetation Sparse
- Woody Growth/Undesirable Vegetation
- Standing Water/Boggy Areas
- Sediment Accumulation
- Erosion (banks and bottom)
- Trash/Debris
- Maintenance Access

8.) Miscellaneous

- Encroachment in Easement Area
- Graffiti/Vandalism
- Public Hazards
- Burrowing Animals/Pests
- Other

Inspection Summary / Additional Comments: _____

OVERALL FACILITY RATING (Circle One)

- 0 = No Deficiencies Identified
- 1 = Monitor (potential for future problem exists)
- 2 = Routine Maintenance Required
- 3 = Immediate Repair Necessary

This inspection form shall be kept a minimum of 5 years and made available to the City of Colorado Springs upon request.

Appendix E: Annual Inspection and Maintenance Submittal Form



Annual Inspection and Maintenance Reporting Form for Stormwater BMPs

(This form to be submitted to City of Colorado Springs prior to May 31 of each year)

Date: _____

To: City of Colorado Springs/Stormwater Team
Attn: Ensure Operations and Maintenance Program Inspector
PO Box 1575, MC 520
Colorado Springs, CO 80901-1575

Re: Certification of Inspection and Maintenance; Submittal of forms

Property/Subdivision Name: _____

Property Address: _____

Contact Name: _____

Contact Phone #: _____

Contact Email Address: _____

I verify that the required stormwater facility inspections and required maintenance have been completed in accordance with the Stormwater BMP Maintenance Agreement and the Inspection and Maintenance Manual associated with the above referenced property.

The required Stormwater Facility Inspection and Maintenance forms are attached to this form.

Name of Party Responsible for Inspection
& Maintenance

Property Owner

Authorized Signature

Signature



CITY OF COLORADO SPRINGS

EXTENDED DETENTION BASIN (EDB) MAINTENANCE FORM

Subdivision/Business Name: _____ Completion Date: _____

Subdivision/Business Address: _____ Contact Name: _____

Maintenance Category: Routine Restoration Rehabilitation
(Circle All That Apply)

MAINTENANCE ACTIVITIES PERFORMED

ROUTINE WORK

- MOWING
- TRASH/DEBRIS REMOVAL
- OUTLET WORKS CLEANING (TRASH RACK/WELL SCREEN)
- WEED CONTROL (HERBICIDE APPLICATION)
- MOSQUITO TREATMENT
- ALGAE TREATMENT

RESTORATION WORK

- SEDIMENT REMOVAL
 - FOREBAY
 - TRICKLE CHANNEL
 - INFLOW
- EROSION REPAIR
 - INFLOW POINT
 - TRICKLE CHANNEL
- VEGETATION REMOVAL/TREE THINNING
 - INFLOW(S)
 - TRICKLE CHANNEL
 - UPPER STAGE
 - BOTTOM STAGE
- REVEGETATION
- JET-VAC/CLEARING DRAINS
 - FOREBAY
 - OUTLET WORKS
 - INFLOWS

REHABILITATION WORK

- SEDIMENT REMOVAL (DREDGING)
 - BOTTOM STAGE
 - UPPER STAGE
- EROSION REPAIR
 - OUTLET WORKS
 - UPPER STAGE
 - BOTTOM STAGE
 - SPILLWAY
- STRUCTURAL REPAIR
 - INFLOW
 - OUTLET WORKS
 - FOREBAY
 - TRICKLE CHANNEL

OTHER _____

ESTIMATED TOTAL MANHOURS: _____

COSTS INCURRED (include description of costs): _____

EQUIPMENT/MATERIAL USED (include hours of equipment usage and quantity of material used):

COMMENTS/ADDITIONAL INFO:

This Maintenance Activity Form shall be kept a minimum of 5 years and made available to the City of Colorado Springs upon request.