80122

Operation and Maintenance Plan for Martin Spring Stormwater Filters
PRS 16-021(c), TA-16 Martin Springs Canyon
Los Alamos National Laboratory, Los Alamos, New Mexico

IT 2001
Storm water

3666

CONTENTS

List of Tables

1.0 INTRODUCTION

In May 2001, two stormwater filters were installed in Martin Spring Canyon to remove high explosive and barium contaminants from Martin Spring. The filters were installed as part of a feasibility study for treatment of high explosive (HE) and barium contaminated groundwater.

Stormwater Management in Portland, Oregon designed and constructed the stormwater filters. Sandia National Laboratories, Environmental Restoration Technologies Department, prepared the final installation design. A licensed professional engineer from IT Corporation reviewed and approved the installation. IT Corporation crew members completed the field installation.

Stormwater filters are commonly used to treat runoff from parking lots. In this case however they were used to treat spring water. In order to filter both the high explosive and barium contaminants, it was necessary to install two separate units each with different filter media. The first unit contains granular activated charcoal (GAC) to treat HE and the second unit contains ion exchange resin to treat barium. The units were plumbed in series with the spring water first entering the GAC filter, then the ion exchange resin. Each unit contained four filter cartridges weighing approximately 120 pounds each. The cartridges are enclosed by a 10 gauge steel box: 10'4"L x 3'8 ¾"D x 2'8"W. Total weight of each unit was approximately 1500 pounds. A detailed diagram of the cartridges and explanation of the stormfilter flow mechanics is included in Appendix 1.

The following maintenance and operations plan has been adapted from guidelines published by Stormwater Management, Inc. of Portland Oregon. This plan ensures the Martin spring stormwater filters will function properly and effectively

2.0 MAINTENANCE AND OPERATIONS PLAN

2.1 Major and Minor Maintenance

Two levels of maintenance will be conducted: inspection/minor maintenance and major maintenance. Inspection/minor maintenance activities are combined since minor maintenance does not require special equipment and typically little or no materials are in need of disposal. Inspection/minor maintenance typically involves opening the flow restricting valves (to pre-set levels) and clearing vegetation and debris.

Major maintenance may include cartridge recharging. Major maintenance may involve disposal of filter media materials that require consideration of regulatory guidelines. The following table summarizes the activities associated with stormwater filter maintenance.

Table 2.1-1

Stormwater Filter Maintenance Outline

Type	Maintenance Activity	Facility Component Requiring Maintenance	Signs that a Maintenance Activity is Required	Expected Facility Performance After Maintaining
Minor	Trash and debris removal	StromFilter cartridges and containment structure	Floatable objects or other trash is present in the filter. Remove to avoid hindrance of filtration and eliminate unsightly debris and trash.	Unsightly debris is permanently removed from storm system. Floatable objects do not hinder filtration.
Major	Cartridge replacement and sediment removal	StormFilter cartridges and containment structure	Media has been contaminated by high levels of pollutants, such as after a spill	New media is able to effectively treat stormwater.
Minor / Major	Flushing with water	Drainage system piping	Debris or sediment obstructs drainage system.	Outflow is not restricted.

2.2 Quarterly and Flood Event Inspections

On a quarterly basis and following high flow events it will be necessary to conduct an inspection of the stormfilter units. A sample inspection form is included in Appendix 2. The condition of mechanical filter components will be evaluated in the following manor:

1. Visually inspect the external condition of the unit and take notes concerning defects/problems.
2. Open the doors to the vault and allow the system to air out for 5-10 minutes.
3. Without entering the vault, inspect the inside of the unit, including components.
4. Record in the field log notebook the condition of the external and internal condition of the vault. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components. If flow is occurring, note the level of water and estimate the flow rate per drainage pipe.
5. If present, remove large loose debris using a pole with a grapple or net on the end.
6. Close and fasten door.
7. Summarize observations in the field log book.

2.3 Quarterly and Flood Event Maintenance

Every three months and following major runoff events it may be necessary to remove sediment from the filter units. Periodic removal of sediment from the filter unit will prevent sediment from clogging the filter media. This in turn will extend the functioning duration of the cartridge. Sediment shall be removed using a small scoop attached to a pole.

2.4 Annual Inspections

Annual inspections shall include both a field and an office component. First all laboratory analysis shall be reviewed. Concentrations of HE, barium shall be evaluated in context with the spring outlet, the GAC stormwater filter, and the ionic resin stormwater filter. If either of the stormwater filters are not sufficiently reducing the concentrations of the respective contaminants, a though maintenance of the units shall be conducted. Following maintenance, it may be necessary to sample the filter media. Laboratory analysis of the media will indicate if the drop in performance can be attributed to media or to other operational difficulties. If the filter media is no longer active, the cartridges will be replaced.

Using flow values from Martin Spring and the analytical results, it will be possible to calculate contaminant loading. Based on contaminant loads, it should be possible to forecast filter media replacement or regeneration.

In the field the units shall be inspected in a similar manor to the quarterly inspection. Ideally the inspection should occur during low flow conditions. A sample inspection form is included in Appendix 3.

2.5 Cartridge Replacement

Filter cartridges will be replaced as needed. Cartridge longevity will depend on flow rates and contaminant concentrations. The mechanics of cartridge replacement follow:

Use the appropriate sling if filter removal / replacement is performed. Care must be used to avoid damaging the filter during removal and installation.

1. Remove deposited sediment from the floor of the vault and forebay, and assess the condition of the vault and manifold prior to installation of new cartridge.
2. Install new cartridge.
3. Close and fasten door.
4. Transport old cartridge for media replacement or regeneration as appropriate.

2.5 Personnel, Health and Safety

All maintenance and operations activities shall be conducted by a field team consisting of two or three people. At least one crew member must understand proper stormfilter function including removal and installation of cartridges. All operations or maintenance will be conducted in compliance with SSHASP 01-001.

APPENDIX 1: STORMFILTER DESIGN AND FLOW MECHANICS

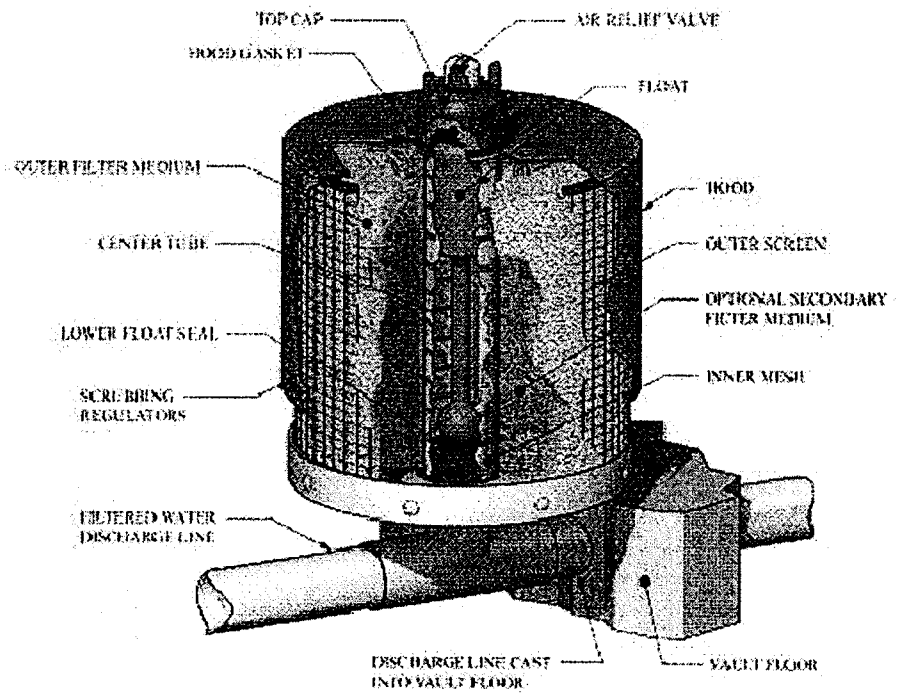

Figure 1. The StormFilter Cartridge

Priming System Function

When stormwater in the StormFilter unit enters a StormFilter cartridge, it percolates horizontally through the cartridge's filter media and collects in the center tube of the cartridge, where the float in the cartridge is in a closed (downward) position.

Water continues to pass through the filter media and into the cartridge's center tube. The air in the cartridge is displaced by the water and purged from beneath the filter hood through the one-way check valve located in the cap. Once the center tube is filled with water (approximately 18 inches deep), there is enough buoyant force on the float to open the float valve and allow the treated water in the center tube to flow into the under-drain manifold. This causes the check valve to close, initiating a siphon that draws polluted water throughout the full surface area and volume of the filter. Thus, the entire filter cartridge is used to filter water throughout the duration of the storm, regardless of the water surface elevation in the unit. This siphon continues until the water surface elevation drops to the elevation of the hood's scrubbing regulators.

The cartridges are connected to the under-drain manifold with a plastic connector. Since some media used is potentially buoyant, a threaded connector affixed to the under-drain manifold with compression bolts is necessary to ensure that the cartridge isn't lifted out of place. For the heavier compost media, a slip connector is used.

The StormFilter is also equipped with flow spreaders that trap floating debris and surface films, even during overflow conditions. Depending on individual site characteristics, some systems are equipped with high and/or base flow bypasses. High flow bypasses are installed when the calculated peak storm event generates a flow that overcomes the overflow capacity of the system. This is especially

important for precast systems. Base flow bypasses are sometimes installed to bypass continuous inflows caused by ground water seepage, which usually do not require treatment. All StormFilter units are designed with an overflow. The overflow operates when the inflow rate is greater than the infiltration capacity of the filter media.

APPENDIX 2: MINOR AND POST FLOOD MAINTENANCE INSPECTION SHEET

StormFilter Minor Maintenance and Inspection Data Sheet

Date: _____ **Personnel:** _____

Location: _____ **System Size:** _____

System Type: **Cast-In-Place** **Precast** **Linear**

System Observations

Media Months in Service: _____

Oil and Grease in Forebay: **Yes** **No** _____

Sediment Depth in Forebay: _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

_____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged: **Yes** **No** How Deep: _____

StormFilter Minor Maintenance Activities (check off if done and give description)

Trash and Debris Removal: _____

Minor Structural Repairs: _____

Drainage Area Report

Excessive Oil and Grease Loading: **Yes** **No** Source: _____

Sediment Accumulation on Pavement: **Yes** **No** Source: _____

Erosion of Landscaped Areas: **Yes** **No** Source: _____

Items Needing Further Work: _____

_____

_____

Other Comments: _____

APPENDIX 3: MAJOR AND ANNUAL MAINTENANCE INSPECTION SHEET

StormFilter Major Maintenance Inspection Data Sheet

Note: It may be desirable to conduct this inspection during a storm to observe the relative flow throu the filter cartridges. If the submerged cartridges are severely plugged, large amounts of sediments be present and very little flow will be discharged from the drainage pipes. If this is the case, it is likel that the cartridges need to be replaced.

Date: _____ **Personnel:** _____

Location: _____ **System Size:** _____

System Type: **Cast-In-Place** **Precast** **Linear**

System Observations

Media Months in Service: _____

Oil and Grease in Forebay: **Yes** **No** _____

Sediment Depth in Forebay: _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged: **Yes** **No** How Deep: _____

Drainage Area Report

Excessive Oil and Grease Loading: **Yes** **No** Source: _____

Sediment Accumulation on Pavement: **Yes** **No** Source: _____

Erosion of Landscaped Areas: **Yes** **No** Source: _____

Other Comments: _____

_____

_____

_____

Review the condition reports from the previous minor and major maintenance visits.