



Permanent BMP Operations & Maintenance Manual



STATE OF HAWAII, DEPARTMENT OF
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ATTACHMENTS

Treatment PBMP Inspection and Maintenance Form

Pervious Surface PBMP Inspection and Maintenance Form

Vegetated PBMP Inspection and Maintenance Form

Evaporation Ponds / Infiltration Beds PBMP Inspection and Maintenance Form

1.0 INTRODUCTION

The State of Hawaii Department of Transportation (HDOT), Airports Division (hereinafter “DOTA”) owns and operates Small Municipal Separate Storm Sewer Systems (MS4) as defined in the Code of Federal Regulations (CFR), Title 40, Section 122.26(b)(16) at the Daniel K. Inouye International Airport (HNL) and Kahului Airport (OGG). The MS4s convey storm water from structures, runways, taxiways, and roadways to State waters.

The MS4 discharges are regulated by the Clean Water Act and the National Pollutant Discharge Elimination System (NPDES) Permit No. HI S000005 for HNL and NPDES Permit No. HI 14KE349 for OGG issued by the Hawaii Department of Health (DOH). The NPDES Permits require DOTA to reduce or eliminate the impact of storm water discharges on the receiving waters.

A Storm Water Management Program Plan (SWMPP) was developed and implemented for both HNL and OGG. The HNL SWMPP includes the Post-Construction Storm Water Management in New Development and Redevelopment Program (hereinafter “Post-Construction”) and the OGG SWMPP includes the Construction and Post Construction Storm Water Management Plan, which requires specified construction projects to include Permanent Best Management Practices (PBMP) to ensure that permanent controls are in place to prevent or minimize water quality impacts to the Maximum Extent Practicable (MEP).

From the time that a PBMP is constructed and activated, it requires inspection and maintenance for correct operation to ensure it continues to function as designed to provide water quality treatment. The Permanent BMP Operation & Maintenance (O&M) Manual (hereinafter “PBMP O&M Manual”) discusses the routine inspection practices based on the type of BMP installed; and the preventive and corrective maintenance needed to properly maintain the storm water PBMPs.

DOTA tracks the PBMP inventory in the Enviance database. Inspection and maintenance data is also tracked with the Enviance system.

Although this document has specifically been prepared to address PBMP inspections and maintenance at HNL and OGG, it will also be used as a reference for other DOTA airports throughout the State of Hawaii.

1.1 Requirements

The HNL MS4 NPDES Permit No. HI S000005 requirements for this PBMP O&M Manual are as follows.

| NPDES Permit Requirements |
|--|
| Part D.1.e. – Post-Construction Storm Water Management in New Development and Redevelopment |
| Part D.1.e.(3) – BMP, Operation and Maintenance, and Inspection Database The Permittee shall continue to implement its Database System to track the frequency of inspections and maintenance of the Permanent BMPs. In addition to the standard information collected for all projects (e.g., project name, owner, location, start/end date, etc.), the database shall also include, at a minimum: <ul style="list-style-type: none">• Type and number of LID practices• Type and number of Source Control BMPs• Type and number of Treatment Control BMP• Latitude/Longitude coordinates of controls using Global Positioning Systems (GPS) and NAD83 or other Datum as long as the datum remains consistent• Photographs of controls• Operation and maintenance requirements• Frequency of inspections• Frequency of maintenance All storm water treatment and LID BMPs shall be inspected at least once a year for proper operation; maintenance shall be performed as necessary to ensure proper operation. |
| Part D.1.e.(4) – Education and Training (ii) Inspectors – All Permittee staff and those contractors under DOTA contract responsible for inspecting permanent post-construction BMPs and LID practices shall receive annual training. |

The OGG MS4 NPDES Permit No. HI 14KE349 requirements for this PBMP O&M Manual are as follows.

| NPDES Permit Requirements |
|---|
| Hawaii Administrative Rules, Chapter 11-55 Appendix K |
| Part 6.(a)(5)(C) – Post-Construction Storm Water Management in New Development and Redevelopment Develop, implement, and enforce a program to reduce pollutants in storm water runoff entering the permittee's small municipal separate storm sewer system from new development and redevelopment projects that disturb greater than or equal to one acre, including construction sites less than one acre that are part of a larger common plan of development or sale that would disturb one acre or more, that, at a minimum, includes the following: Procedures for long-term operation and maintenance of best management practices. |

1.2 Storm Water PBMP Inventory

The majority of PBMPs are treatment control oil water separators (OWS) situated at the gates, hardstands, wash rack areas, the Aircraft Rescue and Fire Fighting (ARFF facility), and ramp and road areas. Additional treatment controls include drain inlets with trash collectors and hydrodynamic separator (HDS) units. Source and treatment control PBMPs include grassed swales and bioswales. Source control PBMPs include evaporation ponds and infiltration beds. Low impact development (LID) pervious surface PBMPs includes permeable pavement.

Per the HNL SWMPP, the minimum inspection frequency is annual to ensure the PBMPs are functioning properly and maintenance is performed as necessary. For DOTA owned PBMPs, the District Maintenance Superintendents will ensure that inspection and maintenance data is submitted to the Environmental Section (AIR-EE). For Tenant owned PBMPs, AIR-EE will obtain maintenance data during the tenant inspections for inclusion in the annual report.

However, actual maintenance is site specific and maintenance may be needed more frequently, depending on the amount and quality of runoff delivered to the PBMP. Routine maintenance to remove sediment, trash, debris, or overgrown vegetation will help avoid more costly rehabilitative maintenance to repair damages that may occur when the PBMPs are not adequately maintained on a routine basis.

1.2.1 Treatment PBMPs

The goal for PBMP implementation is to retain runoff on-site as much as feasible, with consideration of the mission of DOTA and applicable Federal Aviation Administration rules. The secondary goal is to ensure that the runoff to be conveyed off-site is provided with treatment prior to entering the receiving waters. Treatment controls are engineered technologies designed to remove pollutants from runoff by detention, filtration, settling, or separation. The DOTA's preferred treatments for storm water runoff are OWS, HDS units, and storm drain inserts.

Oil Water Separators

Oil water separators are chambers designed to remove petroleum compounds and greases, floatable debris, and settled solids from storm water. The oil water separators are utilized as a flow-through polishing device, and are installed in operational areas prone to frequent small spills and drips that have a significant cumulative impact on storm water quality, such as airport gates and ramp areas.

Hydrodynamic Separator (HDS)

Hydrodynamic separators are flow-through structures with a settling or separation unit to remove sediments, floatables, and other pollutants. Hydrodynamic separators fit in conventional manholes and separation occurs by means of swirl action or indirect filtration.

An example is the Continuous Deflective Separation (CDS) technology which directs solid pollutants into the lower catchment chamber and the floatables to the surface of the upper chamber using a non-mechanical, non-blocking screen technology. The natural motion of water separates and traps sediments by direct infiltration. As storm water flows through the system, a very fine screen deflects the pollutants, which are captured in a litter sump in the center of the system.

Storm Drain Inserts

Storm drain inserts are installed within drain inlets to screen or filter trash from entering storm water intake pipes. The FloGard® product is a multipurpose storm drain insert designed to capture sediment, debris, trash and oils/grease from low (first flush) flows.

1.2.2 LID PBMPs

Low Impact Development (LID) refers to storm water management practices that seek to mimic predevelopment hydrology by minimizing disturbed areas and impervious cover, and then infiltrating, storing, detaining, evapotranspiring, and/or biotreating storm water runoff close to its source. LID employs principles such as preserving and re-creating natural landscape features and minimizing the quantity of impervious surfaces to create functional and appealing site drainage that treats storm water as a resource, rather than a waste product.

Permeable Pavement

Permeable pavement is a LID site design BMP that reduces storm water runoff volumes and rates from parking lots and runoff from other surfaces. It typically consists of a permeable interlocking paver, pervious concrete, or porous asphalt. The paving layer is underlain with gravel layers, providing both structural support and storage volume for storm water runoff.

1.2.3 Source and Treatment Control Vegetative PBMPs

Source control PBMPs are low technology practices that minimize the contact between pollutants storm water runoff and/or eliminate runoff from discharge to surface water bodies. Vegetative PBMPs reduce the potential for contamination at the source of pollution to prevent discharge of contaminated runoff to the storm drainage system.

Grassed Swales

A grassed swale provides treatment of runoff through interaction with vegetation, conveys runoff to storm sewers or surface waters, and prevents flooding of runways and taxiways. A grassed swale provides some passive volume control capabilities by providing pervious surfaces and therefore reducing the total runoff volume to be controlled.

Bioswales

A bioswale is a vegetated swale, ditch, or depression that conveys storm water, and provides treatment of storm water runoff without extensive maintenance. The particles suspended in the storm water are negatively charged, and are attracted to the positively charged base of the vegetation in a bioswale, thus removing pollutants from storm water runoff.

1.2.4 Source Control Evaporation Ponds and Infiltration Bed PBMPs

Evaporation Ponds

Evaporation ponds are artificial ponds with shallow, large surface areas that are designed to hold a set volume of runoff, and efficiently evaporate water by sunlight and exposure to the ambient temperatures. Cleaning water from inspection and maintenance of BMPs are transferred or discharged to the evaporation ponds.

Infiltration Bed

Infiltration devices enhance percolation to groundwater by directing surface runoff to locations where it can come into contact with pervious underlying soils and then detaining that runoff until it can soak into the underlying soil. Infiltration devices reduce runoff volume, recharge groundwater, and have high removal efficiencies for sediment and for pollutants adsorbed onto sediment particles.

2.0 TREATMENT PBMPs

2.1 Oil Water Separators

Oil water separators are permanent treatment control devices designed to remove contaminants. The conventional separator and the coalescing plate interceptor (CPI) are two commonly used oil water separators.

The primary function of oil water separators is to specifically remove petroleum compounds, other floatable debris, and settleable solids. This BMP addresses petroleum products such as gasoline, diesel, jet fuel, and used oil.

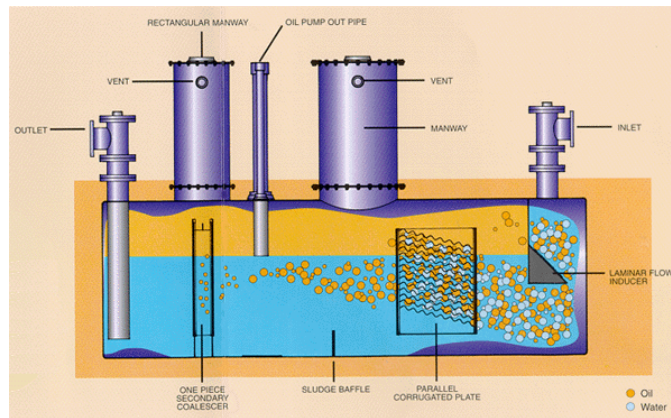


Figure 1. Oil Water Separator.

2.1.1 OWS Inspection Procedures

- Check POI Basin number. If markings are faded reapply paint.
- Inspect area surrounding opening of OWS for repair and cleaning.
- Open manhole cover or grate to inspect OWS vault.
- Visually inspect system components for damages, blockages, or obstructions and notate observations on the inspection form.
- Look for fuel, oil, grease.
- Look for floatable debris.
- Look for any leaks, cracks, missing or broken pieces.
- Check sediment on bottom with long aluminum pole.

2.1.2 OWS Maintenance Procedures

- Remove floatable debris with scope net, and record quantity on inspection form.
- Remove sediment on bottom with scope net, and record amount.
- Pressure wash the interior and exterior of the OWS with airport-approved degreaser.
- Replace oil absorbent boom.
- Notify Airports contract administrator to report any repairs needed.
- At any time should the inspector smell or see fuel in OWS, stop work and notify the contractor manager who will report it to the Airports contract administrator for immediate maintenance.

- Dispose oil absorbent boom, trash, and floatable debris as solid waste.
- Transport any liquid from OWS removed during cleaning for disposal.
- Deliver any nonhazardous sediment removed from the bottom of OWS for testing and disposal.
- Fill out the Treatment PBMP Inspection and Maintenance Form.

See Attachment Storm Water Inspection and Maintenance Forms – Treatment PBMP Inspection and Maintenance Form.

2.2 Hydrodynamic Separators

The CDS System patented hydrodynamic separator (HDS) unit or other types of HDS units are flow-through structures installed underground as part of a storm drainage system, with a settling or separation unit to remove sediments, floatables, and other pollutants.

The CDS-specific patented Gravity system is used to remove settleable particles, and employs phase separation to remove buoyant materials (free oils and grease) from the water matrix. Common design features include by-pass, swirl action, screening action, and coalescence action.

The by-pass feature allows only low flows to be treated while high flows by-pass the treatment chamber. The swirl action feature allows storm water to enter the unit on a tangent to the chamber which promotes a swirling motion. Sediments are removed by gravity and deposited at the bottom of the chamber

Hydrodynamic separators require frequent maintenance and can only be expected to function effectively in conjunction with an effective and enforceable maintenance plan. Maintenance should be conducted during dry weather when no flow is entering the system.

The HDS inline systems are cleaned using vacuum trucks to pump out trash, sediment, and water that have collected at the bottom.

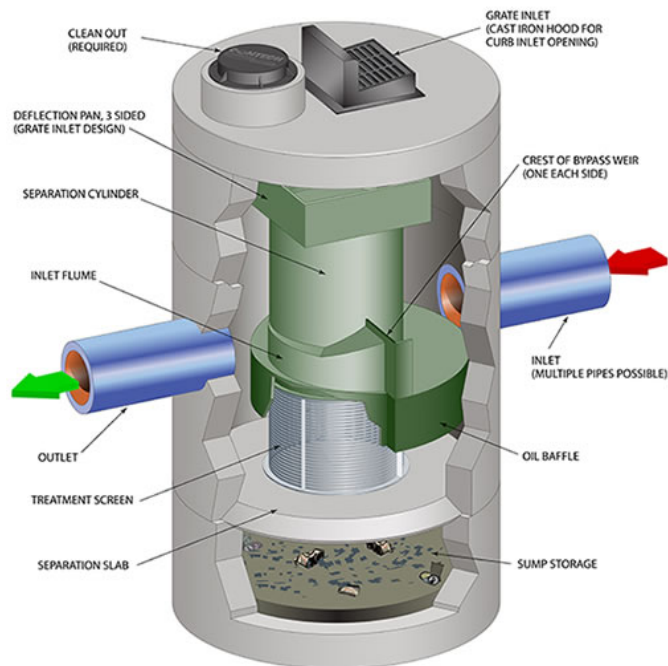


Figure 2. CDS Hydrodynamic Separator unit.

2.2.1 HDS Inspection Procedures

- Check POI Basin number. If markings are faded reapply paint.
- Inspect area surrounding the opening of the HDS drain for repair and cleaning.
- Open the separation chamber manhole cover or grate to inspect vault.
- Visually inspect system components for damage, blockages, or obstructions and record observations on the inspection form.
- Look for fuel, oil, grease.
- Look for floatable debris.
- Check sediment depth with long aluminum pole to determine if cleaning is needed based on the specified unit cleaning depth
- Look for any leaks, cracks, missing or broken pieces.
- Remove access covers and visually inspect the internal components for any broken or missing parts, and record observations on the inspection form.
- Inspect the inlet and/or outlet pipe for blockage or obstruction.
- Estimate volume of floating trash and debris, and record quantity on inspection form.
- Complete inspection of entire tank and screen, and note any problems.
- Close lid.
- Notify DOTA contract administrator to report any repairs needed.
- Fill out the Treatment PBMP Inspection and Maintenance Form.

2.2.2 HDS Maintenance Procedures

- Remove floating trash, debris, and oils from the water surface with scope net or an extension on the end of the boom hose of the vacuum truck, and record quantity on inspection form.
- Completely dewater the structure through the vortex tubes and evacuate all accumulated sediment from the sediment sump.
- Per DOTA, access is provided to transfer approximately 5,000 gallons of water from holding tank water to the evaporation ponds located at the airport.
- If over one cubic yard, remove sediment from bottom of holding tank with a vacuum truck.
- If less than one cubic yard, contractor will enter confined space and remove sediment by bucket and rope. Only OSHA Confined Space Entry trained and certified personnel may enter the structure.

- Some jetting may be required to fully evacuate sediment from the sump. This is easily achieved by inserting a jet hose through the vortex tube opposite the tube used for vacuum hose access.
- If absorbent material is used in the unit, note the color of material. Should damage or significant discoloration be observed, replace the material.
- If sorbent pads are required and are tethered to the structure, only personnel that are OSHA Confined Space Entry trained and certified may enter the structure to remove and replace the spent pads.
- Inspect the unit for unusual odors or evidence of pests (e.g. mosquitoes or rodents).
- Properly dispose all materials removed from the HDS during maintenance in accordance with local regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sump catch basins or manholes.
- Deliver nonhazardous sediment removed from the bottom of the OWS for testing and disposal.
- Fill out the Treatment PBMP Inspection and Maintenance Form.

See Attachment Storm Water Inspection and Maintenance Forms – Treatment PBMP Inspection and Maintenance Form.

2.3 Drain Inlets (Catch Basins) with Trash Collectors

Drain inlet (catch basin) insert filters are designed to remove trash, sediment, and contaminants such as hydrocarbons and metals from storm water runoff. A metal frame with a filter screen is the primary method for pollutant removal. A non-leaching absorbent material in a pouch can be placed with the insert to remove hydrocarbons or metals.

The catch basin with FloGard® is a multipurpose catch basin insert designed to capture sediment, debris, trash, and oils and grease from low (first flush) flows.

Drain inlets with trash collectors should be visually inspected for damage, conditions found, and obstructions. Inspection of the surrounding area should also be performed and documented.



Figure 3. Catch basin with FloGard® insert.

2.3.1 Drain Inlet Inspection Procedures

- Open catch basin grated lid.
- Visually inspect system components for damage, blockages or obstructions.
- Inspect the filter liner, gaskets, stainless steel frame and mounting brackets for serviceable condition.
- For minor damage or defects, inspectors should document the observation and record corrective actions on the inspection form.
- For extensive damage that affects filter efficiency such as a torn liner, replacement is recommended.
- Measure pollutant accumulation with a measuring rod or calibrated dipstick, and record quantity on inspection form.
- If the unit is more than 75% full, recommend cleaning.
- If boom is saturated, torn, and/or unserviceable, recommend replacement.
- Fill out the Treatment PBMP Inspection and Maintenance Form.

2.3.2 Drain Inlet Maintenance Procedures

- Remove the insert with netting (if applicable).
- Measure the weight of debris collected in each unit and record quantity on inspection form.
- Identify the types of debris collected in each unit, e.g., trash, sediment, organics, etc.
- Remove all debris from the interior of the basket, and dispose trash and floatable debris as solid waste.
- Brush the screen clean and, if needed, follow up with a wash (if applicable).
- Remove and replace the absorbent material from the D-ring, if it is unserviceable, and properly dispose (if applicable).
- Use an industrial vacuum to reach into the filtration basket and suction out collected debris. Clean the screens with a spray wand or brush.
- Reinstall the basket into the inlet, and replace the grate.
- Fill out the Treatment PBMP Inspection and Maintenance Form.

See Attachment Storm Water Inspection and Maintenance Forms – Treatment PBMP Inspection and Maintenance Form.

3.0 LOW IMPACT DEVELOPMENT PBMPs

3.1 Permeable Pavement

Permeable pavement is pavement that allows for percolation through void spaces in the pavement surface into subsurface layers. Permeable pavements reduce runoff volumes and rates, and can provide pollutant control via infiltration, filtration, sorption, sedimentation, and biodegradation processes.

Permeable pavement surfaces can reduce the impervious area of the project, which in turn can reduce the footprint used to determine the types and capacities of treatment control and flow control BMPs.



Figure 4. Permeable pavement at HNL Elliot Street parking lot.

3.1.1 Permeable Pavement Inspection Procedures

- Inspect the permeable pavement for breakage and cracking, oil leaks, and visual evidence of sediment accumulation.
- Respond to oil leaks with absorbent materials and/or remove the contaminated sediment.
- Remove any trash or litter observed during inspection.
- Inspect any landscaped bioswales adjacent to the permeable pavement for bare spots or eroded areas.
- If there is soil washout from the planted areas, clean off the pavement to prevent clogging of the pore space.
- Inspect all inlet structures within or draining the permeable pavement to assess need for cleaning.
- Fill out the Pervious Surface PBMP Inspection and Maintenance Form.

3.1.2 Permeable Pavement Maintenance Procedures

- Vacuum the permeable pavement with an industrial vacuum or vacuum sweeper.
- A regenerative air sweeper with a blower system that generates a high velocity air column may be used to force the air against the pavement at an angle to loosen debris from the pavement surface, then transport it across the width of the sweeping head and lift sediment and debris into the containment hopper via a suction tube. Note: Simple brooms sweepers are not recommended for permeable pavement maintenance.
- If the pavement surface has become significantly clogged such that routine vacuum sweeping does not restore permeability, then an intense combination of washing and vacuuming techniques may be required.
 - Wash the porous pavements with clean, low pressure water (power head cone nozzle that concentrates water in a narrowly rotating cone), followed by immediate vacuuming. Note: If the pressure of the washing nozzle is too great, contaminants may be driven further into the permeable surface.
 - “Walk behind” vacuum units with scrub pressure kept relatively low may be effective, easy to operate, and inexpensive for small parking lots. For the most clogged areas, power wash after scrubbing to get out the deeply ground in sediment.
- Maintenance crews are encouraged to determine the most effective strategy for cleaning permeable installations.
- Fill out the Pervious Surface PBMP Inspection and Maintenance Form.

See Attachment Storm Water Inspection and Maintenance Forms – Pervious Surface PBMP Inspection and Maintenance Form.

4.0 SOURCE AND TREATMENT CONTROL VEGETATIVE PBMPs

4.1 Grassed Swales

Bioretention facilities use landscaping features to treat storm water runoff through infiltration. Runoff filters through the vegetation, prepared soil mix, and gravel in the landscaped area, thereby removing pollutants.

Bioretention facilities have a variety of components that can be installed to enhance infiltration, such as an underdrain or native plants. Grassed swales are a type of bioretention facility that provides treatment of runoff through interaction with vegetation, conveys runoff to storm sewers or surface waters, and prevents flooding of runways and taxiways.



Figure 5. Grassed swale at HNL Elliot Street permeable pavement parking lot.

The fully vegetated bioswale and the open channel bioswale are the two basic types of vegetated swales based upon the degree of vegetation. When vegetated, the primary pollutants managed by this PBMP are sediment and debris; however, vegetation may also filter a variety of other potential pollutants, such as nutrients, metals, bacteria, oil and grease, and organic compounds.

4.1.1 Grassed Swales Inspection Procedures

- Inspect surface drainage systems and remove any sediment buildup and trash.
- Inspect surfaces damaged by erosion, rodents, vehicles or other causes.
- Inspect and schedule repair of grassed swales in advance of the first seasonal rains to allow for any repairs, as needed.
- Remove trash and debris from the storm drainage system leading to and within grassed swales.
- Walk around the grassed swale area, and note locations of any erosional or drainage changes.
- Note any landscaping changes that need to be addressed (e.g. grass cutting).
- Observe discharge, if present, and origin of discharge if it can be viewed. Note if alternate drainage patterns have developed.
- Conditions that warrant cleaning or maintenance of the grassed swale are:
 - Significantly overgrown areas require landscape maintenance.

- Area exhibits significant erosion or changes to the drainage pattern (water drains away from BMP or is bypassed).
- Water ponding directly over a grassed swale area suggests the biofiltration media may be clogged.
- Recent oil spill or fuel spill.
- Output flow is significantly dirty or contains significant odors.
- Remove sediment and debris before the vegetation is adversely impacted.
- Check the asphalt edge of a street or parking lot that drains directly into a grassed swale for cracks due to plant growth or occasional car traffic.
- Fill out the Vegetative PBMP Inspection and Maintenance Form.

4.1.2 Grassed Swales Maintenance Procedures

- Regular plant maintenance including mowing, irrigation, and pruning.
- Remove accumulated sediment and debris.
- Re-establish eroded areas, replace dead vegetation, repair erosion, and replenish mulch.
- Unclog the underdrain (if applicable) and structural repairs.
- Remove vegetation clippings.
- Avoid fertilizers and herbicides which are the types of pollutants removed by the vegetation in a grassed swale.
- Re-grade to reshape the grassed swale cross-section as sediments collect and form pools. Remove and properly dispose of the sediments.
- Irrigate regularly during dry periods.
- Fill out the Vegetative PBMP Inspection and Maintenance Form.

See Attachment Storm Water Inspection and Maintenance Forms – Vegetative PBMP Inspection and Maintenance Form.

4.2 Bioswales (Wedelia)

Wedelia (*Wedelia trilobata*) is an aggressive, creeping ground cover that forms a dense mat with its stems rooting into the ground as the plant spreads horizontally. It produces an infertile seed head that is unpalatable to birds that feed on grain, and thus reduces the attraction of birds and wildlife in tropical airfield environments.

Wedelia's lateral growth rather than vertical is due to exposure and natural desiccation from the wind in an open, non-irrigated environment typical of airfields.



Figure 6. Bioswale with Wedelia groundcover.

Wedelia stabilizes soils; reduces erosion; slows runoff; allows sediments to drop out; uptakes carbon, oils, salts, metals, and other pollutants, thus providing good treatment of storm water runoff without the extensive maintenance. Bioswales consisting of Wedelia groundcover are drought and water tolerant, and pollution tolerant.

This vegetative PBMP satisfies FAA safety requirements for decreased utilization by critical birds and rodents, while balancing the need to maintain vegetation for storm water runoff concerns. Wedelia has sufficient durability to withstand relatively light levels of traffic; however, it is not suited to repeated exposure to vehicular traffic.

4.2.1 Bioswales (Wedelia) Inspection Procedures

- Monitor vegetated areas for the presence of wildlife.
- Inspect area for trash, debris, and sediment buildup.
- Inspect Wedelia groundcover for damage by erosion, rodents, and vehicles.
- Inspect and weed the Wedelia groundcover, as needed.
- Remove trash and debris from the storm drainage system leading to the bioswale or in the bioswale.
- Walk around the area and note locations of any erosional or drainage changes.
- Note any damaged areas of the Wedelia groundcover to report for maintenance.
- Check the asphalt edge of a street or parking lot that drains directly into a bioswale for cracks due to plant growth or occasional car traffic.
- Fill out the Vegetative PBMP Inspection and Maintenance Form.

4.2.2 Bioswales (Wedelia) Maintenance Procedures

- Water and fertilize only enough to provide adequate growth and color.
- Remove accumulated sediment and debris before the vegetation is adversely impacted.
- Protect bare spots to allow groundcover to re-establish and repair potential erosion.
- Remove unwanted vegetation (e.g., weeds) and dispose properly.
- Fill out the Vegetative PBMP Inspection and Maintenance Form.

See Attachment Storm Water Inspection and Maintenance Forms – Vegetative PBMP Inspection and Maintenance Form.

5.0 EVAPORATION PONDS AND INFILTRATION BEDS PBMPs

5.1 Evaporation Ponds

Evaporation ponds are retention basins that provide water quantity and water quality control. The pond is a surface depression that captures and stores storm water runoff from the surrounding drainage area, and releases it through evaporation.

The evaporation pond soil types do not allow infiltration, but detains the storm water on-site to reduce the contaminants that leave the site.

The evaporation ponds function to reduce total annual surface runoff volume and discharges to the receiving waters.



Figure 7. Evaporation ponds at HNL.

5.1.1 *Evaporation Ponds Inspection Procedures*

- Inspect evaporation ponds annually and following each major storm event to check for leakage or overflow.
- Walk around the entire perimeter of the pond.
- Inspect for changes to the drainage of the landscape, and for erosion or channel irregularities that need to be repaired.
- Inspect for sediment or vegetation that blocks the passage of water, or any new or missing vegetation.
- Inspect the areas for trash or sediment accumulation.
- Inspect pond embankments for erosion, holes excavated by rodents or other animals, and vegetative cover both above and at bank levels.
- Inspect the pond bottom for sediment deposition, deposition of noxious materials or other debris.
- Inspect inlet structures for erosion, sediment deposition, channel scour, and plugging.
- Inspect evaporation pond elements such as embankments and side slopes; vegetative cover on embankments, perimeter, and inside the pond; perimeter fencing, and emergency spillways.
- Fill out the Evaporation Ponds/Infiltration Beds PBMP Inspection and Maintenance Form.

5.1.2 Evaporation Ponds Maintenance Procedures

- Remove debris and sediment accumulation (when the sediment layer exceeds 12 inches) from the evaporation pond whenever these materials prevent proper functioning.
- Remove any litter or debris in the immediate vicinity.
- Repair eroded areas.
- Fill out the Evaporation Ponds/Infiltration Beds PBMP Inspection and Maintenance Form.

See Attachment Storm Water Inspection and Maintenance Forms – Evaporation Ponds/Infiltration Beds PBMP Inspection and Maintenance Form.

5.2 Infiltration Beds

Subsurface infiltration beds are hidden storm water management features for temporary storage, infiltration, and flow control of storm water runoff. Infiltration beds generally consist of a vegetated, highly pervious soil media underlain by a uniformly graded aggregate bed. Vegetation helps increase the amount of evapotranspiration that takes place.

Storm water runoff from nearby impervious areas is conveyed to the subsurface storage media, where it is distributed via a network of perforated piping. Storm structures such as catch basins, inlets, and area drains are connected to subsurface infiltration beds to provide sediment and debris removal. These structures provide critical control of sediment disposition within the rock bed, and increase longevity and reduce the maintenance burden of infiltration facilities.

Generally, subsurface infiltration and the vegetation associated with subsurface infiltration practices require less maintenance than vegetative PBMPs.

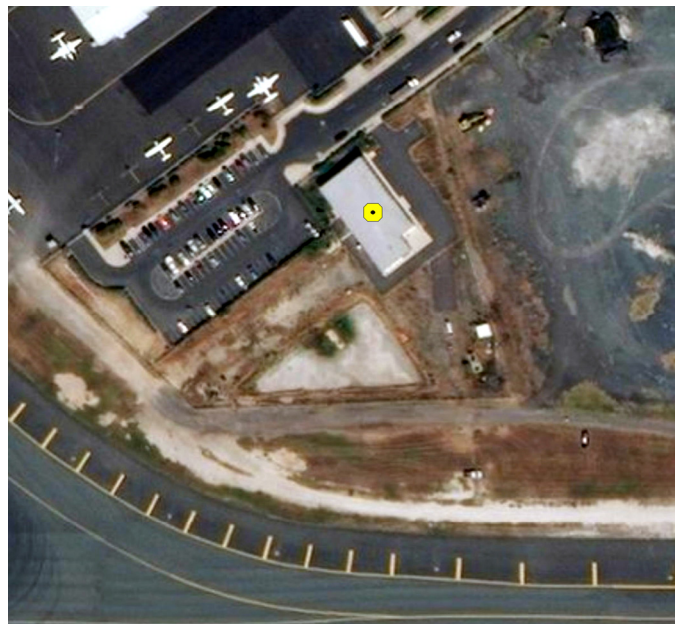


Figure 8. Infiltration bed at HNL.

5.2.1 Infiltration Beds Inspection Procedures

- Inspect the status of basin vegetation for evidence of standing water in the basin.
- Look for accumulated sediment in the bottom of the basin, and remove it when levels reach a depth that results in inadequate infiltration rates.
- Look for unusual or unpleasant odors, and locate and remove the source of the odor (e.g., inappropriate materials from storm water flows, decaying vegetation, or non-storm water related organic matter).
- Inspect pretreatment BMPs such as swales, filter strips, sediment catch basins and manholes, and inlet and outlet structures.
- Inspect embankments for erosion.
- Fill out the Evaporation Ponds/Infiltration Beds PBMP Inspection and Maintenance Form.

5.2.2 Infiltration Beds Maintenance Procedures

- If surface basin soils have been clogged, remove, replace, or recondition the clogged soils.
- Remove excessive sediment from the basin as necessary when the floor of the basin is thoroughly dry.
- Maintain the overlying vegetation in good condition, and re-vegetate any bare spots as soon as possible.
- Clean catch basins and inlets for regular removal of sediment and debris, and following each major storm event.
- Mow the buffer area, side slopes and basin bottom, and remove grass clippings and accumulated organic matter to prevent clogging of surface area.
- If necessary, remove the top layer of the buffer area using light equipment that will not compact the underlying soil, and deeply till the remaining soil and re-vegetate as soon as possible.
- Prohibit vehicular access on subsurface infiltration areas and avoid excessive compaction by mowers.
- Fill out the Evaporation Ponds/Infiltration Beds PBMP Inspection and Maintenance Form.

See Attachment Storm Water Inspection and Maintenance Forms – Evaporation Ponds/Infiltration Beds PBMP Inspection and Maintenance Form.

ATTACHMENTS

Storm Water Inspection and Maintenance Forms

Treatment PBMP Inspection and Maintenance Form

Pervious Surface PBMP Inspection and Maintenance Form

Vegetated PBMP Inspection and Maintenance Form

Evaporation Ponds / Infiltration Beds Inspection and Maintenance Form

Treatment PBMP Inspection and Maintenance Form

Section 1: Background Data

| | | | | |
|---|------------|-----------------|-------|---|
| Inspector(s): | | Date: | Time: | EID #: |
| Tenant Leased Areas: <input type="checkbox"/> Yes <input type="checkbox"/> No | | If yes, PMID #: | | Tenant Name: |
| Weather: | Longitude: | Latitude: | | Reference Photo's Taken: <input type="checkbox"/> Completed |
| Land Use Drainage Area (Check all that apply): <input type="checkbox"/> Industrial <input type="checkbox"/> Commercial <input type="checkbox"/> Open Space <input type="checkbox"/> DOTA Common Use Area (e.g. ramp or runway) <input type="checkbox"/> Other: | | | | |
| Type of Inspection: <input type="checkbox"/> Monthly <input type="checkbox"/> Quarterly <input type="checkbox"/> Annual <input type="checkbox"/> Re-inspection <input type="checkbox"/> Other | | | | |
| PBMP Category: <input type="checkbox"/> Low Impact Development (LID) <input type="checkbox"/> Source Control <input type="checkbox"/> Storm Water Treatment | | | | |
| Types of PBMPs: <input type="checkbox"/> O/W Separator <input type="checkbox"/> CDS Units <input type="checkbox"/> Drain Inlets with Trash Collectors <input type="checkbox"/> Hydrodynamic Separator <input type="checkbox"/> Other: | | | | |

Section 2: Visual Inspection

| Maintenance Item | S | U | Comments / Actions Required: |
|--|---|---|------------------------------|
| Pretreatment | | | |
| Sediment Accumulation | | | |
| Trash and Debris | | | |
| Inlets | | | |
| Inlet Structural Condition | | | |
| Blockage? | | | |
| Oil Containment Chamber | | | |
| Oil Volume | | | |
| Oil-absorbing pad condition | | | |
| Sediment Collection Chamber | | | |
| Sediment Volume | | | |
| Sludge Accumulation | | | |
| Outlets | | | |
| Structural Condition | | | |
| Sediment, Trash, Debris Accumulation | | | |
| Erosion | | | |
| Other | | | |
| Spills or Leaks Evident | | | |
| No Excessive Ponding | | | |
| Water Conveyed Through System Properly | | | |

S – Satisfactory / U – Unsatisfactory

Section 3: Corrective Actions

Maintenance Needed? ☐ Yes ☐ No (Review O&M Manual for Specific PBMP Maintenance Requirements)

Date Corrected: _____

Explanation of Maintenance Activities: _____

Total Amount of Trash Removed: _____ (lbs)

Total Amount of Sludge Removed: _____ (lbs)

Total Amount of Oil Removed: _____ (lbs)

Section 4: Waste Removed

| Date | Section | Single Use Plastics, Styrofoam, Rubber (lb) | Metal, Glass, Fiberglass, Paper, Cardboard (lb) | Cigarette Butts, other misc. man- made trash (lb) | Green Trash (landscaping debris, cut wood, plant/grass clippings) (lb) | Green Waste (vegetation, branches, leaves, non- landscaping green waste) | Sediment, Sand, Rock, Aggregate, Asphalt Debris (lb) | Comments |
|-------|---------|--|---|---|---|---|--|----------|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Total | | | | | | | | |

Pervious Surface PBMP Inspection and Maintenance Form

Section 1: Background Data

| | | | |
|---|-----------------|-----------|---|
| Inspector(s): | Date: | Time: | EID #: |
| Tenant Leased Areas: <input type="checkbox"/> Yes <input type="checkbox"/> No | If yes, PMID #: | | Tenant Name: |
| Weather: | Longitude: | Latitude: | Reference Photo's Taken: <input type="checkbox"/> Completed |
| Land Use Drainage Area (Check all that apply): <input type="checkbox"/> Industrial <input type="checkbox"/> Commercial <input type="checkbox"/> Open Space <input type="checkbox"/> DOTA Common Use Area (e.g. ramp or runway) <input type="checkbox"/> Other: | | | |
| Type of Inspection: <input type="checkbox"/> Monthly <input type="checkbox"/> Quarterly <input type="checkbox"/> Annual <input type="checkbox"/> Re-inspection <input type="checkbox"/> Other | | | |
| PBMP Category: <input type="checkbox"/> Low Impact Development (LID) <input type="checkbox"/> Source Control <input type="checkbox"/> Storm Water Treatment | | | |
| Types of PBMPs: <input type="checkbox"/> Permeable Pavement <input type="checkbox"/> Permeable Pavers <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Wood Mulch <input type="checkbox"/> Other: | | | |

Section 2: Visual Inspection

| Maintenance Item | S | U | Comments / Actions Required: |
|---|---|---|------------------------------|
| General BMPs | | | |
| Structural Appearance | | | |
| Unauthorized Modification | | | |
| Trash and Debris | | | |
| Contamination (evidence of oil, gasoline etc.) | | | |
| Odor | | | |
| Vegetation Management | | | |
| Weeds | | | |
| Structure | | | |
| Damaged Areas | | | |
| Obstructions (overflow device obstructed or debris has collected) | | | |
| Clogged Pores | | | |
| Sediment | | | |
| Sediment Accumulation | | | |
| Standing Water | | | |
| No Excessive Ponding | | | |

S – Satisfactory / U – Unsatisfactory

Section 3: Corrective Actions

Maintenance Needed? ☐ Yes ☐ No *(Review O&M Manual for Specific PBMP Maintenance Requirements)*

Date Corrected: _____

Explanation of Maintenance Activities: _____

Total Amount of Trash Removed: _____ (lbs)

Vegetated PBMP Inspection and Maintenance Form

Section 1: Background Data

| | | | |
|---|-----------------|-----------|---|
| Inspector(s): | Date: | Time: | EID #: |
| Tenant Leased Areas: <input type="checkbox"/> Yes <input type="checkbox"/> No | If yes, PMID #: | | Tenant Name: |
| Weather: | Longitude: | Latitude: | Reference Photo's Taken: <input type="checkbox"/> Completed |
| Land Use Drainage Area (Check all that apply): <input type="checkbox"/> Industrial <input type="checkbox"/> Commercial <input type="checkbox"/> Open Space <input type="checkbox"/> DOTA Common Use Area (e.g. ramp or runway) <input type="checkbox"/> Other: | | | |
| Type of Inspection: <input type="checkbox"/> Monthly <input type="checkbox"/> Quarterly <input type="checkbox"/> Annual <input type="checkbox"/> Re-inspection <input type="checkbox"/> Other | | | |
| PBMP Category: <input type="checkbox"/> Low Impact Development (LID) <input type="checkbox"/> Source Control <input type="checkbox"/> Storm Water Treatment | | | |
| Types of PBMPs: <input type="checkbox"/> Bioswales (Wedelia) <input type="checkbox"/> Grassed Swale <input type="checkbox"/> Other: | | | |

Section 2: Visual Inspection

| Maintenance Item | S | U | Comments / Actions Required: |
|--|---|---|------------------------------|
| General BMPs | | | |
| Structural Appearance | | | |
| Unauthorized Modification | | | |
| Trash and Debris | | | |
| Contamination (evidence of oil, gasoline etc.) | | | |
| Odor | | | |
| Vegetation Management | | | |
| Grass Height (maintain 2-6 inch) | | | |
| Proper Vegetation Cover | | | |
| Dead / Diseased Vegetation | | | |
| Brush or Tree Growth | | | |
| Weeds | | | |
| Erosion | | | |
| Evidence of Erosion | | | |
| Sediment | | | |
| Sediment Accumulation | | | |
| Standing Water | | | |
| No Excessive Ponding | | | |

S – Satisfactory / U – Unsatisfactory

Section 3: Corrective Actions

Maintenance Needed? ☐ Yes ☐ No (*Review O&M Manual for Specific PBMP Maintenance Requirements*)

Date Corrected: _____

Explanation of Maintenance Activities: _____

Total Amount of Trash Removed: _____ (lbs)

Evaporation Ponds / Infiltration Beds PBMP Inspection and Maintenance Form

Section 1: Background Data

| | | | |
|---|-----------------|-----------|---|
| Inspector(s): | Date: | Time: | EID #: |
| Tenant Leased Areas: <input type="checkbox"/> Yes <input type="checkbox"/> No | If yes, PMID #: | | Tenant Name: |
| Weather: | Longitude: | Latitude: | Reference Photo's Taken: <input type="checkbox"/> Completed |
| Land Use Drainage Area (Check all that apply): <input type="checkbox"/> Industrial <input type="checkbox"/> Commercial <input type="checkbox"/> Open Space <input type="checkbox"/> DOTA Common Use Area (e.g. ramp or runway) <input type="checkbox"/> Other: | | | |
| Type of Inspection: <input type="checkbox"/> Monthly <input type="checkbox"/> Quarterly <input type="checkbox"/> Annual <input type="checkbox"/> Re-inspection <input type="checkbox"/> Other | | | |
| PBMP Category: <input type="checkbox"/> Low Impact Development (LID) <input type="checkbox"/> Source Control <input type="checkbox"/> Storm Water Treatment | | | |
| Types of PBMPs: <input type="checkbox"/> Evaporation Pond <input type="checkbox"/> Infiltration Bed | | | |

Section 2: Visual Inspection

| Maintenance Item | S | U | Comments / Actions Required: |
|--|---|---|------------------------------|
| General BMPs | | | |
| Structural Appearance | | | |
| Unauthorized Modification | | | |
| Trash and Debris | | | |
| Contamination (evidence of oil, gasoline etc.) | | | |
| Odor | | | |
| Vegetation Management | | | |
| Grass Height | | | |
| Proper Vegetation Cover | | | |
| Dead / Diseased Vegetation | | | |
| Brush or Tree Growth | | | |
| Weeds | | | |
| Erosion | | | |
| Evidence of Erosion | | | |
| Sediment | | | |
| Sediment Accumulation | | | |
| Standing Water | | | |
| No Excessive Ponding | | | |
| Inlets | | | |
| Inlet Condition | | | |

S – Satisfactory / U – Unsatisfactory

Section 3: Corrective Actions

Maintenance Needed? ☐ Yes ☐ No (Review O&M Manual for Specific PBMP Maintenance Requirements)

Date Corrected: _____

Explanation of Maintenance Activities: _____

Total Amount of Trash Removed: _____ (lbs)