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STORM WATER MANAGEMENT PLAN (SWMP) FOR NAVY REGION HAWAII (NRH)

JBPHH, Oahu, Hawaii

Note: Portions of this Plan have been redacted due to National Security concerns

NPDES Permit No. HI S000257

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Appendices

- 1-1 Final Permit Documents [\[Redacted due to national security concerns\]](#)
 - Final NRH Municipal Separate Storm Sewer System Permit No. HI S000257 (Effective Date March 23, 2015)
 - Permit Rationale
- 1-2 Navy Region Hawaii Organizational Chart
- 3-1 BMPs for Allowable Non-storm Discharges
- 3-2 BMPs for Disposal of Waste Materials and Contaminated Water
- 3-3 Enforcement Response Plan *(Currently Under Development)*
- 3-4 Wastewater Spill Response Reporting Guidelines [\[Redacted due to national security concerns\]](#)
- 4-1 Initial BMP Site Inspection Checklist
- 4-2 Storm Water Pollution Prevention Plan Content Review Checklist
- 4-3 Construction Oversight Field Inspection Checklist
- 5-1 LID/EISA Constraints and Waiver Request *(Currently Under Development)*
- 6-1 Trash Reduction Plan
- 6-2 Action Plan for Maintenance of Structural Controls
- 7-1 Integrated Pest Management Plan [\[Redacted due to national security concerns\]](#)
- 9-1 Semi-annual Facility Inspection Checklist
- 9-2 Facility-wide Maintenance BMPs *(Currently Under Development)*
- 10-1 List of Commercial Facilities
- 11-1 SIC Codes for Industrial Facilities Requiring Permit Coverage
- 11-2 Industrial Storm Water Pollution Control Plans [\[Redacted due to national security concerns\]](#)
 - List of Industrial Facilities
 - NRH Industrial Facilities and Base Drainage Map
 - Storm Water Pollution Control Plans
- 11-3 Best Management Practices Fact Sheets
- 12-1 Sampling Locations and Rationale [\[Redacted due to national security concerns\]](#)
- 12-2 Other Permit-identified Sites [\[Redacted due to national security concerns\]](#)
- 13-1 Program Effectiveness Assessment Plan

List of Acronyms and Abbreviations

ADP	Available Demonstrated Practices
ADT	Available Demonstrated Technology
AFFF	Aqueous Film Forming Foam
AMS	Asset Management System
APWO	Assistant Public Works Officer
AUL	Authorized Use List
BAT	Best Available Technology Economically Achievable
BBL	Barrel
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CETEP	Centralized Environmental Training and Education Program
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CMP	Corrugated Metal Pipe
CO	Commanding Officer
COD	Chemical Oxygen Demand
CWA	Clean Water Act
DJBC	Deputy Joint Base Commander
DOD	Department of Defense
DOE	Department of Education
DOH	Department of Health
DOT	Department of Transportation
DRMO	Defense Reutilization Marketing Office
DRMS	Defense Reutilization Marketing Service
EDOP	Effective Date of Permit

EA	Environmental Assessment
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act (2007)
EV	NRH Environmental Division
EPA	Environmental Protection Agency
EQA	Environmental Quality Assessment
EPCRA	Emergency Planning and Community Right-to-Know Act
FEAD	Facilities Engineering and Acquisition Division, formerly “Resident Officer in Charge of Construction (ROICC)”
FMD	Facility Management Division
FWPCA	Federal Water Pollution Control Act
GAC	Granular Activated Carbon
GIS	Geographic Information System
GP	General Permit
GPD	Gallons per Day
GPM	Gallons per Minute
HAR	Hawaii Administrative Rules
HAZMIN	Hazardous Waste Minimization
HM	Hazardous Material
HW	Hazardous Waste
IDDE	Illicit Discharge Detection and Elimination
IP	Individual Permit
IPM	Integrated Pest Management
IRP	Installation Restoration Program
JB4	Joint Base Public Works Officer
JBC	Joint Base Commander
JBPHH	Joint Base Pearl Harbor-Hickam
LFPE	Logistics Facilities Public Works Engineering
LID	Low Impact Development

MEP	Maximum Extent Practicable
MGD	Million Gallons per Day
MPP	Monitoring Program Plan
MS4	Municipal Separate Storm Sewer System
MSDS	Material Safety Data Sheet
NAD 83	North American Datum 83
NAVFAC Hawaii	Naval Facilities Engineering Command Hawaii
NAVFAC Pacific	Naval Facilities Engineering Command Pacific
NEPMU-6	Navy Environmental Preventative Medicine Unit 6
NGPC	Notice of General Permit Coverage
NIOSH	National Institute for Occupational Safety and Health
NOI	Notice of Intent (for coverage under a general NPDES Permit)
NSDEPP	Non-Storm Water Discharge Elimination and Prevention Program
NPDES	National Pollutant Discharge Elimination System
NRH	Navy Region Hawaii
O&M	Operation and Maintenance
O&HS SC	Oil & Hazardous Substance Spill Contingency
OHS	Oil and Hazardous Substance
OJT	On the Job Training
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyls
Permit	NRH's Municipal Separate Storm Sewer System (MS4) and Industrial NPDES Permit, No. HI S000257
pH	Hydrogen-Ion Activity
PID	Photoionization Detector
PM	Project Manager
PMP	Pest Management Plan
PPM	Parts Per Million
PPV Housing	Public-Private Venture Housing

PROD	Production Division
PVC	Polyvinyl Chloride
POL	Petroleum, Oil, Lubricant
POTW	Publicly Owned Treatment Works
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendment and Reauthorization Act
SAS	Satellite Accumulation Site
SIC	Standard Industrial Classification
SLC	Shop Level Coordinator
SOP	Standard Operating Procedures
SPCC	Spill Prevention, Control, and Countermeasures
SWMP	Storm Water Management Plan
SWPCP	Storm Water Pollution Control Plan
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TMK	Tax Map Key
TOC	Total Organic Carbon
TSDf	Treatment, Storage, and Disposal Facility
TSS	Total Suspended Solids
UIC	Underground Injection Control
U.S.C.	United States Code
USCG	United States Coast Guard
USMC	United States Marine Corps
UST	Underground Storage Tank
VOC	Volatile Organic Compound

Definitions

Activity	An independent command performing a specific mission and having its own unit identification code.
Acute Toxicity	Any toxic effect that is produced within a short period of time, generally 96 hours or less. Although the effect most frequently considered is mortality, the end result of an acute effect could be any harmful biological effect.
Adsorption	The collection of a gas, liquid, or dissolved substance in a condensed form on a surface. An example would be the tendency of contaminants to collect on and adhere to sediment particles.
Algae	Aquatic, non-flowering plants that lack roots and use light energy to convert carbon dioxide and inorganic nutrients such as nitrogen and phosphorus into organic matter by photosynthesis. Common algae include dinoflagellates, diatoms, seaweeds, and kelp. An algal bloom can occur when excessive nutrient levels and other physical and chemical conditions enable the algae to reproduce rapidly.
Aquifer	The underground layer of rock or soil in which groundwater resides. Aquifers are replenished or recharged by surface water percolating through soil. Wells are drilled into aquifers to extract water for human use.
Base Flow	The flow contribution to a creek by groundwater. During dry periods, base flow constitutes the majority of stream flow.
Baseline Load	Quantitative estimate of the debris currently being discharged from the MS4
Best Available Technology Economically Achievable (BAT)	<p>Defined at CWA Section 304(b)(2). In general, BAT represents the best available economically achievable performance of plants in the industrial subcategory or category. Factors considered in assessing BAT include:</p> <ul style="list-style-type: none">• cost of achieving BAT effluent reductions;• age of equipment and facilities involved;• the processes employed by the industry and potential process changes;• non-water quality environmental impacts, including energy requirements; and• other factors as EPA deems appropriate.
Best Conventional Pollutant Control Technology (BCT)	<p>Defined in CWA Section 304(b)(4), addresses conventional pollutants from existing industrial point sources. In addition to considering the other factors specified in Section 304(b)(4)(B), EPA establishes BCT limitations after consideration of a two part "cost-reasonableness" test. This methodology was published in a Federal Register notice on July 9, 1986 (51 FR 24974).</p>

Best Management Practice (BMP)

Measure that is implemented to protect water quality and reduce the potential for pollution associated with storm water runoff.

Bioaccumulation The process by which a contaminant accumulates in the tissue of an organism. For example, certain chemicals in food eaten by a fish tend to accumulate in its liver and other tissues.

Bioavailable Available for biological uptake.

Biodegradation The conversion of organic compounds into simpler compounds (such as carbon dioxide and water) through biochemical activity. Toxic compounds can be converted into non-toxic compounds through biodegradation. However, in some cases, complex compounds are first converted into intermediate substances that can be more toxic than the original substance.

Biofiltration Treatment technology that uses microorganisms in the destruction of volatile organic compounds. Waste gases are purified by passage through a biologically active, porous medium. As the waste gases pass through the medium, contaminants are absorbed into a wet/biofilm layer and are aerobically degraded to carbon dioxide, water, and biomass end products.

Biochemical Oxygen Demand (BOD)

The amount of oxygen in water required by bacteria to decompose organic matter under an aerobic condition. BOD is an indicator of water quality: a high BOD value indicates a high level of pollution. Although BOD is not a specific compound, it is defined as a conventional pollutant under the Clean Water Act.

Biomagnification The process by which concentrations of contaminants increase (magnify) as they pass up the food chain such that each animal in the food chain has higher tissue concentrations than did its food. For example, concentrations of certain contaminants can increase as they are passed from plankton to herring to salmon to seals.

Channelization The process of making a channel or channels. A channel is the bed of a stream or river, or the hollow or course in which a stream flows.

Check Dam A small dam designed to slow the velocity of water and sediment in a channel, used especially for grade control and channel erosion reduction.

Chemical Oxygen Demand (COD)

A test that measures the amount of oxygen in water required for chemical oxidation of organic matter.

Chronic Toxicity Any toxic effect on an organism that results after exposure of long duration (often 1/10th of the life span or more). The end result of a chronic effect can be death although the usual effects are sublethal (e.g., inhibited reproduction or growth).

These sublethal effects may be reflected by changes in the productivity and population structure of the community.

Clean Water Act (CWA)

The Federal Water Pollution Control Act enacted by Public Law 92-500 as amended by Public Laws 95-217, 95-576, 96-483, and 97-117; 33 U.S.C. 1251 et seq. It is the primary federal law in the U.S. governing water pollution.

Coliform Bacteria Organisms residing in the intestinal tracts of human beings and other warm-blooded animals. The presence of coliform bacteria indicates the presence of fecal contamination.

Combined Sewer Overflow (CSO)

A pipe that discharges untreated wastewater during storms from a sewer system that carries both sanitary wastewater and storm water. The overflow occurs because the system does not have the capacity to transport and treat the increased flow caused by storm water runoff.

Combined Sewer System

A wastewater collection and treatment system where domestic and industrial wastewater is combined with storm runoff. Although such a system does provide treatment of storm water, in practice the systems cannot handle major storm flows resulting in untreated discharges from combined sewer overflows.

Critical Area A source area that has a high likelihood for the release of pollutants.

Culvert A drain, usually a concrete or metal pipe, crossing under a road or an embankment.

Detention The process of collecting and holding back storm water for later release to receiving waters.

Dissolved Oxygen Oxygen that is present (dissolved) in water and therefore available for fish and other aquatic animals to use. If the amount of dissolved oxygen in the water is too low, then aquatic animals may die. Wastewater and naturally occurring organic matter contain oxygen-demanding substances that consume dissolved oxygen.

Dry Weather Flow Flow from anything other than a storm event; non-storm runoff (e.g., air conditioning condensate, landscaping overflow, etc.).

Environmental Impact Statement (EIS)

A document that discusses the likely significant impacts of a proposal, methods to lessen the impacts, and alternatives to the proposal, required by the National Environmental Policy Act (NEPA) and the Hawaii Environmental Impact Statement Law, Chapter 343, HRS.

Erosion	Wearing away of rock or soil by the gradual detachment of rock or soil fragments by water, wind, ice, and other mechanical and chemical forces.
Eutrophication	The process by which a body of water becomes enriched with nutrients, especially nitrogen and phosphate, stimulating the growth of aquatic plants. Excessive plant growth tends to have undesirable effects such as closing streams and reducing water clarity. Also, when large numbers of plants decay, they consume disproportionate amounts of dissolved oxygen, reducing the amount of oxygen available for use by other aquatic life.
Facility	An industrial operation created to serve a particular function.
Fecal Coliform	See Coliform Bacteria.
Geometric Mean	An arithmetic average of the logarithmic values; obtained by combining all data points, computing the logarithm (the power to which a number is raised), taking the average (mean), and transferring it back to an arithmetic number.
Grated Inlet	A storm drain inlet structure with a grate framework opening to allow storm water runoff to enter.
Habitat	The specific area or environment in which a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be free of harmful contaminants.
Health Risk	The risk or likelihood that a person's health will be adversely affected.
Herbicide	A chemical agent that destroys or inhibits plant growth.
Illegal Dumping	The illegal act of putting something other than storm water into a storm water system.
Illicit Connection	An unauthorized connection of a pipe carrying something other than storm water to a storm water system.
Illicit Discharge	Any discharge to a separate storm sewer that is not composed entirely of storm water except discharges pursuant to an NPDES permit and discharges resulting from firefighting activities.
Impervious	A surface that cannot be easily penetrated; for instance, rain does not readily penetrate asphalt or concrete surfaces.
Inflow and Infiltration (I/I)	Excess water that enters a sewer system. Since a sewer system can only handle a certain amount of wastewater at one time, excess flows can trigger overflows of raw wastewater. Inflow refers to water that unnecessarily flows into the system, for example, from manhole covers. Infiltration is water that seeps into the system through cracks and gaps in the pipes. Typically, inflow and infiltration are clean water not needing treatment.

Insecticide A chemical agent that destroys insects.

Land Use The way land is developed and used in terms of the types of activities allowed (agriculture, residences, industries, etc.) and the size of buildings and structures permitted. Certain types of pollution problems are often associated with particular land use practices, such as sedimentation from construction activities.

Materials Management

Employ proper handling and storage (inventory control and material labeling) procedures to transport and store significant materials according to Federal, state, and local regulations (i.e., (1) use barrel cart or forklift to move drums; and (2) store significant materials in proper containers and in a covered area).

Metals Metals are elements naturally found in rocks and minerals that are released to the environment by weathering and erosion. This material can also be released as pollutants by human activity, as is the case for (heavy) metals, such as mercury, lead, nickel, zinc, and cadmium. These are of environmental concern because they are generally toxic to life above 'trace' concentration. Since metals are elements, they do not break down in the environment over time and can be incorporated into plant and animal tissue.

Monitor To systematically and repeatedly measure conditions in order to track changes. For example, dissolved oxygen in a bay might be monitored over a period of several years in order to identify any trends in its concentration.

Municipal Separate Storm Sewer System (MS4)

A conveyance or system of conveyances (including roads, drainage systems, municipal streets, grated inlets, curbs, gutters, ditches, man-made channels, or storm drains) owned or operated by a state, city, or other public body, designed or used for collecting or conveying storm water. MS4s are not a combined sewer and are not part of a Publicly Owned Treatment Works (POTW). MS4s discharge directly into receiving waters.

National Pollutant Discharge Elimination System (NPDES)

NPDES is a part of the federal CWA, which requires point source dischargers to obtain permits. These permits are referred to as NPDES permits, and are administered in Hawaii by the Clean Water Branch of the State of Hawaii Department of Health.

NPDES States NPDES States have NPDES permitting authority. The state agency administers and enforces the storm water program within the state. They may issue individual and general permits for industrial dischargers, including those that are developed as a result of the group application process. Having such authority does not, however, oblige a state to issue general permits (either baseline or group). States with general

permitting authority may elect to issue only individual permits. Most states with general permitting authority are expected to use it.

Under the Clean Water Act, state NPDES programs must be at least as strict as the EPA's programs but may be more stringent. Several states have indicated that their program requirements will exceed the EPA minimums. Moreover, NPDES states may choose to promulgate baseline permits but are not required to do so.

Non-NPDES States NPDES states that currently do not have general permitting authority are particularly hard pressed by the regulation's deadlines. These states administer the NPDES program in the same manner as other NPDES states, except that they do not have the EPA-delegated authority to issue general permits.

Non-Point Source Pollution

Pollution that enters water from dispersed and uncontrolled sources such as surface runoff. Non-point sources (e.g., forest practices, agricultural practices, on-site sewage disposal, street and paved area runoff) may contribute pathogens, suspended solids, and toxicants. While individual sources may seem insignificant, the cumulative effects of non-point source pollution are significant.

Non-Point Sources (NPS)

Diffuse sources from which contaminants originate to accumulate in surface water or groundwater. These sources can add to a cumulative problem with serious health or environmental consequences.

Non-Storm Water Discharge

Any discharge to storm water systems that is not composed entirely of storm water.

Nutrients Essential chemicals needed by plants or animals for growth. If other physical and chemical conditions are optimal, excessive amounts of nutrients can lead to degradation of water quality by promoting excessive growth, accumulation, and subsequent decay of plants, especially algae. Some nutrients can be toxic to animals at high concentrations.

Organics A broad term that includes numerous compound which are derived (naturally or by man-made processes) from animal or vegetation sources or from petroleum. Typical organic matter would include fallen leaves, grasses, pollen, animal wastes, paper, other litter, oil and grease, gasoline, pesticide, and various synthetic products.

Outfall (Industrial) The point of discharge of storm water to adjacent property, to a municipal separate storm water system, or directly to waters of the United States. The outlet can be from a storm water system or drain system.

Outfall (Non-Industrial)

The outlet point of storm water discharges excluded from the NPDES industrial storm water program.

Oxygen-Demanding Materials

Materials such as food waste and dead plant or animal tissue that use up dissolved oxygen in the water when they are degraded through chemical or biological processes. BOD is a measure of how much oxygen demand a substance has.

Parameter A quantifiable or measurable characteristic. For example, height, weight, sex, and hair color are all parameters that can be determined for humans. Water quality parameters include temperature, pH, salinity, dissolved oxygen concentration, and many others.

Pathogen An agent such as a virus, bacterium, or fungus that can cause diseases in humans. Pathogens can be present in municipal, industrial, and non-point source discharges.

Percolate To pass through a permeable substance. For instance, septic effluent percolates through soil.

Permeable Surfaces

Surfaces, such as soil, that allow some percolation or infiltration of water into the ground and ultimately the groundwater system. This is in contrast to impermeable surfaces, such as concrete, that allow water to run off with little or no infiltration.

Pesticide A general term to describe chemical substances used to destroy or control organisms. Pesticides include insecticides, algicides, fungicides, and others. Many of these substances are manufactured and are not naturally found in the environment. Others, such as pyrethrum, are natural toxins which are extracted from plants and animals.

pH The degree of alkalinity or acidity of a solution. A pH of 7.0 indicates neutral water, while a pH of 5.5 is acidic. A reading of 8.5 is alkaline or basic. The pH of water influences many of the types of chemical reactions that will occur in it. For instance, a slight decrease in pH may greatly increase the toxicity of substances such as cyanides, sulfides, and most metals. A slight increase may greatly increase the toxicity of pollutants such as ammonia.

Pluvial Of or having to do with rain; formed by the action of rain.

Point Sources A source of pollutants from a single point of conveyance such as a pipe. For example, the discharge pipe from a sewage treatment plant or factory is a point source.

Pollutant A contaminant that adversely alters the physical, chemical, or biological properties of the environment. The term includes pathogens, toxic metals, carcinogens, oxygen-demanding materials, and all other harmful substances. With reference to non-point sources, the term is sometimes used to apply to contaminants released in low concentrations from many activities which collectively degrade water quality. As defined in the federal CWA, pollutant means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological

materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.

Primary-Treated Sewage

Sewage that has undergone primary treatment.

Primary Treatment A wastewater treatment method that uses settling, skimming, and (usually) chlorination to remove solids, floating materials, and pathogens, respectively, from wastewater. Primary treatment removes about 35 percent of BOD and less than half of the metals and toxic organic substances.

Priority Pollutants Substances listed by the EPA under the CWA as toxic and having priority for regulatory controls. The list currently includes metals (13), inorganic compounds containing cyanide and arsenic, and a broad range of both natural and artificial organic compounds (111).

Receptors When referring to water quality, receptors are users of the water body, such as fish or humans ingesting fish that are affected by the condition of the water.

Regulatory Framework

A particular set of laws, rules, procedure, and agencies designed to govern a particular type of activity or solve a particular program.

Representative Storm Event

A storm event that results in more than 0.1 inch of total rainfall and occurs more than 72 hours since the last event of more than 0.1 inch of total rainfall.

Riprap A foundation, wall, or revetment made of various sizes of rock placed irregularly in water or on the soft bottom of a water body.

Riparian Pertaining to the banks of streams, lakes, or tidewater.

Secondary Treatment

A wastewater treatment method that usually involves the addition of biological treatment to the settling, skimming, and disinfection provided by primary treatment. Secondary treatment may remove up to 90 percent of BOD and significantly more metals and toxic organics than primary treatment.

Sediment Material suspended in or settling to the bottom of a liquid, such as the sand and mud that make up much of the shorelines and bottom of the ocean. Sediment input to streams and rivers comes from natural sources, such as erosion of soils and weathering of rock; or anthropogenic sources, such as forest or agricultural practices, or construction activities. Certain contaminants tend to collect on and adhere to sediment particles.

Separated Sewer System

A wastewater collection and treatment system where domestic and industrial wastewater is separated from storm water runoff. A separated system consists of independent sanitary wastewater and storm water systems. The storm water is discharged directly into open water and the sanitary wastewater goes to a treatment plant.

Significant Materials

Includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under Section 101(14) of CERCLA; any chemical the facility is required to report pursuant to Section 313 of Title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

Significant Quantities

The volume, concentrations, or mass of a pollutant in storm water discharge that can cause or threaten to cause pollution, contamination, or nuisance; adversely impact human health or the environment; and cause or contribute to a violation of any applicable water quality standards for the receiving water.

Siltation

The process by which a river, lake, or other water body becomes clogged with sediment. Silt can clog gravel beds and prevent successful salmon spawning.

Source Control BMP

An effort to prevent or limit the exposure of significant materials to storm water at the source.

Storm Drain

A system of gutters, pipes, or ditches used to carry storm water from surrounding lands to streams, lakes, or the ocean, which is vulnerable to deliberate dumping or spills, and storm water runoff pollutants that can be generated through a variety of routine human activities. This term also refers to the end of the pipe where the storm water is discharged (i.e., Storm Drain Outlet).

Storm Water

Storm water runoff, snow melt runoff, and surface runoff and drainage.

Storm Water Discharge Associated with Industrial Activity

The discharge from any conveyance which is used for collecting and conveying storm water and which is directly related to manufacturing, processing or raw materials storage areas at an industrial plant. The term includes, but is not limited to, storm water discharges from industrial plant yards; immediate access roads and rail lines used or traveled by carriers of raw materials, manufactured products, waste material, or by-products used or created by the facility; material handling

	<p>sites; refuse sites; sites used for the application or disposal of process waste waters; sites used for the storage and maintenance of material handling equipment; sites used for residual treatment, storage, or disposal; shipping and receiving areas; manufacturing buildings; storage areas (including tank farms) for raw materials, and intermediate and finished products; and areas where industrial activity has taken place in the past and significant materials remain and are exposed to storm water.</p>
Surcharge	<p>This refers to a condition where the hydraulic capacity of a storm water system is temporarily exceeded (e.g., during a storm event).</p>
Surge	<p>A large mass of moving water, such as a wave or swell. Also a heavy, violent swelling motion, such as a surge of water through a storm drain during a heavy rain.</p>
Suspended Solids	<p>Organic or inorganic particles that are suspended in and carried by the water. The term includes sand, mud and clay particles as well as solids in wastewater.</p>
Swale	<p>A broad, shallow, vegetated channel. A swale is essentially a vegetated drainage ditch that has been engineered to collect and transport storm water in a way that allows the vegetation to filter sediments and pollutants.</p>
Total Suspended Solids (TSS)	<p>The weight of particles that are suspended in water. Suspended solids in water reduce light penetration in the water column, can clog the gills of fish and invertebrates, and are often associated with toxic contaminants because organics and metals tend to bind to particles.</p>
Toxic	<p>Poisonous, carcinogenic, or otherwise directly harmful to life.</p>
Trash	<p>For the purposes of this plan, “trash” will be considered analogous to “litter” as defined below by the Hawaii Revised Statutes (HRS) §391-1.</p> <p style="padding-left: 40px;"><i>“Litter” means rubbish, refuse, waste material, garbage, trash, offal, or any debris of whatever kind or description, whether or not it is of value, and includes improperly discarded paper, metal, plastic, glass, or solid waste.</i></p> <p>A distinction is made that trash is not inclusive of non-man made materials, such as branches, leaves, and other vegetation, that is deposited into waterbodies naturally.</p>
Tributary	<p>A stream that flows into another.</p>
Turbidity	<p>A measure of the amount of material suspended in the water. Increasing the turbidity of the water decreases the amount of light that penetrates the water column. High levels of turbidity are harmful to aquatic life.</p>
Urban Runoff	<p>A substance, such as rain, that runs off of surfaces in a watershed in excess of the amount absorbed by the surfaces (usually the ground). Urban runoff can contain sediments and contaminants (non-point source pollution) that can add to water quality degradation in the watershed. Increases in impervious surface usually result in increased urban runoff.</p>

Volatile	Can be readily vaporized at a relatively low temperature.
Watershed	The geographic region from which water drains into a particular river or body of water. A watershed includes hills, lowlands, and the body of water into which the land drains. Watershed boundaries are defined by the ridges of separating watersheds.
Weir	A low dam built across a stream, primarily to control water level or to divert water into another facility. Also used to measure flow.
Wetlands	Wetlands are transitional areas between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is saturated with water or covered by shallow water at some time during the growing seasons each year.
Zoning	To designate by ordinances areas of land reserved and regulated for different land uses.

1 Introduction

On February 23, 2015, the Department of the Navy – Navy Region Hawaii (NRH) was issued National Pollutant Discharge Elimination System (NPDES) Permit No. HI S000257 (referred to hereinafter as the “Permit”) by the State of Hawaii Department of Health (DOH), which took effect on March 23, 2015. Refer to Appendix 1-1 for the final permit and rationale.

Under the Permit, NRH is authorized to discharge storm water and specified non-storm water discharges into State Waters from the following facilities:

- Joint Base Pearl Harbor – Hickam (JBPHH) Small Municipal Separate Storm Sewer System (Small MS4)
- Navy Industrial areas or facilities (as specified in the Permit)
- Any additional storm sewer outfalls and Navy Industrial areas and facilities identified by NRH, throughout the Permit term, as potentially significant pollutant sources.

The State Waters identified in the Permit consist of inland streams and open coastal waters in and around the Island of Oahu, Hawaii. These include Pearl Harbor, Halawa Stream, Kaiapo Canal, Kaukonahua Stream, Kumumau Canal, Maililili Stream, Mamala Bay, Manuwai Canal, Poamoho Stream, Transportation Canal, Ulehawa Stream, Unnamed tributary of Waikele Stream, Unnamed gulches in Wahiawa, Waikakalaua, and Waiawa Streams.

Per Part D.1 of the Permit, NRH is required to further develop, improve, implement and enforce its Storm Water Management Plan (SWMP). The Permit states:

Permit Reference	SWMP Section
<p>Part D. Storm Water Management Plan (SWMP)</p> <p>1. <i>The Permittee shall develop, implement, and enforce a SWMP designed to address the requirements of this permit and reduce, to the MEP, the discharge of pollutants to and from its Small MS4 to protect water quality and to satisfy the appropriate water quality requirements of the CWA. The SWMP shall implement the applicable components of the current SWMP and, at a minimum, include the following information for each of the SWMP components described in Part D.1.a to Part D.1.f:</i></p> <ul style="list-style-type: none"> • <i>The Best Management Practices (BMPs), plus underlying rationale and mechanism of execution that shall be implemented for each of the program components.</i> • <i>The measurable goals, standards and milestones for each of the BMPs, plus underlying rationale, including interim measures to assess the effectiveness of each program component and to guide the overall program implementation.</i> • <i>The name or position title and affiliation of the person or persons responsible for implementation or coordination of each program component.</i> • <i>Monitoring to determine effectiveness of the controls and of the overall storm water program.</i> 	<p>Section 1</p>

<ul style="list-style-type: none"> • <i>Evaluation of information collected and the resulting programmatic changes in an effort to maximize program resources to comply with this permit.</i> • <i>Specify the legal authority allowing for the requirements of this Permit to be met.</i> <p><i>The SWMP shall be developed per the requirements of this permit, be consistent with the format of this permit, shall be submitted to DOH in accordance with Parts A.6 and A.7 within 18 months after the effective date of this permit, or as otherwise specified, and shall be fully implemented upon submittal, including any plans, policies, or systems required to be developed and implemented as part of the SWMP. The Permittee shall implement the existing SWMP until submittal of the revision. The SWMP and any of its revisions, additions, or modifications are enforceable components of this permit.</i></p>	
<ol style="list-style-type: none"> 2. <i>The Permittee shall revise the SWMP, as necessary, if the discharge from the Small MS4 is causing or contributing to the exceedance of any discharge limitation or water quality standard established in HAR, Section 11-54-4. The revisions shall include BMPs and/or other measures to reduce the amount of pollutants found to be in exceedance from entering State Waters.</i> 3. <i>The Permittee shall properly address all modifications, concerns, requests, and/or comments to the satisfaction of the DOH and/or EPA.</i> <ol style="list-style-type: none"> a. <i>SWMP Modifications - The storm water pollution control activities described in the SWMP may need to be modified, revised, or amended from time to time over the life of the permit to respond to changed conditions and to incorporate more effective approaches to pollutant control. Minor changes may be proposed by the Permittee or requested by DOH or the EPA. Proposed changes that imply a major reduction in the overall scope and/or level of effort of the SWMP must be made for cause and in compliance with 40 CFR §122.62 and Part 124. A written report shall be submitted to the Director of Health (Director) for acceptance at least 30 calendar days prior to the initiation date of the major modification. The Permittee shall report and justify all other modifications made to the SWMP in its Annual Report for the year in which the modification was made.</i> b. <i>System Modifications include any planned physical alterations or additions to the permitted Small MS4 and any existing outfalls newly identified over the term of the permit. All alterations and/or additions to the Small MS4 with the potential to significantly affect the quality or quantity of discharge shall be identified by letter within 30 calendar days of the completion of the alteration and/or addition and summarized in the Annual Report.</i> 	<p>Section 1.6</p>

This revised SWMP is to be implemented upon submittal to DOH. The SWMP and any of its revisions, additions, or modifications are enforceable components of the Permit.

1.1 Objective

The goal of NRH's SWMP is to protect the water quality of surface waters affected by its small MS4 and specified industrial activities. This SWMP is designed to accomplish this task using a multi-faceted approach, which is outlined in several program components in accordance with the Permit.

For the purpose of this document, the term "tenants" will be used to describe all individuals, organizations, and installations that make up JBPHH. This includes, but is not limited to military personnel and their dependents, civilian employees, construction and maintenance contractors, industrial facilities, commercial businesses, schools, and recreational facilities.

The main objectives of this SWMP are to outline programs that:

- Promote awareness of NRH's SWMP among its tenants;
- Use education and training as a tool to manage the NRH Storm Water Program and identify areas for improvement;
- Identify responsible parties for implementation of the various SWMP components;
- Identify potential sources of storm water pollution, as regulated by the Permit;
- Implement, evaluate, and modify existing Best Management Practices (BMPs), as needed, to prevent storm water pollution from all tenants on Base and address changing conditions on Base;
- Facilitate implementation of facility-specific Storm Water Pollution Control Plans for specified industrial activities;
- Support regular inspections to oversee and enforce compliance with Permit, State and Federal regulations through this SWMP; and
- Routinely monitor to measure effectiveness of controls and the overall Storm Water Management Program in preventing, minimizing, and removing pollutants in storm water discharge, for continued development of the SWMP.

This SWMP is intended to be a user-friendly document to facilitate the Base-wide implementation of NRH's Storm Water Management Program, and meet State and Federal requirements. It is aimed at the development and application of comprehensive, cost-effective practices that prevent, reduce, and eliminate pollutants in storm water discharges throughout JBPHH to the maximum extent practicable (MEP).

1.2 Navy Region Hawaii Background

NRH consists of two major Naval installations, JBPHH on Oahu, and Pacific Missile Range Facility Barking Sands on Kauai. The focus of this SWMP are operations directly related to JBPHH. Any further references to NRH in this document are intended to be with respect to JBPHH only.

JBPHH was formed as a result of the October 1, 2010 merger between Naval Station, Pearl Harbor and Hickam Air Force Base. JBPHH provides support to several mission areas and functions ranging from a flying mission, port operations and support, and a wide variety of industrial and administrative functions and agencies.

1.2.1 Overview of JBPHH

The Permit coverage applies to JBPHH and its specified industrial facilities located throughout the island of Oahu, Hawaii. These activities take place in the main area of Joint Base which includes the contiguous areas of the former Hickam Air Force Base and the former Pearl Harbor Naval Base, as well as several non-contiguous areas. The sub areas of JBPHH are listed below (see Figure 1-1):

- 1.2.1.1 Former Hickam AFB Sub Area – includes all areas of the former Hickam AFB
- 1.2.1.2 Pearl Harbor Naval Base Sub Area – includes the former Naval Submarine Base Pearl Harbor, the former Naval Supply Center Pearl Harbor, and areas formerly part of Pearl Harbor Naval Shipyard.
- 1.2.1.3 Ford Island Sub Area
- 1.2.1.4 JBPHH Lualualei Annex Sub Area
- 1.2.1.5 JBPHH Wahiawa Annex Sub Area
- 1.2.1.6 Makalapa Crater Sub Area
- 1.2.1.7 Moanalua Sub Area
- 1.2.1.8 Pearl City Peninsula Sub Area
- 1.2.1.9 NAVFAC Hawaii Compound Sub Area
- 1.2.1.10 Waipio Peninsula Sub Area
- 1.2.1.11 West Loch Sub Area
- 1.2.1.12 Family Housing Sub Areas
- 1.2.1.13 Misc. Sub Areas

There are often several different commands and agencies operating simultaneously within each of these areas and sub areas. This SWMP is intended to provide direction with regard to general Base-wide activities versus for specific commands.

The following sections provide a general overview of each non-contiguous area covered by the Permit, including a general description of usage, drainage and topography. For additional information regarding specific industrial activities that take place within each area, refer to Chapter 11.

Figure 1-1 Vicinity Map

Note: Figure 1-1 has been Redacted due to National Security Concerns

1.2.1.1 *Former Hickam AFB Sub Area*

The former Hickam AFB Sub Area is located on a flat plain region built upon an uplifted marine terrace along the southern coast of Oahu. Hickam is bordered by the Honolulu International Airport (HIA) to the east, the JBPHH entrance channel to the west, and Mamala Bay to the south. The sub area serves several functions, to include aircraft operations and support, administrative, military family housing, and other personnel support services. Hickam and HIA share runways, constituting a single airport complex operated under a joint-use agreement.

The former Hickam AFB sub area portion of JBPHH encompasses approximately 2,520 acres of land. Impervious areas consist of buildings, sidewalks, paved roads, and runways. Approximately 60 percent of the total Hickam area is covered by impervious surfaces.

All of the sub area is relatively flat and often experiences ponding during heavy rains. Runoff across the Hickam sub area is controlled by a number of constructed and natural drainage features. Storm water runoff is controlled by scuppers, and a network of storm drain systems. In areas that are less developed, storm water flows are primarily conveyed as sheet flow or by swales. A few small size retention ponds are located in various locations throughout Hickam. These channel systems discharge into the Maunuwai, Kumumauu, or Transportation Canals. Storm drain systems discharge directly into Mamala Bay, Pearl Harbor Entrance Channel, or the Reef Runway Lagoon.

1.2.1.2 *Pearl Harbor Naval Base Sub Area*

The Pearl Harbor Naval Base Sub Area consists of all the lands and activities of the former main base of the Pearl Harbor Naval Complex. It includes the former Naval Station Pearl Harbor, the former Naval Submarine Base Pearl Harbor, the former Naval Supply Center Pearl Harbor, and areas formerly part of the Pearl Harbor Naval Shipyard. It does not include the industrial portions within the fence line of the Controlled Industrial Area of the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, which for storm water management purposes is covered under a separate permit.

The Naval Base Sub Area supports a wide range of functions and activities to include berthing wharves, support facilities, administration, military family housing, and other personnel support services. The area enclosed by the sub area is approximately 790 acres. The majority of the area is situated on relatively level ground at an elevation of approximately 10 feet above MSL. The area is generally flat, but slopes gently to the northwest. Approximately 90 percent of the sub area is impervious to storm water infiltration.

Three smaller areas are part of the Naval Base Sub Area and are described below.

- The Marine Barracks facility is roughly 44 acres that slope gently toward the northwest at less than 1 percent. The elevations within this area range from 12 to 19 feet MSL. The impervious areas at the Marine Barracks consist of buildings, sidewalks, and paved helicopter pad, roads and parking lots. Approximately 80 percent of the total area at Marine Barracks is impervious to storm water infiltration.
- Naval Supply System Command Fleet Logistics Center (NAVSUP FLC) encompasses approximately 432 acres of land. With the exception of the steep hillside near the Upper Tank Farm, the area is relatively flat, with a mild slope to the northwest. Approximately 90 percent of the total area of the activity is impervious to storm water infiltration.

- The Shipyard covers a total area of approximately 504 acres, with approximately 56 acres of NAVFAC Hawaii - owned facilities. Generally, the area is flat and slopes gently toward the northwest with elevations ranging from 10 to 23 feet MSL. Approximately 94 percent of the area covered by NAVFAC Hawaii-owned facilities in the Shipyard is impervious.

1.2.1.3 Ford Island Sub Area

Ford Island is situated in the middle of Pearl Harbor surrounded by Middle Loch to its west, East Loch to the east, Southeast Loch to the southeast and the entrance channel to the south. The operational facilities on Ford Island include piers and wharfs, and administrative and support facilities. The sub area also includes a number of visitor industry facilities that include the Battleship Missouri Memorial, and the Pacific Aviation Museum. The auxiliary landing field's runway and taxiway on Ford Island are considered historic features of the island, and are not currently used for Navy aircraft operations.

Ford Island encompasses approximately 450 acres. The area is relatively flat, with elevations ranging from 10 to 25 feet mean sea level (MSL) and slopes ranging from flat to approximately 3 percent. Approximately 50 percent of the total area is impervious.

Storm water runoff from Ford Island discharges as sheet flow or from outlet pipes to Pearl Harbor. The runway runs from southwest to northeast, typically setting a dividing line for the drainage flows on the island. Surface runoff generated on the northwest side of the island generally flows northwesterly along slopes ranging from the nearly flat slope (at the runway), to roughly 3 percent (at water's edge). On the southeast side of the island, the runoff flows southeasterly along slopes ranging from almost flat (at the landing field) to approximately 2 percent (at water's edge).

1.2.1.4 JBPHH Lualualei Annex Sub Area

JBPHH Lualualei Annex Sub Area (Lualualei Annex) is located in the Lualualei Valley on the leeward coast of Oahu, just east of the town of Waianae. It is bounded on three sides by the Waianae mountain range. Land use in the area surrounding the station is largely rural with small truck farms and residential developments dominating. The nearest urban area is the town of Maili.

Lualualei Annex uses approximately 7,500 acres for naval magazine facilities and an additional 1,720 acres for the radio facilities, for a combined area of 9,220 acres. The entire site is sparsely occupied, with impervious surfaces covering less than 5 percent of the total area.

Approximately 8,220 acres gently slope to the west while the balance of the land lies on the steep western face of the Waianae range. Runoff from the Waianae Mountains flows in a westerly direction across the site eventually to natural streams. Pipe culverts convey the stream flow under roads along the western boundary of the Activity, toward the radio facilities. Surface runoff generally flows in a northwesterly direction toward Mailiili Stream. Runoff from buildings near the main gate, at the south end of the site, flows overland in drainage swales to the Ulehawa Stream (intermittent) southwest of Lualualei Annex. All the streams identified as receiving waters for this area drain in a west-southwest direction to the Pacific Ocean.

1.2.1.5 JBPHH Wahiawa Annex Sub Area

JBPHH Wahiawa Annex Sub Area (Wahiawa Annex) is located in the central plateau region of Oahu. The main tenant is the Naval Computer and Telecommunications Area Master Station Pacific (NCTAMS PAC). Lands adjacent to the station are largely agriculture lands. The nearest urban areas are the town of

Wahiawa and Whitmore Village. The gulches bordering the station were formed by the North Fork Kaukonahua Stream to the south and the Poamoho Stream to the north. Wahiawa Annex is divided by a small gully.

Wahiawa Annex is approximately 700 acres of land. Land occupied by the station slopes gently east to west from an elevation of approximately 1,300 feet above MSL to an elevation of 1,000 feet above mean sea level. As the foothills of the Koolau Range are encountered a short distance east of the station, the terrain becomes steeper and extremely rough. Impervious areas consist mainly of buildings, sidewalks, patios, tanks, sheds, and paved areas. Approximately 5 percent of the total area of Wahiawa Annex is impervious to storm water infiltration.

Storm water runoff from the areas surrounding the industrial facilities on the north side of the Wahiawa Annex drains into the Poamoho Stream directly or through catch basins. The remainder of the site drains to North Fork Kaukonahua Stream as sheet flow or via the storm drain system.

1.2.1.6 Makalapa Crater Sub Area

Makalapa Crater Sub Area (MC) is located within the eroded Makalapa Crater area, south of Aloha Stadium, and between Kamehameha Highway and the H-1 Freeway. The site consists of administrative facilities, bachelors and military family housing, and other support facilities.

MC Sub Area is approximately 110 acres with elevations up to 65 feet MSL. Approximately 25 percent of the site is covered by impervious surfaces.

Storm water runoff generated at MC generally follows the topography of the site. The northern portion of the site flows to Halawa Stream, which feeds East Loch, Pearl Harbor, a few hundred feet to the west. The central portion tends to drain to a large, adjacent vegetated area. Storm water runoff generated in the southern region of MC flows southerly as sheet flow or through a system of culverts and ditches that discharge to Southeast Loch, Pearl Harbor.

1.2.1.7 Moanalua Sub Area

The Moanalua Sub Area includes the Pearl Harbor NEX Mall, the NEX Distribution Center, Moanalua Shopping Center, and the Navy Marine Golf Course.

The Moanalua Sub Area encompasses approximately 175 acres. The part of the sub area that does not include the Navy Marine Golf Course is highly developed and nearly 80 percent of this area is covered by impervious surfaces which are surrounded by a grassy buffer strip on all sides. Storm water generated on the northeast portion of this site generally flows toward storm drain inlets and catch basins within the front parking area and in Bougainville Drive. Storm water from the southwest portion of the facility flows away from the building and is collected by storm drain inlets throughout the paved lots.

The Navy Marine Golf Course portion of this sub area is comprised of 164 acres of mainly vegetated surfaces. Impervious surfaces include the paved parking lots and buildings, which contribute to 5 percent of the entire site. Storm water runoff generated onsite is generally infiltrated into the surrounding vegetated areas or conveyed to retention basins located throughout the course. Storm drain inlets near housing areas on the north side of the golf course convey runoff in a southerly direction to discharge onto adjacent grass areas. Grassy swales throughout the golf course channel larger flows toward a drainage ditch that leaves the golf course at its south central boundary.

1.2.1.8 Pearl City Peninsula Sub Area

The Pearl City Peninsula Sub Area (PCP) is located on the west shore of East Loch. It is bounded on the south and west by Middle Loch, on the north by residential housing, and on the east by East Loch. The site can be accessed from the north via Lehua Avenue. The Pearl City Peninsula Landfill site is located on the northwest side of the peninsula. A National Wildlife Refuge lies directly west of the landfill site, and directly south is the abandoned Pearl City Sewage Treatment Plant. Outside of the landfill area, PCP is used for Navy administrative and training activities.

The PCP Sub Area is comprised of a total of approximately 126 acres. Nearly 60 percent of the facility has impervious ground cover.

Surface drainage at the southern portion of the peninsula generally follows the topography from the center of the peninsula to the east where runoff discharges into the Ford Island Channel as sheet flow or via a series of storm drain inlets. Surface drainage also flows both to the south and to the west where it discharges into Middle Loch.

1.2.1.9 NAVFAC Hawaii Compound Sub Area

The NAVFAC Hawaii Compound Sub Area (NAVFAC Hawaii) is located approximately one mile east of the PH Naval Base Sub Area and is adjacent to the Pearl Harbor NEX Mall complex. It is bounded by the Bougainville Industrial Park on the north, Salt Lake Boulevard on the east, Moanalua Terrace Housing on the south, and Radford Drive on the west. NAVFAC Hawaii provides a wide range of support and services for the management and operations of shore facilities.

The NAVFAC Hawaii Sub Area covers approximately 71 acres. The topography of the facility rises gently to the southeast where approximately half of the area is on a 10- to 15-foot-high terrace. The ground slopes uniformly at approximately 0.5 percent away from the terraced areas to points of flow concentration to the northwest. Approximately 60 percent of the area in the NAVFAC Hawaii Sub Area is impervious.

Runoff is collected in underground storm drainage systems running southeasterly and northeasterly. The systems terminate at the northwest corner of the site and drain into an 84-inch storm drain which empties into Pearl Harbor approximately 3,600 linear feet downstream.

1.2.1.10 Waipio Peninsula Sub Area

Waipio Peninsula Sub Area (WP) is located on a narrow strip of land along the northwest shoreline of Middle Loch, Pearl Harbor. The Waipio Point Access Road provides entry to the facility. The facility consists of Navy facilities and leased areas that are used for recreational purposes.

The Navy facilities at WP cover approximately three (3) acres of land. Ground cover is comprised of moderately sloped asphalt concrete pavement, flat gravel storage areas, and small grassy areas. Roughly 70 percent of the site is covered by impervious surfaces.

All storm water generated onsite is discharged to Middle Loch via sheet flow or storm drain outlet. Storm drain inlets are located throughout the southern half of the site, and in these areas runoff is direct to the drain inlet prior to discharging to Middle Loch.

1.2.1.11 West Loch Sub Area

The West Loch Sub Area (WL) is located on the southwest portion of West Loch, Pearl Harbor, and just north of the Pearl Harbor Entrance.

WL consists of approximately 2,700 acres of sparsely occupied land located on flat to gently sloping land.

The majority of storm water runoff generated on the site sheet flows toward West Loch, with the exception of a few sparsely located storm drain inlets near the south boundary of the site.

1.2.1.12 Family Housing Sub Areas

There are several Family Housing Sub Areas located on Oahu outside of the boundaries of the sub areas described above. These include Moanalua, Moanalua Terrace, Maloelap, Catlin Park, Halsey Terrace, Salt Lake Storage, Doris Miller, Radford Terrace, Ohana Nui, Hale Moku, Hokulani, Little Makalapa, Manana, Halawa, McGrew Point, and Camp Stover, which are under a Public-Private Venture. Iroquois Point and Puuloa Housing are managed under long-term ground lease by Ford Island Ventures.

1.2.1.13 Miscellaneous Sub Areas

There are several smaller sub areas included in the Permit, located around the island of Oahu. These include Waiawa, Aiea, Halawa Landing, Richardson Field, Hale Keiki, and Red Hill.

1.3 Storm Water Program Background

Storm water discharge has long been identified as a significant source of water pollution. In 1972, in an effort to improve the direction of water pollution control in the United States, Congress passed legislation under the Federal Water Pollution Control Act (FWPCA) to create the NPDES program. The NPDES program established regulations for any persons wishing to discharge pollutants into waters of the United States (U.S.). These NPDES permits set limits on the composition, quantity and the mass or concentration of pollutants being discharged.

To more adequately address existing water pollution concerns, the FWPCA was amended by the Clean Water Act (CWA) of 1977 to restore and maintain the chemical, physical and biological integrity of the Nation's waters. The CWA provided the U.S. Environmental Protection Agency (EPA) with the authority to control point source discharges, and also required each State to establish water quality standards for its surface waters.

In 1987, the CWA was amended by the Water Quality Act which gave the EPA the authority to regulate storm water discharges associated with discharges from large and medium MS4s, industrial activities, and construction sites that disturb five (5) or more acres. On November 16, 1990, the EPA promulgated regulations under the "Phase I Rule," which are contained in the Code of Federal Regulations (CFR), Title 40 Parts 122, 123 and 124, establishing permit application requirements for these storm water discharges. Additionally, on December 8, 1999, EPA promulgated the final Phase II storm water regulations for smaller MS4s areas and smaller construction sites, which disturb areas of one (1) to five (5) acres.

The EPA only requires permits for the discharge of storm water for specific types of industrial activities, in accordance with 40 CFR § 122.26(b)(14). Those industries requiring storm water permits are described in one of two ways: by a narrative description or by a Standard Identification Classification (SIC) code. NRH has specified the industrial facilities that trigger these EPA-regulated SIC codes, and are

subsequently subject to regulation under the Clean Water Act. These industrial facilities are described in detail in Chapter 11.

1.3.1 Hawaii Storm Water Program

The State of Hawaii has been delegated NPDES permitting authority by the EPA. Through such delegation, the State of Hawaii DOH is responsible for administering the NPDES program throughout Hawaii in the same manner that the EPA's regional offices administer the program in non-NPDES States. Effective November 15, 2014, the DOH revised regulations implementing the storm water program in Hawaii Administrative Rules (HAR) Title 11; Chapter 54, Water Quality Standards (Chapter 11-54); and Chapter 55, Water Pollution Control (Chapter 11-55). Effective December 6, 2013, DOH readopted the NPDES General Permits in HAR 11-55, Appendices B through L. NPDES General Permit in HAR 11-55, Appendix M became effective in August 2012.

The DOH storm water regulations present two permit application options for storm water discharges in Hawaiian waters; (1) Individual Permit (IP) application; and (2) Notice of Intent (NOI) for coverage under a General Permit (GP). The IPs address design and water quality standards specific to an individual facility, whereas the GP is used to authorize a category of discharges within a specific geographic area. In the case of a GP, the applicant must meet the requirements of the GP such as common storm point sources, operations, wastes generated, disposal practices, etc. The GP requires information regarding existing programs, the means available to the municipality to control pollutants, and a field screening analysis of major outfalls to detect illicit connections. Building on this information, the permit requires a limited amount of representative data and a description of a proposed storm water management plan.

To obtain authorization to discharge storm water from industrial activities, the property owner may acquire storm water permits for the lessees that have industrial activities or have the lessees obtain the permits directly through the DOH. Since NRH owns all of the industrial facilities within its property, the industrial storm water discharges have been incorporated into Part E of its Permit HIS000257.

1.3.2 Navy Region Hawaii Storm Water Permit Requirements

NRH's permitting strategy is to have all NRH Activities on Oahu subject to permitting covered under one permit. To achieve this, NRH decided to permit its storm water systems similar to the municipal permitting approach and developed a program for the multiple NRH Activities within its jurisdiction to comply with Federal and State storm water regulations.

The previous NPDES Permit No. HI 1121466 was issued to NRH for the Navy Storm Water System on Oahu on August 24, 2001 and became effective on September 24, 2001. On January 12, 2006, the Permittee submitted a permit renewal application and Permit No. HI 1121466 was administratively extended on June 22, 2006. With the renewal application DOH changed the permit reference to No. HIS000006.

Prior to 2010, Hickam Air Force Base was a separate installation with its own NPDES permit and storm water management program. US Air Force 15th Wing (Hickam Air Force Base) was issued Permit No. HI S000069 on October 15, 2007. The permit was modified on December 1, 2010, to transfer ownership to NRH. This permit was administratively extended on October 12, 2012.

Naval Station Pearl Harbor and Hickam Air Force Base merged on October 1, 2010, into JBPHH under the oversight of NRH. At that time, JBPHH requested that the two separate base permits be combined. Due

to the similar nature of the operations, types of discharge, and shared resources, DOH went through the process to issue the current NPDES Permit No. HI S000257, on February 23, 2015, which became effective March 23, 2015.

The Permit specifies the conditions and requirements that authorize NRH to discharge storm water associated with its Small MS4 and specified industrial activities. These provisions require NRH to:

- Effectively prohibit non-storm water discharges to State Waters, either from its Small MS4 or from commercial and industrial facilities specified in the Permit. Discharges covered by other NPDES permits and allowable non-storm water discharges that have been identified in the Permit (see *Section 1.3.2.1*) and certain NRH-identified discharges (see *Section 3.1.1*) are conditionally exempt.
- Reduce the discharge of pollutants from its Small MS4 to the MEP.
- Reduce the discharge of pollutants from industrial facilities, classified in accordance with 40 CFR §122.26(b)(14), including other JBPHH-owned and operated facilities that are potential significant sources of pollution to storm water, to the appropriate discharge limitations. This is subject to the Best Available Technology economically achievable (BAT)/Best Conventional Pollutant Control Technology (BCT) discharge requirement, and any other applicable State or Federal regulations for such facilities. At NRH, these facilities have been captured within the list of industrial facilities requiring NPDES permit coverage. Any additional JBPHH-owned and operated facilities that are identified as potential significant sources of pollution in storm water, will be added at that time and included in the subsequent annual report.

1.3.2.1 Allowable Non-Storm Water Discharges

The following lists non-storm water discharges that are identified as allowable in Part B of the Permit. These discharges may be released into the JBPHH Small MS4 and its facilities provided that it meets all conditions specified in Appendix 3-1, BMPs for Allowable Non-storm Discharge. In the event that NRH determines any of these allowable non-storm water discharges to be a source of pollution, it will no longer be permitted.

- Water line flushing;
- Steam line condensate and flushing;
- Landscape irrigation;
- Diverted stream flows;
- Rising ground waters;
- Uncontaminated ground water infiltration (as defined in 40 CFR §35.2005(20));
- Uncontaminated pumped ground water, foundation and footing drains, not including construction related dewatering activities;
- Discharges from potable water sources, including but not limited to, waterline flushing, emergency eye wash basins and showers, drinking water fountains, and foundation drains;
- Air conditioning condensate;
- Irrigation water, excluding runoff from commercial agriculture;
- Springs;
- Water from crawl space pumps and footing drains;
- Water from individual residential car washing;

- Flows from riparian habitats and wetlands;
- Dechlorinated swimming pool discharges;
- Residual street wash water (water only), including wash water from sidewalks, plazas, and driveways, but excluding parking lots; and
- Discharges or flows from firefighting activities and training.

The Permit also allows NRH to develop a list of other similar occasional incidental non-storm water discharges that will not be addressed as illicit discharges. These conditional discharges, along with the appropriate controls or conditions needed to classify these as posing no significant source of pollutants, must be specified in this SWMP and are included in Section 3.1.1 Conditionally Allowable Non-storm Water Discharge.

1.4 Navy Region Hawaii Environmental Policy

NRH Environmental Policy is established by the Commander of NRH (CNRH). CNRH is committed to reducing the impact to the environment and to demonstrate environmental stewardship of our natural resources. NRH's environmental policy is as follows:

- Comply with environmental laws, regulations, and other applicable requirements. Achieve significant improvements in the compliance stature and procedures in hazardous waste management.
- Implement sustainable practices for energy efficiency and reduction in water consumption.
- Utilize Environmental Management System (EMS) as a tool to establish and review environmental objectives and targets.
- Prevent or minimize pollution at its source to reduce the generation of waste.
- Provide continual improvement of our environmental performance and community relations.

1.5 Navy Region Hawaii Storm Water Program

NRH obtained individual NPDES Permit No. HI S000257 for storm water and specified non-storm water discharges from the JBPHH Small MS4 and specified industrial facilities.

In accordance with the requirements of the Permit, this SWMP was prepared to meet the storm water discharge requirements of:

- Title 40 of the CFR, Parts 122, 123, and 124, Subparts A and D, and 125 (effective July 1, 2014);
- NPDES Permit Program in the HAR, Title 11, Chapter 55, Water Pollution Control (effective November 15, 2014);
- HAR, Title 11, Chapter 54, Water Quality Standards (effective November 15, 2014);
- HAR, Title 11, Chapter 55, Appendix B (effective December 6, 2013); and
- Applicable portions of the Clean Water Act, Sections 301, 302, 307 and 402.

The information provided in this SWMP outlines the Base-wide practices required to comply with the Permit, and furthermore to protect and improve the water quality of receiving waters downstream of JBPHH facilities to the MEP. A summary of NRH's Storm Water Management Program is displayed in Figure 1-2.

This document is intended to guide all responsible NRH tenants in implementing and managing NRH's Storm Water Management Program. It is also a complete and comprehensive compliance document, developed to meet the State and Federal requirements described above.

1.5.1 Implementation of the SWMP

This updated SWMP becomes effective and enforceable upon its submission to the DOH. As a Base-wide program, the policies outlined in this SWMP are applicable to all tenants located and operating at JBPHH and its facilities.

In the event that the Permit requirements conflict with any other State or Federal regulations, NRH will comply with the more stringent requirement.

Figure 1-2 Storm Water Management Program Summary

**Navy Region
Hawaii Storm
Water
Management
Program**

Public Education & Outreach (Chapter 2)

Objective: Raise awareness and effect positive behavioral change throughout the community with respect to the goals and implementation of the base-wide Storm Water Management Plan.

Illicit Discharge Detection and Elimination Program (Chapter 3)

Objective: Detect and eliminate all illicit discharges to the MS4, through a program of field screening, compliant investigation, monitoring, tracking of illicit discharges discovered, and approved connections to MS4.

Construction Site Runoff Control (Chapter 4)

Objective: Reduce to the maximum extent practicable (MEP) the discharge of pollutants from all construction sites, through standardized policies, best management practices (BMPs), routine inspections, and tracking.

Post-construction Storm Water Management Pollution (Chapter 5)

Objective: Implement permanent controls, in all new development and redevelopment projects, to prevent or minimize water quality impacts to the MEP, through construction design and plan review, and a BMP Database to inventory BMPs, schedule and track routine maintenance.

Prevention/Good Housekeeping:

Debris Control BMPs Program (Chapter 6)

Chemical Applications BMPs Program (Chapter 7)

Erosion Control BMPs Program (Chapter 8)

Maintenance Activities BMPs Program(Chapter 9)

Commercial Activities Discharge Management Program (Chapter 10)

Objective: Incorporate BMPs throughout various basewide maintenance programs, to reduce the discharge of pollutants from all NRH property to the MEP.

Industrial Activities

(Chapter 11)

Objective: Reduce the discharge of pollutants from all industrial facilities basewide, through requirements to implement BMPs, inventory, inspections, and tracking of these facilities.

Monitoring Program (Chapter 12)

Objective: Provide an ongoing measureable assessment of the progress and effectiveness of the implementation of NRH's Storm Water Management Program.

Reporting (Chapter 13)

Objective: To conduct annual evaluations and monitor the progress of NRH's Storm Water Management Program. It also supports the continued development of SWMP by identifying areas for improvement, and tracking monitoring results and all changes/progress made in the program throughout the year.

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1.5.2 Program Organization & Responsibilities

Permit No. HI S000257 and this updated SWMP supersede all previous versions. NRH is responsible to ensure compliance with the Permit No. HI S000257 and the conditions established within this SWMP. All tenants on Base are subject to the rules and regulations of these documents.

Oversight of the policies and development of the Base-wide SWMP is managed by NAVFAC Hawaii Environmental Department (EV), who also acts as NRH's Environmental Department. This includes: plan revisions, as necessary; annual reporting; and ensuring that this document, and any subsequent updates, are available to affected parties. More detailed information is provided in Chapter 13, Reporting Requirements.

The Base is unique from most MS4s in that within its property boundary, it owns the property and almost all of the facilities.

There are several different tenants on Base, however, NRH is structured such that the Joint Base Commanding Officer (JBC) has ultimate authority to enforce Base-wide compliance with the requirements of the Permit. In addition to the EV, there are various levels of authority between the JBC and each tenant on Base, through which day-to-day practices are monitored and managed.

The primary entities responsible for various NRH storm water pollution prevention activities are listed below.

- NAVFAC Hawaii, Environmental Department (EV) – provides Navy regional environmental coordinator support, Navy on-scene coordinator support, and environmental compliance, restoration, and planning for NRH and to support JB
- NAVFAC Hawaii, Capital Improvements (CI) – responsible for project management, design and construction management, and engineering services
- NAVFAC Hawaii, Public Works (PW) – responsible for utilities, facilities sustainment and management, facility support contract management, base support vehicles and equipment, and facility services
- NAVFAC Hawaii, Utilities and Energy Management Product Line (UEM) – responsible for planning and management of utilities commodities, including construction and maintenance projects and energy management and conservation
- NAVFAC Hawaii, Asset Management (AM) – responsible for real estate services and program management, planning, and management of the Geospatial Information Systems Program
- JBPHH Public Works Department, Facility Management Division (FMD) – responsible for execution plans for facilities, requesting projects and funding, interfacing with tenants, and maintenance planning, site approvals, land use compatibility, space management, community liaison and encroachment planning, facilities requirements, and planning documents
- JBPHH Public Works Department, Assistant Public Works Officers (APWOs) – responsible for coordination of project scoping, execution, requirements, planning, and energy conservation within a geographic area
- JBPHH Public Works Department, Facility Engineering and Acquisition Division (FEAD) - responsible for engineering services and management of Naval Facilities Engineering Command (NAVFAC) construction and services contracts.

- JBPHH Public Works Department, Production Division (PROD) – responsible for NAVFAC Hawaii in-house construction and maintenance projects
- JBPHH Public Works Department, Environmental Division (PRJ4) – responsible for environmental compliance inspections and oversight for JBPHH, and environmental services (e.g., collection and disposal of hazardous waste, industrial waste water treatment, recycling, laboratory services, pest management oversight, and recycling)
- Morale, Welfare, and Recreation (MWR) – responsible for management of commercial and recreational facilities
- Navy Exchange – responsible for management of commercial facilities
- Hunt and Actus Lend-Lease – responsible for management of Public-Private Venture (PPV) Housing

As appropriate NRH will conduct enforcement actions and ensure that the necessary corrective action for any Permit “non-compliance” issues. Enforcement procedures will be developed, as needed, for each storm water program set forth in this document. Typically all non-compliance issues are handled through an escalation of levels of authority involved for issues that have continued to go unaddressed. In these situations, notification of the JBC is the last resort and this has been found to be an effective mechanism for ensuring Base-wide rules and regulations are followed. To date there have been no issues that have required escalation to the level of the JBC.

The organization of the overall Storm Water Management Program is shown in Figure 1-3. The entities responsible for ensuring that each Storm Water Management Program task is completed in compliance with Permit requirements, are listed below that task.

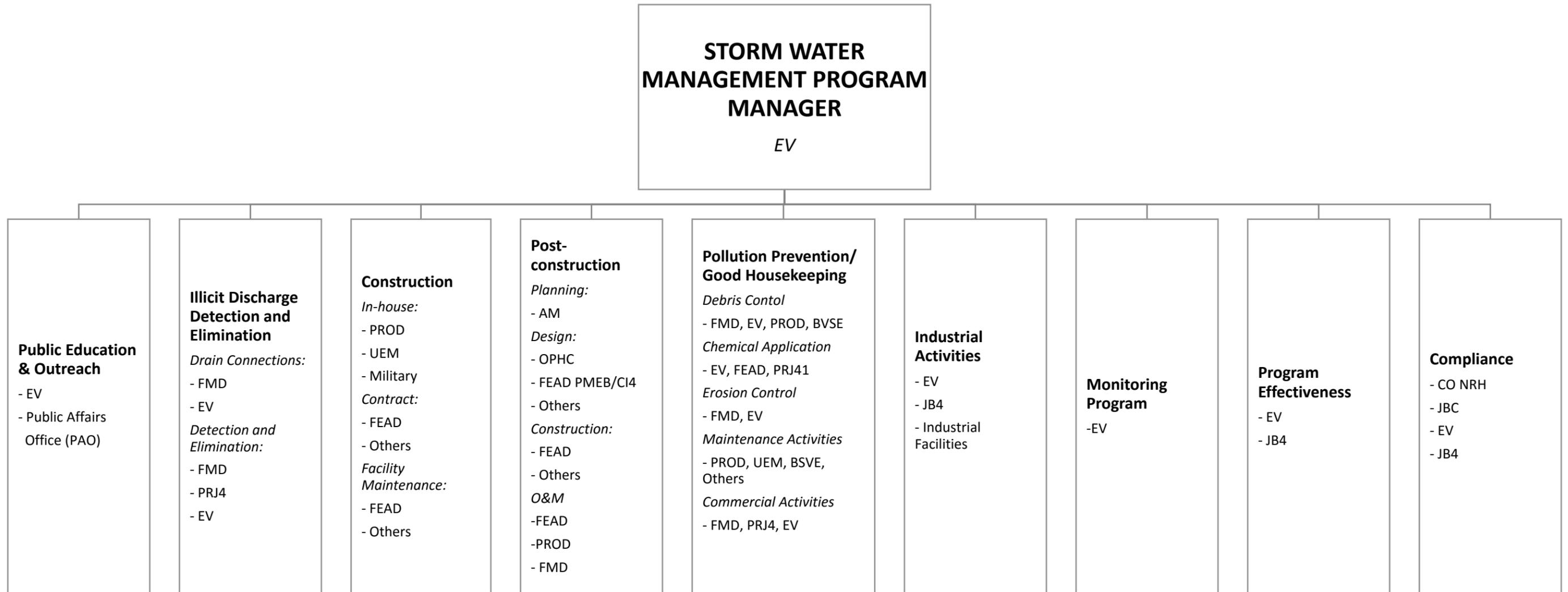


Figure 1-3 Storm Water Management Program Organizational Chart

1.6 Revisions and Updates

To promote the continued improvement and efficacy of NRH's Storm Water Management Program, this SWMP is intended to be a "living document." Modifications to the SWMP are triggered by the criteria presented in Parts D.2 and D.3 of the Permit (see Section 1.0).

Generally, revisions or additions to the SWMP may include any of, but not exclusively, the following:

- Changes in program organization, operation, maintenance, or construction of new facilities at NRH that affect the Small MS4 and/or storm water pollution control.
- Addition or removal of industrial facilities covered by this Permit, including changes to the primary activity at an industrial facility.
- Observations or patterns discovered through routine maintenance or monitoring, and any significant spills.
- Program deficiencies, and the appropriate mitigation to ensure the protection of storm water runoff quality and compliance with the Permit.
- Program improvements and justification for the change.

NRH is required to document any changes made to the Storm Water Management Program throughout each year, to be included in the Annual Report and as a revision to the SWMP at the end of that year.

Proposed changes that imply a major reduction in the overall scope and/or level of effort of the SWMP must be made for cause and in compliance with 40 CFR §122.62 and Part 124. A written report shall be submitted to the Director of Health (Director) for acceptance at least 30 calendar days prior to the initiation date of the major modification. System modifications to the Small MS4 and any existing outfalls newly identified over the term of the permit with the potential to significantly affect the quality or quantity of discharge shall be identified by letter within 30 calendar days of the completion of the alteration and/or addition and summarized in the Annual Report.

All information, reports, and updates related to this Permit and SWMP shall be submitted through the CWB Compliance Submittal Form for Individual NPDES Permits and Notice of General Permit Coverages (NGPCs), as outlined in Part A.7 of the Permit. This form is accessible through the e-Permitting Portal website at:

<https://eha-cloud.doh.hawaii.gov/epermit/View/home.aspx>

There is additional information, regarding annual reporting and SWMP revisions, provided in Chapter 13.

1.6.1 Permit Renewal

The current NRH NPDES Storm Water Permit and the authorization to discharge will expire at midnight on February 22, 2020. A renewal application will be required prior to the expiration of the permit.

1.6.2 Accuracy of Information Contained in this Plan

This Storm Water Management Plan is accurate as best as practicable, based on available information, data collected during routine field survey, and updates from previous plans. It is hereby acknowledged that the major provisions of the Plan are accurate, but that there may be changing conditions that occurred after the routine field surveys which need to be identified and reflected in periodic updates.

2 Public Education and Outreach

In accordance with the Permit, Parts D.1.a and Parts D.1.b, NRH is required to develop and implement a public education and involvement program to educate the community about the impacts of storm water, illicit discharges, and storm water pollution prevention.

The program shall, at a minimum, include the following:

1. Activity-specific educational materials and/or training for various targeted groups on Base.
2. Create positive changes in attitude, knowledge, and awareness.
3. Enable the public to identify and report pollution-causing activities (i.e. illicit discharges).
4. Outreach activities, as specified in the Permit, to promote awareness for the general public.
5. Program evaluation based on an annual survey of tenants, number of brochures distributed, participation in events, volunteer hours, etc.
6. Public involvement in the development of the SWMP including an informational meeting-prior to finalizing the SWMP, and other SWMP-related projects that can be used to educate the public about the impacts of storm water.

The Permit describes the requirements for the Public Education and Involvement Program as follows:

Permit Reference	SWMP Section
<p>Part D.1.a. Public Education and Outreach</p> <p><i>The Permittee shall develop and implement a comprehensive education and involvement program to distribute educational materials to the community or conduct equivalent outreach activities about the Permittee’s Small MS4 program and storm water pollution prevention BMPs, impacts of storm water as well as enabling the public to identify and report a pollution-causing activity (i.e., spotting an illicit discharge) and the steps that the public can take to reduce pollutants in storm water runoff. The program shall target: changes in attitude, knowledge, and awareness; BMP implementation; pollutant load reduction; and changes in discharge and receiving water quality. The SWMP shall include a written public education plan for how the Permittee will reach all targeted audiences and implement the permit requirements described below.</i></p>	<p style="text-align: center;">Section 2</p>
<p>Part D.1.a.(1) Targeted Groups - <i>The Permittee shall address the following targeted groups in the Base-wide Awareness Plan with a standardized branding message as well as specific training materials, and shall describe outreach activities and anticipated frequencies that each activity will be conducted over the permit term:</i></p> <ol style="list-style-type: none"> 1) <i>Military personnel and dependents that work or live on base;</i> 2) <i>Civilian personnel that work on base;</i> 3) <i>Construction and maintenance contractors that work on base;</i> 4) <i>Landscaping personnel and contractors;</i> 5) <i>Construction industry;</i> 6) <i>Industrial facilities covered by the NPDES permit program;</i> 	<p style="text-align: center;">Section 2.2</p>

<p>7) <i>Commercial businesses (i.e., automobile detailing, automobile repair and maintenance, retail gasoline outlets, and restaurants, including those types of businesses highly ranked, pursuant to Part D.1.f.(5)(d).);</i></p> <p>8) <i>Schools, recreational facilities;</i></p> <p>9) <i>Any other source that the Permittee determines may contribute a significant pollutant load to its Small MS4.</i></p> <p><i>Within 18 months of the effective date of this Permit, the Permittee shall identify the specific targeted groups described above.</i></p>	
<p>Part D.1.a.(2) Outreach Activities – <i>The Permittee shall include in the Base-wide Awareness Plan the following activities, with prescribed frequencies that each activity will be conducted over the permit term:</i></p> <ol style="list-style-type: none"> 1) <i>Publicize the telephone numbers for facilities and on-base personnel to report illegal discharges;</i> 2) <i>Distribution of brochures to the residential community and industrial/commercial facilities;</i> 3) <i>Participation in special events (e.g., Earth Day Educational Events) and exhibits;</i> 4) <i>An informative web site, that provides educational materials/information for residents and commercial tenants regarding storm water pollution, storm water pollutant controls and best management practices, and applicable storm water rules and regulations at the Facility. The website shall also provide links to a copy of the SWMP, the most recent storm water annual report, a copy of this permit, and telephone numbers and email address to report illegal storm water activity. Any public meetings regarding storm water policy, regulations, or the SWMP shall also be posted with the applicable date, time, and location.</i> 5) <i>Pesticides, herbicides, and fertilizer use program;</i> 6) <i>The promotion of water conservation;</i> 7) <i>Storm drain stenciling or marker installation;</i> 8) <i>Proper disposal of grass clippings, leaves, and other green waste;</i> 9) <i>A hazardous waste information and awareness program to promote awareness of proper disposal and handling of hazardous waste by residents and tenants (i.e., household chemicals, used oil, automotive fluids, paint, pesticides, and other toxics); and</i> 10) <i>If determined to be necessary by the Permittee, public meetings/resident panels to discuss storm water management policies.</i> <p><i>Information regarding: hazardous waste disposal; the proper disposal of grass clippings, leaves, and other green wastes; a link to the storm water website; and a phone number and email address to report illegal storm water activity shall be provided to all new residents and tenants on the Facility.</i></p>	<p style="text-align: center;">Section 2.3</p>

<p>Part D.1.a.(3) Evaluation Methods - <i>The Permittee shall evaluate the progress of the public education program based on the following:</i></p> <ol style="list-style-type: none"> 1) <i>An annual survey of Facility residents and tenants to measure both behavior and knowledge relating to storm water. The surveys can be conducted in person at events, on the phone, or using Web-based survey tools. The results of the survey shall be compared to past surveys.</i> 2) <i>Number of brochures distributed.</i> 3) <i>Participation in events.</i> 4) <i>Any other methods that the Permittee determines to be effective.</i> <p><i>The results of the evaluation shall be summarized in the Annual Report.</i></p>	<p>Section 2.5</p>
<p>Part D.1.b Public Involvement/Participation</p> <p><i>The Permittee shall include the public (i.e., JBPHH personnel, tenants, residents, contractors, and other stakeholders) in developing, reviewing, and implementing the SWMP. The SWMP shall be made available to the public in accordance with Part A.6. Following the public comment period, an informational meeting shall be scheduled and announced prior to finalizing the SWMP to answer questions from the public. Other activities to involve the public may include providing volunteer opportunities that improve water quality, organizing a citizen advisory group to solicit ongoing input from the public about changes to the SWMP and specific SWMP-related projects, or organizing water quality-focused clean-up events to educate the public about storm water impacts.</i></p>	<p>Section 2.4</p>

2.1 Program Goals

The goal of the public education and outreach program is to raise awareness and effect behavior change by involving the community in the overall goals and implementation of the Storm Water Management Program. Greater knowledge of the program will garner greater public support for the program, as well as a more willingness to comply with the BMPs put forth in the program. The program should create: positive changes in attitude, knowledge, and awareness; BMP implementation; pollutant load reduction; and an improvement in discharge and receiving water quality. The program will prioritize activities and target specific groups with specific goals in mind to maximize use of available funding, which can vary based on defense budgets.

2.2 Targeted Groups

Specific groups have been identified for targeted outreach based on their potential ability to impact storm water runoff quality. The Base-wide Awareness efforts will include activity-specific messages and outreach activities. The Permit identifies the following groups as targeted audiences:

- Military personnel and dependents that work or live on base (including all military housing);
- Civilian personnel that work on base;
- Construction and maintenance contractors that work on base;

- Landscaping personnel and contractors;
- Construction Industry;
- Industrial facilities covered by the NPDES permit program;
- Commercial businesses (i.e., automobile detailing, automobile repair and maintenance, retail gasoline outlets, and restaurants, including those types of businesses that have been highly ranked in Section 10.4.1 - based on the relative risk of contamination of storm water runoff);
- Schools (including personnel, teachers, and students); and
- Recreational facilities (including personnel and participants/customers).

Additionally, NRH may identify any other source that they determine to be a potential pollutant concern to its Small MS4. These groups include:

- Consultants and contractors that work on Navy land;
- Pesticide applicators;
- Environmental consultants;
- Health and safety consultants; and
- Custodians.

Depending on the results of these activities and feedback from the targeted groups, the outreach efforts may change over time.

2.3 Outreach Activities

2.3.1 Storm Water Brochures

NRH developed a brochure on “A Guide to Understanding Storm Water,” which promotes general environmental awareness and storm water pollution prevention. This brochure includes basic definition and information on storm water pollution awareness and specific BMPs with regard to yard maintenance, auto care, pet waste, household waste, and general good housekeeping practices. This brochure is geared towards the general population that work and live on the base for general storm water knowledge. The brochure includes links to sources for more information and a telephone number to EV to report any questionable discharges to the MS4. This brochure is available to all NRH personnel, distributed at NRH activities like the annual Earth Day Fair, and posted on the NRH webpage.

2.3.2 Industrial Facilities Training Brochure

Industrial facilities on base are inspected semi-annually by in-house personnel or contractor personnel. During these inspections, facility occupants are trained via a brochure that explains BMPs for industrial facilities.

2.3.3 NRH Storm Water Webpage

NRH has an existing webpage (http://www.cnic.navy.mil/storm_water) that provides access to policies and programs and is available to the general public. Links and documents posted on the webpage include information related to storm water pollution prevention, storm water pollutant controls, BMPs, and applicable storm water rules and regulations, including:

- Educational materials aimed at residents and commercial tenants, such as good housekeeping practices, disposal of household hazardous wastes, and Base policies addressing pollution prevention (i.e., *A Guide to Understanding Storm Water*);

- Links to storm water related documents including, the public review drafts of the (security redacted) Storm Water Monitoring Plan and the Storm Water Program Effectiveness Assessment Plan during the public comment period;
- Contact information for the NAVFAC Hawaii Public Affairs Office, to provide written comments for the draft storm water plans during the public comment period;
- Procedures for reporting illicit discharges;
- Contact information for the NAVFAC Hawaii EV office to request a copy of NRH's current SWMP, NPDES Permit, or Storm Water Annual Report; and
- Public meeting notices regarding storm water policies, regulations, and/or the SWMP, including locations and time, as applicable.

2.3.4 NRH and NAVFAC HI Facebook Pages

NRH and NAVFAC HI both have Facebook pages, and frequently posts updates on the Facebook pages several times each month. Examples include a storm water awareness article that had also been distributed to all NAVFAC Hawaii employees about recently installed storm drain markers. The pages also feature information about public participation activities like cleanup events.

<https://www.facebook.com/NavyRegionHawaii>

<https://www.facebook.com/NAVFAC-Hawaii>

2.3.5 Newspaper Articles

The Hookele, which is available free of charge throughout the base to the Navy and Air Force communities and workforce in Hawaii, publishes articles dedicated to storm water pollution prevention awareness. The topics of these articles include a wide range of environmental issues, including:

- Water quality;
- Pollution prevention;
- Pesticides, herbicides, and fertilizer use;
- Promotion of water conservation;
- Proper disposal of green waste;
- Hazardous materials/waste awareness and disposal;
- General good housekeeping practices; and
- The NRH storm water "hotline."

2.3.6 NAVSUP Fleet Logistics Center Newsletter

The Environmental Protection Program Newsletter for NAVSUP Fleet Logistics Center Pearl Harbor (FLCPH), "Malama ka Aina a me ke Kai (Caring for the Land and the Sea)," includes an annual Earth Day message. FLCPH also maintains a Facebook page with posts regarding Earth Day, how to be more "green" at work and at home, and use of xeriscaping.

2.3.7 Personnel Training

New personnel arrivals receive orientation training and materials, which include storm water pollution prevention, general good housekeeping and BMPs.

For industrial facilities, a separate storm water brochure is handed out during storm water inspections which explain the NPDES storm water permit in more depth. The brochure contains information on

allowable non-storm water discharges, storm water monitoring, and SWPCP site specific BMPs. The brochure also explains reportable conditions to the respective environmental point of contact such as any allowable emergency non-storm water discharges, any Environmental Assessment or Environmental Impact Statements that involves a private party connection to the Navy storm water drainage system, and any illicit discharges or connections. Navy Personnel are also trained as needed during the annual storm water inspection visits at the industrial facilities.

NAVFAC Hawaii Construction Department personnel receive annual classroom training on BMPs and storm water protection via a PowerPoint presentation and a question-and-answer session. This training includes construction and design engineers and field inspectors, and is conducted by EV personnel. The purpose of the training is to improve awareness of storm water pollution and its effects, and also includes information on storm water regulations regarding construction storm water permits and construction best management practices.

Shipyards personnel receive annual training, which includes BMPs and storm water protection.

The Navy has an internal web-based training: Environmental Compliance Assessment, Training and Tracking System (ECATTS), which includes a storm water module. ECATTS is required for construction contractors who work on NAVFAC construction contracts at JBPHH.

Standard Work Practices (similar to BMPs) are implemented where required.

2.3.8 Pesticide Applicators Training

Application of pesticides and synthetic fertilizers is primarily done by Navy in-house certified pesticide applicators, contractors under Government contract, and maintenance staff who are required to be properly trained. The Navy conducts annual pesticide training and has strict supply system requirements which prohibit the purchase of pesticides by unqualified personnel. The Pesticide Management Plans provide the authorized list of pesticides, which are approved by Navy entomologists.

2.3.9 Good Housekeeping Training

Good Housekeeping Training is the responsibility of each facility within JBPHH.

2.3.10 Military Housing Residents Handbook

A residential community handbook for Navy neighborhoods is available to all on-base residents and is made part of the housing informational package for new residents and is available on the Ohana Military Communities Navy Hawaii website (<http://www.ohananavycommunities.com>) and the Lend Lease Hickam Communities website (<http://www.hickamcommunities.com>). Hickam residents receive a Hickam Communities handbook managed by the Lend Lease Community. All other JBPHH Residents not managed by Hickam Communities are managed by the Ohana Military Communities and receive an Ohana Community Management Handbook. Both residential guides have a section mentioning storm water pollution prevention with basic information to not dump anything down a storm drain.

The residential guides contain information regarding storm water pollution prevention and general good housekeeping practices. BMP tips to residents address various topics, including:

- sweeping sidewalks and driveways;
- not hosing debris into storm drains;

- repairing vehicle leaks;
- avoiding overuse of fertilizers;
- picking up animal waste, litter and debris from yards;
- not overwatering lawns or landscaping;
- using only biodegradable, ammonia free and phosphate-free soaps when washing cars on residential property;
- how to report illegal dumping;
- how to report blocked storm drain inlets;
- contact information for assistance concerning storm water pollution prevention; and
- proper hazardous waste information.

“Ohana Military Communities- Community Handbook”

https://forestcitymgmt.entrata.com/media_library/2197/56d75c37a72d7473.pdf

“Hickam Communities – Resident Guide and Community Standards Handbook.”

https://winnmilitary.entrata.com/media_library/12710/56e71ac90df25345.pdf

2.3.11 Household Hazardous Materials

Residents are kept informed about proper household hazardous materials, including pesticide and fertilizer application, via a resident handbook, brochures, and other outreach/education material, as noted in Section 2.3.2, above. Brochures regarding household hazardous wastes are also available at the Recycling Centers.

The Housing PPV provides residents with information regarding the base household hazardous material reuse center. The reuse center accepts residents’ excess household hazardous materials and reissues the items as needed.

2.3.12 Earth Day Events

The Navy Morale, Welfare, and Recreation’s Earth Day event at Hickam Marina is a free family-friendly event that is open to military and civilians with Base access. The event featured eco-friendly exhibits and activities that help raise environmental awareness and educate families on ways to protect and preserve Hawaii’s fragile land and ocean environments. A storm water booth was set up at the event where NRH informational brochures are handed out, including the NRH “A Guide to Understanding Storm Water,” along with other handouts from the EPA storm water website. The Navy invites various other agencies to partner and promote environmental awareness at this event.

Additional Earth Day events are held at the Naval Exchange (NEX) Outdoor Living Center and Hickam Communities. Storm water program representatives attend these fairs and distribute brochures and answer questions to engage the public and increase storm water awareness. Displays at these events include informational posters, games, and brochures.

2.4 Public Involvement/Participation

As with Public Education and Outreach, there is great value in allowing the public to play an active role in both the development and implementation of the Storm Water Management Program. An active and involved community will help develop a large public support base for the program including a broader

base of expertise and allow for shorter implementation schedules due to fewer obstacles in the form of public challenges.

2.4.1 Development, Review, and Implementation of the SWMP

In accordance with the Permit, all plans related to the development of the draft and final SWMP shall be made available to the public for review and comment. The availability of plans shall be posted on the NRH webpage (http://www.cniv.navy.mil/storm_water) during the review period. The public review period is a minimum of 30 calendar days, and all comments/responses will be submitted to the DOH along with the submittal of each document.

An informational meeting shall be conducted prior to finalizing the SWMP to solicit further comments from the public. The meeting is tentatively scheduled for the week of September 6, 2016; final date and location to be announced on the webpage. The final SWMP shall incorporate any questions from the public.

Following the completion of the final SWMP, NRH will make the document available on its webpage and, upon request, at the EV office.

2.4.2 Base Beautification Projects

NRH personnel conduct routine cleanup and beautification projects. Base cleanups are conducted several times a year at JBPHH, with special focus at waterfront and high visibility areas.

2.4.3 Community Clean-up Events

NRH conducts and participates in several clean-up events, which help to raise public awareness about the impacts of trash and illicit discharges on storm water runoff quality.

NRH personnel participate in various community clean-up events, working with members of the community to clean up trash, green waste, and debris to help keep pollutants from entering the receiving waters. Activities include trash pick-up and beautification projects like beach clean-ups and the Adopt-a-Stream and Adopt-a-Block programs. Past events also include wetland and marsh cleanups to remove invasive vegetation, implement weed control, and replant native species to minimize erosion.

EV is responsible for documentation of participation numbers, amount of trash collected, and any observed trends or correlations to the other SWMP activities.

2.4.4 Storm Drain Marking

The ongoing Storm Drain Marking Program on the base promotes increased public awareness about storm water pollution and discourages illicit discharges to the MS4. Markers include both stenciling and permanent placards. The Permit requires that all storm drains receiving runoff from industrial and/or commercial facilities be marked, where feasible, within five (5) years of the effective date of permit. Priority shall be given to major streets and areas with pedestrian traffic. Additional information about the placard requirements is included in SWMP Chapter 6.

In 2010, highlights from the storm drain stenciling event of 160 storm drains at the FLCPH was included as a 15-second segment of the EPA Earth Day website. The clip is at the 2:52 mark at <http://www.youtube.com/watch?v=SVRypLxo8I>.

2.4.5 Partnerships

Past community clean-up activities have included various members of the community, including:

- City and County of Honolulu Department of Environmental Services
- State Department of Transportation
- State Department of Education
- Honolulu Police Department
- Hawaiian Electric Company
- Lions Club
- Boys and Girls Club
- State Department of Land and Natural Resources
- Hawaii Nature Center
- National Oceanic and Atmospheric Administration
- U.S. Coast Guard
- Community Colleges
- Community Associations
- Civic Clubs
- Navy Hale Keiki School
- Boy Scouts
- Waianae Mountains Watershed Management Partnership
- AmeriCorps

NRH will continue to investigate the possibility of partnering with other MS4 permit holders, nonprofit organizations, and other interested community organizations to raise awareness, implement BMPs, reduce pollutant loads, and improve storm water runoff quality.

2.4.6 Promoting Public Participation

There are a variety of other methods to involve the public in the NRH Storm Water Management Program, however, success of such programs is largely dependent on community interest. EV will continue to offer ideas, guidance, and/or opportunities to public groups that have shown interest in participating in SWMP-related programs.

2.4.7 Annual Survey

EV will conduct surveys annually to evaluate the effectiveness of the public education and outreach program. EV is currently evaluating the efficacy of developing an online survey. The survey will be distributed to randomly selected personnel and groups to get a wide representation of the program's outreach. The annual survey and survey methods may be revised pending the response rate from the previous year.

2.4.8 Program Points of Contact

For questions regarding the storm water program or to request a copy of the current Permit, SWMP, or Storm Water Annual Report, contact:

NRH Storm Water Program, NAVFAC Hawaii Environmental Office, (808) 471-1171 extension 337

To report a questionable discharge into the storm drain system or nearby waters, base personnel should contact the following:

For observations in JBPHH Family Housing, contact the Area Housing Manager

For all other areas, contact

JBPHH Installation Environmental Compliance Office, (808) 449-3184, or

NRH Storm Water Program, NAVFAC Hawaii Environmental Office, (808) 471-1171 extension 337

2.5 Evaluation Methods

A summary of each year's efforts toward public and targeted group outreach will be included in the annual report. See SWMP Chapter 13, Reporting Requirements, and Appendix 13-1, Written Strategy for Determining the Effectiveness of the SWMP, for additional information.

2.6 Summary of Public Education, Outreach and Participation

Table 2-1 Summary of Public Education, Outreach and Participation

Outreach Activity	Targeted Group												Measurable Goals
	Military residents and dependents	Military and Civilian workers	Construction and maintenance contractors	Landscaping personnel and contractors;	Industrial facilities	Commercial businesses	Schools	Recreational facilities.	Pesticide applicators	Environmental consultants	Health and safety consultants	Custodians	
Storm Water Brochures	X	X	X	X	X	X	X	X	X	X	X	X	Number distributed
Industrial Facilities Training Brochure		X	X	X	X				X	X		X	Number distributed
NRH Storm Water Webpage	X	X	X	X	X	X	X	X	X	X	X	X	Number of visits
NRH Facebook Page	X	X	X	X	X	X	X	X	X	X	X	X	Number of visits, friends
Newspaper Articles	X	X	X	X	X	X	X	X	X	X	X	X	Publications per year
NAVSUP Fleet Logistics Center Newsletter		X	X	X	X								Publications per year
Personnel Training		X	X	X	X	X	X	X	X	X	X	X	Number of attendees
Pesticide Applicator Training		X	X	X	X		X	X	X	X			Number of attendees
Good Housekeeping Training	X	X	X	X	X	X	X	X	X	X	X	X	Number of attendees
Military Housing Residents Handbook	X												Number of new residents
Household Hazardous Materials	X												Number of residents

Outreach Activity	Targeted Group												Measureable Goals
	Military residents and dependents	Military and Civilian workers	Construction and maintenance contractors	Landscaping personnel and contractors;	Industrial facilities	Commercial businesses	Schools	Recreational facilities.	Pesticide applicators	Environmental consultants	Health and safety consultants	Custodians	
Earth Day Events	X	X	X	X	X	X	X	X	X	X	X	X	Annual
Base Beautification Projects	X	X	X	X	X	X	X	X	X	X	X	X	Ongoing; number events per year, number of participants per event
Community Clean-up Events	X	X	X	X	X	X	X	X	X	X	X	X	Ongoing; number events per year, number of participants per event
Storm Drain Marking	X	X	X	X	X	X	X	X	X	X	X	X	Number of storm drains completed per year
Annual Survey	X	X	X	X	X	X	X	X	X	X	X	X	Number of participants
Storm Water Hotline	X	X	X	X	X	X	X	X	X	X	X	X	Number of complaints/requests received

3 Illicit Discharge Detection and Elimination

Per the Permit, Part D.1.c, NRH is required to review and update its Illicit Discharge Detection and Elimination (IDDE) program to detect and eliminate illicit connections and illegal discharges into its MS4. The upgraded Illicit Discharge Detection and Elimination (IDDE) program will include:

1. Review and approval process for drain connections;
2. Compilation of non-storm water discharges and measures to prevent these discharges;
3. System mapping;
4. Field screening and data tracking;
5. Subsurface oil investigation, cleanup, and interim control measures;
6. Public reporting;
7. Complaint investigation;
8. Spill prevention and response,
9. Handling and disposal of used oil, toxic materials, and other household hazardous wastes;
10. Enforcement, and
11. Training.

The IDDE Program is administered in accordance with the Permit requirements, as follows:

Permit Reference	SWMP Section
<p>Part D.1.c. Illicit Discharge Detection and Elimination (IDDE)</p> <p><i>Within 18 months of the effective date of this Permit, the Permittee shall review and update its IDDE program to detect and eliminate illicit connections and illegal discharges into its MS4. Future activities shall be based on information collected during past activities and an assessment of their effectiveness. The IDDE program shall include:</i></p>	Section 3
<p>Part D.1.c.(i) Require Connection Approval. <i>The Permittee shall require approval for connection to the Small MS4 for facilities not under the direct control of the Permittee and maintain a database of all approved connections to the Small MS4. The SWMP shall specify requirements for issuing connection approval for facilities not under the direct control of the Permittee.</i></p>	Section 3.2
<p>Part D.1.c.(ii) Identify Non-Storm Water Discharges. <i>The Permittee shall compile a list of non-storm water discharges that are considered to be significant contributors of pollutants to the system and measures to be taken to prevent these discharges into the Permittee’s Small MS4, or reduce the amount of pollutants in these discharges.</i></p>	Section 3.3

<p>Part D.1.c.(iii) System Mapping. <i>The Permittee shall create and maintain an up-to-date and accurate storm sewer system map showing the location of storm water drainage systems, outfalls and the names and locations of all waters of the U.S. that receive discharges from those outfalls. The map shall be in an electronic form within a geographic information system (GIS). The system mapping shall be completed within 18 months of the effective date of this Permit.</i></p>	<p>Section 3.4</p>
<p>Part D.1.c.(iv) Field Screening and Tracking. <i>The Permittee shall develop a storm water collection system surveillance program to monitor all outfalls and the collection system for evidence of illicit discharges during wet and dry weather.</i></p> <p>(a) <i>The program shall designate priority areas for screening, specify the frequency for screening, identify the procedures to be followed if a discharge is observed, and include upstream tracking components. If any outfall locations are submerged, or under piers or wharves at the time of inspection, the monitoring personnel shall inspect the discharge line (or contributing tributary lines), at the closest location(s) upstream of the discharge location and outside tidal influence.</i></p> <p><i>The Permittee shall maintain an illicit discharge monitoring and tracking database which tracks outfall and collection system inspections and illicit discharges and spills. For each illicit discharge or spill, the database shall record the location, receiving water, type of discharge, responsible party, naval response, and resolution of the discharge to the Small MS4.</i></p> <p><i>At least once every five (5) years, the Permittee shall conduct a survey of all identified commercial and industrial facilities to identify illicit discharges due to new connections, or the implementation of new practices by the tenants that may result in illicit discharges. The Permittee shall pay particular attention to the use of hose bibs to wash down pavement and work areas, and for vehicle washing.</i></p>	<p>Section 3.5</p>
<p>(b) <i>Subsurface Oil Investigation, Cleanup, and Interim Control Measures. The Permittee shall develop and implement a subsurface oil investigation, cleanup, and interim control measures. At a minimum, the Permittee shall ensure:</i></p> <ol style="list-style-type: none"> 1. <i>File an annual notification with the National Response Center to cover releases caused by subsurface oil seepage.</i> 2. <i>If oil seepage is observed, notify the Facility Response Team, as designated in the NRH Integrated Contingency Plan (ICP) and/or the Oil or Hazardous Substance (OHS) Spill Contingency and Emergency Response Plan, who at a</i> 	<p>Section 3.6</p>

<p><i>minimum shall:</i></p> <ul style="list-style-type: none"> <i>i) Minimize the migration into Pearl Harbor by using oil booms, when appropriate, and properly clean up and dispose of any collected oil and use absorbent booms if oil sheen continues to be visible.</i> <i>ii) Investigate to ensure that the discharge is not caused by current facility operations or activities.</i> <i>iii) If the problem is caused by current operations or activities, the following shall be conducted.</i> <ul style="list-style-type: none"> <i>a) Immediately correct the operations or activities that caused the pollution incident.</i> <i>b) Implement BMPs within the first working day after the source of discharge has been identified to ensure that potential for further discharge into the storm sewer system is eliminated.</i> <i>c) Document results of the investigation and submit with the Annual Report.</i> 	
<p>Part D.1.c.(v) Public Reporting. <i>The Permittee shall implement a program to facilitate public reporting of illicit discharges (i.e., environmental hotline, email address, or website). The environmental hotline and email shall be clearly posted on its website at all times.</i></p>	<p>Section 3.7</p>
<p>Part D.1.c.(vi) Investigate Complaints. <i>The Permittee shall promptly investigate observed, suspected, or reported illicit flows and pursue enforcement actions, as appropriate. All complaints shall be responded to as soon as practicable, not to exceed 12 hours. If more than 12 hours passes between a complaint and follow up investigation, the Permittee shall record the reason for the delay.</i></p>	<p>Section 3.7</p>
<p>Part D.1.c.(vii) Spill Prevention and Response. <i>The Permittee shall develop a program to prevent, respond to, contain, and remediate all wastewater and other spills that may enter into its Small MS4 from any source. Spill response teams shall minimize the entry of pollutants from spills into the Small MS4, and contamination of surface water, to the maximum extent practicable.</i></p> <p><i>The Permittee shall implement a procedure whereby DOH is notified of all wastewater spills or overflows from private laterals and failing septic systems into its MS4. The Permittee shall prevent, respond to, contain, and clean up wastewater from any such notification.</i></p>	<p>Section 3.8</p>

<p>Part D.1.c.(viii) Proper Disposal. <i>The Permittee shall facilitate the proper management and disposal or recycling of used oil, vehicle fluids, toxic materials, and other household hazardous wastes. Such a program shall include educational activities, public information activities, and identification of collection sites or methods.</i></p>	<p>Section 3.9</p>
<p>Part D.1.c.(ix) Enforcement. <i>The Permittee shall develop policies for enforcement and penalties when in noncompliance with its requirements including for persons discharging prohibited wastes and pollutants to its Small MS4. The Permittee shall pursue enforcement actions against military and civilian personnel, and commercial and industrial tenants whom illegally discharge pollutants to its Small MS4. Additionally, the Permittee shall ensure the elimination of all identified illicit discharges via structural or nonstructural implementation, or through permitting/authorization and the implementation of appropriate BMPs.</i></p>	<p>Section 3.10</p>
<p>Part D.1.c.(x) Training. <i>The Permittee shall provide annual training to staff responsible for the implementation the conditions of this SWMP on identifying and eliminating illicit connections, illegal discharges, and spills to its Small MS4. This training shall be consistent with the requirements of the SWMP, and incorporate findings from historic monitoring (i.e., types of illicit discharges that are most common).</i></p>	<p>Section 3.11</p>

3.1 Illicit Discharges

The EPA defines an illicit discharge as “...any discharge to an MS4 that is not composed entirely of stormwater...,” with the exception of those that are specifically permitted by an NPDES Permit.

3.1.1 Conditionally Allowable Non-storm Water Discharge

Permit Specified Discharge Limitations

Part B.2. of the Permit includes a list of conditionally allowable non-storm water discharges, provided the discharge is not determined to be a source of pollution by NRH. In the event that any of the listed discharges or any individual discharge is observed or expected to be a significant source of pollutants to the MS4, the discharge will no longer be allowed.

- Water line flushing;
- Steam line condensate and flushing;
- Landscape irrigation;
- Diverted stream flows;
- Rising ground waters;
- Uncontaminated ground water infiltration (as defined in 40 CFR §35.2005(20));
- Uncontaminated pumped ground water, foundation and footing drains, not including construction related dewatering activities;
- Discharges from potable water sources including but not limited to, waterline flushing, emergency eye wash basins and showers, drinking water fountains, and foundation drains;
- Air conditioning condensate;

- Irrigation water, excluding runoff from commercial agriculture;
- Springs;
- Water from crawl space pumps and footing drains
(including discharge from buildings with basements, and crawl space pumps used by utility companies to dewater utility manholes and other maintenance and operations substructure facilities);
- Water from individual residential car washing;
- Flows from riparian habitats and wetlands;
- Dechlorinated swimming pool discharges;
- Residual street wash water (water only), including wash water from sidewalks, plazas, and driveways, but excluding parking lots; and
- Discharges or flows from firefighting activities and training.
(note: fire hydrant testing and fire sprinkler testing may be discharged if source is potable water [allowable discharge above])

Additional Allowable Non-storm Water Discharges

Part B.2. of the Permit also authorizes NRH to develop a list of other similar occasional incidental non-storm water discharges that will not be addressed as illicit discharges. These non-storm water discharges must not be reasonably expected (based on the information available to NRH) to be significant sources of pollutants to the MS4, because of either the nature of the discharges or conditions established for allowing these discharges to the MS4 (e.g., controls required for frequency, required best management practices, proximity to sensitive water bodies, etc.). The controls or conditions placed on these discharges must be documented in the SWMP. In the event that any of the listed discharges or any individual discharge is observed or expected to be a significant source of pollutants to the MS4, the discharge will no longer be allowed.

Therefore, in addition to the list of non-storm water discharges specified in the Permit and listed above, NRH has determined that the following may be considered an allowable non-storm water discharge under the specified conditions:

- Boat Rinsing
 - The intent of the rinsing activity is salt removal.
 - Rinsing must be limited to water only.
 - No soaps, detergents, or chemicals are allowed.
 - No high pressure washing.
 - Engine maintenance/degreasing activities must be conducted at designated locations with appropriate controls and cannot be discharged directly to the MS4.
 - No discharge of bilge water to the MS4.
- Dive Gear Rinse and Dry
 - The intent of the rinsing activity is salt removal.
 - Rinsing must be limited to water only.
 - No soaps, detergents, or chemicals are allowed.
- Parachute Rinse and Dry
 - The intent of the rinsing activity is salt removal.
 - Rinsing must be limited to water only.

- No soaps, detergents, or chemicals are allowed.
- Aircraft Rinsing
 - The intent of the rinsing activity is salt removal.
 - Rinsing must be limited to water only.
 - No soaps, detergents, or chemicals are allowed.
 - No high pressure washing.
- Water from Building Exterior Rinsing
 - The intent of the rinsing activity is dust removal.
 - Rinsing must be limited to water only.
 - No soaps, detergents, or chemicals are allowed.
 - No high pressure washing.
- Water from Charity Car Washes
 - Washing shall only occur in areas designated by EV.
 - Prior approval must be received by NRH.
 - Rules established by EV for charity car washes shall be followed.
 - BMPs per Appendix 3-1 must be implemented.
 - Forms must be reviewed and signed stating and BMPs will be implemented.
- Condensate
 - Condensate from ice machines and air compressors.
 - Source of water is from potable sources or natural humidity similar to air conditioning condensate.
- Unpolluted saltwater
 - Unpolluted saltwater from saltwater distribution lines, but not dewatering.
 - No additives are allowed.

A table of allowable discharges and required BMPs is included in Appendix 3-1.

3.2 Review and Approval Process for Drain Connections

FMD is developing a connection approval process with assistance from EV for facilities not under direct control of NRH that connect to the MS4. In general, the process will include the following steps:

- New construction projects will require submittal of a MS4 connection application and design plans to FMD for review and approval.
- Approved connections will be logged into a database and tracked by FMD.
- Asset Management Department will require new lease agreements to include a requirement for tenants to submit a MS4 connection application if they are connected or planning to connect to the MS4.

EV will assist FMD with any changes and updates to the MS4 connection application and tracking database.

3.3 Significant and Common Non-storm Water Discharges

EV has identified non-storm water discharges that are considered to be significant and/or common contributors of pollutants to the MS4. Several of these non-storm water discharges were identified based on the results of illicit discharge connection surveys completed over the past five years. A listing of the

significant and common contributors along with measures taken or to be taken to prevent discharges is presented in Table 3-1 below.

**Table 3-1
 Non-storm Water Discharges and Control Measures**

Non-storm Water Discharge Type	Control Measure
Illicit discharge from facility process	Identify process stream and determine required treatment. Design and construct industrial wastewater treatment system with disposal to sanitary sewer system or other off-site disposal facility.
Illicit vehicle washing	Limit vehicle washing to designated vehicle wash racks only. Conduct training for facility personnel to stress the importance of washing vehicles only at designated wash racks.
Illicit wash down of facility work areas	Implement good housekeeping BMPs. Acceptable methods of cleaning shall be employed (i.e., dry sweeping, mopping with discharge of wash water to utility sink, etc.). Conduct BMP training with facility personnel.
Illicit discharge of oil and grease from commercial food facilities.	Limit washing and rinsing to designated sinks that discharge to a grease trap prior to the sanitary sewer system. Conduct BMP training with facility personnel.
Illicit discharge of chemicals, materials, and wastes due to improper storage.	Implement good housekeeping BMPs. Wastes shall be stored in proper containers and under cover. Spill pallets will be used beneath waste drums. Chemicals and materials shall be stored in proper containers or areas to prevent exposure to storm water. Conduct BMP training with facility personnel.
Illicit discharge of oil and other fluids from leaking equipment and vehicles.	Conduct routine preventive maintenance to prevent leaks. Perform regular inspections of equipment and vehicles to detect leaks. Use drip pans beneath leaking equipment and vehicles. Complete maintenance of equipment and vehicles in designated areas under cover. Conduct BMP training with facility personnel.

The most cost-effective method to eliminate prohibited non-storm water discharges, including unauthorized disposal and illicit connection discharges, is to prevent prohibited liquids and materials from entering the storm water system. This can best be accomplished by adopting the following BMPs on a Facility-wide basis, as appropriate. (These BMPs are described fully in Appendix 11-3.)

BMP 009 Train Employees to Properly Dispose of Wastes

BMP 010	Permanently Seal Floor Drains that Discharge to the Storm Drain System
BMP 011	Confirm that No Industrial Sinks Are Connected to the Storm Drain System
BMP 022	Permanently Seal Drains Within Critical Areas that Discharge to the Storm Drain
BMP 026	Routinely Clean Catch Basin
BMP 027	Stencil Signs on Storm Drain Inlets
BMP 055	Use Overpack Containers or Containment Pallets to Store One-Pint to 55-Gallon Drums or Containers Outside of Storage Areas
BMP 113	Conduct Personnel Training Regarding the SWPCP
BMP 117	Do Not Pour or Deposit Waste into Storm Drains
BMP 118	Routinely Report Any Observed Non-Storm Water Discharges

In addition, proper disposal of waste materials and/or contaminated water will help to prevent non-storm water discharges. BMPs for disposal of waste materials and contaminated water are presented in Appendix 3-2.

3.4 System Mapping

Maps have been created that show the location of storm water drainage systems, outfalls and the names and locations of all waters of the U.S. that receive discharges from those outfalls. A contracted survey of the storm water drainage system for the majority of JBPHH has just been completed to update the maps and assess condition of each storm drain inlet and observable outfalls. The update to the GIS for the rest of the system is under contract, and scheduled for completion in 2017. The data from the survey has been compiled into GIS.

FMD will be responsible for maintaining the geodatabases and maps. As new drain connections are approved or system components are modified, FMD will update the GIS information.

3.5 Field Screening Plan and Tracking

Routine illicit connection inspections are performed to identify storm water discharges that are not identified as allowable in the Permit. Commercial and industrial areas are inspected at least once every five years to identify illicit discharges due to new connections, or the implementation of new practices by the tenants. Illicit discharge surveys are funded and contracted approximately every five years with the surveys conducted over a span of several years. Particular attention is paid to the use of hose bibs to wash down pavement and work areas and for vehicle washing.

Outfall and collection system inspections are conducted by FMD, PRJ4, or EV during routine maintenance completed throughout the year. Based on historic data, EV will also designate priority areas for inspection and conduct specific inspections of the outfalls during the wet and dry seasons. If any outfall location is submerged or under piers or wharves at the time of inspection, the monitoring personnel will inspect the closest upstream storm drain structure or contributing tributary line outside of tidal influence.

Outfall inspections include a visual survey of the physical conditions at each site. Observations are documented, including photographs. If dry weather flow is observed, the flow is visually examined for characteristics such as color, odor, sheen or suds. If such characteristics indicate the presence of non-storm water discharges, the survey will be expanded to track the flow upstream and determine the location of the discharge to initiate corrective actions.

A list of pollutant indicators that may be observed in the MS4 inlets and outlets are included in Table 3-1 to assist in identifying their possible sources and associated activities.

In-depth investigations shall occur at each priority area outfall at least once per permit term. If illicit discharges are observed at the outfall, EV is responsible for the investigation of the contributing drainage basin, including industrial inventory and activities within the area. EV personnel shall conduct additional inspections during dry weather conditions, and walkthrough inspections at industrial and commercial facilities to review existing BMPs and compliance with SWPCPs, as applicable.

EV will maintain an illicit discharge monitoring and tracking database which tracks outfall and collection system inspections and illicit discharges and spills. For each illicit discharge or spill, the database will record the location, receiving water, type of discharge, responsible party, naval response, and resolution of the discharge to the Small MS4.

**Table 3-2
 Possible Sources of Pollutant Indicators**

Indicators	Possible Sources
Ammonia	Broken sanitary wastewater lines, lawn/agricultural runoff
Bacteria/algae	Decomposing organic matter
Cloudy/opaque water	Metal fabrication
Cloudy appearance	Erosion
Copper	Pesticides, plating, paint shops, or spills
Discolored sediments	Metal fabrication
Floatable solids	Trash and debris
Gray color, sewage odor	Cross connection between sanitary and storm sewer
High chlorine	Swimming pools
High or low pH	Plastic/fiberglass shops, metal plating, masonry wastes
Inhibited vegetation	Various
Metal/concrete corrosion	Metal plating
Multicolor water	Construction sites
Oil, grease, fuel	Gas stations
Oily sheen	Auto repair shops/salvage yards
Phenols	Wood preservatives, pesticides
Pungent/burning odor	Chemical industry
Sediment deposits	Construction site
Soapy film, detergents	Laundries
Unusual colors/odors	Various
Volatile chemical odor	Painting, vehicle/equipment repair, metal plating

3.6 Subsurface Oil Investigation, Cleanup, and Interim Control Measures

During heavy rain, subsurface oil may infiltrate into the drainage structures of the Pearl Harbor Naval Complex, though efforts have been made to line and fix drains to prevent this from occurring. In addition, it appears that subsurface oil occasionally leaches into the harbor as a result of tidal influence in areas within the Pearl Harbor Naval Complex and Hickam with no defined storm water outfalls.

The Navy has ongoing investigation and remediation activities for the source of this oil under the Installation Restoration program. Specifically, the Navy is evaluating environmental conditions on the entire Pearl Harbor Naval Complex, and taking remediation actions as needed.

The subsurface oil is due to historic releases of fuel and not linked to a current industrial activity, and is addressed in this section instead of being subject to the BMPs set forth in other sections of this SWMP. The Navy does implement BMPs to the MEP. Specifically, the Navy places booms in the vicinity of the storm water outfalls where significant sheens have been observed to control and minimize the migration of the subsurface oil discharges into the harbor. In addition, the Navy is investigating the feasibility of other technologies that, among other things, may mitigate infiltration of the subsurface oil into the drainage system.

Pursuant to Section 311 of the Clean Water Act, 33 U.S.C. 1321, and 40 CFR 300.300 of the National Oil and Hazardous Substances Pollution Contingency Plan, the Navy is required to notify the National Response Center of a "discharge of oil." Specifically, per 40 CFR 110.3, the regulations provide that a notice must be filed when there has been a discharge of oil that causes a film or sheen upon or discoloration of the surface water. As noted above, oily sheen appears in Pearl Harbor after heavy rain and in areas surrounding closed pipe storm drain discharge points from subsurface contamination. The Navy has discussed this matter with the United States Coast Guard (USCG) and DOH and it was agreed that an annual notification will be made to cover these subsurface discharges. However, if it is determined that the source of the discharge is not from this subsurface contamination then the Navy will file a separate notification.

Due to the nature of the subsurface oil conditions, the Navy has been carefully evaluating the situation and selecting and implementing long-term remedies. Primary studies included a Remedial Investigation/Feasibility (RI/FS) Study Report drafted in 1994, which contains the results of soil sampling and limited groundwater monitoring. This was followed by a 2008 Shipyard RI for Subsurface Fuel, Shipyard Geographic Study Area (GSA) that investigated several sites and UST locations in addition to multiple other studies around the base. Several recovery systems were installed in the northern part of the Naval Station Sub-Area, and barrier walls have also been constructed in a few locations. For most locations around the base, there have been no recent recorded incidents of fuel getting into the harbor. There is one area where barriers and a recovery system are in place, but there is still a slow leak of oil. The release is contained by absorbent booms and pompoms. Further studies are underway at localized plumes. There is no known incidence of subsurface oil plumes at Hickam reaching fuel to receiving waters. The Navy will continue its efforts to characterize the subsurface oil conditions, to evaluate cleanup options.

The following are steps that will be taken by the Navy for subsurface oil that may infiltrate into the MS4 or seep into Pearl Harbor.

Subsurface Oil Investigation, Cleanup, and Interim Control Measures

1. *File an annual notification with the National Response Center to cover releases caused by subsurface oil seepage.*
2. *If oil seepage is observed, notify the Facility Response Team, as designated in the NRH Integrated Contingency Plan (ICP) and/or the Oil or Hazardous Substance (OHS) Spill Contingency and Emergency Response Plan, who at a minimum shall:*
 - a. *Minimize the migration into Pearl Harbor by using oil booms, when appropriate, properly clean up and dispose of any collected oil, and use absorbent booms if oil sheen continues to be visible;*
 - b. *Investigate to ensure that the discharge is not caused by current facility operations or activities;*
 - c. *If the problem is caused by current operations or activities, the following shall be conducted:*
 - i. *Immediately correct the operations or activities that caused the pollution incident.*
 - ii. *Implement BMPs within the first working day after the source of discharge has been identified to ensure that potential for further discharge into the storm sewer system is eliminated.*
 - iii. *Document results of the investigation and submit with the Annual Report.*

3.7 Public Reporting and Complaint Investigation

The building managers are responsible for sweeps and inspections of their areas. PRJ4 and EV are responsible for regular compliance inspection for storm water under other programs in the SWMP and other environmental media. PRJ4 and EV are responsible for responding to complaints received via phone by people who live and work on base, as noted below:

Complaint Hotline: (808) 722-1674

The environmental hotline and email will be clearly posted on NRH's website (http://www.cnic.navy.mil/storm_water) at all times and provided during new arrival orientation and various storm water training with facility personnel.

If an illicit discharge is observed, EV and PRJ4 will work with the responsible party to correct the violation as soon as possible. All reported illicit discharges and corrective measures are tracked through the database described in Section 3.5, above, and enforced as described in the "Enforcement Response Plan" (Appendix 3-3).

EV and PRJ4 will promptly investigate observed, suspected, or reported illicit flows and pursue enforcement actions, as appropriate. All complaints will be responded to as soon as practicable, not to exceed 12 hours. If more than 12 hours passes between a complaint and follow up investigation, EV will record the reason for the delay.

3.8 Spill Prevention and Response

NRH has completed a Spill Prevention and Control and Countermeasures (SPCC) Plan and an Integrated Contingency Plan. These plans help to ensure that oil storage facilities are equipped with proper spill prevention and spill response tools.

The Spill Response Program responds to releases of oil or hazardous substances originating from NRH's area of responsibility (AOR). This Program ensures compliance with all federal, state, and local laws and regulations pertaining to Oil Pollution Act of 1990 (OPA 90) Facility Response Planning, Spill Contingency Planning, Resource Conservation and Recovery Act (RCRA) Contingency Planning, and Risk Management Planning.

The Spill Response Program is responsible for planning, training, mobilizing personnel and assets to respond to spills, and for partnering with federal/state/local emergency planning agencies.

The Spill Response Program:

- Maintains the Region's Integrated Contingency Plan (ICP) that serves as a mechanism to ensure that CNRH's Spill Management Team (SMT) is adequately prepared to respond to an emergency Oil or Hazardous Substance (OHS) incident.
- Conducts annual Facility Response Team Training and Incident Response exercises using Incident Command System principles and establishing a Unified Command, and using a wide range of equipment and assets.
- Provides the Navy representative to the Honolulu Area Planning Committee, the Local Emergency Planning Committee, the State Emergency Response Commission, the Natural Resources Damage Assessment Restoration and Rehabilitation Sub-Committee, the Marine Oil Spill Ephemeral Sampling Work Group, and the Risk Assessment and Nearshore/Shoreline Protection Sub-Committee.
- Protects the marine environment, Wildlife Management Areas, wetlands, base property, surrounding communities and human health by planning, preparing, and exercising response to worst-case discharge scenarios.

In regards to wastewater spills, the Wastewater Branch is responsible for spill prevention and response. The Wastewater Branch has developed a Spill Prevention and Response Manual, which is maintained on-site at the base wastewater reclamation facility. Wastewater Branch personnel are responsible for spill response and executing notifications and reporting in accordance with the Wastewater Spill Response Reporting Guidelines (Appendix 3-4) [Redacted due to national security concerns].

3.9 Used Oil and Toxic or Hazardous Materials/Waste Disposal

3.9.1 Household Hazardous Materials/Waste

Pamphlets addressing household hazardous waste are available at the New Arrivals brief and on the Base website. The pamphlet identifies the various types of household hazardous materials that require proper disposal as household hazardous waste and provides locations where residents may drop these materials off for proper disposal.

The NRH housing department provides residents with information regarding the base household hazardous material reuse center. The reuse center accepts residents' excess household hazardous

materials and reissues the items as needed. Household hazardous materials that are not reissued are turned into the 90-day Hazardous Waste Accumulation site for disposal.

3.9.2 Privately Owned Vehicle (POV) Maintenance

Vehicle repairs, engine cleaning, and oil changes are conducted at approved locations, including a commercial business or the Auto Skills Center. These facilities are trained and equipped to deal with the proper management and disposal or recycling of used oil, vehicle fluids, etc. Information regarding vehicle maintenance is distributed by PPV entities to all residents.

3.9.3 Industrial Vehicle Maintenance

Maintenance occurs at most of the industrial facilities on Base, including boats, automobiles/vehicles, and aircraft. Refer to the various facilities' SWPCPs (Chapter 11 of this SWMP) for additional information about specific hazardous materials and BMPs associated with vehicle maintenance.

3.9.4 Hazardous Waste Accumulation Point

Proper hazardous materials handling and waste management at industrial and commercial locations is the responsibility of all personnel, with oversight by the PRJ4 and EV. Hazardous waste accumulation points have been established at industrial and commercial locations throughout JBPHH. Hazardous wastes/materials are picked up from these accumulation points as needed by the HAZMIN Center for disposal for most facilities. There may be some minor exceptions (tenants that have their own EPA ID number or others like PPV Housing may arrange for pickup by private contractors).

3.10 Enforcement

To ensure compliance with the Permit requirements, NRH is developing enforcement procedures in its "Enforcement Response Plan" (Appendix 3-3). NRH shall pursue enforcement actions against military and civilian personnel, contractors, and commercial and industrial tenants whom illegally discharge pollutants to its Small MS4. NRH will ensure the elimination of all identified illicit discharges via structural or nonstructural measures or through permitting/authorization and implementation of appropriate BMPs.

NRH is unique from most MS4s in that within its property boundary, it owns the property and almost all of the facilities, and provides funding for a majority of work. Due to the nature and internal structure of NRH, the most effective means for enforcement is escalation of unaddressed violations to the next higher authority.

If an observed deficiency is not addressed within the allotted mitigation period, the issue will be brought to the attention of the EV director. The party in violation will receive a written notice and deadline for compliance. If the issue remains unresolved, it will be escalated to the next higher authority.

The penalty for non-compliance of the Permit regulations is at the discretion of the Joint Base Commanding Officer (JBC). Commander, NRH, has ultimate authority for Permit policies and enforcement actions.

In the event that NRH has been unable to resolve an observed deficiency within its authority, or otherwise deems the site to pose an immediate or significant threat to water quality, EV shall provide an e-mail notification to DOH within one (1) week of such determination. EV will follow-up with written notification and include a copy of all inspection checklists, notes, and related correspondence in pdf

format (300 minimum dpi) within two (2) weeks of the determination. All written notifications submitted via email will be directed to:

cleanwaterbranch@doh.hawaii.gov, Attn: Enforcement Section Supervisor

3.11 Training

EV will provide annual training to staff responsible for the implementation of the conditions of this SWMP on identifying and eliminating illicit connections, illegal discharges, and spills to the MS4. This training will be consistent with the requirements of the SWMP, and incorporate findings from historic monitoring (i.e., types of illicit discharges that are most common). Specific training will include the following.

3.11.1 Hazardous Waste Accumulation Point Management

EV and PRJ train personnel responsible for hazardous waste accumulation points when inspections are conducted at the facility (at a minimum, annually) Personnel (military, civilian, and contractors) who generate, package, handle, store, transport, manage and/or supervise those who manage hazardous waste in the performance of their duties at JBPHH are required to follow the requirements of the “Hazardous Waste Management Plan” of February 2014.

3.11.2 BMP Training

NRH incorporates BMPs to prevent illicit discharges into its training for personnel responsible for construction management of NRH projects. Storm water pollution prevention has been incorporated into training for new arrivals at NAVFAC Hawaii. NRH is developing a “BMP” training class. Storm water pollution prevention will be part of this class and include training on applicable BMPs. The class will also include training on identifying and eliminating illicit connections, illegal discharges, and spills to the MS4. The EV Storm Water Program Manager is responsible for the information provided at the class. The list of attendees or a general headcount will be included in the annual report.

3.11.3 Waterfront Operations

As part of the BMP Training, those personnel that work on Waterfront Operations are trained on the SPCC Plan and the Spill Contingency Plan so that they can promptly respond to any spills.

4 Construction Site Runoff Control Program

Per the Permit, Part D.1.d, NRH is required to develop and implement a Construction Site Runoff Control Program as part of its construction site management. The primary goal of the Construction Site Runoff Control Program is to reduce the discharge of pollutants from construction sites to the Navy’s Small MS4 to the maximum extent practicable (MEP). This Construction Plan applies to all construction sites within JBPHH and annexes covered by the Permit, which include both in-house and contract construction and maintenance projects. All sites are required to comply with applicable NRH policies and standards.

The objectives of this Construction Site Runoff Control Program are to:

1. Require proposed construction projects to implement BMPs and to standardize implementation and maintenance of the BMPs.
2. Maintain an inventory of construction projects and track project information.
3. Standardize and administer the plan review and approval of construction project plans and permits to ensure that BMP measures are implemented to the MEP prior to, during, and after construction.
4. Conduct inspections using standard inspection forms and track inspections in databases.
5. Establish enforcement policies and penalties for projects in non-compliance with NRH policies, standards, and project-specific requirements and permits and develop and implement an Enforcement Response Plan (ERP).
6. Provide annual construction BMP training to staff and contractors with construction storm water responsibilities.
7. Provide educational material to project applicants, contractors, and other responsible parties.

The Permit describes the requirements for the Construction Site Runoff Control Program as follows:

Permit Reference	SWMP Section
<p>Part D.1.d. Construction Site Runoff Control</p> <p><i>The Permittee shall develop and implement a construction site management program to prevent the discharge of pollutants from construction projects disturbing one (1) acre or more, including construction activities less than one (1) acre that are part of a larger common plan of development that would disturb one (1) acre or more and smaller projects that have the potential to discharge pollutants to the Navy’s Small MS4. Only projects meeting these criteria are required to be covered under this program. The construction site management program shall consist of installation-wide instructions, directives, or other regulatory mechanism, including enforcement procedures and actions that require erosion and sediment control, and to ensure compliance. The construction site management program shall include the following minimum elements:</i></p>	<p style="text-align: center;">Section 4</p>
<p>Part D.1.d.(i) Requirement to implement BMPs – <i>The Permittee shall establish policies to require proposed construction projects to implement BMPs and standards to minimize the discharge of pollutants within storm water, including erosion and sediment control BMPs. Further the Permittee</i></p>	<p style="text-align: center;">Section 4.2</p>

<p><i>shall establish requirements to control non-storm water wastes (i.e., discarded building materials, truck washout, chemicals, litter, and sanitary waste) from contacting storm water or otherwise impacting water quality.</i></p> <p><i>These standards shall be reviewed annually and, as necessary, revised to include descriptions of new, modified, or revised BMPs, including permanent BMPs and Low Impact Development (LID) practices. Any revisions shall be discussed within the Annual Report and the documents included within its SWMP Plan. All documents shall be made available to Facility staff, contractors, and consultants, as appropriate.</i></p>	
<p>Part D.1.d.(ii) Inventory of construction sites – <i>The Permittee shall develop and implement a system to track all construction projects occurring on the Facility. This system shall track information on the project and contain, at a minimum:</i></p> <ul style="list-style-type: none"> <i>(a) The basic site information including location, status, size of the project and area of disturbance;</i> <i>(b) Permit or file number , if available;</i> <i>(c) Relevant contact information for each project (e.g., names, address, phone, email, etc. for the site operators and contractor);</i> <i>(d) Status of design and BMP Plan review and approval, inspection dates, and if applicable, enforcement actions and whether the project has applied for coverage under HAR, Chapter 11-55, Appendix C, NPDES General Permit Authorizing the Discharge of Storm Water Associated with Construction Activity (a.k.a. General Construction Activity Storm Water permit) (unless the project will disturb less than one acre of land) and satisfied any other applicable requirements of the NPDES permit program (i.e., an individual NPDES permit);</i> <i>(e) The location of the project with respect to all waterbodies, waterbodies listed as impaired under the CWA Section 303(d) and approved by EPA;</i> <i>(f) Project threat to water quality;</i> <i>(g) The required inspection frequency;</i> <i>(h) The project start and anticipated completion dates; and</i> <i>(i) The date the Permittee approved the erosion and sediment control plan in accordance with this section.</i> <p><i>The system used to track/inventory construction sites shall be completed, up-to-date, and in use within 18 months of the effective date of this Permit.</i></p>	<p style="text-align: center;">Section 4.3</p>

<p>Part D.1.d.(iii) Plan Review and Approval – The Permittee shall:</p> <p><i>Prior to approval of the construction plans and specifications, unless where the contractor is responsible for preparing the site-specific BMP Plan, the Permittee shall review the appropriate site-specific BMP Plan and other pollution prevention measures (e.g., for erosion and sediment control, grading, post-construction BMP and landscaping) or similar plan(s)/document(s) to verify that they are consistent with the requirements of this permit, implement appropriate BMPs, are protective of water quality, and that the implementation of measures to ensure that the discharge of pollutants from the site will be reduced to the maximum extent practicable, and will not cause or contribute to an exceedance of water quality standards. Where the contractor is responsible for preparing the site-specific BMP Plan or other pollution prevention measures, the Permittee must review and approve the plan or other pollution prevention measures prior to the start of construction activities.</i></p> <p><i>The Permittee shall not allow construction to commence on any project until it has verified that the project has been issued all relevant JBPBH permits (e.g., drainage connection, discharge of surface storm water runoff permit, etc.) and received from DOH a Notice of General Permit Coverage for the discharge of storm water associated with construction activities (unless the project will disturb less than one (1) acre of land), hydrotesting and/or dewatering effluent and satisfied any other applicable requirements of the NPDES permit program (i.e., an individual NPDES permit).</i></p> <p><i>The Permittee shall update and submit for review and acceptance with the SWMP, a plan review checklist that its reviewers shall use in evaluating the plans and BMPs or other similar document(s) which have been implemented pursuant to this Part. Copies of this plan review checklist shall be provided to applicants for connection, discharge, and encroachment permits and authorization to perform work at the Facility; and to consultants and contractors for their use in developing the Plans or other similar document(s) for contracted construction projects. The plan review checklist shall include, at a minimum, but not be limited to comments on any deficiencies and the date when comments were addressed to the satisfaction of the Permittee. A system shall be implemented to ensure all comments, identified during the review process has been properly addressed.</i></p>	<p>Section 4.4</p>
<p>Part D.1.d.(iv) Inspections – The Permittee shall:</p> <p>(a) <i>The Permittee shall develop and implement a standard inspection form(s) and reporting and corrective procedures for inspections, including use of an inspection checklist, or equivalent, and the Permittee shall track inspection results in a database or equivalent system. The inspection checklist shall, include at a minimum, but not be limited to identifying any</i></p>	<p>Section 4.5</p>

<p><i>deficiencies and the date of the corrective actions. If allowable due to security concerns, photos shall accompany the inspection checklist to document the deficiencies. The inspection form(s), inspection checklist, reporting and corrective procedures shall be submitted to DOH for review and acceptance with the SWMP.</i></p> <p><i>(b) Prior to the initiation of ground-disturbing activities, except for activities associated with the installation of BMPs at a site, an engineer or qualified inspector shall inspect the site to verify BMPs as required by the BMP Plan and/or other documents have been installed correctly and in the correct locations prior to the commencement of ground-disturbing activity. The inspector shall be employed or retained by the Permittee and familiar with the project's site-specific BMP Plan and/or other equivalent document(s). Inspections shall include a review of site Erosion and Sediment Controls, good housekeeping practices, and compliance with accepted erosion and sediment control plans, construction BMPs Plans, and other similar documents and approved permits. The inspector shall also identify any site conditions having the potential for erosion and sediment runoff, including other pollutant discharges which may occur as a result of the project's construction activities and ensure that they are remedied by the appropriate party.</i></p> <p><i>(c) Construction projects shall be inspected at least quarterly by a qualified construction inspector who is independent (i.e., not involved in the day-to-day planning, design, or implementation) of the construction projects to be inspected. The Permittee may use more than one qualified construction inspector for these inspections. The reporting procedures shall include, at a minimum, notification of any critical deficiencies to the Small MS4 Coordinator and site personnel overseeing the project. The Permittee shall develop and implement written procedures for conducting inspections, identifying and requiring appropriate corrective actions, and follow-up inspections when deficiencies had been identified at an inspected project.</i></p> <p><i>(d) The Permittee shall identify construction projects for which more frequent inspections may be appropriate, and perform such inspections as necessary to ensure the correct implementation of BMPs and the protection of water quality. Prior to the initiation of ground-disturbing activities, the minimum inspection frequency and inspection priority shall be identified for each construction project.</i></p> <p><i>Within 18 months of the effective date of this Permit, the</i></p>	
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<p><i>Permittee shall develop written procedures for evaluating prioritization of construction sites. Prioritization criteria shall be based on project threat to water quality. Project threat to water quality includes soil erosion potential, site slope, projects size and type, sensitivity of receiving water bodies, proximity to receiving water bodies, and non-storm water discharges. Inspection frequencies shall be conducted based on the prioritization criteria described above.</i></p> <p><i>(e) At the conclusion of all construction projects, the Permittee shall inspect the project to ensure that all disturbed areas have been stabilized and that all temporary erosion and sediment control measures that are no longer needed have been removed.</i></p>	
<p>Part D.1.d.(v) Enforcement – <i>The Permittee shall:</i></p> <p><i>(a) Establish policies for enforcement and penalties for those in non-compliance with the requirements of the construction site management program, and</i></p> <p><i>(b) Develop and implement an Enforcement Response Plan to include written procedures for appropriate corrective and enforcement actions, and follow-up inspections when an inspected project is not in full compliance with its requirements, other permits, and any other applicable requirements under the NPDES permit program.</i></p>	<p>Section 4.6</p>
<p>Part D.1.d.(vi) process to refer noncompliance and non filers to DOH – <i>In the event the Permittee has exhausted its use of sanctions and cannot bring a construction site or construction operator into compliance with its policies, standards, or this permit, or otherwise deems the site to pose an immediate and significant threat to water quality, the Permittee shall provide e-mail notification to cleanwaterbranch@doh.hawaii.gov, Attn: Enforcement Section Supervisor within one (1) week of such determination. E-mail notification shall be followed by written notification in accordance with Part A.7. and include a copy of all inspection checklists, notes, and related correspondence in pdf format (300 minimum dpi) within two (2) weeks of the determination. In instances where an inspector identifies a site that has not applied for permit coverage under the NPDES permit program, the Permittee shall provide written notification in accordance with Part A.7. to DOH within two (2) weeks of the discovery.</i></p>	<p>Section 4.7</p>
<p>Part D.1.d.(viii) Education – <i>The Permittee shall implement an education program as part of its ongoing SWMP to ensure that project applicants, contractors, and other responsible parties have an understanding of the storm water requirements they need to implement.</i></p>	<p>Section 4.8</p>

4.1 Program Organization

As a military installation, JBPHH has several different types of construction projects and the agency that handles the oversight of each one depends on the nature of the work and who funds the work. The overseeing agency has the most immediate authority over the day-to-day activities at each construction site. As such, the Construction Site Runoff Control Program is structured to place responsibility for implementation of NRH's SWMP policies at construction sites to each of these corresponding agencies. The Joint Base Public Works Department (JB4) and EV are responsible for managing the overall Construction Site Runoff Control Program and updating policies as deemed necessary to improve the effectiveness of the program. Although typically any issues observed with regard to SWMP implementation or non-compliance with the MS4 Permit are resolved at a lower level of authority, the Joint Base Commanding Officer (JBC) has the authority to adjust policies or direct enforcement actions for tenants/agencies subject to the Construction Site Runoff Control Program. Commander, NRH, has ultimate authority for Permit policies and enforcement actions. This is described in more detail in Section 4.6, Enforcement.

To address the Permit requirements for construction site runoff, the various types of execution methods for construction and maintenance projects that occur on base and the corresponding agency responsible for oversight, are summarized in the organizational chart presented in Figure 4-1. Typically construction projects are categorized as either:

- (i) *In-house Maintenance and Construction*— These are projects that are typically less than 5,000 square feet (SF) and/or related to emergency repair work. They are usually managed by the Production Division (PROD) and the Utilities and Energy Management Product Line (UEM). Some in-house projects are accomplished and managed by military personnel (e.g., Seabees).
- (ii) *Contract Maintenance and Construction* – These projects are usually contracted to an outside contractor to construct. Project management and oversight is typically accomplished by the Facility Engineering and Acquisition Division (FEAD) for NRH projects. Construction for tenants may be accomplished by FEAD or other contracting agencies (e.g., PPV housing, Ford Island Ventures, Hawaii Air National Guard, Army Corps of Engineers, etc.). Oversight and management of these other contracted projects are by these other agencies.

Due to the nature of certain in-house maintenance and construction projects, where the potential risk of storm water pollution is minimal or projects are needed to address public health and safety, certain projects may be exempt from the requirements of the Construction Site Runoff Control Program. Exemptions will be decided upon on a case-by-case basis. Such projects may include:

- Routine maintenance to maintain the original hydraulic capacity, or the original purpose of the facility (only upon review of the Environmental Division (PRJ4)/EV);
- Emergency construction activities required to immediately protect public health and safety; and
- Interior remodeling that involves no outside exposure of construction materials/waste to storm water.

These qualifying characteristics are subject to the discretion of the environmental department, and may be revised as determined necessary and/or justifiable. All projects that do not meet these exemption criteria will be referred to herein as “*non-exempt*” construction projects.

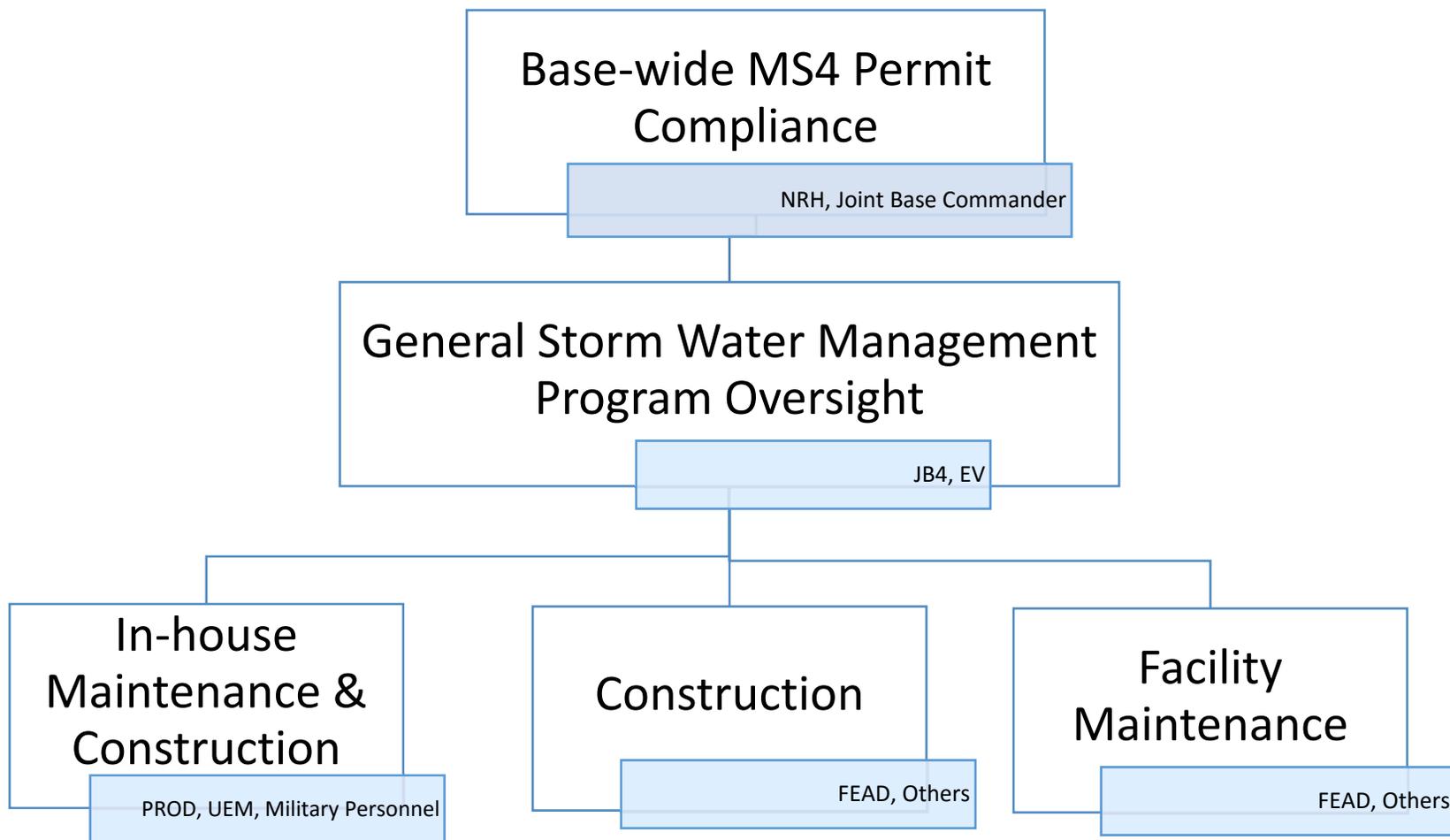


Figure 4-1 Construction Site Runoff Control Program Organizational Chart

4.2 BMP Implementation

The Base Instruction that implements this SWMP as Base policy establishes the requirement to implement BMPs on construction projects to minimize the discharge of pollutants with storm water, including controls for erosion and sediment and non-storm water. JB4, Capital Improvements (CI), and EV are responsible for establishing policies and standards that need to be met on contracted construction projects. These policies are incorporated as requirements into the construction contracts. A copy of the Initial BMP Site Inspection Checklist is provided in Appendix 4-1. Tenants and other contractors working on base are required to comply with all applicable laws and regulations and basewide instructions and permits. In-house construction projects will be required to implement BMPs per the requirements of this SWMP.

In addition, there are specific requirements for handling, storage, and disposal of wastes generated during construction.

These standards and requirements will be reviewed annually and, as necessary, revised to include descriptions of new, modified, or revised BMPs, including permanent BMPs and Low Impact Development (LID) practices. Any revisions will be discussed within the Annual Report and the documents included within this SWMP. All documents will be made available to facility staff, contractors, and consultants, as appropriate.

4.3 Inventory of Construction Projects

There are three general categories of construction projects at NRH; (1) In-house Maintenance and Construction, (2) NAVFAC FEAD Contract Construction and Maintenance, and (3) Other Contracting Agency's Maintenance and Construction. Several construction projects are likely to be on-going at any given time. The benefits of maintaining an inventory of construction sites include:

- Helping to ensure that construction and BMP plans have been reviewed;
- Tracking potential points of discharge of pollutants into the system;
- Easily attaining project data and point of contacts to address issues; and
- Maintaining records of projects to verify that applicable inspections are being conducted, and that necessary enforcement actions are being implemented.

Effectively maintaining and managing this information will enable NRH to identify and address compliance issues efficiently as well as help recognize recurring issues within the Construction Site Runoff Control Program or repeat offenders of the Permit requirements. Being able to easily identify and address issues will help promote the continual improvement of the Construction Site Runoff Control Program and facilitate its effectiveness in reducing storm water pollution from construction sites.

The information to be tracked as part of the inventory for construction projects will consist of the following.

- Basic site information including location, status, size of the project and area of disturbance;
- Permit or file number , if applicable and available;
- Relevant contact information for each project (e.g., names, address, phone, email, etc. for the site operators and contractor);
- Status of design and BMP Plan review and approval

- Inspection dates, and if applicable, enforcement actions
- If a Notice of Intent (NOI) has been filed, or a Notice of General Permit Coverage (NGPC) received for project-specific NPDES permit coverage if required.
 - If projects disturbs one or more acre of land or is part of a larger common plan of development that disturbs one or more acre of land, coverage under HAR, Chapter 11-55, Appendix C, NPDES General Permit Authorizing the Discharge of Storm Water Associated with Construction Activity
 - If project will involve discharges of non-storm water (e.g., hydrotesting/disinfecting water, dewatering effluent, waste water, etc.), coverage under the applicable general permit in HAR Chapter 11-55
 - Or if an individual permit application has been applied for or received, or any other requirement of the NPDES permit program has been satisfied
- Location of the project with respect to all waterbodies, and whether waterbodies are listed as impaired under the CWA Section 303(d) and approved by EPA;
- Project threat to water quality;
- Required inspection frequency;
- Project start and anticipated completion dates; and
- Date the Permittee approved the erosion and sediment control plan in accordance with this section.

An inventory of applicable construction sites will be maintained as required by the Permit, by the responsible agency displayed in Table 4-1. All records are kept at the associated agency’s office and will be made available, when necessary, upon request by EV or DOH.

Table 4-1 Location of Inventory of Construction Sties

Type of Construction Project	Agency Responsible for Site Management
In-house Maintenance and Construction	JB4, PROD, UEM, CI, Military agency responsible for construction
Contract Construction and Maintenance:	JB4, FMD, APWOs, FEAD, Other Contracting Agencies

To prevent overburdening the tracking systems and procedures in place, in-house maintenance and construction projects (*exempt or non-exempt*) that (1) disturb an area of less than 5,000 sf, and (2) can reasonably be considered to hold a negligible potential for discharging pollutants via storm water (with concurrence from PRJ4/EV), will not be included in the inventory of construction sites. Even *exempt* projects (such as emergency repair projects) are considered for tracking if these criteria are not met, because tracking can be instrumental in identifying recurring or resultant issues in the future. By eliminating the tracking efforts required by these smaller tasks, NRH will be able to direct more of its

resources towards the management of projects that pose a greater potential to have an impact on storm water quality.

4.4 Plan Review and Approval

As a part of the design process, designers will consider requirements of this Construction Site Runoff Control Program as well as those of the Permit. NRH/JB4 will perform a review of all non-exempt construction project plans developed in order to ensure applicable requirements are met.

Review of all storm water pollution prevention plans (SWPPP) and supporting documents will be conducted by the agency responsible for overseeing the project listed in Table 4-1. Reviews may also be done by PRJ4/EV. The Storm Water Pollution Prevention Plan Content Review Checklist in Appendix 4-2 will be used to guide the plan review process. Plan review is conducted similarly for all types of projects, and approval shall occur as follows:

- Document the process whereby all proposed construction projects are required to implement measures to ensure that the discharge of pollutants from the site will be reduced to the MEP and will not cause or contribute to an exceedance of water quality standards.
- Review and approve of the applicable Site-Specific SWPPP/BMP Plan to verify that it fully meets all requirements of the Permit and the checklist prior to approval of construction plans and specifications (if prepared prior to contract award) or prior to the start of construction activities (if prepared after contract award);
- If applicable to the project, ensure that there is proof of filing a Notice of Intent (NOI) or NPDES application for permit coverage and that a Construction BMPs Plan has been prepared; and
- Not allow construction to commence on any project unless and until it is verified that the project has been issued all relevant JBPHH permits (e.g., drainage connection, discharge of surface storm water runoff permit, etc.), received from DOH a Notice of General Permit Coverage for the discharge of storm water associated with construction activities (if applicable - the project will disturb one or more acre of land or is part of a larger common plan of development that disturbs one or more acre of land), or other discharge as applicable (e.g., hydrotesting/disinfecting water, dewatering, etc.) , and satisfied any other applicable requirements of the NPDES permit program (e.g., individual NPDES permit).

If a plan submittal does not meet the requirements outlined by the plan review process, all deficiencies are noted on the project's Plan Review Checklist. The applicant must resubmit the checklist, with comments describing how each deficiency has been addressed. At a minimum, the reviewing agency will keep a record of deficiencies/comments noted, and the date in which revisions were made to the satisfaction of the reviewer. Other relevant information may be tracked at the discretion of the agency.

Prior to commencement of construction, the Navy PM or contractor is responsible for ensuring that necessary approvals, including documentation of any revisions made to satisfy reviewer comments, have been received and updated in the project record.

Any pertinent revisions to the SWPPP and supporting documents following review approval, including but not limited to design or concept changes, shall be resubmitted to the appropriate agency for review. As necessary, EV will oversee or provide assistance during the plan review process. EV will also review, update, and distribute the Plan Review Checklist as needed.

4.4.1 Approval to Discharge or Connect to MS4

Following review of the project SWPPP and all other pertinent documents, some projects may be required to obtain additional approval from JB4. Approval to discharge or connect to the MS4 is required for connection to the MS4 for facilities not under the direct control of JBC, or certain project-related discharges to the MS4 (e.g., dewatering or hydrotesting, surface storm water runoff associated with construction activities that disturb one or more acres of land or that are part of a larger common plan or development that would disturb one or more acre of land). The connection approval process is described in Section 3.2. JB4 will work with the Facility Management Division (FMD) to determine if the storm drain system has adequate capacity to accept a connection request. They will also work with EV as needed to address any technical issues or concerns.

4.4.2 Commencement of Construction

Prior to any construction, a project owner must receive notice of the completion and acceptance of a SWPPP review and revised dig permit, if applicable. All construction activities, for in-house, military or contract projects, will also be prohibited until it is verified whether the project has received all applicable permits (e.g., Notice of General Permit Coverage (NGPC) under HAR, Chapter 11-55, Appendix C, from the DOH), and has satisfied all other requirements of the NPDES program.

4.5 Inspections

Inspections shall be conducted and include a review of site erosion and sediment controls, good housekeeping practices, and compliance with approved erosion control plans or construction BMPs plans. Inspectors shall use the approved inspection checklist, provided in Appendix 4-3. Inspection results will be tracked in a database or equivalent system by the agency responsible for the construction and made available to EV/JB4 upon request.

There are three construction inspection requirements that must be met for all applicable maintenance and construction projects. They are as follows:

- **Initial Site Inspection:**
 - Purpose: To ensure that BMPs are correctly installed, in the right locations, and in accordance with all approved SWPPP related documents.
 - Inspector: An engineer or qualified inspector familiar with the project's site-specific BMP Plan and related documents.
- **Quarterly Site Inspections:**
 - Purpose: To ensure the continued performance of BMPs throughout the life of the project, that SWPPP related documents are available to workers onsite, and to make sure that appropriate adjustments are made to BMPs that are found to be deficient. These inspections will be conducted for all projects.
 - Inspector: A qualified, independent inspector, with no involvement in the day-to-day planning, design, or implementation of the project.
 - Frequency: Quarterly.
- **Other Frequencies of Inspections:**
 - Purpose: To ensure that, for construction projects where more frequent inspections are appropriate, performance of BMPs continues throughout the life of the project, that SWPPP related documents are available to workers onsite, and to make sure that

appropriate adjustments are made to BMPs that are found to be deficient. Prior to beginning any ground-breaking activities the minimum inspection frequency and priority will be identified for each construction project.

- ***Inspector:*** A qualified, independent inspector, with no involvement in the day-to-day planning, design, or implementation of the project.
- ***Frequency:*** As determined prior to the beginning of the project, and may be adjusted through the duration of the project.

A prioritization process is being developed by NRH to identify sites that require more frequent inspections. More frequent inspections would be conducted if problems are identified during construction. FEAD construction projects already require erosion and sediment control inspections, inspections by Navy personnel involved with the project, and regular quality control reports. More frequent inspections may be required for non-FEAD projects located in close proximity to water bodies.

EV will be responsible for periodically reviewing and distributing updates to the inspection checklist and prioritization process as needed.

Critical Deficiency: A deficiency that poses an immediate risk of discharge of pollutants to a storm drain MS4, or water body, or observed violation of regulations. Critical deficiencies include, but are not limited to, the following examples:

- Any evidence or observed discharge of non-storm water to the storm drain system, or water body generated by construction activity;
- No SWPPP or BMP document
- No required NPDES permit;
- Absence of perimeter controls and/or linear barriers required by the SWPPP document;
- There are identified storm drain inlets, surface waters, or State waters within or adjacent to the project site in close proximity to disturbed soil areas without control measures in place so there is an immediate threat of untreated storm water discharges;
- Work in an active stream channel or other surface water body without proper implementation of required BMPs; and
- Any presence of any spilled oil or hazardous materials near unprotected storm drain inlets, swales, ditches, or water body.

4.5.1 Initial Inspections

Prior to the initiation of non-exempt construction activities, the site will be inspected by an engineer or qualified inspector for BMPs.

As a part of the initial inspection, the inspector will review the site's BMP plan and applicable permits and verify that BMPs have been installed as required, correctly and in the correct locations prior to the commencement of ground-disturbing activity. Specifically, the inspector will review erosion and sediment controls, good housekeeping practices, and compliance with site plans, Construction BMPs Plans, and other similar documents and approved permits. If the inspector identifies any site conditions that have the potential to result in the discharge of pollutants, corrective actions and re-inspection will be required prior to the commencement of construction activities. Prior to this inspection, a contractor may only disturb the soil to the extent that is required to install BMPs.

4.5.2 Quarterly and Other Frequency Inspections

All non-exempt construction projects will be inspected quarterly to ensure that all BMPs specified in the SWPPP are properly maintained and continue to be sufficient in preventing storm water pollution resulting from construction activities through the duration of the project. All inspections will be conducted by independent (i.e. not involved in the day-to-day planning, design, or implementation of the construction project) qualified inspectors.

Inspections will also be conducted upon complaints from citizens or concerned groups. Unannounced and follow-up inspections may be conducted as deemed necessary. EV will coordinate with the overseeing agency if violations are documented. If violations are observed during general inspections, either the tenant or EV will be notified. EV will direct the issue accordingly. Adjustments to inspection frequency will be made at the discretion of the overseeing agency and EV, in accordance with the Permit requirements.

4.5.3 Corrective Action and Reporting Procedure

Critical deficiencies will be reported immediately to EV and the construction manager. Failure to address identified critical deficiencies can be escalated to the next higher authority and enforcement conducted through the contract or tenant lease agreement, as necessary.

4.5.4 Tracking Inspection Results

As a part of the inspection, all the documentation for the site must be produced by a project representative (e.g. BMP plan, applicable permits, site inspections, and training records). Inspectors will then verify that site conditions match those required in site documents. Further, the inspector will ensure that BMPs are properly maintained and effective in containing potential pollutants. Any deficiencies noted during these inspections shall be promptly corrected by the contractor. The inspections results, corrective actions, and follow-up inspection results will be tracked by the individual agencies and will be available for review by EV.

4.6 Enforcement

To ensure compliance with the Construction Site Runoff Control Program and the Permit requirements, NRH is in the process of developing enforcement procedures for all maintenance and construction projects. The Enforcement Response Plan (ERP) will include policies and written procedures for appropriate corrective and enforcement actions, including penalties as appropriate, for projects found to be in non-compliance with the Construction Site Runoff Control Program. The ERP will also include follow-up inspections when an inspected project is not in full compliance with its requirements, other permits, and any other applicable requirements under the NPDES permit program.

4.6.1 Referral of Non-compliance and Non-filers to DOH

In the event that NRH has been unable to resolve an observed deficiency within its authority, or otherwise deems the site to pose an immediate or significant threat to water quality, EV shall provide an e-mail notification to DOH within one (1) week of such determination. EV will follow-up with written notification and include a copy of all inspection checklists, notes, and related correspondence in pdf format (300 minimum dpi) within two (2) weeks of the determination.

In the event that NRH identifies that a construction site has not applied for permit coverage under the NPDES permit program, EV will provide written notification to DOH within two (2) weeks of the discovery.

All written notifications submitted via email will be directed to:

cleanwaterbranch@doh.hawaii.gov, Attn: Enforcement Section Supervisor

4.7 Construction BMP Training

Employees in targeted positions, whose jobs or activities are engaged in construction will be trained regarding the requirements of the Construction Site Runoff Control Program. Positions with Construction Site Runoff Control Program responsibilities include construction engineers, construction and maintenance inspectors and plan reviewers, and any other staff responsible for managing the Construction Site Runoff Control Program.

Training sessions are being developed that will relate to specific facility construction activities, and include information on proper installation and maintenance of approved BMPs, Construction Site Runoff Control Program policies, rules, procedures, and resolution of any issues observed during the previous year.

EV will be responsible for ensuring that updated information, current inspection forms, and any other updates to the Construction Site Runoff Control Program policy, procedures, etc. are made available to personnel and contractors working in construction.

4.8 Education

As part of the effective management of its Construction Site Runoff Control Program, NRH will implement an ongoing education program directed at all parties subject to the requirements of the Construction Site Runoff Control Program, including project applicants, contractors, and other responsible parties.

The program will promote a general understanding of the SWMP, and more specifically of the requirements that they must meet as participants of the Construction Site Runoff Control Program. Part of this education involves knowledge of the proper procedures/approvals necessary to begin construction, as well as knowledge of how to remain in good standing throughout the construction process, and where to go for additional information and assistance.

5 Post-Construction Storm Water Management

Per the Permit, Part D.1.e, NRH is required to develop, implement, and enforce a Post-construction Storm Water Management Program. The purpose of the program is to address storm water runoff from all new development and redevelopment projects that result in a land disturbance of one (1) acre or more and smaller projects that have the potential to discharge pollutants to the MS4.

The Post-construction Program implements the following control measures to minimize storm water impacts to the MEP and ensure permanent controls are in place for applicable projects:

1. Develop and implement revised standards, and feasibility criteria for requiring post-construction permanent BMPs (PBMPs), including Low Impact Development (LID) measures that will effectively reduce pollutants, including foreseeable potential future pollutants, to NRH’s MS4.
2. Review and accept plans for projects to ensure that appropriate PBMPs have been included in the project design and bid package.
3. Develop, operate and maintain an Asset Management System (AMS) database to track PBMP installations including inspections, operations and maintenance, and inspection frequency of PBMPs.
4. Provide education and outreach materials on the selection, design, installation, operation, and maintenance of storm water BMPs, structural controls, PBMPs, and LID practices.
5. Provide annual training for staff and contractors responsible for inspecting PBMPs and LID practices.

The Post-construction Program is administered in accordance with the Permit requirements, which state:

Permit Reference	SWMP Section
<p><i>Part D.1.e. Post-construction Storm Water Management in New Development and Redevelopment</i></p> <p><i>The Permittee shall develop, implement, and enforce a Post-Construction Storm Water Management program to address storm water runoff from all projects that result in a land disturbance of one (1) acre or more and smaller projects that have the potential to discharge pollutants to the Facility’s Small MS4. The initial program shall be developed within 18 months of the effective date of this Permit.</i></p> <p><i>The Permittee’s program must ensure that permanent controls are in place to prevent or minimize water quality impacts to the MEP. Review and update, as necessary, the criteria defining when types of permanent post-construction BMPs (i.e., LID techniques), must be included in a project design to address storm water impacts and pollutants of concern. For State waters on the State CWA Section 303(d) list or State established and EPA approved TMDLs, the pollutants of concern to be targeted shall include the parameters causing impairment. The program shall include, at a minimum, the following elements:</i></p>	<p style="text-align: center;">Section 5</p>

<p>Part D.1.e.(i) Standards Revision – Within 18 months after the effective date of this Permit, the Permittee shall develop standards for addressing post-construction BMPs, including Low Impact Development (LID) requirements. LID refers to storm water management practices which seek to mimic a site’s 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. The standards shall be applicable to all construction projects disturbing at least one (1) acre and smaller projects that have the potential to discharge pollutants to the Permittee’s Small MS4. LID employs principles such as preserving and recreating natural landscape features and minimizing imperviousness to create functional and appealing site drainage that treats storm water as a resource, rather than a waste product. LID treatment measures include harvesting and use, infiltration, evapotranspiration, or biotreatment. The plan for the implementation of LID provisions in the Permittee’s standards shall include at a minimum the following:</p> <ul style="list-style-type: none"> • Criteria for requiring implementation. • Investigation into the development of quantitative criteria for a specific design storm to be managed by LID techniques. Examples of design storm requirements include: 24-hour, 85% storm through infiltration; on-site management of the first inch of rainfall within a 24-hour period; retention of the 100-year, 2-hour storm; or on-site management of the 24-hour, 95% storm. • Feasibility criteria for circumstances in which a waiver could be granted for the LID requirements. • When a LID waiver is granted, alternatives such as offsite mitigation and/or non-LID treatment control BMPs could be required. 	<p>Section 5.2</p>
<p>Part D.1.e.(ii) Review of Plans for Post-Construction BMPs – For design-bid-build projects, the Permittee shall include in all requests for proposals (RFPs), a requirement to ensure that appropriate permanent post-construction BMPs, which include LID practices, have been included in the project design and are included in the bid package to ensure compliance with this part of the permit. Projects shall be reviewed and approved prior to implementation. For design-build projects, the Permittee shall review and approve the project design prior to implementation. No project shall proceed without the inclusion of appropriate permanent post-construction BMPs unless a waiver is granted by the Permittee based on specific documentation demonstrating that such post-construction BMPs are not feasible. Project documents for projects that will include installation of permanent post-construction BMPs shall also include appropriate requirements for their future continued maintenance.</p>	<p>Section 5.3</p>

<p>Part D.1.e.(iii) BMP, Operation and Maintenance, and Inspection Database – The Permittee shall operate and maintain all Post construction BMPs to the design OR operational optimized specifications. The Permittee shall ensure that the post-construction BMP effectively reduces discharges of pollutants and is protected from degradation not accounted for within its designed lifespan. Within 18 months of the effective date of this Permit, the Permittee shall develop and implement a computer-based tracking system (i.e., Asset Management System) to track the frequency of inspections and maintenance of post-construction BMPs (Permanent BMPs). The tracking system shall contain a complete inventory of all Permanent BMPs. In addition to standard information collected for all projects (e.g., project name, owner, location, start/end date, etc.), the tracking system shall also include, at a minimum:</p> <ol style="list-style-type: none"> 1) Type and number of LID Practices; 2) Type and number of Source Control BMPs; 3) Type and number of Treatment Control BMPs; 4) Latitude/Longitude coordinates of controls using Global Positioning Systems (GPS) and NAD83 or other Datum as long as the datum remains consistent; 5) Photographs of controls if allowable due to security; 6) Operation and maintenance requirements; 7) Frequency of inspections; 8) Inspection results, necessary follow up actions, and response; and 9) Frequency of maintenance. 	<p>Section 5.4</p>
<p>Part D.1.e.(iv) Education and Training</p> <p>(i) <i>Project Proponents</i> – The Permittee shall provide education and outreach material for those parties with project design and construction storm water responsibilities on the selection, design, installation, operation and maintenance of storm water BMPs, structural controls, post construction BMPs, and LID practices. The outreach material may include a simplified flowchart for thresholds triggering specified requirements, a list of required permits, implementing agencies, fees, overviews, timelines and a brief discussion of potential environmental impacts associated with storm water runoff.</p> <p>(ii) <i>Inspectors</i> – All Permittee personnel and contractors responsible for inspecting permanent post-construction BMPs and LID practices shall receive annual training.</p>	<p>Section 5.5</p>

5.1 Program Organization

The program organization for the Post-construction Storm Water Management Program would be dependent on who is responsible for design and construction of the project. The agencies responsible for overseeing that all Post-construction Storm Water Management Program requirements are met for the various types of construction projects are identified in Figure 5-1. The Post-construction Storm Water Management Program includes planning, design, and a long-term maintenance component, which is coordinated by the Facility Management Division (FMD), under the overall direction of the Public Works Department (JB4).

Figure 5-1 outlines the organization of the Post-construction Storm Water Management Program, the blue boxes indicate the agency responsible for general oversight of each phase.

NAVFAC typically accomplishes project management, planning, design, and construction for most NRH and tenant projects. Construction for tenants may be accomplished by other contracting agencies. Parties responsible for each are described below. Work contracted by other agencies would be planned, designed, and managed by the agencies responsible for the project. Operation and maintenance (O&M) for the PBMPs would be responsibility of the tenant. NRH/JB4 would be responsible for compliance oversight and tracking for O&M.

Typically NAVFAC construction projects at NRH are categorized as either:

- (i) In-house Maintenance and Construction— These are projects that are typically less than 5,000 SF and/or related to emergency repair work. They are usually managed by the Production Division (PROD) and the Utilities and Energy Management Product Line (UEM). Some in-house projects are accomplished and managed by military personnel (e.g., Seabees). If needed, project planning is accomplished by NAVFAC Hawaii Asset Management Department (AM) and design is accomplished by NAVFAC Hawaii FEAD Project Management and Engineering Branch (PMEB). FMD is responsible for O&M of Navy PBMPs and tracking following completion of construction. O&M may be accomplished by in-house (PROD) or contracted personnel.
- (ii) Contract Maintenance and Construction – These projects are contracted to an outside contractor to construct. Construction management and oversight are accomplished by FEAD. Project planning is accomplished by NAVFAC Hawaii or the Pacific Asset Management Department (AM) and design is accomplished by PMEB or Design Business Line (OPHC) or NAVFAC Pacific Design Division (CI4). FMD is responsible for O&M and tracking following completion of construction. O&M of Navy PBMPs may be accomplished by in-house (PROD) or FEAD contracted personnel.

To address the Permit requirements, construction projects subject to the requirements of the Post-construction Storm Water Management Program are those that disturb one (1) or more acres, or smaller projects that have the potential to discharge pollutants into NRH’s MS4. This program covers all new development and redevelopment projects.

For the purpose of this SWMP and the Post-construction Storm Water Management Program, the following construction activities are not considered for classification as “redevelopment” projects:

- Routine maintenance to maintain the original hydraulic capacity, line and grade, or the original purpose of the facility;
- Trenching and pavement resurfacing activities related only to utility work;
- Resurfacing or replacement of damaged pavement;
- Emergency construction activities required to immediately protect public health and safety;
- Interior remodeling that involves no outside exposure of construction materials/waste to storm water; and
- Exterior building renovations that do not disturb ground or increase the footprint of impermeable surfaces.

Those projects classified as exempt projects are subject to the discretion of the overseeing agency and EV.

Similar to all other programs in this SWMP, the JBC has the authority to adjust policies or direct enforcement actions for tenants/agencies. Commander, NRH, has ultimate authority for Permit policies and enforcement actions.

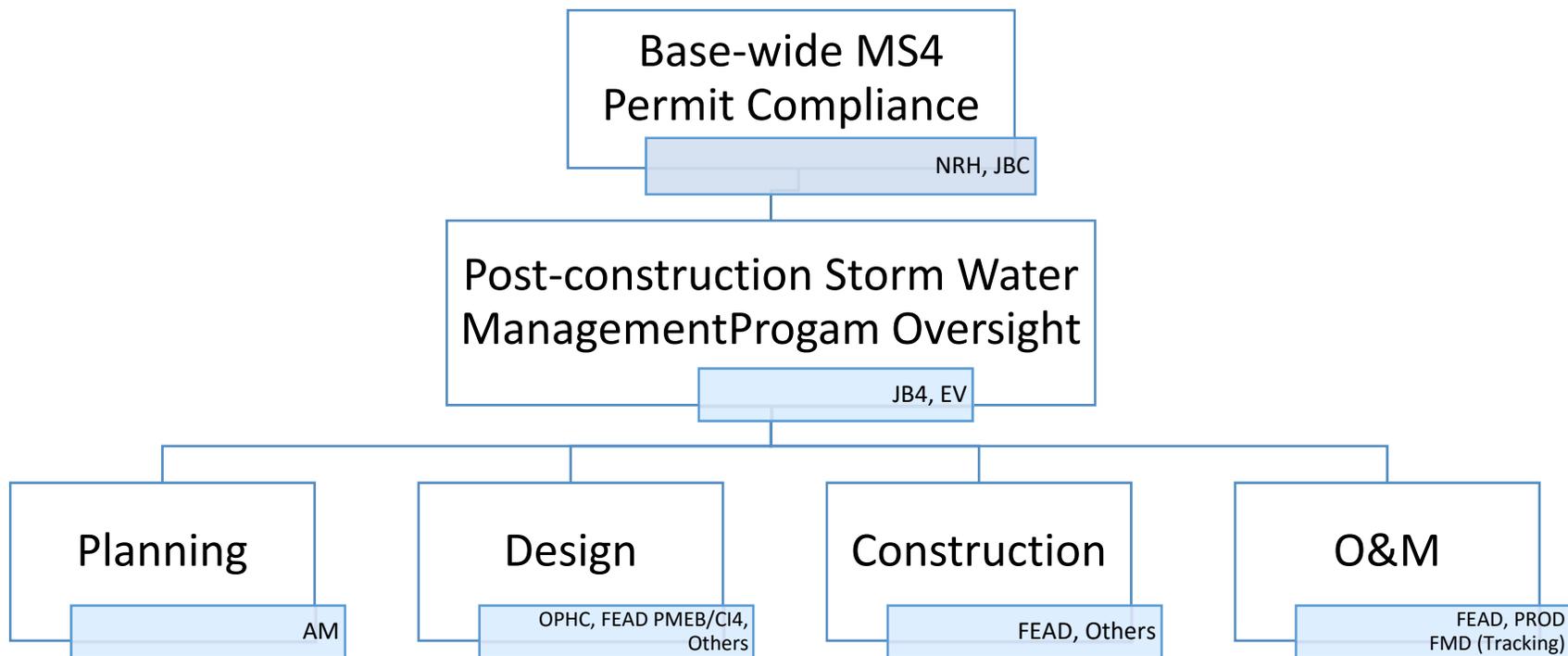


Figure 5-1 Post-construction Storm Water Management Program Organizational Chart

5.2 Standards Revision

In accordance with the Permit, Part D.1.e(1), NRH uses existing Navy and Department of Defense policies for implementing LID. NRH will be determining whether it is necessary to develop a separate “Plan for Requiring Low Impact Development in the Standards (Plan for Requiring LID).” Low impact development (LID) aims at preserving or mimicking the site’s predevelopment hydrology. This is achieved by minimizing ground disturbance and use of impervious cover, and infiltrating, storing, detaining, evapotranspiring, and/or biotreating storm water runoff as close to its source as reasonably possible. Ideally LID measures are based on the concept of preserving or recreating the natural landscape features and minimizing imperviousness, and treating storm water as a resource rather than a waste product. NRH’s LID design standards are intended to prioritize management practices that favor harvesting and use, infiltration, evapotranspiration, or biotreatment, followed by other practices to treat and release storm water.

The revised Plan for Requiring LID is anticipated to cover the following items:

- Criteria for requiring implementation of LID;
- Quantitative criteria for a specific design storm to be managed by LID techniques;
- Feasibility criteria for circumstances in which a waiver could be granted for the LID requirements;
- List of alternatives that may be implemented when an LID waiver is granted;
- Draft LID planning and design example checklist; and
- Draft LID and PBMP inspection example checklists.

NRH has already implemented the required LID standards for its projects in accordance with updated LID Standards. These standards are outlined in Section 438 of the Energy Independence and Security Act of 2007 (EISA) and establish strict storm water runoff requirements for federal development and redevelopment projects with a footprint of 5,000 square feet or more. The Under Secretary of Defense released a policy memorandum on January 19, 2010, for DoD Implementation of Storm Water Requirements under Section 438 of the Energy Independence and Security Act (EISA), which identified the design storm criteria as the 95th percentile storm. This policy memorandum also includes a flow chart that includes examples of on-site design options and technical constraints. NAVFAC projects are required to follow the requirements of the Unified Facilities Criteria (UFC) 3-210-10, Low Impact Development, which provides design criteria for LID and technical feasibility criteria.

5.3 Review of Plans for Post-construction BMPs

A primary goal of the Post-construction Storm Water Management Program is to ensure that no applicable construction project will proceed without the inclusion of the appropriate PBMPs and documentation outlining future PBMP maintenance requirements. To achieve this goal, all projects, design-bid-build and design-build alike, must be reviewed and accepted for suitable use of PBMPs. This review and acceptance process will be conducted by the overseeing agency shown in Figure 5-1, and will incorporate all LID standards that have been developed for the Permit.

All project owners will have access to the criteria for requiring LID, and the “Low Impact Development Planning and Design Checklist,” (LID Design Checklist) which is being developed. No non-exempt project shall proceed without the inclusion of appropriate PBMPs unless a waiver has been granted with

approval by the Regional Engineer based on specific documentation demonstrating that PBMPs are not technically feasible. Criteria for technical feasibility include restrictions imposed by State or local regulations on types of LID features (e.g., green infrastructure, rain harvesting). Economics may be a factor, but should not be considered the only constraint to justify technical infeasibility.

At the time of review, the project owner must also submit documentation of required maintenance activities. These will also be reviewed for long-term feasibility, and may require reviewers to collaborate with JB4 (FMD).

To assure the implementation of adequate PBMPs, no construction shall begin or be awarded until the plans have been appropriately reviewed and accepted by the overseeing agency. As part of the Plan for Requiring LID, the applicant must also submit a description of the alternative measures or non-LID PBMPs that will be implemented should the LID waiver be granted by NRH due to technical constraint(s).

5.4 PBMP, Operation and Maintenance, and Inspection Database

Adequately operating and maintaining PBMPs is an important factor in ensuring their long-term effectiveness. A successful maintenance program relies on routine inspection and accurate tracking/recordkeeping.

When vegetated PBMPs are installed there is a stabilization period over which the contractor is responsible for their maintenance. This stabilization period can be helpful in identifying design problems, or oversights during installation. When non-vegetated structural PBMPs are installed, they are required to be functional and clean when turned over to the base. To facilitate the turnover of PBMP ownership to NRH, the contractor may document any observed maintenance baseline or other information that may be useful to JB4. The process for a contractor to turn over ownership of a new or redeveloped facility to NRH includes:

- Submittal of as-built plans, with clear distinction of all PBMPs (supplemental written documentation may be submitted for additional clarification of any details);
- Submittal of all relevant documentation outlining PBMP/LID specifications and required future maintenance; and
- Submittal of proof of PBMP stabilization (photos, prior maintenance records, etc.), if applicable.

These documents are to be submitted to JB4 who will ensure that FMD, PROD, EV, and others receive them as necessary. Once proof of stabilization has been accepted, maintenance of the applicable PBMPs will fall under the responsibility of FMD. It is up to the project owner/contractor to ensure that all relevant information is provided to NRH.

A copy of the as-built plans will also be provided to JB4 to be used to update NRH's existing Geographic Information System (GIS) file and its existing overall storm drain system database, which is used primarily for tracking and scheduling of maintenance work. At a minimum, the PBMP Database will include:

- General Information: Project name, owner, general location, start/end date of construction, date of acceptance by JB4;
- Type and number of LID practices;
- Type and number of Source Control PBMPs;

- Type and number of Treatment Control PBMPs;
- Latitude/Longitude coordinates of controls using Global Positioning Systems and NAD83 or other Datum as long as the datum remains consistent;
- Photographs of controls (as allowable due to security);
- Operation and maintenance requirements;
- Frequency of inspections, (or contact information for inspection records);
- Inspection results, necessary follow up actions, and responses; and
- Frequency of maintenance, (or contact information for maintenance records).

JB4's maintenance program will allocate resources and prioritize the operation and maintenance of facilities with the maximum potential to affect storm water quality. The PBMP Database will be used to ensure that all PBMPs, including LID features, are met. This requires that inspections be conducted on a routine basis for each PBMP, with maintenance performed as necessary to retain its function.

Routine maintenance activities will also be conducted to the MEP, but priority will be given to PBMPs that have been identified by inspection, or public notification, as malfunctioning. Inspection and maintenance records will be tracked via work orders generated by FMD, and by field notes documented by maintenance personnel. All inspection/maintenance records will be maintained by FMD, and made available to EV/PRJ4 upon request.

5.5 Education and Training

5.5.1 Project Proponents

As part of its Post-construction Storm Water Management Program, NRH will implement an ongoing education program directed at those parties with project design and construction storm water responsibilities on the selection, design, installation, operation, and maintenance of storm water BMPs, structural controls, PBMPs, and LID practices. Education of all participating parties will promote consistency, and efficiency within the Post-construction Program.

NRH will use its Plan for Requiring LID and may develop other materials, as needed, to facilitate learning on, including but not limited to:

- thresholds triggering specified requirements;
- list of required permits;
- implementing agencies, fees, overviews, and timelines; and
- brief discussion of potential environmental impacts associated with storm water runoff.

EV is responsible for oversight of NRH's post-construction education and outreach program, including contents and method of which information is circulated. Outreach material will be developed, revised, and distributed at the discretion of the EV. These materials will be used to address observed issues or general program policy updates.

5.5.2 Inspectors

EV will oversee the conduct of, at a minimum, annual training for all staff and contractors tasked with inspecting PBMPs. Information will focus on proper installation and maintenance of approved PBMPs, Post-construction Program policies, procedures, and resolution of any issues observed during the previous year.

EV will be responsible for updating and ensuring that current resources are available to NRH staff and contractors tasked with managing any portion of the Post-construction Storm Water Management Program.

6 Debris Control BMPs Program Plan

A crucial component of NRH's SWMP is its Base-wide Pollution Prevention and Good Housekeeping Program (Storm Water Pollution Prevention Program). Generally this is a multi-faceted system maintenance program aimed at reducing discharge of pollutants from all NRH-owned property to the MEP. NRH-owned property includes facility roads, parking lots, maintenance facilities, sites with industrial activity, and its Small MS4. NRH's Storm Water Pollution Prevention Program is separated into five main components including:

1. Debris Control BMPs Program Plan (Chapter 6);
2. Chemical Applications BMP Program Plan (Chapter 7);
3. Erosion Control BMPs Program Plan (Chapter 8);
4. Maintenance Activities BMPs Program Plan (Chapter 9); and
5. Commercial Activities Discharge Management Program (Chapter 10).

Each of these components is described in detail in individual chapters as noted above. This chapter focuses on NRH's Debris Control BMPs Program Plan (Debris Control Program).

Per the Permit, Part D.1.f.(i), NRH is required to develop and implement a Debris Control Program as part of the System Maintenance Plan. As described above, the Debris Control Program applies to all NRH-owned property, including structural and vegetated BMPs, and related appurtenances. For the purposes of this plan, "trash" will be considered analogous to "litter" as defined below by the Hawaii Revised Statutes (HRS) §391-1.

"Litter" means rubbish, refuse, waste material, garbage, trash, offal, or any debris of whatever kind or description, whether or not it is of value, and includes improperly discarded paper, metal, plastic, glass, or solid waste.

A distinction is made that trash is not inclusive of non-man made materials, such as branches, leaves, and other vegetation, that is deposited into waterbodies naturally.

The main objective of the Debris Control Program is to reduce the discharge of pollutants from NRH facilities, especially sediment and trash, to the MEP. The Debris Control Program will identify and track problem areas, and prioritize maintenance efforts to maximize removal of debris once captured within the MS4.

Main components of the Debris Control Program include:

1. Use of an Asset Management System (AMS), in conjunction with mapping of the Small MS4, to maintain an inventory of Small MS4 facilities and any related appurtenances (including maintenance equipment). The AMS is also used to facilitate scheduling and tracking of prioritized inspection and maintenance efforts.
2. Prioritized inspection and maintenance efforts for the Small MS4, and a preliminary schedule outlining how work will be completed.
3. A prioritized storm drain marking program for commercial and industrial areas that also incorporates an element of Public Outreach.
4. A Base-wide *Action Plan for Maintenance of Structural Controls*.

5. A Base-wide *Trash Reduction Plan*.

This Debris Control Program is outlined in accordance with the Permit requirements, as follows:

Permit Reference	SWMP Section
<p>Part D.1.f Pollution Prevention/Good Housekeeping</p> <p><i>The Permittee shall develop and implement a system maintenance program to reduce to the MEP the discharge of pollutants from all Facility roads, parking lots, maintenance facilities, sites with industrial activity, and the Permittee’s Small MS4. At a minimum, the program shall include:</i></p>	<p>Section 6</p>
<p>Part D.1.f.(i) Debris Control BMPs Program Plan – <i>Within 18 months of the effective date of this Permit, the Permittee shall develop a Debris Control BMPs Program Plan. The Debris Control BMPs Program Plan shall be implemented as part of the System Maintenance Program, and at a minimum include:</i></p>	<p>Section 6</p>
<p>Part D.1.f.(i)(a) Asset Management System and Mapping – <i>The Permittee shall implement a comprehensive Asset Management System and map of its Small MS4, including structural and vegetative BMPs; and inventory of related appurtenances including maintenance equipment, to ensure appropriate debris removal and system maintenance. The asset management system shall, at a minimum, assign an identification number for each drain inlet, outfall, and BMPs, and map their location on the Geographic Information System (GIS). The Permittee shall use this asset management system to establish priorities and to schedule and track efforts of appropriate system maintenance and debris removal program activities such as street sweeping, catch basin cleaning, and green waste and accumulated soil removal. The asset management system shall include justification of its priorities on the basis of potential impacts to water quality.</i></p> <p><i>The Asset Management System and Mapping shall be completed, up-to-date and implemented within 18 months of the effective date of this Permit.</i></p>	<p>Section 6.2</p>

<p>Part D.1.f.(i)(b) Inspection/Maintenance Schedule - <i>The Permittee shall include in its SWMP procedures and a schedule for inspections of major streets, streets in the industrial and commercial areas where storm water runoff discharges into the Small MS4, inlets/catch basins, and other collection system assets (i.e., collection system pipes and BMPs).</i></p> <p><i>The need for sweeping and/or maintenance/cleaning shall, at a minimum, be determined based upon material accumulation rates and/or potential threat of discharge to State waters that may have an effect on water quality. The schedule shall provide that each major street mile, storm drainage feature, and BMP is inspected at least once during the term of this permit (maintenance/cleaning may be conducted in lieu of inspections to satisfy this requirement). Structural controls that were not previously inspected shall be inspected/cleaned within one (1) year after the effective date of this permit and placed on the priority based schedule. At a minimum all structural controls shall be inspected/cleaned once per permit term. The priority-based schedule shall be annually reviewed; updated as necessary; and the changes, along with explanations of the changes submitted within the Annual Report.</i></p> <p><i>Within 18 months of the effective date of this Permit the Permittee shall have developed procedures for prioritizing inspections and maintenance and developed an initial schedule for inspections and maintenance.</i></p>	<p>Section 6.3</p>
<p>Part D.1.f.(i)(c) Storm Drain Marking - <i>The Permittee shall evaluate the effectiveness of its storm drain marking (stenciling or placards) and revise it as necessary to meet its purpose. This program shall be a part of the Public Outreach component of the SWMP. The purpose of the storm drain markings shall be discussed within the SWMP. Within five (5) years of the effective date of this permit, all storm water drains receiving runoff from industrial or commercial activities shall be marked (stenciling or placards), where feasible. Priority shall be given to the Permittee's major streets in industrial and commercial areas and areas with pedestrian traffic.</i></p>	<p>Section 6.4</p>
<p>Part D.1.f.(i)(d) Maintenance of Structural Controls - <i>The Permittee shall develop and implement an Action Plan to maintain, and improve, as necessary, structural BMPs. The Action Plan shall cover a 5 year period and be updated annually to include additional retrofit projects with water quality protection measures. At a minimum, annual updates to the Action Plan shall consider system inspection results, storm water monitoring data, recent construction, and required operations and maintenance. The annual updates to the Action Plan shall be included in the Annual Report with a description of the projects status. The Action Plan shall include, but not be limited to projects in compliance with any TMDL implementation and monitoring plan.</i></p>	<p>Section 6.5</p>

<p>Part D.1.f.(i)(e) Trash Reduction Plan - <i>The Permittee shall develop and implement, a trash reduction plan which assesses the issue, and identifies and implements control measures, and monitors these activities to reduce trash loads from the Small MS4. The plan shall specify the rationale for specific BMPs considered and implemented by the Permittee, and the method to assess the effectiveness of the implemented BMPs. The plan shall include, at a minimum, roadside litter pickup, regularly scheduled litter container servicing, and public outreach.</i></p> <p><i>The Annual Report shall include a summary of its trash load reduction actions (control measures and BMPs) including the types of actions and levels of implementation, and a summary of the effectiveness of the implemented control measures and BMPs.</i></p>	<p>Section 6.6</p>
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6.1 Program Organization

Implementation of the Debris Control Program requires collaboration between the EV and the Public Works Department (JB4). JB4 consists of multiple agencies, Facility Area Leads (APWO), FMD, FEAD, and PROD. These divisions manage the Debris Control Program for all of Main Base and facilities in outlying areas. The Debris Control Program applies Base-wide to all NRH-owned facilities, including those occupied by its tenants.

Much of the Debris Control Program success is related to management of NRH’s Base-wide Facilities Maintenance Program. Several good housekeeping practices are currently conducted on Base as part of the Facilities Maintenance Program. These include street sweeping, catch basin cleaning, green waste and accumulated soil removal, regular refuse collection, and storm drain inspections. Building managers at all facilities on base are required to perform routine inspections around their facilities to determine if the area requires cleaning or additional trash removal. If there are any issues that need to be addressed, the building manager will put a request in to FMD to have it addressed.

An overview of responsibilities for each department is as follows:

- EV - General program oversight, development of Debris Control Program standards, and working with the JB4 to ensure that the components of the Debris Control Program meet all Permit requirements. Additional responsibilities include:
 1. Fund and oversee the storm drain marking program.
 2. Annual Reporting of Debris Control Program progress.
- JB4 – Act as a liaison between tenants and its divisions. Delivering instruction to applicable tenants and overseeing implementation of each program component.
 - FMD – General program development, and initiating change to existing standards and instructions. Development, funding, and management of AMS. Review and update priority based maintenance schedules.
 - PROD – Responsible for minor maintenance of the Small MS4 and other related projects to maintain facility operations.
 - APWO – Liaison to all major clients and tenants and provide facilities management.

- Building Managers, and Base Inspectors (PRJ4) - Conduct routine inspections around industrial/commercial facilities, and regional zone inspections to identify problem areas within the storm drain system.

Similar to all other programs in this SWMP, the JBC has the authority to adjust policies or direct enforcement actions for tenants/agencies subject to the Debris Control BMPs Program. Commander, NRH, has ultimate authority for Permit policies and enforcement actions This is described in more detail in Section 4.6, Enforcement.

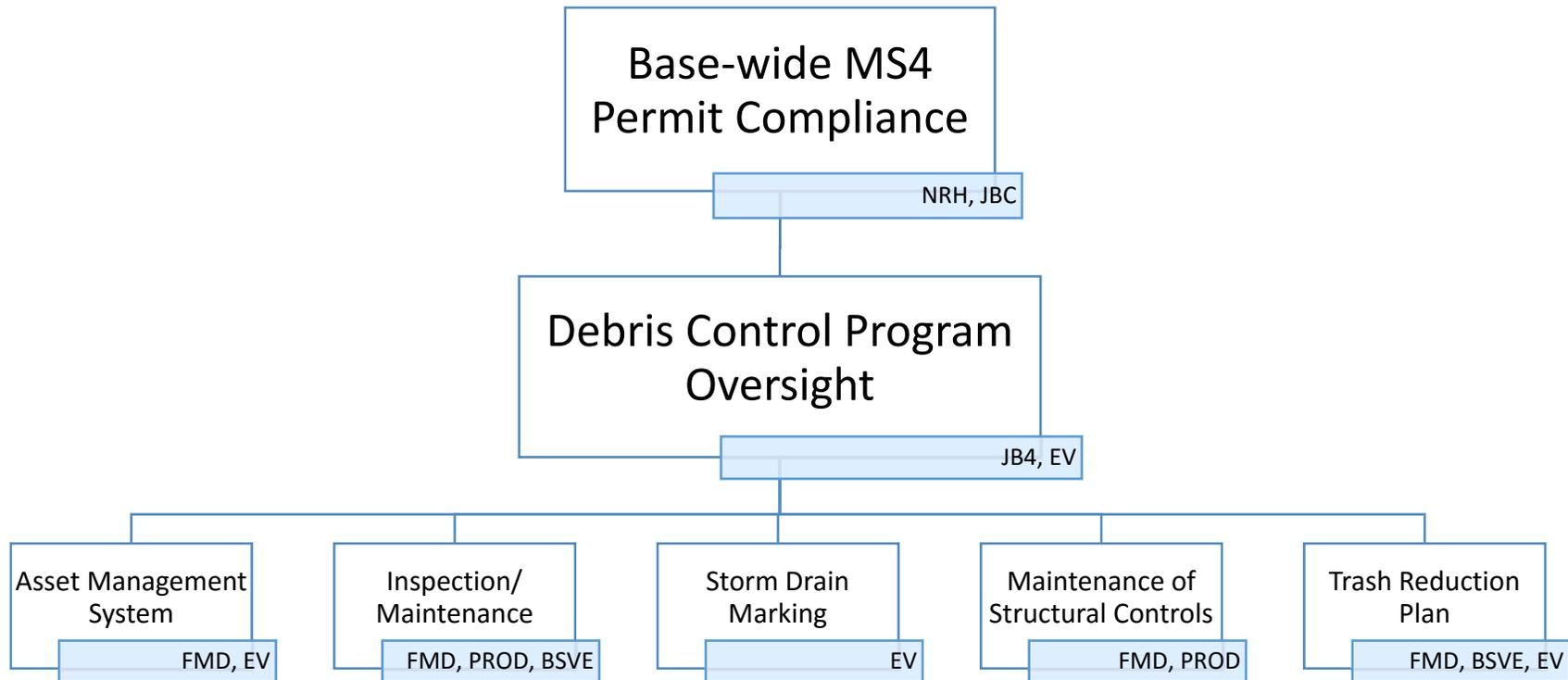


Figure 6-1 Debris Control Program Organizational Chart

6.2 Asset Management System and Mapping

NRH is in the process of developing a Base-wide AMS to track and manage inspections and maintenance of its entire MS4 system. The AMS will serve as an ongoing inventory of facilities and will be used to prioritize inspections/maintenance activities, such that resources are focused on areas that pose the greatest risk to water quality.

The AMS shall, at a minimum, assign an identification number for each drain inlet, outfall, and BMP, and map their location on the Geographic Information System (GIS). The AMS will include an inventory of related appurtenances, including maintenance equipment, to ensure appropriate debris removal and system maintenance. The AMS will be used to establish priorities and to schedule and track system maintenance and debris removal activities such as street sweeping, catch basin cleaning, and green waste and accumulated soil removal. It will include justification of the priorities on the basis of potential impacts to water quality.

Currently NRH has a GIS map, which includes storm drainage features. FMD will be responsible for having it maintained. Tracking of permanent BMPs (PBMPs) is discussed in Chapter 5.

With the goal of developing a routine storm drain cleaning program, NRH initiated a Base-wide storm drain survey/assessment contract in 2013. This project is the first storm drain survey of this scale for NRH. The project is characterizing the existing storm drain system, including assignment of identification numbers to drain inlets, manholes, and adjoining outfalls, and will be used to identify structural problem areas, and the condition of drain inlets and pipes. The survey for most of JBPHH and outlying areas has been completed, and will be loaded into GRX by Fall 2016. A second contract was awarded for Hickam and some of the smaller outlying areas, which will be completed in 2017. An additional project was started in 2015 to assess the conditions of outfalls and the surrounding areas to identify any other maintenance and repair requirements. With the completion of these projects, NRH will have current storm drain maps accompanied by a geographical information system (GIS) geodatabase. Any known permanent BMPs, identified on EV's preliminary list, that are not already in the new geodatabase will be added for inventory and tracking. These assessment projects will be used to scope cleaning and to update the prioritized inspections and maintenance schedule.

When it is updated by the survey, the geodatabase will be managed by FMD, or others as determined by JB4. As new construction occurs, as-built construction plans will be provided for entry into the geodatabase.

6.3 Inspection/Maintenance Schedule

FMD will work with PROD and APWO to develop a priority-based schedule for routine maintenance and debris removal activities, such as street sweeping, catch basin cleaning, and green waste and accumulated soil removal for each area on Base. The current system will be reviewed and revised to address future concerns and priorities. The factors that will be used to determine areas prioritized for maintenance efforts, in order from highest to lowest priority, will be:

1. Concerns or notifications brought to the attention of EV or JB4 or through any inspections.

2. Sediment and debris loading observed during the initial storm drain assessment, and subsequent inspections.
3. Proximity to commercial and industrial facilities.
4. Potential to impact water quality of receiving waters, and proximity to receiving waters.
5. Proximity to areas prone to erosion, or containing several trees, or areas with higher accumulation of plant debris.
6. Cost effectiveness. Maintenance and inspections will be grouped into areas that will most effectively utilize available resources at NRH.

Currently NRH conducts street sweeping, storm drain cleaning and trash removal to help reduce the accumulation of sediment and debris within its Small MS4. Storm drains surrounding industrial areas are also inspected periodically for any problems. Storm drain maintenance and repair is performed as often as possible to ensure function of the system and to prevent accumulated debris from being washed into receiving waters. These efforts will be reviewed and redistributed as necessary to comply with Permit requirements.

As part of the part of the Permit requirements, NRH is required to put together a prioritized inspection/maintenance schedule for specified Small MS4 features. It required that each of these MS4 elements is inspected/maintained as much as needed based on sediment and debris accumulation observations. Each feature will be inspected at least once during the Permit term. At a minimum, all structural controls will be inspected/cleaned once per permit term. To more effectively use its resources, NRH is permitted to conduct maintenance in lieu of a separate inspection to meet this requirement. The following outlines the facilities subject to the inspection/maintenance requirement for the Debris Control Program:

1. *Major streets* – Any roadway on JBPHH or its outlying areas identified by JB4/NRH as containing heavy traffic or used primarily for accommodating general traffic movement around the base will be subject to routine street sweeping of the roadway, shoulders and/or medians to prevent storm water pollution from debris and sediment.
2. *Streets within Industrial and Commercial Areas where Storm Water Discharges to the MS4* – any roadways on JBPHH or its outlying areas within industrial or commercial areas that contain MS4 features will be subject to prioritization for inspections and maintenance for sweeping and debris control.
3. *Storm Drain System Features*– This includes all MS4 features, including but not limited to catch basins, storm drain inlets, pipes, gutters, open ditches, and trenches.
4. *Major Permanent BMPs* - Any permanent storm water BMP or LID feature. .
5. Any street or area outside of the specified areas identified as needing maintenance during a regional zone inspection or as reported by the public.

As mentioned in Section 6.2, as the first step toward effectively prioritizing inspection and maintenance activities, three different storm drain survey/assessment projects are underway. The three assessments are anticipated to be completed during 2017. The initial assessment and future inspections and maintenance will be used to approximate the rate of sediment and debris accumulation in storm drains throughout the Base. Based on observed trends, NRH will develop a sediment and debris accumulation threshold to facilitate future maintenance prioritization efforts and a required frequency of maintenance. The thresholds will correspond to various types of storm drain features observed on Base,

such as depth of sediment within a storm drain inlet or BMP, or amounts of debris observed on a mile of roadway.

NRH is in the process of setting up a separate project to develop a storm drain repair plan based on findings of the storm drain survey/assessment studies. This work will address structural deficiencies observed during the assessments.

Priority areas and storm drain features will be categorized into three groups. The groups will be roughly outlined as follows:

HIGH PRIORITY – Features that currently exceed the sediment and debris accumulation thresholds, or that pose a high potential risk to storm water quality or receiving waters.

MEDIUM PRIORITY – Features that do not have a large amount of sediment and debris accumulation, but can be reasonably expected to reach or exceed the threshold by the time of the next inspection.

LOW PRIORITY – Features that are currently functioning well, and are not reasonably expected to be significantly impacted by observed sediment and debris loading will be addressed on a lower priority, or as resources are available.

NRH will continue to make necessary modifications to the initial priority requirements as more data become available, or more observations are recorded. Much of this information will be provided as feedback from PROD, FMD, and APWO as maintenance efforts are conducted.

With the information currently available, a preliminary implementation schedule for the Inspection/Maintenance Program is outlined in Table 6-1. This schedule is subject to change, as more information becomes available following completion of the initial storm drain system assessment and as Maintenance Program achievements and challenges are reviewed on an annual basis. Changes along with explanations of the changes will be submitted within the Annual Report. The schedule is also subject to change based on what is needed to address observed deficiencies of the MS4 system or complaints received throughout the Permit term. These emergency issues will continue to be addressed and given priority for available maintenance resources, when needed.

**Table 6-1
 Inspections/Maintenance Program Implementation Schedule**

Task	Year 1	Year 2	Year 3	Year 4	Year 5
Conduct Preliminary Inspections/Maintenance of Major Roadways, Streets in Industrial and Commercial Areas, and All Storm Drain System Features	X	X	X		
Establish and Update Internal Asset Management System and Mapping, as needed	X	X	X	X	X
Address Emergency Maintenance Issues	X	X	X	X	X
Determine Prioritization Ranking System		X			
Appropriation of Funding for Required Inspections/Maintenance Activities based on priorities developed: <ul style="list-style-type: none"> • High Priority • Medium Priority • Low Priority 		X	X	X	
Implementation of Inspections/Maintenance Activities: <ul style="list-style-type: none"> • High Priority • Medium Priority • Low Priority 			X	X	X
Evaluation and Updates of the Priority-based Scheduling, and Overall Debris Control Program, as needed (in the Annual Report)	X	X	X	X	X

6.4 Storm Drain Marking

As part of its Public Outreach Program, *Section 2.4.3*, and under the Debris Control Program, storm drain structures may be marked to indicate its eventual discharge into the nearby receiving waters. The installation of informational storm drain stenciling or placards is intended to create public awareness of the connection of the storm drain system to the ocean and other waterbodies, with the intent of discouraging intentional or negligible behaviors that negatively impact storm water quality. Storm drain placards have already been installed on inlets in industrial areas and some areas of family housing. Efforts to mark storm drain inlets are ongoing and are based on the availability of funds. Storm drain stenciling or placards are required (within five years of EDOP) at all storm drains receiving runoff from industrial and commercial areas, where feasible.

NRH will continue to evaluate the effectiveness of its existing storm drain markings (e.g., by documenting public participation in storm drain stenciling events, and by noting any observable changes in trash accumulation levels within storm drains before and after storm drain markings are installed as described in the Public Education and Outreach section of the Program Effectiveness Assessment Plan), and change the types of markings if needed.

NRH will complete the installation of storm drain markings on all storm drain inlets receiving runoff from industrial and commercial areas, within 5 years of the effective date of the permit if possible, but subject to the availability of funding.

Priority will be given to industrial and commercial areas with pedestrian traffic, and areas determined in the initial assessment to be a HIGH priority for maintenance. As needed, stencils or placards will be replaced during scheduled storm drain inlet maintenance.

An evaluation of effectiveness and justification for future placement of placards will be described in the Annual Report.

6.5 Maintenance of Structural Controls

In accordance with the Permit, NRH is in the process of developing an *Action Plan for Maintenance of Structural Controls* (see attached plan, Appendix 6-2). This is a five (5) year plan intended to reduce storm water pollution by ensuring the effectiveness of existing Base-wide structural BMPs (used synonymously with the term “permanent BMPs”) through maintenance and, if needed, improvements.

Key elements of the *Action Plan for Maintenance of Structural Controls* will include:

- Existing policies regarding structural BMPs;
- Implementation of a Base-wide inventory of structural BMPs;
- Inspections/Maintenance for structural BMPs;
- Identification of areas for improvement, or suitable for retrofit projects with water quality protection measures; and
- Five (5) year implementation schedule.

Every year, the program status and implementation schedule shall be evaluated, and annual updates to the *Action Plan for Maintenance of Structural Controls* will be incorporated into the Annual Report. The update will also consider system inspection results, storm water monitoring data, recent construction, and required operations and maintenance, and new retrofit projects with water quality protection

measures, where applicable. These updates will include, but are not limited to, projects in compliance with any TMDL implementation and monitoring plan.

6.6 Trash Reduction Plan

In accordance with the Permit, NRH has developed a *Trash Reduction Plan* (see Appendix 6-1). The goal of NRH's Trash Reduction Plan will be to reduce its overall debris discharges from its Small MS4 to receiving waters.

The main objectives of the *Trash Reduction Plan* are to:

- Assess the issue of trash generation;
- Identify and implement control measures; and
- Monitor control measures and evaluate overall effectiveness.

Some of the components in the *Trash Reduction Plan* include:

- A definition of "trash" for NRH;
- Existing NRH solid waste programs and policies;
- Existing control measures and BMPs;
- An implementation plan for trash reduction; and
- Methods for measuring program success.

Annual reports will be used to review progress of NRH's *Trash Reduction Plan* including trash load reduction actions taken (controls measures and BMPs) including types of actions and levels of implementation, and a summary of the effectiveness of these measures in each year. This annual review will be used to identify any areas of concern and make modifications to the plan, if needed.

7 Chemical Applications BMPs Program Plan

A crucial component of NRH’s SWMP is its Base-wide Pollution Prevention and Good Housekeeping Program (Storm Water Pollution Prevention Program). Generally this is a multi-faceted system maintenance program aimed at reducing discharge of pollutants from all NRH-owned property to the MEP. NRH-owned property includes facility roads, parking lots, maintenance facilities, sites with industrial activity, and its Small MS4. NRH’s Storm Water Pollution Prevention Program is separated into five main components including:

1. Debris Control BMPs Program Plan (Chapter 6) ;
2. Chemical Applications BMP Program Plan (Chapter 7);
3. Erosion Control BMPs Program Plan (Chapter 8);
4. Maintenance Activities BMPs Program Plan (Chapter 9); and
5. Commercial Activities Discharge Management Program (Chapter 10).

Each of these components is described in detail in individual chapters as noted above. This chapter focuses on NRH’s Chemical Applications BMP Program Plan.

Per the Permit, NRH is required to develop and implement a Chemical Applications BMP Program Plan as part of the System Maintenance Program.

The main elements of the Chemical Applications Program are:

1. Training requirements for all applicators of chemicals; and
2. Implementation of appropriate requirements for pesticide, herbicide, and fertilizer applications (i.e., BMPs).

This Chemical Applications Program is outlined in accordance with the Permit requirements. The MS4 Permit states:

Permit Reference	SWMP Section
<p>Part D.1.f Pollution Prevention/Good Housekeeping</p> <p><i>The Permittee shall develop and implement a system maintenance program to reduce to the MEP the discharge of pollutants from all Facility roads, parking lots, maintenance facilities, sites with industrial activity, and the Permittee’s Small MS4. At a minimum, the program shall include:</i></p>	Section 7
<p>Part D.1.f.(2) Chemical Applications BMPs Program Plan</p> <p><i>(i) Training - The Permittee shall develop an Authorized Use List of the chemicals the Facility uses and implement training for Facility personnel and commercial applicators, as necessary, to ensure compliance with federal and State laws and regulations, including certification and training requirements, to minimize or eliminate runoff of potential pollutants to the receiving waters.</i></p>	Sections 7.2 and 7.3
<p><i>(ii) Implement appropriate requirements for pesticide, herbicide,</i></p>	Section 7.4

<p><i>and fertilizer applications - The Permittee shall implement BMPs to reduce the contribution of pollutants associated with the application, storage, and disposal of pesticides, herbicides, and fertilizers from residential, commercial, and industrial areas and activities to its Small MS4.</i></p> <p><i>BMPs shall include, at a minimum: (1) training, educational activities, applicable certifications and other measures for commercial applicators; (2) integrated pest management measures that rely on non-chemical solutions; (3) the use of native vegetation; (4) chemical application, as needed; and (5) the collection and proper disposal of unused pesticides, herbicides, and fertilizers.</i></p>	
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7.1 Program Organization

EV is responsible for general oversight and program management. Similar to all other programs in this SWMP, the JBC has the authority to adjust policies or direct enforcement actions for tenants/agencies subject to the Chemical Applications BMPs Program. Commander, NRH, has ultimate authority for Permit policies and enforcement actions. A streamlined schematic of this organizational structure is outlined in Figure 7-1. For additional roles and responsibilities for pesticides, as well as detailed responsibilities for key organizations and personnel, refer to Appendix 7-1 , Integrated Pest Management Plan (IPMP) Section 2 [Redacted due to national security concerns].

To address the Permit requirements, the Chemical Applications BMPs Program applies Base-wide to all areas of potential chemical application, including but not limited to facilities, right-of-ways, landscaped areas, and areas leased to tenants. The PPV Housing hires licensed contractors for chemical applications within the housing areas. Other tenants themselves are not permitted to apply chemicals, in accordance with their tenant agreements, and must contact Public Works with pest control-related requests.

7.2 Training

The IPMP requires that any NRH employee, contractor or employees of contractors applying registered pesticides, (i) work under the direction of a certified applicator, (ii) follow the pesticide label information, and (iii) comply with all other State, City, or Federal regulations for corresponding chemicals. It should be noted that herbicides are considered pesticides under the IPMP.

All pesticide applicators from the facilities pest control shop and the golf course are required to attend pesticide applicator training for pesticide applicator certification or recertification training to ensure that pesticides are applied properly and safely in accordance with DODINST 4150.7 and OPNAVINST 6250.4C.

Any personnel who have not been trained and do not possess a valid Certificate of Competency (DD Form 1826) must have “line of sight” supervision by a certified applicator. Uncertified personnel hired as pesticide applicator trainees must receive certification training within two (2) years of employment. On the job training (OJT) can range from six to 12 months depending on the proficiency of the new employee, based on written and/or practical exams. Certification Training courses are offered locally and on the mainland. Personnel who fail to obtain a passing grade on the examination must achieve

passing grade on the (second) follow-up exam or they will be considered unqualified, and action will be taken to remove them from performing pest management functions.

Each pesticide applicator possessing a Certificate of Competency must be recertified every three (3) years through NAVFAC Pacific. Personnel who do not receive a passing grade must retake the exam within 120 days of the original recertification examination, but will be allowed to continue their OJT. Pesticide applicators that fail to pass the follow-up examination will be subject to personnel reassignment within the command.

No individual is permitted to apply any pesticides on base prior to completion of the applicable training requirements. Pest Management and BMPs related to chemical application are discussed in the annual SOP trainings. Additional information regarding training and certification can be found in Appendix 7-1, IPMP Section 2.4.

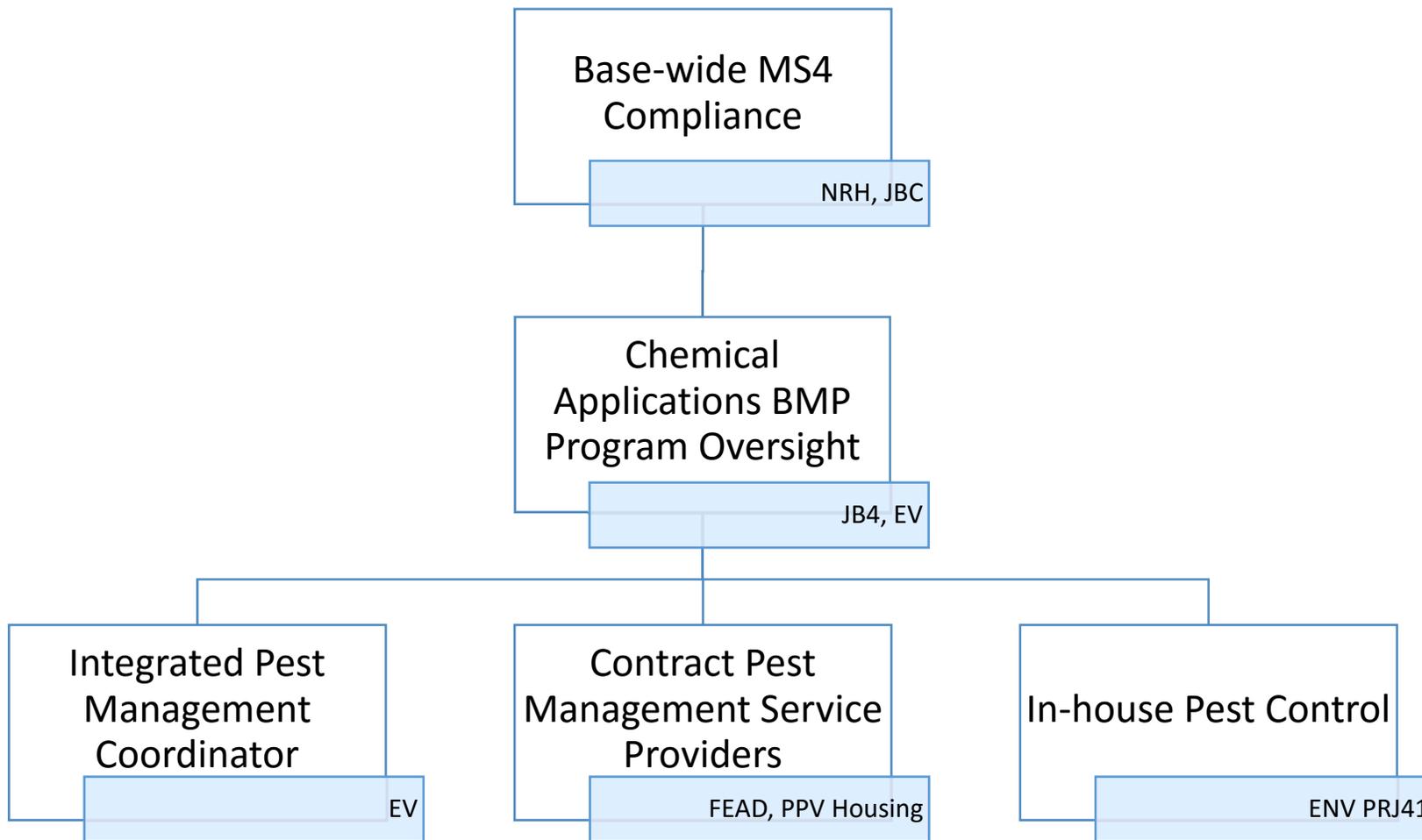


Figure 7-1: Chemical Applications Program Organizational Chart

7.3 Authorized Use List

DoD and DoN directives require installations to submit a list of pesticides that will be used on JBPHH property to the NAVFAC Pacific Professional Pest Management Consultant (PPMC) for review and approval (OPNAVINST 6250.4C). The purpose of this approval process is to ensure that only registered pesticides which are safe, effective and appropriate for the site will be used on the installation. Requests for pesticide approval will be submitted to the NAVFAC Pacific PPMC via the Installation Pest Management Coordinator (IPMC) using the Navy Online Pesticide Reporting System (NOPRS) (see section 2.6.3.1 of the IPMP) or the Pesticide Approval Spreadsheet (PAS). Pesticides approved for use on JBPHH property are also listed in Appendix E of the IPMP. Once a pesticide is approved, it may be used on-site as per the label directions. Navy Policy is to use the least toxic pesticide in the minimum amount required.

A copy of the manufacturer's label and a SDS for each pesticide are used to approve pesticides. The Pest Management Performance Assessment Representative (PMPARs) and the Pest Management Service Provider (PMSPs) should also maintain copies. The labels and SDSs of pesticides in use at a site shall be present onsite.

The IPMP is reviewed and updated annually, and any modifications to the plan should be included in the Annual Report.

7.4 Implement Appropriate Requirements for Pesticide, Herbicide, and Fertilizer Applications (Chemical Application BMPs)

NRH has an ongoing program designed to ensure that pesticides and herbicides are safely and properly applied, but also to ensure that any pesticide or herbicide application does not affect or enter U.S. waters to the MEP. NRH uses an integrated pest management approach and uses pesticide/herbicide application only when no other non-chemical approaches are practical.

The IPMP implements BMPs to reduce the contribution of pollutants associated with the application, storage, and disposal of pesticides and herbicides from residential, commercial, and industrial areas and activities to the MS4. Standard Work Practices (i.e., BMPs) are implemented where required. Contractors are prohibited from mixing, storing or disposing of pesticides and herbicides on Navy property per contract specifications. Further, only pesticides approved by NAVFAC Pacific entomologists are authorized for use on Navy property.

Other examples of standard work practices that could be used include mowing and cutting slopes and bottoms of ditches prior to pesticide and herbicide application, to ensure that pesticides and herbicides do not reach waters via overspray or runoff; and using a dye based marker applicator attached to a pesticide sprayer for use near ditches to assist pesticide applicators to ensure that they know exactly where the pesticides are being applied and are not reaching unintended target areas such as ditches/drain areas. Additionally, routine (e.g., every 3 month) application of pesticides is not authorized. Pesticides may be applied on a regular schedule only if the area is pre-inspected to verify that the application is needed. Other standard work practices used include not spraying if wind velocity exceeds 10 mph or spraying in accordance with label requirements to prevent drift into non-target areas. Contractors are also required to have spill kits and be familiar with emergency response notification procedures which include contacting Navy personnel.

NRH has strict supply system requirements which prohibit the purchase of pesticides and herbicides by unqualified personnel. The inventory and supply system also helps to minimize the ordering of excess pesticides and herbicides, which reduces the need to dispose of excess or expired pesticides and herbicides. The IPMP does contain requirements and standard work practices for the collection and proper disposal of unused pesticides and herbicides (Appendix 7-1).

The IPMP does not address the use of fertilizers. Rather, fertilizers are applied by the various entities responsible for landscape maintenance in accordance with the manufacturer's instructions. EV will be developing BMPs for general use of fertilizers for distribution to landscape maintenance personnel and contractors, and residents. Training on the use of fertilizers will be incorporated into the general storm water awareness training conducted by EV.

In the Navy housing areas, residents are kept informed about proper household pesticide and fertilizer application via a resident handbook, brochures, and other outreach/education material. A handbook passed out to Navy Housing residents includes a section on Pest Control. Terminix is the licensed application provider for residential homes and KN Landscape occasionally applies herbicides and fertilizers for the housing areas. "Partner's Plan for Pest Control" is the management plan for the housing areas that specifies pest control standards, guidelines, techniques and recordkeeping and training requirements. Pest control applications for construction projects are managed through the Site Specific Best Management Plans for each neighborhood and phase, as applicable during construction.

In the Hickam housing areas (which have been privatized to Actus/Hickam Communities), residents are kept informed about proper household pesticide and fertilizer application via a resident handbook, brochures, and other outreach/education material. Hickam residents are provided "Resident Guide and Community Standards Handbook (Hickam Community Housing LLC)" which is Attachment A to the Tenant Lease. In terms of storm water pollution prevention, residents are advised to avoid overuse of fertilizers and pesticides and to avoid overwatering lawns or other landscaping. If necessary, they are advised to request pest control services from Hickam Community Housing maintenance.

Residents are required to turn in excess or expired pesticides, herbicides, and fertilizers to the base household hazardous material reuse center. The reuse center accepts residents' excess household hazardous materials and reissues the items as needed. Household hazardous materials that are not reissued are turned into the 90-day Hazardous Waste Accumulation site for disposal.

Alternative BMPs such as use of native vegetation to reduce the use and need for pesticide and herbicide applications will be evaluated by JB4 and EV.

7.5 Reports and Records

7.5.1 Records

Online reporting of pesticide/herbicide use is currently available. Pesticide reports will be reviewed by the IPMC and NAVFAC Pacific PPMC to provide program oversight to the installation and to generate data for tracking overall DoN pesticide usage.

All NRH PMSPs that have Internet access may use the Navy Online Pesticide Reporting System to record, report, and manage pesticide and pest management records. This system is preferred to other methods because it eliminates the need to send hardcopy or electronic records to the IPMC and then to the

PPMC. The records are entered directly into a central database that can be accessed by the PPMC and the IPMC and downloaded into a spreadsheet. The only computer requirement is reliable internet access. IPMCs that wish to use this on their installation must contact the NAVFAC Pacific PPMC to establish a “Supervisor” account. PMSP applicators can then contact the IPMC to request an “Applicator” account.

Additional information regarding record keeping forms and procedures can be found in Appendix 7-1, IPMP Section 2.6.

8 Erosion Control BMPs Program Plan

A crucial component of NRH’s SWMP is its Base-wide Pollution Prevention and Good Housekeeping Program (Storm Water Pollution Prevention Program). Generally, this is a multi-faceted system maintenance program aimed at reducing discharge of pollutants from all NRH-owned property to the MEP. NRH-owned property includes facility roads, parking lots, maintenance facilities, sites with industrial activity, and its MS4. NRH’s Storm Water Pollution Prevention Program is separated into five main components including:

1. Debris Control BMPs Program Plan (Chapter 6);
2. Chemical Applications BMP Program Plan (Chapter 7);
3. Erosion Control BMPs Program Plan (Chapter 8);
4. Maintenance Activities BMPs Program Plan (Chapter 9); and
5. Commercial Activities Discharge Management Program (Chapter 10).

Each of these components is described in detail in individual chapters as noted above. This chapter focuses on NRH’s Erosion Control BMPs Program Plan (Erosion Control BMPs Program).

Per the Permit, Part D.1.f.(iii), NRH is required to develop and implement an Erosion Control BMPs Program as part of the System Maintenance Program. The main elements of the Erosion Control BMPs Program are:

1. Implementation of erosion control improvements as necessary, and identification of erosional areas;
2. Implementation of temporary erosion control measures as appropriate when permanent solutions are not immediately possible; and
3. Development of a maintenance plan for vegetated portions of the drainage systems used for erosion and sediment control and LID features.

This Erosion Control BMPs Program is outlined in accordance with the Permit requirements. The Permit states:

Permit Reference	SWMP Section
<p>Part D.1.f Pollution Prevention/Good Housekeeping</p> <p><i>The Permittee shall develop and implement a system maintenance program to reduce to the MEP the discharge of pollutants from all Facility roads, parking lots, maintenance facilities, sites with industrial activity, and the Permittee’s Small MS4. At a minimum, the program shall include:</i></p>	Section 8
<p>Part D.1.f.(iii) Erosion Control BMPs Program Plan</p> <p><i>Within 18 months of the effective date of this Permit, the Permittee shall develop an Erosion Control BMPs Program Plan. The Erosion Control BMPs Program Plan shall be implemented as part of the System Maintenance Program, and at a minimum include:</i></p>	Section 8
<p><i>(a) Implement permanent erosion control improvements as necessary, ensuring that erosional areas with the potential for significant</i></p>	Section 8.2

<p><i>water quality impact, but with limited public safety concerns, are also considered a high priority for remediation. Identification of erosional areas with the potential for significant water quality impact shall include areas where there is evidence of rilling, gullyng, and/or other evidence of significant sediment transport, and areas in close proximity to receiving waters listed as impaired by either sediment, siltation and/or turbidity.</i></p>	
<p><i>(b) Require the implementation of temporary erosion control measures (e.g., erosion control blankets and/or fabrics, gravel bag placement and silt fencing/fiber rolls) on erosional areas with the potential for significant water quality impact if a permanent solution is not immediately possible. Notwithstanding any other implementation provisions, the SWMP shall require the implementation of such temporary erosion control measures on all applicable areas. For projects which require a CWA Section 401 Water Quality Certification (WQC), the WQC application shall be submitted to DOH within one (1) year of the effective date of this permit and be implemented with six (6) months of the WQC or other regulatory permit(s) issuance date.</i></p>	<p>Section 8.3</p>
<p><i>(c) Within 18 months of the effective date of this Permit, the Permittee shall develop a maintenance plan for vegetated portions of the drainage system used for erosion and sediment control, and LID features; including controlling any excessive clearing/removal, cutting of vegetation, and application of herbicide which affects its usefulness. The maintenance plan shall be implemented as part of the Erosion Control BMPs Program Plan.</i></p>	<p>Section 8.4</p>

8.1 Program Organization

JB4 and EV are responsible for general oversight of the Erosion Control BMP Program. This includes revising erosion control BMPs or policies, as needed, to meet program requirements and to facilitate program implementation. EV is responsible for including a status report of any such revisions and program updates in each Annual Report. Data provided by JB4 through inspections or complaints/notifications will be used to identify and prioritize areas of erosional concern. For NRH projects, permanent erosion control measures will be designed by NAVFAC HI Design Business Line (OPHC) or Facilities Engineering and Acquisition Division (FEAD), Project Management and Engineering Branch (PMEB /PAC Design Division (CI4) and installed by the Production Division (PROD) or Contractor managed by FEAD. Some tenants may have erosion control projects within their leased areas, but they are not common. These projects may be contracted by other agencies that would be responsible for contract management (e.g., Public-Private Venture (PPV) Housing, Ford Island Ventures, and Hawaii Air National Guard). Maintenance of erosion control BMPs and LID features is discussed in Chapter 6. Similar to all other programs in this SWMP, the JBC has the authority to adjust policies or direct enforcement actions for tenants/agencies subject to the Erosion Control BMPs Program. Commander, NRH, has ultimate authority for Permit policies and enforcement actions. A streamlined schematic of this organizational structure is outlined in Figure 8-1.

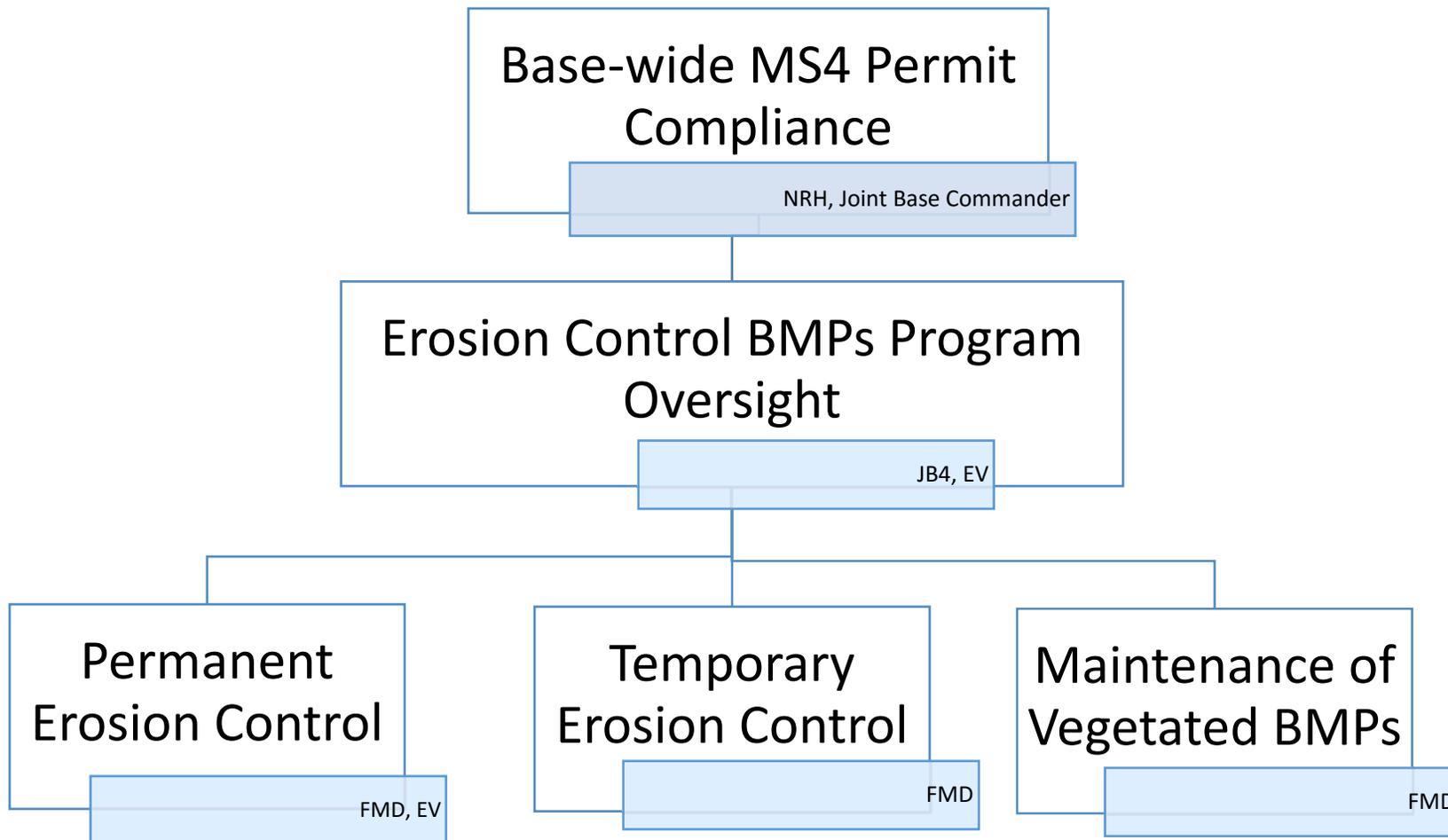


Figure 8-1: Erosion Control Program Organizational Chart

8.2 Permanent Erosion Control Improvements

As part of the permit requirements, NRH is required to implement erosion control improvements as necessary to address impact to water quality. EV and JB4 will implement the following procedure for identifying and implementing construction of permanent erosion control improvements.

Areas with erosional concerns will be identified to EV and FMD via routine maintenance and inspection of facilities, observations/complaints, or from inspections completed for other programs of the SWMP such as SWPCP inspections and illicit discharge inspections.

EV and FMD will identify areas that require construction of permanent erosion control improvements. EV and FMD will prioritize the implementation of projects using the following prioritization guidance:

High Priority – Highest priority will be given to: areas that affect public health and safety (i.e., direct exposure to dust and runoff) and areas where erosional runoff discharges directly to the MS4 or receiving water. Priority will be based on potential for impact to water quality based on evidence of erosion (e.g. rilling, gullying and/or other evidence of significant sediment transport, and areas in close proximity to receiving waters listed as impaired by either sediment, siltation and/or turbidity).

Secondary considerations for prioritization will be based on potential for erosion and proximity to storm drain inlets/swales or receiving waters.

Medium Priority – Medium priority will be given to areas that will eventually discharge to the MS4 or receiving water, but first discharge to a BMP feature (i.e., grassed swale or sedimentation basin).

Low Priority – Low priority will be given to bare areas that will erode, but not discharge to the MS4 or receiving water. These projects will have no impact on the MS4 or receiving waters.

EV will provide the prioritized list of areas to FMD. FMD will determine the responsible party and create projects. OPHC or FEAD, PMEB /CI4 will be responsible for design and construction of erosion control improvements.

EV and FMD will update the prioritized list of projects, as needed, to include new areas identified during routine maintenance and inspections and remove those projects where erosion control improvements have been completed.

8.3 Temporary Erosion Control Measures

Temporary erosion control measures will be implemented, as soon as possible, to address any erosional areas identified as posing a significant risk to water quality when a permanent solution is not immediately possible. Other projects will be implemented in priority order. FMD will be responsible for having temporary erosion control measures (e.g., erosion control blankets and/or fabrics, gravel bags, and silt fencing/fiber rolls) on erosional areas. Until permanent control measures are constructed, FMD will be responsible for ensuring that someone (PROD, FEAD, other agency) performs adequate maintenance to maintain the function of these BMPs and to protect the receiving waters.

There are currently no projects that have been identified by EV that require a Water Quality Certification (WQC). EV will evaluate any newly identified maintenance and/or construction projects to ensure that a WQC and any other NPDES requirements are submitted to DOH when applicable.

Although temporary erosion control measures will be in place, EV and FMD will continue to work toward constructing a permanent erosion control to address the situation as soon as possible.

8.4 Maintenance for Vegetated Best Management Practices

Permanent BMPs and LID features will be incorporated into the Asset Management System, which will be maintained as various construction projects are completed. Vegetated portions of the drainage system and LID features will be maintained by FMD in accordance with the Maintenance Activities BMPs Program (See Chapter 9). As part of this program, a maintenance activities BMP field manual has been developed. This field manual addresses controlling any excessive clearing/removal, cutting of vegetation, and application of herbicide which affects usefulness of the erosion control measure or LID feature.

As new vegetated areas and LID features are established, FMD will update their maintenance schedule database to incorporate maintenance of the areas or features per the recommended frequencies.

9 Maintenance Activities BMPs Program Plan

A crucial component of NRH’s SWMP is its Base-wide Pollution Prevention and Good Housekeeping Program (Storm Water Pollution Prevention Program). Generally, this is a multi-faceted system maintenance program aimed at reducing discharge of pollutants from all NRH-owned property to the MEP. NRH-owned property includes facility roads, parking lots, maintenance facilities, sites with industrial activity, and its MS4. NRH’s Storm Water Pollution Prevention Program is separated into five main components including:

1. Debris Control BMPs Program Plan (Chapter 6) ;
2. Chemical Applications BMPs Program Plan (Chapter 7);
3. Erosion Control BMPs Program Plan (Chapter 8);
4. Maintenance Activities BMPs Program Plan (Chapter 9);and
5. Commercial Activities Discharge Management Program (Chapter 10).

Each of these components is described in detail in individual chapters as noted above. This chapter focuses on NRH’s Maintenance Activities BMPs Program Plan (Maintenance Activities BMPs Program).

Per the Permit, Part D.1.f.(iv), NRH is required to develop and implement a Maintenance Activities BMPs Program as part of the System Maintenance Plan. The Maintenance Activities BMPs Program establishes pollution prevention strategies for maintenance activities, including routine maintenance projects. Ensuring the implementation of proper source control measures and spill response procedures can effectively reduce the discharge of pollutants associated with maintenance activities. Appropriate implementation of BMPs is required for all maintenance activities.

The objectives of this program are to:

1. Develop and implement a written procedure to implement minimum BMPs for maintenance activities.
2. Implement and enforce the requirements of the SWPCP as presented in Chapter 11 and Appendix 11-2.
3. Train staff on proper BMP implementation and pollution prevention strategies.

This Maintenance Activities BMPs Program is outlined in accordance with the Permit requirements. The Permit states:

Permit Reference	SWMP Section
<p>Part D.1.f.(iv) Maintenance Activities BMPs Program Plan <i>Within 18 months of the effective date of this Permit, the Permittee shall develop a Maintenance Activities BMPs Program Plan. The Maintenance Activities BMPs Program Plan shall be implemented as part of the System Maintenance Program, and at a minimum include:</i></p>	<p style="text-align: center;">Section 9</p>

<p><i>(a) Facility-Wide Maintenance Activities – Within 18 months of the effective date of this Permit, the Permittee shall develop a written procedure to implement minimum BMPs for routine infrastructure maintenance activities that have the potential to impact the quality of receiving waters, and ensure the implementation of the applicable BMPs. Routine maintenance activities include, but are not limited to: vehicle and equipment maintenance, vehicle or equipment fueling, chemical storage, recycling, paving and road repairs, street cleaning, concrete work, curb and gutter replacement, buried utility repairs and installation, vegetation removal, painting and paving, debris and trash removal, and spill cleanup.</i></p> <p><i>The procedures shall ensure that appropriate BMPs are verifiable through field inspections (i.e., field inspectors can quickly determine if the appropriate BMPs have been implemented).</i></p>	<p>Section 9.1</p>
<p><i>(b) SWPCPs. The Permittee shall implement and enforce the requirements of the SWPCPs, as discussed in Part E.1. of this Permit.</i></p>	<p>Section 9.2</p>
<p><i>(c) Training - The Permittee shall develop and provide annual training for storm water pollution prevention to Facility maintenance personnel and contractors with the potential to impact storm water runoff. The training shall identifying potential sources of pollution specific to Facility-wide maintenance activities, general BMPs that can be used to reduce and/or eliminate potential sources of pollutants, and procedures for establishing and implementing site-specific BMPs. The training shall educate Facility maintenance personnel that they serve a role in protecting water quality. Facility Maintenance personnel shall be made aware of the NPDES permit, the overall SWMP, and the applicable BMPs Program(s).</i></p>	<p>Section 9.3</p>

9.1 Program Organization

The program organization for the Maintenance Activities Program, is shown on Figure 9-1. Military personnel and the Production Division (PROD) is responsible for most general maintenance projects for facilities within NRH, with the exception of some non-Navy tenants (e.g., Hawaii Department of Education, Public-Private Venture (PPV) Housing, Ford Island Ventures, and commercial tenants). The Utilities and Energy Management Product Line (UEM) is responsible for maintenance projects for utilities, and Base Support Vehicle and Equipment Product Line (BSVE) is responsible for NAVFAC vehicle and equipment maintenance and some maintenance projects for facilities. Some facility maintenance is contracted through FEAD. Figure 9-1 shows the agencies responsible for overseeing that all Maintenance Activities Program requirements are met. The blue boxes indicate the agency responsible for implementation of BMPs at the facilities.

JB4 and EV are responsible for general oversight of the Maintenance Activities Program. This includes revising maintenance activity BMPs or policies, as needed, to meet program requirements and to facilitate program implementation.

9.2 Maintenance Activities Best Management Practices Field Manual

A field manual with BMPs for maintenance activities has been developed as part of this SWMP (see Appendix 9-2). The field manual is a handbook that provides direction, guidance, and procedures for maintenance activities performed by in-house personnel to reduce to the MEP, pollutants from being discharged to the MS4 or receiving waters.

Routine maintenance projects are scheduled or cyclical projects performed to preserve the life of a system; to restore the original function or delay the deterioration of an existing asset without substantially increasing its structural capacity; or to maintain the original line and grade, hydraulic capacity or original purpose of a facility, system or asset, in which land disturbance does not go beyond the original footprint of the previous structure. The field manual will contain BMPs for the most common activities performed in the field which include:

- Vehicle and equipment maintenance;
- Vehicle or equipment fueling;
- Chemical storage;
- Recycling;
- Paving and road repairs;
- Street cleaning;
- Concrete work;
- Curb and gutter replacement;
- Buried utility repairs and installation;
- Vegetation removal;
- Painting and paving;
- Debris and trash removal; and
- Spill cleanup.

The procedures will ensure that appropriate BMPs are verifiable through field inspections. The field manual will be updated as needed.

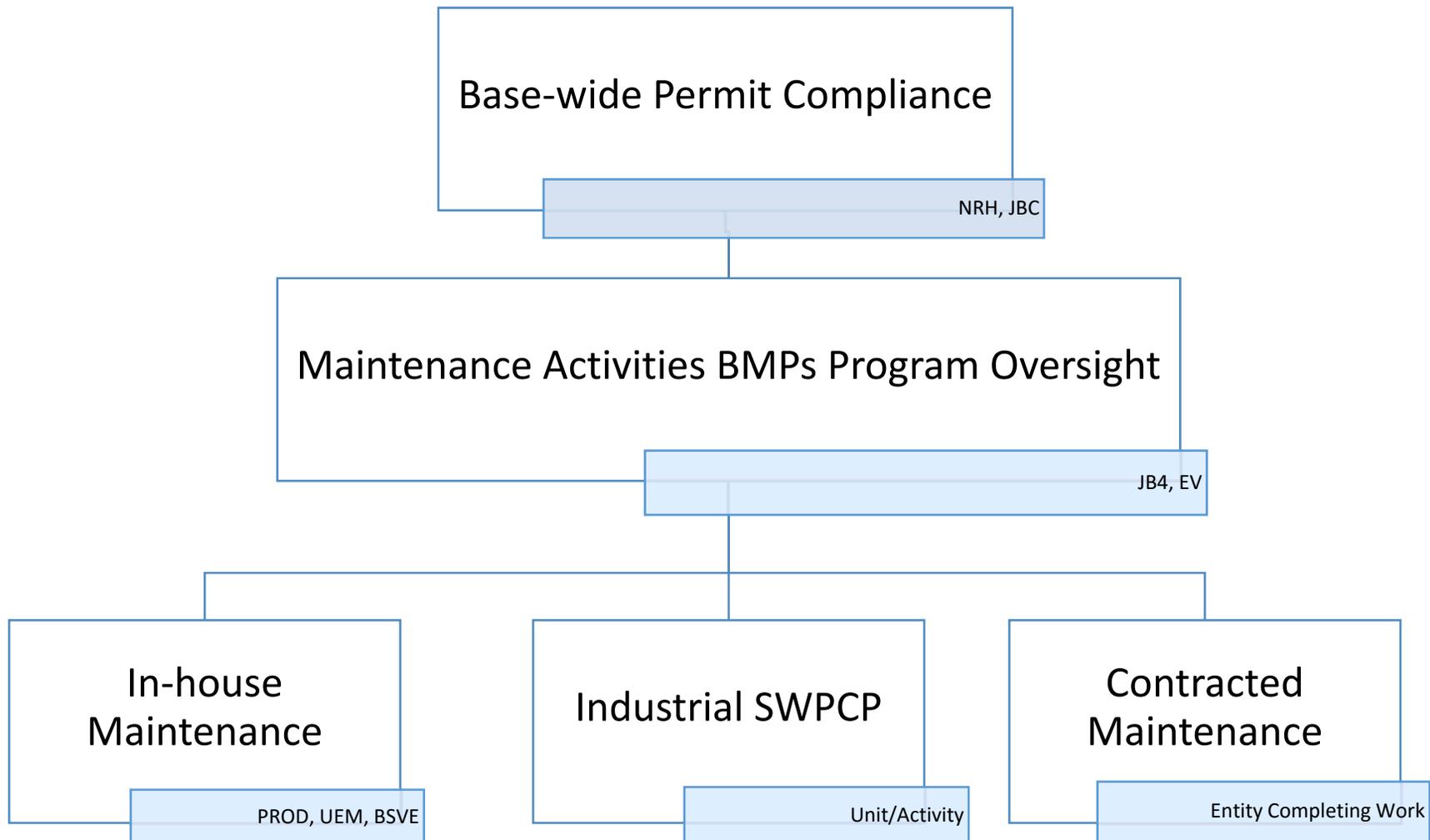


Figure 9-1 Maintenance Activities Program Organizational Chart

9.3 Storm Water Pollution Control Plan (SWPCP)

NRH has developed SWPCPs for industrial activities identified in the permit. The components of the SWPCPs are described in detail in Chapter 11, and site-specific SWPCPs are contained in Appendix 11-2 [redacted due to national security concerns]. Copies of the SWPCPs for each of the industrial facilities are available from EV and maintained at each facility.

The SWPCP for each facility contains applicable BMPs designed to reduce the potential for pollutant discharge to the MS4 or receiving water to the MEP using the Best Available Technology currently available (BAT)/ Best Conventional Pollution Control Technology (BCT).

To ensure that the requirements of the SWPCP are properly implemented and maintained, PRJ4 will conduct and document inspections of these facilities on a semi-annual basis. The facility designated person will conduct facility inspections on a periodic basis. The inspections will be documented on a “Semi-annual Facility Inspection Checklist” (see Appendix 9-1) and stored electronically. Updates to the BMPs and SWPCPs will be made as necessary.

9.4 Training

As part of its Maintenance Activities Program, EV will implement annual training for maintenance staff and contractors on proper maintenance activities to prevent storm water pollution. The training will focus on the field manual, identification of potential sources of pollution, general BMPs that can be used to reduce and/or eliminate such sources, and procedures for establishing site-specific BMPs for their activities. The training will be intended to educate maintenance personnel that they serve a role in protecting water quality, and will include, but not be limited to the Permit and overall SWMP.

EV is responsible for oversight of NRH’s maintenance activities education and outreach program, including contents and method of which information is circulated. Outreach material for tenants, personnel, contractors, and facilities will be developed, revised, and distributed at the discretion of EV. These materials will be used to address observed issues or general program policy updates.

10 Commercial Activities Discharge Management Program

A crucial component of NRH’s SWMP is its Base-wide Pollution Prevention and Good Housekeeping Program (Storm Water Pollution Prevention Program). Generally, this is a multi-faceted system maintenance program aimed at reducing discharge of pollutants from all NRH-owned property to the MEP. NRH-owned property includes facility roads, parking lots, maintenance facilities, sites with industrial activity, and its MS4. NRH’s Storm Water Pollution Prevention Program is separated into five main components including:

1. Debris Control BMPs Program Plan (Chapter 6) ;
2. Chemical Applications BMP Program Plan (Chapter 7);
3. Erosion Control BMPs Program Plan (Chapter 8);
4. Maintenance Activities BMPs Program Plan (Chapter 9); and
5. Commercial Activities Discharge Management Program (Chapter 10).

Each of these components is described in detail in individual chapters as noted above. This chapter focuses on NRH’s Commercial Activities Discharge Management Program (CADM Program).

Per Permit Part D.1.f.(v), NRH is required to develop and implement a CADM Program as part of the System Maintenance Program to reduce to the MEP the discharge of pollutants from all commercial facilities and activities that discharge into the Small MS4.

The CADM Program is made up of the following components:

1. An inventory and map of commercial facilities and activities that discharge directly or indirectly to the Small MS4.
2. Requirement for commercial facilities to implement BMPs, including an approval process for non-JBPHH connections or surface runoff discharges to the Small MS4.
3. An inspection program for all commercial facilities and activities.
4. Designate priority levels for inspection frequency.
5. Annual review and summary of CADM Program progress.
6. Enforcement policies and procedures.
7. Training of all related personnel, specific to each component of the CADM Program.

As indicated in the Permit, “commercial facilities/activities,” include at a minimum facilities and activities such as shopping centers, restaurants, and any other commercial facility that either the Permittee or DOH determines has the potential to contribute loading to the Small MS4.

The Permit describes the requirements for the CADM Program as follows:

Permit Reference	SWMP Section
<p><i>Part D.1.f Pollution Prevention/Good Housekeeping</i></p> <p><i>The Permittee shall develop and implement a system maintenance program to reduce to the MEP the discharge of pollutants from all Facility roads, parking lots, maintenance facilities, sites with industrial activity, and the Permittee’s Small MS4. At a minimum, the program shall include:</i></p>	<p>Sections 6-10</p>

<p>Part D.1.f.(v) Commercial Activities Discharge Management Program - <i>Within 18 months of the effective date of this Permit, the Permittee shall develop a Commercial Activities Discharge Management Program to reduce to the MEP the discharge of pollutants from all commercial facilities and activities which discharge into the Permittee's Small MS4. The Commercial Activities Discharge Management Program shall be implemented as part of the System Maintenance Program, and at a minimum include:</i></p>	<p>Section 10</p>
<p>Part D.1.f.(v)(a) Inventory and Map of Commercial Facilities and Activities – <i>The Permittee shall develop and maintain a commercial facilities and activities inventory (commercial inventory), of commercial facilities and activities discharging, directly or indirectly, to its Small MS4. Additionally, the Permittee shall maintain an updated map of the Small MS4 showing commercial facilities that discharge directly or indirectly into the storm drainage system.</i></p> <p><i>The commercial inventory shall include the facility name, location, nature of business or activity, SIC/NAICS code(s) that best reflect the facility product(s) or service(s), principal storm water contact, and receiving water.</i></p> <p><i>At a minimum, the commercial inventory shall include facilities and activities such as shopping centers, restaurants, and any other commercial facility that either the Permittee or DOH determines has the potential to contribute loading to the Small MS4.</i></p> <p><i>The inventory of commercial facilities shall be completed and up-to-date within 18 months of the effective date of this Permit.</i></p> <p><i>The map of commercial facilities shall be completed, up-to-date, and fully implemented within 18 months of the effective date of this Permit.</i></p>	<p>Section 10.2</p>
<p>Part D.1.f.(v)(b) Requirement to Implement BMPs - <i>Require written approval for drainage connections and discharge of surface runoff into the Small MS4 for non-JBPHH connections and maintain a database of the approvals. The approval shall obligate the facility to implement appropriate BMPs.</i></p>	<p>Section 10.3</p>
<p>Part D.1.f.(v)(c) Inspection of Commercial Facilities and Activities - <i>The Permittee shall develop and implement a commercial inspection program which reflects the findings/outcomes of the investigations.</i></p> <p><i>The Permittee shall ensure commercial facilities and activities identified in the commercial inventory required under Part D.1.f.(v)(a) are inspected and re-inspected as often as necessary based on its findings to ensure corrective action was taken and the deficiencies are resolved.</i></p> <p><i>At a minimum, the Permittee shall inspect commercial facilities with a high priority designation, annually. At a minimum, the Permittee shall inspect all commercial facilities at least once every five (5) years.</i></p>	<p>Section 10.4</p>

<p><i>The Permittee shall conduct inspections that at a minimum, appropriately identify deficiencies, assess potential impacts to receiving waters, evaluate the appropriateness and effectiveness of deployed BMPs, and require controls to minimize the discharge of pollutants to the Small MS4. The Permittee is encouraged to conduct the inspections consistent with the applicable portions (e.g., Chapter 11 – Storm Water) of the "NPDES Compliance Inspection Manual" (EPA 305-X-04-001), dated July 2004 to the maximum extent possible. Inspectors shall be properly trained to conduct the inspections, and shall use an inspection checklist, or equivalent, and photographs of significant non-compliance (where allowable) to document site conditions and BMP conditions. Records of all inspections shall be maintained for a minimum of five (5) years, or as otherwise indicated.</i></p>	
<p>Part D.1.f.(v)(d) <i>The Permittee shall submit an annual summary of inspection activities done within the previous period with the Annual Report. At a minimum the annual summary shall identify the commercial facilities inspected, the number of commercial inspections, significant inspection findings that remain unresolved for greater than three (3) calendar months, and an overall assessment of the effectiveness of the Commercial Activities Discharge Management Program.</i></p>	<p>Section 10.4</p>
<p>Part D.1.f.(v)(e) Enforcement Policy for Commercial Facilities and Activities - <i>The Permittee shall establish and implement policies for enforcement and penalties for commercial facilities/activities which have failed to comply. The policy shall be part of an overall escalating enforcement policy and must consist of the following:</i></p> <ul style="list-style-type: none"> • <i>Conducting inspections.</i> • <i>Issuance of written documentation to a facility representative within 30 calendar days of storm water deficiencies identified during inspection. Documentation must include copies of all field notes, correspondence, photographs, and sampling results if applicable.</i> • <i>A timeline for correction of the deficiencies.</i> • <i>Provisions for re-inspection and pursuing enforcement actions, if necessary.</i> <p><i>In the event the Permittee has exhausted all available sanctions and cannot bring a facility or activity into compliance with its policies and this permit, or otherwise deems the facility or activity an immediate and significant threat to water quality, the Permittee shall provide e-mail notification to cleanwaterbranch@doh.hawaii.gov, Attn: Enforcement Section Supervisor within one (1) week of such determination. E-mail notification shall be followed by written notification and include a copy of all inspection checklists, notes, photographs, and related correspondence in pdf format (300 minimum dpi) within two (2) weeks of the determination. In instances where an inspector identifies a facility that has not applied for the General Industrial Storm Water permit coverage or any</i></p>	<p>Section 10.5</p>

<p><i>other applicable NPDES permit, the Permittee shall provide email notification to DOH within one (1) week of such determination.</i></p>	
<p>Part D.1.f.(v)(f) Training - <i>The Permittee shall provide annual training to Facility personnel responsible for conducting commercial facilities/activities inspections on how to conduct commercial inspections, BMPs and source control measures for commercial facilities, and inspection and enforcement techniques. The training shall also include being able to identify industrial activities (i.e., to be covered under the NPDES General Permit for Industrial Storm Water discharge) or other activities that are potential sources of pollutants so that they may be covered under this permit. This training shall be specific to Facility activities, policies, rules, and procedures.</i></p>	<p>Section 10.6</p>

10.1 Program Organization

Commercial activities at JBPHH are managed primarily by two major tenants; Morale Welfare and Recreation (MWR) and Navy Exchange (NEX). Although tenant-specific responsibilities are defined within each individual tenant agreement, all entities that operate on Base are required to follow Base-wide instructions. As such, both MWR and NEX are required to follow the policies and procedures outlined in this SWMP.

JB4 (FMD, APWO, PRJ4), with assistance from EV is responsible for the oversight of general management and implementation of the CADM Program on JBPHH. The following is an overview of the basic responsibilities for each entity (see *Figure 10-1 CADM Program Organization*):

- EV – General program oversight to ensure CADM Program Permit compliance, training of personnel implementing/enforcing the CADM Program, and annual review and modifications, as needed, to the CADM Program. EV is also responsible for any necessary coordination with DOH, if there are persistent issues with non-compliance.
- FMD/APWO - Act as the liaison between the Base and tenants, maintain an inventory and map of commercial facilities at JBPHH, require written approvals for drainage connections of non-JBPHH tenants, maintain an inventory of non-JBPHH drainage connections, general oversight of CADM Program implementation by tenants.
- PRJ4 – work with EV to implement, track, and enforce the commercial facilities inspection program.

Any persistent issues with non-compliance of a tenant will be handled by escalating issues to the next higher level of authority. The Joint Base Commanding Officer (JBC) has the authority to adjust policies or direct enforcement actions for tenants/agencies subject to the CADM Program. Commander, NRH, has ultimate authority for Permit policies and enforcement actions.

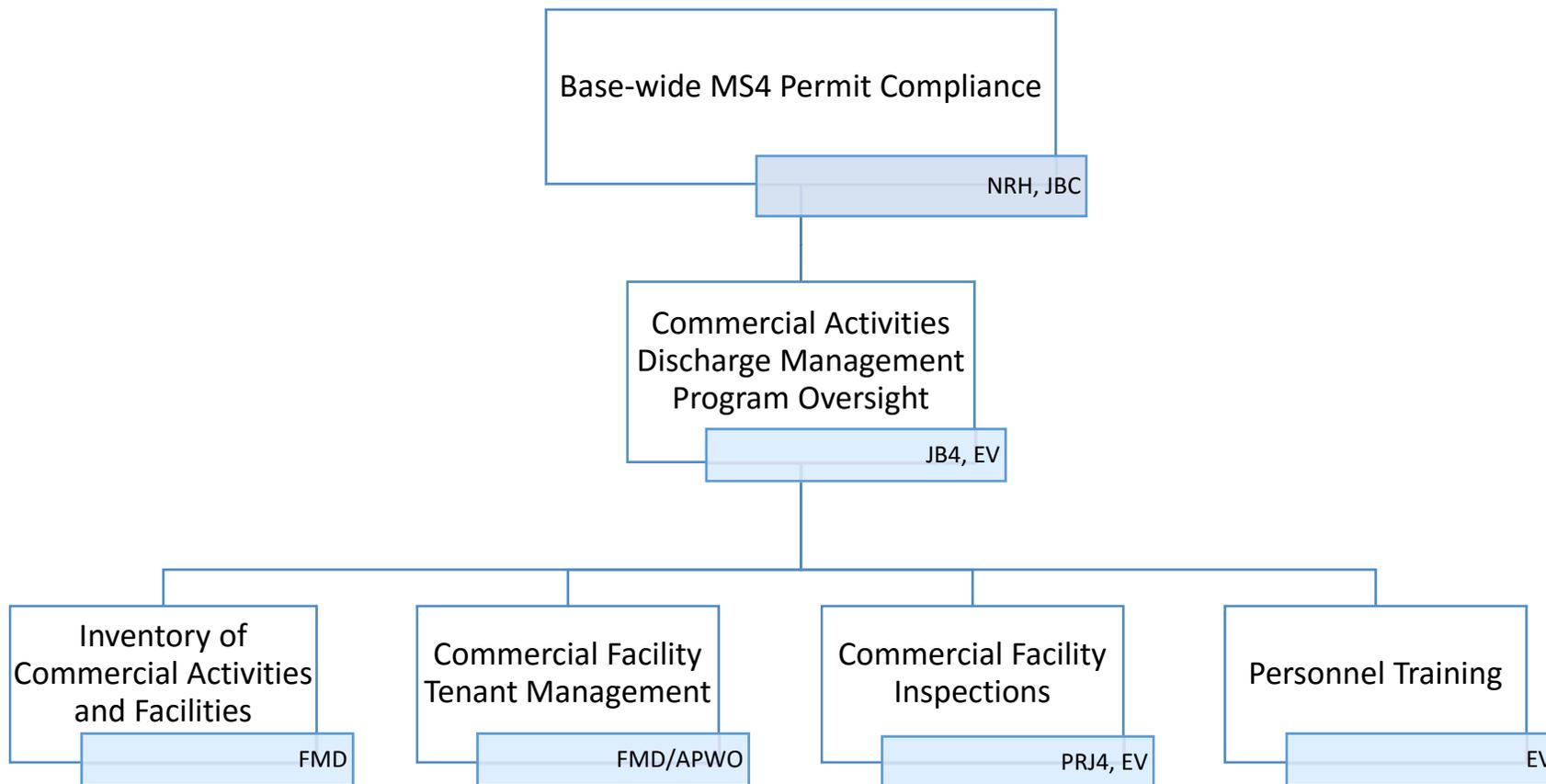


Figure 10-1: Commercial Activities Discharge Management Program Organizational Chart

10.2 Inventory and Map of Commercial Facilities and Activities

EV compiled a preliminary list of commercial facilities on JBPHH for inclusion in the commercial inventory and map, see *Appendix 10-1*. NRH has awarded a contract to develop the commercial inventory and map required by permit which will be completed by calendar year 2016. The commercial inventory will include all applicable facilities and activities that discharge directly or indirectly to the Small MS4. The inventory will be periodically updated and used to track the following information:

- Facility Name;
- Priority Ranking (described in Section 10.4);
- Location (building number, geographic area, street address);
- Receiving Water;
- Nature of business or activity;
- Standard Industrial Classification (SIC) or North American Industry Classification System (NAICS) code(s) that best reflect products and services; and
- Principal storm water contact.

The commercial inventory and map will include the following types of facilities and activities:

- Shopping Centers;
- Restaurants; and
- Any other commercial facility that either EV or DOH determines is contributing pollutants to the MS4 that may cause or contribute to an exceedance of State water quality standards.

Some retail facilities are covered by the Permit as industrial facilities, and will be covered in *Chapter 11 Industrial Facilities* and not the CADM Program. Storm water discharges from these facilities are covered by the Permit.

FMD is responsible for maintaining and updating the inventory and associated maps, as needed.

10.3 Requirement to Implement BMPs

All commercial activities on Base are required to comply with Base-wide instructions, including the implementation of BMPs.

In accordance with Section 3 of this SWMP, all drainage connections not under the direct control of NRH, including connections from commercial facilities, will require review and approval from FMD. The drainage connection approval will require commercial facilities and activities to implement BMPs that will be subject to inspection and enforcement.

10.4 Inspection of Commercial Facilities and Activities

NRH has developed inspection program guidelines dependent on findings/outcomes of the investigations, to ensure that the requirements of the CADM Program are implemented and that corrective actions are taken, if needed.

At a minimum, inspections will be used to:

- Identify deficiencies, such as illegal connections to the Small MS4, illicit discharges, potential sources of pollution, and deficiencies in BMPs;

- Assess potential impacts to receiving waters;
- Evaluate the suitability and effectiveness of BMPs implemented at each facility; and
- Outline required corrective actions, when deficiencies are identified.

Inspections of commercial facilities are primarily the responsibility of the tenant command that contracted the commercial facility. All facilities identified in the commercial inventory are required to be inspected and re-inspected as often as necessary to ensure compliance with storm water as well as other environmental laws and regulations. Each facility will be assigned a priority level of low or high, depending on the perceived potential risk to storm water quality. The priority rankings will be based on factors including, but not limited to, proximity to receiving waters, type of commercial activity, severity of potential pollutant concerns, and results of past inspections. These priority rankings may change to reflect findings of inspections or other new information. EV/PRJ4 will conduct compliance inspections as required by permit. Facilities that have been identified as high priority will be inspected annually, and at a minimum, all remaining commercial facilities must be inspected at least once every five years.

Additional inspections will also be conducted by PRJ4, as needed. Inspectors will use the *Industrial and Commercial Site Inspection Sheet* (being developed for this program) and photographs (where allowable) to document non-compliant findings and site conditions during inspections. Inspections are conducted in accordance with the applicable portions of the NPDES Compliance Inspection Manual (USEPA 305-X-04-001), published in July, 2004, to the maximum extent possible

Inspectors will be trained on a variety of topics as presented in Section 10.6 of this SWMP.

In addition to general inspection information, deficiencies will be documented by PRJ4 and provided to EV. Any discrepancies discovered in the commercial inventory list will also be brought to the attention of FMD and EV, so that the appropriate modifications can be made to databases, maps, and inspection schedules.

NRH will submit annual summaries of inspection activities done within the previous period to DOH with the Annual Report on January 31st of each year. At a minimum, annual CADM Program summaries will include:

- Commercial facilities inspected;
- The total number of commercial inspections completed (including follow-up visits);
- Significant findings that remain unresolved for greater than three (3) calendar months;
- An overall assessment of the CADM Program; and
- Any revisions that should be made to the commercial inventory or the CADM Program.

Records of inspections are maintained for a minimum of five (5) years.

10.5 Enforcement Policy

The CADM Program applies Base-wide to all identified commercial facilities and activities. NRH is developing an enforcement policy that will apply to all industrial and commercial activities and facilities. The commercial facilities enforcement policy will include:

- Inspections;

- Written documentation to a facility representative of storm water deficiencies within thirty (30) calendar days of the inspection. This documentation must include copies of all pertinent field notes, correspondence, photographs (if allowable), and sampling results (if applicable);
- A timeline for required corrective actions; and
- Provisions for follow-up inspections and enforcement procedures.

Similar to the enforcement policy for all other SWMP components, the CADM Program is part of an overall escalating enforcement policy, where JBC has the authority to adjust policies or direct enforcement actions for tenants/agencies. Commander, NRH, has ultimate authority for Permit policies and enforcement actions.

In instances where an inspector discovers that a commercial facility conducts Permit regulated industrial activities, and has not applied for NPDES permit coverage for discharges of storm water associated with industrial activities or any other applicable NPDES permit, EV will be immediately notified. EV will assess the situation, to determine if Permit coverage is needed, and will provide email notification to DOH within one (1) week of such a determination.

In the event that NRH has been unable to resolve an observed deficiency within its authority and cannot bring a facility or activity into compliance with its policies and this Permit, or otherwise deems the facility to pose an immediate or significant threat to water quality, EV shall provide an e-mail notification to DOH within one (1) week of such determination. EV will follow-up with written notification and include a copy of all inspection checklists, notes, and related correspondence in pdf format (300 minimum dpi) within two (2) weeks of the determination.

All written notifications submitted via email will be directed to:

cleanwaterbranch@doh.hawaii.gov, Attn: Enforcement Section Supervisor

10.6 Training

Training on how to conduct commercial inspections will be provided to inspectors and tenant commands, if necessary, on an as-needed basis or at least annually. The training will address the following areas:

- Inspection and enforcement techniques;
- Identifying deficiencies during inspections of commercial facilities and activities;
- Assessing potential impacts to receiving waters;
- BMPs and source control measures for commercial facilities to reduce storm water pollution;
- Evaluating the appropriateness and effectiveness of BMPs;
- Identification of types of industrial activities that require NPDES permit coverage for industrial storm water or other activities that are potential sources of pollutants so that they may be covered under this Permit; and
- Forms and/or processes for documenting inspections of commercial facilities and activities.

The training will be specific to Facility activities and NRH policies, rules, and procedures.

11 Industrial Facilities

As part of its SWMP, NRH is required to ensure that specific types of industrial facilities are covered in the Permit, and are in compliance with the Permit and all other State and Federal regulations. The determination of whether industrial facilities need to be covered under this Permit is based on the Standard Industrial Classification (SIC) code of its primary activity. The main regulatory components for these industrial facilities include the Storm Water Pollution Control Plans (SWPCPs) developed for each site; HAR, Chapter 11-55, Appendix B (dated December 6, 2013); and the Permit.

The overall objective of this Industrial Facilities Program is to reduce pollutants from NRH facilities, classified as “industrial” in accordance with Appendix D of EPA’s 2008 Multi-sector General Permit and 40 CFR §122.26(b)(14), to the MEP. At a minimum, pollutants are to be reduced to the appropriate discharge limitations subject to the BAT/BCT discharge requirement, consistent with the Clean Water Act and other applicable federal and state requirements.

Key components of the Industrial Facilities Program are to:

1. Ensure that industrial facilities are covered by the Permit, as required, or that the appropriate measures have been taken to qualify for “No Exposure” Certification or “No Discharge” documentation or similar for qualifying industrial sites;
2. Develop a map of storm water sewer sheds and identify where each industrial activity or facility occurs;
3. Develop, implement and routinely update a facility-specific SWPCP for each industrial facility covered by the Permit;
4. Maintain Permit compliance for all industrial facilities covered by the Permit;
5. Designate an individual from each industrial facility to receive appropriate training and be accountable for ensuring implementation of the facility-specific SWPCP;
6. Develop and implement Facility-wide spill prevention and response procedures;
7. Conduct inspections for identified industrial areas or facilities;
8. Provide annual training to all personnel that work within industrial areas or facilities;
9. Inform DOH of any changes to the list of industrial facilities (i.e., either adding or removing a facility) and significant changes to SWPCPs in the Annual Report; and
10. Submit “MS4 NPDES Individual Permit – Industrial Storm Water Discharge Notification” form for each industrial facility.

As mentioned, the EPA only requires permits for the discharge of storm water for specific types of industrial activities, in accordance with Appendix D of EPA’s 2008 Multi-sector General Permit and 40 CFR § 122.26(b)(14). Those industries requiring storm water permits are described in one of two ways - by a narrative description, or by a SIC code.

Requirement to obtain permit is based on the SIC code for primary site activity. This means that, if the listed activity is not the primary site activity, it does not need a permit. A “primary site activity” is considered to be the principal industrial activity in which a facility or plant engages in. The “site” is considered to be the area or areas immediately surrounding the plant or facility where the industrial activity takes place. Excluded from the term “site” are areas located on facility or plant lands separate from the facility or plant’s industrial activities, such as office buildings and accompanying parking lots, as

long as drainage from the excluded area is not mixed with storm water drained from the facility or plant defined as the primary site activity. Permit requirements for activities described by a narrative definition are considerably more stringent because any of the described activity occurring on site would require regulation.

For purposes of this SWMP, five broad categories of industrial activity are described by the narrative definition as an “industrial activity” and are subject to permit for discharges of storm water associated with the facility and need for SWPCPs:

- 40 CFR Subchapter N Industries;
- Landfills;
- Steam Power Generation Facilities;
- Sewage Treatment Plants; and
- Hazardous Waste Treatment, Storage, and Disposal Facilities.

Five general categories of industrial activity are described by SIC codes:

- Heavy Manufacturing;
- Light Manufacturing;
- Mining;
- Recyclers; and
- Industrial Transportation.

A quick reference guide with the SIC codes for industrial facilities that require inclusion in the Permit in accordance with Appendix D of EPA’s 2008 Multi-sector General Permit and 40 CFR § 122.26(b)(14) is provided in Appendix 11-1.

The Industrial Facilities Program is outlined in accordance with the Permit requirements. *Part E “JBPHH Industrial Facilities,”* of the Permit states:

Permit Reference	SWMP Section
<p>Part E.1. Industrial Storm Water Pollution Control Plans (SWPCPs)</p> <p><i>Within 12 months of the effective date of this Permit, the Permittee shall develop Industrial SWPCPs to prevent the discharge of pollutants specifically from sources identified as Industrial Storm Water Dischargers, as specified in section E.1.a. The SWPCPs shall be incorporated and implemented as part of the final SWMP specified in Part D of this permit. The Industrial SWPCPs shall, at a minimum, include the following:</i></p>	<p>Section 11.2</p>
<p>Part E.1.a Industrial Areas, Facilities, and Activities - <i>Within three (3) months of the effective date of this Permit, the Permittee shall identify all Industrial areas, facilities, and activities which discharge storm water to the Small MS4. At a minimum, the identified industrial areas or facilities shall include any activities identified in Appendix D of EPA’s 2008 Multi-sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP) and any other area/activity that either the Permittee or DOH determines has the potential to contribute pollutant</i></p>	<p>Section 11.2</p>

<p>loading to the MS4.</p>	
<p>Part E.1.b - The Permittee shall develop a map of the Small MS4's storm water sewer sheds and identify where each industrial activity or facility occurs, and define all potential types of industrial activity that may occur at the specified area or facility. The Permittee shall define representative monitoring locations where either the industrial areas or facilities connect to the greater Small MS4 within each storm water sewer shed. These locations are to be used for the Permittee's industrial storm water monitoring requirements to determine whether industrial storm water BMPs are being implemented to the MEP to prevent the discharge of pollutants from the Small MS4 to State waters.</p> <p>The map of the Small MS4's storm water sewer sheds shall be completed, up-to-day, and fully implemented within 18 months of the effective date of this Permit.</p>	<p>Section 11.2</p>
<p>Part E.1.c - Within 12 months of the effective date of this Permit, the Permittee is to develop and implement, for each industrial area or facility, a SWPCP. At a minimum the SWPCP shall comply with the requirements in HAR, Chapter 11-55, Appendix B, of December 6, 2013 including the following:</p>	<p>Section 11.3</p>
<p>Part E.1.c.(i) A Site or facility specific map identifying:</p> <ul style="list-style-type: none"> • The locations of drainage structures, • Each drainage area, paved areas and buildings and other ground cover within each drainage area, • Outdoor storage areas, • Areas where there are industrial activities, • Material and/or waste disposal areas, • Structural measures for the control of storm water, • Locations of any treatment devices, • Hazardous waste storage or disposal areas, • Storm water sampling locations, • Outfall locations, and • The nearest receiving waters. 	<p>Appendix 11-2 [Redacted due to national security concerns]</p>
<p>Part E.1.c.(ii) Pollutant Sources. For each industrial area or facility identified pursuant to Part E.1.a. of this permit, the Permittee shall identify pollutants of concern for each area, including those parameters listed in HAR, Chapter 11-54-4 that the Permittee believes to be present in the storm water runoff from the facility and/or activity. The Permittee shall consider the types of industrial activity that may potentially occur at each site, and the type of materials used and stored at each site. At a minimum, the identified pollutants shall include any pollutants identified in Part 8 of EPA's 2008 MSGP for the applicable industrial activity.</p>	<p>Appendix 11-2</p>

<p>Part E.1.c.(iii) Best Management Practices (BMPs). <i>The Permittee shall develop BMPs to minimize the discharge of pollutants within storm water. Site specific BMPs shall be incorporated as necessary for identified industrial areas or facilities. A copy of the applicable BMPs for each identified industrial area shall be posted at each industrial location or in a location immediately assessable by all personnel that work within the identified industrial area. The Permittee shall consider the use of containment structures, covering materials by roof or tarpaulin, preventive maintenance, good housekeeping measures, waste minimization, removal of exposed pollutants, and spill prevention practices. The implementation of BMPs shall be sufficient to meet the requirements of HAR, Chapter 11-55, Appendix B of December 6, 2013, Section 8.b.</i></p>	<p>Appendices 11-2 and 11-3</p>
<p>Part E.1.c.(iv) Spill prevention and response procedures. <i>The Permittee shall develop and implement Facility-wide spill prevention and response procedures to prevent and minimize the occurrence of spills, and prevent contact with storm water runoff or the potential to discharge to receiving water. The spill prevention and response procedures shall identify Facility personnel responsible for its implementation. Additionally, the SWPCP shall include existing information regarding significant leaks or spills of toxic or hazardous pollutants at the Facility that have taken place within five (5) years of the submittal date of the SWPCP.</i></p>	<p>Specific spill response procedures and responsibilities are located in the CNRH Integrated Contingency Plan (ICP), and the CNRH Spill Prevention Control and Countermeasure (SPCC) Plan</p>
<p>Part E.1.c.(v) Inspections. <i>The Permittee shall specify the frequency and protocol for inspections that ensure the SWPCP and spill prevention and response procedures are effectively carried out. Inspections for identified industrial areas or facilities shall be conducted at least semi-annually. The SWPCP shall specify that records of the inspections shall at a minimum include: dates on which the inspections were conducted, weather conditions at the time of the inspection, inspection findings, any photo documentation, any impact to receiving waters, timeframes for corrective actions to be performed, and corrective actions taken.</i></p>	<p>Section 11.3</p>
<p>Part E.1.c.(vi) Training. <i>The Permittee shall provide annual training to all Facility and military personnel that work within the identified industrial areas or facilities with the potential to impact storm water runoff quality and impact receiving water quality. The training shall be sufficient to ensure the SWPCP will be properly implemented.</i></p>	<p>Section 11.3</p>
<p>Part E.1.c.(vii) A list of allowable non-storm water discharges. <i>The Permittee shall identify all allowable non-stormwater discharges within the industrial areas. Allowable non-storm water discharges shall be limited to those specified in Part B.2 of this permit.</i></p> <p><i>The list of allowable non-storm water discharges shall be compiled within three (3) months of the effective date of this Permit.</i></p>	<p>Section 3</p>
<p>Part E.1.c.(viii) Storm water outfalls and monitoring locations. <i>The Permittee shall identify all industrial storm water outfalls and industrial</i></p>	<p>Section 12</p>

<p><i>storm water monitoring locations for industrial areas and pollutant sources identified pursuant to Part E.1.a. and E.1.b. of this permit.</i></p> <p><i>All industrial storm water outfalls and monitoring locations shall be identified within one (1) year of the effective date of this Permit.</i></p>	
<p>Part E.1.c.(ix) Monitoring procedures. <i>The Permittee shall develop and implement monitoring procedures necessary to implement the requirements of Part F of this permit for the discharge of storm water from industrial facilities. The specified monitoring procedures shall at a minimum include a written narrative of the proposed monitoring objectives and description of monitoring activities. The monitoring locations shall be clearly marked on a sampling map with an explanation of why the location was selected and the identification of the pollutants of concern for each of the sampling locations.</i></p>	Section 12
<p>Part E.1.c.(x) Rules and regulations. <i>The Permittee shall implement rules and regulations throughout the Facility to prevent the discharge of pollutants into the Small MS4. Where rules and regulations are not sufficient to implement the requirements of this permit, the Permittee shall develop them prior to the finalization of the SWPCP. The SWPCP shall include a summary (or references) of such rules and regulations.</i></p>	Appendix 11-2
<p>Part E.1.c.(xi) Annual review. <i>The Permittee shall review and update the SWPCP as often as needed to comply with the conditions of this permit. At a minimum, the SWPCP shall be reviewed annually. The Permittee shall document all SWPCP reviews and report any significant changes to DOH within 30 calendar days of when the changes occur. Any significant changes to the SWPCP shall be highlighted within the Annual Report. The term “significant changes” shall include, but not be limited to the size and location of the industrial area or facility, type of industrial activities, BMPs and housekeeping practices, sampling location, and sampling parameters.</i></p>	Section 11.3
<p>Part E.2. <i>Industrial facilities (identified as specified in Part E.1.a.) covered under this permit shall comply with the requirements in HAR, Chapter 11-55, Appendix B of December 6, 2013. All industrial facilities covered under this permit shall be identified annually within the Annual Report. The addition or removal of industrial facilities covered under this permit shall be highlighted annually as a component of the Annual Report.</i></p>	Section 11.4
<p>Part E.3. <i>An individual at each industrial site shall be charged with ensuring implementation of the SWPCP. This individual shall be trained to implement the SWPCP, including but not limited to, conducting inspections, identifying deficiencies and performing corrective actions. To ensure consistency and provide assistance and oversight, the Permittee shall identify an individual who shall oversee the industrial facilities inspections.</i></p>	Section 11.3
<p>Part E.4. <i>The Permittee shall submit within 90 calendar days from the effective date of this permit for review and acceptance, the form, titled “MS4 NPDES Individual Permit – Industrial Storm Water Discharge</i></p>	Section 11.4

<p><i>Notification.” The deadline to complete the SWPCP for each industrial facility (identified in Appendix 1) shall be in accordance with Part E.1. of this permit.</i></p>	
<p>Part E.5. <i>The Permittee may add new or currently existing Industrial and/or new Small MS4 facilities into this permit by request in writing to the DOH. Along with a written request, for Industrial facilities or other facilities that contribute significant sources of pollutants in storm water, the Permittee shall submit the form, titled “MS4 NPDES Individual Permit – Industrial Storm Water Discharge Notification” and SWPCP to the DOH for review and comment. Upon acceptance of the information, the DOH will provide a response by email. The SWPCP must be implemented upon the start-up of the facility or for an existing facility, the SWPCP must be implemented upon submittal of the written request.</i></p>	<p>Section 11.4</p>

11.1 Program Organization

Implementation of facility-specific SWPCPs is primarily the responsibility of the facility manager. An individual at each industrial site is designated for ensuring implementation of the SWPCP, as required by the Permit. EV is responsible for general program oversight and, with help from JB4, for identifying facilities that should be added or removed from Permit coverage. This also involves oversight of the Monitoring Program described in Chapter 12, and providing annual updates of all activities, SWPCP revisions, as required, and status of inspections. NRH will implement the requirements to prevent the discharge of pollutants from industrial facilities into the MS4 via the base instructions. The JBC has the authority to adjust policies or direct enforcement actions for tenants/agencies subject to the Industrial Facilities Program. Commander, NRH, has ultimate authority for Permit policies and enforcement actions.

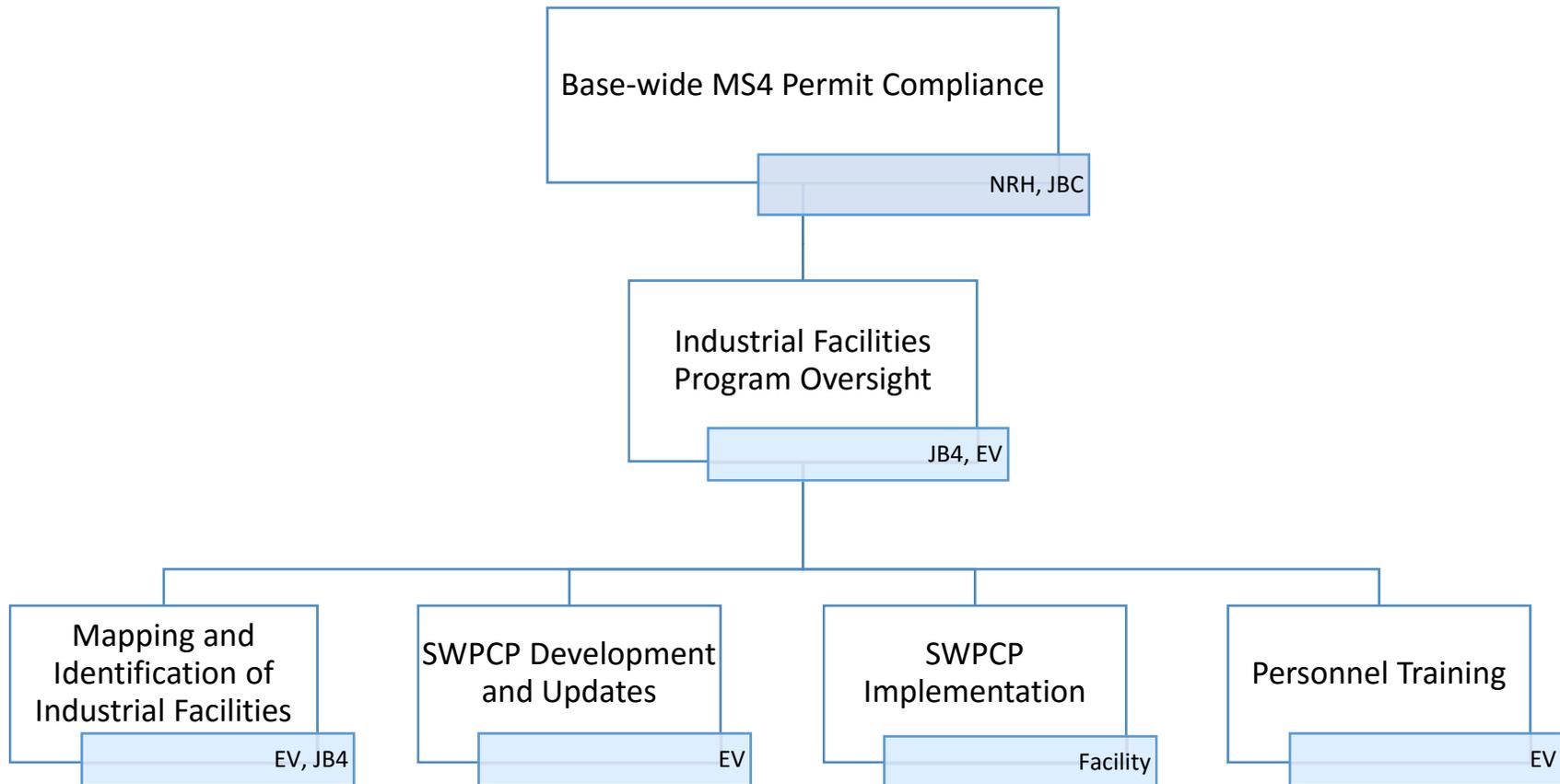


Figure 11-1 Industrial Facilities Program Organizational Chart

11.2 Industrial Facility Mapping and Identification

EV has developed a map of the Small MS4's storm water sewer sheds and will be identifying locations of industrial areas, facilities, and activities within each storm water sewer shed which discharge storm water to the Small MS4. EV will evaluate each area, facility, and activity to determine if they require permit coverage. If a facility requires permit coverage, a facility specific SWPCP will be prepared and implemented (see Section 11.3). Updates will be made periodically as activities and facilities change within JBPHH (see Section 11.4).

11.3 Facility-specific Storm Water Pollution Control Plans

NRH conducted site visits for all industrial facilities covered by the Permit. SWPCPs will be updated accordingly to meet the requirements specified in HAR Chapter 11-55, Appendix B, Section 6. Figure 1 (included Appendix 11-2) [redacted due to national security concerns] displays the locations of all industrial facilities covered by the Permit. BMPs listed within the SWPCPs reference a list of BMPs, with corresponding detailed descriptions, that was put together for ease of reference in Appendix 11-3. Each facility-specific SWPCP has been included in Appendix 11-2.

Copies of the updated SWPCPs will be provided to each industrial facility, and a representative from the facility will review and accept any changes. EV will verify that a designated person from each facility has received the required training and has been given the responsibility of implementing all practices indicated within the SWPCP. Each updated SWPCP will be implemented upon submittal of this SWMP to DOH. Each facility will ensure that a copy of the SWPCP is available onsite at all times.

The person designated at each facility for ensuring SWPCP compliance will be responsible for conducting inspections, identifying deficiencies, and performing corrective actions. Inspections will be conducted semi-annually. The facility will keep records of the inspections. PRJ4 will also conduct semi-annual inspections for NRH at industrial facilities covered by the Permit. Records of the inspections shall at a minimum include: dates on which the inspections were conducted, weather conditions at the time of the inspection, inspection findings, any photo documentation, any impact to receiving waters, timeframes for corrective actions to be performed, and corrective actions taken.

The permit requires that storm water samples be collected at each facility. EV will be responsible for the monitoring program as outlined in Section 12.

SWPCPs will be reviewed as needed, at a minimum of once annually, and will be updated as needed by the facility and EV. Any changes will be provided to the corresponding facility for review and acceptance before it is submitted to DOH. EV will document all SWPCP reviews and report any significant changes to DOH within 30 calendar days of when the changes occur. Any significant changes to the SWPCP will be highlighted within the Annual Report. The term "significant changes" shall include, but not be limited to the size and location of the industrial area or facility, type of industrial activities, BMPs and housekeeping practices, sampling location, and sampling parameters.

EV will provide annual training to all Facility and military personnel that work within the identified industrial areas or facilities with the potential to impact storm water runoff quality and impact receiving water quality. The training will be sufficient to ensure the SWPCP will be properly implemented.

11.4 Changes to Industrial Facilities Covered by the MS4 Permit

NRH will continue to manage its industrial program to add or remove industrial areas, facilities, and activities which discharge storm water to its MS4, as they are identified. If new industrial areas, facilities, and activities are identified, NRH will determine whether these facilities require permit coverage. Written requests to DOH are required for the addition of industrial facilities or other facilities that contribute significant sources of pollutants in storm water. EV will be responsible for having appropriate documentation prepared. A facility-specific SWPCP will be prepared in accordance with the requirements of Part E.1.c and HAR 11-55, Appendix B of December 6, 2013. The SWPCP will be provided to the corresponding facility for review and acceptance. EV will complete the form titled “MS4 NPDES Individual Permit – Industrial Storm Water Discharge Notification” and submit it along with a written request to DOH for review and comment. Upon acceptance of the information, DOH will provide a response by e-mail. The SWPCP must be implemented upon the start-up of the facility or for an existing facility, upon the submittal of the written request. The addition or removal of industrial facilities covered under the Permit shall be highlighted annually as part of the Annual Report.

If a change to the industrial facility coverage is required in the future, the EV will follow the applicable procedures outlined in the Permit, Part E.2 or E.5. In addition, if a listed facility changes use (i.e. SIC code change that does not require permit coverage) or is no longer in use, the EV will notify DOH via the Annual Report that the facility be removed from the permit list.

12 Monitoring Plan

12.1 Introduction

This Monitoring Plan provides the technical and management procedures that will be implemented to meet the monitoring requirements of the NPDES Permit HI S000257 (herein referred to as the “Permit”). All monitoring described in this plan are required by the Permit and/or state and federal storm water regulations. The Permit requires the Department of the Navy, Navy Region Hawaii to monitor their storm water discharges associated with industrial activities. The State of Hawaii Department of Health (DOH) also requires each effluent flow or pollutant (as specified in the Permit) to be monitored according to the prioritized schedule to yield data that reasonably characterizes the nature of the discharge.

The Permit also requires monitoring for compliance with Total Maximum Daily Loads (TMDLs). Currently Navy Region Hawaii only has one TMDL waste load allocation (WLA), which is for the North Fork of Kaukonahua Stream. Monitoring for compliance with this TMDL WLA is detailed under a separate monitoring plan (*2016 TMDL Storm Water Monitoring at North Fork of Upper Kaukonahua Stream, Navy Region Hawaii, December 2015*).

The Permit describes the requirements for the Monitoring Plan as follows:

Monitoring Plan (Part F.1):

1) 1. Monitoring Plan

- a. *The Permittee shall submit the Monitoring Plan to the Director within one (1) year after the effective date of this permit for review and acceptance. Any revisions to the Monitoring Plan shall be submitted by January 31st of each year. All revisions to the Monitoring Plan shall be implemented over the coming calendar year.*

The monitoring program must be designed and implemented to meet the following objectives:

 - (i) *Assess compliance with this permit (including TMDL I&M Plans and demonstrating consistency with WLAs);*
 - (ii) *Determine whether the Permittee’s industrial facilities (as specified in Part E) comply with water quality requirements set forth in Part F.2 of this permit;*
 - (iii) *Measure the effectiveness of each element/control measure of the Permittee's storm water management program;*
 - (iv) *Assess the overall health based on the chemical, physical, and biological impacts to receiving waters resulting from storm water discharges and an evaluation of the long term trends;*
 - (v) *Characterize storm water discharges from the Small MS4;*
 - (vi) *Identify sources of specific pollutants;*
 - (vii) *Detect and eliminate illicit discharges and illegal connections to the Small MS4; and*
 - (viii) *Assess the water quality issues in watershed resulting from storm water discharges to receiving waters.*
- b. *The plan shall, at a minimum, include the following items:*
 - (i) *Written narrative of the proposed monitoring plan's objectives, including but not limited to the objectives identified in Part F.1.a., and description of activities;*

- (ii) The monitoring locations on a sampling location map with an explanation of why the location was selected and the identification of the pollutants of concern for each of the sampling locations.*
- (iii) The Permittee shall develop a priority based monitoring schedule for each type of industrial area or facility identified pursuant to Part E.1.a. of this permit. The monitoring schedule will prioritize facilities or areas with the greatest potential of pollutant discharge. The facilities or areas ranked first within each type shall be monitored annually. Industrial areas or facilities not ranked first shall be monitored on a rotational basis (at least two (2) areas or facilities monitored per year per type). The Plan shall provide the rationale for the priority rankings, identify the types of industry within each of the priority areas or facilities, and provide a monitoring schedule for the rotational monitoring of industrial areas or facilities. Areas or facilities which exceed any of the limitations are required to be monitored during the next representative storm event for all parameters until none of the limitations are exceeded.*
- (iv) For each activity, a description of how the results will be used to determine compliance with this permit.*
- (v) Identification of management measures proven to be effective and/or ineffective at reducing pollutants and flow.*
- (vi) Written documentation of the following:*
 - (a) Characteristics (timing, duration, intensity, total rainfall) of the storm event(s);*
 - (b) Parameters for measured pollutant loads; and*
 - (c) Range of discharge volumes to be monitored, as well as the timing, frequency, and duration at which they are identified;*
- (vii) Written documentation of the analytical methods to be used;*
- (viii) Written documentation of the Quality Assurance/Quality Control procedures to be used; and*
- (ix) Estimated budget to be implemented over the coming calendar year.*

12.2 Sampling Locations and Rationale

Monitoring locations were designated using a priority based ranking system per industrial type. Element Environmental, LLC (E2) reviewed documentation from previous SWPCP performed by HDR and reported in “Prefinal Draft Storm Water Program Plan Commander, Navy Region Hawaii Joint Base Pearl Harbor-Hickam” Appendix G5 and G7, 29 June 2012, and visited the industrial sites identified in the permit from November through December 2015, in order to determine site ranking and sampling priority. The following facilities or areas with the greatest potential of pollutant discharge for their standard industrial code type will be monitored annually. The remaining sites will be monitored on a rotational basis with at least two locations (where more than one per industrial type exists) monitored per year. Details for each location, including a sampling location map, justification for the sample location and a list of pollutants of concern are listed in Appendix 12-1.

12.2.1 Annual Monitoring Sites

Sampling locations identified as a priority within an industrial type are provided in Table 12-1. These sites will be monitored once per year throughout the five (5) year period of this permit.

Table 12-1 Annual Monitoring Sites for JBPHH

Building	Industrial Activity	Major SIC Code
217, 217a	Descriptions redacted due to national security concerns	44
B-23, B-24, B-25, B-26		37/44
1770		37
439		24
35		41
BWPU		49
553, 229		42
1715		50
2010		51
2130		28
2131		76
2036		15
2177, 2178, 2183, 2184, 2185, 2186		73
2072, 2073		55/75
1219, 1220		35

12.2.2 Secondary Monitoring Locations

Sampling locations not identified as the highest priority when grouped by industrial type are listed in Table 12-2. These locations will be monitored once over the five (5) year permit period as per the schedule provided in Table 12-3.

12.3 Priority Based Monitoring Schedule

The monitoring schedule in Table 12-3 was established by prioritizing industrial sites by industrial classification and then by rank of potential of pollutant discharge. Appendix 12-1 lists the individual sites and rationale that was used to create the schedule.

Table 12-2 Secondary Monitoring Points to be Monitored over a 5 Year Period

Building	Industrial Activity	Major SIC Code
19	Descriptions redacted due to national security concerns	44
A2, A3, A4, A5		44
3		44
S-375, S-376		44
454		44
1631, 1725		37
M-1, M-2, M-3, M-4		37/44
683		37
1320		37
1588		37
1766		37
Wharves S-1, S-8, to S- 21		37
Hotel Piers 1 to 4		37
FORFAC		37
449		42
1757, 1758		37
K-3, K-4 to K-11		44
415		55
4		41
3		41
57/462		24
W-1/W-2/W-3		44
W-4/W-5		44
X-24, X-31, 77, 78		50
1526		42
IWTC		42
S-169		55
Bldg. 159 (In process of being moved to Bldg. 1656)		50
Area 3		37
60		37
YRDH-6, YC-1638		37

Building	Industrial Activity	Major SIC Code
1037		55
1055		37
YFN-1222, YC-1637, YR-83		37
1070, 1072	Descriptions redacted due to national security concerns	42
1073, 2001		55
2002		41
2006		41
75065, 1720		50
2025		28
2030		41
2125		51
2157, 2152		51
3002		51
3004		51
3020		51
3200		75
3400, 3408		55
3407		28
3424		55
3455, 3460		44
11666		35
1055, 2030, 2125		75
12604		51
12605		51
3386		35
4002		41
2184	55	

Table 12-3 Priority Based Monitoring Schedule

Sampling Location		Year				
		2016	2017	2018	2019	2020
Bishop Point	19			X		
	A2, A3, A4, A5			X		
Ford Island	217, 217a	X	X	X	X	X
	3				X	
	S-375, S-376				X	
	454		X			
Merry Point	1725, 1631		X			
	M-1, M-2, M-3, M-4		X			
Bravo Wharves	B-23, B-24, B-25, B-26	X				
Subbase	1770	X	X	X	X	X
	683				X	
	1320				X	
	1588			X		
	1766			X		
	Wharves S-1, S-8, to S- 21		X			
NAVSUP Fleet Logistics	Hotel Piers 1 to 4	X				
	FORFAC	X				
	449			X		
	1757, 1758		X			
	K-3, K-4 to K-11		X			
Lualualei	415					X
	4					X
	439	X	X	X	X	X
Westloch	3					X
	57/462		X			
	W-1/W-2/W-3					X
	W-4/W-5					X
	18 & G NAVFAC HI #60					X
Wahiawa NCTAMS	S238 NAVFAC HI #65					X
NAVFAC HI Main	X-24, X-31, 77, 78	X	X	X	X	X
Marine Barracks	35	X	X	X	X	X
PH Shipyard	1526				X	
	BWPU	X	X	X	X	X
	IWTC					X
	S-169	X				
	Bldg. 159 (In process of being moved to Bldg. 1656)		X			
Makalapa Gate	553, 229	X	X	X	X	X

Sampling Location		Year				
		2016	2017	2018	2019	2020
Waipio Peninsula	Area 3					X
	60					X
	YFN-1222, YC-1637, YR-83					X
	YRDH-6, YC-1638					X
Hickam	1037		X			
	1055			X		
	1070, 1072		X			
	1073, 2001		X			
	1715	X	X	X	X	X
	2002	X				
	2006			X		
	2010	X	X	X	X	X
	75065			X		
	1720, 2025			X		
	2030		X			
	2130	X	X	X	X	X
	2131	X	X	X	X	X
	2036	X	X	X	X	X
	2125			X		
	2157, 2152				X	
	2177, 2178, 2183, 2184, 2185, 2186	X	X	X	X	X
	3002				X	
	1055, 2030, 2125		X			
	12604		X			
	12605		X			
	2072, 2073	X	X	X	X	X
	1219, 1220	X	X	X	X	X
	4002		X			
	2184				X	
	3455, 3460	X				
3004			X			
HIANG	3020	X				
	3200			X		
	3400, 3408			X		
	3407		X			
	3424			X		
	11666			X		
	3386		X			

12.4 Permit Compliance

A description of how results from each activity are used to ensure permit compliance are provided in this section. Results from sample analysis and physical observations of storm water discharges will be evaluated against acceptable runoff effluent limitations as provided in Table 1 of the Permit and HAR, Chapter 11-54. Data will be evaluated to measure the effectiveness of control measures of the management program and to assess the overall health of impacts to receiving waters. Monitoring locations where sample results fail to meet the limitations will be investigated for potential sources of pollutants including natural sources. The site will also be inspected to determine if illicit discharges or illegal connections are present. Based on the findings, BMPs will be evaluated for potential improvements.

12.5 Management Measures Effectiveness

Both visual observations during storm water monitoring and storm water sample analysis results will be used to help determine whether management measures are effective at reducing pollutants and flow. Visual observations of management measures will be recorded on field sampling sheets when possible during storm water sampling. Examples may include storm water breaching an absorbent sock or a sock that is effectively preventing a sheen from entering a storm drain inlet. Data from storm water analysis will be evaluated to determine whether management measures used to reduce a pollutant are effective or not by comparing numerical values to past exceedances.

12.6 Storm Event Selection Criteria

The Permit requires that the permittee collect samples for analysis from a representative storm. A representative storm is defined as a storm which accumulates a minimum of 0.1 inch of rain throughout the storm and occurs at least 72 hours after the previous qualifying rainfall event. Sampling shall start within the first 15 minutes of storm water discharge.

12.7 Storm Water Sampling and Analysis

This section provides information for storm water sampling and analysis. Sample collection and transport are discussed in Section 12.7.1. Analytical parameters, holding times and container requirements are discussed in Section 12.7.2. Locations where parameters fail to meet the limitations of the permit, must be resampled until parameters return to compliance through the use of improved management practices.

12.7.1 Sample Collection and Transport

Samples are to be collected within the first 15 minutes of discharge at the sampling location. A sample collected within the first 15 minutes is considered a "Grab" sample. Subsequent samples collected beyond 15 minutes are to be combined and are considered a composite sample. A composite sample shall be taken every 15 minutes up to 1 hour after the start of discharge. Composite samples are to be flow proportional as described below. Sampling may cease if the discharge flows for more than one (1) hour.

If the duration of a discharge event is less than 30 minutes, the sample collected during the first 15 minutes fulfills the requirement of a composite sample and shall be analyzed for all parameters. Enough sample should be collected as a grab sample to perform all analysis. If the duration of the discharge event lasts longer than a half hour, each 15 minute sample shall be combined proportional to the flow

occurring at the time each sample was taken, including the initial grab sample, into one composite sample. Flow proportions can be established by adjusting the timing of sampling, to increase during periods of greater flow or by volume, collecting more sample for greater flow at the given intervals.

For discharge events greater than 30 minutes in duration, labile analytes are to be tested from the grab sample and all others from the composite as described in Table 12-4.

12.7.1.1 Manual Sampling

Samples may be collected manually or with automated sampling equipment such as an ISCO Avalanche or Global WS750. Manual sample collection may include the use of a sheet flow sampler such as a surface bailer type device, direct grabs using a glass jar such as the 1.8 liter ISCO container or through a peristaltic pump with tubing run down through a storm drain inlet. Care must be taken to use sampling equipment with inert surfaces to avoid interactions with target analysis such as Oil and Grease. Equipment should be Teflon lined, glass or stainless steel. If low level analysis of metals associated with steel, such as chromium are required, contact with metal surfaces should also be avoided. Monitoring locations were designated based on collecting discharge from an industrial site. Each site poses different challenges in obtaining a representative sample. Appendix 12-1 addresses sampling challenges and suggested sampling approaches for each monitoring location.

12.7.1.2 Automated Sampling

Automated sampling improves the efficiency of sampling and is useful in collecting samples from discharge events that occur outside of typical business hours. Deployment of automated samplers require a site visit prior to a qualifying storm event. Automated samplers utilize a peristaltic pump which delivers sample to jars within the unit. A mechanism moves the sample stream between jars according to user defined programmed events. This allows the sampler to take composite and grab samples. Teflon lined sample tubing is secured to a sampling intake screen which is typically mounted within a storm drain inlet upstream of a weir. A fluid sensor is secured just above the sample intake to initiate sampling once discharge is detected. A pressure transducer and Doppler velocity unit may also be secured beside the sample inlet to measure flow. The tubing and wiring is then routed to the auto-sampler. A rain gauge may be attached to the sampler to record rainfall, used to determine compliance with a qualifying event or to help establish flow. The ISCO Avalanche auto-sampler is equipped with a pH flow cell and thermometer for recording field parameters real time and a refrigerated sample storage compartment. Data obtained while samples are collected by the ISCO include pH, rainfall, temperature and flow. Samples are stored cool until retrieved. The Global WS750 sampler is triggered by flow but does not record the additional information.

Automated samplers require routine maintenance once deployed until samples are successfully obtained. It is recommended that samplers are visited on a weekly basis. Batteries need to be checked and replaced as needed, pH probes require calibration checks, sample inlets should be cleared of debris and sediment and tubing connections should be checked and replaced when faulty. Discharge events may trigger an auto-sampler that fail to meet the 0.1 inch qualifying event requirement. In this case, samples need to be removed, bottles cleaned and replaced and batteries recharged or replaced. Once a sampler has successfully obtained a qualifying sample, it should be removed from the sampling location, maintained and either deployed at another site or placed in storage.

Table 12-4 NPDES Permit S000257 Limitations and Monitoring Requirements for Storm Water Associated with Industrial Sites

Effluent Parameter (units)	Effluent Limitation {1}	Type of Sample {2}
Flow (gallons)	{4}	Calculated or Estimated
Biochemical Oxygen Demand (5-Day) (mg/l)	{4}	Composite {3}
Chemical Oxygen Demand (mg/l)	{4}	Composite {3}
Total Suspended Solids (mg/l)	{4}	Composite {3}
Total Phosphorus (mg/l)	{4}	Composite {3}
Total Nitrogen (mg/l) {5}	{4}	Composite {3}
Nitrate + Nitrite Nitrogen (mg/l)	{4}	Composite {3}
Oil and Grease (mg/l)	15	Grab {6}
pH Range (Standard Units)	{7} {8}	Grab {9}
Ammonia Nitrogen (mg/l)	{4}	Composite
Turbidity (0.1 NTU)	{4}	Grab
Dissolved Oxygen (0.1 mg/l)	{4}	Grab
Oxygen Saturation (1%)	{4}	Grab
Temperature (0.1 °C)	{4}	Grab
Copper (µg/l)	6+ (freshwater) 2.9 (saltwater)	Composite {3}
Zinc (µg/l)	22+ (freshwater) 95 (saltwater)	Composite {3}
Additional Toxic Pollutants {10}	{11}	{12}

mg/l = milligrams per liter = 1000 micrograms per liter (µg/l)

+ = The value listed as the minimum standard. Depending upon the receiving water CaCO₃ hardness, higher standards may be calculated using the respective formula in the U.S. Environmental Protection Agency publication Quality Criteria for Water (EPA 440/5-86-001, Revised May 1, 1987).

NOTES:

{1} Pollutant concentration levels shall not exceed the storm water discharge limits or be outside the ranges indicated in the table. Actual or measured levels which exceed those storm water discharge limits or are outside those ranges shall be reported to the CWB required in HAR, Chapter 11-55, Appendix B, Section 10(c) of December 6, 2013.

{2} The Permittee shall collect samples for analysis from a discharge resulting from a representative storm. A representative storm means a rainfall that accumulates more than 0.1 inch of rain and occurs at least 72 hours after the previous measurable (greater than 0.1 inch) rainfall event.

“Grab sample” means a sample collected during the first 15 minutes of the discharge.

“Composite sample” means a combination of at least two (2) sample aliquots, collected at periodic intervals. The composite shall be flow proportional; either the time interval between each aliquot or the volume of each aliquot must be proportional to the total flow

of storm water discharge flow since the collection of the previous aliquot. The Permittee may collect aliquots manually or automatically.

Samples for analysis shall be collected during the first 15 minutes of the discharge and at 15-minute intervals thereafter for the duration of the discharge, as applicable. If the discharge lasts for over an hour, sample collection may cease.

- {3} *If the duration of the discharge event is less than 30 minutes, the sample collected during the first 15 minutes of the discharge shall be analyzed as a grab sample and reported toward the fulfillment of this composite sample specification. If the duration of the discharge event is greater than 30 minutes, the Permittee shall analyze two (2) or more sample aliquots as a composite sample.*
- {4} *Monitor and Report. The value shall not exceed the applicable limit as specified in Chapter 11-54 for the applicable classification of the receiving state waters. If no limitation is specified in Chapter 11-54, then the Permittee shall monitor and report the analytical result. DOH may include discharge limitations specified in Section 11-55-19 and discharge limitations based on Federal Register, Vol. 73, No. 189, Pages 56572–56578, dated September 29, 2008.*
- {5} *The Total Nitrogen parameter is a measure of all nitrogen compounds in the sample (nitrate, nitrite, ammonia, dissolved organic nitrogen, and organic matter present as particulates).*
- {6} *The Permittee shall measure Oil and Grease using EPA Method 1664, Revision A.*
- {7} *The following pH limitations applies to discharge into state waters classified as inland streams:*
- (a) *For streams, pH shall not deviate more than 0.5 units from ambient conditions and shall not be lower than 5.5 nor higher than 8.0.*
- (b) *For the Pearl Harbor Estuary, pH shall not deviate more than 0.5 units from ambient conditions and shall not be lower than 6.8 nor higher than 8.8.*
- {8} *The pH limitation for discharge into state waters classified as marine open coastal waters and embayments shall not deviate more than 0.5 units from a value of 8.1, except at coastal locations where and when freshwater from stream, storm drain or groundwater discharge may depress the pH to a minimum level of 7.0.*
- {9} *The Permittee shall measure pH within 15 minutes of obtaining the grab sample.*
- {10} *Toxic pollutants, as identified in Appendix D of 40 CFR Part 122 (for JBPHH facilities whose storm water discharges are associated with industrial activity as listed in 40 CFR 122.26(b)(14)) or in HAR, Chapter 11-54, Section 11-54-4, need only be analyzed if they are identified by the Permittee as potential pollutants requiring monitoring in the SWPCP. The Permittee shall test for the total recoverable portion of all metals. If any toxic pollutant is detected equal to or greater than the discharge limitation, the Permittee shall revise the SWPCP, as necessary, to reduce the presence of the pollutant in the discharge of storm water to below the discharge limitation.*

- {11} *Effluent limitations are the acute water quality standards established in HAR, Section 11-54-4. For pollutants which do not have established acute water quality standards, monitoring results shall be reported.*
- {12} *Cyanide and the volatile fraction of the toxic organic compounds shall be sampled by grab sample. All other pollutants, as identified in Appendix D of the 40 CFR Part 122 or in HAR Section 11-54-4 shall be sampled by composite sample.*

12.7.1.3 Sample Transport

Once samples have been obtained, either manually or through automation, samples may need to be analyzed for pH, dissolved oxygen, oxygen saturation, temperature and turbidity using field equipment if the parameters were not measured by automated equipment or if they cannot be transported to the laboratory within the method holding times. Samples must then be transferred to appropriate laboratory provided bottles, placed in a cooler with ice and transported to an analytical laboratory. A chain of custody (see Section 12.8.2) must be filled out and accompany the samples. Sample containers, holding times and preservative requirements can be found in Table 12-5.

12.7.2 Analytical Requirements

The Permit requires that all sites be analyzed for the parameters listed in Table 12-4. In addition to the tests listed in the table, Additional Toxic Pollutants are required. These pollutants are determined during site visits as identified during the SWPCP process. Tables 12-7 and 12-8 describe chemical pollutants associated with significant materials from 40 CFR 122.26(b)(14) defined industrial activities that were encountered during site visits and documented in the SWPCP. Table 12-6 lists the cumulative potential toxic pollutants from sampling locations listed in Tables 12-1 and 12-2. Individual pollutant lists by sampling location are provided in Appendix 12-1.

Table 12-5 NPDES Permit S000257 Sample Container Requirements

Parameter Name ¹	Units	Methodology	Maximum Holding Time	Preservation	Container Type/ Size
TFH	mg/L	GC/FID	7 days (extract) 40 days (analysis)	4°C, pH<2, HCl	1x1 liter amber
TPH(D)	µg/L	GC/FID	7 days (extract) 40 days (analysis)	4°C, pH<2, HCl	1x4 oz amber
TPH(G)	µg/L	GC/FID	14 days (analysis)	4°C, pH<2, HCl	3x40 mL VOA
O&G	mg/L	gravimetric	7 days (extract)	4°C, pH<2, H ₂ SO ₄	1x1 liter amber
VOCs	µg/L	GC/MS	14 days	4°C	3x40 mL VOA
BTEX	ug/L	GC/PID	14 days	4°C	3x40 mL VOA
PAHs	µg/L	GC/MS	7 days (extract) 40 days (analysis)	4°C, Na ₂ S ₂ O ₃ day K	1x1 liter amber
MBAS	mg/L	Colorimetric	48 hours	4°C	1x25 mL
Carb	µg/L	HPLC	7 days (extract) 40 days (analysis)	4°C	1x1 liter amber
Herb	µg/L	GC/ECD	7 days (extract) 40 days (analysis)	4°C	1x1 liter amber
GEs	mg/L	GC/MS	14 days	4°C	3x40 mL VOA
Alcs	mg/L	GC/MS	14 days	4°C	3x40 mL VOA
metals	µg/L	ICP	6 months	pH<2, HNO ₃	500 mL plastic
BOD5	mg/L	Electrode	48 hours	4°C	1000 mL plastic
COD	mg/L	Photo Spectroscopy	28 days	4°C, pH<2, H ₂ SO ₄	50 mL plastic
TKN	mg/L	IC	28 days	4°C, pH<2, H ₂ SO ₄	500 mL plastic
NH ₄ ⁺	mg/L	Colorimetric	14 days	4°C, pH<2, H ₂ SO ₄	500 mL plastic
Nitrate & Nitrite	mg/L	Colorimetric	28 days	4°C	500 mL plastic
Total P	mg/L	ICP	28 days	4°C, pH<2, H ₂ SO ₄	500 mL plastic
TSS	mg/L	Gravimetric	7 days	4°C	100 mL plastic

Notes.

1. Alcs	- Alcohols	GC	- Gas chromatography	Ten	- Metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Se,
BOD5	- Five-Day Biochemical Oxygen Demand	GEs	- Glycol esters	Metal	Ag, Zn) analysis by inductively coupled plasma atomic emission spectroscopy method and atomic absorption spectroscopy method
BTEX	- Benzene, Toluene, Ethylbenzene, Xylene	Herb	- Chlorinated Herbicides	s	- Total fuel hydrocarbons
Carb	- Carbamates	ICP	- Inductively coupled plasma atomic emission spectroscopy	TFH	- Total Kjeldahl Nitrogen
COD	- Chemical Oxygen Demand	MBAS	- Methylene blue active substances	TKN	- Total petroleum hydrocarbons (as diesel)
Dup RPD	- Duplicate Relative Percent Difference	mg/L	- Milligrams per Liter	TPH(D)	- Total petroleum hydrocarbons (as gasoline)
ECD	- Electron Capture Detection	MS	- Mass spectrometry	TPH(G)	- Total Suspended Solids
EDTA	- Ethylenediaminetetraacetic acid	MS RPD	- Matrix spike relative percent difference	TSS	- Total Dissolved Solids
FID	- Flame ionization detection	NH4+	- Ammonium	TDS	- Micrograms per Liter
		O&G	- Oil and Grease	ug/L	- Volatile Organic Compounds
		P	- Phosphorous	VOCs	

Table 12-6 Analytical Parameters, Methodologies and Detection Levels

Parameter	Method	Detection Level (mg/L)
Basewide Requirements		
BOD5	SM5210B	2.0
COD	410.2	10
TSS (Total Suspended Solids)	SM 2540D	2.0
Total Phosphorous	365.2, 365.1, 365.3	0.02
Total Nitrogen = TKN + Nitrate/Nitrite	Summation	N/A
TKN	351.2	0.1
Nitrate & Nitrite	353.2	0.0015
Oil and Grease	1664 A	2.0
pH	150.1, 4500-H ⁺ B FM	N/A
Ammonia	350.1	0.001
Turbidity	180.1	0.1 (NTU)
Dissolved Oxygen	SM4500-O FM	0.1
Oxygen Saturation	Calc FM	(1%)
Temperature	SM 2550B FM	1 °C
Cu (Copper)	200.8 low level	0.002
Zn (Zinc)	200.8 low level	0.09
Toxic Pollutants as determined by SWPCP		
TPH		
TFH - TPH(D) + TPH(G)	Summation	N/A
TPH (Diesel)	8015	0.1
TPH (Gas)	8015	0.1
BTEX		
Benzene	624	0.001
Toluene	624	0.001
Ethylbenzene	624	0.001
Total Xylenes	624	0.001
MBAS	425.1, SM 18 th 5540 C	0.1
Carbamates		
Carbaryl (Sevin)	TLC, 632	0.005
Carbofuran (Furadan)	632	0.005
Methiocarb (Mesurol)	TLC, 632	0.005
Methomyl (Lannate)	632	0.005
Oxamyl (Vydate)	632	0.005
Propoxur (Baygon)	TLC, 632	0.005
Chlorinated Herbicides:		
2,4-D	8151A	0.0002
Dalapon	8151A	0.0002
Dinoseb	8151A	0.0002

Parameter	Method	Detection Level (mg/L)
Alcohols and Esters		
Glycol Esters: Ethylene Glycol	8015B, 8260M	25
Alcohols: Isopropyl Alcohol	8015B, 8260M	5
Reactive Parameters		
Cyanide, Total mg/kg	335.3	0.1
Sulfide	SM4500-S2	0.1
Other Metals		
Titanium	200.8 low level	0.25
Iron	200.8 low level	0.1
Aluminum	200.8 low level	0.7
Magnesium	200.8 low level	0.1
Ten Metals		
As (Arsenic)	200.8 low level	0.06
Cd (Cadmium)	200.8 low level	0.04
Cr (Chromium)	200.8 low level	1
Pb (Lead)	200.8 low level	0.1
Hg (Mercury)	245.1	0.002
Ni (Nickel)	200.8 low level	0.09
Se (Selenium)	200.8 low level	0.25
Ag (Silver)	200.8 low level	0.002
PAHs		
Acenaphthene	625	0.01
Benzo (a)pyrene	625	0.01
Fluoranthene	625	0.01
Naphthalene	625	0.01
Solvents		
Halogenated Volatile Organic Compounds	624	0.001
Semivolatiles	625	0.001

Table 12-7 Organic Analytical Parameters Associated with Potential Pollutants

Potential Pollutant	Analytical Parameter																
	TFH	TPH(D)	TPH(G)	TPH(IR)	O&G	PCBs	VOCs	BTEX	MBAS	Carb	Herb	GEs	Alcs	Expls	PAHs	Fec. Col.	Fec. Str.
Adhesives/Resins/Glue							X								X		
Alcohols													X				
Algicides											X						
Antifreeze/Coolant												X					
Caustics															X		
Detergents/Surfactants									X								
Dielectric/Electrolytes						X											
Diesel Fuel		X													X		
Explosives														X			
Firefighting Foam									X			X					
Freon					X												
Gasoline			X					X							X		
Hydraulic/Calibration Fluid	X																
Jet Fuel		X															
Kerosene	X																
Lubricants					X												

Potential Pollutant	Analytical Parameter																
	TFH	TPH(D)	TPH(G)	TPH(IR)	O&G	PCBs	VOCs	BTEX	MBAS	Carb	Herb	GEs	Alcs	Expls	PAHs	Fec. Col.	Fec. Str.
Metal Cleaners	X																
Oil & Grease					X										X		
Paint Thinner	X																
Paint/Varnish															X		
Pesticides/ Herbicides										X	X						
Photographic Chemicals							X										
Sanitary Waste																X	X
Solvents	X																
Tar				X													
Transformer Oil						X											
Used Oil					X												
Wash Water					X				X								

- Notes:
- Alcs - Alcohols
 - BTEX - Benzene, toluene, ethylbenzene, total xylenes
 - Carb - Carbamates
 - Expls - Explosives (nitroaromatics & nitroamines)
 - Fec. Col. - Fecal Coliform
 - Fec. Str. - Fecal Streptococci
 - GEs - Glycol esters
 - Herb - Chlorinated herbicides
 - MBAS - Methylene blue active substances
 - O&G - Oil and Grease
 - PAHs - Poly Aromatic Hydrocarbons
 - PCBs - Polychlorinated biphenyls
 - TFH - Total fuel hydrocarbons
 - TPH(D) - Total petroleum hydrocarbons (as diesel)
 - TPH(G) - Total petroleum hydrocarbons (as gasoline)
 - TPH(IR) - Total petroleum hydrocarbons (as infrared spectroscopy)
 - VOCs - Volatile organic compounds

Table 12-8 Inorganic and General Analytical Parameters Associated with Potential Pollutants

Potential Pollutant	Analytical Parameter																		
	Cu	Cr	Hg	Ag	Ti	Pb	Cd	Ten Metals	pH	NH ₄ ⁺	Nitrate & Nitrite	Total P	Sulfate & Sulfite	Anions & Cations	Resid. Cl ₂	Asb.	SC	TSS	TDS
Acids								X	X										
Algicides	X																		
Anti-Freeze/Coolant	X																		
Asbestos																X			
Caustics									X					X					
Chlorine/Sodium Hypochlorite															X				
Chromate		X							X										
Detergents/Surfactants									X										
Dielectric/Electrolytes								X											
Fertilizers										X	X	X	X						
Gypsum													X	X					
Lead						X													
Lubricants								X											
Metal Cleaners								X	X										
Oxidizers								X	X										
Paint Chips	X					X												X	
Paint/Varnish	X				X														
Photographic Chemicals			X	X							X								
Salts									X					X			X		X
Sandblasting Waste Solids								X										X	X
Sanitary Waste										X									
Sediment																		X	X
Tar								X											

Potential Pollutant	Analytical Parameter																			
	Cu	Cr	Hg	Ag	Ti	Pb	Cd	Ten Metals	pH	NH ₄ ⁺	Nitrate & Nitrite	Total P	Sulfate & Sulfite	Anions & Cations	Resid. Cl ₂	Asb.	SC	TSS	TDS	
Ten Metals								X												
Transformer Oil								X												
Used Oil								X												

Notes:

- Ag Silver
- Anions & Cations HCO₃⁻, CO₃⁻², Cl⁻, SO₄⁻², NO₃⁻, F⁻, OH⁻, Na⁺, K⁺, Ca⁺², Mg⁺²
- Asb. Asbestos
- Cr Chromium (total)
- Cu Copper
- Hg Mercury
- NH₄⁺ Ammonium
- P Phosphorus
- Resid Cl₂ Residual Chlorine
- SC Specific Conductance
- Ten Metals Metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Zn) analysis by inductively coupled plasma atomic emission spectroscopy method and atomic absorption spectroscopy method.
- Ti Titanium
- TSS Total Suspended Solids
- TDS Total Dissolved Solids

12.8 Quality Assurance/Quality Control

A thorough Quality Assurance/Quality Control (QA/QC) plan is an essential component of a monitoring program, involving extensive field sampling and laboratory analyses. Because of the inherent variability in storm water samples, it is important to minimize additional uncertainties that may be introduced by sample handling and analytical techniques. This section describes the major elements of the QA/QC plan as related to sampling procedures and to methods of chemical analyses performed in the monitoring program. The plan fulfills the QA/QC requirements of the Permit.

The objectives of the QA/QC plan are to assure that: (1) all elements of the monitoring program are conducted, and (2) all monitoring is conducted by trained personnel. Implementation of a sound QA/QC plan ensures that the data collected are of high quality and defensible in court. QA/QC procedures will be followed in all phases of the monitoring program including sampling, laboratory analysis, and data reporting/validation. This plan includes elements to address both sampling and analytical concerns including sample contamination, variability, accuracy, and precision.

12.8.1 Field Sample Procedures

Adherence to proper sampling preparation, sample handling, and laboratory procedures is essential to maintaining data quality and integrity. This section details the required standard operating procedures for sampling and sample handling as set forth by the EPA.

12.8.1.1 Reconnaissance and Preparation

Representative sampling sites have been selected in accordance with feasibility, accessibility, and safety constraints. Communication with laboratories will be established and a Sampling Field Notebook will be prepared, as described in Section 12.8.1.2 noted below. Field teams will be trained by experienced personnel. Supervisors will be responsible for coordination of sampling efforts and for preparedness of teams.

12.8.1.2 Sampling Field Notebook

A specific Sampling Field Notebook will be prepared and kept on file. The Sampling Field Notebook will contain the following items and procedures:

- List of equipment
- Location (map and description) of sampling point(s)
- Field Data Sheets
- Field sampling instructions
- Sample packing, transfer, and tracking (chain-of-custody) instructions and forms

These procedures will be followed by the field personnel in all phases of the field monitoring program. Personnel with field experience in storm water sampling will be responsible for training field sampling personnel.

12.8.2 Chain-of-Custody Procedures

All sample custody and transfer procedures will follow EPA-recommended procedures and emphasize careful documentation of sample collection and handling processes, including transfer of sample and chain-of-custody details such as sample date and time, number of sample containers and sampling method required. Field teams will adhere to proper chain-of-custody and documentation procedures for all sampling operations. Preformatted sample and chain-of-custody forms will be used to document the

relevant information for each sample bottle and the transfer of bottles to the laboratory. An example of a completed chain-of-custody form is shown in Exhibit 12-1.

12.8.3 Laboratory Procedures

Analysis for the routine parameters will be performed by a qualified laboratory. A qualified laboratory shall meet ISO17025 requirements. The laboratory must make every effort to meet target detection limits, holding times, and sample preservation techniques. The laboratory shall provide a written QA/QC report addressing any deviations from the QA/QC requirements.

12.8.3.1 Accuracy

Laboratory accuracy can be assessed through performance and evaluation programs, and/or a certification of performance. As an alternative, the use of “blind” standard reference samples supplied by Environmental Resource Associates (ERA) and through the analysis of laboratory-prepared matrix spike samples, or “internal standards”, can be used. Blind ERA reference samples would be analyzed once every quarter in which samples are analyzed. A goal of five percent of the samples shall be analyzed as matrix spike duplicates. For the matrix spike duplicate, a known standard analyte concentration is first spiked, or added, to an original sample and then duplicated. The accuracy of the analytical methods is evaluated from the results of the analytical recoveries of the first, or matrix spike, and second, or matrix spike duplicate spikes.

12.8.3.2 Precision

Laboratory precision must be assessed through the analysis of laboratory duplicates, for example analysis of two portions derived from the same sample, at the frequency of 10 percent of the samples. In addition, five percent of the samples will be analyzed for matrix spike duplicates as described above.

12.8.3.3 Laboratory Blanks

Sample contamination resulting from laboratory analysis procedures or sample storage methods will be assessed through the use and analysis of laboratory blanks and equipment blanks. Laboratory blanks, including reagent and/or method, shall be reported for each day samples are analyzed.

12.8.3.4 Completeness

All reported analyses will be evaluated against the requested analyses to assess the completeness of the analytical characterization of the water samples. Any missing data will be accounted for by the laboratory or field programs, with an overall goal of 95 percent completeness.

12.8.4 Data Reduction, Validation, and Reporting

Overall data quality will be assessed by laboratory personnel responsible for QA/QC based on sampling and analytical conditions, adherence to internal QC procedures, and results of accuracy and precision checks. Actual detection limits will be reported in the final analytical report summary along with the results of the external QA samples, field duplicates, laboratory duplicates, matrix spike duplicates, and equipment and reagent blanks. Corrective action will be identified if necessary.

Exhibit 12-1 Sample Chain of Custody Form

Client Contact		Project Manager: Matt Neal		Site Contact: Matt Neal		Date: 12/22/14		COC No:														
Element Environmental llc 99-030 Hekaha St. Unit 9 Aiea, HI 96701 (808) 489-1200 Phone (808) 489-1300 FAX Project Name: Navy Stormwater Site: PWC1-2014 P O #		Tal/Fax:		Lab Contact:		Carrier:		_____ of _____ COCs														
Sample Identification		Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Performs MS/MSD (Y/N)	Total Suspended Solids EPA 160.1	Total Dissolved Solids EPA 160.1	TKN EPA 361.4 Total N calc	Nitrate-Nitrite as N 353.2	Total Phos 365.1	Oil and Grease 1684	BTEX by EPA 824	GRO 8016	DRO/ RRO 8016	As, Cd, Cr, Cu, Pb, Ni, Se, Ag, Zn, Ti 200.7	Mercury by 245.1	H Hawaii PAHs by 625	Sample Specific Notes:	
PWC-1		12/22/2014	8:56	G	SW	13	N															
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other																						
Possible Hazard Identification: Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample. <input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown										Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) <input type="checkbox"/> Return to Client <input type="checkbox"/> Disposal by Lab <input type="checkbox"/> Archive for _____ Months												
Special Instructions/QC Requirements & Comments: 4 Hawaii PAHs include Acenaphthene, Benzo(a)pyrene, Flouranthene, Napthalene																						
Custody Seals Intact: <input type="checkbox"/> Yes <input type="checkbox"/> No		Custody Seal No.:		Cooler Temp. (°C): Obs'd: _____ Com'd: _____		Therm ID No.:																
Relinquished by:		Company:		Date/Time:		Received by:		Company:		Date/Time:												
Relinquished by:		Company:		Date/Time:		Received by:		Company:		Date/Time:												
Relinquished by:		Company:		Date/Time:		Received in Laboratory by:		Company:		Date/Time:												

Form No. CA-C-WI-002, Rev. 4.3, dated 12/05/2013

12.8.5 Reporting Requirements

An Annual Report, which will include a Monitoring Report, shall be submitted to DOH by January 31st of each year of the permit. Monitoring reporting will be completed in accordance with the Permit. Storm water monitoring results shall be submitted on a DOH discharge monitoring report. Monitoring results exceeding the effluent limitations shall be reported to the Director of DOH CWB as soon as the results become available, but in no case later than 60 days after the samples were taken.

12.9 Analytical Requirements, Map and Sampling Information by Monitoring Location

Appendix 12-1 provides detailed information for field personnel to identify the appropriate analysis to perform for each sample location, identify sampling locations in relationship to permitted facilities with map oriented photos of each location and relevant information to successfully sample each location. Individual site descriptions are provided and justification is presented for sites listed on the permit that are no longer viable.

12.10 Other Permit-identified Sites

Based on the 2016 site visits, NAVFAC Hawaii is recommending the removal of eight (8) sites from the monitoring requirements. A brief discussion about the conditions and activities at these sites are provided in Appendix 12-2.

13 Reporting Requirements

In accordance with the Permit, Part G, and 40 CFR §122.42(c), NRH is required to submit two (2) Annual Reports to DOH by January 31st of each year. These reports include the following:

1. An Annual Report, which includes documentation of all SWMP activities during the previous calendar year and demonstrates compliance with the Permit with respect to various activities and milestones.
2. An Annual Monitoring Report, which documents the sampling events, data collection and water quality assessments described in Chapter 12, Monitoring Requirements, including Discharge Monitoring Reports (DMR) for industrial facilities, if needed.

Well-maintained records management and clear reporting formats are necessary for regulatory compliance. They are also useful for the assessment of the effectiveness of the storm water management program.

In addition to the annual reporting requirements, certain updates to the SWMP may occur at any time during the permit period. As stated in Part D.2 and D.3 of the Permit, NRH is also required to report any of the following SWMP modifications:

1. If the discharge from the Small MS4 exceeds of any discharge limitation or water quality standard established in HAR, Section 11-54-4, revisions, as necessary, shall include BMPs and/or measures to reduce the amount of pollutants found to be in exceedance from entering State Waters.
2. Change in conditions and incorporation of more effective approaches to pollutant control.
3. System modifications, including any planned physical alterations or additions to the permitted MS4 and any existing outfalls newly identified over the term of the permit.

The Permit describes the reporting requirements as follows:

Permit Reference	SWMP Section
<p>Part G.1 Industrial Storm Water Report <i>DMRs for industrial storm water collected pursuant to Part F.2 of this Permit shall be submitted within 60 calendar days of sample collection and be submitted via NetDMR once established by the DOH. NetDMR is a Web-based tool that allows NPDES permittees to electronically sign and submit their DMRs to EPA's Integrated Compliance Information System (ICIS-NPDES) via the Environmental Information Exchange Network. A DMR must be submitted for the facility which is scheduled to be monitored even if sampling was not conducted. If monitoring is not conducted, the DMR shall be submitted with the Annual Monitoring Report. An explanation as to why sampling was not conducted shall be explained with the submittal.</i></p>	Section 13.1
<p>Part G.2 Annual Report <i>a. The Permittee shall submit the Annual Report by January 31st of each year in pdf format (minimum 300 dpi) in accordance with Part A.7. The Annual Report shall cover the past calendar year.</i></p>	Section 13.2 and Section 13.6

<p>b. <i>The Permittee shall revise its SWMP to include a description of reporting procedures and activities, including schedules and proposed content of the Annual Reports such that, at a minimum, the following is reported for each storm water program component in each Annual Report:</i></p> <p>(1) <i>Requirements - Describe what the Permittee was required to do (describe status of compliance with conditions of this permit and other commitments set forth in the SWMP).</i></p> <p>(2) <i>Past Year Activities - Describe activities over the reporting period in comparison to the requirements, including, where applicable, progress accomplished toward meeting specific measurable goals, standards and milestones or other specific performance requirements. When requirements were not fully met, include a detailed explanation as to why the Permittee did not meet its commitments for the reporting period. Also describe an assessment of the SWMP, including progress towards implementing each of the SWMP program components.</i></p> <p>(3) <i>Future Activities - Describe planned activities, including, where applicable, specific activities to be undertaken during the next reporting period toward accomplishing specific measurable goals, standards and milestones or other specific performance requirements.</i></p> <p>(4) <i>Resources - Report on the status of the Permittee's resource base for implementing this NPDES permit during the applicable reporting period and an estimate of the resources over and above those required in the current reporting period that will be required in the next reporting period.</i></p> <p>c. <i>Modifications - In each Annual Report, the Permittee shall describe any modifications made to the SWMP and implementation schedule during the past year, including justifications. The Permittee shall also describe major modifications made to the Permittee's Small MS4, including, but not limited to, addition and removal of outfalls, drainage lines, and JBPHH facilities that impact water quality in the receiving waters or the implementation of the SWMP.</i></p> <p>d. <i>Program Effectiveness Reporting - Within one (1) year of the effective date of the permit, the Permittee shall submit to DOH a written strategy for determining effectiveness of its SWMP. The strategy shall include water quality monitoring efforts as well as program implementation information and other indicators. The Permittee shall include an assessment of program effectiveness and identification of water quality improvements or degradation beginning with the 2nd Annual Report.</i></p>	
<p>Part G.3 Annual Monitoring Report</p>	<p>Section 13.3</p>

As part of the Annual Report, the Permittee shall submit an Annual Monitoring Plan by January 31st of each year in pdf format (minimum 300 dpi) in accordance with Part A.7. The Annual Monitoring Report shall cover the past calendar year.

The monitoring report shall at a minimum, include the following items:

- a. Discussion on the activities/work implemented to meet each objective, as outlined in Part F.1.a., including any additional objectives identified by the Permittee, and the results [e.g., assessment of the water quality issues in each watershed resulting from storm water discharges, refer to Part F.1.a.(vii)] and conclusions.*
- b. Written narrative of the past calendar year's activities, including those coordinated with other agencies, objectives of activities, results and conclusions.*
- c. Data gathered on levels of pollutants in non-storm water discharges to the Small MS4; and*
- d. Using rainfall data collected by the Permittee and other agencies, the Permittee shall relate rainfall events, measured pollutant loads, and discharge volumes from the watershed and other watersheds that may be identified from time to time by the Director or Permittee.*
- e. The date when monitoring occurred for each municipal industrial facility covered under this permit. The monitoring event shall be of a representative storm event, where results were available for all required parameters following the QA/QC measures as described in your Annual Monitoring Plan.*
- f. A summary of all data collected for Industrial Facilities, and a compliance summary, shall be included in the Annual Monitoring Report. In each Annual Monitoring Report the Permittee shall include a summary of the industrial storm water data with a comparison of the monitoring results to applicable effluent limitations. The Permittee shall highlight each exceedance of applicable effluent limitations, and provide a discussion regarding the perceived causes of the exceedances and potential corrective actions necessary to comply with all applicable effluent limitations. The Annual Monitoring Report shall include a discussion regarding the feasibility to implement the identified potential corrective actions to comply with applicable effluent limitations, and specify if the corrective actions have been implemented into the SWMP or SWPCP.*
- g. A summary of all data collected pursuant to Part F.3 of this Permit, and a comparison of the applicable WLAs and measured loading for turbidity and total nitrogen. The Permittee shall provide a detailed description of monitoring activities and compliance determination with the applicable WLAs. Any WLA exceedances shall be highlighted. Corrective actions to meet the applicable WLAs shall be discussed for each exceedance, including the type of*

<p><i>corrective action necessary, the feasibility of implementation, and a time frame for implementation.</i></p>	
<p>Part G.4 WLA Completion Report for the North Fork of Kaukonahua Stream <i>The Permittee shall submit to DOH a WLA Completion Report for the North Fork of Kaukonahua Stream by October 31, 2016. The WLA Completion Report shall be made available on the Permittee's website for public review and comment. The report shall include at a minimum the following:</i></p> <ul style="list-style-type: none"> <i>(i) A map of the Small MS4 and drainage area to the North Fork of Kaukonahua Stream, which identifies collection areas, all outfalls, monitoring locations, and receiving waters.</i> <i>(ii) An inventory of the types of industrial activities that may impact storm water runoff quality.</i> <i>(iii) Detailed information on the activities to be implemented to maintain compliance with the applicable WLAs.</i> <i>(iv) Monitoring data, calculations, a comparison of applicable WLAs and measured loadings, and summary of the evaluation methodology and findings.</i> 	<p>Section 13.4</p>

13.1 Industrial Storm Water Reports

DMRs for industrial storm water collected pursuant to Part F.2 of this Permit will be submitted within 60 calendar days of sample collection. A DMR must be submitted for all facilities scheduled for monitoring. If monitoring is not conducted, the DMR will be submitted with the Annual Monitoring Report. An explanation as to why sampling was not conducted will be explained with the submittal.

13.2 Annual Reports

The structure of the annual report will be consistent with the structure of this SWMP.

The Annual Report chapters are organized by program element, as follows:

- Public Education and Outreach, including Public Involvement/Participation;
- Illicit Discharge Detection and Elimination;
- Construction Site Runoff Control;
- Post-Construction Storm Water Management in New Development and Redevelopment;
- Pollution Prevention/Good Housekeeping;
- Industrial and Commercial Activities Discharge Management; and
- Monitoring.

Each chapter in the Annual Report contains the following information:

- Requirements - Status of compliance with permit requirements and commitments set forth in this SWMP,
- Past year's activities,
- Future activities,
- Resources – resource base for the current and future reporting period,
- Modifications – any changes to the SWMP, schedule, and/or the MS4, and

- Program effectiveness reporting – evaluation of activities and collected information to assess the effectiveness of past SWMP activities and to refine future decision making regarding resource allocation and program implementation.

Part D.3. of the permit states, *“The Permittee shall properly address all modifications, concerns, requests, and/or comments to the satisfaction of the DOH and/or EPA... Minor changes may be proposed by the Permittee or requested by DOH or the EPA. Proposed changes that imply a major reduction in the overall scope and/or level of effort of the SWMP must be made for cause and in compliance with 40 CFR §122.62 and Part 124. A written report shall be submitted to the Director of Health (Director) for acceptance at least 30 calendar days prior to the initiation date of the major modification. The Permittee shall report and justify all other modifications made to the SWMP in its Annual Report for the year in which the modification was made.”*

The Annual Report will be reviewed by the EV Director. Upon approval/concurrence, the report will be submitted through the CWB Compliance Submittal Form for Individual NPDES Permits and Notice of General Permit Coverages (NGPCs), as outlined in Part A.7 of the permit. This form is accessible through the e-Permitting Portal website at:

<https://eha-cloud.doh.hawaii.gov/epermit/View/home.aspx>

13.3 Annual Monitoring Reports

Annual monitoring reports will be completed in accordance with the Permit and the Monitoring Plan, as described in Chapter 12 of this SWMP. The report will include a summary of collected data and an assessment of the results.

The Annual Monitoring Report will be reviewed by the EV Director. Upon approval/concurrence, the report shall be submitted through the CWB Compliance Submittal Form for Individual NPDES Permits and Notice of General Permit Coverages (NGPCs), as outlined in Part A.7 of the permit. This form is accessible through the e-Permitting Portal website at:

<https://eha-cloud.doh.hawaii.gov/epermit/View/home.aspx>

Monitoring results exceeding the effluent limitations will be reported to DOH CWB as part of the DMRs.

13.4 WLA Completion Report for the North Fork of Kaukonahua Stream

EV will submit to DOH a WLA Completion Report for the North Fork of Kaukonahua Stream by October 31, 2016. The WLA Completion Report will be made available via NRH's storm water webpage, as allowable, for public review and comment. The report will include at a minimum the following:

- (i) A map of the Small MS4 and drainage area to the North Fork of Kaukonahua Stream, which identifies collection areas, all outfalls, monitoring locations, and receiving waters.
- (ii) An inventory of the types of industrial activities that may impact storm water runoff quality.
- (iii) Detailed information on the activities to be implemented to maintain compliance with the applicable WLAs.

- (iv) Monitoring data, calculations, a comparison of applicable WLAs and measured loadings, and summary of the evaluation methodology and findings.

13.5 Records Management

The SWMP and supporting records are considered public documents under Section 308(b) of the CWA. Therefore, any member of the public may request to review NRH's storm water permit documentation. Additionally, the SWMP and supporting data will need to be made available upon request of a representative of the EPA and DOH, as allowable by security concerns.

Copies of the SWMP, annual reports, monitoring information, and data pertaining to the Permit must be retained at the EV office for a minimum period of five years from the date of measurement, observation, report, or application. The above may be made available to the public upon request; however, any information that is deemed sensitive (and the release of which would be harmful to a government or private interest) cannot be released and is exempt from the Freedom of Information Act.

As noted in Chapter 1, the designated record keeper role on the permit management team is responsible for archiving all documents associated with the SWMP, including the site map, inspection reports, maintenance records, and annual reports.

13.6 Written Strategy for Determining the Effectiveness of the SWMP

The Program Effectiveness Assessment Plan, dated March 2016 and submitted to DOH CWB on March 30, 2016, presents the strategy for:

- (1) measuring progress of permit compliance and implementation of BMPs;
- (2) tracking program component effectiveness over the permit period; and
- (3) setting the frame work to be able to link program implementation with environmental improvements over time.

See Appendix 13-1.

APPENDIX 1-1

Final Permit and Rationale

Navy Region Hawaii Permit No. HI S000257

Effective Date of Permit: March 23, 2015

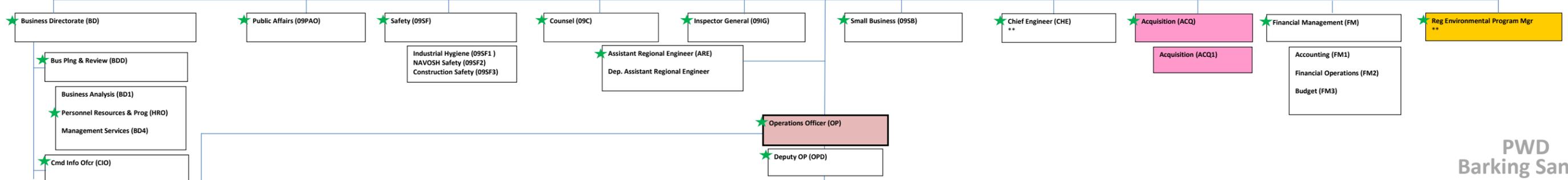
[Redacted due to national security concerns]

APPENDIX 1-2

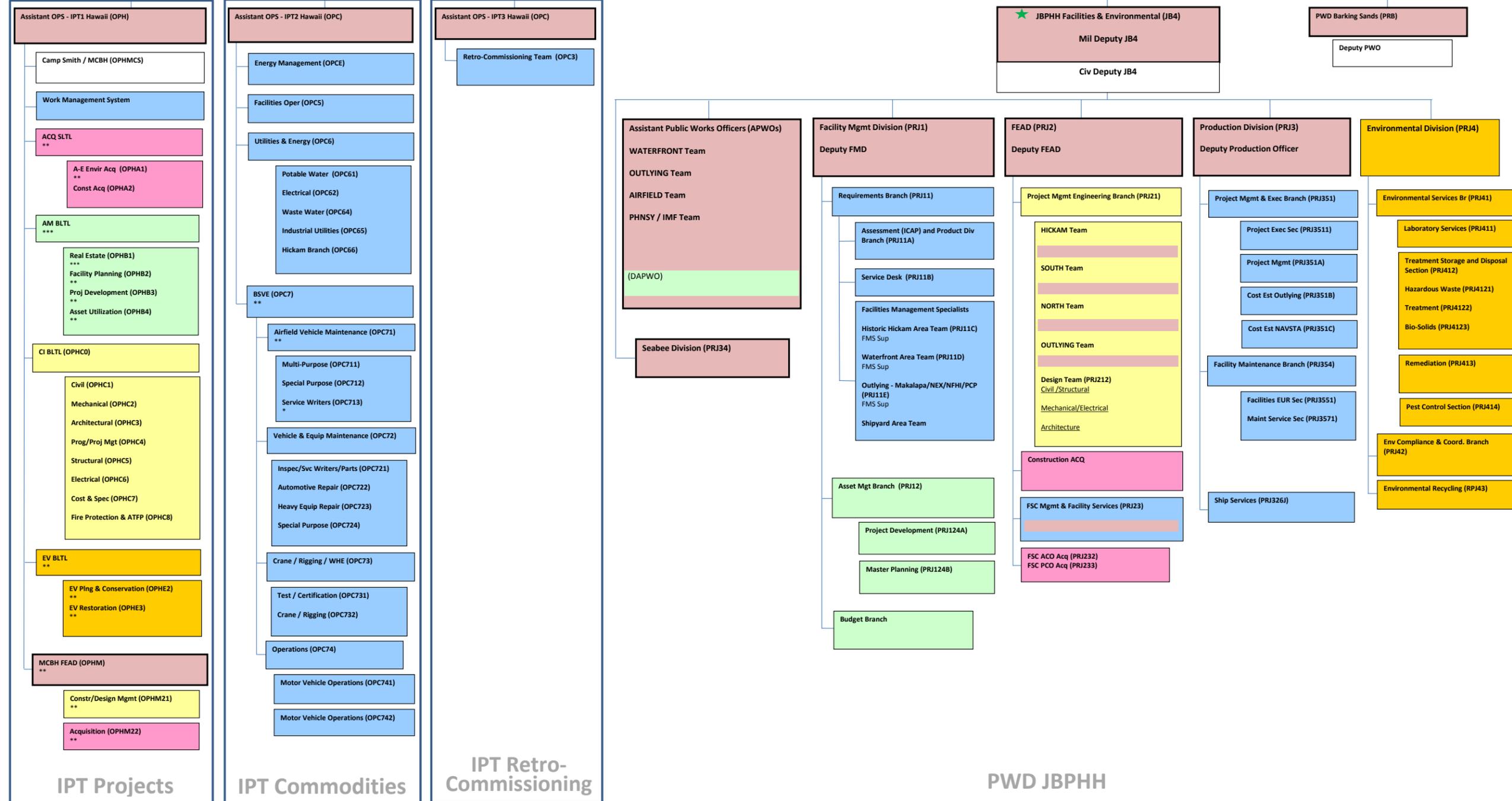
Navy Region Hawaii Organizational Chart

NAVFAC HI Organizational Chart
25 March 2016

★ Commanding Officer (00) / Regional Engineer (RE)
★ Executive Officer (09) / Deputy Regional Engineer (DRE)



PWD Barking Sands



Business Lines

LEGEND

- Military
- Asset Management
- Capital Improvements
- Public Works
- Environmental
- Acquisition

★ ESG Members
** Double-Hatted Employee
*** Triple-Hatted Employee

For Official Use Only

APPENDIX 3-1

BMPs for Allowable Non-storm Water Discharge

NOTE: In the event that any of the listed discharges is observed or expected to be significant sources of pollutants to the MS4, the discharge will no longer be allowed.

BMPs FOR ALLOWABLE NON-STORM DISCHARGE

Allowable Discharge	BMP Water Description
Water line flushing <i>(including steamline condensate and flushing)</i>	If applicable, clean pavement surfaces of dust, debris, or other pollutants prior to discharge to the paved surface, street gutter, or drainage ditch. If possible, discharge to vegetated, pervious areas that do not have high erosion potential.
Landscape irrigation	Reduce watering demand by watering during the cool part of the day. Follow manufacturer's application instructions to prevent excessive herbicide and/or pesticide use.
Diverted stream flows	BMPs not applicable
Rising ground waters	BMPs not applicable
Uncontaminated ground water infiltration (as defined in 40 CFR §35.2005(20))	Install temporary pollution prevention measures (sandbags, plastic sheets, hay bales, silt fences, sediment traps/basins, etc.) at drainage inlets or conveyances, where possible, prior to discharge. If possible, place sandbags, silt fences, or hay bales around drainage inlets prior to discharge and/or discharge to vegetated, pervious areas that do not have high erosion potential.
Uncontaminated pumped ground water, not including construction related dewatering activities	Clean pavement surfaces of dust, debris, or other pollutants, and remove any oil sheen or slick prior to discharge to paved surface, street gutter, or drainage ditch. If possible, place sandbags, silt fences, or hay bales around drainage inlets prior to discharge and/or discharge to vegetated, pervious areas that do not have high erosion potential.
Discharges from potable water sources and foundation and footing drains <i>(including emergency eye wash basins and showers, and drinking fountains on piers)</i>	Waterline Flushing: Clean pavement surfaces of dust, debris, or other pollutants prior to discharge to the paved surface, street gutter, or drainage ditch. If possible, discharge to vegetated, pervious areas that do not have high erosion potential. Emergency Eye Wash and Shower and Drinking Fountains: Quantity of discharge will be very small. Pollution potential negligible for NRH.

NOTE: In the event that any of the listed discharges is observed or expected to be significant sources of pollutants to the MS4, the discharge will no longer be allowed.

BMPs FOR ALLOWABLE NON-STORM DISCHARGE

Allowable Discharge	BMP Water Description
Condensate – air conditioning, ice machines, and air compressors	Quantity of discharge will be very small. Pollution potential negligible for NRH
Irrigation water	Reduce watering demand by watering during the cool part of the day. Follow manufacturer's application instructions to prevent excessive herbicide and/or pesticide use.
Springs	BMPs not applicable
Water from crawl space pumps, uncontaminated water from utility manholes or boxes, and footing drains <i>(including discharge from buildings with basements, and crawl space pumps used by utility companies to dewater utility manholes and other maintenance and operations substructure facilities)</i>	Clean pavement surfaces of dust, debris, or other pollutants, and remove any oil sheen or slick prior to discharge to paved surface, street gutter, or drainage ditch. If possible, place sandbags, silt fences, or hay bales around drainage inlets prior to discharge and/or discharge to vegetated, pervious areas that do not have high erosion potential.
Water from individual residential car washing	Wash cars at designated wash areas. Minimize detergent use and do not wash engine components. Pavement surfaces where cars are being washed shall be cleaned by sweeping and removing debris and other pollutants prior to the car wash activity. For charity car washes, BMPs have been developed and will be implemented during these events.
Water from charity car washes	Wash cars at designated wash areas. Minimize detergent use and do not wash engine components. Pavement surfaces where cars are being washed shall be cleaned by sweeping and removing debris and other pollutants prior to the car wash activity. For charity car washes, BMPs have been developed and will be implemented during these events.
Flows from riparian habitats and wetlands	BMPs not applicable

NOTE: In the event that any of the listed discharges is observed or expected to be significant sources of pollutants to the MS4, the discharge will no longer be allowed.

BMPs FOR ALLOWABLE NON-STORM DISCHARGE

Allowable Discharge	BMP Water Description
Dechlorinated swimming pool discharges	Dechlorinate water prior to discharge. Clean pavement surfaces of dust, debris, or other pollutants prior to discharge to paved surface, street gutter, or drainage ditch. If possible, discharge to vegetated, pervious areas that do not have high erosion potential.
Residual street wash water (water only), including wash water from sidewalks, plazas, and driveways, but excluding parking lots	Clean surfaces by sweeping and remove debris and other pollutants prior to washdown.
Discharges or flows from firefighting activities <i>(including fire hydrant testing, fire sprinkler testing, and firefighter training activities)</i>	BMPs not applicable for emergency situations. For training and testing activities, clean pavement surfaces of dust, debris, or other pollutants prior to discharge to the paved surface, street gutter, or drainage ditch. If possible, discharge to vegetated, pervious areas that do not have high erosion potential.
Boat Rinsing	The intent of the rinsing activity is salt removal. Rinsing must be limited to water only. No detergents are allowed. Engine maintenance/degreasing activities must be conducted at designated locations featuring an oil-water separator and cannot be discharged directly to the MS4. No discharge of bilge water to the MS4.
Dive Gear Rinsing	The intent of the rinsing activity is salt removal. Rinsing must be limited to water only. No detergents are allowed.
Parachute Rinsing and Drying	The intent of the rinsing activity is salt removal. Rinsing must be limited to water only. No detergents are allowed.
Aircraft Rinsing	The intent of the rinsing activity is salt removal. Rinsing must be limited to water only. No detergents are allowed. Engine maintenance/degreasing activities must be conducted at designated locations featuring an oil-water separator and cannot be discharged directly to the MS4.

NOTE: In the event that any of the listed discharges is observed or expected to be significant sources of pollutants to the MS4, the discharge will no longer be allowed.

BMPs FOR ALLOWABLE NON-STORM DISCHARGE

Allowable Discharge	BMP Water Description
Exterior building wash water (water only) <i>(including piers and wharves – water only without detergent)</i>	Clean surfaces by sweeping and remove debris and other pollutants prior to washdown.
Emergency pipe and tank hydrotesting and disinfecting	Dechlorinate water prior to discharge. Clean pavement surfaces of dust, debris, or other pollutants prior to discharge to paved surface, street gutter, or drainage ditch. If possible, discharge to vegetated, pervious areas that do not have high erosion potential.
Emergency trench dewatering	Clean pavement surfaces of dust, debris, or other pollutants, and remove any oil sheen or slick prior to discharge to paved surface, street gutter, or drainage ditch. If possible, place sandbags, silt fences, or hay bales around drainage inlets prior to discharge and/or discharge to vegetated, pervious areas that do not have high erosion potential.
Unpolluted saltwater from saltwater distribution lines	No additives shall be added or present in the saltwater. If applicable, clean pavement surfaces of dust, debris, or other pollutants prior to discharge to the paved surface, street gutter, or drainage ditch.

APPENDIX 3-2

BMPs for Disposal of Waste Materials and Contaminated Water

NOTE: Use this table to choose alternative strategies to dispose of potential pollutants. The alternatives are listed in order of priority.

BMPs FOR DISPOSAL OF WASTE MATERIAL AND CONTAMINATED WATER

Discharge/Activity	Disposal Priorities
Dumpster cleaning water	<ol style="list-style-type: none"> 1. Clean at dumpster owner's facility and discharge waste through grease interceptor to sanitary sewer system. 2. Clean on-site and discharge through grease interceptor to sanitary sewer system.
Cleaning paved areas	<ol style="list-style-type: none"> 1. Sweep and dispose as trash (dry cleaning only). 2. For vehicle leaks, follow this 3-step process: <ol style="list-style-type: none"> a. Clean up leaks with rags or absorbents. b. Sweep using granular absorbent material (cat litter). c. Mop and dispose of mop water to sanitary sewer system (or collect rinse water and pump to the sanitary sewer system). 3. Same as 2 above, except for 2c. Instead, discharge rinse water (no soap) to soil or grassy area.
Landscape/Garden Maintenance	
Pesticides	<ol style="list-style-type: none"> 1. Use up. Rinse containers; use rinse water as product. Dispose rinsed containers as trash. 2. Dispose waste in accordance with Federal, State and Local regulations.
Garden clippings	<ol style="list-style-type: none"> 1. Compost. 2. Take to landfill.
Tree trimming	<ol style="list-style-type: none"> 1. Chip, if necessary, before composting or recycling.

NOTE: Use this table to choose alternative strategies to dispose of potential pollutants. The alternatives are listed in order of priority.

BMPs FOR DISPOSAL OF WASTE MATERIAL AND CONTAMINATED WATER

Discharge/Activity	Disposal Priorities
Decorative fountains and ponds (no fish)	<ol style="list-style-type: none"> 1. Do not use metal-based algaecides (i.e., copper sulfate). 2. Recycle/reuse (e.g., irrigation). 3. Discharge to sanitary sewer system. 4. Determine chlorine residual = 0, wait 24 hours, and then discharge to storm water system.
Acid or other pool/fountain cleaning	<ol style="list-style-type: none"> 1. Neutralize and discharge to sanitary sewer.
Swimming pool and decorative fountain filter backwash (Dechlorinated water only)	<ol style="list-style-type: none"> 1. Reuse for irrigation. 2. Dispose on pervious areas. 3. Settle, dispose to sanitary sewer system.
Vehicle Wastes	
Used motor oil	<ol style="list-style-type: none"> 1. Use secondary containment while storing.
Antifreeze	<ol style="list-style-type: none"> 1. Use secondary containment while storing. Dispose waste in accordance with Federal, State and Local regulations.
Other vehicle fluids and solvents	<ol style="list-style-type: none"> 1. Dispose waste in accordance with Federal, State and Local regulations.
Automobile batteries	<ol style="list-style-type: none"> 1. Send to auto battery recycler. 2. Take to recycling center. 3. Store in appropriate storage containers or on containment pallets.
Construction trailer waste	<ol style="list-style-type: none"> 1. Use holding tank. Dispose to sanitary sewer system.
Vehicle and boat washings (using detergent or other compounds)	<ol style="list-style-type: none"> 1. Recycle. 2. Discharge to sanitary sewer system, never to storm water system.

NOTE: Use this table to choose alternative strategies to dispose of potential pollutants. The alternatives are listed in order of priority.

BMPs FOR DISPOSAL OF WASTE MATERIAL AND CONTAMINATED WATER

Discharge/Activity	Disposal Priorities
Rinse water from dust removal at new fleet vehicles	<ol style="list-style-type: none"> 1. Discharge to sanitary sewer system. 2. If rinsing dust from exterior surfaces for appearance purposes, use no soap (water only); discharge to soil or grassy area.
Vehicle leaks at vehicle repair facilities	<p>Follow this 3-step process:</p> <ol style="list-style-type: none"> 1. Clean up leaks with rags or absorbents. 2. Sweep, using granular absorbent material (cat litter). 3. Mop and dispose of mop water to sanitary sewer.
Other Wastes	
Spent fix from photo processing	<ol style="list-style-type: none"> 1. Collect for hauling as hazardous waste. 2. Treat to silver discharge limit.
Cooling water and demineralized water	<ol style="list-style-type: none"> 1. Recycle/reuse. 2. Discharge to sanitary sewer system.
Kitchen grease	<ol style="list-style-type: none"> 1. Provide secondary containment, collect, send to recycler. 2. Provide secondary containment, collect, send to wastewater treatment plant by hauler.
Cleaning of kitchen floor mats, exhaust filters, and compressed air line flushing, etc.	<ol style="list-style-type: none"> 1. Clean inside building and route discharge through grease trap to sanitary sewer system. 2. Clean outside in container or bermed area and route discharge to sanitary sewer system.

NOTE: Use this table to choose alternative strategies to dispose of potential pollutants. The alternatives are listed in order of priority.

BMPs FOR DISPOSAL OF WASTE MATERIAL AND CONTAMINATED WATER

Discharge/Activity	Disposal Priorities
Cleanup wastewater from sewer backup	<ol style="list-style-type: none"> 1. Follow this procedure: <ol style="list-style-type: none"> a. Block storm water system, contain, collect, and return spilled material to the sanitary sewer system. b. Block storm water system, rinse remaining material to collection point, and pump to sanitary sewer system. (No rinse water may flow to storm water system.)

Notes:

- "Discharge to sanitary sewer" Dispose into sink, toilet, or sanitary sewer clean-out connection
- "Dispose as trash" Dispose in dumpsters or trash containers for pickup or eventual disposal in landfill
- "Dispose as hazardous waste" Contract with a hazardous waste hauler to remove and dispose

APPENDIX 3-3

Final Enforcement Response Plan
Reserved for Future Use - Currently Under Development

APPENDIX 3-4

Wastewater Spill Notification/Response Guidelines
[Redacted due to national security concerns]

APPENDIX 4-1

Initial BMP Site Inspection Checklist

INITIAL BMP SITE INSPECTION CHECKLIST

Site Name: _____ Installation: _____ Location: _____

Date: _____ Permit Number: _____ Inspector: _____

Inspection Criteria	Yes	No	N/A	Comments
Is the inspection occurring before the initiation of ground-disturbing activities?				
Is the SWPPP/ BMP plan complete including all site maps?				
Are BMPs installed in the locations specified in the plan?				
Are all site BMPs and erosion/sediment controls installed correctly?				
Are good housekeeping practices used?				
Is the site in compliance with all Permittee-accepted permits, plans?				
Will other pollutant discharges occur as a result of the project's construction activity?				
Will any part of the site have the potential for erosion and sediment runoff?				

Additional Comments:

APPENDIX 4-2

Storm Water Pollution Prevention Plan Content Review Checklist

**Navy Region Hawaii
Storm Water Pollution Prevention Plan Content Review Checklist**

Project Name: _____	Location: _____	Date: _____
NPDES Tracking No: _____	Reviewed By: _____	Contractor Name _____

Permit Citation	Are the required SWPPP elements included?	Yes	No	N/A	Comments/ Notes
Project Activity and Description					
7.2.1	SWPPP identifies a “storm water team” including personnel name and individual responsibilities				
7.2.2	Defines the nature of construction activities, total site area (in acres) that is expected to be disturbed by construction activities (including any off-site areas)				
	Indicates the maximum area expected to be disturbed at one time				
7.2.3	If applicable, an explanation is given if the project is in response to a public emergency or natural disaster				
7.2.4	Provides the name of all contractors and indicates the areas of the project each contractor controls				
Project Scheduling					
7.2.5	Contains a sequence of scheduled construction activities and approximate start and end dates				
7.2.5.1	Includes a schedule of the approximate dates storm water control measures will be installed and made operational				
7.2.5.2	Maintains a schedule of the initiation and duration of earth-disturbing activities including when grading, excavating and filling activities will occur				
7.2.5.3	If applicable, the work schedule indicates when construction activity will be temporarily or permanently ceased				
7.2.5.4 & 5.2.1	The dates of temporary and final site stabilization are included, including when ground disturbance will occur, which is consistent to stabilizing soil immediately after earth-disturbing activities have ceased on all portions of the site				

7.2.5.5	The schedule includes approximate dates of when temporary storm water control measures, construction equipment, and vehicles will be removed from the project site				
	The schedule outlines the estimated start and end dates of pollutant-generating activities				
Site Maps and Work Boundaries					
7.2.6	Contains a legible site map showing property boundaries and locations where construction activities will occur				
7.2.6.1.	Map includes approximate slopes <u>before</u> and <u>after</u> grading and drainage patterns with flow patterns				
7.2.6.1.c & 7.2.6.1.d	Map includes locations where sediment, soil and other materials will be stockpiled, including contaminated spoils				
7.2.6.1.e & 7.2.6.1.f	Crossings of any state waters and vehicle exit points (to paved roads) are included				
7.2.6.1.g	All impervious surfaces are identified including built structures (upon completion of construction)				
7.2.6.1.h	Construction support area locations are included				
7.2.6.2	Site maps include locations of all state waters and listed impaired water bodies within or in the immediate vicinity of the project site				
7.2.6.3	If state waters are identified within 50 feet of earth disturbances, the map provides boundary lines of natural buffers (50-foot undisturbed) or buffers with double sediment control				
7.2.6.4	Map includes topography of the site, existing vegetation cover and drainage patterns of storm water onto, over and from the site property before and after major grading activities				
Storm Water Discharge Locations					
7.2.6.5	Storm drain inlets have been located on and near the immediate vicinity of the sites that receive project storm water discharge				
7.2.6.7& 7.2.6.8	Includes the locations of storm water control measures and the locations where chemicals will be used and stored				
Construction Site Pollutants					
7.2.7.a	A list and description of all pollutant-generating activities are included				

7.2.7.b	Inventory of pollutants or pollutant constituents for each pollutant-generating activity that could be discharged from the construction site are listed				
7.2.8	All sources of non-storm water are identified, including control measures to prevent discharges				
7.2.9	If state waters are located within 50 feet of project earth disturbances, natural buffers and additional sediment control measures are described				
Erosion and Sediment Control					
7.2.10.1	All storm water control measures that will be installed and maintained on the project site are described				
7.2.10.1.a	Information is included on the type and design of all storm water control measures to be implemented and maintained				
7.2.10.1.b	Site specific sediment controls will be made operational prior to the initiation of earth disturbing activities				
7.2.10.1.c	If applicable, control measures are enacted to prevent the contact of any contaminated soil to storm water				
7.2.10.1.d	Stabilization techniques are used for vehicle exit points				
7.2.10.1.e	If applicable, linear project's BMPs are documented to the extent practicable				
7.2.10.2	Specific vegetative and/or non-vegetative stabilization measures are outlined				
Post Construction and Spill Prevention Management					
7.2.10.3	Post construction BMP measures are described				
7.2.11.1	A spill prevention plan is included with spill response procedures for stopping, containing and cleaning up spills				
7.2.11.1.b	Procedures are defined for notifying appropriate facility personnel in the case of a hazardous substance spill				
7.2.11.2	Measures for handling and disposing of waste (including hazardous, sanitary) generated onsite are outlined				
Staff Training Documentation and Inspections					
7.2.12	Procedures for maintaining storm water control measures, conducting inspections and taking corrective actions are outlined				

7.2.12.a, 7.2.12.b & 7.2.12.c	Personnel responsible for conducting inspections, an inspection schedule and any implemented inspection forms are included				
7.2.13	Documentation included shows personnel have been trained on their specific responsibilities				
7.2.14	If applicable, documentation of compliance with the Safe Drinking Water Act Underground Injection Control (UIC) is included				
7.2.15	The contactors information is listed (name, position title, address, phone, email)				
7.2.15.2. a	If applicable, the following are included: a copy of the drainage system owner's approval, county-approved grading permit, section 401 water quality certification and a copy of the department of the army permit				
SWPPP Certifications and Amendments					
7.2.17	The SWPPP has been certified, signed and dated				
7.2.18.a & 7.2.18.b	After the issuance of the NGPC the SWPPP includes a copy of the NOI (with any correspondence with the department) and a copy of the NGPC including attachments				
7.4.1.4.	If applicable, where the department requires additional discharge requirements, a copy of any correspondence is included with a description of additional storm water control measures				
7.4.4	If applicable, modifications made to the SWPPP are certified, signed and dated by the Certifying Person				
	Is a hydrotesting or other non-storm water permit required?				

Additional Comments:

Date Corrections Received by NRH:

NRH, Clean Water Program will not allow construction to commence on any contract or in-house project until a Clean Water Program employee has reviewed the SWPPP to verify that it meets the requirements of HAR, Chapter 11-55, Appendix C and any other requirements under the NPDES permit program.

The SWPPP document has been reviewed according to the above criteria.

Reviewed By (NRH Clean Water Program Signature)

Date

APPENDIX 4-3

Construction Oversight Field Inspection Checklist

Construction Oversight Field Inspection Checklist

Inspection Date:		Name and phone # of those present during inspection:	
Time:			

Site Information

Construction site name:	
Permit number:	Location/ watershed:
Inspection: <input type="checkbox"/> Announced <input type="checkbox"/> Unannounced	Surface waters located within 50 feet of disturbance? <input type="checkbox"/> Yes <input type="checkbox"/> No
Approximate % of exposed site: _____	Phase (if construction site is multi-phased): Construction completed, restoration in progress
Construction stage: <input type="checkbox"/> Preliminary Stage <input type="checkbox"/> Mass Grading Stage <input type="checkbox"/> Streets and Utilities Stage <input type="checkbox"/> Vertical Construction Stage	
Completed Activities:	

Weather and Discharge Observations

Weather during inspection: <i>(complete weather observations below if inspection performed during rain event)</i>			
Date rain predicted to occur:		Predicted % chance of rain:	
Estimate storm beginning: (date and time)	Estimate storm duration: (hours)	Estimate time since last storm: (days or hours)	Rain gauge reading: (inches)
Discharge Observations (if inspection performed during a rain event) Location(s):			
Odors	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>	Floating material	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Suspended Material	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>	Sheen	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Discolorations	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>	Turbidity	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

BMP Effectiveness

(add additional sheets or attached detailed BMP Inspection Checklists)

Outfalls or BMPs Evaluated	Deficiencies/ Comments
EROSION CONTROL (vegetation preservation, etc. see SWPPP)	
SEDIMENT CONTROL – Storm drain inlet protection	
HOUSE KEEPING- General housekeeping , washout facilities, litter, solid waste	
SEDIMENT CONTROL – Tracking control	
SEDIMENT CONTROL – Perimeter control/silt fence	
NON-STORMWATER – Vehicle & equipment fueling, storage, and maintenance	
NON-STORMWATER – Other (paving, concrete, water conservation)	
WASTE MANAGEMENT – Material and stockpile	

management			
Photos Taken: Yes <input type="checkbox"/> No <input type="checkbox"/>		Photo Reference IDs:	
Site Inspections, Monitoring, and Sampling			
Requirement		Comments	
SWPPP/ SSCBMP/NGPC Retained Onsite:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
SWPPP/ SSCBMP/ Site maps Current:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Weekly Inspections Performed:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Amendment log up to date:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Inspections conducted within 24 hours of storm event of < 0.25 inches:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Documented staff training?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Corrective Actions Identified			
Corrective Action:			
Follow-up:			
	Date correction received: _____	Photo reference: _____	Initials: _____
Corrective Action:			
Follow-up:			
	Date correction received: _____	Photo reference: _____	Initials: _____
Corrective Action:			
Follow-up:			
	Date correction received: _____	Photo reference: _____	Initials: _____
Corrective Action:			
Follow-up:			
	Date correction received: _____	Photo reference: _____	Initials: _____
Inspector Information			
Inspector Name:		Inspector Title:	
Signature:		Date:	

APPENDIX 5-1

LID/EISA Constraints and Waiver Request
Reserved for Future Use - Currently Under Development

APPENDIX 6-1

Draft Final Trash Reduction Plan
August 2016

*DRAFT FINAL, PREDECISIONAL FOR DISCUSSION PURPOSES ONLY, DO NOT
CITE OR QUOTE*

TRASH REDUCTION PLAN

Storm Water Management Plan

Navy Region Hawaii

NPDES Permit No. HI S000257

Prepared by:

Navy Region Hawaii

August 2016

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List of Acronyms and Abbreviations

BMP	Best Management Practice
MS4	Municipal Separate Storm Sewer System
NAVFAC	Naval Facilities Engineering Command
NPDES	National Pollutant Discharge Elimination System
OPNAVINST	Chief of Naval Instruction
Permit	Navy Region Hawaii's NPDES Permit No. HI S000257

1 Introduction

As of the effective date, February 23, 2015, the Department of the Navy, Navy Region Hawaii (NRH) is required to comply with the conditions of the National Pollutant Discharge Elimination System (NPDES) Permit No. HIS000257 (referred to hereinafter as the "Permit"). The Permit includes authorized storm water and specified non-storm water discharges into Pearl Harbor, Halawa Stream, Kaiapo Canal, Kauhonahua Stream, Kumumauu Canal, Mailiilii Stream, Mamala Bay, Manuwai Canal, Poamoho Stream, Transportation Canal, Ulehawa Stream, unnamed tributary of Waikele Stream, unnamed gulches in Wahiawa, Waikakalaua, and Waiawa Streams. Per the Permit, Part D.1.f.(1).(e), NRH is required to provide a Trash Reduction Plan. The Permit states:

Pollution Prevention/Good Housekeeping, Part D.1.f.(1).(e)

"Trash Reduction Plan - The Permittee shall develop and implement, a trash reduction plan which assesses the issue, and identifies and implements control measures, and monitors these activities to reduce trash loads from the Small MS4. The plan shall specify the rationale for specific BMPs considered and implemented by the Permittee, and the method to assess the effectiveness of the implemented BMPs. The plan shall include, at a minimum, roadside litter pickup, regularly scheduled litter container servicing, and public outreach.

The Annual Report shall include a summary of its trash load reduction actions (control measures and BMPs) including the types of actions and levels of implementation, and a summary of the effectiveness of the implemented control measures and BMPs."

2 Trash Defined

For the purposes of this plan, “trash” will be considered analogous to “litter” as defined below by the Hawaii Revised Statutes (HRS) §391-1.

“Litter” means rubbish, refuse, waste material, garbage, trash, offal, or any debris of whatever kind or description, whether or not it is of value, and includes improperly discarded paper, metal, plastic, glass, or solid waste.

A distinction is made that trash is not inclusive of non-man made materials, such as branches, leaves, and other vegetation, that is deposited into waterbodies naturally.

3 Navy Region Hawaii Solid Waste Policy and Program

3.1 Navy Region Hawaii Solid Waste Policy

NRH's Solid Waste policies are guided by Executive Orders (EO) and the Department of Defense (DoD) strategic plans.

EO 13514 requires the head of each Federal agency to promote pollution prevention and eliminate waste by:

- (1) minimizing the generation of waste and pollutants through source reduction;
- (2) diverting at least 50 percent of non-hazardous solid waste, excluding construction and demolition (C&D) debris by the end of fiscal year 2015;
- (3) diverting at least 50 percent of C&D materials and debris by the end of fiscal year 2015;
- (4) increasing diversion of compostable and organic material from the waste; and
- (5) reducing printing paper use and acquiring uncoated printing and writing paper containing at least 30 percent postconsumer fiber.

Based on this EO, the DoD developed a *Strategic Sustainability Performance Plan* (DoD, 2012). This plan established a policy goal for all DoD component installations to achieve diversion rates of 60 percent for C&D waste, and 50 percent for all other wastes, by fiscal year 2015 and thereafter through fiscal year 2020.

Implementation of these goals is achieved through the development of an Integrated Solid Waste Management Plan (ISWMP) as described in the following section.

3.2 Navy Region Hawaii Integrated Solid Waste Management Plan

NRH in conjunction with the Navy has adopted Chief of Naval Instruction (OPNAVINST) 5090.1D entitled *Environmental Readiness Program*. Chapter 28 of OPNAVINST 5090.1D is entitled *Solid Waste Management and Resource Recovery Ashore*, and is applicable to all Navy installations worldwide that generate one or more tons of solid waste per day. These installations must follow the solid waste reporting, solid waste management planning, recycling requirements, and affirmative procurement requirements outlined in this chapter. Chapter 28 specifically requires that an ISWMP and QRP (where economically feasible) be developed and implemented.

NRH's updated ISWMP was completed in 2014 (NAVFAC, 2014). The ISWMP established historic and existing solid waste generation and recycling quantities. The JBPHH community generates approximately 17,530 tons of municipal solid waste each year with annual recycling rates ranging from 14 to 22 percent.

The ISWMP presented a framework for NRH to increase their solid waste diversion through the following means:

- Source reduction – includes recommendations for administration, custodians, dining facilities, barracks, shops, Exchange and Commissary, and Supply Department.
- Recycling – includes recommendations for increasing recycling.
- Green waste management – includes alternatives for green waste management.

- C&D demolition debris management – includes recommendations for source reduction and recycling of building materials.
- Sustainable acquisition – includes recommendations for acquisition of environmentally friendly products.
- Education – includes recommendations for public awareness outreach to workers and residents.

Additional information about the ongoing base initiatives to reduce solid waste are presented in the ISWMP.

4 Existing Control Measures and BMPs

NRH has already implemented the following control measures to reduce trash.

4.1 Public Education and Outreach

Trash reduction and recycling initiatives are presented to workers and residents through the following means:

- Informational brochures in the orientation packet presented to new arrivals.
- Informational brochures presented to industrial facilities and storefront personnel during annual inspections.

The brochures inform the general public and the industrial facilities on trash reduction's impact on storm water pollution control. Brochures for industrial facilities will stress BMPs, and periodic inspections of facility spaces and work areas to ensure that storm water pollution is identified and stopped. Brochures for the general public will target military members, their families and other base personnel. It will provide general information about how storm water will end up in the ocean, and how pollutants and waste picked up by storm water and discharged to the ocean can affect marine life and coastal water quality. For example, green waste disposal direction provides guidance for all personnel on JBPHH regarding proper disposal of green waste.

Future programs are to include collaboration with schools to incorporate storm water education and volunteer events into their curriculum.

4.2 Litter Clean Up

A small team of base inspectors is responsible for daily base-wide monitoring and beautification. These regional 'zone inspections' are responsible for picking up litter they encounter during their rounds.

Building managers are responsible for daily policing routine and inspection of grounds around their facility. They ensure that the grounds, sidewalks, curbs, and pavements around the facility are free of debris and trashcans/dumpsters are not over flowing and regularly picked up.

Additionally, JBPHH also conducts Base-wide Cleanups throughout the year as community events on a volunteer basis, with focus on the waterfront, perimeter of the base, and high-visibility areas. By regularly cleaning trash, litter, and green waste, this helps to prevent and minimize any runoff into the storm drain system.

NRH conducts quarterly cleanings along the water, which are regularly attended by local Hawaiian Civic groups. Cleanups also regularly include participation of local community groups, schools, and sailors.

4.3 Street Sweeping

Sweeping of major streets and streets in the industrial and commercial areas continue to be conducted regularly in some areas and on an as-needed basis in other areas by Production Division and Base Support Vehicles and Equipment (BSVE). BSVE owns two street sweepers and performs sweeping of between 960 and 1080 miles of streets per year. BSVE maintains monthly charts that outline regular cleanings by area. Most areas are swept on a weekly basis while others, NCTAMS for example, are swept

on an as-needed basis. This sweeping schedule is adjusted in response to observations by inspectors and workers.

Streets through residential areas are cleaned by the lessees of the land. Hickam streets are cleaned by Production Division (Code PRJ3).

Base areas are also inspected regularly and additional street sweepings are directed and implemented as needed. Work leaders in the BSVE inspect streets regularly. Further, Building Managers are required to inspect up to 50 feet from their facilities or half the distance to their adjacent building.

4.4 Trash Pickup

Regular trash pickup is provided to assure proper disposal of solid wastes. Trash pickup in residential areas is performed by contractors twice per week. Trash pickup in industrial and commercial areas of the Base is performed by a contractor funded by the Facility Maintenance Division (FMD) on a regular schedule. The pickup frequency is dependent on the amount of trash generated at the facility. Building Managers must routinely inspect refuse collection. If the Building Manager determines that their area needs to be cleaned, they will put in a request to the Facilities Operations Specialist (FOS).

4.5 Structural BMPs

Structural BMPs for trash collection have been installed in a few select locations as follows.

- Navy Housing Dumpsters that are placed in roofed areas are to be kept positioned under roof cover.
- As much as practicable, dumpsters shall remain with their lids/covers in place to prevent contact between storm water and dumpster contents.

In addition, storm drain lines, manholes, and inlets/catch basins will be inspected in coordination with disaster-preparedness efforts.

4.6 Inspections

Base Inspectors conduct patrols of the industrial and commercial areas of the Base. The inspectors will document and report any illicit dumping, including litter. Any illicit dumping observed by the inspectors will be reported to Environmental for follow-up corrective actions. All litter is collected and properly disposed.

5 Implementation Plan

NRH will continue to implement their existing control measures and BMPs identified in the previous section. Key components for trash reduction will include:

- **Regular Trash Pickup** – Residential, commercial, and industrial areas will have regular trash pickup. Periodic inspections will be conducted by Building Managers to determine if the pickup schedule and/or number of trash bins need to be adjusted.
- **Street Sweeping** – Street sweeping will be completed on a routine basis. Periodic inspections will be conducted by Production Division or BSVE to determine if the sweeping schedule needs to be adjusted.
- **Litter Cleanup** - Base Inspectors conduct daily patrols of the residential, industrial, and commercial areas of the Base. The inspectors will document and report any illicit dumping, including litter. Any illicit dumping observed by the inspectors will be reported to Environmental for follow-up corrective actions. All litter is collected and properly disposed.
- **Public Outreach** - Base-wide Cleanups will be conducted throughout the year as community events on a volunteer basis, with focus on the waterfront, perimeter of the base, and high-visibility areas. Brochures for residents and tenants will be provided that include the importance of trash reduction and implementation of BMPs.

Public outreach will occur during community events such as Earth Day events on base, and at other events. Small Earth Day events are typically held at several locations on base, including the NEX store, the Hickam Marina, and Hickam Communities. Storm water program representatives will attend these fairs to pass out brochures, answer questions, and try to engage the public to increase storm water awareness.

Online public outreach will also be included. Storm water awareness information on the base's Facebook page as well as a storm water tab on the Region website will be used to educate the public on the importance of trash reduction in meeting overall storm water goals. Online resources will be updated periodically as appropriate.

- **Inspections and BMP Implementation** – Commercial and industrial facilities will be inspected according to the requirements of this Permit and as covered in the pertinent sections of this Storm Water Management Plan. BMPs will be implemented as needed. Informational brochures that are updated annually will also be distributed during the inspections.

6 Measuring Program Success

Program success will be measured both quantitatively and qualitatively. Quantitative measures may include:

- Quantity of trash generated and disposed.
- Miles of streets swept.
- Quantity of road side litter picked up and disposed.
- Number of inspections completed at commercial and industrial facilities to determine if BMPs are being properly implemented.
- Number of corrective actions completed at commercial and industrial facilities.
- Number of special cleanup events conducted and number of public participants.

Qualitative measures may include number of educational materials distributed and increase in public awareness through on-line resources.

NRH may consider conducting inspections at select structural BMPs annually to establish existing trash loads and the trash reduction over time. These measurements may allow NRH to evaluate whether the trash control measures presented in the previous section are effective in reducing the amount of trash or if additional measures will need to be implemented. A sample inspection form is provided as an attachment to this plan.

7 References

1. *2015 Storm Water Annual Report, Commander, Navy Region Hawaii, NPDES Permits HI S000006 and HI S000069.* Naval Facilities Engineering Command, Engineering Service Center.
2. *Authorization to Discharge Under the National Pollutant Discharge Elimination System, Permit No. HI S0002257. February 23, 2015.*
3. *Environmental Readiness Program, OPNAVINST 5090.1D.* Department of the Navy. January 10, 2014.
4. *Building Manager Handbook.* Joint Base Pearl Harbor-Hickam. November 23, 2015.

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APPENDIX 6-2

Action Plan for Maintenance of Structural Controls

August 2016

*DRAFT FINAL, PREDECISIONAL FOR DISCUSSION PURPOSES ONLY, DO NOT
CITE OR QUOTE*

ACTION PLAN FOR MAINTENANCE OF STRUCTURAL CONTROLS

Storm Water Management Plan

Navy Region Hawaii

NPDES Permit No. HI S000257

Prepared by:

Navy Region Hawaii

August 2016

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List of Acronyms and Abbreviations

BMP	Best Management Practice
DOH	State of Hawaii Department of Health
EV	NAVFAC Hawaii Environmental Department
FMD	Joint Base Pearl Harbor-Hickam Facilities Management Division
JBPHH	Joint Base Pearl Harbor-Hickam
LID	Low Impact Development
MS4	Municipal Separate Storm Sewer System
NAVFAC	Naval Facilities Engineering Command
NPDES	National Pollutant Discharge Elimination System
NRH	Navy Region Hawaii
OPNAVINST	Chief of Naval Operations Instruction
Permit	Navy Region Hawaii's NPDES Permit No. HI S000257
PROD	Joint Base Pearl Harbor-Hickam Production Division
SWMP	Storm Water Management Plan
TMDL	Total Maximum Daily Load

1 Introduction

On February 23, 2015, the Department of the Navy – Navy Region Hawaii (NRH) was issued the National Pollutant Discharge Elimination System (NPDES) Permit No. HI S000257 (referred to hereinafter as the “Permit”) by the State of Hawaii Department of Health (DOH), which took effect on March 23, 2015. The Permit expires at midnight on February 22, 2020.

Under the Permit, NRH is authorized to discharge storm water and specified non-storm water discharges into State Waters from the following facilities:

- Joint Base Pearl Harbor – Hickam (JBPHH) Small Municipal Separate Storm Sewer System (Small MS4)
- Navy Industrial areas or facilities (as specified in the Permit)
- Any additional storm sewer outfalls and Navy Industrial areas and facilities identified by NRH, throughout the Permit term, as potentially significant pollutant sources.

The State Waters identified in the Permit consist of inland streams and open coastal waters in and around the Island of Oahu, Hawaii. These include Pearl Harbor, Halawa Stream, Kaiapo Canal, Kauhonahua Stream, Kumumauu Canal, Mailiili Stream, Mamala Bay, Manuwai Canal, Poamoho Stream, Transportation Canal, Ulehawa Stream, Unnamed tributary of Waikele Stream, Unnamed gulches in Wahiawa, Waikakalaua, and Waiawa Streams.

This Action Plan for Maintenance of Structural Controls is outlined in accordance with the Permit requirements, as follows:

Pollution Prevention/Good Housekeeping, Part D.1.f.(i)(d):

“Maintenance of Structural Controls - The Permittee shall develop and implement an Action Plan to maintain, and improve, as necessary, structural BMPs. The Action Plan shall cover a 5 year period and be updated annually to include additional retrofit projects with water quality protection measures. At a minimum, annual updates to the Action Plan shall consider system inspection results, storm water monitoring data, recent construction, and required operations and maintenance. The annual updates to the Action Plan shall be included in the Annual Report with a description of the projects status. The Action Plan shall include, but not be limited to projects in compliance with any TMDL implementation and monitoring plan.”

The objectives of this plan are to (1) outline a program of routine inspections and maintenance that will ensure existing structural controls function properly, and (2) improve, as necessary, existing structural controls to optimize function of these resources. By utilizing existing resources more effectively, NRH can more cost-effectively prevent storm water pollution from its Small MS4 and other related facilities.

For the purpose of this plan, “structural controls” are considered to be permanent, structural (vegetated or non-vegetated) BMPs. These are engineered systems designed to control runoff, store runoff, or remove pollutants from storm water via chemical or physical treatment. These systems are effective in mitigating storm water quality issues caused by conditions such as erosion and debris; some examples of which include the following:

- Detention/Retention Basins
- Sand Filters
- Infiltration Trenches
- Permeable Pavement
- Vegetated Swales
- Vegetated Buffers/Biofilters
- Bio-retention Cells
- Storm Water Inlet Water Quality Inserts
- Vortex Separation/Continuous Deflection Systems

2 Structural Controls at JBPHH

2.1 Navy Region Hawaii Policy

In accordance with the Permit, Part D.1.e(1), NRH uses existing Navy and Department of Defense policies for implementing LID. NRH will be determining whether it is necessary to develop a separate “Plan for Requiring Low Impact Development in the Standards (Plan for Requiring LID).” Low impact development (LID) aims at preserving or mimicking the site’s predevelopment hydrology. This is achieved by minimizing ground disturbance and use of impervious cover, and infiltrating, storing, detaining, evapotranspiring, and/or biotreating storm water runoff as close to its source as reasonably possible. Ideally LID measures are based on the concept of preserving or recreating the natural landscape features and minimizing imperviousness, and treating storm water as a resource rather than a waste product. NRH’s LID design standards are intended to prioritize management practices that favor harvesting and use, infiltration, evapotranspiration, or biotreatment, followed by other practices to treat and release storm water.

The revised Plan for Requiring LID is anticipated to cover the following items:

- Criteria for requiring implementation of LID;
- Quantitative criteria for a specific design storm to be managed by LID techniques;
- Feasibility criteria for circumstances in which a waiver could be granted for the LID requirements;
- List of alternatives that may be implemented when an LID waiver is granted;
- Draft LID planning and design example checklist; and
- Draft LID and PBMP inspection example checklists.

NRH has already implemented the required LID standards for its projects in accordance with updated LID Standards. These standards are outlined in Section 438 of the Energy Independence and Security Act of 2007 (EISA) and establish strict storm water runoff requirements for federal development and redevelopment projects with a footprint of 5,000 square feet or more. The Under Secretary of Defense released a policy memorandum on January 19, 2010, for DoD Implementation of Storm Water Requirements under Section 438 of the Energy Independence and Security Act (EISA), which identified the design storm criteria as the 95th percentile storm. This policy memorandum also includes a flow chart that includes examples of on-site design options and technical constraints. NAVFAC projects are required to follow the requirements of the Unified Facilities Criteria (UFC) 3-210-10, Low Impact Development, which provides design criteria for LID and technical feasibility criteria.

NRH LID policy has authorized a waiver process to be used in “infrequent situations where LID is not appropriate given the characteristics of the site.” This waiver process is required to be reviewed by the Core Civil Technical Discipline Provider for concurrence and requires the Regional Engineer level review for approval.

2.2 Program Organization

NAVFAC Hawaii Environmental Department (EV) is responsible for general oversight and management of this Action Plan, to ensure that it is kept up-to-date and compliant with the Permit. The Facility Management Division (FMD) and Assistant Public Works Officers (APWOs) are responsible for making the action plan available to applicable entities, and coordinating its implementation.

Inspection/maintenance work may be accomplished by the Production Division (PROD), contractors managed by the Facilities Engineering and Acquisition Division (FEAD), or by tenants. FMD would modify the prioritized scheduling of these efforts, as needed.

Similar to all other programs in this SWMP, the Joint Base Commanding Officer (JBC) has the authority to adjust policies or direct enforcement actions for tenants/agencies subject to the Erosion Control BMPs Program. Commander, NRH, has ultimate authority for Permit policies and enforcement actions.

2.3 Existing Structural BMPs

Structural BMPs have been constructed throughout JBPHH, and will be installed in the future in accordance with the NRH LID Policy. In the past, there has been no formal tracking system to monitor the long term operation of these structures. However, regional zone inspections, and routine inspections by building managers have been used to identify functional problems with existing systems. Maintenance has typically been performed on an as-needed basis.

EV is in the process of developing an initial list of known structural BMPs at JBPHH. FMD is developing a Geographical Information System (GIS) based Asset Management System (AMS) that will be used for inventory and tracking of maintenance in its entire Small MS4. Structural BMPs will also be identified and tracked as part of this AMS.

3 Proposed Actions

The following sections outline the measures that NRH will take to prevent storm water pollution through maintenance and use of structural controls.

3.1 Inventory and Tracking of Structural Controls

To effectively assess the needs of a Base-wide structural BMPs maintenance program, NRH has taken the first step toward building an inventory of structural BMPs. This is being done by initiating its Base-wide storm drain system survey. The information gathered from the survey will be used to develop an AMS, part of which will be used to identify locations of structural BMPs. As mentioned, there was no formal method of tracking structural BMPs on Base. The initial inventory of structural BMPs will consist of anything identified during an initial Base-wide inventory conducted by EV.

The process for a construction contractor to turn over ownership of a new or redeveloped facility to NRH includes:

- Submittal of as-built plans, with clear distinction of all structural BMPs (supplemental written documentation may be submitted for additional clarification of any details);
- Submittal of all relevant documentation outlining structural BMP/LID specifications and required future maintenance; and
- Submittal of proof of structural BMP stabilization (photos, prior maintenance records, etc.), if applicable.

These documents are to be submitted to JB4 who will ensure that FMD, PROD, EV, and others receive them as necessary. Any newly constructed structural BMPs will be flagged, when as-built construction plans are submitted to FMD, for entry into the Base-wide AMS. At the same time, any BMP-specific maintenance documents will be submitted to FMD and PROD to ensure these are accessible for those conducting routine maintenance.

Once a structural BMP is identified, the AMS will be updated accordingly to include:

- Geographic location;
- Prioritization level for maintenance/required frequency of maintenance;
- Storage location for reference material on BMP-specific maintenance or other general information; and
- Information related to completed inspection/maintenance activities.

3.2 Structural Controls Maintenance

NRH is currently in the process of developing debris and sediment accumulation, and vegetation thresholds, to define inspection/maintenance priority levels and required frequencies of maintenance. The thresholds and maintenance frequencies will be based on results of the ongoing storm drain system survey.

Each structural BMP identified in the AMS will be assigned a priority level, ranging from low priority to high priority, based on its potential to negatively impact storm water quality. This categorization will be assigned by the FMD.

Subsequent maintenance of all structural BMPs will be based on the prioritization schedule coordinated by FMD for the *Debris Control BMPs Program (Section 6.3)*, in the NRH Storm Water Management Plan (SWMP). Each structural BMP identified in the AMS will be inspected/maintained a minimum of once during the Permit term.

The prioritization and maintenance scheduling for structural BMPs will be reviewed at a minimum of annually and modified, as needed, to most effectively utilize available resources and protect storm water runoff quality. FMD is responsible for coordinating any necessary adjustments.

3.3 Structural Control Improvements and Retrofit Projects

The structural controls maintenance program will continue to evolve as more information is gathered from routine inspections and maintenance, and to comply with changing Total Maximum Daily Load (TMDL) implementation and monitoring plan requirements. This includes ongoing assessment for areas that may qualify for new structural BMPs or retrofit improvements to existing features, such as areas known to flood during heavy rains, or those with high levels of erosion and/or trash.

FMD will evaluate potential improvement projects based on feedback during routine inspections and maintenance, and information provided by tenants on Base or other entities conducting routine inspections. All major construction and renovation projects will continue to be reviewed for LID Policy compliance during the design phase, and identified areas of concern will be considered in this review process.

Once a new or retrofit structural BMP project is identified, it will be prioritized similarly to the prioritization levels for maintenance. Projects identified for areas posing the most significant risk or

benefit to storm water quality will be considered as “High Priority.” Those posing a minimal threat to storm water quality will be classified as “Low Priority.”

4 Implementation Schedule

This Action Plan is intended to provide a 5-year outline for maintenance and improvement activities for structural controls at JBPHH. The following Table 4-1, is a tentative schedule based on a preliminary assessment of existing conditions.

Table 4-1 Implementation Schedule for Maintenance and Improvements of Structural Controls

Task	Year 1	Year 2	Year 3	Year 4	Year 5
Conduct Preliminary Inventory/Assessment of Identified Existing Structural BMPs	X	X			
Define Prioritized Ranking System for Maintenance and Improvement Projects	X	X			
Establish AMS and Mapping Tools, Update as Needed	X	X	X	X	X
Address Emergency Maintenance or Repair Issues	X	X	X	X	X
Identify and Evaluate Potential New or Retrofit Structural BMP Projects	X	X	X	X	X
Appropriation of Funding for Routine Inspection/Maintenance Activities, and New or Retrofit Projects: <ul style="list-style-type: none"> ○ High Priority ○ Medium Priority ○ Low Priority 		X	X	X	
Implementation of Inspections/Maintenance Activities, and New or Retrofit Structural BMP Projects: <ul style="list-style-type: none"> ○ High Priority ○ Medium Priority ○ Low Priority 			X	X	X
Evaluation and Updates of the Action Plan and Implementation Schedule, as Needed (in the Annual Report)	X	X	X	X	X

This implementation schedule will be subject to change based on changing site conditions, availability of funding, permitting requirements/delays, and other unforeseen circumstances.

5 Annual Updates

The Action Plan for Maintenance of Structural Controls is to be reviewed annually by FMD. The review will take in to account feedback from inspection and maintenance activities, and any applicable reports from other tenants during the past year. Other factors to be considered in the annual review are:

- Program progress;
- Changes to permit requirements;
- Inspection/maintenance results;
- Storm water monitoring data;
- Recent construction, and status of ongoing or potential structural BMP projects;
- Required operations and maintenance activities; and
- Evaluation of newly identified areas of concern.

The implementation schedule will also be revised, as needed, to reflect revisions made to the Action Plan. Any modifications that must be made will go through EV, to be included in the Annual Report as well.

6 References

1. *Final Storm Water Management Plan for Navy Region Hawaii, JBPHH, Oahu, Hawaii*. Navy Region Hawaii. September 23, 2016.
2. *2015 Storm Water Annual Report, Commander, Navy Region Hawaii, NPDES Permits HI S000006 and HI S000069*. Naval Facilities Engineering Command, Engineering Service Center.
3. *Authorization to Discharge Under the National Pollutant Discharge Elimination System, Permit No. HI S0000257*. February 23, 2015.
4. *Environmental Readiness Program, OPNAVINST 5090.1D*. Department of the Navy. January 10, 2014.
5. *Building Manager Handbook*. Joint Base Pearl Harbor-Hickam. November 23, 2015.

APPENDIX 7-1

JBPHH Integrated Pest Management Plan

December 2013

[Redacted due to national security concerns]

APPENDIX 9-1

Semi-annual Facility Inspection Checklist

TRACKER ID: ####

Insp Date

Inspector:

Shop ID

[Past Inspections](#)

Program: Storm Water - Regul

Storm Water - Regulated

Waste at WAP

Location

Command

ChangeAIM

How?

AIM Info

AIM SHOP NOTES	
INSPECTOR ID: <input type="text"/>	<div style="border: 1px solid gray; height: 150px;"></div>
AIM INSP <input type="text"/> ###	
SHOPCODE <input type="text"/>	
SHOPPOC <input type="text"/>	
SHOPPHONE <input type="text"/>	
DateEdit: <input type="text"/>	

UPLOAD CHECKLIST

Tracker ID



Upload HW Qs

Upload SPCC Qs

Upload Stormwater Qs

Upload Unsched Qs

Refresh

Comments/Findings

Checklist

You can delete Qs if you loaded the wrong ones

[Def Rpt](#)

QKEY	Compliance Criteria	Def?	Quest No	Comments	Root Cause	# of DefQs	
15743 STORM-010 57856	Are Good Housekeeping Practices (e.g., maintaining a clean and orderly facility) being implemented at the facility to minimize/prevent contaminants (e.g., oil, HAZMAT/HAZWASTE) from being exposed to rainfall and entering the storm drainage system.	<input type="checkbox"/>	1	<input type="text"/>	<input type="text"/>	0	<input type="button" value="Corr"/>
15743 STORM-020 57857	Are Spill prevention and response practices being implemented at the facility? (e.g., proper storage of HAZMAT/HAZWASTE, OHS spill procedures, spill kits, etc.)	<input type="checkbox"/>	2	<input type="text"/>	<input type="text"/>		<input type="button" value="Corr"/>
15743 STORM-031 57858	Are required erosion and sediment controls being implemented at the facility to minimize rainfall coming into contact to exposed surfaces (e.g. bare soil)?	<input type="checkbox"/>	3	<input type="text"/>	<input type="text"/>		<input type="button" value="Corr"/>
15743 STORM-040 57859	Are HAZMAT/HAZWASTE storage systems/containers/lockers exposed to rainfall in adequate condition? (e.g., no visible holes or signs of leakage).	<input type="checkbox"/>	4	<input type="text"/>	<input type="text"/>		<input type="button" value="Corr"/>
15743 STORM-050 57860	Are drip pans utilized to contain leaks from equipment stored outdoors and exposed to rainfall? (Equipment such as portable pumps/generators, material handling equipment, etc. should be checked for leaks)	<input type="checkbox"/>	5	<input type="text"/>	<input type="text"/>		<input type="button" value="Corr"/>
15743 STORM-060 57861	Are storm drain inlets relatively clean and properly working	<input type="checkbox"/>	6	<input type="text"/>	<input type="text"/>		<input type="button" value="Corr"/>

15743	57662	STORM-070	Are the major operations and facilities the same and no changes need to be incorporated into the SWPCP? (e.g., no facility closure, no increase in material storage areas, no new industrial operations, etc.)	<input type="checkbox"/>	7			Corr
15743	57663	STORM-080	In general, is the significant material inventory and potential storm water pollutants the same?	<input type="checkbox"/>	8			Corr
15743	57664	STORM-090	Are the Best Management Practices (BMPs) associated with the industrial facility implemented in a satisfactory matter?	<input type="checkbox"/>	9			Corr
15743	57665	STORM-100	If standing water or dry weather flows are observed in the drainage system, can the following be determined: The standing water or dry weather flow is a result of having a rainfall event <72 hours and/or an allowable non-storm weather discharge.	<input type="checkbox"/>	10			Corr
15743	57666	STORM-110	If standing water or dry weather flow are observed, the characteristics of the water show no significance in the color or clarity, and no significant floatable or oil and grease were observed, and water samples were not collected or needed.	<input type="checkbox"/>	11			Corr
15743	57667	STORM-120	In general, visual observation of the drainage system has verified the absence of any significant stains/sediments, accumulation, sludge, odor, vegetation growth, or biological activity.	<input type="checkbox"/>	12			Corr
15743	57668	STORM-130	During the inspection, was it verified that there are no illicit connections?	<input type="checkbox"/>	13			Corr
15743	57669	STORM-140	Were handouts provided to facility personnel as part of their annual training requirement?	<input type="checkbox"/>	14			Corr
15743	57670	STORM-150	If the facility is adjacent to receiving waters, are the waters free of turbidity, substances of color, floating oil and grease, floating debris, and scum?	<input type="checkbox"/>	15			Corr

CodeName	QKEY	Compliance Criteria	PROGRAM	Deficiency	DEF Code
1	STORM-010	Are Good Housekeeping Practices (e.g., maintaining a clean and orderly facility) being implemented at the facility to minimize/prevent contaminants (e.g., oil, HAZMAT/HAZWASTE) from being exposed to rainfall and entering the storm drainage system.	STORM	Good Housekeeping Practices (e.g., maintaining a clean and orderly facility) are not being implemented at the facility to minimize/prevent contaminants (e.g., oil, HAZMAT/HAZWASTE) from being exposed to rainfall and entering the storm drainage system.	01
2	STORM-020	Are Spill prevention and response practices being implemented at the facility? (e.g., proper storage of HAZMAT/HAZWASTE, OHS spill procedures, spill kits, etc.)	STORM	Spill prevention and response practices have not been implemented at the facility. (e.g., proper storage of HAZMAT/HAZWASTE, OHS spill procedures, spill kits, etc.)	02
3	STORM-031	Are required erosion and sediment controls being implemented at the facility to minimize rainfall coming into contact to exposed surfaces (e.g. bare soil)?	STORM	Required erosion and sediment controls are not being implemented at the facility to minimize rainfall coming into contact to exposed surfaces (e.g., bare soil) and causing soil erosion problems?	03
4	STORM-040	Are HAZMAT/HAZWASTE storage systems/containers/lockers exposed to rainfall in adequate condition? (e.g., no visible holes or signs of leakage).	STORM	HAZMAT/HAZWASTE storage systems, containers and/or lockers are exposed to rainfall are not in adequate condition (e.g., visible holes or signs of leakage).	04
5	STORM-050	Are drip pans utilized to contain leaks from equipment stored outdoors and exposed to rainfall? (Equipment such as portable pumps/generators, material handling equipment, etc. should be checked for leaks)	STORM	Drip pans utilized to contain leaks from equipment (such as portable pumps/generators, material handling equipment, etc. should be checked for leaks) are stored outdoors and are exposed to rainfall.	05
6	STORM-060	Are storm drain inlets relatively clean and properly working	STORM	Storm drain inlets are not clean and do not work properly.	06
7	STORM-070	Are the major operations and facilities the same and no changes need to be incorporated into the SWPCP? (e.g., no facility closure, no increase in material storage areas, no new industrial operations, etc.)	STORM	The major operations and facilities are not the same and changes need to be incorporated into the SWPCP. (e.g., facility closure, increase in material storage areas, new industrial operations, etc.)	07
8	STORM-080	In general, is the significant material inventory and potential storm water pollutants the same?	STORM	In general, the significant material inventory and potential storm water pollutants are not the same.	08
9	STORM-090	Are the Best Management Practices (BMPs) associated with the industrial facility implemented in a satisfactory matter?	STORM	The Best Management Practices (BMPs) associated with the industrial facility are not being implemented in a satisfactory matter.	09
10	STORM-100	If standing water or dry weather flows are observed in the drainage system, can the following be determined: The standing water or dry weather flow is a result of having a rainfall event <72 hours and/or an allowable non-storm weather discharge.	STORM	Standing water or dry weather flows are observed in the drainage system. The standing water or dry weather flow is the result of a non-storm weather discharge which is not approved.	10
11	STORM-110	If standing water or dry weather flow are observed, the characteristics of the water show no significance in the color or clarity, and no significant floatable or oil and grease were observed, and water samples were not collected or needed.	STORM	For standing water or dry weather flows observed, the characteristics of the water show significance in the color or clarity, and significant floatable or oil and grease were observed.	11
12	STORM-120	In general, visual observation of the drainage system has verified the absence of any significant stains/sediments, accumulation, sludge, odor, vegetation growth, or biological activity.	STORM	In general, visual observation of the drainage system indicates the presence of significant stains/sediments, accumulation, sludge, odor, vegetation growth, or biological activity.	12
13	STORM-130	During the inspection, was it verified that there are no illicit connections?	STORM	During the inspection, was it verified that there are one or more illicit connections to the Storm Water System.	13

14	STORM-140	Were handouts provided to facility personnel as part of their annual training requirement?	STORM	There is no documentation to show that the Storm Water Training pamphlet handouts were provided to facility personnel as part of their annual training in the past year.	14
15	STORM-150	If the facility is adjacent to receiving waters, are the waters free of turbidity, substances of color, floating oil and grease, floating debris, and scum?	STORM	Receiving waters contain turbidity, substances of color, floating oil and grease, floating debris, or scum.	15

APPENDIX 9-2

Facility-wide Maintenance BMPs
Reserved for Future Use - Currently Under Development

APPENDIX 10-1

List of Commercial Facilities

FACILITY_NO	FACILITY_USE	USE_CATEGORY_DESC	USER_UNIT_TITLE	LESSEE_NAME	FACILITY_NAME	SHORE_TASK
276	NEX OUTDOOR LIVING STORE	EXCHANGE RETAIL STORE	NEX PEARL HARBOR HI		NEX OUTDOOR LIVING STORE-MOA	RETAIL EXCHANGE
70	NEX APPLIANCE STORE	EXCHANGE RETAIL STORE	NEX PEARL HARBOR HI		NEX APPLIANCE STORE	RETAIL EXCHANGE
2646	NEX PET STORE	EXCHANGE RETAIL STORE	NEX PEARL HARBOR HI		NEX HARDWARE STORE-MOANALUA	RETAIL EXCHANGE
2269	NEX GARDEN SHOP STRGE	EXCHANGE RETAIL STORE	NEX PEARL HARBOR HI		NEX GARDEN SHOP STORAGE-MOA	RETAIL EXCHANGE
2272	NEX GARDEN SHOP STRGE	EXCHANGE RETAIL STORE	NEX PEARL HARBOR HI		NEX GARDEN SHOP STORAGE	RETAIL EXCHANGE
2273	NEX GARDEN SHOP STRGE	EXCHANGE RETAIL STORE	NEX PEARL HARBOR HI		NEX GARDEN SHOP STRGE	RETAIL EXCHANGE
631	NEX THE MALL AT PEARL HARBOR	EXCHANGE RETAIL STORE	NEX PEARL HARBOR HI		NAVY EXCHANGE MAIN RETAIL	RETAIL EXCHANGE
4	VACANT	EXCHANGE RETAIL STORE	JBPHH PEARL HARBOR HI		STATION CENTER	RETAIL EXCHANGE
2028H	EXCH, SALES STORE (18580)	EXCHANGE RETAIL STORE	ARMED FORCES EXCHANGES		AIR PASSENGER TERMINAL	RETAIL EXCHANGE
1232H	EXCH, SALES STORE (18580)	EXCHANGE RETAIL STORE	ARMED FORCES EXCHANGES		EXHANGE SALES STORE	RETAIL EXCHANGE
1235H	EXCH, SALES STORE (18580)	EXCHANGE RETAIL STORE	ARMED FORCES EXCHANGES		EXHANGE SALES STORE	RETAIL EXCHANGE
6882	MINIMART	LOCATION EXCHGE	NEX PEARL HARBOR HI		LOCATION EXCHANGE	RETAIL EXCHANGE
75	LOCATION EXCHANGE	LOCATION EXCHGE	NEX PEARL HARBOR HI		ADMINISTRATION BUILDING	RETAIL EXCHANGE
510		LOCATION EXCHGE	STATE AND LOCAL AGENCIES		PACIFIC WARFIGHTING CENTER	RETAIL EXCHANGE
360	NEX MINI-MART	LOCATION EXCHGE	NEX PEARL HARBOR HI		NEX MINI-MART/BARBER SHOP	RETAIL EXCHANGE
6890	LOCATION EXCHGE(RESTCTD)	LOCATION EXCHGE	NEX PEARL HARBOR HI		NEX MINI-MART HALSEY	RETAIL EXCHANGE
794	LOCATION EXCHGE	LOCATION EXCHGE	NEX PEARL HARBOR HI		NEX MINI-MART/PEARL CITY	RETAIL EXCHANGE
198	NEX MINI-MART	LOCATION EXCHGE	NEX PEARL HARBOR HI		NEX MINI-MART/BARBER SHOP	RETAIL EXCHANGE
550	MINI-MART	LOCATION EXCHGE	NATIONAL SECURITY AGENCY		OPERATIONS CONTROL CENTER	RETAIL EXCHANGE
150	MINI MART (VACANT)	LOCATION EXCHGE	JBPHH PEARL HARBOR HI		ADMINISTRATIVE OFFICE	RETAIL EXCHANGE
2186	MINI MART	LOCATION EXCHGE	NEX PEARL HARBOR HI		NEX MINI-MART HOLOMOKU	RETAIL EXCHANGE
2073H	EXCH, SVC STN (18580)	LOCATION EXCHGE	ARMED FORCES EXCHANGES		EXCHANGE SERVICE OUTLET	RETAIL EXCHANGE
1756H	EXCH, BRANCH (18580)	LOCATION EXCHGE	ARMED FORCES EXCHANGES		AAFES MINI-MALL	RETAIL EXCHANGE
75	SUBWAY	EXCHANGE / MWR FOOD SVC	NEX PEARL HARBOR HI		ADMINISTRATION BUILDING	RETAIL EXCHANGE
88A	FOOD SERVICE OUTLET	EXCHANGE / MWR FOOD SVC	JBPHH PEARL HARBOR HI		ALL HANDS ARIZONA CLUB	RETAIL EXCHANGE
372	NEX CAFETERIA - (SUBWAY)	EXCHANGE / MWR FOOD SVC	NEX PEARL HARBOR HI		DET DINING FAC	RETAIL EXCHANGE
631	NEX FOOD COURT AT MALL PH	EXCHANGE / MWR FOOD SVC	NEX PEARL HARBOR HI		NAVY EXCHANGE MAIN RETAIL	RETAIL EXCHANGE
548	SNACK BAR (VACANT)	EXCHANGE / MWR FOOD SVC	JBPHH PEARL HARBOR HI		SNACK BAR	RETAIL EXCHANGE
3	BLIND VENDOR FOOD SERVICE	EXCHANGE / MWR FOOD SVC	STATE AND LOCAL AGENCIES		CAFETERIA	RETAIL EXCHANGE
550	DINING FACILITY	EXCHANGE / MWR FOOD SVC	NATIONAL SECURITY AGENCY		OPERATIONS CONTROL CENTER	RETAIL EXCHANGE
1302	MAMA'S LUNCH (NEX)	EXCHANGE / MWR FOOD SVC	JBPHH PEARL HARBOR HI		SNACK BAR SHELTER	RETAIL EXCHANGE
1237	VACANT NEX POPEYES	EXCHANGE / MWR FOOD SVC	JBPHH PEARL HARBOR HI		NEX SERVICE OUTLETS	RETAIL EXCHANGE
1314	PIZZA HUT/TACO BELL	EXCHANGE / MWR FOOD SVC	JBPHH PEARL HARBOR HI		ENLISTED PERSONNEL CLUB	RETAIL EXCHANGE
223	STEAK OUT GRILL (NEX)	EXCHANGE / MWR FOOD SVC	NEX PEARL HARBOR HI		ENVIRONMENTAL BLDG	RETAIL EXCHANGE
1557	EINSTEIN BROS./SUBWAY	EXCHANGE / MWR FOOD SVC	NEX PEARL HARBOR HI		EINSTEIN BROS/SUBWAY	RETAIL EXCHANGE
427	NEX L AND L DRIVE INN - VACANT	EXCHANGE / MWR FOOD SVC	NEX PEARL HARBOR HI		NEX BLDG	RETAIL EXCHANGE
711	MWR BURGER KING	EXCHANGE / MWR FOOD SVC	JBPHH PEARL HARBOR HI		BEEMAN CENTER	RETAIL EXCHANGE
1719	NEX MCDONALDS	EXCHANGE / MWR FOOD SVC	JBPHH PEARL HARBOR HI		MCDONALDS	RETAIL EXCHANGE
2186	NEX SUBWAY/SEATTLES BEST	EXCHANGE / MWR FOOD SVC	NEX PEARL HARBOR HI		NEX MINI-MART HOLOMOKU	RETAIL EXCHANGE
2096H	EXCH, CAFE SNK BAR (18580)	EXCHANGE / MWR FOOD SVC	ARMED FORCES EXCHANGES		EXCHANGE CAFE SNACK BAR	RETAIL EXCHANGE
2028H	EXCH, CAFE SNK BAR (18580)	EXCHANGE / MWR FOOD SVC	ARMED FORCES EXCHANGES		AIR PASSENGER TERMINAL	RETAIL EXCHANGE
1102H	EXCH, CAFE SNK BAR (18580)	EXCHANGE / MWR FOOD SVC	ARMED FORCES EXCHANGES		HEADQUARTERS MAJOR COMMAND	RETAIL EXCHANGE
1250H	EXCH, CAFE SNK BAR (18580)	EXCHANGE / MWR FOOD SVC	ARMED FORCES EXCHANGES		EXCHANGE CAFE SNACK BAR	RETAIL EXCHANGE
1756H	EXCH, CAFE SNK BAR (18580)	EXCHANGE / MWR FOOD SVC	ARMED FORCES EXCHANGES		AAFES MINI-MALL	RETAIL EXCHANGE
75	BARBER SHOP	EXCHANGE SERVICE OUTLETS	NEX PEARL HARBOR HI		ADMINISTRATION BUILDING	RETAIL EXCHANGE
360	NEX BARBER SHOP	EXCHANGE SERVICE OUTLETS	NEX PEARL HARBOR HI		NEX MINI-MART/BARBER SHOP	RETAIL EXCHANGE
631	NEX SERVICE OUTLETS AT MALL PH	EXCHANGE SERVICE OUTLETS	NEX PEARL HARBOR HI		NAVY EXCHANGE MAIN RETAIL	RETAIL EXCHANGE
198	NEX BARBER SHOP	EXCHANGE SERVICE OUTLETS	NEX PEARL HARBOR HI		NEX MINI-MART/BARBER SHOP	RETAIL EXCHANGE
551	BARBER SHOP	EXCHANGE SERVICE OUTLETS	NATIONAL SECURITY AGENCY		VISITOR CONTROL CENTER	RETAIL EXCHANGE
550	BLIND VENDOR	EXCHANGE SERVICE OUTLETS	NATIONAL SECURITY AGENCY		OPERATIONS CONTROL CENTER	RETAIL EXCHANGE
1237	VACANT ENTPR CAR RENTAL/BARBER	EXCHANGE SERVICE OUTLETS	JBPHH PEARL HARBOR HI		NEX SERVICE OUTLETS	RETAIL EXCHANGE

FACILITY_NO	FACILITY_USE	USE_CATEGORY_DESC	USER_UNIT_TITLE	LESSEE_NAME	FACILITY_NAME	SHORE_TASK
1314	NEX BARBER SHOP	EXCHANGE SERVICE OUTLETS	NEX PEARL HARBOR HI		ENLISTED PERSONNEL CLUB	RETAIL EXCHANGE
1337	NEX UNIFORM SHOP	EXCHANGE SERVICE OUTLETS	NEX PEARL HARBOR HI		NEX UNIFORM SHOP	RETAIL EXCHANGE
427	NEX BARBER SHOP - VACANT	EXCHANGE SERVICE OUTLETS	NEX PEARL HARBOR HI		NEX BLDG	RETAIL EXCHANGE
2186	BARBER SHOP	EXCHANGE SERVICE OUTLETS	NEX PEARL HARBOR HI		NEX MINI-MART HOLOMOKU	RETAIL EXCHANGE
2073H	EXCH, SVC OUTLET (18580)	EXCHANGE SERVICE OUTLETS	ARMED FORCES EXCHANGES		EXCHANGE SERVICE OUTLET	RETAIL EXCHANGE
2028H	CAR RENTAL OFFICE (18580)	EXCHANGE SERVICE OUTLETS	ARMED FORCES EXCHANGES		AIR PASSENGER TERMINAL	RETAIL EXCHANGE
1102H	AAFES BARBER SHOP (18580)	EXCHANGE SERVICE OUTLETS	ARMED FORCES EXCHANGES		HEADQUARTERS MAJOR COMMAND	RETAIL EXCHANGE
1232H	EXCH, SVC OUTLET (18580)	EXCHANGE SERVICE OUTLETS	ARMED FORCES EXCHANGES		EXHANGE SALES STORE	RETAIL EXCHANGE
1249H	EXCH, SVC OUTLET (18580)	EXCHANGE SERVICE OUTLETS	ARMED FORCES EXCHANGES		EXCHANGE SERVICE OUTLET	RETAIL EXCHANGE
1756H	EXCH, SVC OUTLET (18580)	EXCHANGE SERVICE OUTLETS	ARMED FORCES EXCHANGES		AAFES MINI-MALL	RETAIL EXCHANGE
289	EXCHANGE LAUNDRY (NAVY LODGE)	EXCHANGE LAUNDRY DRY CL	NEX PEARL HARBOR HI		NAVY LODGE LAUNDRY BLDG	RETAIL EXCHANGE
1314	LAUNDROMAT	EXCHANGE LAUNDRY DRY CL	NEX PEARL HARBOR HI		ENLISTED PERSONNEL CLUB	RETAIL EXCHANGE
1709	NEX BRAVO 25 LAUNDRY	EXCHANGE LAUNDRY DRY CL	JBPHH PEARL HARBOR HI		NEX BRAVO 25 LAUNDRY	RETAIL EXCHANGE
1102H	AAFES DRY CLEANERS (18580)	EXCHANGE LAUNDRY DRY CL	ARMED FORCES EXCHANGES		HEADQUARTERS MAJOR COMMAND	RETAIL EXCHANGE
1756H	EXCH LDY&CLN PLT (18580)	EXCHANGE LAUNDRY DRY CL	ARMED FORCES EXCHANGES		AAFES MINI-MALL	RETAIL EXCHANGE
444	VACANT	EXCHANGE MAINTENANCE SHOP	JBPHH PEARL HARBOR HI		WAREHOUSE	RETAIL EXCHANGE
427	NEX VENDING & FAC MAINT SHOP	EXCHANGE MAINTENANCE SHOP	NEX PEARL HARBOR HI		NEX BLDG	RETAIL EXCHANGE
2638	MCDONALDS	INSTALLATION REST (MWR)	PRIVATE ORGANIZATIONS	MSC, LLC	MCDONALD'S MOANALUA SHOP CTR	MWR
2643	TACO BELL	INSTALLATION REST (MWR)	PRIVATE ORGANIZATIONS	MSC, LLC	TACO BELL MOANALUA SHOP CTR	MWR
2644	JACK IN THE BOX	INSTALLATION REST (MWR)	PRIVATE ORGANIZATIONS	MSC, LLC	JACK IN THE BOX MOA SHOP CTR	MWR
2650	KENTUCKY FRIED CHICKEN MOA CTR	INSTALLATION REST (MWR)	PRIVATE ORGANIZATIONS	MSC, LLC	KENTUCKY FRIED CHICKEN MOA	MWR
52	CAFETERIA STORAGE	INSTALLATION REST (MWR)	JBPHH PEARL HARBOR HI		CAFETERIA STORAGE	MWR
64	VACANT	INSTALLATION REST (MWR)	JBPHH PEARL HARBOR HI		STOREHOUSE GENERAL	MWR
29	VACANT	INSTALLATION REST (MWR)	JBPHH PEARL HARBOR HI		CIVILIAN CAFETERIA	MWR
6882	EXCHANGE GAS STATION	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		LOCATION EXCHANGE	RETAIL EXCHANGE
2601	CHEVRON GAS STATION	EXCHGE AUTO REPAIR STA	PRIVATE ORGANIZATIONS	MSC, LLC	CHEVRON GAS STATION MOA CTR	RETAIL EXCHANGE
71	JOHNSON CIRCLE GAS STATION	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		NEX SERVICE STATION-MOANALUA	RETAIL EXCHANGE
2647	ALOHA GAS STATION	EXCHGE AUTO REPAIR STA	PRIVATE ORGANIZATIONS	MSC, LLC	7-ELEVEN/ALOHA GAS MOA SHOP	RETAIL EXCHANGE
6890A	NEX GAS STATION	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		NEX GAS STA, HALSEY TERRACE	RETAIL EXCHANGE
794A	NEX GAS STATION	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		NEX GAS STATION	RETAIL EXCHANGE
329	EXCHGE GAS STATION	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		NAVY EXCHANGE GAS STATION	RETAIL EXCHANGE
1257	NEX AUTO SVC CENTER	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		NEX AUTO SERVICE CTR	RETAIL EXCHANGE
1594	NEX AUTO SVC CTR	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		NEX AUTO HOBBY SHOP	RETAIL EXCHANGE
1326	EXCHGE AUTO REPAIR STA	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		EXCHANGE FILLING STATION	RETAIL EXCHANGE
795	EXCHANGE GAS SERVICE&AUTO-REPA	EXCHGE AUTO REPAIR STA	NEX PEARL HARBOR HI		EXCHANGE FILLING STATION	RETAIL EXCHANGE
2072H	EXCH, SVC STN (18580)	EXCHGE AUTO REPAIR STA	ARMED FORCES EXCHANGES		EXCHANGE SERVICE STATION	RETAIL EXCHANGE
1754H	EXCH, SVC STN (18580)	EXCHGE AUTO REPAIR STA	ARMED FORCES EXCHANGES		AAFES MINI-MALL ON KUNTZ	RETAIL EXCHANGE
103	MWR EQUIPMENT RENTAL	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		MWR COMMUNITY MTG RM	MWR
433	MWR STRG LOCKER RENTALS	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		MWR STRG LOCKER RENTAL	MWR
161	SPEC SERV - OUTDOOR ADVENTURE	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		FIELD HSE/BLOCH ARENA	MWR
1598	TENNIS PRO SHOP	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		TENNIS PRO SHOP	MWR
1666	HOBBY-X PAINTBALL	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		TENNIS COURT PAVILION	MWR
427H	TENNIS PRO SHOP (75767)	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		MISC RECREATION BUILDING	MWR
1092H	DIVING CLUB (75767)	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		MISC RECREATION BLDG	MWR
1760H	MWR OUTDOOR REC CTR (75767)	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		MWR OUTDOOR REC AND ITT	MWR
3485H	MWR SUP/NAF C-STOR (75767)	MWR OUTDOOR REC CTR	JBPHH PEARL HARBOR HI		MWR SUPPLY/NAF CENTRAL STRG	MWR
58	AUTO SKILLS CTR (VACANT)	MWR AUTO SKILLS CTR	JBPHH PEARL HARBOR HI		AUTO HOBBY SHOP	MWR
613	VACANT	MWR AUTO SKILLS CTR	JBPHH PEARL HARBOR HI		AUTO HOBBY SHOP	MWR
2641	AUTO HOBBY SHOP	MWR AUTO SKILLS CTR	PRIVATE ORGANIZATIONS	MSC, LLC	AUTO HOBBY SHOP-MOANALUA	MWR
2641A	AUTO HOBBY SHOP SHELTER	MWR AUTO SKILLS CTR	PRIVATE ORGANIZATIONS	MSC, LLC	AUTO HOBBY SHOP SHELTER	MWR
4002H	H/SHP, AUTOMOTIVE (75767)	MWR AUTO SKILLS CTR	JBPHH PEARL HARBOR HI		HOBBY SHOP AUTOMOTIVE	MWR

FACILITY_NO	FACILITY_USE	USE_CATEGORY_DESC	USER_UNIT_TITLE	LESSEE_NAME	FACILITY_NAME	SHORE_TASK
4003H	H/SHP, AUTOMOTIVE (75767)	MWR AUTO SKILLS CTR	JBPHH PEARL HARBOR HI		HOBBY SHOP AUTOMOTIVE	MWR
1720H	H/SHP, AUTOMOTIVE (75767)	MWR AUTO SKILLS CTR	JBPHH PEARL HARBOR HI		EXCH GARAGE	MWR
90	MWR SINGLE SAILOR CENTER	MWR MIL REC CENTER	JBPHH PEARL HARBOR HI		SINGLE SAILOR CENTER	MWR
1314	MWR MIL REC CENTER	MWR MIL REC CENTER	JBPHH PEARL HARBOR HI		ENLISTED PERSONNEL CLUB	MWR
89	ARMED SERVICES YMCA	MWR MIL REC CENTER	PRIVATE ORGANIZATIONS	HONOLULU ASYMCA	ARMED SERVICES YMCA	MWR
1616	HOBBY-X PAINTBALL	MWR MIL REC CENTER	JBPHH PEARL HARBOR HI		TENNIS PRO SHOP	MWR
2647	7-ELEVEN STORE	NEX PACKAGE STORE	PRIVATE ORGANIZATIONS	MSC, LLC	7-ELEVEN/ALOHA GAS MOA SHOP	RETAIL EXCHANGE
631	NEX PACKAGE STORE AT MALL PH	NEX PACKAGE STORE	NEX PEARL HARBOR HI		NAVY EXCHANGE MAIN RETAIL	RETAIL EXCHANGE
581	VACANT	MWR READY STOR	JBPHH PEARL HARBOR HI		MWR POV STORAGE	MWR
43	VACANT	MWR READY STOR	JBPHH PEARL HARBOR HI		WAREHOUSE	MWR
212A	VACANT	MWR READY STOR	JBPHH PEARL HARBOR HI		MWR GOLF COURSE MAINT STRG	MWR
5180	VACANT	MWR READY STOR	JBPHH PEARL HARBOR HI		MWR GROUNDS EQUIPMENT STRG	MWR
1925	YOUTH CHILD PROGRAM STORAGE	MWR READY STOR	JBPHH PEARL HARBOR HI		MWR CHILD YOUTH PROGRAM	MWR
393	QOL/MWR/SECURITY STORAGE	MWR READY STOR	JBPHH PEARL HARBOR HI		GENERAL WAREHOUSE STORAGE	MWR
469	USS MISSOURI MEM ASSN STORAGE	MWR READY STOR	PRIVATE ORGANIZATIONS	USS MISSOURI MEMORIAL ASN	PIER UTILITY BLDG	MWR
1337	MWR STORAGE	MWR READY STOR	JBPHH PEARL HARBOR HI		NEX UNIFORM SHOP	MWR
1605	NEX STORAGE SHED	MWR READY STOR	NEX PEARL HARBOR HI		MWR STORAGE SHED	MWR
1606	NEX STORAGE SHED	MWR READY STOR	NEX PEARL HARBOR HI		MWR STORAGE SHED	MWR
644	MWR STORAGE/ISSUE	MWR READY STOR	JBPHH PEARL HARBOR HI		MWR MAINTENANCE	MWR
711	COMMUNITY STRG(MISC)	MWR READY STOR	JBPHH PEARL HARBOR HI		BEEMAN CENTER	MWR
1650	MWR STORAGE	MWR READY STOR	JBPHH PEARL HARBOR HI		MWR STORAGE	MWR
1664A	FIELD MAINT. EQUIPMENT STRGE	MWR READY STOR	JBPHH PEARL HARBOR HI		MILLICAN CONCESSION STORAGE	MWR
2098H	YOUTH FITNESS STORAGE (75767)	MWR READY STOR	JBPHH PEARL HARBOR HI		YOUTH FITNESS STORAGE	MWR
3360H	VACANT (18644)	MWR READY STOR	JBPHH PEARL HARBOR HI		ROD AND GUN CLUB	MWR
1713H	MWR SUP/NAF C-STOR (75767)	MWR READY STOR	JBPHH PEARL HARBOR HI		REC SUP/HSG SUP	MWR
1172	MWR EQUIP MAINT SHOP	MWR EQUIP MAINT SHOP	JBPHH PEARL HARBOR HI		AUTO HOBBY SHOP	MWR
3460H	HARBOR MAINT SHOP(75767)	MWR EQUIP MAINT SHOP	JBPHH PEARL HARBOR HI		MISC RECREATION BUILDING	MWR
2283	MWR CAR WASH & VACUUM AREA	MWR CAR WASH	JBPHH PEARL HARBOR HI		MOANALUA CAR WASH	RETAIL EXCHANGE
75065H	POV WASHRACK (75767)	MWR CAR WASH	JBPHH PEARL HARBOR HI		POV WASHRACK	RETAIL EXCHANGE
221399	VEH, RV, BOAT STO COMPOUND	MWR VEH/ RV/ BOAT STO CPD	JBPHH PEARL HARBOR HI		MWR BOAT STRGE B575 COMPOUND	MWR
200775	QOL VEHICLE PARKING	MWR VEH/ RV/ BOAT STO CPD	JBPHH PEARL HARBOR HI		PAVEMENTS/CONCRETE	MWR
460	W/I EXPLOSIVE ARC (VACANT)	MWR REC GRNDS	JBPHH PEARL HARBOR HI		PLAYGROUND	MWR
526		MWR REC GRNDS	JBPHH PEARL HARBOR HI		PLAYGROUND	MWR
427A	GOLF PARK	MWR REC GRNDS	JBPHH PEARL HARBOR HI		GOLF PARK	MWR

APPENDIX 11-1

SIC Codes for Industrial Facilities Requiring Permit Coverage

Primary Activities & Standard Industrial Classification (SIC) Codes

Federal regulations require sites with **primary activities and/or SIC codes** that fall under any of the eleven categories of industrial activity, defined at 40 CFR 122.26(b)(14)(i)-(xi) except category (x) to obtain permit coverage or certify a condition of no exposure. The facilities classified with the following **primary activities and/or SIC codes** are required to obtain NPDES storm water permit coverage or certify a condition of no exposure.

Primary Activities:

- **Hazardous waste treatment, storage, or disposal facilities** (including those that are operating under interim status or a permit under Subtitle C of the RCRA).
- **Landfills** (active, inactive, or closed) and land application sites that receive or have received industrial wastes.
- **Steam electric power generating facilities**, including coal handling sites.
- **Wastewater Treatment Facilities** (or other treatment works) with a design flow of at least 1.0 million gallons per day (MGD).
- Facilities involved in the recycling of material, including **metal scrapyards, battery reclaimers, salvage yards, and automobile junkyards**, including, but not limited to those classified as SIC 5015 and 5093.
- **Transportation activities** at facilities classified by the SIC codes listed in the box on Page 5 are required to obtain coverage if the facility conducts any vehicle maintenance and/or it operates maintenance shops, equipment cleaning, or airport de-icing. Vehicle maintenance means fueling, vehicle rehabilitation, mechanical repairs, painting, and lubrication. Includes SIC groups 40-45, (except 4221-4225) and 5171. For a complete description see listing under **Transportation** (box, Page 5).

SIC Codes:

Mining

Metal Mining

- 1011 Iron ores
- 1021 Copper ores
- 1031 Lead and zinc ores
- 1041 Gold ores
- 1044 Silver ores
- 1061 Ferroalloy ores (except vanadium)
- 1081 Metal Mining Services
- 1094 Uranium-radium-vanadium ores
- 1099 Miscellaneous metal ores, not elsewhere classified (NEC)

Coal Mining

- 1221 Bituminous coal and lignite surface mining
- 1222 Bituminous coal underground mining
- 1231 Anthracite mining
- 1241 Coal Mining Services

Oil and Gas Extraction

- 1311 Crude petroleum and natural gas
- 1321 Natural gas liquids
- 1381 Oil and gas well drilling
- 1382 Oil and gas field exploration services
- 1389 Oil and gas field services, NEC

Mining and Quarrying of Nonmetallic Minerals (except fuels)

- 1411 Dimension stone
- 1422 Crushed and broken limestone
- 1423 Crushed and broken granite
- 1429 Crushed and broken stone, NEC
- 1442 Construction sand and gravel
- 1446 Industrial sand
- 1455 Kaolin and ball clay
- 1459 Clay, ceramic and refractory minerals, NEC
- 1474 Potash, soda and borate minerals
- 1475 Phosphate rock
- 1479 Chemical and fertilizer minerals mining NEC
- 1481 Nonmetallic minerals services
- 1499 Miscellaneous nonmetallic minerals except fuels

Manufacturing

Food and Kindred Products

- 2011 Meat packing plants
- 2013 Sausages and other prepared meat products
- 2015 Poultry slaughtering and processing
- 2021 Creamery butter
- 2022 Natural, processed and imitation cheese
- 2023 Dry, condensed and evaporated dairy products
- 2024 Ice cream and frozen desserts
- 2026 Fluid milk
- 2032 Canned specialties
- 2033 Canned fruits, vegetables, preserves, jams and jellies
- 2034 Dried & dehydrated fruits, vegetables and soup mixes
- 2035 Pickled fruits & vegetables sauces, seasonings, and salad dressings
- 2037 Frozen fruits, fruit juices, and vegetables
- 2038 Frozen specialties, NEC
- 2041 Flour and other grain mill products
- 2043 Cereal breakfast foods
- 2044 Rice milling
- 2045 Prepared flour mixes and doughs
- 2046 Wet corn milling
- 2047 Dog and cat food
- 2048 Prepared animal and fowl feeds (except dog and cat food)
- 2051 Bread and other bakery products (except cookies and crackers)
- 2052 Cookies and crackers
- 2053 Frozen bakery products (except bread)
- 2061 Cane sugar (except refining)
- 2062 Cane sugar refining
- 2063 Beet sugar
- 2064 Candy and other confectionary products
- 2066 Chocolate and other cocoa products
- 2067 Chewing gum
- 2068 Salted & roasted nuts and seeds
- 2074 Cottonseed oil mills
- 2075 Soybean oil mills
- 2076 Vegetable oil mills, except corn, cottonseed and soybean
- 2077 Animal & marine fats and oils
- 2079 Shortening margarine & other fats and oils NEC

2082 Malt beverages
2083 Malt
2084 Wines, brandy and brandy spirits
2085 Distilled and blended liquors
2086 Bottled & canned soft drinks and carbonated waters
2087 Flavoring extracts and flavoring syrups, NEC
2091 Canned & cured fish and seafoods
2092 Prepared fresh or frozen fish and seafoods
2095 Roasted coffee
2096 Potato chips, corn chips and similar snacks
2097 Manufactured ice
2098 Macaroni, spaghetti, vermicelli and noodles
2099 Food preparations NEC

Tobacco Products

2111 Cigarettes
2121 Cigars
2131 Chewing & smoking tobacco and snuff
2141 Tobacco stemming and redrying

Textile Mill Products

2211 Broadwoven cotton mills
2221 Broadwoven manmade fiber and silk mills
2231 Broadwoven wool mills
2241 Narrow cotton, wool, silk, and manmade fiber mills
2251 Women's full-length and knee-length hosiery (except socks)
2252 Hosiery, NEC
2253 Knit outerwear mills
2254 Knit underwear and nightwear mills
2257 Weft knit fabric mills
2258 Lace and warp knit fabric mills
2259 Knitting mills, NEC
2261 Broadwoven cotton finishing plants
2262 Broadwoven manmade fiber and silk finishing plants
2269 Textile finishing plants, NEC
2273 Carpets and rugs
2281 Yarn spinning mills
2282 Yarn texturizing, throwing, twisting, and winding mills
2284 Thread mills
2295 Coated fabrics, not rubberized
2296 Tire cord and fabrics
2297 Nonwoven fabrics
2298 Cordage and twine
2299 Textile goods, NEC

Apparel and Other Finished Products Made from Fabrics and Similar Materials

2311 Men's and boys' suits, coats, and overcoats
2321 Men's and boys' shirts (except work shirts)
2322 Men's and boys' underwear and nightwear
2323 Men's and boys' neckwear
2325 Men's and boys' separate trousers and slacks
2326 Men's and boys' work clothing
2329 Men's and boys' clothing, NEC
2331 Women's, misses' & juniors' blouses and shirts
2335 Women's, misses' & juniors' dresses
2337 Women's, misses' & juniors' suits, skirts, and coats
2339 Women's, misses' & juniors' outerwear
2341 Women's, misses' children's, and infants' underwear and nightwear
2342 Brassieres, girdles and allied garments
2353 Hats, caps and millinery
2361 Girl's, children's & infants' dresses, blouses & shirts
2369 Girl's, children's & infants' outerwear NEC
2371 Fur goods
2381 Dress and work gloves (except knit and all-leather)
2384 Robes and dressing gowns
2385 Waterproof outerwear

2386 Leather and sheep-lined clothing
2387 Apparel belts
2389 Apparel and accessories, NEC
2391 Curtains and draperies
2392 Housefurnishings (except curtains and draperies)
2393 Textile bags
2394 Canvas and related products
2395 Pleating, decorative and novelty stitching, tucking for the trade
2396 Automotive trimmings, apparel findings and related products
2397 Schiffli machine embroideries
2399 Fabricated textile products, NEC

Lumber and Wood Products

2421 Sawmills and planing mills-general
2426 Hardwood dimension and flooring mills
2429 Special products sawmills, NEC
2431 Millwork
2434 Wood kitchen cabinets
2435 Hardwood veneer and plywood
2436 Softwood veneer and plywood
2439 Structural wood members, NEC
2441 Nailed and lock corner wood boxes and shooks
2448 Wood pallets and skids
2449 Wood containers, NEC
2451 Mobile homes
2452 Prefabricated wood buildings and components
2491 Wood preserving
2493 Reconstituted wood products
2499 Wood products, NEC

Furniture and Fixtures

2511 Wood household furniture (except upholstered)
2512 Upholstered wood household furniture
2514 Metal household furniture
2515 Mattresses, foundations, & convertible beds
2517 Wood TV, radio, phonograph and sewing machine cabinets
2519 Household furniture, NEC
2521 Wood office furniture
2522 Office furniture (except wood)
2531 Public building and related furniture
2541 Wood office & store fixtures, partitions, shelving and lockers
2542 Office & store fixtures, partitions and shelving (except wood)
2591 Drapery hardware, window blinds and shades
2599 Furniture and fixtures, NEC

Paper and Allied Products

2611 Pulp mills
2621 Paper mills
2631 Paperboard mills
2652 Setup paperboard boxes
2653 Corrugated and solid fiber boxes
2655 Fiber cans, tubes, drums, and similar products
2656 Sanitary food containers (except folding)
2657 Folding paperboard boxes, including sanitary
2671 Packaging paper & plastics film (coated and laminated)
2672 Coated and laminated paper, NEC
2673 Plastics, foil and coated paper bags
2674 Uncoated paper and multiwall bags
2675 Die-cut paper, paperboard and cardboard
2676 Sanitary paper products
2677 Envelopes
2678 Stationary, tablets, and related products
2679 Converted paper and paperboard products NEC

Printing, Publishing and Allied Industries

2711 Newspaper publishing or newspaper publishing and printing
2721 Periodical publishing or periodical publishing and printing
2731 Book publishing or book publishing and printing
2732 Book printing
2741 Miscellaneous publishing
2752 Commercial lithographic printing
2754 Commercial gravure printing
2759 Commercial printing, NEC
2761 Manifold business forms
2771 Greeting cards
2782 Blankbooks, looseleaf binders, and devices
2789 Bookbinding and related work
2791 Typesetting
2796 Platemaking and related services

Chemicals and Allied Products

2812 Alkalies and chlorine
2813 Industrial gases
2816 Inorganic pigments
2819 Industrial inorganic pigments, NEC
2821 Plastic materials, synthetic resins and elastomers
2822 Synthetic rubber (vulcanizable elastomers)
2823 Cellulosic manmade fibers
2824 Manmade organic fibers, except cellulosic
2833 Medicinal chemicals and botanical products
2834 Pharmaceutical preparations
2835 In vitro and in vivo diagnostic substances
2836 Biological products (except diagnostic substances)
2841 Soap and other detergents, except specialty cleaning
2842 Specialty cleaning, polishing and sanitation preparations
2843 Surface active agents, finishing agents and sulfonated oils
2844 Perfumes, cosmetics and other toilet preparations
2851 Paints, varnishes, lacquers, enamels and allied products
2861 Gum and wood chemicals
2865 Cyclic organic crudes and intermediates and organic dyes
2869 Industrial organic chemicals, NEC
2873 Nitrogenous fertilizers
2874 Phosphatic fertilizers
2875 Fertilizers, mixing only
2879 Pesticides and agricultural chemicals, NEC
2891 Adhesives and sealants
2892 Explosives
2893 Printing ink
2895 Carbon black
2899 Chemicals and chemical preparations, NEC

Petroleum Refining and Related Industries

2911 Petroleum refining
2951 Asphalt paving mixtures and blocks
2952 Asphalt felts and coatings
2992 Lubricating oils and greases
2999 Petroleum and coal products, NEC

Rubber and Miscellaneous Plastic Products

3011 Tires and inner tubes
3021 Rubber and plastic footwear
3052 Rubber, plastic hose, and belting
3053 Gaskets, packing and sealing devices
3061 Molded, extruded and lathe-cut mechanical rubber goods
3069 Fabricated rubber products, NEC
3081 Unsupported plastics film and sheet
3082 Unsupported plastics profile shapes
3083 Laminated plastics plate, sheet and profile shapes
3084 Plastics pipe
3085 Plastics bottles
3086 Plastics foam products
3087 Custom compounding of purchased plastics resins

3088 Plastics plumbing, fixtures

3089 Plastics products NEC

Leather and Leather Products

3111 Leather tanning and finishing
3131 Boot & shoe cut stock and findings
3142 House slippers
3143 Men's footwear (except athletic)
3144 Women's footwear (except athletic)
3149 Footwear (except rubber), NEC
3151 Leather gloves and mittens
3161 Luggage
3171 Women's handbags and purses
3172 Personal leather goods (except women's handbags and purses)
3199 Leather goods, NEC

Stone, Clay, Glass and Concrete Products

3211 Flat glass
3221 Glass containers
3229 Pressed & blown glass and glassware
3231 Glass products, made of purchased glass
3241 Hydraulic cement
3251 Brick and structural clay tile
3253 Ceramic wall and floor tile
3255 Clay refractories
3259 Structural clay products, NEC
3261 Vitreous china plumbing fixtures and bathroom fittings
3262 Vitreous china table and kitchen articles
3263 Fine earthenware (whiteware) table and kitchen articles
3264 Porcelain electrical supplies
3269 Pottery products, NEC
3271 Concrete block and brick
3272 Concrete products, except block and brick
3273 Ready-mixed concrete
3274 Lime
3275 Gypsum products
3281 Cut stone and stone products
3291 Abrasive products
3292 Asbestos products
3295 Ground or otherwise treated minerals and earths
3296 Mineral wool
3297 Nonclay refractories
3299 Nonmetallic mineral products, NEC

Primary Metal Industries

3312 Steel works, blast furnaces (including coke ovens) and rolling mills
3313 Electrometallurgical products except steel
3315 Steel wiredrawing, nails, and spikes
3316 Cold-rolled steel sheet, strip and bars
3317 Steel pipe and tubes
3321 Gray and ductile iron foundries
3322 Malleable iron foundries
3324 Steel investment foundries
3325 Steel foundries, NEC
3331 Primary copper smelting and refining
3334 Primary aluminum production
3339 Primary nonferrous metals smelting and refining, NEC
3341 Secondary nonferrous metals smelting and refining
3351 Copper rolling, drawing and extruding
3353 Aluminum sheet, plate and foil
3354 Aluminum extruded products
3355 Aluminum rolling and drawing, NEC
3356 Nonferrous metals rolling, drawing, and extruding NEC
3357 Nonferrous wire drawing and insulating
3363 Aluminum die-castings
3364 Nonferrous die-castings, except aluminum

3365 Aluminum foundries
3366 Copper foundries
3369 Nonferrous foundries, except aluminum and copper
3398 Metal heat treating
3399 Primary metal products, NEC

Fabricated Metal Products except Machinery and Transportation Equipment

3411 Metal cans
3412 Metal shipping barrels, drums, kegs, and pails
3421 Cutlery
3423 Hand and edge tools (except machine tools and handsaws)
3425 Saw blades and handsaws
3429 Hardware, NEC
3431 Enameled iron and metal sanitary ware
3432 Plumbing fixtures and trim
3433 Heating equipment (except electric and warm air furnaces)
3441 Fabricated structural metal
3442 Metal doors, frames, sash, molding and trim
3443 Fabricated plate work (boiler shops)
3444 Sheet metal work
3446 Architectural and ornamental metal work
3448 Prefabricated metal buildings and components
3449 Miscellaneous structural metal work
3451 Screw machine products
3452 Bolts, nuts, screws, rivets, and washers
3462 Iron and steel forgings
3463 Nonferrous forgings
3465 Automotive stampings
3466 Crowns and closures
3469 Metal stampings, NEC
3471 Electroplating, plating, polishing, anodizing, and coloring
3479 Coating, engraving, and allied services, NEC
3482 Small arms ammunition
3483 Ammunition (except small arms)
3484 Small arms
3489 Ordnance and accessories, NEC
3491 Industrial valves
3492 Fluid power valves and hose fittings
3493 Steel springs (except wire)
3494 Valves and pipe fittings, NEC
3495 Wire springs
3496 Miscellaneous fabricated wire products
3497 Metal foil and leaf
3498 Fabricated pipe and pipe fittings
3499 Fabricated metal products, NEC

Industrial and Commercial Machinery and Computer Equipment

3511 Steam, gas & hydraulic turbines and generator units
3519 Internal combustion engines, NEC
3523 Farm machinery and equipment
3524 Lawn & garden tractors and home lawn & garden equipment
3531 Construction machinery and equipment
3532 Mining machinery and equipment (except oil and gas field)
3533 Oil & gas machinery and equipment
3534 Elevators and moving stairways
3535 Conveyors and conveying equipment
3536 Overhead traveling cranes, hoists, and monorail systems
3537 Industrial trucks, tractors, trailers, and stackers
3541 Metal cutting machine tools
3542 Metal forming machine tools
3543 Industrial patterns
3544 Special dies, tools, die sets, jigs, fixtures and molds
3545 Cutting tools, accessories and precision measuring devices
3546 Power-driven handtools
3547 Rolling mill machinery and equipment
3548 Electric & gas welding and soldering equipment

3549 Metalworking machinery, NEC
3552 Textile machinery
3553 Woodworking machinery
3554 Paper industries machinery
3555 Printing trades machinery and equipment
3556 Food products machinery
3559 Special industry machinery, NEC
3561 Pumps and pumping equipment
3562 Ball and roller bearings
3563 Air and gas compressors
3564 Industrial & commercial fans, blowers and air purification equipment
3565 Packaging machinery
3566 Speed changers, industrial high speed drives and gears
3567 Industrial process furnaces and ovens
3568 Mechanical power transmission equipment, NEC
3569 General industrial machinery and equipment, NEC
3571 Electronic computers
3572 Computer storage devices
3575 Computer terminals
3577 Computer peripheral equipment, NEC
3578 Calculating and accounting machines (except electronic computers)
3579 Office machines, NEC
3581 Automatic vending machines
3582 Commercial laundry, drycleaning, and pressing machines
3585 Air-conditioning, heating, and refrigeration equipment
3586 Measuring and dispensing pumps
3589 Service industry machinery, NEC
3592 Carburetors, pistons, piston rings, and valves
3593 Fluid power cylinders and actuators
3594 Fluid power pumps and motors
3596 Scales and balances (except laboratory)
3599 Industrial & commercial machinery and equipment, NEC

Electronic and other Electrical Equipment and Components (except Computer Equipment)

3612 Power, distribution and specialty transformers
3613 Switchgear and switchboard apparatus
3621 Motors and generators
3624 Carbon and graphite products
3625 Relays and industrial controls
3629 Electrical industrial apparatus, NEC
3631 Household cooking equipment
3632 Household refrigerators and home & farm freezers
3633 Household laundry equipment
3634 Electric housewares and fans
3635 Household vacuum cleaners
3639 Household appliances, NEC
3641 Electric lamp bulbs and tubes
3643 Current-carrying wiring devices
3644 Noncurrent-carrying wiring devices
3645 Residential electric lighting fixtures
3646 Commercial, industrial and institutional electric lighting fixtures
3647 Vehicular lighting equipment
3648 Lighting equipment, NEC
3651 Household audio and video equipment
3652 Phonograph records and prerecorded audio tapes & disks
3661 Telephone and telegraph apparatus
3663 Radio and TV broadcasting & communications equipment
3669 Communications equipment NEC
3671 Electron bulbs
3672 Printed circuit boards
3674 Semiconductors and related devices
3675 Electronic capacitors
3676 Electronic resistors
3677 Electronic coils, transformers, and other inductors

3678 Electronic connectors
 3679 Electronic components NEC
 3691 Storage batteries
 3692 Primary batteries (dry and wet)
 3694 Electrical equipment for internal combustion engines
 3695 Magnetic and optical recording media
 3699 Electrical machinery, equipment and supplies NEC

Transportation Equipment

3711 Motor vehicles and passenger car bodies
 3713 Truck and bus bodies
 3714 Motor vehicle parts and accessories
 3715 Truck trailers
 3716 Motor homes
 3721 Aircraft
 3724 Aircraft engines and engine parts
 3728 Aircraft parts and auxiliary equipment, NEC
 3731 Ship building and repairing
 3732 Boat building and repairing
 3743 Railroad equipment
 3751 Motorcycles, bicycles, and parts
 3761 Guided missiles and space vehicles
 3764 Guided missile and space vehicle propulsion units & parts
 3769 Guided missile and space vehicle parts & equipment, NEC
 3792 Travel trailers and campers
 3795 Tanks and tank components
 3799 Transportation equipment, NEC

Measuring, Analyzing, and Controlling Instruments:

Photographic, Medical and Optical Goods: and Watches and Clocks

3812 Search, detection, navigation, and guidance systems
 3821 Laboratory apparatus and furniture
 3822 Automatic environmental and appliance controls
 3823 Process measurement, display, and control instruments
 3824 Totalizing fluid meters and counting devices
 3825 Electricity & signal measurement and testing instruments
 3826 Laboratory analytical instruments
 3827 Optical instruments and lenses
 3829 Measuring and controlling devices, NEC
 3841 Surgical & medical instruments and apparatus
 3842 Orthopedic, prosthetic and surgical appliances and supplies
 3843 Dental equipment and supplies
 3844 X-Ray apparatus & tubes and related irradiation apparatus
 3845 Electromedical and electrotherapeutic apparatus
 3851 Ophthalmic goods
 3861 Photographic equipment and supplies
 3873 Watches, clocks, clockwork operated devices & parts

Miscellaneous Manufacturing Industries

3911 Precious metal jewelry
 3914 Silverware, plated ware, and stainless steel ware
 3915 Jewelers' findings and materials and lapidary work
 3931 Musical instruments
 3942 Dolls and stuffed toys
 3944 Games, toys, and children's vehicles (except dolls and bicycles)
 3949 Sporting and athletic goods, NEC
 3951 Pens, mechanical pencils, and parts
 3952 Lead pencils, crayons and artists' materials
 3953 Marking devices
 3955 Carbon paper and inked ribbons
 3961 Costume jewelry and novelties (except precious metal)
 3965 Fasteners, buttons, needles and pins
 3991 Brooms and brushes

3993 Signs and advertising specialties
 3995 Burial caskets
 3996 Linoleum and other hard surface floor coverings NEC
 3999 Manufacturing industries NEC

Transportation Activities

4011 - 4215 (see below)
 4221 Farm product warehousing and storage
 4222 Refrigerated warehousing and storage
 4225 General warehousing and storage
 4226 - 4581 (see below)

Durable Goods

5015 Used motor vehicle parts
 5093 Scrap and waste materials

Transportation (see note in Primary Activities)

Railroad Transportation

4011 Line-haul railroad operation
 4013 Railroad switching and terminal establishments

Local and Suburban Transit and Interurban Highway Passenger Transportation

4111 Local and suburban transit
 4119 Local passenger transportation, NEC
 4121 Taxicab service
 4131 Intercity and rural bus transportation
 4141 Local bus charter service
 4142 Bus charter service, except local
 4151 School bus operation
 4173 Terminal and service facilities for passenger transportation

Motor Freight Transportation and Warehousing

4212 Local trucking without storage
 4213 Trucking, except local
 4214 Local trucking with storage
 4215 Courier service, except by air
 4226 Special warehousing and storage, NEC
 4231 Trucking terminal and maintenance facilities

United States Post Office

4311 United States Postal Service

Water Transportation

4412 Deep sea foreign freight transportation
 4424 Deep sea domestic freight transportation
 4432 Freight transportation on the Great Lakes/Saint Lawrence Seaway
 4449 Water freight transportation, NEC
 4481 Deep sea passenger transportation, NEC
 4482 Ferry operation
 4489 Water passenger operation NEC
 4491 Marine cargo handling
 4492 Towing and tugboat services
 4493 Marina operation
 4499 Water transportation services, NEC

Transportation by Air

4512 Scheduled air transportation
 4513 Air courier services
 4522 Nonscheduled air transportation
 4581 Airports, flying fields, and airport terminal services

Nondurable Goods

5171 Petroleum bulk stations and terminals

APPENDIX 11-2

Industrial Storm Water Pollution Control Plans
[Redacted due to national security concerns]

APPENDIX 11-3

Best Management Practices Fact Sheets
August 2016

Best Management Practices Fact Sheets

This appendix presents generic descriptions of Best Management Practices (BMPs). For ease of reference each BMP has been assigned a number. Table 11-3-1 summarizes all BMPs by its assigned number, name, functional category, and implementation category. Each of the listed BMPs is described in more detail in the pages following. This additional information includes:

- Description of potential pollutants and their sources addressed by the BMP
- Description of the BMP
- Frequency of BMP application (if applicable)
- Training needs
- Effectiveness and cost
- Limitations

The BMPs listed in Table 11-3-1 are either currently used at NRH, will be implemented by one of its industrial facilities in accordance with the corresponding Storm Water Pollution Control Plan (SWPCP) in Appendix 11-2, or may become applicable in the future for new or modified facilities.

TABLE 11-3-1 BEST MANAGEMENT PRACTICES

BMP No.	BMP Title	Functional Category⁽¹⁾	Implementation Category⁽²⁾	Implementation Schedule
001	Label All Drums, Cans, Containers, Tanks, and Valves	SC	NS	
002	Restrict Access to Area and Equipment	SC	S	
003	Perform Regular Cleaning	SC	NS	
004	Avoid Hosing Down the Site	SC	NS	
005	Perform Regular Pavement Sweeping	SC	NS	
006	Control Spills	SC	NS	
007	Place Trash Receptacles at Appropriate Locations	SC	NS	
008	Train Employees to Properly Dispose of Wastes	SC	NS	
009	Permanently Seal Floor Drains that Discharge to the Storm Drain System	SC	S	
010	Confirm that No Industrial Sinks are Connected to the Storm Drain System	SC	NS	
011	Construct Berm or Dike Around Critical Areas	SC	S	
012	Pave Bermed Areas	SC	S	
013	Provide Valve for Outlet Pipe in Containment Area	SC	S	
014	Recycle	SC	NS	
015	Store Waste and Recycling Materials in Proper Containers	SC	NS	
016	Limit Significant Materials Inventory	SC	NS	
017	Provide Roof to Cover Source Area	SC	S	
018	Control Roof Downspout Discharge	SC	S	
019	Minimize Storm Water Run-On from Adjacent Facilities and Properties	SC	S	
020	Reduce Waste	SC	NS	

TABLE 11-3-1 BEST MANAGEMENT PRACTICES

BMP No.	BMP Title	Functional Category⁽¹⁾	Implementation Category⁽²⁾	Implementation Schedule
021	Repair Leaky Roofs	SC	NS	
022	Permanently Seal Drains Within Critical Areas that Discharge to the Storm Drain	SC	S	
023	Place Portable Rubber Mats over Storm Drain Inlets	SC	NS	
024	Insert Filter in Catch Basin	Other	NS	
025	Place Absorbent Blankets in Catch Basin	Other	NS	
026	Routinely Clean Catch Basins	SC	NS	
027	Stencil Signs on Storm Drain Inlets	SC	NS	
028	Keep Equipment and Vehicles Clean	SC	NS	
029	Maintain Equipment in Good Condition	SC	NS	
030	Implement Qualifying Tests for Equipment and Vehicle Operators	SC	NS	
031	Conduct Refresher Courses in Operating and Safety Procedures	SC	NS	
032	Dispose of Obsolete Equipment, Inoperable Vehicles, and Surplus Materials	SC	NS	
033	Check Vehicles and Equipment for Leaks	SC	NS	
034	Park Vehicles or Equipment Indoors or under a Roof	SC	NS	
035	Park Vehicles on an Impervious Surface	SC	NS	
036	Designate Special Areas for Draining or Replacing Fluids	SC	NS	
037	Drain All Fluids from Stored or Salvaged Vehicles and Equipment	SC	NS	
038	Completely Drain Oil Filters Before Disposal	SC	NS	

TABLE 11-3-1 BEST MANAGEMENT PRACTICES

BMP No.	BMP Title	Functional Category⁽¹⁾	Implementation Category⁽²⁾	Implementation Schedule
039	Wash Equipment and Vehicles in Designated Area	SC	NS	
040	Discharge Wash Water to a Sanitary Sewer	SC	NS	
041	Recycle Pressure Wash Solvents	SC	NS	
042	Use Drip Pans under Leaking Equipment	SC	NS	
043	Designate Areas for Washing Non-Vehicular Air Filters and Other Greasy Equipment	SC	NS	
044	Conduct Maintenance within a Building or Covered Area	SC	NS	
045	Reduce the Amount of Liquid Cleaning Agents Used	SC	NS	
046	Centralize Liquid Solvent Cleaning to One Location	SC	NS	
047	Substitute Non-Toxic or Less-Toxic Cleaning Solvents	SC	NS	
048	Use Solvents Efficiently	SC	NS	
049	Use Outside Contractor for Handling Used Solvents and Other Significant Materials	SC	NS	
050	Properly Store Containers	SC	NS	
051	Use Overpack Containers or Containment Pallets to Store 55 Gallon Drums or Containers Outside of Storage Areas	SC	NS	
052	Use "Doghouse" Design for Outdoor Storage of Small Liquid Containers	SC	S	
053	Do Not Store Used Parts or Containers Directly on Ground	SC	NS	
054	Do Not Allow Open Flames Near Flammable Material	SC	NS	
055	Use Door Skirt or Seal	SC	S	

TABLE 11-3-1 BEST MANAGEMENT PRACTICES

BMP No.	BMP Title	Functional Category⁽¹⁾	Implementation Category⁽²⁾	Implementation Schedule
056	Employ Proper Handling Procedures to Transport Materials and Waste	SC	NS	
057	Store Liquids and Significant Materials within a Building or Covered Area	SC	NS	
058	Provide Overfill Protection	SC	NS	
059	Monitor Major Fueling Operations	SC	NS	
060	Provide Absorbent Booms in Unbermed Fueling Areas	SC	NS	
061	Eliminate Topping off Tanks	SC	NS	
062	Install Leak Detection System	SC	NS	
063	Designate Areas for Fueling from Mobile Fuel Tankers	SC	NS	
064	Restrict Access to Tanks	SC	S	
065	Lock Fuel Tanks When Not in Use or on Standby	SC	NS	
066	Keep Tanks, Piping, and Valves in Good Condition	SC	NS	
067	Protect Tanks from Being Damaged by Vehicles	SC	S	
068	Protect Fill Pipe from Being Damaged by Vehicles	SC	S	
069	Provide Protection for Permanent Aboveground Tanks from Discharge of Firearms	SC	NS	
070	Enclose Outdoor Sanding and Painting Operations and Use Tarps to Contain and Collect Solid Wastes	SC	NS	
071	Vacuum Particulate Wastes from Sanding or Painting Operations	SC	NS	
072	Conduct Indoor Sanding and Painting in an Enclosed Area	SC	NS	

TABLE 11-3-1 BEST MANAGEMENT PRACTICES

BMP No.	BMP Title	Functional Category⁽¹⁾	Implementation Category⁽²⁾	Implementation Schedule
073	Avoid Sanding or Painting in Windy Weather	SC	NS	
074	Use Efficient Painting Equipment	SC	NS	
075	Do Not Empty Toilet Tanks During Transit or in the Port	SC	NS	
076	Do Not Discharge Bilge Water in Harbor	SC	NS	
077	Do Not Discharge Bilge Water in Harbor	SC	NS	
078	Use Oil Containment Booms	SC	NS	
079	Properly Dispose of Sediment Generated by Cleaning Sanitary Sewer Lines	SC	NS	
080	Eliminate Treated Wood Products or Use Wood Treated with Less-Toxic Chemicals	SC	NS	
081	Establish Integrated Pest Control	SC	NS	
082	Conduct Pesticide Operations under the Supervision of Licensed Applicator	SC	NS	
083	Divert Drainage to Treatment Facility/Sanitary Sewer	SC	S	
084	Divert Drainage to a Low-Flow Sump	Other	S	
085	Construct Oil/Water Separator	Other	S	
086	Deleted			
087	Deleted			
088	Deleted			
089	Deleted			
090	Deleted			
091	Deleted			
092	Deleted			
093	Deleted			

TABLE 11-3-1 BEST MANAGEMENT PRACTICES

BMP No.	BMP Title	Functional Category⁽¹⁾	Implementation Category⁽²⁾	Implementation Schedule
094	Deleted			
095	Deleted			
096	Construct Concrete Grid Pavement	Other	S	
097	Regularly Inspect and Maintain Storm Water Conveyance System	SC	NS	
098	Regularly Inspect and Test Equipment	SC	NS	
099	Prepare Appropriate Spill Prevention and Response Plans	SC	NS	
100	Conduct Personnel Training Regarding the SWPPP	SC	NS	
101	Store Containers Inside Secondary Containment	SC	NS	
102	Control Dust and Particulates	SC	S	
103	Do Not Pour or Deposit Waste into Storm Drains	SC	NS	
104	Routinely Report Any Observed Non-Storm Water Discharges	SC	NS	
105	Deleted			
106	Deleted			
107	Deleted			
108	Deleted			
109	Deleted			
110	Timing of Construction			
111	Staging Areas			
112	Preservation of Existing Vegetation			
113	Clearing Limits			
114	Stabilization of Construction Entrance and Roads			

TABLE 11-3-1 BEST MANAGEMENT PRACTICES

BMP No.	BMP Title	Functional Category⁽¹⁾	Implementation Category⁽²⁾	Implementation Schedule
115	Erosion Prevention on Temporary and Private Roads			
116	Dust Control			
117	Cover for Materials and Equipment			
118	Spill Prevention and Control			
119	Vehicle/Equipment Washing and Maintenance			
120	Waste Management			
121	Mulching			
122	Hydromulching			
123	Geotextile			
124	Matting			
125	Pipe Slope Drain			
126	Slope Roughening			
127	Gradient Terracing			
128	Retaining Walls			
129	Gabions			
130	Riprap Slope and Outlet Protection			
131	Inlet Protection			
132	Check Dams			
133	Temporary Stream Crossing			
134	Straw Bales/Biofilter Bags			
135	Silt Fence			
136	Vegetative Buffer Strip			
137	Sedimentation Trap (Basin)			

TABLE 11-3-1 BEST MANAGEMENT PRACTICES

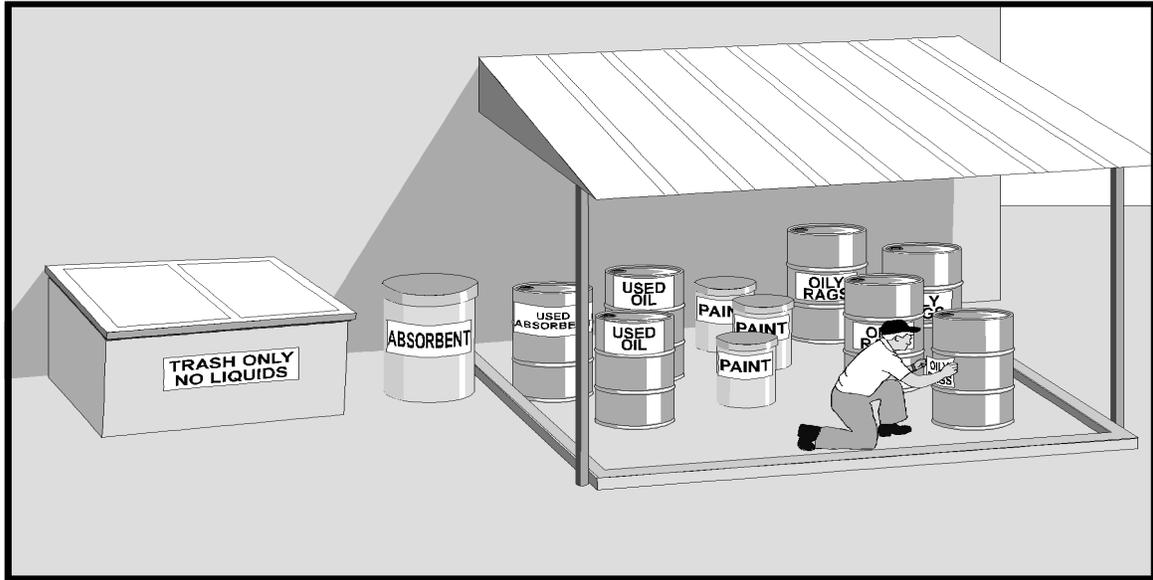
BMP No.	BMP Title	Functional Category⁽¹⁾	Implementation Category⁽²⁾	Implementation Schedule
138	Portable Sediment Tank			
139	Temporary Swale			
140	Earth Dike			
141	Perimeter Dike/Swale			
142	Temporary Berms (Sandbags)			
143	Temporary Storm Drain Diversion			
144	Topsoiling			
145	Seeding			
146	Sodding			
147	Planting			

Notes:

- (1) SC - Source Control
 Other - Best Management Practice Other than Source Control
- (2) S - Structural
 NS - Non-Structural

Best Management Practices Fact Sheets

BMP 001 - Label All Drums, Cans, Containers, Tanks, and Valves



Description of Potential Pollutant and Source: Drums, cans, and containers can be improperly managed and disposed of due to uncertainty of the container's contents. Tanks which are not labeled may result in improper use of the tank or fuel, which may result in the exposure of significant materials to storm water and/or receiving waters. Similarly, unlabeled valves may be opened without proper precaution due to lack of user information. Storm water quality will be affected if significant materials are improperly disposed to the storm drain and/or receiving waters. Lack of labeling will also make it difficult to quickly identify the type of material released so facility personnel can respond correctly. Labels also identify hazardous materials at the facility and are a good way to request caution in certain areas (e.g., drums indicating flammability).

Description of BMP: Label all drums, valves, pumps, cans, tanks, and containers to reduce the chance of misuse and eventual spills. Labeling ensures that the appropriate procedures, equipment, and storage containers are used. All containers will be labeled as to what is in the container (e.g., used solvent, unleaded gas). In addition, containers of hazardous substances will be labeled regarding the potential hazard (e.g., corrosive, flammable). Department of Transportation (DOT) labeling is an effective labeling method. DOT requires that labels be prominently displayed on transported hazardous and toxic materials. Labeling required by DOT will be expanded to piping and containers, making it easy to recognize materials that are corrosive, radioactive, reactive, flammable, explosive, or poisonous. Fuel tanks will be labeled as to the material stored, such as unleaded gasoline, diesel fuel, and JP-4. An uncontrolled storm drain inlet will not be located inside the bermed area and there will not be any cutouts in the berm to release uncontrolled drainage.

For tanks the posted signs will be no less than 8 inches by 10 inches with 3/4-inch letters. They will describe the products stored in each tank and the tank capacity. The lettering will be of sufficient size and boldness to be legible at a distance of 15 feet or more on all of the tank's visible sides.

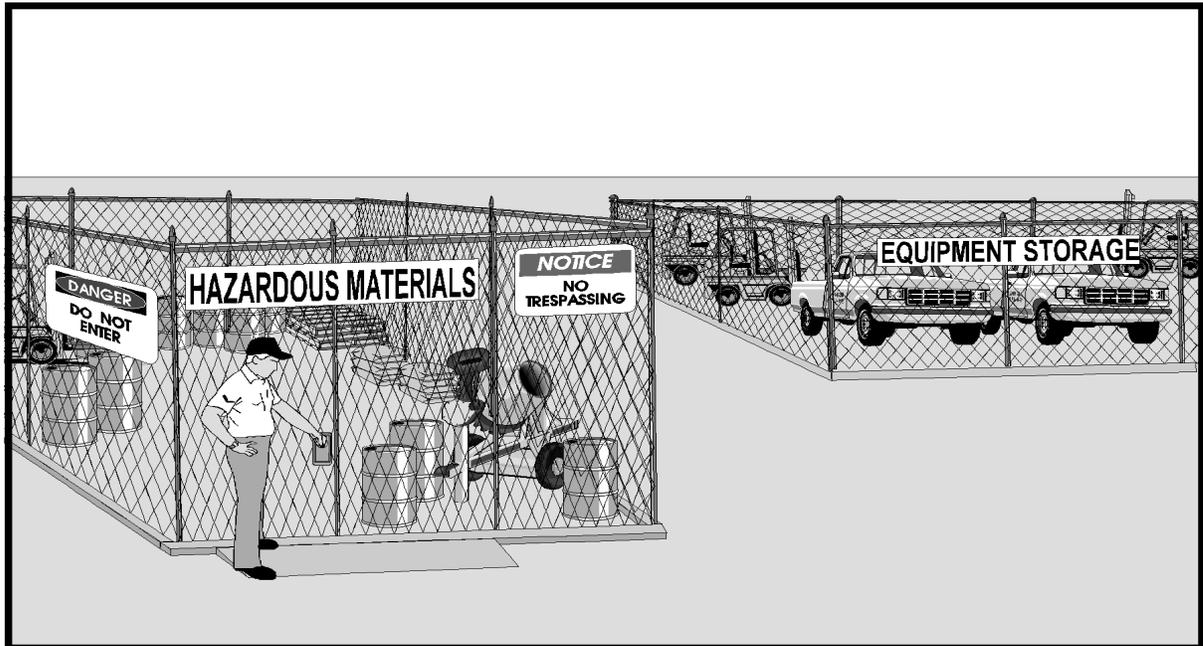
Application Guidance: Proper labeling will always be used.

Training: Personnel will be trained not to remove labels on containers.

Effectiveness and Cost: Proper labeling is an effective, low-cost BMP.

Limitations: None

BMP 002 - Restrict Access to Area and Equipment



Description of Potential Pollutant and Source: Vandalism of vehicles and facility property may result in the release of significant materials.

Description of BMP: Areas where vehicles, equipment and materials are stored and are accessible to the public will be fenced and gated to discourage trespassing. Access to equipment will also be restricted. Only authorized personnel will be allowed to operate equipment. The fences and gates will be properly maintained, and additional security measures including lighting of the area will be implemented if the fencing alone proves insufficient. Where appropriate, security guards or alarms will be used.

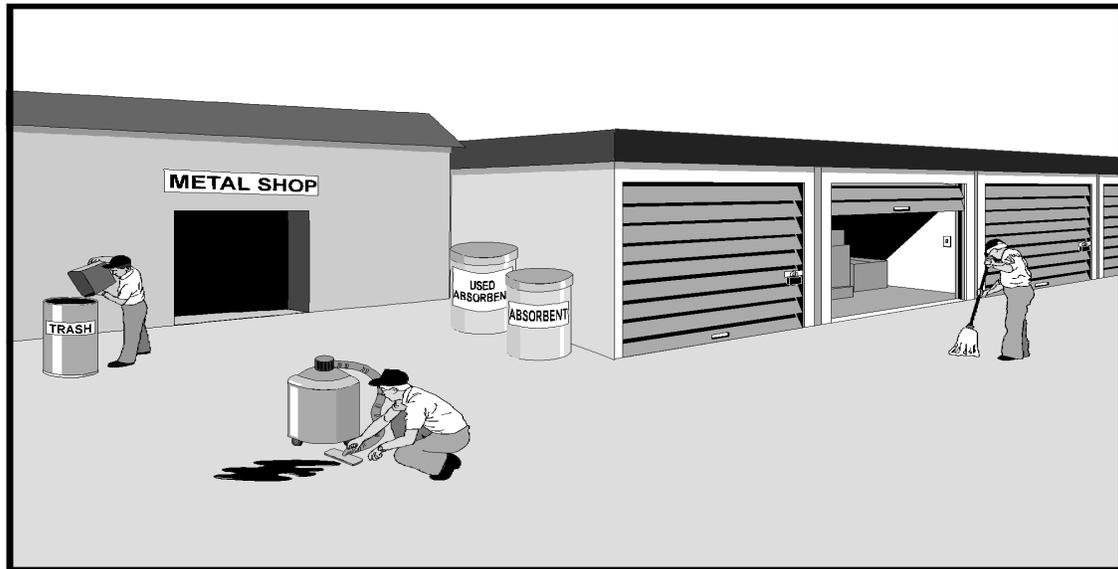
Application Guidance: As needed.

Training: N/A

Effectiveness and Cost: Effectiveness and costs will vary depending on the application.

Limitations: None

BMP 003 - Perform Regular Cleaning



Description of Potential Pollutant and Source: Dirt, surplus materials, and spilled or dropped materials are often allowed to accumulate in areas such as maintenance shops, manufacturing facilities, metal fabrication shops, loading docks, and storage areas. Pollutants from the accumulated material can be transported by storm water to the storm drain system. A clean and orderly work area reduces the possibility of accidental spills caused by mishandling of chemicals and equipment and should reduce safety hazards to personnel.

Description of BMP: Maintaining a regular general sweeping and cleaning schedule reduces buildup of waste materials and minimizes the amount of significant materials exposed to storm water. General cleaning includes dusting and keeping work areas neat and organized.

Floors and ground surfaces will be kept dry using brooms, shovels, vacuum cleaners, or cleaning machines. It is important to perform dry sweeping and dry cleaning (as opposed to hosing down areas as discussed in BMP 004). Garbage and waste materials will be collected and disposed regularly. Particular emphasis will be placed on sweeping and cleaning outdoor areas as close as possible to a forecasted rainfall. Any granular absorbent materials used for spill cleanup will be removed and properly disposed before a rainfall.

Application Guidance: Cleanup and sweeping will be performed daily and more often as necessary to remove all loose trash, paint cans, discarded construction materials, sediment, oil, solvents, plastics and other significant materials. Additional clean up and sweeping will be performed before anticipated storm events. Additionally, a regular sweeping schedule will be maintained.

The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Personnel will be trained to ensure that all waste be managed within guidelines of applicable federal, state, and local regulations. Signs will be posed as reminders.

Effectiveness and Cost: Regular general cleaning is a highly effective, low-cost BMP.

Limitations: None

BMP 004 - Avoid Hosing Down the Site



Description of Potential Pollutant and Source: Cleaning work sites by hosing down causes wash water to transport pollutants to the storm drain where it can be exposed to storm water.

Description of BMP: Cleaning the work site by hosing down will be avoided and dry methods of cleaning will be used. Dry methods include sweeping or using damp rags or mops. If possible or practical, hoses will be removed. If hosing down is unavoidable, the downstream drain will be temporarily plugged as described in the following BMPs:

- Place Portable Rubber Mats Over Storm Drain Inlets
- Insert Filter In Catch Basin
- Place Absorbent Blankets In Catch Basin

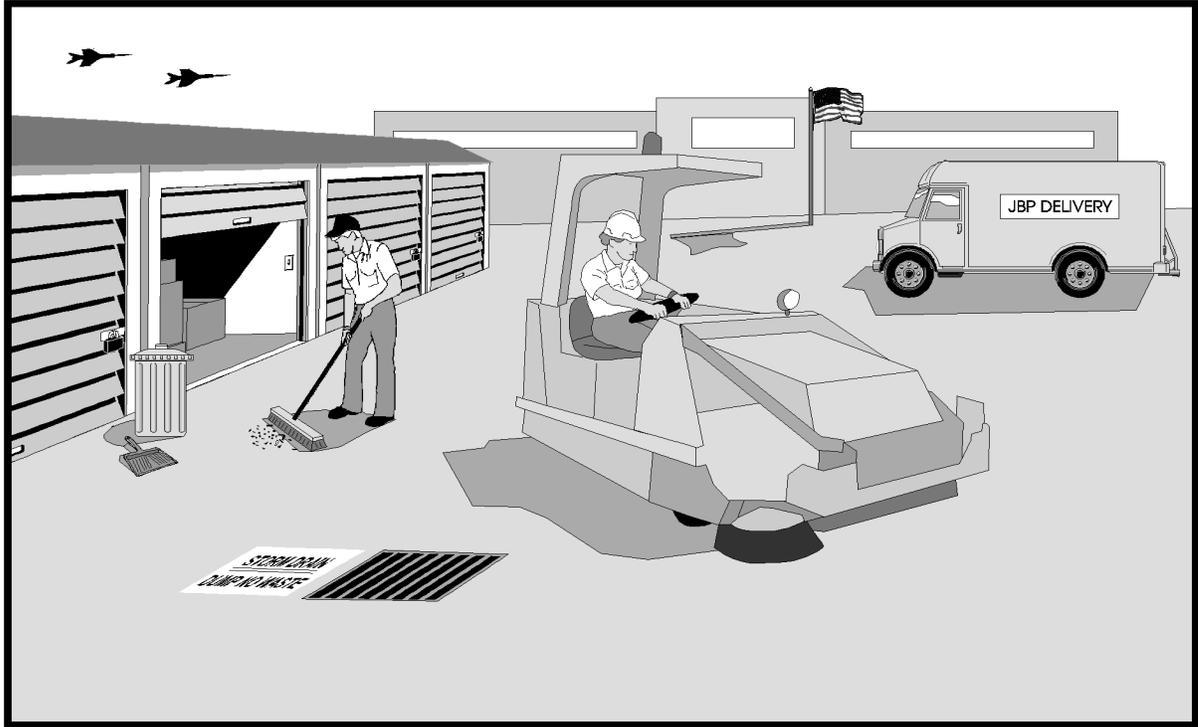
Application Guidance: Methods of dry cleaning will be used whenever possible at all work stations, loading/unloading sites, maintenance sites, storage areas, and parking lots.

Training: New personnel will be notified of the policy; signs should be posted. If possible or practical, hoses should be removed.

Effectiveness and Cost: Eliminating hosing down is a highly effective, low-cost BMP.

Limitations: None

BMP 005 - Perform Regular Pavement Sweeping



Description of Potential Pollutant and Source: Trash, litter and particulate matter typically accumulate on paved surfaces. These materials are then transported during storm events into the storm drain system or directly into receiving waters (e.g., from piers).

Description of BMP: Regular dry sweeping of paved areas will prevent pollutants and debris from entering storm drains.

Application Guidance: Dry sweeping of paved areas will be performed bimonthly. Particular emphasis will be placed on sweeping the paved areas prior to the wet season and frequently during the wet season.

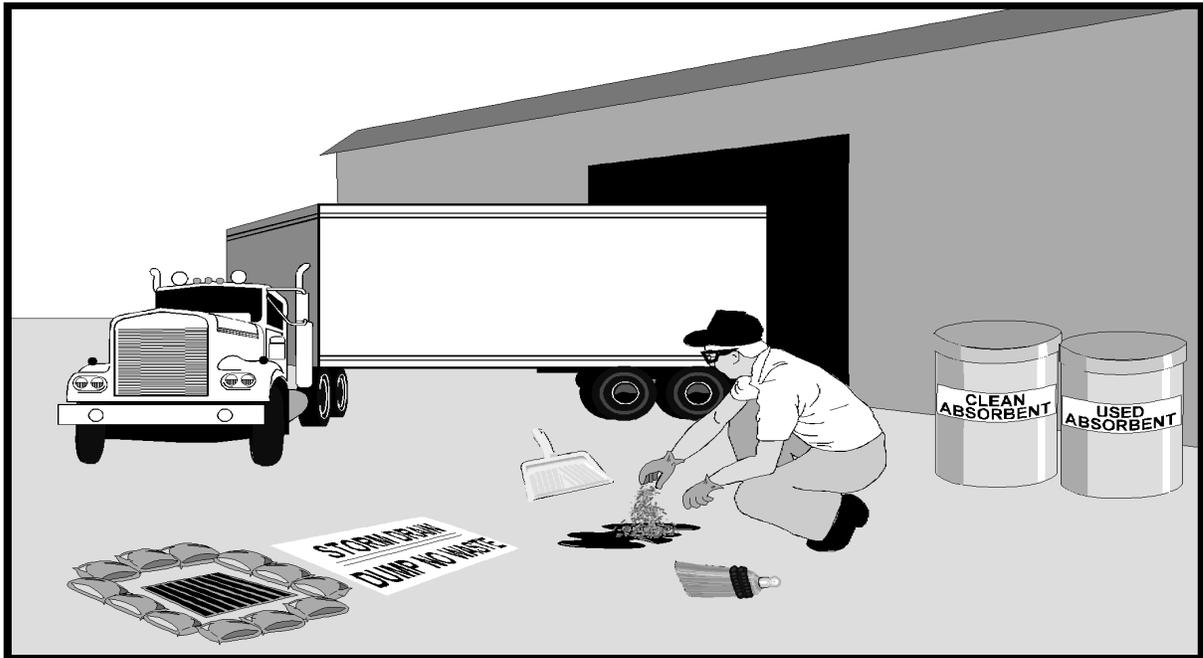
The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Personnel will be trained to use a small vacuum sweeper, if available, instead of a mechanical brush sweeper since the vacuum is more effective at removing fine particulate matter.

Effectiveness and Cost: Dry sweeping is a moderately effective, high-cost BMP, especially if a vacuum sweeper must be purchased.

Limitations: Layout of the site, amount of paved surface area, and the availability of funds for purchase of equipment may limit the use of this practice.

BMP 006 - Control Spills



Description of Potential Pollutant and Source: Spills of significant materials may be exposed to storm water and transported to storm drains and/or receiving waters.

Description of BMP: To reduce the potential for spills, material safety data sheets (MSDS) will be followed for handling, storage, and cleanup of all significant materials.

Any spill, large or small, of significant materials will be controlled immediately to prevent pollutants from being transported to storm drains and/or receiving waters. Appropriate spill control material will be kept on site. Smaller spills will be contained using absorbent material such as kitty litter, straw, or sawdust. Drums of absorbent material will be easily accessible and clearly marked, and containers for spent absorbent material will be readily available. Spent absorbent material will be managed appropriately and disposed in accordance with applicable regulations.

Larger spills will be controlled using spill kits, booms, and other response equipment commensurate with the size of the spill. The methods outlined in the Activity's spill prevention and response for hazardous materials will be followed for spills of any potential storm water pollutants. The date, time, nature and volume of material spilled, and cleanup measures taken will be recorded for all spills.

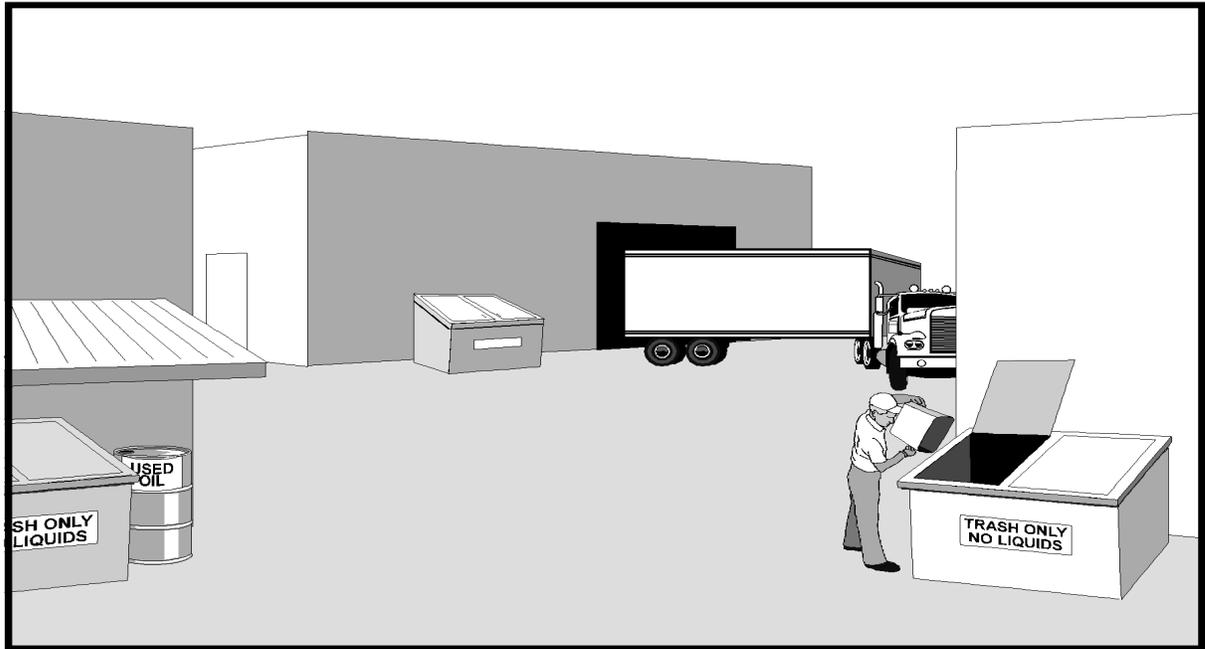
Application Guidance: Controlling spills will be practiced under all working conditions.

Training: Personnel will be trained in spill prevention and response procedures including the use of personal protection equipment (gloves, eye and face protection, etc.). This will include what absorbent or equipment to use, how to use the absorbent or equipment, where to find it, how to dispose of the spent absorbent or other material, and who to notify in the event of a spill.

Effectiveness and Cost: Spill control is a moderately effective, low-cost BMP.

Limitations: None

BMP 007 - Place Trash Receptacles at Appropriate Locations



Description of Potential Pollutant and Source: Improperly located or insufficient numbers of trash receptacles will promote poor housekeeping practices. This will increase the opportunity for pollutants from all source areas to reach storm water.

Description of BMP: Proper and frequent placement of trash receptacles will promote the proper disposal of waste materials. This reduces the opportunity for pollutants to reach storm water. Trash receptacles will be easily accessible for personnel.

Application Guidance: Placement of trash receptacles at appropriate locations will always be practiced.

Training: Personnel will be trained as to the location of trash receptacles.

Effectiveness and Cost: Appropriately located trash receptacles are an effective, low-cost BMP.

Limitations: None

BMP 008 - Train Employees to Properly Dispose of Wastes



Description of Potential Pollutant and Source: Waste poured or deposited into storm drains contains pollutants which will enter the storm drain system and receiving waters without treatment.

Description of BMP: Employees will be trained on proper waste disposal and recycling procedures.

Application Guidance: Training will be performed for all new personnel and semi-annually for all personnel.

The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

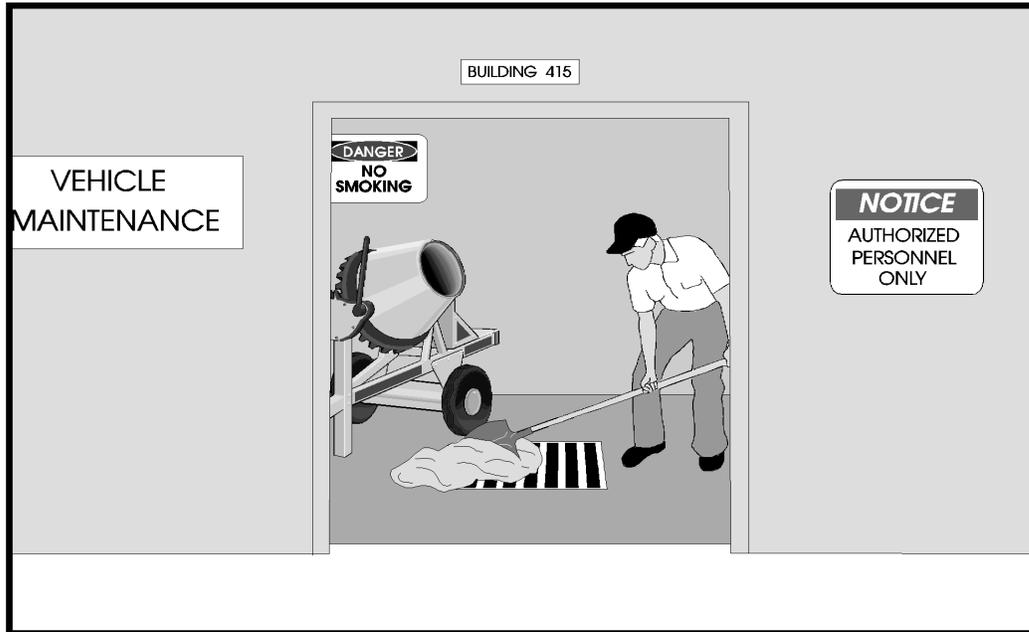
Training: Training will include the following:

- Train personnel at all levels not to pour or deposit wastes into storm drains or storm drain connections.
- Train personnel to properly dispose or recycle materials.
- Train personnel at all levels to report any observable non-storm water discharges.

Effectiveness and Cost: This is a highly effective, low-cost BMP.

Limitations: None

BMP 009 - Permanently Seal Floor Drains that Discharge to the Storm Drain System



Description of Potential Pollutant and Source: Floor drains that are connected to the storm drain system provide a pathway for spilled or leaked material to enter the system.

Description of BMP: Floor drains inside buildings will be permanently sealed (whenever this would not adversely affect safety or structural integrity) to prevent accidental illegal dumping of pollutants into the storm drain system.

Application Guidance: N/A

Training: N/A

Effectiveness and Cost: This is a highly effective, low-cost BMP.

Limitations: None

BMP 010 - Confirm that No Industrial Sinks Are Connected to the Storm Drain System



Description of Potential Pollutant and Source: Industrial sinks connected to the storm drain system can introduce pollutants directly to the storm drain system and receiving waters without treatment.

Description of BMP: Sinks in industrial areas will be connected to the sanitary sewer or other disposal location. "As-builts," piping diagrams, and building or site plans will be inspected to verify that the sinks are not connected to the storm drain system, especially in casually constructed shop areas. Additional reconnaissance may be performed to look for plumbing changes not shown on available plans. If an illicit connection to the storm drain system is suspected, additional testing should be performed.

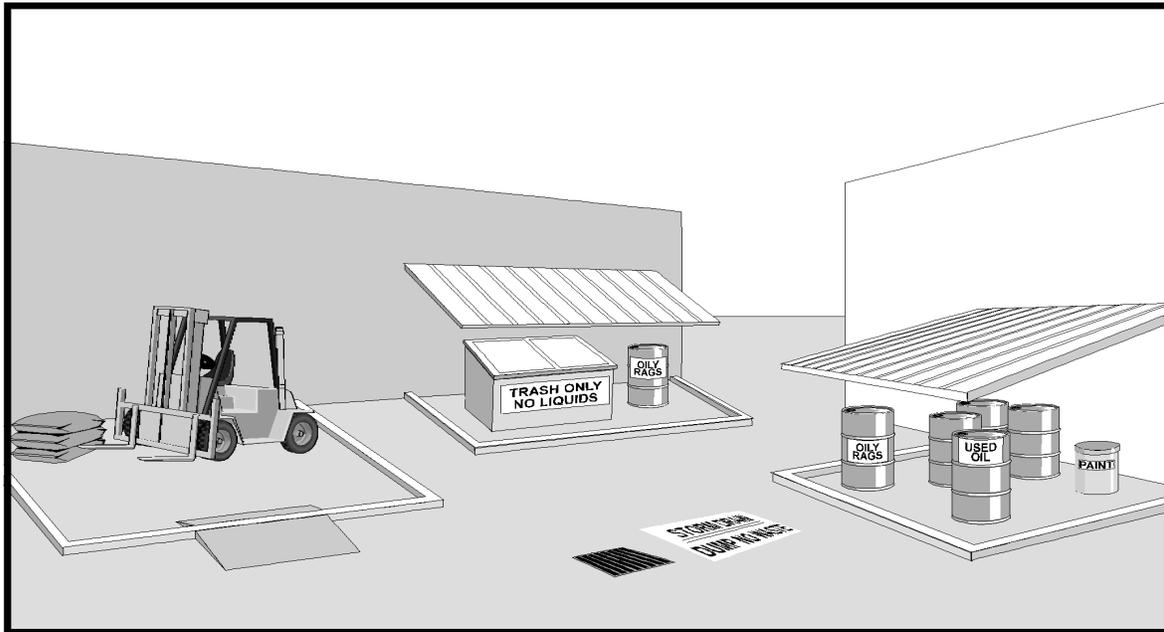
Application Guidance: N/A

Training: N/A

Effectiveness and Cost: This is a highly effective, low- to moderate-cost BMP.

Limitations: None

BMP 011 - Construct Berm or Dike Around Critical Areas



Description of Potential Pollutant and Source: Critical areas are source areas that have a high likelihood for the release of pollutants. This includes material handling areas, material storage areas, and equipment repair and maintenance areas. As a result of spills and leaks or exposure to storm water, pollutants can flow from critical areas into the storm water system. In addition, small spills and leaks can accumulate on the surface area and be washed away by storm water.

Description of BMP: A raised berm or dike will be constructed around a critical areas. This will provide secondary containment and prevent any spills or leaks from leaving the area. This secondary containment will also be provided where mobile tankers containing fuel are customarily stationed. It may be required to construct a "speed bump" to allow vehicle access into the area. (Note: double walled tanks do not require this BMP. Also, 40 CFR 112.7 requires bulk petroleum storage tanks be provided with secondary containment.) A drain valve will be installed and procedures to drain storm water from the bermed area will be posted (see BMP 014).

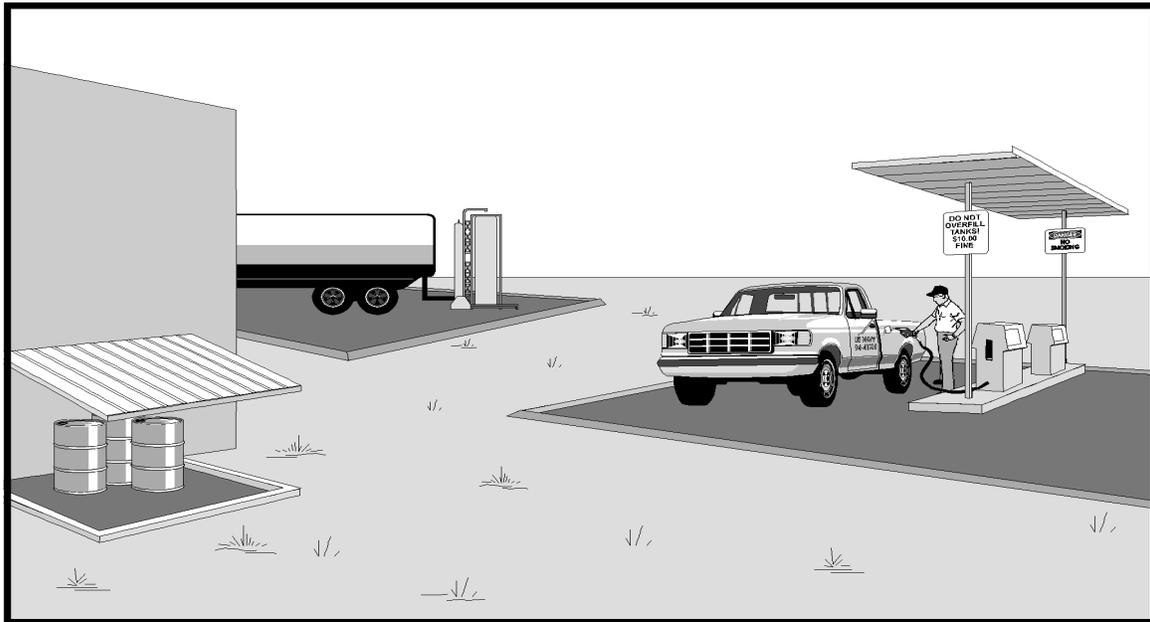
Application Guidance: Install as needed.

Training: N/A

Effectiveness and Cost: This is a highly effective BMP. The cost will vary depending on the size of the fueling operation.

Limitations: The size of some tank and fueling operations areas could make this BMP relatively expensive.

BMP 012 - Pave Bermed Areas



Description of Potential Pollutant and Source: Critical areas are source areas that have a high likelihood for the release of pollutants. This includes material handling areas, material storage areas, and equipment repair and maintenance areas. Material which has leaked or spilled onto the ground surface may infiltrate into the soil and then be transported to storm drains by storm water.

Description of BMP: Critical areas should be contained by a berm or dike. (See BMP 012, "Construct Berm or Dike Around Critical Area.") The area within the berm will be sufficiently impervious to prevent infiltration of the material in the event of a spill. The impervious material will be concrete, asphalt concrete, or other impervious paving material. The lining material will also be clay, plastic or another impervious material. A storm drain must not be located within the impervious area. (Note: 40 CFR 112.7 requires bulk petroleum storage tanks be provided with secondary containment.)

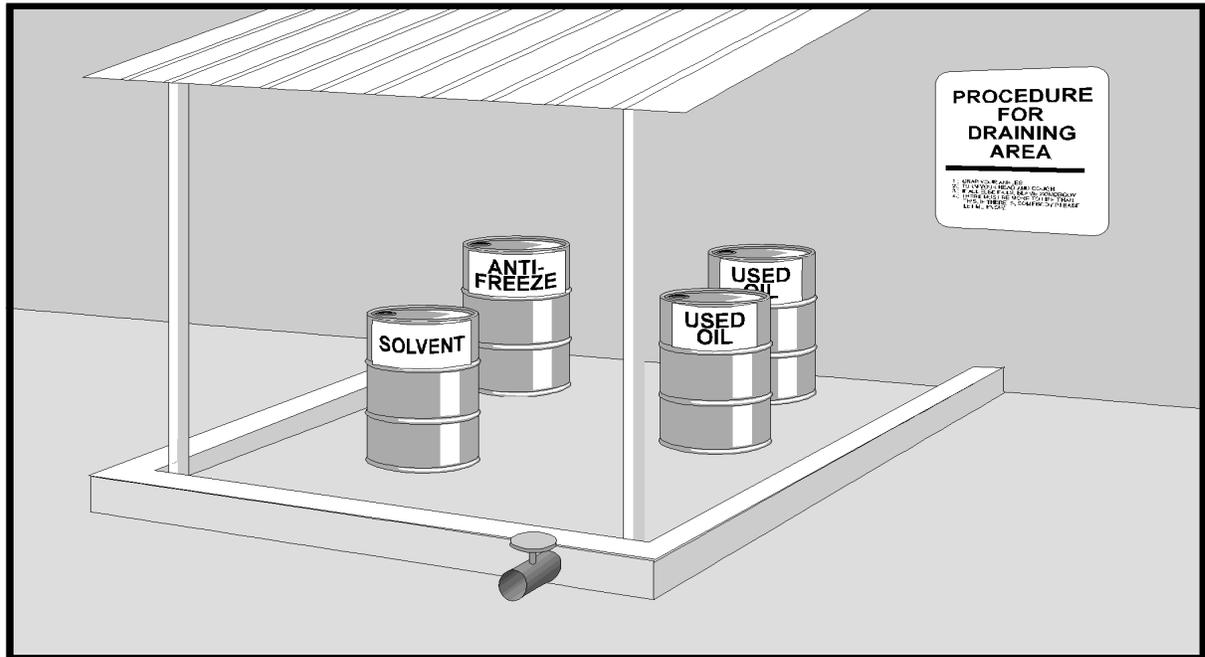
Application Guidance: Install as needed.

Training: N/A

Effectiveness and Cost: This is an effective BMP. Costs will vary based on the size of the area.

Limitations: The size of some tank and fueling operations areas could make this BMP expensive.

BMP 013 - Provide Valve for Outlet Pipe in Containment Area



Description of Potential Pollutant and Source: Spilled or leaked material may be discharged from containment areas through open outlet pipe valves or by overflowing.

Description of BMP: Outlet pipe valves will be installed and kept closed. During storm events, containment areas will be drained following guidelines specifically developed for that area. Storm water accumulated in containment areas may be released to the storm drain system after the water quality has been evaluated based on the types of materials stored in the containment area and/or after laboratory analyses. If sheening, discoloration, odor, or evidence of spills is observed, the water will not be discharged to the storm drain system prior to treatment or further evaluation.

In containment areas where oils are stored, skimming spilled oil off the water using absorbents will be adequate treatment prior to discharge to storm drain system. However, the water will either be pumped out and stored pending chemical analytical results or properly disposed.

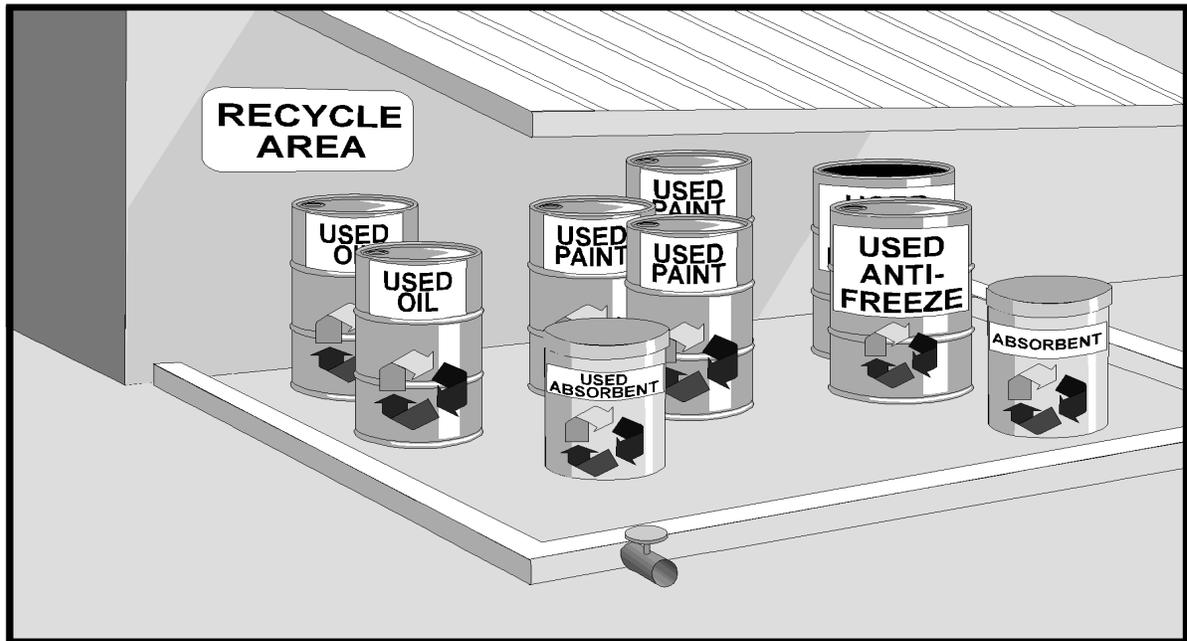
Application Guidance: The accumulated storm water will be released or removed at least every 24 hours during storm events.

Training: Personnel will be trained to drain containment areas according to the procedures developed for each containment area. Personnel will also be trained in the proper method of disposing materials that have been contained in the area after a spill.

Effectiveness and Cost: This is an effective, low to moderate-cost BMP.

Limitations: None

BMP 014 - Recycle



Description of Potential Pollutant and Source: Many materials, both hazardous and non-hazardous, can be sources of pollutants. Recycling will be employed to reduce the amount of waste material exposed to storm water on the Activity.

Description of BMP: Recycling will be used to the fullest extent possible in all situations.

Application Guidance: Recycling collections will be conducted at least weekly for recyclable items such as solvents, oil, scrap metals, wash water and absorbent materials. Separating the recyclable items facilitates recycling.

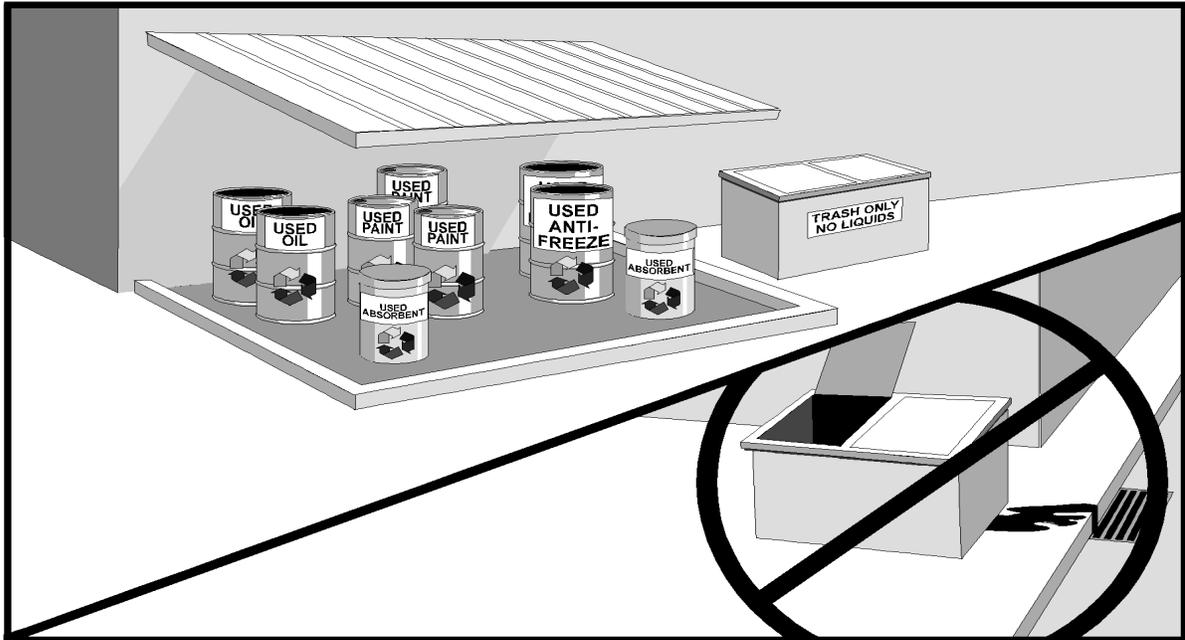
The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Personnel will be trained on proper recycling techniques along with posting and maintenance of signs.

Effectiveness and Cost: Effectiveness and cost will be site specific.

Limitations: Local vendors may not be available to receive certain recyclable materials.

BMP 015 - Store Waste and Recycling Materials in Proper Containers



Description of Potential Pollutant and Source: Dry waste, including items such as scrap metal, floor sweepings, metal chips, and paper goods, can be dispersed by wind or operational error if not stored properly. If a dumpster's lid is not kept closed, animals may carry garbage out of the containers. Uncovered dumpsters also expose waste to storm water, which may leak out of the dumpster and into the storm sewer system.

Description of BMP: Waste and recycling drums and containers will be located in centralized areas that provide proper labeling (both containers and location) and easy access. If possible, the area will have secondary containment. Waste containers will be emptied regularly. Dumpsters will all have lids; lids should be kept closed when not in use. If the dumpster has inadequate capacity and it is not possible to keep the cover closed, the frequency of pick-up will be increased, or the dumpster will be replaced with a model of greater capacity.

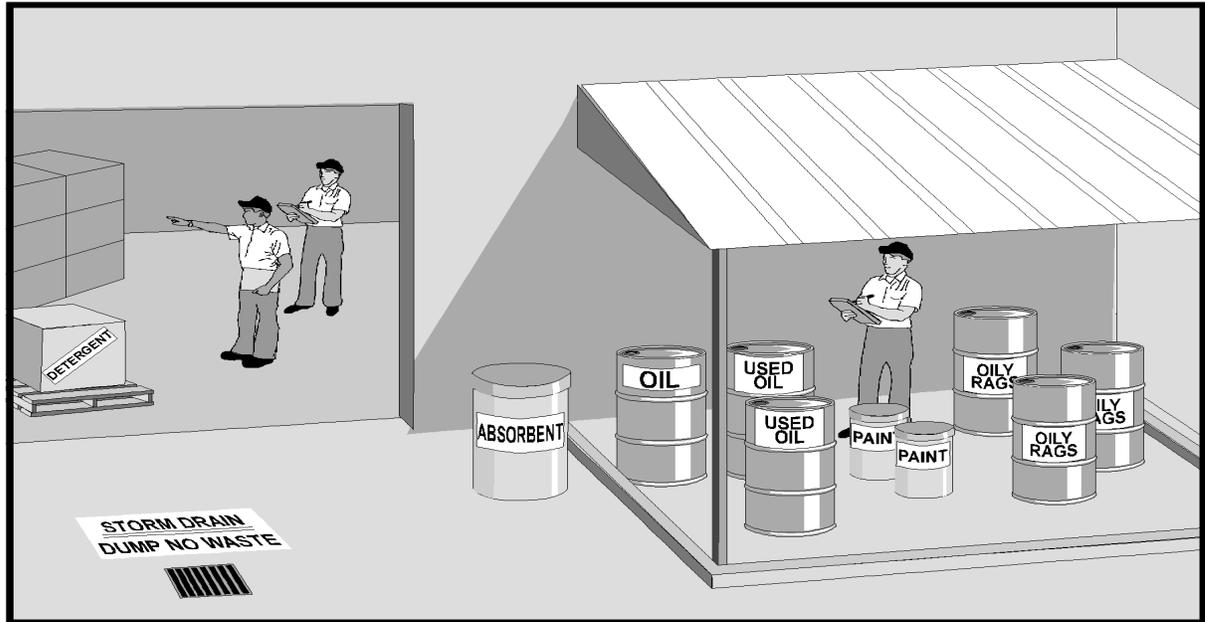
Application Guidance: This practice will be followed wherever waste material, including recycled materials, is stored.

Training: Personnel will be notified of the location of dry waste disposal areas and the proper transportation methods to the sites. Personnel will also be reminded to always keep dumpster lid closed. Signs may be posted at each area indicating type of waste to be disposed depending on need.

Effectiveness and Cost: Controlled waste areas are a moderately effective, low-cost BMP.

Limitations: None

BMP 016 - Limit Significant Materials Inventory



Description of Potential Pollutant and Source: Reducing the amount of significant materials reduces the potential for the material to enter the storm drain system.

Description of BMP: Inventory control will be used to prevent excess storage of unnecessary or infrequently used significant materials.

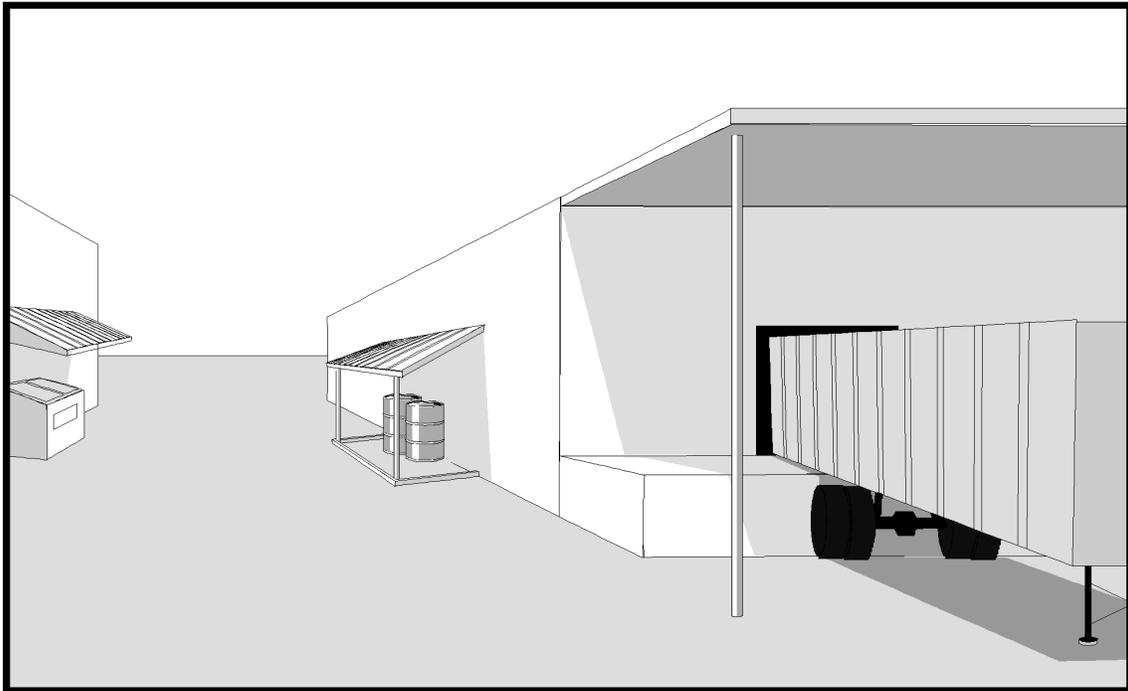
Application Guidance: This BMP will be used in all cases where significant materials are stored.

Training: Procurement officers and warehouse managers will be trained to accurately estimate delivery schedules and user's needs.

Effectiveness and Cost: This is a moderately effective, low-cost BMP.

Limitations: None

BMP 017 - Provide Roof to Cover Source Area



Description of Potential Pollutant and Source: Spills, leaks and outdoor storage of materials can result in the exposure of significant materials to storm water.

Description of BMP: Contact of storm water with significant materials will be minimized by constructing a roof over the source area. Roofs are effective covering for fuel transfer areas, material loading/unloading areas, equipment maintenance, metal fabrication, hazardous waste storage, and materials storage areas.

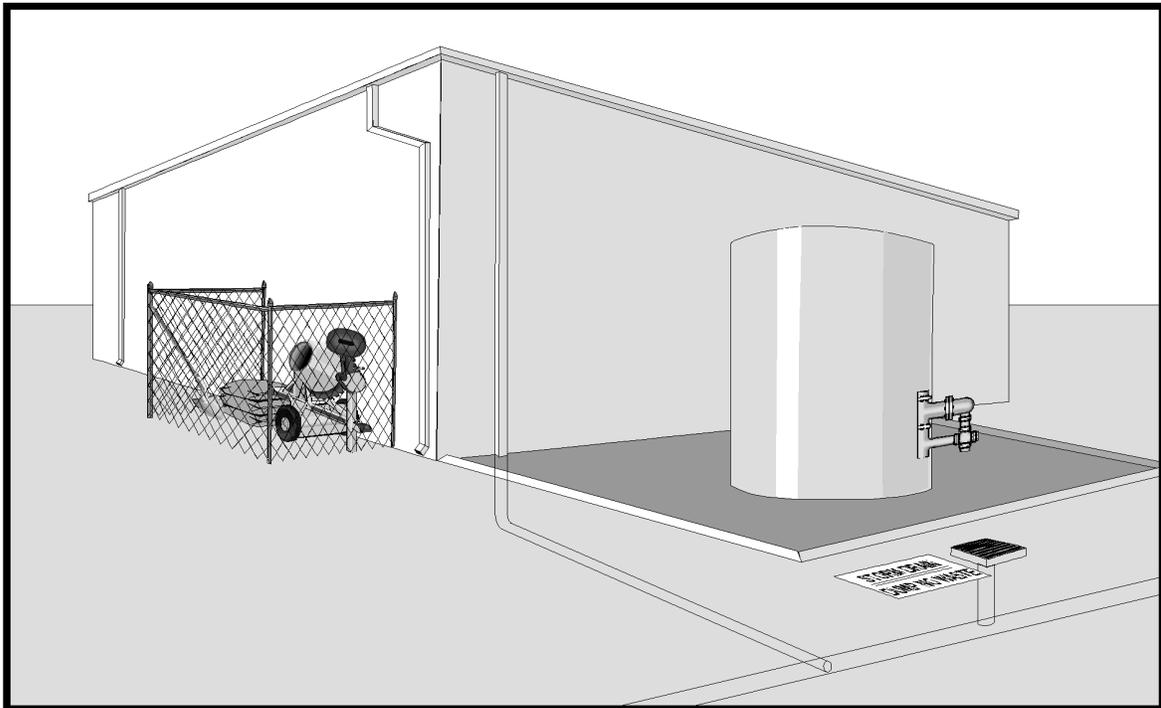
Application Guidance: Install as needed.

Training: N/A

Effectiveness and Cost: Roofs are an effective, variable-cost BMP. Cost can be high for large areas.

Limitation: The height of the equipment or the size of the area may make this BMP infeasible.

BMP 018 - Control Roof Downspout Discharge



Description of Potential Pollutant and Source: Storm water collected on roofs and directed through downspouts to industrial areas can transport pollutants to the storm drain system.

Description of BMP: Roof runoff will be controlled in areas where roof downspout discharges flow over areas of high pollutant use or storage, such as areas used for fueling, metal fabricating, lead tool and dye storage, or hazardous waste storage. Roof downspouts will be re-directed to non-industrial areas or connected directly to the storm drain system.

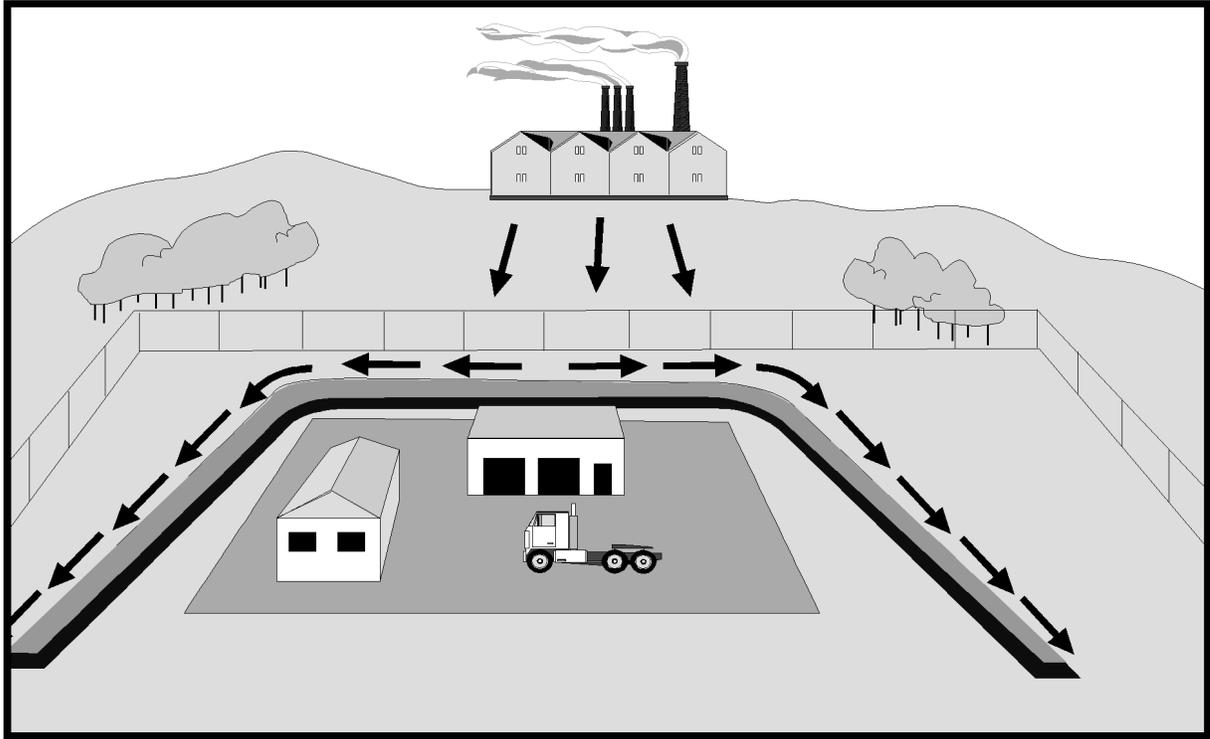
Application Guidance: This BMP will be applied whenever storm water collected on roofs discharges to areas polluted with significant materials.

Training: N/A

Effectiveness and Cost: This is an effective BMP, but costs can be variable. Re-diverting gutters and downspouts can be expensive if diversion distances are great or there are many downspouts to divert.

Limitations: It may not be feasible to relocate roof downspouts to areas where potential pollutants are not present.

BMP 019 - Minimize Storm Water Run-On from Adjacent Facilities and Properties



Description of Potential Pollutant and Source: Significant run-on from other facilities or adjacent properties can result in either increased pollutant exposure to storm water on site (from the increased volume of water movement) or in increased transport of off-site pollutants onto the facility.

Description of BMP: Run-on will be controlled by berming or using diversion ditches to direct flow away from or around the site. Alternatively, run-on will be slowed by use of vegetated strips, grassed swales, or infiltration basins or trenches.

Application Guidance: This BMP will be used whenever a significant volume of off-site drainage flows into an area where possible pollutants are present. This BMP will also be used where run-on may be polluted.

Training: N/A

Effectiveness and Cost: This BMP is effective, but costs can be variable. Creation of diversion channels and an extensive drainage network for a site could be expensive.

Limitations: Concentrating flow in diversion channels may not be possible with the current site drainage system.

BMP 020 - Reduce Waste



Description of Potential Pollutant and Source: Reducing the amount of waste produced at a site reduces the amount of significant materials potentially exposed to storm water.

Description of BMP: Reducing waste will minimize or eliminate the discharge of pollutants to storm water. Methods to reduce waste include, but are not limited to, substituting or eliminating raw materials, modifying existing processes or equipment, planning and sequencing production, tracking waste generation, listing amounts of materials disposed, and separating wastes. Personnel will be trained to: use only the amount needed; buy the least toxic products; use solvents more than once; provide good inventory control; do not overbuy; and purchase long-lasting products.

Application Guidance: These methods will be implemented under most working conditions.

Training: N/A

Effectiveness and Cost: Effectiveness and cost will be site specific.

Limitations: None

BMP 021 - Repair Leaky Roofs



Description of Potential Pollutants and Their Source: Hazardous substances, parts, equipment, vehicles, and materials are often stored indoors or in covered areas. During storage, significant materials such as oil, grease, and solvents may leak or spill onto the floor, ground, or pavement. If storm water enters these areas through leaky roofs, the pollutants may be washed into the storm drain system.

Description of BMP: Repair leaky roofs as required for each building. Alternatively, the stored materials will be moved to another covered area.

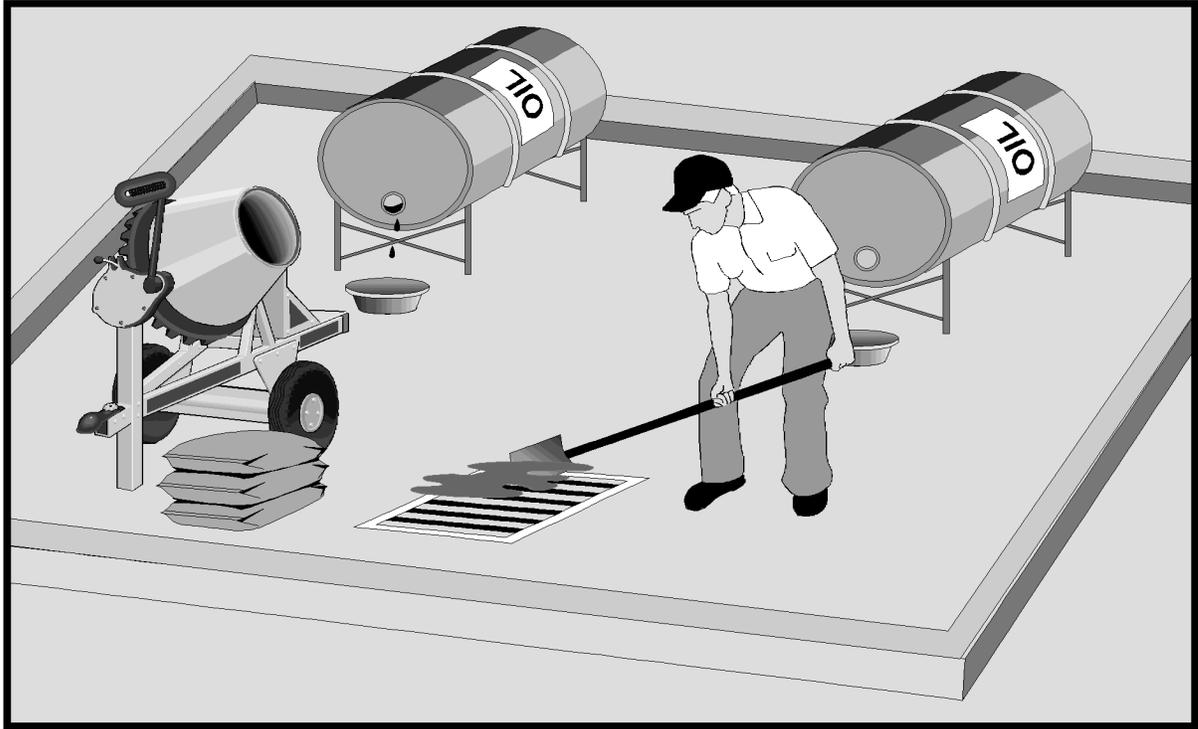
Application Guidance: Leaky roofs will be repaired wherever there is a potential for the exposure of significant materials to storm water.

Training: Personnel will be trained to notify their supervisors when leaks are observed in roofs.

Effectiveness and Cost: This is a moderately effective, variable-cost BMP.

Limitations: None

BMP 022 - Permanently Seal Drains Within Critical Areas that Discharge to the Storm Drain



Description of Potential Pollutant and Source: Certain activities may result in spills. The spilled material may flow or be washed into nearby storm drains, receiving waters, or surfaces resulting in exposure to storm water.

Description of BMP: Seal drains within the critical areas that discharge to the storm drain to prevent significant materials from being washed into the storm drain system. Critical areas are those that have a high likelihood to release pollutants, including material handling areas, material storage areas, and equipment repair and maintenance areas.

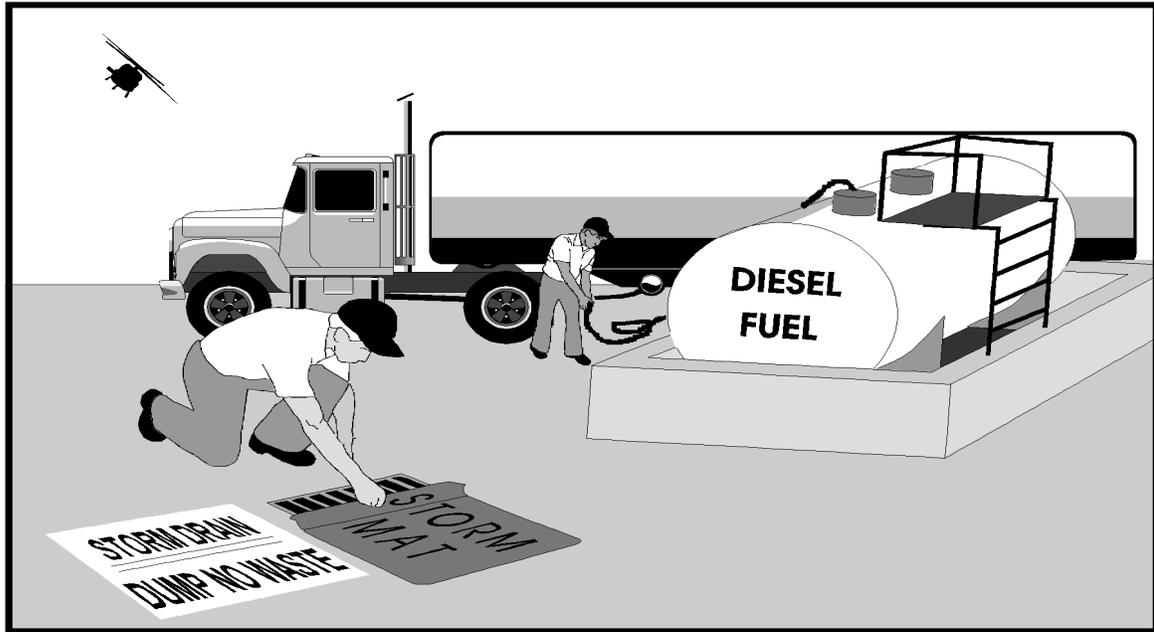
Application Guidance: This BMP will be applied to storm drain inlets in all critical areas as needed.

Training: N/A

Effectiveness and Cost: This is a highly effective, low-cost BMP.

Limitations: If the area draining to the storm drain inlet is large and the inlet is at a low point, this is not a practical BMP. Under these circumstances implementation of this BMP will result in ponding. In this case, use BMP 023, "Place Portable Rubber Mats over Storm Drain Inlets."

BMP 023 - Place Portable Rubber Mats over Storm Drain Inlets



Description of Potential Pollutant and Source: Spills are more likely to occur during certain operations, such as materials transfer. If these operations occur near a storm drain, the material may be discharged into the storm drain system.

Description of BMP: If operations which are likely to spill significant materials occur near a storm drain, a rubber portable mat will be placed over the storm drain during the operation. If a spill occurs during the operation, the mat will prevent the pollutant from entering the storm drain system. The spilled material can be properly cleaned up and disposed of before removal of the rubber mat.

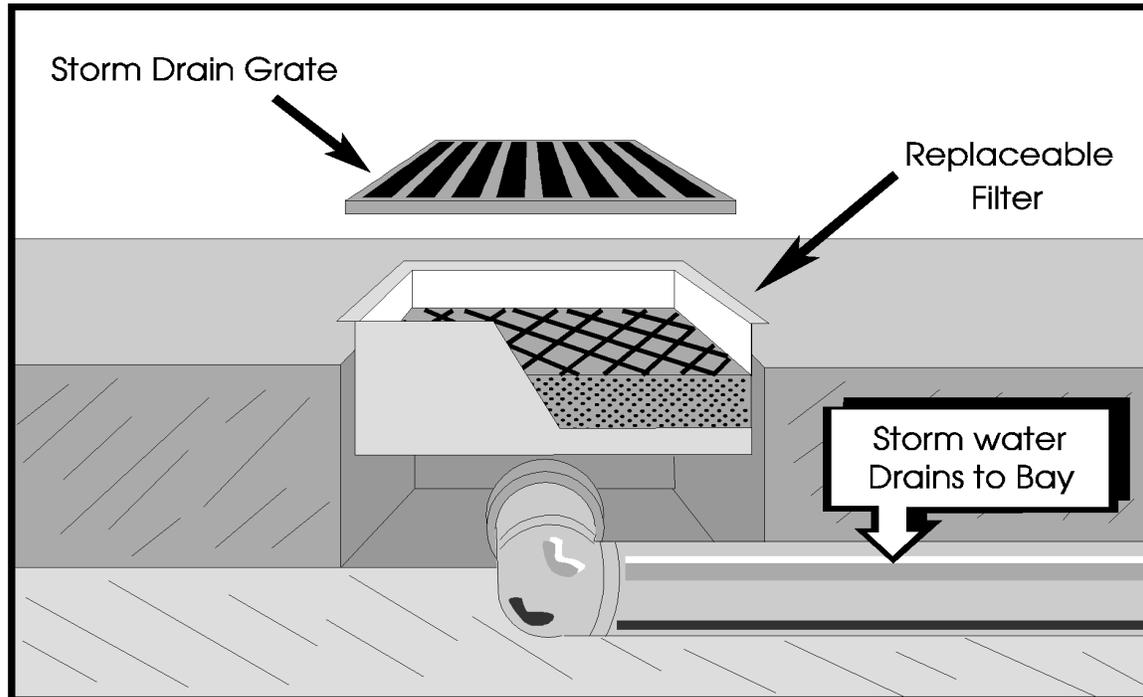
Application Guidance: Portable rubber mats will be placed over the storm drain for the duration of any operation which is likely to discharge pollutants into the storm drain.

Training: Personnel will be trained regarding the use of the portable mat. In addition, personnel will be trained in proper cleanup and disposal of any spilled material.

Effectiveness and Cost: This is a highly effective, low-cost BMP.

Limitations: This BMP works best on flat storm drain inlets.

BMP 024 - Insert Filter in Catch Basin



Description of Potential Pollutant and Source: Sediments, oil, and other pollutants generated from industrial activities can pollute storm water.

Description of BMP: Catch basin filters use sand and organic material to trap sediments, oil, and other storm water contaminants. The filters are designed to be easily retrofitted into existing catch basins by suspending the device inside catch basins. Filters will be replaced regularly according to manufacturer's recommendations.

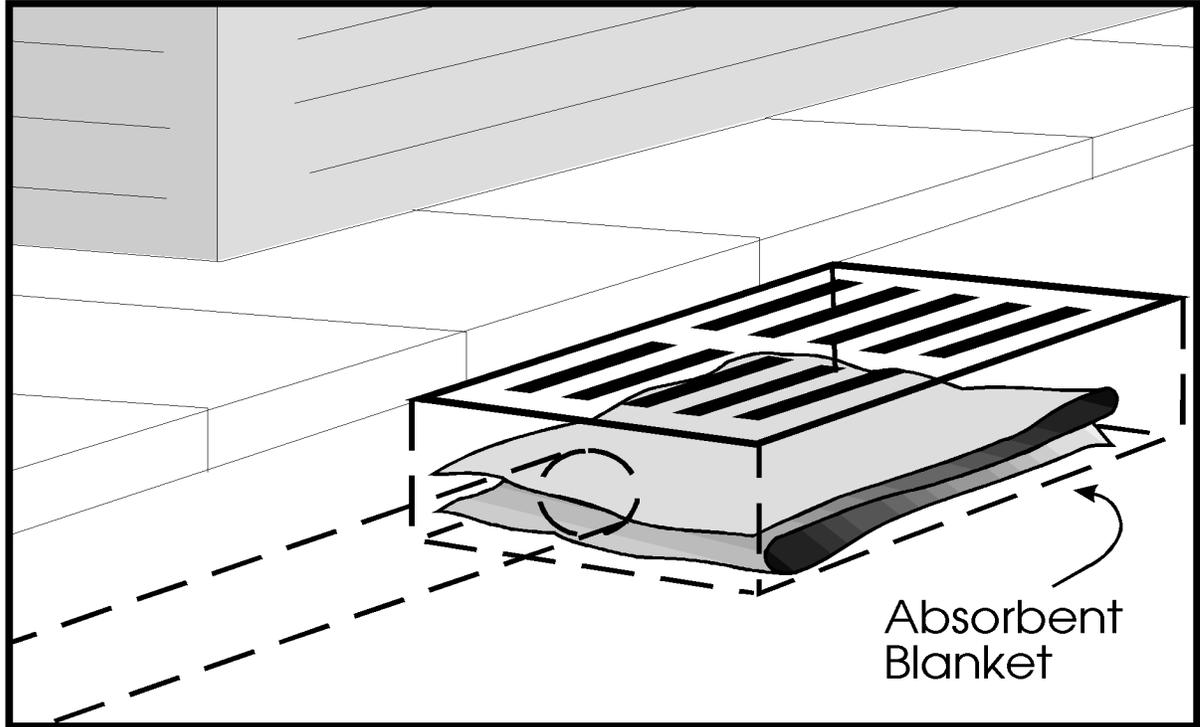
Application Guidance: This BMP will be used in areas where high concentrations of pollutants enter a storm drain catch basin.

Training: N/A

Effectiveness and Cost: Catch basin filters appear to be a moderately effective, moderate-cost BMP. However, this BMP has not been evaluated for effectiveness in Southern California.

Limitations: This BMP should only be used where storm water with high concentrations of pollutants drains into a storm drain inlet.

BMP 025 - Place Absorbent Blankets in Catch Basin



Description of Potential Pollutant and Source: Oil and grease from maintenance activities can be discharged into the storm drain system.

Description of BMP: Oil and grease absorbing blankets will be placed in catch basins and inlets. This BMP will be used in areas where high concentrations of oil and grease are exposed to storm water which can enter a storm drain catch basin or inlet.

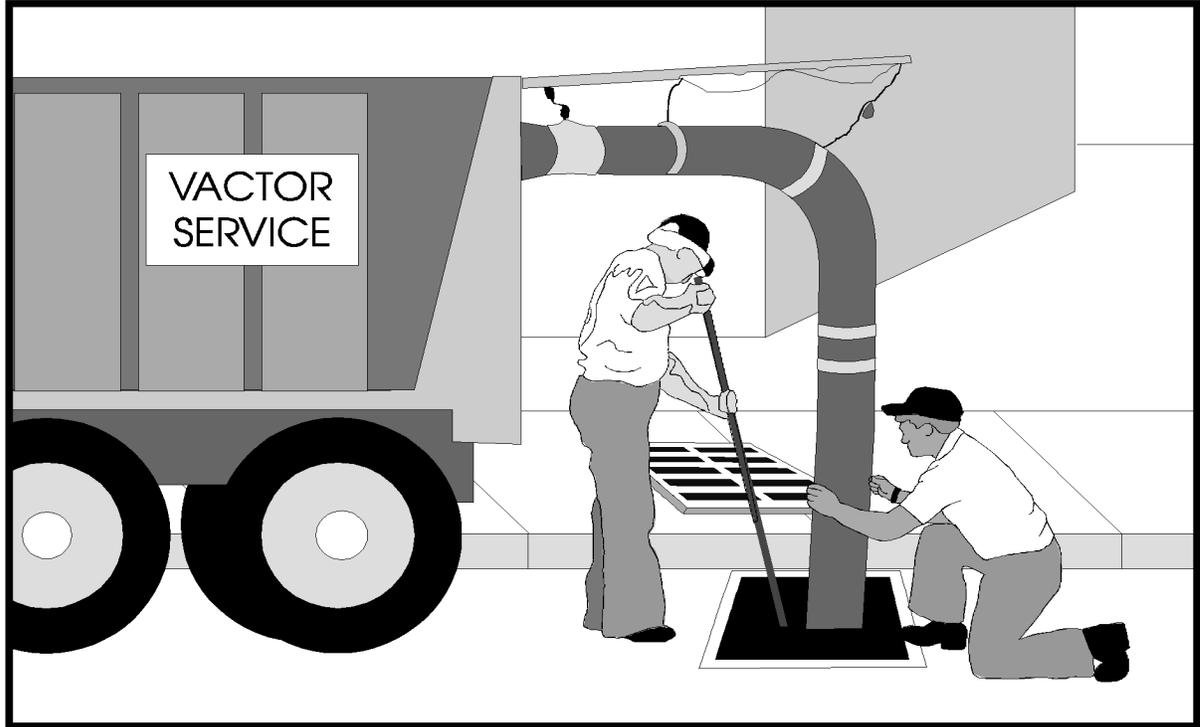
Application Guidance: The blankets will be changed semi-annually (or as needed) to ensure their continued effectiveness.

Training: Personnel will be trained to inspect the blankets monthly and replace them semi-annually or as needed.

Effectiveness and Cost: The blankets are an effective measure to reduce concentrations of hydrocarbons in storm water. The cost is moderate.

Limitations: This BMP can only be used when storm water with high concentrations of oil and grease drains into a storm drain catch basin or inlet.

BMP 026 - Routinely Clean Catch Basins



Description of Potential Pollutant and Source: Depending on their design, catch basins can accumulate sediment, trash, and debris. If the accumulated pollutants are not removed, they may be resuspended by storm water.

Description of BMP: Catch basins will be routinely cleaned to prevent clogging and to remove accumulated pollutants. The accumulated sediment will be tested to determine if it is a hazardous waste and then properly disposed. If the sediment is not a hazardous waste, it may be disposed in a landfill.

Application Guidance: Catch basins will be cleaned at least quarterly. One of these cleanings will be just before the rainy season.

The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Personnel will be trained in the proper testing, removal, and disposal of the sediment, or a qualified contractor will be used to perform these services.

Effectiveness and Cost: This is a moderately effective, low-cost BMP.

Limitations: The accumulated sediments may be a hazardous waste.

BMP 027 - Stencil Signs on Storm Drain Inlets



Description of Potential Pollutant and Source: Storm drain inlets generally discharge to storm drains or directly into receiving waters (i.e., rivers, oceans, lakes). Some storm drain inlets lead to water quality facilities, such as oil/water separators. However, such facilities are typically only 40 to 80 percent effective in reducing pollutant concentrations and may not be effective in treating storm flows. Therefore, material, such as used oil, solvents, and solid waste, that enters the storm drains may be exposed to storm water.

Description of BMP: Clearly mark storm drain inlets to warn against illegal dumping.

Application Guidance: All storm drain inlets will be properly labeled.

Training: N/A

Effectiveness and Cost: Stenciling storm drains is a variably effective, inexpensive BMP.

Limitations: None

BMP 028 - Keep Equipment and Vehicles Clean



Description of Potential Pollutant and Source: Through usage, equipment and vehicles accumulate oil and grease. During rain events, these pollutants are exposed to storm water and transported into the receiving waters.

Description of BMP: Equipment and vehicles will be cleaned regularly using either dry or wet methods to reduce the amount of pollutants exposed to rainfall.

Application Guidance: All vehicles and equipment exposed to storm water will be washed monthly and as needed to be kept clean.

The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Personnel will be instructed on how often to clean and wash vehicles or equipment.

Effectiveness and Cost: Keeping equipment and vehicles clean is a highly effective, low-cost BMP.

Limitations: None

BMP 029 - Maintain Equipment in Good Condition



Description of Potential Pollutant and Source: Equipment may leak fuel, grease, oil, or other potential pollutants due to corrosion, loose fittings, poor welding, and improper or poorly fitted gaskets. Without regular inspection of equipment and facilities, leaking or poorly operating equipment may continue to be used without being repaired.

Description of BMP: Equipment will be kept in good working condition and inspected regularly for fluid leaks. Equipment which is leaking or in poor working condition will be repaired or replaced.

Application Guidance: Equipment will be inspected daily before use for leaks and maintained in good condition at all times. Equipment which is not frequently used will be inspected monthly.

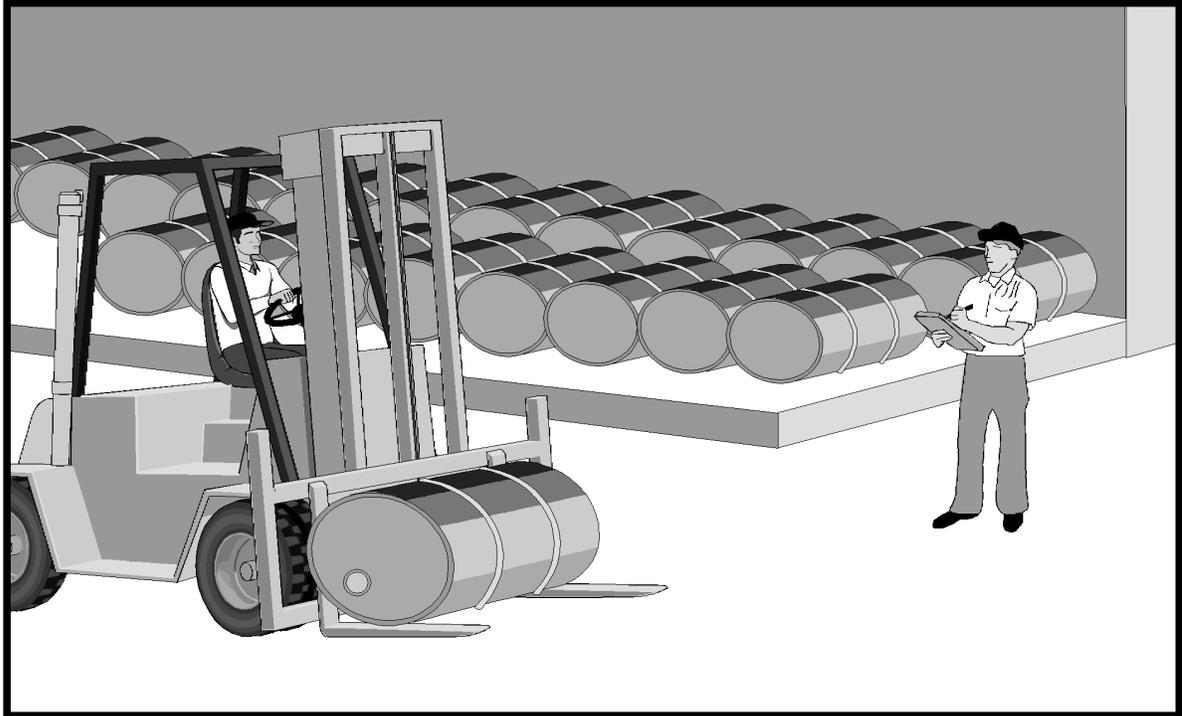
The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Personnel will be trained to regularly inspect for leaks or conditions that could lead to the exposure of significant materials to storm water. Personnel will be trained to routinely inspect equipment before each use. Procedures for notifying the appropriate maintenance personnel if a leak is found will be established.

Effectiveness and Cost: Keeping equipment in good condition is a moderately effective BMP. The cost of repairing or replacing equipment will vary.

Limitations: None

BMP 030 - Implement Qualifying Tests for Equipment and Vehicle Operators



Description of Potential Pollutant and Source: Through misuse or unfamiliarity with operating procedures, accidents may occur that result in leaks or spills that may expose significant materials to storm water.

Description of BMP: Implementation of qualifying tests for personnel operating equipment or vehicles reduced the chances of leaks and spills caused by accidents.

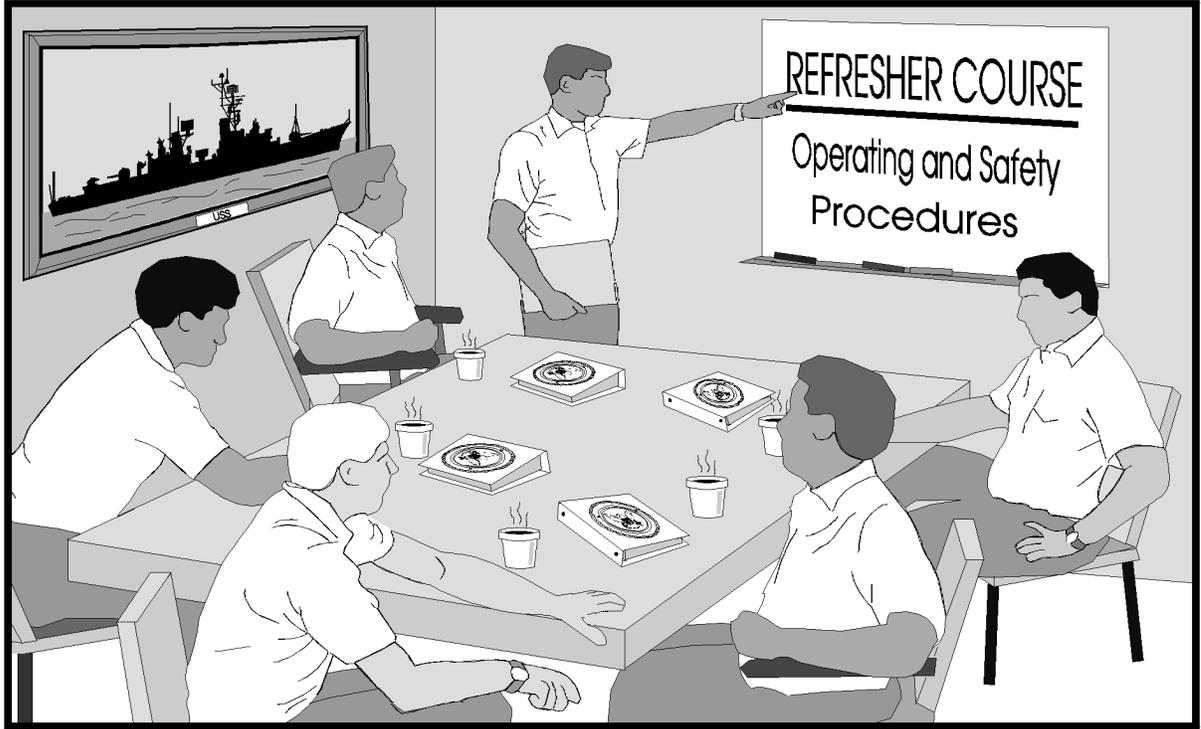
Application Guidance: Qualifying tests will always be used where equipment or vehicles are used.

Training: Personnel will be trained in safe operating procedures, basic maintenance, and spill response procedures associated with the particular equipment or vehicle.

Effectiveness and Cost: Qualifying tests are an effective, variable-cost BMP.

Limitations: None

BMP 031 - Conduct Refresher Courses in Operating and Safety Procedures



Description of Potential Pollutant and Source: Through time, personnel may forget certain correct operating and safety procedures, which may result in storm water pollution. Also, personnel need to be informed of new procedures and policies regarding equipment operation.

Description of BMP: Personnel will be required to have training and refresher courses in operating and safety procedures. This will help to reduce spills and accidents caused by negligence.

Application Guidance: Training and refresher courses will be conducted semi-annually.

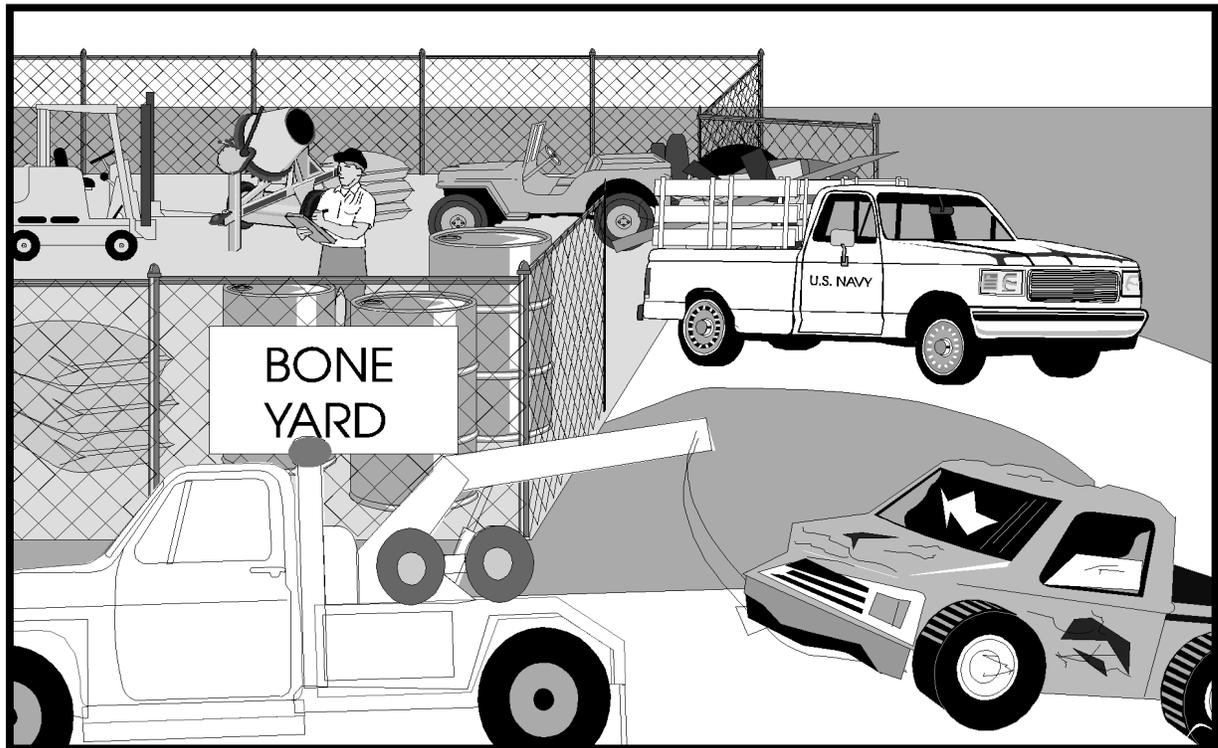
The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Instructors will be trained. A course will be prepared that covers both equipment manufacturers' recommendations for safety and operations as well as facility procedures and policies regarding equipment operation.

Effectiveness and Cost: Training is a highly effective, moderate-cost BMP.

Limitations: Cost and logistics could be a problem in implementing this practice.

BMP 032 - Dispose of Obsolete Equipment, Inoperable Vehicles, and Surplus Materials



Description of Potential Pollutant and Source: Obsolete equipment, inoperable vehicles, and surplus materials are often stored in areas not subject to routine inspection. These materials often leak a variety of fluids which can be exposed to storm water.

Description of BMP: Proper off-site disposal of obsolete equipment, inoperable vehicles, and surplus materials reduces the chances of pollutants reaching storm water.

Application Guidance: This practice will be implemented quarterly.

The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: N/A

Effectiveness and Cost: Disposing of unused equipment and supplies is a highly effective, moderate-cost BMP.

Limitations: None

BMP 033 - Check Vehicles and Equipment for Leaks



Description of Potential Pollutant and Source: Vehicles, aircraft, or equipment entering or stored at a maintenance facility may be leaking a variety of fluids (fuel, oil, antifreeze, freon, etc.). These materials can be exposed to storm water.

Description of BMP: All vehicles and equipment at the site, whether incoming, parked, stored, or salvaged, must be inspected for oil and fluid leaks. Drivers of fleet vehicles, such as delivery trucks, will also check under their vehicles each morning for fluid leaks. If leaks are present, drip pans will be placed under the vehicle or equipment. Once the vehicle is removed from the site, the former parking area will be inspected for stains, and these stains will be cleaned using rags or dry solvents.

Application Guidance: Any vehicle or equipment coming in for repairs, painting, or storage will be inspected for leaks. Fleet vehicles will be inspected each morning. Vehicles that are parked, stored, or salvaged will be provided with drip pans, as will tanker rail cars waiting to be unloaded.

The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Signs will be posted to remind personnel of proper procedures.

Effectiveness and Cost: Checking for leaks is a moderately effective, low-cost BMP.

Limitations: None

BMP 034 - Park Vehicles or Equipment Indoors or under a Roof



Description of Potential Pollutant and Source: Vehicles and equipment often leak or may be covered with oil and grease. If exposed to storm water, these pollutants can enter the storm drain system receiving waters.

Description of BMP: By parking vehicles and equipment indoors or under a roof, the exposure of significant materials to storm water from this source will be eliminated or reduced.

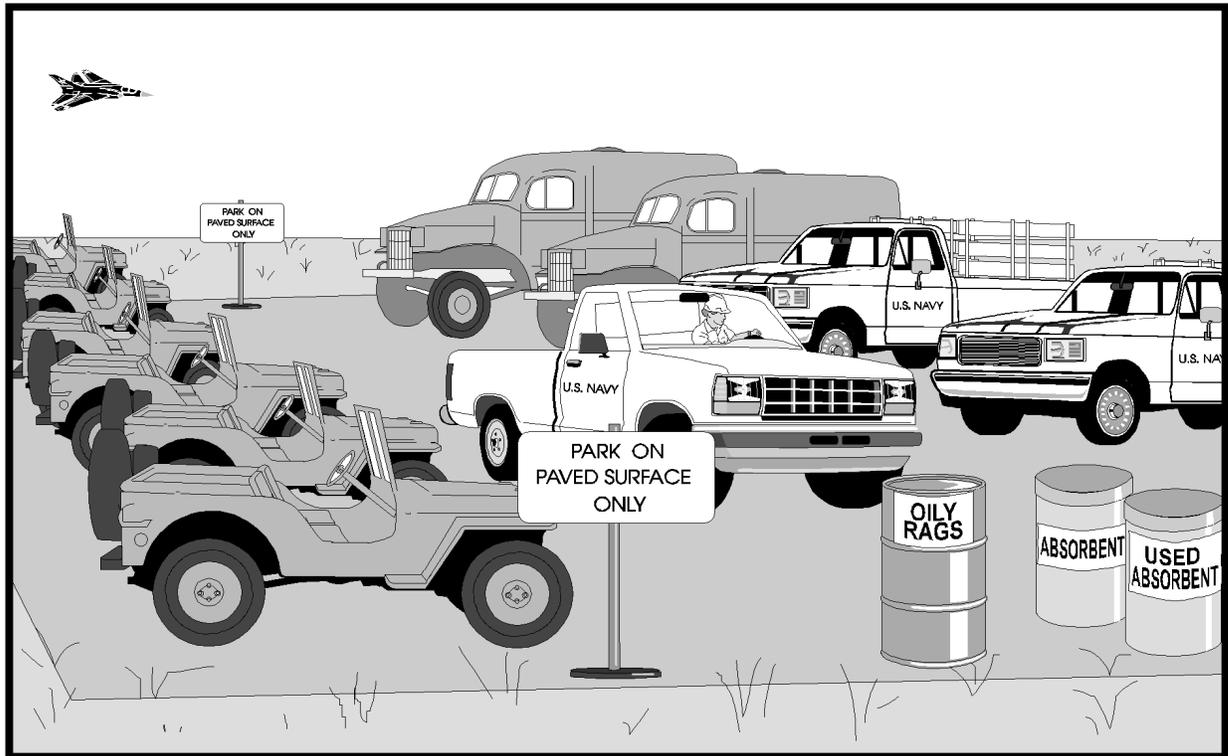
Application Guidance: When available, all vehicles and equipment will be parked indoors or under a roof.

Training: Personnel will be notified of any altered parking locations.

Effectiveness and Cost: Parking vehicles indoors or under cover is a highly effective, low-cost BMP if existing cover is available.

Limitations: The amount of indoor or covered parking available, size of vehicles or equipment and construction costs if cover must be constructed may restrict the use of this practice.

BMP 035 - Park Vehicles on an Impervious Surface



Description: Pollutants leaking or spilled onto the ground surface from vehicles can infiltrate into the soil. These pollutants (i.e., oil, fuel, etc.) may then be exposed to storm water and transported to surface water.

Description of BMP: Vehicles will be parked on an impervious surface. For this BMP, an impervious surface is defined as a surface that cannot be readily penetrated by rainfall, such as concrete and asphalt pavement. Leaks and spills will be cleaned from these surfaces.

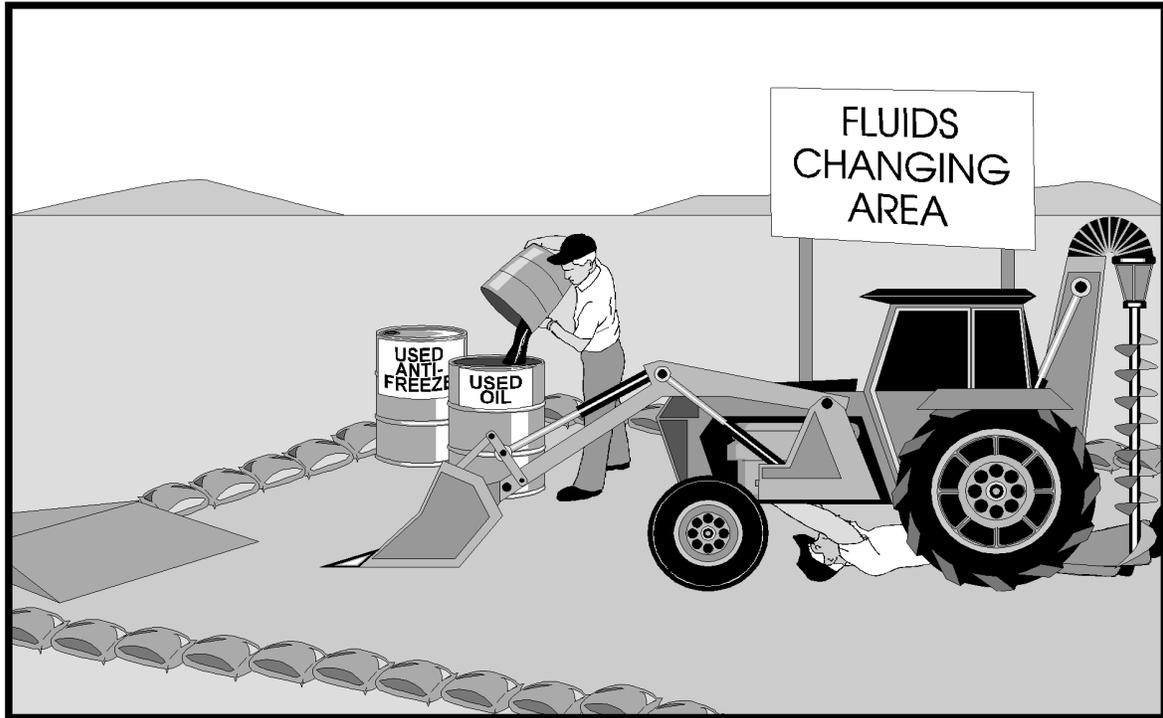
Application Guidance: Vehicles will always be parked on impervious surfaces, especially during the rainy season.

Training: Signs will be posted to remind personnel that all vehicles are to be parked on paved surfaces.

Effectiveness and Cost: Parking vehicles on impervious surfaces is a moderately effective, low-cost BMP.

Limitations: Very large traffic volumes may make implementation of this BMP difficult.

BMP 036 - Designate Special Areas for Draining or Replacing Fluids



Description of Potential Pollutant and Source: Draining and replacing motor oil, coolants, and other fluids in uncontrolled areas of the facility can potentially result in improper handling and disposal of waste and accidental spillage in an unprotected area. These materials can then be exposed to storm water.

Description of BMP: Motor oil, coolants, and other fluids will be drained and replaced at designated maintenance facilities to reduce the potential for improper handling activities. If this is not possible, special areas will be designated for these activities. Consideration will be given to placing these areas indoors or using bermed concrete pads if outdoors.

Application Guidance: This procedure will be followed whenever vehicle or equipment maintenance is being performed.

Training: Personnel will be instructed that vehicle maintenance will only be performed at designated areas.

Effectiveness and Cost: Using designated special areas for draining fluids is an effective, low-cost BMP.

Limitations: Existing facilities may be inadequate; construction cost may be prohibitive.

BMP 037 - Drain All Fluids From Stored or Salvaged Vehicles and Equipment



Description of Potential Pollutant and Source: Vehicles and equipment undergoing long-term storage or salvage often contain a variety of liquids (oil, antifreeze, hydraulic fluid, etc.) that can leak or spill, thereby exposing these materials to storm water.

Description of BMP: All oil and other fluids will be drained, collected, and recycled from vehicles being stored long term or salvaged (i.e., parts vehicles).

Application Guidance: Vehicles or equipment that are to be stored without use for more than three months will be drained of all fluids. Signs will be posted on these vehicles from which fluids have been drained.

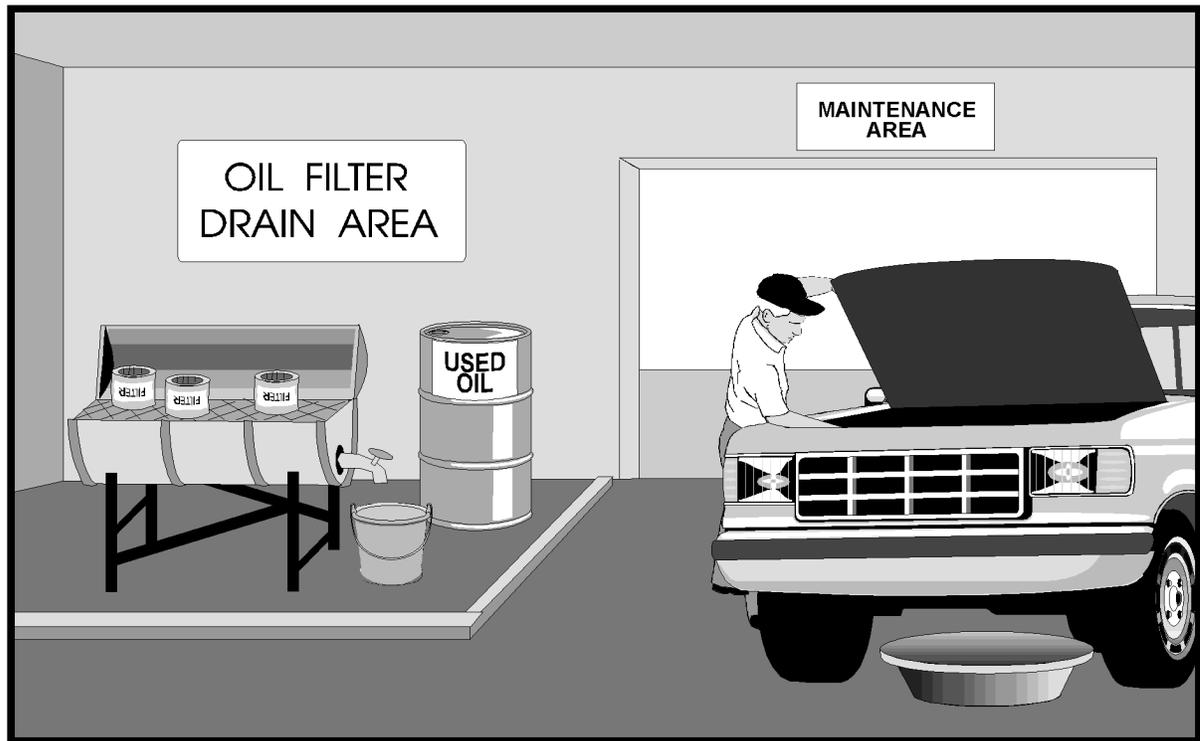
The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Signs will be posted as reminders to personnel.

Effectiveness and Cost: Draining oil and fluids is a moderately effective, low-cost BMP.

Limitations: None

BMP 038 - Completely Drain Oil Filters before Disposal



Description of Potential Pollutant and Source: Oil filters that are disposed in trash containers can leak significant materials which can be exposed to storm water.

Description of BMP: Filters will be completely drained into collection drums before recycling or disposal.

Application Guidance: All filters will be completely drained after being changed.

Training: Signs will be posted to remind personnel of requirement to completely drain oil filters before disposal.

Effectiveness and Cost: Completely draining filters is a moderately effective, low-cost BMP.

Limitations: None

BMP 039 - Wash Equipment and Vehicles in Designated Area



Description of Potential Pollutant and Source: Washing equipment and vehicles outdoors or in areas where wash water flows onto the ground can pollute storm water. It is difficult to control the wastewater from washing operations if it is not done in a designated area.

Description of BMP: Facilities will have designated, bermed wash areas that contain wash water and prevent contact with storm water. These areas will drain to the sanitary sewer (BMP 042) or to a sump. If a sump is used, wash water will be recycled.

Application Guidance: This practice will be followed wherever vehicles, equipment and aircraft are washed.

Training: N/A

Effectiveness and Cost: This is a highly effective, variable-cost BMP.

Limitation: Some municipalities may require pretreatment and monitoring of wash water discharges to the sanitary sewer. This would greatly increase the cost of this practice. The treatment plant owner will be notified and approval obtained before discharge.

BMP 040 - Discharge Wash Water to a Sanitary Sewer



Description of Potential Pollutant and Source: Wash water from vehicle, equipment, and floor cleaning activities often contains such as grease, oil, and gasoline which can be exposed to storm water. Wash water must not be discharged to the storm drain.

Description of BMP: Wash water will be discharged to a sanitary sewer to ensure that it does not enter a storm drain. (See BMP 041, "Wash Equipment and Vehicles in Designated Areas.") Wash water from mopping floors will also be discharged to the sanitary sewer.

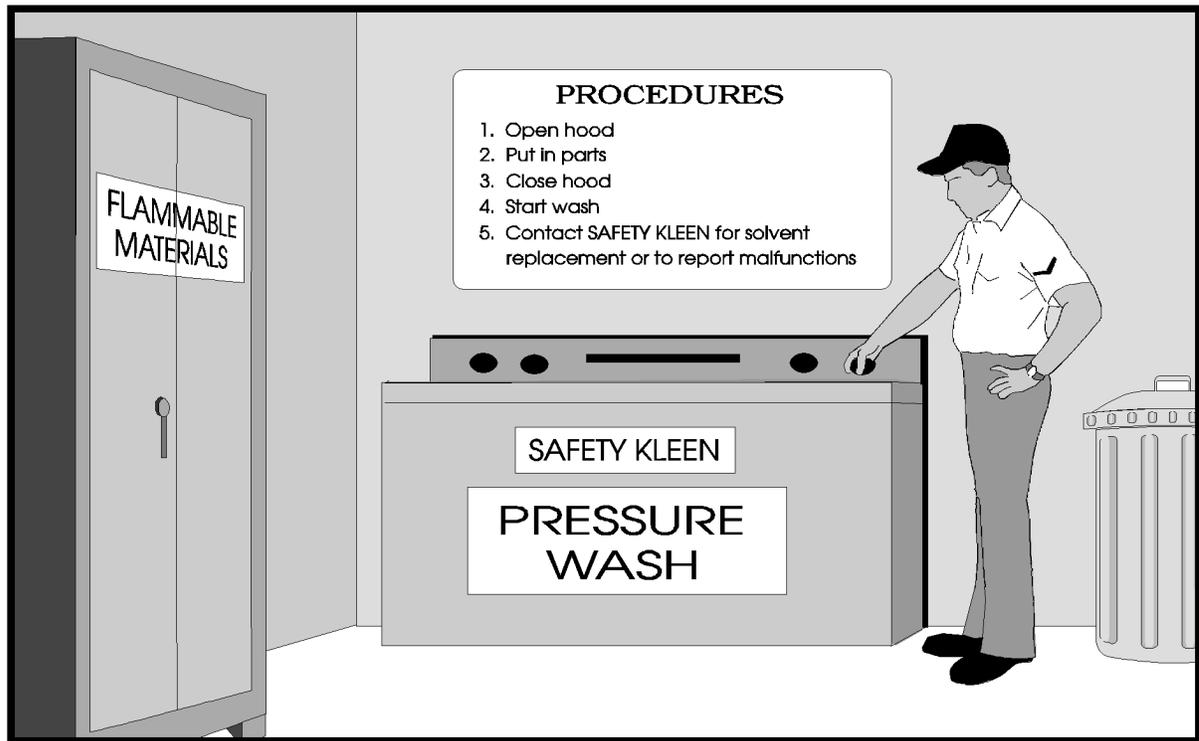
Application Guidance: All wash water from vehicle and equipment cleaning activities will be discharged to a sanitary sewer. In areas where wash water cannot be discharged to a sanitary sewer, wash water will be collected in a dead-end sump, tank, or other device and transported or pumped to the nearest treatment facility for proper disposal.

Training: Personnel will be trained to know where cleaning activities will be performed.

Effectiveness and Cost: Discharging wash water to a sanitary sewer is a highly effective, variable-cost BMP.

Limitations: Some municipalities may require pretreatment and monitoring of wash water discharges to the sanitary sewer. This would greatly increase the cost of this practice. The treatment plant owner will be notified and approval obtained before discharge.

BMP 041 - Recycle Pressure Wash Solvents



Description of Potential Pollutants and Source: Pressure wash wastes from cleaning ships, vehicles, and equipment can contain dirt, oils, grease, and paint particles.

Description of BMP: Pressure wash wastes will be recycled by using a closed loop system or a "zero discharge system."

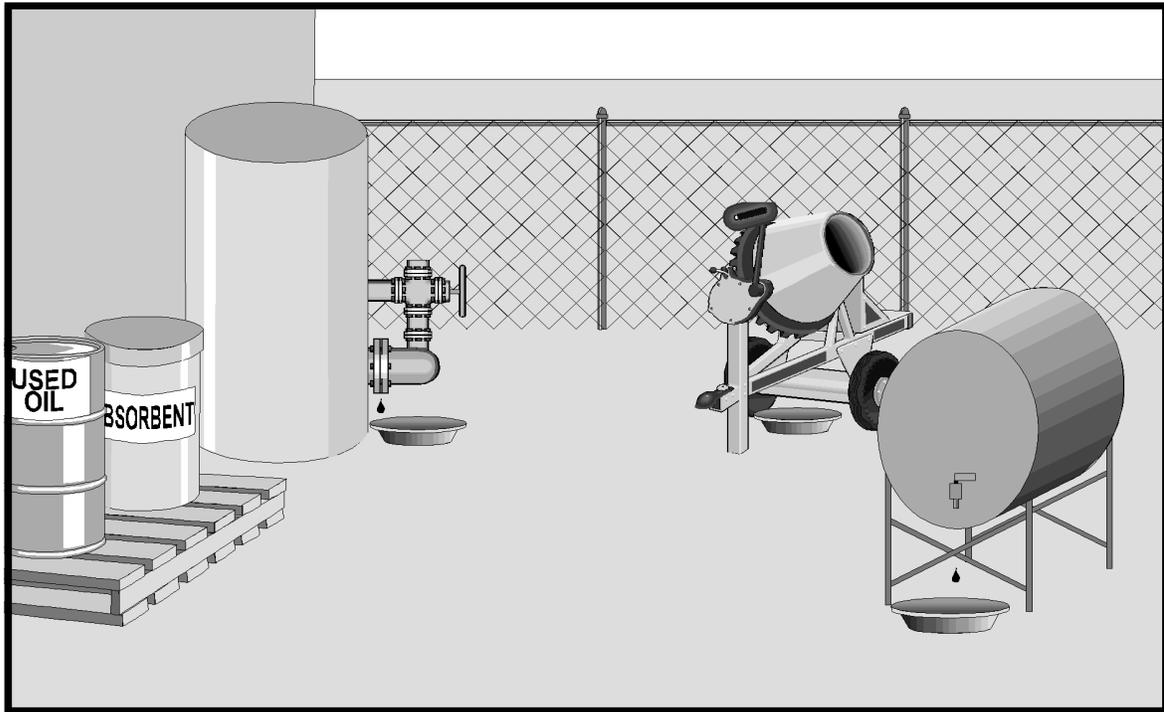
Application Guidance: Pressure wash wastes will be recycled whenever practical.

Training: Personnel will be trained in the proper use of pressure wash systems.

Effectiveness and Cost: This is a highly effective, variable-cost BMP. The cost can vary based on the availability of a local wastewater treatment facility and hauling and disposal costs. Also, the size of the pressure wash facility will affect the cost.

Limitations: None

BMP 042 - Use Drip Pans under Leaking Equipment



Description of Potential Pollutants and Source: Equipment such as pumps, air conditioners, and boilers may leak fluids. These fluids typically contain pollutants that may be exposed to storm water and transported into the storm sewer system if they are not collected.

Description of BMP: Drip pans will be placed under leaking equipment to collect any leaking fluid. This temporary BMP will be used until the equipment is properly repaired or replaced.

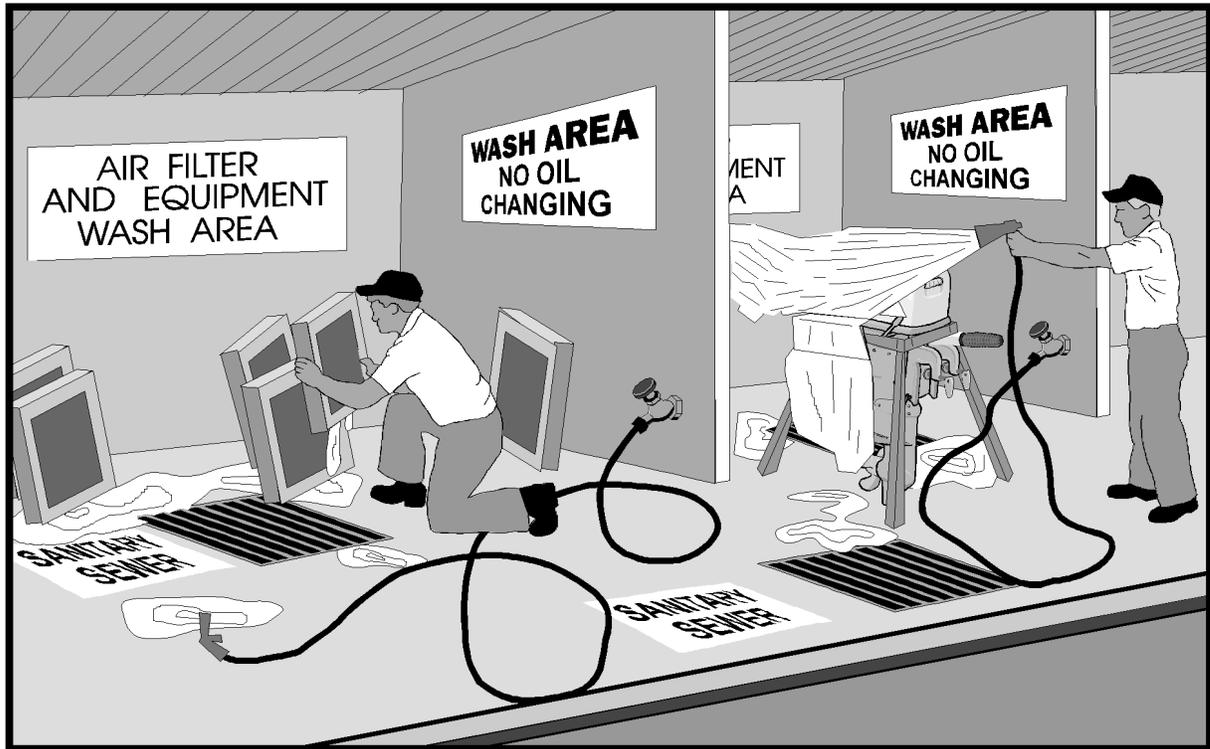
Application Guidance: Any equipment which is leaking fluid will be repaired or replaced. However, until the leak is stopped, a drip pan will be used to collect the fluid.

Training: Personnel will be trained to immediately place a drip pan under leaking equipment and notify the appropriate maintenance personnel. The drip pan will be routinely checked and the collected material disposed properly.

Effectiveness and Cost: This is a highly effective, low-cost BMP.

Limitations: None

BMP 043 - Designate Areas for Washing Non-Vehicular Air Filters and Other Greasy Equipment



Description of Potential Pollutant and Source: Non-vehicular air filters, such as those used in large kitchens, and other equipment accumulate a large amount of grease. Current maintenance may involve cleaning the filters in an area where the oil can be exposed to storm water and enter the storm drain system.

Description of BMP: Air filters (from mess hall cooking grills or other facilities where air filters can contain significant amounts of grease and soot) will be cleaned in an area where wash water and grease are contained in a sump or discharged to sanitary sewer lines.

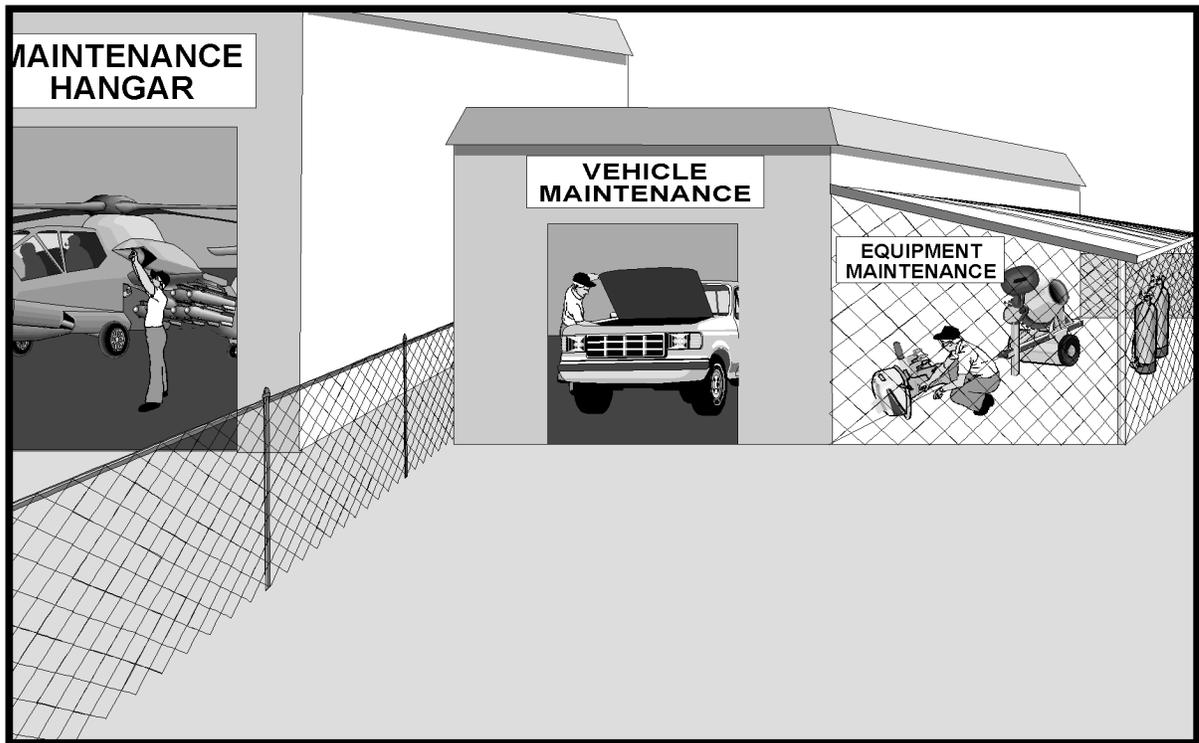
Application Guidance: This practice will be followed whenever greasy filters and other greasy equipment are cleaned.

Training: Personnel will be instructed to clean the air filters and other greasy equipment in areas where the wash water will be discharged to a sanitary sewer. A sign will be posted notifying the user where to clean the filter.

Effectiveness and Cost: Cleaning filters in a controlled area is a highly effective, low-cost BMP.

Limitations: None

BMP 044 - Conduct Maintenance within a Building or Covered Area



Description of Potential Pollutant and Source: Many pollutants such as oil, grease, or solvents may be leaked or spilled during maintenance activities. If maintenance is performed outside, in an uncovered area, storm water may transport the leaked and spilled material into the storm drain system.

Description of BMP: To the extent practical, maintenance will be conducted within a building or covered area. This includes performing aircraft/helicopter maintenance in hangars and vehicle maintenance in garages. If maintenance, including fluid top-offs, is performed outdoors, it will be conducted on an impervious surface, such as a concrete pad. Rainfall runoff from the pad will be directed to a storm water treatment facility. Leaks and spills will be cleaned up as soon as possible using rags or dry absorbents. Used rags and absorbent will be disposed properly. The garage floor will be cleaned regularly and all wash water from cleaning the floor will be disposed in the sanitary sewer.

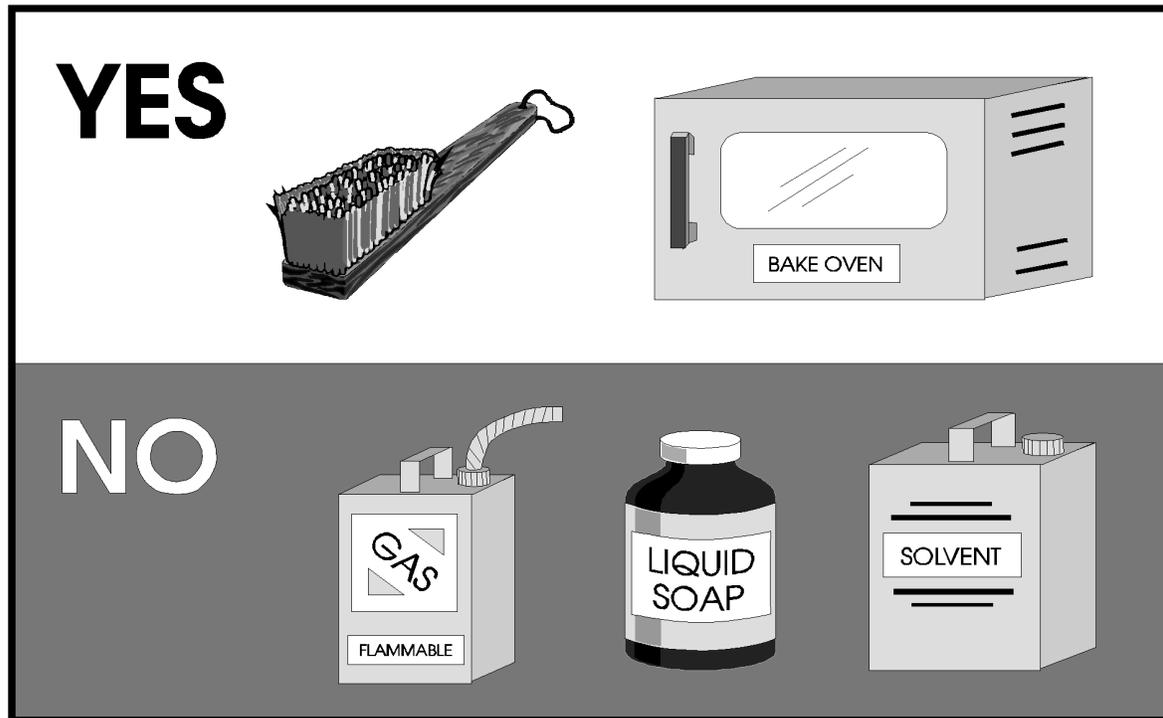
Application Guidance: All maintenance will be conducted within a building or covered area, if possible. If not possible, the maintenance will be done on an impervious surface.

Training: Personnel will be trained to perform all maintenance, including fluid top-offs, only in the designated area. Personnel will be trained in keeping the maintenance area clean.

Effectiveness and Cost: This is a moderately effective BMP. The cost will vary depending upon the availability of a building in which to perform all maintenance.

Limitations: This BMP may not be possible for the maintenance of large equipment and vehicles.

BMP 045 - Reduce the Amount of Liquid Cleaning Agents Used



Description of Potential Pollutant and Source: Liquid cleaners (i.e., soaps, detergents, solvents, gasoline, etc.) are significant materials which must not be exposed to storm water.

Description of BMP: Use of methods other than liquid cleaning agents will reduce the amount of waste produced and the potential for spills of cleaning liquids. Alternative cleaning methods include scraping parts with a wire brush or using a bake oven.

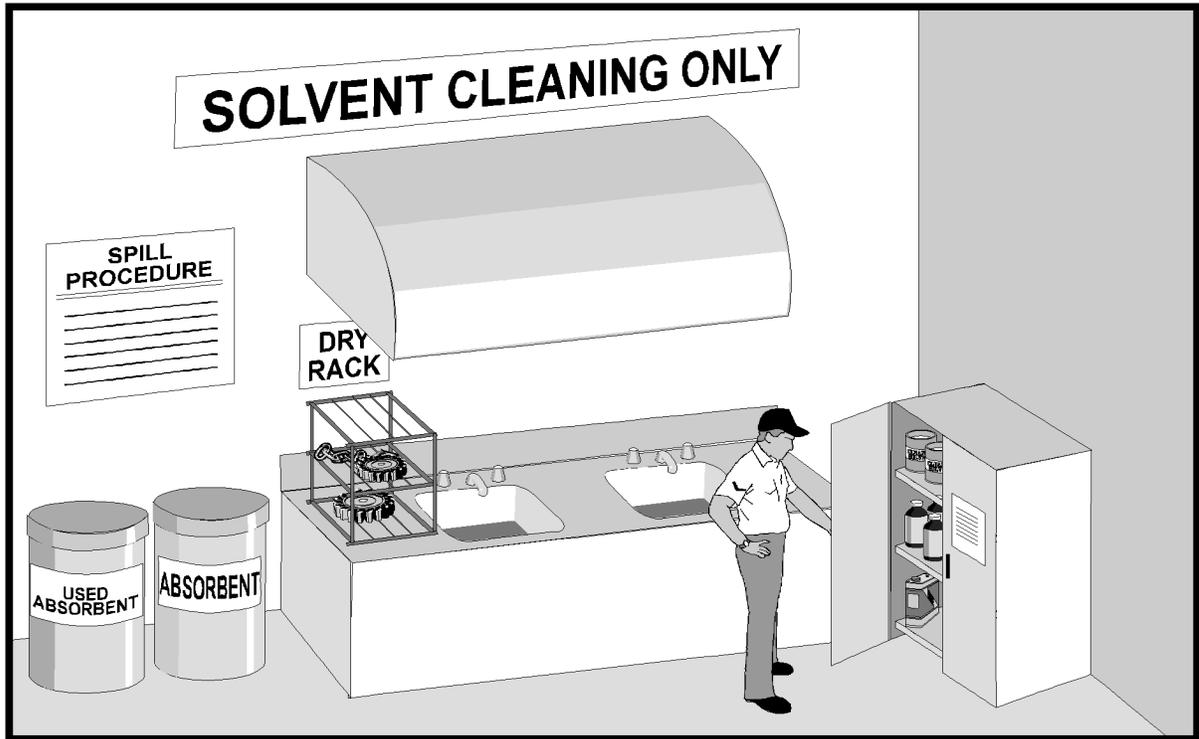
Application Guidance: Substitute cleaning methods will be used in all maintenance operations. These include: vehicle, equipment, aircraft and ship maintenance; metal work; and painting.

Training: Personnel will be trained in selected alternative methods of cleaning. Signs will be posted as reminders.

Effectiveness and Cost: Effectiveness and cost of non-liquid cleaning procedures will be site specific.

Limitations: Substitute cleaning methods may not be adequate for some operations.

BMP 046 - Centralize Liquid Solvent Cleaning to One Location



Description of Potential Pollutant and Source: Widespread use of liquid solvents to clean parts results in a potential for spills, illegal dumping, and improper use of the solvent.

Description of BMP: If cleaning parts with liquid solvents is unavoidable, the cleaning will be conducted in central locations. This practice will reduce the number of personnel using the solvents, promote proper use and disposal, and minimize the potential for spills (assuming that the central locations are properly operated and maintained). Drip pans, drain boards and drying racks will be located adjacent to and oriented such that excess solvent is directed back into a sink or holding tank for recycling. All storage containers will be clearly labeled.

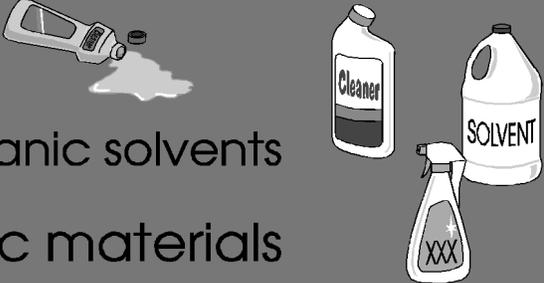
Application Guidance: Central cleaning locations will be used whenever parts are cleaned with liquid solvents in maintenance and salvage operations.

Training: Personnel will be notified of the locations of the cleaning stations. Personnel will be trained in proper procedures, such as removing dipped parts slowly as to avoid spills, and how to recycle used solvent.

Effectiveness and Cost: Central cleaning stations are a moderately effective, moderate-cost BMP.

Limitations: The size of the parts being cleaned may preclude having it centralized.

BMP 047 - Substitute Non-Toxic or Less-Toxic Cleaning Solvents

YES	<input checked="" type="checkbox"/>	Non-caustic detergents	
	<input checked="" type="checkbox"/>	Water-based degreasers	
NO	<input type="checkbox"/>	Organic solvents	
	<input type="checkbox"/>	Toxic materials	

Description of Potential Pollutant and Source: Organic solvents, typically used for cleaning equipment and parts, are considered a major pollutant in storm water. Exposure of these materials to storm water can be minimized by using less-toxic substitutes.

Description of BMP: One method to reduce the impact of storm water pollutants is to substitute non-toxic or less-toxic materials. This includes using non-caustic detergents for parts cleaning, detergent or water-based degreasers in place of organic degreasers, replacing chlorinated solvents with non-chlorinated solvents, and using phosphate-free detergents. However, even non-toxic materials are considered storm water pollutants and must be managed properly.

Application Guidance: Less-toxic materials will be substituted whenever possible.

Training: The procurement office will be trained regarding the constituents of cleaning materials and alternative materials. Personnel will be trained to know the differences between new and previously used materials.

Effectiveness and Cost: Effectiveness and cost will vary depending on site conditions.

Limitations: There may be no adequate alternative cleaning solvent available at a reasonable cost.

BMP 048 - Use Solvents Efficiently



Description of Potential Pollutant and Source: Many repair and maintenance operations use a wide variety of solvents. Spills and leaks of solvents can occur, exposing these materials to storm water. By using these materials efficiently, the potential for exposure can be reduced.

Description of BMP: Reusing solvents or using solvents sparingly will reduce the risk of spills and leaks. Pre-soaking parts in "dirty" solvent before placing in fresh solvent reduces the volume of solvent used.

Application Guidance: This practice will be followed as often as is practical.

Training: Personnel will be trained in efficient use of solvents.

Effectiveness and Cost: Efficient use of solvents is a moderately effective, low-cost BMP.

Limitations: None

BMP 049 - Use Outside Contractor for Handling Used Solvents and Other Significant Materials



Description of Potential Pollutants and Source: Improper storage, handling, and disposal of solvents, oils, paint thinners, and other toxic chemicals can occur with untrained personnel. This can result in exposure of these materials to storm water. Use of contractors specializing in handling these materials can minimize this exposure.

Description of BMP: Private contractors handle the disposal and replenishing of solvents, used oil, and other significant materials used in industrial or maintenance operations. An example is "Safety Kleen," a company which handles solvents used for parts washing.

Application Guidance: Private contractors will be used for disposing and replenishing significant materials continually.

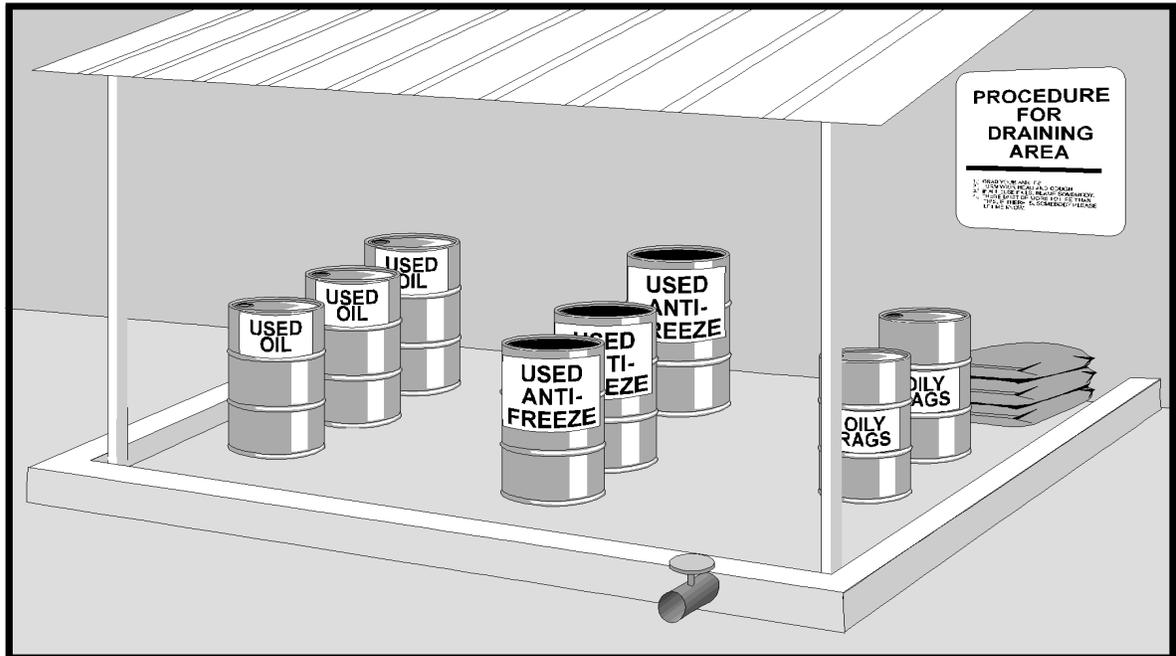
The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Personnel will be trained to contact the private contractors when services are needed and prepare the proper manifests (records of transportation).

Effectiveness and Cost: This is a moderately effective, moderate-cost BMP.

Limitations: Availability of private contractors may be a limitation. Quantities of materials/waste will also limit the application of this BMP.

BMP 050 - Properly Store Containers



Description of Potential Pollutant and Source: Improper storage of containers can result in the exposure of significant materials to storm water.

Description of BMP: Containers will be properly stored. This includes the following:

- Providing adequate aisle space (typically 3 feet) to facilitate material transfer and easy access for inspections.
- Storing containers, drums, and bags away from vehicle traffic routes to reduce the potential for mechanical impact and accidental spills. Do not store bags that are easily punctured near high-traffic areas where they may be hit by moving equipment or personnel.
- Stacking containers according to manufacturer's instructions to avoid damaging the containers from improper weight distribution.
- Storing liquid containers in a bermed area.

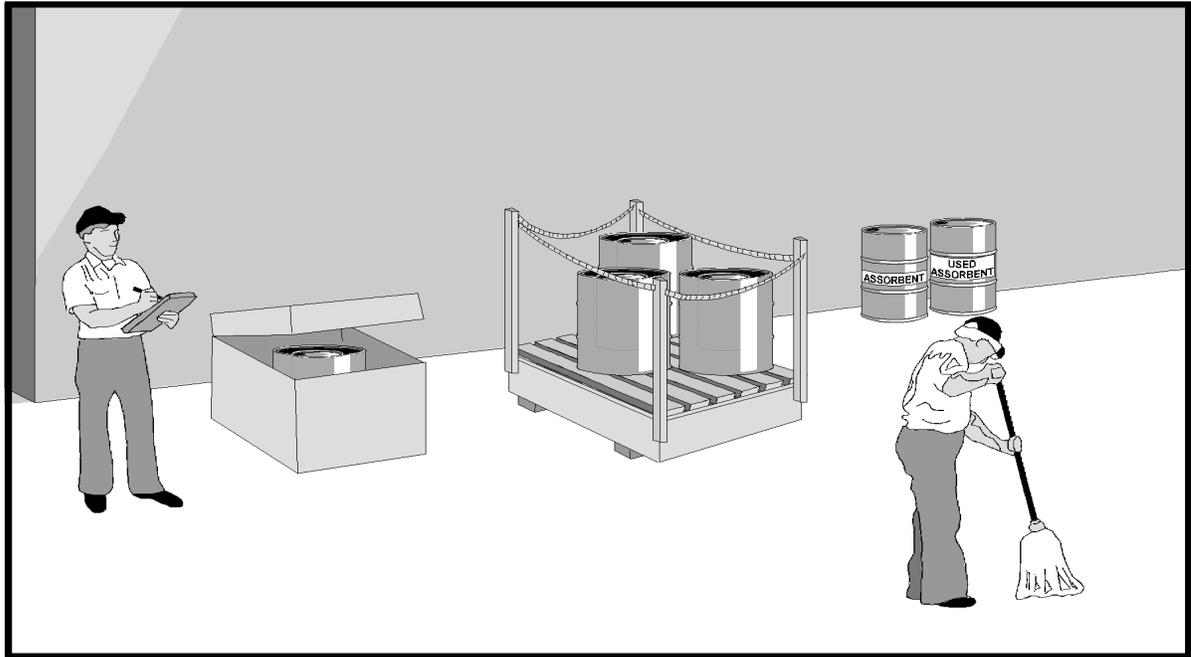
Application Guidance: Containers will be properly stored.

Training: Training on the proper storage of materials will be provided periodically to the appropriate personnel.

Effectiveness and Cost: This is a moderately effective, low-cost BMP.

Limitations: None

BMP 051 - Use Overpack Containers or Containment Pallets to Store 55-Gallon Drums Outside of Storage Areas



Description of Potential Pollutant and Source: Chemicals, oils, solvents or liquid materials stored outside in 55-gallon drums may leak. The leaking material can then be exposed to storm water and transported to the storm drain system receiving waters.

Description of BMP: Overpack containers and containment pallets are secondary containers usually constructed of plastic. They are large enough to hold the contents of the containers stored in them if they should break or leak. Using overpack containers or containment pallets minimizes the amount of pollutants reaching surface waters due to leaks. Overpack containers should be protected against damage from vehicles.

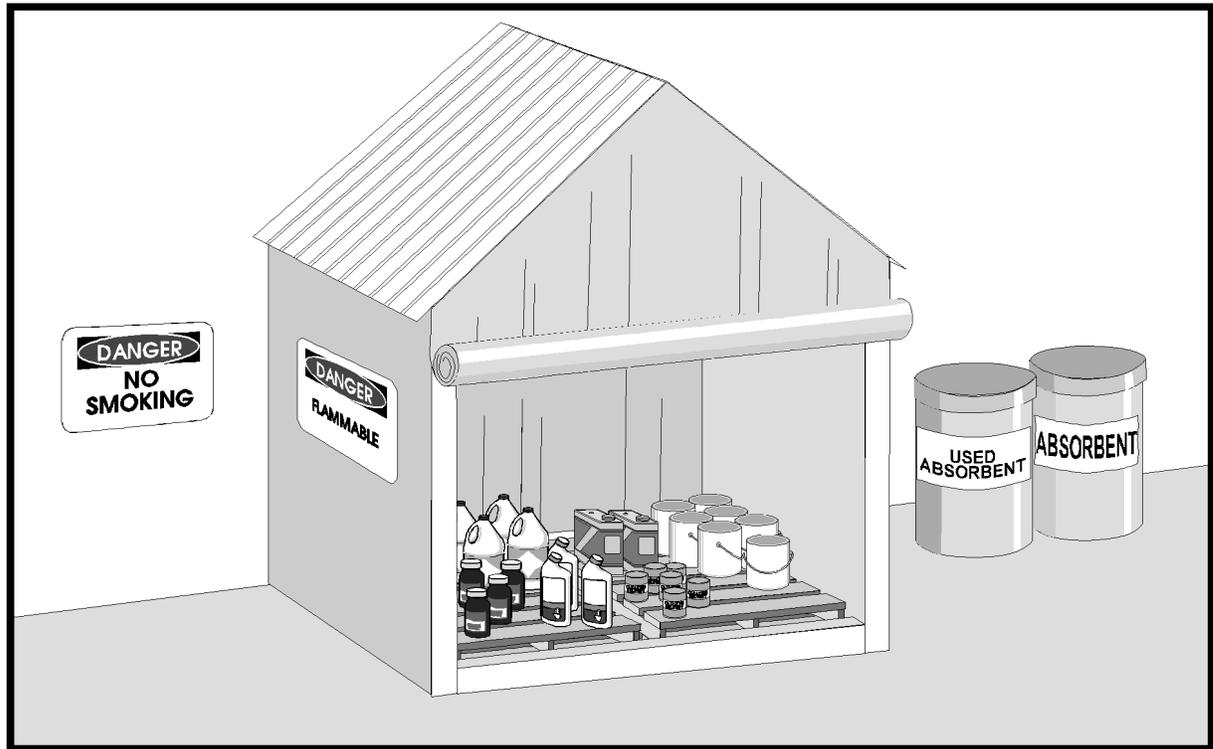
Application Guidance: Overpack containers or containment pallets will be used whenever 55-gallon drums of hazardous materials must be stored outside.

Training: Personnel will be trained to ensure that overpack containers or containment pallets are used.

Effectiveness and Cost: Overpack containers and containment pallets are a highly effective, moderate-cost BMP.

Limitations: Cost could be high if the number of drums needing containment is high.

BMP 052 - Use "Doghouse" Design for Outdoor Storage of Small Liquid Containers



Description of Potential Pollutant and Source: Small containers of liquid materials (i.e., paints, solvents, antifreeze, etc.) are often stacked or stored outside. Leaks and spills from these containers can be exposed to storm water and be transported to the storm drain or receiving waters.

Description of BMP: Small containers of liquid will be stored properly. Containers can either be stored inside buildings or in "doghouses." The roof and flooring of a doghouse design prevents direct contact of significant materials with storm water. A doghouse design is a term used to describe a storage shed that has two solid structural walls, a roof, and two canvas walls. The structural walls support the structure, while the canvas walls provide easy access to the liquid containers in the shed. Secondary containment, such as berms and curbs, will also be used for this type of structure to contain any leaks or spills that may occur. A doghouse design has two benefits:

1. Protection of liquid containers from direct contact with rainfall
2. Storage of numerous containers in a centralized location without occupying too much space

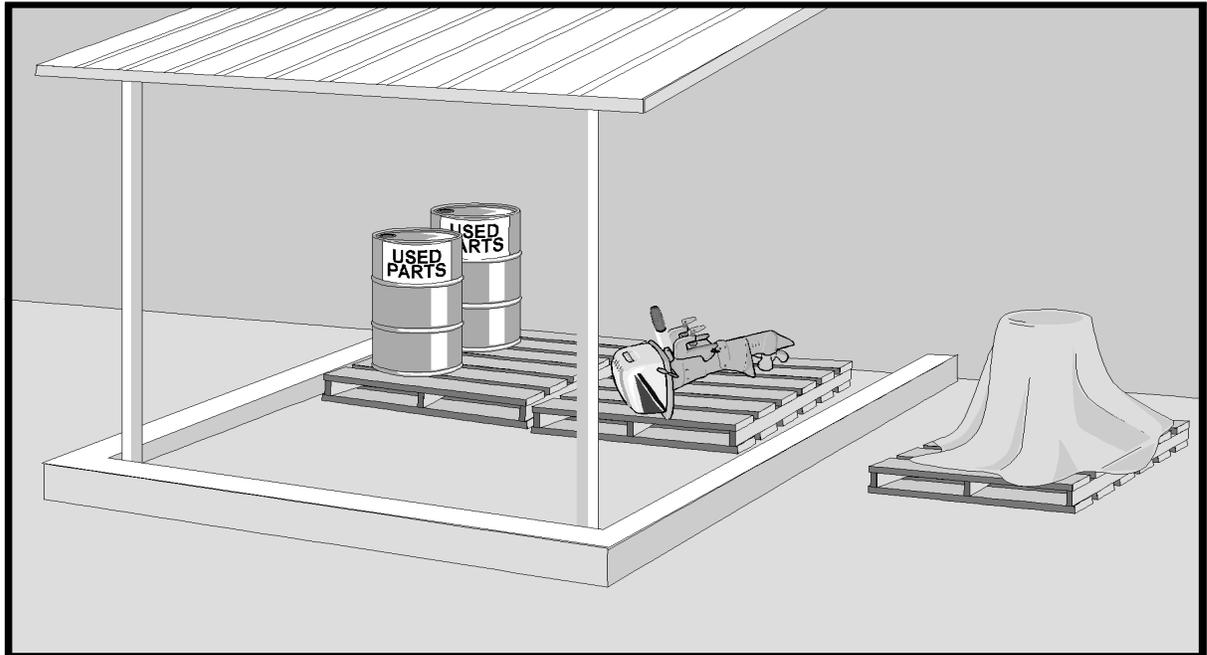
Application Guidance: Liquid containers kept outdoors will be covered at all times.

Training: N/A

Effectiveness and Cost: This is a moderately effective, moderate-cost BMP.

Limitations: Storage sheds often must meet building and fire code requirements, and some fire ordinances may preclude the use of this practice.

BMP 053 - Do Not Store Used Parts or Containers Directly on Ground



Description of Potential Pollutants and Their Source: Used parts are often covered with oil, grease, and other potential pollutants. Containers, such as 55-gallon drums and flammable materials storage lockers, may develop leaks and spill potential pollutants onto the ground or pavement. If the used parts or containers are stored directly on the pavement or ground, significant materials can be exposed to storm water which can transport the pollutants into the storm drain system or receiving waters.

Description of BMP: Used parts and containers will not be stored directly on the pavement or the ground. If possible, used parts and containers will be stored indoors. If outdoor storage is necessary, smaller parts will be placed inside a leak-proof, covered container, such as a labeled 55-gallon drum, and placed on a wooden pallet. Larger parts will be placed on wooden pallets or waterproof tarpaulins and covered with secure tarpaulins. Containers will be placed on wooden pallets to prevent the bottoms from rusting and to facilitate spill and leak detection. Placing used parts and containers in roofed, bermed storage areas is also acceptable.

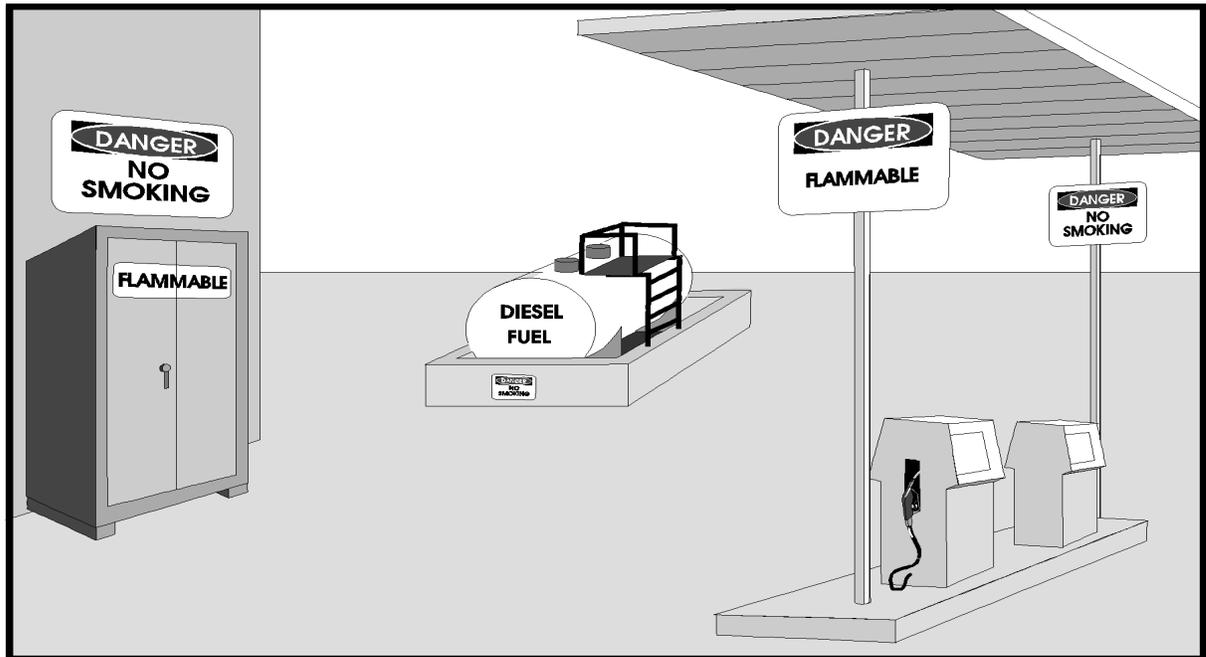
Application Guidance: Used parts and containers will never be stored directly on the pavement or ground.

Training: Personnel will be trained to never store used parts or containers directly on the ground or pavement.

Effectiveness and Cost: This is a moderately effective, low-cost BMP.

Limitations: None

BMP 054 - Do Not Allow Open Flames Near Flammable Material



Description of Potential Pollutant and Source: Water or other material used to extinguish a fire often is washed into the storm drain system. This material could contain pollutants from the item on fire. In addition, an area that has been destroyed by a fire is likely to discharge contaminants into the storm drain system. These materials can be exposed to storm water and transported to receiving waters.

Description of BMP: No open flames of any kind will be permitted within 50 feet of flammable material. Many paints are flammable. Smoking will be forbidden within flammable material areas, and only spark-proof tools will be used. Signs will be posted indicating flammables and no smoking. (Note: 29 CRF 1910.106 requires this BMP for areas where flammables are stored).

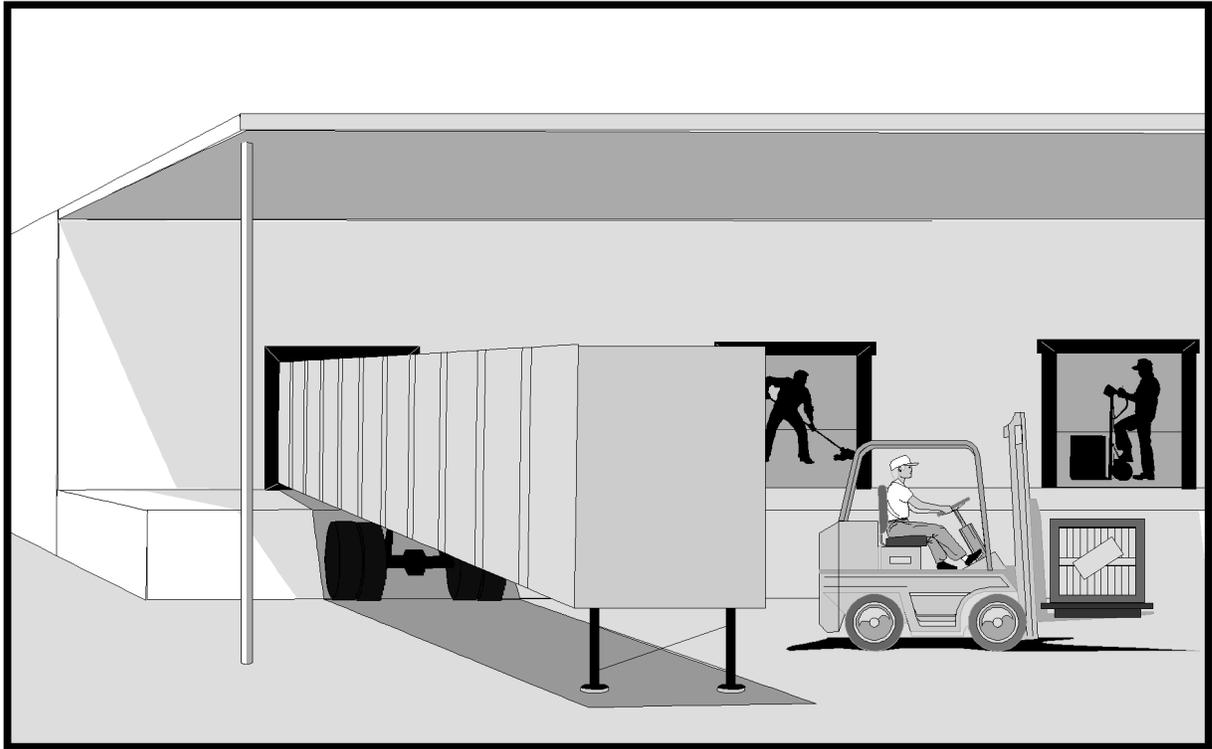
Application Guidance: No open flames or smoking will be allowed near flammable materials that are stored or that are being used. Only spark-proof tools will be used.

Training: Personnel will be trained to routinely check the label on materials to determine if they are flammable. Flammable materials will be properly stored and used.

Effectiveness and Cost: This is an effective, low-cost BMP.

Limitations: None

BMP 055 - Use Door Skirt or Seal



Description of Potential Pollutant and Source: Spills often occur during loading and unloading of liquid wastes and other significant materials from trucks and trailers. These materials can be exposed to storm water and transported to the storm drain system and/or receiving waters.

Description of BMP: A door skirt is a rubber or plastic strip that encloses a trailer end during loading operations. Existing docking facilities will be retrofitted with door skirts or seals where appropriate.

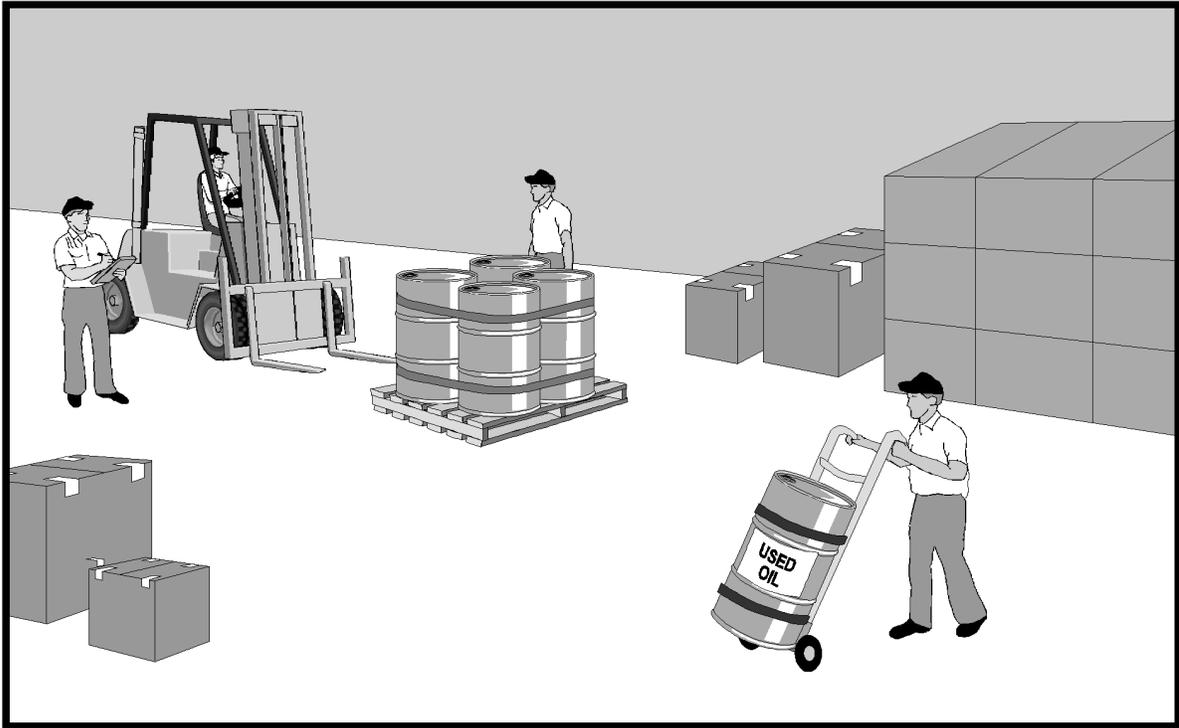
Application Guidance: A door skirt or seal will be installed at docking facilities as appropriate.

Training: N/A

Effectiveness and Cost: The door skirt is a moderately effective, low-cost BMP.

Limitations: None

BMP 056 - Employ Proper Handling Procedures to Transport Materials and Waste



Description of Potential Pollutant and Source: Materials and waste are usually transported using forklifts, trailers, trucks, etc. If these loads are not properly secured or are handled incorrectly, drums can be ruptured and spills can occur. This can expose the materials to storm water, which can transport them to the storm drain system and/or receiving waters.

Description of BMP: Drums will be moved by using a barrel cart or by placing the drum on a pallet and moving it with a forklift. As a minimum, two persons will assist the forklift operator when transferring a drum to or from a pallet. When multiple drums are stacked on a single pallet, the drums will be secured together with metallic strapping to reduce the potential for spillage due to weight shift. Mechanical puncture of a drum with the tines (i.e., the prongs) of the forklift will be avoided.

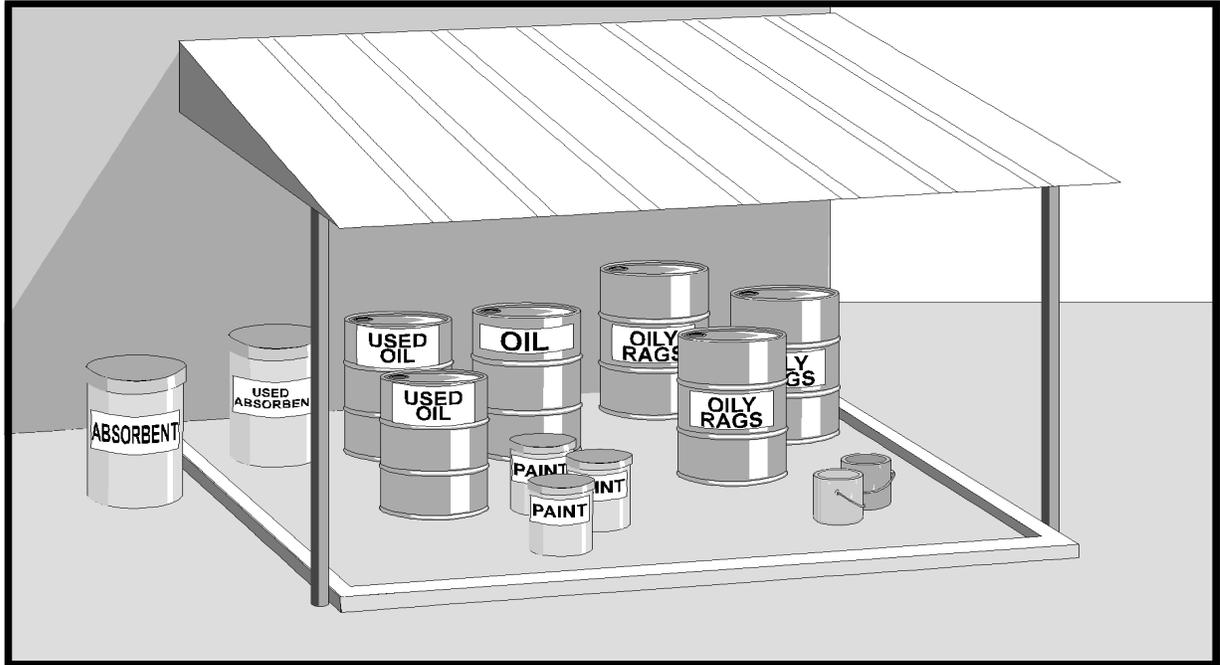
Application Guidance: Significant materials and wastes will be transported according to federal, state, and local regulations at all times.

Training: Personnel will be trained in hazardous material/waste spill prevention procedures.

Effectiveness and Cost: This practice is a highly effective, moderate-cost BMP.

Limitations: None

BMP 057 - Store Liquids and Significant Materials within a Building or Covered Area



Description of Potential Pollutant and Source: Many significant materials may be leaked or spilled during storage, handling, or transport. If significant materials are stored outside, in covered areas, these materials can be exposed to storm water, which can transport the leaked or spilled material into the storm drain system.

Description of BMP: To the extent practical, significant materials will be stored within a building or covered area. The materials will be stored on an impervious surface, such as a concrete pad. Rainfall runoff from the pad will be directed to a storm water treatment facility or contained. Leaks and spills will be cleaned up as soon as possible using rags or dry absorbents. Used rags and absorbents will be disposed of properly. Any wash water from cleaning the floor will be disposed of in the sanitary sewer.

Application Guidance: All significant materials will be stored within a building or covered area.

Training: Personnel will be trained to store significant materials in designated areas.

Effectiveness and Cost: This is a moderately effective BMP. The cost will vary based on whether a building for storing the substances is available.

Limitations: None

BMP 058 - Provide Overfill Protection



Description of Potential Pollutant and Source: Overflows during fueling or transfer of fuels or liquids to the storage tanks can expose significant materials to storm water, which can transport them to the storm drain system and/or receiving waters.

Description of BMP: Adequate control of overflows will be achieved by installing overfill prevention equipment that automatically shuts off flow, restricts flow, or sounds an alarm when the tank is almost full. Existing tanks will be retrofitted with this equipment.

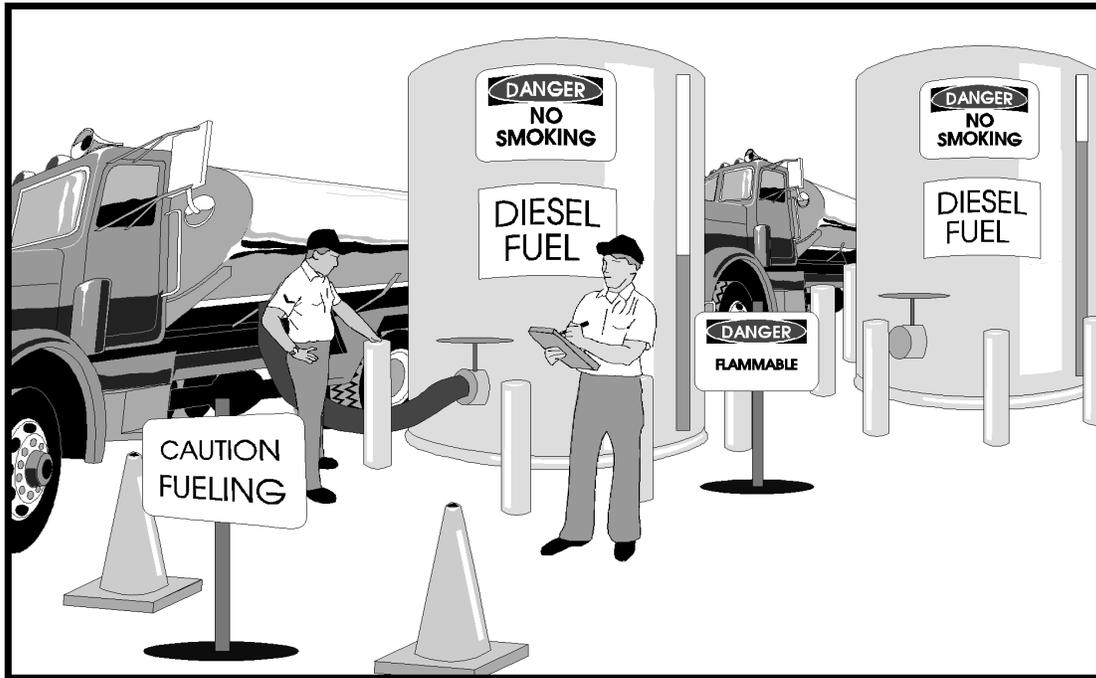
Application Guidance: Overfill protection will be used during any fuel or liquid handling operation. This includes vehicles, equipment, aircraft and ships. Overfill protection will be included in initial construction and retrofitting of existing installations.

Training: Personnel will be trained in the use of the overfill protection devices at their facilities. Overfill protection procedures will be posted in fueling areas and other liquid material transfer areas.

Effectiveness and Cost: Overfill protection is a highly effective, low-cost BMP.

Limitations: None

BMP 059 - Monitor Major Fueling Operations



Description of Potential Pollutant and Source: Overflows during fueling or transfer of fuels or liquids to the storage tanks can expose significant materials to storm water. These materials can then be transported to the storm drain or receiving waters.

Description of BMP: Careful monitoring of fuel transfer operations will reduce overfilling. A policy mandating second party monitoring of fuel transfers will be adopted.

Application Guidance: Fuel transfer operations will be observed during all high-volume transfers. High-volume transfers typically involve a fuel tanker truck.

Training: Personnel will be trained in appropriate emergency spill response actions and proper fueling procedures. Fueling procedures will include the following items:

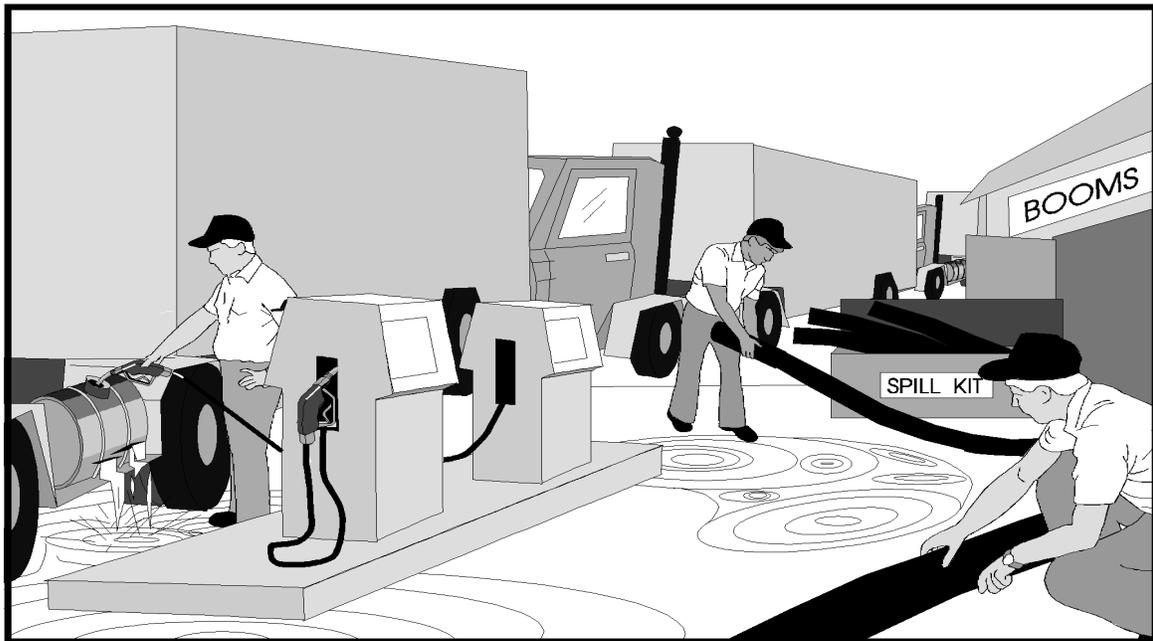
- Determine that sufficient space is available in the storage tank or drum to receive the entire trailer compartment's capacity by gaging the tank or drum immediately before discharging additional product into the storage tank. Gaging can be accomplished by using stick readings, sight gages, or sensor readouts.
- Ensure that the tank trailer is accurately spotted at the proper unloading spot.
- Ensure that the tank trailer brakes are set; the driver remains with the vehicle and observes the transfer lines during the entire unloading procedure.
- Place caution signs in the proximity of the tank trailer to give necessary warning to approaching vehicles and personnel. These signs must remain posted until after the tank trailer is unloaded and disconnected from the discharge connection.

- Ensure that no open flames of any kind are permitted within 100 feet of the tank trailer. Smoking is strictly forbidden within this area. Only spark-proof tools are to be used.
- Limit performance of unloading operations only to reliable persons properly instructed and made responsible for careful compliance with applicable regulations.
- Attach ground strap at the facility to bumper of tank trailer unless the transfer hose provides the proper ground, once the products in the tank and trailer compartments have been verified as being the same.
- Ensure that the facility storage tank is vented before connecting the unloading line unless unloading uses a vapor recovery system. Connect vapor recovery system(s) if applicable.
- Attach unloading line to the proper connection on the outlet leg of the tank truck.
- Open bottom outlet valve and proper valves in the unloading lines.
- Start product unloading, checking to ensure that there is no leakage at any of the connections. Should leakage appear, immediately stop the unloading process by closing the necessary outlet valves. The driver must continuously observe the connections to ensure that they are secure throughout the fluid transfer process.
- After liquid has been removed, close all valves, disconnect facility unloading from tank trailer, replace cap to outlet, and tighten all other closures.
- Gage the tank after delivery to ensure that the product amount delivered agrees with the manifest or bill of lading. Be certain that any discrepancies noted at the time of delivery are noted on the manifest or bill of lading and are initialed by the driver.
- Remove all portable signs and release the tank trailer.

Effectiveness and Cost: Observing major fueling operations is a moderately effective, low-cost BMP.

Limitations: None

BMP 060 - Provide Absorbent Booms in Unbermed Fueling Areas



Description of Potential Pollutant and Source: Spills during major fueling operations may expose potential pollutants to storm water. These materials can be transported to the storm drain system and/or receiving waters.

Description of BMP: Absorbent booms will be stored at fueling areas which are not bermed. The absorbent booms are portable and are used if a spill occurs during the fueling operations.

Application Guidance: Absorbent booms will be kept at all fueling areas.

Training: Personnel will be trained regarding the proper use and placement of the absorbent booms to contain spills. This information will be obtained from the manufacturer of the absorbent booms.

Effectiveness and Cost: This is a moderately effective BMP. The cost will vary based on the size of the fueling area.

Limitations: None

BMP 061 - Eliminate Topping Off Tanks



Description of Potential Pollutant and Source: Trying to completely fill tanks after the pumps automatically shut off, or "topping off," often results in fuel spills and exposure of significant materials to storm water.

Description of BMP: A policy will be developed to discourage "topping off" tanks. The policy will include incentives, posting signs stating the policy, or penalties.

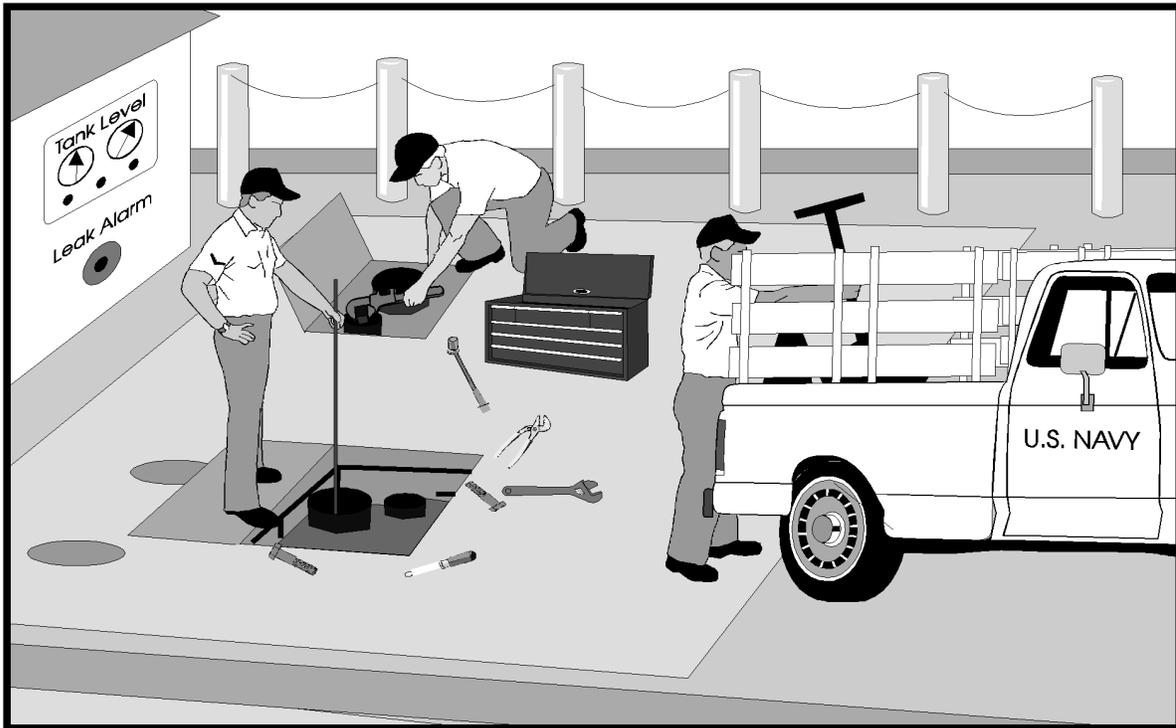
Application Guidance: This BMP will be applied to all fuel or liquid handling operations.

Training: New personnel will be informed of policy and signs should be posted as a reminder.

Effectiveness and Cost: Eliminating "topping off" is a highly effective, low-cost BMP.

Limitations: None

BMP 062 - Install Leak Detection System



Description of Potential Pollutant and Source: An underground storage tank may leak fuel which may subsequently become exposed to storm water. These materials can be transported to storm drains and/or receiving waters.

Description of BMP: A leak detection system will be installed on USTs. There are numerous methods of leak detection systems. The more effective and costly methods include tank automatic gaging, vapor monitoring, groundwater monitoring, and interstitial monitoring. A low-cost, but less effective leak detection method involves using inventory control to keep track of the amount of fuel dispensed into the tank versus the amount pumped out. (Note: This BMP is a requirement of 40 CFR 280.43.)

Application Guidance: Tanks will be monitored for leaks every 30 days.

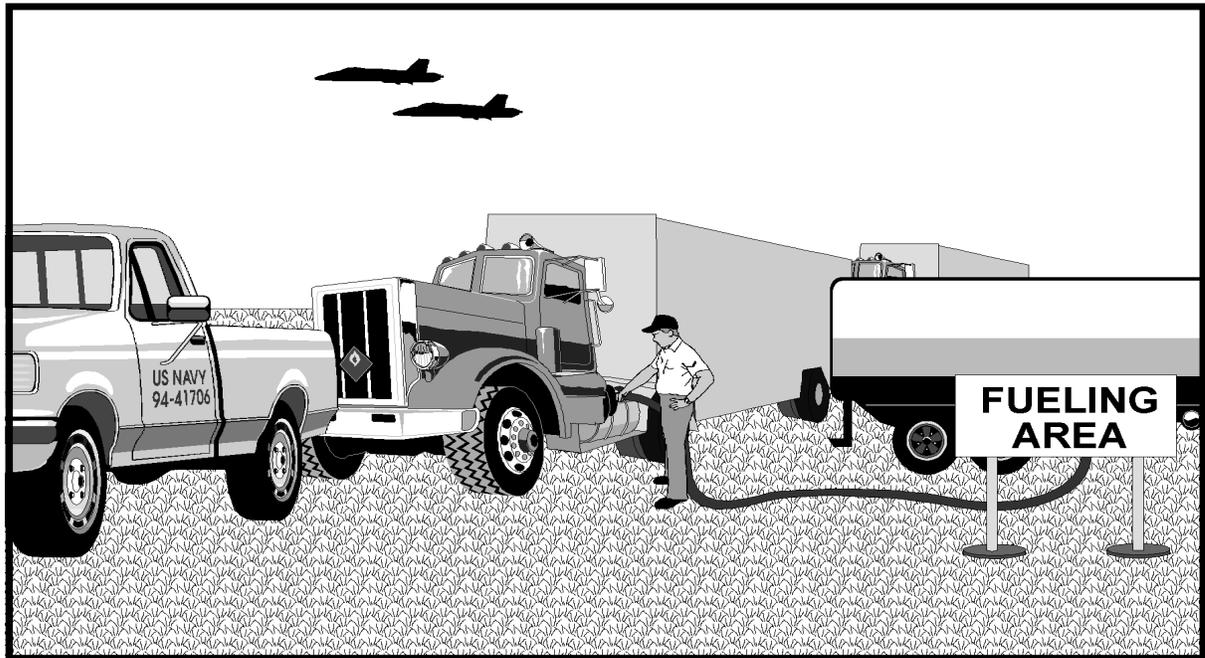
The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Designated personnel will be trained on the operation and maintenance of the leak detection system in use at their facilities.

Effectiveness and Cost: The effectiveness and cost of the leak detection system depends on the method used. Inventory control is a less effective, low-cost BMP. The other methods are highly effective and have higher costs.

Limitations: For previously installed tanks, inventory control may be the most economically feasible option.

BMP 063 - Designate Areas for Fueling from Mobile Fuel Tankers



Description of Potential Pollutant and Source: Overflows during fueling can expose significant materials to storm water. These materials can be transported to the storm drain and/or receiving waters.

Description of BMP: Minimize the use of mobile fuel tankers. Designating areas for fueling will reduce the chances of fuel spills reaching storm water. Most vehicles, with the exception of tracked vehicles such as tanks and bulldozers, should be able to travel to designated areas with minimal lost time.

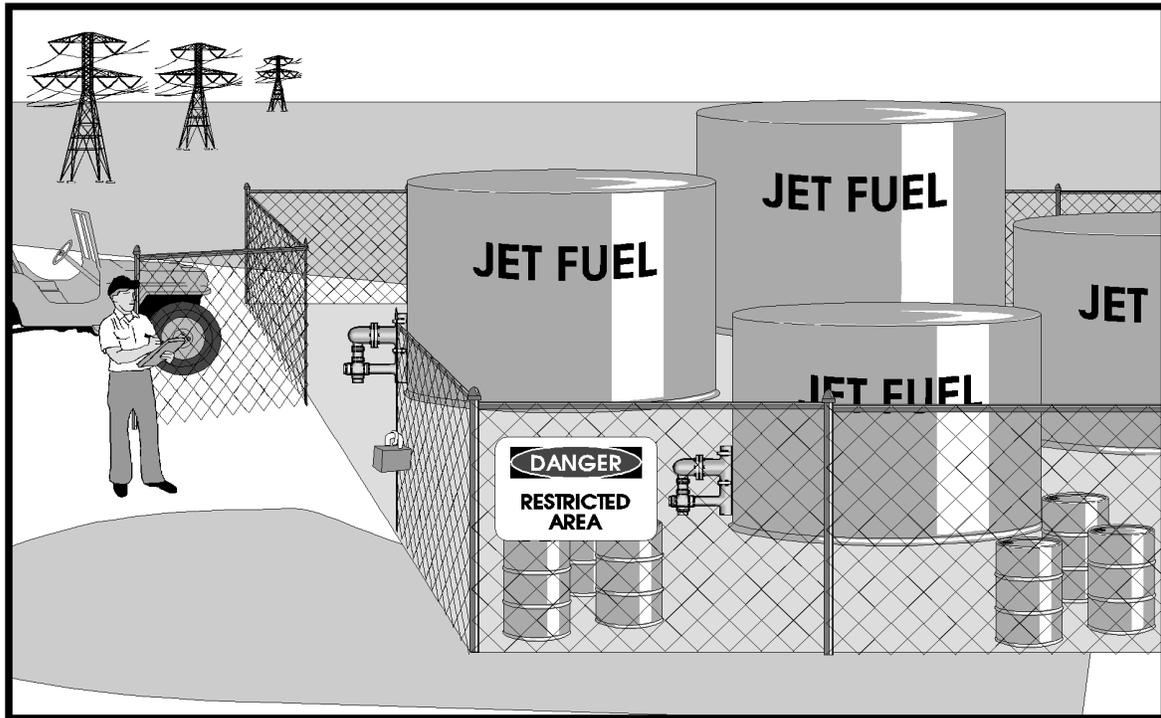
Application Guidance: Fueling areas will be designated whenever a large number of mobile equipment are being used.

Training: Personnel will be notified of the locations of designated fueling areas.

Effectiveness and Cost: Designated fueling areas are a highly effective, low-cost BMP.

Limitations: None

BMP 064 - Restrict Access to Tanks



Description of Potential Pollutant and Source: Improper use or vandalism of fuel tanks may result in discharge of fuel to the ground. This fuel may then be exposed to storm water and transported to the storm drain and/or receiving waters.

Description of BMP: Access to the tank and valves will be restricted to properly trained personnel. The area can be restricted by a locked gate. This BMP is recommended for fuel tank farms.

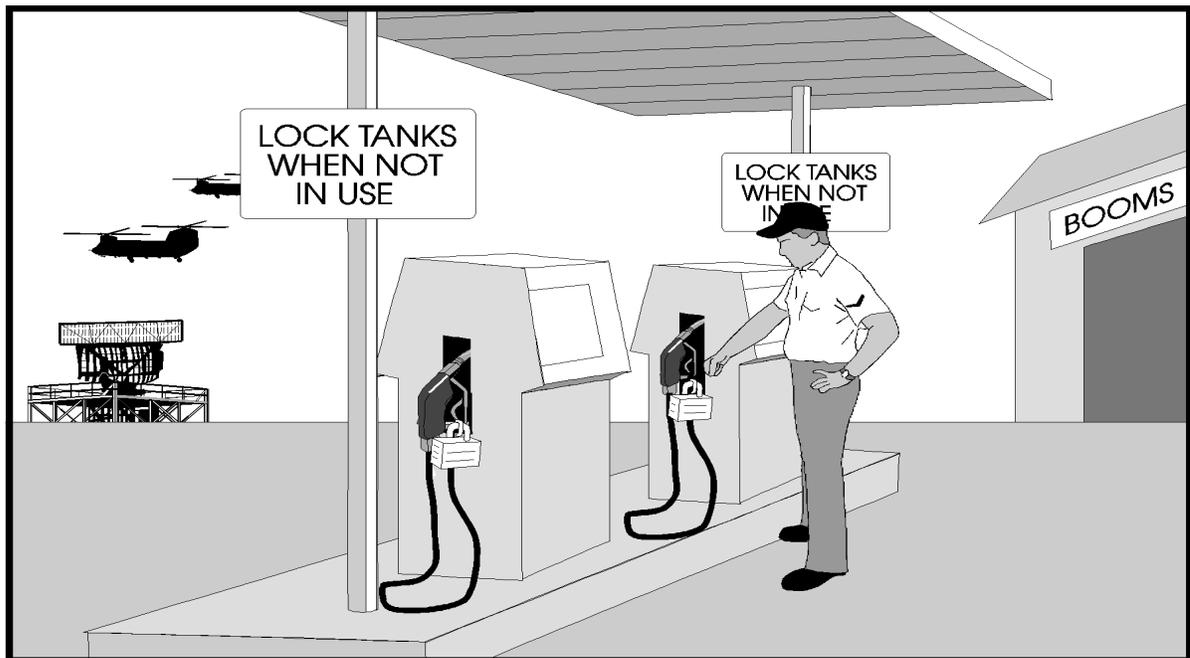
Application Guidance: Access to valves will be restricted at all times to properly trained personnel.

Training: Personnel who use fuel tanks will be trained in the proper operation of the system. Non-trained personnel who need fuel will be informed how to contact trained personnel for fuel dispensing.

Effectiveness and Cost: This is an effective, low-cost BMP.

Limitations: The placement of some tanks may make it difficult to restrict access them.

BMP 065 - Lock Fuel Tanks When Not in Use or on Standby



Description of Potential Pollutant and Source: Unauthorized use of fuel tanks increases the possibility of accidental fuel spills and exposure to storm water. Unauthorized use after normal hours of operation could potentially result in a large spill of fuel.

Description of BMP: Fuel tank valves and fill pipes will be locked when idle to ensure that accidental user error does not occur.

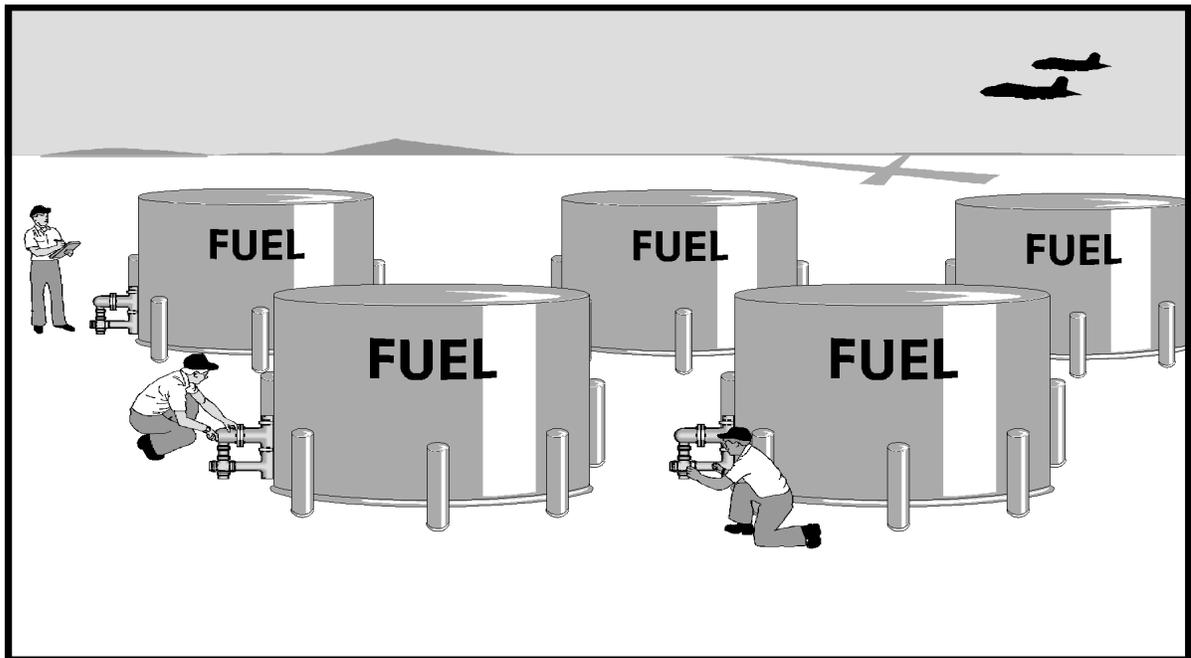
Application Guidance: Idle fuel tanks will be locked at all times.

Training: Personnel operating fuel tanks will be trained to know when tanks should be locked. Tanks which are frequently used will be locked at the end of the normal operating day.

Effectiveness and Cost: Locking tank valves is a highly effective, low-cost BMP.

Limitations: None

BMP 066 - Keep Tanks, Piping, and Valves in Good Condition



Description of Potential Pollutant and Source: Tanks, piping, and valves may leak fuel or other significant materials due to corrosion, loose fittings, poor welding, or improperly or poorly fitted gaskets. This can expose these materials to storm water, which can transport them to storm drains and/or receiving waters.

Description of BMP: Tanks, piping, and valves will be kept in good working condition. Tanks, piping, or valves which are leaking will be repaired or replaced.

Application Guidance: Tanks, piping, and valves will be inspected monthly and kept in good condition at all times. If applicable, preventive maintenance will be performed.

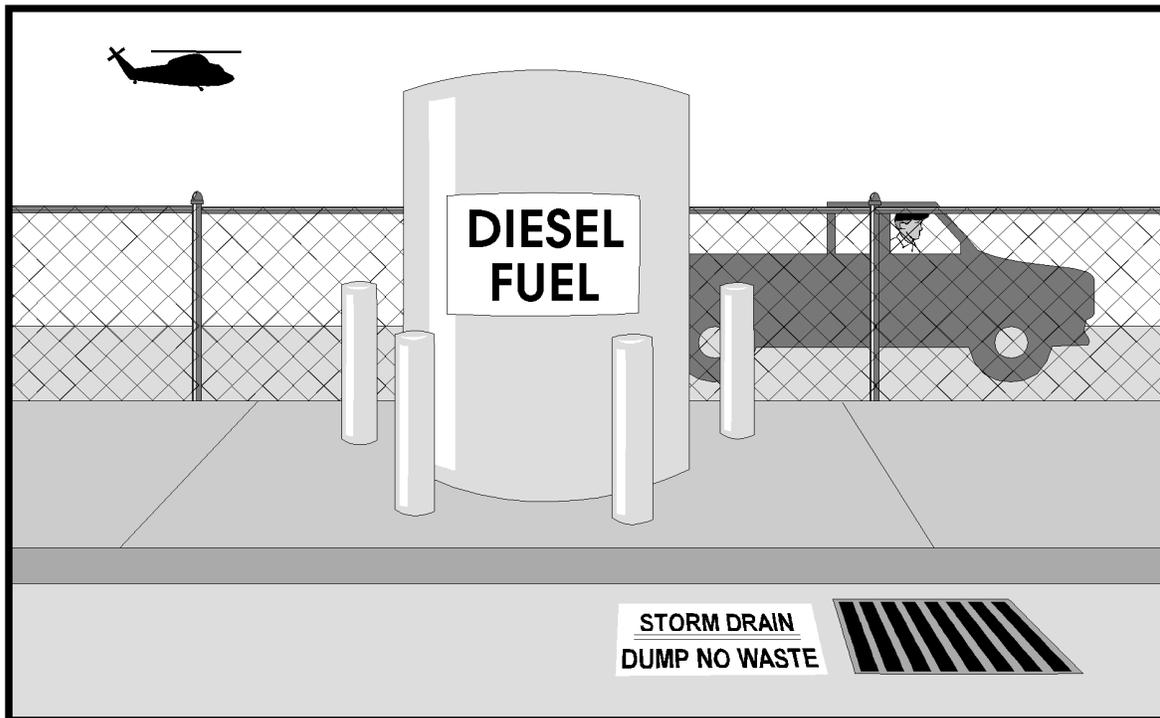
The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: Personnel will be trained to regularly inspect for leaks or conditions that could lead to the discharge of chemicals, or storm water contact with waste materials. Personnel will be trained to routinely inspect equipment before each use. Tanks, piping and valves which are not frequently used, will be inspected weekly. Procedures for notifying the appropriate maintenance personnel if a leak is found, will be established.

Effectiveness and Cost: Keeping tanks, piping, and valves in good condition is a highly effective BMP. The cost of repairing or replacing piping and valves is typically low. The cost of repairing or replacing tanks will vary based on the size of the tank and its present condition.

Limitations: None

BMP 067 - Protect Tanks from Being Damaged by Vehicles



Description of Potential Pollutant and Source: If a tank is damaged by a vehicle, fuel, or other significant materials may be leaked from the tank and become exposed to storm water. The materials can then be transported to the storm drain and/or receiving waters.

Description of BMP: Protect tanks from being damaged by vehicles. Bollards or traffic barriers may be used if the tank location is accessible to vehicles. Fences and curbs may also protect the tanks.

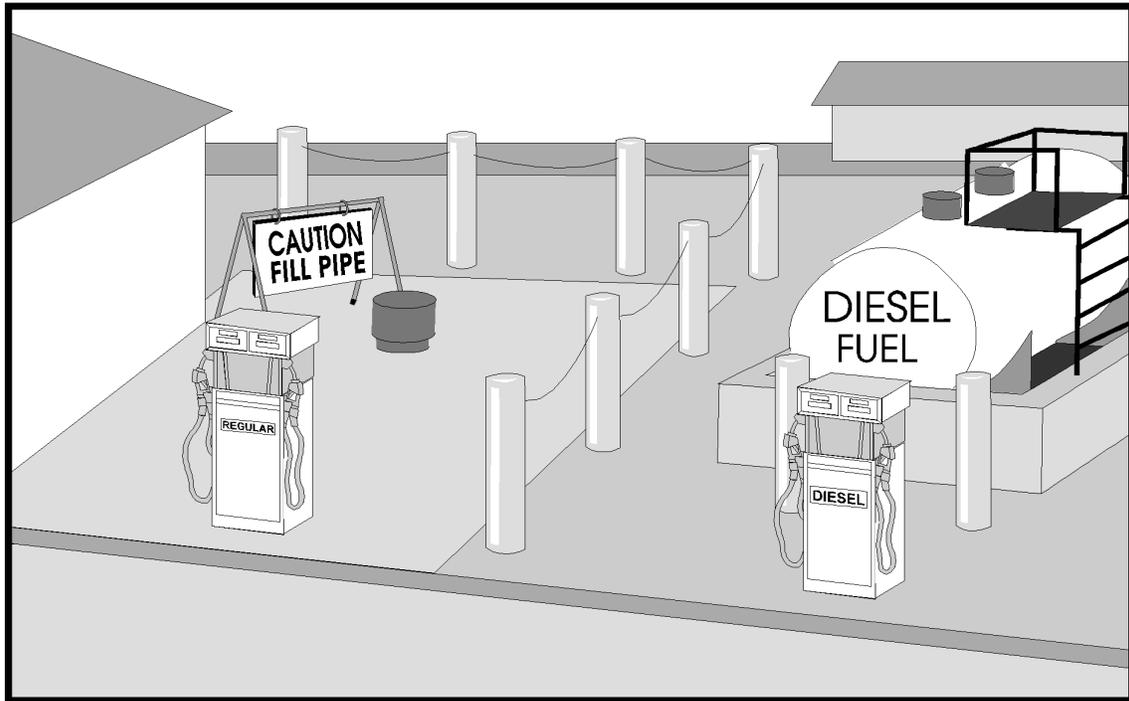
Application Guidance: Tanks will be guarded from being damaged by vehicles.

Training: N/A

Effectiveness and Cost: This is an effective, low-cost BMP.

Limitations: None

BMP 068 - Protect Fill Pipe from Being Damaged by Vehicles



Description of Potential Pollutant and Source: If a fill pipe is damaged by a vehicle, fuel may leak from the tank and become exposed to storm water. These materials or other significant materials can then be transported to the storm drain and/or receiving waters.

Description of BMP: Protect fill pipes from being damaged by vehicles. Bollards or traffic barriers will be used if the tank location is accessible to vehicles.

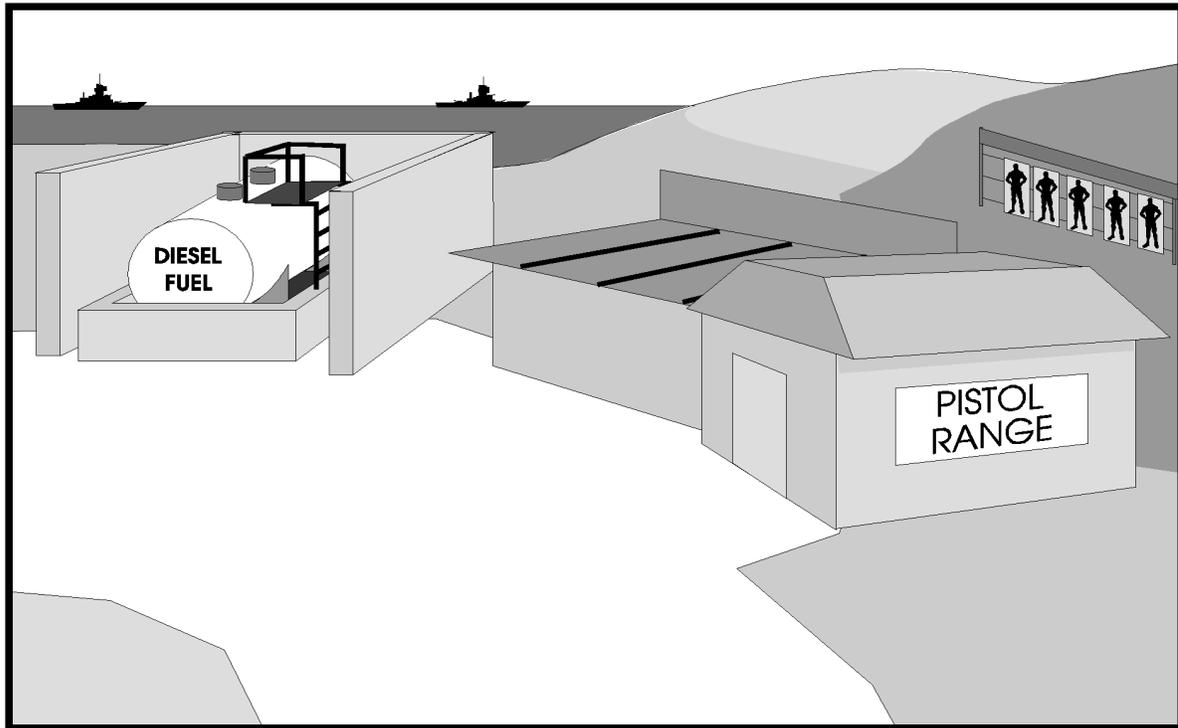
Application Guidance: Fill pipes will be guarded from damage by vehicles.

Training: N/A

Effectiveness and Cost: This is an effective, low-cost BMP.

Limitations: None

BMP 069 - Provide Protection for Permanent Aboveground Tanks from Discharge of Firearms



Description of Potential Pollutant and Source: Stray munitions may penetrate aboveground storage tanks, causing spills and leaks of fuel or other significant materials. These materials can be exposed to storm water and transported to the storm drain and/or receiving waters.

Description of BMP: When aboveground storage tanks are located in areas where firearms are discharged, concrete barriers will be used to protect the inner tank. The concrete will protect against damage from stray fire.

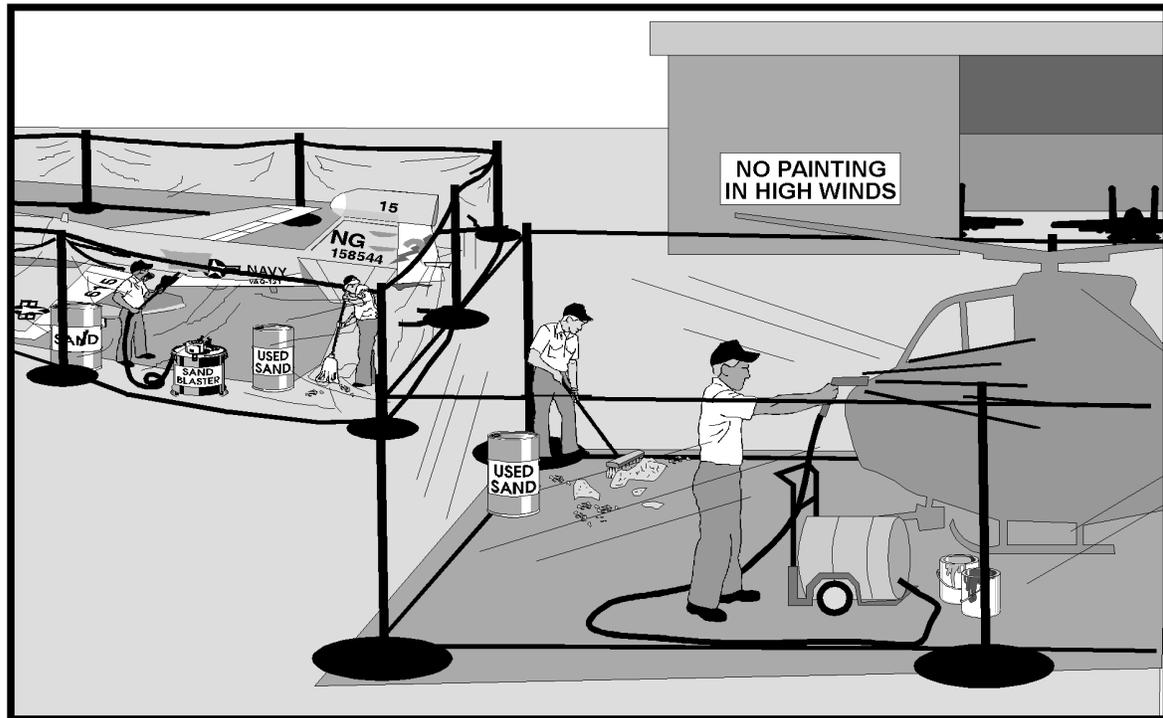
Application Guidance: This practice will be followed wherever there is any chance of firearms being discharged in the vicinity of aboveground storage tanks.

Training: N/A

Effectiveness and Cost: Concrete encapsulation is a highly effective, moderate-cost BMP.

Limitations: N/A

BMP 070 - Enclose Outdoor Sanding and Painting Operations and Use Tarps to Contain and Collect Solid Wastes



Description of Potential Pollutant and Source: Sanding, in preparation for painting, and painting itself creates wastes including glass, metal, stone and other wastes that may become exposed to storm water if not properly collected and disposed. These materials can then be transported to storm drains and/or receiving waters.

Description of BMP: Containment of paint-related wastes can be accomplished by covering all sanding and painting activities with tarps or plastic sheeting and by placing a tarp under and/or around all sanding and painting operations. These wastes will be collected in labeled drums and disposed of appropriately.

Application Guidance: This practice will be used in all sanding and painting operations performed outside of sanding or painting booths.

Training: Personnel will be instructed in procedures for the containment, collection and disposal for the control of particulates from sanding and painting; tarps will be monitored for holes. The waste will be recycled or disposed in a landfill if it is not a hazardous waste. Signs will be posted where sandblasting activities take place to remind personnel about proper disposal practices.

Effectiveness and Cost: Containment, collection and disposal of sandblasting wastes is a highly effective, usually moderate-cost BMP. However, costs for large-scale painting and sanding activities (e.g., ships and large equipment) could be high.

Limitations: The size of some operations may make implementation of this practice difficult. Some municipalities may also require that sandblasting wastes be disposed of as a hazardous material.

BMP 071 - Vacuum Particulate Wastes from Sanding or Painting Operations



Description of Potential Pollutant and Source: Sanding, in preparation for painting, and painting itself creates wastes that may become exposed to storm water and transported to storm drains and/or receiving waters.

Description of BMP: Containment of paint-related wastes can be accomplished by performing painting and sanding activities in facilities equipped with a vacuum and filters.

Application Guidance: This practice will be used in all sanding and painting operations.

Training: Personnel will be instructed in procedures for proper operation of vacuum and filters.

Effectiveness and Cost: Performing sanding and painting operations under vacuum is a highly effective, usually moderate-cost BMP. However, costs for large-scale sanding and painting activities (e.g., ships and large equipment) could be high.

Limitations: The size of some operations may make implementation of this practice difficult.

BMP 072 - Conduct Indoor Sanding and Painting in an Enclosed Area



Description of Potential Pollutant and Source: Paint, sand, glass, metal, or stone particles from painting, sanding, and sandblasting operations can become exposed to storm water if not properly contained. These materials may then be transported to storm drains and/or receiving waters.

Description of BMP: Conduct painting, sanding, and sandblasting in an enclosed area to prevent contaminated particles from being exposed to storm water. Wastes from these operations will be disposed of appropriately.

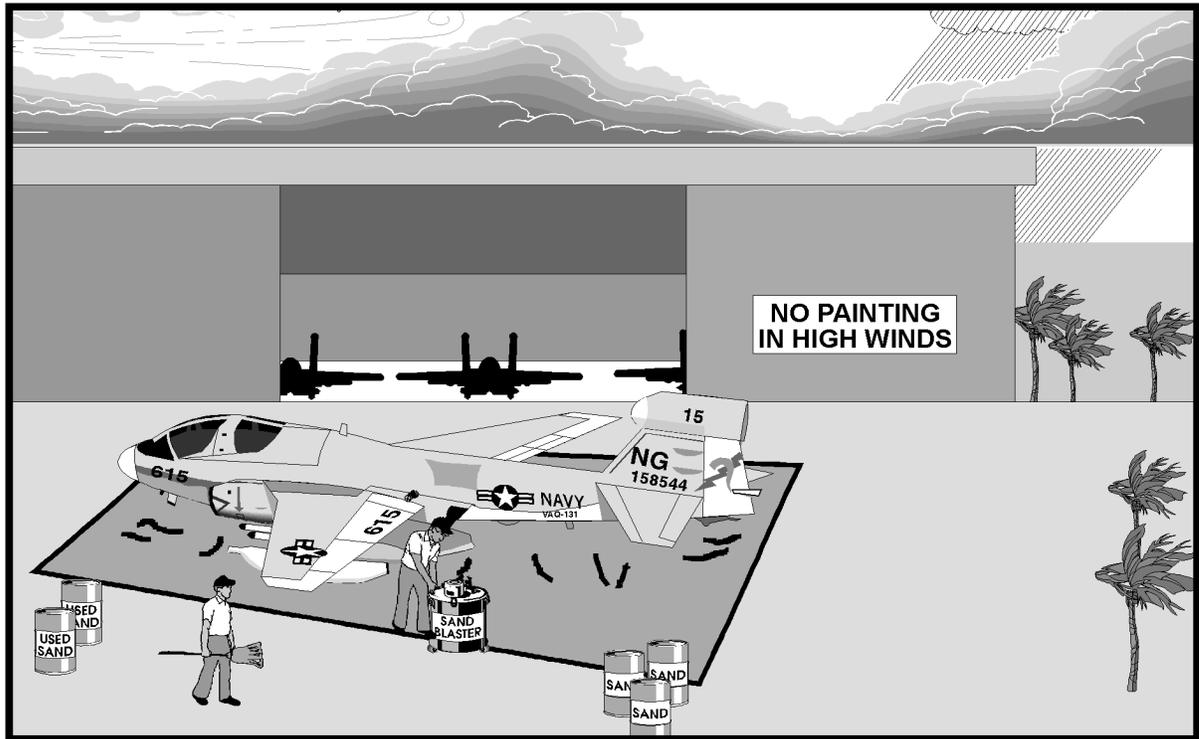
Application Guidance: If possible, all painting, sanding, and sandblasting activities will be performed indoors and preferably in an enclosed covered area.

Training: Signs will also be posted to remind personnel about proper locations.

Effectiveness and Cost: Conducting painting, sanding, and sandblasting in an enclosed area is an effective, variable-cost BMP.

Limitations: The size of some activities may make implementation of this BMP difficult.

BMP 073 - Avoid Sanding or Painting in Windy Weather



Description of Potential Pollutant and Source: Sanding or painting in windy weather will cause dispersal of particulates which can expose them to storm water. These materials can then be transported to storm drains and/or receiving waters.

Description of BMP: If sanding or painting cannot be performed in an enclosed, covered area, avoid performing either operation in windy weather.

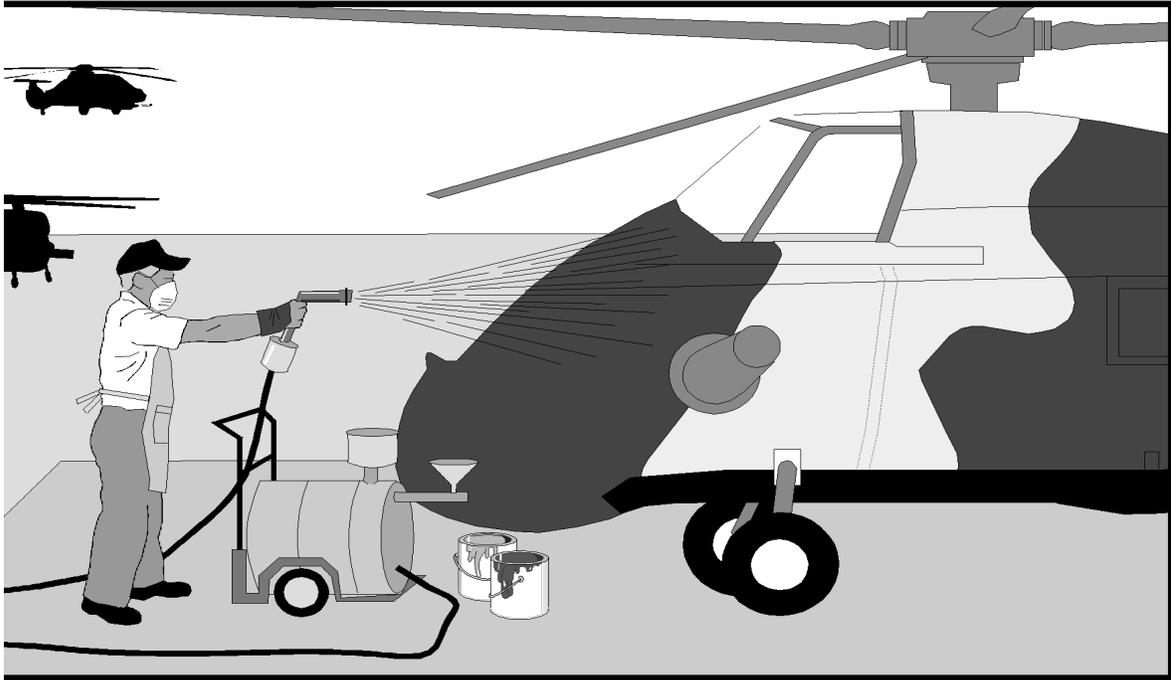
Application Guidance: This practice will be followed at all times.

Training: Personnel will be given instruction as to when it is too windy to perform sanding or painting. This information may be obtained from the equipment manufacturer.

Effectiveness and Cost: Avoiding windy weather is a moderately effective, low-cost BMP.

Limitations: May cause inconvenience.

BMP 074 - Use Efficient Painting Equipment



Description of Potential Pollutant and Source: Traditional painting methods often result in loss of particulate matter to air and ground (paint chips, paint spray) and exposure to storm water. These materials can then be transported to storm drains and/or receiving waters.

Description of BMP: Highly efficient painting equipment is now available that reduces overspraying. This reduces the amount of solid pollutants that can reach storm water. More efficient equipment includes electrostatic spray guns, air-atomized spray guns, high volume/low pressure spray guns and gravity feed spray guns.

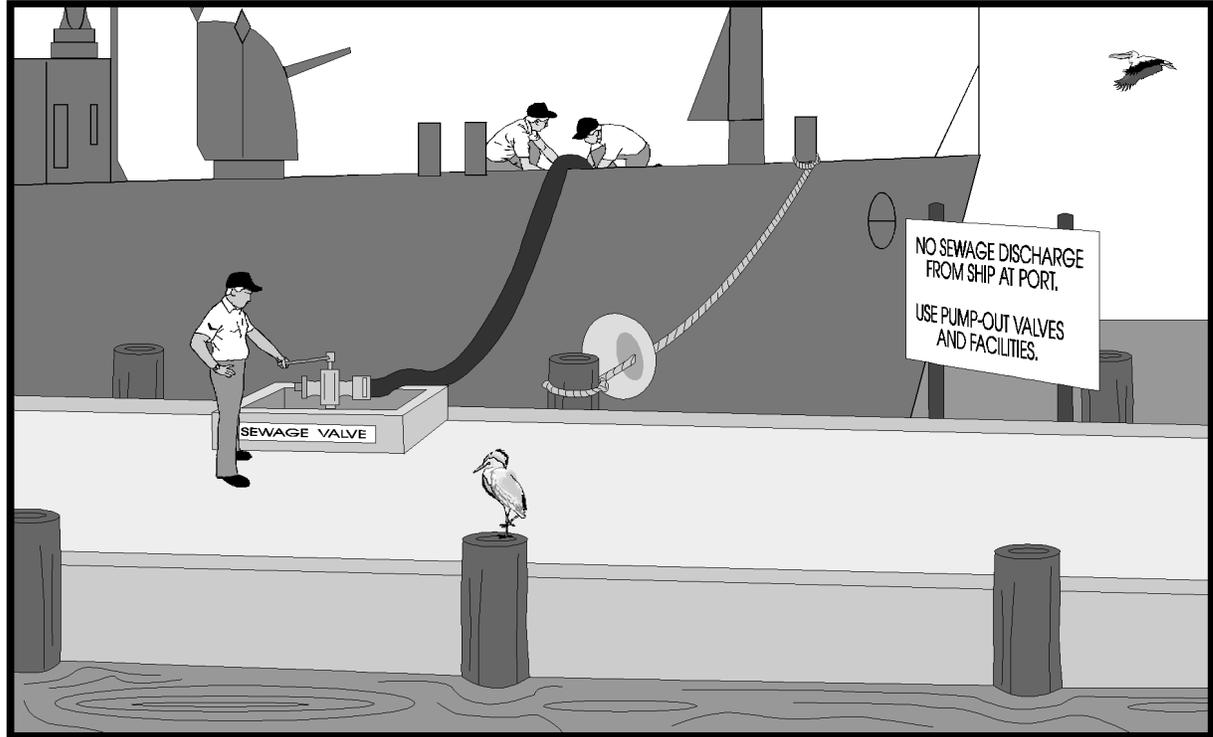
Application Guidance: All spray painting equipment will be replaced with more efficient equipment when economically feasible.

Training: Personnel will be trained on new equipment. A qualification test may be appropriate.

Effectiveness and Cost: New spray equipment is a moderately effective, variable-cost BMP.

Limitations: Cost may be high to retrofit/replace existing equipment.

BMP 075 - Do Not Empty Toilet Tanks During Transit or in the Port



Description of Potential Pollutant and Source: Toilet holding tanks in trains, aircraft, boats, and ships are often emptied directly to the environment during transport or at the port, resulting in potential viral and bacterial contamination of storm water.

Description of BMP: Toilet holding tanks should never be emptied during transit or into storm drains at the port. Sanitary sewage from ships or boats can be disposed using pump-out stations, portable on-site pump-outs, or commercial mobile pump-out facilities.

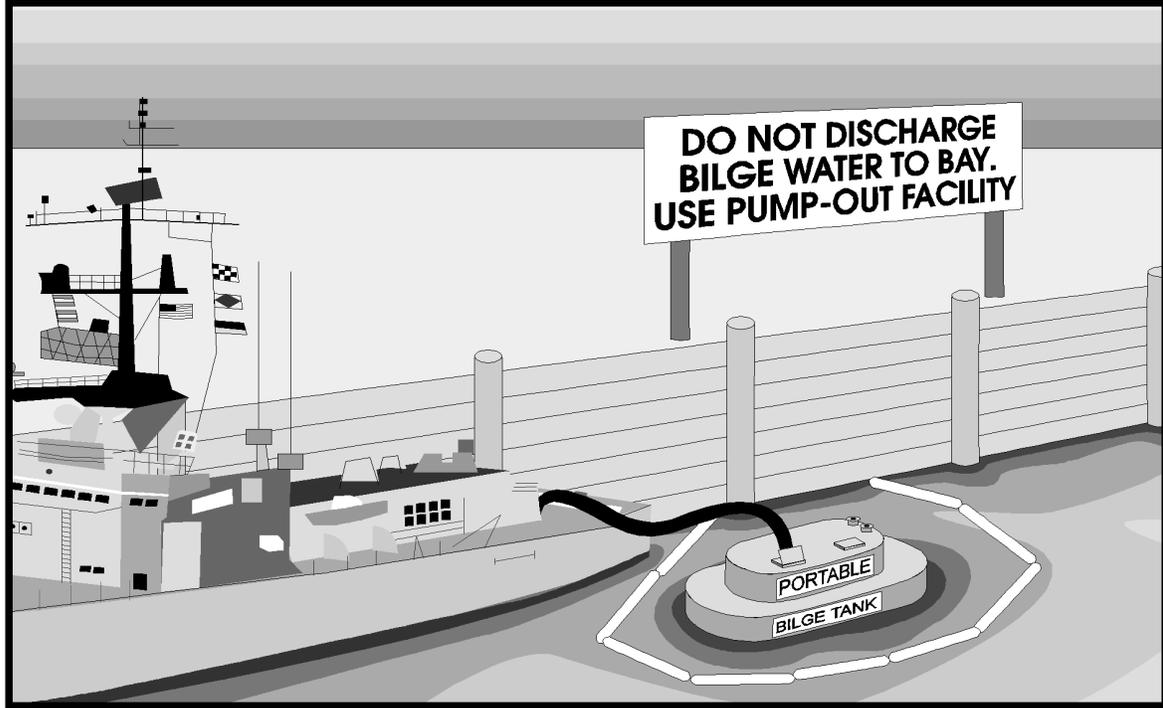
Application Guidance: This practice will be implemented for all aircraft, rail cars, boats, and ships.

Training: Signs will be posted as reminders.

Effectiveness and Cost: This is a highly effective, low-cost BMP.

Limitations: None

BMP 076 - Do Not Discharge Bilge Water in Harbor



Description of Potential Pollutant and Source: Bilge water (sump water collected in the ship bottom) can contain a variety of pollutants, especially oil and grease. Water from throughout the ship, including the engine room, collects in the bilge.

Description of BMP: Eliminating the discharge of bilge water reduces the chances of oil and fuel reaching storm water. This wastewater will be pumped to wastewater treatment facilities whenever this service is available.

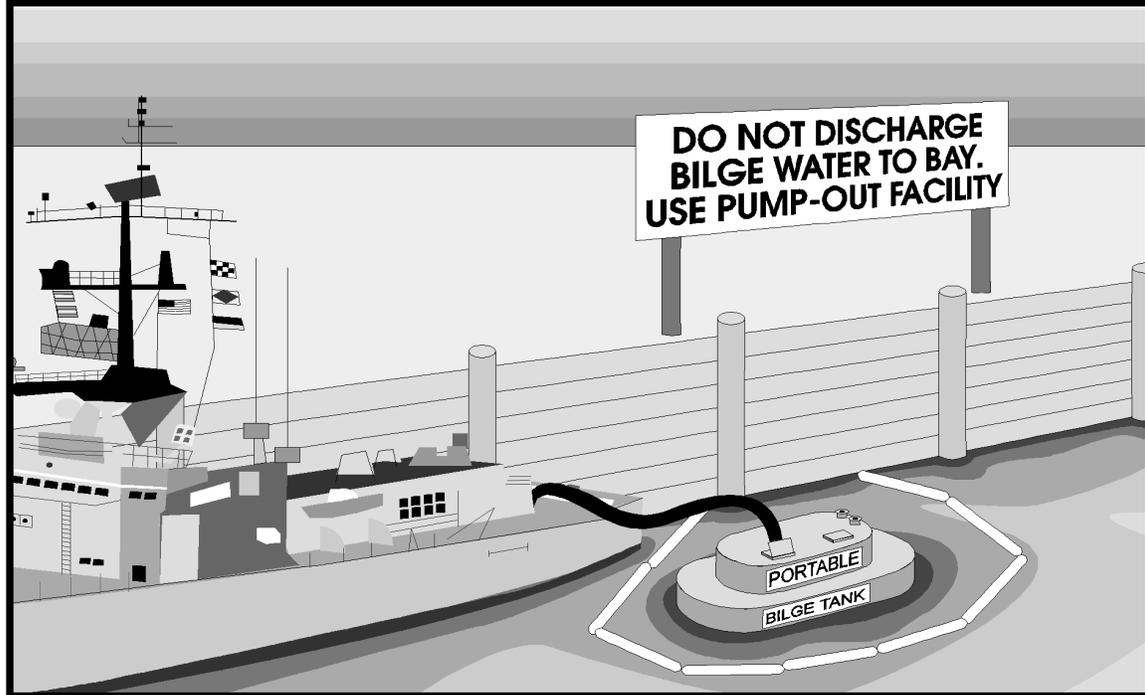
Application Guidance: This practice will be followed for all watercraft.

Training: Signs will be posted as reminders.

Effectiveness and Cost: This is a highly effective, variable-cost BMP.

Limitations: Sometimes discharge of bilge water in the harbor may be necessary for proper use of the ship.

BMP 077 - Do Not Discharge Bilge Water in Harbor



Description of Potential Pollutant and Source: Bilge water (sump water collected in the ship bottom) can contain a variety of pollutants, especially oil and grease. Water from throughout the ship, including the engine room, collects in the bilge.

Description of BMP: Eliminating the discharge of bilge water reduces the chances of oil and fuel reaching storm water. This wastewater will be pumped to wastewater treatment facilities whenever this service is available.

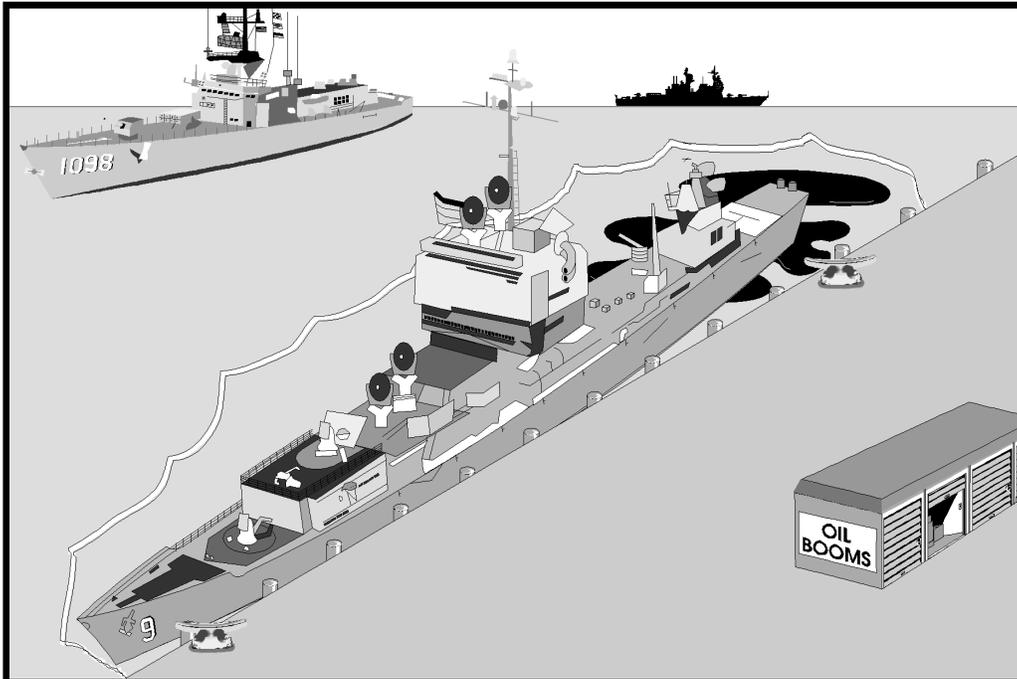
Application Guidance: This practice will be followed for all watercraft.

Training: Signs will be posted as reminders.

Effectiveness and Cost: This is a highly effective, variable-cost BMP.

Limitations: Sometimes discharge of bilge water in the harbor may be necessary for proper use of the ship.

BMP 078 - Use Oil Containment Booms



Description of Potential Pollutant and Source: Maintenance of ships occurs in wet dock; maintenance may include painting, refueling, and scrubbing, all of which generate potential pollutants which may become exposed to storm water and transported to receiving waters.

Description of BMP: Oil containment booms are designed to contain hydrocarbons that may be exposed to storm water during a ship's stay at a shipyard. Booms enable efficient cleanup of hydrocarbons. An oil containment boom is a barrier composed of a chain of floatable logs, which repel water and absorb oil and fuel.

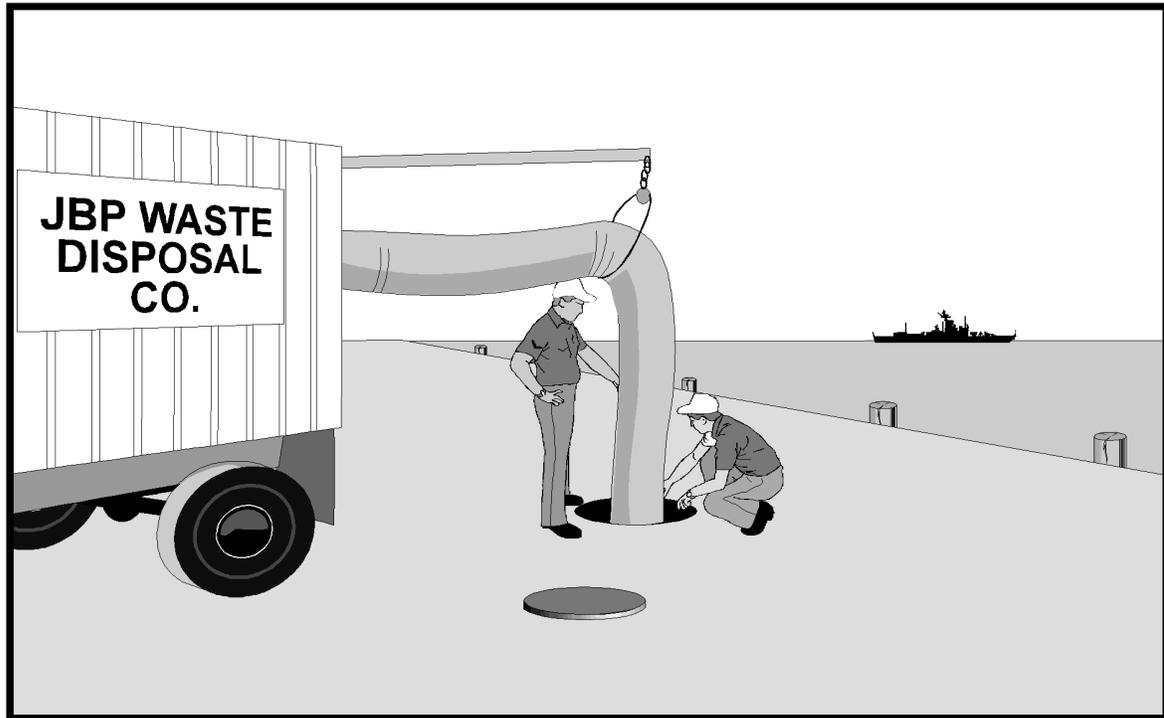
Application Guidance: Oil containment booms will be placed around ships under repair, prior to storms, while they are berthed at the shipyard.

Training: Personnel who deploy the booms will be properly trained in the use of oil containment booms.

Effectiveness and Cost: Oil containment booms are a moderately effective, moderate-cost BMP.

Limitations: None

BMP 079 - Properly Dispose of Sediment Generated by Cleaning Sanitary Sewer Lines



Description of Potential Pollutant and Source: The cleaning of sewer lines and manholes generates sediments. These sediments contain both inorganic and organic materials, are odorous, and are contaminated with microorganisms and heavy metals which, if improperly managed, can become exposed to storm water. These materials can then be transported to storm drains and/or receiving waters.

Description of BMP: Sediments generated during the cleaning of sewer lines and manholes will be disposed properly. This will often require disposal in permitted landfills.

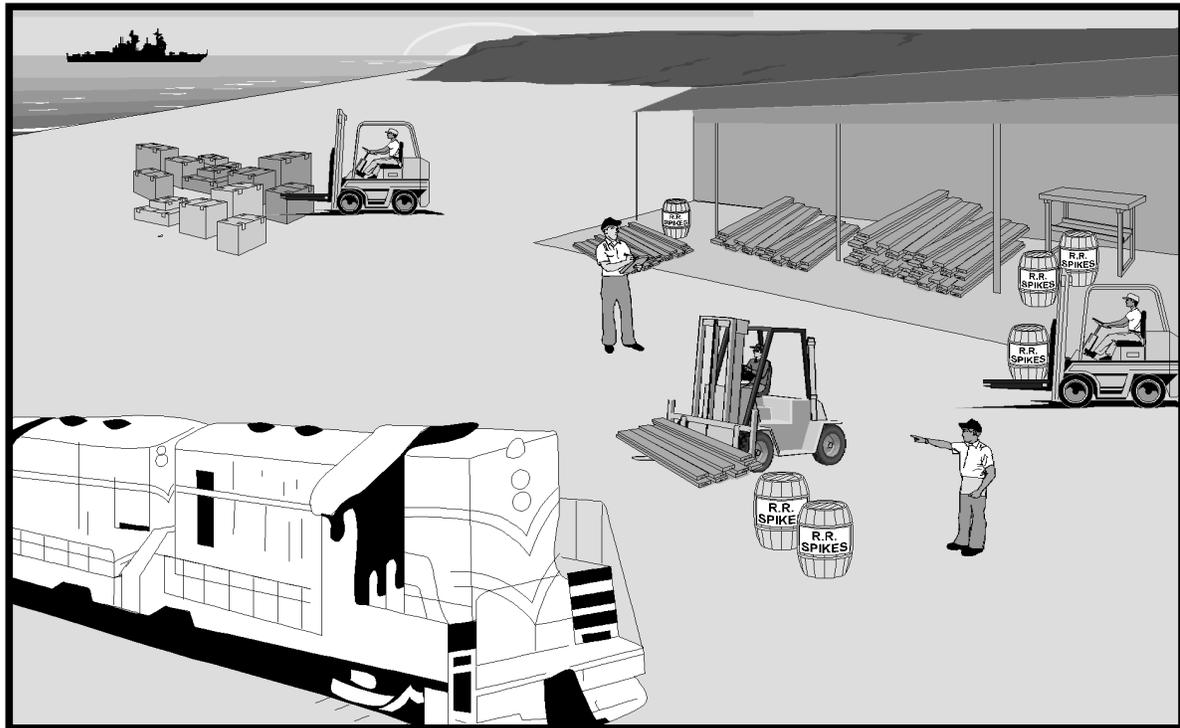
Application Guidance: This BMP will be used whenever cleaning the sewer line.

Training: Personnel will be trained regarding the proper disposal of the sediments.

Effectiveness and Cost: Properly disposing of sediments is a moderately effective, low-cost BMP.

Limitations: None

BMP 080 - Eliminate Treated Wood Products or Use Wood Treated with Less-Toxic Chemicals



Description of Potential Pollutant and Source: Wood products intended for outdoor use are generally coated with toxic chemicals such as creosote or pentachlorophenol, which can leach out of the wood and become exposed to storm water. These materials can then be transported to storm drains and/or receiving waters.

Description of BMP: Consideration will be given to substituting alternate materials for wood products that are preserved with creosote or pentachlorophenol.

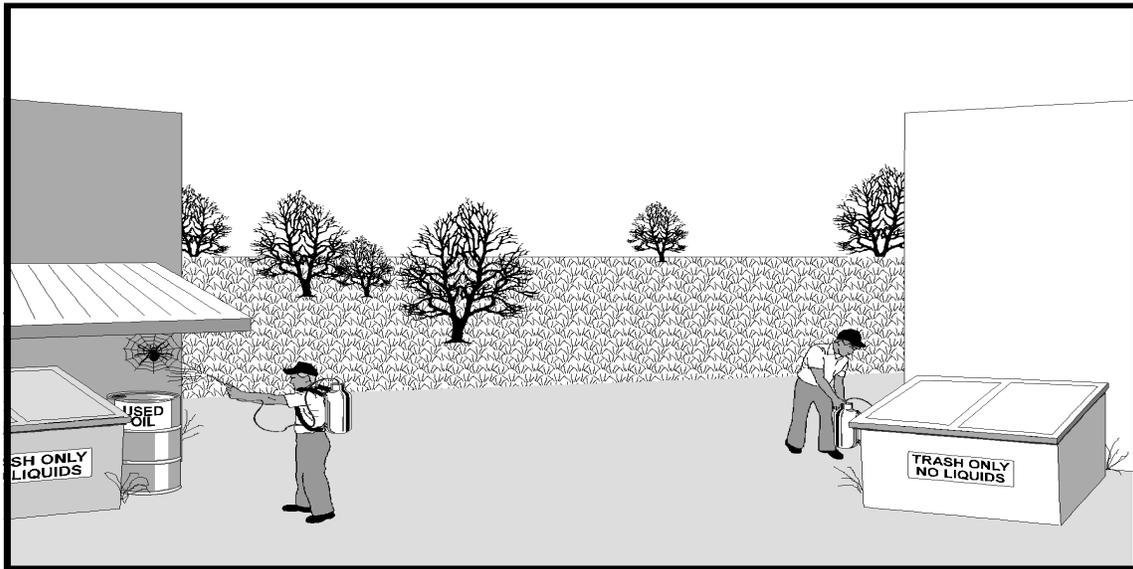
Application Guidance: This practice will be used when installing or replacing piers, railroad ties or utility poles, and other facilities using treated wood products.

Training: N/A

Effectiveness and Cost: This is a moderately effective, variable-cost BMP.

Limitations: Cost may be prohibitive and acceptable alternatives may not be available.

BMP 081 - Establish Integrated Pest Control



Description of Potential Pollutant and Source: Pesticides and herbicides may be spilled, over-applied, and/or incorrectly applied, resulting in exposure of storm water. These materials can then be transported to the storm drain and/or receiving waters.

Description of BMP: Integrated pest management control involves eliminating excessive pesticide use by proper application procedures and/or the use of alternatives. This reduces the amount of pesticides which can potentially enter the storm water. Pesticides include insecticides, herbicide, fungicides, and rodenticides.

The use of pesticides for insect and weed control will be minimized by the following:

- Mechanical removal of weeds, eggs, larvae, cocoons, and insects
- Habitat changes to minimize pest insect breeding
- Timing of application to the most vulnerable phase of the pest insect breeding
- Concentration of effort on the most affected areas
- Use of natural predators and pathogens specific to pests
- Use of degradable and non-carcinogenic pesticides

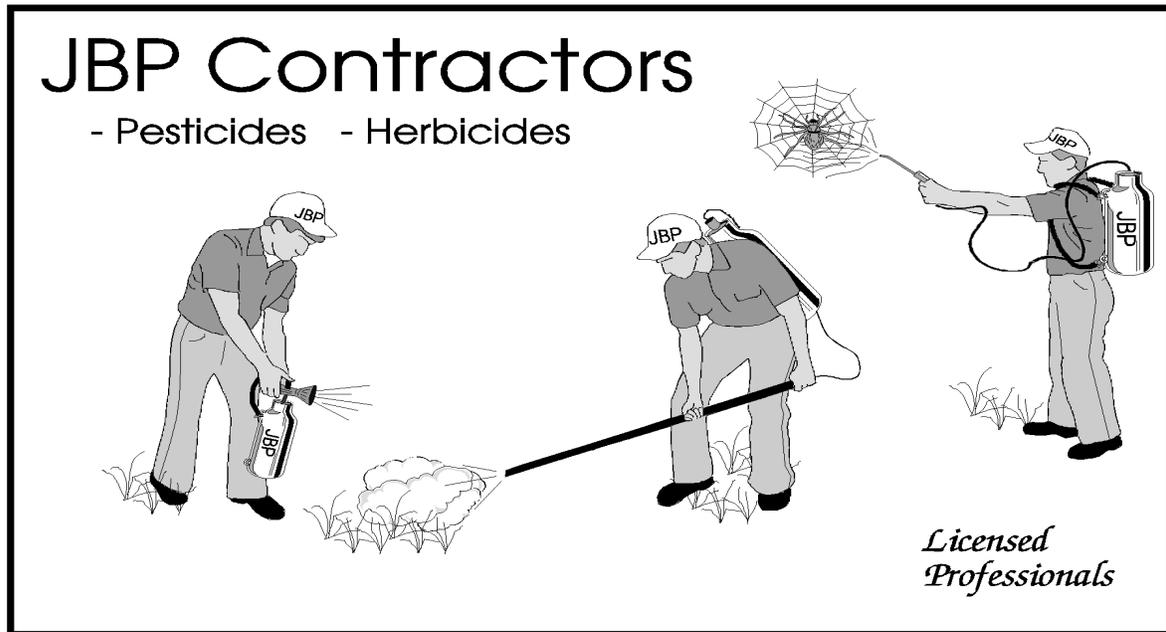
Additionally, no pesticides will be applied within 3 days prior to any predicted rain event. During the wet season, pesticide application will be kept to a minimum.

Application Guidance: Injury and tolerance levels will be used to determine if the pest problem is serious enough to justify some kind of treatment. Whenever pest control is necessary, an integrated management plan will be developed.

Training: All persons applying pesticides will be required to understand the pertinent provisions of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and state laws and regulations and be certified, if required.

Effectiveness and Cost: Effectiveness and cost will depend on whether natural or pesticide controls are used. This BMP can be highly effective and low cost when properly developed.

Limitations: None



Description of Potential Pollutant and Source: Pesticides and herbicides may be spilled, over applied, or incorrectly applied, which would result in their exposure to storm water. These materials can then be transported to the storm drain and/or receiving waters.

Description of BMP: A licensed pesticide handler will be used to conduct or supervise all activities related to pesticide handling.

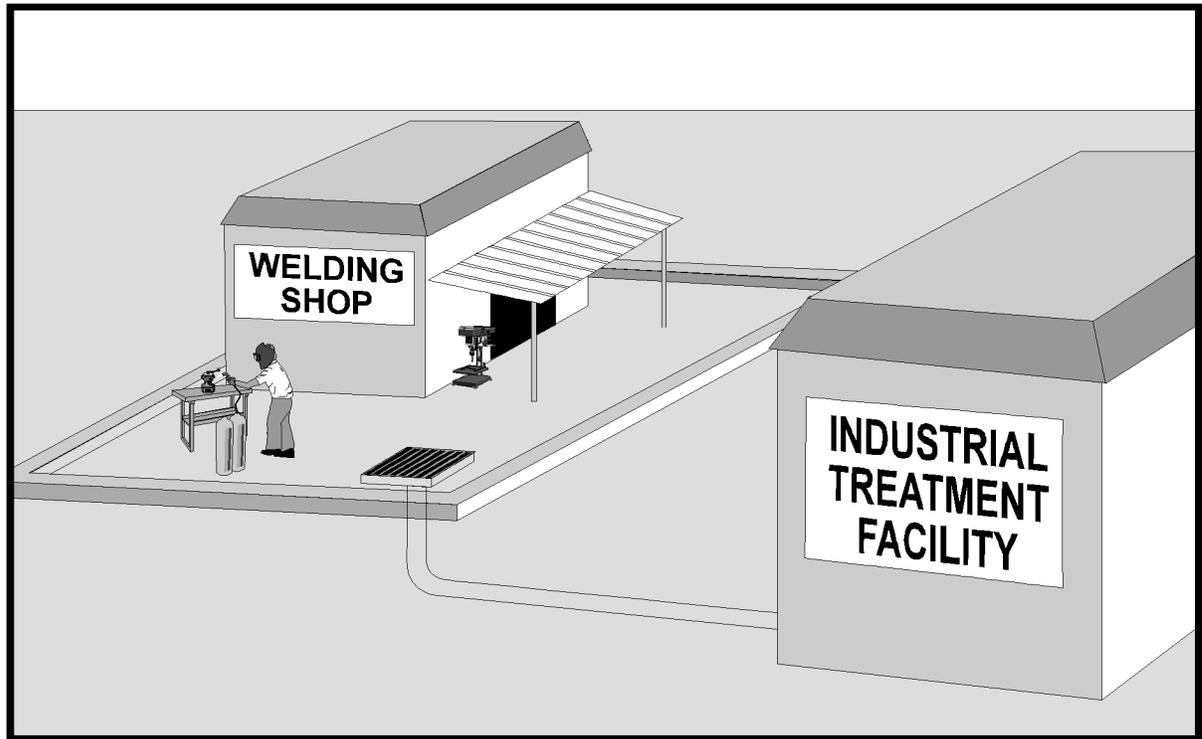
Application Guidance: This BMP will be applied whenever pesticides are used or stored.

Training: Personnel will be trained and certified in the application, mixing, and storage of pesticides.

Effectiveness and Cost: This is a moderately effective, moderate-cost BMP.

Limitations: None

BMP 083 - Divert Drainage to Treatment Facility/Sanitary Sewer



Description of Potential Pollutant and Source: Diverting drainage to treatment facilities prevents significant materials from entering the storm drain system.

Description of BMP: Using pipes, ditches, swales, and other types of conveyance systems, drainage from industrial areas which may be exposed to significant materials can be diverted to a wastewater treatment facility or sanitary sewer.

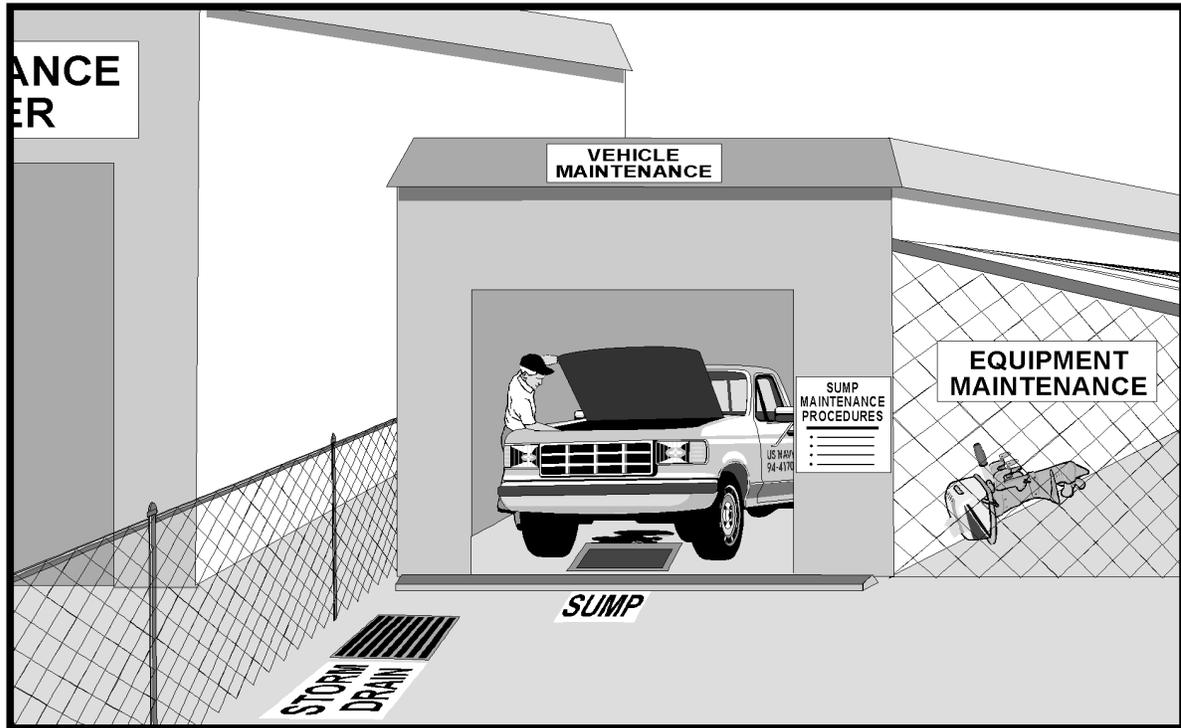
Application Guidance: If source controls cannot be used to keep pollutants from entering the storm water runoff, diverting drainage to treatment facilities/sanitary sewers is the most effective method of reducing pollutants to receiving waters.

It is not practical or allowed by most municipalities to discharge large quantities of storm water to treatment facilities. This BMP will only be used for small quantities of highly polluted water. This may include equipment or vehicle wash water, boiler blowdown, or runoff from maintenance areas (with no off-site drainage onto area).

Effectiveness and Cost: Diverting drainage from industrial areas is a highly effective, high-cost BMP. The initial construction cost of a connection to a sanitary sewer may not be high, if a sewer is located nearby. However, the continuing operating cost of the treatment facility which will treat the diverted drainage makes this a high-cost BMP.

Limitations: Permission must be granted by the wastewater treatment facility to divert the drainage to the facility. In addition, certain pollutants in the runoff may not be removed at a traditional treatment facility. This BMP is not feasible if there is a large quantity of runoff that must be controlled.

BMP 084 - Divert Drainage to a Low-Flow Sump



Description of Potential Pollutants and Source: Often spills flow directly into the storm drain system. Once the spilled material combines with the runoff in the storm drain, the pollutant concentrations can only be reduced with a structural control such as an oil/water separator, wet pond, or filtration basin.

Description of BMP: A low-flow sump collects small spills so that the spilled material is not discharged into the rest of the storm drain system.

Application Guidance: Low-flow sumps will be used in areas where discharge into the storm drain system and spills are likely to occur. This may occur at refueling locations, material loading/unloading areas, and maintenance areas.

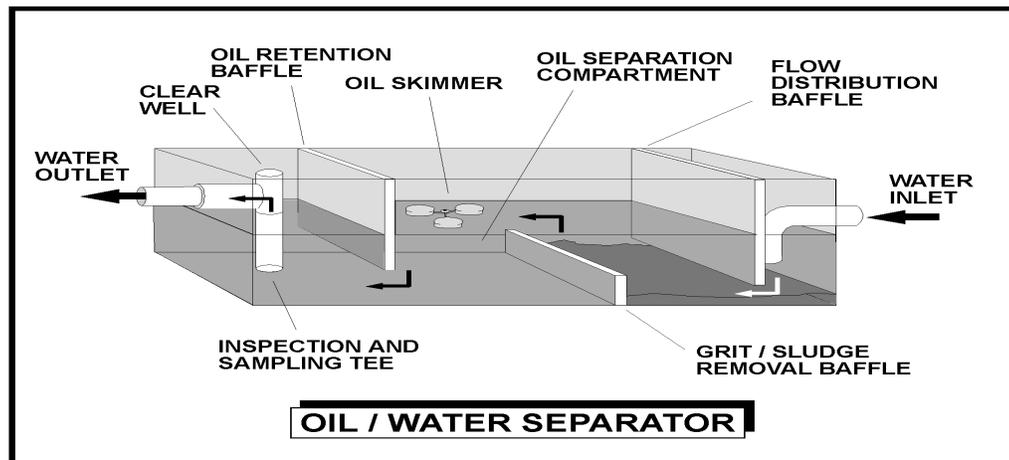
Operation and Maintenance: Low-flow sumps will be cleaned at least four times a year and after any major spill. Materials trapped in the sump will be properly disposed.

The frequency of implementation of this BMP has been suggested as general guidance. However, a facility operator may wish to establish a frequency more suitable to the facility. This will require a level of judgment on behalf of the SWPPP implementers.

Effectiveness and Cost: This BMP is highly effective for small leaks and spills. It is not effective for large spills or leaks. This is a moderate-cost BMP.

Limitations: The sediment removed during maintenance must be tested and may be a hazardous waste and must be disposed of properly.

BMP 085 - Construct Oil/Water Separator



Description of Potential Pollutants and Source: Oil/water separators are designed to remove petroleum compounds and grease from storm water. They will also remove floatable debris and settleable solids.

Description of BMP: Oil/water separators are underground vaults where storm water is piped in and out of the separator. Oil/water separators come in many configurations. A common configuration is the three-chamber oil/water separator. The first chamber is the sedimentation chamber that allows for sedimentation of coarse materials and screening of debris. The second chamber provides separation of oil, grease, and gasoline. The third chamber is provided to prevent any possibility of a surcharge pressure from occurring and as a safety relief for the structure if a blockage occurs.

Application Guidance: Oil/water separators are applicable to situations where the concentrations of oil-and-grease-related compounds will be usually high, and source control cannot provide effective control. This generally occurs at equipment maintenance and washing facilities, gas stations, and loading areas. Separators may also be used in areas heavily used by mobile equipment, such as loading wharfs at marine ports.

Operation and Maintenance: The degree and frequency of maintenance significantly affects the performance of the oil/water separator. Cleaning the oil/water separator will prevent the accumulated debris and oil to be discharged from the structure during intense storms.

Oil/water separators will be checked monthly during the wet season and will be cleaned at least four times a year. They will always be cleaned in October, before the start of the wet season. The accumulated oil will be properly disposed.

The frequency for implementing of this BMP has been provided as general guidance. A facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations.

Effectiveness and Cost: This is a moderately effective, high-cost BMP.

Limitations: Oil/water separators are less effective when storm water runoff has high sediment concentrations or detergent levels which disperse oil.

Oil/water separators are only effective for highly pervious drainage areas. Oil/water separators cannot effectively treat large volumes of runoff. The max drainage area to oil/water separators is typically 1 acre.

The sediment removed during maintenance will be tested. If it is a hazardous waste, it will be disposed of accordingly.

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BMP 087 - Deleted

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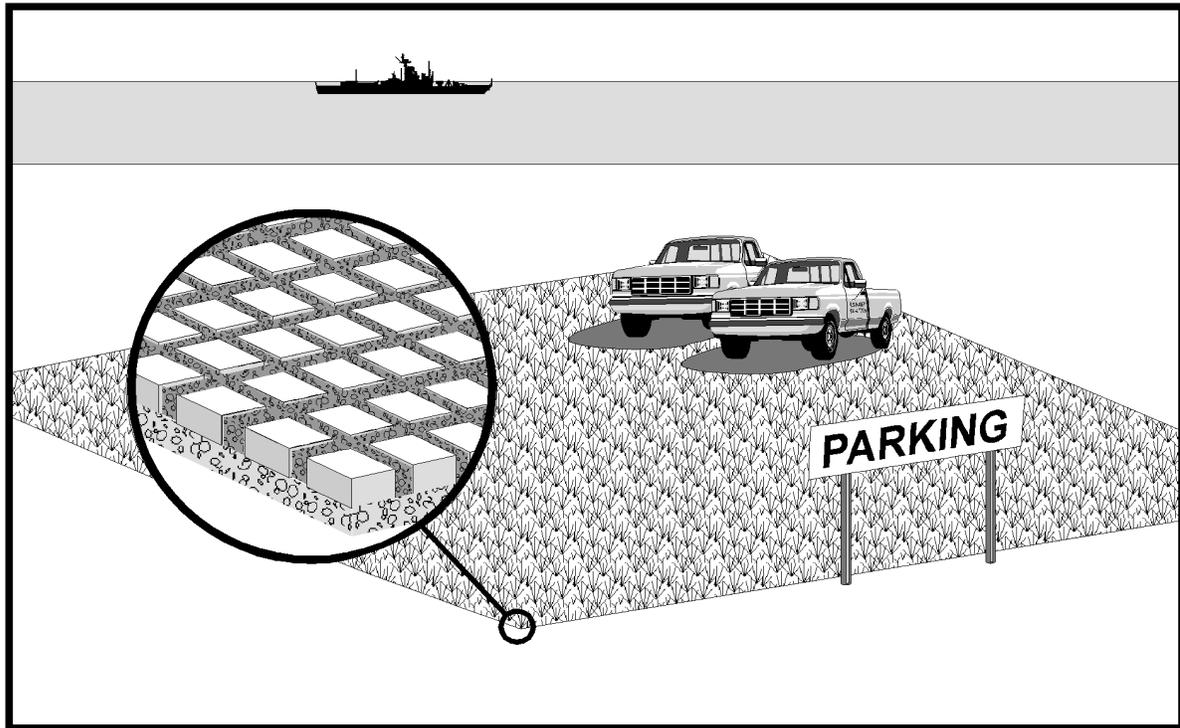
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BMP 096 - Construct Concrete Grid Pavement



Description of Potential Pollutant and Source: Concrete grid pavement can be used to treat rainfall runoff from parking areas with low-volume traffic.

Description of BMP: Concrete grid pavement consists of concrete blocks with regularly interspersed void areas which are filled with pervious materials such as gravel, sand, or grass. The blocks are typically placed on a sand and gravel base and designed to provide a load-bearing surface that is adequate to support vehicles, while allowing infiltration of surface water into the underlying soil.

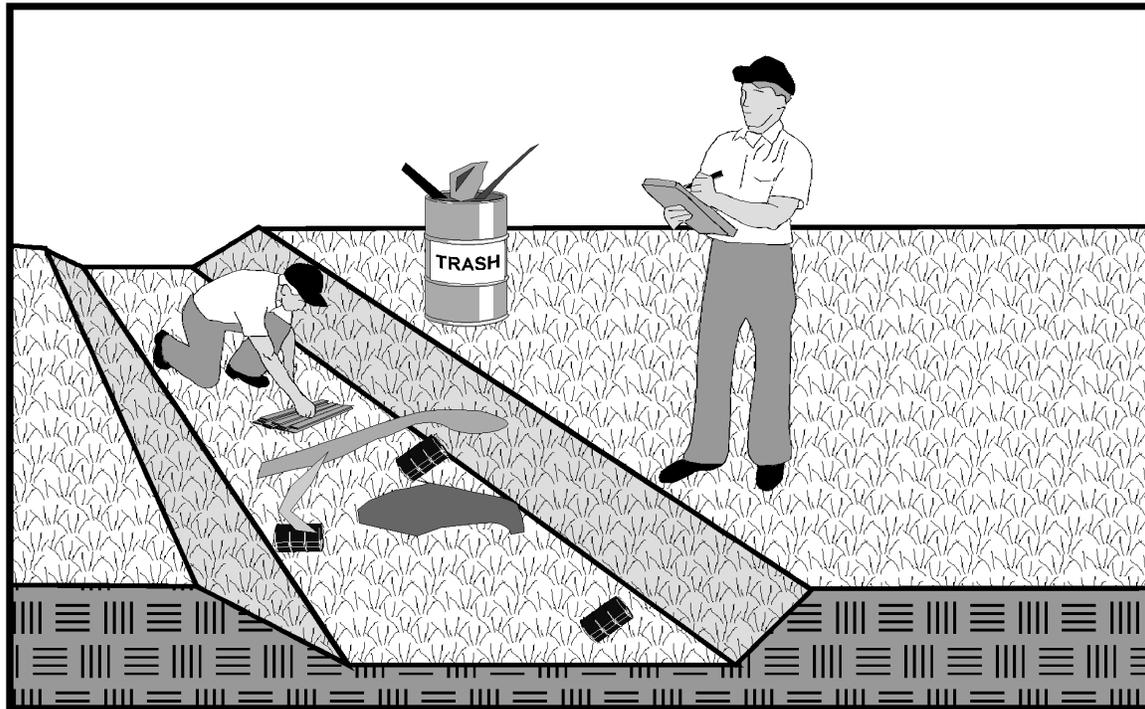
Application Guidance: Concrete grid pavement can be used in areas with low traffic volume. Suggested uses are low volume parking spaces, multi-use open space, fire lanes, and stream banks/lakeside erosion protection. Concrete grid pavement is only used to treat the runoff from the rainfall falling directly on it.

Operation and Maintenance: Concrete grid pavement offers an alternative means to providing a load-bearing surface without greatly increasing the impervious areas. Like all infiltration practices, they require maintenance to prevent clogging of the system. In addition, concrete grid pavement with grass requires additional "normal" grass maintenance, such as mowing, watering, and fertilizing. However, extra care should be taken when applying fertilizers and pesticides that may have an adverse effect on concrete products.

Effectiveness and Cost: Concrete grid pavements provide moderately effective removal of fine particle pollutants. This is a relatively high-cost BMP.

Limitations: Concrete grid pavement can cause groundwater contamination and is not suitable for areas with high-volume traffic.

BMP 097 - Regularly Inspect and Maintain Storm Water Conveyance Systems



Description of Potential Pollutant and Source: Over time, storm water conveyance systems may fill up with sediments and clog. Also, drainage swales may erode and be a source of sediment pollution to storm water.

Description of BMP: Storm water conveyance systems will be regularly inspected and maintained. This will include inspection of drainage swales and outfall pipes to ensure that the area is not eroding.

Other storm water conveyance systems, such as oil/water separators, catch basins, and detention ponds, will be inspected and properly maintained.

Application Guidance: Storm water conveyance systems will be inspected monthly.

The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

Training: The Storm Water Pollution Prevention Personnel will assign personnel responsible for inspections. Personnel will be provided a copy of a site plan showing the location of all storm water conveyance systems which need to be inspected.

Effectiveness and Cost: This is a moderately effective, low-cost BMP.

Limitations: None

BMP 098 - Regularly Inspect and Test Equipment



Description of Potential Pollutant and Source: Regular inspection and testing of equipment should prevent breakdowns and failures, which can result in the exposure of significant materials to storm water.

Description of BMP: Equipment will be regularly inspected and tested. These inspections will uncover conditions such as cracks or slow leaks which could cause breakdowns or failures that result in discharges of chemicals to storm sewers or surface waters.

The following is a list of some of the equipment that will be included in the inspection and testing program:

- Aboveground storage tanks
- Machinery
- Material storage areas
- Pressure release valves
- Process and material handling equipment
- Pumps and piping
- Sumps
- Wastewater treatment plants

Application Guidance: Equipment will be inspected and tested monthly.

The frequency for implementing of this BMP has been provided as general guidance. However, a facility operator may wish to establish a more suitable frequency. This will require SWPPP implementers to make judgments based on facility operations and conditions.

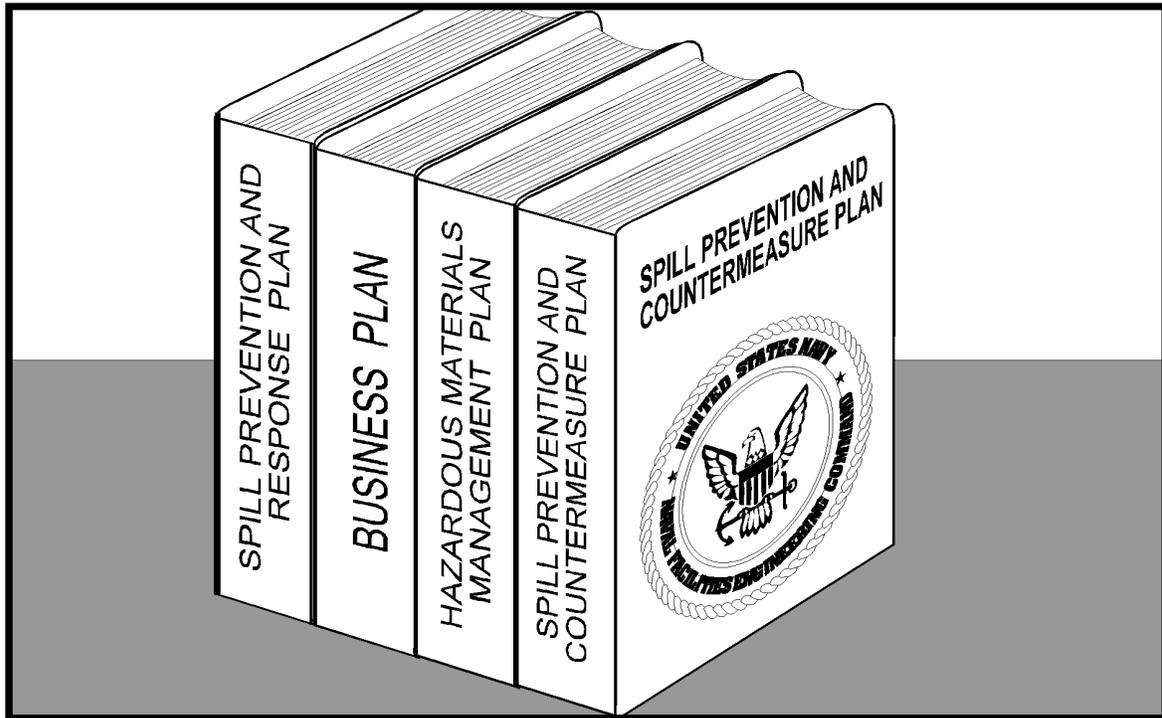
Training: An effective preventive maintenance program will include the following:

- Identification of equipment, systems, and facility areas that will be inspected.
- Schedules for periodic inspections or tests of these equipment and systems.
- Appropriate and timely adjustment, repair, or replacement of equipment and systems.
- Maintenance of complete records on inspections, equipment and systems.

Effectiveness and Cost: This is a highly effective, low-cost BMP.

Limitations: None

BMP 099 - Prepare Appropriate Spill Prevention and Response Plans



Description of Potential Pollutant and Source: Spills of significant materials may be exposed to storm water and transported to storm drains and/or receiving waters.

Description of BMP: Prepare the appropriate plans to comply with all local, state, and federal regulations related to spill prevention and response. The plans may include a Spill Prevention, Control, and Countermeasure (SPCC) Plan, Business Plan, Hazardous Materials Management Plan, and others. The plans should cover all industrial activities involving material handling and storage. (40 CFR 300 requires that sites which store or dispense petroleum products have an SPCC plan.)

The plans address actions that should be taken in the event of a spill of hazardous materials. The plans should include the location of necessary equipment (e.g., absorbent material, fire extinguishers), and internal and external reporting procedures including the names and phone numbers of the appropriate people to notify in the event of a spill. In addition, the plans should describe specific material handling procedures and storage requirements.

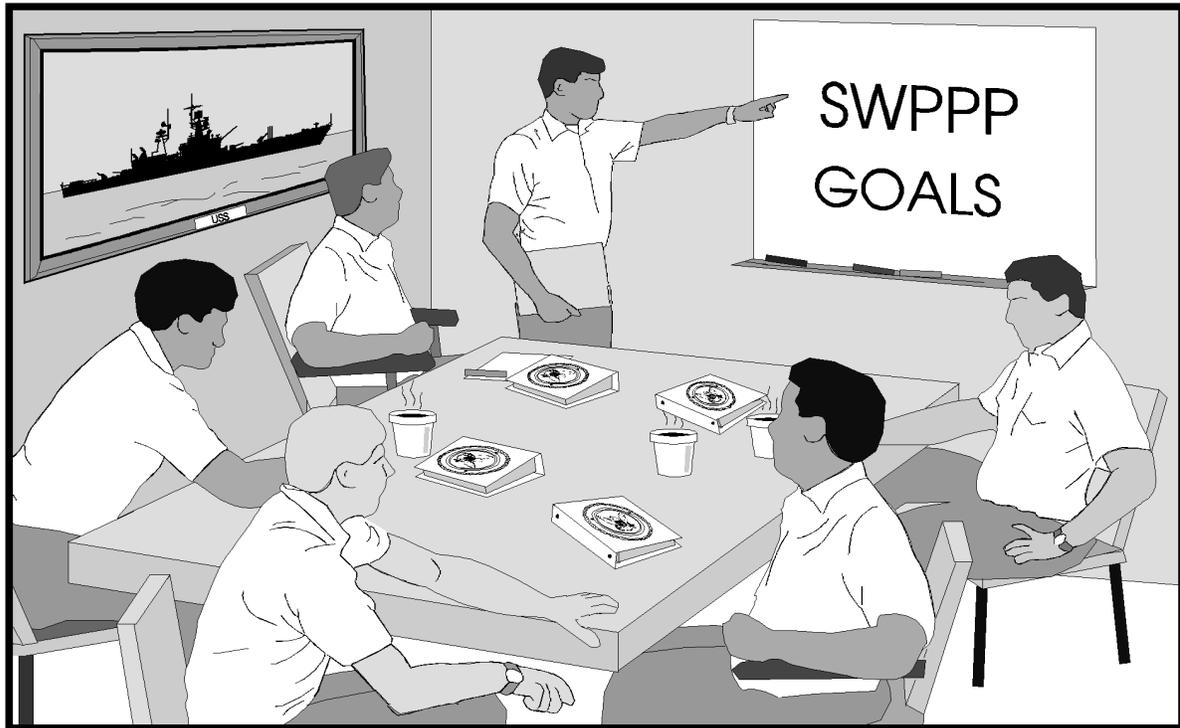
Application Guidance: N/A

Training: Personnel will be trained in the appropriate procedures for all spill prevention and response.

Effectiveness and Cost: This is an effective, low-cost BMP.

Limitations: None

BMP 100 - Conduct Personnel Training Regarding the SWPPP



Description of Pollutant Source: When properly trained, personnel are more capable of preventing spills, responding safely and effectively to an accident when it occurs, and recognizing situations that could lead to storm water contamination.

Description of BMP: Personnel at all levels of responsibility will be trained in the components and goals of the SWPPP.

Application Guidance: Training will be conducted quarterly and at new personnel orientations.

Training: Training will address each component of the SWPPP, including how and why tasks are to be implemented. Topics will include:

- Good housekeeping
- Material management practices
- Spill prevention and response

Effectiveness and Cost: This is a highly effective, moderate-cost BMP.

Limitations: None

BMP 101 - Store Containers Inside Secondary Containment



Description of Potential Pollutant and Source: Improper storage of containers of significant materials can result in the release of materials and chemicals that can cause storm water runoff pollution. Secondary containment can prevent storm water runoff pollution.

Description of BMP: Containers will be properly stored. Containers of significant materials will be stored inside secondary containment cabinets appropriate to the size and quantity of the substances stored. Cabinets will have covered shelves and provide secondary containment for spills of the substances that spill inside the cabinets. In many instances the cabinets will be locked to restrict access to the substances. Metal lockers typically used to store flammable substances are usually appropriate for preventing contact between significant materials and storm water.

The secondary containment will be placed away from vehicle traffic routes to reduce the potential for mechanical impact and accidental spills.

A manifest list of the materials stored inside the locker should be posted on or inside the locker.

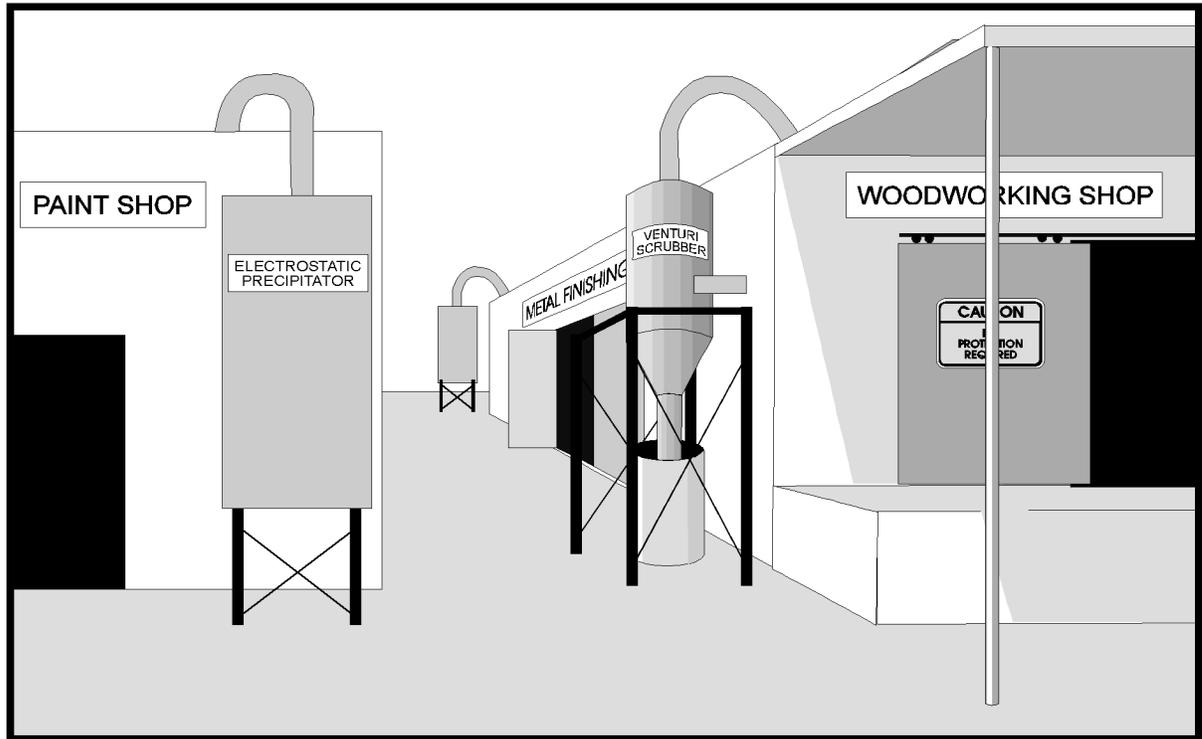
Application Guidance: Containers will always be properly stored.

Training: Personnel will be trained in preventing substances stored outside from entering the storm water and storing substance effectively.

Effectiveness and Cost: This is a moderately effective, low-cost BMP.

Limitations: None

BMP 102 - Control Dust and Particulates



Description of Potential Pollutant and Source: Many indoor and outdoor industrial processes can generate significant quantities of dust and particulates. These materials contain pollutants that can be exposed to storm water if uncontrolled. Examples of industrial processes which generate significant quantities of dust and particulates include metal finishing, painting, sanding, grinding, sawing, milling, sandblasting, welding and cement manufacture.

Description of BMP: The emission of dust and particulates from indoor and outdoor industrial processes will be controlled. Control measures include the use of filters, baghouses, electrostatic precipitators, cyclone concentrators, waterwalls and other measures.

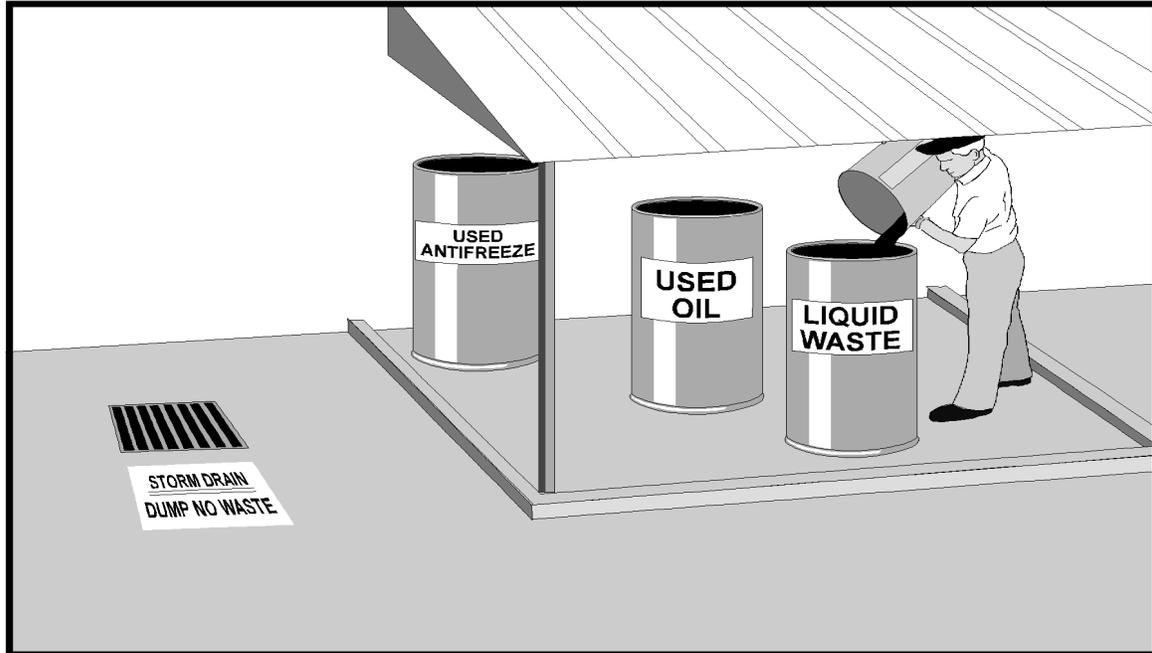
Application Guidance: All industrial processes which generate dust and particulates will be fitted with dust control devices.

Training: Personnel will be trained to properly use and maintain dust and particulate control equipment.

Effectiveness and Cost: This is an effective, moderate-cost BMP.

Limitations: It may not be possible to control outdoor processes.

BMP 103 - Do Not Pour or Deposit Waste into Storm Drains



Description of Potential Pollutant and Source: Waste poured or deposited into storm drains contains pollutants that can enter the storm drain system and receiving waters without treatment.

Description of BMP: Waste will not be poured or deposited into storm drains or storm drain connections. All wastes will be disposed properly or recycled. Refer also to BMP 027, "Stencil Signs On Storm Drain Inlets."

Application Guidance: Wastes will always be properly disposed.

Training: Personnel will be trained in proper disposal procedures. Signs will be posted at storm drain inlets.

Effectiveness and Cost: This is a highly effective, low-cost BMP.

Limitations: None

BMP 104 - Routinely Report Any Observed Non-Storm Water Discharges



Description of Potential Pollutant and Source: Unknown significant materials may be present in non-storm water discharges resulting from improper disposal of wastes or illicit connections to the storm drain system. These non-storm water discharges drain to receiving waters without treatment.

Description of BMP: Adequate routine reporting procedures will be developed and made available to all personnel who may observe either an act of illegal dumping or an unexplained non-storm water discharge. Information regarding reporting procedures will be posted in all industrial facilities. A member of the pollution prevention team will be designated to respond to reports.

Application Guidance: Reporting forms will be made available at all times.

Training: Training will be performed as part of BMP 008 training.

Effectiveness and Cost: This is an effective BMP, and the costs are low.

Limitations: None

BMP 105 - Deleted

BMP 106 - Deleted

BMP 107 - Deleted

BMP 108 - Deleted

BMP 109 - Deleted

BMP #110 - Timing of Construction

DESCRIPTION

Schedule and sequence construction work and erosion control applications so that they occur under optimal conditions--that is, during periods when the potential for erosion is lowest. Proper timing will minimize erosion and also maximize the effectiveness of control methods.

APPLICATIONS

This measure applies to almost any ground-disturbing activity, but it is especially relevant to large construction projects and any areas where work activities can be planned to coincide with periods of low erosion potential, such as during dry weather.

When construction during the wet season is unavoidable, use other BMPs described in this Catalog to control erosion, such as any of the slope protection techniques.

LIMITATIONS

None.

DESIGN PARAMETERS

- Construction work involving soil disturbance or exposure should be scheduled during seasonal low-runoff periods under favorable soil moisture conditions whenever possible.
- Erosion controls should be installed in stages to protect completed work and minimize exposed soils.
- Sediment collection systems should be installed prior to activities expected to produce sediment.
- Slope stabilization measures should be initiated within 14 calendar days after construction activities in that portion of the site where earthmoving activities have temporarily or permanently ceased.
- Consider site characteristics and permit conditions when deciding what kind of erosion control devices to incorporate into a construction project. Select measures that can be installed without disrupting critical timing or sequencing of other construction or erosion control activities.

Targeted Pollutants

- Sediment
- Nutrients
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area unlimited

Max slope unlimited

Min bedrock depth N/A

Min water table N/A

SCS soil type ABCD

Freeze/Thaw Good

Drainage/flood control no

- Identify the locations and dimensions for all erosion control and storm water management measures as clearly as possible on the site plans. This will help ensure effectiveness and proper timing of installation or implementation.

CONSTRUCTION GUIDELINES

Develop a scheduling/sequencing plan that addresses the following timing considerations. If using a Critical Path Method (CPM) for scheduling, incorporate the erosion control and storm water management practices into the CPM.

- Work activities that leave a site most susceptible to erosion should be scheduled for periods when the potential for erosion is lowest.
- Allow time to install sediment collection systems, drainage systems, and runoff diversion devices before beginning ground-disturbing work in a given area.
- Plan to install and maintain effective soil stabilization measures as work progresses, not just at the completion of all construction.
- Conduct work in units or stages so that some portions of the project site are final-graded and ready for seeding each time an approved season of seeding arrives. (See BMP # 111-Staging Areas).

MAINTENANCE

- Continually monitor site conditions and progress of work. Update the project work schedule to maintain appropriate timing and sequencing of construction and control applications.

BMP #111 - Staging Areas

DESCRIPTION

This BMP includes measures for collecting runoff from a staging area, materials storage site, or industrial activity area or for diverting water flow away from such areas so that pollutants do not mix with clean stormwater runoff. Various flow diversion structures, called stormwater conveyances, can be used to contain runoff on site, to channel it around the industrial area, or to carry pollutant-laden water directly to a treatment device or facility. Several options are available:

Stormwater Conveyances: This term includes many kinds of channels, gutters, drains, and sewers. Stormwater conveyances can be either temporary or permanent. They are constructed or lined with many different materials, including concrete, clay tiles, asphalt, plastics, metals, riprap, compacted soils, and vegetation. The type of material used depends on the use of the conveyance.

Dikes or Berms: Diversion dikes or berms are ridges built to block runoff from passing beyond a certain point. Temporary dikes are usually made with compacted soil. More permanent ones are constructed out of concrete, asphalt, or other durable materials.

Graded Areas and Pavement: Land surfaces can be graded, or graded and paved, so that stormwater runoff is directed away from construction activity areas. The slope of the grade allows the runoff to flow, but keeps it from washing over areas that may be contaminated with pollutants. Like conveyances and dikes, grading can prevent runoff from entering construction areas and becoming contaminated with pollutants from these areas. Grading can be a permanent or temporary control measure.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>unlimited</u>
Max slope	<u>15 %</u>
Min bedrock depth	<u>NA</u>
Min water table	<u>NA</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>yes</u>

APPLICATIONS

Stormwater Conveyances: Stormwater conveyances can be used for two different purposes. The first is to keep uncontaminated stormwater from getting into areas of a construction site where it may become contaminated. This can be accomplished by collecting the stormwater in a conveyance and directing the flow away from those areas. Secondly, conveyances can be used to collect stormwater downhill from construction areas and keep it separate from runoff that has not been in contact with those areas. When potentially contaminated stormwater is collected in a conveyance like this, it can be directed to a treatment device or another facility on the site if desired.

Other beneficial aspects of stormwater conveyances include:

- Prevention of temporary flooding at industrial sites.

- Low maintenance.
- Erosion-resistant conveyance of stormwater runoff.
- Long-term control of stormwater flows.

Dikes or Berms: Diversion dikes are used to prevent the flow of stormwater runoff onto construction or staging/storage areas. Limiting the flow across these areas reduces the volume of stormwater that may carry pollutants from the area and which may require treatment. This method is suitable for sites where significant volumes of stormwater runoff tend to flow onto active materials handling or equipment staging sites and other construction areas. Typically, dikes are built on slopes just uphill from an active construction area together with some sort of a conveyance, such as a swale. The conveyance is necessary to keep the water away from the dike so that the water will not pool and seep through the dike. See BMP #140-Earth Dike.

Some advantages of diversion dikes are that they:

- Effectively limit stormwater flows over industrial site areas.
- Can be installed at any time.
- Are economical, temporary structures when built from soil on site.
- Can be converted from temporary to permanent at any time.

Graded Areas and Pavement: Grading is appropriate for any construction site where outdoor activities may pollute stormwater runoff--parking lots or outdoor storage areas, for example. Grading is often used in conjunction with coverings, buffer zones, and other practices to reduce the runoff velocity, increase infiltration of uncontaminated runoff, or direct pollutant-laden runoff to stormwater treatment facilities. Grading and paving are relatively inexpensive and easy to implement.

LIMITATIONS

Stormwater Conveyances

- Once the stormwater is concentrated in conveyances, it must be routed through stabilized structures all the way to its discharge to a receiving water or other stormwater BMP.
- May increase flow rates.
- May be impractical if there are space limitations.
- May be expensive to install, especially for small facilities or after a site has already been constructed.

Dikes and Berms

- Are not suitable for large drainage areas unless there is a gentle slope.
- May require maintenance after heavy rains.

Graded Areas and Pavement

- May be uneconomical to regrade and resurface large areas.
- May not be effective during heavy precipitation.

DESIGN PARAMETERS

Stormwater Conveyances: In planning for stormwater conveyances, consider the amount and speed of the typical stormwater runoff. Also, consider the stormwater drainage patterns, so that channels may be located to collect the most flow and can be built to handle the amount of water they will receive. When deciding on the type of material for the conveyance, consider the resistance of the material, its durability, and its compatibility with any pollutants it may carry.

Conveyance systems are most easily installed when a facility is first being constructed. Where possible, use existing grades to decrease costs. Grades should be positive to allow for the continued movement of the runoff through the conveyance system; however, grades should not create an increase in velocity that causes an increase in erosion. Consider the materials used for lining the conveyance and the types of outlet controls provided.

Dikes and Berms: In planning for the installation of dikes, consider the slope of the drainage area, the height of the dike, the amount of runoff it will need to divert, and the type of conveyance that will be used with the dike. Steeper slopes result in higher volumes of runoff and higher velocities which the dike must be capable of handling. Remember that dikes are limited in their ability to manage large volumes of runoff. See BMPs #140-Earth Dike for additional parameters.

Graded Areas and Pavement: When designing graded and paved areas, be sure to consider both control and containment of runoff flows. The grading should control the uncontaminated flow by diverting it around areas that may have pollutants. The grading should also contain the contaminated flows or divert them to treatment facilities.

CONSTRUCTION GUIDELINES

Stormwater Conveyances: Specific construction methods apply to the type of conveyance being used.

Dikes and Berms: Ideally, dikes are installed before construction activity begins. However, dikes can be easily constructed at any time. Temporary dikes (usually made of dirt) generally only last for 18 months or less, but they can be made into permanent structures by stabilizing them with vegetation. Slope protection such as vegetation is crucial for preventing the erosion of the dike.

Graded Areas and Pavement: Staging/storage areas should be designated prior to the start of construction.

MAINTENANCE

It is best to inspect stormwater conveyances within 24 hours of a rainstorm and remove debris promptly. Make daily inspections during periods of prolonged rainfall, since heavy storms may clog or damage the conveyances. It is important to repair damage to these structures as soon as possible.

Dikes should be inspected regularly for damage. This is especially important after storm events since a heavy rain may wash parts of a temporary dike away. Any necessary repairs should be made immediately to make sure the structure continues to function effectively.

Inspect unpaved, graded areas to check for gullies and other signs of erosion. Inspect paving regularly for cracks that may allow contaminants to seep into the ground. Also, check to make sure that the drains receiving the discharge from the paved area remain free of clogged sediment or other debris so that the water does not back up into areas where pollutants may be.

BMP #112 - Preservation of Existing Vegetation

DESCRIPTION

Protect existing vegetation (including trees, grasses, and other plants) by preventing disturbance or damage to specified areas of a construction site or right-of-way. Preserving natural vegetation provides buffer zones and stabilized areas which help control erosion, protect water quality, and enhance aesthetic benefits. This practice minimizes the amount of bare soil exposed to erosive forces.

APPLICATIONS

This technique is applicable to all types of sites. Areas where preserving vegetation can be particularly beneficial are floodplains, wetlands, stream banks, steep slopes, and other areas where other structural erosion controls would be difficult to establish, install, or maintain. Compared to newly planted or seeded areas, preserving natural vegetation has many advantages:

- It can handle higher quantities of storm water runoff than newly seeded areas.
- It does not require time to establish (it is effective immediately).
- It has greater filtering capacity because the vegetation and root structure are usually denser in preserved natural vegetation than in newly seeded or base areas.
- It usually requires less maintenance, watering, and chemical application (e.g., fertilizer, pesticides) than planting new vegetation.

It also:

- Enhances aesthetics.
- Provides areas for infiltration, thus reducing the quantity and velocity of storm water runoff.
- Allows areas where wildlife can remain undisturbed.
- Provides noise buffers and screens for on-site operations.

LIMITATIONS

Preservation of natural vegetation may be impractical in some situations because:

- It may constrict the area available for construction activities.

Targeted Pollutants	
<input checked="" type="radio"/>	Sediment
<input type="radio"/>	Phosphorus
<input type="radio"/>	Trace metals
<input type="radio"/>	Bacteria
<input type="radio"/>	Petroleum hydrocarbons

Physical Limits	
Drainage area	<u>unlimited</u>
Max slope	<u>unlimited</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>N/A</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>no</u>

- It may not be cost-effective in areas with high land values.

DESIGN PARAMETERS

- Successful preservation of vegetation requires good planning and site management to minimize the impact of construction activities on existing vegetation. The areas to be preserved should be identified in the plans and clearly marked in the field before any site disturbance begins. Clearly mark all trees to be preserved, and protect against ground disturbance within the dripline of each marked tree as shown on the attached figure. The dripline marks the edge of the tree's foliage where drips from rainfall would drop. Most of the tree's roots lie within the dripline and are vulnerable to damage.
- Preserving natural vegetation may affect some aspects of staging, work sequencing, and construction cost. In addition, control measures may be needed around the perimeter of the preserved area to maintain adequate water flow and drainage and to prevent damage from excessive erosion or sedimentation. Be sure to consider these and related factors when preparing the project site plan and project cost estimates.
- Consider the use of design exceptions to enable preservation of natural vegetation in certain areas where it would typically be removed and where its preservation would not pose safety problems.

CONSTRUCTION GUIDELINES

- Check the project plans for areas designated for preservation of natural vegetation. Keep all construction equipment, materials, and waste out of the designated areas.
- Do not modify existing drainage patterns through or into any preservation area unless specifically directed by the plans or approved by the local permitting authority.
- Perform maintenance activities as needed to ensure that the vegetation remains healthy and able to aid in erosion control and sediment collection.

MAINTENANCE

Inspect at regular intervals to make sure the preserved vegetated areas remain undisturbed and are not being overwhelmed by sediment. Implement maintenance or restorative actions as needed. Proper maintenance is important to ensure healthy vegetation that can control erosion. Different species, soil types, and climatic conditions will require different maintenance activities such as mowing. Maintenance should be performed regularly, especially during construction.

BMP #113 - Clearing Limits

DESCRIPTION

Minimize the total amount of bare soil exposed to erosive forces by (1) controlling the amount of ground that is cleared and grubbed at one time in preparation for construction, and (2) limiting the amount of time that bare ground may remain exposed before slope protection or stabilization measures are put into place. This measure, in conjunction with appropriate timing (avoiding the rainy season) , can reduce erosion and sedimentation.

APPLICATIONS

Any areas where vegetation must be removed to facilitate construction. This practice should be a design consideration of all projects. It may be necessary to carefully coordinate land clearing, grading, and erosion control measures--see BMP #110-Timing of Construction.

LIMITATIONS

None.

DESIGN PARAMETERS

- Evaluate the erosion potential of the project site (based on slope, soil type, intended season of work, use of heavy equipment).
- Based on the above analysis, establish the maximum allowable area that may be exposed at one time. The project site plan should clearly specify the maximum allowable exposure area.
- Initiate slope protection and reclamation as work progresses to help minimize the amount of disturbed soil.
- In all cases, stabilization measures should be initiated within 14 days after ceasing work in a given area or as soon as practicable during seasonally arid periods.

CONSTRUCTION GUIDELINES

- Do not disturb any areas that are not actually needed for the specified construction or related staging activities. See BMP #112-Preservation of Existing Vegetation.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area unlimited
Max slope unlimited
Min bedrock depth N/A
Min water table N/A
SCS soil type ABCD
Freeze/Thaw good
Drainage/Flood control no

- Conduct work in units or stages so that construction and stabilization take place promptly after clearing and grubbing and as much of the site as possible is ready for seeding each time the specified seeding season arrives.
- Implement soil stabilization measures concurrently with the progress of clearing and grading work to minimize the length of time that bare ground lies exposed to erosion.
- At the approach of a designated seeding season, be prepared to seed all portions of the project that are ready for seeding (as required).

MAINTENANCE

Conduct periodic inspections to check for unnecessary ground disturbance. Also check for clearing and grubbing beyond the contractor's capability and progress in keeping grading and pollution control measures current (in accordance with accepted work schedule).

BMP #114 - Stabilization of Construction Entrance and Roads

DESCRIPTION

A temporary sediment removal device--normally a pad of crushed rock or stone--can be installed at the approach from a construction site to a public roadway, to stabilize the road. This BMP is used to limit sediment tracking from vehicles and equipment leaving the construction site onto public rights-of-way and streets.

APPLICATIONS

A stabilized construction entrance (SCE) is appropriate in the following locations:

- Wherever vehicles are entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk or parking area.
- At any unpaved entrance/exit location where there is risk of transporting mud or sediment onto paved roads.

LIMITATIONS

This control measure is not necessarily needed for temporary roads within the construction site (see BMP #115-Erosion Prevention on Temporary Roads).

DESIGN PARAMETERS

Width: The width should be at least 10 ft (3 meters) but not less than the full width of points where ingress or egress occurs. At sites where traffic volume is high, the entrance should be wide enough for two vehicles to pass safely. Flare the entrance where it meets the existing road to provide a turning radius.

Length: The minimum length should be 50 ft (15 meters) except on a single residence lot where a 30 ft minimum would apply.

Depth: Total depth of rock should be at least 6 inches (385 mm).

Aggregate: Fractured stone 2 to 8 in (50 to 200 mm) in diameter (for the base layer) and crushed stone 2 in (50 mm) in diameter or, reclaimed or recycled concrete equivalent.

Geotextile (filter fabric): Most installations will include geotextile (filter fabric) with the properties listed in the table below, to be placed over the entire area to be covered with aggregate. Work on single residential lots will generally not need

Targeted Pollutants

- Sediment
- ◐ Phosphorus
- ◐ Trace metals
- Bacteria
- ◐ Petroleum hydrocarbons

Physical Limits

Drainage area unlimited

Max slope 15 %

Min bedrock depth 3 feet

Min water table NA

SCS soil type ABCD

Freeze/Thaw good

Drainage/Flood control no

geotextile unless there's potential for excessive erosion, a high water table or other risk factor.

Stabilization of Construction Entrance/Roads/Driveways

The geotextile shall be a woven or nonwoven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The geotextile shall be inert to commonly encountered chemicals, hydro-carbons, mildew, rot resistant, and conform to the properties of the following table:

Geotextile Properties	Light Duty ¹ Roads Grade Subgrade	Heavy Duty ² Haul Roads Rough Graded	Test Method
Grab Tensile Strength (lbs)	200	220	ASTM D1682
Elongation at Failure (%)	50	60	ASTM D1682
Mullen Brust Strength (lbs)	190	430	ASTM D3786
Puncture Strength (lbs)	40	125	ASTM D751 modified
Equivalent Opening Size	40-80	40-80	US Std Sieve CW- 02215
Aggregate Depth (in)	6	10	--

¹Light Duty Road: Are sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Trevira Spunbond 1115, Mirafi 100X, Typar 3401, or equivalent.

²Heavy Duty Road: Are sites with only rough grading, and where most ravel would be multi-axle vehicles. Trevira Spunbond 1135, Miraft 600X, or equivalent.

³Geotextiles not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

Drainage: Runoff from a stabilized construction entrance should drain to a sediment trap or a sediment basin. Piping of surface water under the entrance shall be provided as needed. If piping is impossible, install a mountable berm with 5:1 slopes.

Dust Control: Dust control should be provided at all times (see BMP #116-Dust Control).

CONSTRUCTION GUIDELINES

- Clear all vegetation, roots, and all other obstructions in preparation for grading.
- Prior to placing geotextile (filter fabric), make sure that the entrance is properly graded and compacted.
- To reduce maintenance and loss of aggregate, place geotextile over the existing ground before placing the stone for the entrance.
- Place a 1 ft (300 mm) layer of fractured stone over the entire width and length of the entrance.
- Place a 4 in layer of 2 in (100 mm layer of 50 mm) crushed stone over the base layer.

MAINTENANCE

The entrance must be maintained in a condition which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with additional 2 in (50mm) stone (as conditions demand) and repair or clean-out of any structures used to trap sediment.

All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. When necessary, vehicle wheels must be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with aggregate which drains into an approved sediment trap.

Trapped sediment shall be removed from the site or stabilized on site and prevented from entering storm drains, ditches or watercourses. Disturbed soil areas resulting from removal shall be permanently stabilized.

The stabilized construction entrance may be removed after final site stabilization is achieved or after the temporary BMPs are no longer needed.

BMP #115 - Erosion Prevention on Temporary and Private Roads

DESCRIPTION

Any of several measures can be used to control erosion and sedimentation originating with haul roads, detours, access roads, and other unpaved or temporary roadbeds associated with a construction project. Possible measures include :

Road Placement: Place temporary roads as far as possible away from streams, surface waters or wetlands .

Open-Top Box Culvert: A wooden culvert installed across the road grade to convey surface runoff and roadside ditch flows to the downslope side. Open-top box culverts are useful for collecting surface runoff and ditch flows and channeling this water across the road without eroding the drainage system or road surface.

Waterbar (or Cross Ditch): A cut and berm built at a downward angle across the roadway, extending from the cutbank to the opposite fill shoulder. Waterbars reduce erosion by diverting storm water runoff from the road surface and directing it to a safe discharge area.

Road Sloping: Constructing the road with an outward slope of 1 to 2 percent from the cut slope to the fill slope. Sloped roads are designed to divert surface water off the entire road surface so that water does not concentrate in any specific location.

Rolling Dip: Constructing the road with shallow, outward-sloping dips or undulations to collect surface runoff and convey it away from the road surface.

Level Spreader: A drainage outlet constructed by cutting a shallow trench at zero grade across a slope to disperse concentrated runoff. Level spreaders convert concentrated flow into sheet flow for discharge at nonerosive velocities onto areas stabilized by vegetation. By reducing runoff velocity, they help reduce erosion, enable sediment to settle out, and enhance infiltration.

Targeted Pollutants

-  Sediment
-  Phosphorus
-  Trace metals
-  Bacteria
-  Petroleum hydrocarbons

Physical Limits

Drainage area unlimited

Max slope 15%

Min bedrock depth 3 ft

Min water table N/A

SCS soil type ABCD

Freeze/Thaw good

Drainage/Flood control no

APPLICATIONS

Open-Top Box Culvert: Used, as a substitute for pipe culverts, for cross drainage on lightly used, unpaved roads on steep grades (greater than 6 percent).

Waterbar: Used as a temporary or permanent drainage facility on light-use, low-maintenance, unpaved roads. Waterbars should be placed above grade changes to prevent water from flowing down steeper portions of roads or skid trails. Bars may also be placed above intersections of roads, skid trails, or landings to protect these disturbed areas.

Road Sloping: Used as a drainage measure on temporary or low-traffic haul roads where erosion of the roadbed and fill slope is unlikely due to low runoff volume or intensity.

Rolling Dip: Used as a runoff diversion measure to prevent erosion of the road surface. Rolling dips are effective on long inclines to keep storm water from flowing directly down the road, where it may cause gullying and other damage to the road surface and grade.

Level Spreader: Useful where concentrated runoff from bare ground or other unstabilized areas can be diverted onto stabilized areas under sheet flow conditions. Level spreaders are often placed at the outlets of diversion dikes or runoff interception trenches to control runoff, dissipate water velocity, and disperse the water over a broad surface area. Level spreaders are relatively inexpensive to install. They may be used on slopes of 3:1 or flatter.

LIMITATIONS

Open-Top Box Culvert: Generally, box culverts are not required on grades of 6 percent or less and are ineffective under continuous or recurrent use where cleaning is sporadic.

Waterbar: Suitable only for light-use, low-maintenance, unpaved roads.

Road Sloping: Suitable only for low-traffic haul roads where runoff volume and intensity are low.

Rolling Dip: Not suitable on road grades steeper than 5 percent.

Level Spreader: Level spreaders are not recommended for use in most situations. They are not suitable on slopes steeper than 3:1 or where the soils are easily erodible. They should be constructed only on natural soils, not on fill material. Level spreaders cannot handle large quantities of sediment-laden storm water. If altered by erosion or other disturbance, they may "short circuit" and actually concentrate flows into small streams instead of spreading the flows into sheet flow.

DESIGN PARAMETERS

Open-Top Box Culvert: Box culverts can be built from logs; lumber; discarded guardrail; or commercial, corrugated steel. They are installed at a skewed angle downgrade across the roadway, with the discharge end extending 6 to 12 in (150 to 300 mm) beyond the surface of the roadbed.

Spacing between culverts should be in accordance with recommended cross drainage spacing in Table 1. Where recommended spacing is less than 33 ft (10 meters), the road should be paved with gravel or crushed rock.

Waterbar: Waterbars are generally constructed using a blade-equipped tractor or by hand. The size of the waterbar depends on the amount of precipitation in the area, the soil erodibility, and anticipated traffic.

- The waterbar should extend from the cutbank side of the road completely across to the fillslope side.
- Cut dimensions: Up to 16 in (400 mm) deep across road, 8 to 16 in (200 to 400 mm) deep at outlet, 3 to 4 ft (1.0 to 1.2 meters) wide.
- Berm dimensions and orientation: 1 to 2 ft (300 to 600 mm) high 5 in (150 mm) minimum height, skewed at angle of 30° to 40° across road.
- Spacing between bars: Use Table 1, for recommended cross drain spacing on low to relatively moderately steep topography.
- Discharge: Runoff should not be directed onto fill material without proper energy dissipation and drainage away from the fill.

Road Sloping:

- The slope should be approximately 1 to 2 percent from the cut slope outward to the fill slope.
- Berms on the outside of the road should be limited or removed to allow water to flow off the road surface.
- Provide sediment collection or erosion-control measures at the toe of the fill slope to prevent excessive erosion and sediment transport.

Rolling Dip: (applies to roads greater than 150 ft long only)

- The dip should be approximately 1 ft (0.3 meter) below the surface plane of the road. The upgrade approach to the bottom of the dip should be approximately 66 ft (20 meters) long. The downgrade approach to the bottom of the dip should be approximately 23 ft (7 meters) long.
- Align the dip across the road at nearly a 90-degree angle and slope it outward approximately 5 percent.

Table 1. Recommended Cross Drain Spacing (Source: ITD, 1994)

Road Grade (percent)	Spacing Between Open-Top Culverts, feet (meters)
2 to 5	300 to 500 (90 to 150)
6 to 10	200 to 300 (60 to 90)
11 to 15	100 to 200 (30 to 60)
16 to 20	<100 (<30)

CONSTRUCTION GUIDELINES

Open-Top Box Culvert: Construct a box-like frame (three-sided, open-topped) of logs; lumber; discarded guardrail; or commercial, corrugated steel. Install it flush with the road surface, skewed at an angle downgrade across the roadway. Set the inflow end at the same grade as the side ditches on the road and extend it into the cut bank. The discharge end should extend 6 to 12 in (150 to 300 mm) beyond the surface of the roadbed and should be directed onto vegetated ground or riprap or into another erosion-control structure such as a sediment trap or catch basin.

Waterbar: Cut each waterbar into solid soil to a minimum depth of 6 in (150 mm) next to the cutbank and 8 in (200 mm) at the road shoulder, with an adverse grade on the downgrade or downgrade side of the waterbar. Build a continuous, firm berm of soil, at least 6 in (150 mm) above normal grade, parallel to the waterbar cut on its downhill side. Include a bank tie-in point, cut 6 to 12 in (150 to 300 mm) into the roadbed. For added stability, the bar may be compacted with a nonerosive fill material. The completed waterbar must extend across the full roadway width, aligned at an angle of 30° to 40° relative to the roadway. A dissipation or filter device (such as riprap or silt fence) may be needed below the waterbar to control erosion and trap sediment.

Road Sloping: Road sloping is built into the road during construction. Install erosion- and sediment-control measures downslope before completing the finish grade of the sloped road. Then construct the outward slope of 1 to 2 percent, as specified in the contract plans.

Rolling Dip: Rolling dips are built into the road, during construction, following the natural contours of the land. Install erosion and sediment measures at the low point of the dip (drainage outfall to fillslope) before final grading to direct storm water discharge from the dip. Construct the dip according to the specifications shown in the contract plans. If not specified, make the dip 1 ft (300 mm) deep, with a 23 ft (7-meter)-long approach on the downgrade side and a 66 ft (20-meter)-long approach on the upgrade side.

MAINTENANCE

Inspect all devices regularly according to provisions of the contract or project site plan. Make repairs promptly to avoid progressive damage. Remove accumulated sediments as necessary to ensure proper functioning.

Open-Top Box Culvert: Clean and repair the culverts on a regular basis. Remove sediments and other debris which may block drainage flow or decrease structural efficiency.

Waterbar: Properly constructed bars should require little or no maintenance. However, all waterbars need to be open at the lower end so water can easily flow away from the roadway. Hand shovel work may be necessary following high runoff periods or severe storms to ensure unrestricted flow.

Road Sloping: Minor regrading may be required to maintain slope angle.

Rolling Dip: Outflows should be kept free of debris to prevent ponding.

BMP #116 - Dust Control

DESCRIPTION

This fact sheet describes products or measures used for reducing or preventing wind erosion by protecting the soil surface, roughening the surface reducing the surface wind velocity. Several dust control treatments are described below. Other methods are also available .

Vegetative Cover: For disturbed areas not subject to traffic, vegetation provides the most practical method of dust control (see BMP #145-Seeding and BMP #146-Sodding).

Mulch (including gravel mulch): When properly applied, mulch offers a fast, effective means of controlling dust (see BMP#121-Mulching).

Spray-On Adhesive: Asphalt emulsions, latex emulsions, or resin in water can be sprayed onto mineral soil to prevent their blowing away (see BMP #122-Hydromulching).

Sprinkling: The site may be sprinkled with water until the surface is wet. Sprinkling is especially effective for dust control on haul roads and other traffic routes.

Stone: Stone or gravel used to stabilize construction roads and disturbed soils can also be effective for dust control and reduce soil losses from those areas by up to 80 percent.

Surface Roughening: Tilling or discing the surface of disturbed soils to produce a rough surface or ridges which when perpendicular to prevailing winds can reduce soil losses due to wind by 80 percent (see BMP #126-Slope Roughening).

Barriers: A board fence, wind fence, sediment fence, or similar barrier can control air currents and blowing soil. All of these fences are normally constructed of wood. Perennial grass and stands of existing trees may also serve as wind barriers. Barriers prevent erosion by obstructing the wind near the ground and preventing the soil from blowing off-site.

APPLICATIONS

The above measures for dust control should be used when open dry areas of soil are anticipated on the site. Clearing and grading activities create the opportunity for large amounts of dust to be blown. Therefore, one or several dust control measures should be considered prior to clearing and grading. In many cases, water erosion control measures incorporated into the project will indirectly prevent wind erosion.

As a standard practice, any exposed area should be stabilized using vegetation to prevent both wind and water erosion. When rainfall is insufficient to establish vegetative cover, mulching is an effective way of conserving moisture, preventing

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>N/A</u>
Max slope	<u>5%</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>N/A</u>
SCS soil type	<u>N/A</u>
Freeze/Thaw	<u>N/A</u>
Drainage/Flood control	<u>no</u>

surface crusting, reducing runoff and erosion, and helping to establish vegetation. It is a critical treatment on sites with erosive slopes.

LIMITATIONS

Vegetative measures may not be practical during dry periods unless a reliable supply of establishment water is available. Other methods should be stipulated in the project contract to ensure that dust control is not overlooked.

Barriers (such as walls or fences) can be part of the long-term dust control strategy in arid and semiarid areas, but they are not a substitute for permanent stabilization.

DESIGN PARAMETERS

Dust Prevention: The best method of controlling dust is to prevent dust production. This can best be accomplished by limiting the amount of bare soil exposed at one time. In project design, identify all areas where ground disturbance will not be allowed. Design and locate haul roads, detours, and staging areas to avoid unnecessary exposure of bare ground and avoid using areas that are the most susceptible to wind erosion.

In the stormwater site plan, specify staging or work sequencing techniques that minimize the risk of wind erosion from bare soil. In most cases, this will require a change from traditional construction techniques that allow large areas to be disturbed at the outset of construction and to remain exposed for long periods of time.

Vegetative Cover: Follow recommended seeding and planting specifications. If site conditions are favorable, use an extended seeding season to ensure that seeding becomes established over as much of the project as possible before winter shutdown or substantial completion. Specify the use of establishment water to accelerate vegetative stabilization if other means of long-term slope protection are not feasible.

Mulch: Apply according to the design parameter for BMP #121.

Sprinkling: Apply at a rate of 3.2 gallons per acre (35 liters per hectare) so that the soil is wet but not saturated or muddy and so that air quality requirements are maintained.

Stone: At ingress/egress to public highways, apply as indicated in BMP #114-Stabilization of Construction Entrance. For detours, haul roads, or temporary traffic routes through the construction site, provide a 2.4 in (60 mm) minimum thick layer of fractured stone 1 to 2 in (25 to 50) mm in diameter. Also see BMP#115-Erosion Prevention on Temporary Roads.

Surface Roughening: Tilling or discing should leave 6 in (150 mm) (minimum) furrows, preferably perpendicular to the prevailing wind direction, to gain the greatest reduction in wind erosion. If the surface cannot be furrowed perpendicular to the prevailing wind direction, roughening the surface by using a ripper/scarifier (grader) or a ripper (cat) will produce the desired result of a 6 in (150mm) irregular surface.

Barriers: A wind barrier generally protects soil downwind for a distance of 10 times the height of the barrier. If additional protection is needed, use other methods in conjunction with the barrier.

CONSTRUCTION GUIDELINES

Site Assessment: Assess the potential problem of wind erosion and dust generation at the project site. Consider the soil type, prevailing wind direction, and the effect of other prescribed erosion control measures.

Use Preventive Strategies Wherever Possible:

- Minimize amount of bare ground exposed at one time.
- Minimize amount of ground disturbance occurring when wind erosion is highest.

Implement Dust Control Measures as Needed:

- Provide stabilized roadway to minimize amount of dust generated by construction vehicles and highway traffic (gravel, pave or moisten the bare areas of the highway or detour route).
- Apply protective materials to exposed areas (e.g., stone, mulch, adhesive/emulsions).
- Install barriers to prevent dust from blowing off site.
- Establish vegetation at the earliest possible opportunity (using establishment water if necessary to ensure viability).
- Keep haul roads, detours, and other bare areas moist by sprinkling them with water.

MAINTENANCE

Dust control requires constant attention--it is not a one-time or once-in-awhile activity. Dust control sprinkling may have to be done several times a day during hot, dry weather.

Areas protected by mulch, adhesive emulsions, or barriers need to be checked at regular intervals according to the inspection schedule set forth in the stormwater plan. Remove sediments that accumulate behind any sediment fence or barrier when the accumulation reaches one half the height of the barrier. Dispose of the sediments only in an approved location (not in wetlands or where they will contribute to pollution at the disposal site).

Apply chemical controls (emulsions and resins) at the manufacturer's specified rates and in accordance with all federal, state, and local regulations governing their use. Chemical products must be stored, handled, and disposed of in accordance with all applicable regulations and department policies.

BMP #117 - Cover for Materials and Equipment

DESCRIPTION

This BMP includes partial or total physical enclosure of materials, equipment, process operations, or activities. Covering prevents stormwater from coming into contact with potential pollutants and reduces material loss from wind blowing. Tarpaulins, plastic sheeting, roofs, buildings, and other enclosures are examples of covering that are effective in preventing stormwater pollution. Covering can be temporary or permanent.

APPLICATIONS

Covering is a simple, effective, and usually inexpensive way of reducing or preventing pollution. It is appropriate for outdoor material storage piles, such as stockpiles of dry materials, topsoil, spoils piles, gravel, sand, compost, sawdust, wood chips, and building materials. It is also effective where containers of liquids or solids are stored or transferred. Although it may be too expensive to cover or enclose all construction activities, the high-risk parts of a site can often be separated and covered. For example, chemical preparation areas, vehicle maintenance and washing areas, storage areas for chemically treated products and toxic wastes (e.g., used oils).

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>N/A</u>
Max slope	<u>N/A</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>N/A</u>
SCS soil type	<u>N/A</u>
Freeze/Thaw	<u>N/A</u>
Drainage/Flood control	<u>no</u>

LIMITATIONS

- Covering alone may not protect exposed materials from contact with stormwater runoff/run-on.
- Requires frequent inspections. Consider curbing or an elevated platform to prevent pollution from run-on water.

DESIGN PARAMETERS

In selecting an appropriate covering, evaluate the strength and longevity of the covering, as well as its compatibility with the materials or items being enclosed. Cost, aesthetics, weather conditions, drainage patterns, and size of the stockpiles or storage area are other factors affecting the choice of covering.

- In designing a covering for materials, remember to provide adequate access for loading, handling, and transfer. Cost considerations may justify a less-than-optimum access arrangement in some cases. For instance, tarpaulins and plastic sheeting have to be removed or rearranged to allow continued access as materials are depleted, but they are less expensive than a permanent structure such as a roof or shed.
- Climate or weather conditions also influence the choice or design of a covering. Tarpaulins and sheeting may be difficult to keep secured in extremely windy areas.
- Where a permanent structure is indicated for a particular area or activity, consider building a roof instead of a complete enclosure. This will reduce costs and may also eliminate the need for ventilation and lighting systems that could be needed in a building.
- Consider the nature of the materials being enclosed, especially if they pose environmental or safety dangers. Materials that are biological, flammable, explosive, or chemically reactive require special ventilation and temperature control measures.
- Covering alone may not protect exposed materials from stormwater contact. Where stormwater runoff is a potential problem, place the material on an elevated, impermeable surface or build curbing around the outside of the materials to prevent pollution of stormwater from adjacent areas.

CONSTRUCTION GUIDELINES

Tarpaulins and Plastic Sheeting: Obtain enough fabric or sheeting to cover the indicated volume or area. Anchor the edges of the covering with stakes, tie-down ropes, large rocks, tires, or other readily available, heavy objects. Maintain an overlap of one meter along the border of separate sheets and securely anchor the overlap area so that it does not separate (through wind or other causes), allowing water to leak into the protected materials.

Roofs, Sheds, and Buildings: Construct according to plans or drawings in accordance with existing building codes and departmental standards for such construction.

MAINTENANCE

Frequently inspect coverings for damage and general wear. Repair or replace them immediately, as needed.

BMP #118 - Spill Prevention and Control

DESCRIPTION

This fact sheet describes methods of minimizing exposure of pollutants to storm water runoff by enclosing any drips, overflows, leaks, and other liquid material releases or by isolating pollutant spills from stormwater runoff.

There are numerous spill containment methods, ranging from large structural barriers to simple, small drip pans. The benefits vary based on cost, maintenance requirements, and the size of spill control. Three possible options are discussed below:

Containment Diking: Temporary or permanent earth berms, concrete berms, or retaining walls designed to hold spills. Diking is one of the best protective measures against stormwater pollution because it surrounds the area of concern and holds the spill, keeping spill materials separated from the storm water outside of the diked area. Diking is one of the most common types of spill containment. Also see BMP #140-Earth Dike and BMP #142-Temporary Berms.

Curbing: Like containment diking, curbing is a barrier that surrounds an area of concern. It prevents spills or leaks from being released to the environment by routing runoff to treatment or control areas. The terms "curbing" and "diking" are sometimes used interchangeably, but curbing is usually small scale and cannot contain large spills like diking can.

As with diking, common materials for curbing include earth, concrete, synthetic materials, metal, or other impenetrable materials. Asphalt is also a common material used in curbing.

Drip Pans: Pans used to contain very small volumes of leaks, drips, and spills. Drip pans can be depressions in concrete, asphalt, or other impenetrable materials, or they can be made of metals, plastic, or any material that does not react with the dripped chemicals. Empty or discarded containers may be used as drip pans. Catch drips so that the materials or chemicals can be cleaned up easily or recycled before they can contact stormwater. Drip pans can be a temporary or permanent measure.

APPLICATIONS

Containment Diking: Diking can be used at any construction site, but it is most commonly used for controlling large spills or releases from liquid storage areas and liquid transfer areas. It is an effective containment method around tank truck loading and unloading areas. Proper diking contains spills, leaks, and other releases and prevents them from flowing into runoff conveyances, nearby streams, or infiltration

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area N/A
Max slope N/A
Min bedrock depth N/A
Min water table N/A
SCS soil type N/A
Freeze/Thaw N/A
Drainage/Flood control no

into groundwater. It also allows for proper disposal and/or recycling of materials captured within the dike.

Curbing: Curbing is usually small scale; it cannot contain large spills like diking can. However, many facilities use curbing to contain small areas used for handling and transferring liquid materials.

Curbing is already a common practice. It is inexpensive, easy to install, and provides excellent control of run on. As with diking, materials spilled within a curbed area can be collected for proper disposal and/or recycling.

Drip Pans: Drip pans can be used at any site where valves and piping are present and the potential for small-volume leakage and dripping exist. Although leaks and drips should be repaired and eliminated as part of preventive maintenance programs, drip pans can provide a temporary solution where repair or replacement must be delayed. In addition, drip pans can be an added safeguard when they are positioned beneath areas where leaks and drips may occur.

Drip pans are inexpensive, easy to install, and simple to operate. They allow for reuse or recycling of the collected material.

LIMITATIONS

Containment Diking:

- May be too expensive for some smaller facilities.
- Requires maintenance.
- Could collect polluted stormwater, with possible infiltration to ground water.

Curbing:

- Not effective for holding large spills.
- May require more maintenance than diking.

Drip Pans:

- Suitable only for small volumes.
- Must be inspected and cleaned frequently.
- Must be secured during poor weather conditions.
- Requires that personnel are trained in proper disposal methods so that contents are not disposed of improperly.

DESIGN PARAMETERS

Containment Diking:

- Size: For tank truck loading and unloading operations, the diked area should be capable of holding an amount equal to any single tank truck compartment.
- Materials: Materials used to construct the dike should be strong enough to safely hold spilled materials. The materials used usually depend on what is available on site and the substance to be contained. Dikes may be made of earth (i.e., soil or clay), concrete, synthetic materials (liners), metal, or other impervious materials. Containment dikes may need to be designed with impervious materials to prevent leaking or pollution of stormwater, surface water, and ground water supplies.
-
- In general, strong acids and bases may react with metal containers, concrete, and some plastics. So where spills may consist of these substances, other alternatives should be considered. Some of the more reactive organic chemicals may also need to be contained with special liners. If uncertain about the suitability of certain dike construction materials, refer to the *Material Safety Data Sheet* (MSDS) for the chemical being contained.

Curbing: When using curbing for runoff control, protect the berm by limiting traffic and installing reinforced berms in areas of concern.

Materials spilled within a curbed area can be tracked outside of that area when personnel and equipment leave the area. This tracking can be minimized by grading within the curbing to direct the spilled materials to a downslope side of the curbed area. This will keep the materials away from personnel and equipment that pass through the area. It will also allow the materials to accumulate in one area, making cleanup much easier.

Manual or mechanical methods, such as those provided by sump systems, can be used to remove accumulated material from a curbed area.

Drip Pans: When using drip pans, consider local weather conditions, the location of the drip pans, materials used for the drip pans, and how the pans will be cleaned.

The location of the drip pan is important. Because drip pans must be inspected and cleaned frequently, they must be easy to reach and remove. Take special care to avoid placing drip pans in precarious positions such as next to walkways or on an uneven surface. Drip pans in these locations are easily overturned and may present a safety or environmental hazard.

Weather is also an important factor. Heavy winds and rainfall can move or damage drip pans because the pans are small and lightweight. To prevent this, secure the pans by installing or anchoring them. Drip pans may be placed on platforms or behind wind blocks or may be tied down.

MAINTENANCE

Containment Diking: Inspect containment dikes during or after significant storms or spills to check for washouts or overflows. In addition, regular testing to ensure that

dikes are capable of holding spills is recommended. Soil dikes may need to be inspected on a more frequent basis.

Changes in vegetation, inability of the structure to retain stormwater dike erosion, or soggy areas indicate problems with the dike's structure. Damaged areas should be patched and stabilized immediately, where necessary. Earthen dikes may require special maintenance of vegetation, such as mowing and irrigation.

When evaluating the performance of the containment system, pay special attention to the overflow system, since it is often the source of uncontrolled leaks. If overflow systems do not exist, accumulated stormwater should be released periodically. Polluted stormwater should be treated prior to release. Mechanical parts (such as pumps) or manual systems (slide gates, stopcock valves) may require regular cleaning and maintenance.

Curbing: Since curbing is sized to contain small spill volumes, frequent maintenance is needed to prevent overflow of any spilled materials. Inspect all curbed areas regularly and clean clogging debris. Repair the curb by patching or replacing it as needed to ensure effective functioning. Inspections should be conducted before forecasted rainfall events and immediately after storm events. If spilled or leaked materials are observed, cleanup should start immediately to allow space for future spills. In addition, prompt cleanup of spilled materials will prevent dilution by rainwater, which can adversely affect recycling opportunities.

Drip Pans: For drip pans to be effective, site operators must pay attention to the pans and empty them when they are nearly full. Because of their small holding capacities, drip pans will easily overflow if not emptied. Also, recycling efforts can be affected if stormwater accumulates in drip pans and dilutes the spilled material. It is important to have clearly specified and easily followed practices of reuse/recycle and/or disposal, especially the disposal of hazardous materials. Consider dumping the drip pan contents into a nearby larger-volume storage container and periodically recycling the contents of the storage container.

Frequent inspection of the drip pans is necessary due to the possibility of leaks in the pan itself. Also check for random leaking of piping or valves and for irregular, slow drips that may increase in volume. Conduct inspections before forecasted rainfall events to remove accumulated materials. Empty accumulations immediately after each storm event.

BMP #119 - Vehicle/Equipment Washing and Maintenance

DESCRIPTION

A typical system is a lined, depressed area that collects the water used in washing off the trucks, cars, or other construction vehicles/machinery, and drains it into a collection or treatment system.

APPLICATIONS

A wash down area is used on projects where the soil is silty or heavy in clay, and has the likelihood of transporting dirt and mud offsite. Projects that will take place over the course of the rainy season, and areas where water is expected to be encountered (high ground water table) in the normal course of the project should be considered as candidates.

LIMITATIONS

Washing vehicles generates liquid, semi-solid and solid wastes. These wastes must be contained on-site or treated to prevent pollution of surface and ground water.

Off-site: Treatment is required for all discharges to waters of the State since it could be contaminated with degreasers, hydrofluoric acid, hydrochloric acid, nitric acid, phosphoric acid, oil, hydraulic fluids, lubrication, and engine cleaning solvents. Waters of the State are all surface waters (canals, rivers, ponds, streams and lakes), and all ground water.

Contact the local permitting authority to determine proper disposal methods.

On-site: If wash water discharge to a sediment pond is the system of choice, sufficient acreage is required for the operation.

DESIGN PARAMETERS

Detergents used for vehicle washing should not contain phosphates. Phosphates are a plant nutrient that can cause excessive growth of aquatic plants when discharged into a stream or lake.

A stabilized construction entrance and road (BMP #114), to reduce off-site tracking of mud, dirt and rocks, should be installed at the vehicle wash/maintenance area. Washing and maintenance should be conducted in disturbed areas (staging area), but not in a cut or fill area until grading has been performed, and not where there

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>N/A</u>
Max slope	<u>5%</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>N/A</u>
SCS soil type	<u>N/A</u>
Freeze/Thaw	<u>N/A</u>
Drainage/Flood control	<u>no</u>

will be a high volume of construction traffic. Highly erodible soils or frequently wet areas should be avoided.

Off-site discharge options:

- Lagoon: Pond-like structure that works on the principle of evaporation, is easy to install and requires low maintenance. There is a need to be aware of safety issues (fencing the area from the public).
- Land application system: Large land area is required. This alternative is the lowest in out-of-pocket cost.
- Filtering and recycling of wash water: A good option for conservation measures. Initially, expense would be high. Monitoring of the operation would be more intensive.
- Municipal waste water treatment plant: This option is available only in areas where a municipal waste water treatment plant exists and the operation is capable of handling the load. This is the best option for limiting liability for larger construction projects.

CONSTRUCTION GUIDELINES

Designate an area that can be graded and bermed. The design should collect waste water for evaporation or direct it to an off-site containment or treatment system. A lined pond should be used where pollutants such as oil, grease, fuels, etc., may reach the high ground water table.

MAINTENANCE

Check system for integrity. Are the controls working as designed? Clean up sediments that have been tracked by vehicles onto nearby roadways.

BMP #120 - Waste Management

DESCRIPTION

This BMP entails meeting the regulatory requirements of hazardous waste management which includes hazardous waste determination; acquiring an EPA identification number; accumulation; record keeping reporting; and transportation manifesting. Good housekeeping will minimize the contribution of pollutants to stormwater discharges by handling and storing hazardous materials onsite in a clean and orderly manner.

APPLICATIONS

Compliance with applicable regulations will protect human health and the environment from hazardous waste generated by construction activities, reduce liability, and prevent unnecessary interruptions to schedules (i.e., project shut down due to environmental investigations/enforcement actions). The first step in preventing pollution of stormwater runoff is to maintain a clean and orderly work environment. This will reduce the possibility of accidental spills. Common sense is the simplest, inexpensive method to utilize. Improving the operation and maintenance of industrial machinery; material storage practices; material inventory controls; routine and regular clean-up; maintaining well organized work areas; and educational programs for employees regarding these practices will assist in reaching these goals.

LIMITATIONS

Carelessness and poor judgment often result in problems associated with the disposal of hazardous materials. Not being fully aware of all the hazards at the site could increase the potential for mishandling of such wastes, resulting in stormwater contamination.

DESIGN PARAMETERS

Select a designated waste collection area on-site. Secure an adequate number of containers with lids or covers. If possible provide a covered area or spill containment pallets. Arrange for waste collection before containers overflow (additional containers and more frequent pick-ups will be needed during the demolition phase). Provide immediate cleanup in case of a spill. Assure waste is transported and disposed of at an approved facility. A liner, concrete pad, berm, etc., should be utilized to keep waste separated and contain accidental spills, so they do not pollute stormwater

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>N/A</u>
Max slope	<u>N/A</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>N/A</u>
SCS soil type	<u>N/A</u>
Freeze/Thaw	<u>N/A</u>
Drainage/Flood control	<u>no</u>

runoff. Provide labels and signs for the area to educate contractors about proper storage and handling, and to comply with regulatory requirements.

CONSTRUCTION GUIDELINES

The best way to avoid polluting runoff from outside material storage areas is to prevent stormwater run-on or rain from coming in contact with the materials. Methods that can be utilized to accomplish this are

- Identifying, controlling, and enforcing storage and disposal/stockpile areas
- Providing a barrier such as a liner, concrete pad or berm
- Protecting the storage area by:
 - storing the material indoors
 - covering the area with a roof
 - covering the material with a temporary covering
- Engineering safeguards such as:
 - overflow protection devices
 - protective guards around tanks, storage area, etc.

MAINTENANCE

- Regularly pick up and dispose of all garbage and waste material.
- Make sure equipment is working properly.
- Routinely inspect for leak or conditions that could lead to discharges of chemicals or contact of stormwater:
 - external corrosion and structural failure
 - installation problems
 - evidence of spills or overfills
- Locate storage areas away from direct traffic routes.
- Stack according to directions to avoid damage due to improper weight distribution.
- Store likes together, separate incompatible wastes.
- Assign hazardous material inventory to a limited number of people.
- Keep up-to-date inventory of all hazardous materials and wastes.

- Identify all chemical substances present at the work site.
- Label all containers with name, hazards, handling, and first aid information.
- Mark those that require special instructions.
- Cleanup of liquid or dry material spills.
- Provide initial and annual training for employees on the hazards and the proper handling procedures.
- Do not mix products together unless specifically recommended.
- Use all the product before disposing of container.
- Do not remove original product label from container until container has been completely emptied.

BMP #121 - Mulching

DESCRIPTION

Mulching is a temporary soil stabilization or erosion control practice where materials such as straw, grass, grass hay, compost, wood chips or wood fibers are placed on or incorporated into the soil surface. In addition to stabilizing soils, mulching can reduce the speed of stormwater runoff over an area. When used together with seeding or planting, mulching can aid in plant growth by holding the seed, fertilizers, and topsoil in place, by helping to retain moisture, and by insulating against extreme temperatures.

Mulching protects the soil surface from splash erosion. It retards runoff, traps sediment, and creates more favorable conditions to assist germination and the early development of plants. Common natural and synthetic (stabilizers) mulches suitable for use at construction sites include:

Vegetative materials: wheat straw, rye straw, barley straw, grass hay

Wood products: wood cellulose fibers, wood chips, bark, sawdust

Other organic materials: leaves, peat, manure, compost

Rock products: gravel, slag, crushed stone

Fabricated mulch: jute, burlap, coconut (coir), excelsior, Kraft paper string

Synthetic mulch: asphalt, vinyl, plastics, latex, rubber, adhesives or "tackifiers".

APPLICATIONS

Mulch is an immediate, effective, and inexpensive means of controlling dust and erosion and aiding revegetation of construction sites. It provides immediate protection to soils that are exposed and that are subject to heavy erosion; it retains moisture (which may minimize the need for watering); and it requires no removal because of natural deterioration of most mulching materials.

Mulching is often used alone in areas where temporary seeding cannot be used because of the season or climate. It may be used in conjunction with other treatments for increased effectiveness. Use of mulch may or may not require a binder, netting, or tacking agent to hold the mulch in place. On steep slopes and critical areas such as waterways, mulch matting is used with netting or anchoring to hold it in place.

- To aid in establishing vegetation, mulch seeded and planted areas where slopes are steeper than 2:1, where runoff is flowing across the area, or when seedlings need protection from bad weather. If the mulching effect is to be maintained longer than three months, the preferred mulch is vegetative

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>2 ac</u>
Max slope	<u>50%</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>N/A</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>fair</u>
Drainage/Flood control	<u>no</u>

material. Wheat straw is the most preferred vegetative material, followed by rye straw, barley straw, or grass hay.

- Wood chips are suitable for areas that will not be closely mowed and around ornamental plantings. Chips decompose slowly and do not require tacking, but they must be treated with nitrogen to prevent nutrient deficiency. Wood chips can be very inexpensive if they are obtained from trees cleared on the site. Chips should not be used on slopes greater than six percent because they tend to wash down slopes.
- Bark mulch is suitable for areas planted to grasses that will not be closely mowed. The bark may be applied mechanically or by hand.
- Crushed stone and gravel mulches are appropriate for dust control and soil protection on low-use dirt roads, driveways, and other areas of light vehicular activity within the construction site.

LIMITATIONS

Disadvantages of mulch include the following:

- It may delay germination of some seeds because cover reduces the soil surface temperature.
- Mulch can be easily blown or washed away by runoff if not secured or incorporated. Lightweight mulch, such as straw requires matting, crimping, or other methods to hold it in place.
- Some mulch materials, such as wood chips, may absorb nutrients necessary for plant growth.
- Straw mulch provides organic matter as it breaks down and is incorporated into the soil. If applications are too heavy, however, soil nutrient levels (especially nitrogen) may decline during the period of decomposition. Therefore, prescribed application rates of both the straw mulch and the specified fertilizer should be strictly followed. The use of a fertilizer low in phosphorus is recommended.
- Synthetic spray-on materials are not recommended except for temporary dust/erosion control or for steep, rocky slopes where other mulches and mechanical methods cannot be effectively applied. The synthetic mulches may create impervious surfaces and can have adverse effects on water quality.
- Avoid applying mulch as the only control on long slopes. Break up concentrated flows on these slopes with other BMPs, such as BMP #127- Gradient Terracing, or BMP #132-Check Dams.

DESIGN PARAMETERS

GUIDE TO MULCH MATERIALS, RATES, AND USES				
Mulch Material	Quality Standards	Application Rate 1100 ft ² (per 100 m ²)	Depth and Coverage	Remarks
Gravel, slag,	Washed, 3/4 to 1 1/2 in (20	280 ft ³ (8 m ³) (or more to ensure	2.75 to 3.1 in (70 to 80	Excellent mulch for short slopes

or crushed stone	to 40 mm) diameter with at least 30% of it larger than 3/4 in (20 mm) diameter.	90% coverage at 2.5 tons/1100 ft ² (2.3 metric tons/100 m ²).	mm uniform covering.	around woody plants and ornamentals. Use where subject to foot traffic. Approximately 42.5 lb/ft (660 kg/m ³).
Hay or straw	Air dried, free of unwanted seeds and coarse material. Fibers should not be chopped or ground to reduce fiber length. Minimum fiber length - 8 in (200 mm).	88 TO 110 lb (40 to 50 kg) (2 to 3 bales).	50 to 80 mm to form a uniform mat through which 20 to 40% of the original ground surface can be seen.	Use where the mulching effect is to be maintained for >3 months. Subject to blowing unless kept moist, punched, or tacked down. Most common and widely used mulching material. Can be used in critical erosion areas.
Wood fiber cellulose	Dyed material should not contain any growth inhibiting factors.	22 to 33 lb (10 to 15 kg)		If used on critical areas, double the normal application rate. Apply with hydromulch. No tie-down required. Packaged in 110 lb (50 kg) bags.
Wood chips	Do not use kiln-dried or air-dried material. Chip size 1/2 x 1 1/2 in (15 x 40 mm) diameter and 1/10 to 1/2 in (3 to 15 mm thick).		2.75 to 3.1 in (70 to 80 mm) uniform depth	Applying at over the specified thickness may markedly reduce soil nutrients for a long time. Increase fertilizer 25 percent with wood chip mulch on revegetation sites.
Compost	Odorless or earthy smell	5.3 to 53 ft ³ (0.15 to 1.5m ³)	2 to 3.1 in (50 to 80 mm) uniform depth	Inexpensive, but may not be available in some areas.

-

Stone and gravel:

- After the gravel or stone is applied, construction traffic may move over it. Areas which become compacted or depressed should be remulched to the same level as the remaining area to prevent flows from the site from becoming channelized into these depressions.
- Upon completion of activities on the site, the gravel or stone mulch may be left in place during revegetation operations.
- When used for driveways or dirt roads, a filter blanket should be placed under the gravel.

Straw:

- Straw mulch forms a loose layer when applied over a loose soil surface. To protect the mulch from wind drifting and water damage, it should be stabilized by covering it with netting, such as jute, or by spraying it with a tacking agent. See construction guidelines for more information.
- Straw mulch should cover the entire seeded area or exposed slope. The mulch should extend into existing vegetation or stabilized areas on all sides to prevent wind or water damage which may start at the edges of the mulched area
- The straw fibers should be applied to form a uniform cover of loose straw through which 20 percent or less of the original ground surface can be seen. No large clumps of unscattered straw should exist after application.

- On small slopes, straw mulch should be applied by hand broadcasting to a uniform depth of 2 to 3.1 in (50 to 80 mm). On larger slopes, straw can be blown onto the slope to achieve a uniform cover of 2 to 3.1 in (50 to 80 mm).

Wood chips:

- Due to bacterial action during decomposition, nutrient concentrations in the soil may be depressed under a layer of wood chips. Because of this, applications should not exceed the specified thickness which would cause a marked decline in some soil nutrients for longer periods.
- When using wood chips to mulch revegetation projects, the specified application of fertilizer should be increased approximately 25 percent to replenish soil nutrients lost due to breakdown of wood chips.

Effectiveness of mulches:

- Crushed stone and gravel mulches retain their effectiveness indefinitely if properly applied and protected from compacting traffic. Sediment generation reduction is estimated at 70 to 90 percent, and nutrient generation reduction at 50 to 70 percent.
- Straw mulches react similarly to hydromulches, as they break down fairly rapidly. However, straw is twice as effective and at about half the cost of hydromulches. Sediment reduction by straw mulch without vegetation is 90 to 95 percent for a few months. It drops to 70 to 90 percent in 6 months, and further to 40 to 60 percent in 2 years, and 10 to 30 percent after that. Nutrient reductions are estimated at 60 to 80 percent for a few months, 50 to 70 percent in 6 months, 20 to 50 percent up to 2 years, and 0 to 10 percent beyond 2 years.
- Wood chips deteriorate more slowly than wood fiber and therefore retain their effectiveness longer. Sediment reductions of 90 to 95 percent can be expected for a year, 80 to 90 percent up to 2 years, and 50 to 60 percent beyond 2 years. Nutrient reductions of 60 to 80 percent, 50 to 70 percent, and 30 to 50 percent are estimated for the same period.

CONSTRUCTION GUIDELINES

Seeding (temporary or permanent) can take place prior to or concurrent with mulching. Other surface runoff control measures should be installed prior to seeding and mulching. If seeding is prior to mulching, mulches must be applied to seeded areas immediately after seeding. Mulches should not be applied when free surface water is present, but may be applied to damp ground. The choice of materials for mulching will be based on the type of soil to be protected, site conditions, season, and economics.

Straw mulch: The straw must be stabilized to prevent it from being damaged by water or wind (blown away). Use one of the following methods:

- Hand punching can be used on small sites, sites with rock and stone on the surface, sites with slopes which are steeper than 3:1, or sites which have been wattled. Take care not to damage wattling or planted vegetation. Use a spade or shovel to punch the straw into the slope until all areas have straw standing perpendicularly to the slope and embedded at least 4 in (100 mm)

into the slope. The bunches of straw should resemble the tufts of a toothbrush.

- Roller punching can be used on large, gently sloping sites without significant outcroppings of rock and stone. Roller punching should not be used on sites which have been wattled (unless there is adequate space between lines of wattling) or on planted sites. A roller equipped with straight studs not less than 6 in (150 mm long), from 4 to 6 in (100 to 150 mm) wide, and approximately 3/4 in (20 mm) thick, will best accomplish the desired effect. Studs should stand approximately 8 in (200 mm) apart and should be staggered. All corners should be rounded to prevent withdrawing the straw from the soil. Vegetative planting may be conducted following roller punching.
- Crimper punching involves specially designed straw-crimping rollers. These are suitable for use wherever roller punching can be used. The crimpers consist of serrated disk blades, set 4 to 8 in (100 to 200 mm) apart, which force straw mulch into the soil. Crimping should be done in two directions with the final pass conducted across the slope rather than up and down it.
- Tacking agents may be used on any type of site, but are best used only on very stony or rocky soils or small, steep slopes. Apply 28.5 ft³/ac (2.0 cubic meters per hectare) of the tacking agent or its equivalent over the straw mulch. Agents which are neutral or nearly neutral in color and of demonstrated effectiveness for the soils and climate of the application area are acceptable.
- Matting may be used on large, steep areas which cannot be punched with a roller. Jute or wood excelsior on plastic netting shall be applied over unpunched straw according to BMP #124-Matting.

MAINTENANCE

Inspect all mulched areas periodically (according to the inspection interval prescribed in the project site stormwater plan and after runoff-producing storm events. Repair damaged areas of the mulch immediately. Reseed or replant such areas, if necessary, before replacing the mulch cover.

Straw mulch and other organic products do not have to be removed when the vegetation becomes established.

BMP #122 - Hydromulching

DESCRIPTION

Hydraulic mulching is a process where wood fiber mulch, processed grass, hay or straw mulch are applied with a tacking agent in a slurry with water to provide temporary stabilization of bare slopes or other bare areas. This mulching method provides uniform, economical slope protection. It may be combined with hydroseeding as a revegetation method (see BMP #145-Seeding).

APPLICATIONS

Hydraulic mulching is an effective way to increase water retention (thereby reducing erosion) for six months or up to one year. Beyond one year, the effectiveness drops off.

Hydraulic mulching can be applied to areas that are within about 200 feet (60 meters) of a road or that can otherwise be reached by truck. Small roadside slopes and large, relatively flat areas are well adapted to this method. When adequate moisture exists, the slurry can be combined with seed and fertilizer to initiate stabilization and revegetation in a single application (see BMP #112-Preservation of Existing Vegetation). The mulch usually lasts about a year. The growing vegetation is needed to provide continued stabilization.

LIMITATIONS

- Loses effectiveness after one year.
- Only suited for physically stable slopes (at natural angle of repose, or less).
- Avoid hydraulic mulching on long uninterrupted slopes. Break up concentrated flows with other BMPs, such as BMP #127-Gradient Terracing or BMP #132-Check Dams.

DESIGN PARAMETERS

Effectiveness: Hydraulic mulching initially reduces sediment generation by 70 to 80 percent as compared to sediment production off bare slopes. Within two years, the breakdown of wood fiber will have reduced its effectiveness to 40 to 60 percent. Beyond that time, only 10 to 30 percent effectiveness can be expected, and the mulch should be replaced. Nutrient generation is typically reduced 50 to 70 percent for six months, 20 to 50 percent up to two years, and 0 to 10 percent beyond two years.

Equipment: The hydraulic mulching machine should be equipped with a gear-driven pump and a paddle agitator. Agitation by recirculation from the pump is not

Targeted Pollutants

- Sediment
- ◐ Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>2 ac</u>
Max slope	<u>15 %</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>N/A</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>fair</u>
Drainage/Flood control	<u>no</u>

acceptable. Agitation must be sufficient to produce a homogeneous slurry of tacking agent and mulch (and seed fertilizer, if used).

Application rates: Apply the water at a minimum rate of 3000 gallons per acre (28 cubic meters per hectare). Tacking agent should be applied at 28.5 ft³ (2.0 m³) of wet ingredients per acre (hectare) or 90 kilograms of dry ingredients per hectare.

When seeding is combined with hydraulic mulching, be sure to include an appropriate specified formulation at the specified rate. Legume seeds should be pellet inoculated with the appropriate bacteria. Inoculation rates should be four times that required for dry seeding.

CONSTRUCTION GUIDELINES

- The time allowed between placement of seed in the hydraulic mulcher and the emptying of the hydraulic mulcher tank should not exceed 30 minutes.
- Wood fiber may be dyed to aid in uniform placement. Dye should not stain concrete or painted surfaces nor injure plant or animal life when applied at the manufacturer's recommended rate.
- Application of the slurry should proceed until a uniform cover is achieved.
- The applicator should not be directed at one location for too long a period of time or the applied water will cause erosion.

MAINTENANCE

Hydraulically-mulched slopes should be inspected periodically for damage due to wind, water, or human disturbance. Repair all damaged areas immediately using hydraulic mulching at the original specifications or straw mulch.

BMP #123 - Geotextile

DESCRIPTION

Geotextiles are porous fabrics known in the construction industry as filter fabrics, road rugs, synthetic fabrics, construction fabrics, or simply fabrics. Geotextiles are manufactured by weaving or bonding fibers made from synthetic materials such as polypropylene, polyester, polyethylene, nylon, polyvinyl chloride, glass, and various mixtures of these materials.

The material is applied from a roll and anchored into place to provide a continuous sheet over the exposed slope or surface. This sheeting reduces raindrop impact and surface erosion on disturbed soils. It can also protect new vegetation and aid in growth and establishment of vegetation by retarding evaporation of soil moisture. They can also be used on benched slopes.

Geotextiles are used for a variety of purposes as separators or reinforcement, for filtration and drainage, and for erosion control on slopes or stream banks.

Matting or netting made of biodegradable materials (such as jute, wood fiber, straw, coconut, paper, or cotton) can be used for many of these same purposes, but is not as durable. These products are discussed separately under BMP #124-Matting.

APPLICATIONS

Geotextiles are an effective tool to prevent surface erosion and promote rapid establishment of a permanent (or temporary) vegetative cover. The two main applications are for slope protection and as a flexible channel lining. For slope protection applications, the fabrics are useful in preventing the loss of top soil, thereby reducing surface erosion and promoting establishment of vegetative cover. They should be given serious consideration where slope, high flows, or other factors prevent use of organic matting.

Used alone, geotextiles can function as erosion control matting to stabilize channels and swales or to protect recently-planted seedlings until they become established. They may be placed in ditches or along stream banks to protect new plantings if more elaborate measures such as riprap or rock revetments are not appropriate. The purpose of this application is to protect the integrity of the ditch or stream while permanent vegetative cover becomes established.

Geotextiles are also used as separators. An example of such a use is geotextile as a separator between riprap and soil. This "sandwiching" prevents the soil from being eroded from beneath the riprap.

The primary advantages of geotextiles are:

- Relatively low cost for many applications.

Targeted Pollutants	
<input checked="" type="radio"/>	Sediment
<input type="radio"/>	Phosphorus
<input type="radio"/>	Trace metals
<input type="radio"/>	Bacteria
<input type="radio"/>	Petroleum hydrocarbons

Physical Limits	
Drainage area	<u>100 ac</u>
Max slope	<u>100%</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>N/A</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>no</u>

- Ease and convenience for many applications.
- Quick and effective protection against erosion problems.
- Design methodologies are available for many uses.
- A wide variety of geotextile products is available to match specific needs.
- Synthetic geotextiles may be removed and reused if economically feasible.
- Better resistance to high flow situations than organic matting.

LIMITATIONS

- Effectiveness may be reduced drastically if the fabric is not properly selected, designed, or installed.
- Many synthetic geotextiles are sensitive to light and must be protected prior to installation.
- Geotextiles that are not biodegradable should not be used where their presence or appearance is aesthetically unacceptable.
- Should not be placed on 1:1 (50%) slopes if they are to be covered with overlying material.

DESIGN PARAMETERS

Maximum slope steepness: Products are available for up to 1:1 steepness.

Durability/decomposition: Some synthetic geotextiles persist a very long time and should be considered a permanent measure. Others remain effective for less than a year. Those types designed to assist in establishment of vegetation will eventually photodegrade or decompose. If a short-term, degradable product is needed, see BMP #124-Matting.

Materials: In determining how much fabric is needed, allow for an overlap of 4 in (100 mm) on both sides of each roll and 3 ft (1 m) at the ends of rolls. Also, the fabric should extend beyond the edge of the exposed area at least 1 ft (300 mm) at the sides and 3 feet (1 m) at the top and bottom. Staples should be of 1/10 in (3 mm) diameter (or heavier) steel wire. Allow for a spacing of approximately 5 ft (1.5 m) apart along the sides and center of each roll and not more than 1 ft (300 mm) apart along upper end of a roll or at the overlap of two rolls.

CONSTRUCTION GUIDELINES

- The soil must be reasonably smooth. Fill and compact any rills and gullies. Remove protruding rocks and other obstructions.
- Apply the individual rolls up and down the slope, from the top to the bottom-- never along the contour.

- Overlap the sides of rolls at least 4 in (100 mm), and make sure there is at least a 3 ft (1 m) overlap when an uphill roll joins to a downhill roll. The uphill roll should overlie the downhill roll.
- Extend the fabric beyond the edge of the mulched or seeded area at least 300 mm at the sides and 3 ft (1 m) at the top and bottom of the area. If existing vegetation or structures mark the boundaries of the area, the fabric should continue into the stable vegetated area or to the edge of the structure.
- At the top of the area, bury the end of each roll in a trench at least 8 in (200 mm) deep. The trench should then be backfilled and tamped.
- Staples should be driven perpendicularly into the slope face. Place them approximately 5 ft (1.5 m) apart down the sides and center of the roll, and not more than 1 ft (300 mm) apart at the upper end of a roll or at the end overlap of two rolls.
- Be sure the fabric makes uniform contact with the slope face underneath. No "bridging" of rills or gullies should be allowed.

MAINTENANCE

Inspect weekly or monthly and within 24 hours after each runoff-producing storm. To assure proper functioning, complete one inspection during the first runoff-producing event after installation. If fabric sheeting is damaged or missing, replace it immediately to restore full protection. Also inspect to ensure that channelization and erosion is not occurring underneath fabric (sediment outwash is the most visible sign of this.)

Products used for temporary control may be removed and reused, if this can be done without leaving the area susceptible to erosion.

BMP #124 - Matting

DESCRIPTION

A porous net or fibrous sheet that is laid over the ground surface for slope stabilization and erosion control, or to hold a mulch in place and protect it against wind or water damage. Matting and netting are sometimes classified as geotextiles (see BMP #123), but in this catalog, matting is considered to be materials made from biodegradable materials including straw, coconut (coir), jute, wood fiber (excelsior), paper, and cotton. Some of these organic materials may be held in place by plastic netting.

APPLICATIONS

A wide variety of matting materials may be used for erosion control. Most are of two main types: woven—such as jute, or bonded to plastic—such as excelsior. Application examples for these two types are listed below.

Jute matting: Jute matting or netting is available as a heavy fiber net which is generally purchased in rolls and is stapled/anchored to slopes to provide a uniform covering. This covering protects mulches, provides additional water-holding capacity, and aids in moderating environmental fluctuations near the ground surface (as does a mulch).

Jute matting can be applied over straw, grass hay, wood fiber, or manure mulches when wind or water damage would occur without a protective net. Matting is the best single method for protecting the integrity of a mulched area. It may be applied alone as an alternative to straw or wood fiber mulches on flat sites for dust control and seed germination enhancement, but should not be applied alone where runoff quantities are significant.

Wood fiber (Excelsior) matting: Wood fiber matting is made by bonding wood excelsior fibers to a paper or plastic reinforcing net. The matting is generally purchased in rolls and stapled to slopes to provide a uniform covering which can protect mulches, provide enhanced water-holding capacity, and aid in moderating environmental fluctuations near the ground surface.

Matting can be useful in the following circumstances:

- Construction sites becoming temporarily inactive (inactive period greater than two weeks and less than one year).
- Graded areas receiving permanent revegetation treatment by seeding.
- Bare areas receiving permanent revegetation treatment by seeding.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>100 ac</u>
Max slope	<u>100%</u>
Min bedrock depth	<u>2 ft</u>
Min water table	<u>N/A</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>no</u>

Plastic netting: Plastic netting (photo/biodegradable) is a monolithic plastic clothlike material. It is used primarily to hold straw and other materials in place. Plastic netting is more durable than jute or wood fiber matting. It is much easier to handle and requires less labor, but has no mulch capabilities itself. Plastic netting alone provides no soil stabilization or erosion control. It is best used to hold down mulches until vegetation becomes established.

LIMITATIONS

- Should not be used where overland water flow will exceed 6.5 ft/s (2 m/s). Because of the following characteristics of plastic netting and wood fiber matting, jute matting, straw or straw coconut matting are preferred.
- Plastic netting does not function as a mulch (as does jute matting) since it does not absorb water. When plastic netting is used to anchor straw mulch, it increases the effectiveness of the mulch, but does not provide direct control of erosion and sedimentation or nutrient generation. Straw mulch rates should be increased 25 percent when plastic netting is used instead of jute or straw.
- Wood fiber matting is more difficult to put in place than jute, and is less predictable in controlling erosion. Properly applied, it can be as effective as jute matting at sediment and nutrient reduction. However, it is often 10 to 20 percent less effective.

DESIGN PARAMETERS

- Jute matting should be fiber cloth of a uniform plain weave, undyed and unbleached single jute yarn, 3 to 4 ft (1.0 to 1.2 m) wide and weighing an average 0.4 lb per linear foot (600 grams per linear meter) of cloth with a tolerance of plus or minus 5 percent. It should have approximately 78 warp ends per width of cloth and 45 weft ends per linear meter of cloth. The yarn shall be of a loosely twisted construction having an average twist of not less than 6.3 turns per 4 in (100 mm) and should not vary in thickness by more than half of its normal diameter.
- Wood fiber matting should consist of machine-produced mats of curled wood excelsior, of which 80 percent have a 8 in (200 mm) or longer fiber length. It should be of consistent thickness with the fiber evenly distributed over the entire area of the blanket (backing). The top side of each blanket should be covered with a 1 x 3 in (25 x 75 mm) weave of twisted Kraft paper or biodegradable plastic mesh that has a high wet strength. Blankets should be fire and smolder resistant and contain no chemical additives. Blankets shall be in rolls 3 to 4 ft (1.0 to 1.2 m) wide and 130 to 200 ft (40 to 60 m) long.
- Plastic netting with mesh opening from 1/10 x 1/10 in (3 x 3 mm) to 1/5 x 1/5 in (6 x 6 mm) should be applied over straw mulch similarly to the method specified below for jute matting.

Effectiveness: Jute matting acts similarly to straw mulch or hydromulch. Sediment reduction is typically 70 to 90 percent for up to 6 months, 40 to 60 percent for up to 2 years, and 10 to 30 percent beyond 2 years. Nutrient reduction is estimated at 50

to 70 percent for 6 months, 20 to 50 percent for up to 2 years, and 0 to 10 percent beyond 2 years.

Due to the difficulty of proper application, wood excelsior matting has a more variable effectiveness than straw, jute, or hydromulch. Properly applied, it can be as effective. Sediment reduction should range from 50 to 90 percent, 20 to 60 percent, and 0 to 30 percent in 6 months, 2 years, and beyond 2 years, respectively. Nutrient reductions for the same time periods are estimated to be 30 to 70 percent, 10 to 50 percent, and 0 to 10 percent.

CONSTRUCTION GUIDELINES

The following guidelines apply to all matting and netting installations.

- The soil must be reasonably smooth. Fill and compact any gullies and rills. Rocks, vegetation or other obstructions which rise above the level of the soil should be removed.
- After site preparation and seeding (if any), the rolls of netting or matting should be rolled onto the surface from the top of the slope to the bottom of the slope. It is preferred that rolls are not constructed in a horizontal direction across the slope face. The rolling should follow water flow direction.
- At the top of the area, bury the end of each roll in a trench at least 8 in (200 mm) deep. The trench should then be backfilled and tamped.
- Overlap the sides of rolls at least 4in (100 mm), and make sure that there is at least a one-meter overlap when an uphill roll joins to a downhill roll. The uphill roll should overlie the downhill roll.
- Extend the matting beyond the edge of the mulched or seeded area at least 1 ft (300 mm) at the sides and one meter at the top and bottom of the area. If existing vegetation or structures mark the boundaries of the area, the matting should continue into the stable vegetated area or to the edge of the structure.
- Staples should be driven perpendicularly into the slope face. Place them approximately 3 ft (1.0 m) apart down the sides and center of the roll, and not more than 1 ft (300 mm) apart at the upper end of a roll or at the end overlap of two rolls.
- Staples should be of heavy gauge wire 7/100 in (2 mm in diameter or greater), bent into a "U" shape, with legs at least 6 in (150 mm) long, and a 1 in (25 mm) crown. Use longer staples and greater frequency in loose or sandy soil.
- Be sure the matting makes uniform contact with the slope face underneath. No "bridging" of rills or gullies should be allowed.
- If wood fiber matting is to be applied without other mulches, the minimum thickness of mat should be 1.5 (40 mm). If the mat is to be applied over other mulches, the minimum mat thickness shall be 0.6 (15 mm).

MAINTENANCE

Inspect at regular intervals and after each runoff-producing storm event. Make repairs as necessary to restore complete coverage and full effectiveness of the matting or netting.

BMP #125 - Pipe Slope Drain

DESCRIPTION

A pipe slope drain is a device used to carry concentrated runoff from the top to the bottom of a slope that has already been damaged by erosion or is at high risk for erosion. It may be used to convey runoff from offsite around a disturbed portion of the site. It may also be used to drain saturated slopes that have the potential for soil slides. Pipe slope drains can be either temporary or permanent, depending on the method of installation and the material used.

Pipe slope drains are made of flexible tubing or rigid pipe with a prefabricated entrance section. Other temporary slope drains may use plastic sheeting, stone gutters, fiber mats, riprap, concrete or asphalt ditches, or half-round pipe. Outlet protection such as riprap must be provided for velocity dissipation at the drain outlet.

APPLICATIONS

Pipe slope drains are used whenever it is necessary to convey water down a slope without causing erosion. They are especially effective before a slope has been stabilized or before permanent drainage structures are ready for use. Pipe slope drains may be used with other devices, including sediment traps (BMP #137), and vegetative buffer strips (BMP #136).

Temporary pipe slope drains, usually flexible tubing or conduit, may be installed prior to the construction of permanent drainage structures. Permanent slope drains may be placed on or beneath the ground surface; pipes, sectional downdrains, paved chutes, or clay tiles may be used.

Pipe slope drains are appropriate in the following general locations:

- On cut or fill slopes before permanent storm water drainage structures have been installed.
- Where earth dikes or other diversion measures have been used to concentrate flows.
- On any slope where concentrated runoff crossing the face of the slope may cause gullies, channel erosion, or saturation of slide-prone soils.
- As an outlet for a natural drainageway.

The drainage area may be up to 10 acres (4 hectares).

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>5 ac</u>
Max slope	<u>50%</u>
Min bedrock depth	<u>2 ft</u>
Min water table	<u>5 ft</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>yes</u>

LIMITATIONS

Not suitable for drainage areas greater than 10 acres (4 hectares).

DESIGN PARAMETERS

Pipe sizing: Typical relationships between area and pipe diameter are shown below:

RELATIONSHIP BETWEEN AREA AND PIPE DIAMETER	
Maximum Drainage Area acres (hectares)	Pipe Diameter in (millimeters)
0.5 acres (0.2)	12 in (300)
1.5 acres (0.6)	18 in (450)
2.5 acres (1.0)	21 in (525)
3.5 acres (1.4)	24 in (600)
5.0 acres (2.0)	30 in (750)

Spacing: For a two-lane highway construction project, experience has shown that temporary slope drains should be spaced at a longitudinal interval of 500 ft (150 meters) on a 2 percent grade, 200 ft (60 meters) on a 4 percent grade, and as may be dictated by field conditions on a grade of 5 percent or greater.

Materials: Pipe may be any heavy-duty, flexible tubing designed for this purpose, including nonperforated, corrugated plastic pipe; corrugated metal pipe; bituminous fiber pipe; or specially designed flexible tubing.

A standard flared end section secured with a watertight fitting should be used for the inlet. A standard T-section fitting may also be used. Extension collars should be 1 ft (300 mm) long segments of corrugated pipe. All fittings must be watertight.

Slope of drain: Try for a 3 percent minimum.

CONSTRUCTION GUIDELINES

Temporary slope drains should be installed with inlets at points where water is discharged from ditches, berms, or other points of concentrated flow. All drains should be anchored to the slope to prevent disruption by water or other forces. The inlet section of the drain should be properly installed to funnel the flow into the drain. It is often necessary to construct cross berms to direct flow into the inlet.

- Place the pipe slope drain on undisturbed or well-compacted soil.

- Soil around and under the entrance section must be hand tamped in 4 to 8 in (100- to 200-mm) lifts to the top of the dike to prevent piping failure around the inlet.
- Place filter cloth under the inlet, extend it 3 to 5 ft (1 to 2 meters) in front of the inlet, and key it in 6 in (150 mm) on all sides to prevent erosion. A 6 in (150-mm) metal toe plate may also be used for this purpose.
- Securely stake the pipe slope drain to the slope at intervals of 10 ft (3 meters) or less, using grommets provided for this purpose.
- Make sure that all slope drain sections are securely fastened together and have watertight fittings.
- Extend the pipe beyond the toe of the slope and discharge at a nonerosive velocity into a stabilized area or to a sedimentation trap or pond. Use rock outlet protection if necessary.
- The pipe slope drain should have a slope of 3 percent or steeper.
- The height at the centerline of the earth dike should range from a minimum of 1 ft (300 mm) over the pipe to twice the diameter of the pipe measured from the invert of the pipe. It should also be at least 6 in (150 mm) higher than the adjoining ridge on either side.
- At no point along the dike will the elevation of the top of the dike be less than 6 in (150 mm) higher than the top of the pipe.
- Immediately stabilize all areas disturbed by installation or removal of the pipe slope drain.

MAINTENANCE

- Inspect the slope drain regularly and after every storm. Make any necessary repairs within 7 days or before the next storm (whichever comes first).
- Check to see that water is not bypassing the inlet or undercutting the inlet or pipe. If necessary, install headwalls or sandbags to prevent bypass flow.
- Check for erosion at the outlet point and check the pipe for breaks or clogs. Install additional outlet protection if needed and immediately repair the breaks and clean any clogs.
- Do not allow construction traffic to cross the pipe slope drain and do not place any material on it.
- If a sediment trap has been provided, clean it out when the sediment level reaches one-third to one-half the design volume.
- A temporary slope drain should remain in place up to 30 days after slopes have been completely stabilized.

BMP #126 - Slope Roughening

DESCRIPTION

This BMP entails establishing a rough soil surface by creating horizontal grooves, furrows, depressions, or steps running parallel to the slope contour over the entire face of a slope. This reduces the speed of runoff, increases infiltration, and traps sediment. It also helps establish vegetative cover by reducing runoff velocity and providing stable, level areas where seedlings can take hold and grow. This measure may be used prior to seeding/planting and should be applied using appropriate machinery.

Alternately, in some cases, leaving the slope in a roughened condition will control erosion and provide suitable rooting areas for plant seedlings better than a finely-graded slope. Other measures, such as flow diversion must be used to keep erosion from occurring while vegetation is being established.

APPLICATIONS

Slope and surface roughening provide simple, inexpensive, and immediate short-term erosion control for bare soil where vegetative cover is not yet established. The practice is appropriate for all slopes, although different methods are used depending on the steepness of the slope, the type of slope (cut or fill), soil and rock characteristics, future mowing and maintenance requirements, and type of equipment available. All slopes steeper than 3:1 and greater than 5 ft (1.5 meters) vertical height require roughening and may also require terracing, grooving, or furrowing prior to seeding.

LIMITATIONS

This BMP is limited to slopes in medium to highly cohesive soils or in soft rock which can be excavated without ripping. Slope angle must be gentle enough to permit access to heavy equipment. The method is not applicable for use in moraines and other depositional soils. In addition, serration is of limited effectiveness in anything more than a gentle rain, and it is only a temporary measure. If the roughening is washed away in a heavy storm, the surface will have to be reroughened and reseeded.

This BMP is not a stand-alone measure, it must be implemented in conjunction with other BMPs.

DESIGN PARAMETERS

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>1 ac</u>
Max slope	<u>20%</u>
Min bedrock depth	<u>3 ft</u>
Min water table	<u>5 ft</u>
SCS soil type	<u>BCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>no</u>

Slope roughening can be used with seeding, planting, and temporary mulching to stabilize an area. For steeper slopes and slopes that will be left roughened for longer period of time, try a combination of surface roughening and vegetative stabilization. Surface roughening should be applied immediately after grading activities have ceased (temporarily or permanently) in an area.

Different methods can be used to roughen the slope surface. They include stair-step grading, grooving (using disks, spring harrows, or teeth on a front-end loader), and tracking (driving a crawler tractor up and down a slope, leaving the cleat imprints perpendicular to the slope). The selection of an appropriate method depends on the grade of the slope, mowing requirements after vegetative cover is established, whether the slope was formed by cutting or filling, and type of equipment available.

Slopes steeper than 2:1: Any slope steeper than 2:1 should be terraced or stair-step graded, with benches wide enough to retain sediment eroded from the slope above. See BMP #127 (Gradient Terracing).

Slopes between 3:1 and 2:1: Cut slopes with a gradient steeper than 3:1 but less than 2:1 should be stair-step graded or groove cut. Stair-step grading works well with soils containing large amounts of small rock. Each step catches material discarded from above and provides a level site where vegetation can grow. Stairs should be wide enough to work with standard earth-moving equipment. Grooving can be done by any implement that can be safely operated on the slope, including those described above. Grooves should not be less than 3.1 in (80 mm) deep or more than 16 in (400 mm) apart.

Fill slopes with a gradient steeper than 3:1 but less than 2:1 should be compacted every 12 in (300 mm) of depth. The face of the slope should consist of loose, uncompacted fill 4 to 6 in (100 to 150 mm) deep that can be left rough or can be grooved as described above, if necessary.

It is important to avoid excessive compacting of the soil surface, especially when tracking, because soil compaction inhibits vegetation growth and causes higher runoff speed. Therefore, it is best to limit roughening with tracked machinery to sandy soils that do not compact easily and to avoid tracking on clay soils.

Slopes flatter than 3:1: Any cut or filled slope that will be mowed should have a gradient less than 3:1. Such a slope can be roughened with shallow grooves parallel to the slope contour by using normal tilling. Grooves should be close together (less than 10 in (250 mm)) and not less than 1 in (25 mm) deep.

CONSTRUCTION GUIDELINES

Timing of work: To slow erosion, slope or surface roughening should be done as soon as possible after the vegetation has been removed from the slope. The roughened areas should be seeded as quickly as possible, preferably within seven days after serration/roughening if weather conditions or water availability permits. In material that ravels or sloughs readily, delay the revegetation effort until at least 30 days after slope serration.

On slopes composed of material that weathers rapidly, slope roughening should be completed early in the summer. This will allow material to slough off the step face prior to fall seeding or planting so it does not smother the seeds or seedlings.

Equipment: Various types of heavy equipment of various kinds can be successfully used for slope roughening:

- A front-end loader equipped with disks, harrows, or teeth can make grooves across the slope.
- Driving a crawler tractor up and down the slope will make cleat imprints perpendicular to the slope.
- A dozer, equipped with a special blade containing a series of square grooves and positioned at the same angle as the cut, can serrate the slope along the contours.

Methods:

- Fill slopes constructed with highly erodible soils or soils containing high-clay contents shall be minimally compacted prior to establishing a roughened surface. However, excessive compaction of the surface soil is undesirable because of reduction in infiltration and suppression of vegetation rooting.
- Make the grooves or depressions approximately horizontal (or parallel the roadway grade if its profile grade is less than 2 percent).
- Excavate each series of grooves in the opposite direction from the preceding series to minimize buildup of loose material at the ends of the steps or cuts.
- Loose material collected at the ends of steps should be removed and the ends blended into the natural ground surface.
- If encountering rock that is too hard to rip, try to blend the grooves into the rock.
- Remove materials which fall into the ditchline or roadway and any rock fragments larger than one-third the shelf width.
- Construct a slope bench at the bottom of the slope face.

MAINTENANCE

Inspect the slopes periodically for damage from surface runoff and seepage and inspect after each runoff-producing storm. Damage caused by construction-related activities should be repaired as soon as possible. If rills appear (small watercourses that have steep sides and are usually less than 100 mm deep), they should be immediately filled, and the slope should be promptly regraded and adequately protected.

BMP #127 - Gradient Terracing

DESCRIPTION

Gradient terracing is a term used to describe an earth embankment or ridge-and-channel arrangement constructed along the face of a slope at regular intervals. Gradient terraces are constructed at a positive grade. They reduce erosion damage by capturing surface runoff and directing it to a stable outlet at a speed that minimizes erosion.

APPLICATIONS

Gradient terraces are usually limited to use on long, steep slopes that have a water erosion problem or where it is anticipated that water erosion will be a problem. They are used for reducing runoff velocity and increasing the distance of overland runoff flow. They hold moisture better than do smooth slopes, and they minimize sediment loading of surface runoff.

LIMITATIONS

Gradient terraces should not be constructed on excessively steep slopes or in areas with sandy or rocky soils. They will be effective only where suitable runoff outlets will be available. Gradient terraces may significantly increase cut and fill costs and cause sloughing if too much water infiltrates the soil.

DESIGN PARAMETERS

Gradient terraces should be designed and installed according to a plan determined by an engineering survey and layout. It is important that gradient terraces are designed with adequate outlets, such as a grassed waterway, vegetated area, or tile outlet. In all cases, the outlet should direct the runoff from the terrace system to a point where the outflow will not cause erosion or other damage. Vegetative cover should be used in the outlet where possible. The design elevation of the water surface of the terrace should not be lower than that at the junction of the outlet area when both are operating at design flow. Terraces can be constructed with linings to carry water to the outlet and can be used with a dike or similar measure above the terrace to divert runoff from reaching the terraced slope.

CONSTRUCTION GUIDELINES

Construction of gradient terraces should be completed using equipment that is capable of meeting the specification established in the construction plans.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area 10 ac

Max slope 50%

Min bedrock depth 6 ft

Min water table 8 ft

SCS soil type BCD

Freeze/Thaw good

Drainage/Flood control Yes

MAINTENANCE

Inspect the gradient terraces regularly during project construction and inspect them after any major storm. If used as a permanent BMP, inspect at least once a year after project completion and after major storms. Evaluate whether the terrace is functioning effectively as a runoff collection and diversion device and note whether other stabilization measures (including vegetation) are performing effectively. Take prompt action as needed to ensure proper drainage and slope stability.

BMP #128 - Retaining Walls

DESCRIPTION

Walls constructed against a slope or stream bank to prevent slope erosion or slope failure, or undercutting of the bank. Examples of retaining wall materials include: concrete, concrete masonry, rock, wood planking or railroad ties, and metal bins. Also see BMP #129- Gabions.

APPLICATIONS

For slope protection or stabilization under extreme conditions or to protect erodible, unstable stream banks.

Concrete retaining wall: An engineered concrete wall which is designed to stabilize a slope and retain the rock or soil behind it. In addition to a solid concrete wall, precast, interlocking concrete blocks could be used.

Masonry retaining wall: An engineered structure similar to a concrete retaining wall but using masonry blocks, usually of specific design for aesthetic appeal.

Native rock retaining wall: A low-gravity wall constructed of rock materials native to the construction site. It provides an aesthetically attractive method of stabilizing a slope. Native rock is suitable for walls up to about 6.5 feet (2 meters) in vertical height where the slope is steeper than 2:1 behind the wall. They can be higher on slopes of 2:1 (or flatter) gradient with proper engineering design.

Redwood (wood planking) retaining wall: A retaining wall constructed of redwood planking and posts. Redwood retaining walls are useful for relatively small slopes of loose material which are underlain by a rigid rock base material or a firm, non-plastic subsoil with high shear strength. The firm foundation is necessary to securely anchor the wall. Can construct in poorer foundation soils by using longer posts and closer spacing, 3 feet (1.0 meter) maximum. Redwood will generally last longer than other woods.

Railroad tie retaining wall: A retaining wall constructed of railroad ties. These are useful for relatively small slopes of loose material which are underlain by a rigid base of rock or a firm, non-plastic subsoil. The wall must be securely anchored to the rock base or firm subsoil.

Mechanically stabilized earth (MSE) retaining walls: The following are considered MSE walls: reinforced earth, retained earth, Hilfiker, Genesis (Keystone/Tensar), and T-wall. All of those designs use some type of anchored structure to retain earthen materials behind a wall.

LIMITATIONS

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>unlimited</u>
Max slope	<u>67 %</u>
Min bedrock depth	<u>N/A</u>
Min water table	<u>3</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>fair</u>
Drainage/Flood control	<u>no</u>

Retaining walls should be considered a permanent measure only. Cost and site-specific design requirements limit their use to situations where other stabilization measures would be ineffective or aesthetically unacceptable.

- Native rock retaining walls have a maximum height of about 6.5 feet (2 meters).
- Redwood retaining walls require a firm foundation to anchor the wall.
- Wood treated with creosote or other chemicals to retard decay may leach out and cause toxic effects. Treated railroad ties should not be used along sensitive streams for instance.

DESIGN PARAMETERS

Retaining walls require a site-specific design. Wall heights, requirements for drainage, and suitable materials must be determined through on-site inspections. Listed in this fact sheet are some suggestions of appropriate applications of retaining walls for erosion control. All types of retaining walls should conform to local building codes and ordinances. Plans and specifications should be prepared by professional engineers for most installations, including all that fall outside the parameters listed under the physical limits.

CONSTRUCTION GUIDELINES

Concrete retaining walls: Construct as designed by a professional engineer or as shown on the plans.

Masonry retaining walls: Construct as designed by a professional engineer or as shown on the plans.

Native rock retaining walls:

- Remove all large rocks from the eroding slope face and stockpile on site.
- Excavate a footing trench along the toe of the slope.
- Place the largest rocks in the footing trench with their longitudinal axis normal to the embankment face. Arrange subsequent rock layers so that each rock above the foundation course has a three-point bearing on the underlying rocks.
- The slope of the wall should be between 1/2:1 and vertical, depending upon the height of the wall, the height of the slope, the width of the right-of-way, or other limitations on space.
- Obtain fill material from the slope and place it behind the rock wall. Slope above the wall should be maintained at 2:1 or less with a slope bench at the toe. Backfill the footing trench with excavated material.
- If a roadway is located at the toe of the wall, pave the roadway up to the base of the rock wall and provide roadway curb for water transport. If a

roadway is not located at the toe of the retaining wall, slope the backfilled material away from the wall at 2 percent and stabilize it.

- Revegetate the stabilized slope immediately with a method applicable to the particular site. (See Sections 4.5 and 5.2 of this manual.)

Redwood (wood planking) retaining wall:

- Prepare the site by rough grading the slope surface, then work from the bottom of the slope towards the top.
- Set the bottom course of redwood posts into rigid base foundation material and secure with a concrete collar.
- Install planking on the upslope side of the posts. Provide sufficient vertical spacing to allow drainage at the base of the wall and between planks.
- Backfill behind the wall with material from the slope above. Slope the backfill material between redwood walls at 2 percent toward the top of the lower wall.
- Proceed in a similar fashion up the slope to the desired height.
- Revegetate the backfilled benches behind the walls according to procedures applicable to the specific site (see Sections 4.5 and 5.2 of this manual).

Railroad tie retaining wall:

- Prepare the site by rough grading the slope surface, then work from the bottom of the slope toward the top.
- Set the bottom course of railroad ties onto a rigid base foundation material and secure with pinning or metal collars.
- Backfill behind the wall with material from the slope above. Slope the backfill material between the tiers of railroad ties at 2 percent toward the top of the lower wall. If the engineered wall requires deadmen, install in accordance with the design drawing.
- Proceed in a similar fashion up the slope to the desired height. If the total height exceeds 2 meters, the wall must be designed and approved by a registered engineer.
- Revegetate the backfilled benches behind the walls according to procedures applicable to the specific site (see Sections 4.5 and 5.2 of this manual).

MSE retaining wall:

- Prepare the site and construct as shown on the plans.

MAINTENANCE

Retaining walls must be inspected periodically on regular intervals to detect signs of structural failure, and to check for damage caused by subsurface drainage or

material sloughing. In stream bank installations, inspect for signs of undercutting and other instability. Make all repairs promptly, as needed.

BMP #129 - Gabions

DESCRIPTION

Rectangular wire-mesh cages that are filled with rock and wired together to form a protective but permeable structure for slope stabilization and erosion control .

APPLICATIONS

Gabions can be used as retaining walls to mechanically stabilize steep slopes, or for revetments, weirs, channel linings, culvert headwalls, and culvert outlet aprons. They are particularly useful where seepage is anticipated. For related information, refer to BMP #128 (Retaining walls).

LIMITATIONS

Materials costs and professional design requirements may make use of gabions impractical. Gabions may alter stream dynamics or adversely affect wildlife habitat. When used in channels with high sediment loads, the galvanizing wire on the cages quickly wears off, causing rusting and the premature failure of the cages.

DESIGN PARAMETERS

- Construction plans and specifications should be prepared by professionals familiar with the use of gabions. The structure must be able to handle expected storm and flood conditions.
- On streambank applications, the foundation is an important design feature of the structure. Consider the potential for the stream to erode the sides and bottom of the channel and make sure the gabions will be supported properly.
- The gabion structure must be securely "keyed" into the foundation and abutment surfaces. The rock filling holds the gabions in place by gravity, but tie-backs may be used if conditions warrant additional structural strength.
- Gabions are usually placed on a filter blanket (gravel layer of filter cloth) or both.

Materials

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area unlimited

Max slope 40%

Min bedrock depth N/A

Min water table 2 ft

SCS soil type ABCD

Freeze/Thaw good

Drainage/Flood control no

Gabions should be fabricated in such a manner that the sides, ends, lids, and diaphragms can be assembled at the construction site into a rectangular basket of required sizes. Gabions should be of single unit construction -- the base, ends, and sides should either be woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh.

Where the length of the gabion exceeds its horizontal width, the gabion should be equally divided by diaphragms, of the same mesh and gage as the body of the gabions, into cells whose length does not exceed the horizontal width. The gabion should be furnished with the necessary diaphragms secured in proper position on the base section in such a manner that no additional tying at this juncture will be necessary.

All perimeter edges should be securely selvaged or bound so that the joints formed by tying the selvages have the same strength as the body of the mesh.

The fill material for the wire gabions should be rock ranging in size from a minimum of 4 inches (100 mm) to a maximum of 8 inches (200 mm), both measured in the greatest dimension. Rock should be sound, durable, well graded, and should be obtained from a source approved by the Engineer.

See the ITD Catalog of Best Management Practices (July 1994) for additional detailed design criteria for gabions.

CONSTRUCTION GUIDELINES

Empty gabion baskets should be placed on a smooth, firm foundation excavated as directed by the plans. Each row, tier, or layer of baskets should be reasonably straight and should conform to the line and grade shown on the plans or established by the Project Engineer. The empty gabion baskets should be fastened to the adjacent baskets along the top and vertical edges. Each layer should be fastened to the underlying layer along the front, back and ends. Fastening should be performed in the same manner as provided for assembling the gabion units.

Unless otherwise indicated on the plans, the vertical joints between basket units of adjacent tiers or layers, along the length of the structure, should be staggered by at least one cell.

Before filling each gabion with rock, all kinks and folds in the wire mesh should be removed and all baskets should be properly aligned. A standard fence stretcher, chain fall or steel rod may be used to stretch the wire baskets and hold alignment.

The gabion cells should be carefully filled with rock placed by hand/machine in such a manner that the alignment of the structure will be maintained and so as to avoid bulges and to minimize voids. All exposed rock surface should have a reasonably smooth and neat appearance. No sharp rock edges should project through the wire mesh.

The gabion cells in any row or layer should be filled in stages so that local deformations may be avoided. At no time should any cell be filled to a depth exceeding 12 inches (305 mm) more than any adjacent cell.

The layer of rock should completely fill the gabion basket so that the lid will bear on the rock when it is secured. The lid should be joined to the sides, ends, and diaphragms in the same manner as specified for joining the vertical edges. The gabion basket lid should be secured so that no more than 1 inch (25 mm) gap remains at any connection.

Gabion rows or layers not completed at the end of each shift should have the last gabion filled with rock tied internally as an end gabion.

The area behind the gabion structure should be backfilled with granular material. Geotextile, if required, should be spread uniformly over the back of the gabion structure as shown on the plans. Joining edges of the geotextile should be overlapped a minimum of 12 inches (305 mm) and should be anchored in position with approved anchoring devices. The Contractor should place the backfill material in a manner that will not tear, puncture, or shift the geotextile.

See the ITD Catalog of Best Management Practices (July 1994) for additional detailed design criteria for gabions.

MAINTENANCE

Inspect regularly and after each major storm. Check for signs of undercutting or other instability. Repair damaged areas immediately to restore designed effectiveness and to prevent damage or erosion of the slope or streambank.

Check wire of cages for rusting and wear. Repair where possible or replace.

BMP #130 - Riprap Slope and Outlet Protection

DESCRIPTION

An arranged layer or pile of rock placed over the soil surface on slopes and at or below storm drain outfalls or temporary dikes.

Riprap used as slope protection protects against erosion and dissipates the energy of runoff or surface water flow. Outlet protection reduces the speed of concentrated storm water flows and thereby reduces erosion or scouring at storm water outlets. In addition, outlet protection lowers the potential for downstream erosion. This type of protection can be achieved through a variety of techniques, including stone or riprap outlet structures and armored scour holes installed below the storm drain outlet.

APPLICATIONS

For slope protection, use riprap or blanketed slopes. Outlet protection should be installed at the outlets of all pipes, culverts, catch basins, sediment basins, ponds, interceptor dikes, and swales or channel sections where the velocity of flow may cause erosion in the receiving channel. Outlet protection should also be used at outlets where the velocity of flow at the design capacity may result in plunge pools (small, permanent pools located at an inlet or outfall).

Outlet protection should be installed early during construction activities, but may be added at any time, as necessary.

LIMITATIONS

The minimum particle size of the rock must be sized for the maximum expected velocity of flow out of the outlet and the soil conditions where the outlet will be located.

DESIGN PARAMETERS

The design of rock outlet protection depends entirely on the location. Pipe outlets at the top of cuts or on slopes steeper than 10 percent, cannot be protected by rock aprons or riprap sections due to reconcentration of flows and high velocities encountered after the flow leaves the apron.

Tailwater depth: The depth of tailwater immediately below the pipe outlet must be determined for the design capacity of the pipe. If the tailwater depth is less than half

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area 5 ac

Max slope 40%

Min bedrock depth N/A

Min water table N/A

SCS soil type ABCD

Freeze/Thaw good

Drainage/flood control no

the diameter of the outlet pipe and the receiving stream is wide enough to accept divergence of the flow, it shall be classified as a Minimum Tailwater Condition. If the tailwater depth is greater than half the pipe diameter and the receiving stream will continue to confine the flow, it shall be classified as a Maximum Tailwater Condition. Pipes which outlet onto flat areas with no defined channel may be assumed to have a Minimum Tailwater Condition.

Apron Size: The apron length and width shall be determined according to the tailwater condition.

If the pipe discharges directly into a well-defined channel, the apron shall extend across the channel bottom and up the channel banks to an elevation one foot above the maximum tailwater depth or to the top of the bank, whichever is less.

The upstream end of the apron, adjacent to the pipe shall have a width two (2) times the diameter of the outlet pipe, or conform to pipe end section if used.

Bottom Grade: The outlet protection apron shall be constructed with no slope along its length. There shall be no overfall at the end of the apron. The elevation of the downstream end of the apron shall be equal to the elevation of the receiving channel or adjacent ground.

Alignment: The outlet protection apron shall be located so that there are no bends in the horizontal alignment.

Materials: The outlet protection may be done using rock riprap, grouted riprap or gabions (BMP #129). Riprap size shall be based on calculated shear stress. It shall be composed of a well graded mixture of stone size so that 50 percent of the pieces, by weight, shall be larger than the d50 size determined by using the charts. A well graded mixture as used herein is defined as a mixture composed primarily of larger stone sizes but with a sufficient mixture of other sizes to fill the smaller voids between the stones. The diameter of the largest stone size in such a mixture shall be 1.5 times the d50 size. Thickness: The minimum thickness of the riprap layer shall be 1.5 times the maximum stone diameter for d50 of 15 inches or less; and 1.2 times the maximum stone size for d50 greater than 15 inches. The following chart lists some examples:

ROCK RIPRAP SIZES AND THICKNESS

Unit shear stress (lb/ft ²)	d ₅₀ (inches)	d _{max} (inches)	Minimum blanket thickness (inches)
0.67	2	4	6
2.00	6	9	14
3.00	9	14	20
4.00	12	18	27
5.00	15	22	32

6.00	18	27	32
7.80	21	32	38
8.00	24	36	43

Unit shear stress calculated as $T = yds$

where:

T = shear stress in lb/ft^2

y = unit weight of water, $62.4 \text{ lb}/\text{ft}^3$

d = flow depth in ft

s = channel gradient in ft/ft

Stone Quality: Stone for riprap shall consist of field stone or rough unhewn quarry stone. The stone shall be hard and angular and of a quality that will not disintegrate on exposure to water or weathering. The specific gravity of the individual stones shall be at least 2.5.

Recycled concrete equivalent may be used provided it has a density of at least 150 pounds per cubic foot, and does not have any exposed steel or reinforcing bars.

Filter: A filter is a layer of material placed between the riprap and the underlying soil surface to prevent soil movement into and through the riprap. Riprap shall have a filter placed under it in all cases.

A filter can be of two general forms: A gravel layer or a plastic filter cloth. The plastic filter cloth can be woven or non-woven monofilament yarns, and shall meet these base requirements: thickness 10-60 mils, grab strength 90-120 lbs; and shall conform to ASTM D-1777 and ASTM D-1682.

Gravel filter blanket, when used, shall be designed by comparing particle sizes of the overlying material and the base material. Design criteria is available in any soils or civil engineering reference or from the National Resources Conservation Service (formerly the Soil Conservation Service).

DESIGN PROCEDURE AND EXAMPLES

1. Investigate the downstream channel to assure that non-erosive velocities can be maintained.
1. Determine the tailwater condition at the outlet to establish which curve to use.
2. Enter the appropriate chart with the depth of flow and discharge velocity to determine the riprap size and apron length required. It is noted that references to pipe diameter in the charts are based on full flow. For other than full pipe flow, the parameters of depth of flow and velocity must be used.

3. Calculate apron width at the downstream end if a flared section is to be employed.

Example 1: *Pipe Flow (full) with discharge to unconfined section*

A circular conduit is flowing full:

$Q = 280$ cfs, diam. = 66", tailwater (surface) is 2 ft. above pipe invert, (minimum tailwater condition)

Read $d_{50} = 1.2'$, and apron length 38'

Apron width = diam. + $L_a = 5.5 + 38 = 43.5'$

Example 2: *Box Flow (partial) with high tailwater*

A box conduit discharging under partial flow conditions. A concrete box 5.5' x 10' is flowing 5.0' deep, $Q = 600$ cfs and tailwater surface is 5' above invert (Max. tailwater condition).

$V = \frac{Q}{A} = \frac{600}{50} = 12$ fps

A 5x10

At the intersection of the curve $d = 60"$ and $V = 12$ fps, read $d_{50} = 0.4'$

Then reading to the $d = 60"$ curve, read apron length = 40'

Apron width, $W =$ conduit width + $0.04 L_a = 10 + (0.4)(40) = 26'$

Example 3: *Open Channel Flow with Discharge to Unconfined Section*

A trapezoidal concrete channel 5' wide with 2:1 side slopes is flowing 2' deep, $Q = 180$ cfs (velocity = 10 fps) and the tailwater surface downstream is 0.8' (minimum tailwater condition).

At intersection of the curve $d=24'$ and $V = 10$ fps, read $d_{50} = 0.7'$

Then reading up to the $d = 24"$ curve, read apron length = 22'

Apron width, $W =$ bottom of width of channel + $L_a = 5 + 22 = 27'$

Example 4: *Pipe flow (partial) with discharge to a confined section*

A 48" pipe is discharging with a depth of 3', $Q = 100$ cfs, and discharge velocity of 10 fps (established from partial flow analysis) to a confined trapezoidal channel with a 2' bottom, 2:1 side slopes, $n = .04$, and grade of 0.6%.

Calculation of the downstream channel (by Manning's Equation) indicates a normal depth of 3.1' and normal velocity of 3.9 fps.

Since the receiving channel is confined, the maximum tailwater condition controls.

At the intersection of $d = 36''$ and $v = 10$ fps, Read $d_{50} = 0.3'$

Reading up to the $d = 36''$ curve, read apron length = 30'

Since the maximum flow depth in this reach is 3.1', that is the minimum depth of riprap to be maintained for the entire length.

CONSTRUCTION GUIDELINES

- The subgrade for the filter, riprap or gabion shall be prepared to the required lines and grades. Any fill required in the subgrade shall be compacted to a density of approximately that of the surrounding undisturbed material.
- The rock or gravel shall conform to the specified grading limits when installed respectively in the riprap or filter.
- Filter cloth shall be protected from punching, cutting, or tearing. Any damage other than an occasional small hole shall be repaired by placing another piece of cloth over the damaged part or by completely replacing the cloth. All overlaps whether for repairs or for joining two pieces of cloth shall be a minimum of one foot.
- Stone for the riprap or gabion outlets may be placed by equipment. Both shall be constructed to the full course thickness in one operation and in such a manner as to avoid displacement of underlying materials. The stone for riprap or gabion outlets shall be delivered and placed in a manner that will insure that it is reasonably homogenous with the smaller stones and spalls filling the voids between the larger stones. Riprap shall be placed in a manner to prevent damage to the filter blanket or filter cloth. Hand placement will be required to the extent necessary to prevent damage to the permanent works.
- Complete construction of the outlet protection before allowing erosive flows to pass through the outlet.

MAINTENANCE

Once a riprap outlet has been installed, the maintenance needs are relatively low. Inspect after heavy storms and high flows for scouring under the outlet and dislodged stones, and repair damage promptly. For dikes, maintain the area upstream of the outlet structure so that accumulated sediments can be removed when they reach a depth of one-third the height of the dike, or 12 inches (300 mm), whichever is less.

BMP #131 - Inlet Protection

DESCRIPTION

Inlet protection consists of a filtering measure placed around an inlet or drain to trap sediment and prevent the sediment from entering the storm drain system. Additionally, it serves to prevent the silting-in of inlets, storm drainage systems, or receiving channels. Inlet protection may be composed of gravel and stone with a wire mesh filter, block and gravel, filter fabric, or sod. Care must be taken not to cause flooding with diverted flow.

APPLICATIONS

Inlet protection is appropriate for small drainage areas (less than 1 acre) where storm drains will be ready for use before the drainage area reaches final stabilization. Storm drain inlet protection is also used where:

- A permanent storm drain structure is being constructed on site and there is danger of sediment silting it in before permanent site stabilization.
- There is a threat of sediment silting in an inlet which is in place prior to permanent stabilization.
- Ponding around the inlet structure could be a problem to traffic on site.

Filter fabric is used for inlet protection when storm water flows are relatively small, with low velocities. Filter fabric inlet protection is appropriate for most types of inlets where the drainage area is 1 acre or less.

Block and gravel filters can be used where velocities are higher. They may be used with most types of inlets where overflow capability is needed and in areas of heavy flows (238 gal/min (15 liters/second) or greater).

Gravel and mesh filters can be used where flows are higher and in locations subject to disturbance by site traffic. This type of protection may be used with most inlets where overflow capability is needed and in areas of heavy flows (238 gal/min (15 liters/second) or greater).

Sod inlet filters are usually used where sediments in the storm water runoff are low.

LIMITATIONS

Filter fabric inlet protection cannot be used where inlets are paved because the fabric must be staked.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>1 ac</u>
Max slope	<u>5%</u>
Min bedrock depth	<u>2 ft</u>
Min water table	<u>2 ft</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>no</u>

Straw bales (BMP #134) are not recommended for inlet protection when the area adjacent to the inlet is paved. Additionally, the bales must be anchored. Consider sandbags (BMP #142) in situations where anchoring of straw bales is not possible (e.g., paved road surfaces).

Inlet protection is a high maintenance item compared with other more permanent measures.

DESIGN PARAMETERS

Several different designs are in use and the configurations vary. Most of the following design considerations apply to all three main types of inlet protection (filter fabric, gravel and mesh, and block and gravel). Some additional concerns apply to only one or two of the types.

Drainage area: Not to exceed 1 acre. Overland flow to the inlet should be no greater than 15 liters/second.

Slope gradient: The drainage area should be fairly flat, with slopes of 5 percent or less. With filter fabric designs, the area immediately surrounding the inlet should not exceed a slope of one percent.

Height of filter fabric: To avoid failure caused by pressure against the fabric when overtopping occurs, it is recommended that the height of the filter fabric be limited to 16 in (0.4 meters) above the crest of the drop inlet.

Sump: Where possible, a filter fabric or block-and-gravel protection device should be provided with a sediment trapping sump 12 to 20 in (300 to 500 mm) deep as measured from the crest of the inlet. Side slopes should be 2:1. The recommended volume of excavation is 860 ft³/acre (60 cubic meters/hectare) of ground disturbed.

Orientation: To achieve maximum trapping efficiency in gravel-and-mesh or block-and-gravel traps, the longest dimension of the basin should be oriented toward the longest inflow area.

Materials for filter fabric inlet protection:

- Filter fabric (see the fabric specifications for silt fence, BMP #135)
- Wooden stakes 2x2 in (50 mm x 50 mm) (or 2x4 in (50 mm x 100 mm)), with a minimum length of 3 ft (1.0 meter)
- Heavy-duty wire staples at least 45 in (10 mm) long
- Washed gravel 0.8 to 1.2 in (20 to 30 mm) in diameter, with less than 5 percent fines

Materials for excavated gravel inlet protection:

- Hardware cloth or wire mesh with 2/5 to 3/5 in (10 to 15 mm) openings
- Filter fabric (see the fabric specifications for silt fence, BMP #135)
- Washed gravel 0.8 to 4 in (20 mm to 100 mm) in diameter

Materials for block and gravel inlet protection:

- Hardware cloth or wire mesh with 2/5 to 3/5 in (10 to 15 mm) openings
- Filter fabric (see the fabric specifications for silt fence, BMP #135)
- Concrete blocks 4 to 12 in (100 mm to 300 mm) wide
- Washed gravel 0.8 to 4 in (20 mm to 100 mm) in diameter

CONSTRUCTION GUIDELINES

Filter fabric:

- Place a stake at each corner of the inlet and around the edges at no more than 3 ft (1 meter) apart. Drive the stakes into the ground 20 in (500 mm) if possible, or a minimum of 8 in (200 mm).
- For stability, install a framework of wood strips around the stakes at the crest of the overflow area, 20 in (500 mm) above the crest of the drop inlet.
- Excavate a trench 8 to 12 (200 to 300 mm) deep around the outside perimeter of the stakes. If a sediment trapping sump is being provided, then the excavation may be as deep as 2 ft (600 mm).
- Staple the filter fabric to the wooden stakes with heavy-duty staples, overlapping the joints to the next stake. Ensure that 12 to 32 in (300 to 800 mm) of filter fabric extends at the bottom so it can be formed into the trench.
- Place the bottom of the fabric in the trench and backfill the trench all the way around, using washed gravel to a minimum depth of 4 in (100 mm). Use enough gravel to ensure contact between the filter fabric and the underlying surface.

Gravel and mesh:

- Remove any obstructions to excavating and grading. Excavate sump area, grade slopes, and properly dispose of soil.
- Secure the inlet grate to prevent seepage of sediment-laden water.
- Place wire mesh over the drop inlet so the wire extends a minimum of 300 mm beyond each side of the inlet structure. Overlap the strips of mesh if more than one is necessary.
- Place filter fabric over the mesh, extending it at least 500 mm beyond the inlet opening on all sides. Ensure that weep holes in the inlet structure are protected by filter fabric and gravel.
- Place stone or gravel over the fabric/wire mesh to a depth of at least 300 mm.

Block and gravel:

- Secure the inlet grate to prevent seepage of sediment-laden water.
- Place wire mesh over the drop inlet so the wire extends a minimum of 12 to 20 in (300 mm to 500 mm) beyond each side of the inlet structure. Overlap the strips of mesh if more than one is necessary.
- Place filter fabric (optional) over the mesh and extend it at least 20 in (500 mm) beyond the inlet structure.
- Place concrete blocks over the filter fabric in a single row lengthwise on their sides along the sides of the inlet. Excavate the foundation a minimum of 2 in (50 mm) below the crest of the inlet. The bottom row of blocks should be against the edge of the structure for lateral support.
- The open ends of the block should face outward, not upward, and the ends of adjacent blocks should abut. Lay one block on each side of the structure on its side to allow for dewatering of the pool.
- The block barrier should be at least 12 in (300 mm) high and may be up to a maximum of 24 in (600 mm) high. It may be from 4 to 12 in (100 mm to 300 mm) deep, depending on the size of block used.
- Prior to backfilling, place wire mesh over the outside vertical end of the blocks so that stone does not wash down the inlet.
- Place gravel against the wire mesh to the top of the blocks.

Swale, ditch line or yard inlet protection:

- Excavate completely around inlet to a depth of 18" below notch elevation.
- Drive 2 x 4 post 1' into ground at four corners of inlet. Place nail strips between posts on ends of inlet. Assemble top portion of 2 x 4 frame using overlap joint shown. Top of frame (weir) must be 6" below edge of roadway adjacent to inlet.
- Stretch wire mesh tightly around frame and fasten securely. Ends must meet at post.
- Stretch filter cloth tightly over wire mesh, the cloth must extend from top of frame to 18" below inlet notch elevation. Fasten securely to frame. Ends must meet at post, be overlapped and folded, then fastened down.
- Backfill around inlet in compacted 6" layers until layer of earth is even with notch elevation on ends and top elevation on sides.
- If the inlet is not in a low point, construct a compacted earth dike in the ditch line below it. The top of the dike is to be at least 6" higher than the top of frame (weir).
- This structure must be inspected frequently and the filter fabric replaced when clogged.

Curb Inlet Protection:

- Attach a continuous piece of wire mesh (30" min. width by throat length plus 4') to the 2" x 4" weir (measuring throat length plus 2') as shown on the standard drawing.
- Place a piece of approved filter cloth (40-85 sieve) of the same dimensions as the wire mesh over the wire mesh and securely attach to the 2" of 4" weir.
- Securely nail the 2" x 4" weir to 9" long vertical spacers to be located between the weir and inlet face (max. 6' apart).
- Place the assembly against the inlet throat and nail (minimum 2') lengths of 2" x 4" to the top of the weir at spacer locations. These 2" x 4" anchors shall extend across the inlet top and be held in place by sandbags or alternate weight.
- The assembly shall be placed so that the end spacers are a minimum 1' beyond both ends of the throat opening.
- Form the wire mesh and filter cloth to the concrete gutter and against the face of curb on both sides of the inlet. Place clean 2" stone over the wire mesh and filter fabric in such a manner as to prevent water from entering the inlet under or around the filter cloth.
- This type of protection must be inspected frequently and the filter cloth and stone replaced when clogged with sediment.

Assure that storm flow does not bypass inlet by installing temporary earth or asphalt dikes directing flow into inlet.

MAINTENANCE

- Inspect regularly and after every storm. Make any repairs necessary to ensure the measure is in good working order.
- Remove accumulated sediment and restore the trap to its original dimensions when sediment has accumulated to half the design depth of the trap. All sediments removed must be disposed of properly.
- On gravel-and-mesh devices, clean (or remove and replace) the stone filter or filter fabric if it becomes clogged.
- On filter fabric devices, replace the fabric immediately if it becomes clogged. Make sure the stakes are firmly in the ground and that the filter fabric continues to be securely anchored.
- Inlet protection should remain in place and operational up to 30 days after the drainage area is completely stabilized.

Inlet protection (IDT, 1994)

Straw Bale Inlet Protection (Minnesota Pollution Control Agency, 2000; based on Michigan Soil Erosion and Sediment Control Guidebook)

Curb Inlet Sediment Barrier (Woodward-Clyde Consultants, 1994)

Inlet protection Detail

BMP #132 - Check Dams

DESCRIPTION

A small dam constructed in an open channel, swale, or drainageway. Check dams may be temporary or permanent barriers made of logs and brush, straw bales, stone, or other materials. They are used to reduce or prevent excessive bank and bottom erosion by reducing the gradient or runoff velocity.

APPLICATIONS

Check dams are often used in natural or constructed channels or swales where adequate vegetation cannot be established promptly. They are used below small drainage structures (smaller than 36 inch (900 mm) pipe culverts) but may be used below large structures if a diversion ditch cannot be used. Log and brush check dams should be placed where they will not cause flooding and where they can be left in place.

LIMITATIONS

Check dams should never be placed in live streams unless approved by appropriate local, state and/or federal authorities.

DESIGN PARAMETERS

Drainage area: The drainage area above the check dam should be between 1 and 4 hectares.

Spacing: The dams must be spaced so that the toe of the upstream dam is never any higher than the top of the downstream dam. Excavating a sump immediately upstream from the check dam improves its effectiveness.

Height: Maximum height should be 2 feet (600 mm). The center of the dam must be 16 to 10 inches (50 to 250 mm) lower than either edge, to form a weir for the outfall.

Width: The check dam should be as much as 20 inches (500 mm) wider than the banks of the channel to prevent undercutting as overflow water re-enters the channel.

Stabilization: Provide outlet stabilization below the lowest check dam (where the risk of erosion is greatest) and consider the use of channel linings or protection such as plastic sheeting or riprap where there may be significant erosion or prolonged submergence.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>10 ac</u>
Max slope	<u>50%</u>
Min bedrock depth	<u>2 ft</u>
Min water table	<u>N/A</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>yes</u>

Materials:

- Stone 2 to 16 inches (50 to 400 mm) in diameter
- Logs 6 to 8 inches (150 to 200 mm) in diameter
- Sandbags filled with pea gravel
- Filter fabric meeting the standard specifications (see BMP #135, Silt Fence)

Embedding: The logs should be driven into the ground a minimum of 28 inches (700 mm).

CONSTRUCTION GUIDELINES

Rock check dams: Place the stones on filter fabric either by hand or using appropriate machinery; do not simply dump them in place. Keep the side slopes 1:2 or flatter.

Lining the upstream side of the dam with a layer of 0.8 to 1.1 inch (20 to 30 mm) gravel 12 inches (300 mm) deep is a suggested option for additional channel protection.

Log check dams: Logs must be firmly embedded in the ground. Intermingled brush and logs or filter cloth may be attached to the upstream side of the dam to retard the flow and trap additional sediment. If a filter cloth is used, it should be securely stapled to the top of the dam and adequately anchored in the streambed.

Sandbag check dams: Be sure that all bags are securely sealed. Place the bags by hand or use appropriate machinery to place them in an interlocking pattern.

Gravel-filled burlap bags: Gravel-filled burlap bags may be used for temporary check dams in areas of concentrated flow. Fold the burlap bag flaps under the bags in a direction away from the water flow. Construct gravel bag check dams such that the crest of the downstream check dam is approximately level with the toe of the upstream check dam. Install check dams so the side end points are higher than the centerline crest. Erosion caused by high flows around the edges should be corrected immediately.

Riprap may be necessary on the downstream side of the dam to protect the streambed from scour.

MAINTENANCE

Inspect the check dams regularly and after every runoff-producing storm. Make any repairs necessary to ensure the measure is in good working order.

Remove accumulated leaves and sediments from behind the dam when they reach a depth of one-half the original height of the dam. Dispose of all materials properly so they don't contribute to pollution problems at the disposal site.

Restore stone as necessary for the dams to maintain their correct height. On sandbag dams, inspect the sandbag fabric for signs of deterioration.

Check dams (Portland and USA, 1994)

Gravel-filled sandbag check dams (Woodward-Clyde Consultants, 1994)

BMP #133 - Temporary Stream Crossing

DESCRIPTION

A temporary stream crossing is a bridge or culvert across a stream or watercourse for short-term use by construction vehicles or heavy equipment. Vehicles moving over unprotected stream banks will damage the bank, thereby releasing sediments and degrading the stream bank. A stream crossing provides a means for construction vehicles to cross streams or watercourses without moving sediment to streams, and without damaging the streambed or channel, or causing flooding.

APPLICATIONS

A temporary stream crossing is used when heavy equipment must be moved from one side of a stream channel to another, or where light-duty construction vehicles have to cross the stream channel frequently for a short period of time. Temporary stream crossings should be installed only when it is necessary to cross a stream and a permanent crossing is not feasible or not yet constructed.

The specific loads and the stream conditions will dictate what type of stream crossing to employ.

Bridges: Where available materials and designs are adequate to bear the expected loadings, bridges are the preferred method to cross a stream as they provide the least obstruction to flows and fish migration.

Culverts: Culverts are the most common type of stream crossings and are relatively easy to construct. A pipe (to carry the stream flow) is laid into the channel and covered by gravel (simply put--backfill, density, bedding and galvanized headwall).

LIMITATIONS

Bridges are expensive to design and install. These costs may make it difficult to justify using a bridge as a temporary crossing in some situations.

Culverts cause greater disturbance during installation and removal. In sensitive stream systems, these impacts may not be justifiable.

Always attempt to minimize or eliminate the need to cross streams. Temporary stream crossings are a direct source of pollution; therefore, every effort should be made to use an alternate method such as a longer detour. When it is absolutely necessary to cross a stream, a well-planned approach will minimize damage to the stream bank and reduce erosion.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

- Drainage area N/A
- Max slope N/A
- Min bedrock depth 2 ft
- Min water table N/A
- SCS soil type ABCD
- Freeze/Thaw good
- Drainage/Flood control yes

Use of the following stream crossing measures below the high water mark of a stream or other water body (waters of the U.S.) should be carefully evaluated due to Section 404 permit requirements. If the project will remain a Categorical Excluded (Cat-Ex) project, you may proceed if the situation is discussed in the Cat-Ex. Otherwise, Section 404 permitting (401 Certification)/a Water Resources, Stream Alteration Permit, may be required. The design of temporary stream crossings involves extensive knowledge of hydrologic processes, and therefore must be designed by a Professional Engineer.

DESIGN AND PLANNING PARAMETERS - GENERAL

In-Stream Excavation - In-stream excavation shall be limited to only that necessary to allow installation of the temporary bridge or culvert as described below.

Elimination of Fish Migration Barriers - Temporary bridges pose the least potential for creating barriers to aquatic migration. The construction of a temporary bridge or culvert shall not cause a significant water level difference between the upstream and downstream water surface elevations.

Crossing Alignment - The temporary waterway crossing shall be at right angles to the stream. Where approach conditions dictate, the crossing may vary 15 degrees from a line drawn perpendicular to the centerline of the stream at the intended crossing location.

Road Approaches - The centerline of both roadway approaches shall coincide with the crossing alignment centerline for a minimum distance of 50 feet from each bank of the waterway being crossed. If physical or right-of-way restraints preclude the 50 feet minimum, a shorter distance may be provided. All fill materials associated with the roadway approach shall be limited to a maximum height of 2 feet above the existing flood plain elevation.

Surface Water Diverting Structure - A water diverting structure such as a swale shall be constructed (across the roadway on both roadway approaches) 50 feet (maximum) on either side of the waterway crossing. This will prevent roadway surface runoff from directly entering the waterway. The 50 feet is measured from the top of the waterway bank. Design criteria for this diverting structure shall be in accordance with the BMP fact sheet in this Catalog for the individual design standard of choice. If the roadway approach is constructed with a reverse grade away from the waterway, a separate diverting structure is not required.

Road Width - All crossings shall have one traffic lane. The minimum width shall be 12 feet with a maximum width of 20 feet.

Time of Operation - All temporary crossings shall be removed within 14 calendar days after the structure is no longer needed. Unless prior written approval is obtained from the Water Resources Administration, all structures shall be removed within one year from the date of the installation.

Materials:

- Aggregate - There shall be no earth or soil materials used for construction within the waterway channel. (3/4" to 4") also referenced as AASHTO

designation No. 1 shall be the minimum acceptable aggregate size for temporary crossings. Larger aggregates will be allowed.

- Filter Cloth - Filter cloth is a fabric consisting of either woven or nonwoven plastic, polypropylene, or nylon used to distribute the load, retain fines, allow increased drainage of the aggregate and reduce mixing of the aggregate with the subgrade soil. Filter cloths such as Mirafi, Typar, Adva Filter, Polyfilter X, or approved equivalent shall be used, as required by the specific method.

Considerations for Choosing a Specific Method (Bridge or Culvert): The following criteria for erosion and sediment control shall be considered when selecting a specific temporary access waterway crossing standard method:

- Site aesthetics - Select a standard design method that will least disrupt the existing terrain of the stream reach. Consider the effort that will be required to restore the area after the temporary crossing is removed.
- Site location - Locate the temporary crossing where there will be the least disturbance to the soils of the existing waterway banks. When possible locate the crossing at the point receiving minimal surface runoff.
- Physical site constraints - The physical constraints of a site may preclude the selection of one or more of the standard methods.
- Time of year - The time of year may preclude the selection of one or more of the standard methods due to fish spawning or migration restrictions.
- Vehicular loads and traffic patterns - Vehicular loads, traffic patterns, and frequency of crossings should be considered in choosing a specific method.
- Maintenance of Crossing - The standard methods will require various amounts of maintenance. The bridge method should require the least maintenance, whereas the ford method will probably require more intensive maintenance.
- Removal of the structure - Ease of removal and subsequent damage to the waterway should be primary factors in considering the choice of a standard method.

DESIGN PARAMETERS - TEMPORARY BRIDGE

This is the preferred method for temporary access waterway crossings. Normally, bridge construction causes the least disturbance to the waterway bed and banks when compared to culverts.

Most bridges can be quickly removed and reused.

Temporary access bridges pose the least chance for interference with fish migration when compared to the other temporary access waterway crossings.

CONSTRUCTION GUIDELINES - TEMPORARY BRIDGE

Restriction: Construction, use, or removal of a temporary access bridge will not normally have any time of year restrictions since construction, use or removal should not affect the stream or its banks.

Bridge Placement: A temporary bridge structure shall be constructed at or above bank elevation to prevent the entrapment of floating materials and debris.

Abutments: Abutments shall be placed parallel to and on stable banks.

Bridge Span: Bridges shall be constructed to span the entire channel. If the channel width exceeds 8 feet (as measured from top-of-bank to top-of-bank) then a footing, pier or bridge support may be constructed within the waterway. One additional footing, pier or bridge support will be permitted for each additional 8 foot width of the channel. However, no footing, pier or bridge support will be permitted within the channel for waterways less than 8 feet wide.

Stringers: Stringers shall either be logs, sawn timber, prestressed concrete beams, metal beams, or other approved.

Deck Material: Decking materials shall be of sufficient strength to support the anticipated load. All decking members shall be placed perpendicular to the stringers, butted tightly, and securely fastened to the stringers. Decking materials must be butted tightly to prevent any soil material tracked onto the bridge from falling into the waterway below.

Run Planks (optional): Run planking shall be securely fastened to the length of the span. One run plank shall be provided for each track of the equipment wheels. Although run planks are optional, they may be necessary to properly distribute loads.

Curbs or Fenders: Curbs or fenders may be installed along the outer sides of the deck. Curbs or fenders are an option which will provide additional safety.

Bridge Anchors: Bridges shall be securely anchored at only one end using steel cable or chain. Anchoring at only one end will prevent channel obstruction in the event that floodwaters float the bridge. Acceptable anchors are large trees, large boulders, or driven steel anchors. Anchoring shall be sufficient to prevent the bridge from floating downstream and possibly causing an obstruction to the flow.

Stabilization: All areas disturbed during installation shall be stabilized within 14 calendar days of that disturbance.

MAINTENANCE - TEMPORARY BRIDGE

Inspection - Periodic inspection shall be performed by the user to ensure that the bridge, streambed, and stream banks are maintained and not damaged.

Maintenance: Maintenance shall be performed, as needed to ensure that the structure complies with the standard and specifications. This shall include removal and disposal of any trapped sediment or debris. Sediment shall be disposed of outside of the flood plain and stabilized.

Removal: When the temporary bridge is no longer needed, all structures including abutments and other bridging materials shall be removed within 14 calendar days. In all cases, the bridge materials shall be removed within one year of installation.

Final Clean-Up: Final clean-up shall consist of removal of the temporary bridge from the waterway, protection of banks from erosion, and removal of all construction materials. All removed materials shall be stored outside the waterway flood plain.

Equipment: Removal of the bridge and clean up of the area shall be accomplished without construction equipment working in the waterway channel.

Final Stabilization: All areas disturbed during removal shall be stabilized within 14 calendar days of that disturbance.

DESIGN PARAMETERS - TEMPORARY CULVERT

A temporary access culvert is a structure consisting of a section(s) of circular pipe, pipe arches, or oval pipes of reinforced concrete, corrugated metal, or structural plate, which is used to convey flowing water through the crossing.

Temporary culverts are used where (1) the channel is too wide for normal bridge construction, or (2) anticipated loading may prove unsafe for single span bridges.

Temporary culverts can be salvaged and reused.

CONSTRUCTION GUIDELINES - TEMPORARY CULVERT

Culvert Strength - All culverts shall be strong enough to support their cross sectional area under maximum expected loads.

Culvert Size - The size of the culvert pipe shall be the largest pipe diameter that will fit into the existing channel without major excavation of the waterway channel or without major approach fills. If a channel width exceeds 3 feet, additional pipes may be used until the cross sectional area of the pipes is greater than 60 percent of the cross sectional area of the existing channel. The minimum size culvert that may be used is a 12" diameter pipe.

Culvert Length - The culvert(s) shall extend a minimum of one foot beyond the upstream and downstream toe of the aggregate placed around the culvert. In no case shall the culvert exceed 40 feet in length.

Filter Cloth - Filter cloth shall be placed on the streambed and streambanks prior to placement of the pipe culvert(s) and aggregate. The filter cloth shall cover the streambed and extend a minimum six inches and a maximum one foot beyond the end of the culvert and bedding material. Filter cloth reduces settlement and improves crossing stability.

Culvert Placement - The invert elevation of the culvert shall be installed on the natural streambed grade to minimize interference with fish migration (free passage of fish).

Culvert Protection - The culvert(s) shall be covered with a minimum of one foot of aggregate. If multiple culverts are used they shall be separated by at least 12" of compacted aggregate fill. At a minimum, the bedding and fill material used in the construction of the temporary access culvert crossings shall conform with the aggregate requirements cited in Section I.H. 1. above.

Stabilization - All areas disturbed during culvert installation shall be stabilized within 14 calendar days of the disturbance.

MAINTENANCE - TEMPORARY CULVERT

Inspection - Periodic inspection shall be performed to ensure that the culverts, streambed, and streambanks are not damaged, and that sediment is not entering the stream or blocking fish passage or migration.

Maintenance - Maintenance shall be performed, as needed in a timely manner to ensure that structures are in compliance with this standard and specification. This shall include removal and disposal of any trapped sediment or debris. Sediment shall be disposed of and stabilized outside the waterway flood plain.

Removal - When the crossing has served its purpose, all structures including culverts, bedding and filter cloth materials shall be removed within 14 calendar days. In all cases, the culvert materials shall be removed within one year of installation.

Final Clean-up - Final clean-up shall consist of removal of the temporary structure from the waterway, removal of all construction materials, restoration of original stream channel cross section, and protection of the stream banks from erosion. Removed material shall be stored outside of the waterway flood plain.

Equipment - Removal of the structure and clean up of the area shall be accomplished without construction equipment working in the waterway channel.

Final Stabilization - All areas disturbed during culvert removal shall be stabilized within 14 calendar days of the disturbance.

Temporary stream crossing (North Carolina, 1988)

Temporary stream crossing (California, 1993)

Temporary Access Bridge

Temporary Access Culvert

BMP #134 - Straw Bales/Biofilter Bags

DESCRIPTION

Temporary sediment barriers, consisting of a row of entrenched or anchored straw bales and/or biofilter bags, reduce the transport of sediment from a construction site by providing a temporary physical barrier to sediment and reducing runoff velocities. The barriers can be placed in various combinations to construct the required structure, as shown on the attached figures. They may also be used as a barrier to divert or direct small amounts of runoff around active work areas or to a slope drain, sediment trap or other filtration/sedimentation BMP. Both biofilter bags (plastic mesh bags filled with wood chips) and straw bales are temporary measures. They have a limited life span and must be regularly inspected and replaced when damaged.

APPLICATIONS

The barriers are effective at storm drain inlets, across minor swales and ditches, as diversion dikes and berms, along property lines, and for other applications where the need for a barrier is temporary and structural strength is not required. For instance:

- At the toe of embankment slopes
- At the outlet of slope drains
- As filter cores for log check dams
- In front of silt fences
- To protect inlets along paved streets

LIMITATIONS

These types of barriers are only suitable where flow rates are low (475 gal/min (30 liters per second) or less). They require regular inspections and repair, and periodic replacement (about 3 months maximum usefulness).

Do not use straw bale barriers for drainage areas greater than 1 acre (0.5 hectare). Straw bale barriers often prove ineffective at erosion control if poorly installed and maintained. Even when properly installed, temporary barriers are not usually as effective as silt fences (see BMP #135) or gravel berms (see BMP# 142). Straw bales used in conjunction with either of these controls may improve effectiveness and durability. Certified weed-free straw bales must be used instead of hay bales.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

- Drainage area 1 ac/400ft
bales
- Max slope 2% for bales;
10% for biobags
- Min bedrock depth 2 ft
- Min water table 2 ft
- SCS soil type ABCD
- Freeze/Thaw fair
- Drainage/Flood control no

DESIGN PARAMETERS

Constructed Slope	Percent Slope	Slope Length Feet
2:1	50	25
2.5:1	40	50
3:1	33	75
3.5:1	30	100
4:1	25	125

Where slope gradient changes through the drainage area, steepness refers to the steepest slope section contributing to the straw bale dike.

The practice may also be used for a single-family lot if the slope is less than 15 percent. The contributing drainage area in this instance shall be less than one acre and the length of slope above the dike shall be less than 200 feet.

Concentrated flows: No greater than 475 gal/min (30 liters) per second.

Useful life: 3 months maximum, depending on site conditions.

Buffer zone: An undisturbed buffer zone of 3 to 6.5 ft (1-2 meters) is necessary between the barriers and surface waters to allow safe removal of the barrier and of accumulated sediments.

Embedding: The barrier must be embedded to a minimum depth of 6 in (150 mm) and backfilled for the entire length of the barrier. Each bale or bag should be securely anchored with two stakes 2 in X 2 in X 3 ft (50 mm x 50 mm x 1 meter) or steel drift pins driven at least 20 in (500 mm) into the ground.

CONSTRUCTION GUIDELINES

Barriers used for sediment control at the toe of slopes must be in place prior to disturbing the slope. Install the bales a short distance away from the toe of the slope to increase the effective area but outside of any ditch channel.

Place the barriers in a single row lengthwise on the contour for sheet flow applications, or perpendicular to the contour in concentrated flow applications. When flows are expected to be high enough to surpass the infiltration capacity of the devices, the center (low point) bales shall be wrapped in filter fabric with a 3 ft (1 meter) tail stapled securely and extending from the down gradient side of the barrier to prevent scouring. The ends of the adjacent barriers must tightly abut one another.

Any gaps between barriers should be filled with tightly wedged straw. For concentrated flow applications, extend the end of the barrier so that the bottoms of the end units are at a higher elevation than the top of the lowest middle unit to

assure that sediment laden water flows through or over the barrier instead of around the ends.

MAINTENANCE

Perform one inspection during the first runoff producing event after the installation of the barriers to assure proper functioning. No more than one foot depth of sediment should be allowed to accumulate behind either bales or biofilter bags. Damaged barriers, undercutting, or end runs must be repaired immediately. Bales should be replaced as needed due to disintegration or rotting.

If approved, straw bales or biofilter bags may be used after project completion as mulch. Temporary sediment barriers should be removed within 30 days of final stabilization of the site. If rebar is used it must be removed.

Straw Bale Dike

Biobag placement for overland flow (Portland and USA, 1994)

Biobag placement for ditches and swales (Portland and USA, 1994)

BMP #135 - Silt Fence

DESCRIPTION

A silt fence is a temporary sediment barrier consisting of a filter fabric stretched and attached to supporting posts. (Wire fence backing is necessary with several types of filter fabric commonly used.) Silt fences assist in sediment control by retaining some of the eroded soil particles and slowing the runoff velocity to allow particle settling.

APPLICATION

Silt fences can be used near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The fences should remain in place until the disturbed area is permanently stabilized.

Silt fences can also be used along the toe of fills, on the downhill side of large through-cut areas, along streams, and at natural drainage areas to reduce the quantity of sediment and to dissipate flow velocities to downstream areas.

Also use at grade breaks on cut/fill slopes and above interceptor dikes.

The silt fence should be constructed after the cutting and slashing of trees and before excavating haul roads, fill benches, or any soil disturbing construction activity in the drainage areas.

Targeted Pollutants	
<input checked="" type="radio"/>	Sediment
<input type="radio"/>	Phosphorus
<input type="radio"/>	Trace metals
<input type="radio"/>	Bacteria
<input type="radio"/>	Petroleum hydrocarbons

Physical Limits	
Drainage area	<u>1 ac/100 ft</u>
Max slope	<u>33%</u>
Min bedrock depth	<u>2 ft</u>
Min water table	<u>2 ft</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>good</u>
Drainage/Flood control	<u>no</u>

LIMITATIONS

Silt fences should not be used where there is a concentration of water in a channel or drainageway or where soil conditions prevent the minimum fabric toe-in depth or minimum depth for installation of support posts. If concentrated flow occurs after installation, take corrective action by placing rock berms or other corrective measures in the areas of concentrated flow.

DESIGN PARAMETERS

Maximum allowable slope lengths: Maximum allowable slope lengths contributing runoff to a silt fence are listed in the table below:

Slope Steepness	Maximum Slope Length (Feet)
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2:1	50
3:1	75
4:1	125
5:1	175
Flatter than 5:1	200

Maximum drainage area: Maximum drainage area for overland flow to a silt fence shall not exceed ½ acre per 100 feet of fence

Design Calculations: Design computations are not required. All silt fences shall be placed as close to the contour as possible, and the area below the fence must be undisturbed or stabilized.

Site Plan Details: A detail of the silt fence shall be shown on the plan, and contain the following minimum requirements:

- The type, size, and spacing of fence posts.
- The size of woven wire support fences.
- The type of filter cloth used.
- The method of anchoring the filter cloth.
- The method of fastening the filter cloth to the fencing support.

Joining Filter Fabric: Where ends of filter fabric come together, they shall be overlapped, folded and stapled to prevent sediment bypass.

Materials:

Silt Fence Fabric: The fabric shall meet the following specifications unless otherwise approved by the appropriate erosion and sediment control plan approval authority. Such approval shall not constitute statewide acceptance. Statewide acceptability shall depend on in-field and/or laboratory observations and evaluations.

Fabric Properties	Value	Minimum Acceptable Test Method
Grab Tensile Strength (lbs)	90	ASTM D1682
Elongation at Failure (%)	50	ASTM D1682
Mullen Burst Strength (PSI)	190	ASTM D3786
Puncture Strength (lbs)	40	ASTM D751 (modified)
Equivalent Opening Size	40-80	US Std Sieve CW-02215

Ultraviolet Radiation Stability %	90	ASTM-G-26
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Fence Posts (for fabricated units): The length shall be a minimum of 36 inches long. Wood posts will be of sound quality hardwood with a minimum cross sectional area of 3.0 square inches. Steel posts will be standard T and U section weighing not less than 1.00 pound per linear foot.

Wire Fence (for fabricated units): Wire fencing shall be a minimum 14¼ gage with a maximum 6" mesh opening, or as approved.

Prefabricated Units: Envirofence or approved equal may be used in lieu of the above method providing the unit is installed per manufacturer's instructions.

CONSTRUCTION GUIDELINES

- Posts should be spaced 10 ft (3 meters) apart when a wire mesh support fence is used and no more than 6.5 ft (2 meters) apart when using extra-strength filter fabric (without a wire fence). The posts should extend at least 16 in (0.4 meter) into the ground.
- If standard strength filter fabric filter is to be used, fasten the optional wire mesh support fence to the upslope side of the posts using heavy duty wire staples, tie wires, or hog rings. Extend the wire mesh support to the bottom of the trench. The filter fabric should then be stapled or wired to the fence.
- Extra strength filter fabric does not require a wire mesh support fence. Staple or wire the filter fabric directly to the posts.
- Do not attach filter fabric to trees!
- Where joints in the fabric are required, splice it together only at a support post, with a minimum 6 in (150 mm) overlap, and securely seal the joint.
- Embedded filter fabric should extend in a flap which is anchored by backfill, to prevent fabric from pulling out of ground.

MAINTENANCE

Silt fences should be inspected periodically for damage (such as tearing by wind, animals, or equipment) and for the amount of sediment which has accumulated. Remove the sediment when it reaches one-half the height of the silt fence. In situations where access is available, machinery can be used. Otherwise, the silt must be removed manually. The key elements to remember are:

- The sediment deposits should be removed when heavy rain or high water is anticipated.
- The sediment deposits should be placed in an area where there is little danger of erosion.

- The silt fence should not be removed until adequate vegetative growth ensures no further erosion of the slopes. Generally, the fabric is cut at ground level, the wire and posts are removed, then the sediment is spread, seeded, and protected (mulched) immediately.

BMP #136 - Vegetative Buffer Strip

DESCRIPTION

A vegetative buffer strip is a gently sloping area of vegetative cover that runoff water flows through before entering a stream, storm sewer, or other conveyance. The buffer strip may be an undisturbed strip of natural vegetation or it can be a graded and planted area .

Vegetative buffer strips act as living sediment filters that intercept and detain storm water runoff. They reduce the flow and velocity of surface runoff, promote infiltration, and reduce pollutant discharge by capturing and holding sediments and other pollutants carried in the runoff water. Vegetative buffer strips function much like vegetated or grassed swales. Buffer strips, however, are fairly level and treat sheet flow across them, whereas grassed swales are indentations that treat concentrated flows running along them (see treatment BMP #5 - vegetated swale).

APPLICATIONS

- Used for temporary or permanent control, usually in conjunction with other sediment collection and slope protection practices. Consider use with level spreaders (treatment BMP #21) or diversion measures such as earth dikes (BMP #140) and slope drains (BMP #125). Also, silt fences (BMP #135) installed up-gradient can prevent overloading of the buffer strip.
- May be placed at many locations between the source of sediment (road surface, side slopes) and a natural or constructed waterway. They are inexpensive and easily constructed, and can be put into place at any time if climatic conditions allow for planting.
- May be used at almost any site that can support vegetation, but is best suited for areas where the soils are well drained or moderately well drained and where the bedrock and the water table are well below the surface.
- Provides low to moderate treatment of pollutants in storm water while providing a natural look to a site.
- Can provide habitat for wildlife.
- Can screen noise and views if trees or high shrubs are planted on the filter strips.

LIMITATIONS

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area unlimited

Max slope 20%

Min bedrock depth 5 ft

Min water table 3 ft

SCS soil type ABCD

Freeze/Thaw fair

Drainage/Flood control no

- Not effective for filtering high velocity flows from large paved areas, steep slopes, or hilly areas. Consider other measures if slopes exceed 15 percent.
- Requires significant land space.
- May have a short useful life due to clogging by sediments and oil and grease.
- Do not use planted or seeded ground as a buffer strip for sediment trapping until the vegetation is well established.

DESIGN PARAMETERS

Width and length: A buffer strip must be at least 20 ft (6 meters) wide to function well. Along live streams or above wetlands, the minimum width should be 100 ft (30 meters). The length of the strip should be approximately 50 to 82 ft (15 to 25 meters). Where slopes become steeper, increase the length of the strip.

Plant materials: Tall, dense stands of grass form good sediment traps, as do willows and alder. The willows and alder can be native or planted. A combination of grasses with willows or alder is also effective. Any planted species should be deep rooted and able to adjust to low oxygen levels. Vegetative cover should be at least 75 percent to assure adequate removal of sediments. Forested strips are always preferred to vegetated strips, and existing vegetation is preferred to planted vegetation. In planning for vegetated strips, consider climatic conditions, since vegetation may not take hold in especially dry and/or cold regions.

Effectiveness: In many cases, a vegetative buffer strip will not effectively control runoff and retain sediments unless employed in conjunction with other control measures. Where heavy runoff or large volumes of sediment are expected, provide diversion measures or other filtering measures above or below the buffer strip.

CONSTRUCTION GUIDELINES

- Try to direct sediment-laden water onto naturally vegetated or stabilized planted ground.
- Fertilizing seeded or planted ground may enhance growth (and improve its effectiveness as a buffer strip).
- Do not place any equipment, construction debris, or extra soil in the buffer strip (or the strip will be damaged).

MAINTENANCE

Inspections: Inspect the buffer strip at regular intervals to ensure proper functioning. Check for damage by equipment and vehicles. In newly planted areas, check the progress of germination and plant growth, and arrange for fertilizing, if needed, to enhance growth and establishment. (Planted ground must not be used for a sediment trap until the vegetation is well established.) Make sure that water flowing

through the buffer strip is not causing additional erosion nearby, and not forming ponds due to erosion within the buffer strip.

Maintenance: Buffer strips in natural vegetation do not generally require maintenance; however, on some sites it may be necessary to remove sediments and replant on a regular basis. Promptly repair any damage from equipment, vehicles, or erosion.

BMP #137 - Sedimentation Trap (Basin)

DESCRIPTION

A temporary or permanent dam or basin used to collect, trap, and store sediment produced by construction activities, or as a flow detention facility for reducing peak runoff rates. Sediment basins can be designed to maintain a permanent pool or to drain completely dry. Either way, the basin detains sediment-laden runoff long enough to allow most of the sediment to settle out.

A sediment basin can be constructed by excavation or by placing an earthen embankment across a low area or drainage swale. The pond has a riser and pipe outlet with a gravel outlet or spillway to slow the release of runoff and provide some sediment filtration.

APPLICATIONS

Sediment traps are appropriate where physical site conditions or land ownership restrictions preclude the effective use of barrier-type erosion control measures. It may be used below construction operations which expose critical areas to soil erosion.

A temporary sediment basin used in combination with other control measures, such as seeding or mulching, is especially effective for removing sediments.

Note that the use of sedimentation basins on construction sites greater than or equal to 5 acres with an NPDES stormwater permit has special requirements. Refer to Part IV.D.2.a.(2)(a) of the NPDES stormwater general permit for onsite activities.

LIMITATIONS

- May not be feasible downstream of narrow right-of-way due to lack of space.
- May not be practical in highly erodible soil types (0.01 and smaller, very fine sand, silt and clay) due to extremely large basin size requirements.
- May not remove enough of the fine silts. Additional control measures such as filter cloth around riser should be used to minimize release of fine silts. If filter cloth is used, regular inspection and replacement is required to deal with clogging.
- Should not be located in any active stream channel.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area 5 ac

Max slope 10%

Min bedrock depth 3 ft

Min water table 2 ft

SCS soil type BCD

Freeze/Thaw good

Drainage/Flood control no

DESIGN PARAMETERS

Design of the basin should be based upon the total drainage area lying upstream and (if permanent) on the future use of such lands. Design should be approved by a professional engineer.

The volume of the sediment basin should be at least 1800 ft³ /acre (125 cubic meters per hectare) of total drainage area (about 1/2 in (13 mm) over the watershed). Disturbed areas greater than 10 acres (4 hectares) within the same drainage basin should be provided a basin with a capacity of 3600 ft³ (250 cubic meters) per hectare of total drainage area (1 in (25 mm) over the watershed) to meet the NPDES regulations.

The basin should be designed with baffles or other deflectors to spread the flow throughout the basin. It should also include an emergency spillway and riser pipe(s). These structures must be designed on a site-specific basis using standard engineering practices. The basin pond must be sized by calculating the settling zone volume and adding the necessary sediment storage volume. The settling zone volume is determined by the pond surface area calculated using the following equation:

$$SA = 1.2Q_x / V_{sed}$$

Where:

SA = the pond surface area in square meters

Q_x = the design inflow (in cubic meters per second) based on the runoff from the design storm event for the drainage area.

V_{sed} = the settling velocity for the design soil particle in meters per second. The following table lists theoretical settling velocities for different particle sizes (#200 sieve=0.074 mm).

Size in (mm)	V_{sed} in/sec (m/sec.)
0.02 (0.5)	0.0023 (0.058)
0.008 (0.2)	0.00079 (0.020)
0.004 (0.1)	0.00028 (0.007)
0.002 (0.05)	0.000079 (0.002)
0.0008 (0.02)	0.000012 (0.0003)
0.0004 (0.01)	0.0000028 (0.00007)
0.0002 (0.005)	0.00000079 (0.00002)

For particle sizes of 0.01 and smaller, the V_{sed} 's are so low that the SA becomes extremely large, often making the overall basin size requirement too large to be practical. In this case, extra protection

measures should be taken to negate the need for the basin.

The settling volume requirement is then calculated by multiplying the surface area by the settling depth. The settling depth must be a minimum of 1 ft (0.6 meter) and a maximum of 4 ft (1.2 meters) and is governed by a relationship with the basin length (distance from the inlet to the outlet). The ratio of length to settling depth should be greater than 200. For example, if the length was (120 meters), the settling depth must be less than 2 ft (0.6 meters) to achieve the ratio of greater than 200.

Typically, a sediment storage depth of 3 ft (1.0 meter) is appropriate unless large volumes of soil are expected from highly erodible site conditions. In this case use the "universal soil loss equation" or other applicable estimating methods to design the storage depth on a site-specific basis.

Determine the final pond dimensions and volume as follows:

- 1) Determine the pond geometry for the sediment settling volume calculated above by adding a sediment storage depth of 3 ft(1.0 meter) and 3: 1 side slopes from the bottom of the basin. The bottom must be level.
- 2) Extend the side slopes (at 3: 1) as necessary to obtain the settling zone volume at the settling zone depth determined above.
- 3) Adjust the geometry of the basin to effectively combine the settling zone volume and sediment storage volume while preserving the depth and side slope criteria listed above.

Sediment basins covered by this standard should be limited to the following category:

The water surface at the crest elevation of the pipe spillway should not exceed 10 ft (3 meters) measured upward from the original stream bed to the crest elevation of the pipe spillway; and the drainage area should not exceed 150 acres (60 hectares).

Because finer silts may not settle out completely, additional erosion control measures should be used to minimize release of the fine silt. Runoff should enter the basin as far from the outlet as possible to provide maximum retention time.

CONSTRUCTION GUIDELINES

The temporary sediment basin should be installed before clearing and grading is undertaken. It should not be built within an active stream channel. Putting a dam in such a site could destroy aquatic habitat, and failure of the dam could result in flooding. A temporary sediment basin should be constructed only if there is sufficient space and appropriate topography. The basin should be made large enough to handle the maximum expected amount of site drainage. Fencing around the basin may be necessary for safety reasons or to discourage vandalism.

The following general construction criteria are critical to successful installation and operation of sediment basins.

- Locate the dam to provide maximum volume capacity for silt behind the structure.
- Prepare the dam site by clearing vegetation and removing topsoil before beginning dam construction. Areas under the embankment and any structural works should be cleared and grubbed, and the topsoil stripped to remove all trees, vegetation, roots and other objectionable material. To facilitate cleanout and restoration, the pool area (measured at the top of the pipe spillway) should be cleaned of all brush, trees or other debris.
- Level the bed for the pipe spillway to provide uniform support through its entire length under the dam.
- Construct an emergency spillway (as per design) on undisturbed soil--not on fill. The design width and entrance/exit channel slopes are critical to the spillway's ability to successfully protect the dam with a minimum of erosion hazard in the spillway channel. The spillway should be lined with
 - 4 in (100 mm) of concrete, reinforced with 6 X 6 in (150 mm x 150 mm) 10/10 wire mesh extending to a minimum of 36 in (900 mm) down each face of the embankment. The spillway should be at least 20 in (500 mm) deep with 1: 1.5 slide slopes.
- All pipe joints must be securely fastened and watertight. The riser should be rigidly and securely fastened to the barrel and the bottom of the riser should be sealed (watertight). The barrel should be placed on a firm foundation according to the lines and grades shown on the plans.
- Place at least 1 ft (600 mm) of hand-compacted backfill (maximum 6 in (150 mm) lifts) over the pipe spillway before crossing it with construction equipment. The movement of the hauling and spreading equipment over the fill should be controlled so that the entire surface of each lift will be traversed by not less than one tread tract of the equipment.
- The pipe spillway should discharge at ground elevation below the dam, and not more than 12 in (300 mm) above any streambed.
- Fill material should be taken from approved designated borrow areas, and should be of the type and quality conforming to that specified for the adjoining fill material. It should be free of roots, woody vegetation, oversize stones, rocks exceeding 6 in (150 mm) diameter, or other objectionable materials. Do not use frozen material.
- Areas on which fill is to be placed should be scarified prior to placement of fill. Fill materials should be placed in 6 in (150 mm) maximum lifts, compacted by construction equipment. The embankment should be raised and compacted to an elevation which provides for anticipated settlement to design elevation (allow at least 10 percent for settlement). Lifts should be continuous over the entire length of the fill and approximately horizontal.
- Stabilize the embankment and emergency spillway with revegetation or other stabilization measures.

MAINTENANCE

Sediment basins should be readily accessible for maintenance and sediment removal. They should be inspected after each rainfall and be cleaned out when about half the volume has been filled with sediment. Poorly draining basins require maintenance to clean clogged riser or filter cloth. Removed sediment should be disposed of and stabilized in an approved location such that spoils do not re-enter waters of the state. Sediment may not be dumped into any water of the U.S. without appropriate permitting.

The sediment basin should remain in operation and be properly maintained until vegetation or other measures permanently stabilize the drainage area. A well built temporary sediment basin that is large enough to handle the post-construction runoff volume may later be converted to use as a permanent storm water management structure.

If the pond is located near a residential area, it is recommended for safety reasons that a sign be posted and that the area be secured by a fence.

BMP #138 - Portable Sediment Tank

DESCRIPTION

A sediment tank is a compartmented tank container through which sediment laden water is pumped to trap and retain the sediment prior to pumping the water to drainageways, adjoining properties, and rights-of-way below the sediment tank site.

APPLICATIONS

A sediment tank should be used on sites where excavations are deep, and space is limited, such as urban construction, where direct discharge of sediment laden water to stream and storm drainage systems is to be avoided.

DESIGN PARAMETERS

Location: The sediment tank shall be located for ease of clean-out and disposal of the trapped sediment, and to minimize the interference with construction activities and pedestrian traffic.

Tank Size: The following formula should be used in determining the storage volume of the sediment tank:
Pump Discharge (G.P.M.) x 16 = Cubic Foot Storage.

An example of a typical sediment tank is shown in on the attached drawing. Other container designs can be used if the storage volume is adequate and approval is obtained from the local approving agency.

INSTALLATION GUIDELINES

Follow manufacturer's specifications.

VARIATION WITH FLOCCULATION

The pollution removal efficiency of the sediment tank can be considerably increased by using flocculation chemicals, such as alum (aluminum sulfate) in the tank. Flocculation will allow some very small suspended solids to settle that otherwise would never be removed. The time it takes to settle out larger particulates will also decrease. However, a flocculation tank setup is considerably more complicated as the rate of flocculant addition must be carefully monitored.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

- Drainage area 5
- Max slope NA
- Min bedrock depth NA
- Min water table NA
- SCS soil type NA
- Freeze/Thaw good
- Drainage/Flood control no

BMP #139 - Temporary Swale

DESCRIPTION

A temporary excavated drainage way designed to prevent runoff from entering disturbed areas by intercepting and diverting it to a stabilized outlet. Another purpose of a temporary swale is to intercept sediment laden-water and divert it to a sediment trapping device.

APPLICATIONS

Temporary Swales are constructed:

- To divert flows from a disturbed area
- Intermediately across disturbed areas to shorten overland flow distance.
- To direct sediment laden water along the base of slopes to a trapping device.
- To transport offsite flows across disturbed areas such as rights-of-way.

Swales collecting runoff from disturbed areas shall remain in place until the disturbed areas are permanently stabilized.

DESIGN PARAMETERS

Design Criteria. The following design criteria should be met, depending on the drainage area served by the swale:

Swale A Swale B

Drainage Area 5 ac or less 5-10 ac

Bottom Width of Flow Channel 4 feet 6 feet

Depth of Flow Channel 1 foot 1 foot

Side Slopes 2:1 or flatter 2:1 or flatter

Grade 0.5% min, 0.5% min,

20% max 20% max

Outlet.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area 10

Max slope 14 %

Min bedrock depth 5 ft

Min water table 3 ft

SCS soil type BCD

Freeze/Thaw fair

Drainage/Flood control yes

- The temporary swale shall be designed with an outlet that functions with a minimum of erosion, and dissipates runoff velocity prior to discharge off the site.
- Runoff shall be conveyed to a sediment trapping device such as a sediment trap or sediment basin until the drainage area above the swale is adequately stabilized.
- The on-site location may need to be adjusted to meet field conditions in order to utilize the most suitable outlet condition.
- If a swale is used to divert flows from entering a disturbed area, a sediment trapping device may not be needed.

CONSTRUCTION GUIDELINES

Stabilization of the swale shall be completed within 10 days of installation with proper seeding or mulching techniques (see BMP #145-Seeding or BMP #121-Mulching). The flow channel shall be stabilized according to the following criteria:

Type of treatment	Channel grade (percent)	Flow Channel A (less than 5 acres)	Flow Channel B (5-10 acres)
1	0.5-3.0	Seed and Straw Mulch	Seed and Straw Mulch
2	3.1-5.0	Seed and Straw Mulch	Seed and cover with Jute or Excelsior; Sod, or line with 2" stone
3	5.1-8.0	Seed and cover with Jute or Excelsior; Sod, or line with 2" stone	Line with 4-8" stone or Recycled Concrete Equivalent ^a
4	9.1-20	Line with 4-8" stone or Recycled Concrete Equivalent ^a	Engineering Design

^a Recycled Concrete Equivalent shall be concrete broken into the required size, and shall contain no steel reinforcement.

In highly erodible soils, as defined by the Soil Survey (NRCS/SCS) of the project's county, refer to the next higher slope grade for type of stabilization.

Also see Treatment BMP #1 - Vegetated Swale, for additional construction guidelines for swales.

MAINTENANCE

See treatment BMP #1 - Vegetated Swale.

BMP #140 - Earth Dike

DESCRIPTION

An earth dike is a temporary berm or ridge (or ridge-and-channel combination) of compacted soil located in a manner to channel water to a desired location. Earth dikes are used to protect work areas from upslope runoff and to divert sediment-laden water to appropriate traps or stable outlets. The channel portion (if used) generally has a lining of stone, riprap, or vegetation for stabilization.

APPLICATIONS

Earth dikes are used in construction areas to control erosion, sedimentation, or flood damage. Earth dikes can be used in the following situations:

- Across unprotected slopes, as slope breaks, to reduce length.
- Below slopes to divert excess runoff to stabilized outlets.
- At or near the perimeter of the construction area to keep sediment-laden runoff from leaving the site.
- To protect cut or fill slopes by diverting upslope flows away from disturbed areas to a stabilized outlet.
- To direct any sediment-laden runoff to a sediment-trapping device.
- To direct clean water away from disturbed areas

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area 10 ac
Max slope 10%
Min bedrock depth 5 ft
Min water table 5 ft
SCS soil type ABC
Freeze/Thaw Fair
Drainage/Flood control yes

LIMITATIONS

- Despite an earth dike's simplicity, improper design can limit its effectiveness.
- Frequent inspection and maintenance are essential to the proper performance of this BMP.
- When the drainage area above the earth dike is greater than 10 acres (4 hectares), consult the United States Department of Agriculture - Soil Conservation Service (USDA-SCS) standards and specifications for diversions.

DESIGN PARAMETERS

The earth dike shall be constructed of compacted soil or coarse aggregate according to the following criteria:

SUGGESTED DIKE DESIGN CRITERIA		
Criteria	Drainage area under 5 acres (2 hectares)	Drainage area between 5 to 10 acres (2 to 4 hectares)
Dike Height	18 in (.53 m)	3 ft (1.0 m)
Dike Width	2 ft (0.6 m)	3 ft (1.0 m)
Flow Width	4 ft(1.3 m)	6 ft (2.0 m)
Flow Depth in channel	8 in (0.2 m)	15 in (0.4 m)
Side Slopes	2:1 or flatter	2:1 or flatter
Grade	0.5% - 20%	0.5% - 20%

The channel formed behind the dike should have a positive grade to a stabilized outlet. The channel should be stabilized with vegetation or other stabilization measures.

Grades over 10 percent may require site-specific design developed or approved by a registered engineer.

CONSTRUCTION GUIDELINES

Some general considerations include proper compaction of the earth dike, appropriate location to divert the intercepted runoff, and proper ridge height and thickness. Earth dikes should be constructed along a positive grade. Other than the discharge point, there should be no dips or low points where stormwater will collect.

Runoff intercepted from disturbed areas should be diverted to a sediment-trapping device. Runoff from undisturbed areas can be channeled to an existing swale or to a level spreader. Stabilization for the dike and flow channel (or drainage swale) should be stabilized as soon as possible. Stabilization materials can include vegetation, stone, or riprap.

Where: Construct the dike where it will not interfere with major areas of construction traffic so that vehicle damage to the dike will be kept to the minimum.

When: Install the dike prior to the majority of soil disturbing activity. The dike may be removed when stabilization of the drainage area and outlet are complete.

Site preparation: Clear the area of all trees, brush, stumps, or other obstructions.

Construction: Construct the dike to the designed cross-section, line and grade making sure that there are no irregularities or bank projections to impede the flow. Construct the connecting portion to any stream channel last.

Compaction: The dike should be compacted using earth moving equipment (to prevent failure of the dike).

Stabilization: The dike must be stabilized at least 10 days after installation. The flow channel shall be stabilized according to the following criteria:

Type of treatment	Channel grade (percent)	Flow channel A (less than 5 acres)	Flow channel B (5-10 acres)
1	0.5-3.0	Seed and Straw Mulch	Seed and Straw Mulch
2	3.1-5.0	Seed and Straw Mulch	Seed and cover with Jute or Excelsior; Sod, or line with 2" stone
3	5.1-8.0	Seed and cover with Jute or Excelsior; Sod, or line with 2" stone	Line with 4-8"stone or Recycled Concrete Equivalent
4	8.1-20	Line with 4-8"stone or Recycled Concrete Equivalent	Engineering Design

^a Recycled Concrete Equivalent shall be concrete broken into the required size, and shall contain no steel reinforcement.

In highly erodible soils, as defined by the Soil Survey (NRCS/SCS) of the project's county, refer to the next higher slope grade for type of stabilization.

Outlet: Earth dikes shall have an outlet that functions with a minimum of erosion. Runoff shall be conveyed to a sediment trapping device until the drainage area above the dike is adequately stabilized. The on-site location may need to be adjusted to meet field conditions in order to utilize the most suitable outlet.

MAINTENANCE

- Inspect diversion dikes regularly and after every storm. Make any repairs necessary to ensure they are in good working order.
- Inspect the dike, flow channel and outlet for deficiencies or signs of erosion.
- If material must be added to the dike, be sure it is properly compacted.
- Reseed/stabilize the dike as needed to maintain its stability regardless if there has been a storm event or not.

BMP #141 - Perimeter Dike/Swale

DESCRIPTION

A temporary ridge of soil excavated from an adjoining swale located along the perimeter of the site or disturbed area. The purpose of a perimeter dike/swale is to prevent off-site storm runoff from entering a disturbed area and to prevent sediment laden storm runoff from leaving the construction site or disturbed area.

APPLICATIONS

A perimeter dike/swale is constructed to divert flows from entering a disturbed area, or along top of slopes to prevent flows from eroding the slope, or along base of slopes to direct sediment laden flows to a trapping device.

The perimeter dike/swale shall remain in place until the disturbed areas are permanently stabilized.

DESIGN PARAMETERS

The perimeter dike/swale shall not be constructed outside the property lines without obtaining legal easements from effected adjacent property owners.

A detailed design is not required for the perimeter dike/swale. However, the following criteria shall be used:

Drainage area: Less than 2 acres (for drainage areas larger than 2 acres, but less than 10 acres, see BMP #140 - earth dike; for drainage areas larger than 10 acres, see BMP #143 - storm drain diversion).

Height: 18 inches minimum from bottom of swale to top of dike evenly divided between dike height and swale depth.

Bottom width of dike: 2 feet minimum.

Width of Swale: 2 feet minimum.

Grade: Dependent upon topography, but shall have positive drainage

(sufficient grade to drain) to an adequate outlet. Maximum allowable grade not to exceed 20 percent.

Outlet

- The perimeter dike/swale shall have an outlet that functions with a minimum of erosion.

Targeted Pollutants

- Sediment
- Phosphorus
- ◐ Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area 2 acres

Max slope 10 %

Min bedrock depth 5 ft

Min water table 5 ft

SCS soil type ABC

Freeze/Thaw fair

Drainage/Flood control yes

- Diverted runoff from a protected or stabilized upland area shall outlet directly onto an undisturbed stabilized area.
- Diverted runoff from a disturbed or exposed upland area shall be conveyed to a sediment trapping device such as a sediment trap (BMP #137), or to an area protected by any of these practices.
- The on-site location may need to be adjusted to meet field conditions in order to utilize the most suitable outlet.

CONSTRUCTION GUIDELINES

The disturbed area of the dike and swale shall be stabilized within 10 days of installation, in accordance with the guidelines seed and straw mulch or straw mulch only if not in the seeding season. (See BMPs #143 and #121).

MAINTENANCE

See BMP #140 - Earth Dike, or treatment BMP #1 - Vegetated Swale.

BMP #142 - Temporary Berms (Sandbags)

DESCRIPTION

A temporary berm is a ridge of compacted soil, or sandbags which intercepts and diverts runoff from small construction areas. Temporary berms are often constructed along the top edge of fill slopes but may also be constructed across the roadway (as a transverse berm) at a slight angle with the centerline.

Berms are used to prevent runoff onto newly constructed slopes until vegetation is established or until permanent measures are in place. They intercept flow from the construction area and direct it to temporary slope drains or to outlets where it can be safely discharged.

APPLICATIONS

Temporary berms are used to direct or divert runoff flows, or as barriers to collect and store runoff. They are used at storm drain inlets, across minor swales and ditches, and for other applications where the structure is of a temporary nature.

LIMITATIONS

Temporary berms do not provide filtration. Therefore, they can only be used for minor flows.

DESIGN PARAMETERS

Soil berm: A berm of soil with an approximate height of 12 to 20 in (300 to 500 mm) with a minimum top width of 2 to 2.3 ft (600 to 700) mm and side slopes of 2:1 or flatter. Berms should be high enough to prevent flow from overtopping. Berms are normally constructed from embankment materials.

Sandbag berm: The following dimensions are suitable for sandbag berms.

- Height - 20 in (0.5 meter) minimum
- Top width - 20 in (0.5 meter) minimum
- Bottom width - approximately 4.25 to 5 ft (1.3 to 1.5 meters)
- Sandbag size - length 2 to 2.6 ft (0.6 to 0.8 meters), width 16 to 20 in (0.4 to 0.5 meters), depth or thickness 6 to 8 in (150 to 200 mm), and weight 88 to 132 lb (40-60 kg)

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area 5 ac

Max slope 50%

Min bedrock depth N/A

Min water table N/A

SCS soil type ABCD

Freeze/Thaw good

Drainage/Flood control yes

CONSTRUCTION GUIDELINES

Soil berm: All berms should be graded to drain to a slope drain inlet. When practical, embankments should be constructed with a gradual slope to one side of the embankment. This will permit the placement of all temporary berms and slope drains on one side of the embankment. When fills are constructed on sidehill slopes, the top surface should slope toward the inside so that surface runoff will be away from the fill slope.

- Compact the entire width of the berm. This can be accomplished with the track of a bulldozer or, preferably, with a grader wheel (rubber).

Sandbag berm:

- Install so that flow under or between bags is prevented.
- Stack the sandbags in an interlocking fashion to provide additional strength for resisting the force of the flowing water. However, do not stack them more than three high without broadening the foundation using additional sandbags, or providing additional stability.
- Sandbag sediment barriers should store the runoff from design storm as specified.

MAINTENANCE:

Temporary berms should be inspected and repaired periodically as well as after each significant rainfall.

Sandbags should be reshaped or replaced as needed during inspection. Additional inspections should be made daily during wet weather. When silt reaches 6 inches (150 mm), the accumulated silt should be removed and disposed of at an approved site in a manner that will not contribute to additional siltation. The sandbag berm should be left in place until all upstream areas are stabilized and accumulated silt has been removed. Removal of bags should be done by hand.

BMP #143 - Temporary Storm Drain Diversion

DESCRIPTION

The re-direction of a storm drain line or outfall channel so that it may temporarily discharge into a sediment trapping device. The purpose is to prevent sediment laden water from entering a watercourse, public or private property through a storm drain system, or to temporarily provide underground conveyance of sediment laden water to a sediment trapping device.

APPLICATIONS

One of the following practices or procedures shall be used whenever the off-site drainage area is less than 50 percent of the on-site drainage area to that system. A special exception may be given, at the discretion of the local permitting authority, where site conditions make this procedure impossible.

DESIGN METHODS FOR TEMPORARY DIVERSION

- Construction of a sediment trap (basin) (see BMP #137) below a permanent storm drain outfall: Temporarily divert storm flow into the basin or trap constructed below permanent outfall channel.
- In-line diversion of storm drain at an inlet or manhole: Achieved by installing a pipe stub in the side of a manhole or inlet and temporarily blocking the permanent outfall pipe from that structure. A temporary outfall ditch or pipe may be used to convey storm flow from the stub to a sediment trap or basin. This method may be used just above a permanent outfall or prior to connecting into an existing storm drain system.
- Delay completion of the permanent storm drain outfall and temporarily divert storm flow into a sediment trap: Earth dike (BMP #140), swale (BMP #139) or designed diversion is used, depending on the drainage area, to direct flow into a sediment trap. The trap should be constructed to one side of the proposed permanent storm drain location whenever possible.
- Installation of a stormwater management basin early in the construction sequence: Install temporary measures to allow use as a sediment basin. Since these structures are designed to receive storm drain outfalls, diversion should not be necessary.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area 5 ac
Max slope 50%
Min bedrock depth NA
Min water table NA
SCS soil type ABCD
Freeze/Thaw good
Drainage/Flood control yes

COMPLETION AND DISPOSITION

When the areas contributing sediment to the system have been stabilized procedures can be taken to restore the system to its planned use.

The following removal and restoration procedure is recommended:

1. Flush the storm drain system to remove any accumulated sediment.
1. Remove the sediment control devices, such as traps, basins, dikes, swales, etc.
2. For sites where an inlet was modified, brick shut the temporary pipe stub and open the permanent outfall pipe.
3. Establish permanent stabilized outfall channel as noted on the plans.
4. Restore the area to grades shown on the plan and stabilize with vegetative measures.
5. For basins that will be converted to stormwater management, remove the accumulated sediment, open the low flow orifice, and seed all disturbed areas to permanent vegetation.

BMP #144 - Topsoiling

DESCRIPTION

This BMP includes the placement of topsoil or other suitable plant growth material over disturbed lands to provide a suitable soil medium for vegetative growth and a supply of native or locally occurring seeds and propagules. Topsoiling may involve bringing in soils from off site or merely replacing fertile topsoils that were stripped and stockpiled during earlier site development activities.

APPLICATIONS

Topsoiling is recommended on slopes 2:1 or flatter where the native soil is unsuitable for vegetative growth. It is an effective way of improving plant establishment on sites where moisture, nutrients, or pH levels are low, or where the remaining soil is too shallow to support root systems.

LIMITATIONS

Be careful not to apply topsoil over a subsoil of contrasting texture. For instance, a clay-like topsoil placed over a sandy soil may cause the topsoil to slough as water flows between the two soil layers of different permeability. Also, topsoil should not be applied when the subsoil is frozen or extremely wet.

DESIGN PARAMETERS

Plan to maintain the existing or established grade of the subsoil. The topsoil should be uniformly distributed at a minimum compacted depth of 2 inches (50 mm) on slopes 3:1 or steeper, and 4 inches (100 mm) deep on flatter slopes. The soil should be a loam, sandy loam, clay loam, silt loam, sandy clay loam, or other mixture approved by an agronomist. It should be free of subsoil, refuse, sticks, noxious weed seeds, other extraneous materials, and stones larger than 1.5 inches (40 mm) diameter.

Topsoil can either be obtained commercially or stripped, stockpiled, and replaced on the construction site. Stockpiled topsoils should undergo a laboratory analysis to determine organic content, pH, and soluble salts. A pH of 6.0 to 7.5 and organic content of not less than 1.5 percent by weight is recommended. Where soil pH is less than 6.0, lime may be applied to adjust pH to 6.5 or higher. Any soils having soluble salt content greater than 500 parts per million should not be used.

If desired, it is possible to place a thin layer of topsoil 1.2 to 2 inches (30 to 50 mm) thick on benched slopes. In such applications, it is important not to apply so much topsoil that the value of the benches is destroyed. This method is especially valuable

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area unlimited

Max slope 50%

Min bedrock depth 3 ft

Min water table 2 ft

SCS soil type N/A

Freeze/Thaw fair

Drainage/Flood control no

on rocky benches, especially on south- or west-facing slopes, however, proper placement of the soil is often a problem. In some cases, soil has been bucketed onto slopes. This produces an uneven spread and the quantity is hard to control. Soil can also be blown onto the slope using a snow blower. In that case, organic matter can be mixed with the soil, but the soil should be screened to remove any rocks larger than 2 inches (50 mm). The advantage is that the amount of soil needed is much less and it can be spread very rapidly on the horizontal surfaces. The soil may need some form of stabilization before the next rain event. Consider whether mulch, matting, geotextiles or seeding is required and when.

CONSTRUCTION GUIDELINES

The following guidelines apply to the placement of topsoil:

- The existing or established grade of subsoil should be maintained.
- Lime may be uniformly applied over designated areas where subsoil is highly acidic or heavy in clay content.
- Prior to spreading topsoil, loosen the subgrade by discing (or other method) to a depth of 2 inches (50 mm) to permit bonding of subsoil to topsoil. Tracking a bulldozer vertically over the slope will pack the soil and create horizontal erosion check slots to prevent topsoil from sliding down the slope.
- Spread the topsoil uniformly at a minimum compacted depth of 2 inches (50 mm) on 1:3 or steeper slopes and 4 inches (100 mm) on flatter slopes. A depth of 6 to 12 inches (150 to 300 mm) is preferred. Any surface irregularities should be corrected in an effort to prevent formation of water-holding depressions.
- Where quantities of stockpiled topsoil on site are limited, it is more desirable to cover all areas of exposed subsoil to a lesser depth than to cover partial areas to the suggested minimum depth of 3.1 inches (80 mm).
- Topsoil should not be placed when the subgrade is frozen, excessively wet or in a condition that may otherwise be detrimental to proper grading or proposed sodding or vegetation establishment.

MAINTENANCE

Periodically and after major storm events, inspect, repair, and reseed as necessary to control slope erosion and subsequent topsoil losses.

BMP #145 - Seeding

DESCRIPTION

Permanent Seeding means growing a long-term or permanent vegetative cover (plants) on disturbed areas or areas that need assistance in revegetation. The purpose of permanent seeding is to reduce erosion and sedimentation and to establish desirable competitive ground cover for wildlife habitat and ease of roadside maintenance. This practice uses prescribed perennial grasses, legumes and native shrubs or wild flowers that will hold the soils, reduce storm water runoff and act as a bio-filtering system on long term basis.

The guidelines given in this fact sheet for design, construction and maintenance can also be used to install temporary seeding on construction sites.

APPLICATIONS

Temporary seeding should be considered as slope protection and erosion control practice for construction sites. Permanent seeding should be considered for any disturbed area where all construction or maintenance activities have ceased or been finalized and is now ready for permanent vegetative cover. Typical areas subject to permanent vegetative cover are all areas disturbed by new construction, reconstruction, maintenance, materials source site and areas in need of revegetation.

The primary advantages of seeding are:

- It establishes good soil stabilization.
- It prevents soil erosion and sedimentation.
- It contains and filters storm water runoff.

Additional advantages specific to permanent seeding are:

- It provides wildlife ground cover and habitat.
- It competes with undesirable vegetation and noxious weeds.
- It provides aesthetic qualities.
- It reduces the cost of maintenance.

LIMITATIONS

Targeted Pollutants

- Sediment
- ◐ Phosphorus
- ◐ Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area unlimited

Max slope 5%

Min bedrock depth 2 ft

Min water table 2 ft

SCS soil type ABCD

Freeze/Thaw fair

Drainage/Flood control no

Permanent vegetative ground cover will take several years before sufficient establishment takes place. Establishment will occur quicker in high precipitation areas, usually over 20 inches (500 mm), as opposed to the arid or semi-arid regions of the state. Permanent seeding should be conducted in conjunction with various forms of mulching, matting and annual grass (cereal grain) as a nurse crop.

Other factors that contribute to the success or failure of permanent seeding are:

- Seeding should be done at the proper time of year.
- Proper application of fertilizers as prescribed will contribute to the success of the seeding.
- Once seeded, the site should not be disturbed.
- Irrigation may have to be used in low precipitation area (arid/semi-arid) for establishment.

DESIGN PARAMETERS

Conduct all permanent seeding and fertilizing in accordance with local requirements. See Appendix F in this manual for additional guidelines.

CONSTRUCTION GUIDELINES

- Permanent seeding is the last phase of reclaiming any disturbed soils.

MAINTENANCE

- Inspect all seeded areas on a regular basis and after each major storm event to check for areas where corrective measures may have to be made.
- Indicate which areas need to be reseeded or where other remedial actions are necessary to assure establishment of permanent seeding.
- Continue monitoring of the site/area until permanent vegetation is established.

BMP #146 - Sodding

DESCRIPTION

This BMP entails the placement of rolls or strips of sod as a landscape planting or erosion control measure. Sod is a layer of soil bound by grass and plant roots into a thick mat. It is commercially available in rolled strips that are laid over an area of exposed soil. Sod stabilizes the area by immediately covering the surface with vegetation and enabling storm water to infiltrate into the ground.

APPLICATIONS

Sodding is appropriate for any graded or cleared area that might erode and where a permanent, long-lived plant cover is needed immediately. It can be a temporary or permanent BMP. Possible uses for sod include buffer zones, stream banks, dikes, swales, slopes, outlets, level spreaders, and filter strips.

Primary advantages of sod are:

- Provides immediate dense vegetative cover and erosion control.
- Provides more stabilizing protection than initial seeding.
- Generates less weed growth than seeded vegetation does.
- Can be available for site activities (open to foot traffic) within a shorter time than can seeded vegetation.
- Can be placed at any time of the year as long as water is available and moisture conditions in the soil are favorable.

LIMITATIONS

- Purchase and installation costs are higher than for seeding.
- Continued irrigation may be required if the sod is placed during dry seasons or on sandy soils. Watering may be necessary after planting and during periods of drought or intense heat.
- Sod should not be installed during very hot or wet weather.

Targeted Pollutants

- Sediment
- Phosphorus
- Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>unlimited</u>
Max slope	<u>14%</u>
Min bedrock depth	<u>2 ft</u>
Min water table	<u>2 ft</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>fair</u>
Drainage/Flood control	<u>no</u>

DESIGN PARAMETERS

Materials: Use grasses that require little or no maintenance (watering or fertilizing). This may require advance planning to obtain grasses that are desirable for the location.

Site preparation: The soil surface should be first graded before laying down the sod. Topsoil may be needed in areas where soil textures or conditions are inadequate (such as dense or impermeable soils). Add lime and fertilizers as needed to promote good plant growth conditions.

Slope: Do not place sod on slopes greater than 3:1 if slopes are to be mowed. If placed on steep slopes, the sod should be laid with staggered joints or be pegged down (or both).

Installation methods: Sod can be applied in strips or other patterns, or alternate areas can be seeded to reduce expense. If placed on steep slopes or next to running waterways, consider placing chicken wire, jute, or other matting over the sod for extra protection against lifting. See BMP #124-Matting and Netting or BMP #123-Geotextiles.

CONSTRUCTION GUIDELINES

- Spread and grade the topsoil (if used). Sod may be placed directly on the ground (without topsoil) only if it has been specifically grown for sites with no topsoil.
- Prepare the soil surface by fine-grading the surface before laying sod. Sodding should then take place immediately after the soil bed is established.
- Lay the sod in a staggered pattern, as shown. Sod in waterways must be laid parallel to the flow.
- Sod can be laid in strips on the contour to reduce effective slope length.
- Roll or compact the sod immediately after installation to ensure firm contact with the underlying soil.
- Water to a depth of 4 inches (100 mm), as needed.

MAINTENANCE

- Inspect the sod frequently after it is first installed, especially after large storm events, until it is established as permanent cover. Remove and replace any dead sod.
- Once the sod is established, mow the area as needed.
- Water as often as necessary during periods of intense heat or lack of rain.
- Sodding usually serves as both a temporary and permanent measure and therefore does not require removal.

BMP #147 - Planting

DESCRIPTION

This BMP fact sheet describes the process of establishing vegetation by setting out plants that have been grown to a specified size or age. The plants may be potted in plastic tubes or in containers of various sizes, or root wrapped, or may be bare root stock .

Plantings are often specified for aesthetic purposes (landscaping) but can serve various erosion control functions as well. The living trees and shrubs in a planted area will grow large enough to provide soil stabilization and erosion control benefits sooner than the seeds of woody species can germinate and grow to effective size.

The use of trees and shrubs also provides greater aesthetic and biological diversity and, in many areas, is more compatible with vegetation on lands adjoining the planted site.

Also refer to Appendix F for additional design guidance regarding using landscaping to maximize water quality benefits.

APPLICATIONS

Planting is the preferred method of revegetation in many situations where seeding and other slope treatments are either not effective or not appropriate as permanent measures. Such areas may include:

- Any finished slope that will remain undisturbed for at least ten years, especially if the area is bordered by forests, wetlands or other naturally occurring woody vegetation. On such sites, trees and shrubs may be the desirable vegetation from a long-term perspective, but may be very difficult or unreliable to establish from seed.
- Extremely rocky slopes or sites. If natural vegetation is present in significant amounts, such areas are difficult to seed and mulch effectively. Plantings can be used to provide additional stabilization.
- Streets or materials source sites that have been abandoned permanently.
- All types of landscaping, including urban thoroughfares and interchanges, and residential streets where landscape aesthetics are a concern.
- Wetlands and wildlife habitat areas: in such areas, it may be critical to plant the desired species initially, so that the site is not overrun by weeds or undesirable plant species that detract from the intended use of the site.

Targeted Pollutants

- Sediment
- ◐ Phosphorus
- ◐ Trace metals
- Bacteria
- Petroleum hydrocarbons

Physical Limits

Drainage area	<u>unlimited</u>
Max slope	<u>50%</u>
Min bedrock depth	<u>3 ft</u>
Min water table	<u>3 ft</u>
SCS soil type	<u>ABCD</u>
Freeze/Thaw	<u>fair</u>
Drainage/Flood control	<u>no</u>

- Areas where the higher rate of transpiration for trees and shrubs (compared to grasses and forbs) helps remove excess moisture from the soil.

LIMITATIONS

- Purchase and installation costs are higher than for seeding.
- Continued or periodic irrigation may be required if planting occurs during dry season or on sandy soils. Watering may also be necessary up to two years after planting and during periods of drought or intense heat.
- Specific seasons of work apply for planting. Planting outside the designated season should not be allowed unless provisions for special care and maintenance of the plants are enforceable.

DESIGN PARAMETERS

Advantages of Planting: Many shrubs and trees are difficult to establish from seed in natural environments and natural seed crops vary widely from year to year. Rapid invasion from native vegetation and rapid establishment of sown seed of woody species is therefore unreliable. Vegetative plantings are used to provide living shrubs and trees that will grow to adequate size to provide soil stabilization and erosion control faster than seeds of woody species can germinate and grow to these dimensions.

Materials: Planted material may be grown from either cuttings or seed. At delivery to a job site, the plants may be potted (in containers), root wrapped, or bare root stock. Some species are successfully planted as sprigs or tubelings.

Use of Native Species: If possible, use species that are native to the area. Native species provide long-term soil stabilization which is aesthetically harmonious with natural vegetation and which requires little long-term maintenance. Short-term maintenance is necessary to ensure the establishment of the vegetation.

Maximizing Effectiveness: Successful planting projects depend on selecting suitable plant species, using healthy planting stock, and planting when the season and weather conditions are favorable. The site must be properly prepared for planting, and must be properly maintained after planting to ensure long-term survival of the plants. Make sure the contract and plans include adequate provisions for all aspects of the planting process.

Since vegetative planting places living plants on a site, thus decreasing the length of time necessary to establish a complete revegetation project, it is more effective than seeding methods for revegetation. Adequate maintenance is absolutely necessary to achieve this effectiveness since vegetative planting require irrigation for at least the first year, and will benefit from irrigation for two or more years.

Vegetative planting may be combined with seeded grasses and legumes which provide immediate surface coverage (see BMP #145-Seeding).

CONSTRUCTION GUIDELINES

Make sure that planting site is adequately graded and that tree locations and planting areas (for shrubs, vines, and ground covers) are marked and approved before planting begins.

Plant materials must be examined before use to ensure that species, container sizes, and root and soil condition are acceptable. If possible, the growth medium for containerized plants should be similar to the soil type on the revegetation site. Container size guidelines are as follows:

- Tree species may be of bare root stock or of potted stock. Pots should be one gallon (4 liter) size or larger.
- Shrub species may be of bare root stock or of potted stock. The preferred planting pot is a tube of woven plastic that is planted with the plant contained in it. The pot deteriorates over time. The pots should be 2 inches (50 mm) long, with both ends open.
- Paper pots must be 2 to 3.1 inches (50 to 80 mm) square and 8.5 to 12 inches (220 to 300 mm) long. The paper around the rim should be removed to ground level at planting.
- Peat pots are not recommended since research has shown greater mortality of plantings in peat pots due to drying. If peat pots are used, any exposed peat pot material showing after planting should be removed.
- In general, no container should be less than 2 inches (50 mm) wide and 6 inches (150 mm) deep.

Plant storage: Store bundled bare root planting stock, whether tree or shrub species, in a cool, moist place from time of receipt until time of planting. This time should not exceed 10 days.

Store potted planting stock in shade, out-of-doors, and kept lightly sprinkled with water to maintain a moist soil from the time of receipt to the time of planting. This time should not exceed 30 days.

Planting procedures:

- Plant the mixture of trees and shrubs that has been prescribed. In no case should this be less than 690 plants per acre (1,700 plants per hectare). If bare root stocks are used, planting rates should be increased by 1.25 times the stated rate.
- Voluntary or unskilled labor may be used in planting. However, a supervisor who is skilled in the techniques being used should direct the labor.
- Construct a basin 12 inches (300 mm) in diameter and depressed no more than 2 inches (50 mm) from the elevation of the downslope lip.
- Open the planting hole with a planting bar or shovel. Then place the plant near the downslope lip of the basin. This allows sloughing from the slope to fall in to the basin without burying the young plant.

- Carefully remove plants from their containers, if any, and place them in the planting holes so that the crown of the plant is at the surface of the soil. No air space should be allowed around the roots, nor should the roots be folded under. Plants in individual containers made of decomposable material are planted without removing them from the container.
- Apply fertilizer at the rate specified, and place wood chip or wood fiber mulch to a depth of 2 inches (50 mm) around each plant.
- The soil should be wetted to field capacity to a depth of 3.1 to 4 inches (80 to 100 mm) at the time of planting and each time the soil moisture level drops below the permanent wilting percentage.

MAINTENANCE

- Irrigation of vegetative plantings during the first two years following planting is required to increase the survival rate. Water as often as necessary during periods of intense heat or lack of rain.
- Inspect plantings frequently after first installed to see if plants are thriving. Remove and replace dead plants to restore the prescribed number of living plants per hectare.
- After storm events, examine the planting basins and mulch cover and make any needed repairs.

APPENDIX 12-1

Sampling Locations and Rationale

[Redacted due to national security concerns]

APPENDIX 12-2

Other Permit-identified Sites

[Redacted due to national security concerns]

APPENDIX 13-1

Draft Final Program Effectiveness Assessment Plan

March 2016

DRAFT FINAL, PREDECISIONAL FOR DISCUSSION PURPOSES
ONLY, DO NOT CITE OR QUOTE

PROGRAM EFFECTIVENESS ASSESSMENT PLAN

Storm Water Management Plan

Department of the Navy, Navy Region Hawaii

NPDES Permit No. HI S000257

Prepared by:

Navy Region Hawaii

March 2016

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List of Acronyms and Abbreviations

BMP	Best Management Practice
CASQA	California Storm Water Quality Association
DOE	Department of Education
DOH	State of Hawaii Department of Health
GIS	Geographic Information System
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
NAVFAC	Naval Facilities Engineering Command
NEX	Navy Exchange
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRH	Navy Region Hawaii
O&M	Operation and Maintenance
SWMP	Storm Water Management Plan
SWPCP	Storm Water Pollution Control Plan
TMDL	Total Maximum Daily Load
WLA	Waste Load Allocation

1 Introduction

As of the effective date, March 23, 2015, the Department of the Navy, Navy Region Hawaii is required to comply with the conditions of the National Pollutant Discharge Elimination System (NPDES) Small Municipal Separate Storm Sewer System (MS4) and Navy Industrial Facilities Permit No. HI S000257 (referred to hereinafter as the "Permit"). The Permit includes authorized storm water and specified non-storm water discharges into waters in and around Oahu, Hawaii (Pearl Harbor, Halawa Stream, Kaiapo Canal, Kaukonahua Stream, Kumumauu Canal, Mailiili Stream, Mamala Bay, Manuwai Canal, Poamoho Stream, Transportation Canal, Ulehawa Stream, Unnamed Tributary of Waikele Stream, and Unnamed Gulches in Wahiawa, Waikakalaua, and Waiawa Streams). Per the Permit, Part G.2.b.vi, Navy Region Hawaii is required to provide a Program Effectiveness Assessment Plan. The Permit states:

Reporting Requirements, Part G.2.b.vi:

"Program Effectiveness Reporting - Within one (1) year of the effective date of the permit, the Permittee shall submit to DOH a written strategy for determining the effectiveness of its SWMP. The strategy shall include water quality monitoring efforts as well as program implementation information and other indicators. The Permittee shall include an assessment of program effectiveness and identification of water quality improvements or degradation beginning with the 2nd Annual Report."

For the purpose of this Program Effectiveness Plan, the term "Base" is inclusive of all areas covered by the Permit. This includes Joint Base Pearl Harbor Hickam (JBPHH) and other specified Navy industrial areas and facilities. This plan presents the strategy for:

- (1) measuring progress of permit compliance and implementation of Best Management Practices (BMPs);
- (2) tracking program component effectiveness over the permit period; and
- (3) setting the frame work to be able to link program implementation with environmental improvements over time.

1.1 Strategy

This plan has been developed to incorporate elements of the California Storm Water Quality Association (CASQA) approach to program effectiveness as detailed in their 2007 manual. The approach is based on expected outcomes that result from implementing the various components of the storm water management program. The outcomes are characterized into six Outcome Levels as shown on Figure 1, which has been adapted from CASQA. The pyramid structure illustrates the progression from implementing activities to protecting water quality. The Outcome Levels help categorize and define the desired results or goals of programs and control measures.

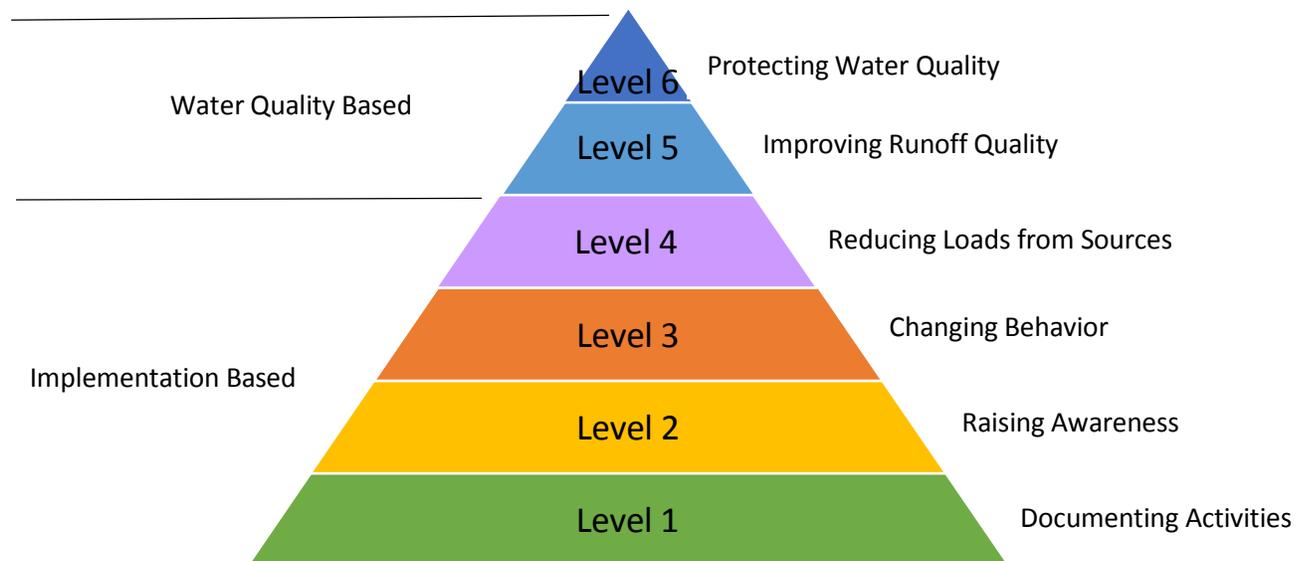


Figure 1: Outcome Levels

The Outcome Levels are defined as follows:

Level 1 – Documenting Activities

Many program activities are directly established as permit requirements and can be tracked by simply documenting activities. Level 1 outcomes may take the form of a confirmation of task completion (yes/no answers) or direct tabulation of efforts (such as the number of inspections completed or plans reviewed). Level 1 outcomes can also include documenting progress towards measurable goals by confirming whether they have been met or not. Level 1 outcomes reflect program implementation and permit compliance and are assumed to be beneficial to water quality but are not indicators of the direct impact of program implementation on environmental conditions.

Level 2 – Raising Awareness

Level 2 outcomes reflect how well the program is able to increase the level of knowledge and awareness and change attitudes of target audiences including tenant commands, civilian workers, residents, commercial and industrial businesses, contractors, and designers. Measuring these outcomes is done through various methods including surveys and training quizzes, and may be inferred through observations of community involvement such as the number of visits to the Navy Region Hawaii environmental website, and other partner websites. Similar to Level 1 outcomes, Level 2 outcomes are assumed to be beneficial to water quality but are not indicators of the direct impact of program implementation on environmental conditions.

Level 3 – Changing Behavior

The goal of raising knowledge and awareness (in Level 2 outcomes) is to effect behavior change that results in the implementation of recommended BMPs. Level 3 outcomes indicate how effective program components are in motivating behavior change and BMP implementation among target audiences. These changes can be tracked using surveys; site visits and inspections

to observe BMP implementation at sites such as construction sites or industrial facilities; and tabulating changes in program involvement.

Level 4 – Reducing Pollutant Loads from Sources

Many BMPs are intended to reduce the amount of pollutants that have the potential to discharge into the MS4. Level 4 outcomes provide program managers with feedback/ data regarding reductions in pollutant loads as a result of the implementation or enhancement of a BMP. These outcomes can include information such as the amount of debris collected during street sweeping, the amount of trash collected during volunteer cleanups, and by examining photos of the debris present in drainage ways and detention basins. The data are compared to baseline estimates to provide feedback on the effectiveness of BMPs and control strategies.

Level 5 – Improving Runoff Quality

The primary goal of the Storm Water Management Plan (SWMP) is to reduce pollutants to the MS4 to the maximum extent practicable (MEP) and to ensure that discharges do not cause or contribute to exceedances of water quality standards in receiving waters. Level 5 outcomes may be the most direct measure of program effectiveness as it relates to improving the quality of storm water runoff. Level 5 outcomes may be measured as reductions in one or more specific pollutants and may reflect effectiveness of BMP implementation at the above outcome levels.

Level 6 – Protecting Receiving Water Quality

The ultimate objective of any NPDES SWMP is to protect receiving water quality. These outcomes are the most challenging to document and are many times affected by more than the quality of storm water discharges, including sanitary sewer overflows, rising groundwater, agricultural runoff, and other non-point source pollutants. Additionally, receiving water quality is dependent upon partnerships with other agencies, land owners and stakeholders, and the general public. Assessment methods include compliance with water quality standards, Total Maximum Daily Load (TMDL) programs, biological assessments, and other monitoring assessments. It may take years to establish a reliable data set and even longer periods of time to allow the cumulative impacts of multiple program elements to take effect.

1.2 Assessment Measures

In each outcome level, several methods are available to determine if outcomes are being achieved.

These methods include:

- confirming that permit requirements have been met;
- tabulating specific activities and load reduction;
- surveying employees and residents;
- inspecting construction sites and post-construction BMPs; and
- monitoring runoff and receiving waters.

A summary of the assessment methods and their application to each outcome level are listed in Table 1, below.

Table 1: Assessment Methods for Different Outcome Levels

Assessment Method	Outcome Level					
	Level 1 Documenting Activities	Level 2 Raising Awareness	Level 3 Changing Behavior	Level 4 Reducing Loads from Sources	Level 5 Improving Runoff Quality	Level 6 Protecting Receiving Water Quality
Confirmation	X					
Tabulation	X	X	X	X		
Survey		X	X			
Inspection	X	X	X	X		
Monitoring				X	X	X

Notes: Table has been adapted from CASQA Municipal Stormwater Program Effectiveness Assessment Guidance, 2007.

The various data collected will be tracked and compared from year to year in order to meet goals or as a way to view trends and help guide the program for subsequent years. The data will be tracked using program databases and the Navy's Geographic Information System (GIS), which contains an inventory of MS4 features and other related data. Updating the GIS and data tracking will be an ongoing process that is integral to allow for effective monitoring and preventative storm water quality measures.

1.3 Measurable Goals

As required by the Permit, Navy Region Hawaii has developed specific measurable goals or milestones related to each program component. The measurable goals are based on past experiences, previous trends or results of previous surveys, or based on compliance with the Permit. Measurable goals have been incorporated into this approach as data assessment measures and are used to assist tracking program effectiveness.

1.4 Program Assessment and Reporting

Overall Program Assessment will be incorporated into the Annual Report required by the Permit. Most program assessment will be conducted at the implementation level (Outcome Levels 1 to 4). Water quality assessments (Outcome Levels 5 and 6) are conducted as part of Navy Region Hawaii's ongoing Annual Monitoring program.

1.5 Document Organization

The following chapters describe the outcomes that Navy Region Hawaii aims to achieve during this Permit term and the data collected that will be used to assess each of the following programs:

- Public Education and Outreach;
- Illicit Discharge Detection and Elimination;
- Construction Site Runoff Control;
- Post Construction Storm Water Management in New Development and Redevelopment;
- Pollution Prevention and Good Housekeeping; and
- Industrial and Commercial Discharge Management.

Each section will present outcome objectives and assessments measures as follows:

- Outcome Objectives: lists the desired outcomes that each program will strive to achieve during the permit term. The outcomes are categorized by the Outcome Levels.
- Assessment Measures: lists the data that will be used to assess each desired outcome. The measures are categorized by assessment method (i.e., confirmation, tabulation, etc.) and may directly or indirectly measure progress towards the desired outcome.

2 Public Education and Outreach

Assessing the Public Education and Outreach is an iterative process that relies on a variety of methods. The target audiences include tenant commands; civilian personnel; residents; industrial and commercial businesses; construction operators; and schools, including staff, students, and contractors. The desired outcomes are to raise awareness and effect behavior change through a variety of methods including distributing educational materials, conducting media campaigns, holding workshops, forming partnerships with other agencies and groups, and participating in special events. This program will be assessed to Outcome Levels 1 through 3.

Outcome Level	Outcome Objectives and Data Assessment
<p>1 2</p>	<p><i>Objective:</i> Increase public support, interest, knowledge, and awareness of Storm Water Management Program.</p> <p><i>Assessment Measures:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Distribute brochures/pamphlets to new arrivals (e.g., residents and commercial/industrial workers) in orientation materials. ○ Provide storm water pollution prevention information to Base staff, contractors, and industrial and commercial businesses during environmental training classes. ○ Implement outreach through community newsletters and the Base website. ○ Stencil storm drains, with priority given to industrial and commercial areas, and areas with pedestrian traffic. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of brochures/pamphlets distributed to new arrivals. ○ Number of training classes and number attendees. ○ Number of volunteer hours. ○ Number of storm drains stenciled. ○ Annual survey. ○ Number of public informational/training meetings.
<p>1 2 3</p>	<p><i>Objective:</i> Increase public participation in special events.</p> <p><i>Assessment Measure:</i> <u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of events. ○ Number of volunteers. ○ Number of volunteer hours. ○ Number of participants in special events each year.

3 Illicit Discharge Detection and Elimination

The goal of Navy Region Hawaii’s Illicit Discharge Detection and Elimination Program is to eliminate improper discharge activities. This will be accomplished through maintenance of up-to-date records and maps of the storm drain system; training and implementation of Navy instructions prohibiting illicit storm water discharges; advertising and providing locations for turn-in of household waste materials; continuing the review and approval process for new storm drain connections; responding to complaints; inspection of facilities and the storm drain system; and maintaining spill prevention and response programs for wastewater and subsurface oil. This program will be assessed primarily at Outcome Levels 1 through 3.

Outcome Level	Outcome Objectives and Data Assessment
<p>1 2 3</p>	<p><i>Objective:</i> Encourage and facilitate public involvement in identifying and reporting illicit discharge.</p> <p><i>Assessment Measures:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Maintain base hotline and respond to complaints. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of complaints.
<p>1 2 3</p>	<p><i>Objective:</i> Decrease the number of improper discharge activities.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Maintain base hotline and respond to complaints. ○ Advertise and provide locations for turn-in of household waste materials. ○ Inspection of facilities and the storm drain system. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of complaints. ○ Number of illicit discharge investigations. ○ Number of follow-up visits. ○ Number of corrective actions completed including distribution of educational materials. ○ Number of spills. <p><u>Inspection:</u></p> <ul style="list-style-type: none"> ○ Photo documentation of identified problem areas.

<p>1 2</p>	<p><i>Objective:</i> Continue to maintain an educated Base staff regarding illicit discharge detection and elimination.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Provide training to Base staff including industrial and commercial workers on Environmental Standard Operating Procedures and Spill Prevention and Response. <p><u>Inspection:</u></p> <ul style="list-style-type: none"> ○ Results of in-house audits. ○ Results of annual Storm Water Pollution Control Plan (SWPCP) inspections.
<p>1</p>	<p><i>Objective:</i> Continue review of new storm drain connections by Naval Facilities Engineering Command (NAVFAC) Hawaii and approval by Navy Region Hawaii.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Maintain up-to-date map of storm water system components in GIS. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of new drain connection agreements approved each year, as required.

4 Construction Site Runoff Control

The Construction Site Runoff Control Program focuses on storm water discharges from construction projects that drain to drainage facilities and natural drainage ways that Navy Region Hawaii has ownership and responsibility for. Construction projects on Base include smaller projects completed by Facilities Maintenance, larger projects completed by NAVFAC, and other projects by the Department of Education (DOE), Navy Exchange (NEX), Army and Air Force Exchange Service, and Housing Public Private Venture contractors.

Navy Region Hawaii tracks the implementation of BMPs to minimize polluted runoff through design drawing review and completing inspections of active construction sites. The Construction Site Runoff Control Program will be assessed at Outcome Levels 1 through 3.

Outcome Level	Outcome Objectives and Data Assessment
<p style="text-align: center;">1</p>	<p><i>Objective:</i> Continue to maintain an effective plan review program to ensure proper permits are obtained and followed.</p> <p><i>Assessment Measures:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ BMP Checklist for Construction Site Plan Approval is completed. ○ Construction sites of one or more acres will submit a notice of intent (NOI) for coverage under DOH’s general permit for construction activities or an individual NPDES permit application. ○ Plan review will ensure new developments meet Federal and State regulations, NPDES permit conditions, and building and landscape design criteria.
<p style="text-align: center;">1</p>	<p><i>Objective:</i> Continue to maintain an effective construction site inspection program.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Construction sites inspected in accordance with established frequencies. ○ Scheduled follow-up inspections are conducted. ○ Construction Site BMP Checklists are completed for all inspections. ○ Appropriate enforcement actions are taken when warranted.

<p>1 2</p>	<p><i>Objective:</i> Continue to maintain an educated and trained staff.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Provide training for employees responsible for plan review. ○ Provide training for employees responsible for construction site inspections.
<p>1 2 3</p>	<p><i>Objective:</i> Increase contractor effectiveness.</p> <p><i>Assessment Measure:</i> <u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of written notices issued. ○ Number of stop work orders issued. ○ Number of contract enforcement provisions applied. ○ Number of DOH referrals. ○ Number of repeat violations. ○ Response time for corrective actions.
<p>1</p>	<p><i>Objective:</i> Continue to maintain inventory of construction sites.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ All approved projects added to database. ○ Inspection data recorded.
<p>1</p>	<p><i>Objective:</i> Continue review and approval of new storm drain connections by Navy Region Hawaii.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Maintain up-to-date map of storm water system components in GIS. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of new drain connection agreements approved each year, as required

5 Post-Construction Management in New Development and Redevelopment

Post-construction storm water discharges can impact receiving waters by increasing the type and quantity of pollutants in storm water, and by increasing the overall quantity of storm water delivered to the receiving water body during storms. The objective of post-construction runoff controls is to improve storm water quality by installing and maintaining post-construction BMPs, both structural and non-structural, in applicable development and redevelopment projects that have the potential to discharge pollutants into the MS4.

The Post-Construction Management Program includes inspection and operation and maintenance of post-construction BMPs, which also includes routine training and outreach for staff. The Post-Construction Management Program will be assessed at Outcome Levels 1 through 3.

Outcome Level	Outcome Objectives and Data Assessment
1	<p><i>Objective:</i> Continue to maintain an effective plan review program to ensure post-construction runoff controls are incorporated into new development and redevelopment projects.</p> <p><i>Assessment Measures:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ BMP Checklist for Construction Site Plan Approval is completed. ○ Plan review will ensure new developments meet Federal and State regulations and NPDES permit conditions.
1 2	<p><i>Objective:</i> Continue to maintain an effective post-construction BMP inspection and maintenance program.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Post-construction BMPs inspected for operation and maintenance (O&M) in accordance with established frequencies. ○ Scheduled follow-up O&M inspections are conducted. ○ Permanent BMP Inspection Reports are completed for all inspections. ○ O&M completed in accordance with established frequencies. ○ Asset management system is kept up to date to track the frequency of inspections and maintenance of post-construction BMPs. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of post-construction BMP O&M inspections. ○ Number of follow-up O&M inspections.

<p>1 2</p>	<p><i>Objective:</i> Continue to maintain an educated and trained staff.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Provide training for employees responsible for plan review. ○ Provide training for employees responsible for post-construction BMP O&M inspections.
<p>1 2 3</p>	<p><i>Objective:</i> Increase awareness of post-construction facility responsibilities.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Education/outreach to facilities with post-construction BMPs. <p><u>Tabulation/Inspection:</u></p> <ul style="list-style-type: none"> ○ Number of O&M inspections with missing or incomplete inspection and maintenance logs. ○ Number of inspections with corrective actions required. ○ Number of O&M inspections requiring follow-up inspections.

6 Pollution Prevention and Good Housekeeping

The objective of the Pollution Prevention/Good Housekeeping Program is to reduce the amount of pollutants entering receiving bodies of water through both education and proper procedures. It requires examination and subsequent alternation of actions to help ensure a reduction in the type of pollution that:

- (1) collects on streets, parking lots, open spaces, and storage and vehicle maintenance areas and is discharged into local waterways; and
- (2) results from actions such as environmentally damaging land development and flood management practices or poor maintenance of storm drain systems.

The program is assessed at Outcome Levels 1 through 4.

Outcome Level	Outcome Objectives and Data Assessment
<p>1 2</p>	<p><i>Objective:</i> Continue to maintain an educated and trained staff.</p> <p><i>Assessment Measures:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Inspect industrial facilities included in the Permit annually. ○ Inspect commercial facilities according to the priority schedule developed. ○ Train maintenance personnel annually and have new maintenance employees trained as part of the orientation program.
<p>1 4</p>	<p><i>Objective:</i> Decrease potential for storm water impact from street debris.</p> <p><i>Assessment Measures:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Complete street sweeping. ○ Conduct cleaning and debris removal from drainage structures. ○ Stencil storm drains, with priority given to industrial and commercial areas, and areas with pedestrian traffic. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of storm drains stenciled ○ Number of curb miles swept. ○ Volume of trash collected.
<p>1 2 4</p>	<p><i>Objective:</i> Decrease potential for storm water impact from chemical applications.</p> <p><i>Assessment Measures:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Develop an Authorized Use List of chemicals used.

	<ul style="list-style-type: none"> ○ Monitor fertilizer and pesticide application in application logs and reduce usage where feasible. ○ Periodically collect and dispose of unused pesticides, herbicides, and fertilizers according to manufacturers' instruction. ○ Conduct annual training for personnel on proper maintenance activities. ○ Conduct annual training for personnel and contractors applying pesticides, herbicides or fertilizers. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Volume of excess/unused chemicals collected for disposal. ○ Number of facilities inspected annually. ○ Number of training sessions, and/or number of attendees to training sessions.
<p>1 3 4</p>	<p><i>Objective:</i> Improve implementation of temporary or permanent BMPs to reduce pollutants to the MS4</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u> Develop, implement, and maintain up-to-date site-specific BMPs and SWPCPs developed and implemented, as needed.</p> <p><u>Inspections:</u></p> <ul style="list-style-type: none"> ○ Number of facilities inspected annually.
<p>1 4</p>	<p><i>Objective:</i> Improve condition and utility of storm water system through inspection and maintenance program.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Conduct cleaning and debris removal from storm drainage structures, at least once during the term of the permit. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ Number of inlets/catch basins cleaned or maintained. ○ Number of inlets/catch basins inspected. ○ Number of inspections resulting in recommendations of additional maintenance. ○ Volume of debris removed.
<p>1</p>	<p><i>Objective:</i> Continue to maintain an updated inventory of the MS4.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Maintain an up-to-date map of storm water system components in GIS.

<p>1 4</p>	<p><i>Objective:</i> Reduce discharge of pollutants to the MS4 by Retrofitting Structural BMPs.</p> <p><i>Assessment Measure:</i></p> <p><u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Develop and implement an Action Plan for Retrofitting Structural BMPs. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ See Action Plan for Retrofitting Structural BMPs.
<p>1 2 4</p>	<p><i>Objective:</i> Reduce discharge of trash into and out of the MS4.</p> <p><i>Assessment Measure:</i></p> <p><u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Develop and implement a Trash Reduction Plan <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ See Trash Reduction Plan
<p>1 4</p>	<p><i>Objective:</i> Reduce effects of erosion on storm water quality.</p> <p><i>Assessment Measure:</i></p> <p><u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Develop and implement an Erosion Control BMPs Program Plan. <p><u>Tabulation:</u></p> <ul style="list-style-type: none"> ○ See Erosion Control BMPs Program Plan

7 Industrial and Commercial Discharge Management

The Industrial and Commercial Activities Discharge Management Program addresses environmental compliance at industrial and commercial facilities within the Base. The program focuses on documenting the inspection efforts, raising awareness among private commercial and industrial facility personnel, and increasing use of BMPs by these personnel. This program is assessed at Outcome Levels 1 through 3.

Outcome Level	Outcome Objectives and Data Assessment
<p>1 2 3</p>	<p><i>Objective:</i> Increase use of BMPs among industrial and commercial facilities to reduce possible spills, illegal connections and illicit discharges.</p> <p><i>Assessment Measures:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Inspect industrial facilities included in the Permit semi-annually. ○ Inspect commercial facilities at least once every five years. ○ Require a permit or written equivalent approval for drainage connections and discharge of surface runoff into the MS4. ○ Provide all facilities educational/BMP handouts or other outreach materials. ○ Deficiencies corrected by facilities issued a non-compliance notice. ○ Conduct annual training for inspectors (to identify deficiencies, assess potential impacts to receiving waters, and evaluate the appropriateness and effectiveness of deployed BMPs). <p><u>Tabulation/Inspection:</u></p> <ul style="list-style-type: none"> ○ Number of inspections conducted. ○ Number of revisits completed. ○ Number of deficiencies issued. ○ Number of corrective actions completed including distribution of educational materials. ○ Number of contract enforcement provisions applied. ○ Number of inspector training sessions, and/or number of attendees to inspector training sessions.
<p>1 2 4</p>	<p><i>Objective:</i> Improve implementation of temporary or permanent BMPs at industrial and commercial facilities to reduce pollutants to the MS4</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Develop, implement, and maintain up-to-date site-specific BMPs and SWPCPs developed and implemented, as needed. ○ Require a permit or written equivalent approval for drainage connections and discharge of surface runoff into the MS4.

	<ul style="list-style-type: none"> ○ Conduct annual training for inspectors (to identify deficiencies, assess potential impacts to receiving waters, and evaluate the appropriateness and effectiveness of deployed BMPs). <p><u>Inspections:</u></p> <ul style="list-style-type: none"> ○ Number of facilities implementing temporary or permanent BMPs. ○ Number of inspector training sessions, and/or number of attendees to inspector training sessions.
<p>1 2</p>	<p><i>Objective:</i> Improve monitoring and tracking of industrial and commercial discharge management.</p> <p><i>Assessment Measure:</i> <u>Confirmation:</u></p> <ul style="list-style-type: none"> ○ Maintain up-to-date inventory/database of industrial facilities and activities. ○ Maintain up-to-date inventory/database of commercial facilities and activities, sorted by priority area. ○ Require a permit or written equivalent approval for drainage connections and discharge of surface runoff into the MS4. ○ Develop and maintain database of permits/written approvals for drainage connections and discharge of surface runoff into the MS4.

8 Monitoring

Navy Region Hawaii conducts storm water monitoring at industrial facilities annually. The results of the monitoring are summarized in the Annual Monitoring Report submitted to DOH. Analytical results are also submitted to DOH through facility specific Discharge Monitoring Reports, which are submitted after each sampling event. As data are collected over time, the results can be used to evaluate long-term trends in pollutant reductions and assist in determining the effectiveness of the various programs in the SWMP. Navy Region Hawaii may also utilize water quality monitoring analysis results conducted by other agencies such as the City and County of Honolulu, the United State Geological Survey, and DOH to provide a comparison between discharges from the MS4 and water quality in receiving waters. The water quality monitoring results from sampling the MS4 will be used to compare relative contributions and progress towards improving water quality. The monitoring program provides data assessment measures to assess the program at Levels 1 and 4 through 6, and sets the framework for an integrated assessment between all Outcome Levels.

Waste load allocations (WLA) have been developed for discharge from the MS4 into the North Fork of Kaukanohua Stream. Monitoring for WLAs began in 2015 and will continue annually in accordance with the Permit. Monitoring results will be documented in a WLA Completion Report to demonstrate compliance with Permit required WLAs.