

BG-40 Landscape Maintenance



Photo Credit: Geoff Brosseau

Description

This category includes businesses that provide landscaping and landscape maintenance/gardening services.

Pollutant Sources

The following are sources of pollutants:

- Selecting plants or landscape design,
- Installing new landscaping,
- Maintaining landscapes,
- Using pesticides and fertilizers, and
- Using gas-powered equipment.

Pollutants can include:

- Nutrients (fertilizers, yard wastes),
- Pesticides,
- Heavy metals (copper, lead, and zinc),
- Hydrocarbons (fuels, oils and grease), and
- Sediments.

Approach

Minimize the potential for stormwater pollution and the need for resources/controls (water, pesticides, fertilizers) by creating and maintaining landscapes in a way that is compatible with the local soils, climate, and amount of rain and sun. Make stormwater pollution prevention BMPs a part of standard operating procedures and the employee training program.



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Provide employee education materials in the first language of employees, as necessary.

Source Control BMPs

The best management practices are listed by activity or area.

Landscape Design	<ul style="list-style-type: none"> <input type="checkbox"/> Specify native, low maintenance, and insectary (attract beneficial insects) plants and landscape designs. <input type="checkbox"/> Design zoned, water-efficient irrigation systems using technologies such drip irrigation, soaker hoses, or microspray systems. Landscape design should be consistent with the local Water Efficient Landscape Ordinance. See the following website for a list of local ordinances: ftp://ftp.water.ca.gov/Model-Water-Efficient-Landscape-Ordinance/Local-Ordinances/ <input type="checkbox"/> Do not landscape riparian areas, except to remove non-native plants and replace them with native riparian landscaping. <input type="checkbox"/> Replant with native species where possible when landscaping or building an ornamental pond. Do not assume something is native because you have seen it in your area. Contact the local nursery for information or visit the California Exotic Pest Plant Council website (www.caleppc.org).
Landscape Installation	<ul style="list-style-type: none"> <input type="checkbox"/> Protect stockpiles and landscaping materials from wind and rain by storing them under tarps or secured plastic sheeting. <input type="checkbox"/> Schedule grading and excavation projects during dry weather. <input type="checkbox"/> Divert runoff from exposed soils or lower its velocity by leveling and terracing. <input type="checkbox"/> Use temporary check dams or ditches to divert runoff away from storm drains. <input type="checkbox"/> Protect storm drains with sandbags or other sediment controls. <input type="checkbox"/> Revegetation is an excellent form of erosion control for any site. Keep soils covered with vegetation or temporary cover material (mulch) to control erosion. <input type="checkbox"/> Check plant roots before buying a plant. Do not buy plants with roots are that kinked or circling around the container. Do not buy plants with soft, rotten, or deformed root crowns. <input type="checkbox"/> Do not pile soil around the plant any higher than the root crown.
Landscape Maintenance	<p>Yard Waste</p> <ul style="list-style-type: none"> <input type="checkbox"/> Allow leaf drop to become part of the mulch layer in tree, shrub, and groundcover areas. <input type="checkbox"/> Keep lawn mower blades sharp, and grasscycle.

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- Grasscycle – leave grass clippings on the lawn when mowing. Once cut, grass clippings first dehydrate, and then decompose, quickly disappearing from view. Proper mowing is required for successful grasscycling. Cut grass when the surface is dry, and keep mower blades sharp. Follow the "1/3 Rule": mow the lawn often enough so that no more than 1/3 of the length of the grass blade is cut in any one mowing. Frequent mowing will produce short clippings that will not cover up the grass surface. The lawn may have to be cut every seven days when the lawn is growing fast but only every 7 to 14 days when the lawn is growing slowly.
- Do not leave clippings on pavement or sidewalks where they can wash off into the street, gutter, or storm drain.
- Collect lawn and garden clippings, pruning waste, and tree trimmings. Chip if necessary, and compost or take to the local municipal yard waste recycling/composting facility.
- In communities with curbside pick-up of yard waste, place clippings and pruning waste at the curb in approved bags or containers. No curbside pickup of yard waste is available for commercial properties.
- Do not blow or rake leaves or other yard waste into the street, or place yard waste in gutters or on dirt shoulders, unless it is being piled up for recycling (allowed by some municipalities). After pick-up, sweep up any leaves, litter, or residue in gutters or on street.

Fertilizing and Pruning

- Perform soil analysis seasonally to determine actual fertilization need and application rates.
- Fertilize garden areas with a mulch of leaves, bark, or composted manure and/or garden waste.
- Apply chemical fertilizer only as needed, when plants can best use it, and when the potential for it being carried away by runoff is low. Make sure the fertilizer spreader is calibrated.
- Prune plants sparingly, if at all. A healthy plant – one that is native to the area and growing under the right conditions – should not need pruning, except when it is not in the right location (where safety or liability is a concern).

Watering

- Use soil probes to determine soil moisture depth, overall moisture levels, and the need to adjust irrigation schedules.
- Check sprinklers regularly. Adjust as needed to minimize or eliminate overspray onto impervious surfaces. Replace broken sprinklers or lines.

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	<p>Pest and Weed Control</p> <ul style="list-style-type: none">□ Obtain appropriate licenses for pest control and pesticides. Contact the Department of Pesticide Regulation for more information.□ Become trained in and offer customers less-toxic pest control or Integrated Pest Management (IPM).□ The label on a pesticide container is a legal document. Use a pesticide only as instructed on the label.□ Store pesticides, fertilizers, and other chemicals indoors or in a shed or storage cabinet.□ Use pesticides sparingly, according to instructions on the label. Rinse empty containers, and use rinsewater as product.□ Dispose of rinsed, empty containers in the trash. Dispose of unused pesticides as hazardous waste.□ To control weeds, use drip irrigation and mulch. Hand-pull weeds including roots or cut down to ground. Repeat cutting before they flower, grow new leaves, or go to seed. Use herbicides containing pelargonic acid or herbicidal soap as a last resort. <p>Handling Gasoline</p> <ul style="list-style-type: none">□ Use only containers approved by a nationally recognized testing lab, such as Underwriters Laboratories (UL). Keep the container tightly sealed. Containers should be fitted with a spout to allow pouring without spilling and to minimize the generation of vapors.□ Fill cautiously. Always use a funnel and/or spout to prevent spilling or splashing when fueling power mowers, blowers, and all other gas-powered equipment.□ Avoid spilling gasoline on the ground, especially near wells. If a spill occurs use kitty litter, saw dust, or an absorbent towel to soak up the spill, then dispose of it properly.□ Store carefully. Gasoline moves quickly through soil and into groundwater, therefore, store and use gasoline and fuel equipment as far away from your drinking water well as possible. Be certain to keep a closed cap on the gasoline container. Store at ground level, not on a shelf to minimize the danger of falling and spilling.□ Do not dispose of gasoline down the drain, into surface water, onto the ground, or in the trash. Contact the local municipality for directions on proper disposal of excess or old gasoline. Transport old gas in an approved gasoline container. <p>Working Near Waterbodies</p> <ul style="list-style-type: none">□ Do not dump lawn clippings, other yard waste, or soil along creek banks or in creeks.
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	<ul style="list-style-type: none"><input type="checkbox"/> Do not store stockpiles of materials (soil, mulch) along creek banks. These piles can erode over time into a creek.<input type="checkbox"/> Do not spray pesticides or fertilizers by creeks.<input type="checkbox"/> Do not over water near streams. The excess water may carry pesticides, fertilizers, sediments, and anything else in its path directly into the creek.
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Treatment Control BMPs

Not applicable.

More Information

Bay Area Stormwater Management Agencies Association, 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Protection. Available on-line at:
<http://www.scvurppp-w2k.com/pdfs/0910/StartAtTheSource.pdf>.

Bay Area Stormwater Management Agencies Association, Undated. *Landscape designs for Stormwater Management - Stormwater Control for Small Projects*. Available at:
http://www.acterra.org/programs/stewardship/doc/landscape_dispersion.pdf.

Bay Area Water Pollution Prevention Agencies, 2001. Less-Toxic Pest Management- Problem Pesticides. Available on-line at:
<http://www.sccgov.org/sites/iwm/hhw/Documents/505018Problem%20Pesticides.pdf>.

California Invasive Plant Council, Undated Website. *Prevention BMPs for Land Managers*. Available on-line at: <http://www.cal-ipc.org/ip/prevention/landmanagers.php>.

California Department of Resources Recycling and Recovery (CalRecycle), 1999. *Grasscycle! Make the Most of Your Lawn. Make the Most of Your Time*. Available on-line at:
<http://www.calrecycle.ca.gov/publications/Documents/Organics/44399011.pdf>.

California Department of Resources Recycling and Recovery (CalRecycle). *Capitol Park Training Manual Description and Guidelines for Horticultural Practices*. Available on-line at: <http://www.calrecycle.ca.gov/organics/landscaping/Demos/Manual.pdf>.

Southern Sonoma County Resource Conservation District, Undated pamphlet. *A Guide for Rural Landowners and Residents of Petaluma and Sonoma Creek Watersheds*. Available on-line at:
[http://www.conservation.ca.gov/dlrp/watershedportal/Documents/SSCRCD%20Creek%20Care%20Guide%20\(southern%20sonoma%20rcd\).pdf](http://www.conservation.ca.gov/dlrp/watershedportal/Documents/SSCRCD%20Creek%20Care%20Guide%20(southern%20sonoma%20rcd).pdf).

USEPA, Office of Water National Pollution Discharge Elimination System, Undated website. *Stormwater Menu of BMPs Municipal Landscaping*. Available on-line at:
<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=1>.

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Bay Area Stormwater Management Agencies Association, 1999. Start at the Source – Design Guidance Manual for Stormwater Quality Protection. Available on-line at:
<http://www.scvurppp-w2k.com/pdfs/0910/StartAtTheSource.pdf>.

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Bay Area Stormwater Management Agencies Association, Undated. *Landscape designs for Stormwater Management - Stormwater Control for Small Projects*. Available at: http://www.acterra.org/programs/stewardship/doc/landscape_dispersion.pdf.

City of San Diego, 2012. *Storm Water Standards*. Available on-line at: <http://www.sandiego.gov/development-services/news/pdf/stormwatermanual.pdf>.

City of San Francisco, 2009. *San Francisco Stormwater Design Guidelines*. Available on-line at: <http://www.sfwater.org/modules/showdocument.aspx?documentid=2779>.

County of Los Angeles Department of Public Works, 2009. *Stormwater Best Management Practice Design and Maintenance Manual For Publicly Maintained Storm Drain Systems*. Available on-line at: <http://dpw.lacounty.gov/idd/publications/Stormwater%20BMP%20Design%20and%20Maintenance%20Manual.pdf>.

Description

Non-stormwater discharges (NSWDs) are flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain if local regulations allow. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include: potable water sources, fire hydrant flushing, air conditioner condensate, landscape irrigation drainage and landscape watering, emergency firefighting, etc. as discussed in Section 2.

However there are certain non-stormwater discharges that pose an environmental concern. These discharges may originate from illegal dumping of industrial material or wastes and illegal connections such as internal floor drains, appliances, industrial processes, sinks, and toilets that are illegally connected to the nearby storm drainage system through on-site drainage and piping. These unauthorized discharges (examples of which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains.

Non-stormwater discharges will need to be addressed through a combination of detection and elimination. The ultimate goal is to effectively eliminate unauthorized non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of

Objectives

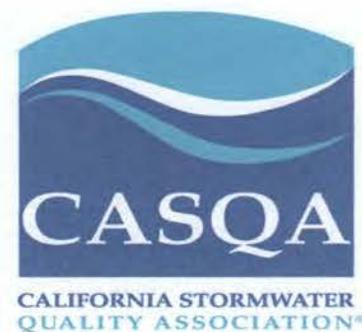
- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

	Good Housekeeping	✓
	Preventative Maintenance	
	Spill and Leak Prevention and Response	✓
	Material Handling & Waste Management	
	Erosion and Sediment Controls	
	Employee Training Program	✓
	Quality Assurance Record Keeping	✓



pollutants on streets and into the storm drain system and downstream water bodies.

Approach

Initially the Discharger must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is the elimination of unauthorized non-stormwater discharges. See other BMP Fact Sheets for activity-specific pollution prevention procedures.

General Pollution Prevention Protocols

- Implement waste management controls described in SC-34 Waste Handling and Disposal.
- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” or similar stenciled or demarcated next to them to warn against ignorant or unintentional dumping of pollutants into the storm drainage system.
- Manage and control sources of water such as hose bibs, faucets, wash racks, irrigation heads, etc. Identify hoses and faucets in the SWPPP, and post signage for appropriate use.

Non-Stormwater Discharge Investigation Protocols

Identifying the sources of non-stormwater discharges requires the Discharger to conduct an investigation of the facility at regular intervals. There are several categories of non-stormwater discharges:

- Visible, easily identifiable discharges, typically generated as surface runoff, such as uncontained surface runoff from vehicle or equipment washing; and
- Non-visible, (e.g., subsurface) discharges into the site drainage system through a variety of pathways that are not obvious.

The approach to detecting and eliminating non-stormwater discharges will vary considerably, as discussed below:

Visible and identifiable discharges

- Conduct routine inspections of the facilities and of each major activity area and identify visible evidence of unauthorized non-stormwater discharges. This may include:
 - ✓ Visual observations of actual discharges occurring;

- ✓ Evidence of surface staining, discoloring etc. that indicates that discharges have occurred;
- ✓ Pools of water in low lying areas when a rain event has not occurred; and
- ✓ Discussions with operations personnel to understand practices that may lead to unauthorized discharges.
- If evidence of non-stormwater discharges is discovered:
 - ✓ Document the location and circumstances using Worksheets 5 and 6 (Section 2 of the manual), including digital photos;
 - ✓ Identify and implement any quick remedy or corrective action (e.g., moving uncovered containers inside or to a proper location); and
 - ✓ Develop a plan to eliminate the discharge. Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge.
- Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge. Make sure the facility SWPPP is up-to-date and includes applicable BMPs to address the non-stormwater discharge.

Other Illegal Discharges (Non visible)

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of “as-built” piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate discharges to the storm drain system.
- Visual Inspection and Inventory:
 - ✓ Inventory and inspect each discharge point during dry weather.
 - ✓ Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system.
 - ✓ Non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- A review of the “as-built” piping schematic is a way to determine if there are any connections to the stormwater collection system.

- Inspect the path of loading/unloading area drain inlets and floor drains in older buildings.
- Never assume storm drains are connected to the sanitary sewer system.

Monitoring for investigation/detection of illegal discharges

- If a suspected illegal or unknown discharge is detected, monitoring of the discharge may help identify the content and/or suggest the source. This may be done with a field screening analysis, flow meter measurements, or by collecting a sample for laboratory analysis. Section 5 and Appendix D describe the necessary field equipment and procedures for field investigations.
- Investigative monitoring may be conducted over time. For example if, a discharge is intermittent, then monitoring might be conducted to determine the timing of the discharge to determine the source.
- Investigative monitoring may be conducted over a spatial area. For example, if a discharge is observed in a pipe, then monitoring might be conducted at accessible upstream locations in order to pinpoint the source of the discharge.
- Generally, investigative monitoring requiring collection of samples and submittal for lab analysis requires proper planning and specially trained staff.

Smoke Testing

Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two piping systems. Smoke testing is generally performed at a downstream location and the smoke is forced upstream using blowers to create positive pressure. The advantage to smoke testing is that it can potentially identify multiple potential discharge sources at once.

- Smoke testing uses a harmless, non-toxic smoke cartridges developed specifically for this purpose.
- Smoke testing requires specialized equipment (e.g., cartridges, blowers) and is generally only appropriate for specially trained staff.
- A Standard Operating Procedure (SOP) for smoke testing is highly desirable. The SOP should address the following elements:
 - ✓ Proper planning and notification of nearby residents and emergency services is necessary since introducing smoke into the system may result in false alarms;
 - ✓ During dry weather, the stormwater collection system is filled with smoke and then traced back to sources;

- ✓ Temporary isolation of segments of pipe using sand bags is often needed to force the smoke into leaking pipes; and
- ✓ The appearance of smoke in a waste vent pipe, at a sewer manhole, or even the base of a toilet indicates that there may be a connection between the sanitary and storm water systems.
- Most municipal wastewater agencies will have necessary staff and equipment to conduct smoke testing and they should be contacted if cross connections with the sanitary sewer are suspected. See SC-44 Drainage System Maintenance for more information.

Dye Testing

- Dye testing is typically performed when there is a suspected specific pollutant source and location (i.e., leaking sanitary sewer) and there is evidence of dry weather flows in the stormwater collection system.
- Dye is released at a probable upstream source location, either the facility's sanitary or process wastewater system. The dye must be released with a sufficient volume of water to flush the system.
- Operators then visually examine the downstream discharge points from the stormwater collection system for the presence of the dye.
- Dye testing can be performed informally using commercially available products in order to conduct an initial investigation for fairly obvious cross-connections.
- More detailed dye testing should be performed by properly trained staff and follow SOPs. Specialized equipment such as fluorometers may be necessary to detect low concentrations of dye.
- Most municipal wastewater agencies will have necessary staff and equipment to conduct dye testing and they should be contacted if cross connections with the sanitary sewer are suspected.

TV Inspection of Drainage System

- Closed Circuit Television (CCTV) can be employed to visually identify illicit connections to the industrial storm drainage system. Two types of CCTV systems are available: (1) a small specially designed camera that can be manually pushed on a stiff cable through storm drains to observe the interior of the piping, or (2) a larger remote operated video camera on treads or wheels that can be guided through storm drains to view the interior of the pipe.
- CCTV systems often include a high-pressure water jet and camera on a flexible cable. The water jet cleans debris and biofilm off the inside of pipes so the camera can take video images of the pipe condition.

- CCTV units can detect large cracks and other defects such as offsets in pipe ends caused by root intrusions or shifting substrate.
- CCTV can also be used to detect dye introduced into the sanitary sewer.
- CCTV inspections require specialized equipment and properly trained staff and are generally best left to specialized contractors or municipal public works staff.

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks may include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. These wastes can cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
 - ✓ Illegal dumping hot spots;
 - ✓ Types and quantities (in some cases) of wastes;
 - ✓ Patterns in time of occurrence (time of day/night, month, or year);
 - ✓ Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills);
 - ✓ An anonymous tip/reporting mechanism; and
 - ✓ Evidence of responsible parties (e.g., tagging, encampments, etc.).
- One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

Once a site has been cleaned:

- Post “No Dumping” signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Inspection

- ❑ Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- ❑ Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- ❑ Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.



Spill and Leak Prevention and Response

- ❑ On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- ❑ Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- ❑ Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- ❑ For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- ❑ See SC-11 Spill Prevention Control and Cleanup.



Employee Training Program

- ❑ Training of technical staff in identifying and documenting illegal dumping incidents is required. The frequency of training must be presented in the SWPPP, and depends on site-specific industrial materials and activities.
- ❑ Consider posting a quick reference table near storm drains to reinforce training.
- ❑ Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.
- ❑ Educate employees about spill prevention and cleanup.
- ❑ Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan. Employees should be able to identify work/jobs with high potential for spills and suggest methods to reduce possibility.
- ❑ Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

- ❑ Conduct spill response drills annually (if no events occurred) in order to evaluate the effectiveness of the plan.
- ❑ When a responsible party is identified, educate the party on the impacts of his or her actions.



Quality Assurance and Record Keeping

Performance Evaluation

- ❑ Annually review internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- ❑ Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.
- ❑ Develop document and data management procedures.
- ❑ A database is useful for defining and tracking the magnitude and location of the problem.
- ❑ Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- ❑ Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- ❑ Annually document and report the results of the program.
- ❑ Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.
- ❑ Document training activities.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended “work-arounds.”

- ❑ Many facilities do not have accurate, up-to-date ‘as-built’ plans or drawings which may be necessary in order to conduct non-stormwater discharge assessments.
 - ✓ Online tools such as Google Earth™ can provide an aerial view of the facility and may be useful in understanding drainage patterns and potential sources of non-stormwater discharges
 - ✓ Local municipal jurisdictions may have useful drainage systems maps.

- Video surveillance cameras are commonly used to secure the perimeter of industrial facilities against break-ins and theft. These surveillance systems may also be useful for capturing illegal dumping activities. Minor, temporary adjustments to the field of view of existing surveillance camera systems to target known or suspected problem areas may be a cost-effective way of capturing illegal dumping activities and identifying the perpetrators.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital facility cost requirements may be minimal unless cross-connections to storm drains are detected.
- Indoor floor drains may require re-plumbing if cross-connections are detected.
- Leaky sanitary sewers will require repair or replacement which can have significant costs depending on the size and industrial activity at the facility.

Maintenance (including administrative and staffing)

- The primary effort is for staff time and depends on how aggressively a program is implemented.
- Costs for containment, and disposal of any leak or discharge is borne by the Discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Permit Requirements

The IGP authorizes certain Non-Storm Water Discharges (NSWDs) provided BMPs are included in the SWPPP and implemented to:

- Reduce or prevent the contact of authorized NSWDs with materials or equipment that are potential sources of pollutants;
- Reduce, to the extent practicable, the flow or volume of authorized NSWDs;
- Ensure that authorized NSWDs do not contain quantities of pollutants that cause or contribute to an exceedance of a water quality standards (WQS); and,

- Reduce or prevent discharges of pollutants in authorized NSWs in a manner that reflects best industry practice considering technological availability and economic practicability and achievability.”

References and Resources

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WEF Press Alexandria, Virginia, 2009. Existing Sewer Evaluation and Rehabilitation: *WEF Manual of Practice No. FD-6 ASCE/EWRI Manuals and Reports on Engineering Practice No. 62, Third Edition*.

Spill Prevention, Control & Cleanup SC-11

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental spills. Preparation for accidental spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify hazardous material storage areas, specify material handling procedures, describe spill response procedures, and provide locations of spill clean-up equipment and materials. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills. An adequate supply of spill clean-up materials must be maintained onsite.

Approach

General Pollution Prevention Protocols

- Develop procedures to prevent/mitigate spills to storm drain systems.
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- Establish procedures and/or controls to minimize spills and leaks. The procedures should address:
 - Description of the facility, owner and address, activities, chemicals, and quantities present;

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

 Good Housekeeping	
 Preventative Maintenance	
 Spill and Leak Prevention and Response	✓
 Material Handling & Waste Management	
 Erosion and Sediment Controls	
 Employee Training Program	✓
 Quality Assurance Record Keeping	✓



Spill Prevention, Control & Cleanup SC-11

- ✓ Facility map of the locations of industrial materials;
 - ✓ Notification and evacuation procedures;
 - ✓ Cleanup instructions;
 - ✓ Identification of responsible departments; and
 - ✓ Identify key spill response personnel.
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.



Spill and Leak Prevention and Response

Spill Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- If illegal dumping is observed at the facility:
- ✓ Post “No Dumping” signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
 - ✓ Landscaping and beautification efforts may also discourage illegal dumping.
 - ✓ Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.
- Store and contain liquid materials in such a manner that if the container is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.
- If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.



Preventative Maintenance

- Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
- Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site’s spill control plan and/or proper spill cleanup procedures.

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- Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*
- Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.
- Label all containers according to their contents (e.g., solvent, gasoline).
- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- Identify key spill response personnel.

Spill Response

- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible.
 - ✓ Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills.
 - ✓ If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
 - ✓ If possible use physical methods for the cleanup of dry chemicals (e.g., brooms, shovels, sweepers, or vacuums).
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Spill Prevention, Control & Cleanup SC-11

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board or local authority as location regulations dictate.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to 911 for dispatch and clean-up assistance when needed. Do not contact fire agencies directly.
- Establish a system for tracking incidents. The system should be designed to identify the following:
 - ✓ Types and quantities (in some cases) of wastes;
 - ✓ Patterns in time of occurrence (time of day/night, month, or year);
 - ✓ Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills);
 - ✓ Clean-up procedures; and
 - ✓ Responsible parties.



Employee Training Program

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
 - ✓ The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur; and
 - ✓ Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

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Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- Develop spill prevention and control plan, provide and document training, conduct inspections of material storage areas, and supply spill kits.
- Extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident;
- Weather conditions;
- Duration of the spill/leak/discharge;

Spill Prevention, Control & Cleanup SC-11

- Cause of the spill/leak/discharge;
- Response procedures implemented;
- Persons notified; and
- Environmental problems associated with the spill/leak/discharge.

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- Date and time the inspection was performed;
- Name of the inspector;
- Items inspected;
- Problems noted;
- Corrective action required; and
- Date corrective action was taken.

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems;
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);
- External corrosion and structural failure;
- Spills and overfills due to operator error; and
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa.

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Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanges, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.

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- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use absorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Spill Prevention, Control & Cleanup SC-11

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
 - Cover fueling area if possible.
 - Use a perimeter drain or slope pavement inward with drainage to a sump.
 - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage “topping-off” of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use absorbent materials on small spills and general cleaning rather than hosing down the area. Remove the absorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities.

The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department).
- Develop procedures to prevent/mitigate spills to storm drain systems.
- Identify responsible departments.

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- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- Address spills at municipal facilities, as well as public areas.
- Provide training concerning spill prevention, response and cleanup to all appropriate personnel.

References and Resources

California's Nonpoint Source Program Plan. <http://www.swrcb.ca.gov/nps/index.html>.

Clark County Storm Water Pollution Control Manual. Available online at: <http://www.co.clark.wa.us/pubworks/bmpman.pdf>.

King County Storm Water Pollution Control Manual. Available online at: <http://dnr.metrokc.gov/wlr/dss/spcm.htm>.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: <http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities>

Santa Clara Valley Urban Runoff Pollution Prevention Program. <http://www.scvurppp.org>.

The Stormwater Managers Resource Center. <http://www.stormwatercenter.net/>.

Vehicle and Equipment Fueling SC-20

Description

Spills and leaks that occur during vehicle and equipment fueling can contribute hydrocarbons, oil and grease, as well as heavy metals, to stormwater runoff. Implementing the following management practices can help prevent fuel spills and leaks.

Approach

- Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- Use properly maintained off-site fueling stations whenever possible. These businesses are better equipped to handle fuel and spills properly.
- Focus pollution prevention activities on containment of spills and leaks, most of which may occur during liquid transfers.



Good Housekeeping

- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Manage materials and waste properly (see Material Handling and Waste Management) to reduce adverse impacts on stormwater quality.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Post signs at sinks to remind employees not to pour wastes down drains.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓



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- Clean yard storm drain inlets(s) regularly and especially after large storms.
- Do not pour materials down storm drains.
- Build a shed or temporary roof over fueling area to limit exposure to rain.
- Post signs to remind employees and customers not to top off the fuel tank when filling and signs that ban customers and employees from changing engine oil or other fluids at that location.
- Report leaking vehicles to fleet maintenance.
- Ensure the following safeguards are in place:
 - ✓ Overflow protection devices on tank systems to warn the operator or automatically shut down transfer pumps when the tank reaches full capacity.
 - ✓ Protective guards around tanks and piping to prevent vehicle or forklift damage.
 - ✓ Clear tagging or labeling of all valves to reduce human error.
 - ✓ Emergency shut-off and emergency phone number.



Preventative Maintenance

Fuel Dispensing Areas

- Inspect vehicles and equipment for leaks regularly and repair immediately.
- Sweep the fueling area weekly, if it is paved, to collect loose particles, and wipe up spills with rags and other absorbent material immediately. Do not hose down the area to a storm drain.
- Fit underground storage tanks with spill containment and overfill prevention systems meeting the requirements of Section 2635(b) of Title 23 of the California Code of Regulations.
- Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments.
- Post signs at the fuel dispenser or fuel island warning vehicle owners/operators against "topping off" of vehicle fuel tanks.
- Design fueling area to prevent stormwater runoff and spills. Use a perimeter drain or slope pavement inward with drainage to sump; regularly remove materials accumulated in sump.
- Pave area with concrete rather than asphalt.

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- Cover fueling area with an overhanging roof structure or canopy so that precipitation cannot come in contact with the fueling area. Where covering is not feasible and the fuel island is surrounded by pavement, apply a suitable sealant that protects the asphalt from spilled fuels.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank. Cover storm drains in the vicinity during transfer.

Air/Water Supply Area

- Minimize the possibility of stormwater pollution from air/water supply areas by doing at least one of the following:
 - ✓ Spot clean leaks and drips routinely to prevent runoff of spillage.
 - ✓ Grade and pave the air/water supply area to prevent run-on of stormwater.
 - ✓ Install a roof over the air/water supply area.
 - ✓ Install a low containment berm around the air/water supply area.

Inspection

- Aboveground Tank Leak and Spill Control:
 - ✓ Check for external corrosion and structural failure.
 - ✓ Check for spills and overfills due to operator error.
 - ✓ Check for failure of piping system.
 - ✓ Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
 - ✓ Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
 - ✓ Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
 - ✓ Conduct integrity testing periodically by a qualified professional.
- Inspect and clean, if necessary, storm drain inlets and catch basins within the facility boundary before October 1 each year.

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Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date.
- Maintain an adequate stockpile of spill cleanup materials at locations where it will be readily accessible.
- Clean leaks, drips, and other spills with as little water as possible.
 - ✓ Use rags for small spills,
 - ✓ Use a damp mop for general cleanup,
 - ✓ Use dry absorbent material for larger spills.
- Use the following three-step method for cleaning floors:
 - ✓ Clean spills with rags or other absorbent materials
 - ✓ Sweep floor using dry absorbent material
 - ✓ Mop the floor. Mop water may be discharged to the sanitary sewer via a toilet or sink.
- Remove the adsorbent materials promptly and dispose of properly when using absorbent materials on small spills.
- Store portable absorbent booms (long flexible shafts or barriers made of absorbent material) in unbermed fueling areas.
- Report spills promptly.
- If a dead-end sump is not used to collect spills, install an oil/water separator.



Material Handling and Waste Management

- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the sanitary sewer.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.

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- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
 - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
 - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
 - ✓ Install a roof over the waste receptacle area.
 - ✓ Install a low containment berm around the waste receptacle area.
 - ✓ Use and maintain drip pans under waste receptacles.
- Post “no littering” signs.



Employee Training Program

- Educate employees about facility-wide pollution prevention measures and goals.
- Train designated employees (e.g., those involved with the handling or management of fuels) on proper fueling and cleanup procedures.
- Train designated employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Make sure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- Ensure that employees are familiar with the site’s spill control plan and/or proper spill cleanup procedures.
- Use a training log or similar method to document training. The training log should include entries for:
 - ✓ Training topic,
 - ✓ Trainer,
 - ✓ Attendees,
 - ✓ Frequency,
 - ✓ Comments,
 - ✓ Target date for completion of training, and
 - ✓ Date completed.

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Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for vehicle and equipment fueling, quantities of materials removed, and improvement actions.
- Keep accurate logs of spill response actions that document what types of liquids were spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- The retrofitting of existing fueling areas to minimize stormwater exposure or spill runoff can be expensive. Good design must occur during the initial installation. Extruded curb along the “upstream” side of the fueling area to prevent stormwater run-on is of modest cost.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration.
- Routine cleanout of sumps and oil/water separators is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the system. Sediment removal is also required on a regular basis to keep the device working efficiently.

Supplemental Information

Designing New Installations

The elements listed below should be included in the design and construction of new or substantially remodeled facilities.

Fuel Dispensing Areas

- Fuel dispensing areas must be paved with Portland cement concrete (or, equivalent smooth impervious surface), with a 2 to 4% slope to prevent ponding, and must be

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separated from the rest of the site by a grade break that prevents run-on of stormwater to the extent practicable. The fuel dispensing area is defined as extending 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus 1 foot, whichever is less. The paving around the fuel dispensing area may exceed the minimum dimensions of the "fuel dispensing area" stated above.

- The fuel dispensing area must be covered, and the cover's minimum dimensions must be equal to or greater than the area within the grade break or the fuel dispensing area, as defined above. The cover must not drain onto the fuel dispensing area.
- If necessary, install and maintain an oil control device in the appropriate catch basin(s) to treat runoff from the fueling area.

Outdoor Waste Receptacle Area

- Grade and pave the outdoor waste receptacle area to prevent run-on of stormwater to the extent practicable.

Air/Water Supply Area

- Grade and pave the air/water supply area to prevent run-on of stormwater to the extent practicable.

Designated Fueling Area

- If your facility has large numbers of mobile equipment working throughout the site and you currently fuel them with a mobile fuel truck, consider establishing a designated fueling area. With the exception of tracked equipment such as bulldozers and perhaps small forklifts, most vehicles should be able to travel to a designated area with little lost time. Place temporary "caps" over nearby catch basins or manhole covers so that if a spill occurs it is prevented from entering the storm drain.

Examples

The Spill Prevention Control and Countermeasure (SPCC) Plan, which is required by law for some facilities, is an effective program to reduce the number of accidental spills and minimize contamination of stormwater runoff.

The City of Palo Alto has an effective program for commercial vehicle service facilities. Many of the program's elements, including specific BMP guidance and lists of equipment suppliers, are also applicable to industrial facilities.

References and Resources

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: <http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities>.

Vehicle and Equipment Fueling SC-20

Oregon Department of Environmental Quality, 2013. *Industrial Stormwater Best Management Practices Manual- BMP 8 Vehicle, Pavement and Building Washing*. Available online at: <http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf>

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: <http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf>.

Sacramento County Environmental Management Stormwater Program: Best Management Practices –Vehicle Washing. Available online at: <http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html>.

Santa Clara Valley Urban Runoff Pollution Prevention Program. <http://www.scvurppp-w2k.com/>.

US EPA. National Pollutant Discharge Elimination System – Stormwater Menu of BMPs - Municipal Vehicle and Equipment Washing, Available online at: <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=132>.

Washington State Department of Ecology, 2012. *Vehicle and Equipment Washwater Discharges Best Management Practices Manual*. Publication no. WQ-R-95-056. Available online at: <https://fortress.wa.gov/ecy/publications/publications/95056.pdf>.

Vehicle and Equipment Cleaning SC-21

Description

Wash water from vehicle and equipment cleaning activities performed outdoors or in areas where wash water flows onto the ground can contribute toxic hydrocarbons and other organic compounds, oils and greases, nutrients, phosphates, heavy metals, and suspended solids to stormwater runoff. Use of the procedures outlined below can prevent or reduce the discharge of pollutants to stormwater during vehicle and equipment cleaning.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives

General Pollution Prevention Protocols

- If possible, use properly maintained off-site commercial washing and steam cleaning businesses whenever possible. These businesses are better equipped to handle and properly dispose of the wash waters.
- Use dry cleaning methods to remove debris and sweep area; avoid washing with water when possible.
- Good housekeeping practices can minimize the risk of contamination from wash water discharges.
- Use biodegradable, phosphate-free detergents for washing vehicles as appropriate
- Emphasize the connection between the storm drain system and runoff, help reinforce that vehicle and equipment washing activities affect local water quality through storm drain stenciling programs.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Addressed

 Good Housekeeping	✓
 Preventative Maintenance	✓
 Spill and Leak Prevention and Response	✓
 Material Handling & Waste Management	✓
 Erosion and Sediment Controls	
 Employee Training Program	✓
 Quality Assurance Record Keeping	✓



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- Map on-site storm drain locations to avoid discharges to the storm drain system.
- Designate specific wash area with clarifier or place wash areas away from storm drain connections.



Good Housekeeping

- Mark the area clearly as a wash area by:
 - ✓ Posting signs stating that only washing is allowed in wash area; and
 - ✓ Providing information on how washing is to be done.
- Provide trash containers in wash area.
- Have all vehicle and equipment washing done in areas designed to collect and hold the wash and rinse water or effluent generated. Recycle, collect or treat wash water effluent prior to discharge to the sanitary sewer system.
- If washing/cleaning must occur on-site, consider washing vehicles and equipment inside the building or on an impervious surface to control the targeted constituents by directing them to the sanitary sewer.
- If washing must occur on-site and outdoor:
 - ✓ Use designated paved wash areas. This area must be covered or bermed to collect the wash water and graded to direct the wash water to a treatment or disposal facility.
 - ✓ Do not conduct oil changes and other engine maintenance in the designated washing area. Perform these activities in a place designated for oil change and maintenance activities.
 - ✓ Cover the wash area when not in use to prevent contact with rain water.
- Do not permit steam cleaning wash water to enter the storm drain system.
- If possible, conduct pressure and steam cleaning at appropriate off-site areas to avoid generating runoff with high pollutant concentrations.



Preventative Maintenance

- Install sumps or drain lines to collect wash water for treatment.
- Use hoses with nozzles that automatically turn off when left unattended.
- Perform routine inspections of drain lines, holding tanks, and hoses and repair leaks immediately.

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- Perform routine inspection and maintenance of wash water recycling and treatment systems.



Spill Response and Prevention Procedures

- Keep the spill prevention and control plan up-to-date.
- Have an emergency plan, equipment, and trained personnel ready at all times to deal immediately with major spills.
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.



Material Handling and Waste Management

- Collect all wash water from vehicle and equipment cleaning operations. Consider treating and reusing or discharging wash waters to a sanitary sewer system.
- Large quantities of wash waters may require treatment at the facility. Treatment using a process treatment system (e.g., holding tank, filtration system, and related appurtenances) will require engineering and capital expenditures.
- Collect and treat small amounts of wash water at the facility and either recycle or discharge to the sanitary sewer system or collect and dispose of as an industrial waste.
- Discharge wash waters into sanitary sewer only after contacting local sewer authority to find out if pretreatment is required.



Employee Training Program

- Train employees on proper cleaning and wash water disposal procedures and conduct “refresher” courses on a regular basis.
- Train staff on proper maintenance measures for the wash area.
- Train employees and contractors on proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
- Use a training log or similar method to document training.



Quality Assurance and Record Keeping

- Keep accurate maintenance/inspection logs that document the minimum BMP activities performed for vehicle and equipment cleaning activities and improvement actions.

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- ❑ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ❑ Establish procedures to complete logs and file them in the central office.

Other Facility-Specific Considerations

- ❑ Some municipalities may require pretreatment and monitoring of wash water discharges to the sanitary sewer.
- ❑ Steam cleaning can generate significant pollutant concentrations requiring that careful consideration be given to the environmental impacts and compliance issues related to the condensate wastewater generated.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of certain BMPs. Provided below are typical limitations and recommended “work-arounds”:

- ❑ Most car washing best management practices are inexpensive, and rely more on good housekeeping practices (where vehicles are washed, planning for the collection of wash water) than on expensive technology. However, the construction of a specialized area for vehicle washing can be expensive. Also, for facilities that cannot recycle their wash water, the cost of pre-treating wash water through either structural practices or planning for collection and hauling of contaminated water to sewage treatment plants can be cost-prohibitive.
- ❑ A potential work-around is to use properly maintained off-site commercial washing and steam cleaning businesses whenever possible.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- ❑ Many facilities will already have indoor covered areas where vehicle and equipment cleaning takes place and will require no additional capital expenditures for providing cover.
- ❑ Capital investments will be required at some sites if systems to collect and recycle/treat and properly discharge wash water are not in place. The cost associated with these investments will vary depending on the size of the washing facility and local regulations regarding effluent wash water.

Maintenance

- ❑ Perform wash and collection system inspections and repair.
- ❑ Sweep washing areas frequently to remove solid debris.

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- Repair berms and dikes as necessary.
- Inspect and maintain sumps, oil/water separators, and on-site treatment/recycling units.

Supplemental Information

Designated Cleaning Areas

- Washing operations outside should be conducted in a designated wash area having the following characteristics:
 - ✓ Paved with Portland cement concrete
 - ✓ Covered and bermed to prevent contact with stormwater and contain wash water
 - ✓ Sloped for wash water collections
 - ✓ Drainage system for wash water to the sanitary or recycle treatment process waste sewer, or to a dead-end sump equipped with an oil/water separator if necessary.

References and Resources

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Vehicle and Equipment Repair SC-22

Description

Vehicle or equipment maintenance and repair are potentially significant sources of stormwater pollution, due to use of harmful materials and wastes during maintenance and repair processes. Engine repair and service (e.g., parts cleaning), replacement of fluids (e.g., oil change), and outdoor equipment storage and parking (leaking vehicles) can impact water quality if stormwater runoff from areas with these activities becomes polluted by a variety of contaminants. Implementation of the following activities must be done where applicable to prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment maintenance and repair activities.

Approach

The BMP approach is to reduce the potential for pollutant discharges through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives. General pollution prevention protocols are presented followed by applicable minimum BMPs as required by the Industrial General Permit.

General Pollution Prevention Protocols

- Designate a vehicle maintenance area designed to prevent stormwater pollution.
- Minimize contact of stormwater with outside operations through berming and appropriate drainage routing.
- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Use drop cloths and drip pans.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

 Good Housekeeping	✓
 Preventative Maintenance	✓
 Spill and Leak Prevention and Response	✓
 Material Handling & Waste Management	✓
 Erosion and Sediment Controls	
 Employee Training Program	✓
 Quality Assurance Record Keeping	✓



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- Minimize use of solvents. Clean parts without using solvents whenever possible, or use water-based solvents for cleaning.
- Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.

Operational Protocols

General

- Move maintenance and repair activities indoors whenever feasible.
- Place curbs around the immediate boundaries of process equipment.



Good Housekeeping

- Store idle equipment under cover
- Use a vehicle maintenance area designed to prevent stormwater pollution - minimize contact of stormwater with outside operations through berming and appropriate drainage routing.
- Avoid hosing down your work areas. If work areas are washed, collect and direct wash water to sanitary sewer. Use dry sweeping if possible.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Post signs at sinks to remind employees not to pour wastes down drains.
- Clean yard storm drain inlets(s) regularly and especially after large storms.
- Do not pour materials down storm drains.
- Cover the work area to limit exposure to rain.
- Place curbs around the immediate boundaries of process equipment.
- Build a shed or temporary roof over areas where parked cars await repair or salvage, especially wrecked vehicles. Build a roof over vehicles kept for parts.



Preventive Maintenance and Repair Activities

- Provide a designated area for vehicle maintenance.
- Inspect vehicles and equipment for leaks regularly and repair immediately.
- Make sure incoming vehicles are checked for leaking oil and fluids. Do not allow leaking vehicles or equipment on-site without correcting the source of the leak and cleaning up any spill.
- Keep equipment clean; don't allow excessive build-up of oil and grease.

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- Perform all vehicle fluid removal or changing inside or under cover if possible to prevent the run-on of stormwater and the runoff of spills.
- Use a tarp, ground cloth, or drip pans beneath the vehicle or equipment to capture all spills and drips if temporary work is being conducted outside. Collected drips and spills must be disposed, reused, or recycled properly.
- It is important to sweep the maintenance area weekly, if it is paved, to collect loose particles, and wipe up spills with rags and other absorbent material immediately. Do not hose down the area to a storm drain.
- Establish standard procedures to prevent spillage/leakage of fluids including:
 - ✓ Keep a drip pan under the vehicle while you unclip hoses, unscrew filters, or remove other parts. Use a drip pan under any vehicle that might leak while working on it to keep splatters or drips off the shop floor.
 - ✓ Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
 - ✓ Keep drip pans or containers under vehicles or equipment that may drip during repairs.
 - ✓ Do not change motor oil or perform equipment maintenance in non-appropriate areas.
- Drain oil and other fluids first if the vehicle or equipment is to be stored outdoors. Elevate and tarp stored vehicles and equipment.
- Monitor parked vehicles closely for leaks. Pans should be placed under any leaks to collect the fluids for proper disposal or recycling.
- Mechanics should clean vehicle parts without using liquid cleaners wherever possible to reduce waste.
- Steam cleaning and pressure washing may be used instead of solvent parts cleaning. The wastewater generated from steam cleaning must be discharged to an on-site oil water separator that is connected to a sanitary sewer or blind sump. Non-caustic detergents should be used instead of caustic cleaning agents, detergent-based or water-based cleaning systems in place of organic solvent degreasers, and non-chlorinated solvent in place of chlorinated organic solvents for parts cleaning. Refer to SC21 for more information on steam cleaning.
- Fifth-wheel bearings on trucks require routine lubrication. Typically chassis grease is applied to the fifth-wheel bearing at rates that result in grease dripping off of the bearing into the environment. To address this concern the following options are available:
 - ✓ Use specialized lubricants with good adhesion (e.g., stay in place) properties. Carefully follow manufacturer's label regarding the use of adhesive lubricant for

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truck fifth-wheels. Typically this means applying no more than 8 oz. of grease. No visible extrusion of lubricant from the fifth-wheel bearing when truck and trailer are connected should be present.

- ✓ Use on-board truck or on-board trailer automatic lubrication systems. If these systems apply lube thinner than National Grease Lubrication Institute #2, equipment for collection of used lubricant is needed to prevent excess lubricant from dripping off the truck.
- ✓ Use plastic or Teflon plates instead of grease or other lubricants. Carefully follow manufacturer's instructions for installation and operation.
- Use one of the following for lubricating vehicle-trailer coupling:
 - ✓ Specialized adhesive lubricants;
 - ✓ Grease-free fifth wheel slip plates (e.g., plastic or Teflon coatings); and
 - ✓ On-Board automatic lubricating systems.



Spill and Leak Prevention and Response Procedures

- Keep your spill prevention and control plan up-to-date.
- Place an adequate stockpile of spill cleanup materials where it will be readily accessible.
- Clean leaks, drips, and other spills with as little water as possible. Use rags for small spills, a damp mop for general cleanup, and dry absorbent material for larger spills. Use the following three-step method for cleaning floors:
 - ✓ Clean spills with rags or other absorbent materials;
 - ✓ Sweep floor using dry absorbent material; and
 - ✓ Mop the floor.

Mop water may be discharged to the sanitary sewer via a toilet or sink.

- Remove the adsorbent materials promptly and dispose of properly when using adsorbent materials on small spills.



Material Handling and Waste Management

- Designate a special area to drain and replace motor oil, coolant, and other fluids, where there are no connections to the storm drain or the sanitary sewer, and drips and spills can be easily cleaned up.
- Drain all fluids immediately from wrecked vehicles. Ensure that the drain pan or drip pan is large enough to contain drained fluids (e.g., larger pans are needed to contain antifreeze, which may gush from some vehicles).

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- ❑ Do not pour liquid waste to floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- ❑ Do not put used or leftover cleaning solutions, solvents, and automotive fluids and in the sanitary sewer.
- ❑ Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- ❑ Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- ❑ Place oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal since municipalities prohibit or discourage disposal of these items in solid waste facilities.
- ❑ Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters. Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater.
- ❑ Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling or household hazardous waste facilities.



Employee Training Program

- ❑ Train employees and contractors in the proper handling and disposal of engine fluids and waste materials.
- ❑ Employees should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
- ❑ Conduct annual training to ensure that employees are familiar with the facility's spill control plan and/or proper spill cleanup procedures (You can use reusable cloth rags to clean up small drips and spills instead of disposables; these can be washed by a permitted industrial laundry. Do not clean them at home or at a coin-operated laundry business).
- ❑ Use a training log or similar method to document training.



Quality Assurance and Recordkeeping

- ❑ Keep accurate maintenance logs to evaluate materials removed and improvements made.
- ❑ Establish procedures to collect and file maintenance logs in the central office.

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Other Facility-Specific Considerations

Parts Cleaning

Vehicle and equipment maintenance facilities often must clean parts as a part of day-to-day operations. The following activities should be considered:

- Clean vehicle parts without using liquid cleaners wherever possible to reduce waste.
- Steam cleaning and pressure washing may be used instead of solvent parts cleaning.
- Wastewater generated from steam cleaning must be discharged to an on-site oil water separator that is connected to a sanitary sewer or blind sump.
- Use non-caustic detergents instead of caustic cleaning agents, detergent-based or water-based cleaning systems in place of organic solvent degreasers, and non-chlorinated solvent in place of chlorinated organic solvents for parts cleaning. Refer to SC21 for more information on steam cleaning.

Potential Limitations and Work-Arounds

- Some facilities may have space constraints and time limitations that may preclude all work from being conducted indoors.
 - ✓ Designate specific areas for outdoor activities.
 - ✓ Require employees to understand and follow preventive maintenance and spill and leak prevention BMPs.
- It may not be possible to contain and clean up spills from vehicles/equipment brought on-site after working hours.
 - ✓ Provide a designated area for afterhours deliveries.
 - ✓ Install spill kits.
- Drain pans (usually 1 ft. x 1 ft.) are generally too small to contain antifreeze
 - ✓ Purchase or fabricate large drip pans (3 ft. x 3 ft.) with sufficient volume to contain expected quantities of liquids based on equipment/vehicle specifications.
- Dry floor cleaning methods may not be sufficient for some spills.
 - ✓ Use three-step method instead.
- Identification of engine leaks may require some use of solvents.
 - ✓ Minimize the use of solvents and use drip pans to collect spills and leaks.
- Prices for recycled materials and fluids may be higher than those of non-recycled materials.

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- Some facilities may be limited by a lack of providers of recycled materials, and by the absence of businesses to provide services such as hazardous waste removal, structural treatment practice maintenance, or solvent equipment and solvent recycling.

Potential Facilities and Maintenance Requirements

Facilities Requirements

- For facilities that already have covered areas where maintenance takes place, have berms or other means to retain spills and leaks, and/ have other appropriate constructed systems for containment, there may not need to be any significant new capital investment. Capital costs will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.



Maintenance Requirements

- Most of the operations and maintenance activity associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore, significant additional operations and maintenance efforts are not likely to be required.
- For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration. Routine cleanout of oil and grease is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.
- It is important to sweep the maintenance area weekly, if it is paved, to collect loose particles, and wipe up spills with rags and other absorbent material immediately. Do not hose down the area to a storm drain.

Supplemental Information

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, 1,1,1-trichloroethane or methylene chloride. Many of these cleaners are harmful and must be disposed of as a hazardous waste. Cleaning without using liquid cleaners (e.g., wire brush) whenever possible reduces waste. Prevent spills and drips of solvents and cleansers to the shop floor. Do all liquid cleaning at a centralized station so the solvents and residues stay in one area. Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents.

- Clean parts without using liquid cleaners whenever possible to reduce waste.
- Prevent spills and drips of solvents and cleansers to the shop floor.

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- Do all liquid cleaning at a centralized station so the solvents and residues stay in one area.
- Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse.

Recycling

Separating wastes allows for easier recycling and may reduce treatment costs. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents (e.g., 1,1,1-trichloroethane) separate from non-chlorinated solvents (e.g., kerosene and mineral spirits).

Many products made of recycled (i.e., refined or purified) materials are available. Engine oil, transmission fluid, antifreeze, and hydraulic fluid are available in recycled form. Buying recycled products supports the market for recycled materials.

- Recycling is always preferable to disposal of unwanted materials.
- Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.
- Label and track the recycling of waste material (e.g., used oil, spent solvents, batteries).
- Purchase recycled products to support the market for recycled materials.

Safer Alternatives

If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:

- Use non-caustic detergents instead of caustic cleaning for parts cleaning.
- Use detergent-based or water-based cleaning systems in place of organic solvent degreasers. Wash water may require treatment before it can be discharged to the sewer.
- Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
- Choose cleaning agents that can be recycled.

References and Resources

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Vehicle and Equipment Repair SC-22

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Outdoor Liquid Container Storage SC-31

Description

Accidental releases of materials from above ground liquid storage tanks, drums, and dumpsters present the potential for contaminating stormwater with many different pollutants. Tanks may store many potential stormwater runoff pollutants, such as gasoline, aviation gas, diesel fuel, kerosene, oils, greases, lubricants and other distilled, blended and refined products derived from crude petroleum. Materials spilled, leaked, or lost from storage tanks may accumulate in soils or on other surfaces and be carried away by rainfall runoff. These source controls apply to containers located outside of a building used to temporarily store liquid materials and include installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

Approach

General Pollution Prevention Protocols

- Educate employees about pollution prevention measures and goals.
- Keep an accurate, up-to-date inventory of the materials delivered and stored on-site.
- Try to keep chemicals in their original containers, and keep them well labeled.
- Develop an operations plan that describes procedures for loading and/or unloading. Refer to SC-30 Outdoor Loading/Unloading of Materials for more detailed BMP information pertaining to loading and unloading of liquids.
- Protect materials from rainfall, run-on, runoff, and wind dispersal:
 - ✓ Cover the storage area with a roof.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

 Good Housekeeping	
 Preventative Maintenance	✓
 Spill and Leak Prevention and Response	✓
 Material Handling & Waste Management	✓
 Erosion and Sediment Controls	
 Employee Training Program	✓
 Quality Assurance Record Keeping	✓



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- ✓ Minimize stormwater run-on by enclosing the area or building a berm around it.
- ✓ Use a walled structure for storage of liquid containers.
- ✓ Use only watertight containers and keep the lids closed.
- Employ safeguards against accidental releases:
 - ✓ Provide overflow protection devices to warn operator or automatic shutdown transfer pumps.
 - ✓ Provide protection guards (bollards) around tanks and piping to prevent damage from a vehicle or forklift.
 - ✓ Provide clear tagging or labeling, and restrict access to valves to reduce human error.
 - ✓ Berm or surround tank or container with secondary containment system, including dikes, liners, vaults, or double walled tanks.
 - ✓ Be aware and ready to address the fact that some municipalities require secondary containment areas to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.
 - ✓ Contact the appropriate regulatory agency regarding environmental compliance for facilities with “spill ponds” designed to intercept, treat, and/or divert spills.
 - ✓ Have registered and specifically trained professional engineers identify and correct potential problems such as loose fittings, poor welding, and improper or poorly fitted gaskets for newly installed tank systems.
- Use MSDSs to ID hazardous components and keep incompatible products apart and to list/have available appropriate PPE and clean-up products.



Good Housekeeping

- Provide storage tank piping located below product level with a shut-off valve at the tank; ideally this valve should be an automatic shear valve with the shut-off located inside the tank.
- Provide barriers such as posts or guardrails, where tanks are exposed, to prevent collision damage with vehicles.
- Provide secure storage to prevent vandalism-caused contamination.
- Place tight-fitting lids on containers.

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- Enclose or cover the containers where they are stored.
- Raise the containers off the ground by use of pallet or similar method, with provisions for spill control.
- Do not store liquid containers near the storm drainage system or surface waters.
- Sweep and clean the storage area regularly if it is paved, do not hose down the area to a storm drain.



Preventative Maintenance

- Inspect storage areas regularly for leaks or spills.
- Conduct routine inspections and check for external corrosion of material containers. Also check for structural failure, spills and overfills due to operator error, failure of piping system.
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installations for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Replace containers that are leaking, corroded, or otherwise deteriorating with ones in good condition. If the liquid chemicals are corrosive, containers made of compatible materials must be used instead of metal drums.
- New or secondary containers must be labeled with the product name and hazards.



Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date.
- Maintain an adequate stockpile of spill cleanup materials at locations where it will be readily accessible.
- Have an emergency plan, equipment, and trained personnel ready at all times to deal immediately with major spills.
- Collect spilled liquids and properly dispose of them.
- Remove the adsorbent materials promptly and dispose of properly when using adsorbent materials on small spills.
- Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.

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- Prevent operator errors by using engineering safeguards and thus reducing accidental releases of pollutants.



Material Handling and Waste Management

- Contain the material in such a manner that if the container leaks or spills, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters or groundwater.
- Place drip pans or absorbent materials beneath mounted container taps, and at potential drip and spill locations during filling and unloading of containers. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
- Ensure that any underground or aboveground storage tanks are designed and managed in accordance with applicable regulations, identified as a potential pollution source, and have secondary containment such as a berm or dike with an impervious surface.
- Do not pour liquids into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.



Employee Training Program

- Train employee (e.g., fork lift operators) and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
- Train employees in proper spill response and prevention, materials handling, and waste management.
- Use a training log or similar method to document training.



Quality Assurance and Record Keeping

- Keep accurate maintenance/inspection logs that document minimum BMP activities performed for liquid container storage and improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Other Facility-Specific Considerations

- Storage sheds often must meet building and fire code requirements.

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- The local fire district must be consulted for limitations on clearance of roof covers over containers used to store flammable materials.
- All specific standards set by Federal and State laws concerning the storage of oil and hazardous materials must be met.
- Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code.
- Storage of oil and hazardous materials must meet specific Federal and State standards including:
 - ✓ Spill Prevention Control and Countermeasure Plan (SPCC) Plan;
 - ✓ Secondary containment;
 - ✓ Integrity and leak detection monitoring; and
 - ✓ Emergency preparedness plans.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital investments such as sheds, covers, dikes, and curbs will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- Conduct regular inspections and make repairs and improvements as necessary.
- Conduct regular broom dry-sweeping of area. Do not wash with water.

Supplemental Information

The most common causes of unintentional releases are:

- Installation problems;
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);
- External corrosion and structural failure;
- Spills and overfills due to operator error; and
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa.

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Aboveground Tank Leak and Spill Control

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10% of the volume of the containers or 110% of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- Other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine weekly inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Inspect new tank or container installation visually for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently release accumulated stormwater during the wet season.
- Have periodic integrity testing conducted by a qualified professional.

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Dikes

One of the best protective measures against contamination of stormwater is the use of dikes. Containment dikes are berms or retaining walls that are designed to hold spills. Use of dikes is an effective pollution prevention measure for above ground storage tanks and railcar or tank truck loading and unloading areas. The dike surrounds the area of concern and holds the spill, keeping spill materials separated from the stormwater side of the dike area. Diking can be used in any industrial or municipal facility, but it is most commonly used for controlling large spills or releases from liquid storage areas and liquid transfer areas.

- For single-wall tanks, containment dikes should be large enough to hold the contents of the storage tank for the facility plus rain water.
- For trucks, diked areas should be capable of holding an amount equal to the volume of the tank truck compartment. Diked construction material should be strong enough to safely hold spilled materials.
- Dike materials can consist of earth, concrete, synthetic materials, metal, or other impervious materials.
- Strong acids or bases may react with metal containers, concrete, and some plastics.
- Where strong acids or bases are stored, alternative dike materials should be considered. More active organic chemicals may need certain special liners for dikes.
- Dikes may also be designed with impermeable materials to increase containment capabilities.
- Dikes should be inspected during or after significant storms or spills to check for washouts or overflows.
- Regular checks of containment dikes to insure the dikes are capable of holding spills should be conducted.
- Inability of a structure to retain stormwater, dike erosion, soggy areas, or changes in vegetation indicate problems with dike structures. Damaged areas should be patched and stabilized immediately.
- Earthen dikes may require special maintenance of vegetation such as mulching and irrigation.
- Remove accumulated stormwater after precipitation events and dispose of according to local regulations.

Curbing

Curbing is a barrier that surrounds an area of concern. Curbing is similar to containment diking in the way that it prevents spills and leaks from being released into the environment. Curbing is usually small scaled and does not contain large spills to the degree that dikes can. Curbing is common at many facilities in small areas where

Outdoor Liquid Container Storage **SC-31**

handling and transfer of liquid materials occur. Curbing can redirect contaminated stormwater away from the storage area. It is useful in areas where liquid materials are transferred from one container to another. Asphalt is a common material used for curbing; however, curbing materials can include earth, concrete, synthetic materials, metal, or other impenetrable materials.

- Spilled materials should be removed immediately from curbed areas to allow space for future spills.
- Curbs should have manually-controlled pump systems rather than common drainage systems for collection of spilled materials.
- The curbed area should be inspected regularly to clear clogging debris.
- Maintenance should also be conducted frequently to prevent overflow of any spilled materials as curbed areas are designed only for smaller spills.
- Remove accumulated stormwater after precipitation events and dispose of according to local regulations.
- Curbing has the following advantages:
 - ✓ Excellent run-on control;
 - ✓ Inexpensive;
 - ✓ Ease of installment;
 - ✓ Provides option to recycle materials spilled in curb areas; and
 - ✓ Common industry practice.

References and Resources

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Outdoor Equipment Operations SC-32

Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, and solid waste treatment and disposal are examples of process operations that can lead to contamination of stormwater runoff. The targeted constituents will vary for each site depending on the operation being performed.

Approach

Implement source control BMPs to limit exposure of outdoor equipment to direct precipitation and stormwater run-on. Refer to SC-22 Vehicle and Equipment Repair for additional information.

General Pollution Prevention Protocols

- Perform the activity during dry periods whenever possible.
- Install secondary containment measures where leaks and spills may occur.
- Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.
- Connect process equipment area to public sanitary sewer or facility wastewater treatment system when possible. Some jurisdictions require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.



Good Housekeeping

- Manage materials and waste properly (see Material Handling and Waste Management) to reduce adverse impacts on stormwater quality.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

	Good Housekeeping	✓
	Preventative Maintenance	✓
	Spill and Leak Prevention and Response	✓
	Material Handling & Waste Management	✓
	Erosion and Sediment Controls	
	Employee Training Program	✓
	Quality Assurance Record Keeping	✓



Outdoor Equipment Operations SC-32

- Cover the work area with a permanent roof if possible.
- Use drop cloths for sanding and painting operations.
- Use a vacuum for fine particle clean-up in pavement cracks and crevices.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (run-on prevention).
- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Use roll down or permanent walls when windy/breezy to prevent wind transport of particulates/pollutants.



Preventative Maintenance

- Design outdoor equipment areas to prevent stormwater runoff and spills. Use a perimeter drain or slope pavement inward with drainage to sump.
- Dry clean the work area regularly. Do not wash outdoor equipment with water if there is a direct connection to the storm drain.
- Pave area with concrete rather than asphalt.
- Inspect outdoor equipment regularly for leaks or spills. Also check for structural failure, spills and overfills due to operator error, and/or failure of piping system.
- Inspect and clean, if necessary, storm drain inlets and catch basins within the outdoor equipment area before October 1 each year.



Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Prevent operator errors by using engineering safe guards and thus reducing accidental releases of pollutant.



Material Handling and Waste Management

Outdoor Equipment Operations SC-32

- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drain or sewer connections.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
 - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
 - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
 - ✓ Install a roof over the waste receptacle area.



Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees on proper equipment operation and maintenance procedures.
- Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Ensure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for outdoor equipment, types and quantities of materials removed and disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

Outdoor Equipment Operations SC-32

- Providing cover over outdoor equipment may be impractical or cost-prohibitive.
 - ✓ Operate outdoor equipment only during periods of dry weather.
- Regular operations and time limitations may require outdoor activities during wet weather.
 - ✓ Designate specific areas for outdoor activities.
 - ✓ Allow time for work area clean-up after each shift.
 - ✓ Require employees to understand and follow preventive maintenance and spill and leak prevention BMPs.
 - ✓ Design and install secondary containment and good housekeeping BMPs for outdoor equipment area.
- Storage sheds often must meet building and fire code requirements.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Many facilities will already have indoor covered areas where vehicle and equipment repairs take place and will require no additional capital expenditures.
- If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration.
- Routine cleanout of oil and grease is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.

Outdoor Equipment Operations SC-32

References and Resources

Minnesota Pollution Control Agency. *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: <http://www.pca.state.mn.us/index.php/view-document.html?gid=10557>.

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Sacramento County Environmental Management Stormwater Program: Best Management Practices. Available online at: <http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html>.

Santa Clara Valley Urban Runoff Pollution Prevention Program. <http://www.scvurppp-w2k.com/>

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Outdoor Storage of Raw Materials SC-33

Description

Stockpiles of raw materials, by-products, and finished products exposed to rain and/or runoff can pollute stormwater. Stormwater can become contaminated when materials wash off or dissolve into water due to improper storage and containment. To prevent or reduce the discharge of pollutants to stormwater from raw material delivery and storage, pollution prevention and source control measures must be implemented, such as minimizing the storage of hazardous materials on-site, enclosing or covering materials, storing materials in a designated area, installing secondary containment, conducting regular inspections, preventing stormwater run-on and runoff, and training employees and subcontractors. This fact sheet focuses on source control BMPs for stockpiles of solid materials; if the raw material, by-product, or product is a liquid, more information for outside storage of liquids can be found under SC-31 Outdoor Liquid Container Storage.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- Emphasize employee education for successful BMP implementation.
- Store materials that could contaminate stormwater inside or under permanent cover. If this is not feasible, then all outside storage areas should be covered with a roof and bermed or enclosed to prevent stormwater contact.
- Elevate and tarp solid materials such as beams, metal, etc.
- Minimize the inventory of raw materials kept outside.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

 Good Housekeeping	✓
 Preventative Maintenance	✓
 Spill and Leak Prevention and Response	✓
 Material Handling & Waste Management	
 Erosion and Sediment Controls	✓
 Employee Training Program	✓
 Quality Assurance Record Keeping	✓



Outdoor Storage of Raw Materials SC-33

- Keep an accurate, up-to-date inventory of the materials delivered and stored on-site.
- Stormwater runoff that could potentially be contaminated by materials stored outdoors should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.



Good Housekeeping

- If raw materials cannot all be stored inside or under permanent cover, prevent exposure to direct precipitation and stormwater run-on by installing a storm-resistant waterproof covering made of polyethylene, polypropylene or hypalon over all materials stored outside. The covers must be in place at all times when work with the stockpiles is not occurring (Applicable to small stockpiles only).
- Implement erosion control practices at the perimeter of the facility site and at any catch basins to prevent erosion of the stockpiled material off-site, if the stockpiles are so large that they cannot feasibly be covered and contained.
- Minimize stormwater run-on by enclosing the area or building a berm around it.
- Keep storage areas clean and dry.
- Slope paved areas in a manner that minimizes pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or groundwater, such as compost, logs, and wood chips. A minimum slope of 1.5% is recommended.
- Secure drums stored in an area where unauthorized persons may not gain access to prevent accidental spillage, pilferage, or any unauthorized use.
- Install curbing or berms along the perimeter of the area to prevent the run-on of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the stockpile areas.
- Slope the area inside the curb or berm to a drain with sump. The sump should be equipped with an oil and water separator if applicable for materials stored onsite.
- Do not store materials on top of or directly adjacent to storm drain inlets.
- Cover wood products treated with chromated copper arsenate, ammonical copper zinc arsenate, creosote, or pentachlorophenol with properly secured tarps or store indoors.



Preventative Maintenance

- Maintain outdoor storage containers in good condition. Replace leaky or otherwise inadequate containers as necessary.
- Maintain outdoor waterproof covers (e.g., tarps) in good condition and properly secure them to be storm resistant. Replace tarps damaged by UV exposure or wear and tear on a regular basis.

Outdoor Storage of Raw Materials SC-33

- ❑ Perform routine inspection of storm drains and sumps and regularly remove accumulated materials.
- ❑ Dry clean the work area regularly. Do not wash outdoor material storage areas with water if there is a direct connection to the storm drain.
- ❑ Pave outdoor storage areas for liquids such as solvents with concrete rather than asphalt.
- ❑ Conduct regular inspections of storage areas so that leaks and spills are detected as soon as possible.
- ❑ Routinely inspect berms, curbing, containment, and sediment controls for proper function and repair as necessary.



Spill and Leak Prevention and Response

- ❑ Keep the facility spill prevention and control plan up-to-date.
- ❑ Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- ❑ Have employees trained in spill containment and cleanup present during the loading/unloading of hazardous or otherwise dangerous materials.



Erosion and Sediment Controls

- ❑ Keep materials covered to prevent erosion of stockpiles. This may not be feasible for large stockpiles.
- ❑ Install sediment controls such as fiber rolls around the perimeter of stockpiles to prevent transport of raw materials to the storm drain.
- ❑ Install drain inlet protection around all inlets to prevent raw materials from entering storm drain.
- ❑ Install sediment controls such as silt fence around the perimeter of the site to prevent transport of raw materials to the storm drain or offsite surface waters.



Employee Training Program

- ❑ Educate employees about pollution prevention measures and goals.
- ❑ Train employees how to properly store outdoor raw materials using the source control BMPs described above.
- ❑ Use a training log or similar method to document training.
- ❑ Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

Outdoor Storage of Raw Materials SC-33



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for outdoor storage of raw materials, types and quantities of materials removed and disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Other Facility-Specific Considerations

- Storage sheds often must meet building and fire code requirements. Storage of reactive, ignitable, or flammable liquids must comply with the Uniform Fire Code and the National Electric Code.
- Some municipalities require that secondary containment areas (regardless of size) be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.
- The local fire district must be consulted for limitations on clearance of roof covers over containers used to store flammable materials.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended “work-arounds”

- Space limitations may preclude storing all materials indoors.
 - ✓ Implement good housekeeping, preventative maintenance, and erosion and sediment controls as described above.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Many facilities will already have indoor covered areas where raw materials will be stored and will require no additional capital expenditures.
- If outdoor storage of materials is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.
- Purchase and installation of erosion and sediment controls will require additional capital investments, and this amount will vary depending on site characteristics.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Outdoor Storage of Raw Materials SC-33

Maintenance

- Accurate and up-to-date inventories should be kept of all stored materials.
- Berms and curbs may require periodic repair and patching.
- Parking lots or other surfaces near bulk materials storage areas should be swept periodically to remove debris blown or washed from storage areas.
- Sweep paved storage areas regularly for collection and disposal of loose solid materials, do not hose down the area to a storm drain or conveyance ditch.
- Erosion and sediment controls require regular inspection and periodic replacement or reinstallation.

Supplemental Information

Raw Material Containment

Paved areas should be sloped in a manner that minimizes pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or groundwater, such as compost, logs, and wood chips. A minimum slope of 1.5% is recommended.

- Curbing or berms should be placed along the perimeter of the area to prevent the run-on of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from stockpile areas.
- The storm drainage system should be designed to minimize use of catch basins in the interior of the area as they tend to rapidly fill with manufacturing material.

The area should be sloped to drain stormwater to the perimeter where it can be collected or to internal drainage alleyways where material is not stockpiled.

The “doghouse” design has been used to store small liquid containers. The roof and flooring design prevent contact with direct rain or runoff. The doghouse has two solid structural walls and two canvas covered walls. The flooring is wire mesh about secondary containment.

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook*. Available online at: <http://www.pca.state.mn.us/index.php/view-document.html?gid=10557>.

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Santa Clara Valley Urban Runoff Pollution Prevention Program. <http://www.scvurppp-w2k.com/>.

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA’s Multi Sector General Permit. Available online at:
<http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm>.

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- Accomplish reduction in the amount of waste generated using the following source controls:
 - ✓ Production planning and sequencing;
 - ✓ Process or equipment modification;
 - ✓ Raw material substitution or elimination;
 - ✓ Loss prevention and housekeeping;
 - ✓ Waste segregation and separation; and
 - ✓ Close loop recycling.
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- Recycle materials whenever possible.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

 Good Housekeeping	✓
 Preventative Maintenance	✓
 Spill and Leak Prevention and Response	✓
 Material Handling & Waste Management	✓
 Erosion and Sediment Controls	
 Employee Training Program	✓
 Quality Assurance Record Keeping	✓



- Use the entire product before disposing of the container.
- To the extent possible, store wastes under cover or indoors after ensuring all safety concerns such as fire hazard and ventilation are addressed.
- Provide containers for each waste stream at each work station. Allow time after shift to clean area.



Good Housekeeping

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain. Clean in a designated wash area that drains to a clarifier.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- If possible, move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.



Preventative Maintenance

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.

- ❑ Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- ❑ Cover the area with a permanent roof if feasible.
- ❑ Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- ❑ Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- ❑ Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, vacuuming, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- ❑ Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- ❑ Repair leaking equipment including valves, lines, seals, or pumps promptly.



Spill Response and Prevention Procedures

- ❑ Keep your spill prevention and plan up-to-date.
- ❑ Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.
- ❑ Collect all spilled liquids and properly dispose of them.
- ❑ Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- ❑ Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
 - ✓ Vehicles equipped with baffles for liquid waste; and
 - ✓ Trucks with sealed gates and spill guards for solid waste.



Material Handling and Waste Management

Litter Control

- ❑ Post “No Littering” signs and enforce anti-litter laws.
- ❑ Provide a sufficient number of litter receptacles for the facility.
- ❑ Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- ❑ Keep waste collection areas clean.

- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.



Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for waste handling and disposal, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and the types of waste handled. Significant capital costs may be associated with reducing wastes by modifying processes or implementing closed-loop recycling.
- Many facilities will already have indoor covered areas where waste materials will be stored and will require no additional capital expenditures for providing cover.
- If outdoor storage of wastes is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

References and Resources

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Santa Clara Valley Urban Runoff Pollution Prevention Program. <http://www.scvurppp-w2k.com/>

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA’s Multi Sector General Permit. Available online at:

<http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm>.

Description

Promote the use of less harmful products and products that contain little or no TMDL and 303(d) list pollutants. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

Approach

Pattern a new program after the many established programs around the state and country. Integrate this best management practice as much as possible with existing programs at your facility.

Develop a comprehensive program based on:

- The "Precautionary Principle," which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests

Objectives

- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

 Good Housekeeping	
 Preventative Maintenance	
 Spill and Leak Prevention and Response	
 Material Handling & Waste Management	
 Erosion and Sediment Controls	
 Employee Training Program	✓
 Quality Assurance Record Keeping	



by methods that pose a lower risk to employees, the public, and the environment.

- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies
- Procedures
 - ✓ Standard operating procedures (SOPs);
 - ✓ Purchasing guidelines and procedures; and
 - ✓ Bid packages (services and supplies).
- Materials
 - ✓ Preferred or approved product and supplier lists;
 - ✓ Product and supplier evaluation criteria;
 - ✓ Training sessions and manuals; and
 - ✓ Fact sheets for employees.

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC-20 – SC-22) and SC-41 Building and Grounds Maintenance.



Employee Training Program

- Employees who handle potentially harmful materials should be trained in the use of safer alternatives.
- Purchasing departments should be trained on safer alternative products and encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.
- Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources provided in this fact sheet.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended “work-arounds”

- Alternative products may not be available, suitable, or effective in every case.

- ✓ Minimize use of hazardous/harmful products if no alternative product is available.

Regulatory Considerations

This BMP has no regulatory requirements unless local/municipal ordinance applies. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements;
- Storm water runoff sampling requirements;
- Training and licensing requirements; and
- Record keeping and reporting requirements.

Cost Considerations

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.
- Some alternative products may be slightly more expensive than conventional products.

Supplemental Information

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Refined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes with low VOC content are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps.

All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.

- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting. Use paper products with post-consumer recycled content and implement electric had dryers.

Examples

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

References and Resources

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information

California Department of Toxic Substances Control,

<http://www.dtsc.ca.gov/PollutionPrevention/GreenTechnology/Index.cfm>.

CalRecycle, <http://www.calrecycle.ca.gov/Business/Regulated.htm>.

City of Santa Monica Office of Sustainability and Environment,

<http://www.smgov.net/departments/ose/>.

City of Palo Alto, <http://www.city.palo-alto.ca.us/cleanbay>.

City and County of San Francisco, Department of the Environment,

<http://www.sfenvironment.org/toxics-health/greener-business-practices>.

Green Business Program, <http://www.greenbiz.ca.gov/GRlocal.html> .

Product Stewardship Institute, <http://www.productstewardship.us/index.cfm>.

Sacramento Clean Water Business Partners.

<http://www.sacstormwater.org/CleanWaterBusinessPartners/CleanWaterBusinessPartners.html>.

USEPA. National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges From Industrial Facilities,

<http://cfpub.epa.gov/npdes/stormwater/indust.cfm>.

USEPA Region IX Pollution Prevention Program,

<http://www.epa.gov/region9/waste/p2/business.html>.

Western Sustainability and Pollution Prevention Network, <http://wsppn.org/>.

Metals (mercury, copper)

National Electrical Manufacturers Association – Environmental Stewardship,
<http://www.nema.org/Policy/Environmental-Stewardship/pages/default.aspx>.

Sustainable Conservation, <http://www.suscon.org>.

Auto Recycling Project

Brake Pad Partnership

Pesticides and Chemical Fertilizers

Bio-Integral Resource Center, <http://www.birc.org>.

California Department of Pesticide Regulation,
<http://www.cdpr.ca.gov/dprprograms.htm>.

University of California Statewide IPM Program,
<http://www.ipm.ucdavis.edu/default.html>.

Dioxins

Bay Area Dioxins Project,
http://www.abag.ca.gov/bayarea/dioxin/project_materials.htm.

Contaminated or Erodible Areas SC-40

Description

Areas within an industrial site that are bare of vegetation or are subject to activities that promote the suppression of vegetation are often subject to erosion. In addition, they may or may not be contaminated from past or current activities. If the area is temporarily bare because of construction, see SC-42 Building Repair, Remodeling, and Construction. Sites with excessive erosion or the potential for excessive erosion should consider employing the soil erosion BMPs identified in the Construction BMP Handbook. Note that this fact sheet addresses soils that do not exceed hazardous waste criteria (see Title 22 California Code of Regulations for Hazardous Waste Criteria).

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

Implement erosion and sediment control BMPs to stabilize soils and reduce pollutant discharges from contaminated or erodible surfaces.



Erosion and Sediment Controls

- Preserve natural vegetation whenever possible. See also EC-2 Preservation of Existing Vegetation, in the Construction BMP Handbook.
- Analyze soil conditions.
- Remove contaminated soil and dispose of properly.
- Stabilize loose soils by re-vegetating whenever possible. See also EC-4 Hydroseeding, in the Construction BMP Handbook.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

	Good Housekeeping	
	Preventative Maintenance	
	Spill and Leak Prevention and	
	Material Handling & Waste Management	
	Erosion and Sediment Controls	✓
	Employee Training Program	✓
	Quality Assurance Record Keeping	✓



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Contaminated or Erodible Areas SC-40

- Utilize non-vegetative stabilization methods for areas prone to erosion where vegetative options are not feasible. Examples include:
 - ✓ Areas of vehicular or pedestrian traffic such as roads or paths;
 - ✓ Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
 - ✓ Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
 - ✓ Areas where vegetation will not grow adequately within the construction time frame.

There are several non-vegetative stabilization methods and selection should be based on site-specific conditions. See also EC-16 Non-Vegetative Stabilization, in the Construction BMP Handbook.

- Utilize chemical stabilization when needed. See also EC-5 Soil Binders, in the Construction BMP Handbook.
- Use geosynthetic membranes to control erosion if feasible. See also EC-7 Geotextiles and Mats, in the Construction BMP Handbook.
- Stabilize all roadways, entrances, and exits to sufficiently control discharges of erodible materials from discharging or being tracked off the site. See also TC 1-3 Tracking Control, in the Construction BMP Handbook.
- Implement wind erosion control measures as necessary. See also WE-1 Wind Erosion Control, in the Construction BMP Handbook.



Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly install and maintain the erosion and sediment source control BMPs described above. Detailed information is provided in the Construction BMP Handbook.
- Use a training log or similar method to document training.



Quality Assurance and Record Keeping

- Keep accurate logs that document actions taken to maintain and improve the effectiveness of the erosion and sediment control BMPs described above.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Contaminated or Erodible Areas SC-40

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Many facilities do not have contaminated or erodible areas and will require no additional capital expenditures.
- For sites with contaminated or erodible areas, purchase and installation of erosion and sediment controls will require additional capital investments, and this amount will vary depending on site characteristics and the types of BMPs being implemented.
- Minimize costs by maintaining existing vegetation and limiting site operations on bare soils.

Maintenance

- The erosion and sediment control BMPs described above require periodic inspection and maintenance to remain effective. The cost of these actions will vary depending on site characteristics and the types of BMPs being implemented.
- Irrigation costs may be required to establish and maintain vegetation.

Supplemental Information

Stabilization of Erodible Areas

Preserving stabilized areas minimizes erosion potential, protects water quality, and provides aesthetic benefits. The most effective way to control erosion is to preserve existing vegetation. Preservation of natural vegetation provides a natural buffer zone and an opportunity for infiltration of stormwater and capture of pollutants in the soil matrix. This practice can be used as a permanent source control measure.

Vegetation preservation should be incorporated into the site. Preservation requires good site management to minimize operations on bare soils where vegetation exists. 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 mulching, fertilizing, liming, irrigation, pruning and weed and pest control.

The preferred approach is to leave as much native vegetation on-site as possible, thereby reducing or eliminating any erosion problem. However, assuming the site already has contaminated or erodible surface areas, there are four possible courses of action which can be taken:

- The area can be revegetated if it is not in use and therefore not subject to damage from site activities. In as much as the area is already devoid of vegetation, special measures are likely necessary. Lack of vegetation may be due to the lack of water and/or poor soils. The latter can perhaps be solved with fertilization, or the ground may simply be too compacted from prior use. Improving soil conditions may be sufficient to support the recovery of vegetation. Use process wastewater for irrigation if possible, and see the Construction BMP Handbook for further procedures on establishing vegetation.

Contaminated or Erodible Areas SC-40

- Watering trucks to prevent dust.
- Chemical stabilization can be used as an alternate method in areas where temporary seeding practices cannot be used because of season or climate. It can provide immediate, effective, and inexpensive erosion control. Application rates and procedures recommended by the manufacturer should be followed as closely as possible to prevent the products from forming ponds and creating large areas where moisture cannot penetrate the soil. See also EC-5, Soil Binders, in the Construction BMP Handbook for more information. Advantages of chemical stabilization include:
 - ✓ Applied easily to the surface;
 - ✓ Stabilizes areas effectively; and
 - ✓ Provides immediate protection to soils that are in danger of erosion.
- Contaminated soils should be cleaned up or removed. This requires determination of the level and extent of the contamination. Removal must comply with State and Federal regulations; permits must be acquired and fees paid.
- Non-vegetated stabilization methods are suitable for permanently protecting from erosion by water and wind. Non-vegetated stabilization should only be utilized when vegetation cannot be established due to soil or climactic conditions, or where vegetation may be a potential fire hazard.

Examples of non-vegetative stabilization BMPs are provided below:

- ✓ **Decomposed Granite (DG) and Gravel Mulch** are suitable for use in areas where vegetation establishment is difficult, on flat surfaces, trails and pathways, and when used in conjunction with a stabilizer or tackifier, on shallow slopes (i.e., 10:1 [H:V]). DG and gravel can also be used on shallow rocky slopes where vegetation cannot be established for permanent erosion control.
- ✓ **Degradable Mulches** can be used to cover and protect soil surfaces from erosion both in temporary and permanent applications. In many cases, the use of mulches by themselves requires routine inspection and re-application. See EC-3 Hydraulic Mulch, EC-6 Straw Mulch, EC-8 Wood Mulch, or EC-14 Compost Blankets of the Construction BMP Handbook for more information.
- ✓ **Geotextiles and Mats** can be used as a temporary stand-alone soil stabilization method. Depending on material selection, geotextiles and mats can be a short-term (3 months – 1 year) or long-term (1-2 years) temporary stabilization method. For more information on geotextiles and mats see EC-7 Geotextiles and Mats of the Construction BMP Handbook.
- ✓ **Rock Slope Protection** can be used when the slopes are subject to scour or have a high erosion potential, such as slopes adjacent to flowing waterways or slopes subject to overflow from detention facilities (spillways).

Contaminated or Erodible Areas SC-40

- ✓ **Soil Binders** can be used for temporary stabilization of stockpiles and disturbed areas not subject to heavy traffic. See EC-5 Soil Binders for more information. References and Resources.

References and Resources

California Stormwater Quality Association 2012, *Construction Stormwater Best Management Practice Handbook*. Available at <http://www.casqa.org>.

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: <http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities>.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: <http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf>.

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Tahoe Regional Planning Agency, *Best Management Practices Handbook*, 2012. Available online at: <http://www.tahoebmp.org/Documents/2012%20BMP%20Handbook.pdf>.

The Storm Water Managers Resource Center, <http://www.stormwatercenter.net>.

U.S. Environmental Protection Agency, *Construction Site Stormwater Runoff Control*. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=4.

General Description

Vegetated swales (also referred to as bioswales, biofiltration swales, or landscaped swales) are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, reduce flow velocity, and increase time of concentration of stormwater runoff. Vegetated swales can be implemented to provide effective pretreatment for detention and infiltration stormwater BMPs.

Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. Therefore, swales are best suited for small landscaped portions of industrial or commercial facilities with low peak flow rates. They are not well suited to treat stormwater runoff from industrial areas that have insufficient source control BMPs.

Inspection/Maintenance Considerations

A thick vegetative cover is needed for vegetated swales to function properly. Usually, swales require little more than normal landscape maintenance activities such as irrigation and mowing to maintain pollutant removal efficiency. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g., debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained. The application of fertilizers and pesticides should be minimized.

Advanced BMPs Covered



Maintenance Concerns

- Channelization
- Vegetation/Landscape Maintenance
- Vector Control
- Aesthetics
- Flow Obstructions

Targeted Constituents

Sediment	▲
Nutrients	●
Trash	●
Metals	▲
Bacteria	●
Oil and Grease	▲
Organics	▲

Legend (Removal Effectiveness)

● Low ■ High ▲ Medium

* Requires Pretreatment

Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.



Vegetated Swale

TC-30

Inspection Activities	Suggested Frequency
<input type="checkbox"/> Inspect after seeding and after first major storms for any damages.	Post construction
<input type="checkbox"/> Inspect for signs of erosion, damage to vegetation, channelization of flow, debris and litter, and areas of sediment accumulation. Perform inspections at the beginning and end of the wet season. Additional inspections after periods of heavy runoff are desirable.	Semi-annual
<input type="checkbox"/> Inspect level spreader for clogging, grass alongside slopes for erosion and formation of rills or gullies, and sand/soil bed for erosion problems.	Annual
Maintenance Activities	Suggested Frequency
<input type="checkbox"/> Mow grass to maintain a height of 3–4 inches, for safety, aesthetic, or other purposes. Litter should always be removed prior to mowing. Clippings should be composted. <input type="checkbox"/> Irrigate swale during dry season (April through October) or when necessary to maintain the vegetation. <input type="checkbox"/> Provide weed control, if necessary to control invasive species.	As needed (frequent, seasonally)
<input type="checkbox"/> Remove litter, branches, rocks blockages, and other debris and dispose of properly. <input type="checkbox"/> Maintain inlet flow spreader (if applicable). <input type="checkbox"/> Repair any damaged areas within a channel identified during inspections. Erosion rills or gullies should be corrected as needed. Bare areas should be replanted as necessary.	Semi-annual
<input type="checkbox"/> Declog the pea gravel diaphragm, if necessary. <input type="checkbox"/> Correct erosion problems in the sand/soil bed of dry swales. <input type="checkbox"/> Plant an alternative grass species if the original grass cover has not been successfully established. Reseed and apply mulch to damaged areas.	Annual (as needed)
<input type="checkbox"/> Remove all accumulated sediment that may obstruct flow through the swale. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation, or once it has accumulated to 10% of the original design volume. Replace the grass areas damaged in the process. <input type="checkbox"/> Rototill or cultivate the surface of the sand/soil bed of dry swales if the swale does not draw down within 48 hours.	As needed (infrequent)

Additional Information

Research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

The swale bottom and side slopes should be covered with dense vegetative cover to filter pollutants out of runoff and helps reduce flow velocities and protect the swale from erosion. Fine, close-growing grasses are ideal because increasing the surface area of the vegetation exposed to runoff improves the effectiveness of the swale. Drought tolerant vegetation than can tolerate sediment and debris accumulations are best-suited for swales.

References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06)*, 2010. Available online at:

<http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-09-239-06.pdf>.

California Stormwater Quality Association. *Stormwater Best Management Practice Handbook, New Development and Redevelopment*, 2003. Available online at:

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<http://www.stormwatercenter.net/Cold%20Climates/cold-climates.htm>.

Tahoe Regional Planning Agency. *Best Management Practices Handbook*, 2012.

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<http://www.tahoebmp.org/Documents/2012%20BMP%20Handbook.pdf>.

U.S. Environmental Protection Agency, *Post-Construction Stormwater Management in New Development and Redevelopment*. BMP Fact Sheets. Available online at:

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Ventura Countywide Stormwater Quality Management Program. *Technical Guidance Manual for Stormwater Quality Control Measures*, 2010. Available online at: http://www.vcstormwater.org/documents/workproducts/technicalguidancemanual/2010revisions/Ventura%20Technical%20Guidance%20Document_5-6-10.pdf.

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General Description

Vegetated buffer strips (vegetated filter strips, biostrips, filter strips, and grassed filters) are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. They are an effective, easy to implement BMP that often go unrecognized at industrial and commercial facilities.

Vegetated buffer strips function by slowing runoff velocities and allowing sediment and other pollutants to settle and by providing some infiltration into underlying soils. They are well-suited to treating runoff from roads, roof downspouts, small parking lots, and pervious surfaces. They can be implemented to provide effective pretreatment for detention and infiltration stormwater BMPs.

Vegetated buffer strips can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. Therefore, they are best suited for small landscaped portions of industrial or commercial facilities with low peak flow rates. They are not well suited to treat stormwater runoff from industrial areas that have insufficient source control BMPs.

Inspection/Maintenance Considerations

Vegetated buffer strips require frequent landscape maintenance. In many cases, vegetated buffer strips initially require intense maintenance, but less maintenance is needed over time. Maintenance tasks may be conducted by a landscaping contractor. Maintenance requirements typically include grass or shrub-growing activities such as irrigation, mowing, trimming, removal of invasive species, and replanting when necessary. Buffer strips require more attention as the volume of sediment increases. Vegetated buffer strips can become a nuisance due to mosquito breeding in level spreaders (unless

Advanced BMPs Covered



Maintenance Concerns

- *Vector Control*
- *Invasive Species Management*
- *Vegetation/Landscape Maintenance*
- *Erosion*
- *Channelization of Flow*
- *Aesthetics*

Targeted Constituents

<i>Sediment</i>	■
<i>Nutrients</i>	●
<i>Trash</i>	▲
<i>Metals</i>	■
<i>Bacteria</i>	●
<i>Oil and Grease</i>	■
<i>Organics</i>	▲

Legend (Removal Effectiveness)

● Low ■ High ▲ Medium

* Requires Pretreatment

Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.



Vegetated Buffer Strip

TC-31

designed to dewater completely in 96 hours or less) and/or if proper drainage slopes are not maintained.

Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <input type="checkbox"/> Once the vegetated buffer strip is established, inspect at least three times per year. Repair all damage immediately. <input type="checkbox"/> Inspect buffer strips after seeding and repair as needed. 	Post construction
<ul style="list-style-type: none"> <input type="checkbox"/> Inspect buffer strip and repair all damage immediately. <input type="checkbox"/> Inspect soil and repair eroded areas. 	After major storms
<ul style="list-style-type: none"> <input type="checkbox"/> Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable. <input type="checkbox"/> Inspect pea-gravel diaphragm/level spreader for clogging and effectiveness and remove built-up sediment. <input type="checkbox"/> Inspect for rolls and gullies. Immediately fill with topsoil, install erosion control blanket and seed or sod. <input type="checkbox"/> Inspect to ensure vegetation is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket. <input type="checkbox"/> Check for debris and litter, and areas of sediment accumulation. 	Semi-annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <input type="checkbox"/> Water plants daily for 2 weeks after construction. 	Post construction
<ul style="list-style-type: none"> <input type="checkbox"/> Mow regularly to maintain vegetation height between 2 - 4 inches, and to promote thick, dense vegetative growth. Cut only when soil is dry to prevent tracking damage to vegetation, soil compaction and flow concentrations. Clippings are to be removed immediately after mowing. <input type="checkbox"/> Remove all litter, branches, rocks, or other debris. Damaged areas of the filter strip should be repaired immediately by reseeding and applying mulch. <input type="checkbox"/> Regularly maintain inlet flow spreader. <input type="checkbox"/> Irrigate during dry season (April through October) when necessary to maintain the vegetation. 	Frequently, as needed
<ul style="list-style-type: none"> <input type="checkbox"/> Remulch void areas. <input type="checkbox"/> Treat diseased trees and shrubs, remove dead vegetation. 	Semi-annual
<ul style="list-style-type: none"> <input type="checkbox"/> Remove sediment and replant in areas of buildup. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation. <input type="checkbox"/> Limit fertilizer applications based on plant vigor and soil test results. <input type="checkbox"/> Rework or replant buffer strip if concentrated flow erodes a channel through the strip. 	Annual

Additional Information

Research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

The buffer strip should be covered with dense vegetative cover to filter pollutants out of runoff and helps reduce flow velocities and protect the strip from erosion. Fine, close-growing grasses are ideal because increasing the surface area of the vegetation exposed to runoff improves the effectiveness of the swale. Drought tolerant vegetation that can tolerate sediment and debris accumulations is best-suited for vegetated buffer strips.

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<http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-09-239-06.pdf>.

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General Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through a sand bed and is subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Inspection/Maintenance Considerations

Bioretention requires monthly landscaping maintenance, including measures to ensure that the area is functioning properly and irrigation during dry periods. In many cases, bioretention areas initially require intense maintenance, but less maintenance is needed over time. Maintenance tasks may be conducted by a landscaping contractor, who may already be hired at the site.

Sediment may enter the bioretention cell and form a crust on the soil surface, limiting the porosity of the soil. Raking of the mulch and soil surface may be needed to maintain high infiltration rates. In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Bioretention systems can become a nuisance due to mosquito and midge breeding. Maintaining soil porosity and basic housekeeping practices such as removal of debris accumulations and vegetation management are necessary to ensure that the system dewateres completely (recommended 72 hour residence time or less) to prevent creating mosquito and other vector habitats.

Advanced BMPs Covered



Maintenance Concerns

- *Clogged Soil or Outlet Structures*
- *Sediment Accumulation*
- *Invasive Species Management*
- *Vegetation/Landscape Maintenance*
- *Erosion*
- *Channelization of Flow*
- *Vector Control*
- *Aesthetics*

Targeted Constituents

<i>Sediment</i>	■
<i>Nutrients</i>	▲
<i>Trash</i>	■
<i>Metals</i>	■
<i>Bacteria</i>	■
<i>Oil and Grease</i>	■
<i>Organics</i>	■

Legend (Removal Effectiveness)

● Low ■ High ▲ Medium

* Requires Pretreatment

Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.



Inspection Activities	Suggested Frequency
<input type="checkbox"/> Inspect soil and repair eroded areas.	Monthly
<input type="checkbox"/> Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable.	Semi-annual inspection
<input type="checkbox"/> Inspect to ensure vegetation is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket.	
<input type="checkbox"/> Check for debris and litter, and areas of sediment accumulation.	
<input type="checkbox"/> Inspect health of trees and shrubs.	
Maintenance Activities	Suggested Frequency
<input type="checkbox"/> Water plants daily for 2 weeks.	At project completion
<input type="checkbox"/> Remove litter and debris.	Monthly
<input type="checkbox"/> Remove sediment. <input type="checkbox"/> Remulch void areas. <input type="checkbox"/> Irrigate during dry periods. <input type="checkbox"/> Treat diseased trees and shrubs. <input type="checkbox"/> Mow turf areas. <input type="checkbox"/> Repair erosion at inflow points. <input type="checkbox"/> Repair outflow structures. <input type="checkbox"/> Unclog underdrain. <input type="checkbox"/> Regulate soil pH. <input type="checkbox"/> Make structural changes or repairs as needed to eliminate pools of water that stand longer than 96 hrs to prevent mosquito production, particularly during the warmer months of the year. Identify and eliminate sources of non-stormwater runoff that feed standing water pools. Coordinate with the local mosquito and vector control agency to control mosquitoes, if necessary.	As needed
<input type="checkbox"/> Remove and replace dead and diseased vegetation.	Semi-annual
<input type="checkbox"/> Add mulch.	Annual
<input type="checkbox"/> Replace tree stakes and wires.	
<input type="checkbox"/> Mulch should be replaced every 2 to 3 years or when bare spots appear or infiltration rates are reduced. Remulch prior to the wet season.	Every 2-3 years, or as needed

Additional Information

Landscaping is critical to the function and aesthetic value of bioretention areas. It is preferable to plant the area with native vegetation, or plants that provide habitat value, where possible. Another important design feature is to select species that can withstand the hydrologic regime they will experience. At the bottom of the bioretention facility, plants that tolerate both wet and dry conditions are preferable. At the edges, which will remain primarily dry, upland species will be the most resilient. It is best to select a combination of trees, shrubs, and herbaceous materials.

For areas with low permeability native soils or steep slopes, bioretention areas can be designed with an underdrain system that routes the treated runoff to the storm drain system rather than depending entirely on infiltration.

Special considerations are required for bioretention to be effective in cold climates – see the Stormwater Managers Resource Center for more information.

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