Appendix P Stormwater Hotspots

P.1 Stormwater Hotspots

Stormwater hotspots are defined as commercial, industrial, institutional, municipal, or transport-related operations that produce higher levels of stormwater pollutants, and/or present a higher potential risk for spills, leaks or illicit discharges. The following operations are classified as stormwater hotspots operations in the District of Columbia:

H-1 Vehicle Maintenance and Repair

H-2 Vehicle Fueling

H-3 Vehicle Washing

H-4 Vehicle Storage

H-5 Loading and Unloading

H-6 Outdoor or Bulk Material Storage

If any of the above operations are expected to occur on the proposed site for which a Stormwater Management Plan (SWMP) is required, the Stormwater Hotspot Cover Sheet must be completed. Further, if a Construction General Permit Stormwater Pollution Prevention Plan ($SWPPP_{CGP}$) was not required or the $SWPPP_{CGP}$ does not cover operational pollution prevention practices, then the *Stormwater Hotspot Checklist* must be submitted with the SWMP.

This appendix contains the following information:

- Stormwater Hotspot Cover Sheet
- Stormwater Hotspot Checklist
- Hotspot operation pollution prevention profile sheets for operations H-1 through H-6

P.2 Stormwater Hotspot Cover Sheet

GOVERNMENT OF THE DISTRICT OF COLUMBIA
District Department of the Environment
1200 First Street NE, Fifth Floor, Washington DC 20002

Stormwater Hotspot Cover Sheet

Project Name: _____

Applicant Name: _____

Date: _____

Please indicate the appropriate hotspot operations for your project (check all that apply). If none apply check N/A.

Hotspot Operations:

___ Vehicle Maintenance and Repair (H-1)

___ Vehicle Fueling (H-2)

___ Vehicle Washing (H-3)

___ Vehicle Storage (H-4)

___ Loading and Unloading (H-5)

___ Outdoor or Bulk Material Storage (H-6)

___ N/A

If "N/A" is checked, please include this sheet only with plan submittal.

Otherwise, please indicate which of the following items are being included with the submittal of the Stormwater management Plan (SWMP). ***Note: If a SWPPP$_{CGP}$ has not been completed or the SWPPP$_{CGP}$ does not cover operational pollution prevention practices, then the Stormwater Hotspot Checklist must be completed for the SWMPsubmittal to be considered complete.***

___ A completed Construction General Permit Stormwater Pollution Prevention Plan (SWPPP$_{CGP}$)

___ A completed ***Stormwater Hotspot Checklist***

P.3 Stormwater Hotspot Checklist

Stormwater Hotspot Checklist

Instructions: *Complete the following site information:*

	Requirement	***Description***
Site Description	List the type of facility and facility address	
Site Operations	Describe the operations to be conducted on-site.	
Receiving Waters	Name(s) of the receiving water(s). If drains to a municipal storm sewer system, include ultimate receiving waters.	
Site Materials	Significant materials to be stored on site (specify indoor or outdoor storage)	
Stormwater Management Practices	List the stormwater management practices being used to treat runoff from the site. Where appropriate, include description of design modifications appropriate for treatment of hotspot runoff (i.e., bioretention area with impermeable liner and underdrain)	
Spill Prevention and Response	Describe methods to prevent spills along with clean-up and notification procedures.	
Employee Education Program	Description of employee orientation and education program.	

Instructions: *Fill in the appropriate page number(s) from the site plans where the following site elements are clearly indicated.*

Site elements	Site Plan Sheet Number(s)	Check if N/A	Approved (for official use only)
Material loading and access areas			
Material storage and handling areas			
Cleaning and maintenance areas			
Vehicle or machinery storage areas			
Vehicle or machinery maintenance/service areas			
Treatment or disposal areas for significant materials			
Hazardous waste storage areas			
Areas of outdoor manufacturing			
Stormwater management calculations			
Drainage area outline for each stormwater inlet or structure			
Stormwater management practices			
Stormwater management maintenance inspection agreements			
Spill Prevention and Response Kits			
Facility inspection agreements for inspections of areas where potential spills of significant materials or industrial activities can impact stormwater			

For official use only:

Date of Submission: _____ ***Date Received: _____***	***Reviewed by: _____*** ***Reviewed on: _____***	***Plan Accepted: Y / N***

Instructions: *Complete this table only if operation H-1 was checked on Page Q.2.*

H-1 Vehicle Maintenance and Repair Operations			
Description of Operation			
Requirement	**Description of pollution prevention mechanism or BMP to be implemented**	**Site Plan Sheet Number(s)**	**Approved (for official use only)**
Provide locations for recycling collection of used antifreeze, oil, grease, oil filters, cleaning solutions, solvents, batteries, hydraulic and transmission fluids			
Cover all vehicle and equipment repair areas with a permanent roof of canopy.			
Connect outdoor vehicle storage areas to a separate stormwater collection system with an oil/grit separator or sand filter.			
Designate a specific location for outdoor maintenance activities that is designed to prevent stormwater pollution (paved, away from storm drains, and with stormwater containment measures)			
Stencil or mark storm drain inlets with "No Dumping, Drains to _____" message			

For official use only:		
Date of Submission: _____ ***Date Received: _____***	***Reviewed by: _____*** ***Reviewed on: _____***	***Plan Accepted: Y / N***

Instructions: *Complete this table only if operation H-2 was checked on Page Q.2.*

H-2 Vehicle Fueling			
Description of Operation			
Requirement	**Description of pollution prevention mechanism or BMP to be implemented**	**Site Plan Sheet Number(s)**	**Approved (for official use only)**
Cover fueling stations with a canopy or roof to prevent direct contact with rainfall			
Design fueling pads to prevent the run-on of stormwater and pretreat any runoff with an oil/grit separator or a sand filter			
Locate storm drain inlets away from the immediate vicinity of the fueling area			
Stencil or mark storm drain inlets with "No Dumping, Drains to _____" message			
Pave fueling stations with concrete rather than asphalt			

For official use only:		
Date of Submission: _____ ***Date Received: _____***	***Reviewed by: _____*** ***Reviewed on: _____***	***Plan Accepted: Y / N***

Instructions: *Complete this table only if operation H-3 was checked on Page F.2.*

H-3 Vehicle Washing			
Description of Operation			
Requirement	**Description of pollution prevention mechanism or BMP to be implemented**	**Site Plan Sheet Number(s)**	**Approved (for official use only)**
Include flow-restricted hose nozzles that automatically turn off when left unattended.			
a containment system for washing vehicles such that wash water does not flow into storm drain system.			
orm drain inlets with "No Dumping, Drains to _____" signs to deter disposal of wash water in the storm drain system			
Design facilities with designated areas for indoor vehicle washing where no other activities are performed (e.g., fluid changes or repair services)			

For official use only:		
Date of Submission: _____ ***Date Received: _____***	***Reviewed by: _____*** ***Reviewed on: _____***	***Plan Accepted: Y / N***

Instructions: *Complete this table only if operation H-4 was checked on Page Q.2.*

H-4 Vehicle Storage			
Description of Operation			
Requirement	**Description of pollution prevention mechanism or BMP to be implemented**	**Site Plan Sheet Number(s)**	**Approved (for official use only)**
Label storm drain inlets with "No Dumping, Drains to _____" message			
All stormwater runoff from the fleet storage area must receive pretreatment via an oil/grit separator or sand filter.			
Untreated stormwater from the fleet storage area may not be discharged off site.			
Connect outdoor vehicle storage areas to a separate stormwater collection system with an oil/grit separator or sand filter.			

For official use only:		
Date of Submission: _____ ***Date Received: _____***	***Reviewed by: _____*** ***Reviewed on: _____***	***Plan Accepted: Y / N***

Instructions: *Complete this table only if operation H-5 was checked on Page Q.2.*

H-5 Loading and Unloading			
Description of Operation			
Requirement	**Description of pollution prevention mechanism or BMP to be implemented**	**Site Plan Sheet Number(s)**	**Approved (for official use only)**
Design liquid storage areas with impervious surfaces and secondary containment			
Minimize stormwater run-on by covering storage areas with a permanent canopy or roof			
Slope containment areas to a drain with a positive control (lock, valve, or plug) that leads to the sanitary sewer (if permitted) or to a holding tank			
Provide permanent cover for building materials stored outside			
Direct runoff away from building material storage areas			
Install a high-level alarm on storage tanks to prevent overfilling			
For official use only:			
Date of Submission: _____ ***Date Received: _____***	***Reviewed by: _____*** ***Reviewed on: _____***	***Plan Accepted: Y / N***	

Instructions: *Complete this table only if operation H-6 was checked on Page Q.2.*

H-6 Outdoor or Bulk Material Storage			
Description of Operation	(include methods of storage, usage, treatment, and disposal).		
Requirement	**Description of pollution prevention mechanism or BMP to be implemented**	**Site Plan Sheet Number(s)**	**Approved (for official use only)**
Grade the designated loading/unloading to prevent run-on or pooling of stormwater			
Cover the loading/unloading areas with a permanent canopy or roof			
Install an automatic shutoff valve to interrupt flow in the event of a liquid spill			
Install a high-level alarm on storage tanks to prevent overfilling			
Pave the loading/unloading area with concrete rather than asphalt			
Position roof downspouts to direct stormwater away from loading/unloading areas			

For official use only:		
Date of Submission: _____ ***Date Received: _____***	***Reviewed by: _____*** ***Reviewed on: _____***	***Plan Accepted: Y / N***

P.4 Hotspot Operation Pollution Prevention Profile Sheets

The following profile sheets include:

H-1 Vehicle Maintenance and Repair

H-2 Vehicle Fueling

H-3 Vehicle Washing

H-4 Vehicle Storage

H-5 Loading and Unloading

H-6 Outdoor or Bulk Material Storage

H-1	**Hotspot Source Area: Vehicles**	
	VEHICLE MAINTENANCE AND REPAIR	

Description

Vehicle maintenance and repair operations can exert a significant impact on water quality by generating toxins such as solvents, waste oil, antifreeze, and other fluids. Often, vehicles that are wrecked or awaiting repair can be a stormwater hotspot if leaking fluids are exposed to stormwater runoff (Figure 1). Vehicle maintenance and repair can generate oil and grease, trace metals, hydrocarbons, and other toxic organic compounds. Table 1 summarizes a series of simple pollution prevention techniques for vehicle maintenance and repair operations that can prevent stormwater contamination. You are encouraged to consult the Resources section of this sheet to get a more comprehensive review of pollution prevention practices for vehicle maintenance and repair operations.

Figure 1: Junkyard and Potential Source of Stormwater Pollution

Application

Pollution prevention practices should be applied to any facility that maintains or repairs vehicles in a subwatershed. Examples include car dealerships, body shops, service stations, quick lubes, school bus depots, trucking companies, and fleet maintenance operations at larger industrial, institutional, municipal or transport-related operations. Repair facilities are often clustered together, and are a major priority for subwatershed pollution prevention.

Table 1: Pollution Prevention Practices for Vehicle Maintenance and Repair Activities

- Avoid hosing down work or fueling areas
- Clean all spills immediately using dry cleaning techniques
- Collect used antifreeze, oil, grease, oil filters, cleaning solutions, solvents, batteries, hydraulic and transmission fluids and recycle with appropriate agencies
- Conduct all vehicle and equipment repairs indoors or under a cover (if done outdoors)
- Connect outdoor vehicle storage areas to a separate stormwater collection system with an oil/grit separator that discharges to a dead holding tank, the sanitary sewer or a stormwater treatment practice
- Designate a specific location for outdoor maintenance activities that is designed to prevent stormwater pollution (paved, away from storm drains, and with stormwater containment measures)
- Inspect the condition of all vehicles and equipment stored outdoors frequently
- Use a tarp, ground cloth, or drip pans beneath vehicles or equipment being repaired outdoors to capture all spills and drips
- Seal service bay concrete floors with an impervious material so cleanup can be done without using solvents. Do not wash service bays to outdoor storm drains
- Store cracked batteries in a covered secondary containment area until they can be disposed of properly
- Wash parts in a self-contained solvent sink rather than outdoors

Primary Training Targets
Owners, fleet operation managers, service managers, maintenance supervisors, mechanics and other employees are key targets for training.

Feasibility
Pollution prevention techniques for vehicle repair facilities broadly apply to all regions and climates. These techniques generally rely on changes to basic operating procedures, after an initial inspection of facility operations. The inspection relies on a standard operations checklist that can be completed in a few hours.

Implementation Considerations
Employee training is essential to successfully implement vehicle repair pollution prevention practices. The connection between the storm drain system and local streams should be emphasized so that employees understand why any fluids need to be properly disposed of. It is also important to understand the demographics of the work force; in some communities, it may require a multilingual education program.

Cost - Employee training is generally inexpensive, since training can be done using posters, pamphlets, or videos. Structural practices can vary based on what equipment is required. For instance, solvent sinks to clean parts can cost from $1,500 to $15,000, while spray cabinets may cost more than $50,000. In addition, proper recycling/disposal of used or spilled fluids usually requires outside contractors that may increase costs.

Resources
Stormwater Management Manual for Western Washington: Volume IV -- Source Control BMPs. http://www.ecy.wa.gov/biblio/9914.html

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial. http://www.cabmphandbooks.com/

Coordinating Committee For Automotive Repair (CCAR) Source: US EPA CCAR-*Green*Link®, the National Automotive Environmental Compliance Assistance Center CCAR-*Green*Link® Virtual Shop http://www.ccar-greenlink.org/

Auto Body Shops Pollution Prevention Guide. Peaks to Prairies Pollution Prevention Information Center. http://peakstoprairies.org/p2bande/autobody/abguide/index.cfm

Massachusetts Office of Technical Assistance (OTA). Crash Course for Compliance and Pollution Prevention Toolbox http://www.mass.gov/eea/grants-and-tech-assistance/education-and-training/education-and-outreach/ota-publications/guidance-docs/crash-course.html

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. http://www.swrcb.ca.gov/water_issues/programs/stormwater/murp.shtml

US EPA. Facility Regulatory Tour: Vehicle Maintenance.https://www.fedcenter.gov/assistance/facilitytour/vehicle/

City of Santa Cruz. Best Management Practices for Vehicle Service Facilities (in English and Spanish). http://www.cityofsantacruz.com/Modules/ShowDocument.aspx?documentid=5989

City of Los Angeles Bilingual Poster of BMPs for Auto Repair Industry http://www.lastormwater.org/wp-content/files_mf/bmp_auto_poster_8.5x14.pdf

H-2	**Hotspot Source Area: Vehicles**	
	VEHICLE FUELING	

Description

Spills at vehicle fueling operations have the potential to directly contribute oil, grease, and gasoline to stormwater, and can be a significant source of lead, copper and zinc, and petroleum hydrocarbons. Delivery of pollutants to the storm drain can be sharply reduced by well-designed fueling areas and improved operational procedures. The risk of spills depends on whether the fueling area is covered and has secondary containment. The type, condition, and exposure of the fueling surface can also be important. Table 1 describes common pollution prevention practices for fueling operations.

Application

These practices can be applied to any facility that dispenses fuel. Examples include retail gas stations, bus depots, marinas, and fleet maintenance operations (Figure 1). In addition, these practices also apply to temporary above-ground fueling areas for construction and earthmoving equipment. Many fueling areas are usually present in urban subwatersheds, and they tend to be clustered along commercial and highway corridors. These hotspots are often a priority for subwatershed source control.

Figure 1: Covered Retail Gas Operation Without Containment for Potential

Table 1: Pollution Prevention Practices For Fueling Operation Areas

- Maintain an updated spill prevention and response plan on premises of all fueling facilities (see Profile Sheet H-7)
- Cover fueling stations with a canopy or roof to prevent direct contact with rainfall
- Design fueling pads for large mobile equipment to prevent the run-on of stormwater and collect any runoff in a dead-end sump
- Retrofit underground storage tanks with spill containment and overfill prevention systems
- Keep suitable cleanup materials on the premises to promptly clean up spills
- Install slotted inlets along the perimeter of the "downhill" side of fueling stations to collect fluids and connect the drain to a waste tank or stormwater treatment practice. The collection system should have a shutoff valve to contain a large fuel spill event
- Locate storm drain inlets away from the immediate vicinity of the fueling area
- Clean fuel-dispensing areas with dry cleanup methods. Never wash down areas before dry cleanup has been done. Ensure that wash water is collected and disposed of in the sanitary sewer system or approved stormwater treatment practice
- Pave fueling stations with concrete rather than asphalt
- Protect above ground fuel tanks using a containment berm with an impervious floor of Portland cement. The containment berm should have enough capacity to contain 110 percent of the total tank volume
- Use fuel-dispensing nozzles with automatic shutoffs, if allowed
- Consider installing a perimeter sand filter to capture and treat any runoff produced by the station

Primary Training Targets
Training efforts should be targeted to owners, operators, attendants, and petroleum wholesalers.

Feasibility
Vehicle fueling pollution prevention practices apply to all geographic and climatic regions. The practices are relatively low-cost, except for structural measures that are installed during new construction or station remodeling.

Implementation Considerations
Fueling Area Covers - Fueling areas can be covered by installing an overhanging roof or canopy. Covers prevent exposure to rainfall and are a desirable amenity for retail fueling station customers. The area of the fueling cover should exceed the area where fuel is dispensed. All downspouts draining the cover or roof should be routed to prevent discharge across the fueling area. If large equipment makes it difficult to install covers or roofs, fueling islands should be designed to prevent stormwater run-on through grading, and any runoff from the fueling area should be directed to a dead-end sump.

Surfaces - Fuel dispensing areas should be paved with concrete; the use of asphalt should be avoided, unless the surface is sealed with an impervious sealant. Concrete pads used in fuel dispensing areas should extend to the full length that the hose and nozzle assembly can be pulled, plus an additional foot.

Grading - Fuel dispensing areas should be graded with a slope that prevents ponding, and separated from the rest of the site by berms, dikes or other grade breaks that prevent run-on of urban runoff. The recommended grade for fuel dispensing areas is 2–4 percent (CSWQTF, 1997).

Cost - Costs to implement pollution prevention practices at fueling stations will vary, with many of the costs coming upfront during the design of a new fueling facility. Once a facility has implemented the, ongoing maintenance costs should be low.

Resources
Best Management Practice Guide – Retail Gasoline Outlets. Prepared by Retail Gasoline Outlet Work Group.
http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/los_angeles_ms4/tentative/rgo%20bmp%20guide_03-97_.pdf

Stormwater Management Manual for Western Washington: Volume IV -- Source Control BMPs.
http://www.ecy.wa.gov/biblio/9914.html

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: New Development and Redevelopment.
http://www.cabmphandbooks.com/

City of Los Angeles, CA Best Management Practices for Gas Stations
http://www.lacitysan.org/watershed_protection/pdfs/gasstation.pdf

City of Dana Point Tips for the Automotive Industry
http://www.danapoint.org/Modules/ShowDocument.aspx?documentid=3309

*Alachua County, FL Best Management Practices for Controlling Runoff from Gas Stations*http://www.alachuacounty.us/Depts/EPD/Documents/WaterResources/Gas%20Stations.pdf

California Stormwater Regional Control Board Retail Gasoline Outlets: New Development Design Standards For Mitigation Of Stormwater Impacts
http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/los_angeles_ms4/tentative/rgopaper.pdf

http://www.waterboards.ca.gov/rwqcb4/water_issues/programs/stormwater/municipal/los_angeles_ms4/tentative/rgopapersupplement_12-01_.pdf

Canadian Petroleum Products Institute Best Management Practices Stormwater Runoff from Petroleum Facilities
http://canadianfuels.ca/userfiles/file/CPPI%20-%20BMP%20Stormwater%20runoff%20-%20March-04.pdf

City of Monterey (CA). Posters of Gas Station BMPs.

Pinole County, CA Typical Stormwater Violations Observed in Auto Facilities and Recommended Best Management Practices (BMPs)
http://www.ci.pinole.ca.us/publicworks/downloads/AutoStormwater.pdf

H-3	**Hotspot Source Area: Vehicles**
	VEHICLE WASHING

Description
Vehicle washing pollution prevention practices apply to many commercial, industrial, institutional, municipal and transport-related operations. Vehicle wash water may contain sediments, phosphorus, metals, oil and grease, and other pollutants that can degrade water quality. When vehicles are washed on impervious surfaces such as parking lots or industrial areas, dirty wash water can contaminate stormwater that ends up in streams.

Application
Improved washing practices can be used at any facility that routinely washes vehicles. Examples include commercial car washes, bus depots, car dealerships, rental car companies, trucking companies, and fleet operations. In addition, washing dump trucks and other construction equipment can be a problem. Washing operations tend to be unevenly distributed within urban subwatersheds. Vehicle washing also occurs in neighborhoods, and techniques to keep wash water out of the storm drain system are discussed in the car washing profile sheet (N-11). Table 1 reviews some of the pollution prevention techniques available for hotspot vehicle washing operations.

Primary Training Targets
Owners, fleet managers, and employees of operations that include car washes are the primary training target.

Feasibility
Vehicle washing practices can be applied to all regions and climates. Vehicle washing tends to occur more frequently in summer months and in drier regions of the country. Sound vehicle washing practices are not always used at many sites because operators are reluctant to change traditional cleaning methods. In addition, the cost of specialized equipment to manage high volumes of wash water can be too expensive for small businesses.

Improved vehicle washing practices are relatively simple to implement and are very effective at preventing stormwater contamination. Training is essential to get owners and employees to adopt these practices, and should be designed to overcome cultural and social barriers to improved washing practices.

Table 1: Pollution Prevention Practices for Vehicle Washing

- Wash vehicles at indoor car washes that recycle, treat or convey wash water to the sanitary sewer system
- Use biodegradable, phosphate-free, water-based soaps
- Use flow-restricted hose nozzles that automatically turn off when left unattended
- Wash vehicles on a permeable surface or a washpad that has a containment system
- Prohibit discharge of wash water into the storm drain system or ground by using temporary berms, storm drain covers, drain plugs or other containment system
- Label storm drains with “No Dumping” signs to deter disposal of wash water in the storm drain system
- Pressure and steam clean off site to avoid runoff with high pollutant concentrations
- Obtain permission from sewage treatment facilities to discharge to the sanitary sewer

Implementation Considerations

The ideal practice is to wash all vehicles at commercial car washes or indoor facilities that are specially designed for washing operations. Table 2 offers some tips for indoor car wash sites. When washing operations are conducted outside, a designated wash area should have the following characteristics:

- Paved with an impervious surface, such as Portland cement concrete
- Bermed to contain wash water
- Sloped so that wash water is collected and discharged to the sanitary sewer system, holding tank or dead-end sump
- Operated by trained workers to confine washing operations to the designated wash area

Table 2: Tips for Indoor Car Wash Sites *(Adapted from U.S. EPA, 2003)*

- Facilities should have designated areas for indoor vehicle washing where no other activities are performed (e.g., fluid changes or repair services)
- Indoor vehicle wash areas should have floor drains that receive only vehicle washing wastewater (not floor washdown or spill removal wash waters) and be connected to a holding tank with a gravity discharge pipe, to a sump that pumps to a holding tank, or to an oil/grit separator that discharges to a municipal sanitary sewer
- The floor of indoor vehicle wash bays should be completely bermed to collect wash water
- Aromatic and chlorinated hydrocarbon solvents should be eliminated from vehicle-washing operations
- Vehicle-washing operations should use vehicle rinse water to create new wash water through the use of recycling systems that filter and remove grit.

Outdoor vehicle washing facilities should use pressurized hoses without detergents to remove most dirt and grime. If detergents are used, they should be phosphate-free to reduce nutrient loading. If acids, bases, metal brighteners, or degreasing agents are used, wash water should be discharged to a treatment facility, sanitary sewer, or a sump. In addition, waters from the pressure washing of engines and vehicle undercarriages must be disposed of using the same options.

Discharge to pervious areas may be an option for washing operations that generate small amounts of relatively clean wash water (water only - no soaps, no steam cleaning). The clean wash water should be directed as sheet flow across a vegetated area to infiltrate or evaporate before it enters the storm drain system. This option should be exercised with caution, especially in environmentally sensitive areas or protected groundwater recharge areas.

The best way to avoid stormwater contamination during washing operations is to drain the wash water to the sanitary sewer system. Operations that produce high volumes of wash water should consider installing systems that connect to the sewer. Other options for large and small operations include containment units to capture the wash water prior to transport away for proper disposal (Figure 1). If vehicles must be washed on an impervious surface, a storm drain filter should be used to capture solid contaminants.

Cost - The cost of using vehicle-washing practices can vary greatly and depends on the size of the operation (Table 3). The cost of constructing a commercial grade system connected to the sanitary sewer can exceed $100,000. Disposal fees and frequency of washing can also influence the cost. Training costs can be minimized by using

Figure 1: Containment System Preventing Wash Water from Entering the Storm Drain

educational materials available from local governments, professional associations or EPA's National Compliance Assistance Centers (http://www.assistancecenters.net/). Temporary, portable containment systems can be shared by several companies that cannot afford specialized equipment independently.

Table 3: Sample Equipment Costs for Vehicle Washing Practices

Item	Cost
Bubble Buster	$2,000–$2,500*
Catch basin insert	$65*
Containment mat	$480–$5,840**
Storm drain cover (24-in. drain)	$120 **
Water dike/ berm (20 ft)	$100.00 **
Pump	$75–$3,000**
Wastewater storage container	$50–$1,000+**
*Source: *U.S. EPA, 1992 **Robinson, 2003*	

Resources

EPA FedSite Facility Regulatory Tour: http://www.fedcenter.gov/assistance/facilitytour/vehicle/washing/

Alachua County BMP for Outdoor Car Washing. http://www.alachuacounty.us/Depts/EPD/WaterResources/StormwaterPollutionAndSolutions/Reducing%20Stormwater%20Pollution%20Documents/Carwash%20BMP.pdf

Kitsap County Sound Car Wash Program. http://www.kitsapgov.com/sswm/carwash.htm.

Robinson, C., Proprietor, "Latimat" portable wastewater containment system. Personal Communication June 2, 2003. *http://www.latimat.com*

Washington Department of Ecology. 1995. Vehicle and Equipment Wash Water Discharges: Best Management Practices Manual. Olympia, Washington. http://www.ecy.wa.gov/pubs/95056.pdf

U.S. Environmental Protection Agency. Pollution Prevention/Good Housekeeping for Municipal Operations. http://cfpub2.epa.gov/npdes/stormwater/menuofbmps/poll_18.cfm

U.S. EPA. 1992. Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. US EPA Office of Wastewater Management. Washington, D.C. EPA 832-R-92-006.

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial. http://www.cabmphandbooks.com/

H-4	**Hotspot Source Area: Vehicles**	
	VEHICLE STORAGE	

Description

Parking lots and vehicle storage areas can introduce sediment, metals, oil and grease, and trash into stormwater runoff. Simple pavement sweeping, litter control, and stormwater treatment practices can minimize pollutant export from these hotspots. Table 1 provides a list of simple pollution prevention practices intended to prevent or reduce the discharge of pollutants from parking and vehicle storage areas.

Application

Pollution prevention practices can be used at larger parking lots located within a subwatershed. Examples include regional malls, stadium lots, big box retail, airport parking, car dealerships, rental car companies, trucking companies, and fleet operations (Figure 1). The largest, most heavily used parking lots with vehicles in the poorest condition (e.g., older cars or wrecked vehicles) should be targeted first.

This practice is also closely related to parking lot maintenance source controls, which are discussed in greater detail in profile sheet H-11.

Primary Training Targets

Owners, fleet operation managers, and property managers that maintain parking lots are key training targets.

Figure 1: Retail Parking Lot

Table 1: Pollution Prevention Practices for Parking Lot and Vehicle Storage Areas

Parking Lots

- Post signs to control litter and prevent patrons from changing automobile fluids in the parking lot (e.g., changing oil, adding transmission fluid, etc.)
- Pick up litter daily and provide trash receptacles to discourage littering
- Stencil or mark storm drain inlets with "No Dumping, Drains to _____" message
- Direct runoff to bioretention areas, vegetated swales, or sand filters
- Design landscape islands in parking areas to function as bioretention areas
- Disconnect rooftop drains that discharge to paved surfaces
- Use permeable pavement options for spillover parking (Profile sheet OS-11 in Manual 3)
- Inspect catch basins twice a year and remove accumulated sediments, as needed
- Vacuum or sweep large parking lots on a monthly basis, or more frequently
- Install parking lot retrofits such as bioretention, swales, infiltration trenches, and stormwater filters (Profile sheets OS-7 through OS-10 in Manual 3)

Vehicle Storage Areas

- Do not store wrecked vehicles on lots unless runoff containment and treatment are provided
- Use drip pans or other spill containment measures for vehicles that will be parked for extended periods of time
- Use absorbent material to clean up automotive fluids from parking lots

Feasibility
Sweeping can be employed for parking lots that empty out on a regular basis. Mechanical sweepers can be used to remove small quantities of solids. Vacuum sweepers should be used on larger parking lot storage areas, since they are superior in picking up deposited pollutants (see Manual 9). Constraints for sweeping large parking lots include high annual costs, difficulty in controlling parking, and the inability of current sweeper technology to remove oil and grease. Proper disposal of swept materials might also represent a limitation.

Implementation Considerations
The design of parking lots and vehicle storage areas can greatly influence the ability to treat stormwater runoff. Many parking areas are landscaped with small vegetative areas between parking rows for aesthetic reasons or to create a visual pattern for traffic flow. These landscaped areas can be modified to provide stormwater treatment in the form of bioretention (Figure 2).

Figure 2: Parking Lot Island Turned Bioretention

Catch basin cleanouts are also an important practice in parking areas. Catch basins within the parking lot should be inspected at least twice a year and cleaned as necessary. Cleanouts can be done manually or by vacuum truck. The cleanout method selected depends on the number and size of the inlets present (see Manual 9).

Most communities have contractors that can be hired to clean out catch basins and vacuum sweep lots. Mechanical sweeping services are available, although the cost to purchase a new sweeper can exceed $200,000. Employee training regarding spill prevention for parking areas is generally low-cost and requires limited staff time.

Resources
California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial
http://www.cabmphandbooks.com/

Stormwater Management Manual for Western Washington: Volume IV -- Source Control BMPs. WA Dept. of Ecology
http://www.ecy.wa.gov/biblio/9914.html

H-5	Hotspot Source Area: Outdoor Materials	
	LOADING AND UNLOADING	

Description
Outdoor loading and unloading normally takes place on docks or terminals at many commercial, industrial, institutional, and municipal operations. Materials spilled or leaked during this process can either be carried away in stormwater runoff or washed off when the area is cleaned. As a result, many different pollutants can be introduced into the storm drain system, including sediment, nutrients, trash, organic material, trace metals, and an assortment of other pollutants. A number of simple and effective pollution prevention practices can be used at loading/unloading areas to prevent runoff contamination, as shown in Table 1.

Application
While nearly every commercial, industrial, institutional, municipal and transport-related site has a location where materials or products are shipped or received, the risk of stormwater pollution is greatest for operations that transfer high volumes of material or liquids, or unload potentially hazardous materials. Some notable examples to look for in a subwatershed include distribution centers, grocery stores, building supply outlets, lawn and garden centers, petroleum wholesalers, warehouses, landfills, ports, solid waste facilities, and maintenance depots (Figure 1). Attention should also be paid to industrial operations that process bulk materials and any operations regulated under industrial stormwater NPDES permits.

Primary Training Targets
Owners, site managers, facility engineers, supervisors, and employees of operations with loading/unloading facilities are the primary training target.

Table 1: Pollution Prevention Practices for Loading and Unloading Areas

- Avoid loading/unloading materials in the rain
- Close adjacent storm drains during loading/unloading operations
- Surround the loading/unloading area with berms or grading to prevent run-on or pooling of stormwater. If possible, cover the area with a canopy or roof
- Ensure that a trained employee is always present to handle and cleanup spills
- Inspect the integrity of all containers before loading/unloading
- Inspect equipment such as valves, pumps, flanges, and connections regularly for leaks, and repair as needed
- Install an automatic shutoff valve to interrupt flow in the event of a catastrophic liquid spill
- Install a high-level alarm on storage tanks to prevent overfilling
- Pave the loading/unloading area with concrete rather than asphalt
- Place drip pans or other temporary containment devices at locations where leaks or spills may occur, and always use pans when making and breaking connections
- Position roof downspouts to direct stormwater away from loading/unloading areas and into bioretention areas
- Prepare and implement an Emergency Spill Cleanup Plan for the facility (see Profile Sheet H-7)
- Sweep loading/unloading area surfaces frequently to remove material that could otherwise be washed off by stormwater
- Train all employees, especially fork lift operators, on basic pollution prevention practices and post signs
- Use seals, overhangs, or door skirts on docks and terminals to prevent contact with rainwater

Feasibility
Loading/unloading pollution prevention practices can be applied in all geographic and climatic regions, and work most effectively at preventing sediment, nutrients, toxic materials, and oil from coming into contact with stormwater runoff or runon. Few impediments exist to using this practice, except for the cost to retrofit existing loading and unloading areas with covers or secondary containment.

Implementation Considerations
Loading/unloading pollution prevention practices should be integrated into the overall stormwater pollution prevention plan for a facility. Employee training should focus on proper techniques to transfer materials, using informational signs at loading docks and material handling sites and during routine safety meetings.

Cost - Costs to implement loading/unloading pollution prevention practices consist of one-time construction costs to retrofit new or existing loading areas, but annual maintenance costs are relatively low thereafter. Exceptions include industries that elect to use expensive air pressure or vacuum systems for loading/unloading facilities, which can also be expensive to maintain (U.S. EPA, 1992). Ongoing costs include employee training and periodic monitoring of loading/unloading activities.

Figure 1: Loading/Unloading Area of Warehouse

Resources
California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial.
http://www.cabmphandbooks.com/

Stormwater Management Manual for Western Washington: Volume IV -- Source Control BMPs. WA Dept. of Ecology 99-14
http://www.ecy.wa.gov/biblio/9914.html

Ventura County Flood Control District Clean Business Program Fact Sheet

http://www.vcstormwater.org/index.php/clean-business-fact-sheets

Business Best Management Practices Stormwater Bmp #3 - Shipping/Receiving/Loading Docks

City of Los Angeles, CA Reference Guide For Stormwater Best Management Practices
http://www.lacitysan.org/watershed_protection/pdfs/bmp_refguide.pdf

H-6	**Hotspot Source Area: Outdoor Materials**	
	OUTDOOR STORAGE	

Description

Protecting outdoor storage areas is a simple and effective pollution prevention practice for many commercial, industrial, institutional, municipal, and transport-related operations. The underlying concept is to prevent runoff contamination by avoiding contact between outdoor materials and rainfall (or runoff). Unprotected outdoor storage areas can generate a wide range of stormwater pollutants, such as sediment, nutrients, toxic materials, and oil and grease (Figure 1).

Materials can be protected by installing covers, secondary containment, and other structures to prevent accidental release. Outdoor storage areas can be protected on a temporary basis (tarps or plastic sheeting) or permanently through structural containment measures (such as roofs, buildings, or concrete berms). Table 1 summarizes pollution prevention practices available for outdoor storage areas.

Figure 1: Mulch Stored Outdoors at a Garden Center

Application

Many businesses store materials or products outdoors. The risk of stormwater pollution is greatest for operations that store large quantities of liquids or bulk materials at sites that are connected to the storm drain system. Several notable operations include nurseries and garden centers, boat building/repair, auto recyclers/body shops, building supply outlets, landfills, ports, recycling centers, solid waste and composting facilities, highway maintenance depots, and power plants. Attention should also be paid to industrial operations that process bulk materials, which are often regulated under industrial stormwater NPDES permits.

Primary Training Targets

Owners, site managers, facility engineers, supervisors, and employees of operations with loading/unloading facilities are the primary training target.

Feasibility

Outdoor storage protection can be widely applied in all regions and climate zones, and requires routine monitoring by employees. Most operations have used covering as the major practice to handle outdoor storage protection (U.S. EPA, 1999). The strategy is to design and maintain outdoor material storage areas so that they:

- Reduce exposure to stormwater and prevent runon
- Use secondary containment to capture spills
- Can be regularly inspected
- Have an adequate spill response plan and cleanup equipment

Table 1: Pollution Prevention Practices for Protecting Outdoor Storage Areas
• Emphasize employee education regarding storage area maintenance • Keep an up-to-date inventory of materials stored outdoors, and try to minimize them • Store liquids in designated areas on an impervious surface with secondary containment • Inspect outdoor storage containers regularly to ensure that they are in good condition • Minimize stormwater run-on by enclosing storage areas or building a berm around them • Slope containment areas to a drain with a positive control (lock, valve, or plug) that leads to the sanitary sewer (if permitted) or to a holding tank • Schedule regular pumping of holding tanks containing stormwater collected from secondary containment areas

Implementation Considerations

Covers - The use of impermeable covers is an effective pollution prevention practice for non-hazardous materials. Covers can be as simple as plastic sheeting or tarps, or more elaborate roofs and canopies. Site layout, available space, affordability, and compatibility with the covered material all dictate the type of cover needed for a site. In addition, the cover should be compatible with local fire and building codes and OSHA workplace safety standards. Care should be taken to ensure that the cover fully protects the storage site and is firmly anchored into place.

Secondary Containment - Secondary containment is designed to contain possible spills of liquids and prevent stormwater run-on from entering outdoor storage areas. Secondary containment structures vary in design, ranging from berms and drum holding areas to specially designed solvent storage rooms (Figure 2).

Secondary containment can be constructed from a variety of materials, such as concrete curbs, earthen berms, plastic tubs, or fiberglass or metal containers. The type of material used depends on the substance contained and its resistance to weathering. In general, secondary containment areas should be sized to hold 110 percent of the volume of the storage tank or container unless other containment sizing regulations apply (e.g., fire codes).

Figure 2: Secondary Containment of Storage Drums Behind a Car Repair Shop

If secondary containment areas are uncovered, any water that accumulates must be collected in a sanitary sewer, a stormwater treatment system, or a licensed disposal facility. Water quality monitoring may be needed to determine whether the water is contaminated and dictate the method of disposal. If the stormwater is clean, or an on-site stormwater treatment practice is used, a valve should be installed in the containment dike so that excess stormwater can be drained out of the storage area and directed either to the storm drain (if clean) or into the stormwater treatment system (if contaminated). The valve should always be kept closed except when stormwater is drained, so that any spills that occur can be effectively contained. Local sewer authorities may not allow discharges from a large containment area into the sewer system, and permission must be obtained

Table 2: Sample Equipment Costs for Outdoor Storage Protection	
Storage Protection Device	**Cost**
Concrete Slab (6")	$3.50 to $5.00 per ft^2
Containment Pallets	$50 to $350 based on size and # of barrels to be stored
Storage buildings	$6 to $11 per ft^2
Tarps & Canopies	$25 to $500 depending on size of area to cover
Sources: Costs were derived from a review of Ferguson et al.*, 1997 and numerous websites that handle proprietary spill control or hazardous material control products*	

sanitary sewer system are prohibited, containment should be provided, such as a holding tank that is regularly pumped out.

Employee training on outdoor storage pollution prevention should focus on the activities and site areas with the potential to pollute stormwater and the proper techniques to manage material storage areas to prevent runoff contamination. Training can be conducted through safety meetings and the posting of on-site informational signs. Employees should also know the on-site person who is trained in spill response.

Cost - Many storage protection practices are relatively inexpensive to install (Table 2). Actual costs depend on the size of the storage area and the nature of the pollution prevention practices. Other factors are whether practices are temporary or permanent and the type of materials used for covers and containment. Employee training can be done in connection with other safety training to reduce program costs. Training costs can also be reduced by using existing educational materials from local governments, professional associations or from EPA's National Compliance Assistance Centers (http://www.assistancecenters.net).

Resources

California Stormwater Quality Association. 2003 California Stormwater BMP Handbook: Industrial and Commercial. http://www.cabmphandbooks.com/

Rouge River National Wet Weather Demonstration Project. Wayne County, MI. http://www.rougeriver.com/proddata/catalog7ad4.html?category=overview#PI-PAPER-01.00

Storm Water Management Fact Sheet: Coverings. USEPA, Office of Water, http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_covs.pdf

EPA Office of Wastewater Management Storm Water Management Fact Sheet: Coverings http://www.epa.gov/owm/mtb/covs.pdf

Ferguson, T., R. Gigac, M. Stoffan, A. Ibrahim, and H. Aldrich. 1997. Rouge River National Wet Weather Demonstration Project. Wayne County, MI.

California Stormwater Quality Association Factsheet: Outdoor Storage of Raw Materials http://www.cabmphandbooks.com/Documents/Municipal/SC-33.pdf

Alameda Countywide Clean Water Program Outdoor Storage of Liquid Materials http://www.cityofalamedaca.org/getdoc.cfm?id=123

Washtenaw County, MI Community Partners for Clean Streams Fact Sheet Series #1: Housekeeping Practices http://www.ewashtenaw.org/government/drain_commissioner/dc_webWaterQuality/dc_cpcs/cpcs-handbook/cpcs-series-1-housekeeping-practices.pd