County of Nassau

DEPARTMENT OF PUBLIC WORKS

Nassau County Storm Water Management Program
Minimum Control Measure Six
Pollution Prevention/Good Housekeeping

Capital Project No. 82010

Task 2: Generic Operational Storm Water Pollution Prevention Plan for Nassau County Sheriff's Department Facilities

November 2007

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NASSAU COUNTY
PHASE II STORM WATER MANAGEMENT PROGRAM
MINIMUM CONTROL MEASURE NO. 6
POLLUTION PREVENTION AND GOOD HOUSEKEEPING

GENERIC OPERATIONAL STORM WATER
POLLUTION PREVENTION PLAN
FOR
NASSAU COUNTY SHERIFF'S DEPARTMENT

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NOVEMBER 2007

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1.0 INTRODUCTION

This introduction describes the federal and New York State regulatory framework for the Nassau County Storm Water Management Program and the Generic Operational Storm Water Pollution Prevention Plan for the Nassau County Sheriff's Department Facilities (hereafter referred to as the Generic Operational Plan for NCSD).

1.1 Federal and State Storm Water Regulations

As part of the enforcement of the Federal Clean Water Act, a federal regulation, commonly known as Stormwater Phase II, requires permits for storm water discharges from Municipal Separate Storm Sewer Systems (MS4s) in urbanized areas and for construction activities disturbing one or more acres. The term MS4 does not solely refer to municipally owned storm sewer systems, but rather has broader application and includes, in addition to local jurisdictions: the NYS Department of Transportation, public universities, local sewer districts, public hospitals, military bases and prisons. An MS4 is not limited to a system of underground pipes; it can include roads with drainage systems, gutters and ditches. States that are "delegated" or authorized by the federal government are responsible for developing regulations on the State level to implement the federal program.

The United States Environmental Protection Agency's (USEPA) Stormwater Phase II Final Rule and New York State's MS4 Phase II Stormwater Permit Program require an operator of a regulated small MS4 to:

- Design and implement an operation and maintenance program to reduce and prevent discharge of pollutants to the maximum extent practicable from municipal operations and facilities,
- Include a training component in the program on pollution prevention and good housekeeping techniques in municipal operations,
- Select and implement management practices for pollution prevention and good housekeeping in municipal operations, and

- Develop measurable goals to ensure the reduction of all pollutants of concern in storm water discharges to the maximum extent practicable.

1.2 New York State General Permit Requirements

In its role as a delegated State, New York State, through the Department of Environmental Conservation (NYSDEC), issued two general permits, one for MS4s in urbanized areas and one for construction activities. The permits are part of the State Pollutant Discharge Elimination System (SPDES).

On January 8, 2003, the NYSDEC finalized new permits for storm water discharges. The new requirements are aimed at reducing water pollution caused by storm water. The NYSDEC prepared guidance materials and provided statewide seminars on the program to assist municipalities in meeting the requirements of the newly developed general permit.

Operators of regulated MS4s were required to apply for general permit coverage by March 10, 2003. Operators of construction activities that exist on or after March 10, 2003 and that involve one acre or more of land disturbance are also required to obtain SPDES permit coverage through either an individual permit or the new General Construction Permit.

1.3 Nassau County Phase II Storm Water Management Program

While this document focuses on a specific storm water management element, namely Minimum Measure 6 - Pollution Prevention and Good Housekeeping, it is important to note that Nassau County, a regulated MS4, submitted its Notice of Intent (NOI) for coverage under the SPDES General Permit by the March 10, 2003 deadline. A copy of the General Permit is provided in Appendix A for reference. In conjunction with the NOI for the General Permit, the County also prepared its Storm Water Management Program Document. As required by the permit, the County Phase II Storm Water Management Program addresses the six Minimum Storm Water Management Control Measures. These are:

- Public Education and Outreach on Storm Water Impacts
- Public Involvement/Participation
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Control
- Post-construction Storm Water Management
- Pollution Prevention and Good Housekeeping for Municipal Operations

Consistent with Phase II regulations and the General Permit, the County submits annual reports on the Storm Water Management Program and Municipal Compliance Certifications.

The scope of County operations encompassed by Minimum Control Measure 6 is focused on:

- Activities at County owned or operated facilities (e.g., buildings, parks, police department facilities or infrastructure) and
- Operations throughout the community that are the ordinary responsibilities of municipal departments (e.g., street maintenance, storm water drainage system maintenance).

Operations and maintenance activities undertaken by private contractors, but which serve County programs, facilities and responsibilities, are to be included in this scope. Operations that might serve the residential community but which are municipal program responsibilities are also included within this scope. However, this scope does NOT include pollution prevention and good housekeeping practices within commercial or industrial properties or within residential properties unless there is a direct connection to municipal program responsibilities.

1.4 Generic Operational Storm Water Pollution Prevention Plan

Pollution prevention and good housekeeping policies and procedures are already in place in many County facilities. These activities are being performed either under direct control of the

municipality or are contracted or shared with other public entities. New York State recommended that municipalities conduct a self-assessment of their existing policies, procedures and activities that relate to pollution prevention and good housekeeping. This assessment served to identify both strengths and potential gaps or revisions that need to be addressed for compliance with the Phase II Stormwater Permit. The County benefited from the assessment because it helped determine the necessary steps, staff and resources needed to achieve compliance with the Phase II Stormwater Permit requirements.

The New York State Department of Environmental Conservation recommends a coherent approach to setting priorities, policies and procedures, record keeping and worker training for all operations related to storm water management. In addition to hundreds of miles of County roads, there are approximately 80 buildings, structures or facilities owned and/or operated by Nassau County. Any operations that collect, store or release sediments, wastes or other potential pollutants are important elements of storm water management and should be addressed in the comprehensive pollution prevention and good housekeeping program. The approach to preparing Generic Operational Storm Water Pollution Prevention Plans was due in part by the efficacy of preparing plans that could be utilized for "categories" of County facilities or County departments such as the Department of Public Works, Parks Department, Police Department or Sheriffs Department.

It is also important to note that the Generic Operational Plan for NCSD facilities provided herein is specific to Minimum Control Measure 6 (Pollution Prevention and Good Housekeeping for Municipal Operations). The Generic Operational Plan for NCSD Facilities should not be confused with a Storm Water Pollution Prevention Plan (SWPPP) that is prepared for a site-specific, construction or post-construction project or a SWPPP that is prepared for a facility covered under the "initial" phase (Phase I) of the federal storm water management regulations as one of the 11 categories of industrial facilities. Such SWPPPs relate to specific sites and specific projects, and are most relevant to Minimum Measures 4 and 5 of the Storm Water Management Program.

Most pollution prevention and good housekeeping practices should be implemented across the County, at all County facilities and in all County operations. The Generic Operation Plan will include best management practices (BMPs) that have been evaluated by federal and state agencies and deemed to be most effective in accomplishing the goals of storm water management and storm water pollution prevention.

Continued reevaluation of BMPs will also be very important. As the nation-wide effort to reduce storm water pollution progresses, improved BMP references and documentation will become available. New technology will also be field-tested and become available. The results of program implementation may indicate the need for revising priorities. The municipal pollution prevention and good housekeeping program should be considered dynamic.

Section 2.0 of this Generic Operational Plan identifies staff titles that comprise the primary pollution prevention team. Section 3.0 describes the basic operations that occur at NCSD facilities. The description is based primarily on a review of existing documentation that provided a general overview of typical NCSD operations. Section 4.0 provides a description of the potential pollution sources and pathways that can occur at NCSD facilities. The core of the Generic Operations Plan is Section 5.0, which contains numerous activity-specific and NCSD facility-specific BMPs aimed at storm water pollution prevention. Appendix A contains reference material important in the overall understanding of the federal, state and county requirements for municipal programs aimed at preventing or reducing the impacts of storm water pollution. Appendix B contains important excerpts from federal and state publications that are essential in the understanding and implementation of the BMPs that are described throughout the document.

2.0 POLLUTION PREVENTION TEAM

This section identifies job titles responsible for implementing, overseeing and monitoring the Generic Operational Storm Water Pollution Prevention Plan for the Nassau County Sheriff's Department Facilities (Generic Operational Plan for NCSD), particularly the pollution prevention measures (a.k.a. best management practices or "BMPs") listed in Section 5.0. Also described below is the process for making plan revisions and updates.

2.1 Responsible Parties

Day to day responsibility for implementation and monitoring of the Generic Operational Plan for NCSD lies with the supervisor of the particular NCSD facility/operation. The supervisor will require all personnel to be aware of, and to practice, the pollution prevention measures in the Generic Operational Plan consistent with periodic, NCSD-provided, employee education and training on BMP measures.

2.2 Plan Revision and Updates

To the extent that the existing Generic Operational Plan requires revision or updating, the Sheriff will supervise changes in the plan suggested by NCSD or consultants retained to assist NCSD in plan implementation and monitoring.

3.0 FACILITY OPERATIONS

This section describes the Nassau County Sheriff's Department facilities and operations subject to the practices in the General Operational Plan for NCSD.

3.1 Facility Locations

The Nassau County Sheriff's Department facilities include (see Figure 3-1 through Figure 3-3):

- Nassau County Sheriff's Department Mineola Office, Mineola, NY
- Nassau County Correctional Center, East Meadow, NY

3.2 Description of Facilities and Operations

The Nassau County Sheriff's Department encompasses the Correction Division and the Enforcement Division. The Correction Division is responsible for the safety, welfare, supervision and custody of detainees and prisoners at the Nassau County Correctional Center. An aerial photomap of the Correction Center is provided in Figure 3-3. The Enforcement Division assists the Department of Social Services, administers the discovery and seizure of property, executes warrants and conducts evictions as ordered by the New York State Courts.

The following are typical operations and activities that can occur at or be directed from NCSD facilities that could have storm water management implications:

- Vehicle and equipment storage
- Vehicle and equipment maintenance, repair and washing
- Vehicle fueling
- Materials storage
- Waste handling and disposal

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NASSAU COUNTY STORM WATER MANAGEMENT PROGRAM

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GENERAL LOCATIONS OF NASSAU COUNTY SHERIFF'S DEPARTMENT FACILITIES

FIGURE 3-1

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NASSAU COUNTY STORM WATER MANAGEMENT PROGRAM

AERIAL VIEW OF NASSAU COUNTY COURTS

FIGURE 3-2

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NASSAU COUNTY STORM WATER MANAGEMENT PROGRAM

AERIAL VIEW OF NASSAU COUNTY CORRECTIONAL CENTER

FIGURE 3-3

- Maintenance of storm water control structures
- Landscaping and lawn care
- Parking lot and building maintenance

Potential pollution sources related to NCSD facilities and the activities occurring or being directed from them are described in Section 4.0. Best Management Practices (BMPs) for controlling, reducing or eliminating pollution from these activities are described in Section 5.0.

Apart from the normal daily work-shift intervals and seasonal activities, operations and maintenance activities and general housekeeping practices at NCSD facilities are not always conducted within the confines of an hourly, daily or weekly schedule. Maintenance, fueling, repairs and general housekeeping are done predominantly on an "as needed" basis, as the situation dictates. This is of course typical of such operations as vehicle breakdowns and fueling needs do not occur at regular or anticipated intervals. However, periodic and preventative maintenance can often be accomplished at specific time intervals based on the expected use and lifespan of equipment (e.g., oil changes, lubrications, brake maintenance, tune-ups, etc.). Record keeping and files are maintained, but organization of such records and files is not precise or organized in such a way as to facilitate inspection or audit by internal or external agencies. Alternative BMPs for monitoring, recordkeeping and reporting are described later in Section 5.2.

4.0 POTENTIAL POLLUTION SOURCES

This section describes physical characteristics of the typical NCSD sites as they relate to pollution sources and pathways, and the potential for exposed materials and site operations to contribute to pollution in storm water runoff.

4.1 Site Drainage and Exposed Materials

Flat, paved surfaces at NCSD facilities are appropriately graded so that storm water runoff is directed towards storm drains in on-site roadways, curbs or other paved areas. Most of the storm drain systems at these facilities were installed many years ago and detailed maps or charts of the overall storm water collection, storage and drainage system at any particular site are not readily available. Based on a review of older maps, various reports and other sources, the overall storm drain systems servicing NCSD facilities are generally intact and in relatively good condition.

The largest potential for pollution to enter the storm drain system comes from rain or snow melt coming in contact with structures or materials on the site that are exposed to pollution. This storm water then enters a storm drain or catch basin, or in some cases, directly discharges to a nearby water body as sheet flow.

The major potential sources of storm water pollution include:

- Vehicle fueling islands, pumps and dispensers.
- Outdoor storage/parking of NCSD vehicles and other equipment.
- Storage of small containers or drums.
- Damaged storage sheds or bays whose roofs or covers are damaged or not watertight.
- Outdoor areas where vehicles are occasionally "hosed-down."
- Uncovered or damaged solid waste containers (dumpsters, cans, etc.).

4.2 Spills and Leaks

Accidental spills or leaks of petroleum or chemical substances can occur anywhere they are stored or used. Minor drippings of gasoline or diesel fuel from fuel dispenser islands can occur while "topping off" the fuel tank on a vehicle or motorized equipment. Minor spills can also occur during filling of above ground or below ground storage tanks and also mowers and gas cans. Spills and leaks can also occur indoors. While indoor spills and leaks cannot come in contact with precipitation, poor housekeeping can result in some of these contaminants being transferred outdoors on the clothes and boots of workers or from rags and containers carried outside by personnel.

4.3 Risk Identification

In addition to the potential sources of storm water pollution listed in Section 4.2, there are other NCSD operations and activities that may pose a risk of storm water pollution. These are described below:

4.3.1 Loading/Unloading Operations

In addition to spills and leaks that can occur during operations virtually anywhere materials are handled, deliveries of materials in bulk and loaded or unloaded in uncovered outdoor areas at delivery ports or tank inlets can be a source of pollution. Catastrophic failure during a bulk delivery can allow fuel or other contaminants to enter nearby storm water collection structures.

4.3.2 Landscaping Activities

Generally, landscaping activities at NCSD sites is limited to grass cutting and occasional tree and shrub trimming. There is no regular fertilizing of lawn areas or shrubbery. Nevertheless, since landscaped areas and shrubbery do exist to one extent or another at NCSD facilities, any fertilizer or pesticide treatment that becomes necessary would be a potential pollution source.

Specific pollution parameters could include nitrogen and phosphorus from fertilizers and organic contaminants from pesticides including aldrin and dieldren.

4.3.3 Waste Disposal Containers

As in other County facilities and operations, NCSD sites contain a number of solid waste containers (dumpsters or garbage cans) for garbage and refuse generated on site. Most of the solid waste containers are equipped with hinged tops or other covers to prevent precipitation from rain or snow from coming into contact with the solid waste. Dumpsters or garbage cans left open or damaged can allow rain or snow to come in contact with pollutants in the garbage and leak out through seams, cracks or holes in the container. The polluted water can eventually leak out and into nearby storm drains or catch basins. Pollutants in garbage could include decaying organic matter from food waste and/or chemicals from improperly discarded "household hazardous waste" such as cleaners, solvents or disinfectants.

5.0 BEST MANAGEMENT PRACTICES (BMPs) FOR MINIMUM MEASURE 6

This section describes best management practices (BMPs) for the Nassau County Sheriff's Department facilities. The BMPs in this Section are a composite of recognized BMPs approved by the United States Environmental Protection Agency (USEPA), NYSDEC and other regulatory agencies and authorities across the country as effective measures for storm water pollution prevention.

Reference sources for the BMPs include the "Management Practices Catalogue for Nonpoint Source Pollution Prevention and Water Quality Protection in New York State" developed by NYSDEC, "Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices" and the "National Menu of Best Management Practices" developed by the USEPA. Other sources include fact sheets providing technical details, implementation strategies, suitability analysis and cost assessment strategies developed by USEPA and endorsed by NYSDEC for their BMPs. A selection of these materials is provided in the appendices, which are designed to provide technical guidance and assistance to operators implementing the BMPs described in this Section.

For storm water pollution prevention planning, the USEPA recommends that in developing the plan careful consideration is given to maintenance activities, maintenance schedules and inspection procedures for structural and nonstructural controls to reduce pollutants discharged from separate storm sewers. The opportunity for relatively clean runoff to contact potential pollutant sources must be minimized. Controlling pollutants at their source and preventing their wider release is more efficient and cost-effective than removing them from storm water runoff or other water treatment. Remove or capture contaminants before storm water contact, prevent erosion and provide multiple barriers to pollutant releases at storage and waste sites.

Identify all County facilities, operations and activities that could impact storm water quality and be potential pollution sources. Important considerations are controls for reducing or eliminating the discharge of pollutants and procedures for properly disposing of waste removed

from storm sewers, streets, roads, highways, municipal parking lots, maintenance and storage yards and fleet or maintenance shops with outdoor storage areas. Operation and maintenance should be an integral component of all storm water management programs. Regular monitoring will facilitate responses to emergencies such as spills and floods, and help water quality managers target specific pollution prevention or remediation programs. This measure is intended to improve the efficiency of these programs and require new programs where necessary. Properly developed and implemented operation and maintenance programs to reduce the risk of water quality problems.

The Generic Operational Storm Water Pollution Prevention Plan for the Nassau County Sheriff's Department Facilities addresses a number of generic and operational BMPs than can be directly or indirectly undertaken by the NCSD as part of a regular routine of daily practices and procedures. Typical practices are summarized on Table 5-1.

Specific BMPs for NCSD operations are described below in Sections 5.1 and 5.2. As stated previously, important USEPA and NYSDEC Storm Water Management references that should be utilized in implementing the BMPs described below are provided in Appendix B.

5.1 BMPs for NCSD Operations and Maintenance Facilities

5.1.1 Fueling Operations

Storm water can become polluted, enter the storm sewer system and eventually impact water quality in the receiving waters when fuel (gasoline and diesel fuel) and heavy metals are spilled or leaked onto the ground during fueling operations. To prevent such storm water discharges, NCSD staff and working inmates can employ a variety of BMPs. Experience has shown that implementing vehicle fueling BMPs will reduce the likelihood of spills reaching receiving waters. Written procedures should be provided to employees and working inmates who will be using fueling systems that describe these BMPs.

Table 5-1

TYPICAL OPERATIONAL BMPs FOR NCSD OPERATIONS CENTERS

Approach	Suggested Activities
Reduce Solvent Waste	• Keep number of solvents used to a minimum to make recycling easier and reduce hazardous waste management cost. • Perform all liquid cleaning at a centralized station to ensure that solvents and residues stay in one area. • Locate drip pans and draining boards to convey solvents back into solvent sink or holding tank for reuse.
Use Safer Alternatives	• Use nonhazardous cleaners when possible. • Replace chlorinated organic solvents with non-chlorinated ones like kerosene or mineral spirits. • Recycled products such as engines, oil, transmission fluid, antifreeze, and hydraulic fluid can be purchased to support the market of recycled products.
Clean up Spills	• Use little or no water to clean spills, leaks and drips. • Use rags to clean up small spills, dry absorbent material for larger spills and a mop for general cleanup. • Prepare a spill response plan or periodically review and update existing plan, if available.
Use Good Housekeeping	• Organize and conduct employee training and public outreach to reinforce proper disposal practices. • Conduct maintenance work such as fluid changes indoors. • Update facility schematics to accurately reflect all plumbing connections. • Closely monitor parked vehicles for leaks and place pans under any leaks to collect the fluids for proper disposal or recycling. • Promptly transfer used fluids to recycling drums or hazardous waste containers. • Do not pour liquid waste down floor drains, sinks, or outdoor storm drain inlets. • Use drain mats to cover drains in the event of a spill. • Store waste or damaged batteries in leak-proof secondary containers.
Use Alternate Methods for Cleaning Parts and Equipment	• Use detergent-based or water-based cleaning systems instead of organic solvent degreasers. • Use steam cleaning and pressure washing to avoid solvent parts cleaning.

BMPs for fueling operations include the following:

- **Use off-site fueling stations when possible:** Commercial businesses are better equipped to handle fuel and spills properly.

- **Keep spill/overfill alarm equipment (i.e., alarms system) operational:** Overfill alarms warn the fuel delivery truck operator with a visual and audible indicator when the fuel tank is approximately 90% full, at which point the operator knows to end the tank filling process. Most electronic alarm systems have a test button that when pressed sound the audible alarm (buzzer) and visual alarm (red warning light). This indicates that the alarm system is functioning properly. The test button on the overfill alarm should be pressed by the fuel delivery truck driver before filling the tank(s) to ensure its operation. The alarm system should be tested in this manner at least once per month.

- **Avoid "topping off":** Gas pump hand dispensers automatically shut off when the vehicle fuel tank is almost full to prevent spills. Trying to completely fill the tank past this point often results in overfilling the tank and spilling fuel onto the pavement. Discourage topping off through training and posting signs at the fueling area.

- **Cover fueling areas:** Build a roof, shed or secure awning type structure over the fueling area to prevent the direct entry of precipitation onto the fueling area. The cover's minimum dimensions must be equal to or greater than the area within the grade break or the fueling area. The cover should not drain onto the fueling area. Use a perimeter drain or slope the pavement inward so that runoff drains to a blind sump. Install and maintain an oil control device in catch basins that might receive runoff from the fueling area.

- **Don't pave the fueling area with asphalt:** If possible, pave fuel areas with concrete, cement or an equivalent impervious surface instead of asphalt. Asphalt soaks up fuel or can be slowly dissolved by fuel, engine fluids or other liquids. Over time, the asphalt itself can become a source of storm water contamination.

- **Don't hose-off the fueling area with water:** Wash water will pick up fuel, oil and grease and could end up in a storm drain. During routine cleaning, use a damp cloth on the pumps and a damp mop on the pavement instead of a hose. Sweep up any litter or debris. Use sorbent material such as speedy-dry, sawdust or straw to clean up small spills. Spills are not cleaned up until the absorbent is picked up and disposed of properly.

- **Direct any "run-on" away from fueling areas:** Run-on is storm water from other areas that flows or "runs on" to your property or from one area to another within your property. Minimize run-on by grading the fueling area with a 2 to 4% slope to prevent ponding. Berm or curb the area around the fuel site, locate roof downspouts so storm water is directed away from fueling areas and use valley gutters to route storm water around the fueling area.

- **Designate a fueling area when fueling with mobile fuel trucks:** Place temporary "caps" over nearby catch basins or manhole covers so that if a spill occurs it will not enter the storm drain. Storm drains in the vicinity should also be covered. A form of secondary containment should be used when transferring fuel (i.e., liquid tight drip pan or absorbent pad). Install vapor recovery nozzles to help control drips as well as reduce air pollution.

- **Keep spill prevention plans and spill kits located nearby:** Spill kits should be purchased and made available at each fueling area and on each mobile fueling truck. Have designated trained person(s) available either on site or on call at all times to promptly and properly implement spill plans.

- **Inspect fueling areas regularly:** Inspectors should check for external corrosion and structural failure in tanks, for spills and overfills due to operator error and for piping system failures. New tank or container installations should be inspected for loose fittings, poor welds and improper or poorly fitted gaskets. Visually inspect tank foundations, connections, coatings, tank walls and piping systems. Look for corrosion, leaks, cracks, scratches and other physical damage that may weaken the tank or container system. A qualified professional should test aboveground tanks periodically for integrity.

5.1.2 Fleet and Equipment Maintenance

Virtually all fleet and vehicle maintenance at NCSD facilities takes place in indoor garages and bays and is not generally exposed to precipitation from storms. Nevertheless, various activities associated with maintenance (e.g., temporary parking outside the facility, disposal of garage waste into outside dumpsters, pouring liquid waste materials down the drain) have the potential to create a pathway for pollutants to enter storm sewer drainage systems.

BMPs for fleet or vehicle maintenance include the following:

- **Plan for repair work:** Schedule repairs for dry weather when possible. Use a vehicle maintenance area designed to prevent storm water pollution. Minimize contact of storm water with outside operations through berming and appropriate drainage routing. Consider enclosing maintenance in a building and connecting the floor drains to the sanitary sewer. Cover outside work areas with a permanent roof.

- **Check for leaking oil and fluids:** Park vehicles indoors or under roofs or awnings to prevent storm water from coming into contact with them. Vehicles parked outdoors should be inspected regularly for leaks. Pans may be put under leaks to collect fluids for recycling or proper disposal. Don't leave drip pans or other open containers lying

around. Vehicles or equipment to be stored outdoors for extended periods should be drained of fluids. The collected drips and spills must be disposed, reused or recycled properly. Store cracked batteries in leak proof secondary containers. Keep current records of all inspection and maintenance activities.

- **Use nontoxic or low-toxicity materials:** Eliminate or reduce the use of hazardous materials by substituting nonhazardous or less hazardous materials such as: non-caustic detergents instead of caustic cleaning agents; detergent-based or water-based cleaning systems instead of organic solvent degreasers; nonchlorinated solvents like kerosene or mineral spirits instead of chlorinated organic solvents like trichloroethane or methylene chloride.

- **Drain oil filters before disposal:** Drain excess oil in the oil filter in a funnel over the waste oil recycling container or tank. Do not dispose of oil filters in trashcans or dumpsters, which may leak oil and contaminate storm water.

- **Don't pour liquids down the drain**: While inside sinks and drains are connected to the sanitary sewer system, it is possible that parts of the system are "combined" with storm sewer systems. Don't pour cleaning solutions, solvents or automotive fluids down the drain. Promptly transfer used fluids to the proper waste containers, recycling drums or hazardous waste containers accordingly. Post signs at sinks to remind employees and working inmates not to pour wastes down drains.

- **Recycle other materials:** In addition to used oil, there are a number of other products left over from vehicle maintenance that can be recycled, including: degreasers, antifreeze, cleaning solutions, batteries and hydraulic fluids. Separate wastes for easier recycling. Keep hazardous and nonhazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from nonchlorinated solvents.

- **Don't wash or hose down indoor or outdoor areas or spills with water:** All liquid cleaning should be done at a centralized station to ensure that solvents and residues stay in one designated area. Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.

- **Buy recycled products:** Buying recycled products supports the market and economics of recycling in general. Engine oil, transmission oil, antifreeze and hydraulic fluids are available in recycled form.

5.1.3 Used Oil Recycling

Used motor oil is the largest single source of pollution in our nation's waterways. It is a hazardous waste as it contains heavy metals picked up from the engine during use. Used oil becomes dirty from use, rather than wearing out. As a result, motor oil can be recycled.

However, used motor oil should be properly disposed of at a local recycling or disposal facility because it is toxic to humans, wildlife and plants.

Used motor oil is recycled in a number of different ways. It can be reprocessed into fuel for heating and cooling homes. Reprocessing is the most common method of recycling used oil in the United States. Approximately 750 million gallons of used oil are reprocessed every year and marketed to asphalt plants, steel mills, boilers, pulp and paper mills, cement/lime kilns and a number of other places. Motor oil can also be burned in furnaces for heat or in power plants to generate electricity for homes, businesses or schools. It can also be blended for marine fuels, mixed with asphalts for paving or be used in industrial burners. Used motor oil can also be used in specially designed municipal garages, space heaters and automotive bays. Finally, used motor oil can be re-refined into lubricating oils that meet the same standards as virgin/new oil. All of these methods of recycling help to conserve valuable energy resources.

BMPs for used oil recycling include the following:

- **Store used oil in an appropriate clean container:** Before recycling, store used motor oil in a plastic or metal container with a secure lid indoors, rather than dumped in a landfill or down the drain. Containers must comply with State and local building and fire codes and clearly labeled "USED OIL" and with the capacity of the container. Underground containers must be labeled at the fill port. All used oil tanks, regardless of size, are subject to petroleum bulk storage requirements, including registration with NYSDEC. Do not use containers that previously stored household chemicals, such as bleach, gasoline, paint or solvents. Never mix used motor oil with other substances such as antifreeze, pesticides or paint stripper.

- **Provide the public with informational resources:** Programs should encourage the public to contact local service stations, municipal governments, the county government office or the local environmental or health departments, if they are unsure where to safely dispose of their oil.

5.1.4 Vehicle Washing

Vehicle washing is done at NCSD operations centers, but the centers do not have elaborate vehicle washing bays or automatic vehicle washing equipment. Municipal vehicle

washing can generate dry weather runoff contaminated with detergents, oils, grease and heavy metals.

BMPs for vehicle washing include the following:

- **Use commercial carwashes and steam cleaning businesses when possible:** The County can negotiate with commercial car washes and steam cleaning businesses to handle their fleet vehicle washing. This option eliminates the cost of establishing wash areas and the liability of operating a wash facility. This option may be limited to smaller sized vehicles, however, since many car washes do not have bays large enough to handle large municipal vehicles.

- **Use a designated marked wash area:** Designated wash areas must be well marked with signs indicating where and how washing must be done. 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. Oil changes and other maintenance activities cannot be conducted in the designated washing area.

  The area should be paved and bermed or sloped to contain and direct wash water to a sump connected to the sanitary sewer or a holding tank, process treatment system or enclosed recycling system. Note that you must seek the permission of the sewer authority before discharging wastewater to the sanitary sewer and that special treatment requirements may be placed on such discharges. Alternately, the wash water could be recycled, thereby eliminating the pretreatment costs of discharging to the sanitary sewer.

  For small jobs, berm the area surrounding the vehicle and use a wet/dry vacuum to capture the wash water for discharge to the sanitary sewer. For larger jobs, use a combination of berms and a vacuum truck (e.g., those used to clean storm and sanitary sewer systems) to capture and safely dispose of wash water. If detergents are used, clean the pavement to prevent this material from being carried to the storm drain during the next rainstorm.

- **Avoid detergents whenever possible**: Clean parts without using solvents whenever possible. If detergents are necessary, a phosphate-free, non-toxic, biodegradable soap is recommended. Detergents should be avoided if an oil/water separator is used for pretreatment prior to discharge to the sanitary sewer.

- **Stencil storm drains**: Facilities that store vehicles should stencil their storm drains to remind employees and working inmates to wash vehicles within the designated wash area. Signage can also be posted with this message.

- **Keep spill kits located nearby:** Mount spill kits with absorbent containment materials and instructions near wash areas. Immediately contain and treat all spills accordingly. Refer to Section 5.1.8 on spill response and control.

- **Inspect and maintain the wash area:** Paved surfaces and sumps should be inspected and cleaned periodically to remove buildups of particulate matter or other pollutants. Plumbing, recycling and pretreatment systems also require periodic inspection and maintenance. The surrounding area should be visually inspected for leaks, overspray or other signs of ineffective containment due to faulty design or physical damage to berms. Any defects should be corrected.

5.1.5 Parking Lot, Building and Grounds Maintenance

On-site parking lots or other paved areas can be exposed to leaks, drips and/or debris from the large number of parked motor vehicles, some of which are parked for long periods of time. Storm water runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, and abnormal pH. Cars and other vehicles can also track sediment and other debris from off-site paved streets, dirt roads or other areas into the on-site parking lots. Pavement cleaning and street sweeping on a regular basis will minimize pollutant export to storm sewer systems or directly to receiving waters.

BMPs for parking lots, building and grounds maintenance include:

- **Regularly sweep paved areas:** Whether by individuals with brooms or by street sweeping vehicles, regular sweeping of parking lot areas is most effective in removing sediment debris and other pollutants that potentially impact storm water collection systems and receiving waters. Recent improvements in mechanical street sweeper technology have enhanced the ability to pick up finer grained sediment particles that carry a significant portion of the pollutant load.

  Optimum frequency for parking lot sweeping at NCSD facilities is once per week. However, if done with mechanized street sweepers, this activity can be done with less frequency but would require coordination so that parking lot sweeping takes place during non-business hours to avoid the need to find an alternate parking area at the site during the sweeping activities. During periods of heavy snowfall sweeping should be done as soon as possible after the snow melts. Removal of the accumulated sand, grit and debris after the snow melts reduces the amount of pollutants entering surface

waters. On-site personnel should sweep smaller paved areas on a weekly basis. This will require the cooperation of on-site personnel.

- **Visually inspect paved areas:** Employ the same types of visual inspection recommended for vehicle maintenance BMPs in Section 5.1.2 for parking areas and other paved areas (i.e., periodic visual inspection of vehicles for leaks and clean up of small leaks with rags or absorbent materials). On-site personnel can be made aware of the pollution potential and trained to carry out individual inspections of their own vehicles on a regular basis. In addition to protecting the environment, regular inspections can bring to attention a potential problem with personal vehicles and the need for prompt servicing.

- **Control wash water from buildings, rooftops and other large objects:** Use a wastewater collection device that enables collection of wash water and associated solids from pressure washing in situations where soaps or detergents are used and the surrounding area is paved. Use a sump pump, wet vacuum or similarly effective device to collect the runoff and loose materials. Dispose of the collected runoff and solids properly. Screen wash water runoff if soaps or detergents are not used and the surrounding area is paved. Use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff from pressure washers. Disperse runoff as sheet flow as much as possible, rather than as a concentrated stream if you are pressure washing on a grassed area (with or without soap). Keep the wash runoff on the grass and do not drain to pavement. Ensure that this practice does not the kill grass.

- **Protect the ground during repairs and construction:** Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain. Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work and properly dispose of collected material daily. Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

- **Clean tools properly:** Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

- **Follow pollution prevention techniques:** Refer to other sections of this task for BMPs on materials storage and management, waste handling and disposal, maintenance of storm water structures, landscaping and lawn care. Refer to the County publication entitled "Task 3: Integrated Pest Management (IPM) Program" for pesticide and fertilizer storage, handling and transportation.

5.1.6 Materials Storage and Management

Improper material storage areas containing raw materials, by-products, finished products, hazardous materials or containers that are exposed to rain and/or runoff can pollute storm water. Materials must be handled properly in all stages of development, use, storage and disposal. Protecting storage areas from rainfall, run-on and runoff is the principal means of preventing potential pollutants from entering nearby storm water collection and conveyance systems.

BMPs for materials storage areas include:

- **Know what materials are on-site:** Keep an accurate, up-to-date inventory of the materials delivered and stored on-site. Always obtain the material safety data sheets from the supplier or vendor for any chemical used. These provide specific information about the materials. Inspect all shipments and return all unacceptable or damaged materials. Improve purchasing and inventory methods to ensure that materials do not exceed shelf life. Date all raw materials and chemicals and use the first-in, first-out method of inventory control. Reevaluate inventory needs and consider purchasing alternative products. Keep chemicals in their original containers when possible and well labeled. Properly dispose of outdated products.

- **Store materials indoors:** Storing materials indoors to the maximum extent possible, prevents rain, snow, storm water run-on or runoff from coming into contact with the materials. Enclose or cover containers where they are stored to prevent the entry of storm water. Keep containers in good condition without corrosion or leaky seams. Replace containers if they are deteriorating to the point where leakage is occurring. Raise containers off the ground by use of pallet or similar methods, with provisions for spill control and secondary containment. Do not store hazardous materials near storm drains. Train employees and working inmates in proper storage measures.

- **Cover storage areas with a permanent roof**: If sufficient indoor storage space is not available or practical and materials must be stored outdoors, a roof or permanent awning should be constructed to protect the area.

- **Cover storage areas with a temporary covering:** If a permanent roof or cover is not practical or economical, temporary coverings made of polyethylene, polyurethane or polypropylene can be used as temporary coverings.

- **Berm storage area:** Enclosing the area with a berm or curb can minimize storm water run-on and contain small spills. Clean up any spills immediately according to the material labeling and spill kit instructions.

- **Inspect storage areas regularly:** Check for leaks and spills around containers and during pumping of liquids and gases. Check containers for external corrosion, structural failure, scratches, spills and overfills. Inspect new tank or container installations for loose fittings, poor welds and poorly fitted gaskets. Replace damaged containers. If the liquid chemicals are corrosive, containers made of compatible materials must be used. Label new or secondary containers with all product information.

- **Minimize the amount of materials used:** Procedures for operation and maintenance can be easily integrated into management plans. Simple processes, such as routine cleaning of work spaces, proper collection and disposal of wastes, maintenance of machinery, regular inspections of equipment and facilities, inventories and training to respond to spills or leaks all have significant effects on reducing the potential of polluting storm water runoff.

- **Conduct regular inventories of hazardous materials:** Reduce the occurrence of overstocking hazardous materials, increase knowledge about what hazardous materials are present and how they are stored and provide training and documentation of proper handling of hazardous materials.

  An inventory of hazardous materials present at a particular facility consists of three major steps:

  - Identify all hazardous and nonhazardous substances;

  - Label all containers with the name of the material, unit number, expiration date, handling instructions and health or environmental hazards; and

  - Make special note on the inventory of hazardous materials that require special handling, storage or disposal.

- **Wrecked vehicles or damaged equipment stored on-site:** Be especially careful with wrecked vehicles, whether you keep them indoors or out, as well as with vehicles kept on-site as scrap or salvage. Wrecked or damaged vehicles often drip oil and other fluids for several days.

  Utilize the following measures for vehicles or equipment stored outside:

  - As the vehicles arrive, place drip pans under them immediately, even if you believe that all fluids have leaked out before the vehicle reaches your shop.

  - Build a shed or temporary roof over areas where you park vehicles awaiting repairs or salvage, especially if you handle wrecked vehicles. Build a roof over vehicles you keep for parts.

  - Drain all fluids, including air conditioner coolant, from wrecked vehicles and "parts" vehicles. Also drain engines, transmissions and other used parts.

- Store cracked batteries in a nonleaking secondary container. If you drop a battery, handle spilled acid from broken batteries with care. If you use baking soda to neutralize spilled acid during cleanup, remember that the residue is still dangerous to handle and must be disposed of as a hazardous waste.

5.1.7 Waste Handling and Disposal

On-site solid waste management is also important in reducing storm water pollution. Careless handling of household garbage and other solid wastes generated at facilities by workers or visitors can contribute significant amounts of pollution to storm water collection systems. Common sense dictates that care should be taken in how waste materials are carried to, inserted in and stored in waste paper baskets, garbage cans or larger dumpster-type containers.

BMPs for waste handling and disposal include the following:

- **Take care when transferring waste from indoor to outdoor containers**: Smaller waste paper baskets and cans stored indoors will not come in direct contact with precipitation, but waste materials carelessly transferred from these containers to the larger containers outdoors can contribute to storm water debris.

- **Inspect dumpsters regularly:** Check for leaks, damaged covers or covers left open on a regular basis. The outside of the dumpsters should be inspected for boxed wastes or other materials left out of the container instead of being place inside the container, as appropriate. Dumpsters should also be rolled-out from their normal position at least once a month to allow cleaning/sweeping up any garbage, debris or sediment that has accumulated under or behind the dumpster over time.

- **Protect dumpsters:** Additional protection against storm water coming in contact with the dumpster or solid waste within it can be provided by a small roof or awning over the dumpster area.

5.1.8 Spill Response and Control

Uncontrolled spills and leaks can damage storm drain systems and pollute receiving waters. Many activities that occur at or are directed from municipal facilities have a high potential for accidental spills or leaks due to the nature of municipal operations. Thorough spill response planning and preparation allows municipal employees to efficiently respond to

accidents and minimize the discharge of pollutants to the environment. Spill response and control plans should clearly state measures to stop the source, contain and clean up the spill and safely dispose of contaminated materials. Training personnel to prevent and control future spills, the availability of cleanup materials and regular inspections and supervision are all vital components of a successful spill response and control plan.

BMPs for developing a spill response and control plan include the following:

- **Identify materials and areas that could come in contact with storm water:** Make available a description and map of the facility and locations of all activities and materials used. Identify potential spill areas or operations where spills and leaks are likely to occur, including loading/unloading, storage, manufacturing, processing and waste disposal areas, warehouses, service stations, parking lots and access roads. Exercise the proper materials inventory and maintenance described in Section 5.1.6 to reduce the occurrence of spills and leaks.

- **Contain areas prone to spills and leaks:** Install berms or other measures to contain spills and prevent work surface runoff from entering storm drains.

- **Prepare a spill response and control plan:** Develop clear and concise spill prevention and response policies and procedures for any size spill at all facilities, especially those that use or store chemicals. Give step-by-step instructions for the response to spills at each facility and for all materials. Present spill response plans as procedural handbooks and post signs. Standardize the plan's operating procedures and employee training in an effort to minimize accidental pollutant releases. Update spill prevention and control plans with structural and procedural changes. Regularly inspect areas prone to spills to ensure that spill prevention procedures are posted and cleanup equipment is readily available.

  Include the following in the spill response and control plan:

  - Material handling procedures and storage requirements;
  - Spill and leak prevention measures;
  - Spill response personnel and contact information;
  - Material and area specific spill response procedures;
  - Spill containment, diversion, isolation and cleanup procedures;
  - Spill response equipment, including safety and cleanup equipment, and their locations;

- Safety measures for each specific waste;
- Contact information for the appropriate authorities, such as police and fire departments, hospitals or publicly-owned treatment works for assistance;
- Record keeping procedures; and
- Spill prevention and response employee training techniques.

- **Keep spill response and control plans and spill kits located nearby:** Store and maintain appropriate handbooks, signs and spill cleanup materials in a nearby location known to all employees. Store spill kits in an impervious container and include items such as: salvage drums or containers; disposal bags; safety gloves, clothes and equipment; shovels or other soil removal equipment; oil containment booms, covers or berms for sewer drains; and absorbent clay or pads. Inspect each item regularly and replace as required.

If a spill occurs, immediately stop the operation, refer to the spill response and control plan, assess the safety of the situation and locate the spill kit.

BMPs for spill response and control include the following:

- **Notify the key spill response personnel immediately:** Contact the on-site personnel and emergency authorities identified in the spill response and control plan. Perform an assessment of the area where the spill occurred and the downstream area that could be impacted. Relay this information to the key spill response and cleanup personnel. Significant spills must be reported to the NYSDEC Bureau of Spills Management at 631-444-0320 or the NYSDEC Division of Spills Management Hotline at 1-800-457-7362. A NYSDEC spill response coordinator may assist in investigating the source of the spill and will provide instructions for addressing any emergency conditions. If appropriate, contact the National Response Center (NRC) at 1-800-424-8802. Notify the U.S. Coast Guard and the NRC if the spill can reach or has reached marine waters.
- **Contain the spill:** If safe to do so, contain the material and block the nearby storm drains so that the area impacted is minimized. Cover drains with drain mats. If the material is unknown or hazardous, wait for properly trained personnel to contain the spill.

- **Clean up the spill:** If safe to do so, immediately clean up leaks, drips and spills.

  For small nonhazardous spills:

  - Use a rag, damp cloth or absorbent materials for general cleanup of liquids.
  - Use brooms or shovels for the general cleanup of dry materials.
  - Spills should be cleaned up without water whenever possible. If water is used for cleanup, it must be collected and properly disposed of. Wash water cannot be allowed to enter storm drains.
  - Dispose of any waste materials properly.
  - Clean or dispose of any equipment used to clean up the spill properly.

  For large nonhazardous spills:

  - Use absorbent materials for general cleanup of liquids.
  - Use brooms, shovels or street sweepers for the general cleanup of dry materials.
  - Spills should be cleaned up without water whenever possible. If water is used for cleanup, it must be collected and properly disposed of. Wash water cannot be allowed to enter storm drains.
  - Dispose of any waste materials properly.
  - Clean or dispose of any equipment used to clean up the spill properly.

  For hazardous or very large spills:

  - A private cleanup company or Hazmat team may need to be contacted to assess the situation and conduct the cleanup and disposal of the materials.
  - Chemical cleanups of material can be achieved with the use of absorbents, gels and foams. Remove the adsorbent materials promptly and dispose of according to Federal, state and local regulations.
  - Used cleanup materials are also hazardous and must be sent to a certified laundry or disposed of as hazardous waste.

- **Keep records of spills:** A record keeping and reporting system should be set up for documenting reportable quantities of spills, leaks and discharges. Generate and keep on file a detailed report about the spill, the containment and cleanup. This information can be used to train staff about spill prevention and proper procedures. A good record keeping system helps a municipality minimize incident recurrence, correctly respond

with appropriate containment and cleanup activities and comply with legal requirements.

Include the following in the incident report:

- Date and time of the incident;
- Weather conditions;
- Quality and quantity of discharges to the storm drain;
- Duration of the spill;
- Cause of the spill;
- Response procedures implemented;
- Persons and authorities notified; and
- Environmental problems associated with the spill.

5.1.9 Graffiti Removal

Graffiti is not generally a major problem on County roads. However, graffiti can occur on road overpasses, small bridges, highway signs and the facings of County buildings. To the extent that Nassau County Correctional Center inmates under the supervision of NCSD carry out the removal of graffiti, BMPs should be taken into consideration:

BMPs for graffiti removal include the following:

- **Plan for graffiti removal:** Schedule graffiti removal activities for dry weather. Use recycled paint when possible. Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g., gels or spray compounds).
- **Protect storm water inlets:** Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area. If such an area is not available, filter runoff through an appropriate filtering device (e.g., filter fabric) to keep sand, particles and debris out of storm drains. Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks or other structures needing graffiti abatement. If a graffiti abatement method generates wash water containing a cleaning compound (e.g., high pressure washing with a cleaning agent), plug nearby storm drains and vacuum/pump wash water to the sanitary sewer.

- **Thoroughly clean up the job site when the removal work is completed:** Sweep or vacuum thoroughly. Properly dispose of any used absorbent.

5.1.10 Maintenance of On-Site Storm Water Control Structures

The principal storm water control/conveyance structures at typical NCSD facilities are building gutters and leaders, catch basins and storm drains. Identify, map and inspect all facilities' storm water control structures.

BMPs for storm water control structures include the following:

Roof Gutters and Leaders

Rain falling on building roofs are collected in gutters and conveyed by vertical leaders to the pavement near the base of the building. The runoff then generally follows the ground contours of the site to the nearest storm drain or catch basin. As designed, gutters and leaders do not control pollutants, but handle storm water runoff rates, volumes and direction. Develop building site drainage modifications to manage "clean water" and prevent or minimize contact with pollutant sources and maximize infiltration.

- Clean and inspect gutters: Roof gutters should be inspected and cleaned at least once per year and perhaps twice during the fall season if the facility is located near tall trees and brush. Leaves, twigs and even the remains of small birds and mammals can clog roof gutters, cause storm water pollution and impede proper drainage of roof areas.

Catch Basins

Catch basins are chambers or sumps, usually built at the curb line. They allow surface water runoff to enter the storm water conveyance system. Many catch basins have a low area below the invert of the outlet pipe intended to retain coarse sediment. By trapping sediment, the catch basin prevents solids from clogging the storm sewer and being washed into receiving waters. Catch basins must be cleaned periodically to maintain their ability to trap sediment and

consequently their ability to prevent pollution loading. The removal of sediment, decaying debris and highly polluted water from catch basins has aesthetic and water quality benefits, including reducing foul odors, suspended solids and oxygen-demanding substances. Catch basin cleaning is an efficient and cost effective method for preventing the transport of sediment and pollutants to receiving water bodies.

BMPs for catch basin maintenance include the following:

- **Create a catch basin evaluation and cleaning program:** Catch basin cleaning should be performed at any facility with an on-site storm sewer system that includes catch basins and manholes. Although catch basin cleaning is easily implemented, it is often overlooked in an overall storm water management plan. In addition, many of the catch basin cleaning programs that have been implemented focus only on removal of debris from grate openings. Full implementation of the catch basin cleaning BMP should also include removal of debris from the catch basin itself.

  Municipalities are advised to develop and implement a program to evaluate and, if necessary, clean catch basins and other storm water structures that accumulate sediment at least once a year, including a provision to identify and prioritize those structures that may require cleaning more than once a year. This task is a required condition of the Pollution Prevention/Good Housekeeping for Municipal Operations section in the development of a municipal storm water management plan as outlined in the MS4 Storm Water Permit.

- **Clean catch basins regularly:** Catch basins on-site should be inspected at least once a year and cleaned out by a vacuum, guzzler-type truck if they are 1/3 or more filled with sediment and/or debris. If a catch basin significantly exceeds the 1/3 depth standard during the annual inspection, then it should be cleaned more frequently. When sediment fills greater than 60% of sump volume, catch basins reach steady state. Storm flows may then bypass treatment as well as suspend sediments trapped in the catch basin. Frequent clean out can retain the volume in the catch basin sump available for treatment of storm water flows.

  Late fall is an ideal routine time to clean basins - after the leaves have fallen and before the first snowfall. Then, another cleaning in the spring is helpful to remove the buildup of sand, leaves and other debris that accumulated during the winter months. Areas which may contribute to higher pollutant loadings or which discharge to surface waters should be cleaned more frequently.

  A clogged catch basin will generally be obvious if a large amount of storm water is pooling around it during a storm and not draining out in a reasonable amount of time. Sometimes, all that is required is to remove accumulated leaves, twigs and other debris from the periphery of the catch basin grate. Catch basins can be cleaned either

manually or by specially designed equipment. This equipment may include bucket loaders and vacuum pumps. However, the use of an eductor truck (or vactor truck as it is commonly referred to) is typically used for cleaning catch basins.

- **Optimally design catch basins for effective sediment and pollution capture:** The performance of catch basins is related to the volume in the sump (i.e., the storage in the catch basin below the outlet). "Optimal" catch basin sizing criteria relates all catch basin dimensions to the diameter of the outlet pipe (D). Dimensions are:

  - The diameter of the catch basin should be equal to 4D.

  - The sump depth should be at least 4D. This depth should be increased if cleaning is infrequent or if the area draining to the catch basin has high sediment loads.

  - The top of the outlet pipe should be 1.5 D from the inlet to the catch basin.

  Catch basins can also be sized to accommodate the volume of sediment that enters the system. The catch basin sump is sized to accommodate the annual sediment load to the catch basin within a factor of safety. This method is preferable where high sediment loads are anticipated and the optimal design described above is suspected to provide little treatment.

  One design adaptation of the standard catch basin is to incorporate infiltration through the catch basin bottom. Two challenges are associated with this design. The first is the potential groundwater impacts and the second is the potential for clogging and preventing infiltration. Infiltrating catch basins should not be used in commercial or industrial areas due to possible groundwater contamination. While it is difficult to prevent clogging at the bottom of the catch basin, it may be possible to incorporate some pretreatment into the design.

- **Retrofit your catch basins:** Many catch basins are not designed for sediment and pollutant capture. The ideal application of catch basins is as a pretreatment to another storm water management practice. Retrofitting existing catch basins may help to improve their performance substantially. A simple retrofit option of catch basins is to ensure that all catch basins have a hooded outlet to prevent floatable materials, such as trash and debris, from entering the storm drain system.

  A variety of other products, known as "catch basin inserts," may also be used to filter runoff entering the catch basin. There are two basic types of catch basin inserts. One insert option consists of a series of trays, with the top tray serving as an initial sediment trap and the underlying trays comprised of media filters. Another option uses filter fabric to remove pollutants from storm water runoff. These devices have a very small volume compared to the volume of the catch basin sump and would typically require repeated sediment removal. These products require frequent cleaning and may not be effective at removing total suspended solids, partially due to scouring from relatively small (6-month) storm events.

- **Inspect catch basins for spills or hazardous substances:** Operators need to be properly trained in catch basin maintenance. Before removing sediment and debris from a catch basin or other drainage structure, NCSD staff or contractors hired by a municipality should evaluate whether there is any evidence that the sediment and debris was polluted by a spill of oil or other hazardous substance. The catch basin evaluation will aid in determining if waste should be handled as an extremely contaminated waste or hazardous waste and determine what to test for if hazardous waste is suspected.

  NCSD staff or contractors conducting a field evaluation or engaged in cleaning catch basins should be aware of sediment in catch basins with obvious contamination such as unusual color, staining, corrosion, unusual odors, fumes and oily sheen. If the NCSD staff or the contractor believes that a spill has occurred, it must be reported to the NYSDEC Spill Response at (631) 444-0320. A NYSDEC spill response coordinator may assist in investigating the source of the spill and will provide instructions for addressing any emergency conditions. Once any emergency conditions have been addressed, any remaining material in the catch basin should be segregated until tested for all probable contaminants and then cleaned separately from non-contaminated catch basins.

- **Dispose of decant liquids and solids properly:** Sediment and debris removed from catch basins can potentially be classified as contaminated or hazardous waste. As a result, the materials must be disposed in a proper manner to avoid negative environmental impacts. The contents of the vactor truck can be divided into decant liquids and solids which require specific disposal protocol and discharge permits.

  Catch basin maintenance using a vactor truck can result in three types of discharges:

  - Decant wastewater which is discharged from the vactor truck with a sediment trap and hose;

  - Dump wastewater which is the discharge of both sludge and water from the vactor truck; and

  - Rinse wastewater which is the discharge resulting from cleaning the inside of the truck after a dump discharge.

  Material removed from catch basins is usually disposed in conventional landfills. Before any materials can be disposed, it is necessary to perform a detailed chemical analysis to determine if the materials meet applicable Federal, state and local regulations for hazardous wastes. This will help determine how the materials should be stored, treated and disposed. The discharge of decant wastewater and/or any other wastewater associated with catch basin maintenance to a watercourse, wetland or returned to a catch basin or storm drain system is prohibited.

- **Keep records of catch basin maintenance:** Maintenance should include keeping a log of the amount of sediment collected and any data on the removal. The three keys words in field evaluation include awareness, reporting and segregation.

- **Be aware of catch basin limitations:** Limitations associated with cleaning catch basins include:

  - Catch basin debris usually contains appreciable amounts of water and offensive organic material that must be properly disposed.

  - Catch basins may be difficult to clean in areas with poor accessibility and in areas with traffic congestion and parking problems.

  - Cleaning is difficult during the winter when snow and ice are present.

  - Even carefully designed catch basins cannot remove pollutants as well as other storm water treatment practices, such as wet ponds, sand filters and storm water wetlands.

  - Unless frequently maintained, catch basins can become a source of pollutants through suspension of sediments in the sump.

  - Catch basins cannot effectively remove soluble pollutants or fine particles.

Storm Drain Cleaning

- **Clean storm drain systems (piping) regularly:** Routine cleaning reduces the amount of pollutants, trash and debris both in the storm drain system and in receiving waters. Clogged drains and storm drain inlets can cause the drains to overflow, leading to increased erosion. Benefits of cleaning include increased dissolved oxygen, reduced levels of bacteria and support of in-stream habitat. Areas with relatively flat grades or low flows should be given special attention because they rarely achieve high enough flows to flush themselves. If necessary, NCSD can hire professional plumbing services for assistance in removing trapped sediments and debris from storm drains with periodic flushing.

- **Be aware of important considerations in storm drain cleaning:**

  - Cleaning the storm drain by flushing is more successful for pipes smaller than 36 inches in diameter.

  - A water source is necessary for cleaning. The wastewater must be collected and treated once flushed through the system.

  - Depending on the condition of the wastewater, it may or may not be disposed to sanitary sewer systems.

- The efficiency of storm system flushing decreases when the length of sewer line being cleaned exceeds 700 feet.

5.1.11 On-Site Landscaping and Lawn Care

Large scale and sophisticated landscaping is not typical at NCSD facilities. However, virtually all facilities contain at least small areas of grass areas, bushes or small trees. On-site personnel should mow lawns and trim bushes and trees as needed.

BMPs for on-site landscaping and lawn care include the following:

- **Control the amount of substances added to the landscaping:** Leave grass clippings to decompose on the lawn to reduce the amount of chemical fertilizer required. If watering is needed, water in the early morning or night to reduce evaporation and control where the water goes to reduce runoff.

- **Handle materials according to labeling:** None of the NCSD facilities typically use or store chemical fertilizers or pesticides. In any instance where a landscaped area requires re-planting or treatment by fertilizers or pesticides, care should be given to the appropriate method of application and storage of materials in indoor or covered areas. Training to ensure that employees understand the proper handling and application of pesticides and other chemicals can help prevent contamination of storm water runoff. Test soils to determine the need for and the amount of fertilizers used. Handle all chemicals according to labeling.

- **Regularly maintain vegetative cover:** Vegetative cover in critical areas should be maintained and inspected on a regular basis (at least annually) to ensure reestablishment of vegetation in exposed soils to stabilize the soil and prevent sediment transfer to storm sewer systems or water bodies. Inspections in late winter provide a good opportunity to identify areas that need to be reseeded so that plantings can occur by mid-spring. If reseeding is necessary, preparation of the seedbed, application of fertilizer, mulching, installation of silt fences and other measures may be necessary as part of the reseeding operation. Protect seeded areas for one year to allow development of a dense sod. Revegetation of disturbed areas is an effective practice in preventing soil erosion.

- **Properly plan vegetated sites:** Proper site planning can reduce soil erosion and maintenance requirements. Select native species and locate plants in optimal growth areas. Species selection varies based on local climate, shade conditions, soil drainage, adaptability, maintenance requirements and the intended use of the area. Selection of roadside vegetation with higher salt tolerances will also help to maintain runoff-filtering vegetated swales and biofilters. Healthy plants better resist diseases and

insects and require fewer control measures. Consulting with the County Soil and Water Conservation District, Cornell Cooperative Extension, USDA Natural Resources Conservation Service or local garden stores and suppliers can be helpful in making the best species selection.

Adequate site distance for road safety requires low growing plants and turf along roads. Otherwise the vegetative cover has to be maintained mechanically or with herbicides more frequently. Avoid planting trees and shrubs with deep root systems directly over or near water, gas, oil and sewer lines or buried telephone, data and power cables.

5.2 Training, Reporting and Record Keeping

5.2.1 Employee Training

In-house employee training programs are essential to teach employees about storm water management, pollution prevention and BMPs. Well-trained employees can reduce human errors that lead to accidental releases or spills. The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur. Employee training programs should instill all personnel with a thorough understanding of their Storm Water Pollution Prevention Plan (SWPPP), including BMPs, processes and materials they are working with, safety hazards, practices for preventing discharges and procedures for responding quickly and properly to toxic and hazardous material incidents. Training on storm water management and BMPs can be incorporated into established training programs such as safety or health training. Inmates with clearance to work in kitchens, garages or outside work should also be trained in the appropriate storm water management, pollution prevention and BMPs.

BMPs for training include the following:

- **Provide general and targeted training:** Worker training should be addressed at an early stage. Employees who are directly involved in potentially polluting activities should receive both general storm water and targeted BMP training tailored to their activities. This will increase the likelihood that receiving waters and the storm drain system will be protected from inadvertent discharges and spills. It is important to train all staff and inmates working in facilities, regardless of field responsibilities, about general storm water awareness and the detection of illicit discharges. Employees are residents as well, and improving awareness may reduce residential impacts and

increase reporting of illicit discharges, dumping and spills. Also, because municipalities expect residents and business owners to practice pollution prevention and good housekeeping, NCSD employees should set an example for the rest of the community to follow.

- **Use multiple training techniques when available:** Employees and working inmates can be taught through:

  - Posters, meetings, courses, workshops, conferences, videos, bulletin boards, paycheck inserts and email notices about storm water management, potential contaminant sources and prevention of contamination in surface water runoff; and

  - Field training programs that show areas of potential storm water contamination and associated pollutants, followed by a discussion of site-specific BMPs by trained personnel.

  Pollution prevention and storm water management BMP training materials are offered by numerous federal and state agencies and professional and nonprofit organizations. Establish and continue employee rewards or recognition programs for those who participate in pollution prevention programs. In addition, seek employee ideas on pollution prevention and good housekeeping methods and priorities.

- **Include key program components:** These programs can be standardized and repeated as necessary, both to train new employees and to keep objectives fresh in the minds of more senior employees. A training program is also flexible and can be adapted as a facility's storm water management needs change over time. Key program components and specific criteria for implementing an employee training program include:

  - Ensuring strong commitment and periodic input from senior management.

  - Communicating frequently to ensure adequate understanding of pollution prevention goals and objectives.

  - Utilizing experience from past pollution incidents (e.g., spills) to prevent future pollution.

  - Making employees and working inmates aware of BMP monitoring and reporting procedures.

  - Developing operating manuals and standard procedures.

- **Make training an on-going process:** An employee-training program should be a continuing, yearly process. Meetings about the Generic Operational Storm Water Pollution Prevention Plan should be held at least annually, possibly in conjunction with other training programs.

- **Track work practices and training:** After training, it is helpful for managers to periodically check work practices to ensure BMPs are implemented properly. Periodic unscheduled inspections of facilities and maintenance activities will allow managers to gauge what has been learned. Posting reminders (e.g., markers above drains prohibiting discharges of vehicle fluids and wastes, signs above faucets reminding employees not to use water to clean up spills) will reinforce proper procedures. Stickers that list important information and contact numbers for reporting illicit discharges, dumping or spills can be adhered to all municipal vehicles. Stenciling or marking all storm drains at municipal facilities will encourage employees and working inmates to be conscious of discharges. Facility SWPPP and BMP guidance documents should be available to all workers as a reference to use after training.

  Table 5-2 illustrates a sample employee training worksheet. Worksheets such as these can be used to plan and track employee training programs. Program performance depends on employees' participation and on senior management's commitment to reducing storm water pollution. As a result, performance will vary among facilities. These programs require senior management's support to be effective.

5.2.2 Reporting

Internal reporting provides a framework for "chain-of-command" reporting of storm water management issues. Typically, a facility develops a Team concept for implementing, maintaining and revising the facility's pollution prevention plan. The purpose of identifying a Team is to clarify the chain of responsibility for storm water pollution prevention issues and to provide a point of contact for personnel outside the facility who need to discuss the plan. In addition, emphasize communication and coordination across key municipal departments and operations and county and state agencies, organizations and institutions.

BMPs for reporting include the following:

- **Establish an internal reporting structure:** It is important to select appropriate personnel at all levels to serve on the team. Both team and individual responsibilities should be designated with clear goals defined for proper storm water management. Internal reporting should be tied to other baseline BMPs, such as employee training, individual inspections and record keeping ensuring proper implementation. The performance and effectiveness of a facility's internal reporting system is highly variable and dependent upon several factors including:

  - Commitment of senior management.

Table 5-2

SAMPLE EMPLOYEE TRAINING WORKSHEET

EMPLOYEE TRAINING			Name: _____ Title: _____ Date: _____
Instructions: Describe the employee training program for your facility below. The program should, at a minimum, address spill prevention and response, good housekeeping, and material management practices. Provide a schedule for the training program and list the employees who attend the training sessions.			
Training Topics	**Brief Description of Training Program/Materials (e.g., film, newsletter, course)**	**Schedule for Training (list dates)**	**Participants**
Spill Prevention and Response			
Good Housekeeping			
Material Management			
Practices			
Other Topics			

Source: USEPA, 1992.

- Sufficient time and financial resources.
- Quality of implementation.
- Background and experience of the Team.

To ensure that an internal reporting system remains effective, the person or team responsible for maintaining the plan must be aware of any changes in facility operations or with key team members to determine if modifications must be made in the overall execution of the Generic Operational Plan.

- **Establish a qualified Storm Water Pollution Prevention Plan:** The key to implementing internal reporting, as a BMP, is to establish a qualified SWPPP. When setting up a SWPPP, it is important to identify key people on-site who are most familiar with the facility and its operations and who can also provide adequate structure and direction to the facility's entire storm water management program.

5.2.3 Record Keeping

Maintenance record keeping and files are maintained at NCSD facilities, but organization of such records and files is not precise or organized in such a way as to facilitate inspection or audit by internal or external agencies. It is recommended that NCSD facilities document their progress in pollution prevention and good housekeeping programs. Typical items that should be recorded include the results of routine inspections and maintenance activities. Separate record keeping systems should be established to document housekeeping, preventive maintenance inspections, spill prevention and response and training activities.

Record keeping is usually coordinated with internal reporting and other BMPs and is often integrated into the development of a facility's operations and maintenance program. Record keeping is a basic business practice and is applicable to virtually all facilities. Keeping records of spills, leaks and other discharges can help a facility run more efficiently and cleanly. Records of past spills contain useful information for improving BMPs to prevent future spills. If a separate record keeping system for tracking BMPs, monitoring results, etc., is not currently in place at a facility, existing record keeping structures can be easily adapted to incorporate this data. NYSDEC recommends that record keeping reflect the organization of the municipal

government and its operations. This should facilitate and simplify both collecting information and communicating BMP information to field staff.

Records should include:

- The date, exact place and time of material inventories, site and equipment inspections, observations, equipment maintenance and calibrations, etc.
- Names of inspector(s) and observers(s).
- Analytical information (if sampling was done) including the date(s) and time(s) analyses were performed or initiated, the analysts' names, analytical techniques or methods used, analytical results and quality assurance/quality control results of such analyses.
- The date, time, exact location and a complete characterization of significant observations, including spills or leaks.
- Notes indicating the reasons for any exceptions to standard record keeping procedures.
- All calibration and maintenance records of instruments used in storm water monitoring.
- All original strip chart recordings for continuous monitoring equipment.
- Records of any non-storm water discharges.
- Incorporate geographic information systems (GIS) into pollution prevention planning.

APPENDIX A

NYSDEC SPDES MS4 GENERAL PERMIT

Please refer to the County website for viewing or printing out the SPDES General Permit for Storm Water Discharges from Municipal Separate Storm Sewer Systems (MS4s) currently in effect.

APPENDIX B

ADDITIONAL BEST MANAGEMENT PRACTICE RESOURCES

Pollution Prevention/Good Housekeeping for Municipal Operations

Regulatory Text

You must develop and implement an operation and maintenance program that includes a training component and has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. Using training materials that are available from EPA, your State, Tribe, or other organizations, your program must include employee training to prevent and reduce storm water pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and storm water system maintenance.

Guidance

EPA recommends that, at a minimum, you consider the following in developing your program: maintenance activities, maintenance schedules, and long-term inspection procedures for structural and nonstructural storm water controls to reduce floatables and other pollutants discharged from your separate storm sewers; controls for reducing or eliminating the discharge of pollutants from streets, roads, highways, municipal parking lots, maintenance and storage yards, fleet or maintenance shops with outdoor storage areas, salt/sand storage locations and snow disposal areas operated by you, and waste transfer stations; procedures for properly disposing of waste removed from the separate storm sewers and areas listed above (such as dredge spoil, accumulated sediments, floatables, and other debris); and ways to ensure that new flood management projects assess the impacts on water quality and examine existing projects for incorporating additional water quality protection devices or practices. Operation and maintenance should be an integral component of all storm water management programs. This measure is intended to improve the efficiency of these programs and require new programs where necessary. Properly developed and implemented operation and maintenance programs reduce the risk of water quality problems.

BMP Fact Sheets

Source controls

Pet waste collection

Automobile maintenance

Vehicle washing

Illegal dumping control

Landscaping and lawn care

Pest control

Parking lot and street cleaning

Roadway and bridge maintenance

Septic system controls

Storm drain system cleaning

Alternative discharge options for chlorinated water

Materials management

Alternative products

Hazardous materials storage

Road salt application and storage

Spill response and prevention

Used oil recycling

Materials management

Additional Fact Sheets

Municipal Facilities Management

Municipal Employee Training and Education

Municipal Landscaping

Municipal Vehicle Fueling

Municipal Vehicle and Equipment Maintenance

Municipal Vehicle and Equipment Washing

Source controls

Pet Waste Collection

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Animal waste dispensers can increase waste collection by providing an convenient method for disposal

Pet waste collection as a source control involves using a combination of educational outreach and enforcement to encourage residents to clean up after their pets. The presence of pet waste in storm water runoff has a number of implications for urban stream water quality, with perhaps the greatest impact from fecal bacteria. According to recent research, nonhuman waste represents a significant source of bacterial contamination in urban watersheds. Genetic studies by Alderiso et al. (1996) and Trial et al. (1993) both concluded that 95 percent of fecal coliform found in urban storm water were of nonhuman origin. Bacterial source-tracking studies in a watershed in the Seattle, Washington, area also found that nearly 20 percent of the bacteria isolates that could be matched with host animals were matched with dogs. These bacteria can pose health risks to humans and other animals and result in the spread of disease. It has been estimated that for watersheds of up to 20 square miles draining to small coastal bays, 2 or 3 days of droppings from a population of about 100 dogs would contribute enough bacteria and nutrients to temporarily close a bay to swimming and shellfishing (USEPA, 1993).

Pet waste may also be a factor in the eutrophication of lakes. The release of nutrients from the decay of pet waste promotes weed and algae growth, limiting light penetration and the growth of aquatic vegetation. This situation, in turn, can reduce oxygen levels in the water, affecting fish and other aquatic organisms.

Pet waste collection programs use pet awareness and education, signs, and pet waste control ordinances to alert residents to the proper disposal techniques for pet droppings. In some parts of the country, the concept of parks or portions of parks established specifically for urban dog owners has gained in popularity. With provisions for proper disposal of dog feces and siting and design to address storm water runoff, these parks may represent another option for protecting local water quality.

Applicability

Pet ownership is not limited by factors such as region of the country, climate, or topography. For this reason, educational outreach regarding pet waste is appropriate throughout the country. In a survey of Chesapeake Bay residents, it was found that about 40 percent of households own a dog. Just about half of these dog owners actually walked their dog in public areas. Of the half that did walk their dog, about 60 percent claimed to pick up after their dog (Swann, 1999), which is generally consistent with other studies (Table 1). Men were found to be less prone to pick up after their dog than women were (Swann, 1999).

Residents seem to be of two minds when it comes to dog waste. While a strong majority agree that dog waste can be a water quality problem (Hardwick, 1997; Swann, 1999), they generally rank it as the least important local water quality problem (Syferd, 1995 and MSRC, 1997). This finding strongly suggests the need to dramatically improve watershed education efforts to increase public recognition about the water quality and health consequences of dog waste.

Table 1. A comparison of three resident surveys about cleaning up after dogs

Study	Survey Results
Maryland (HGIC, 1996)	• 62% always cleaned up after the dog, 23% sometimes, 15% never • Disposal method: trash can (66%), toilet (12%), other 22%
Washington (Hardwick, 1997)	• Pet ownership: 58% • 51% of dog owners do not walk dogs • 69% claimed that they cleaned up after the dog • 31% do not pick up • Disposal methods: trash can 54%, toilet 20%, compost pile 4% • 4% train pet to poop in own yard • 85% agreed that pet wastes contribute to water quality problems
Chesapeake Bay (Swann, 1999)	• Dog ownership: 41% • 44% of dog owners do not walk dogs • Dog walkers who clean up most/all of the time 59% • Dog walkers who never or rarely cleanup 41% • Of those who never or rarely clean up, 44% would not cleanup even with fine, complaints, or improved sanitary collection or disposal methods • 63% agreed that pet wastes contribute to water quality problems

Design Considerations

Programs to control pet waste typically use "pooper-scooper" ordinances to regulate pet waste cleanup. These ordinances require the removal and proper disposal of pet waste from public areas and other people's property before the dog owner leaves the immediate area. Often a fine is associated with failure to perform this act as a way to encourage compliance. Some ordinances also include a requirement that pet owners remove pet waste from their own property within a prescribed time frame.

Public education programs are another way to encourage pet waste removal. Often pet waste messages are incorporated into a larger non-point source message relaying the effects of pollution on local water quality. Brochures and public service announcements describe proper pet waste disposal techniques and try to create a storm drain-water quality link between pet waste and runoff. Signs in public parks and the provision of receptacles for pet waste will also encourage cleanup.

Another option for pet waste management could be the use of specially designated dog parks where pets are allowed off-leash. These parks typically include signs reminding pet owners to remove waste, as well as other disposal options for pet owners. The following management options have been used in Australian dog parks and could be incorporated for dog parks in the United States (Harlock Jackson et al., 1995):

- *Doggy loos*. These disposal units are installed in the ground and decomposition occurs within the unit. Minimal maintenance is required (no refuse collection).
- *Pooch patch*. A pole is placed in the park surrounded by a light scattering of sand. Owners are encouraged to introduce their dog to the pole on entry to the park. Dogs then return to the patch to defecate and special bins are provided in which owners then place the deposit.
- *The "Long Grass Principle."* Dogs are attracted to long grass for defecating and areas that are mowed less frequently can be provided for feces to disintegrate naturally. A height of around 10 cm (about 4 inches) is appropriate.

The design of these dog parks should be done to mitigate storm water impacts. The use of vegetated buffers, pooper-scooper stations, and the siting of parks out of drainageways, streams, and steep slopes will help control the impacts of dog waste on receiving waters.

Limitations

The reluctance of many residents to handle dog waste is the biggest limitation to controlling pet waste. According to a Chesapeake Bay survey, 44 percent of dog walkers who do not pick up indicated they would still refuse to pick up, even if confronted by complaints from neighbors, threatened with fines, or provided with more sanitary and convenient options for retrieving and disposing of dog waste. Table 2 provides factors that compel residents to pick up after their dog, along with some rationalizations for not doing so.

This strong resistance to handling dog wastes suggests that an alternative message may be necessary. One such example might be to encourage the practice of rudimentary manure management by training dogs to use areas that are not hydraulically connected to the stream or close to a buffer.

Table 2. Dog owners rationale for picking up or not picking up after their dog (Source: HGIC, 1996)

Reasons for not picking it up	Reasons for picking up
• because it eventually goes away • just because • too much work • on edge of my property • it's in my yard • it's in the woods • not prepared • no reason • small dog, small waste • use as fertilizer • sanitary reasons • own a cat or other kind of pet	• it's the law • environmental reasons • hygiene/health reasons • neighborhood courtesy • it should be done • keep the yard clean

Effectiveness

The pollutant removal abilities of pet waste collection programs has never been quantified. There is ample evidence that programs such as these are required in urban areas. For example, in the Four Mile Run watershed in Northern Virginia, a dog population of 11,400 is estimated to contribute about 5,000 pounds of solid waste every day and has been identified as a major contributor of bacteria to the stream. Approximately 500 fecal coliform samples have been taken from Four Mile Run and its tributaries since 1990, and about 50 percent of these samples have exceeded the Virginia State water quality standard for fecal coliform bacteria (NVRC, 2001). A project is currently underway to pinpoint the source of bacterial contamination through DNA fingerprinting.

There is plenty of evidence that pets and urban wildlife can be significant bacterial sources. According to van der Wel (1995) a single gram of dog feces can contain 23 million fecal coliform bacteria. Dogs can also be significant hosts of both *Giardia* and *Salmonella* (Pitt, 1998). A 1982 study of Baltimore, Maryland, catchments reported that dog feces were the single greatest contributor of fecal coliform and fecal strep bacteria (Lim and Olivieri, 1982). This evidence points to a need for enforcement and education to raise resident awareness regarding the water quality impacts of this urban pollutant source.

Cost Considerations

The cost of pet waste collection programs will vary depending on the intensity of the effort and the paths chosen to control pet waste. The most popular way is through an ordinance, but managers must consider the cost of enforcement, including staff and equipment requirements. Public education program costs are determined by the type of materials produced and the method of distribution selected. Signs in parks may initially have a higher cost than printed materials, but can last for many years. Signs may also be more effective because they act as on-site reminders to dog owners to clean up in parks.

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Automobile Maintenance

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Improper disposal of pollutants from automobile maintenance can be prevented by taking used antifreeze to designated waste collection facilities

This pollution prevention measure involves creating a program of targeted outreach and training for businesses and municipal fleets (public works, school buses, fire, police, and parks) involved in automobile maintenance about practices that control pollutants and reduce storm water impacts. Automotive maintenance facilities are considered to be storm water "hot spots" where significant loads of hydrocarbons, trace metals, and other pollutants can be produced that can affect the quality of storm water runoff. Some of the waste types generated at automobile maintenance facilities and at homes of residents performing their own car maintenance include the following:

- Solvents (paints and paint thinners)
- Antifreeze
- Brake fluid and brake lining
- Batteries
- Motor oils
- Fuels (gasoline, diesel, kerosene)
- Lubricating grease.

Estimates show that each year over 180 million gallons of used oil is disposed of improperly (Alameda CCWP, 1992) and that a single quart of motor oil can pollute 250,000 gallons of drinking water (DNREC, 1994). For this reason, automotive maintenance facilities' discharges to storm and sanitary sewer systems are highly regulated. Fluid spills and improper disposal of materials result in pollutants, heavy metals, and toxic materials entering ground and surface water supplies, creating public health and environmental risks. Alteration of practices involving the cleanup and storage of automotive fluids and cleaning of vehicle parts can help reduce the influence of automotive maintenance practices on storm water runoff and local water supplies.

Applicability

The automotive repair industry is the leader in number of generators and amount of total waste produced for small quantity generators of hazardous waste in the United States (USEPA, 1985). Common activities at maintenance shops that generate this waste include the cleaning of parts, changing of vehicle fluids, and replacement and repair of equipment. These activities are also performed by residents at home in their driveway in the course of normal vehicle care. Since the use of automobiles is not limited by geographic or climatic conditions, maintenance facilities are present nationwide and the concerns involving waste created during vehicle repair are similar across the country. In ultra-urban areas, the impacts of automotive maintenance practices are more pronounced due to the greater concentrations of vehicles and higher levels of impervious surface.

Design Considerations

The most effective way to minimize the impacts of automotive maintenance generated waste is by preventing its production. Pollution prevention programs seeking to reduce liquid discharges to sewer and storm drains from automotive maintenance should stress techniques that allow facilities to run a dry shop. Among the suggestions for creating a dry operation are the following:

- Spills should be cleaned up immediately, and water should not be used for clean up whenever possible.
- Floor drains that are connected to the sanitary sewer should be sealed off.
- A solvent service might be hired to supply parts and cleaning materials, and to collect the spent solvent.

Those facilities that are not able to eliminate discharges to the sanitary sewer system may be required to treat their wastewater prior to release from the site. There are several methods for preventing untreated wastewater from entering storm water runoff. Some municipalities require the use of structural treatment devices to pretreat wastes before they are discharged for treatment at sewage treatment plants. These devices prevent oils and grease from entering the sewer system, often by separating the oil and solids from the water through settling or filtration.

Other methods are also available to help prevent or reduce the discharge of pollutants from vehicle maintenance. Table 1 lists some of the common suggestions found regarding practices that can reduce vehicle maintenance and repair impacts. Many of these practices apply both to business owners and to residents who maintain their own vehicles. Additionally, these practices also apply to maintaining municipal fleets, including school buses, public works, fire, police, parks, and other types of municipal fleets. This list is not comprehensive, and many other suggestions for reducing impacts are available to those responsible for managing storm water runoff from maintenance facilities.

Table 1. Recommendations for reducing the storm water impacts of automotive maintenance

Pollution Prevention Method	Suggested Activities
Waste Reduction	• The number of solvents used should be kept to a minimum to make recycling easier and to reduce hazardous waste management cost. • Do all liquid cleaning at a centralized station to ensure that solvents and residues stay in one area. • Locate drip pans and draining boards to direct solvents back into solvent sink or holding tank for reuse.
Using Safer Alternatives	• Use non-hazardous cleaners when possible. • Replace chlorinated organic solvents with nonchlorinated ones like kerosene or mineral spirits. • Recycled products such as engines, oil, transmission fluid, antifreeze, and hydraulic fluid can be purchased to support the market of recycled products.
Spill Clean Up	• Use as little water as possible to clean spills leaks, and drips. • Rags should be used to clean small spills, dry absorbent material for larger spills, and a mop for general cleanup. Mop water can be disposed of via the sink or toilet to the sanitary sewer.
Good Housekeeping	• Employee training and public outreach are necessary to reinforce proper disposal practices. • Conduct maintenance work such as fluid changes indoors. • Update facility schematics to accurately reflect all plumbing connections. • Parked vehicles should be monitored closely for leaks and pans placed under any leaks to collect the fluids for proper disposal or recycling. • Promptly transfer used fluids to recycling drums or hazardous waste containers. • Do not pour liquid waste down floor drains, sinks, or outdoor storm drain inlets. • Obtain and use drain mats to cover drains in the event of a spill. • Store cracked batteries in leakproof secondary containers.
Parts Cleaning	• Use detergent-based or water-based cleaning systems instead of organic solvent degreasers. • Steam cleaning and pressure washing may be used instead of solvent parts cleaning. The wastewater generated from steam cleaning can be discharged to the on-site oil/water separator.

Limitations

There are a number of limitations to implementing recommendations for automotive maintenance facilities. Space and time constraints may make performing work indoors unfeasible. Containment of spills from vehicles brought on-site after working hours may not be possible. Proper disposal education for employees must continually be updated. Installation of structural BMPs for pretreatment of wastewater discharges can be expensive. Prices for recycled materials and fluids may be higher than those of non-recycled materials. Some facilities can 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 BMP maintenance, or solvent recycling equipment.

Maintenance Considerations

For facilities responsible for pretreating their wastewater prior to discharging, the proper functioning of structural BMPs 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 that pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.

Effectiveness

The effectiveness of automotive maintenance best management practices at removing pollutants is difficult to quantify. However, there are studies that demonstrate the effect pollution prevention practices can have in reducing impacts from automotive fluids. A 1994 study of auto recycling facilities demonstrates the effect that using best management practices can have on reducing storm water toxicity and pollutant loads. Through the use of structural and nonstructural BMPs, the study facility was able to reduce concentrations of lead, oil, and grease to levels approaching USEPA benchmarks.

A program that has had great success in controlling contaminated flows from vehicle maintenance facilities is the Clean Bay Business Program in Palo Alto, California. In exchange for allowing inspectors to visit a facility once a year and implementing recommended management practices, the facility is designated as a Clean Bay Business. This entitles the facility to promotional tools like listings twice a year in full-page newspaper ads, decals for shop windows, and other Clean Bay Business materials. Other promotions involving prize drawings and discount coupon giveaways help generate business for the facilities in the program. The effectiveness of the program at creating behavioral changes is evident in the increase in the number of facilities that have received the Clean Bay Business designation. In 1992 when the program began, only 4 percent of businesses used all of the recommended management practices. By 1998, 94 percent of businesses had instituted the practices suggested (NRDC, 1999).

The effectiveness of those programs aimed at altering behaviors detrimental to storm water is impressive. After participation in the program, the changes facilities made had the following impacts:

- 78 direct discharges to storm drains were eliminated by ceasing or modifying the practices used for activities such as parking lot cleaning, vehicle washing, and wet sanding.
- Violations of storm drain protection requirements fell by 90 percent from 1992 through 1995.
- The number of shops conducting outdoor removal of vehicle fluids without secondary containment fell from 43 to 4.

Cost Considerations

The initial per-facility cost for the program was approximately $300, with a cost of $150 for each subsequent year. This cost includes inspector visits and follow-up work, outreach materials, mailing lists, and database management. The program has been expanded to include auto parts stores and outreach to local high schools and adult education repair classes.

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Vehicle Washing

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Using commercial car wash facilities can reduce storm water impacts caused by car washing because such facilities must treat their wash water discharges before release

This management measure involves educating the general public, businesses, and municipal fleets (public works, school buses, fire, police, and parks) on the water quality impacts of the outdoor washing of automobiles and how to avoid allowing polluted runoff to enter the storm drain system. Outdoor car washing has the potential to result in a high loads of nutrients, metals, and hydrocarbons during dry weather conditions in many watersheds, as the detergent-rich water used to wash the grime off our cars flows down the street and into the storm drain. Commercial car wash facilities often recycle their water or are required to treat their wash water discharge prior to release to the sanitary sewer system, so most storm water impacts from car washing are from residents, businesses, and charity car wash fundraisers that discharge polluted wash water to the storm drain system. According to the surveys, 55 to 70 percent of households wash their own cars, with the remainder going to a commercial car wash. Sixty percent of residents could be classified as "chronic car-washers" who wash their cars at least once a month (Smith, 1996, and Hardwick, 1997). Between 70 and 90 percent of residents reported that their car wash water drained directly to the street and, presumably, to the nearest stream. It has been estimated that 25 percent of the population of the United States may be classified as chronic car washers, which translates into about 27 million potential residential car wash polluters (Center for Watershed Protection, 1999).

Applicability

Car washing is a common routine for residents and a popular way for organizations such as scout troops, schools, and sports teams to raise funds. This activity is not limited by geographic region, but its impact on water quality is greatest in more urbanized areas with higher concentrations of automobiles. Currently, only a few pollution prevention programs incorporate proper car washing practices as part of an overall message to residents on ways to reduce nonpoint source pollution. Other programs have extended this message to include charity car washes and provide these charity groups with equipment and training to alleviate the problems associated with polluted wash water entering the storm drain system.

Implementation

The development of a prevention program to reduce the impact of car wash runoff includes outreach on management practices to reduce discharges to storm drains. Some of these management practices include the following:

- Using a commercial car wash.
- Washing cars on gravel, grass, or other permeable surfaces.
- Blocking off the storm drain during charity carwash events or using a insert to catch wash water.
- Pumping soapy water from car washes into a sanitary sewer drain.
- If pumping into a drain is not feasible, pumping car wash water onto grass or landscaping to provide filtration.
- Using hoses with nozzles that automatically turn off when left unattended.
- Using only biodegradable soaps.

Storm drain stenciling programs (see the Storm Drain Stenciling fact sheet) emphasizing the connection between the storm drain system and runoff can also help reinforce the idea that car washing activities can affect local water quality.

In the Pacific Northwest, outreach programs provide materials to charity carwash organizers to prevent car wash water from entering storm drains. These "water friendly "carwash kits are provided free of charge to charity organizers, along with training and educational videos on planning an environmentally friendly carwash. Two types of equipment are available for charity organizations to borrow: a catch-basin insert with a sump pump, or a vacuum/boom device known as a Bubble Buster (Kitsap County, 1999). Both devices capture wash water runoff, allowing it to be pumped to either a sanitary sewer or a vegetated area for treatment.

For businesses, good housekeeping practices can minimize the risk of contamination from wash water discharges. The following are some general best management practices that those businesses with their own vehicle washing facilities can incorporate to control the water quality impacts of wash water discharges:

- All vehicle washing should be done in areas designed to collect and hold the wash and rinse water or effluent generated. Wash water effluent should be recycled, collected, or treated prior to discharge to the sanitary sewer system.
- Pressure cleaning and steam cleaning should be done off-site to avoid generating runoff with high pollutant concentrations. If done on-site, no pressure cleaning and steam cleaning should be done in areas designated as wellhead protection areas for public water supply.
- On-site storm drain locations should be mapped to avoid discharges to the storm drain system.
- Spills should be immediately contained and treated.

Limitations

The biggest limitation to implementing residential car wash best management practices may be the lack of knowledge regarding the impacts of polluted runoff. Many people do not associate the effects of their vehicle washing activities with local water quality and may be unaware that the discharges that enter storm drains are not treated at plants before being discharged into local waters. Surveys indicate that the average citizen does not fully understand the hydrologic connection between their yard, the street, the storm sewer, and the streams. For example, a recent Roper survey found that just 22 percent of Americans know that storm water runoff is the most common source of pollution of streams, rivers, and oceans (NEETF, 1999).

Most car washing best management practices are inexpensive and rely more on good housekeeping practices than on expensive technology. However, the construction of a specialized area for vehicle washing can be expensive for businesses. Also, for facilities that cannot recycle their wash water, the cost of pretreating wash water, through either structural practices or planning for collection and hauling of contaminated water to sewage treatment plants, can represent a cost limitation.

Effectiveness

The effectiveness of car washing management practices at reducing nonpoint source pollutant loads has yet to be measured accurately. Due to the diffuse nature of nonpoint source pollution, it is often difficult to determine the exact impact of a particular pollution prevention measure at reducing pollutant loading. While not much is known about the water quality of car wash water, it is clear that car washing is a common watershed behavior. Three recent surveys have asked residents where and how frequently they wash their cars (Table 2).

Table 2. A comparison of three surveys about car washing.

Study	Car Washing Behavior
Smith, 1996 Maryland	60% washed car more than once a month
Pellegrin, 1998 California	73% washed their own cars 73% report that wash-water drains to pavement
Hardwick, 1997 Washington	56% washed their own cars 44% used a commercial car wash 91% report that wash-water drains to pavement 56% washed car more than once a month 50% would shift if given discounts or free commercial car washes

Residents are typically not aware of the water quality consequences of car washing and do not understand the chemical content of the soaps and detergents they use. Car washing is a very difficult watershed behavior to change since it is often hard to define a better alternative. However, as with all pollution prevention measures, the reduction of pollutant loads from outdoor car washing activities are bound to have a positive effect on storm water quality.

Cost Considerations

Staffing and materials represent the largest expenditure for local governments seeking to administer a nonpoint source education program. Car wash outreach programs are relatively inexpensive to staff and often require only a limited outlay for materials (brochures, training videos, etc.), and staff time devoted specifically to car wash education can be less than 5 percent of an employee's time. For Kitsap County, Washington, the Sound Car Wash program requires roughly 10 to 15 hours a week of staff time over a 25-week period from April to September. Cost for materials and equipment replacement is estimated to be between $1,500 and $3,000 for the same 25-week period (Kitsap County, 1999). The Clean Bay Car Wash kits program in Tacoma, Washington, uses only the catch basin insert option and estimates that it spends no more than $2,000 per year and less than 2 weeks of staff time per year to handle requests for its program (Tacoma Stormwater Utility, 1999).

The purchase of wash water containment equipment is often a one-time expense, and this equipment is often used for a number of years. Two pieces of equipment used in car wash programs developed in the Pacific Northwest provide an example of the potential equipment cost. For the catch-basin insert, the approximate cost of installation is $65. In some cases, locations where charity car washes are frequently held have constructed their own catch basin inserts using plywood. For the Bubble Buster, the cost ranges from $2,000 to $2,500.

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Illegal Dumping Control

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Illegal dumping control as a management practice involves using public education to familiarize residents and businesses with how illegal dumping can affect storm water. By locating and correcting illegal dumping practices through education and enforcement measures, the many risks to public safety and water quality associated with illegal disposal actions can be prevented. For storm water managers, illegal dumping control is important to preventing contaminated runoff from entering wells and surface water, as well as averting flooding due to blockages of drainage channels for runoff.

Signs can be used to discourage dumping in sensitive areas (Source: NCDENR, 2000)

Several types of illegal dumping can occur. The first is the illegal dumping (also known as "open dumping," "fly dumping," or "midnight dumping") of litter that occurs at abandoned industrial, commercial, or residential buildings, vacant lots, and poorly lit areas such as rural roads and railway lines. This dumping primarily happens to avoid disposal fees or the time and effort required for proper disposal at landfills or recycling facilities. A second type of illegal dumping involves disposal of water that has been exposed to industrial activities and then released to the storm drainage system, introducing pollutants into storm water runoff.

Applicability

Illegal dumping can occur in both urban and rural settings and can happen in all geographic regions. The effects of illegal dumping may be more pronounced in areas with heavier rainfall, due to the greater volume of runoff. In more urbanized areas, illegal dumping may occur due to inaccessibility of recycling or solid waste disposal centers, which are often located on the suburban-rural fringe.

Design Considerations

Illegal dumping control programs focus on community involvement and targeted enforcement to eliminate or reduce illegal dumping practices. The key to successfully using this BMP is increasing public awareness of the problem and its implications. Illegal dumping control programs use a combination of public education, citizen participation, site maintenance, and authorized enforcement measures to address illegal waste disposal. Some of the issues that need to be examined when creating a program include the following:

- The locations of persistent illegal dumping activity
- Types of waste dumped and the profile of dumpers
- Possible driving forces behind illegal dumping, such as excessive user fees, restrictive curbside trash pickup, or ineffective recycling programs

- Previous education and cleanup efforts
- Current control programs and local laws or ordinances addressing the problem
- Sources of funding and additional resources that may be required.

Effective illegal dumping control programs use practices that educate and involve the community, local industries, and elected officials in an effort to eliminate the illegal discarding of wastes. An EPA toolkit for preventing illegal dumping focuses on four programmatic areas (USEPA 1998):

1. Cleanup efforts

Cleanup projects will require a coordinated planning effort to ensure that adequate resources and funding are available. Once a site has been cleaned, signs, lighting, or barriers may be required to discourage future dumping. Signs should indicate the fines and penalties for illegal dumping, and a phone number for reporting incidents. Landscaping and beautification efforts might also discourage future dumping, as well as providing open space and increasing property values.

2. Community Outreach and Involvement

This might be the most important tool in ensuring that this best management practice is effective. The organization of special cleanup events where communities are provided with the resources to properly dispose of illegally dumped materials increases the understanding among residents of illegal dumping impacts and supplies opportunities to correctly dispose of materials which may otherwise be illegally dumped. Integration of illegal dumping prevention into community policing programs or use of programs such as Crimestoppers may also be an effective way to increase enforcement opportunities without the additional cost of hiring new staff. Producing simple messages relating the cost of illegal dumping on local taxes, and directions to proper disposal sites will aid in eliminating the problem. Having a hotline where citizens can report illegal activities and educating the public on the connection between the storm drain and water quality will decrease disposal of waste into storm drain inlets.

3. Targeted Enforcement

This tool involves the use of ordinances to regulate waste management and eliminate illegal dumping through methods such as fines, cost recovery penalties for cleanup, and permit requirements for waste management activities. These fines and penalties can be used to help fund the prevention program or to provide rewards to citizens who report illegal dumping activities. Other recommendations for this tool include training of staff from all municipal departments in recognizing and reporting illegal dumping incidents, and dedicating staff who have the authority to conduct surveillance and inspections and write citations for those caught illegally dumping.

4. Tracking and Evaluation

This tool measures the impact of prevention efforts and determines if goals are being met. Using mapping techniques and computer databases allows officials to identify areas where dumping most often occurs, record patterns of dumping occurrence (time of day, day of week, etc.), and calculate the number of citations issued to the responsible parties. This allows for better allocation of resources and more specific targeting of outreach and education efforts for offenders.

Limitations

Illegal dumping is often spurred by cost and convenience considerations, and a number of factors encourage this practice. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law. The absence of routine or affordable pickup service for trash and recyclables in some communities also encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.

Municipalities can coordinate with state and federal agencies to help enforce illegal dumping control measures when resources such as funding and staff for enforcement activities are scarse.

Effectiveness

While the effectiveness of illegal dumping control measures at removing pollutant loads to local waters is hard to quantify, there are numbers to demonstrate the preventative effects these programs have in keeping waste from illegal dump sites and ultimately from storm water runoff. Some examples follow:

- The City/County of Spokane, Washington, Litter Control program is responsible for removing indiscriminate dumping on publicly owned properties and road right-of-ways. The program is estimated to remove 350 tons of illegally dumped material each year.
- Project HALT in Phoenix, Arizona, cleaned up a reported 15,000 tons of waste in 1996 and 1997 and issued more than 165 citations.
- The "Tire Roundup" program sponsored by the Southwest Detroit Environmental Visions community organization pays local residents to bring in illegally dumped tires. In 1995, residents were paid 25 cents per tire, and more than 8,000 tires were collected.

Illegal dumping of household and commercial waste has a variety of impacts on water quality. Hazardous chemicals generated from household, commercial, and industrial sources can contaminate ground and surface water supplies, affecting drinking water and public health as well as aquatic habitat. Reduced drainage of runoff due to blockage of streams, culverts and drainage basins can result in flooding and channel modification. Open burning associated with some illegal sites can cause forest fires that create severe erosion and cause sediment loading in streams. Economically, property values decrease as a result of illegal dumping and affect the local tax base and the ability to maintain pollution prevention programs.

Cost Considerations

The cost of illegal dumping control program activities can vary due to economic and social factors, but with creative thinking potential costs may be reduced. Possible sources of labor for dumping site cleanups can include community and youth groups, county or state corrections programs, or corporations. Equipment for cleanup may be available through either public works or transportation agencies or through donations by private companies. Training municipal staff to report incidents of illegal dumping witnessed during the performance of other duties reduces the need for full-time staff for the program.

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Landscaping and Lawn Care

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Applying too much lawn fertilizer can significantly contribute to water quality problems

This management measure seeks to control the storm water impacts of landscaping and lawn care practices through education and outreach on methods that reduce nutrient loadings and the amount of storm water runoff generated from lawns. Research has indicated that nutrient runoff from lawns has the potential to cause eutrophication in streams, lakes, and estuaries (CWP, 1999a, and Schueler, 1995a). Nutrient loads generated by suburban lawns as well as municipal properties can be significant, and recent research has shown that lawns produce more surface runoff than previously thought (CWP, 1999b). Pesticide runoff (see Pest Control fact sheet) can contribute pollutants that contaminate drinking water supplies and are toxic to both humans and aquatic organisms.

Landscaping, lawn care, and grounds maintenance are a big business in the United States. It has been estimated that there are 25 to 30 million acres of turf and lawn in the United States (Robert and Roberts, 1989, Lawn and Landscape Institute, 1999). If lawns were classified as a crop, they would rank as the fifth largest in the country on the basis of area, after corn, soybeans, wheat, and hay (USDA, 1992). In terms of fertilizer inputs, nutrients are applied to lawns at about the same application rates as those used for row crops (Barth, 1995a). The urban lawn is also estimated to receive an annual input of 5 to 7 pounds of pesticides per acre (Schueler, 1995b).

Not many residents understand that lawn fertilizer can cause water quality problems overall, less than one-fourth of residents rated it as a water quality concern (Syferd, 1995 and Assing, 1994), although ratings were as high as 60 percent for residents who lived adjacent to lakes (Morris and Traxler, 1996, and MCSR, 1997). Interestingly, in one Minnesota survey, only 21 percent of homeowners felt their own lawn contributed to water quality problems, while over twice as many felt that their neighbors' lawns did (MCSR, 1997). Unlike farmers, suburban and rural landowners are often ignorant of the actual nutrient needs of their lawns. According to surveys, only 10 to 20 percent of lawn owners take the trouble to take soil tests to determine whether fertilization is even needed (CWP, 1999). The majority of lawn owners are not aware of the phosphorus or nitrogen content of the fertilizer they apply (Morris and Traxler, 1996) or that mulching grass clippings into lawns can reduce or eliminate the need to fertilize. Informing residents, municipalities, and lawn care professionals on methods to reduce fertilizer and pesticide application, limit water use, and avoid land disturbance can help alleviate the potential impacts of a major contributor of nonpoint source pollution in residential communities.

Applicability

Lawn care, landscaping, and grounds maintenance are done in all parts of the country, in all types of climates, and in every type of community from rural to urban. Lawn fertilization is one of the most widespread watershed practices conducted by homeowners. In a survey of resident attitudes in the Chesapeake Bay, 89 percent of residents owned a yard, and of these, about 50 percent applied fertilizer every year (Swann, 1999). The average rate of fertilization in 10 other resident surveys was even higher, at 78 percent, although this could reflect the fact that these surveys were biased toward predominantly suburban neighborhoods, or excluded non-lawn owners. Because lawn care, landscaping, and grounds maintenance are such common practices, education programs for both residents, municipalities, and lawn care professionals on reducing the storm water impacts of these practices are an excellent way to improve local water quality.

Design Considerations

Designers of education programs that seek to change the impacts of fertilizer, pesticide, and herbicide use on receiving water quality should first consider creating training programs for those involved in the lawn care industry. Nationally, lawn care companies are used by 7 to 50 percent of consumers, depending on household income and lot size. Lawn care companies can exercise considerable authority over which practices are applied to the lawns they tend, as long as they still produce an attractive lawn. For example, 94 percent of lawn care companies reported that they had authority to change practices, and that about 60 percent of their customers were "somewhat receptive to new ideas", according to a Florida study (Israel et al., 1995). De Young (1997) also found that suburban Michigan residents expressed a high level of trust in their lawn care company.

Local governments that want to influence lawn care companies must have an active program that supports those companies that employ techniques to limit fertilizer and pesticide use to the minimum necessary to maintain a green lawn. One way to do this is through providing promotional opportunities. One example is the state of Virginia Water Quality Improvement program that includes the chance for lawn care professionals to enter into an agreement to use more environmentally friendly lawn care practices. In exchange, the lawn care company can use their participation in the program as a promotional tool (VA DCR, 1999). Providing certification for representatives from lawn care companies for attending training workshops put on by cooperative extension offices can also be an effective promotional tool.

Training for employees of lawn and garden centers is another important tool in spreading the message regarding lawn care and pollution control. Many studies indicate that product labels and store attendants are the primary and almost exclusive source of lawn care information for the average consumer who takes care of their own lawn. The Florida Yards and Neighbors program has worked with 19 stores of a large national hardware and garden chain to educate store employees and incorporate messages regarding fertilizer use and pesticide reduction (NRDC, 1999). Often the key strategy to implementing a program like this is to substitute watershed-friendly products for those that are not, and to offer training for the store attendants at the point of sale on how to use and, perhaps more importantly, how not to abuse or overuse such products.

A recent Center for Watershed Protection (CWP) survey of 50 nutrient education programs provides a number of tips to program managers on making outreach programs more effective. The results of the study showed that there were a number of important considerations for increasing the recall and implementation of pollution prevention messages. Table 1 provides some tips that appear to work the best at relaying pollution prevention messages and changing pollution-producing behaviors.

Table 1. Tips for creating more effective resident lawn care outreach programs

Tip 1: *Develop a stronger connection between the yard, the street, the storm, and the stream*.	Outreach techniques should continually stress the link between lawn care and the undesirable water quality it helps to create (e.g., algae blooms and sedimentation).
Tip 2: *Form regional media campaigns*.	Since most communities operate on small budgets, they should consider pooling their resources to develop regional media campaigns that can use the outreach techniques that are proven to reach and influence residents. In particular, regional campaigns allow communities to hire the professionals needed to create and deliver a strong message through the media. Also, the campaign approach allows a community to employ a combination of media, such as radio, television, and print, to reach a wider segment of the population. It is important to keep in mind that since no single outreach technique will be recalled by more than 30 percent of the population at large, several different outreach techniques will be needed in an effective media campaign.
Tip 3: *Use television wisely*.	Television is the most influential medium for influencing the public, but careful choices need to be made on the form of television that is used. The CWP survey found that community cable access channels are much less effective than commercial or public television channels. Program managers should consider using cable network channels targeted for specific audiences, and develop thematic shows that capture interest of the home, garden and lawn crowd (e.g., shows along the lines of "Gardening by the Yard"). Well-produced public service announcements on commercial television are also a sensible investment.

Table 1. Tips for creating more effective resident lawn care outreach programs (Continued)

Tip 4: *Keep messages simple and funny*.	Watershed education should not be preachy, complex, or depressing. Indeed, the most effective outreach techniques combine a simple and direct message with a dash of humor.
Tip 5: *Make information packets small, slick, and durable*.	Educators continually struggle about how to impart the detailed information to residents on how to really practice good lawn care behaviors, without losing their interest. One should avoid creating a ponderous and boring handbook. One solution is to create small, colorful and durable packets that contain the key essentials about lawn care behaviors, and direct contact information to get better advice. These packets can be stuck on the refrigerator, the kitchen drawer or the workbench for handy reference when the impulse for better lawn care behavior strikes.
Tip 6: *Understand the demographics of your watershed*.	Knowing the unique demographics of a watershed allows a program manager to determine what outreach techniques are likely to work for that particular area. For example, if some residents speak English as a second language, a certain percentage of outreach materials should be produced in their native language. Similarly, watershed managers should consider more direct channels to send watershed messages to reach particular groups, such as through church leaders or ethnic-specific newspapers and television channels**.**

Pollution prevention programs may also wish to incorporate a much stronger message that promotes a low- or zero-input lawn. Watershed education programs might strongly advocate no chemical fertilization, reduced turf area, and the use of native plants adapted to the ecoregion (Barth, 1995b). This message provides a balance to the pro-fertilization message that is marketed by the lawn care industry.

Program managers need to incorporate some method for evaluating the effectiveness of their programs at reaching residents. Many programs use "before and after" market surveys to provide information on the level of understanding of residents and the percentage of residents that implement good lawn care practices. These surveys provide insights on what outreach techniques work best for a community and the level of behavior change that can be expected.

Alternative landscaping techniques such as naturescaping and xeriscaping can also be used. *Xeriscaping* is considered to be a viable alternative to the high water requirements of typical landscaping. It is a form of landscaping that conserves water and protects the environment. Xeriscaping does not result in landscaping with cactus and rock gardens. Rather, cool, green landscapes can be used when they are maintained with water-efficient practices. The main benefit of xeriscaping is that it reduces water use (TAMU, 1996). Xeriscaping incorporates seven basic principles that reduce water use (NYDEP, 1997):

- *Planning and design*. Consider drainage, light, and soil conditions; desired maintenance level; which existing plants will remain; plant and color preferences; and budget.

- *Soil improvement*. Mix peat moss or compost into soil before planting to help the soil retain water. Use terraces and retaining walls to reduce water run-off from sloped yards.
- *Appropriate plant selection*. Choose low-water-using flowers, trees, shrubs, and groundcovers. Many of these plants need watering only in the first year.
- *Practical lawns.* Limit the amount of grass area. Plant groundcovers or add hard surface areas like decks, patios, or walkways. If replanting lawns, use drought-tolerant grass seed mixes.
- *Efficient irrigation*. Install drip or trickle irrigation systems, as they use water efficiently.
- *Effective use of mulches*. Use a 3-inch deep layer of mulches such as pine needles or shredded leaves or bark. This keeps soil moist, prevents erosion, and smothers weeds.
- *Appropriate maintenance*. Properly timed fertilizing, weeding, pest control, and pruning will preserve the beauty of the landscape and its water efficiency.

Naturescaping is a way of putting native plants and beneficial wildlife habitat back into your yard or community. It is also a beautiful way to conserve water and energy, reduce pollution of water and soil, and create habitat for wildlife. Native plants are the foundation of naturescaping. The plants that evolved in your region are well adapted to our climate and naturally resistant to local pests and diseases. Once established, natives can often survive on rainwater alone. Naturescaping areas can include replacing some lawn area with a wildflower meadow; hummingbird and butterfly garden, plants and trees selected for seeds, fruit, and nectar; and nesting boxes.

When creating a naturescape, it is important to include four elements: food, water, shelter, and adequate space. When creating a naturescape in your yard or community, keep in mind these steps:

- Visit "wild" places and naturescaped sites and imagine how these landscapes would fit in your yard or community.
- Educate yourself and your community. Learn about native plants and basic design and care concepts. You can attend workshops and read plant and design books.
- When you are ready to develop a site plan, choose a small viewable site. When planning, consider maintenance water, gardening, access to feeders. Know the existing conditions of the area shade/sun, wet/dry, wind patterns, drainage, existing plants and critters. Once you develop a plan and you have gotten any necessary permits, you are ready to gather your material and begin.

A local government can meet with local neighborhood and creek groups to promote community naturescaping, host naturescaping workshops, and establish naturescaping demonstration sites in neighborhoods, and can offer naturescaping assistance to many residential, business, and public projects.

Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

The IPM approach can be applied to both agricultural and nonagricultural settings, such as the home, garden, and workplace. IPM takes advantage of all appropriate pest management options, including -- but not limited to -- the judicious use of pesticides. In contrast, *organic* food production applies many of the same concepts as IPM but limits the use of pesticides to those that are produced from natural sources, as opposed to synthetic chemicals.

IPM is not a single pest control method but, rather, a series of pest management evaluations, decisions, and controls. Integrated pest management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools. Municipalities can encourage homeowners to practice IPM and train/encourage municipal maintenance crews to use these techniques for managing public green areas. There are many methods and types of integrated pest management, including the following:

- Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
- Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
- Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
- Sprinkling the ground surface with abrasive diatomaceous earth can prevent infestations by soft-bodied insects and slugs. Slugs also can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
- In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of. (Pruning equipment should be disinfected with bleach to prevent spreading the disease organism.)
- Small mammals and birds can be excluded using fences, netting, tree trunk guards.
- Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders that prey on detrimental pest species can be promoted.

Limitations

The overriding public desire for green lawns is probably the biggest impediment to limiting pollution from this source. For example, when residents were asked their opinions on more than 30 statements about lawns in a Michigan survey, the most favorable overall response was to the statement "a green, attractive lawn is an important asset in a neighborhood" (De Young, 1997). Nationally, homeowners spend about $27 billion each year to maintain their own yard or to pay someone else to do it (PLCAA, 1999). In terms of labor, a majority of homeowners spend more than an hour a week taking care of the lawn (Aveni, 1994, De Young, 1997). Convincing residents that a nice, green lawn can be achieved without using large amounts of chemicals and fertilizers is difficult when conventional lawn care techniques are often seen as more effective, less time-consuming, and more convenient.

Effectiveness

The effectiveness of pollution prevention programs designed to educate residents on lawn care and landscaping practices has not been well documented to date. However, the need for such programs is evident. Source area monitoring in Marquette, Michigan, found that nitrogen and phosphorus concentrations in residential lawn runoff were 5 to 10 times higher than from any other source area (CWP, 1999). This report confirms earlier Wisconsin research findings that residential lawns yielded the highest phosphorus concentrations of 12 urban pollutant sources examined (Bannerman et al, 1993).

A critical step in crafting an education program is to select the right outreach techniques to send the lawn care message. From the results of a number of market surveys, two outreach techniques have shown some promise in actually changing behavior -- media campaigns and intensive training. Media campaigns typically use a mix of radio, TV, direct mail, and signs to broadcast a general watershed message to a large audience. Intensive training uses workshops, consultation, and guidebooks to send a much more complex message to a smaller and more interested audience. Intensive training requires a more substantial time commitment, ranging from several hours to a few days.

From evaluations of several market surveys, it appears that media campaigns and intensive training can each produce up to a 10- to 20-percent improvement in selected watershed behaviors among their respective target populations. A combination of both outreach techniques is probably needed in most watersheds, as each complements the other. For example, media campaigns cost just a few cents per watershed resident reached, while intensive training can cost several dollars for each resident that is actually influenced. Media campaigns are generally better at increasing awareness and sending messages about negative watershed behaviors. Intensive training, on the other hand, is superior at changing individual practices in the home, lawn, and garden.

Cost Considerations

The cost of creating and maintaining a program that addresses lawn care and landscaping practices and water quality varies depending on the intensity of the effort and what outreach techniques are selected. Media campaigns often require a greater amount of money to create, but are also most likely to reach the largest proportion of the community. Intensive training campaigns may not require as large a creation cost, but often require more staff time. Production costs for materials such as flyers and brochures is often inexpensive ($0.10 to $0.50 per brochure), and soil kits and testing may be provided through a local university to reduce expense. Many cooperative extension offices have already produced materials on lawn care and landscaping techniques to protect water quality, and program managers may save money by utilizing these available resources.

An example of a program that educates residents on better lawn care practices is The Water-Wise Gardener Program of the Prince William County, Virginia, Cooperative Extension service. Through the changes in behavior of more than 700 participants, an estimated aggregate reduction in fertilizer application of 20 tons has been realized in the county in 5 years. The program operates on an average annual budget of approximately $30,000 and requires the yearly time of 1.5 staff persons. Expense is deferred by the use of master gardener volunteers, who act as consultants for volunteer lawns where lawn care practices have been implemented. The program has recently been developed into a regional model that has been applied in several other Virginia counties.

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Pest Control

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

The use of pesticides, such as those pictured here, should be limited to avoid runoff contamination

This management measure involves limiting the impact of pesticides on water quality by educating residents and businesses on alternatives to pesticide use and proper storage and on application techniques. The presence of pesticides in storm water runoff has a direct impact on the health of aquatic organisms and can present a threat to humans through contamination of drinking water supplies. The pesticides of greatest concern are insecticides, such as diazinon and chloropyrifos (CWP, 1999 and Schueler, 1995), which even at very low levels can be harmful to aquatic life. A recent study of urban streams by the U.S. Geological Survey found that some of the more commonly used household and garden insecticides occurred at higher frequencies and concentrations in urban streams than in agricultural streams (USGS, 1999). The study also found that these insecticide concentrations were frequently in excess of USEPA guidelines for protection of aquatic life.

The major source of pesticides to urban streams is home application of products designed to kill insects and weeds in the lawn and garden. It has been estimated that an average acre of a well-maintained urban lawn receives an annual input of 5 to 7 pounds of pesticides (Schueler, 1995). Pesticide pollution prevention programs try to limit adverse impacts of insecticides and herbicides by providing information on alternative pest control techniques other than chemicals or explaining how to determine the correct dosages needed to manage pests. Lawn care and landscaping management programs often include pesticide use management as part of their outreach message.

Applicability

EPA estimates that nearly 70 million pounds of active pesticide ingredients are applied to urban lawns each year. Table 1 compares surveys on residential pesticide use in eleven different areas of the country, broken down by insecticides and herbicides use. It appears that pesticide application rates vary greatly, ranging from a low of 17 percent to a high of 87 percent, but climate is an important factor in determining insecticide and herbicide use.

Table 1. A comparison of eleven surveys of residential insecticide and weedkiller use

Study	Number of Respondents	% Using Insecticides	% Using Herbicides
Chesapeake Bay Swann, 1999	656	21%	–
Maryland, Kroll and Murphy,1994	403	42%	32%
Virginia, Aveni, 1998	100	66%	–
Maryland, Smith, 1994	100	23%	n/a
Minnesota, Morris and Traxler, 1997	981	–	75%
Michigan, De Young, 1997	432	40%	59%
Minnesota, Dindorf, 1992	136	–	76%
Wisconsin, Kroupa, 1995	204	17%	24% **
Florida, Knox et al, 1995	659	83%	–
Texas, NSR, 1998	350	87%	–
California, Scanlin and Cooper, 1997	600	50%	–

Notes: (**) note difference in self-reported herbicide use and those that use a weed and feed product (herbicide combined with fertilizer)

Insecticides appear to be applied more widely in warm weather climates where insect control is a year-round problem (such as Texas, California, and Florida). Anywhere from 50 to 90 percent of residents reported that they had applied insecticides in the last year in warm-weather areas. This can be compared to 20 to 50 percent levels of insecticide use reported in colder regions, where hard winters can help keep insects in check. By contrast, herbicide application rates tend to be higher in cold weather climates to kill the weeds that arrive with the onset of spring (60 to 75 percent in the Michigan, Wisconsin, and Minnesota surveys).

Design Considerations

The use of integrated pest management (IPM) is a popular way for program managers to educate residents and businesses on alternatives to chemical pesticides. IPM reflects a holistic approach to pest control that examines the interrelationship between soil, water, air, nutrients, insects, diseases, landscape design, weeds, animals, weather, and cultural practices to select an appropriate pest management plan. The goal of an IPM program is not to eliminate pests but to

manage them to an acceptable level while avoiding disruptions to the environment. An IPM program incorporates preventative practices in combination with nonchemical and chemical pest controls to minimize the use of pesticides and promote natural control of pest species. Three different nonchemical pest control practices biological (good bugs that eat pests), cultural (handpicking of pests, removal of diseased plants, etc.), and mechanical (zappers, paper collars, etc) are used to limit the need for chemicals. In those instances when pesticides are required, programs seek to have users try less toxic products such as insecticidal soaps. The development of higher tolerance levels among residents for certain weed species is a central concept of IPM programs for reducing herbicide use.

Education on the proper use of pesticides is often included in many lawn care and landscaping management programs. Most often this is in the form of informational brochures or fact sheets on pesticide use around the home or garden. These information packets include tips on identifying pest problems and selecting treatment approaches that reduce environmental impacts; less-toxic pest control products if chemical control is necessary; and the proper mixing, application rates, and cleanup procedures for pesticide use. Program managers can consult cooperative extension programs and university agricultural programs for more information regarding pest control techniques that are more water quality friendly.

Limitations

The public perception that no alternative to pesticide use exists is probably the greatest limitation that program managers will face. Surveys tell us that the public has a reasonably good understanding about the potential environmental dangers of pesticides. Several surveys indicate that residents do understand environmental concerns about pesticides, and consistently rank them as the leading cause of pollution in the neighborhood (Elgin DDB, 1996). Even so, pesticide use still remains high in many urban areas (see Table 1). The time required for homeowners to learn more about alternative pest control techniques may also limit program effectiveness. Many residents prefer the ease of spraying a chemical on their lawns to other pest control techniques they perceive as more time intensive and less reliable. Managers should recognize that IPM programs have their own limitations, including questions about the effectiveness of alternative pest control techniques.

Effectiveness

A national study of the effectiveness of alternative pest control programs at reducing pesticide use and protecting water quality has not yet been performed. Cooperative extension and university agriculture programs across the country have performed studies of the ability of distinct alternative pest control techniques at limiting pesticide use, but a synthesis of these individual studies into a national report has not been performed. However, the need for pesticide control programs is evident from recent studies on the presence of insecticides in storm water. Results of recent sampling of urban streams caused the USGS to conclude that the presence of insecticides in urban streams may be a significant obstacle to restoring urban streams. (USGS, 1999). Table 2 examines eight studies on storm water runoff and insecticide concentrations and provides an example of how insecticides persist even after their use is discontinued.

Additional research done in the San Francisco Bay Region regarding diazinon use further illustrates the need for pest control programs. Results of the study show that harmful diazinon levels can be produced in urban streams from use at only a handful of individual homes in a

given watershed (CWP, 1999). Due to the solubility of diazinon, current storm water and wastewater treatment technologies cannot significantly reduce diazinon levels. The best tool for controlling diazinon in urban watersheds is through source control by educating residents and businesses on pesticide alternatives and safe application.

An example of successful use of IPM is the Grounds Maintenance Program for the City of Eugene, Oregon. This program was started in the early 1980's and includes all the city public parks and recreation areas. The city uses a variety of IPM methods, including water blasting to remove aphids, insecticidal soaps, and limited use of pesticides. The city has also adopted higher tolerance levels for certain weed and pest species that reduces the need to apply pesticides and herbicides. Since the program's inception, pesticide usage by the City of Eugene has dropped bay more than 75 percent (Lehner et. al., 1999). Although no exact cost savings have been calculated from the use of the IPM program, the city turf and grounds supervisor believes the program saves money and has little citizen opposition.

Table 2: Banned or restricted insecticides found in storm water runoff concentrations in µg/l (ppb) (Source: Schueler, 1995)

Study	Chlordane	Lindane	Dieldrin	Other
Baltimore Kroll/Murphy	0.52	0.18	2.44	–
Rhode Island Cohen	Detected	NA	NA	NA
Atlanta Hippe	NA	0.01 (0.048)	NA	–
Atlanta Thomas	Detected	NX	NX	heptachlor
Milwaukee Bannerman	Detected	Detected	Detected	DDT, DDE
Washington MWCOG	0.2	0.2	0.2	Heptachlor
Northern Virginia Dewberry and Davis	ND	Trace	ND	Endrin
Toronto D'Andrea	NA	0.5 to 2	0.1 to 2	–
Toronto D'Andrea	NA	0.5 to 2	0.1 to 2	–
ND=Not Detected, NA=Not Analyzed, NX= Detection reported only if they exceeded water quality standards.				

Cost Considerations

The cost of educating residents on proper pesticide use varies greatly depending on the intensity of the effort. Some cities have begun partnerships that include training of retail employees on IPM techniques, similar to lawn care and landscaping programs. In addition, promotional materials and displays on safer pesticide alternatives are set up. The cost of staff time for training and production of materials must be included in any cost estimate. Since there are currently a

number of good fact sheets on IPM and pesticide use available through cooperative extension programs, managers should consider using this source instead of creating a new one. Another way to save cost would be to utilize master gardener volunteers to help with training, for both residents and store employees.

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Parking Lot and Street Cleaning

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

A street sweeper cleans up pollutants and sediments on the street to reduce the amount of pollutants entering receiving waters

This management measure involves employing pavement cleaning practices such as street sweeping on a regular basis to minimize pollutant export to receiving waters. These cleaning practices are designed to remove from road and parking lot surfaces sediment debris and other pollutants that are a potential source of pollution impacting urban waterways (Bannerman, 1999). Although performance monitoring for the Nationwide Urban Runoff Program (NURP) indicted that street sweeping was not very effective in reducing pollutant loads (USEPA, 1983), recent improvements in street sweeper technology have enhanced the ability of present day machines to pick up the fine grained sediment particles that carry a substantial portion of the storm water pollutant load. Many of today's sweepers can now significantly reduce the amount of street dirt entering streams and rivers, some by significant amounts (Runoff Report, 1998). A debate as to whether this ability to pick up finer particles will improve the overall pollutant removal effectiveness of street sweepers is ongoing, and further research is required to establish the optimal sweeping frequency for pollutant removal and what streets are most appropriate for a sweeping program.

Applicability

Street sweeping is practiced in most urban areas, often as an aesthetic practice to remove sediment buildup and large debris from curb gutters. In colder climates, street sweeping is used during the spring snowmelt to reduce pollutant loads from road salt and to reduce sand export to receiving waters. Seventy percent of cold climate storm water experts recommend street sweeping during the spring snowmelt as a pollution prevention measure (CWP, 1997). The frequency and intensity of rainfall for a region are also key variables in determining how streets need to be swept to obtain a desired removal efficiency. Other factors that affect a street sweeper's ability to reduce nonpoint pollution include the condition of the street, its geographical location, the operator's skill, the presence of parked cars, and the amount of impervious area devoted to rooftop.

Design Considerations

One factor considered most essential to the success of street sweeping as a pollutant removal practice is use of the most sophisticated sweepers available. Innovations in sweeper technology have improved the performance of these machines at removing finer sediment particles, especially for machines that use vacuum-assisted dry sweeping to remove particulate matter. By using the most sophisticated sweepers in areas with the highest pollutant loads, greater reductions in sediment and accompanied pollutants can be realized.

Another important aspect of street sweeping programs is the ability to regulate parking. The ability to impose parking regulations in densely populated areas and on heavily traveled roads is essential.

The frequency and location of street sweeping is another consideration for any program. How often and what roads to sweep are determined by the program budget and the level of pollutant removal the program wishes to achieve. Computer modeling of pollutant removal in the Pacific Northwest suggests that the optimum sweeping frequency appears to be once every week or two (CWP, 1999). More frequent sweeping operations yielded only a small increment in additional removal. The model also suggests that somewhat higher removal could be obtained on residential streets as opposed to more heavily traveled arterial roads.

Sweeping of parking lots is also employed as a nonstructural management practice for industrial sites. This sweeping involves using brooms to remove small quantities of dry chemicals and solids from areas that are exposed to rainfall or storm water runoff. While the effectiveness of this practice at pollutant removal is unknown, the sweeping and proper disposal of materials is a reasonably inexpensive method of pollution prevention that requires no special training or equipment.

Limitations

For street sweeping, the high cost of current sweeper technologies is a large limitation to using this management practice. With costs approaching $200,000 for some of the newer sweeper technologies, storm water managers with limited budgets must consider the high equipment cost together with the uncertainty about pollutant removal efficiency to decide whether a sweeping program is an attractive management option. The potential inability to restrict parking in urban areas may present another limitation. Other possible limitations include the need for sweeper operator training, the inability of current sweeper technology to remove oil and grease, and the lack of solid evidence regarding the expected levels of pollutant removal. Proper disposal of swept materials might also be a limitation.

Maintenance Considerations

Street cleaning programs require a significant investment of capital and a yearly operation and maintenance budget. Sweepers have a useful life of about four years, and proper maintenance can greatly improve sweeping efficiency. Arrangements for disposal of the swept material collected must also be made, as well as accurate tracking of the streets swept and the frequency of sweeping. The operation and maintenance costs for two types of sweepers are included in Table 1.

Effectiveness

Street sweeping programs had largely fallen out of favor as a pollutant removal practice following the 1983 NURP report, but improvements in sweeper technology have caused a recent reevaluation of their effectiveness. New studies show that conventional mechanical broom and vacuum-assisted wet sweepers reduce nonpoint pollution by 5 to 30 percent and nutrient content by 0 to 15 percent. However, newer dry vacuum sweepers can reduce nonpoint pollution by 35 to 80 percent and nutrients by 15 to 40 percent for those areas that can be swept (Runoff Report, 1998).

While actual reductions in storm water pollutants have not yet been established, information on the reductions in finer sediment particles that carry a significant portion of the storm water pollutant load is available. Recent estimates are that the new vacuum assisted dry sweeper might achieve a 50–88 percent overall reduction in the annual sediment loading for a residential street, depending on sweeping frequency (Bannerman, 1999).

A benefit of high-efficiency street sweeping is that by capturing pollutants before they are made soluble by rainwater, the need for structural storm water control measures might be reduced. Structural controls often require costly added measures, such as adding filters to remove some of these pollutants and requiring regular manpower to change-out filters. Street sweepers that can show a significant level of sediment removal efficiency may prove to be more cost-effective than certain structural controls, especially in more urbanized areas with greater areas of pavement.

Cost Considerations

The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between $60,000 and $120,000. Newer technologies might have prices approaching $180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.

If investing in newer technologies, training for operators must be included in operation and maintenance budgets. Costs for public education are small, and mostly deal with the need to obey parking restrictions and litter control. Parking tickets are an effective reminder to obey parking rules, as well as being a source of revenue.

Table 1 gives sweeper cost data for two types of sweepers: mechanical and vacuum-assisted. The table shows that while the purchase price of vacuum-assisted sweepers is significantly higher, the operation and maintenance costs are lower.

Table 1. Estimated costs for two types of street sweepers

Sweeper Type	Life (Years)	Purchase Price ($)	O&M Cost ($/curb mile)	Sources
Mechanical	5	75,000	30	Finley, 1996 SWRPC, 1991
Vacuum-assisted	8	150,000	15	Finley, 1996 Satterfield, 1991

Cost data for two cities in Michigan provide some guidance on the overall cost of a street cleaning program. Table 2 contains a review of the labor, equipment, and material costs for street cleaning for the year 1995 (Ferguson et al., 1997). The average cost for street cleaning was $68/curb mile and approximately 11 curb miles/day were swept.

Table 2. The cost of street cleaning for two cities in Michigan

City	Labor	Equipment	Material and Services	Total
Livonia	$23,840	$85,630	$5,210	$114,680
Plymouth Township	$18,050	$14,550	$280	$32,880

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Roadway and Bridge Maintenance

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Pollutants generated from road and bridge maintenance can be minimized with good housekeeping practices (Source: VDOT, 2000)

This practice involves pollution prevention techniques that reduce or eliminate pollutant loadings from existing road surfaces as part of an operation and maintenance program. Substantial amounts of sediment and pollutants are generated during daily roadway and bridge use and scheduled repair operations, and these pollutant loadings can threaten local water quality by contributing heavy metals, hydrocarbons, sediment, and debris to storm water runoff. Table 1 shows some of the constituents that can be present in highway runoff and their primary sources.

As Table 1 demonstrates, numerous pathways for pollutant deposition on roadways and bridges influence the water quality of storm water runoff. Routine performance of general maintenance activities such as sweeping, vegetation maintenance, and cleaning of runoff control structures can help alleviate the impacts of these pollutants. Modifications in roadway resurfacing practices and application techniques for salt and other deicers can also help reduce pollutant loads to storm water runoff and protect the quality of receiving waters.

Table 1. Highway runoff constituents and their primary sources (Source: USEPA, 1993)

Constituent	Primary Sources
Particulates	Pavement wear, vehicles, atmosphere
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Tire wear, auto exhaust
Zinc	Tire wear, motor oil, grease
Iron	Auto body rust, steel highway structures, moving engine parts
Copper	Metal plating, brake lining wear, moving engine parts, bearing and bushing wear, fungicides and insecticides
Cadmium	Tire Wear, insecticides

Table 1. Highway runoff constituents and their primary sources (Source: USEPA, 1993) (Continued)

Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear, asphalt paving
Manganese	Moving engine parts
Cyanide	Anticake compound used to keep deicing salt granular
Sodium, Calcium, Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate

Applicability

Roadway systems are a large part of the infrastructure of urban areas across the country, and require regular repairs and maintenance due to traffic use and climatic conditions. The level of pollutants found in road and bridge runoff is variable and is determined by a number of factors in addition to traffic volume and climate. Other factors affecting pollutant levels include surrounding land use, the design of the bridge or roadway, the presence of roadside vegetation, the use of insecticides, and the frequency of accidents and spills that can introduce hazardous chemicals. In colder climates, the amount of deicer applied to melt ice and snow can also influence the level of certain pollutants in road runoff and its impacts on local water quality.

Design Considerations

Road and bridge maintenance programs have a number of options for reducing the level of pollutants generated during the maintenance of existing road surfaces. Changes in the methods used for maintaining road surfaces, removing debris and sediment from roadways, and cleaning of runoff control structures can help improve the overall quality of storm water discharges from roads and bridges.

Proper planning for road and bridge resurfacing operations is a simple but effective method to control pollution. Many techniques can be implemented to control the impacts of this maintenance operation. First, paving operations should be performed using concrete, asphalt, or other sealers only in dry weather situations to prevent contamination of runoff. Second, proper staging techniques should be used to reduce the spillage of paving materials during the repair of potholes and worn pavement. These techniques can include covering storm drain inlets and manholes during paving operations; using erosion and sediment control measures to decrease runoff from repair sites; and utilizing pollution prevention materials such as drip pans and absorbent material for all paving machines to limit leaks and spills of paving materials and fluids.

Finally, resurfacing operations could employ porous asphalt for pothole repair and for shoulder areas to reduce the level of storm water runoff from road systems. For more information on permeable road surface materials, see the Porous Pavement fact sheet.

Good cleaning practices can help diminish impacts to storm water runoff. Sweeping and vacuuming of heavily traveled roadways to remove sediment and debris can reduce the amount of pollutants in runoff. Street sweeping as a pollution source control is discussed more extensively in the Parking Lot and Street Cleaning fact sheet. Regular cleaning of runoff control structures such as catch basins can help reduce sediment loads in runoff that will end up in local waterways (see Catch Basins fact sheet).

Proper application of road salt or other deicers also reduces storm water pollution. By routinely calibrating spreaders, a program manager can prevent over-application of deicing materials. In addition to reducing the effects of these materials on the aquatic environment, cost savings may be realized due to reductions in the purchase of deicing materials. Training for transportation employees in proper deicer application techniques, the timing of deicer application, and what type of deicer to apply will also determine the impacts on water quality and aquatic habitat.

Maintenance practices for roadside vegetation also determine the storm water quality of road runoff. Restrictions on the use of herbicides and pesticides on roadside vegetation, and training to ensure that employees understand the proper handling and application of pesticides and other chemicals, can help prevent contamination of runoff. Selection of roadside vegetation with higher salt tolerances will also help to maintain vegetated swales and biofilters that filter out runoff. For more information on vegetated storm water practices, see the Grassed Filter Strips fact sheet.

Bridge runoff may require additional maintenance practices to eliminate storm water runoff impacts. In addition to some of the roadway practices listed above improved, practices in bridge siting and design can help reduce water quality impacts. One technique is to avoid using bridge scupper drains for any new bridges and to routinely clean existing ones to prevent sediment and debris buildup. Scupper drains can cause direct discharges to surface waters and have been found to carry relatively high concentrations of pollutants (CDM, 1993). Program managers should consider endorsing retrofits of scupper drains with catch basins or redirecting water from these drains to vegetated areas to provide treatment. Other techniques such as using suspended tarps, booms, and vacuums to capture pollutants (e.g., paint, solvents, rust, and paint scrapings) generated during bridge maintenance will also help reduce impacts to receiving waters. In addition, using deicers such as glycol, urea, or calcium magnesium acetate (CMA) reduces the corrosion of metal bridge supports that can occur when salt is used.

Limitations

Generally, limitations to instituting pollution prevention practices for road and bridge maintenance involve the cost for additional equipment and training. Since maintenance of roadways and bridges is already required in all communities, staffing is usually in place and alteration of current practices should not require additional staffing or administrative labor.

Limitations may arise in the location of new bridges. The availability and cost of land and other economic and political factors may dictate where the placement of a new bridge will occur. Better design of the bridge to control runoff is required if it is being placed near sensitive waters. The practice of controlling paved areas to limit impervious surface might also be restricted by community regulations of required widths for roadways and shoulders.

Effectiveness

Limited data are available on the actual effectiveness of road and bridge maintenance practices at removing pollutants from storm water runoff. Table 2 examines the effectiveness and cost of some of the operation and maintenance practices recommended for storm water pollution control.

Table 2. Road and bridge maintenance management practices: cost and effectiveness (Source: USEPA, 1993)

<table>
<tr><th></th><th colspan="2">Effectiveness (% Removal)[a]</th><th>Cost</th></tr>
<tr><td>Maintaining Roadside Vegetation</td><td colspan="2">Sediment Control: 90% average
P and N: 40% average
COD, Lead, and Zinc: 50% average
TSS: 60% average</td><td>Natural succession allowed to occur
Average: $100/acre/year
Range: $50-$200/acre/year</td></tr>
<tr><td>Street Sweeping</td><td>Smooth Street
Frequent Cleaning:
TSS: 20%
COD: 5%
Lead: 25%</td><td>Smooth Street
Infrequent Cleaning:
TSS: N/A
COD: N/A
Lead: 5%</td><td>Average: $20/curb mile

Range: $10–$30/curb mile</td></tr>
<tr><td>Litter Control</td><td colspan="2">N/A</td><td rowspan="3">All are accepted as economical practices to control or prevent storm water impacts.</td></tr>
<tr><td>General Maintenance</td><td colspan="2">N/A</td></tr>
<tr><td>Minimizing Deicer Application</td><td colspan="2">N/A</td></tr>
</table>

[a]P=phosphorus; N=nitrogen; TSS=total suspended solids; COD=chemical oxygen demand

Although data may be limited on cost and effectiveness, preventative maintenance and strategic planning are time-proven and cost-effective methods to limit contamination of storm water runoff. It can be assumed that the management practices recommended will have a positive affect on storm water quality by working to reduce pollutant loads and the quantity of runoff. Protecting and restoring roadside vegetation, removal of debris and sediment from roads and bridges, and directing runoff to vegetated areas are all effective ways to treat storm water runoff. Other practices, such as minimizing deicer application, litter control, and proper handling of fertilizers, pesticides, and other toxic materials, work to control some of the pathways of storm water pollution. Employing good road and bridge maintenance practices is an efficient and low-cost means of eliminating some of the impacts of pollutants associated with road systems on local streams and waterways.

Cost Considerations

The maintenance of local roads and bridges is already a consideration of most community public works or transportation departments. Therefore, the cost of pollutant reducing management practices will involve the training and equipment required to implement these new practices. Cost data for some of the new practices that have been recommended are included in Table 2.

Costs may vary greatly in the type of deicer selected for application. Table 3 includes a comparison of four different deicers and the cost for application. It should be noted that CMA has a higher cost than the other deicers, but that reductions in corrosion to infrastructure, damage to roadside vegetation, and amount of material used may offset the higher cost.

Table 3. The estimated cost of four deicer types (Source: Caraco and Claytor, 1997)

Deicer Type	Material Cost Per Ton	Cost Per Lane Mile Per Season
Sodium Chloride	$20–$40	$6,371–$6,909
Calcium Chloride	$200	$6,977–$7,529
Calcium Magnesium Acetate (CMA)	$650–$675	$12,958–$16,319
CG-90 Surface Saver	$185	$5,931–$6,148

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Septic System Controls

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Septic system source control refers to the use of outreach programs to educate homeowners about the proper operation and maintenance of their septic systems to reduce the likelihood of failure. Septic systems are designed to treat wastewater by separating solids from liquids and then draining the liquid into the ground. Sewage flows into the tank where settling and bacterial decomposition of larger particles takes place, while treated liquid filters into the soil. When system failures occur, untreated wastewater and sewage can be introduced into ground water or nearby streams and water bodies.

Workers test a drain field (Source: Texas A&M University, 1996)

Pollution prevention practices are designed to restrict pollutant and nutrient loads from improperly functioning septic systems from entering local water sources. These loadings occur for a number of reasons, including improper siting, inadequate installation, or system operation failures (see Failing Septic Systems fact sheet). As many as 75 percent of all system failures have been attributed to hydraulic overloading (Jarrett et al., 1985). Failures may also occur due to lapses in the regular inspection and maintenance that are required to ensure proper operation during the design life of the septic system. Homeowners may be unaware of the age of their system and whether preemptive planning is necessary before the system fails.

Applicability

Outreach regarding septic systems controls is applicable for large lot development in rural areas that are not served by sewer. When septic systems are used for wastewater treatment, there is a need for educational outreach and training to avoid system failures for owners of both new and existing systems. Septic system maintenance education is extremely important in coastal areas for shoreline development near shellfish beds and spawning areas, where septic effluent discharges can influence water quality and lead to bed closures and algal blooms. There is also a significant need for educational outreach regarding septic system maintenance near lake shoreline developments, where nitrogen inputs can lead to lake eutrophication.

Implementation

The most effective way to control on-site wastewater problems is through a comprehensive management program. An onsite wastewater management program can reduce water quality degradation and save local governments and homeowners time and money, as well as better tracking of the performance of routine maintenance practices. This comprehensive plan is administered by one agency that has ultimate responsibility for all aspects of wastewater management, including on-site disposal systems. (see Failing Septic Systems fact sheet).

Public outreach and training are vital elements in the control of septic system failure. Many of the problems associated with improper septic system functioning may be attributed to a lack of homeowner knowledge of operation and maintenance of the system. Educational materials for homeowners and training courses for installers and inspectors can reduce the incidence of failure. Education is most effective when used in concert with other source reduction practices, such as phosphate bans and use of low-volume plumbing fixtures. Simple messages that can be conveyed to homeowners to reduce system failures and ensure proper functioning include

- Do not wait until septic system shows sign of failure. Inspect the system annually and have it pumped-out at least once every 3 years.
- Keep records of pumping and maintenance and a map of the location of your system and drainfield.
- Practice water conservation indoors and divert roof drains and surface water away from the system.
- Use caution in disposing materials down the drain. Household chemicals can kill the bacteria that make the system work and nondegradable materials (cigarette butts, etc.) can clog the system.
- Keep heavy equipment and vehicles off your system and drainfield.
- Don't cover your drainfield with impermeable surfaces that can block evaporation and the air needed for effluent treatment.

In addition to the general suggestions above, there are other management measures which can be implemented to help maintain a properly operating system. These measures include the following:

Chemical Additive Restrictions

Organic solvents are often advertised for use as septic system cleaners. Little evidence shows that such cleaners perform any useful functions, and they might instead exterminate the microbes necessary for waste treatment, resulting in increased discharge of pollutants. In addition, the chemicals themselves often contain constituents that are listed with U.S. EPA as priority pollutants. Restrictions on the use of these additives can prevent improper system operation and ground water contamination (USEPA, 1993).

Phosphorus Detergent Restrictions

Conventional septic systems are usually very effective at removing phosphorus (see the Failing Septic Systems fact sheet). However, certain soil conditions combined with proximity to sensitive surface waters can result in phosphorus pollutant loading. If such conditions are sufficiently prevalent within areas of concern, restrictions or bans on the use of detergents containing phosphate can be implemented. Eliminating phosphates from detergent can reduce phosphorus loads to septic systems by 40 to 50 percent (USEPA, 1993). As of October 1993, 17 states had enacted phosphate detergent restrictions or bans (Osmond et al, 1995).

Elimination of Garbage Disposals for Households Served by Septic System

Garbage disposals contribute to the loading of suspended solids, nutrients, and biological oxygen demand (BOD) to septic systems, as well as increasing the buildup of solids in septic tanks. Garbage disposals can double the amount of solids added to a septic tank, creating the need for more frequent pumpouts.

Proper Septic System Maintenance

Depending on soil conditions and other factors, septic systems have a failure rate of 5 to 35 percent. When they fail, septic systems can discharge untreated or partially treated wastewater into groundwater. As a result, it is important to ensure that septic systems are maintained and operating properly. This can be accomplished by homeowners or trained inspectors through regular inspections of onsite systems. During inspections, the holding or septic tank should be checked to determine whether or not pumping is necessary. Additionally, the inspection port should be opened and the baffles checked to ensure that they have not been damaged since the last inspection. The absorption field should also be checked for flooding or sogginess, which are indicators of a clogged system or excessive water use. Finally, the entire area should be checked for odors or damp or soggy areas, which are indicative of a leak in the system.

The holding tank should be pumped regularly, with the frequency depending on the capacity of the tank, the flow of wastewater, and the volume of solids in the tank. First, a tank's capacity might become too small if new high-water-use technologies such as a hot tub or whirlpool are installed, or if more people move into the house than when the system was originally installed. Second, when more people move into a house, the wastewater flow will increase, requiring more frequent pumping. Finally, if the house has a garbage disposal or if the occupation of someone in the household results in their having excessively soiled clothing, the volume of solids entering the tank might be greater than usual and require more frequent pumping. These factors should be accounted for when determining how frequently to pump a septic tank.

Table 2 lists estimates of how frequently septic tanks should be pumped on average, based on the size of the tank and household size (NSFC). These values were calculated assuming there was no garbage disposal, which can increase solids by up to 50 percent. Individuals can determine specifically when the holding tank should be pumped by occasionally checking the depth of solids and the level of scum built up on top of the water in the tank. As this can be an unpleasant chore, it is best to have the tank routinely pumped by a certified contractor approximately every 3 years.

Limitations

As with all pollution prevention measures, public ignorance about the suggested practices may be the biggest limitation to septic system source control. Many residents appear to be either unaware of or unwilling to implement the necessary steps to ensure the proper operation and maintenance of their septic systems. A recent survey of residents in the Chesapeake Bay region found that 50 percent of septic owners had not had their systems inspected within the last 3 years and that 46 percent had not had their system cleaned within the same time frame (Swann, 1999). Twelve percent of residents did not even know where their septic system was located. This finding indicates that residents are not receiving the necessary information on septic system care to prevent or reduce the incidence of failure.

Table 2. Estimated septic tank pumping frequencies in years

Tank Size (gallons)	Household Size (number of people)					
	1	**2**	**3**	**4**	**5**	**6**
500	5.8	2.6	1.3	1.0	0.7	0.4
750	9.1	4.2	2.6	1.8	1.3	1.0
900	11.0	5.2	3.3	2.3	1.7	1.3
1,000	12.4	5.9	3.7	2.6	2.0	1.3
1,250	15.6	7.5	4.8	3.4	2.6	2.0
1,500	18.9	9.1	5.9	4.2	3.3	2.6
1,750	22.1	10.7	6.9	5.0	3.9	3.1
2,000	25.4	12.4	8.0	5.9	4.5	3.7
2,250	28.6	14.0	9.1	6.7	5.2	4.2
2,500	31.9	15.6	10.2	7.5	5.9	4.8

Effectiveness

Failing septic systems have been linked to water quality problems in streams, lakes, shellfish beds, and coastal areas. Improvements in system operation and maintenance should be a strong element in watershed plans for those areas where septic systems are used for wastewater treatment. Public education and outreach regarding septic system operation and maintenance can be assumed to produce some positive effect on water quality, but studies on resident behaviors regarding septic pollution prevention practices are limited. Instead, effectiveness of septic source controls is most often measured in the number of informational packets mailed out or the number of attendees for training workshops.

While this may help to define the demand for information, it gives no indication of whether the operation and maintenance practices presented are implemented. To better determine whether pollution prevention outreach is being effective, residential surveys should be part of any program seeking to educate residents on septic systems and their influence on water quality.

Cost Considerations

The cost of septic system pollution prevention programs can vary greatly, depending on factors such as staff time, outreach components, and the extent of septic use within a region. Table 3 provides some examples of programs from various parts of the country and the expenditures for septic outreach.

Once a program is well established, the cost of creating educational materials and training programs decreases and funding can be redistributed to those outreach techniques that have proven to be the most successful. Programs should be sure to secure some funding for media outreach (especially television), as this often ranks as the most popular information source in surveys of resident preferences.

Table 3. Some examples of cost and staff time for septic outreach programs

Program	Expenditure	Staff time (Full time equivalent)	Components
City of Olympia, Washington	$40,000	0.5	• Flyers/brochures • Training workshops • System monitoring
Thurston County, Washington	$35,000	0.5	• Flyer/brochures • Discount coupons for septic pumping • Training workshops
Minnesota Cooperative Extension	$18,000	0.25	• Publications/videos • Flyers/brochures • Training Workshops/community Visits • Septic owners guide distributed with new permits • Satellite conferences for policy makers • Train the trainers program

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Storm Drain System Cleaning

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Storm drain systems need to be cleaned regularly. Routine cleaning reduces the amount of pollutants, trash, and debris both in the storm drain system and in receiving waters. Clogged drains and storm drain inlets can cause the drains to overflow, leading to increased erosion (Livingston et al., 1997). Benefits of cleaning include increased dissolved oxygen, reduced levels of bacteria, and support of instream habitat. Areas with relatively flat grades or low flows should be given special attention because they rarely achieve high enough flows to flush themselves (Ferguson et al., 1997).

Municipalities can hire professional plumbing services to remove trapped sediment and debris from storm drains with periodical flushing (Source: Drain Patrol, no date)

Applicability

This measure is applicable to all storm drain systems. The same principles can be applied to material and waste handling areas, paved and vegetated areas, waterways, and new development projects (Ferguson et al., 1997).

Limitations

While cleaning is necessary for all storm drain systems, there are limitations (adapted from Ferguson et al., 1997) as follows:

- Cleaning the storm drain by flushing is more successful for pipes smaller than 36 inches in diameter.
- A water source is necessary for cleaning. The wastewater must be collected and treated once flushed through the system.
- Depending on the condition of the wastewater, it may or may not be disposed to sanitary sewer systems.
- The efficiency of storm system flushing decreases when the length of sewer line being cleaned exceeds 700 feet.

Maintenance Considerations

Ferguson et al. (1997) report removal of 55 to 65 percent for nonorganic materials and grits and 65 to 75 percent for organics.

Cost Considerations

The cost of a vactor truck can range from $175,000 to $200,000, and labor rates range from $125 to $175 per hour (Ferguson et al., 1997). Ferguson et al. (1997) also cited costs of $1.00 to $2.00 per foot for storm drain system cleaning.

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Alternative Discharge Options for Chlorinated Water

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Chlorinated water discharged to surface waters has an adverse impact on local water quality. Swimming pools are a major source of chlorinated water discharged into sanitary and storm sewer systems. An average swimming pool holds 19,000 gallons of chlorinated water. Pools have high concentrations of chlorine, which is toxic to wildlife and fish.

Chlorinated water from swimming pools should not discharged to the storm sewer system or directly into a waterbody (Source: The Pool Guy, 2001)

Applicability

Many pool owners who live in cooler climates drain their swimming pools to reduce maintenance and potential damage from freezing during harsh winters. These individuals should not discharge pool water to the storm sewer system or directly into a waterbody and should investigate alternative discharge options.

Siting and Design Considerations

The Oregon Department of Environmental Quality suggests that

- Pool owners obtain permission from local sanitary sewer operators or municipal treatment plant operators and discharge to the sanitary sewer system.
- Discharge the chlorinated water to land, where it will not drain to local surface waters.
- Dechlorinate the water before draining the pool.

Montgomery County, Maryland's, Department of Environmental Protection (1997) provides the following guidelines to pool owners and operators:

- Community pools must discharge to the sanitary sewer using a surge tank.
- Residential pools must discharge backwash water to the sanitary sewer.
- If the only option for draining pool water is to discharge directly into the environment, water quality must comply with the applicable water quality criteria.
- Pool water must sit for at least 2 days after the addition of chlorine or bromine or until chlorine or bromine levels are below 0.1 mg/l.
- The pH of discharge water must be between 6.5 and 8.5 before it is discharged.
- Algicides such as copper or silver can interrupt normal algal and plant growth and should not be used.

- Total suspended solids must be below 60 mg/l—suspended particles should be allowed to settle out and the water should not appear murky. Settled material should not be discharged with pool water.
- Discharges to the environment should be directed over a land surface so that some level of filtration by soil particles can occur. The above water quality requirements also apply to land-applied water.

Limitations

Enforcement of safe discharge of chlorinated water may be difficult to achieve.

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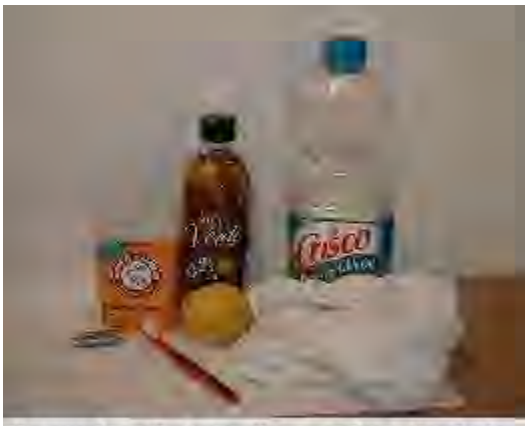
Materials management

Alternative Products

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Using alternatives to toxic substances drastically reduces their presence in storm water and receiving waters. The most common toxic substances found in the home are cleaners, automotive products, and pesticides. Fertilizers, paints, and fuels are among other common hazardous substances frequently found in ground water because of improper disposal (WEF and ASCE, 1998).



Examples of alternative products include rechargeable batteries, baking soda, olive oil, vegetable oil, a lemon, a toothbrush, and a rag

Applicability

The promotion of safer alternative products should be coupled with other programs designed to reduce the presence of hazardous or toxic materials in homes and storm water runoff. Examples of such programs are hazardous materials collection, good housekeeping or material management practices, oil and automotive waste recycling, and spill response and prevention (WEF and ASCE, 1998).

Examples of commonly used products and safer alternatives are as follows (adapted from Washington State Department of Ecology):

- *Aerosols*. Pump-type or non-aerosol products should be used.
- *Art supplies*. One should purchase water-based paints or inks. They should not contain lead or other toxic materials.
- *Batteries*. Rechargeable batteries are a cost-effective alternative to disposable batteries.
- *Chemical fertilizers*. Composting yard clippings and food scraps is an option. Manure (in measured amounts) is another alternative to chemical fertilizers.
- *Gasoline*. Not driving at all is the best way to reduce gasoline use. Purchasing a super-efficient or electric vehicle is the next best alternative. Carpooling, walking, bicycling, and public transportation are other viable options.
- *Household cleaners and detergents.* Baking soda is an excellent cleanser with mild abrasive power that can be used in lieu of heavy-duty cleansers. A mixture of 1 quart water and 2 tablespoons of vinegar can be used as a window cleaner. Three parts olive oil mixed with one part white vinegar can be used for a wood cleanser. Borax and lemon juice make an excellent toilet cleaner. Many other non- or less-toxic alternatives to harsh cleansers exist. A listing of these alternatives can be found at *www.healthdept.co.pierce.wa.us/sourceprotection/alter.html*.

- *Motor Oil*. Re-refined motor oil should be used. Doing so will spur the market for recycled motor oil and decrease reliance on new oil supplies.
- *Pesticides*. Keeping homes and gardens free from food and breeding areas for insect pests prevents the need for pesticides. Onion, garlic, and marigold plants help keep garden pests at bay.

Implementation

One of the best ways to encourage homeowners to switch to alternatives to potentially harmful products is to educate them (see Proper Disposal of Household Hazardous Wastes fact sheet). Municipalities can compile a list of alternative products and post it on their web site, publish it in a newsletter, include it as an insert in a utility bill, or produce magnets or other household products with a select list of nonhazardous alternatives. Municipalities might choose to include commercially available products that have been shown to be "green" alternatives to harsh chemicals.

Limitations

In some cases, alternative products may not be readily available. In addition, cost can be a limiting factor. For example, until recently, environmentally friendly de-icing materials for roads were significantly more expensive than traditional salt (Babcock 1998). Effectiveness of alternatives may be an issue.

The biggest impediment to instituting widespread use of alternative products is public awareness. Municipal staff must convince people to change old habits or to try new products.

Effectiveness

The use of alternative products prevents their hazardous waste counterparts from being disposed of improperly and contaminating storm water.

Cost Considerations

The majority of the cost for this BMP is composed of staff hours. An alternative products campaign should be instituted in conjunction with other public awareness programs; therefore, municipalities should not experience significant cost increases.

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Hazardous Materials Storage

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Failure to properly store hazardous materials dramatically increases the probability that they will end up in local waterways. Many people have hazardous chemicals stored throughout their homes, especially in garages and storage sheds. Practices such as covering hazardous materials or even storing them properly, can have dramatic impacts.

Signs on hazardous material storage containers indicate the dangers associated with each substance

Applicability

Hazardous material storage is relevant to both urban and rural settings and all geographic regions. The effects of hazardous material leakage may be more pronounced in areas with heavier rainfall, due to the greater volume of runoff.

Siting and Design Considerations

EPA (1992) has outlined some management considerations for hazardous materials. They are as follows:

- Ensuring sufficient aisle space to provide access for inspections and to improve the ease of material transport.
- Storing materials well away from high-traffic areas to reduce the likelihood of accidents that might cause spills or damage to drums, bags, or containers.
- Stacking containers in accordance with the manufacturers' directions to avoid damaging the container or the product itself.
- Storing containers on pallets or equivalent structures. This facilitates inspection for leaks and prevents the containers from coming into contact with wet floors, which can cause corrosion. This consideration also reduces the incidence of damage by pests (insects, rodents, etc.).
- Delegating the responsibility for management of hazardous materials to personnel trained and experienced in hazardous substance management.

Covering hazardous materials and areas where such materials are handled reduces potential contact with storm water and wind. Storage areas, outdoor material deposits, loading and unloading areas, and raw materials should all be covered or enclosed. Priority should be given to locations of the most hazardous substances (USEPA 1992).

Residents waiting to dispose of their household hazardous waste should store it properly until their hazardous waste collection day (Kopel,1998). One storage technique requires a plastic container with a lid (e.g., a 5-gallon bucket). The container should be filled halfway with (unused) kitty litter. The hazardous substance in its own original container should be put into the kitty litter-filled plastic bucket. The bucket lid should be fastened, and the contained marked clearly, kept far away from children, and anyone else who might ingest it. Corrosion will be reduced if the container is stored on a shelf, rather than on a concrete or dirt floor.

Limitations

The lifespan of the cover or structure must be taken into account, depending on the hazardous nature of the stored materials. Tarpaulins and plastic sheets may not last in certain types of climatic conditions. If a roof or other structure is required, the lifespan will increase. Any storage facility must meet local fire and building codes (Ferguson, et al. 1997).

Maintenance Considerations

Maintenance of hazardous material storage areas consists mostly of inspection and employee training (Ferguson, et al. 1997). Storage spaces and containers should be routinely inspected for leaks, signs of cracks or deterioration, or any other signs of release.

Effectiveness

Improved storage of hazardous materials is effective at reducing contamination of storm water runoff and receiving waters if proper storage and maintenance techniques are used.

Cost Considerations

Estimates of costs for storing and covering materials vary depending on the substance and type of operation. Ferguson et al. (1997) estimated the costs of a pre-fabricated building at $6 to $11 per ft^2, and the cost of a 6-inch thick concrete slab at $3.50 to $5.00 per ft^2. All hazardous materials should be protected from exposure to storm water regardless of the expense. To offset the cost of covering or enclosing hazardous materials, consider changing procurement, inventory, and disposal practices to minimize the amount of materials stored onsite.

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Road Salt Application and Storage

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

The application and storage of deicing materials, most commonly salts such as sodium chloride, can lead to water quality problems for surrounding areas (Koppelman et al., 1984). Salts, gravel, sand, and other materials are applied to highways and roads to reduce the amount of ice during winter storm events. Salts lower the melting point of ice, allowing roadways to stay free of ice buildup during cold winters. Sand and gravel increase traction on the road, making travel safer.

During storage, road salt should be covered to prevent salt from lumping together or being lost with storm water runoff

Applicability

This practice is applicable to areas that receive snowfall in winter months and require deicing materials. Municipalities in these areas must ensure proper storage and application for equipment and materials.

Siting and Design Considerations

Many of the problems associated with contamination of local waterways stem from the improper storage of deicing materials (Koppelman et al., 1984). Salts are very soluble when they come into contact with storm water. They can migrate into ground water used for public water supplies and also contaminate surface waters.

More information about road deicing materials can be found at the American Association of State Highway and Transportation Officials web page at *www.transportation.org/aashto/home.nsf/FrontPage*.

Limitations

Road salt is the least expensive material for deicing operations; however, once the full social costs are taken into account, alternative products and better management and application of salts become increasingly attractive options.

Maintenance Considerations

Covering stored road salts may be costly; however, the benefits are greater than the perceived costs. Storing road salts correctly prevents the salt from lumping together, which makes it easier to load and apply. In addition, covering salt storage piles reduces salt loss from storm water runoff and potential contamination to streams, aquifers, and estuarine areas. Salt storage piles should be located outside the 100-year floodplain for further protection against surface water contamination.

During road salt application, certain best management practices can produce significant environmental benefits. The amount of road salt applied should be regulated to prevent oversalting of motorways and increasing runoff concentrations. The amount of salt applied should be varied to reflect site-specific characteristics, such as road width and design, traffic concentration, and proximity to surface waters. Calibration devices for spreaders in trucks aid maintenance workers in the proper application of road salts. Alternative materials, such as sand or gravel, should be used in especially sensitive areas.

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Spill Response and Prevention

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Spill response and prevention plans should clearly state measures to stop the source of a spill, contain the spill, clean up the spill, dispose of contaminated materials, and train personnel to prevent and control future spills.

A person works to prevent a spill from entering a storm sewer (DAWG, 2000)

Applicability

Spill prevention and control plans are applicable to construction sites where hazardous wastes are stored or used. Hazardous wastes include pesticides, paints, cleaners, petroleum products, fertilizers, and solvents.

Siting and Design Considerations

Identify potential spill or source areas, such as loading and unloading, storage, and processing areas, places where dust or particulate matter is generated, and areas designated for waste disposal. Also, spill potential should be evaluated for stationary facilities, including manufacturing areas, warehouses, service stations, parking lots, and access roads.

Material handling procedures and storage requirements should be defined and actions taken to reduce spill potential and impacts on storm water quality. This can be achieved by

- Recycling, reclaiming, or reusing process materials, thereby reducing the amount of process materials that are brought into the facility
- Installing leak detection devices, overflow controls, and diversion berms
- Disconnecting any drains from processing areas that lead to the storm sewer
- Performing preventative maintenance on storm tanks, valves, pumps, pipes, and other equipment
- Using material transfer procedures or filling procedures for tanks and other equipment that minimize spills
- Substituting less- or non-toxic materials for toxic materials.

Provide documentation of spill response equipment and procedures to be used, ensuring that procedures are clear and concise. Give step-by-step instructions for the response to spills at a particular facility. This spill response plan can be presented as a procedural handbook or a sign.

The spill response plan should

- Identify individuals responsible for implementing the plan
- Define safety measures to be taken with each kind of waste
- Specify how to notify appropriate authorities, such as police and fire departments, hospitals, or publicly-owned treatment works for assistance
- State procedures for containing, diverting, isolating, and cleaning up the spill
- Describe spill response equipment to be used, including safety and cleanup equipment.

Education is essential for reducing spills. By informing people of actions they can take to reduce spill potential, spills will be reduced and/or prevented. Some municipalities have set up 1-800 numbers for citizens to call in the event of spills. This is helpful for ensuring that spills are cleaned up in a safe, proper, and timely manner.

Limitations

A spill prevention and control plan must be well planned and clearly defined so that the likelihood of accidental spills can be reduced and any spills that do occur can be dealt with quickly and effectively. Training might be necessary to ensure that all workers are knowledgeable enough to follow procedures. Equipment and materials for cleanup must be readily accessible and clearly marked for workers to be able to follow procedures.

Maintenance Considerations

Update the spill prevention and control plan to accommodate any changes in the site or procedures. Regularly inspect areas where spills might occur to ensure that procedures are posted and cleanup equipment is readily available.

Effectiveness

A spill prevention and control plan can be highly effective at reducing the risk of surface and ground water contamination. However, the plan's effectiveness is enhanced by worker training, availability of materials and equipment for cleanup, and extra time spent by management to ensure that procedures are followed.

Cost Considerations

Spill prevention and control plans are inexpensive to implement. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

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Used Oil Recycling

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Used motor oil is a hazardous waste because it contains heavy metals picked up from the engine during use. Fortunately, it is recyclable because it becomes dirty from use, rather than actually wearing out. However, as motor oil is toxic to humans, wildlife, and plants, it should be disposed of at a local recycling or disposal facility. Before disposal, used motor oil should be stored in a plastic or metal container with a secure lid, rather than dumped in a landfill or down the drain. Containers that previously stored household chemicals, such as bleach, gasoline, paint, or solvents should not be used. Used motor oil should also never be mixed with other substances such as antifreeze, pesticides, or paint stripper.

Used oil can be disposed of at a waste collection facility, where it will be collected and later sent to a recycling facility

Used motor oil is recycled in a number of different ways. It can be *reprocessed* into fuel for heating and cooling homes. Reprocessing is the most common method of recycling used oil in the United States. Approximately 750 million gallons of used oil are reprocessed every year and marketed to asphalt plants, steel mills, boilers, pulp and paper mills, cement/lime kilns, and a number of other places. Motor oil can also be burned in furnaces for heat or in power plants to generate electricity for homes, businesses, or schools. It can also be blended for marine fuels, mixed with asphalts for paving, or be used in industrial burners. Used motor oil can also be used in specially designed municipal garages, space heaters, and automotive bays. Finally, used motor oil can be re-refined into lubricating oils that meet the same standards as virgin/new oil. All of these methods of recycling help to conserve valuable energy resources.

When establishing oil recycling programs, municipalities should provide the public with the proper informational resources. Programs should encourage the public to contact local service stations, municipal governments, the county government office, or the local environmental or health departments, if they are unsure where to safely dispose of their oil. The public can also call 1-800-RECYCLE or contact Earth's 911 at *www.1800cleanup.org/* for more information. Finally, state government contacts, who might be able to provide information about oil recycling, can be obtained by the public at *www.noraoil.com/Contact/contact.html*.

Municipalities also need to address oil filter recycling in their recycling programs. Programs should encourage the public to check with local collection facilities to determine whether oil filters are recycled locally. The Filter Manufacturers Council, which was established in 1971 to monitor regulatory and technological developments that affect the oil industry, can also be used as a resource for the public. The Council operates a hotline (1-800-99-FILTER) and a web site (*www.filtercouncil.org/*) to provide information about state regulations and companies that transport, recycle, and process used oil filters. If oil filters are not recycled locally, empty filters should be wrapped in newspaper and disposed of with regular household waste. Oil filters must always be drained of oil, whether recycling or disposing of the filter. The public should also check with trash collectors to determine if their state permits disposal of oil filters in landfills.

Applicability

Motorists that have their oil changed can be classified as a do-it-yourselfer or a do-it-for-me. Do-it-yourselfers change their own oil because they want to save money, they enjoy it, or they take pride in the quality of their own workmanship. According to a recent survey, more than 30 percent of motorists change their own oil. Between 43 and 62 million gallons of used oil were collected and recycled by do-it-yourselfers in 1997 (API, 2000). Therefore, it is important that do-it-yourselfers recycle their used oil. Do-it-for-mes have their oil changed at places such as service stations or quick lubes; they should be sure to check if their mechanic recycles motor oil.

To make recycling motor oil more convenient for the do-it-yourselfers, oil recycling programs should be located throughout all communities. Although oil recycling programs are appropriate in any community, urban areas are in particular need of programs, as more motor oil is used in these areas to maintain a larger number of vehicles. Therefore, oil recycling programs should more heavily target urban areas and provide a greater number of facilities for recycling oil in these areas.

Implementation

Oil recycling programs can be implemented easily throughout the country. Two types of programs currently in use are drop-off locations and curbside collection. Drop-off locations include service stations, recycling centers, auto parts retail stores, quick lubes, and landfills. These locations are effective because they are familiar, convenient, permanent, and well located. Additionally, sites that are permanent allow for effective publicity for recycling programs. Curbside collection programs allow consumers to put their oil out on the curb for collection, as they already do with their other recycling and trash. While this program is more convenient for the user, it requires a hauler to come and collect the oil. Oil recycling programs that use drop-off locations for collection are implemented by local governments, state governments, service stations, quick lubes, auto parts retailers, oil processors, or any combination of the above. Curbside collection programs are implemented by municipal or private waste haulers, municipal or private recycling haulers, or a combination of any of the above.

Local Recycling Programs. Many states, cities, and communities have developed their own recycling programs. For example, the California Integrated Waste Management Board sponsors a used oil recycling program that develops and promotes alternatives to illegal oil disposal. This is accomplished through a statewide network of collection opportunities and outreach efforts that publicize and encourage used oil recycling.

The program provides useful information for the public, including collection locations, certification information, proposed regulations, used oil facts, and a number of other resources. More information about this program can be found at *www.ciwmb.ca.gov/usedoil/Default.htm*. Other cities with used oil programs are King County, Washington; Kansas City, Missouri; Clark County, Ohio; and New Carollton, Maryland. All of these programs can be used as models for other communities to develop their own programs.

National Recycling Programs. In 1991, the American Petroleum Institute (API) established a used oil collection and recycling program. This program works to educate the public about collecting and recycling used oil, making oil collection more convenient, and ensuring that this valuable resource is handled appropriately. Information about API's Used Motor Oil Program is available at *www.recycleoil.org*. API has also developed model legislation, based on Florida's program, to encourage collection and recycling of used oil. Florida's legislation specifically requires states to create a special fund to help cities and towns establish used oil collection facilities. Additionally, it emphasizes the importance of educating the public about oil recycling. Guidance for developing collection programs, in the form of API's model legislation as well as guidebooks and publications, can be found at *www.recycleoil.org/legislative.htm*.

Benefits

Recycling used motor oil is beneficial to the environment, the public health, and the economy. If oil is improperly disposed of in landfills, ditches, or waterways or dumped on the ground or down storm sewers, it can migrate into surface and ground water. It takes only one gallon of oil to contaminate one million gallons of drinking water (USEPA, 2000). This same oil can also seriously harm aquatic plants and animals. Submerged vegetation is especially affected by oil because the oil blocks sunlight from entering the water and hinders photosynthesis. As motor oil causes 40 percent of the pollution in America's waterways (Mississippi DEQ), water pollution could dramatically decrease if that same oil was recycled.

It is also beneficial to recycle motor oil because one gallon of re-refined oil produces 2.5 quarts of lubricating oil, while 42 gallons of crude oil are necessary to produce this same amount. It also takes three times as much energy used to refine crude oil to lubricating oil than it does to re-refine used motor oil. If the 180 million gallons of recoverable motor oil that are thrown away each year were recycled, this would produce enough energy to power 360,000 homes annually. Finally, if the 1.3 billion gallons of oil wasted each year by the United States were re-refined, it would save 1.3 million barrels of oil a day (Mississippi DEQ).

Recycling used motor oil is also beneficial in protecting public health. As oil circulates through a car's engine, it collects rust, dirt, metal particles, and a variety of contaminants. Engine heat can also break down oil additives, producing acids and a number of other substances. Exhaust gases and antifreeze can also leak into oil when the engine is in use. When any of these substances mix with oil, the toxicity of oil is greatly increased. Then, if oil is disposed of improperly and enters the water or air, public health can be seriously threatened.

Recycling used motor oil is also beneficial to the economy. Oil is a valuable resource that can be re-refined and reused in combustion engines. As oil is a non-renewable resource, it will become increasingly more difficult to find new reserves in the future. Therefore, recycling will provide time to develop alternative fuels and lessen dependence on foreign oil suppliers.

Limitations

One limitation to recycling oil is the possibility of contamination during collection. If oil is mixed with other substances or if storage containers have residues of other substances, this can contaminate oil and make it a hazardous waste. In these cases, collection facilities are responsible for disposing of this hazardous waste and abiding by appropriate rules. Another limitation is educating the public. While oil recycling programs can be effective, it is often difficult to effectively educate the public and convince them of the importance of recycling oil. This limitation can be addressed if municipalities include recycling information in utility bill inserts, newspaper ads, and mailings. A last limitation is that some might find it inconvenient to take their oil to a recycling facility. People may not have time to drive their oil to a facility or the facility may be difficult to find. When this happens, people are more likely to dispose of their oil improperly.

Effectiveness

According to a 1998 survey, 30 percent of motorists change their oil themselves. Of those people, 12 to 15 percent report that they improperly dispose of their oil. While most people claim that they put the oil in the trash, 3 to 5 percent say that they dispose of their oil in a storm drain system. Based on this survey, more than half of do-it-yourselfers improperly dispose of used motor oil. A 1994 survey reports that of the 28 percent who are do-it yourselfers, 17 percent report improper disposal. These statistics can be improved through better advertisement of recycling facilities and by making recycling more convenient for the public.

Costs

Costs for used motor oil recycling programs vary depending on whether a community has already established similar types of recycling programs. Major costs associated with oil recycling programs include advertisement costs and oil collection costs. While service stations and collection facilities often allow the public to drop off their oil free of charge, these facilities must pay a recovery service to collect and dispose of their accumulated oil. One such recovery service, US Filter, charges an annual fee of $179 for unlimited waste oil removal, or a $79 fee for one-time oil removal, from service stations, small garage owners, and other types of collection facilities. Costs for programs also vary, depending on whether oil is collected by curbside pickup or at drop-off facilities. As fees will vary, check with a local recovery service for more specific information about oil collection fees.

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Materials Management

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Responsibly managing common chemicals, such as fertilizers, solvents, paints, cleaners, and automotive products, can significantly reduce polluted runoff (WEF and ASCE, 1998). Such products must be handled properly in all stages of their useful lives. Materials management entails the selection of the individual product, the correct use and storage of the product, and the responsible disposal of associated waste(s).

Applicability

In many cases, industries can implement simple housekeeping practices in order to manage materials more effectively. Proper management reduces the likelihood of accidental spills or releases of hazardous materials during storm events. In addition, health and safety conditions at the facility will improve.

Some simple practices for managing materials are improving maintenance of industrial machinery, establishing material storage and inventory controls, improving routine cleaning and inspection of facilities where materials are stored or processed, maintaining organized workplaces, and educating employees about the benefits of the above practices (USEPA, 1992).

Maintenance Considerations

Maintenance associated with materials management should be designed to minimize the amounts of materials used and the wastes generated by industrial processes. Procedures for operation and maintenance can easily be integrated into an industry's management plan. Simple processes, such as routine cleaning of work spaces, proper collection and disposal of wastes, maintenance of machinery, regular inspections of equipment and facilities, and training employees to respond to spills or leaks, have significant effects on reducing storm water runoff.

Another consideration is regular material inventories. Such inventories reduce the occurrence of overstocking hazardous materials, increase knowledge about what hazardous materials are present and how they are stored, and provide documentation of proper handling of hazardous materials. An inventory of hazardous materials present at a particular site consists of three major steps (USEPA, 1992):

- Identify all hazardous and nonhazardous substances present in a facility. This can be accomplished by reviewing all purchase orders for the facility and walking through the facility itself. Compile a list of all chemicals present in a facility and obtain a Material Safety Data Sheet (MSDS) for each one.
- Label all containers with the name of the chemical, unit number, expiration date, handling instructions, and health or environmental hazards. Much of this information will be found on the MSDS. Often, insufficient labeling leads to improper handling or disposal of hazardous substances.
- Make special note on the inventory of hazardous chemicals that require special handling, storage, or disposal.

Cost Considerations

The major costs of these BMPs can be attributed to additional labor. Depending on the extent of the program, varying amounts of staff hours will be required for the necessary education of municipal employees, local businesses, and the public. In addition, posters and bulletin boards that encourage the proper management of materials should be displayed throughout the facility.

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Municipal Facilities Management

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Municipalities own and operate numerous facilities, including maintenance yards, parks, office buildings, schools, and other city-owned properties. The objective of managing stormwater at municipal facilities is to prevent pollutants released during city activities from entering storm drain systems or receiving waters. Activities associated with municipal facilities that are a potential threat to water quality include, but are not limited to, Automobile Maintenance, Residential Car Washing, Hazardous Materials Storage, Materials Management, sign painting, Pest Control, Parking Lot and Street Cleaning, and waste storage and disposal. To effectively prevent or reduce stormwater pollution, a municipality should inventory its facilities and associated activities to assess potential impacts on stormwater quality and revise activities or implement new measures as needed. These activities and control measures should be described in a stormwater pollution prevention plan (SWPPP) or a similar document that describes management actions that will be taken to reduce pollution from the site or activity. Training on stormwater best management practices (BMPs) and principles should be provided to all municipal facilities maintenance staff, and they should have clear guidance on how to use appropriate stormwater practices during typical maintenance operations and facility management activities.

Applicability

The Phase II rule specifies that municipalities develop a program to prevent and reduce pollutant runoff from municipal operations, using training and controls for reducing or eliminating the discharge of pollutants from municipal parking lots, maintenance and storage yards, fleet maintenance shops, salt/sand storage locations, snow disposal areas, and waste transfer stations. The rule also includes development of procedures for properly disposing of waste removed from the separate storm sewers and areas listed above (such as dredge spoil, accumulated sediments, floatables, and other debris). Other municipal facilities that should be evaluated for pollution potential and BMP implementation include those where chemicals are stored, those with outdoor trash storage areas, and areas where potentially hazardous materials are stored or disposed of (e.g., animal shelters, hospitals, clinics).

Some municipalities are required to have coverage under an industrial stormwater permit for municipal facilities they own and manage. If a municipal facility, such as a landfill or transportation facility, has activities included in one of the 11 categories of industrial activity described in 40 CFR 122.26(b)(14)(i)-(xi), the operator must obtain coverage under an NPDES industrial stormwater permit, unless they are conditionally excluded. For those areas where EPA is the permitting authority (in some states, on Indian Country lands, and at some federal facilities), the Multi-Sector General Permit (MSGP) provides facility-specific requirements for many types of industrial facilities in one permit. Most states, however, are authorized to implement the NPDES stormwater program (click here for a list of authorized states) and have their own industrial stormwater permits.

Implementation

Each facility will have different activities and pollutants of concern. Facility managers should consider the housekeeping and pollution prevention BMPs outlined in the Menu of BMPs and develop a SWPPP that outlines how the BMPs will be implemented. If the facility is covered by an industrial stormwater permit, the development and implementation of a SWPPP is one of the permit requirements.

SWPPP development includes a step-by-step process to ensure that pollutants do not enter the storm drain system or receiving waters. BMPs include scheduling activities to reduce the potential for offsite migration of pollutants, such as not scheduling activities immediately before or during rainstorms; prohibiting certain practices, such as the outside storage and use of chemicals; requiring specific maintenance procedures; and other management practices to prevent or reduce pollution. A set of worksheets and a model plan are available in EPA's (1992) Stormwater Management for Industrial Facilities: Development Pollution Prevention Plans and Best Management Practices Summary Document to assist municipal operators. This document describes the five major phases of developing a pollution prevention plan: (1) planning and organization, (2) assessment, (3) BMP selection and plan design, (4) implementation, and (5) evaluation and site inspection.

Planning and Organization: An individual should be designated who will be responsible for developing and implementing the municipal facility SWPPP and other existing environmental facility plans, such as plans governing pesticide use or hazardous materials storage, to ensure consistency and overlap. The municipality should build on relevant portions of other environmental plans as appropriate, although it is important that the SWPPP be a comprehensive, stand-alone document.

Assessment: Municipal facilities that have been identified as having potential to contribute pollutants to the storm drain system should be inspected to identify possible pollution sources and BMP implementation opportunities. It is helpful to create a map of the facility site that identifies pollutant sources, storm drains, drainage ditches, BMPs requiring periodic maintenance, and areas suitable for new BMP implementation or retrofit. The municipality should also conduct an inventory of potentially polluting materials, evaluate past spills and leaks, identify and eliminate sources of nonstormwater discharges and illicit connections, collect and evaluate any existing stormwater quality data, and summarize the findings of the assessment.

Identify BMPs: BMPs should be selected with special consideration given to areas where materials are handled or stored, outdoor processing areas, loading and unloading areas, and onsite waste management and disposal areas. At a minimum, the plan should address appropriate good housekeeping, preventive maintenance, spill prevention and response, erosion and sediment control, and structural stormwater management controls. Employee training, visual inspections, recordkeeping, and reporting should be addressed and included in the SWPPP as well. Additional activity- or site-specific BMPs might also be appropriate.

Implementation: The selected stormwater BMPs should be implemented according to a schedule that reflects the priority level and funding/labor constraints. Also, all municipal employees should receive training to understand and carry out the goals of the SWPPP.

Evaluation: Periodic site evaluations should be conducted and records should be kept of BMP implementation, illicit discharge or spill incidents, employee training, inspections, and monitoring, if any is being conducted. The plan should be revised if parts are shown to be ineffective or if activities or conditions at the facility change.

Limitations

Developing and implementing an effective SWPPP at a municipal facility requires time and commitment, not only from managers, but also from staff and laborers. After development of the SWPPP, facilities should be self-inspected annually, with regular inspections conducted more often to detect leaks, spills, or other pollution issues as soon as possible. Also, without the proper training, municipal employees can be unable or unwilling to implement and maintain the BMPs included in the SWPPP.

Case Studies

The following are examples of municipalities that have successfully implemented municipal facility BMPs. Links are provided for more information.

- The City of Gresham, Oregon, conducted an internal audit of a local maintenance yard where materials such as paint, gasoline, oil, grease, pesticides, and herbicides are stored to identify problems and recommend changes that would improve stormwater quality (see Municipal Stormwater Toolbox for Maintenance Practices). Municipal staff studied stormwater drainage on the site, inventoried equipment and materials, determined the potential for polluting stormwater, inspected the outfalls to a local creek, and interviewed facility operators to learn about existing practices. By participating in the audit, all the facility operators were educated about stormwater drainage and quality and are now actively involved in implementing solutions (Oregon Association of Clean Water Agencies, 1998).

- The City of Santa Monica, California, has implemented numerous practices to control dry and wet weather discharges from municipal areas and activities and has conducted urban runoff training for city employees (USEPA, 2004).

Cost Considerations

The costs of formalizing stormwater management at municipal facilities will vary by facility and by municipality. The majority of the costs are associated with the staff time necessary to develop a SWPPP, train staff, and inspect the facilities to ensure that selected BMPs are applicable and effective.

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Municipal Employee Training and Education

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Municipal employee training programs should be designed to teach staff about potential sources of stormwater contamination and ways to minimize the water quality impact of municipal activities, such as park and open space maintenance, fleet and building maintenance, construction and land disturbances, and storm drain system maintenance. Training programs should include a general stormwater awareness message, pollution prevention/good housekeeping measures, Spill Response and Prevention, and information about the operation and maintenance of structural best management practices (BMPs). Training programs also should include information on stormwater pollution prevention plans (SWPPPs) for municipal facilities and BMPs recommended for use in the field to prevent contaminated discharges. Finally, municipal field staff should be trained to recognize, track, and report illicit discharges.

Applicability

Municipal employees who are directly involved in potentially polluting activities should receive both general stormwater and targeted BMP training tailored to their activities. This will increase the likelihood that receiving waters and the storm drain system will be protected from inadvertent discharges and spills. It is important to train all municipal staff, however, regardless of field responsibilities, about general stormwater awareness and the detection of illicit discharges. Very often, municipal staff are residents as well, and improving the awareness of municipal employees may reduce residential impacts and increase reporting of illicit discharges, dumping, and spills. Also, because municipalities expect residents and business owners to practice pollution prevention and good housekeeping, municipal employees should set an example for the rest of the community to follow.

Siting and Design Considerations

Municipal employees can be educated about stormwater issues in a number of ways: in-house training programs, on-the-job reinforcement, general awareness and educational materials, and workshops or conferences.

Most municipalities have established training programs for field maintenance staff to address safety, materials handling, waste disposal, or other issues. Typically, in-house training formats include formal, classroom style programs that are usually held on an annual basis, and more frequent, informal "tailgate" meetings. Tailgate meetings are usually held weekly to update staff on current issues and tasks, but they often incorporate short training sessions as well. More comprehensive training is usually conducted when new employees are hired or existing employees are looking to be promoted. Basic stormwater information and details about pollution prevention and BMPs can be incorporated into these existing formats. Whenever possible, additional in-field training should be provided to demonstrate proper implementation of operation and maintenance of BMPs and housekeeping measures at

municipal facilities. Videos are also useful tools that may be used during training. For example, the North Central Texas Council of Governments developed a video entitled Preventing Stormwater Pollution: What We Can Do" along with an accompanying Stormwater Pollution Prevention Training Module Series, as tools to assist local governments and state agencies in training their employees on stormwater pollution (North Central Texas Council of Governments, no date). In addition, the City of Memphis has developed training for private industrial facility operators that can be modified to apply to municipal facility maintenance staff and managers (City of Memphis, 2004).

After training, it is helpful for managers to periodically check employees' work practices to ensure BMPs are implemented properly. Periodic unscheduled inspections of facilities and maintenance activities will allow managers to gauge what has been learned. Posting reminders, such as markers above drains prohibiting discharges of vehicle fluids and wastes, or signs above faucets reminding employees not to use water to clean up spills will remind employees of proper procedures. Stickers that list important information and contact numbers for reporting illicit discharges, dumping, or spills can be adhered to all municipal vehicles. Stenciling or marking all storm drains at municipal facilities will prompt employees to be conscious of discharges. Facility SWPPPs and BMP guidance documents should be available to all employees as a reference to use after training.

All municipal staff can benefit from general stormwater information. Some municipalities provide general stormwater awareness information in new employee training. Paycheck inserts or email notices with information about household practices to reduce stormwater impacts or ways to recognize an illicit discharge can increase overall awareness. Stormwater posters or displays in common areas of municipal buildings educate both employees and members of the community. The Alameda Countywide Clean Water Program has developed a number of pollution prevention brochures that could be modified for municipal use (Alameda Countywide Clean Water Program, 2005), and EPA has developed posters, fact sheets, guidebooks and other tools that could be used as well (U.S. Environmental Protection Agency, 2005a). The City of Los Angeles has developed an online handbook to educate city staff about stormwater issues (City of Los Angeles Stormwater Program, no date). Many additional training resources can be found at the North Central Texas Council of Governments Pollution Prevention Training Resources Compilation website (North Central Texas Council of Governments, 2003).

Workshops and conferences about pollution prevention and stormwater management BMPs are offered by numerous federal and state agencies and professional and nonprofit organizations. For example, EPA sponsors workshops and conferences on a variety of stormwater topics, and many states provide stormwater trainings as well (U.S. Environmental Protection Agency, 2005b). These courses are useful if the municipality owns and manages a landfill, or other facility, that requires coverage under an industrial stormwater permit. Employees can learn how to comply with the latest stormwater management regulations, how to develop required stormwater pollution prevention plans, which BMPs to use at a particular facility or site, and methods for collecting and handling samples. By attending these outside events, municipal staff can keep up-to-date on current BMPs and stormwater management approaches while networking with other municipal employees and representatives from industry and regulatory agencies.

Limitations

Comprehensive stormwater training can be hampered by limited staff time, funding constraints, or lack of commitment from management. To combat these problems, stormwater training can be incorporated into existing training programs. Also, training materials and BMP guidance documents are available free of charge on the Internet. For example, Caltrans provides training materials for BMPs to be used during highway construction (California Department of Transportation, 2003).

Cost Considerations

Costs for implementing an in-house employee training program are related to labor and associated overhead costs. Trainers can reduce direct costs by using free educational materials or training tools that are already developed.

General education materials can also be reproduced inexpensively by using existing resources and tools.

Workshops or conferences presented by outside organizations, agencies, or groups can vary in cost. Often these workshops are free or provided for a nominal fee. Many private companies and groups also provide training. For example, the Environmental Resource Center offers a one-day seminar on how to manage industrial stormwater discharges for $499 per person (Environmental Resource Center, no date).

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Municipal Landscaping

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

A typical composting bin (Source: Alameda County Waste Management Authority, 2001)

Lawn and garden activities can contaminate stormwater with pesticide, soil, and fertilizer runoff. Proper landscape management, however, can effectively reduce water use and contaminant runoff, and enhance a property's aesthetics. Environmentally friendly landscape management protects the environment through careful planning and design, routine soil analysis, appropriate plant selection, use of practical turf areas and mulches, efficient water use, and appropriate maintenance.

Other activities that benefit water resources include maintaining healthy plants and lawns, and composting lawn wastes. Healthy plants better resist diseases and insects. Therefore, they require fewer pest control measures. To promote healthy plants, it is often beneficial to till composted material into the soil. Recycling of garden wastes by composting is also effective at reducing waste, although compost bins and piles should not be located next to waterways or storm drains because leachate from compost materials can cause contamination.

There are several benefits to environmentally friendly landscape design. First, proper site planning can reduce maintenance requirements by selecting native species and locating plants in areas where conditions are optimal for growth requirements. Soil analysis can prevent overapplication of fertilizers by eliminating uncertainty regarding existing soil fertility. Careful selection of turf can minimize watering and fertilizer requirements by choosing grasses that thrive in a particular climate. Minimizing turf area by replacing it with ground cover, shrubs, and trees reduces mowing requirements, which subsequently reduces air, water, and noise pollution. Efficient watering practices reduce pollutant transport and erosion from runoff of wasted water. Mulches stabilize exposed soils, prevent growth of nuisance vegetation, and improve soil fertility through the slow release of nutrients from decomposition. Finally, the reduction or judicious application of pesticides and fertilizers reduces the probability of contamination, while ensuring that the maintenance requirements of vegetation are being met.

It is important for municipalities to set a good example for residents. To encourage the use of less-toxic alternatives by municipal crews, King County, Washington, and the City of Seattle voluntarily phased out the use of dozens of pesticides (Johnson, 1999). The decision followed criticism that while the municipalities were urging residents to stop using weed killer and pesticides in yards to help endangered Chinook salmon, they were allowing municipal crews to apply herbicides in municipal parks and along roadsides. Based on a study by the City of Seattle, the municipalities phased-out the use of all hazardous Tier 1 chemicals. Major health

and safety concerns from pest outbreaks are excepted from the phase-out. Environmental groups support the phase-out and hope to see zero pesticide use in the future. Groups representing agriculture, landscaping, and timber interests oppose the plan. They warn that overwhelming weed, mosquito, and rat problems will result. More information can be found at the Seattle Pesticide Reduction website.

Applicability

Municipalities can use environmentally friendly lawn and garden practices on their properties, and they can encourage residents to use the same practices in their yards. Such practices include landscape planning, integrated pest management, planting indigenous species, soil testing, and the reduction, elimination or judicial use of fertilizers and pesticides. Planting drought-resistant plants and using Water Conservation Practices for Homeowners can be especially useful in areas of low rainfall. Areas of high rainfall experience more erosion, so protecting exposed soils with vegetation and mulches is of particular importance in these areas.

Siting and Design Considerations

The following guidelines describe ways in which municipalities can promote environmentally friendly landscaping techniques:

General Programs. An effective public education campaign can help landowners understand the value of good yard practices. The Florida Yardstick, part of the Florida Yards and Neighborhoods Program (University of Florida Cooperative Extension Service, no date), helps landowners evaluate their yard. A 19 x 37 inch poster of a yardstick indicates credits homeowners have earned for recycling, fertilizing, selecting indigenous plants, and so on. The credits represent inches, the best yards adding up to 36. Landowners meeting the 36 inch goal are rewarded with a certificate. More information can be found at the Florida Yardstick website.

Planning and Design. It is important that property owners develop a landscape plan that recognizes the property's natural conditions. For example, a landscape plan should recognize regional and climatic conditions. It should consider the site's topography and existing vegetation, and group plants together according to their water needs. The site's intended use should be considered. A thoughtful landscape plan will promote natural vegetation growth and minimize water loss and contamination. Residents and municipal crews can partner with local nurseries and irrigation and lawn services to determine appropriate landscape designs for a specific site.

Soil Analysis and Improvements. Residents and municipal crews should be encouraged to test soils every 3 to 4 years to determine the amount of nutrients necessary to maintain a healthy lawn. Municipalities can encourage home and garden centers to market and sell soil test kits so that property owners can perform such tests on their own. A local extension service can also perform soil analyses, and their representatives can then provide suggestions for improving a site's ability to retain water and to support specific vegetation.

Appropriate Plant Selection. Encourage property owners and municipal crews to choose local or regional plants when developing an environmentally friendly landscape. Indigenous plant species are generally more water efficient and disease resistant. Furthermore, exotic plants can potentially invade local waterways. Local nurseries can assist in choosing appropriate regional plant species.

Practical Turf Areas. Property owners and municipal crews should be encouraged to plant non-turf areas where possible, because lawns require more water and maintenance than wildflowers, shrubs, and trees. If turf is used, it is important to select a type of grass that can withstand drought and that becomes dormant in hot, dry seasons. Local nurseries can assist property owners and municipal crews with selecting grass types. In addition, when maintaining lawns, the grass should not be cut shorter than 3 to 4 inches in height. Mulched clippings should be left on the lawn as a natural fertilizer.

Efficient Irrigation. Much of the water that is applied to lawns and gardens is not absorbed by the vegetation. When water is applied too quickly, it is lost as runoff along with the top layers of soil. To prevent this, it is important to encourage the use of low-volume watering approaches such as drip-type or sprinkler systems. In addition, encourage property owners and municipal crews to water plants only when needed to enhance plant root growth and avoid runoff problems.

Use of Mulches. Mulches help retain water, reduce weed growth, prevent erosion, and improve the soil for plant growth. Mulches usually contain wood bark chips, wood grindings, pine straws, nut shells, small gravel, or shredded landscape clippings. Property owners should be encouraged to use mulches and should be informed of the benefits of these materials. Additionally, municipalities can start a program to collect plant materials from municipal maintenance activities as well as yard waste from property owners. These materials can be converted to mulch and used at municipal properties or redistributed to property owners.

Fertilizers. Property owners and municipal crews should be discouraged from using fertilizers, or if they are used, from over-applying them. Municipalities can recommend less-toxic alternatives to commercial fertilizers, such as composted organic material.

Municipalities can also recommend practices to reduce the amount of fertilizer entering runoff. For example, slow-release organic fertilizers are less likely to enter stormwater. Application techniques, such as tilling fertilizers into moist soil to move the chemicals directly into the root zone, reduce the likelihood that the chemicals will be mobilized in stormwater. Timing is also important: Warm season grasses should be fertilized in the summer, in frequent and small doses, while cool season grasses should be fertilized in the fall. Also, fertilizer should not be applied on a windy day or immediately before a heavy rain. Municipalities can recommend that property owners apply fertilizer at rates at or below those recommended on the packaging or should apply fertilizer based on the needs of the soil (as determined by a soil test). Safe disposal of excess fertilizer and containers should be encouraged. (see Proper Disposal of Household Hazardous Wastes fact sheet.)

Pesticides. Like fertilizers, pesticides should be used on lawns and gardens only when necessary. Pesticide use can be avoided by selecting hearty plants that are native to the area and by keeping them healthy. It is important to identify any potential pests to determine if they are truly harmful to the plant. The pests should always be removed by hand when possible; chemical pest control should be used only when other approaches fail. If it is necessary to use chemical pesticides, the least toxic pesticide that targets the specific pest in question should be chosen (i.e., boric acid, garlic, insects, etc). If a pesticide is labeled with the word "caution," it is less toxic than one labeled "warning," which is, in turn, less toxic than one that is labeled "danger/poison."

It is important to follow the label directions on the pesticide. Property owners and municipal crews must wear the appropriate protective equipment listed on the label when working with organophosphate insecticides or concentrated sprays or dusts. Read and follow all safety precautions listed on pesticide labels and wash hands and face before smoking or eating. Tools or equipment that were used to apply or incorporate pesticides should always be rinsed in a bucket and the rinse water applied as if it were full-strength pesticide. Any unused pesticide can be saved and disposed of at a household hazardous waste collection location. (see Proper Disposal of Household Hazardous Wastes fact sheet.)

Ordinances. Municipalities can use ordinances as a means of controlling or preventing pesticide usage in the future. For example, the city of Arcata, California, created an ordinance that officially eliminated the use of pesticides on all city properties (Californians for Alternatives to Toxics, 2000). This ordinance followed a 14-year moratorium on pesticides in which the city council and a citizen's task force researched less-toxic alternatives to pesticide use. Municipal workers adapted to the moratorium by devising innovative pest control methods, such as covering the infield dirt in the baseball stadium with tarps between games to prevent weed growth. Other methods that Arcata crews used to prevent weeds included planting local plant species adapted to the city's climate; timely mowing, irrigating, weeding, and thatching lawns; and performing regular street maintenance such as sweeping and crack sealing. The ordinance also mandates the creation of a pest control management plan that will be linked to the city's stormwater discharge program and includes a public education component. The text of the ordinance can be found at the Californians for Alternatives to Toxics website.

Limitations

There are virtually no limitations associated with implementing environmentally friendly lawn and garden practices. Some practices are more applicable in certain climates (for example, there is little need for irrigation practices in areas of very high rainfall), but in general, all practices are low cost and relatively easy to implement. With guidance from a local environmental agency, extension service, or nursery, proper decisions can be made regarding which practices are best for the site in question.

Effectiveness

Using proper landscaping techniques can effectively increase the value of a property while benefiting the environment. Attractive, water-efficient, low maintenance landscapes can

increase property values between 7 and 14 percent (USEPA, 1993). These practices also benefit the environment by reducing water use; decreasing energy use (because less water pumping and treatment is required); minimizing runoff of storm and irrigation water that transports soils, fertilizers, and pesticides; and creating additional habitat for plants and wildlife.

Cost Considerations

Proper landscape activities are very cost effective. Promoting the growth of healthy plants that require less fertilizer and pesticide applications minimizes labor and maintenance costs of lawn and garden care. Using water, pesticides, and fertilizers only when necessary and replacing store-bought fertilizers with compost material can increase the savings for a property owner as well as benefit the environment.

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Municipal Vehicle Fueling

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Fueling fleets of municipal vehicles can generate spills and leaks of fuel (gasoline and diesel fuel) and heavy metals - disproportionately toxic compounds that if washed into the storm drain system by stormwater runoff can seriously impair the water quality of nearby waterbodies. To prevent such discharges, municipal officials can employ a variety of BMPs. They frequently have municipal vehicles refueled at offsite facilities, and then only in designated areas. They store fuel in enclosed, covered tanks. They implement spill controls and train employees and subcontractors in proper fueling procedures (CASQA, 2003a).

This fueling island is roofed and absorbent materials are provided in case of spills. However, the used absorbent hasn't been swept up and disposed of properly.

Applicability

Municipal activities require the use of a variety of vehicles and equipment, such as transit buses, fire trucks, police cruisers, school buses, and public works and maintenance vehicles. These vehicles may refuel at facilities located at numerous municipal facilities. The BMPs suggested in this fact sheet apply to fueling operations regardless of location.

Siting & Design Considerations

Designated fueling areas should be designed to prevent stormwater runoff and spills. The California Stormwater Quality Association recommends that fuel-dispensing areas be paved with cement, concrete, or an equivalent impervious surface, with a two to four percent slope to prevent ponding, and separated from the rest of the site by a grade break or berm that prevents run-on of stormwater.

Fuel dispensing areas should 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. The cover should not drain onto the fuel dispensing area. Use a perimeter drain or slope the pavement inward so that runoff drains to a blind sump. It might be necessary to install and maintain an oil control device in catch basins that might receive runoff from the fueling area.

For facilities where equipment is being fueled with a mobile fuel truck, consider establishing a designated fueling area. Place temporary "caps" over nearby catch basins or manhole covers so that if a spill occurs it is prevented from entering the storm drain (CASQA, 2003b).

A form of secondary containment should be used when transferring fuel from the tank truck to the fuel tank. Storm drains in the vicinity should also be covered. Install vapor recovery nozzles to help control drips as well as reduce air pollution (CASQA, 2003b).

All facilities with fueling areas should have a spill prevention plan and necessary spill kits located nearby. A spill prevention plan specifies material handling procedures and storage requirements, and identifies spill cleanup procedures for areas and processes in which spills may potentially occur. The plan standardizes operating procedures and employee training in an effort to minimize accidental pollutant releases that could contaminate stormwater.

Limitations

Old, outdated equipment and facilities can limit the implementation of appropriate vehicle fueling BMPs. Many municipal fueling areas are uncovered, poorly located or drained, or use equipment prone to leaking or spills. It can be costly to retrofit existing facilities or build new fueling islands that provide a greater degree of stormwater protection. Retraining staff and regularly inspecting facilities also requires staff time.

Maintenance Considerations

Fuel-dispensing areas should be inspected regularly. Inspectors should:

- Check for external corrosion and structural failure in aboveground tanks.
- Check for spills and overfills due to operator error.
- Check for failure of any piping systems.
- Check for leaks or spills during pumping of liquids or gases from a truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installations for loose fittings, poor welds, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, tank walls, and piping systems. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Above-ground tanks should be tested periodically for integrity by a qualified professional.

Dry cleanup methods should be employed when cleaning up fuel-dispensing areas. Such methods include sweeping to remove litter and debris and using rags and adsorbents for leaks and spills. Water should not be used to wash these areas. During routine cleaning, use a damp cloth on the pumps and a damp mop on the pavement, rather than spraying with a hose (Sacramento Stormwater Management Program, 1992). Fuel dispensing nozzles should be fitted with "hold-open latches" (automatic shutoff) except where prohibited by local fire departments. Signs can be posted at the fuel dispenser or island warning vehicle owners/operators against "topping off" vehicle fuel tanks.

Written procedures should be provided to employees who will be using fueling systems that describe these BMPs.

Effectiveness

It is difficult to quantify the effectiveness of vehicle fueling BMPs. However, experience has shown that implementing such BMPs will reduce the likelihood of spills reaching receiving waters. Furthermore, a related study on stormwater runoff from an auto recycling facility found that stormwater management practices and pollution prevention techniques can decrease the concentration of pollutants in stormwater runoff (Swamikannu 1994). Like municipal fueling facilities, auto recycling facilities typically contain higher concentrations of oil, phenols, BOD, metals, and other pollutants compared to other sources. Through the use of structural and non-structural pollution prevention BMPs, the 10-year study of a 17-acre auto-recycling facility in Los Angeles was able to show substantial reductions in the concentrations of metals, oil, and grease. The full study (Auto Recycler and Dismantler Facilities: Environmental Analysis fo the Industry with a Focus on Stormwater Pollution) is currently available (as of 4/10/06). For summary information of the study, see Article 140 in the Practice of Watershed Protection.

Cost Considerations

To avoid future maintenance costs, new and substantially remodeled facilities should implement high-quality design techniques during the initial installation. Retrofitting existing fueling areas with BMPs to help minimize stormwater exposure or spills can be expensive. Staff time for training new-hires, along with staff time for periodic re-training of other employees, will also need to be considered. Spill kits should be purchased and made available at each fueling area and on each mobile fueling truck. Spill kits capable of cleaning-up five to six gallons of spilled liquid, and that include socks, pads, gloves, one or more disposal bags, and a watertight container, range in cost from $24 to $74. A 16- to 20-gallon spill kits cost $85 to $149.

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Municipal Vehicle and Equipment Maintenance

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Common activities at municipal maintenance shops include parts cleaning, vehicle fluid replacement, and equipment replacement and repair. Automotive maintenance facilities are considered to be stormwater "hot spots." Hotspots are areas that generate significant loads of hydrocarbons, trace metals, and other pollutants that can affect the quality of stormwater. Some of the wastes generated at automobile maintenance facilities include:

- Solvents (degreasers, paint thinners, etc.)
- Antifreeze
- Brake fluid and brake pad dust
- Battery acid
- Motor oil
- Fuel (gasoline, diesel, kerosene)
- Lubricating grease

This small auto repair shop performs work outdoors without a roof and without berms or other containment for spills, which increases the threat of stormwater pollution.

Fluid spills and improper disposal of materials result in pollutants, heavy metals, and toxic materials entering ground and surface water supplies, which can create public health and environmental risks. Municipal facilities that properly store automotive fluids and thoroughly clean up spills can help reduce the effects of automotive maintenance practices on stormwater runoff and, consequently, local water supplies.

Applicability

Municipal activities require the use of various vehicles and equipment, such as public works operation and maintenance vehicles, police cars, fire trucks, and school and public transit buses. Maintenance facilities may be located at several municipal facilities. An estimated 180 million gallons of used oil is improperly disposed of annually (Alameda CCWP, 1992), and just a single quart of motor oil can pollute 250,000 gallons of drinking water. For this reason, automotive maintenance facilities' discharges to storm and sanitary sewer systems are highly regulated. For more information on educating the public and commercial businesses about vehicle maintenance, see the Stormwater Outreach for Commercial Businesses fact sheet.

Siting and Design Considerations

The most effective way to minimize wastes generated by automotive maintenance activities is to prevent their production in the first place. Pollution prevention programs trying to reduce polluted liquid discharges from automotive maintenance facilities to storm drains should stress "dry shop" techniques. Among suggestions for creating a dry operation:

- All maintenance activities should be performed inside or under cover.
- Spills should be cleaned up immediately, without water whenever possible and clean up materials disposed of properly.
- Floor drains should be sealed.
- A solvent service can be hired to supply parts and cleaning materials and to collect spent solvent.

Facilities that discharge to the sanitary sewer system may be required to treat their wastewater prior to its release from the site. Some municipalities require the use of structural treatment devices to pretreat wastes before they are discharged to sewage treatment plants. These devices prevent oils and grease from entering the sewer system, often by separating the oil and solids from the water through settling or filtration.

Other methods can also help prevent or reduce pollutant discharges from vehicle maintenance facilities. The following suggestions can reduce vehicle maintenance and repair impacts. Many of these practices apply both to business owners and to residents who maintain their own vehicles. These practices also apply to the maintenance of school buses, public works, fire, police, parks, and other types of municipal fleets. The following list is not comprehensive. Many other suggestions for reducing impacts are available to those responsible for managing stormwater from maintenance facilities.

Waste Reduction

- Keep the number of solvents used to a minimum. It makes recycling easier and it reduces hazardous waste management cost.
- Do all liquid cleaning at a centralized station to ensure that solvents and residues stay in one area.
- Locate drip pans and draining boards to direct solvents back into a solvent sink or holding tank for reuse.

Use of Safer Alternatives

- Use non-hazardous cleaners when possible.
- Replace chlorinated organic solvents with nonchlorinated ones like kerosene or mineral spirits.
- Purchase recycled products, such as engines, oil, transmission fluid, antifreeze, and hydraulic fluid, to help support the recycled products market.

Spill Containment and Cleanup

- Install berms or other measures to contain spills and prevent work surface runoff from entering storm drains.
- Use as little water as possible to clean spills, leaks, and drips.
- Follow the spill prevention plan.

Good Housekeeping

- Reinforce employee training and public outreach to reinforce proper disposal practices.
- Conduct maintenance work such as fluid changes indoors.
- Update facility schematics to accurately reflect all plumbing connections.
- Closely monitor parked vehicles for leaks and place pans under any leaks to collect the fluids for proper disposal or recycling.
- Promptly transfer used fluids to recycling drums or hazardous waste containers.
- Dispose of liquid waste properly.
- In the event of a spill, cover drains with drain mats.
- Store cracked batteries in leakproof secondary containers.

Parts Cleaning

- Use detergent-based or water-based cleaning systems instead of organic solvent degreasers.
- Steam clean or pressure wash parts instead of using solvents. Water discharged into the sanitary sewer may require treatment prior to release. You should check with the sewer authority to determine if treatment is required. The wastewater generated from steam cleaning can be discharged to the on-site oil/water separator, but remember that such separators must be periodically maintained to ensure their effectiveness.

Limitations

There are a number of limitations to implementing recommendations for automotive maintenance facilities. Space and time constraints may rule out indoor work. Containing spills from vehicles brought on-site after working hours may be impossible. Education for employees on proper disposal of wastes must continually be updated. Installing structural BMPs for pretreatment of wastewater discharges can be expensive. Recycled materials and fluids may cost more than non-recycled materials. Some facilities can be limited by a lack of recycled materials providers. Other facilities can be limited by the absence of business that provide hazardous waste removal, structural BMP maintenance, solvent recycling, or other services.

Maintenance Considerations

Outdoor areas, especially parking areas for vehicles awaiting repair, should be inspected regularly for drips, spills and improperly stored materials (unlabeled containers, auto parts that might contain grease or fluids, etc.). Good housekeeping is an important step in reducing stormwater pollution in these hotspot settings.

The proper functioning of structural BMPs is an important maintenance consideration for facilities responsible for pretreating their wastewater prior to discharging.. To maintain their effectiveness, the devices require routine cleanout of oil and grease, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure that pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.

Effectiveness

It's difficult to quantify the effectiveness of automotive maintenance best management practices at removing pollutants. However, there are studies that demonstrate that pollution prevention practices can reduce the impacts of automotive fluids. A 1994 study of auto recycling facilities found that best management practices can reduce stormwater toxicity and pollutant loads. Through the use of structural and nonstructural BMPs, the study facility was able to reduce concentrations of lead, oil, and grease to levels approaching USEPA benchmarks (CWP, 1995).

Palo Alto, California, has instituted a program that has had great success in controlling contaminated flows from vehicle maintenance facilities. The Clean Bay Business Program offers local business the opportunity to be officially recognized as an environmentally responsible retailer. In exchange for allowing inspectors to visit once a year, and for agreeing to implement recommended management practices, participating businesses earn the designation of a Clean Bay Business. In doing so, they gain promotional opportunities like twice annual listings in full-page newspaper ads, decals for shop windows, and other Clean Bay Business materials. Other promotions, like prize drawings and discount coupon giveaways, help generate additional business for participants. The number of businesses that have received the Clean Bay Business designation has risen steadily since the program's inception. In 1992, when the program began, only four percent of businesses used all the recommended management practices. By 1998, that number had risen to 94 percent (NRDC, 1999).

The program's success in altering the behaviors of participating business resulted in the following:

- The elimination of 78 direct discharges to storm drains by ceasing or modifying the practices used in parking lot cleaning, vehicle washing, wet sanding, and other activities.
- A 90 percent drop in violations of storm drain protection requirements from 1992 through 1995.

- The number of shops conducting outdoor removal of vehicle fluids without secondary containment fell from 43 to 4.

Cost Considerations

The initial cost for Palo Alto's program was approximately $300. Each subsequent year costs $150. The cost includes inspector's visits and follow-up work, outreach materials, mailing lists, and database management. The program has been expanded to include auto parts stores and outreach to local high schools and adult education repair classes.

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Municipal Vehicle and Equipment Washing

Pollution Prevention/Good Housekeeping for Municipal Operations

Description

Municipal vehicle washing can generate dry weather runoff contaminated with detergents, oils, grease, and heavy metals. Vehicle washing BMPs can eliminate contaminated wash water discharges to the sanitary sewer system. Such BMPs include installing wash racks that discharge wash water to the sanitary sewer, and contracting the services of commercial car washes, which are permitted to discharge wash water to the sanitary sewer system. Finally, employees and subcontractors should be trained in the municipality's vehicle washing procedures to avoid illicit discharges.

Applicability

Municipalities typically operate a fleet of vehicles, including public works trucks, fire trucks, ambulances, police cars, school buses, and other types of vehicles. Municipalities with a large fleet of vehicles might consider building municipal-operated vehicle washing facilities. Municipalities with small fleets might consider contracting with a commercial car wash. Municipalities that own and operate concrete trucks should look at the Concrete Washout fact sheet for proper washing procedures. For information on how to educate the public about reducing pollution while washing personal vehicles, see the Residential Car Washing and Stormwater Outreach for Commercial Businesses fact sheets.

Siting & Design Considerations

Wash Racks

When installing a wash rack at a municipal facility, several design features should be considered. A designated wash area should be paved and bermed or sloped to contain and direct wash water to a sump connected to the sanitary sewer or to a holding tank, process treatment system, or enclosed recycling system. Note that you must seek the permission of the sewer authority before discharging wastewater to the sanitary sewer, and that special treatment requirements may be placed on such discharges. Alternately, the wash rack could be designed to recycle wash water, thereby eliminating the pretreatment costs of discharging to the sanitary sewer.

The following good housekeeping practices can minimize the risk of contamination from vehicle wash water discharges at municipal facilities (adapted from CASQA, 2003):

- Wash all vehicles in areas designed to collect and hold wash water before its discharge to the sanitary sewer system. Normally, wastewater treatment regulations require wash water to be pretreated prior to its discharge to the treatment plant. Contact your sewer authority to ensure that all requirements are met before designing, building, and operating the wash rack.

- Avoid detergents whenever possible. If detergents are necessary, a phosphate-free, non-toxic, biodegradable soap is recommended. Detergents should be avoided if an oil/water separator is used for pretreatment prior to discharge to the sanitary sewer.
- Municipal facilities that store vehicles should stencil their storm drains to remind employees to wash vehicles within the designated wash area. Signage can also be posted with this message.
- Mount spill kits with absorbent containment materials and instructions near wash racks. Immediately contain and treat all spills.

Commercial Car Washes

Municipalities can negotiate with commercial car washes and steam cleaning businesses to handle their fleet vehicle washing. This option eliminates the cost of building and the liability of operating a wash facility. This option may be limited to smaller sized vehicles, however, since many car washes do not have bays large enough to handle buses, fire trucks, ambulances, and other large vehicles.

Other BMPs

If a vehicle must be washed outside of a facility plumbed to the sanitary sewer, take precautions to avoid wash water discharges to the storm drain system. For small jobs, berm the area surrounding the vehicle and use a wet/dry vacuum to capture the wash water for discharge to the sanitary sewer. For larger jobs, use a combination of berms and a vacuum truck, such as those used to clean storm and sanitary sewer systems, to capture and safely dispose of wash water. If detergents are used, clean the pavement to prevent this material from being carried to the storm drain during the next rainstorm.

Maintenance Considerations

A wash rack's paved surfaces and sump should be inspected and cleaned periodically to remove buildups of particulate matter or other pollutants. Plumbing, recycling, and pretreatment systems also require periodic inspection and maintenance. The area surrounding the wash rack should be visually inspected for leaks, overspray, or other signs of ineffective containment due to faulty design or physical damage to berms. Any defects should be corrected.

Limitations

Building a new wash rack can be expensive. Also, for facilities that cannot recycle their wash water, the cost of pretreating wash water prior to discharge to the sanitary sewer can represent a cost limitation. If the appropriate facilities are available, vehicle washing BMPs are relatively inexpensive housekeeping measures.

Effectiveness

Studies have yet to demonstrate the effectiveness of car washing management practices at reducing stormwater pollutant loads.

Cost Considerations

Municipal wash racks plumbed to the sanitary sewer can be expensive to build. They need to be pursued as a capital improvement project or through other measures based on your local policies for such projects. Costs for contracting with commercial car washes can vary depending on the size of the fleet. Rates are subject to negotiation, but they would constitute an annual operating cost that could be included as part of the municipal budget. Other measures to control discharge of incidental washing to the storm drain system (berms, wet/dry vacuums, etc.) are relatively inexpensive.

References

California Stormwater Quality Association (CASQA). 2004. California Stormwater Industrial/Commercial Best Management Practice Handbook. Stormwater Quality Task Force, Sacramento, CA.

Center for Watershed Protection. 1999. On Watershed Behavior. Watershed Protection Techniques 3(3): 671-679.