



a guide to commercial and industrial
best management practices



Clark County, NV

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Information in this manual adapted, with permission, from the Salt Lake County Stormwater Discharge Management for Industrial Activities Guidance Document available at <http://www.pweng.slco.org/stormwater/pdf/imatrix.pdf>.

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[Introduction]

Purpose of Manual

This manual provides a basic toolbox of BMPs that may be implemented at industrial and commercial facilities in order to reduce pollution to the storm sewer system.

Clark County Water Quality Planning

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(702)668-8674

www.ClarkCountyNV.gov

keyword – water quality

In Nevada’s arid climate, water is a precious resource. In addition to having enough water for our communities, it is essential that the water be of good quality to support swimming, fishing, drinking, irrigating, and other uses. While we’ve made a lot of progress in cleaning up specific sources of pollutants, our everyday actions continue to affect water quality. Water flowing over the land, whether from rain, car washing, or the watering of crops or lawns, picks up a variety of contaminants. These contaminants include oil, sediment, chemicals, nutrients, and toxic materials. The runoff finds its way into our waterways, either directly or through storm drain collection systems.

The term nonpoint source pollution is used to distinguish this type of pollution from point source pollution. Point source pollution comes from specific sources, such as sewage treatment plants or industrial facilities. Scientific evidence shows that although huge strides have been made in cleaning up major point sources, our precious water resources are still threatened by the effects of polluted runoff. In fact, the United States Environmental Protection Agency has estimated that polluted runoff is now the single largest cause of the deterioration of our nation’s water quality.

In the following pages you will find information on non-structural Best Management Practices, or BMPs, that can be used on industrial and commercial properties to limit the amount of stormwater pollution making its way to the Las Vegas Wash and Lake Mead. The BMPs listed in this manual are not specifically required by regulation, but are recommended for implementation as a part of your on-site training and stormwater management program.

Stormwater pollution in Unincorporated Clark County is regulated through Clark County Code Chapter 24.40. For more information on regulations governing stormwater management in Unincorporated Clark County, please visit www.ClarkCountyNV.gov – keyword: Water Quality or (702) 668-8674.

TARGETED POLLUTANTS

High Impact

- Sediment
- Nutrients
- Heavy Metals
- Toxic Materials
- Oxygen Demanding Substances
- Oil & Grease
- Floatable Materials
- Bacteria & Viruses



DESCRIPTION:

Employee training is your first-line BMP and should be used in conjunction with all other BMPs in use at your facility. The information provided in this manual provides information on BMPs and can be used to train employees on important stormwater protection practices.

To inquire about, or schedule, stormwater training through Clark County, please contact the Water Quality Planning Division at (702) 668-8674 or at waterquality@cleanwaterteam.com.

OBJECTIVES:

Employee training should be based on four objectives:

- Promote a clear identification and understanding of the problem, including activities with the potential to pollute stormwater;
- Identify solutions (BMPs);
- Promote employee ownership of the problems and the solutions; and
- Integrate employee feedback into training and BMP implementation.

APPROACH:

- Integrate training regarding stormwater quality management with existing training programs that may be required for your business by other regulations.
- Businesses that are not regulated in Federal, State, or local regulations, may use the information in this Handbook to develop a training program to reduce their potential to pollute stormwater.
- Employee training is a vital component of many of the individual source control BMPs included in this manual.



BMP [NON-STORMWATER DISCHARGES]

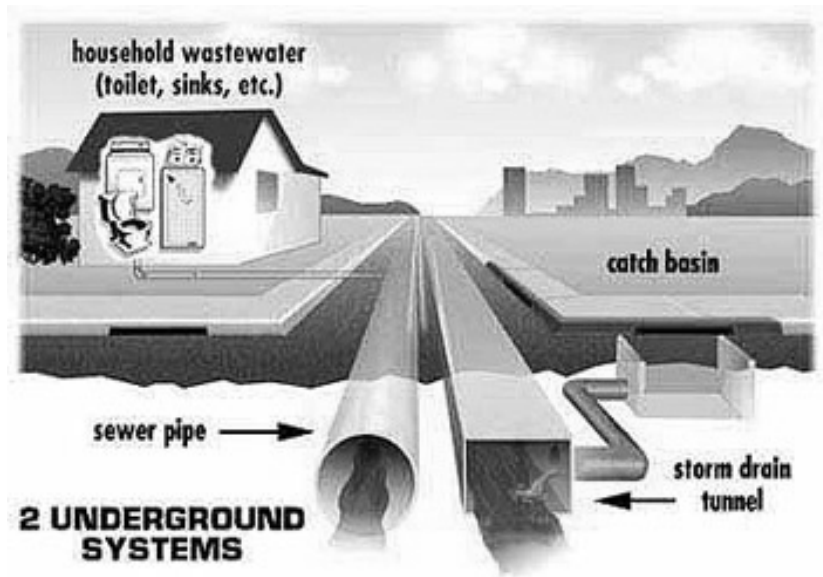
TARGETED POLLUTANTS

High Impact

- Nutrients
- Heavy Metals
- Toxic Materials
- Oxygen Demanding Substances
- Oil & Grease
- Bacteria & Viruses

High Impact

- Sediment
- Floatable Materials



DESCRIPTION:

Eliminate non-stormwater discharges to the stormwater collection system. Non-stormwater discharges may include: process wastewaters, cooling waters, wash waters, and sanitary wastewater.

APPROACH:

The following approaches may be used to identify non-stormwater discharges:

- **Visual inspection:** The easiest method is to inspect each discharge point during dry weather. Keep in mind that drainage from a storm event can continue for several days after the event and groundwater may infiltrate the underground stormwater collection system.
- **Piping Schematic Review:** The piping schematic is a map of pipes and drainage systems used to carry wastewater, cooling water, sanitary wastes, etc... A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system. Inspect the path of floor drains in older buildings.
- **Smoke Testing:** Smoke testing of stormwater collection systems is used to detect connections between the two systems. During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.
- **Dye Testing:** A dye test can be performed by simply releasing a dye into either the sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.
- **Training:** Train field personnel to identify non-stormwater discharges and report them to appropriate facility supervisors and management.

LIMITATIONS:

- Many facilities do not have accurate, up-to-date schematic drawings.
- Video and visual inspections can identify illicit connections to the storm sewer, but further testing is sometimes required (e.g. dye, smoke) to identify sources.



TARGETED POLLUTANTS

High Impact

- Sediment
- Nutrients
- Heavy Metals
- Toxic Materials
- Oxygen Demanding Substances
- Oil & Grease
- Floatable Materials

Medium Impact

- Bacteria and Viruses



DESCRIPTION:

Building and grounds maintenance requires good housekeeping practices as a method to control discharge of pollutants from your site. These procedures include maintenance activities and schedules, procedures for the proper disposal of waste, and long-term inspection and maintenance procedures for all portions of your site including:

- Parking lots
- Process areas
- Landscape areas
- Maintenance and storage yards

APPROACH:

- On undisturbed areas of your property, preserve existing native vegetation to reduce water, fertilizer, and pesticide needs.
- When necessary, carefully use pesticides and fertilizers in landscaping per manufacturer's recommendations.
- Integrate pest management where appropriate.
- Develop and implement a general maintenance schedule that includes a list of task and the frequency of their completion.
- Sweep paved surfaces on a scheduled basis.
- Employ dry clean-up methods whenever possible.
- Clean the storm drainage system at appropriated intervals.
- Properly dispose of wash water, sweepings, and sediments. Promote the recycling and reuse of products and clippings.
- Properly label, seal, and store chemicals and toxic materials under cover and/or within secondary containment.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable, or effective in every case.



BMP [SECONDARY CONTAINMENT]

TARGETED POLLUTANTS

High Impact

- Sediment
- Floatable Materials
- Nutrients
- Heavy Metals
- Oxygen Demanding Substances
- Oil and Grease
- Bacteria and Viruses



DESCRIPTION:

Secondary containment is a liquid tight barrier that will adequately contain materials that are released from a storage container. Secondary containment prevents spills, leaks, etc. from being released into the MS4 by containing runoff or routing it to treatment or control areas. Common forms of secondary containment include curbing, secondary containment pallets, double-walled tanks, and berms.

APPROACH:

- Secondary containment can be used at all industrial facilities. It is particularly useful in areas where liquid materials are transferred.
- Common curbing materials include earth, concrete, asphalt, synthetic materials, metal, or other impenetrable materials.
- For maximum efficiency, materials spilled within a curbed area should be removed immediately.
- Secondary containment areas should have pumping systems, instead of drainage systems, for collecting spilled materials.
- Secondary containment systems should be maintained through repair (patching/ replacement).
- To minimize the amount of spilled material tracked outside of the area by personnel and equipment, grade within the secondary containment area to direct the spilled away for the containment area's ingress/egress.

LIMITATIONS:

- Curbing is not effective for holding large spills.

MAINTENANCE:

- Inspection should be conducted before and after storm events.
- When certain spills occur, cleanup should start immediately, thus preventing overflows and contamination of stormwater runoff.
- Inspection should also be made to clear clogging debris, prevent dilution by rainwater, and to prevent overflow of any materials.
- Pumping of contaminants when necessary.



TARGETED POLLUTANTS

High Impact

- Toxic Materials
- Oil & Grease

High Impact

- Heavy Metals
- Oxygen Demanding Substances



DESCRIPTION:

Drip pans are used to catch drips from valves, pipes, etc. in order to prevent stormwater contamination. Drip pans can be structural depressions in concrete or asphalt, or can be temporary containment pans made of metal, plastic, or any material that does not react with the dripped chemicals. Although leaks and drips should be repaired and eliminated as part of a preventative maintenance program, drip pans can provide a temporary solution when repair or replacement must be delayed. In addition, drip pans can be an additional safeguard when positioned beneath areas where leaks and drips are likely to occur.

APPROACH:

- When using drip pans, consider the location of the drip pan, weather conditions, type of material used for the drip pan, and how it will be cleaned.
- The location of the drip pan is important. Because drip pans must be inspected and cleaned frequently, they must be easy to reach and remove. However, take special care to avoid placing drip pans where they can be easily overturned or may be a safety hazard.
- Develop an inspection schedule to ensure that drip pans are emptied. Frequently inspect areas where drip pans are used for:
 - Leaks in the drip pans.
 - Leaks in piping or valves that may require maintenance.
 - Irregular slow drips that may increase in volume and overwhelm the drip pan.

LIMITATIONS:

- Contain small volumes only.
- Must be inspected and cleaned frequently.
- Must be secured during poor weather conditions.
- Contents may be disposed of improperly unless facility personnel are trained in proper disposal methods.

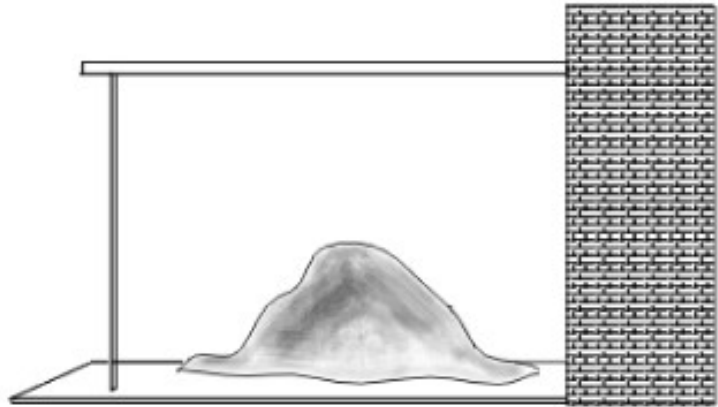
TARGETED POLLUTANTS

High Impact

- Sediment
- Heavy Metals
- Toxic Materials

Medium Impact

- Nutrients
- Oxygen Demanding Substances
- Oil & Grease
- Floatable Material



DESCRIPTION:

Covering certain areas or activities prevents stormwater from coming into contact with sources of pollutants and reduces material loss from wind blowing. Structural covers are partial or total physical enclosure of materials, equipment, process operations, or activities. Roofs, buildings, doghouses and other enclosures are examples of structural covering that are effective in preventing stormwater contamination. Tarps and plastic sheeting are examples of non-structural covers that can be effective in protecting materials from rainwater.

APPROACH:

- Structural covers are appropriate for outdoor material storage piles (e.g., stockpiles of dry materials, gravel, sand, compost, sawdust, wood chips, and de-icing salt) as well as areas where liquids and solids in containers are stored or transferred.
- While it may be too expensive to cover all industrial activities, cover high-risk areas first (e.g., chemical preparation areas, vehicle maintenance areas), then, according to budget, cover the rest of the materials.
- Evaluate the strength and longevity of the covering, as well as its compatibility with the material or activity being enclosed. Some materials that pose environmental and safety dangers require special considerations.
- When designing an enclosure, consider access to materials, their handling, and transfer.
- Covering alone may not protect the materials. When designing, consider placing materials on an elevated, impermeable surface, or build curbing around the outside of the materials to prevent problems run-on/run-off.
- If non-structural coverings are being employed (such as tarps or plastic sheeting), anchor coverings with stakes, tie-down ropes, large rocks, tires, or other easily available heavy objects.

LIMITATIONS:

- Requires frequent inspection.
- May pose health or safety problems if enclosure is built over certain activities.

MAINTENANCE:

- Frequently inspect coverings for rips, holes and general wear.



BMP [SIGNS AND LABELS]

TARGETED POLLUTANTS

High Impact

- Heavy Metals
- Toxic Materials

Medium Impact

- Oil & Grease



DESCRIPTION:

Signs and labels identify problem areas or hazardous materials at a facility. Warning signs, often found at industrial facilities, are a good way to suggest caution in certain areas. Signs and labels can also provide instructions on the use of materials and equipment. Labeling is a good way to organize large amounts of materials, pipes, and equipment, particularly on large sites.

APPROACH:

Signs and labels can be used at all types of facilities. Areas where they are particularly useful are material transfer areas, equipment areas, loading and unloading areas, or anywhere information might prevent contaminants from being released to stormwater.

Signs and labels should be visible and easy to read. All chemical / liquid containers stored outside are required to have labels identifying their contents. Additional signs and labels might provide the following information:

- Names of facility and regulatory personnel, including emergency phone numbers, to contact in case of an accidental discharge, spill, or other emergency.
- Proper uses of equipment that could cause release of stormwater contaminants.
- Types of chemicals used in high-risk areas.
- The direction of drainage lines/ditches and their destination (treatment or discharge).
- Information on a specific material.
- Refer to OSHA standards for sizes and numbers of signs required for hazardous material labeling.
- Label storm drain inlets with “Don’t Pollute, Drains to Lake Mead” or similar.

LIMITATIONS:

No limitations.

MAINTENANCE:

- Periodic checks can ensure that signs are still in place and labels are properly attached.
- Signs and labels should be replaced and repaired as often as necessary.



BMP [OUTDOOR STORAGE AND BULK MATERIAL]

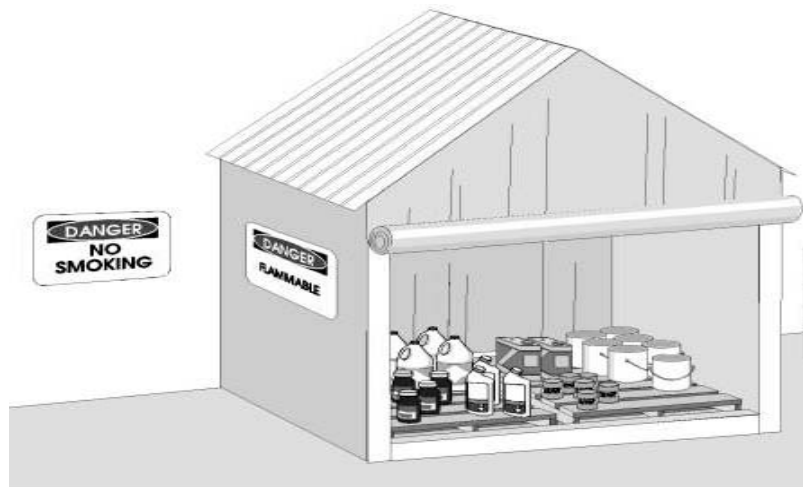
TARGETED POLLUTANTS

High Impact

- Sediment
- Heavy Metals
- Toxic Materials
- Oil & Grease
- Floatable Materials

Medium Impact

- Nutrients



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from outdoor materials and product storage areas by enclosing or covering materials, installing secondary containment, and preventing stormwater run-on.

APPROACH:

- Protect materials from rainfall, run-on, runoff and wind dispersal:
 - Store material indoors, when possible.
 - Cover the storage area with a roof.
 - Cover the material with a temporary covering made of polyethylene, polypropylene, or hypalon.
 - Minimize stormwater run-on by enclosing the area or building a berm around the area.
 - Use a secondary containment pallet for storage of liquid containers.
 - Employ the use of BMPs around stockpiles. BMPs may be non-structural (gravel bags, straw waddles, sorbent socks) or structural (berms, curbing).
- Parking lots or other surfaces near bulk materials should be swept periodically to remove debris blown or washed from storage area.
- Keep liquids in a designated area on a paved impervious surface within a secondary containment.
- Keep outdoor storage containers in good condition.
- Use drain inserts.
- Use sorbent socks and/or straw waddles to protect drainage discharge points.

LIMITATIONS:

- Space limitations may preclude storing some materials indoors.
- Storage sheds often must meet building and fire code requirements.

MAINTENANCE:

- Berm and curbing repair and patching.
- Replacement of straw waddles and sorbent socks.
- Drain insert cleaning.
- Inspection of secondary containment and pumping/disposal of contaminants as necessary.



BMP [HAZARDOUS MATERIAL MANAGEMENT]

TARGETED POLLUTANTS

High Impact

- Toxic Materials

Medium Impact

- Oil & Grease



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use and storage, waste disposal, and training of employees and subcontractors.

APPLICATION:

Many chemicals and materials used on-site are considered hazardous waste. These wastes may include:

- Paints and solvents, petroleum products such as oils, fuels and greases, herbicides and pesticides, acids for cleaning masonry, and concrete curing compounds.
- Sandblasting grit mixed with lead, cadmium or chromium based paints, asbestos, and PCBs.

INSTALLATION/APPLICATION/STORAGE CRITERIA:

The following steps will help reduce stormwater pollution from hazardous wastes:

- Use the entire product before disposing of the container.
- Do not remove the original product label, as it contains important safety and disposal information.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions.
- Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff.
- Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with Federal and State regulations.
- Store hazardous materials indoors or under roof, if possible.
- Always keep containers labeled and sealed.
- If hazardous materials are stored outside, provide secondary containment.
- Never store incompatible materials in the same area.

LIMITATIONS:

Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.

MAINTENANCE:

- Inspect hazardous waste receptacles and areas regularly.
- Arrange for regular hazardous waste collection.



BMP [OUTDOOR LIQUID STORAGE]

TARGETED POLLUTANTS

High Impact

- Heavy Metals
- Toxic Materials
- Oxygen Demanding Substances

Medium Impact

- Oil & Grease



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from outdoor container storage areas by installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

APPROACH:

Protect materials from rainfall, run-on, runoff, and wind dispersal:

- Store materials indoors, when possible.
- Place all liquids stored outdoors on secondary containment pallets or within containment areas.
- Minimize stormwater run-on by enclosing the area or building a berm around the area.
- Use a secondary containment pallet, or similar, for storage of liquid containers.
- Use covered dumpsters for waste product containers.

Storage of oil and hazardous materials must meet the following standards:

- Secondary containment
- Sealed containers
- Labeling
- All federal, state, and local standards

Train operators and employees on proper storage.

Safeguards against accidental releases:

- Overflow protection devices to warn operator or automatic shut down transfer pumps.
- Protection guards (bollards) around tanks and piping to prevent vehicle or forklift damage.
- Clear tagging or labeling.
- Restricting access to valves to reduce human error.
- Regular facility inspections.

Berm or surround tank or container with secondary containment system:

- Dikes, liners, vaults, or double walled tanks. Some municipalities require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

LIMITATIONS:

Storage sheds often must meet building and fire code requirements.

MAINTENANCE:

- Conduct routine inspections.



BMP [OUTDOOR MATERIAL LOADING/UNLOADING]

TARGETED POLLUTANTS

High Impact

- Nutrients
- Heavy Metals
- Toxic Materials
- Oxygen Demanding Substances
- Oil & Grease
- Floatable Materials



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from outdoor loading docks and the loading/unloading of materials.

APPROACH:

- Park tank trucks or delivery vehicles so that spills or leaks can be contained.
- Cover the loading/unloading docks to reduce exposure of materials to rain, when possible.
- A seal or door skirt between trailer and building can also prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on: grade/berm and position roof downspouts to direct stormwater away from loading/unloading areas.
- Contain leaks during transfer.
- Use drip pans under hoses.
- Make sure fork lift operators are properly trained.
- Train employees for spill containment and cleanup.

LIMITATIONS:

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
- It may not be possible to conduct transfers only during dry weather.

MAINTENANCE:

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks: valves, pumps, flanges, and connections.
- Use dry clean-up methods to clean up spills.
- Regularly inspect and maintain loading dock drains, sand/oil separators, etc.



BMP [OUTDOOR PROCESS EQUIPMENT CONTROL]

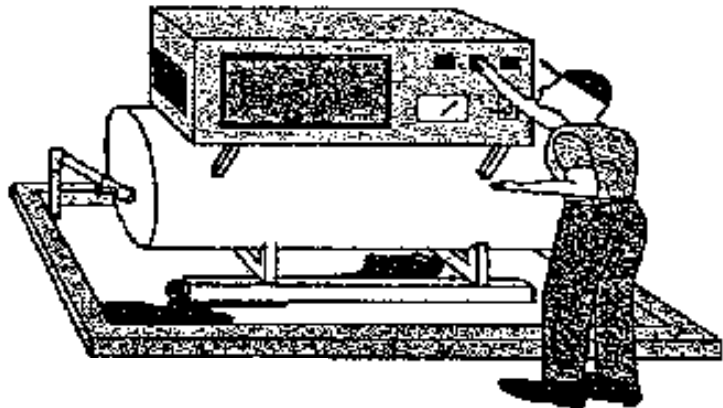
TARGETED POLLUTANTS

High Impact

- Nutrients
- Heavy Metals
- Toxic Materials
- Oxygen Demanding Substances

Medium Impact

- Oil & Grease



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from outdoor process equipment operations and maintenance by reducing the amount of waste created, enclosing or covering all or some of the equipment, installing secondary containment, and training employees.

APPROACH:

- Alter the activity to prevent exposure of pollutants to stormwater.
- Move activity indoors.
- Cover the area with a permanent roof.
- Minimize contact of stormwater with outside manufacturing operations through berming and drainage routing (run-on prevention).
- Contact your local waste treatment facility to identify if any process equipment areas should be connected to public sewer.
- Clean the storm drainage system regularly.
- Use catch basin filtration inserts as a means to capture particulate pollutants.
- Use straw waddles and sorbent socks to capture particulate and oil pollutants from surface runoff.

LIMITATIONS:

- Providing cover may be expensive.
- Space limitations may preclude enclosing some equipment.
- Storage sheds often must meet building and fire code requirements.

MAINTENANCE:

- Routine preventive maintenance, including checking process equipment for leaks.
- Regularly inspect, clean, and replace BMPs.



BMP [VEHICLE AND EQUIPMENT FUELING]

TARGETED POLLUTANTS

High Impact

- Nutrients
- Toxic Materials
- Oil & Grease



DESCRIPTION:

Prevent fuel spills and leaks, and reduce their impacts to stormwater by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

APPROACH:

- Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute stormwater. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.
- If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runoff of stormwater and the runoff of spills.
- Discourage "topping-off" of fuel tanks.
- Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks. Place a stockpile of spill cleanup materials where it will be readily accessible. Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Carry out all federal and state requirements regarding stationary above ground storage tanks. Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should be able to travel to a designated area with little lost time. Train employees and subcontractors in proper fueling and cleanup procedures.

LIMITATIONS:

- Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance (See Construction Entrance BMP in Appendix C of the *Las Vegas Valley Construction Site Best Management Practices Guidance Manual* available at www.lvstormwater.com.)
- Keep ample supplies of spill cleanup materials on-site.
- Inspect fueling areas and storage tanks on a regular schedule.



BMP [VEHICLE AND EQUIPMENT WASHING]

TARGETED POLLUTANTS

High Impact

- Sediment
- Nutrients
- Heavy Metals
- Toxic Materials
- Oxygen Demanding Substances
- Oil & Grease



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment washing and steam cleaning by using off-site facilities, washing in designated, contained areas only, eliminating discharges to the storm drain by infiltrating or recycling the wash water, and training employees and subcontractors.

APPROACH:

- Use off-site commercial washing and steam cleaning businesses as much as possible. Washing vehicles and equipment outdoors or in areas where wash water flows onto paved surfaces or into drainage pathways can pollute stormwater. If you wash a large number of vehicles or pieces of equipment, consider conducting this work at an off-site commercial business. These businesses are better equipped to handle and dispose of the wash waters properly. Performing this work off-site can also be economical by eliminating the need for a separate washing operation at your site.
- If washing must occur on-site, use designated, bermed wash areas to prevent wash water contact with stormwater, washes, and other water bodies. The wash area can be sloped for wash water collection and subsequent infiltration into the ground.
- Use as little water as possible to avoid having to install erosion and sediment controls for the wash area. Use phosphate-free biodegradable soaps. Educate employees and subcontractors on pollution prevention measures. Do not permit steam cleaning on-site. Steam cleaning can generate significant pollutant concentrations.

LIMITATIONS:

- Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades.
- Sending vehicles/equipment off-site should be done in conjunction with Stabilized Construction Entrance (See Construction Entrance BMP in Appendix C of the *Las Vegas Valley Construction Site Best Management Practices Guidance Manual* available at www.lvstormwater.com).
- The measures outlined in this fact sheet are insufficient to address all the environmental impacts and compliance issues related to steam cleaning.
- Clark County Storm Sewer System regulations do not allow non-stormwater discharges unless expressly permitted by the Nevada Division of Environmental Protection.

MAINTENANCE:

- Minimal, some berm repair may be necessary.



TARGETED POLLUTANTS

High Impact

- Heavy Metals
- Toxic Materials
- Oil & Grease

**DESCRIPTION:**

Prevent or reduce the discharge of pollutants to stormwater from vehicles and equipment maintenance and repair by running a dry shop.

APPROACH:

- Keep equipment clean, don't allow excessive build-up of oil and grease.
- Keep drip pans or containers under the areas that might drip.
- Do not change motor oil or perform equipment maintenance in non-appropriate areas.
- Inspect equipment for leaks on a regular basis.
- Segregate wastes.
- Make sure oil filters are completely drained and crushed before recycling or disposal.
- Make sure incoming vehicles are checked for leaking oil and fluids.
- Clean yard storm drain inlets regularly and especially after large storms.
- Do not pour materials down drains or hose down work areas; use dry seeping.
- Store idle equipment under cover.
- Drain all fluids from wrecked vehicles.
- Recycle greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic, and transmission fluids.
- Switch to non-toxic chemicals for maintenance when possible.
- Clean small spills with rags, general clean-up with damp mops and larger spills with absorbent material.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Train employees, minimize use of solvents.

LIMITATIONS:

- Space and time limitations may preclude all work being conducted indoors.
- It may not be possible to contain and clean up spills from vehicles/equipment brought on-site after working hours.
- Dry pans are generally too small to contain antifreeze, which may gush from some vehicles, so drip pans may have to be purchased or fabricated.
- Dry floor cleaning methods may not be sufficient for some spills.

MAINTENANCE:

- Should be low if procedures for the approach are followed.



BMP [WASTE HANDLING AND DISPOSAL]

TARGETED POLLUTANTS

High Impact

- Heavy Metals
- Toxic Materials
- Oil & Grease



DESCRIPTION:

Prevent or reduce the discharge of pollutants to stormwater from waste handling and disposal by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, re-use, and recycling; and preventing run-on and runoff from waste management areas.

APPROACH:

- Maintain usage inventory to limit waste generation.
- Substitute or eliminate raw materials.
- Modify process or equipment.
- SARA Title III, Section 313 requires reporting for over 300 listed chemicals and chemical compounds. This requirement should be used to track these chemicals although this is not as accurate a means of tracking as other approaches.
- Track waste generated.
- Use economic data and review: Waste treatment and disposal cost. Product utility and economic cost. Operation and maintenance labor cost.
- Recycle materials whenever possible.
- Maintain list of and the amounts of materials disposed.
- Segregation and separate waste.
- Cover, enclose, or berm industrial wastewater management areas whenever possible to prevent contact with runoff or runoff.
- Equip waste transport vehicles with anti-spill equipment.
- Minimize spills and fugitive losses such as dust or mist from loading systems.
- Ensure that sediments or wastes are prevented from being tracked off-site.
- Training and supervision.
- Stencil storm drains on the facility's property with prohibitive message regarding waste disposal.

LIMITATIONS:

Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.



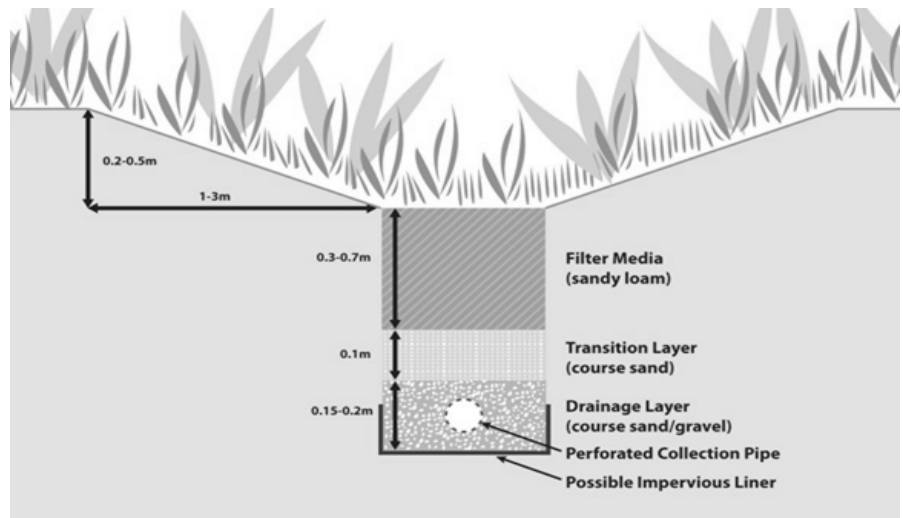
TARGETED POLLUTANTS

High Impact

- Sediment

Medium Impact

- Nutrients
- Heavy Metals
- Oxygen Demanding Substances
- Toxic Materials
- Oil and Grease
- Floatable Materials



DESCRIPTION:

Biofilters are of two types: swale and strip. A swale is a vegetated channel that treats concentrated flow. A strip treats sheet flow and is placed parallel to the contributing surface.

APPLICATION:

Suitable for small catchment areas of a few acres.

INSTALLATION/APPLICATION CRITERIA:

- Comparable performance to wet ponds and constructed wetlands.
- Limited to treating a few acres and availability of water during dry season.
- The surface area must be defined.
- The minimum width for a swale is determined by Manning's Equation.
- Minimum length of a strip is 10 feet.
- The longitudinal slope must not exceed 5%.
- Use a flow spreader and energy dissipater at the entrance of a swale.
- In the Las Vegas Valley, xeroscape or rock should be used in place of vegetation.

LIMITATIONS:

- Poor performance has occurred but this appears to be due to poor design.
- May be limited to areas where summer irrigation is feasible.
- Can be difficult to maintain sheet flow in strips and to avoid channelization in swales.
- Cannot be placed on steep slope.
- Area required may make infeasible on industrial sites.
- Proper maintenance required to maintain health and density of vegetation.

MAINTENANCE:

- Level cross-section and even longitudinal slope for swales.
- Achieve sheet flow with strips.



BMP [CONSTRUCTED WETLANDS]

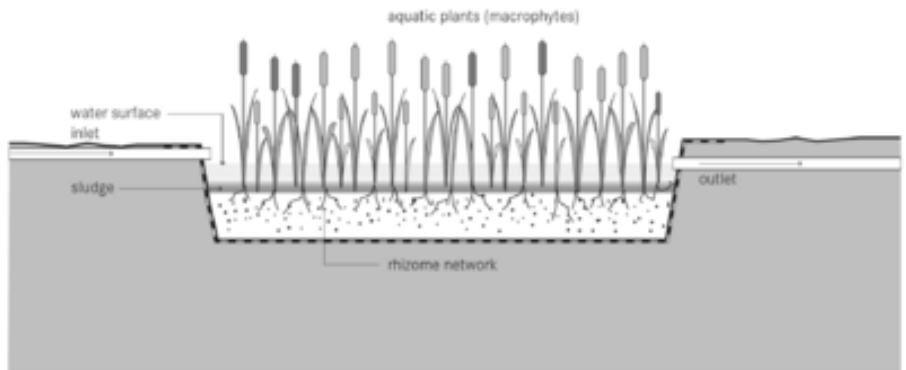
TARGETED POLLUTANTS

High Impact

- Sediment
- Nutrients
- Heavy Metals
- Oxygen Demanding Substances
- Toxic Materials
- Oil and Grease
- Floatable Materials

Medium Impact

- Bacteria and Viruses



DESCRIPTION:

Constructed wetlands have a significant percentage of the built structure covered by wetland vegetation.

APPLICATION:

- Need to achieve high level of particulate and some dissolved contaminant removal.
- Ideal for large, regional tributary areas.
- Multiple benefits of passive recreation and wildlife.

INSTALLATION/APPLICATION CRITERIA:

- Suitable soils for wetland vegetation are required.
- Surface area equal to at least 1% and preferably 2% of the tributary watershed.
- Involve qualified wetland ecologist to design and install wetland vegetation.
- Establishing wetland vegetation may be difficult.

LIMITATIONS:

- Concern for mosquitoes.
- Cannot be placed on steep unstable slopes.
- Need base flow to maintain water level.
- Not feasible in densely developed areas.
- Nutrient release may occur during winter.
- Overgrowth can lead to reduced hydraulic capacity.
- Regulatory agencies may limit water quality to constructed wetlands.

MAINTENANCE:

- Remove foreign debris and sediment build-up.
- Areas of bank erosion should be repaired.
- Remove nuisance species.
- Control mosquitoes.



BMP [DISCONNECTIVITY]

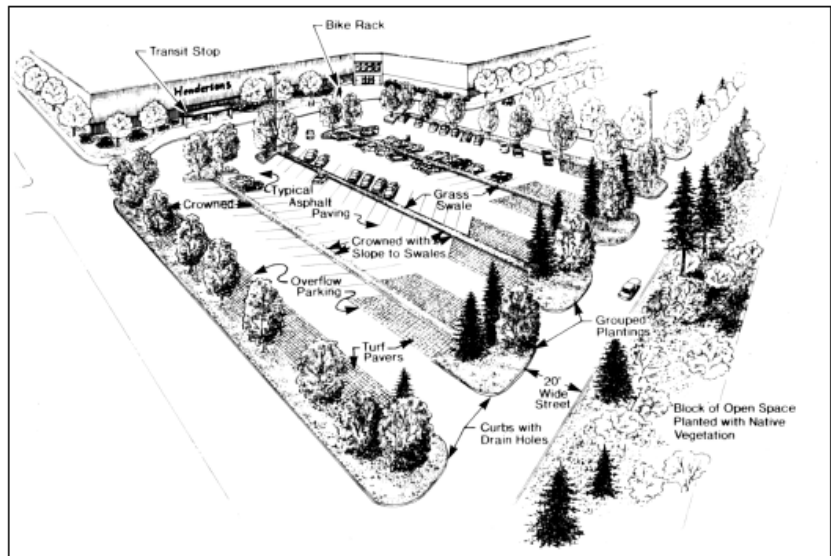
TARGETED POLLUTANTS

High Impact

- Sediment

Medium Impact

- Heavy Metals
- Floatable Materials



Source: Robert W. Droll, ASLA, in Wells 1994.

DESCRIPTION:

Minimizing directly connected impervious areas (DCIAs) is a structural BMP strategy that requires a basic change in drainage design philosophy. The basic principle is to direct stormwater runoff to landscaped areas, grass buffer strips, and vegetated swales to slow down the rate of runoff, reduce runoff volumes, attenuate peak flows, and encourage filtering of stormwater.

APPLICATION:

It can be made an integral part of drainage planning for any development.

INSTALLATION/APPLICATION CRITERIA:

- Use on sites with general terrain slopes flatter than 3-4%.
- Design the site drainage flowpath to maximize flow over vegetated areas before leaving a site.
- Minimize ground slopes to limit erosion and slow down water flow.
- Select vegetation that will not only survive, but also enhance water quality.

LIMITATIONS:

- Potential increase in site open space requirements over the traditional development systems.
- Introduction of a nonconventional development design strategy.
- Infiltration of water near building foundations and parking lots is a concern.
- Will likely result in increased maintenance along the swales.

MAINTENANCE:

- Maintain grass and other vegetation.
- Pick up debris.
- Conduct ongoing inspections for potential erosion problems and changes in drainage patterns.
- Remove sediment buildup and replace damaged ground cover.



BMP [TRENCH SAND FILTER SYSTEM]

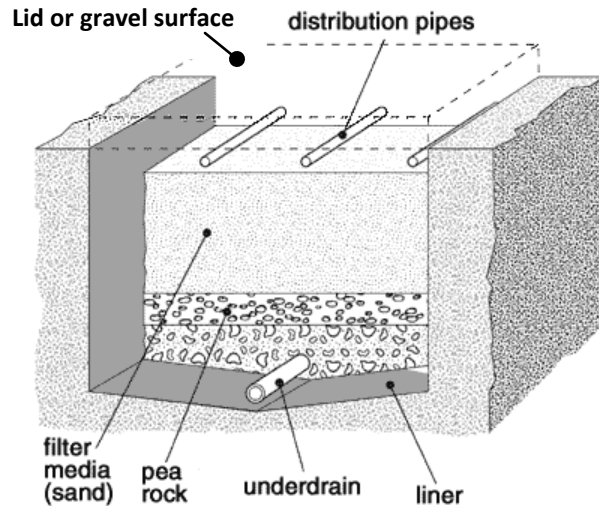
TARGETED POLLUTANTS

High Impact

- Sediment

Medium Impact

- Heavy Metals
- Oxygen Demanding Substances



DESCRIPTION:

An adaptation of the surface sand filter system. The trench sand filter system has two variations. One variation consists of a trench sand filter system with a stone reservoir. The other variation consists of a trench sand filter system with a small sedimentation pond.

APPLICATION:

- Townhouse developments or small commercial redevelopments.

INSTALLATION/APPLICATION CRITERIA:

- Topography should offer sufficient relief to allow the system to function by gravity flow.
- Design for easy maintenance accessibility.
- Design for safety barriers which prevent children from entering the sedimentation pond.

LIMITATIONS:

- Sites with little or no gradient may prevent sufficient gravity flow through the systems.
- Not recommended for parking lots.

MAINTENANCE:

- Stone reservoirs will require periodic replacement of the upper filter cloth and gravel layer.
- Sedimentation ponds will require periodic removal of accumulated sediment.



BMP [LEVEL SPREADER]

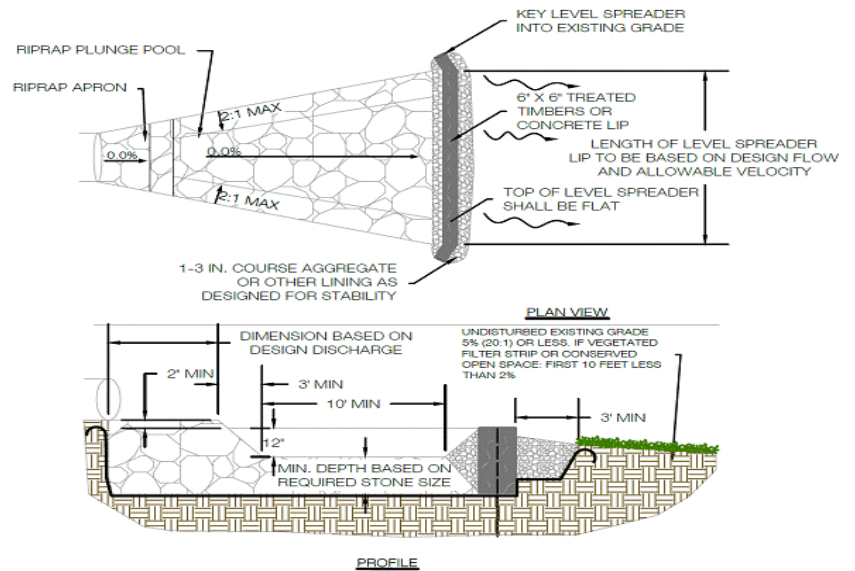
TARGETED POLLUTANTS

High Impact

- Sediment
- Oil and Grease

Medium Impact

- Nutrients
- Heavy Metals
- Oxygen Demanding Substances



DESCRIPTION:

Level spreaders are devices used at stormwater outlets to spread out collected stormwater flows into sheetflow (runoff that flows over ground surface in a thin, even layer). Typically, a level spreader consists of a depression in the soil surface that spreads the flow onto a flat area across a gentle slope. Level spreaders then release the stormwater flow onto level areas stabilized by vegetation to reduce speed and increase infiltration.

APPLICATION:

- Level spreaders are most often used as an outlet for temporary or permanent stormwater conveyances or dikes. Runoff that contains high sediment loads should be treated in a sediment trapping device prior to release into a level spreader.

INSTALLATION/APPLICATION CRITERIA:

- The length of the spreader depends upon the amount of water that flows through the conveyance.
- Larger volumes of water need more space to even out.
- Level spreaders are generally used with filter strips (see Filter Strips BMP).
- The depressions are seeded with vegetation (see Permanent & Temporary Seeding BMP).
- Level spreaders should be constructed on natural soils and not on fill material.
- The entrance to the spreader should be level so that the flow can spread out evenly.

LIMITATIONS:

- Can easily develop “short circuiting” (concentration of flows into small streams instead of sheetflow over the spreader) because of erosion or other disturbance.
- Cannot handle large quantities of sediment-laden stormwater.

MAINTENANCE:

- The spreader should be inspected after every storm event to check for damage.
- If ponding or erosion channels develop, the spreader should be regraded.



BMP [MEDIA FILTER]

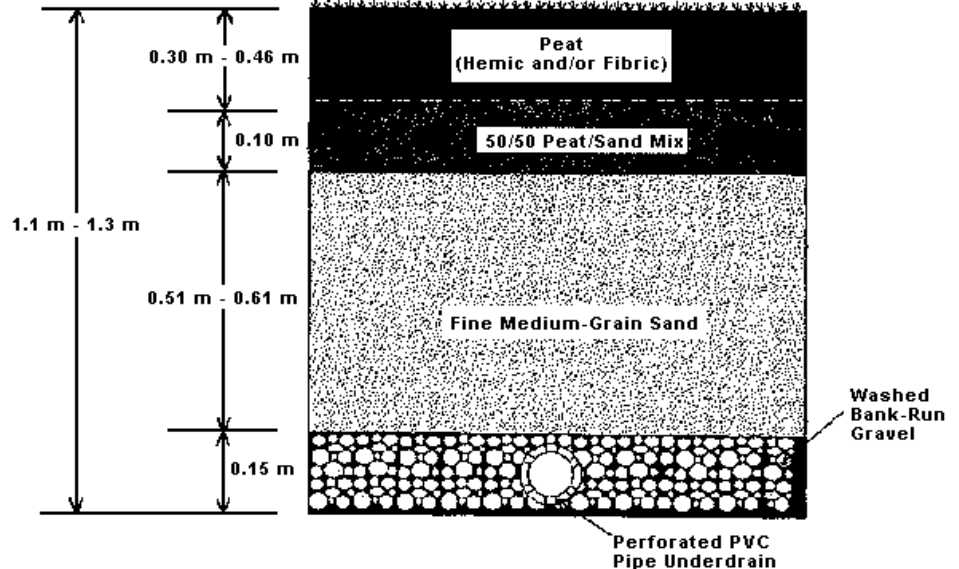
TARGETED POLLUTANTS

High Impact

- Sediment
- Floatable Materials

Medium Impact

- Nutrients
- Heavy Metals
- Oxygen Demanding Substances
- Oil and Grease
- Bacteria and Viruses



DESCRIPTION:

Consists of a settling basin followed by a filter. The most common filter media is sand; some use a peat/sand mixture.

APPLICATION:

- Objective is to remove only sediment (particulate pollutants).
- Use where unavailability of water prevents the use of wet ponds, wetlands, or biofilters.
- Can be placed underground.
- Suitable for individual developments and small tributary areas up to about 100 acres.
- May require less space than other treatment control BMPs.

INSTALLATION/APPLICATION CRITERIA:

- Settling basin smaller than wet or extended detention basin.
- Spread flow across filter.
- Place filter offline to protect from extreme events.
- Minimize erosion in settling basin.

LIMITATIONS:

- Filter may require more frequent maintenance than most of the other BMPs.
- May experience significant head loss.
- Dissolved pollutants are not captured by sand.
- Severe clogging potential if exposed soil surfaces exist upstream.

MAINTENANCE:

- Clean filter surface twice annually; or more often if watershed is excessively erosive.



BMP [OIL/WATER SEPARATORS / WATER QUALITY INLETS]

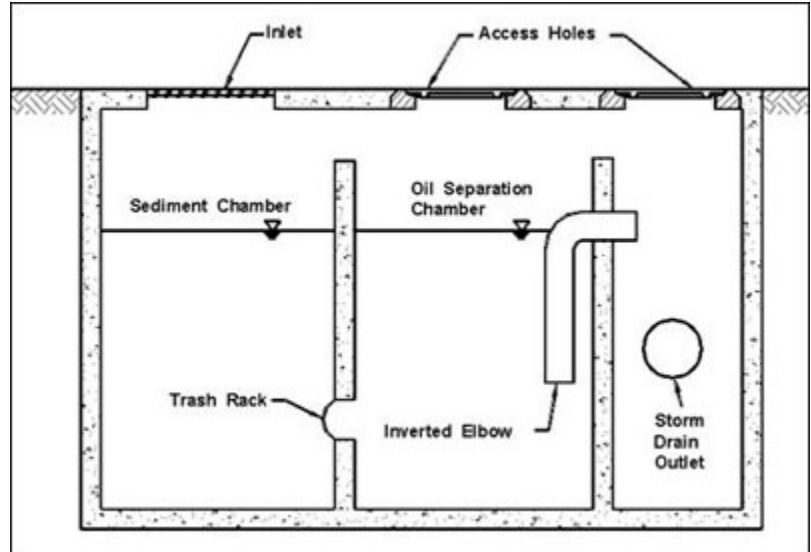
TARGETED POLLUTANTS

High Impact

- Oil and Grease
- Floatable Materials

Medium Impact

- Sediment
- Nutrients
- Heavy Metals
- Toxic Materials
- Oxygen Demanding Substances



DESCRIPTION:

Oil/Water separators are designed to remove specific contaminants: petroleum compounds and grease. However, separators will also remove floatable debris and settleable solids. Two general types of oil/water separators are used: conventional gravity separator and the coalescing plate interceptor (CPI).

APPLICATION:

- Applicable to situations where the concentration of oil and grease related compounds will be abnormally high and source control cannot provide effective control. The general types of businesses where this situation is likely are truck, car and equipment maintenance and washing businesses, as well as businesses that perform maintenance on their own equipment and vehicles.
- Public facilities where separators may be required include marine ports, airfields, fleet vehicle maintenance and washing facilities, and mass transit park-and-ride lots.
- Conventional separators are capable of removing oil droplets with diameters equal to greater than 150 microns.
- CPI separators should be used if smaller droplets must be removed.

INSTALLATION/APPLICATION CRITERIA:

- Sizing related to anticipated influent oil concentration, water temperature and velocity, and the effluent goal.
- To maintain reasonable separator size, it should be designed to bypass flows in excess of first flush.

LIMITATIONS:

- Little data on oil characteristics in stormwater leads to considerable uncertainty about performance.
- Other permits may be required.

MAINTENANCE:

Clean frequently of accumulated oil, grease, and floating debris.



TARGETED POLLUTANTS

High Impact

- Toxic Materials

Medium Impact

- Oil and Grease
- Heavy Metals
- Oxygen Demanding Substances



DESCRIPTION:

Sorbents are materials that are capable of cleaning up spills through the chemical processes of adsorption and absorption. Sorbents adsorb (an attraction to the outer surface of a material) or absorb (taken in by the material like a sponge) only when they come in contact with the sorbent materials. Sorbents include, but are not limited to, the following:

- Common materials such as clays, sawdust, straw and fly ash
- Polymers - polyurethane and polyolefin
- Activated Carbon - powdered or granular
- “Universal Sorbent Material” - a silicate glass foam consisting of rounded particles that can absorb the material.

APPLICATION:

Sorbents are useful BMPs for facilities with liquid materials onsite.

INSTALLATION/APPLICATION CRITERIA:

- Personnel should know the properties of the spilled material(s) to know which sorbent is appropriate. To be effective, sorbents must adsorb the material spilled but must not react with the spilled material to form hazardous or toxic substances.
- Apply immediately to the release area.
- Application is generally simple: the sorbent is added to the area of release, mixed well, and allowed to adsorb or absorb.
- Many sorbents are not reusable once they have been used.
- Proper disposal is required.

LIMITATIONS:

- Requires a knowledge of the chemical makeup of a spill (to choose the best sorbent).
- May be an expensive practice for large spills.
- May create disposal problems and increase disposal costs by creating a solid waste and potentially a hazardous waste.

MAINTENANCE:

No information available.



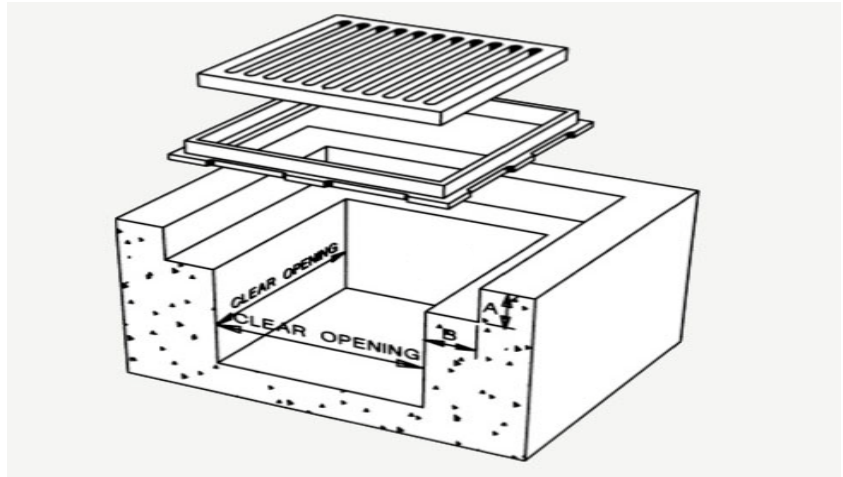
TARGETED POLLUTANTS

High Impact

- Toxic Materials

Medium Impact

- Nutrients



DESCRIPTION:

Sumps are holes or low areas that are structured so that liquid spills or leaks will flow down toward a particular part of a containment area. Frequently, pumps are placed in a depressed area and are turned on automatically to transfer liquids away from the sump when the level of liquids gets too high. Sumps can be temporary or permanent.

APPLICATION:

- Sumps can be used at all facilities. Sumps are used with other spill containment and treatment measures and can be located almost anywhere onsite. Sumps are frequently located in low lying areas within handling or storage areas.

INSTALLATION/APPLICATION CRITERIA:

- Consider the pump location, function, and system alarms when designing a sump system.
- Design and install the sump in the lowest lying area of a containment structure, allowing materials to gather in the area of the sump.
- Construct the sump of impenetrable materials and provide a smooth surface so that liquids are funneled toward the sump.
- It may be appropriate to house the pumps in a shed or other structure for protection and stabilization.

LIMITATIONS:

- Pumps may clog easily if not designed correctly.
- Costs for purchasing and/or replacing pumps may be high.

MAINTENANCE:

- Where pumps are used, frequent inspection and maintenance should be performed.
- It may require a maintenance/servicing agreement with the pump dealers.

BMP [SURFACE SAND FILTER SYSTEM]

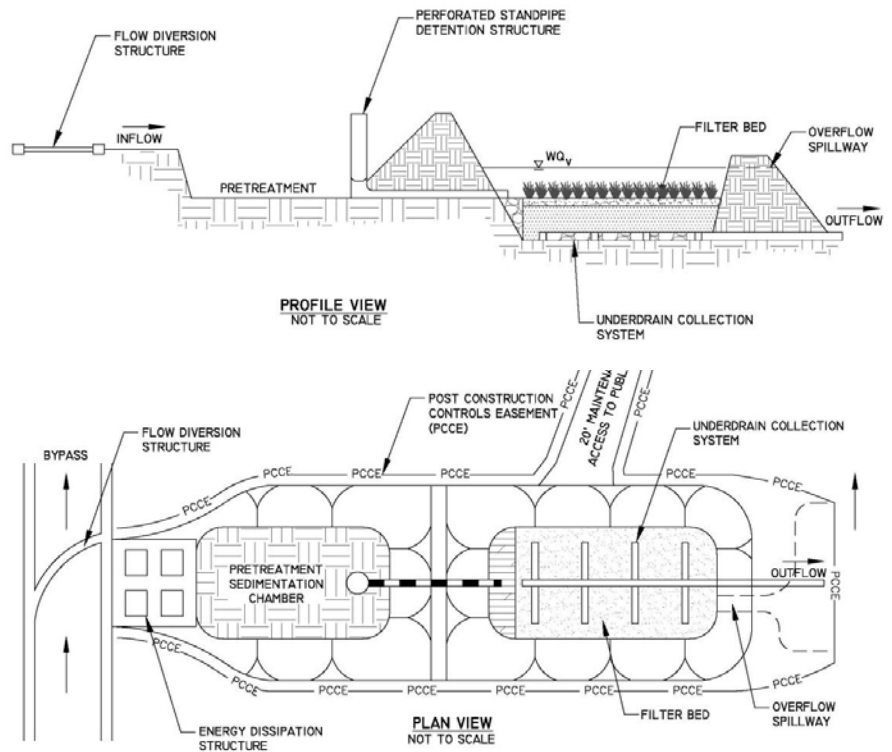
TARGETED POLLUTANTS

High Impact

- Sediment
- Oil and Grease

Medium Impact

- Nutrients
- Heavy Metals
- Oxygen Demanding Substances



DESCRIPTION:

The surface sand filter system (aka Austin sand filter) consists of a sedimentation chamber or pond followed by a surface sand filter with collector under drains in a gravel bed. Filtered runoff is conveyed to a storm sewer or channel by gravity flow or by pumping.

APPLICATION:

- Commercial and institutional parking lots, small shopping centers, and infill development.
- Smaller redevelopment sites where the use of conventional BMPs is not practical.

INSTALLATION/APPLICATION CRITERIA:

- Filter bed chambers that are too shallow could freeze, causing the filter to become ineffective.
- Pretreatment may be necessary to protect the filter media from excessive sediment loading.
- System should be designed for easy maintenance.

LIMITATIONS:

- Sites with little to no gradient may prevent sufficient gravity flow through the system.
- Extended periods of cold weather could affect pollutant removal efficiency.

MAINTENANCE:

- System should be inspected yearly and after storm events to assess the filtration capacity of the filter.
- Filter sand should be replaced every few years to maintain pollutant removal efficiency.

