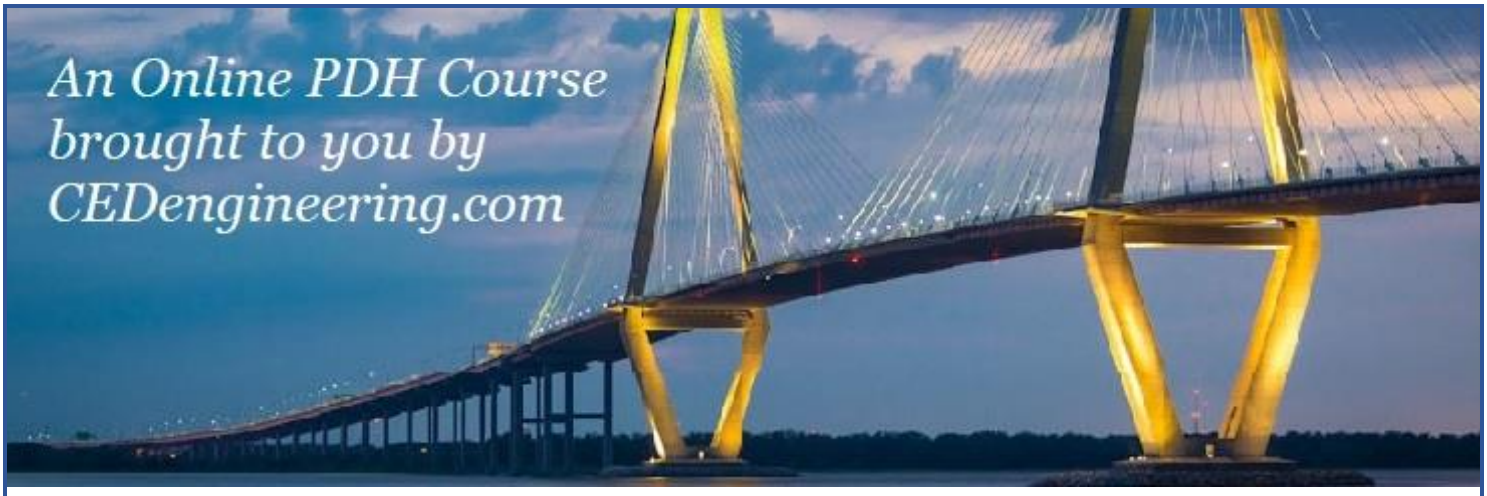


Construction Site Storm Water - Good Housekeeping

Course No: C02-003
Credit: 2 PDH

Gilbert Gedeon, P.E.

Continuing Education and Development, Inc.

P: (877) 322-5800
info@cedengineering.com

This course was adapted from the Environmental Protection Agency (EPA) Best Management Practice relating to the "Good Housekeeping" section of the "Construction Site Storm Water Runoff Control", which is in the public domain.

Construction Site Storm Water Runoff Control

Regulatory Text

- You must develop, implement, and enforce a program to reduce pollutants in any storm water runoff to your small MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. Reduction of storm water discharges from construction activity disturbing less than one acre must be included in your program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more. If the NPDES permitting authority waives requirements for storm water discharges associated with small construction activity in accordance with Sec. 122.26(b)(15)(i), you are not required to develop, implement, and/or enforce a program to reduce pollutant discharges from such sites.

- Your program must include the development and implementation of, at a minimum:

(A) An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under State, Tribal, or local law;

(B) Requirements for construction site operators to implement appropriate erosion and sediment control (ESC) best management practices;

(C) Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality;

(D) Procedures for site plan review which incorporate consideration of potential water quality impacts;

(E) Procedures for receipt and consideration of information submitted by the public, and

(F) Procedures for site inspection and enforcement of control measures.

Guidance

Examples of sanctions to ensure compliance include nonmonetary penalties, fines, bonding requirements, and/or permit denials for non-compliance. EPA recommends that procedures for site plan review include the review of individual pre-construction site plans to ensure consistency with local (ESC) requirements. Procedures for site inspections and enforcement of control measures could include steps to identify priority sites for inspection and enforcement based on the nature of the construction activity, topography, and the characteristics of soils and receiving water quality. You are encouraged to provide appropriate educational and training measures for construction site operators. You may wish to require a storm water pollution prevention plan for construction sites within your jurisdiction that discharge into your system. See Sec. 122.44(s) (NPDES permitting authorities' option to incorporate qualifying State, Tribal and local erosion and sediment control

programs into NPDES permits for storm water discharges from construction sites). Also see Sec. 122.35(b) (The NPDES permitting authority may recognize that another government entity, including the permitting authority, may be responsible for implementing one or more of the minimum measures on your behalf).

BMP Fact Sheets

Runoff Control

Minimize clearing

Land grading

Permanent diversions

Preserving natural vegetation

Construction entrances

Stabilize drainage ways

Check dams

Filter berms

Grass-lined channels

Riprap

Erosion Control

Stabilize exposed soils

Chemical stabilization

Mulching

Permanent seeding

Sodding

Soil roughening

Protect steep slopes

Geotextiles

Gradient terraces

Soil retention

Temporary slope drain

Protect waterways

Temporary stream crossings

Vegetated buffer

Phase construction

Construction sequencing

Dust control

Sediment Control

Install perimeter controls

Temporary diversion dikes

Wind fences and sand fences

Brush barrier

Silt fence

Install sediment trapping devices

Sediment basins and rock dams

Sediment filters and sediment chambers

Sediment trap

Inlet protection

Storm drain inlet protection

Good Housekeeping

Other wastes

General construction site waste management

Spill prevention and control plan

Vehicle maintenance and washing areas

Education and awareness

Contractor certification and inspector training

Construction reviewer

BMP inspection and maintenance

Model ordinances

Additional Fact Sheets

Turf Reinforcement Mats 

Vegetative Covers 

Dust Control 

Good Housekeeping

Other wastes

General Construction Site Waste Management

Construction Site Storm Water Runoff Control

Description

Building materials and other construction site wastes must be properly managed and disposed of to reduce the risk of pollution from materials such as surplus or refuse building materials or hazardous wastes. Practices such as trash disposal, recycling, proper material handling, and spill prevention and cleanup measures can reduce the potential for storm water runoff to mobilize construction site wastes and contaminate surface or ground water.

Applicability

The proper management and disposal of wastes should be practiced at any construction site to reduce storm water runoff. Waste management practices can be used to properly locate refuse piles, to cover materials that may be displaced by rainfall or storm water runoff, and to prevent spills and leaks from hazardous materials that were improperly stored.

Siting and Design Considerations

The following steps should be taken to ensure proper storage and disposal of construction site wastes:

- Designate a waste collection area onsite that does not receive a substantial amount of runoff from upland areas and does not drain directly to a waterbody.
- Ensure that containers have lids so they can be covered before periods of rain, and keep containers in a covered area whenever possible.
- Schedule waste collection to prevent the containers from overfilling.
- Clean up spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the spill.
- During the demolition phase of construction, provide extra containers and schedule more frequent pickups.
- Collect, remove, and dispose of all construction site wastes at authorized disposal areas. A local environmental agency can be contacted to identify these disposal sites.

The following steps should be taken to ensure the proper disposal of hazardous materials:

- Local waste management authorities should be consulted about the requirements for disposing of hazardous materials.
- A hazardous waste container should be emptied and cleaned before it is disposed of to prevent leaks.
- The original product label should never be removed from the container as it contains important safety information. Follow the manufacturer's recommended method of disposal, which should be printed on the label.
- If excess products need to be disposed of, they should never be mixed during disposal unless specifically recommended by the manufacturer.

State or local solid waste regulatory agencies or private firms should be consulted to ensure the proper disposal of contaminated soils that have been exposed to and still contain hazardous substances. Some landfills might accept contaminated soils, but they require laboratory tests first.

Paint and dirt are often removed from surfaces by sandblasting. Sandblasting grits are the byproducts of this procedure and consist of the sand used and the paint and dirt particles that are removed from the surface. These materials are considered hazardous if they are removed from older structures because they are more likely to contain lead-, cadmium-, or chrome-based paints. To ensure proper disposal of sandblasting grits, a licensed waste management or transport and disposal firm should be contracted.

The following practices should be used to reduce risks associated with pesticides or to reduce the amount of pesticides that come in contact with storm water:

- Follow all federal, state, and local regulations that apply to the use, handling, or disposal of pesticides.
- Do not handle the materials any more than necessary.
- Store pesticides in a dry, covered area.
- Construct curbs or dikes to contain pesticides in case of spillage.
- Follow the recommended application rates and methods.
- Have equipment and absorbent materials available in areas where pesticides are stored and used in order to contain and clean up any spills that occur.

The following management practices should be followed to reduce the contamination risk associated with petroleum products:

- Store petroleum products and fuel for vehicles in covered areas with dikes in place to contain any spills.
- Immediately contain and clean up any spills with absorbent materials.
- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.

Phosphorous- and nitrogen-containing fertilizers are used on construction sites to provide nutrients necessary for plant growth, and phosphorous- and nitrogen-containing detergents are found in wash water from vehicle cleaning areas. Excesses of these nutrients can be a major source of water pollution. Management practices to reduce risks of nutrient pollution include the following:

- Apply fertilizers at the minimum rate and to the minimum area needed.
- Work the fertilizer deeply into the soil to reduce exposure of nutrients to storm water runoff.
- Apply fertilizer at lower application rates with a higher application frequency.
- Limit hydroseeding, which is the simultaneous application of lime and fertilizers.
- Ensure that erosion and sediment controls are in place to prevent fertilizers and sediments from being transported off-site.
- Use detergents only as recommended, and limit their use onsite. Wash water containing detergents should not be dumped into the storm drain system—it should be directed to a sanitary sewer or be otherwise contained so that it can be treated at a wastewater treatment plant.

Limitations

An effective waste management system requires training and signage to promote awareness of the hazards of improper storage, handling, and disposal of wastes. The only way to be sure that waste management practices are being followed is to be aware of worker habits and to inspect storage areas regularly. Extra management time may be required to ensure that all workers are following the proper procedures.

Maintenance Considerations

Containers or equipment that may malfunction and cause leaks or spills should be identified through regular inspection of storage and use areas. Equipment and containers should be inspected regularly for leaks, corrosion, support or foundation failure, or any other signs of deterioration and should be tested for soundness. Any found to be defective should be repaired or replaced immediately.

Effectiveness

Waste management practices are effective only when they are regularly practiced at a construction site. Guidelines for proper handling, storage, and disposal of construction site wastes should be posted in storage and use areas, and workers should be trained in these practices to ensure that everyone is knowledgeable enough to participate.

Cost Considerations

The costs associated with construction site waste management are mainly attributed to purchasing and posting signs, increased management time for oversight, additional labor required for special handling of wastes, transportation costs for waste hauling, and fees charged by disposal facilities to take the wastes.

References

California Regional Water Quality Control Board. No date. *Erosion and Sediment Control Field Manual.* San Francisco Bay Region.

USEPA. 1996. *Protecting Natural Wetlands: A Guide to Stormwater Best Management Practices.* EPA 843-B-96-001. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1992. *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.* EPA 832-R-92-005. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

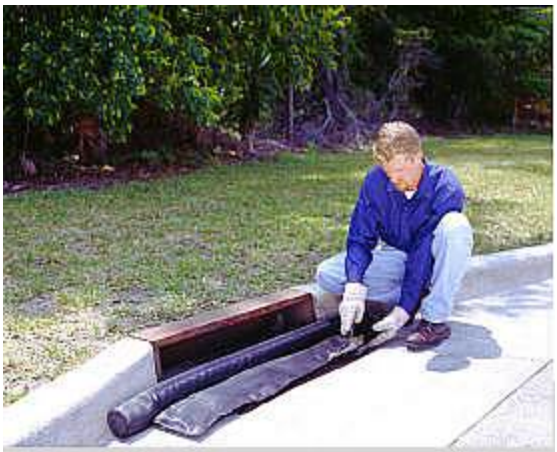
USEPA. 1992. Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. EPA 832-R-92-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Spill Prevention and Control Plan

Construction Site Storm Water Runoff Control

Description

Spill prevention and control 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.



Absorbent snakes can be used to protect storm drains from spills (Spill911, no date)

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.

Define material handling procedures and storage requirements, and take actions to reduce spill potential and impacts on storm water quality. This can be achieved by

- Recycling, reclaiming, or reusing process materials and 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.

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.

References

Spill911. No date. *Spill Containment: Oil and Sediment Curbguard*. [www.spill911.com/acb1/showdetl.cfm?&DID=61&Product_ID =982&CATID=5]. Accessed January 2001.

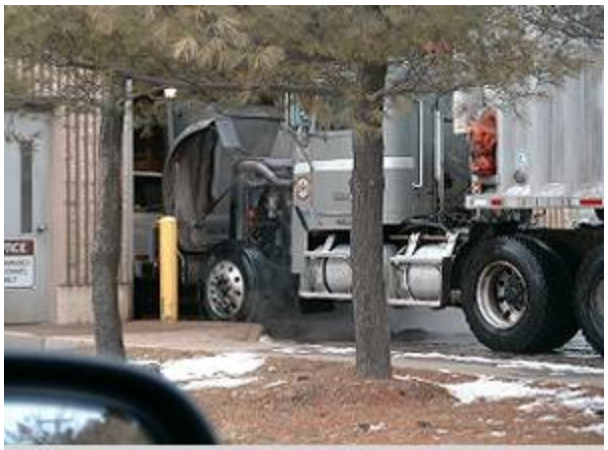
USEPA. 1992. *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.* EPA 832-R-92-005. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

USEPA. 1992. Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. EPA 832-R-92-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Vehicle Maintenance and Washing Areas

Construction Site Storm Water Runoff Control

Description



Trucks should be washed in designated washing areas to prevent untreated wastewater from being discharged to surface or ground waters

Maintenance and washing of vehicles should be conducted using environmentally responsible practices to prevent direct, untreated discharges of nutrient-enriched wastewater or hazardous wastes to surface or ground waters. This involves designating covered, paved areas for maintenance and washing, eliminating improper connections from these areas to the storm drain system, developing a spill prevention and cleanup plan for shop areas, maintaining vehicles and other equipment that may leak hazardous chemicals, covering fuel drums and other materials that are stored outdoors, and properly handling and disposing of automotive wastes and wash water.

Applicability

Environmentally friendly vehicle maintenance and washing practices are applicable for every construction site to prevent contamination of surface and ground water from wash water and fuel, coolant, or antifreeze spills or leaks.

Siting and Design Considerations

Construction vehicles should be inspected for leaks daily and repaired immediately. All used products, including oil, antifreeze, solvents, and other automotive-related chemicals, should be disposed of as directed by the manufacturer. These products are hazardous wastes that require special handling and disposal. Used oil, antifreeze, and some solvents can be recycled at a designated facility, but other chemicals must be disposed of at a hazardous waste disposal site. A local environmental agency can help to identify such facilities.

Special paved areas should be designated for a vehicle repair area and a separate vehicle washing area in which runoff and wastewater from these areas is directed to the sanitary sewer system or other treatment facility as industrial process waste. Vehicle washing facilities should use high-pressure water spray without any detergents as water can remove most dirt adequately. If detergents must be used, phosphate- or organic-based cleansers should be avoided to reduce nutrient enrichment and biological oxygen demand in wastewater. Only biodegradable products should be used—they should not contain halogenated solvents. If possible, blowers or vacuums should be used instead of water to remove dry materials from vehicles. Washing areas must be clearly marked and workers should be informed that all washing must occur in this area. No other activities, such as vehicle repairs, should be conducted in the wash area. If vehicles or equipment are heavily greased

or soiled, the area should be bermed and covered to prevent contamination of runoff from these pollutants.

Limitations

Limitations for vehicle maintenance areas include the cost of waste disposal (a fee may be charged by a hazardous waste disposal facility), the cost of providing an enclosed maintenance area with proper connections to an industrial sanitary sewer, and extra labor required to follow proper storage, handling, and disposal procedures. Vehicle wash areas might require permits, depending on the volume of wastewater produced and the type of detergents used, and it might be expensive to designate an area for vehicle washing with proper connections to the industrial waste handling system.

Maintenance Considerations

Vehicle maintenance areas produce a substantial amount of hazardous waste that requires regular disposal. Spills must be cleaned up and cleanup materials disposed of immediately. Equipment and storage containers should be inspected regularly to identify leaks or signs of deterioration. Maintenance of vehicle wash areas is minimal and involves maintenance of berms and drainage to the sanitary sewer system.

Effectiveness

The techniques mentioned above are very effective at reducing discharges of untreated automotive wastes and wash water to receiving waters. Their effectiveness is highly dependent on the training and level of commitment of personnel to follow procedures.

Cost Considerations

Costs associated with vehicle maintenance and wash areas include building enclosed structures, establishing connections to the sanitary sewer system, grading wash areas to drain only to sanitary sewers, and increased labor associated with special handling of hazardous wastes.

References

NJDEPE. 1992. *Ground Water Protection Practices for Motor Vehicle Services*. New Jersey Department of Environmental Protection and Energy, Trenton, NJ.

Santa Clara Valley NPS Control Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Santa Clara Valley Nonpoint Source Pollution Control Program, San Jose, CA.

USEPA. 1992. *Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.* EPA 832-R-92-005. U.S. Environmental Protection Agency, Office of Water, Washington, DC. September 1992.

USEPA. 1992. *Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices.* EPA 832-R-92-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC. September 1992.

Education and awareness

Contractor Certification and Inspector Training

Construction Site Storm Water Runoff Control

Description

Municipalities can establish training programs to educate contractors about erosion and sediment control practices

In many municipalities, erosion and sediment control (ESC) plans are required under ordinances enacted to protect water resources. These plans describe how a contractor or developer will reduce soil erosion and contain and treat runoff that is carrying eroded sediments. Plans typically include descriptions and locations of soil stabilization practices, perimeter controls, and runoff treatment facilities that will be installed and maintained before and during construction activities. In addition to special area considerations, the full ESC plan review inventory should include (Smolen et al., 1988):

- Topographic and vicinity maps
- Site development plan
- Construction schedule
- ESC plan drawings
- Detailed drawings and specifications for practices
- Design calculations
- Vegetation plan.

One of the most important factors determining whether or not erosion and sediment controls will be properly installed and maintained on a construction site is the knowledge and experience of the contractor. Many communities require certification for key on-site employees who are responsible for implementing the ESC plan.

Several states have contractor certification programs. The State of Delaware requires that at least one person on any construction project be formally certified. The Delaware program requires certification for any foreman or superintendent who is in charge of onsite clearing and land-disturbing activities for sediment and runoff control associated with a construction project. Responsible personnel are required to obtain certification by completing a training program sponsored or approved by the Department of Natural Resources and Environmental Control (DNREC). All applicants seeking approval of a sediment and runoff plan must certify that all personnel involved in the construction project will have a certificate of attendance at a Department-

sponsored or approved training course before initiation of any land-disturbing activity (DNREC, no date). A description of this certification requirement can be found at the DNREC web site at http://www.dnrec.state.de.us/newpages/ssregs14.htm.

The Maine Department of Environmental Protection offers a Voluntary Contractor Certification Program (VCCP) that is a nonregulatory, incentive-driven program to broaden the use of effective erosion control techniques. The VCCP is open to any contractor who is involved with soil-disturbance activities, including filling, excavating, landscaping, and other types of earthworks. For initial certification, the program requires attendance at two 6-hour training courses and the successful completion of a construction site evaluation. To maintain certification, a minimum of one 4-hour continuing education course within every 2-year period is required thereafter. Local soil and water conservation district personnel will complete construction site evaluations during the construction season. Certifications are valid until December 31 of the second year after issuance. Certification will entitle the holder to advertise services as a "DEP Certified Contractor" (MDEP, 1999). More information about this program can be found on the MDEP web site at http://janus.state.me.us/dep/blwq/training/ip-vccp.htm.

Municipalities often do not have the funding and staffing resources to support a construction site inspection program. Municipalities can implement a private inspector program in which individuals can receive stormwater management and ESC training to become certified inspectors to reduce the burden on the governing agency. These private inspectors can be hired directly by the contractor when the governing agency anticipates that a larger, more complicated site will require substantial agency resources.

Contractor certification programs are supplements to a municipal inspection and enforcement program. Such programs will not work if the contractors and inspectors are not held accountable, even without certification. Because there is a potential for contractors and private inspectors to abuse their certification, states such as Delaware require spot checks by county enforcement agents.

Applicability

Contractor certification programs are applicable for municipalities that require erosion and sediment control plans for construction sites. Training and certification will help to ensure that the plans are properly implemented and that best management practices are properly installed and maintained. Inspector training programs are appropriate for municipalities with limited funding and resources for ESC program implementation. The inspectors will lighten the financial and staffing burden of governing agencies to ensure compliance on construction sites.

Implementation

Contractor certification can be accomplished through municipally sponsored training courses, or more informally, municipalities can hold mandatory pre-construction or pre-wintering meetings and conduct regular and final inspection visits to transfer information to contractors (Brown and Caraco, 1997). Information that should be covered in training courses and meetings includes the importance of ESC for water quality protection; developing and implementing ESC plans; the importance of proper installation, regular inspection, and diligent maintenance of ESC practices; and recordkeeping for inspections and maintenance activities. To implement an inspector training program, the governing agency would need to establish a certification course with periodic recertification, review

reports submitted by private inspectors, conduct spot checks for accuracy, and institute fines or other penalties for noncompliance.

Effectiveness

Although the effectiveness of training and certification programs has not been discretely measured, there has been a large response to Delaware's inspector certification program. Within 6 years of implementing the program, 340 people had been certified (CWP, 1997).

Benefits

Contractors are the individuals ultimately responsible for the proper installation and maintenance of ESC practices on construction sites. A contractor certification program will help to improve compliance with ESC programs and foster better relationships between contractors and regulators. Inspector training programs can help to enforce compliance by limiting the burden of inspection for local regulatory agencies. By freeing up staff and other resources, more frequent and thorough inspections can be made.

Limitations

Contractor certification and inspector training programs require a substantial amount of effort on the part of the municipality or regulatory agency. They need to develop curricula for training courses, dedicate staff to teach courses, and maintain a report review and site inspection staff to ensure that both contractors and inspectors are fulfilling their obligations and complying with the ESC program.

Cost Considerations

Costs for contractor certification and inspector training can vary widely depending on the type of training and certification programs that are implemented. However, cost savings can be seen in a decreased need for remedial action because contractors have more ESC experience. Additionally, there will a reduced need for site visits by agency staff because private inspectors can handle the especially time-consuming projects.

References

Brown, W.E., and D.S. Caraco. 1997. Muddy Water In, Muddy Water Out? A Critique of Erosion and Sediment Control Plans. *Watershed Protection Techniques* 2(3):393–403.

Center for Watershed Protection. 1997. Technical Note No. 85. Delaware Program Improves Construction Site Inspection: A Private Inspector Multiplies Compliance Workforce. *Watershed Protection Techniques* 2(3):440–442.

DNREC. No date. *Section 13 Contractor Certification Program*. Delaware Department of Natural Resources and Environmental Control, Dover, DE. [www.dnrec.state.de.us/newpages/ssregs14.htm]. Accessed March 9, 2000.

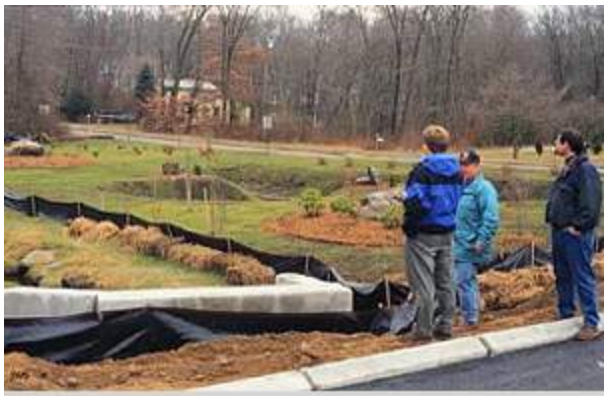
MDEP. 1999. *Maine Department of Environmental Protection Issue Profile: Voluntary Contractor Certification Program*. Maine Department of the Environment, Bureau of Land and Water Quality, Portland, ME. [http://janus.state.me.us/dep/blwq/training/ip-vccp.htm]. Last updated August 1999. Accessed June 1, 2001.

Smolen, M.D., D.W. Miller, L.C. Wyatt, J. Lichthardt, and A.L. Lanier. 1988. *Erosion and Sediment Control Planning and Design Manual*. North Carolina Sedimentation Control Commission, North Carolina Department of Environment, Health, and Natural Resources, and Division of Land Resources Land Quality Section, Raleigh, NC.

Construction Reviewer

Construction Site Storm Water Runoff Control

Description



Construction reviewers periodically inspect construction sites to ensure that contractors have installed and maintained their erosion and sediment controls properly (Source: University of Connecticut Cooperative Extension System, 2000)

According to some state's regulations, the construction reviewer should be able to perform routine inspections of construction sites. According to the state of Delaware, the following guidelines should be followed by the construction reviewer:

- Perform a construction review of active construction sites at least once a week.
- Within five calendar days, inform the person engaged in the land-disturbing activity, and the contractor, by a written construction review report of any violations of the approved plan or inadequacies of the plan. Inform the plan approval agency, if the approved plan is inadequate, within five working days. In addition, send the appropriate construction review agency copies of all construction review reports.
- Refer the project through the delegated inspection agency to the proper department for appropriate enforcement action if the person engaged in the land-disturbing activity fails to address the items contained in the written construction review report. Give verbal notice to the proper department.

Applicability

Construction reviewer training is considered an extremely important aspect of erosion and sediment control and stormwater enforcement. Construction reviewer training allows for third-party inspections of construction permits and BMP implementation. Third-party inspections free up state personnel from the time-consuming efforts to inspect each construction site. However, construction site reviewer training is still in its infant stages and is not yet a nationwide program.

Limitations

Several states do not have enough enforcement officers to inspect a large number of construction sites. The regulatory agency that oversees permits relies heavily on notifications by the public for permit noncompliance at construction sites. Because of some state's dependence on public involvement, numerous construction sites are not inspected.

Effectiveness

If the permit is reviewed by a regulatory agency or third party and the site is inspected on a regular basis, then it is assumed that the contractor certification is a success. For construction reviewers, the state of Delaware has produced a program that has proven both beneficial in protecting the environment and cost effective. The Delaware Department of Natural Resources and Environmental Control's (DNREC) Sediment and Storm Water Program illustrates how an aggressive inspection program depending on privately employed inspectors can limit the water quality impacts of construction. The result is a win-win situation in which the environment is protected, developers have less downtime, DNREC's workload is more reasonable, and local jobs are created. To obtain the mandated construction inspection, developers can hire one of the hundreds of private inspectors licensed under the state's Certified Construction Reviewer (CCR) program, first implemented in 1992.

In New Castle County, Delaware, a Phase I permitted county, the CCR program has been a successful component of the overall storm water management program. The county is enjoying economic growth and related commercial and residential development. Approximately 400 construction sites per year in Delaware require development and implementation of a detailed Sediment and Storm Water Plan. Limited to only three county government inspectors, the county has used the CCR program to leverage greater inspection coverage and increase compliance with federal, state, and local construction requirements. Of the 400 construction starts, more than 75 percent are being inspected by CCRs for at least a portion of the site development. The CCRs inspect active sites weekly and submit a report to the developer/contractor and to the county. County staff time once spent inspecting construction sites can now be spent overseeing the private CCR inspection process. Through the CCR program, New Castle County has saved approximately $100,000 annually, while the rate of compliance with Delaware's Sediment and Storm Water Program requirements has increased.

Cost Considerations

Inspector training costs vary from state to state.

References

DNREC. 1999. *Delaware Sediment and Stormwater Program*. [http://www.dnrec.state.de.us/newpages/stormregs.htm]. Accessed June 1, 2001.

University of Connecticut, Cooperative Extension Service. 2000. [http://nemo.uconn.edu/res&ap/images/71205103web.jpg]. Last updated December 5, 2000. Accessed June 1, 2001.

BMP Inspection and Maintenance

Construction Site Storm Water Runoff Control

Description

To maintain the effectiveness of construction site storm water control best management practices (BMPs), regular inspection of control measures is essential. Generally, inspection and maintenance of BMPs can be categorized into two groups--expected routine maintenance and nonroutine (repair) maintenance. Routine maintenance refers to checks performed on a regular basis to keep the BMP in good working order and aesthetically pleasing. In addition, routine inspection and maintenance is an efficient way to prevent potential nuisance situations (odors, mosquitoes, weeds, etc.), reduce the need for repair maintenance, and reduce the chance of polluting storm water runoff by finding and correcting problems before the next rain.

Routine inspection should occur for all storm water and erosion and sediment control (ESC) measures implemented at a site. These measures may include, but are not limited to, grass-covered areas, seeded areas, mulched areas, areas stabilized with geotextiles or sod, silt fences, earth dikes, brush barriers, vegetated swales, sediment traps, sediment basins, subsurface drains, pipe slope drains, level spreaders, storm drain drop inlet protection measures, gabions, rain barrels, and road and site entrance stabilization measures. Nonroutine maintenance refers to any activity that is not performed on a regular basis. This type of maintenance could include major repairs after a violent storm or extended rainfall, or replacement and redesign of existing control structures.

In addition to maintaining the effectiveness of storm water BMPs and reducing the incidence of pests, proper inspection and maintenance is essential to avoid the health and safety threats inherent in BMP neglect (Skupien, 1995). The failure of structural storm water BMPs can lead to downstream flooding, causing property damage, injury, and even death.

Applicability

All storm water BMPs should be inspected for continued effectiveness and structural integrity on a regular basis for the life of the construction project. Generally, all BMPs should be checked after each storm event in addition to the regularly scheduled inspections. Scheduled inspections vary between BMPs. Structural BMPs like storm drain drop inlet protection might require more frequent inspection than other BMPs to ensure proper operation. Inspection and maintenance of BMPs should continue until all construction activities have ended and all areas of a site have been permanently stabilized. During each inspection, the inspector should document whether the BMP is performing correctly, any damage to the BMP since the last inspection, and what should be done to repair the BMP if damage has occurred.

Siting and Design Considerations

In the case of vegetative or other infiltration BMPs, inspection of storm water management practices following a storm event should occur after the expected drawdown period for a given BMP. This approach allows the inspector to see whether detention and infiltration devices are draining correctly. Inspection checklists should be developed for use by BMP inspectors. The checklists might include

each BMP's minimum performance expectations, design criteria, structural specifications, date of implementation, and expected life span. In addition, the maintenance requirements for each BMP should be listed on the inspection checklist. This checklist will aid the inspector in determining whether a BMP's maintenance schedule is adequate or needs revision. Also, a checklist will help the inspector determine renovation or repair needs.

Limitations

Routine maintenance materials such as shovels, lawn mowers, and fertilizer can be obtained on short notice with little effort. Unfortunately, not all materials that might be needed for emergency structural repairs are obtained with such ease. Thought should be given to stockpiling essential materials in case immediate repairs must be made to safeguard against property loss and to protect human health.

Maintenance Considerations

When considering a maintenance schedule for BMPs to control storm water runoff from construction activities, care should be taken to factor in increased erosion and sedimentation rates for construction sites. Clearing, grading, or otherwise altering the landscape at a construction site can increase the erosion rate by as much as 1,000 times the preconstruction rate for a given site (USEPA, 1992). Depending on the relative amount of disturbed area at a site, routine maintenance might have to occur on a more frequent basis.

It is important that routine maintenance and nonroutine repair of storm water and erosion control BMPs be done according to schedule or as soon as a problem is discovered. Because many BMPs are rendered ineffective for storm water runoff control if not installed and maintained properly, it is essential that maintenance schedules are maintained and repairs are performed promptly. In fact, in some cases BMP neglect can have detrimental effects on the landscape and increase the potential for erosion. However, "routine" maintenance such as mowing grass should be flexible enough to accommodate varying need based on weather conditions. For example, more harm than good might be caused by mowing during a drought or immediately after a storm event.

Effectiveness

The effectiveness of BMP inspection is a function of the familiarity of the inspector with each particular BMP's location, design specifications, maintenance procedures, and performance expectations. Documentation should be kept regarding the dates of inspection, findings, and maintenance and repairs that result from the findings of an inspector. Such records are helpful in maintaining an efficient inspection and maintenance schedule and provide evidence of ongoing inspection and maintenance.

Because maintenance work for storm water BMPs (mowing, removal of sediment, etc.) is usually not technically complicated, workers can be drawn from a large labor pool. As structural BMPs increase in their sophistication, however, more specialized maintenance training might be needed to sustain BMP effectiveness.

Cost Considerations

Mowing of vegetated and grassed areas may be the costliest routine maintenance consideration (WEF, 1998). Management practices using relatively weak materials (such as filter fabric and wooden posts) may mean more frequent replacement and therefore increased costs. The use of more sturdy materials (such as metal posts) where applicable may increase the life of certain BMPs and reduce replacement cost. However, the disposal requirements of all materials should be investigated before BMP implementation to ensure proper handling after the BMP has become ineffective or when it needs to be disposed of after the site has reached final stabilization.

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Model Ordinances

Construction Site Storm Water Runoff Control

Description

Erosion and sedimentation from construction sites can lead to reduced water quality and other environmental degradation. Municipalities can enact erosion and sediment control (ESC) ordinances for construction sites. These local regulations are intended to safeguard the public, protect property, and prevent damage to the environment.

Applicability

Ordinances promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any development or other activity that disturbs or breaks the topsoil or results in the movement of earth on land. ESC ordinances consist of permit application and review, and they can require an erosion and sediment control plan. A number of communities have dealt with construction sites by using an ordinance requiring permits, review and approval, ESC plans, design requirements, inspections, and enforcement. A model ordinance is available on EPA's web site at *www.epa.gov/nps/ordinance/mol2.htm*.

Siting and Design Considerations

Ordinances can set design requirements for grading, erosion control practices, sediment control practices, and waterway crossings. They can set limits for clearing and grading, and they can require action within a certain time frame. For example, soil stabilization might be required to be completed within 5 days of clearing or inactivity in construction.

The following are ways to ensure compliance:

- *Nonmonetary penalties*. Some municipalities require violators to perform restoration work or implement a BMP rather than pay a fine.
- *Fines*. ESC ordinances can set penalties for violations of a permit. For example, a maximum fine might be set for various types of violations. In all cases, the permittee would be fined upon conviction of the violation. Sample text for violations and penalties can be found in a model ordinance on EPA's web site at *www.epa.gov/nps/ordinance/mol2.htm*.
- *Stop work orders*. A stop work order or a permit revocation might be issued when a permit is violated or when development is implemented in a manner found to adversely affect the health, welfare, or safety of persons residing or working in the neighborhood or at development sites, or when there is a risk of injury to persons or property.
- *Bonding requirements*. Bonding requirements are allowances that are set aside specifically to repair damage to temporary construction site erosion and sediment controls (e.g., silt fences) caused by severe storm flows, high winds, or fallen trees. Funds can be used only if documented inspections that show erosion and sediment controls are installed and maintained

as required. This allowance helps to ensure 100-percent compliance by contractors (Deering, 1999).

Limitations

Site inspections are required for an adequate ESC process. An adequate staff of inspectors must be available to review permit applications and proposed ESC plans. Site inspections must be conducted on each construction site. The number of site visits will depend on available staff. Timing for site visits might be based on

- Start of construction
- Installation of ESC measures
- Completion of site clearing
- Completion of rough grading
- Completion of final grading
- Close of the construction season
- Completion of final landscaping.

Maintenance Considerations

Keeping up-to-date with construction projects is a major part of enforcement maintenance. Some municipalities rely on information submitted by the public. The city of Jacksonville, Florida, has a citizen complaint form on its web page at *http://www.coj.net/pub/resd/airwater/CCFORM.HTM*. Some of the categories of complaints are "Discharge of pollutants to storm drains, ditches, rivers, or creeks," "Overflowing manholes or pump stations," "Uncontrolled erosion from land clearing activities," and "Pumping of muddy water into creeks, storm drains, or ditches." City staff have established a goal of contacting complaint submitters within 24 hours (City of Jacksonville, 2000). In the Fresno-Clovis metropolitan area of California, storm water inspections on construction sites are generally sparked by complaints, proximity to the San Joaquin River, and direct discharges to the river or other receiving waterbodies (FMFCD).

Procedures for Site Plan Review

Existing staff should spend as much time as allowed in the field at the construction sites. This allows them a better idea of how controls are being implemented (if at all) and whether another approach should be taken. It is also recommended that existing staff spend as much as 10 percent of their time assigned to contractor training or public outreach (Brown and Caraco, 1997). One firm, Stormwater Services Group, can train construction contractor staff to perform site inspections or can perform one site visit per week and prepare the required weekly written report. Their services start at $75 per week (Stormwater Services Group, 2000).

The Center for Watershed Protection (CWP) surveyed 80 ESC programs in 1997. Responses to the survey showed that each ESC inspector was responsible for an average of 150 sites annually,

indicating a lack of inspectors needed. The state of Delaware created a program that requires developers to hire a private inspector under any of three circumstances (CWP, 1997):

- All sites with more than 50 acres of disturbed area
- Any site, as determined by the state's resource agency
- Sites under construction that present significant management problems.

The state set requirements for private inspectors, such as certification, submission of weekly reports to the contractors, and other qualifications. To prevent bias on the part of inspectors (i.e., not reporting violations because they were hired by the contractors), the state set two provisions-spot checks are conducted by the local ESC agency, and the inspector must be supervised by a Professional Engineer (P.E.). Any discrepancy can lead to an inspector or P.E. losing his license (CWP, 1997).

Brown and Caraco (1997) list 10 elements reviewers should look for in an effective plan:

- Minimize needless clearing and grading
- Protect waterways and stabilize drainage ways
- Phase construction to limit soil exposure
- Stabilize exposed soils immediately
- Protect steep slopes and cuts
- Install perimeter controls to filter sediments
- Employ advanced sediment settling controls
- Certify contractors on ESC plan implementation
- Adjust ESC plan at construction site
- Assess ESC practices after storms.

Effectiveness

Ordinances are only as effective as the degree to which they are enforced.

Cost Considerations

Municipalities that enact erosion and sediment control ordinances must budget for the drafting and enforcement of the regulation.

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