



Construction Stormwater Field Guide

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Chapter 1. INTRODUCTION

Scope and Objective

Construction sites can be a source of sediment and other pollutants to waterways. Best management practices (BMPs) are devices and activities that reduce or eliminate pollution sources and can include silt fences, settling basins, and even training.

This guide is a quick reference for inspectors and resident engineers in construction on topics related to installation, maintenance, and inspection of common BMPs. Using this guide helps departments of transportation (DOTs) stay in compliance with federal, state, and local regulations for improving stormwater quality and provides guidance where local publications may currently be lacking.



Fig. 1-1. Proper management of construction sites through the use of BMPs can dramatically reduce stormwater impacts. Source: RBF Consulting

Preface to Readers

This publication includes discussion of BMPs, organized by their use. Categorization of BMPs may vary from state to state; however the basic recommendations for field implementation remain consistent. The information

presented in this guide is based on techniques and control measures considered generally effective in many areas of the country. This guide is not meant to be a design manual or pollution prevention plan, nor is it meant to supersede, substitute, or make more stringent well-defined practices or regulatory standards.



Fig. 1-2. Construction sites should aim to produce no more sediment risk than the natural condition as this re-vegetated slope does.

Source: *Utah DOT*

Federal Laws and Requirements

Federal water quality regulations require that construction sites disturbing one acre or more of land get coverage under a National Pollutant Discharge Elimination System (NPDES) permit. Permits may be issued by the United States Environmental Protection Agency (EPA) or at the state level.

The goal of the EPA is to prevent the construction site from causing or contributing to water pollution. Water pollution can result from most activities on a construction site if they are not correctly managed with BMPs.

BMPs use the following strategies to protect water quality:

- Reduce the time bare soil is exposed to rainfall by project sequencing and scheduling.



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- Use pollution prevention as a more practical and effective means compared to pollution removal. Do what is possible to prevent pollution contact with stormwater.
- Use effective combinations of erosion and sediment control measures on the construction site.
- Use buffers of natural vegetation when construction sites are next to environmentally sensitive areas or water bodies.
- Control the perimeter of the site with appropriate sediment controls.
- Reduce the volume of construction site runoff wherever feasible.
- Control offsite/onsite runoff during construction to protect slopes and disturbed areas.
- Avoid disturbing natural channels.
- Stabilize bare soil areas as soon as possible, to eliminate erosion.

The information discussed in this guide provides information on installing and maintaining BMPs so that they are effective.

Erosion Control Fundamentals

You need an understanding of the different types of erosion to maintain erosion control BMPs.

Splash erosion is the primary source of erosion. It results from rain drops striking bare soil directly.

Sheet erosion is the removal of a uniform thin layer of soil by raindrop splash or water runoff. It is characterized by a surface film of water 1/16"–1/8" deep.

Rill erosion results from sheet flow that becomes concentrated into many small channels. Rill erosion areas are generally small enough to step across.

Gully erosion is easily identifiable by large (too far to step across), deep cuts in the soil. They are often found in areas

without evidence of other erosion types. Rill erosion can easily progress to gully erosion if BMPs are not installed, installed correctly, or not maintained.



Fig. 1-3. Splash erosion is often very hard to see, but it is a significant physical process.
Source: <http://www.dot.ca.gov> (modified)



Fig. 1-4. Gully formation occurs when flows are not adequately controlled with the appropriate BMPs.
Source: RBF Consulting



Fig. 1-5. All forms of erosion can occur at a construction site. Here the rills and gullies will need repair and could have been prevented with proper BMPs. Source: RBF Consulting

General Tips

Assessment and Planning

You should perform a general site assessment and planning before implementing BMPs. Things to be reviewed in the field include:

- Review the project's stormwater pollution prevention plan (SWPPP) requirements.
- Identify and understand the basic drainage patterns of the project site—from where does runoff originate, where does it go, and how much is anticipated.
- Understand how the continuing sequence of project construction activities will change current drainage patterns based on grading, vegetation changes, paving, and other physical features.
- Identify all areas where runoff will discharge from the site for all phases of construction.
- Identify the areas of the project site that are the most likely sources of sediment. Cover and contain construction materials.

- Select BMPs for runoff management, soil stabilization, and sediment control based on the project site conditions, geography, and typical precipitation patterns.

BMP Tool Box—Runoff Management

Runoff management approaches include tools to convey water into and through the site. In many instances, prudent runoff management strategies involve the diversion of clean water from offsite areas around the site.

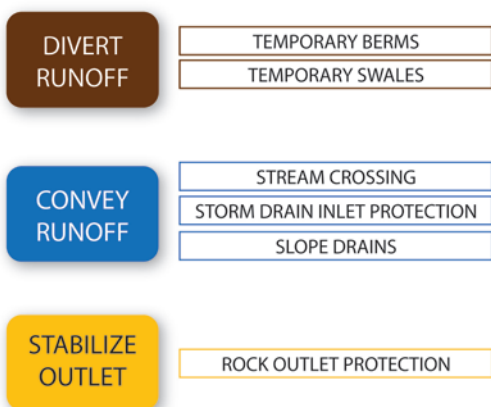


Fig. 1-6. Planning flow chart—runoff management.

BMP Tool Box—Soil Stabilization

Erosion control BMPs include a range of cover options including spray-on binders, spray-on mulches, spray-on matrices, hydroseed, rolled erosion control products (RECPs), and others. They all share common function in that they keep soil from becoming mobile. The best approach for your site will depend on the intended design life, project slope, soil type, environmental requirements, and cost. In general, the original product used for erosion control will need to be reapplied as it becomes ineffective over time.

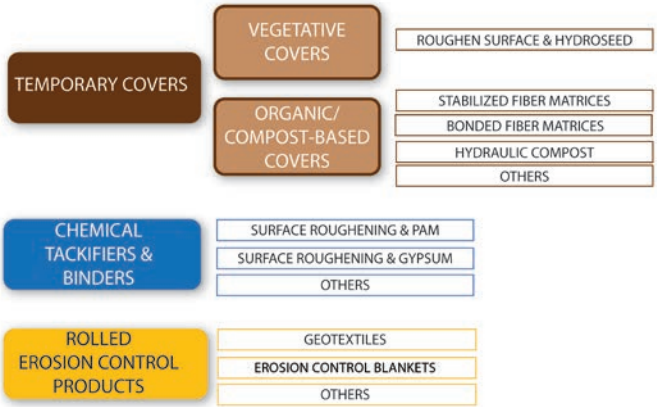


Fig. 1-7. Planning flow chart—soil stabilization.

BMP Tool Box—Sediment Control

Sediment control BMPs include silt fence, wattles, gravel bags, check dams, and sediment basins and traps. These measures should always be used as a supplement to appropriate runoff management and erosion control BMPs.

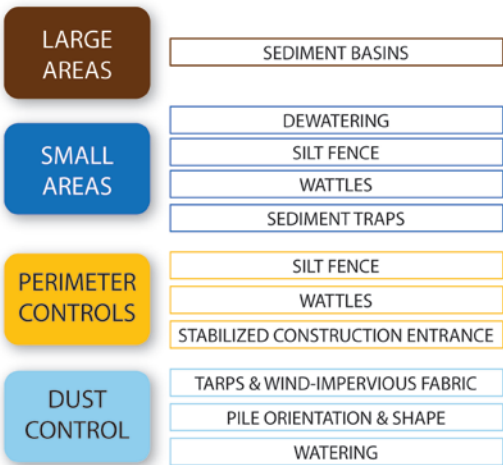


Fig. 1-8. Planning flow chart—sediment control.

Controlling Dust

Wind erosion control practices function by:

- Reducing wind effects on the soil surface by covering piles with a wind-impervious fabric or other material, or by changing pile orientation and shape and/or;
- Water or calcium chloride applications.

Special Considerations for Linear Projects

Linear projects such as highways present special challenges for installation and maintenance of BMPs. Safety considerations, along with limited work area for effectively managing erosion and sediment controls are two main challenges. The following are things to keep in mind when maintaining BMPs for linear projects:

- Avoid deep ponding areas that are not protected by temporary barriers.
- Do not allow water to pond in the clear recovery zone.
- Pay attention to sight distance obstructions when selecting controls. Do not use controls that may obstruct sight lines.
- Create a plan for maintenance. BMPs must be maintained; provide access that does not require traffic control and keeps personnel safe.
- Do not use inlet protection BMPs that would cause flooding in the traveled way, or cause the flow spread to enter the traveled way.
- Use alternative control methods where standing water may create potential hazards.
- Large drainage areas present situations with high flow volumes but limited areas for proper controls. It is imperative to recognize these areas at the beginning of a project and identify BMPs intended to control large flows at the start and as construction progresses. And also:
 - Look to provide diversions to bypass offsite water around the project area.



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- Use alternative BMPs or modify the traditional design when limited work area is a concern.

Communication During Construction

Designate a point of contact within all functional units associated with a project regarding construction stormwater issues. Construction sites change over time. Make sure the site meets the requirements of the stormwater pollution prevention plan (SWPPP) at all times. Keep good documentation, and take pictures of BMPs before and after maintenance.



Fig. 1-9. Covering a pile and maintaining a low profile shape are good ways to reduce wind erosion potential.

Source: RBF Consulting

Record Keeping and Reporting

Project documents must be kept for at least three years from the date the site is stabilized and the NPDES coverage is terminated. At a minimum, records should include:

- Copy of the project SWPPP and its amendments.
- Permit application and termination records.
- Inspection forms, including the date, place, time, significant observations (spills, leaks, etc.), and all non-stormwater discharges.



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- The corrective Action Log.
- Records of weather conditions (keeping a rain gage on site is highly recommended).
- BMP maintenance activity and troubleshooting.
- Names of inspector(s) and other key members of the DOT, contractor, and sub-contractors.



Fig. 1-10. Establishing responsibility for regular inspection and maintenance of stormwater BMPs is an important part of work and communication management key to preventing failures as show here. Source: *RBF Consulting*

Work Management

Stormwater pollution prevention is typically handled by more than one person. Roles and responsibilities should be understood and documented within the project SWPPP including:

- Overall lead
- Spill response
- Weather monitoring
- Housekeeping and BMP installation and maintenance
- Record keeping and reporting
- Training

General BMP Inspection and Troubleshooting

Each BMP presented in this guide has information on inspection, maintenance, and associated work. Many of the problems occurring in the field fall into the following general categories and are not associated specifically with any one BMP. A consideration for all is staff training.

Table 1-1. General BMP Troubleshooting

If Your BMP Experiences	Then Consider
Erosion	• Additional erosion control/soil stabilization BMPs • Diversion of flow around the area of concern using temporary runoff management practices • Modifying your construction sequence or schedule
Turbid Discharge	• Maintenance or redesign
Sediment and Debris Buildup	• Additional erosion control/soil stabilization BMPs • More frequent maintenance and clean out • Diversion using temporary runoff management practices • Modifying your construction sequence or schedule
Standing Water	• Inspection of inlets and pipes for blockage from trash and debris • Limit the drainage area to the BMP using runoff management practices • Increase the size (surface area) of your BMP • Add erosion and sediment control BMPs within the contributing drainage area
Bypass	• Increase the size of your BMP • Verify the size and physical adequacy of inflow and outflow structures, conduits, etc.
Malfunction Due to Design Deficiency	• Provide temporary runoff management controls to divert runoff away from problem area • Use runoff controls to slow the flow of runoff • Contact the design engineer of record for solution
Trackout	• Perform maintenance or provide additional perimeter controls • Verify that access points are controlled • Provide a tire cleaning area • Perform street sweeping

Final Stabilization and Permit Termination

BMPs must be maintained until work is completed, the project site is stabilized, and the project is eligible to end NPDES permit coverage. Requirements vary based on location, but stabilization generally occurs when vegetation covers unpaved areas with a uniform density of at least 70 percent of the pre-project condition. NPDES permit coverage also requires:

- Removal of trash and debris
- Removal of temporary BMPs and stabilization of resulting bare areas
- Repair and stabilization of areas showing erosion
- Permanent BMPs and drainage systems are in place and working



Fig. 1-11. Final stabilization is reached typically at 70 percent uniform cover. That percentage should be applied to the percent cover of pre-existing conditions.

Source: RBF Consulting

Chapter 2. POLLUTION PREVENTION AND GENERAL HOUSEKEEPING

Material and Waste Management

General Description

Building materials, including stockpiles, construction site wastes, sanitary wastes, and concrete wash water must be properly disposed of.

Implement and maintain the following:

- Protect stockpile areas with perimeter controls
- Cover and contain solid and liquid waste, including concrete washout areas and sanitary facilities
- Trash disposal and recycling
- Cover and contain materials
- Have a spill kit and clean up spills



Fig. 2-1. Trash and debris are among those most common pollutants at construction sites. Proximity to open storm drains is especially problematic.

Source: RBF Consulting

Inspection and Maintenance

Inspect weekly or as required otherwise by local procedures or regulatory standards.

Stockpiles and Contaminated Zones

- Inspect covers, liners, perimeter controls, and containment structures for tears or failure points. Repair as necessary to maintain proper function.
- Inspect perimeter controls for breaches or failure points.
- Check for signs of erosion or rilling on stockpiles.
- Inspect capacity of containment structures.



Fig. 2-2. This portable toilet shows no evidence of trash, debris, or drainage of liquid waste. Note the use of perimeter controls along the downward sides.
Source: RBF Consulting

Solid and Liquid Waste Management

- Inspect concrete washout facility for torn liner, missing or damaged gravel bags, and sufficient remaining holding capacity.
- Provide signs for the concrete washout-area location.
- Inspect areas around dumpsters and drainage ways for trash and debris.
- Collect site trash daily. Cover trash containers at the end of each work day and when it is raining.
- If dumpsters are full, empty them immediately.

- Inspect areas in and around portable toilets for trash and debris or liquid waste.

Material Use, Storage, and Spills

- Keep temporary containment facilities free of captured rainwater and spills.
- Keep supplies of spill control and cleanup materials onsite, especially near storage, unloading, and maintenance areas.
- Keep Material Safety Data Sheets (MSDS) and the spill prevention and control plan up to date.
- Ensure SWPPP requirements are followed.
- Do periodic staff training on spill prevention and containment methods.



Fig. 2-3. Paints should ideally be stored inside. When this is not possible, a tarp or cover is the next best option.

Source: RBF Consulting

Other General Practices

Stockpiles and Contaminated Zones

- DO** install perimeter controls around stockpile to protect the pile from erosion and prevent sedimentation.
- DO** wet stockpiles to control dust during dry periods.

- DO** cover stockpiles with plastic sheeting to protect from rain and wind.
- DO** clean up contaminated zones.
- DO NOT** allow ground, surface, or stormwater to flow through contaminated zones.
- DO NOT** stockpile contaminated soils near stormdrains, waterways, wetlands, or low lying areas.



Fig. 2-4. Materials are being properly stored on pallets, and unused materials are covered with a tarp.

Source: Colorado DOT

Solid and Liquid Waste Management

- DO** designate waste collection areas and sanitary facility areas that are level, paved, covered or in secondary containment, and provide easy access for servicing.
- DO** prevent stormwater from entering waste containment areas.
- DO** treat and dispose of sanitary or septic wastes in accordance with state and local requirements.
- DO** secure temporary sanitary facilities to prevent overturning during high winds or by vandals.



DO designate waste collection areas and sanitary facility areas that are level, paved, covered or in secondary containment, and provide easy access for servicing.



Fig. 2-5. Leaving trash dumpsters uncovered is among the most typical mistakes on construction sites.

Source: Nevada DOT

- DO NOT** place liquid waste and chemicals (e.g., petroleum products, paints, solvents, pesticides, curing compounds, etc.) in dumpsters designated for litter and construction debris.
- DO NOT** wash out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- DO NOT** place temporary sanitary facilities or concrete washouts within 50 feet of drainage facilities,

watercourses, and traffic circulation. Keep both away from concentrated storm flow.

DO NOT discharge or bury wastewater.



DO NOT discharge or bury wastewater.



Fig. 2-6. Careful inspection could have prevented this spill onto the roadway. Stormwater inlets near the areas should immediately be assessed for impact. Since the spill appears small, rags may prove effective for cleanup.

Source: RBF Consulting

Material Use, Storage, and Spills

- DO** keep plenty of spill cleanup supplies available for the materials being stored or used onsite. Keep spill cleanup supplies near storage, unloading, and maintenance areas.
- DO** designate an area(s) for material delivery and storage.
- DO** line and berm material storage areas if located on

bare soil. When available, place material storage areas in paved areas.

- DO** store chemicals in a storage shed or in water-tight containers with secondary containment.
- DO** store materials in original containers with legible product labels.
- DO** minimize the storage of hazardous materials onsite.
- DO** keep a list of potential non-visible pollutants at the site. Have authorized and trained personnel do sampling in accordance with requirements, if needed.
- DO** cover and protect spills from stormwater run-on during rainfall so long as it does not compromise cleanup activities.
- DO** use a rag for small spills on paved surfaces. Use a damp mop for general cleanup. Use absorbent material for larger spills.



DO keep a list of potential non-visible pollutants at the site. Have authorized and trained personnel do sampling in accordance with requirements, if needed.



DO use a rag for small spills on paved surfaces. Use a damp mop for general cleanup. Use absorbent material for larger spills.

-
- DO NOT** over-apply fertilizers, pesticides, and herbicides—follow manufacturer's directions. Do not apply if rain is in forecast within three days.



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DO NOT locate temporary storage areas near vehicular traffic.

DO NOT store bagged or boxed materials on the ground. Cover them and store on pallets.

DO NOT hose down or bury dry materials.

DO NOT locate material delivery and storage areas near waterways or any place with the potential to come into contact with stormwater runoff.



Fig. 2-7. Waste and debris permitted to come into contact with large amounts of drainage represent a significantly greater environmental risk.

Source: RBF Consulting



DO NOT locate material delivery and storage areas near waterways or any place with the potential to come into contact with stormwater runoff.



Fig. 2-8. Left—A concrete washout left unprotected.
Source: Nevada DOT



Right—A concrete washout adequately covered.



Fig. 2-9. While there appears room in this concrete washout, it has reached the recommended 75 percent capacity and should be cleaned out.
Source: RBF Consulting



Fig. 2-10. This sanitary facility has not been provided with secondary containment, and is located very close to a large amount of concentrated drainage.

Source: RBF Consulting



Fig. 2-11. Materials should be stored in designated areas and not with direct discharge to unprotected inlets.

Source: RBF Consulting



Fig. 2-12. Workers overlook placement of small amounts of waste material such as this in proper disposal areas.

Source: RBF Consulting



Fig. 2-13. Equipment and vehicles should be inspected routinely for leaks. An ample supply of cleanup materials should be kept at all designated maintenance areas where leaks and spills are likely to occur.

Source: Colorado DOT



Fig. 2-14. This picture depicts residue from cleanout of a concrete truck not performed in a controlled washout area.

Source: RBF Consulting

Street Cleaning

General Description

The construction of streets, roads, highways, and parking lots can generate pollutants like sediment, debris, and trash, which can be controlled by street sweeping. Street sweeping involves the use of self-propelled or walk-behind equipment to remove sediment and other pollutants from paved surfaces.

Inspection and Maintenance

Inspect weekly for pollutant accumulation or as dictated otherwise by local procedures or regulatory standards.

- Inspect entrance and exit points for sediment tracking daily.
- Adjust brooms as necessary to get the best results.



Fig. 2-15. This sweeper is properly cleaning up a construction site.

Source: Colorado DOT

Other General Practices

- DO** perform street cleaning more often based on traffic and inspection results.
- DO** properly dispose of wastes.
- DO NOT** rely on sweeping if it is ineffective due to soil type or moisture present.
- DO NOT** sweep up unknown substances or objects that may be hazardous.



DO perform street cleaning more often based on traffic and inspection results.

Other Associated Work

- If the sweeper is not picking up sediment, adjust the sweeper brooms or consider alternate attachments.
- If sweeping causes excessive dust, use a sweeper with water, air recirculation, or filtration.



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Protection of Permanent BMPs

General Description

Permanent BMPs are used to treat stormwater after site development is completed. State and federal programs require public agencies engaged in new development or redevelopment activities to install permanent BMPs.

Some permanent BMPs can be used as temporary construction BMPs if indicated by the plans. However, other permanent BMPs including infiltration, bioretention, and media filter BMPs must be protected from construction activities. This may be done with the use of diversion berms or ditches and fencing or roping off of future protected areas.

Inspection and Maintenance

Inspect weekly or as dictated otherwise by local procedures or regulatory standards.

- Check condition of construction fencing or roping around permanent BMP areas.
- Inspect diversion berms or ditches for possible breach or washout. Look for signs of sediment entering future infiltration areas.
- Do not allow construction site runoff to enter permanent BMPs unless the BMP has been designated for use during construction and approved by the Engineer.
- Remove sediment retained by diversion berms once it has reached one-half of the exposed height of the berm.



DO stabilize upstream drainage areas before construction of infiltration, bioretention, and media filter BMPs.

Other General Practices

- DO** stabilize upstream drainage areas before construction of infiltration, bioretention, and media filter BMPs.
- DO** place diversion berms around edges of future infiltration sites to prevent sediment from entering during construction.
- DO NOT** use retention/detention permanent BMPs as temporary construction BMPs unless designated for temporary use on plans.



If permanent infiltration, bioretention, or media filter BMP areas are clogged with sediment, they must be re-built.

Other Associated Work

If permanent infiltration, bioretention, or media filter BMP areas are clogged with sediment, they must be cleaned. Additional perimeter protection and soil stabilization measures should be provided where appropriate.

Illegal Discharges

General Description

Illegal (a.k.a. "illicit") discharges refer to unpermitted non-stormwater discharges and dumping of waste within the project site.

Inspection

Inspect weekly, following a runoff-producing event, or as dictated otherwise by local procedures or regulatory standards.

- Inspect site for illegal dumping before beginning the job.



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