

## BEST MANAGEMENT PRACTICES

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### 5.1 INTRODUCTION

Best Management Practices (BMPs) are operational activities or physical controls that reduce the discharge of pollutants and minimize potential impacts upon receiving waters. In order to complete the *Stormwater Pollution Prevention Plan* (SWPPP) for ADOT approval, the contractor is required to select those BMPs which will best control stormwater pollution. Chapter 2 Project Planning and Design Guide of this manual offers one approach for selecting construction BMPs.

This chapter discusses BMP implementation factors and provides a toolbox of BMPs. Each highway construction project has unique conditions that may require new or custom BMPs to be designed or developed to meet water quality goals. Refer to the *ADOT Post-Construction Best Management Practices Manual* for a list of permanent BMPs for use in highway design and construction.

The design standards, details and material specifications for BMPs in this manual are subject to change. Stormwater erosion and pollution control BMPs are rapidly evolving and should be periodically checked for updates in design methods, specifications or materials.

### 5.2 IMPLEMENTING CONSTRUCTION SITE BMPS

Throughout the highway project development process each responsible participant will have identified BMPs to be used to prevent stormwater pollution. Successful implementation of these BMPs depends on many factors including:

- Thorough project site assessment prior to BMP installation and start of construction
- Comprehensive review of plans, details and specifications
- Development of the SWPPP including accurate maps of BMP locations
- Identification of strategies to limit the extent of disturbance throughout the entire project timeline
- Properly sized BMPs (flows typically increase down the watershed)
- Use of combinations of BMPs for most effective erosion and pollution control
- Inspection, maintenance and repair or replacement of BMPs
- Use of alternative BMPs
- Proper employee training
- Diligent record keeping to document BMP inspection, performance and maintenance

The contractor is advised to consider these factors as he or she prepares to implement project BMPs, both those specified in plans and details, and those he has included in the SWPPP.

Stormwater erosion and pollution control is a dynamic process that requires continuing effort to meet water quality goals.

Construction sites that disturb less than one acre are exempt from permit coverage, **however, operators are required to apply stormwater quality and erosion/sediment control BMPs as part of ADOT's compliance practices and pollution prevention measures.** The exemption of NPDES or AZPDES permit coverage for sites under one acre of soil disturbance could be canceled if the operator violates water quality standards by not correctly implementing BMPs.

**BEST MANAGEMENT PRACTICES**

**Construction BMPs**

<b>SC</b>	<b>Sediment Control, continued</b>
SC-12	Compost Sock
SC-13	Rock Berm
<b>GH</b>	<b>Good Housekeeping</b>
GH-1	Vehicle and Equipment Cleaning
GH-2	Vehicle and Equipment Fueling
GH-3	Vehicle and Equipment Maintenance
GH-4	Street Sweeping and Vacuuming
GH-5	Material Delivery and Storage
GH-6	Material Use
GH-7	Stockpile Management
GH-8	Spill Prevention and Control
GH-9	Portable Toilet
<b>NS</b>	<b>Non-Stormwater</b>
NS-1	Water Conservation Practices
NS-2	Dewatering Operations
NS-3	Paving and Milling Operations
NS-4	Temporary Watercourse Crossing
NS-5	Water Diversion
NS-6	Structure Demolition/Removal Over or Adjacent to Water
NS-7	Material and Equipment Use In/Over Watercourses
<b>WM</b>	<b>Waste Management</b>
WM-1	Solid Waste Management
WM-2	Hazardous Waste Management
WM-3	Contaminated Soil Management
WM-4	Concrete Waste Management
WM-5	Liquid Waste Management

<b>CP</b>	<b>Construction Site Planning and Management</b>
CP-1	Construction Sequencing
CP-2	BMP Inspection and Maintenance
<b>EC</b>	<b>Erosion Control</b>
EC-1	Preserve Existing Vegetation
EC-2	Minibenches/Slope Roughening
EC-3	Mulch Cover
EC-4	Seeding
EC-5	Geotextiles/Erosion Control Blankets
EC-6	Soil Binders
EC-7	Crown Ditch
<b>RC</b>	<b>Runoff Control</b>
RC-1	Earth Dikes/Drainage Swales and Lined Ditches
RC-2	Cut to Fill Slope Transitions
RC-3	Erosion Protection at Structures
RC-4	Rock Outlet Protection/ Velocity Dissipation Devices
RC-5	Slope Drains
RC-6	Check Dam
<b>SC</b>	<b>Sediment Control</b>
SC-1	Sediment Control Berm
SC-2	Silt Fence
SC-3	Sediment Trap
SC-4	Sediment Basin
SC-5	Sediment Wattle
SC-6	Sediment Log
SC-7	Gravel Bag Protection
SC-8	Storm Drain Inlet Protection
SC-9	Curb Inlet Protection
SC-10	Stabilized Construction Entrance/Exit
SC-11	Stabilized Construction Roadway

Table 5.1: Construction BMPs

## BEST MANAGEMENT PRACTICES

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### 5.3 CONSTRUCTION BEST MANAGEMENT PRACTICES

Table 5.1 Construction BMPs lists the BMP categories and the BMPs included in this manual. Post-Construction BMPs are discussed in the *ADOT Post-Construction Best Management Practices Manual For Highway Design and Construction (July 2009)*. Use both manuals to assist in developing effective erosion and pollution controls for highway projects.

#### BMP Categories and Sheets

The BMP sheets that follow are organized by category. Each BMP sheet includes a definition, purpose, and the AT A GLANCE section which provides brief information to assist in the selection of BMPs applicable to your project. Photographs and specific information on appropriate applications, limitations, planning/design considerations, material specifications, design standards and inspection and maintenance requirements complete each sheet. ADOT Erosion/Sediment Control and Water Quality Protection Details listed on individual BMP sheets are available at the ADOT Roadside Development Section website: [http://www.azdot.gov/Highways/Roadway\\_Engineering/Roadside\\_Development/Resources.asp](http://www.azdot.gov/Highways/Roadway_Engineering/Roadside_Development/Resources.asp).

#### References and Resources

- *Arizona Department of Environmental Quality – Aquifer Protection Permit.*
- *Arizona Department of Environmental Quality Arizona Department of Transportation Statewide Permit for Discharges to Waters of the United States under the Arizona Pollutant Discharge Elimination System Program, February 2008.*
- *Arizona Department of Environmental Quality Arizona Pollutant Discharge Elimination System General Permit for Discharge from Construction Activities to Waters of the United States, February 2008.*
- *Environmental Protection Agency National Pollutant Discharge Elimination System General Permit for Discharge from Construction Activities to Waters, February, 2012.*
- *ADOT Erosion and Pollution Control Manual: for Highway Design and Construction, January 25, 2005.*
- *ADOT Maintenance and Facilities Best Management Practices Manual, 2010.*
- *ADOT Post-Construction Best Management Practices Manual June 2009.*
- *ADOT Statewide Storm Water Management Plan, February 2005 (3rd revision).*
- *ADOT SWPPP Template, June 10, 2010.*
- *Environmental Protection Agency Developing Your Stormwater Pollution Prevention Plan, A Guide for Construction Sites, May, 2007.*

Additional references and sources are listed on each BMP sheet as applicable.

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**BEST MANAGEMENT PRACTICES****Construction Site Planning & Management (CP) BMPs**

Construction site planning and management can reduce erosion and sediment loss by limiting the amount of disturbed area on the site at any one time, through proper implementation, inspection and maintenance of BMPs, through achievement of final stabilization of disturbed areas as the project progresses and by implementation of other considerations described in the Construction Sequencing BMP.

- CP-1 Construction Sequencing
- CP-2 BMP Inspection and Maintenance

Section 104.09 of the ADOT Stored Specifications states:

“Unless otherwise approved by the Engineer, the contractor shall not expose a surface area of greater than 750,000 square feet (17.22 acres) to erosion through clearing and grubbing, or excavation and filling operations within the project limits until temporary or permanent erosion control devices for that portion of the project have been installed and accepted by the Engineer.

The contractor shall indicate each 750,000 square-foot (17.22 acres) sub-area in the draft SWPPP, along with proposed erosion control measures for each sub-area. The draft SWPPP shall also include the sequence of construction for each sub-area, and installation of the required temporary or permanent erosion control measures.”

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### *APPROPRIATE APPLICATIONS*

- All construction projects.

### *LIMITATIONS*

- Weather and other variables might affect construction schedules. The schedule should be updated to reflect changes due to these variables.

### *PLANNING/DESIGN CONSIDERATIONS*

- Plan and schedule construction activities to minimize the amount of disturbed land exposed to erosive conditions.
- Install and maintain stabilization measures as work progresses, not just at the completion of construction.
- Schedule the installation of construction (temporary) and post-construction (permanent) controls as specified in the applicable stormwater discharge permit (FCGP, AZCGP, ADOT Statewide).
- The schedule of construction activities and concurrent application of construction and post-construction BMPs is developed as part of the SWPPP.
- Schedule clearing and grubbing activity to allow existing vegetation to remain in place as long as possible.
- For larger projects, the contractor shall not expose more than 750,000 square feet in any location until construction or post-construction BMPs have been installed and accepted by the Engineer.
- Stabilize non-active or construction-delayed areas as specified in the CGP.
- Monitor weather forecast and adjust the construction schedule to allow for the implementation of soil stabilization and sediment controls on all disturbed areas prior to the onset of rain.

### *DESIGN STANDARDS*

- Develop the project construction schedule per the applicable permit requirements and ADOT specifications.
- The schedule should:
  - clearly define where and when BMPs will be installed.
  - include dates for installation of permanent drainage systems and runoff diversion devices. Install these devices as early as possible in the construction process.
  - include good housekeeping, non-stormwater and waste management BMPs.
  - include dates for significant long-term operations or activities that may have planned non-stormwater discharges such as dewatering, saw-cutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, bridge cleaning, etc.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow the schedule as written; monitor and modify as needed prior to implementing changes in construction activities.

# Construction Site Planning & Management

## BMP Inspection and Maintenance

CP-2

### DEFINITION

BMP inspection and maintenance are critical to successful construction site stormwater management. Routine (planned) and non-routine (repair) inspection and maintenance help identify potential problems and can reduce the need for BMP replacement or major repair.

### PURPOSE

- Ensure proper BMP installation and functionality.
- Minimize potential impacts of stormwater erosion and pollution through early detection, repair and replacement of ineffective BMPs.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Frequency of inspection and type of maintenance may vary for each BMP</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• CP-1 Construction Sequencing</li> <li>• All BMPs</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Refer to the applicable stormwater discharge permit and individual BMPs for requirements</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping	X		
Non-Stormwater	X		
Waste Management	X		

ARIZONA DEPARTMENT OF TRANSPORTATION - INTERMODAL DIVISION  
Construction Inspection Quantilist  
Roadside Development - Division VIII Storm Water: BMP Inspection

Tracs Number: \_\_\_\_\_ Location: \_\_\_\_\_  
 Reviewer: \_\_\_\_\_ Normal / Rain Event: \_\_\_\_\_  
 Author: Leroy Brady ECC Name: \_\_\_\_\_  
 Version: 02222007

Subcontractor: \_\_\_\_\_ Supervisor: \_\_\_\_\_  
 Type: Inspection Date: \_\_\_\_\_

Conforming	Attributes	
Y N N/A <input type="checkbox"/>	1. The contractor is monitoring rainfall with a commercially manufactured rain gauge accurate to within 0.10 inches of rain, with results filed in the SWPPP, and copies submitted the Engineer on a weekly basis.	Stored Spec.
4	Comments:	104.09-F ADOT-EPCM
Y N N/A <input type="checkbox"/>	2. No clearing, grubbing, earthwork or other work elements affected by the requirements in the Storm Water Pollution Prevention Plan (SWPPP) are started until areas of environmental importance are clearly marked.	
4	Comments:	5.1.2 Stored Spec.
Y N N/A <input type="checkbox"/>	3. Joint inspections (ECC and ADOT) are conducted every 14-calendar days or at the frequency specified in the approved SWPPP, by the contractor's ECC.	
4	Comments:	104.09-F Stored Spec.
Y N N/A <input type="checkbox"/>	4. Joint inspections (ECC and ADOT) are conducted within 24 hours after any storm event of 0.50 inch or more.	
4	Comments:	104.09-F Stored Spec.
Y N N/A <input type="checkbox"/>	5. Complete and accurate Compliance Evaluation Reports are prepared and signed by the ECC for each inspection, filed in the contractor's SWPPP, with a copy to the Engineer.	
4	Comments:	104.09-F ADOT-EPCM
Y N N/A <input type="checkbox"/>	6. BMPs designated by the SWPPP to intercept upslope runoff water or protect fill slopes such as wattles, sediment logs, silt fence and sediment control berms are properly installed prior to excavation and embankment activities.	
4	Comments:	5.2 to 5.3

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Typical Construction Inspection Checklist.

Sediment wattle inspection.

### *APPROPRIATE APPLICATIONS*

- All construction site BMPs.
- Inspection and maintenance must be performed at a minimum per the applicable stormwater discharge permit requirements on all highway construction and/or maintenance projects.

### *LIMITATIONS*

- Stockpiles of materials for timely BMP repair and/or replacement may be necessary.

### *PLANNING/DESIGN CONSIDERATIONS*

- Develop and adhere to a routine inspection schedule per the applicable stormwater discharge permit requirements.
- Erosion Control Coordinators must conduct inspections and identify BMPs in need of repair or replacement.

### *MATERIAL SPECIFICATIONS*

- N/A

### *DESIGN STANDARDS*

- Maintain BMPs per individual BMP sheet design and maintenance sections, ADOT Erosion/Sediment Control and Water Quality Protection Details and project Special Provisions.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Refer to the applicable stormwater discharge permit and individual BMP sheets for requirements.

**BEST MANAGEMENT PRACTICES**

## Erosion Control (EC) BMPs

Erosion control (soil stabilization) consists of preparing the soil surface and applying BMPs or combinations thereof to disturbed soil areas. Temporary soil stabilization shall be applied to disturbed soil areas of construction projects per plans, details, specifications, and applicable Construction General and/or ADOT permits.

Erosion control BMPs are the first line of defense, rely on them to retain soil in place.

- EC-1 Preserve Existing Vegetation
- EC-2 Minibenches/Slope Roughening
- EC-3 Mulch Cover
- EC-4 Seeding
- EC-5 Geotextiles/Erosion Control Blankets
- EC-6 Soil Binders
- EC-7 Crown Ditch

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# Erosion Control

## Preserve Existing Vegetation

EC-1

### DEFINITION

The carefully planned protection of in-place, undisturbed trees and natural vegetated areas within the construction site right-of-way.

### PURPOSE

- Minimize the amount of bare soil exposed to erosive factors.
- Reduce soil erosion, sediment transport and tracking.
- Reduce maintenance.
- Provide buffers, screens and aesthetic values.
- Provide stormwater detention, biofiltration and fully developed habitat for wildlife.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Implement landform grading practices required for slope rounding per plans</li> <li>• Identify and clearly mark vegetation to preserve</li> <li>• Fence preservation areas</li> <li>• Locate temporary roads and staging areas to avoid vegetation</li> <li>• Maintain pre-construction drainage patterns</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• Slope Rounding Standard Drawing C-02 Series</li> <li>• RC-2 Cut to Fill Slope Transitions</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Maintain fencing</li> <li>• Evaluate vegetation for signs of stress and address as necessary</li> <li>• Repair or replace damaged vegetation immediately</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Adjacent vegetation preserved-in-place.



Specimen Saguaro preserved-in-place.

### *APPROPRIATE APPLICATIONS*

- Protect trees and natural areas not in direct conflict with construction zones and activities.
- Stage clearing and grubbing and grading operations to maximize preservation of existing of vegetation.
- Especially beneficial for floodplains, wetlands, stream banks, steep slopes and areas where other erosion controls may be difficult to establish, install or maintain.

### *LIMITATIONS*

- Difficult on sites with restricted access.
- May limit area available for construction activity.

### *PLANNING/DESIGN CONSIDERATIONS*

#### *TIMING*

- Evaluate existing vegetation early in the planning process and adjust grading limits around high quality natural areas.
- Identify areas to be preserved in place on the project plans; clearly mark and fence these on site.
- Conform to scheduling requirements set forth in the Special Provisions.
- Do not begin clearing and grubbing, grading and other soil-disturbing construction activities prior to marking and fencing of existing vegetation.
- Specify a regular watering schedule or install a temporary irrigation system.

#### *DESIGN AND LAYOUT*

- Mark areas to be preserved with highly visible, non-metallic, temporary fencing as described in the project Special Provisions.
- Place temporary fencing beyond the canopy of vegetative cover by a distance that is 1½ times the radius.
- Construct temporary roads within limits of disturbance of permanent road to minimize disturbance to existing vegetation.
- Do not locate construction materials, parking areas and/or store equipment within fenced preservation areas.
- Do not store waste materials or vegetation to be removed within the fenced preservation areas.

#### *CONSTRUCTION ACTIVITIES*

- Cover disturbed tree roots with soil as soon as possible and consult a certified arborist.
- Cleanly cut damaged roots and limbs.
- Consult a certified arborist to examine seriously damaged trees.
- Remove and replace trees if they are damaged seriously enough to affect their survival.
- Aerate soil compacted by construction activity.
- Immediately repair damage to irrigation systems and flush soil from lines.
- Remove fencing from around preserved areas and trees during final site cleanup.

### *MATERIAL SPECIFICATIONS*

- Refer to project Special Provisions for fencing material requirements or other preservation material requirements.

### *DESIGN STANDARDS*

- Conform with Arizona Native Plant Law and local jurisdiction requirements.

### INSPECTION AND MAINTENANCE REQUIREMENTS

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect the preservation fencing to ensure that it is intact and that there has been no encroachment into the preservation area.
- Evaluate preserve-in-place vegetation for signs of stress.
- Address unhealthy and declining vegetation as described in project Special Provisions.
- Maintain preservation fencing as needed



*Mature trees preserved in place. Notice sediment wattles, erosion control blanket, seeding and mulch cover BMPs used in combination to achieve the most effective erosion control for these site conditions.*

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# Erosion Control

## Minibenches/Slope Roughening

EC-2

### DEFINITION

Increasing the relief of a bare soil surface by creating horizontal grooves, parallel contours, furrows, terraces, serrations or stair-steps on the soil surface.

### PURPOSE

- Reduce the speed of runoff, trap sediment and improve water infiltration.
- Improve seed retention, germination and thus revegetation.
- Increase effectiveness of construction and post-construction soil stabilization practices.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Apply to all constructed slopes</li> <li>• Evaluate slope type and equipment availability to determine method of roughening</li> <li>• Seed roughened areas as soon as possible</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• SC-5 Sediment Wattle</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• EC-3 Hydraulic Mulch</li> <li>• EC-4 Seeding</li> <li>• EC-7 Crown Ditch</li> <li>• Slope Rounding, ADOT Standard Drawing C-02 series</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Monitor vegetation establishment</li> <li>• Inspect and repair after storm events</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Compare slope treatment effectiveness.



Minibenched slope with vegetation.

### *APPROPRIATE APPLICATIONS*

- All constructed slopes.
- Soils prone to erosion.
- Where there is a large area of undisturbed slope above a constructed slope.
- Prior to application of permanent seeding.

### *LIMITATIONS*

- Not appropriate on rocky slopes.

### *PLANNING/DESIGN CONSIDERATIONS*

- Construct minibenches from the top of a cut slope down **DURING** slope construction.
- Construct minibenches, terraces, furrows and other horizontal roughening techniques parallel to the contours along the entire length.
- Apply seeding for revegetation and permanent erosion control as the slope is being constructed to conform to the application limits of the seeding/mulching equipment.
- Where horizontal roughening falls away from the contour, additional BMPs may be required to protect the slope.
- Use with other BMPs and run-on diversion measures to prevent scour.

### *MATERIAL SPECIFICATIONS*

- N/A

### *DESIGN STANDARDS*

- ADOT Erosion/Sediment Control and Water Quality Protection Detail: Slope Minibenching.
- ADOT Standard Specifications for Road and Bridge Construction Section 805-3.02(B).
- ADOT Erosion/Sediment Control and Water Quality Protection Detail: Slope Rounding.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.

# Erosion Control

## Mulch Cover

EC-3

### DEFINITION

The placement of a layer of organic material on slopes and other disturbed roadside areas by either incorporating it into the soil through mechanical means (e.g., a drill or studded roller) or by a tackifier that adheres the material to the soil surface. Types of mulch cover include hydraulic mulch, straw mulch, compost mulch and bonded fiber matrix.

### PURPOSE

- Reduce soil erosion through temporary stabilization.
- Improve infiltration.
- Protect exposed soil from erosion by raindrop impact or wind.
- Aid in plant and seeding establishment.
- Prevent surface compaction or crusting.

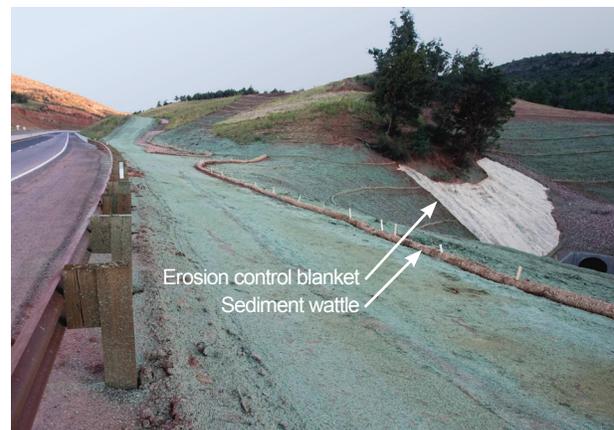
### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Select type of mulch material based on soil type</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• EC-6 Soil Binders</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• CP-1 Construction Sequencing</li> <li>• EC-2 Minibenches/Slope Roughening</li> <li>• EC-7 Crown Ditch</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect for firm continuous contact of material with soil</li> <li>• Inspect and repair until vegetation is established</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Straw mulch cover over a seeded slope.



Mulch cover used in combination with sediment wattles, erosion control blankets and vegetation preserved in place.

### *APPROPRIATE APPLICATIONS*

- Disturbed areas to temporarily stabilize soils until permanent measures are installed and final stabilization is achieved.
- Sensitive areas can be mulched if rain is predicted at the end of a day's operations.

### *LIMITATIONS*

#### HYDRAULIC MULCH

- Wood fiber hydraulic mulches are typically short-lived (less than a growing season).
- Hydraulic tackifiers typically require 24 hours of cure time to be effective; therefore, they should not be applied immediately prior to a storm event.
- Subject to wind and erosion during large storm events.
- May delay seed germination due to changes in soil surface temperature.

#### STRAW MULCH

- Where mechanical straw blowers are used, application areas are typically limited to within approximately 150 feet of equipment. Therefore, for large slopes frequent mobilizations and applications are necessary.
- Application of straw mulch by hand is typically expensive.
- Potential for accidental introduction of undesirable weed species.
- Blown straw becomes an air quality issue when applied in urban areas, if not prewetted.

#### COMPOST/WOOD MULCH

- Susceptible to wind disturbance; therefore must be anchored to the soil by:
  - crimping, tracking, disking or punching.
  - hydraulic bonding using organic or acrylic tackifiers.
  - covering with netting and stapled.
- Potential for accidental introduction of undesirable weed species and/or insects.
- Must be accessible to equipment used for application of mulch.
- Will not withstand significant concentrated flows and is prone to sheet erosion.
- Wood is **not** acceptable as final cover over seeding.

#### BONDED FIBER MATRIX

- Higher application rates required for steeper slopes may inhibit germination of seed and establishment of long-term vegetation.
- Surface treatment only - unlikely to improve compacted, nutrient depleted, or poorly draining soils necessary to ensure vigorous long term vegetative cover.
- Inefficient technique to treat disturbed areas less than 0.5 acres.

### *PLANNING/DESIGN CONSIDERATIONS*

- Required as grading proceeds.
- Mulch cover may or may not require a binder, netting or tacking.
- Hydraulic matrices are typically effective for longer periods of time.

### *MATERIAL SPECIFICATIONS*

- Natural mulches should be used when possible.
- All mulch material should be free of seed.
- Organic soluble powder adhesive, derivative of plant material psyllium or Guar should be used as tackifier.
- Thermally refined wood fiber.
- Compost must meet the requirements Section 810-2.02 of the ADOT Standard Specifications.
- Refer to Standard Specification Section 805-2.03 for types of mulching materials.
- Comply with applicable jurisdictions' regulations and guidelines.

### *DESIGN STANDARDS*

- Crimp or tack mulch material.
- Requires adequate coverage to prevent erosion, washout and poor plant establishment.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Maintain an unbroken ground cover throughout the period of construction if the soils are not being reworked.
- Repair, reseed and/or remulch surfaces if washout, breakage or erosion occurs.
- Install anchors if needed.
- Reapply mulch when more than 20% bare ground is exposed in application areas.

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# Erosion Control

## Seeding

EC-4

### DEFINITION

The ADOT seeding process includes tillage and amending the soil prior to seed application and straw mulching after seed application to protect exposed soils from erosion by water and wind.

### PURPOSE

- Reduce erosion through establishing perennial vegetative cover and/or soil stabilization
- Meet Final Stabilization as required by Section 402 of the Clean Water Act.
- Minimize long-term maintenance costs.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Determine appropriate seed species and rate of application based on project conditions, including soils and climate</li> <li>• Protect adjacent areas from over-spray</li> <li>• Adherence to Section 805 of the ADOT Standard Specifications</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• EC-3 Mulch Cover</li> <li>• EC-5 Geotextiles/Erosion Control Blankets</li> <li>• EC-6 Soil Binders</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• EC-2 Minibenches/Slope Roughening</li> <li>• EC-3 Mulch Cover</li> <li>• SC-5 Sediment Wattles</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Repair and reseed areas if damaged from flooding or erosion</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Hydraulically applied compost may be used on slopes steeper than 3:1 or where broadcast application is not feasible.



Successful wildflower seed germination on properly prepared slope.

### *APPROPRIATE APPLICATIONS*

- Where permanent, long-lived vegetation cover is the most economical or practical.

### *LIMITATIONS*

- Vegetative establishment is affected by dry or cold weather.
- Application cannot occur during windy conditions.
- Seeded areas cannot be driven over by mechanical equipment.
- Requires time for seed to establish; immediate results are not seen.

### *PLANNING/DESIGN CONSIDERATIONS*

- Site conditions must be evaluated prior to determining suitable species selection and application rates. Attributes such as soil types, topography, local climate and season, maintenance requirements, proximity of sensitive areas (e.g., live streams), and existing native vegetation types are factors.
- Follow the seeding steps to achieve the most successful vegetative cover:
  - Tillage: till areas to be seeded per the project specifications; soil shall be loose and friable prior to application.
  - Amending the Soil: apply low solubility/slow release fertilizers, sulfur and compost over rough, ripped soils prior to final tillage per the specifications.
  - Seed Application: apply seed by drilling, hydroseeding or broadcasting as soon as possible after grading is completed.
  - Straw Mulching: mulch with certified, weed-free straw that is crimped and tacked or hydraulically applied.
  - Rain and Time: with rain and time, vegetation will establish if steps 1-4 are implemented properly and in the correct sequence.
- Prior to use, ADOT shall approve application rates for mulches, tackifier, soil amendments and seed mixtures per specifications.

### *MATERIAL SPECIFICATIONS*

- All seed shall be in conformance with requirements of the project specifications.
- ADOT Standard Specifications for Road and Bridge Construction Section 805-2.

### *DESIGN STANDARDS*

- ADOT Standard Specifications for Road and Bridge Construction Section 805-3

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Identify areas that need to be reseeded or where additional BMPs are necessary.
- The contractor is responsible for maintaining all slopes to prevent erosion and reduce sediment loss.

### *REFERENCES AND SOURCES*

- ADOT Standard Specifications for Road and Bridge Construction Section 805

# Erosion Control

## Geotextiles/Erosion Control Blankets

EC-5

### DEFINITION

A natural (excelsior, straw, coconut, etc.) or synthetic (usually polyethylene) material manufactured by weaving or bonding fibers, installed to reduce soil erosion by wind or water.

### PURPOSE

- Reduce rainfall impact and improve infiltration.
- Provide a microclimate to promote seed establishment.
- Protect exposed soil from wind and rain.
- Reduce erosiveness of concentrated flows.
- Hold mulch, seed, fertilizer and topsoil in place.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Obtain prior approval from ADOT Roadside Development Section</li> <li>• Select appropriate geotextile material for site conditions</li> <li>• Properly prepare site</li> <li>• Must be properly anchored</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• Erosion Control BMPs: EC-1-EC-4, EC-6-EC-7</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• EC-4 Seeding</li> <li>• EC-7 Crown Ditch</li> <li>• SC-2 Silt Fence</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect to ensure blanket maintains continuous contact with the ground</li> <li>• Repair or replace if rilling under blanket occurs</li> <li>• Remove trapped sediment after each storm event</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction	X		
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control		X	
Runoff Control		X	
Sediment Control		X	
Good Housekeeping			
Non-Stormwater			
Waste Management			



Blanket used in combination with mulch cover, sediment wattles and rock mulch.



Erosion control blanket installation.

### *APPROPRIATE APPLICATIONS*

- Concentrated flow areas such as ditches and channels with flows exceeding 3.3 ft./sec. (refer to ADOT Hydraulic Manual for channel lining criteria).
- Stockpiles.
- Slopes with highly erosive soils and slopes adjacent to bodies of water, when recommended by ADOT.

### *LIMITATIONS*

- Material, installation and maintenance costs are typically high.
- Not suitable for excessively rocky sites or rough slopes.
- Not suitable for all soil types. May not perform well on clay soils.
- Not suitable for areas where vegetation will be mowed.
- Some geotextiles disintegrate when exposed to light.
- Must be properly anchored; some geotextiles may increase runoff or blow away.
- May trap wildlife.
- Effectiveness depends on strength of fabric and proper installation.

### *PLANNING/DESIGN CONSIDERATIONS*

- Proper selection, design and installation of the appropriate geotextile is critical to its effectiveness.
- Must be properly anchored to reduce undermining.
- Proper site preparation is essential for adequate contact with soil.
- Use only in limited areas to address a specific site condition.

### *MATERIAL SPECIFICATIONS*

- Select geotextile material based on soil conditions.
- Many geotextiles are available; select the geotextile fabric to match specific project needs.
- Erosion control blanket materials include:
  - Straw
  - Jute fiber
  - Wood fiber (Excelsior)
  - Coconut fiber (Coir)
- Refer to Standard Specifications and the project Special Provisions.

### *DESIGN STANDARDS*

- Woven geotextiles are used for filter and separation applications.
- Non-woven geotextiles are used for stabilization, reinforcement and filtration, and separation applications.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect regularly for cracks or tears in the fabric.
- Repair or replace damaged fabric immediately.
- Maintain contact between geotextile and the ground at all times.
- Remove trapped sediment after storm events.

# Erosion Control

## Soil Binders

EC-6

### DEFINITION

The application of dust palliatives (water, polymeric, psyllium or Guar stabilizers or emulsions) to temporarily prevent wind-induced erosion of exposed soils on construction sites.

### PURPOSE

- Reduce the movement of soil particles through temporary soil stabilization.
- Reduce the movement of soil particles by the wind, which causes air pollution and eventual sediment release into waters of the U.S.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Ensure measures are in place before large earth moving occurs</li> <li>• Select appropriate soil binder type based on soil type, slope ratio, topography and wind velocity</li> <li>• Protect adjacent vegetation, vehicular ways and structures from overspray</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• EC-3 Mulch Cover</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• CP-1 Construction Sequencing</li> <li>• EC-1 Preserve Existing Vegetation</li> <li>• EC-2 Minibenches/Slope Roughening</li> <li>• EC-4 Seeding</li> <li>• SC-5 Sediment Wattles</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect prior to forecast of rain, after rain events and per the applicable permit</li> <li>• Reapply if erosion occurs</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction		X	
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Wind erosion is common and increases with disturbed or exposed soil areas.



Application of soil binder.

### *APPROPRIATE APPLICATIONS*

- All soil surfaces exposed to wind.
- Temporary protection of disturbed areas until permanent measures are installed.
- Temporary protection of disturbed areas that must be re-disturbed following a period of inactivity.
- In areas where grading activities will soon resume because binders can often be incorporated back into the soil.
- Where vegetation is not appropriate.
- Material stockpiles.

### *LIMITATIONS*

- Temporary in nature and may require reapplication, especially after heavy or prolonged rainfall.
- Chemical palliatives typically require a cure time of approximately 24 hours.
- Easily disturbed by vehicular or pedestrian traffic.
- Do not adhere well to compacted or dense (clay) soils.
- May not perform well under conditions of low relative humidity or low temperatures.
- May be slippery if oversprayed onto vehicular travelways.
- If not properly applied, can create impervious surfaces where water cannot infiltrate.

### *PLANNING/DESIGN CONSIDERATIONS*

- Contact ADOT Transportation Planning Division, Air Quality Policy Section for the most up to date information about air quality control on construction projects.
- Use dust control treatments that conserve water wherever feasible.
- Site conditions (soil type, temperature, humidity) must be evaluated prior to determining appropriate soil binder type.
- Consider where soil binder will be applied and length of time stabilization will be needed.
- Frequency of application.
- Must be non-toxic to plants and wildlife.
- Investigate products other than those lists below; new products are being continuously developed.

### *MATERIAL SPECIFICATIONS*

#### **POLYMERIC EMULSION BLEND**

- Acrylic Copolymers and polymers.
- Liquid polymers of methacrylates and acrylates.
- Poly-acrylamide and copolymer of acrylamide.
- Hydro-colloid polymers.

#### **PLANT-MATERIAL BASED (short-lived)**

- Guar.
- Psyllium.
- Starch.

#### **PLANT-MATERIAL BASED (long-lived)**

- Pitch and rosin emulsion.

### *DESIGN STANDARDS*

- Comply with federal, state and local air quality regulations and guidelines.
- ADOT Standard Specifications for Road and Bridge Construction.
- Follow manufacturer's recommendations for application rates, pre-wetting of area and cleaning of equipment after use.

### INSPECTION AND MAINTENANCE REQUIREMENTS

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Check areas that have been protected to ensure coverage.
- Daily inspection of high traffic areas and weekly inspection of lower traffic areas.
- Reapplication of binder may be required.

<b>Properties of Soil Binders Used for Erosion Control</b>			
<b>Chemicals</b>	<b>Copolymer</b>	<b>Psyllium</b>	<b>Guar</b>
<b>Comments</b>	forms semi-permeable transparent crust	effective on dry, hard soils	effective on dry, hard soils
	resists ultraviolet radiation and moisture-induced breakdown	forms a crust	forms a crust
<b>Penetration</b>	Moderate	High	High
<b>Longevity</b>	1 to 2 years	3 to 6 months	3 to 6 months
<b>Minimum curing time before rain</b>	24 hours	24 hours	24 hours
<b>Compatibility with Existing vegetation</b>	Good	Poor	Poor
<b>Mode of degradation</b>	Chemically degradable	Biologically degradable	Biologically degradable
<b>Liquid/Powder</b>	Liquid	Powder	Powder

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# Erosion Control

## Crown Ditch

EC-7

### DEFINITION

Structures that intercept, divert and convey surface run-on, usually sheet flow over slopes, to prevent erosion.

### PURPOSE

- Intercept and divert direct runoff to minimize sheet flow on to a slope.
- Direct runoff to a channel or stabilized watercourse.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Determine stormwater flow, velocity and volume when designing crown ditch</li> <li>• Evaluate top of slope vegetation and soil infiltration rates to properly design crown ditch</li> <li>• Periodically divert water by warping ditch into undisturbed slopes</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• RC-1 Earth Dikes/Drainage Swales and Lined Ditches</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• EC-1 Preserve Existing Vegetation</li> <li>• EC-2 Minibenches/Slope Roughening</li> <li>• SC-5 Sediment Wattles</li> <li>• Slope Minibenching Detail</li> <li>• Slope Rounding, ADOT Standard Drawing C-02 series</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect for erosion, deterioration or breaches</li> <li>• Repair as necessary</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction		X	
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



*Crown ditch blends with adjacent landscape and materials.*



*Gabion-style crown ditch used for extreme drainage conditions.*

### *APPROPRIATE APPLICATIONS*

- At the top of cut and fill slopes, but primarily cut slopes.

### *LIMITATIONS*

- Not suitable as sediment trapping structures.
- Provide potential for disturbing existing vegetation and soil.

### *PLANNING/DESIGN CONSIDERATIONS*

- Consider stormwater flow, velocity, volume and slope of the proposed ditch.
- Provide stabilized outlets.
- Requires warping of ditch periodically into undisturbed areas.
- Consider ditch alignment and outlets carefully.
- Stake ditch layout in the field prior to construction to evaluate visibility and avoid existing vegetation where possible.
- Consider maintenance access.

### *MATERIAL SPECIFICATIONS*

- N/A

### *DESIGN STANDARDS*

- Warp crown ditch into undisturbed slopes where ditch slope exceeds 5%.
- Design ditches to daylight into existing drainages.
- ADOT Erosion/Sediment Control and Water Quality Protection Detail: Slope Minibenching.
- ADOT Erosion/Sediment Control and Water Quality Protection Detail: Slope Rounding.
- ADOT Roadway Standard Drawing C-03.10.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.

**BEST MANAGEMENT PRACTICES**

## Runoff Control (RC) BMPs

Runoff controls (also called temporary concentrated flow conveyance controls) consist of BMPs used alone or in combination to intercept, direct, divert, convey, and discharge concentrated flows with a minimum of soil erosion, both on-site and offsite. Runoff controls may be required to direct run-on around or through the project in a non-erosive fashion.

- RC-1 Earth Dikes/Drainage Swales and Lined Ditches
- RC-2 Cut to Fill Slope Transitions
- RC-3 Erosion Protection at Structures
- RC-4 Rock Outlet Protection/Velocity Dissipation Devices
- RC-5 Slope Drains
- RC-6 Check Dam

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# Runoff Control

## Earth Dikes/Drainage Swales/Lined Ditches RC-1

### DEFINITION

Structures and grading techniques that intercept, divert, and convey surface runoff, usually sheet flow, to a desired location.

### PURPOSE

- Divert runoff away from erodible surfaces and toward sediment trapping devices.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Construct and fully stabilize before any major land disturbance</li> <li>• Consider volume and velocity of runoff to be diverted</li> <li>• Consider erodibility of soils</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• EC-7 Crown Ditch</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• CP-1 Construction Sequencing</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Maintain height of dikes for effectiveness</li> <li>• Inspect for erosion or deterioration</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction		X	
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



*Gabion mattress designed for anticipated high-velocity flows.*



*Rock lined ditch.*

### APPROPRIATE APPLICATIONS

- Base of fill slopes where runoff begins to concentrate.
- Top of slopes to control rill and gully erosion. Refer to BMP *EC-7 Crown Ditch*.
- Bottom and mid-slope locations to intercept sheet flow and convey concentrated flows.
- Divert runoff toward a stabilized watercourse or drainage structure.
- Divert sediment laden water to sediment trapping device.
- Divert stormwater around construction staging areas.

### LIMITATIONS

- Runoff must be diverted into existing or stabilized drainages or sediment basins.
- High runoff velocities may scour and erode dikes and swales. May be necessary to combine with other BMPs such as *EC-5 Geotextiles/Erosion Control Blankets*, *RC-6 Check Dam* and/or *SC-6 Sediment Log*.
- Does not control erosion or remove sediment.

### PLANNING/DESIGN CONSIDERATIONS

- Size correctly for expected flows.
- Line ditches where high runoff velocities are expected.
- Stabilize dikes by compaction or other means such as erosion control blankets or riprap.
- Provide stabilized outlets to divert sediment-laden flow into sediment traps.
- Where installed at construction traffic crossings, the top width may be wider and side slopes may be flatter compared to other applications.
- Install early in the construction process, when possible.
- Must conform to local floodplain management regulations and not adversely impact adjacent properties.
- Seed earthen dike and ditch immediately after construction if diversion measure will be used longer than 15 days.

### MATERIAL SPECIFICATIONS

- ADOT Standard Specifications for Road and Bridge Construction Section 810-2.03 and Section 913.
- Project plans, details and Special Provisions.

### DESIGN STANDARDS

- ADOT Erosion/Sediment Control and Water Quality Protection Detail: Sediment Control Berm.
- ADOT Erosion/Sediment Control and Water Quality Protection Detail: Rock Protection for Cut & Fill Transition and Channel Lining.

### INSPECTION AND MAINTENANCE REQUIREMENTS

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for washouts and erosion.
- Check outlet stabilization for signs of erosion.
- Repair where damaged by construction equipment.
- Properly re-compact material added to repair the dike.
- Maintain as described in BMP *SC-3 Sediment Trap* where flows are directed into sediment traps.

# Runoff Control

## Cut to Fill Slope Transitions

RC-2

**DEFINITION**

- Rock riprap/rock mulch placed along cut-fill slope transitions.

**PURPOSE**

- Stabilize and reduce erosion at cut-fill transitions.
- Convey concentrated flows to stabilized drainage.

**AT A GLANCE**

GENERAL INFORMATION
<p><b>Key Design Considerations</b></p> <ul style="list-style-type: none"> <li>• Properly prepare subgrade</li> <li>• Size rock riprap based on flow velocity</li> <li>• Rock riprap must be 1-2 inches below adjacent finish grade</li> </ul>
<p><b>Alternate BMPs to consider:</b></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<p><b>Use in combination with:</b></p> <ul style="list-style-type: none"> <li>• RC-1 Earth Dikes/Drainage Swales and Lined Ditches</li> <li>• RC-4 Rock Outlet Protection/Velocity Dissipation Devices</li> </ul>
<p><b>Maintenance Needs:</b></p> <ul style="list-style-type: none"> <li>• Inspect for erosion and sedimentation in rock riprap</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction	X		
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Cut to fill transition leads to stable drainage.



Riprap should blend with landscape.

### *APPROPRIATE APPLICATIONS*

- Where concentrated surface flows must be conveyed from a cut ditch, down to the toe of the adjoining downstream fill slope.

### *LIMITATIONS*

- Reduce erosion only when they have been sized and constructed properly.

### *PLANNING/DESIGN CONSIDERATIONS*

- Proper subgrade preparation.
- Embed rock riprap into grade.
- Field adjust to meet existing roadside ditch.

### *MATERIAL SPECIFICATIONS*

- Rock riprap should conform to Gradations A or B, as defined by Section 810 of the ADOT Standard Specifications for Road and Bridge Construction.
- Rock mulch should conform to Gradations C, as defined by Section 810 of the ADOT Standard Specifications for Road and Bridge Construction.
- River run materials are not allowed.

### *DESIGN STANDARDS*

- Refer to ADOT Erosion/Sediment Control and Water Quality Protection Detail: Rock Protection for Cut & Fill Transition and Rock Riprap/Mulch Channel Lining.
- Cut-to-fill transition shall terminate at a planned or existing stabilized drainage.
- Size of rock used must be large enough to withstand expected design flow through the transition.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for signs of slope erosion under and around the rock protection, check for erosion and displacement of rock at the outlet. Replace rock and repair as needed.

# Runoff Control

## Erosion Protection at Structures

RC-3

### DEFINITION

Rock riprap placed along the soil interface of concrete and metal structures such as spillways, pipes or drainage structures.

### PURPOSE

- Reduce or eliminate the potential for undercutting and erosion at structures.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Size rock riprap based on volume of runoff expected and slope characteristics</li> <li>• Consider wire-tying riprap if installed on steep slopes</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• SC-7 Gravel Bag Protection</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• SC-2 Silt Fence</li> <li>• SC-5 Sediment Wattle</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect after storm events; repair if damaged or eroded</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction	X		
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Rock at interface of soil and drainage pipe.



Excavation prior to rock placement at drainage structure (use gravel bags to anchor logs/wattles).

### *APPROPRIATE APPLICATIONS*

- At structures that abut a soil surface and where concentration and/or velocity of stormwater is great enough to cause erosive flows.
- At pipe headwalls.

### *LIMITATIONS*

- Riprap loss may occur due to erosion and sliding if rock riprap is placed on slopes greater than 2:1.
- Can increase erosion if installed improperly.

### *PLANNING/DESIGN CONSIDERATIONS*

- Rock interface protection is very effective only when the rock is sized and placed properly.
- Embed rock riprap so that the top is 1 to 2 inches below adjacent finish grade.

### *MATERIAL SPECIFICATIONS*

- Use angular, crushed rock material.
- River run materials are not allowed.

### *DESIGN STANDARDS*

- Size as specified in the contract documents or as directed by the Engineer.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for signs of erosion and undercutting around the structure.
- Replace rock and repair erosion damage as needed.

# Runoff Control

## Rock Outlet Protection/Velocity Dissipation Devices RC-4

### DEFINITION

Rock riprap, grouted or wire-tied riprap placed at outlet ends of culverts, conduits, or channels.  
*NOTE: By definition this is a post-construction BMP. Refer to the ADOT Post-Construction Best Management Practices Manual, Outlet Protection BMP for additional information.*

### PURPOSE

- Prevent scour and reduce velocity of concentrated stormwater flows.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Use only angular rock</li> <li>• Size rock based on velocity of flows and per drainage design</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• RC-3 Erosion Protection at Structures</li> <li>• RC-5 Slope Drains</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect after storm events and repair promptly to prevent a progressive failure</li> <li>• May need to control weed growth</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction		X	
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



*Protection around drainage pipe needs to be addressed.*



*Proper sizing of rock riprap is essential to design effectiveness.*

### *APPROPRIATE APPLICATIONS*

- Where discharge velocities and energies at the outlets of culverts, pipes or channels are sufficient to erode the downstream channel and/or undermine and create turbulence at the outfall area.
- At discharge outlets that carry continuous flows of water.
- At points where lined conveyances discharge to unlined conveyances.
- Wherever ADOT discharges offsite.

### *LIMITATIONS*

- Loose rock may be washed away during high flows.
- Freeze/thaw cycles may break up grouted riprap.

### *PLANNING/DESIGN CONSIDERATIONS*

- Grouted or wire-tied rock riprap can minimize maintenance requirements.
- Rock must be sized and installed properly to be effective. Refer to ADOT Drainage Manual and project drainage plans.
- A sediment trap below the outlet may be required.

### *MATERIAL SPECIFICATIONS*

- Section 810 of the ADOT Standard Specifications.
- Use sound, durable, angular rock.
- River run material is not allowed.

### *DESIGN STANDARDS*

- Refer to ADOT Erosion/Sediment Control and Water Quality Protection Detail: Rock Protection for Inlets, Outlets and Headwall Transition.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for displacement of riprap or damage to underlying fabric
- Inspect for signs of scour beneath the riprap or around the outlet.
- Replace rock and repair apron and slopes as needed.

# Runoff Control

## Slope Drains

RC-5

### DEFINITION

A temporary rigid pipe or flexible conduit drain used to intercept and convey runoff into a stabilized drainage.

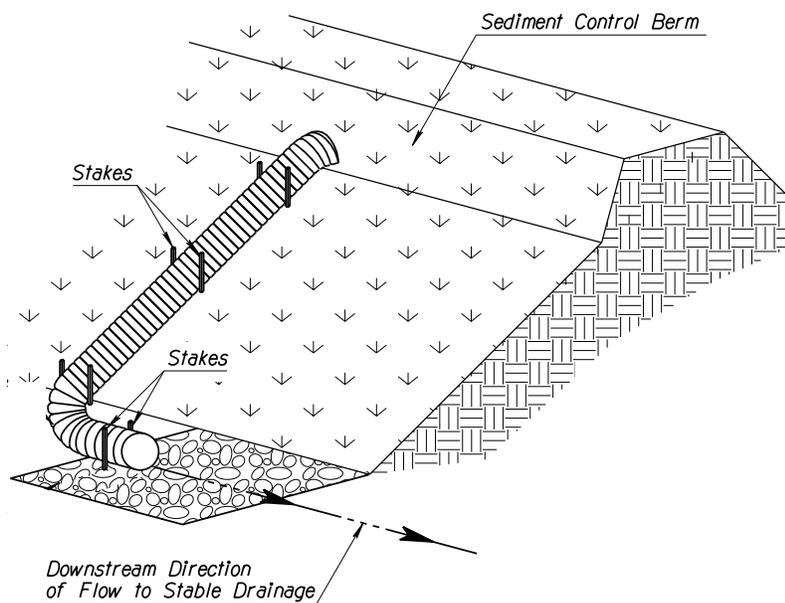
### PURPOSE

- Prevent sheet flow erosion over fill slopes.
- Prevent channelized flows from eroding slopes.

### AT A GLANCE

GENERAL INFORMATION	
<b>Key Design Considerations</b>	<ul style="list-style-type: none"> <li>• Pipe size depends on velocity and volume of flow</li> <li>• Pipe must daylight at a stable drainage</li> </ul>
<b>Alternate BMPs to consider:</b>	<ul style="list-style-type: none"> <li>• RC-4 Rock Outlet Protection/Velocity Dissipation Devices</li> </ul>
<b>Use in combination with:</b>	<ul style="list-style-type: none"> <li>• RC-1 Earth Dikes/Drainage Swales and Lined Ditches</li> <li>• RC-3 Erosion Protection at Structures</li> <li>• RC-4 Rock Outlet Protection/Velocity Dissipation Devices</li> <li>• SC-3 Sediment Trap</li> </ul>
<b>Maintenance Needs:</b>	<ul style="list-style-type: none"> <li>• Inspect after storm event; repair as needed</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction		X	
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Slope Drain detail.

### *APPROPRIATE APPLICATIONS*

- Install where slopes may be eroded by surface runoff.
- Where final road grades are completed but remain unpaved.
- May be used as emergency spillway for sediment basin.

### *LIMITATIONS*

- Volume of runoff to be conveyed must not exceed capacity of structure.
- Larger areas require a paved spillway, rock lined channel or additional pipes.
- May become clogged or overcharged during large storms forcing water around pipe.
- Failure causes extreme slope erosion.

### *PLANNING/DESIGN CONSIDERATIONS*

- Most effective when used in combination with temporary embankment curb

### *MATERIAL SPECIFICATIONS*

- Slope drain types:
  - Rigid pipe.
  - Flexible pipe.

### *DESIGN STANDARDS*

- Pipe inlet may need additional stabilization to prevent undercutting.
- Refer to Erosion/Sediment Control and Water Quality Protection Detail: Downslope Drain.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for structural integrity, blockage and stability at the inlet and outlet.
- Inspect for downstream scour.
- Repair if scour occurs.
- Reinforce inlet with compacted soil or sandbags if undercutting occurs.
- If outlet flow is directed to a sediment-trapping device, sediment should be removed as required for that device.

# Runoff Control

## Check Dam

RC-6

### DEFINITION

A small dam constructed across a roadside ditch or channel.

### PURPOSE

- Reduce the velocity of concentrated water flows.
- Reduce channel erosion.
- Allow sediment to settle.

### AT A GLANCE

GENERAL INFORMATION
<p><b>Key Design Considerations</b></p> <ul style="list-style-type: none"> <li>• Calculate acreage that channel is draining</li> <li>• Base of upstream dam to be at same elevation as top of next downstream dam</li> <li>• Rock material must be placed, not dumped into the channel</li> <li>• Remove dams only after contributing drainage area is stabilized and at the direction of the Engineer</li> </ul>
<p><b>Alternate BMPs to consider:</b></p> <ul style="list-style-type: none"> <li>• SC-6 Sediment Log</li> <li>• Sediment Control</li> <li>• SC-12 Compost Sock</li> </ul>
<p><b>Use in combination with:</b></p> <ul style="list-style-type: none"> <li>• EC-5 Geotextiles/Erosion Control Blankets</li> <li>• RC-4 Rock Outlet Protection/Velocity Dissipation Devices</li> <li>• SC-6 Sediment Log</li> </ul>
<p><b>Maintenance Needs:</b></p> <ul style="list-style-type: none"> <li>• Remove large debris, trash and leaves that have built up behind dam</li> <li>• Remove sediment that has built up to 1/2 the height of the dam</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design		X	
Construction	X		
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Weir in check dam.



Series of check dams in roadside ditch.

### *APPROPRIATE APPLICATIONS*

- Small channels which drain 10 acres or less.
- Channels constructed in erosive soils.
- Channels constructed with steep profile grades (greater than 5%).
- In temporary ditches or swales that, because of their short length of service, will not receive permanent protection.
- In permanent ditches or swales that will not receive permanent non-erodible linings.
- In ditches that need protection during the establishment of vegetative cover.

### *LIMITATIONS*

- Not for use in live streams.
- Do not use in channels that have already been lined or vegetated unless erosion is expected.
- Promotes sediment trapping, which can be re-suspended during subsequent storms or removal of check dam.
- Installation may be affected if installed within Clear Zone.

### *PLANNING/DESIGN CONSIDERATIONS*

- Must be designed and constructed with adequate spillways, dissipater aprons and tie-ins to the channel banks and/or bed to protect the channel and structure during times of peak flow.
- In locating the check dam, consideration shall be given to the effects and the reach of the impounded water and sediment.
- If installation is to be permanent, the final depth of the silted ditch must be considered in the original design of the ditch.
- Rock shall be large enough to stay in place given the expected design flow through the channel.

### *MATERIAL SPECIFICATIONS*

- Check dams shall be constructed of angular rock.
- River run material is not allowed.
- Rock shall be sized as specified in the contract documents or as stated in the ADOT Hydraulics Manual.
- Refer to the ADOT Erosion/Sediment and Water Quality Protection BMP Detail: Rock Check Dam.

### *DESIGN STANDARDS*

- Rock shall be placed to achieve complete coverage of the channel or swale.
- The center of the dam shall be lower than the edges.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Remove sediments when depth reaches one-third of check dam height. Removed sediment shall be incorporated into the project at locations approved by the Engineer or removed from the right-of-way.
- Erosion caused by high flows around the edges of the dam should be corrected immediately.

**BEST MANAGEMENT PRACTICES**

## Sediment Control (SC) BMPs

Sediment control BMPs are back-up control measures to erosion control BMPs to keep sediment from leaving the construction site. Construction (temporary) sediment control practices include those measures that intercept and slow or detain the flow of stormwater to allow sediment to be trapped and settle.

Sediment control BMPs are the second line of defense, rely on them to capture sediment on site.

- SC-1 Sediment Control Berm
- SC-2 Silt Fence
- SC-3 Sediment Trap
- SC-4 Sediment Basin
- SC-5 Sediment Wattle
- SC-6 Sediment Log
- SC-7 Gravel Bag Barrier
- SC-8 Storm Drain Inlet Protection
- SC-9 Curb Inlet Protection
- SC-10 Stabilized Construction Entrance/Exit
- SC-11 Stabilized Construction Roadway
- SC-12 Compost Sock
- SC-13 Rock Berm

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# Sediment Control

## Sediment Control Berm

SC-1

### DEFINITION

A temporary sediment barrier consisting of compacted salvaged topsoil, surface soils and/or vegetation pushed into a small berm at top or toe of fill slopes.

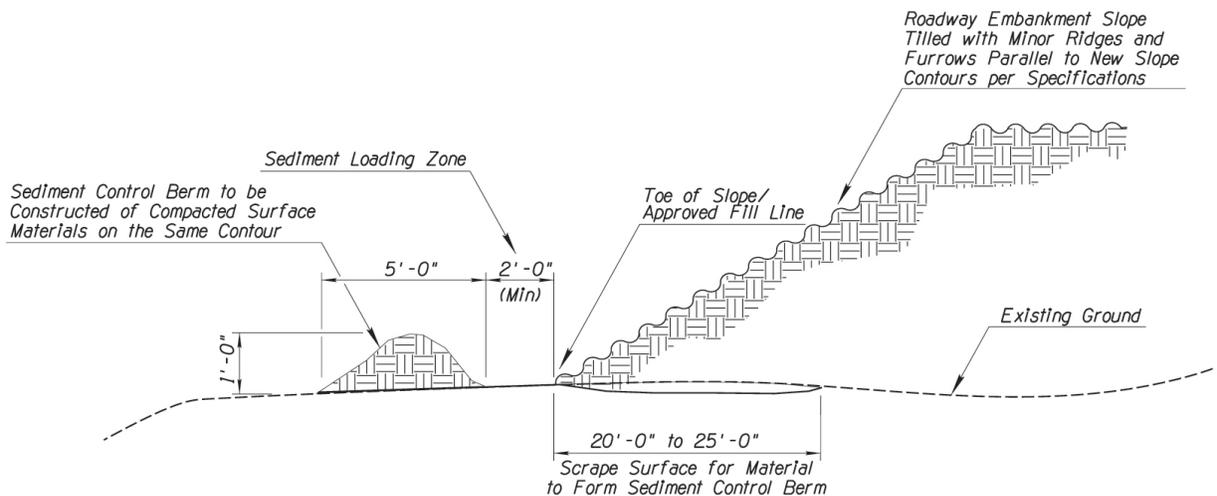
### PURPOSE

- Intercept sediment-laden sheet flow runoff, allowing runoff to infiltrate and sediment to drop out of suspension.
- Stockpiling of surface soil for future plating on slopes.

### AT A GLANCE

GENERAL INFORMATION	
<b>Key Design Considerations</b>	<ul style="list-style-type: none"> <li>• Construct using topsoil prior to placement of roadway embankment</li> <li>• Construct along contour and allow for a minimum 2' sediment loading zone</li> <li>• Place outside of vehicle recovery area</li> </ul>
<b>Alternate BMPs to consider:</b>	<ul style="list-style-type: none"> <li>• SC-2 Silt Fence</li> <li>• SC-5 Sediment Wattle</li> <li>• SC-6 Sediment Log</li> <li>• SC-12 Compost Sock</li> </ul>
<b>Use in combination with:</b>	<ul style="list-style-type: none"> <li>• EC-2 Minibenches/Slope Roughening</li> <li>• RC-6 Check Dam</li> </ul>
<b>Maintenance Needs:</b>	<ul style="list-style-type: none"> <li>• Inspect berm for signs of erosion, particularly after storm events</li> <li>• Remove sediment when 50% capacity is reached</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Sediment Berm detail.

### *APPROPRIATE APPLICATIONS*

- Below the toe or at top of exposed and erodible slopes or soil stockpiles.
- May be utilized in place of silt fence or sediment wattles or logs.
- May be constructed in conjunction with topsoil salvage operations. Soil may be reincorporated into adjacent slopes upon completion of final slope geometry.

### *LIMITATIONS*

- Can create a temporary sedimentation pond on the upstream side of the berm.
- Must be graded out prior to application of BMPs and seeding of final slopes.
- Additional BMPs are required where profile slopes exceed 3% and/or where concentrated flows occur.

### *PLANNING/DESIGN CONSIDERATIONS*

- Berm shall be stabilized to prevent erosion.
- Salvage topsoil as directed in the project plans or by the Engineer.
- Create a stabilized weir for runoff to pond and control water overtopping the berm.

### *MATERIAL SPECIFICATIONS*

- Surface materials i.e. soil, rock, branches, leaves, slash and chips.

### *DESIGN STANDARDS*

- Construct a minimum 2'-0" sediment loading zone between toe of slope and sediment berm.
- Compact sediment control berms per ADOT Erosion/Sediment Control and Water Quality Protection Detail: Sediment Control Berm.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for breaks and erosion in berms.
- Repair as necessary.
- Remove berm when adjacent slope area has been permanently stabilized. Grade area to blend in with existing ground.

# Sediment Control

## Silt Fence

SC-2

### DEFINITION

A temporary sediment barrier consisting of a filter fabric that is entrenched into the soil, stretched between and attached to posts and wire fence for support.

### PURPOSE

- Intercept and slow sediment-laden sheet flow runoff, allowing sediment to drop out of suspension.

### AT A GLANCE

GENERAL INFORMATION
<p><b>Key Design Considerations</b></p> <ul style="list-style-type: none"> <li>• Locate at low or down-slope areas of relatively small disturbance/construction sites</li> <li>• Properly trench bottom of silt fence for maximum functionality</li> <li>• Overlap ends of silt fence where a continuous length of fence is not possible</li> </ul>
<p><b>Alternate BMPs to consider:</b></p> <ul style="list-style-type: none"> <li>• SC-1 Sediment Control Berm</li> <li>• SC-5 Sediment Wattle</li> <li>• SC-12 Compost Sock</li> </ul>
<p><b>Use in combination with:</b></p> <ul style="list-style-type: none"> <li>• EC-2 Minibenches/Slope Roughening</li> <li>• SC-5 Slope Drains</li> </ul>
<p><b>Maintenance Needs:</b></p> <ul style="list-style-type: none"> <li>• Inspect for sediment build-up behind silt fence or for breaks in fence; repair immediately</li> <li>• Remove accumulated sediment when 1/3 fence height is reached</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction		X	
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Proper wire mesh support for fabric.



Do **not** use silt fence across ditches or drainage channels.

### *APPROPRIATE APPLICATIONS*

- At downstream perimeter of disturbed site.
- Below the toe of exposed slopes and soil stockpiles.
- Above active riparian areas as a **last** line of defense.

### *LIMITATIONS*

- Not for use in live streams.
- Do not use in channels that have already been lined or vegetated unless erosion is expected.
- Not practical where large flows or large areas of disturbance are involved.
- Not suitable for areas where large amounts of concentrated runoff are likely.
- Can create a temporary sedimentation pond on the upstream side of the fence and cause temporary flooding.
- Typical fabric lifespan is between five and eight months.
- Only effective if used in combination with upstream BMPs.
- Limited sediment capture area.

### *PLANNING/DESIGN CONSIDERATIONS*

- Use in areas where flows do not exceed .5 cfs and drainage area for the fence does not exceed .25 acre per 100 feet of fence length.
- Do not install silt fence across streams, ditches or waterways.
- Do not use where rocky or hard areas will prevent uniform installation of posts and entrenching of the fabric.
- Must be removed following final approved stabilization of disturbed area.

### *MATERIAL SPECIFICATIONS*

- Refer to Standard Specification Section 1014-8 for fabric requirements.
- Refer to Standard Drawing C-12.10 for additional requirements.

### *DESIGN STANDARDS*

- Install per ADOT Erosion/Sediment Control Water Quality Protection Detail: Silt Fence.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for
  - depth of accumulated sediment
  - splits or tears in fabric
  - fabric attachment to fence posts
  - post stability
  - undercutting
- Remove sediment when it reaches one-third the height of the fence. Removed sediment shall be incorporated into the project at locations approved by the engineer or removed from site.
- Remove fence when up-slope area has been permanently stabilized. Fill and compact post holes and fabric trench, remove accumulated sediment, grade area to blend in with adjacent ground and stabilize area disturbed due to fence removal.

# Sediment Control

## Sediment Trap

SC-3

### DEFINITION

A small impoundment formed by excavation and/or constructing an embankment so that sediment-laden runoff is temporarily detained.

### PURPOSE

- Allow sediment to settle out of construction runoff before the water is discharged.
- Simplify stormwater management on a construction site by trapping small amounts of sediment at multiple spots.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Soils need to be appropriate for infiltration</li> <li>• Locate to minimize potential for groundwater contamination</li> <li>• Use for drainage areas of 5 acres or less</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• SC-1 Sediment Control Berm</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• RC-1 Earth Dikes/Drainage Swales and Lined Ditches</li> <li>• RC-4 Rock Outlet Protection/Velocity Dissipation Devices</li> <li>• RC-5 Slope Drain</li> <li>• SC-5 Sediment Wattle</li> <li>• SC-7 Gravel Bag Protection</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect after storm events to ensure functionality</li> <li>• Repair eroded areas or re-evaluate placement if erosion occurs frequently or install additional BMPs.</li> <li>• Remove accumulated sediment when 50% capacity is reached</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design		X	
Construction			X
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control		X	
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Small sediment trap.



Sediment trap with rock protection.

### *APPROPRIATE APPLICATIONS*

- Projects under construction during the rainy season.
- At the outlets of stormwater diversion structures, channels, slope drains, construction site entrance/exit wash racks or any other runoff conveyance that discharges waters containing sediment and debris.
- At outlets of disturbed soil areas less than 5 acres in size.

### *LIMITATIONS*

- Life span is usually 24 months.
- Detention period is too short for removing fine silt and clay particles.

### *PLANNING/DESIGN CONSIDERATIONS*

- Use for drainage areas of 5 acres or less.
- Note natural drainage patterns and place traps in areas of highest erosion potential.
- Locate for ease of maintenance and inspection.
- Traps are formed by excavating an area and placing an earthen embankment across a low area or drainage swale.
- Most effective when used in combination with other BMPs that stabilize upland soils.

### *MATERIAL SPECIFICATIONS*

- Use Gravel Bags to construct small sediment traps.

### *DESIGN STANDARDS*

- Design to minimize surface area for infiltration and sediment settling.
- Bottom of sediment trap should be flat.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect after each rainfall to ensure trap is draining properly.
- Inspect for damage from erosion.
- Verify that depth of spillway is maintained at a minimum of 1.5 feet below the low point of the trap embankment.
- Remove accumulated sediment when 50 percent sediment capacity is reached.

# Sediment Control

## Sediment Basin

SC-4

### DEFINITION

A temporary basin formed by excavation and/or constructing an embankment so that sediment-laden runoff is temporarily detained.

### PURPOSE

- Capture sediment from stormwater runoff before it leaves the construction site
- Slow the velocity of runoff through detention.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Soils must be appropriate for infiltration</li> <li>• Use for drainage areas of 5-100 acres</li> <li>• Locate to minimize groundwater contamination potential</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• SC-3 Sediment Trap</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• RC-1 Earth Dikes/Drainage Swales and Lined Ditches</li> <li>• RC-4 Rock Outlet Protection/Velocity Dissipation Devices</li> <li>• RC-5 Slope Drain</li> <li>• SC-2 Silt Fence</li> <li>• SC-5 Sediment Wattle</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect after storm events to ensure functionality.</li> <li>• Repair eroded areas or re-evaluate placement if erosion occurs frequently or install additional BMPs.</li> <li>• Remove accumulated sediment when 50% capacity is reached.</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design		X	
Construction		X	
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control		X	
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



A large area allows sediment to settle out.



Soil may not be providing adequate infiltration.

### *APPROPRIATE APPLICATIONS*

- Where sediment-laden water may enter the drainage system or watercourses.
- At outlets of disturbed soil areas measuring between 5 and 100 acres.

### *LIMITATIONS*

- Require large surface areas to permit settling of sediment.
- Not appropriate in live streams.
- If safety is a concern, basins may require protective fencing around the perimeter.
- Size may be limited by availability of right-of-way.
- Ground water contamination, soils and obstructions are concerns.
- Could pose a mosquito problem if basin becomes blocked and there is standing water.

### *PLANNING/DESIGN CONSIDERATIONS*

- Require a large area to be effective.
- Soils must be adequate for infiltration.
- Use in combination with other BMPs for best effectiveness.

### *MATERIAL SPECIFICATIONS*

- Dependent on material chosen to construct the basin. Refer to applicable material spec, i.e. rock mulch.

### *DESIGN STANDARDS*

- Bottom of sediment basin should be flat.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect after each rainfall to ensure trap is draining properly.
- Inspect for damage from erosion.
- Verify that depth of spillway is maintained at a minimum of 1.5 feet below the low point of the trap embankment.
- Remove accumulated sediment when 50 percent sediment capacity is reached.

# Sediment Control

## Sediment Wattle

SC-5

### DEFINITION

Weed-free wheat or rice straw or excelsior wood fiber bound into tight tubular rolls encased in biodegradable natural fiber netting or UV-degradable polypropylene netting used primarily in slope stabilization and in unlined ditches.

### PURPOSE

- Intercept runoff, reduce flow velocities, and promote infiltration.
- Release runoff as sheet flow.
- Reduce sediment transport from runoff.
- Promote (improve) seed germination.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Spacing and wattle diameter depend on slope ratio</li> <li>• Adjacent wattles to be tightly abutted</li> <li>• Must maintain continuous contact with ground</li> <li>• Place along contours perpendicular to slope</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• EC-2 Minibenches/Slope Roughening</li> <li>• SC-12 Compost Sock</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• Erosion Control BMPs: EC-3 through EC-7</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect for rilling or erosion underneath wattles; repair as necessary</li> <li>• Inspect to ensure wattles are properly anchored and have not been damaged</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Proper staking of wattles.



Sediment wattles spaced on a slope.

### *APPROPRIATE APPLICATIONS*

- At the top, face and at grade breaks of exposed slopes.

### *LIMITATIONS*

- Not for use in live streams.
- Do not use in channels that have already been lined or vegetated unless erosion is expected.
- Have a limited sediment capture area.
- Proper staking and entrenchment are critical to wattle effectiveness and to reduce potential movement by high velocity flows.

### *PLANNING/DESIGN CONSIDERATIONS*

- Not for use at toe of slope; use 20" diameter sediment logs instead.
- Do not use where creeping, slumping or sliding of the slope may occur.
- Readily shaped to fit slope contours.
- Must be trenched per project plans, specifications and details to be effective.
- Turn terminal ends of wattles upslope 45% to prevent channeling.
- Typically left in place on slopes after Final Stabilization.

### *MATERIAL SPECIFICATIONS*

- Refer to ADOT Standard Specifications for Road and Bridge Construction section 810-2.06 for requirements.

### *DESIGN STANDARDS*

- Refer to ADOT Erosion/Sediment Control and Water Quality Protection Detail: Sediment Wattle.
- Adjust wattle spacing based on soil erosivity; decrease spacing on more erosive soils, increase spacing on less erosive soils.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect to ensure that wattles remain firmly anchored and have not been damaged by traffic.
- Inspect for tears and splits in wattles and evidence of erosion.
- Repair rills or gullies promptly, re-stake wattle as necessary.
- Remove accumulated sediment when 50 percent sediment capacity is reached prior to seeding and mulching operations. **DO NOT REMOVE SEDIMENT AFTER SEEDING AND MULCHING HAS BEEN COMPLETED.**

# Sediment Control

## Sediment Log

SC-6

### DEFINITION

Excelsior wood fiber that has been bound into a tight tubular roll secured with long-term biodegradable natural fiber netting or UV-degradable polypropylene netting.

### PURPOSE

- Intercept runoff and reduce flow velocities.
- Reduce sediment transport from runoff.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Trenching or burial is not necessary except when used at toe of slope</li> <li>• Must maintain continuous contact with ground</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• RC-6 Check Dam</li> <li>• SC-2 Silt Fence (for perimeter applications)</li> <li>• SC-12 Compost Sock</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• RC-6 Check Dam</li> <li>• SC-8 Storm Drain Inlet Protection</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect for rilling or erosion around sediment logs</li> <li>• Inspect to ensure logs are properly anchored and have not been damaged</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Sediment logs stored on site are immediately available for replacing damaged/displaced logs.



Sediment logs used as check dams.

### *APPROPRIATE APPLICATIONS*

- As check dams for small runoff volumes in roadway ditches and channels downstream of disturbed soils.
- At toe of exposed slopes.
- Along the perimeter of a project.
- Around temporary stockpiles.
- Around storm drain inlets associated with disturbed areas.
- Outfall of small drainage channels or structures.

### *LIMITATIONS*

- Not for use in live streams.
- Do not use in channels that have already been lined or vegetated unless erosion is expected.
- Should not be used in place of linear sediment barrier such as silt fence.
- Not practicable where large flows are involved.
- Not suitable for rock sub-grades where stakes cannot be securely installed.

### *PLANNING/DESIGN CONSIDERATIONS*

- Trenching or burial is not necessary except when used at toe of slope.

### *MATERIAL SPECIFICATIONS*

- Refer to ADOT Standard Specifications for Road and Bridge Construction section 810-2.06 for requirements.

### *DESIGN STANDARDS*

- Refer to ADOT Erosion/Sediment Control and Water Quality Protection Detail: Sediment Log.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect to ensure that logs remain firmly anchored and have not been damaged by traffic.
- If used as check dam, remove sediment, prior to seeding, when it reaches one-third the height of the log.
- Inspect for tears and splits in logs and evidence of erosion.
- Remove sediment when it reaches 1/2 the height of the log.
- Repair rills or gullies promptly, reposition and/or re-stake log as necessary.
- Remove after Final Stabilization.

# Sediment Control

## Gravel Bag Protection

SC-7

### DEFINITION

Bags made of a woven geotextile material, filled with angular gravel.

### PURPOSE

- To slow the velocity of concentrated flow and allow sediment to settle before entering drainage structures or leaving a construction site.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Adjacent construction traffic may limit use</li> <li>Ponding may occur for a short time around bags</li> <li>Stack bags in an overlapping, pyramid configuration</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>SC-8 Storm Drain Inlet Protection</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>SC-2 Silt Fence</li> <li>SC-5 Sediment Wattle</li> <li>SC-6 Sediment Log</li> <li>GH-4 Street Sweeping and Vacuuming</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Follow schedule specified in the applicable stormwater permit</li> <li>Replace bags if deteriorated due to extended sunlight exposure</li> <li>Replace damaged bags</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Gravel bags used to anchor sediment wattle.



Sediment wattles held in place with gravel bags can be used to provide protection for curb inlets.

### *APPROPRIATE APPLICATIONS*

- Drainage structures or at downslope perimeter of construction areas where staking Sediment Wattles is not possible due to soil or ground conditions.
- Where flows are moderately concentrated to divert and/or detain flows.

### *LIMITATIONS*

- Tendency of bag material to tear if subjected to heavy traffic.
- Water can pond at gravel bag barrier until enough time has passed to allow water to filter through.
- Not for use in ditches or as check dams.

### *PLANNING/DESIGN CONSIDERATIONS*

- Adjacent construction traffic may prohibit the use of gravel bags.
- Amount of time gravel bags are needed, as bags exposed to sunlight will need to be replaced every two to three months.

### *MATERIAL SPECIFICATIONS*

- Bags should be woven polypropylene, polyethylene or polyamide fabric. Refer to standard Specification Section 810-1017 for characteristics of fabric material.
- Bag dimensions approximately 24 inches long by 16 inches wide and 4 inches thick.
- Fill material to be clean and washed decomposed granite (DG) free of silt/dust, or other equivalent clean and washed angular shape aggregate/gravel material as approved by the Engineer. All gravel/aggregate materials shall be cleaned and washed by the manufacturer/producer prior to final delivery to the project site. Refer to Standard Specification Section 810-1017 for gradation requirements.

### *DESIGN STANDARDS*

- Use in conjunction with other soil stabilization controls up-slope to provide the most effective erosion and sediment control.
- Stack gravel bags using an overlapping, stair-stepped approach where the upper rows overlap the joints of the lower rows. Ends of adjoining gravel bags to abut tightly.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace gravel bags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches 1/2 of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove gravel bag barriers when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Removed sediment should be disposed of properly or incorporated into the project.

# Sediment Control

## Storm Drain Inlet Protection

SC-8

### DEFINITION

Fabric filter, rock mulch and/or riprap surrounding or placed in a storm drain inlet.

### PURPOSE

- Serve as a final protection measure to filter sediment and debris from entering the storm drain.
- Reduce erosion along the soil interface at the entrance to the drainage structure
- Reduce flow velocity before entering the storm drain system.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Identify inlets to be protected and implement before disturbance occurs</li> <li>• Select type of protection based on site conditions and construction sequencing</li> <li>• Typically used for areas draining 1 acre or less</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• SC-7 Gravel Bag Protection</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• SC-3 Sediment Trap</li> <li>• SC-4 Sediment Basin</li> <li>• SC-6 Sediment Log</li> <li>• SC-12 Compost Sock</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Check all storm drain inlets after each storm event; remove sediment or debris clogging inlet protection</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			X
Sediment Control		X	
Good Housekeeping			
Non-Stormwater			
Waste Management			



Rock mulch and sediment logs used to protect storm drain inlet.

### *APPROPRIATE APPLICATIONS*

- Disturbed drainage areas that have not yet been permanently stabilized.
- Where stormwater surface runoff can enter a drain inlet.

### *LIMITATIONS*

- Ponding can occur at the inlet with possible short term flooding.
- Frequent maintenance may be required in areas susceptible to high flow.
- Effectiveness decreases rapidly if not properly maintained.

### *PLANNING/DESIGN CONSIDERATIONS*

- Identify existing and/or proposed storm drain inlets that must be protected and determine which method of protection to use.
- Use for areas of less than 1 acre; route stormwater to other sediment trapping devices for areas larger than 1 acre.
- Ensure that ponding will not encroach into highway traffic.
- Verify applicable Municipal Separate Storm Sewer System (MS4) ordinances and product requirements.

### *MATERIAL SPECIFICATIONS*

- Refer to Section 810 of the ADOT Standard Specifications for Road and Bridge Construction for material specifications of inlet protection.

### *DESIGN STANDARDS*

- Calculate anticipated flow volumes and velocities to determine the size of rock to use.
- Use geotextile as a separator between the soil and graded rock.
- Refer to ADOT Erosion/Sediment Control and Water Quality Protection Details: Inlet Protection Combined BMPs, Median Inlet Protection and Gravelbag Protection.
- Refer to ADOT construction standard drawings C-13.60 and C-13.65 for slotted drain details.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for
  - damage
  - failure to filter sediment
  - accumulation of sediment or debris
  - damage from temporary flooding after a storm event
- Repair as necessary
- Replace filter fabric if it becomes clogged
- Remove sediment
  - after each rainfall event
  - as specified in the contract documents
  - as directed by the Engineer
- Remove all inlet protection devices within 30 days after the site is stabilized or when inlet protection is no longer needed.
- If necessary, regrade and stabilize disturbed areas after inlet protection is removed.

# Sediment Control

## Curb Inlet Protection

SC-9

### DEFINITION

A temporary filtering device placed in the flow line of completed curb inlets before final stabilization has been achieved.

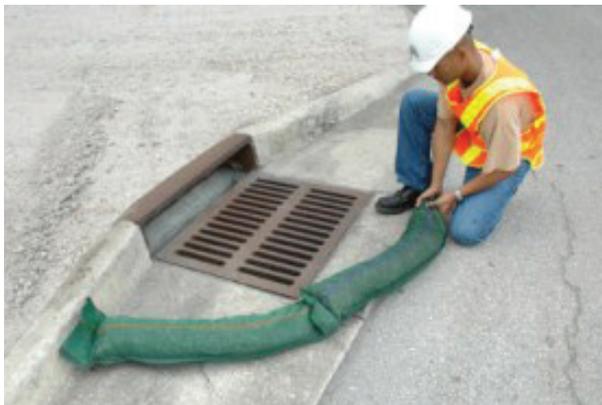
### PURPOSE

- Prevent sediment and debris from entering the stormwater system by filtering runoff.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Identify inlets to be protected and install before disturbance occurs</li> <li>• Select type of protection based on site conditions and construction sequencing</li> <li>• Typically used for areas draining 1 acre or less</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• SC-7 Gravel Bag Protection</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• SC-3 Sediment Trap</li> <li>• SC-4 Sediment Basin</li> <li>• SC-6 Sediment Log</li> <li>• SC-12 Compost Sock</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Check all storm drain inlets after each storm event; remove sediment or debris clogging inlet protection</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			X
Sediment Control			X
Good Housekeeping			
Non-Stormwater			
Waste Management			



A variety of inlet protection products are available.



This inlet protection device is doing a good job of capturing fine sediment. Proper maintenance will help ensure continued performance.

### *APPROPRIATE APPLICATIONS*

- Where completed curb inlets are exposed to sediment-laden runoff from adjacent areas that have not been permanently stabilized.

### *LIMITATIONS*

- Requires consistent maintenance to keep accumulated sediment and debris out of vehicular travel lanes and storm sewer system.
- Are easily damaged on roads open to the public.
- Typically ineffective on slopes steeper than 5%: runoff bypasses the inlet and continues downhill.

### *PLANNING/DESIGN CONSIDERATIONS*

- Consider traffic conditions when designing curb inlet protection; roadways open to public traffic may require different protection than construction sites with limited access.
- Must be used in combination with upslope BMPs.
- Verify applicable Municipal Separate Storm Sewer System (MS4) ordinances and product requirements.

### *MATERIAL SPECIFICATIONS*

- Many materials are available depending on site conditions. All should be UV resistant.
  - Non-woven polyester filter fabric.
  - Natural fiber matting or roll.
  - Woven polypropylene.
  - High density polyethylene fabric.
  - Tightly rolled wood excelsior encased in polyethylene netting.

### *DESIGN STANDARDS*

- Avoid ponding in travel lanes.
- Firmly anchor in place.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for:
  - damage.
  - failure to filter sediment.
  - accumulation of sediment.
  - damage from temporary flooding after a storm event.
- Repair as necessary.

# Sediment Control

## Stabilized Construction Entrance/Exit

SC-10

### DEFINITION

Temporary placement of gravel or gravel in combination with shaker plates or rumble strips where traffic will enter and exit a construction site.

### PURPOSE

- Remove mud and sediment from construction vehicle tires.
- Minimize amount of mud and sediment leaving the area on vehicle tires.
- Stabilize entry/exit area to prevent tire rutting.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Stabilize all entrances prior to construction disturbance</li> <li>• Size the gravel pad to accommodate all vehicles</li> <li>• Install filter fabric between gravel and soil</li> <li>• Multiple stabilized entrances/exits may be needed</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• GH-1 Vehicle and Equipment Cleaning</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• GH-1 Vehicle and Equipment Cleaning</li> <li>• GH-4 Street Sweeping and Vacuuming</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Add gravel or stone as needed</li> <li>• Remove sediment regularly from shaker plates, rumble strips and corrugated steel</li> <li>• Sweep soil tracked onto paved surfaces</li> <li>• Construct new stabilized entrances/exits as construction progresses and as necessary</li> <li>• Equipment on-site to maintain entrance/exit</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			
Sediment Control			X
Good Housekeeping		X	
Non-Stormwater			
Waste Management			



Rumble strips and gravel provide more effective track-out control than gravel alone.



Fencing ensures vehicles enter / exit at trackout.

### **APPROPRIATE APPLICATIONS**

- Whenever traffic will be leaving a construction site and moving directly onto a public road or paved area.
- Entrance/exit should be constructed on level ground.
- Site specific, conditions will dictate need.

### **LIMITATIONS**

- Entrance/exit must be planned and reviewed as part of the project traffic control plan.
- Does not remove all soil from vehicle tires; washing and street sweeping may be necessary.

### **PLANNING/DESIGN CONSIDERATIONS**

- Consider soil type, rain conditions and type of construction traffic.
- Entrances are more effective if designed in conjunction with a tire wash area (prior approval is required and a water source must be provided).
- Dimensions of stabilized entrance/exit must be adequate and appropriate for all types of construction vehicles using it, and long enough for the largest vehicle tires to complete 4 revolutions.
- Make entrance wide enough for two vehicles to pass, if anticipated amount of traffic is heavy.
- Provide a bridge or culvert if entrance/exit crosses a depression, swale or stream. Refer to *BMP NS-4 Temporary Watercourse Crossing*.
- Install section of shaker plates or rumble strips or corrugated steel strips between gravel areas to increase effectiveness, particularly if exists/entrances need to be moved several times during construction. Shaker plates, rumble strips or corrugated steel strips may be used solely instead of gravel.

### **MATERIAL SPECIFICATIONS**

- Adequately sized gravel placed at least 6" in thickness.
- Nonwoven, high survivability filter fabric.

### **DESIGN STANDARDS**

- Refer to ADOT Erosion/Sediment and Water Quality Protection Detail: Stabilized Construction Entrance/Exit Gravel Pad.

### **INSPECTION AND MAINTENANCE REQUIREMENTS**

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for sediment tracked onto roadway.
- Verify that gravel is clean and not filled with sediment.
- Add gravel over time to maintain effectiveness.
- Sweep soil, gravel, and other debris that is tracked onto paved surfaces. Refer to *BMP GH-4 Street Sweeping and Vacuuming*.
- Remove sediment from shaker plates, rumble stripes and corrugated steel strips to maintain maximum effectivity.
- Remove stabilized construction entrance/exit upon completion of construction and stabilize disturbed areas.

# Sediment Control

## Stabilized Construction Roadway

SC-11

### DEFINITION

A temporary access road connecting existing public roads to a construction area.

### PURPOSE

- Control dust, erosion and sediment transport created by vehicular tracking.
- Stabilize access roadways to prevent tire rutting.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Design to support heaviest vehicles and equipment</li> <li>• Use of this BMP may not be applicable to very short duration projects</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• GH-4 Street Sweeping and Vacuuming</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Keep all temporary roadway ditches clear</li> <li>• Periodically apply aggregate on gravel roads</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design		X	
Construction		X	
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			
Sediment Control		X	
Good Housekeeping			X
Non-Stormwater			
Waste Management			



Aggregate-stabilized roadway.

### *APPROPRIATE APPLICATIONS*

- Construction roadways and short-term detour roads:
  - Where mud tracking is a problem during wet weather.
  - Where dust is a problem during dry weather.
  - Adjacent to watercourses.
  - Where poor soils are encountered.

### *LIMITATIONS*

- Remove prior to final project grading and stabilization.
- Site conditions will dictate design and need.
- May not be applicable to very short duration projects.

### *PLANNING/DESIGN CONSIDERATIONS*

- Limit speed of vehicles to control dust.
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support heaviest vehicles and equipment that will use it.
- Stabilize roadway using aggregate, asphalt concrete, or concrete based on longevity, required performance, and site conditions.

### *MATERIAL SPECIFICATIONS*

- The use of cold mix asphalt or asphalt concrete (AC) millings for stabilized construction roadway is not allowed.
- If aggregate is the chosen material, use crushed aggregate greater than 3 inches, but smaller than 6 inches.

### *DESIGN STANDARDS*

- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 inches depth, or place aggregate to a depth recommended by a geotechnical engineer.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for damage and repair as needed.
- Remove when no longer needed and regrade and repair disturbed areas.

# Sediment Control

## Compost Sock

SC-12

### DEFINITION

Tubular netting filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas.

### PURPOSE

- Intercept runoff, reduce flow velocities, and promote infiltration.
- Release runoff as sheet flow.
- Reduce sediment transport from runoff.
- Improve soil quality from nutrients in compost.
- Prevent sediment and debris from entering the stormwater system by filtering runoff.

### AT A GLANCE

GENERAL INFORMATION
<p><b>Key Design Considerations</b></p> <ul style="list-style-type: none"> <li>• Manufacturer's specifications for anchoring are minimum requirements - site conditions may mandate additional staking / securing of socks</li> <li>• Place along contours of slope and/or perpendicular to stormwater runoff</li> <li>• Compost must meet ADOT Project Specifications for compost material</li> <li>• Trenching is not necessary</li> <li>• Must maintain continuous contact with ground surface</li> </ul>
<p><b>Alternate BMPs to consider:</b></p> <ul style="list-style-type: none"> <li>• Perimeter Applications: <ul style="list-style-type: none"> <li>• SC-1 Sediment Control Berm</li> <li>• SC-2 Silt Fence</li> </ul> </li> <li>• Slope Protection: <ul style="list-style-type: none"> <li>• SC-5 Sediment Wattle</li> <li>• SC-6 Sediment Log</li> </ul> </li> <li>• Check Dam: <ul style="list-style-type: none"> <li>• RC-6 Check Dam</li> <li>• SC-6 Sediment Log</li> </ul> </li> <li>• Inlet Protection: <ul style="list-style-type: none"> <li>• SC-8 Storm Drain Inlet Protection</li> <li>• SC-9 Curb Inlet Protection</li> </ul> </li> </ul>
<p><b>Use in combination with:</b></p> <ul style="list-style-type: none"> <li>• Refer to appropriate BMPs, above</li> </ul>
<p><b>Maintenance Needs:</b></p> <ul style="list-style-type: none"> <li>• Inspect for rilling or erosion underneath and/or around socks</li> <li>• Inspect to ensure socks are properly anchored</li> <li>• Ensure there is adequate sediment capture area</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Compost socks used on slope face and as check dams (top), and as inlet protection (bottom).

NOTE: Compost Socks can be used effectively as perimeter controls, slope protection, check dams, and inlet protection. As each use requires different design standards, these have been identified in the following sections where required for clarity.

### ***APPROPRIATE APPLICATIONS***

#### **PERIMETER CONTROL**

- In place of silt fence at downslope perimeter of disturbed site.
- At toe of exposed slopes.
- Around temporary stockpiles.

#### **SLOPE PROTECTION**

- Place at regular intervals at the top, face and at grade breaks of exposed slopes.

#### **CHECK DAMS**

- For small runoff volumes in roadway ditches and channels downstream of disturbed soils.

#### **INLET PROTECTION**

- Drain Inlet /Curb Inlet Protection with proper anchoring and upslope BMPs.

### ***LIMITATIONS***

- Socks must have uniform contact with the ground.
- Proper staking/anchoring is critical to sock effectiveness and to reduce potential movement of sock by high velocity flows.
- Limited sediment capture area.
- Not for use in live streams.

### ***PLANNING/DESIGN CONSIDERATIONS***

- Greater surface area in contact with the ground than for silt fence and sediment logs, reducing the potential for rilling downslope of the sock.
- Can be used where other erosion control BMPs are not feasible, such as laid directly on pavement (no staking is required on pavement, although anchoring may be necessary).
- Anchoring method is dependent upon slope gradient and surface conditions. Refer to manufacturer specifications for minimum requirements. Additional anchoring may be necessary contingent on site conditions.
- Installation does not require trenching, thereby reducing soil surface disturbance.
- Soil surface to receive sock must be uniform to ensure continuous contact between the ground and compost sock.
- Consider using instead of silt fence where fencing may impede wildlife movement.

### ***MATERIAL SPECIFICATIONS***

- Compost must meet the requirements for compost contained in the seeding section of the Project Specifications.
- All compost material shall be free of seed.
- Particle size of compost material shall conform to the following:
  - 2 in. (51 mm) Screen, 100% passing
  - 0.375 in. (10 mm) Screen, 10% to 30% passing
- The material and color of the filter sock shall be selected based on required longevity and site conditions. Filter sock material shall be photodegradable or biodegradable and sock material must be of a thickness, strength, and material appropriate to selected use and project duration.

### *DESIGN STANDARDS*

- Compost socks should be sized appropriately depending on use. Factors influencing diameter of sock to be used include slope ratio, anticipated flow volumes, and soil characteristics. Refer to manufacturer specifications for appropriate design diameter.

### *PERIMETER CONTROL*

- When used in place of silt fence, place sock 5' or greater from toe of slope to maximize space available for sediment deposition between the toe of slope and the compost sock.

### *SLOPE PROTECTION*

- Do not use where creeping, slumping, or sliding of the slope may occur.
- Spacing is dependent on the gradient of the slope, anticipated flow volumes, soil characteristics, and diameter of sock. Refer to manufacturer specifications for appropriate spacing.
- Place socks perpendicular to flow, aligned with slope contours.
- Turn terminal ends of sock upslope 45 degrees to prevent flow around ends of sock.
- Compost socks must be staked per manufacturer specifications.

### *DRAIN INLETS*

- Compost sock should completely enclose drain inlet being protected.
- Always use in conjunction with upslope BMPs.
- Anchoring of compost sock may be necessary. Refer to manufacturer specifications.

### *CHECK DAMS*

- Compost sock should extend sufficiently from either side of the flow line to ensure that water flows through the sock rather than around it.
- Diameter and spacing of compost socks to be per manufacturer specifications.
- Compost socks must be staked per manufacturer specifications.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect to ensure socks remain firmly anchored and have not been damaged by traffic.
- Inspect for tears and splits in socks.
- Repair rills or gullies promptly, reposition and/or re-anchor socks as necessary.
- For all applications EXCEPT slope protection, remove sediment from the upslope side of the compost sock when accumulation reaches one-third of the effective height of the sock.
- For inlet protection, check all storm drain inlets after each storm event; remove sediment or debris clogging inlet protection.
- When used as slope protection, compost socks shall be left in place as a post-construction BMP. Following final stabilization, the netting on the compost sock may be cut the length of the sock, allowing the compost material to spread. Care shall be taken not to disturb the adjacent soil.
- For all applications EXCEPT slope protection, remove socks after Final Stabilization.

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# Sediment Control

## Rock Berm

SC-13

### DEFINITION

A stabilization method intended as a corrective measure on existing slopes exhibiting severe erosion, as well as new slopes with highly erosive soils. Rock berm consists of angular riprap trenched into the slope face parallel to slope contours.

### PURPOSE

- Stabilization for slopes that are unlikely to respond to other sediment control methods.
- Can be used as a corrective measure on existing slopes to stabilize slope while limiting disturbance of established vegetation (as compared to re-grading / minibenches).
- Intercept runoff, reduce flow velocities, promote infiltration and vegetative cover.
- Release runoff as sheet flow, and reduce sediment transport from runoff.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Use for steep slope/high flow volume situations where alternate BMPs are inadequate</li> <li>• Use of rock berms must be approved by ADOT</li> <li>• Spacing and size of berm depend on slope ratio and soil conditions</li> <li>• Construct along contours of slope</li> <li>• Riprap must be trenched into slope</li> <li>• Use outside of clear zone</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• SC-5 Sediment Wattle</li> <li>• EC-2 Minibenches/Slope Roughening</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• Erosion Control BMPs: EC-1 through EC-7</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect for rilling or erosion downslope of berm; repair as necessary</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design		X	
Construction	X		
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater			
Waste Management			



Rock berms used as a corrective measure on an eroded slope. Due to vegetation establishment, areas with rilling were not regraded.



Berms run parallel to slope contours and are trenched into slope face.

### *APPROPRIATE APPLICATIONS*

- Slopes with highly erosive (granitic, low plasticity) soils that cannot be adequately stabilized with alternate BMPs or methods. Rock berms could be used at the top, face and at grade breaks of exposed slopes.

### *LIMITATIONS*

- Less effective for fine-particle sediment removal than sediment wattles, but able to withstand higher flows than wattles.
- Trenching-in of rock berm essential to effectiveness.

### *PLANNING/DESIGN CONSIDERATIONS*

- Use of rock berms must be approved by ADOT prior to installation.
- Geotechnical report must be available for areas where rock berm use is proposed – use of rock berms is dependent on soil type.
- Not for use at toe of slope or within vehicle clear zone.
- Care should be taken to preserve existing vegetation in place on existing slopes.
- Especially suitable for slopes with granitic, or other highly erosive, soils due to the difficulty / length of time required for vegetation establishment.
- Color of riprap used for rock berms should be selected to blend in with adjacent landscape.
- Remain in place on slopes after Final Stabilization.
- Typically a less expensive treatment than re-grading an existing slope.

### *MATERIAL SPECIFICATIONS*

- Rock berms shall be constructed of angular rock; river run material is not allowed.
- Rock size will vary based on height of slope and anticipated velocity and amount of water on slope face. Rock shall be sized as specified in the Project Plans or as stated in the Special Provisions.

### *DESIGN STANDARDS*

- Refer to ADOT Erosion/Sediment Control and Water Quality Protection Detail: Rock Berm.
- Adjust berm spacing based on soil erosivity: decrease spacing if soils are more erosive, increase spacing if soils are less erosive.
- Slope preparation prior to installation of rock berms:
  - On existing slopes with established vegetation, vegetation should be preserved in place to mitigate erosion and slope treatments that would disturb the vegetation (such as minibenching / slope roughening) should not be used.
  - On new slopes, minibenching / slope roughening may be incorporated if appropriate for soil type. ADOT shall provide direction on compatible BMPs to be used with rock berms on a case-by-case basis.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for rilling or erosion downslope of berms; repair rills or gullies promptly.
- Erosion caused by high flows around the edges of the berm should be corrected immediately.

**BEST MANAGEMENT PRACTICES**

## Good Housekeeping (GH) BMPs

Good Housekeeping and Material Management BMPs are procedural and structural pollution prevention measures designed to prevent contamination of stormwater from a broad range of materials. Proper handling, storage and use of materials will ensure that construction site operations do not contribute to the degradation of stormwater runoff through added jobsite-related pollutants. These controls must be implemented for all applicable activities, material usage and site conditions.

- GH-1 Vehicle and Equipment Cleaning
- GH-2 Vehicle and Equipment Fueling
- GH-3 Vehicle and Equipment Maintenance
- GH-4 Street Sweeping and Vacuuming
- GH-5 Material Delivery and Storage
- GH-6 Material Use
- GH-7 Stockpile Management
- GH-8 Spill Prevention and Control
- GH-9 Portable Toilet

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# Good Housekeeping

## Vehicle and Equipment Cleaning

GH-1

### DEFINITION

Procedures and practices used to clean vehicles and equipment prior to or during use on project site.

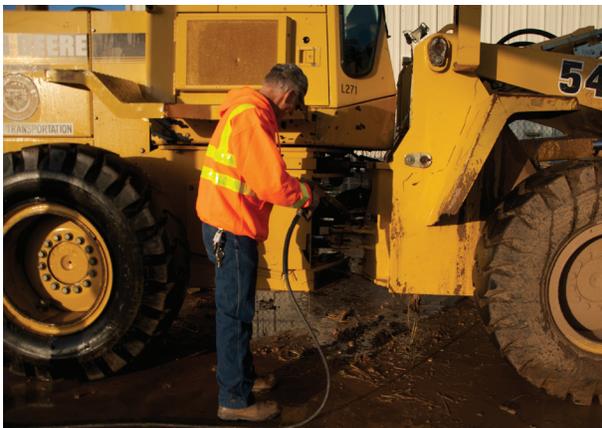
### PURPOSE

- Minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning operations to storm drain or to watercourses.
- Reduce or eliminate spread of noxious weeds and invasive plant species from project site.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Location of cleaning pit</li> <li>• Capacity of cleaning pit</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• Applicable Waste Management BMPs (WM-1 through WM-5)</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect designated cleaning areas for compliance</li> <li>• Verify that personnel are following proper procedures and practices</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping	X		
Non-Stormwater			
Waste Management	X		



Cleaning prior to use on construction site.



Contained equipment cleaning.

### *APPROPRIATE APPLICATIONS*

- All construction sites where vehicle and equipment cleaning is performed.

### *LIMITATIONS*

- Cleaning vehicles and equipment generates liquid, semi-solid and solid wastes which must be contained on-site and/or treated to prevent pollution.

### *PLANNING/DESIGN CONSIDERATIONS*

- On-site vehicle and equipment washing with detergent or steam is **not** allowed.
- Cleaning area shall be an excavated pit to contain wash waters and waste for proper disposal.
- Cleaning water shall not be discharged to storm drains or watercourses.
- Locate cleaning areas close to the active construction site, but away from storm drain inlets, drainage facilities, open ditches and/or watercourses.
- On-site vehicle and equipment cleaning must be consistent with the applicable Arizona Aquifer Protection Permit requirements.

### *MATERIAL SPECIFICATIONS*

- Vehicle and equipment washing with soap, solvents or steam is **not** allowed on the project site unless the Engineer has approved in advance and the resulting wastes are fully contained and disposed of outside of the highway right-of-way in conformance with the Standard Specifications. Resulting wastes shall not be discharged or buried within the highway right-of-way. Obtain required applicable permits.

### *DESIGN STANDARDS*

- The washout pit shall be sized to retain all cleaning and rinse water from vehicle cleaning operations.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Ensure appropriate practices are being implemented by personnel.

# Good Housekeeping

## Vehicle and Equipment Fueling

GH-2

### DEFINITION

Procedures and practices to minimize or eliminate fuel spills and leaks during fueling.

### PURPOSE

- To prevent the pollution of storm drain systems or watercourses from fuel spills and leaks.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Location of fueling area</li> <li>Design and size of fueling and containment area</li> <li>Compliance with federal, state and local requirements</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>GH-8 Spill Prevention and Control</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Inspect vehicles and equipment daily for leaks</li> <li>Spill clean up</li> <li>Proper disposal of contaminated soil and clean up materials</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping	X		
Non-Stormwater			
Waste Management	X		



Fueling site.



Is this containment area the correct size?

### *APPROPRIATE APPLICATIONS*

- These procedures are implemented on all construction sites where vehicle and equipment fueling takes place.

### *LIMITATIONS*

- Only use on-site vehicle and equipment fueling when it is impractical to send vehicles and equipment off-site to be refueled.

### *PLANNING/DESIGN CONSIDERATIONS*

- When fueling must occur on-site, the contractor shall select and designate an area to be used, subject to approval by the Engineer.
- Minimize mobile fueling of construction equipment throughout the site and use spill prevention containment methods wherever fueling occurs.

### *MATERIAL SPECIFICATIONS*

- Absorbent spill clean-up materials and spill kits shall be available in fueling areas and on fueling trucks and shall be disposed of properly after use.

### *DESIGN STANDARDS*

- Federal, state and local requirements shall be observed for any stationary above-ground storage tanks.
- Spill prevention, containment and countermeasures (SPCC) shall be included in the SWPPP if the volume of project-site fuel in a single container exceeds 660 gallons, or if the total fuel storage volume at any one site exceeds 1,320 gallons.
- Containment area must be sized to provide sufficient freeboard.
- Designated fueling areas shall be protected from stormwater runoff and shall be located at least 50 feet from downstream drainage facilities or watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and/or dikes to prevent runoff, runoff and to contain spills.
- Drip pans or absorbent pads shall be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Nozzles used in vehicle and equipment fueling shall be equipped with an automatic shut-off to control drips. Fueling operations shall not be left unattended. Fuel tanks shall not be "topped off."

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect vehicles and equipment daily for leaks.
- Repair vehicle and equipment leaks immediately or remove problem vehicle or equipment from the project site.
- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.
- Immediately put small quantities of fuel-contaminated soils in an on-site container, i.e a bucket, and dispose of properly.
- Keep an ample supply of spill cleanup material on the site.

# Good Housekeeping

## Vehicle and Equipment Maintenance

GH-3

### DEFINITION

A program of equipment maintenance procedures and practices for the construction site.

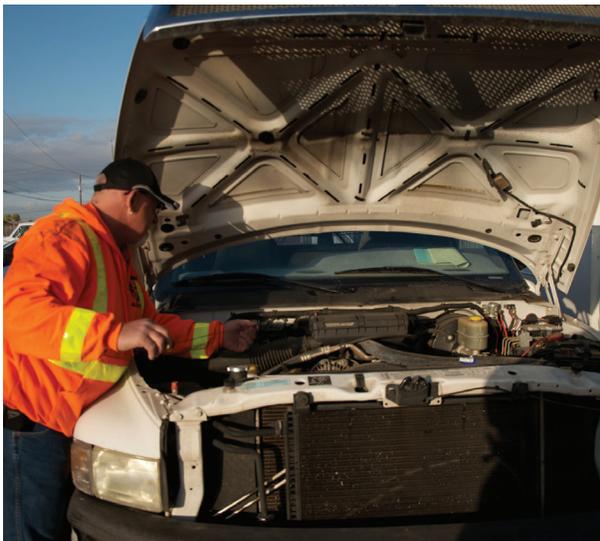
### PURPOSE

- To prevent the contamination of on-site soils and stormwater.
- To insure the proper disposal of equipment fluids, and other vehicle maintenance waste or debris.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Location of maintenance area</li> <li>• Design of maintenance area</li> <li>• Compliance with federal, state and local requirements</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• GH-8 Spill Prevention and Control</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect vehicles and equipment for leaks</li> <li>• Spill clean up</li> <li>• Proper disposal of contaminated soil, waste and clean up materials</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping	X		
Non-Stormwater			
Waste Management	X		



Practice routine maintenance.



Use drip pans or absorbent pads under equipment during maintenance that involves fluids.

### *APPROPRIATE APPLICATIONS*

- On any construction site where heavy equipment and truck storage and maintenance yards are located on-site when approved by the Engineer.

### *LIMITATIONS*

- Comply with local codes and ordinances regarding the disposal of fluids and consumable goods, and the on-site maintenance of equipment.

### *PLANNING/DESIGN CONSIDERATIONS*

- Plan for the proper recycling or disposal of used oils, hydraulic fluids, gear lubricants, batteries, and tires.
- Equipment maintenance and wash-out areas should be located at least 50 feet away from watercourses.
- Provide a contained wash-out area to wash down heavy equipment. Refer to BMP *GH-1 Vehicle and Equipment Cleaning*.

### *MATERIAL SPECIFICATIONS*

- Maintain Material Safety Data Sheets (MSDS) sheets for all oils, hydraulic fluids, lubricants and other substances kept on-site.

### *DESIGN STANDARDS*

- Use appropriate, leak-proof containers for fuels, oils and lubricants to provide for proper disposal.
- Use high-pressure water instead of thinners and solvents to wash down equipment. Wash water and detergents can be disposed of in the sanitary sewer system after grit is removed, after checking with local authorities.
- Use drip pans or absorbent pads under equipment during maintenance that involves fluids.
- Provide spill containment areas around stored oil and chemical drums.
- Never clean or maintain vehicles over bare soil.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect for:
  - Damaged hoses.
  - Leaky gaskets.
  - Container leaks.
- Repair all damages and leaks immediately.

# Good Housekeeping

## Street Sweeping and Vacuuming

GH-4

### DEFINITION

Practices to remove sediment tracked from the project site onto public or private paved roads.

### PURPOSE

- To prevent tracking of sediment outside the project limits.
- To prevent sediment from entering a storm drain or watercourse.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Consider incorporating removed sediment that is debris-free back into the project</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• SC-10 Stabilized Construction Entrance/Exit</li> <li>• SC-11 Stabilized Construction Roadway</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Proper disposal of sweeper waste</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control	X		
Good Housekeeping	X		
Non-Stormwater			
Waste Management	X		



*Plan for proper disposal of waste collected.*



*Water minimizes dust generated by sweeping.*

### *APPROPRIATE APPLICATIONS*

- Use where sediment is tracked from a project site onto paved public or private roads.

### *LIMITATIONS*

- May be ineffective if soil is wet, sticky or compacted.

### *PLANNING/DESIGN CONSIDERATIONS*

- If not mixed with debris or trash, consider incorporating removed sediment back into project.
- Sweepers must meet all federal, state and local air quality regulations.
- Some jurisdictions require vacuum sweepers.

### *MATERIAL SPECIFICATIONS*

- N/A

### *DESIGN STANDARDS*

- Operate at speeds and water application rates per manufacturer's recommendations.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable permit(s).
- Inspect construction entrances, exits and other paved areas daily for sediment accumulation.
- Sweep and vacuum as necessary or as required by the Engineer.
- Dispose of sweeper waste properly and provide documentation of proper disposal.

# Good Housekeeping

## Material Delivery and Storage

GH-5

### DEFINITION

Procedures and practices for the proper handling, delivery, and storage of construction materials at the construction site.

### PURPOSE

- To minimize the risk of discharge from leaks and spills of construction site materials into storm drain system or watercourses.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Covered storage for materials that are potential stormwater contaminants</li> <li>Location of storage areas</li> <li>Compliance with federal, state and local requirements including building and fire codes for storage shed</li> <li>Personnel training is important to successful material handling</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>GH-6 Material Use</li> <li>GH-8 Spill Prevention and Control</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Inspect containers and storage areas for spills and damage</li> <li>Up-to-date inventory of on-site materials</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping	X		
Non-Stormwater			
Waste Management	X		



Covered materials.



Material delivery.

### *APPROPRIATE APPLICATIONS*

- Every construction site shall implement material delivery and storage methods (practices) to properly receive, store and handle construction site material at the project site.
- Materials stored on the construction site include:
  - Soil.
  - Pesticides.
  - Fertilizers.
  - Detergents.
  - Plaster.
  - Petroleum products such as fuel, oil and grease.
  - Asphalt and bitumens.
  - Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds.
  - Concrete compounds.
  - Other materials that may be detrimental if released to the environment.

### *LIMITATIONS*

- Project site space limitations may preclude indoor storage.

### *PLANNING/DESIGN CONSIDERATIONS*

- Train employees and subcontractors on the proper material delivery and storage practices.
- Temporary storage areas shall be located away from vehicular traffic.
- Storage sheds must meet building and fire code requirements.

### *MATERIAL SPECIFICATIONS*

- Material Safety Data Sheets (MSDS) shall be supplied to the Engineer for all materials stored.

### *MATERIAL DELIVERY STANDARDS*

- Employees trained in emergency spill clean-up procedures shall be present when hazardous materials or liquid chemicals are unloaded.
- Keep an accurate, up-to-date inventory of material delivered and stored on-site.
- Chemical and material storage areas shall be located away from low areas, drainages and stream banks, and outside the 100-year flood level.

### *MATERIAL STORAGE AREAS AND PRACTICES*

- MSDS should be centrally located, accessible at all times and all personnel informed of that location.
- Liquids and petroleum products shall be stored in approved containers and drums and placed in temporary containment areas for storage.
- Storage, preparation, and mixing shall be accomplished in temporary containment facilities. Each temporary containment facility shall provide a spill containment volume equal to 1.5 times the volume of all containers therein and shall be impervious to the materials contained therein for a minimum contact time of 72 hours.
- Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.

- To provide protection from wind and rain, temporary containment facilities shall be covered during non-working days and prior to rain events.
- Temporary containment facilities shall be maintained free of accumulated rainwater and spills.
- Materials shall be stored in their original containers and the original product labels shall be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced immediately.
- Bagged and boxed materials shall be stored on pallets and shall not be allowed to accumulate on the ground.
- Stockpiles shall be protected in accordance with BMP *GH-7 Stockpile Management*.
- Minimize the material inventory stored on-site (e.g., only a few days supply).
- Have proper storage instructions posted at all times in an open and conspicuous location.
- Keep hazardous chemicals well labeled and in their original containers.
- Keep ample supply of appropriate spill clean up material near storage areas.
- Use proper devices to transfer chemicals from one container to another.
- Follow manufacturer's instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.

### ***SPILL CLEAN-UP***

- Contain and clean up any spill immediately.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose any hazardous material or contaminated soil.
- Refer to BMP *GH-8 Spill Prevention and Control*.

### ***INSPECTION AND MAINTENANCE REQUIREMENTS***

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Containers and storage areas shall be inspected weekly for spills and damage.
- Storage areas shall be maintained to prevent rainfall and runoff from coming in contact with chemicals or materials.
- Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.
- Clean areas where materials have been removed to insure that no dust or spillage remains to be washed into stormwater.

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### *APPROPRIATE APPLICATIONS*

- All construction sites.
- Procedures apply when the following materials are used or prepared on site:
  - Pesticides.
  - Fertilizers.
  - Detergents.
  - Plaster.
  - Petroleum products such as fuel, oil, and grease.
  - Asphalt and other concrete components.
  - Hazardous chemical such as acids, lime, glues, adhesives, paints, solvents, and curing compounds.
  - Concrete compounds.
  - Other materials that may be detrimental if released to the environment.

### *LIMITATIONS*

- N/A

### *PLANNING/DESIGN CONSIDERATIONS*

- Use recycled and safer alternative products when practical.

### *MATERIAL SPECIFICATIONS*

- Material Safety Data Sheets (MSDS) shall be supplied to the Engineer for all materials used or stored on the project site.

### *MATERIAL USE PRACTICES*

- MSDS should be centrally located, accessible at all times and all personnel informed of that location.
- Latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and no longer hazardous, may be disposed of with other construction debris.
- Do not remove the original product label, it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain or watercourse. Dispose of any paint thinners, residue and sludge(s), that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practical, and rinse to a drain leading to a sanitary sewer where permitted, or into a concrete washout pit or temporary sediment trap. For oil-based paints, clean brushes to the extent practical and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity.
- Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials on-site when practical.
- Do not over-apply fertilizers and pesticides. Prepare only the amount needed.
- Strictly follow the recommended usage instructions. Apply surface dressings in smaller applications, as opposed to large applications, to allow time for it to work in and to avoid excess materials being carried off-site by runoff.
- Application of pesticides shall be performed by a licensed applicator.
- Maintain logs for all pesticides applied, including brand name, formulation, EPA

registration number, amount and date applied, exact location of application, vehicle calibration, and name, address, and certification number of applicator.

- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.
- Comply with all pertinent Federal Regulations.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Spot check employees and subcontractors monthly throughout the job to ensure appropriate practices are being employed.

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# Good Housekeeping Stockpile Management

GH-7

## DEFINITION

Procedures and practices to reduce or eliminate stormwater contact with all piled construction site material including: soil, sand and paving materials such as concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate subbase or premixed aggregate, and asphalt minder (“cold mix” asphalt).

## PURPOSE

- To reduce or eliminate stormwater pollution from construction site stockpiles.

## AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Location of stockpiles</li> <li>Additional protection measures required if rain is predicted</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>EC-6 Soil Binders</li> <li>SC-1 Sediment Control Berm</li> <li>SC-2 Silt Fence</li> <li>SC-5 Sediment Wattles</li> <li>SC-6 Sediment Log</li> <li>WM-3 Contaminated Soil Management</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Repair and/or replace stockpile controls as needed</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control	X		
Good Housekeeping	X		
Non-Stormwater			
Waste Management	X		



Small stockpiles in an urban area.



Larger stockpiles in storage yard.

### *APPROPRIATE APPLICATIONS*

- All projects that stockpile soil, paving and other materials.

### *LIMITATIONS*

- None identified.

### *PLANNING/DESIGN CONSIDERATIONS*

- Locate stockpiles a minimum of 50 feet away from concentrated flows of stormwater, drainage courses and inlets.

### *MATERIAL SPECIFICATIONS*

- Bagged materials shall be placed on palettes and under cover.

### *DESIGN STANDARDS*

- Protect all stockpiles from stormwater run-on using a temporary perimeter sediment barrier such as berms, dikes, silt fences, or gravel bags, compost logs.
- Cover or protect with soil stabilization measures if rain is predicted.
- Implement wind erosion control practices as appropriate; refer to BMP *EC-6 Soil Binders*.
- “Cold mix” stockpiles shall be placed and stored per the project Special Provisions.
- Comply with local jurisdiction air quality requirements.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Repair and/or replace perimeter controls and covers as needed or as directed by the Engineer.

### DEFINITION

Procedures and practices implemented to prevent and control spills.

### PURPOSE

- To minimize or prevent discharges of spilled materials to the drainage system or watercourse.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Spill prevention and control is required whenever chemical and hazardous materials are stored</li> <li>Contractor must prepare and implement a spill prevention and control plan</li> <li>Employee education programs are key</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>Waste Management BMPs (WM-1 through WM-5)</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Verify weekly that spill control clean up materials are located properly</li> <li>Update spill prevention and control plan as necessary.</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping	X		
Non-Stormwater			
Waste Management	X		



Spills onto soil require clean-up.



Spill containment.

### **APPROPRIATE APPLICATIONS**

- Required for all construction activities.
- Spill control procedures are implemented wherever chemicals and/or hazardous substances are used and/or stored.

### **LIMITATIONS**

- This BMP description is very general. The contractor must identify additional appropriate practices for the specific materials used or stored on-site.

### **PLANNING/DESIGN CONSIDERATIONS**

- The contractor shall prepare and implement a spill prevention and control plan. The plan should include procedures for :
  - Storage and use that will prevent spills.
  - Spill clean up including minor and significant/hazardous spills.
  - The containment of spills.
  - The disposal of spilled materials and the material used for clean up.
  - Employee education programs.

### **MATERIAL SPECIFICATIONS**

- Chemical and hazardous substances include, but are not limited to:
  - Soil stabilizers/binders.
  - Dust Palliatives.
  - Pesticides.
  - Fertilizers.
  - Deicing/anti-icing chemicals.
  - Fuels.
  - Lubricants.
  - Other petroleum distillates.
  - Blasting materials
  - Portable toilets.

### **DESIGN STANDARDS**

- Water used for cleaning and decontamination shall not be allowed to enter storm drains nor watercourses and shall be collected and disposed of as described in BMP *WM-5 Liquid Waste Management*.

### **INSPECTION AND MAINTENANCE REQUIREMENTS**

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Verify weekly that spill control clean up materials are located near material storage, unloading and use areas.
- Perform regular preventive maintenance on tanks and fuel lines.
- Update spill prevention and control plan if changes occur in the types of chemicals on site.
- Notify applicable agencies of spills per the permit and all federal, state, and local requirements.

### **ADDITIONAL INFORMATION AND RESOURCES**

- ADEQ Emergency Response Duty Office, (602)-771-2330 or (800)-234-5677.
- ADEQ Waste Management Programs Division, <http://www.azdeq.gov/environ/waste/index.html>

# Good Housekeeping

## Portable Toilet

GH-9

### DEFINITION AND PURPOSE

Procedures and practices to minimize or prevent the discharge of construction site sanitary/septic waste to the storm drain system or to receiving waters.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Place on a level surface</li> <li>Stake or weight into place</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>WM-1 Solid Waste Management</li> <li>WM-5 Liquid Waste Management</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Regular inspection for leaks and spills</li> <li>Periodic service to ensure proper function</li> <li>Regular waste collection by a licensed service</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping	X		
Non-Stormwater			
Waste Management	X		



Location, location, location.



Staking is the preferred method for securing portable toilets.

### *APPROPRIATE APPLICATIONS*

- All construction sites that use temporary and/or portable sanitary/septic systems.

### *LIMITATIONS*

- None identified

### *PLANNING/DESIGN CONSIDERATIONS*

- Locate sanitary facilities in a convenient location.
- Educate employees, subcontractors and other users on sanitary/septic waste storage and disposal systems.

### *MATERIAL SPECIFICATIONS*

- N/A

### *DESIGN STANDARDS*

- Locate temporary sanitary facilities away from drainage facilities, watercourses, and from traffic circulation.
- Do not locate temporary sanitary facilities in areas that will collect water.
- Prepare level, gravel surface or place on concrete, and provide clear access for servicing and on-site personnel.
- Provide containment for spill or leak protection.
- Ensure that temporary septic systems treat wastes to appropriate levels before discharging.
- If using an on-site disposal system (OSDS) such as a septic system, comply with local health agency requirements.
- Properly connect temporary sanitary facilities that discharge to the sanitary sewer system.
- If discharging to the sanitary sewer, contact the local wastewater treatment plant for their requirements.
- Ensure that a licensed service maintains sanitary/septic facilities in good working order.
- Stake portable toilets or secure to a sturdy object (such as a fence or post) to create a stable environment and prevent overturning.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect regularly for leaks or spills.
- Repair leaks or replace facility immediately.
- Arrange for regular waste collection.

**BEST MANAGEMENT PRACTICES**

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## Non-Stormwater (NS) BMPs

Non-stormwater management BMPs are source control measures intended to prevent pollution by limiting or reducing potential pollutants at the source before they come in contact with stormwater. These practices involve day-to-day operations of the construction site and are usually under the control of the contractor.

- NS-1 Water Conservation Practices
- NS-2 Dewatering Operations
- NS-3 Paving and Milling Operations
- NS-4 Temporary Watercourse Crossing
- NS-5 Water Diversion
- NS-6 Structure Demolition/Removal Over or Adjacent to Water
- NS-7 Material and Equipment Use Over Watercourses

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# Non-Stormwater Water Conservation Practices

NS-1

## DEFINITION

Procedures and practices that use water during construction in a manner to minimize erosion and the transport of pollutants.

## PURPOSE

- To conserve water and reduce or eliminate non-stormwater discharges.
- To conserve a critical resource.

## AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Avoid using water to clean construction areas</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• Many Erosion, Sediment and Run-off Control are appropriate for use with this BMP</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Regularly inspect and repair water delivery equipment and systems for leaks</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control			
Good Housekeeping			
Non-Stormwater	X		
Waste Management			



*Check dams slow the flow, allowing water to percolate into the ground, and enhancing seed germination.*



*Don't let this happen!*

### *APPROPRIATE APPLICATIONS*

- Water conservation practices are implemented on all construction sites where water is used.
- Applies to all construction projects and use of water including piped, metered and trucked water.

### *LIMITATIONS*

- None identified.

### *PLANNING/DESIGN CONSIDERATIONS*

- Avoid using water to clean construction areas.
- Direct construction water to areas where it can infiltrate into the ground or be collected or reused.
- Use water harvesting techniques to water areas that are being revegetated.
- Authorized non-stormwater discharges to storm drain systems, channels or receiving waters are acceptable with the implementation of appropriate BMPs.
- Verify allowable non-stormwater discharges applicable in each permit.
- Comply with Arizona Aquifer Protection Permit requirements.

### *MATERIAL SPECIFICATIONS*

- N/A

### *DESIGN STANDARDS*

- N/A

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect and repair water delivery equipment and systems regularly.
- Verify that appropriate BMPs are in place to assist with water conservation.

# Non-Stormwater Dewatering Operations

NS-2

## DEFINITION

Practices that manage the discharge of pollutants, in this case sediment, when accumulated precipitation (stormwater) and non-stormwater must be removed from a work location and or construction site.

## PURPOSE

- Prevent discharge of sediment from the construction site during water removal.

## AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Site conditions will dictate design and use of dewatering operations</li> <li>• Discharges must comply with regional and watershed-specific discharge requirements</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• Several Erosion, Sediment and Run-off Control may be appropriate for use with this BMP</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect filtering device frequently and repair/replace to ensure proper operation</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction		X	
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control	X		
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater	X		
Waste Management			



Dewatering during bridge work.



Sediment is retained in the basin during this dewatering operation.

### *APPROPRIATE APPLICATIONS*

- Controlling sediment from dewatering operations is required on all projects that pump sediment-laden water from work areas and plan to discharge the pumped water into a conveyance system or watercourse. Dewatering discharges include but are not limited to:
  - Removal of uncontaminated groundwater.
  - Removal of accumulated rainwater from work areas.
  - Removing water from cofferdams or diversions.

### *LIMITATIONS*

- Site conditions will dictate design and use of dewatering operations.
- The controls discussed in this BMP address sediment only. If the presence of polluted water is identified in the contract, the contractor shall implement dewatering pollution controls as required by the contract documents. If the quality of water to be removed by dewatering is not identified as polluted in the contract documents, but is later determined by observation or testing to be polluted, the contractor shall notify the Engineer and comply with Standards Specifications, "Differing Site Conditions."
- The controls detailed in this BMP only allow for minimal settling time for sediment particles. Use only when site conditions restrict the use of the other control methods.
- Dewatering operations will require and must comply with applicable federal, state and local permits.
- Avoid dewatering discharges where possible by infiltration in appropriate areas.

### *PLANNING/DESIGN CONSIDERATIONS*

- Contractor shall notify the Engineer of planned discharges.
- The Engineer will coordinate monitoring and permit compliance.
- Discharges must comply with regional and watershed-specific discharge requirements.

### *MATERIAL SPECIFICATIONS*

- N/A

### *DESIGN STANDARDS*

- Ensure that dewatering discharges do not cause erosion at the discharge point.
- Sediment Control Treatment: Dewatering effluent (groundwater and accumulated precipitation) that is laden with suspended solids shall be treated to remove soil particles. Sediment basins are an example of a temporary treatment device.
- Filter bags may be used for small-scale dewatering operations.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect filtering device frequently and repair or replace when sediment build-up prevents the structure from functioning as designed.
- If adequate freeboard is not present, monitor weather forecast and discharge prior to the next event.
- Accumulated suspended solids removed from a dewatering device shall be spread on the project site and stabilized at locations designated by the Engineer.

# Non-Stormwater Paving and Milling Operations

NS-3

## DEFINITION

Procedures implemented during paving surfacing, resurfacing, or saw-cutting to prevent pollutants from entering stormwater systems, drainage ways or watercourses.

## PURPOSE

- Prevent water used during paving and milling operations from entering stormwater systems or drainage ways.

## AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Cleaning of vehicles and equipment</li> <li>• Proper disposal of paving and milling debris</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• GH-1 Vehicle and Equipment Cleaning</li> <li>• GH-8 Spill Prevention and Control</li> <li>• WM-1 Solid Waste Management</li> <li>• WM-5 Liquid Waste Management</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect and maintain machinery regularly to minimize leaks and drips.</li> <li>• Ensure that employees and subcontractors are implementing appropriate measures during paving operations.</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping			
Non-Stormwater	X		
Waste Management	X		



Saw-cutting.



Asphalt paving operation.

### APPROPRIATE APPLICATIONS

- Everywhere paving, surfacing, resurfacing, or saw-cutting operations may pollute stormwater runoff or discharge to the storm drain system or watercourses.

### LIMITATIONS

- Finer solids are not effectively removed by filtration systems.
- Paving opportunities may be limited during wet weather to minimize discharge of pollutants.

### PLANNING/DESIGN CONSIDERATIONS

- Clean equipment off-site whenever possible.
- If on-site cleaning is necessary follow BMP *GH-1 Vehicle and Equipment Cleaning*
- If on-site cleaning is necessary manage debris per BMP *WM-1 Solid Waste Management*.
- Disposal of Portland Concrete Cement and Asphaltic Concrete waste will be in conformance with the Standard Specifications.

### MATERIAL SPECIFICATIONS

- Material used to coat asphalt transport trucks, asphalt trucks and asphalt spreading equipment shall not contain soap and be non-foaming and non-toxic.
- Reuse of saw-cutting water is permissible if settled and pH levels test in the normal range (6-9 pH) and water is not allowed to runoff the project site.

### DESIGN STANDARDS

#### ASPHALTIC CONCRETE PAVING

- Place drip pans or absorbent materials under paving equipment while not in use to catch or contain drips and leaks.
- Minimize the washing of sand or gravel from new asphalt into storm drains, streets, and receiving waters by sweeping where practical.
- Cover drainage inlet structures and manholes with filter fabric during application of seal coat, tack coat, slurry seal and/or fog seal.
- Do not apply seal coat, tack coat, slurry seal, or fog seal if rainfall is predicted to occur during the application or curing period.
- Dispose old or spilled asphalt as approved by the Engineer. Do not allow AC millings, pieces or chunks used in embankments or shoulder backing to enter any storm drains or watercourses. Apply temporary BMP perimeter controls until structure is stabilized or permanent controls are in place.
- Collect and remove all broken asphalt and recycle when practical; otherwise, dispose in accordance with special provisions or as directed by the Engineer.
- Place any AC chunks and pieces used in embankments above the water table and cover by at least 1 foot of material.
- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.

#### PORTLAND CEMENT CONCRETE PAVING

- Do not wash sweepings from exposed aggregate concrete into storm drain systems. Collect and return to aggregate base stockpile or dispose of properly.
- Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in BMP *WM-4 Concrete Waste Management* or dispose of properly.
- Do not allow saw-cut Portland Concrete Cement (PCC) slurry to enter storm drains or watercourses.

- Residue from milling operations must not flow across pavement and nor be left on the surface of pavement. Refer to BMPs *WM-4 Concrete Waste Management and WM-5 Liquid Waste Management*.

### THERMOPLASTIC STRIPING

- Inspect all thermoplastic striper and pre-heater equipment shutoff valves to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Fill the pre-heater carefully to prevent splashing or spilling of hot thermoplastic. Leave 6 inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move when the vehicle is deadheaded.
- Do not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.
- Clean truck beds daily of loose debris and melted thermoplastic. When possible recycle thermoplastic material. Thermoplastic waste shall be disposed of in accordance with project specifications.

### RAISED/RECESSED PAVEMENT MARKER APPLICATION AND REMOVAL

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system or watercourses.
- Load melting tanks with care and do not fill beyond six inches from the top to leave room for splashing when vehicle is deadheaded.
- When servicing or filling melting tanks ensure all pressure is released before removing lids to avoid spills.
- On large-scale projects use mechanical or manual methods to collect excess bituminous material from the roadway after removal of markers.
- Waste shall be disposed of in accordance with Standard Specifications.

### INSPECTION AND MAINTENANCE REQUIREMENTS

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect and maintain machinery regularly to minimize leaks and drips.
- Ensure that employees and subcontractors are implementing appropriate measures during paving operations.
- Keep ample supplies of drip pans and absorbent materials on-site.

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# Non-Stormwater Temporary Watercourse Crossing

NS-4

## DEFINITION

A structure placed across a watercourse allowing vehicles to cross during construction.

## PURPOSE

- To provide a safe, stable way for construction vehicle traffic to cross a watercourse.
- To provide streambank stabilization.
- To reduce the risk of damage to the streambed or channel.
- To eliminate erosion and downstream sedimentation caused by vehicles moving through the streambed.

## AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• May require additional permitting</li> <li>• Design and install under direction of registered Civil or Structural Engineer</li> <li>• Select a location where erosion potential is low</li> <li>• Construct at natural elevation of the streambed</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• SC-3 Sediment Trap</li> <li>• NS-2 Dewatering Operations</li> <li>• NS-5 Water Diversion</li> <li>• NS-7 Material and Equipment Use Over Water</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect and maintain to ensure crossing, watercourse and banks are stable</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction	X		
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping			
Non-Stormwater	X		
Waste Management			



Temporary bridge.



Design must consider the heaviest loads.

### APPROPRIATE APPLICATIONS

- In all cases where construction equipment or vehicles need to cross a waterway or as specified in ADOT Stored Specification 104SWDEQ or 104SWEPA.
- When alternative access routes are not feasible.
- When crossing perennial streams or waterways causes significant erosion.

*ADOT Specification Section 104SWEPA: Unless otherwise approved in writing by the Engineer, fording of running streams with construction equipment will not be permitted; therefore, temporary bridges or other structures shall be used whenever an appreciable number of crossings is necessary.*

### LIMITATIONS

- Installation and removal will disturb the waterway.
- May require additional permitting such as U.S. Army Corps of Engineers 404 permit and environmental clearance.
- Installation may require dewatering or temporary diversion of the stream. Refer to BMP *NS-2 Dewatering Operations*.
- Crossing structure may become a constriction in the waterway, which can obstruct flood flow and cause flow backups or washouts. If improperly designed, flow backups can increase the pollutant load through washouts and scouring.

### PLANNING/DESIGN CONSIDERATIONS

- Consult with ADOT Office of Environmental Services, Water Quality Section, prior to installation of any temporary watercourse crossing.
- Select crossing site where erosion potential is low.
- Select areas where the runoff from highway side slopes will not spill into the crossing side slopes.
- All crossing designs must consider storm event-generated runoff.
- Design and installation require knowledge of stream flows and soil strength. Designs shall be under the direction of, and approved by, a registered civil and/or structural engineer. Both hydraulic and construction loading requirements shall be considered with the following:
  - Comply with the requirements for culvert and bridge crossings, as contained in the ADOT Highway Design Manual, particularly if the temporary stream crossing will remain through the rainy season.
  - Provide stability in the crossing and adjacent areas to withstand the design flow. The design flow and safety factor shall be selected based on careful evaluation of the risks due to over topping, flow backups, or washout.
  - Install sediment traps immediately downstream of crossings outside of the drainage in order to capture sediments. Refer to BMP *SC-3 Sediment Trap*.
  - Avoid oil or other potentially hazardous waste materials for surface treatment.
- Types of temporary crossings to consider:
  - Culverts
    - Use on perennial and intermittent streams
    - Relatively easy to construct
    - Able to support heavy loads
  - Fords
    - Use on dry streams washes and ephemeral stream and low flow perennial streams during the dry season in arid areas.
    - Least expensive of the crossing types with the maximum load limits.

# Non-Stormwater Temporary Watercourse Crossing

NS-4

- Temporary fords are not appropriate if construction will continue through the rainy season, if thunderstorms are likely or if the stream is perennial.
- Bridges
  - Use on streams with high flow velocities, steep gradients and/or where temporary restrictions in the channel are not allowed.
  - Generally more expensive to design and construct
  - Least disturbance to the stream bed
  - Least constrictive of waterway flows

## *MATERIAL SPECIFICATIONS*

- N/A

## *DESIGN AND CONSTRUCTION STANDARDS*

- Stabilize construction roadways, adjacent work area and stream bottom against erosion.
- Construct during dry periods to minimize stream disturbance and reduce costs.
- Construct at or near the natural elevation of the streambed to prevent potential flooding upstream of the crossing.
- Vehicles and equipment shall not be driven, operated, fueled, cleaned, maintained, or stored in the wet or dry portions of a water body where wetland vegetation, riparian vegetation, or aquatic organisms may be destroyed, except as authorized by the Engineer as necessary to complete the work.
- Temporary water body crossings and encroachments shall be constructed to minimize scour. Cobbles used for temporary water body crossings or encroachments shall be clean, rounded river cobble.
- The exterior of vehicles and equipment that will encroach on the watercourse within the project shall be maintained free of grease, oil, fuel, and residues.
- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. Precautions shall be taken to avoid damage to vegetation by people or equipment.
- Riparian vegetation, when removed pursuant to the provisions of the work, shall be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation shall be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble shall be removed upon completion of project activities.
- Any temporary artificial obstruction placed within flowing water shall only be built from material, such as clean gravel bags, which will cause little or no siltation.

## *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect periodically to ensure that the bridge, streambed, and banks are maintained and not damaged.
- Maintenance shall be performed, as needed to ensure that the structure, streambed and banks are stable.

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# Non-Stormwater Water Diversion

NS-5

## DEFINITION

A system of structures and measures that intercept clear surface water runoff upstream of a project site, transport it around the site, and discharge it downstream with minimal water quality degradation for either the project construction operations or the construction of the diversion. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, drainage, and interceptor swales.

## PURPOSE

- Reduce sediment pollution from construction work in or adjacent to the watercourse.

## AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Requires additional permitting</li> <li>• Design to accommodate fluctuations in water depth or flow</li> <li>• Avoid damage to nearby vegetation</li> <li>• Protect adjacent slopes from erosion</li> <li>• Provide for velocity dissipation at transition areas</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• RC-1 Earth Dikes/Drainage Swales and Lined Ditches</li> <li>• RC-4 Rock Outlet Protection/Velocity Dissipation Devices</li> <li>• NS-4 Temporary Watercourse Crossing</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• CP-1 Construction Sequencing</li> <li>• NS-2 Dewatering Operations</li> <li>• NS-4 Temporary Watercourse Crossing</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect diversion structures before and after storms and at least once a week</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design		X	
Construction	X		
Maintenance		X	
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control	X		
Sediment Control	X		
Good Housekeeping			
Non-Stormwater	X		
Waste Management			



A flow bypass channel is used during placement of a multi-section culvert. Note the clear water in the diversion channel.

### *APPROPRIATE APPLICATIONS*

- Implement where work must be performed in a running stream or watercourse after appropriate permits have been secured.

### *LIMITATIONS*

- Diversion/encroachment activities will usually disturb the waterway during installation and removal of diversion structures.
- Diversion/encroachment activities may constrict the waterway, which can obstruct flood flows and cause flooding or washouts.
- Specific permit requirements or mitigation measures, such as Corps, Arizona Game and Fish Department, Federal Emergency Management Agency (FEMA), etc. may be included in contract documents because of clear water diversion/ encroachment activities.

### *PLANNING/DESIGN CONSIDERATIONS*

#### *GENERAL*

- Where working areas encroach on live streams, barriers adequate to prevent the flow of muddy water into streams shall be constructed and maintained between working areas and streams. During construction of the barriers, muddying of streams shall be held to a minimum.
- Diversion structures must be adequately designed to accommodate fluctuations in water depth or flow volume due to storms, flash floods, etc.
- Heavy equipment driven in wet portions of a watercourse to accomplish work shall be completely clean of petroleum residue, and water levels are below the gear boxes of the equipment in use, or lubricants and fuels are sealed such that inundation by water shall not result in leaks.
- Mechanical equipment operated in the water shall not be submerged to a point above any axle of said mechanical equipment.
- Excavation equipment buckets may reach out into the water for the purpose of removing or placing fill materials. Only the bucket of an excavator/backhoe may operate in a water body. The main body of the crane/excavator/backhoe shall not enter water-covered portions of a water body, except as necessary to cross the stream to access the work site.
- Stationary equipment such as motors and pumps, located within or adjacent to a watercourse, shall be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained, or placed in operation, sufficient water shall, at all times, be allowed to pass downstream to maintain aquatic life downstream.
- The exterior of vehicles and equipment that will encroach on a water body within the project shall be maintained free of grease, oil, fuel, and residues.
- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. Precautions shall be taken to avoid damage to vegetation by people or equipment.
- Riparian vegetation, when removed pursuant to the provisions of the work, shall be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation shall be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble shall be removed upon completion of project activities. Drip pans shall be placed under all vehicles and equipment placed on structures over watercourses when the vehicle or

equipment is planned to be idle for more than one hour.

- Where possible, avoid or minimize diversion/encroachment impacts by scheduling construction during periods of low flow or when the stream is dry. Refer also to the project Special Provisions for scheduling requirements.
- Scheduling shall also consider seasonal releases of water from dams, wastewater treatment plants, seasonal riparian wildlife, and water demands due to crop irrigation.
- Construct diversion structures with materials free of potential pollutants such as soil, silt, sand, clay, grease, or oil. If gravel bags are used, they shall be filled with clean materials free of silt, clay, and organic substances.

### TEMPORARY DIVERSIONS/ENCROACHMENTS

- Construct diversion channels in accordance with BMP *RC-1 Earth Dikes/Drainage Swales and Lined Ditches*.
- In high flow velocity areas, stabilize slopes of embankments and diversion ditches using an appropriate liner, in accordance with BMP *EC-5 Geotextiles/Erosion Control Blankets*, or, use rock slope protection, as described in the Standard Specifications Section.
- Where appropriate, use natural streambed materials such as large cobbles and boulders for temporary embankment/slope protection, or other temporary soil stabilization methods.
- Provide for velocity dissipation at transitions in the diversion, such as the point where the stream is diverted to the channel and the point where the diverted stream is returned to its natural channel. Refer also to BMP *RC-4 Rock Outlet Protection/Velocity Dissipation Devices*.

### TEMPORARY DRY CONSTRUCTION AREAS

- When dewatering behind temporary structures to create a temporary dry construction area, such as coffer dams, pass pumped water through a sediment settling device, such as a portable tank or settling basin, before returning water to the water body. Refer also to BMP *NS-2 Dewatering Operations*.
- If the presence of polluted water or sediment is identified in the contract, the contractor shall implement dewatering pollution controls as required by the contract documents. If the quality of water or sediment to be removed while dewatering is not identified as polluted in the contract documents, but is later determined by observation or testing to be polluted, the contractor shall notify the Engineer and comply with the Standard Specifications.
- Any substance used to assemble or maintain diversion structures, such as form oil, shall be non-toxic and non-hazardous.
- Any material used to minimize seepage underneath diversion structures, such as grout, shall be non-toxic, non-hazardous, and as close to a neutral pH as possible.

### MATERIAL SPECIFICATIONS

- N/A

### DESIGN STANDARDS

- N/A

### INSPECTION AND MAINTENANCE REQUIREMENTS

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- At a minimum inspect diversion/encroachment structures before and after significant storms and at least once per week while in service.

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# Non-Stormwater

## Structure Demolition/Removal Over or Adjacent to Water

NS-6

### DEFINITION

Procedures to protect watercourses from debris and wastes associated with structure demolition or removal operations over or adjacent to them.

### PURPOSE

- Ensure prevention of pollution to waterways beneath or adjacent to structures during all demolition or removal activities.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Acquire applicable permits prior to structure demolition or removal</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• GH-7 Stockpile Management</li> <li>• NS-7 Material and Equipment Use Over Water</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Inspect equipment and debris catching devices daily</li> <li>• Inspect stockpile protection measures and repair as needed</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design		X	
Construction	X		
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping			X
Non-Stormwater	X		
Waste Management	X		



*The demolition of the Guthrie Bridge over the Gila River presented multiple sediment and pollution control challenges.*

### *APPROPRIATE APPLICATIONS*

- All construction projects with full or partial structure demolition or removal including, but not limited to bridge widening projects and concrete channel removal.

### *LIMITATIONS*

- Specific permit requirements may be included in the contract documents.

### *PLANNING/DESIGN CONSIDERATIONS*

- Refer to the BMP *NS-5 Clear Water Diversion* to direct water away from the work area.
- Plan for and ensure the safe passage of wildlife.
- Demolition triggers National Emission Standards for Hazardous Air Pollutants (NESHAPS).

### *STANDARDS*

- Do not allow demolished material to enter the watercourse.
- Use attachments on construction equipment such as backhoes to catch debris from small demolition operations.
- Use covers or platforms approved by the Engineer to collect debris.
- Stockpile accumulated debris and waste generated during demolition away from watercourses and per the BMP *GH-7 Stockpile Management*.
- Report discharges to watercourses to the Engineer immediately upon discovery and a written discharge notification must follow within the time frame specified in the applicable permit.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect demolition areas over or near adjacent watercourses on a daily basis.
- Empty debris-catching devices regularly. Remove collected debris and store debris away from the watercourse and protect debris from run-on and runoff.

# Non-Stormwater

## Material & Equipment Use In/Over Watercourses

NS-7

### DEFINITION

Procedures for the proper use, storage, and disposal of materials and equipment on barges, boats, temporary construction pads, or similar locations.

### PURPOSE

- Minimize or eliminate the discharge of potential pollutants to a watercourse.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Acquire and comply with all necessary permits</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>GH-3 Vehicle and Equipment Maintenance</li> <li>GH-5 Material Delivery and Storage</li> <li>GH-8 Spill Prevention and Control</li> <li>NS-6 Structure Demolition/Removal Over or Adjacent to Water</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Inspect equipment for leaks and spills daily; repair as necessary</li> <li>Inspect and maintain all associated BMPs</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design		X	
Construction	X		
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			
Runoff Control			
Sediment Control			
Good Housekeeping	X		
Non-Stormwater	X		
Waste Management	X		



Bridge repair.

### APPROPRIATE APPLICATIONS

- Implement for construction materials and wastes (solid and liquid) and any other materials that may be detrimental if released.
- Applicable where materials and equipment are used on barges, boats, docks, and other platforms over or adjacent to a watercourse.

### LIMITATIONS

- N/A

### PLANNING/DESIGN CONSIDERATIONS

- Comply with all necessary permits required for construction within or near the watercourse.
- Secure all materials to prevent discharges to receiving waters via wind.
- Identify types of spill control measures to be employed, including the storage of such materials and equipment.
- Ensure that staff are trained regarding the deployment and access of control measures and that measures are being used.
- Prepare an Emergency Evacuation Plan that defines implementation procedures in the event of a sudden flood event.

### STANDARDS

- Use drip pans and absorbent materials for equipment and vehicles and ensure that an adequate supply of spill cleanup materials is available.
- Drip pans shall be placed under all vehicles and equipment placed on docks, barges, or other structures over watercourses when the vehicle or equipment is expected to be idle for more than one hour.
- Discharges to waterways shall be reported to the Engineer immediately upon discovery. A written discharge notification must follow within the time frame specified in the applicable permit.
- Provide watertight curbs or toe boards to contain spills and prevent materials, tools, and debris from leaving the barge, platform, dock, etc.
- Ensure the timely and proper removal of accumulated wastes. Refer to BMPs *WM-1 Solid Waste Management* and *WM-2 Hazardous Waste Management*.

### INSPECTION AND MAINTENANCE REQUIREMENTS

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Inspect equipment for leaks and spills daily, repair as necessary.
- Ensure that employees and subcontractors implement appropriate measures for storage and use of materials and equipment.
- Inspect and maintain all associated BMPs and perimeter controls to ensure continuous protection of the watercourse.

**BEST MANAGEMENT PRACTICES**

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## Waste Management (WM) BMPs

Waste management BMPs are also source control measures to prevent pollution by limiting or reducing potential pollutants at the source before they come in contact with stormwater. These BMPs involve day-to-day operations of the construction site, are under the control of the contractor, and are additional “good housekeeping practices” that involve keeping a clean, orderly construction site.

- WM-1 Solid Waste Management
- WM-2 Hazardous Waste Management
- WM-3 Contaminated Soil Management
- WM-4 Concrete Waste Management
- WM-5 Liquid Waste Management

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# Waste Management

## Solid Waste Management

WM-1

### DEFINITION

Practices to use to minimize and prevent waste associated with construction activities from entering storm drains and watercourses.

### PURPOSE

- Control a major cause of pollution on construction sites.
- Prevent the contamination of stormwater from stockpiled waste materials.
- Prevent the clogging of storm drain systems.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Clearly post guidelines on site</li> <li>• Plan the frequency of disposal</li> <li>• Properly store and cover in a convenient location</li> <li>• Separate green waste for use as compost or mulch</li> <li>• Recycle where possible</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• GH-6 Material Use</li> <li>• GH-7 Stockpile Management</li> <li>• NS-6 Structure Demolition/Removal Over or Adjacent to Water</li> <li>• NS-7 Material and Equipment Use Over Water</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Regularly check for and remove litter and debris from drainage grates and other drainage structures</li> <li>• Adhere to a regular, scheduled maintenance plan</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance			X
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			X
Sediment Control			X
Good Housekeeping	X		
Non-Stormwater	X		
Waste Management	X		



*This waste container should be emptied soon.*



*Dumpsters must be watertight. If there is a drain, it must be plugged.*

### *APPROPRIATE APPLICATIONS*

- Required for all construction projects that generate solid waste such as construction wastes (brick, pavement, timber), vegetative material and litter.

### *LIMITATIONS*

- May require extra management time to ensure all workers are following proper procedures.

### *PLANNING/DESIGN CONSIDERATIONS*

- Proper solid waste procedures and practices are overseen and enforced by the Contractor's Erosion Control Coordinator.
- Plan the frequency of disposal to remove solid waste before it accumulates beyond the capacity of the on-site facilities.
- Place on-site facilities in convenient locations for ease of maintenance.
- Prohibit littering by employees, subcontractors and visitors. Collect litter from work areas within the construction limits of the project and place in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public or others.
- Notify trash-hauling contractors that only watertight dumpsters are permitted for use on project site.
- Coordinate disposal of construction debris and all domestic garbage with the local jurisdiction.
- Consider using inert waste material as fill, as directed by the Engineer.
- Consider separating green waste for compost or mulch.

### *MATERIAL SPECIFICATIONS*

- Material that is to be stockpiled or disposed of offsite shall be in accordance with ADOT Standard Specifications for Road and Bridge Construction Section 107.11.

### *DESIGN STANDARDS*

- Locate solid waste storage areas at least 50 feet from drainages and do not locate in areas prone to flooding or ponding.
- Divert stormwater away from stored solid waste with temporary berms or dikes or by other means.
- Provide watertight trash receptacles in the contractor's yard, field trailer areas and other locations where workers congregate for lunch and break periods.
- Provide cover for dumpsters and waste containers.
- Dumpster washout on the project site is not permitted.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Check for and remove litter and debris from drainage grates and other drainage structures.
- Provide regular on-site trash collection.
- Provide regular maintenance of trash containers and dumpsters.
- Provide cover for dumpsters and waste containers to prevent entry of rainwater and loss of contents by high winds.

# Waste Management

## Hazardous Waste Management

WM-2

### DEFINITION

The planning and practice to meet the requirements for handling hazardous waste materials on a construction site.

### PURPOSE

- Control the release of hazardous materials.
- Prevent the contamination of stormwater.
- Prevent a delay in the project schedule and additional costs and fees due to environmental investigations/enforcement actions.

### AT A GLANCE

GENERAL INFORMATION
<p><b>Key Design Considerations</b></p> <ul style="list-style-type: none"> <li>• Clearly post guidelines on site</li> <li>• Comply with all federal, state and local laws</li> <li>• Identify hazardous materials to be used on the construction site</li> <li>• Maintain careful records of storage, handling and disposal of hazardous materials</li> <li>• Locate away from storm drains or watercourses and away from moving vehicles and equipment; keep in appropriate containers</li> </ul>
<p><b>Alternate BMPs to consider:</b></p> <ul style="list-style-type: none"> <li>• N/A</li> </ul>
<p><b>Use in combination with:</b></p> <ul style="list-style-type: none"> <li>• GH-8 Spill Prevention and Control</li> <li>• WM-1 Solid Waste Management</li> <li>• WM-3 Contaminated Waste Management</li> </ul>
<p><b>Maintenance Needs:</b></p> <ul style="list-style-type: none"> <li>• Inspect all perimeter controls, containment structures, covers and liners; immediately repair and replace</li> <li>• Dispose of waste material as directed by the Engineer and as specified in the project specifications and the applicable permits</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			X
Sediment Control			X
Good Housekeeping	X		
Non-Stormwater	X		
Waste Management	X		



These waste containers are a good example of clear labeling and covered storage.

### *APPROPRIATE APPLICATIONS*

- Required for all construction activities that use hazardous materials and generate hazardous waste.

### *LIMITATIONS*

- May require extra management time to ensure all workers are following proper procedures.
- Lifespan of the cover or structure.

### *PLANNING/DESIGN CONSIDERATIONS*

- Contractor must comply with all federal, state and local laws regarding hazardous materials on a construction site.
- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Identify hazardous materials that will be needed on the construction site and plan for storage, use and disposal.
- Maintain careful records of the storage, handling and disposal of hazardous materials.

### *MATERIAL SPECIFICATIONS*

- Hazardous wastes include waste generated from the use of:
  - Petroleum products.
  - Septic wastes.
  - Paints and stains.
  - Wood preservatives.
  - Asphalt products.
  - Pesticides.
  - Acids.
  - Solvents.
  - Roofing tar.
  - Any materials deemed hazardous waste in the state of Arizona.
- In the event of a spill of a hazardous material, the contractor shall follow the provisions of the ADOT Standard Specifications for Road and Bridge Construction Section 107.07.

### *DESIGN STANDARDS*

- Designate hazardous waste storage areas on site away from storm drains or watercourses and away from moving vehicles and equipment.
- Segregate hazardous waste from non-hazardous construction site debris.
- Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drum or similar), under cover, and within secondary containment.
- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Never mix waste types or combine container contents.
- In the event of a hazardous material spill, the Erosion Control Coordinator shall modify the SWPPP as necessary within 14 calendar days to include a description of the release, the circumstances leading to the release, and the date of the release.
- Maintain a clean and orderly work environment.
- Dispose of waste within 90 days of being generated or as directed by the Engineer.
- The contractor shall assist in any efforts to clean up hazardous material spills, as directed by the Engineer or other authorities.
- Dispose of soil contaminated from spills according to applicable state and federal

regulations.

- Notify the National Response Center (800-424-8802) of spills of Federal reportable quantities.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- The contractor's Erosion Control Coordinator monitors on-site hazardous waste storage and disposal procedures.
- Inspect perimeter controls, containment structures, covers and liners on a weekly basis and immediately repair or replace as needed.

### *ADDITIONAL INFORMATION AND RESOURCES*

- Information about the requirements for the handling of hazardous waste on construction sites is available from the Arizona Department of Environmental Quality (ADEQ) Waste Management Program, (602) 771-4153.
- 24-hour ADEQ Emergency Response Duty Office, (602)-771-2330 or (800)-234-5677.
- ADEQ Waste Management Programs Division: Hazardous Waste Management, <http://www.azdeq.gov/enviro/waste/hazwaste/index.html>

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# Waste Management

## Contaminated Soil Management

WM-3

### DEFINITION AND PURPOSE

Procedures and practices to minimize or eliminate the discharges of pollutants to drainage systems or to watercourses from contaminated soil.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Clearly post guidelines on site</li> <li>Follow appropriate agency practices and regulations</li> <li>Identify contaminated soils in planning stages</li> <li>Test suspected areas at a certified lab</li> <li>Require employees and subcontractors complete a safety training program</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>WM-2 Hazardous Waste Management</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Monitor on-site contaminated soil storage and disposal procedures</li> <li>Inspect hazardous waste receptacles and areas regularly</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			X
Sediment Control			X
Good Housekeeping	X		
Non-Stormwater	X		
Waste Management	X		



Evidence of contaminated soils.



Contaminated soils are not always readily apparent. Past site uses and activities should be researched early in the design process.

#### *APPROPRIATE APPLICATIONS*

- Construction projects in highly urbanized or industrial areas where soil contamination may have occurred due to spills, illicit discharges, and leaks from underground storage tanks.
- Highway widening projects in older areas where median and shoulder soils may have been contaminated by aerially deposited lead (ADL).

#### *LIMITATIONS*

- The procedures and practices presented in this BMP are general. The contractor needs to identify appropriate practices and procedures for the specific contaminants known to exist or discovered on site.
- May require extra management time to ensure all workers are following proper procedures.

#### *PLANNING/DESIGN CONSIDERATIONS*

- Contaminated soils are often identified during project planning and development with known locations identified in the plans and specifications. The contractor shall review applicable reports and investigate appropriate call-outs in the plans and specifications.
- The contractor may further identify contaminated soils by investigating:
  - Past site uses and activities.
  - Detected or undetected spills and leaks.
  - Acid or alkaline solutions from exposed soil or rock formations high in acid or alkaline forming elements.
- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris. Test suspected soils at a certified laboratory.
- Prior to performing any excavation work at the locations containing material classified as hazardous, employees and subcontractors shall complete a safety training program covering the potential hazards as identified.
- Educate employees and subcontractors in identification of contaminated soil and on contaminated soil handling and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

#### *HANDLING PROCEDURES*

##### **MATERIAL AND AERIALY DEPOSITED LEAD (ADL)**

- Materials from areas designated as containing (ADL) may, if allowed by the contract special provisions, be excavated, transported, and used in the construction of embankments and/or backfill.
- Excavation, transportation, and placement operations shall result in no visible dust.
- Use caution to prevent spillage of lead containing material during transport.
- Monitor the air quality during excavation of soils contaminated with lead.

##### **CONTAMINATED SOILS**

- Test suspected soils at an approved certified laboratory.
- If the soil is contaminated, work with the local regulatory agencies to develop options for treatment and/or disposal.
- Avoid temporary stockpiling of contaminated soils or hazardous material.
- If temporary stockpiling is necessary:
  - Cover the stockpile with tarps.
  - Install a berm around the stockpile to prevent runoff from leaving the area.

- Do not stockpile in or near storm drains or watercourses.
- Remove and place contaminated material and hazardous material on exteriors of transport vehicles either into the current transport vehicle or the excavation prior to the vehicle leaving the exclusion zone.
- Monitor the air quality continuously during excavation operations at all locations containing hazardous material.
- Procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the contaminated material and the hazardous material.
- Collect water from decontamination procedures and treat and/or dispose of it at appropriate disposal site.
- Collect non-reusable protective equipment, once used by any personnel, and dispose of at an appropriate disposal site.
- Install temporary security fence to surround and secure the exclusion zone. Remove fencing when no longer needed.
- Excavation, transport, and disposal of contaminated material and hazardous material shall be in accordance with the rules and regulations of the following agencies (the specifications of these agencies supersede the procedures outlined in this BMP):
  - U.S. Department of Transportation (USDOT).
  - U.S. Environmental Protection Agency (USEPA).
  - Arizona Department of Environmental Quality (ADEQ).
  - Arizona Division of Occupation Safety and Health Administration.
  - Local regulatory agencies.

### PROCEDURES FOR UNDERGROUND STORAGE TANK REMOVALS

- Obtain the required underground storage tank removal permits and approval from the federal, state, and local agencies which have jurisdiction over such work prior to commencing tank removal operations.
- Arrange to have tested, as directed by the Engineer, any liquid or sludge found in the underground tank prior to its removal to determine if it contains hazardous substances.
- Take soil samples beneath the excavated tank and perform analysis as required by the local agency representative(s) following the tank removal.
- Transport the underground storage tank, any liquid and/or sludge found within the tank, and all contaminated substances and hazardous substances removed during the tank removal to disposal facilities permitted to accept such waste.

### WATER CONTROL

- Take all necessary precautions and preventive measures to prevent the flow of water, including ground water, from mixing with hazardous substances or underground storage tank excavations. Such preventative measures may consist of, but are not limited to: berms, cofferdams, grout curtains, freeze walls, and seal course concrete or any combination thereof.
- Discharge contaminated water to clean, closed top, watertight holding tanks; treat, and dispose of in accordance with federal, state, and local laws.

### INSPECTION AND MAINTENANCE REQUIREMENTS

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- The Contractor's Erosion Control Coordinator and/or construction supervisor shall monitor on-site contaminated soil storage and disposal procedures.
- Monitor air quality continuously during excavation operations at all locations containing

# Waste Management

## Contaminated Soil Management

WM-3

hazardous material.

- Coordinate contaminated soils and hazardous substances/waste management with the appropriate federal, state, and local agencies.
- Inspect hazardous waste receptacles and areas regularly.

# Waste Management

## Concrete Waste Management

WM-4

### DEFINITION

Methods and procedures for the management of concrete waste including concrete slurry, mortar mixing stations and on-site concrete washout facilities.

### PURPOSE

- Prevent fresh concrete or cement-laden mortar from entering a storm drainage system and/or receiving water.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>• Clearly post guidelines on site</li> <li>• Locate for convenient truck access, near pour site; not within 50' of storm drains</li> <li>• Multiple washout facilities may be needed on sites with extensive concrete work</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>• SC-1 Sediment Control Berm</li> <li>• SC-7 Gravel Bag Protection</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>• SC-4 Sediment Basin</li> <li>• SC-10 Stabilized Construction Entrance/Exit</li> <li>• SC-11 Stabilized Construction Roadway</li> <li>• WM-1 Solid Waste Management</li> <li>• WM-5 Liquid Waste Management</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>• Monitor on-site concrete waste per applicable permit requirements</li> <li>• Remove and dispose of hardened concrete in washout areas</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction		X	
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			X
Sediment Control			X
Good Housekeeping	X		
Non-Stormwater	X		
Waste Management	X		



This simple containment system is appropriate for small jobs.



Slurry residue must be properly captured and contained.

### *APPROPRIATE APPLICATIONS*

- Where concrete is used as a construction material or where concrete dust and debris result from demolition activities.
- Where slurries containing Portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from saw-cutting, coring, grinding, milling, grooving, and hydro-concrete demolition.
- Where concrete trucks and other concrete-coated equipment are washed on site, when approved by the Engineer.
- Coring and saw-cutting operations/locations.
- Mortar mixing stations.

### *LIMITATIONS*

- May require extra management time to ensure all workers follow proper procedures.

### *PLANNING/DESIGN CONSIDERATIONS*

- Locate concrete washout facilities a minimum of 50 feet from storm drains, open ditches, or watercourses.
- Locate concrete washout facilities for convenient truck access, near the pour site if possible.
- Provide multiple washout facilities on sites with extensive concrete work.
- Designate and post signage for each washout area.
- Educate employees, subcontractors and suppliers on the concrete waste management techniques described herein.

### *MATERIAL SPECIFICATIONS*

- N/A

### *DESIGN STANDARDS*

- Temporary pit or bermed area or for washout of concrete trucks, tools, mortar mixers, etc.
- Concrete slurry waste.
  - Place berms or sandbags or other BMPs around coring and saw-cutting locations to capture and contain slurry.
  - Vacuum slurry waste or collect it in a temporary lined pit and allow to dry.
  - Properly dispose of slurry residue.

### *INSPECTION AND MAINTENANCE REQUIREMENTS*

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- The contractor's Erosion Control Coordinator shall monitor on-site concrete waste storage and disposal procedures at least weekly.
- Maintain temporary concrete washout facilities to provide adequate holding capacity with a minimum freeboard of 4 inches for above grade facilities and 12 inches for below grade facilities. Maintenance shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.

# Waste Management

## Liquid Waste Management

WM-5

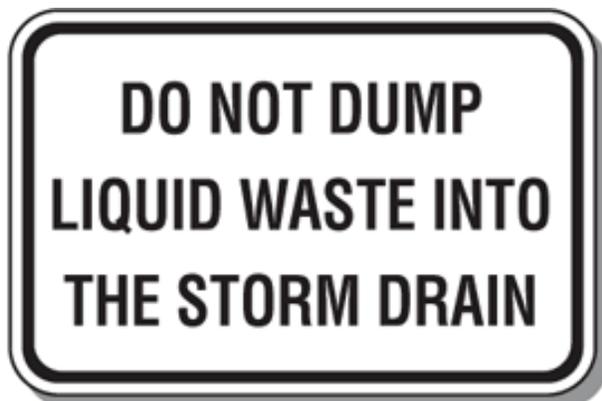
### DEFINITION AND PURPOSE

Procedures and practices to prevent discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes.

### AT A GLANCE

GENERAL INFORMATION
<b>Key Design Considerations</b> <ul style="list-style-type: none"> <li>Clearly post guidelines on site</li> <li>Verify allowable non-stormwater discharges in applicable PDES permit</li> <li>Additional permits may apply</li> </ul>
<b>Alternate BMPs to consider:</b> <ul style="list-style-type: none"> <li>N/A</li> </ul>
<b>Use in combination with:</b> <ul style="list-style-type: none"> <li>SC-3 Sediment Trap</li> <li>GH-1 Vehicle and Equipment Cleaning</li> <li>GH-8 Spill Prevention and Control</li> <li>WM-2 Hazardous Waste Management</li> <li>WM-4 Concrete Waste Management</li> </ul>
<b>Maintenance Needs:</b> <ul style="list-style-type: none"> <li>Check employees and subcontractors monthly to ensure appropriate practices are employed</li> <li>Inspect containment areas and capturing devices frequently for damage and repair as needed</li> </ul>

RATINGS	H	M	L
<b>Associated Costs</b>			
Design			X
Construction			X
Maintenance	X		
<b>BMP Objectives</b>			
Erosion Control			X
Runoff Control			X
Sediment Control			X
Good Housekeeping	X		
Non-Stormwater			X
Waste Management	X		



Clear and appropriate signage can help achieve project goals.



Training is a key part of ensuring compliance.

### APPROPRIATE APPLICATIONS

- Construction projects that generate any of the following non-hazardous by-products, residuals or wastes:
  - Drilling slurries and drilling fluids.
  - Grease-free and oil-free wastewater and rinse water.
  - Dredgings.
  - Concrete or stucco.
  - Paint or release oils or agents.
  - Curing compounds.
  - Other non-stormwater liquid discharges not permitted by separate permits.

### LIMITATIONS

- Disposal of some liquid wastes may be subject to specific laws and regulations or to requirements of other permits secured for the construction project.
- Does not apply to dewatering operations, solid wastes, hazardous wastes, or concrete slurry residue. Refer to BMPs *NS-2 Dewatering Operations*, *WM-1 Solid Waste Management*, *WM-2 Hazardous Waste Management* and *WM-4 Concrete Waste Management*.
- Does not apply to non-stormwater discharges permitted by any ADEQ permit held by the pertinent ADOT District, unless the discharge is determined by ADOT to be a source of pollutants. Typical permitted non-stormwater discharges can include: water line flushing; landscape irrigation; diverted stream flows; rising ground waters; uncontaminated pumped ground water; discharges from potable water sources; foundation drains; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; flows from riparian habitats and wetlands; and, discharges or flows from emergency fire fighting activities.
- May require extra management time to ensure all workers follow proper procedures.

### PLANNING CONSIDERATIONS AND GENERAL PRACTICES

- The Contractor's Erosion Control Coordinator shall oversee and enforce proper liquid waste management procedures and practices.
- Instruct employees and subcontractors how to safely differentiate between nonhazardous liquid waste and potential or known hazardous liquid waste.
- Instruct employees, subcontractors, and suppliers that it is unacceptable for any liquid waste to enter any storm drainage device, waterway, or receiving water.
- Educate employees and subcontractors on liquid waste generating activities, and liquid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Verify which non-stormwater discharges are permitted by the ADOT Statewide AZPDES permit; different regions might have different requirements not outlined in this permit. Some listed discharges may be prohibited if ADOT determines the discharge to be a source of pollutants.
- Apply BMP *GH-1 Vehicle and Equipment Cleaning* for managing wash and rinse water from vehicle and equipment cleaning operations.

### CONTAINING LIQUID WASTES

- Drilling residue and drilling fluids are not allowed to enter storm drains and watercourses and shall be properly disposed of outside the highway right-of-way.
- Drilling residue and drilling fluids may be dried by infiltration and evaporation in a

containment facility constructed in conformance with the provisions concerning the Temporary Concrete Washout Facilities detailed in BMP *WM-4 Concrete Waste Management* if an appropriate location is available, as determined by the Engineer.

- Contain liquid wastes generated as part of an operational procedure, such as water-laden dredged material and drilling mud; do not allow to flow into drainage channels or receiving waters prior to treatment.
- Contain liquid wastes in a controlled area, such as a holding pit, sediment basin, roll-off bin, or portable tank.
- Containment devices must be structurally sound and leak free.
- Containment devices must be of sufficient quantity or volume to completely contain the liquid wastes generated.
- Take precautions to avoid spills or accidental releases of contained liquid wastes. Apply the education measures and spill response procedures outlined in BMP *GH-8 Spill Prevention and Control*.
- Do not locate containment areas or devices where accidental release of the contained liquid can threaten health or safety, or discharge to watercourses, channels, or storm drains.

### **CAPTURING LIQUID WASTES**

- Capture all liquid wastes running off a surface which has the potential to affect the storm drainage system such as wash water and rinse water from cleaning walls or pavement.
- Do not allow liquid wastes to flow or discharge uncontrolled. Use temporary dikes or berms to intercept flows and direct them to a containment area or device for capture.
- If the liquid waste is sediment laden, use a sediment trap (refer to BMP *SC-3 Sediment Trap*) for capturing and treating the liquid waste stream, or capture in a containment device and allow sediment to settle.

### **DISPOSING OF LIQUID WASTES**

- Dewater the contained liquid waste using procedures such as described in BMPs *NS-2 Dewatering Operations* and *SC-4 Sediment Basin* and dispose of resulting solids per BMP *WM-1 Solid Waste Management* or per Standard Specifications for off-site disposal.
- Method of disposal for some liquid wastes may be prescribed in Water Quality Reports, AZPDES permits, Environmental Impact Reports, 401 or 404 permits, local agency discharge permits, etc., and may be defined elsewhere in the Special Provisions.
- Liquid wastes, such as from dredged material, may require testing and certification whether it is hazardous or not before a disposal method can be determined. For disposal of hazardous waste, refer to BMP *WM-4 Hazardous Waste Management*.
- If necessary, further treat liquid wastes prior to disposal. Treatment may include, though is not limited to, sedimentation, filtration, and chemical neutralization.

### **INSPECTION AND MAINTENANCE REQUIREMENTS**

- Follow inspection schedule specified in the applicable stormwater discharge permit.
- Spot check employees and subcontractors at least monthly throughout the job to ensure appropriate practices are being employed.
- Remove deposited solids in containment areas and capturing devices as needed, and at the completion of the task. Dispose of any solids as described in the BMP *WM-1 Solid Waste Management*.
- Inspect containment areas and capturing devices frequently for damage, and repair as needed.

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