Stormwater Management During Construction

Best Management Practices (BMP's) for Construction in Waterways

Training Program

Student Manual

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STUDENT MANUAL TABLE OF CONTENTS

TOPICAL OUTLINE

Note: 10 minute breaks will be hourly

Section	*Delivery*	*Length*	*Objective*
Introduction to Course Course Outline Learning Objectives	DISCUSSION QUIZ 1	15 Min. – 30 Min.	NA
Module 1 Regulatory Review and Permit Requirements	SLIDES	1 Hour	1
Module 2 Planning (SWMP) Design Considerations for BMP's	SLIDES	1 Hour	2, 3
Module 3 Selecting & Installing BMP's to control erosion	SLIDES	1.5 Hours	4 - 6
LUNCH		1 Hour	
Module 4 Selecting & Installing BMP's to control sedimentation	SLIDES QUIZ 2	1 Hour	4 - 6
Module 5 Materials Handling	SLIDES	1 Hour	4-6

TARGET AUDIENCE

This course addresses primarily work in and adjacent to waterways. It is designed to provide local inspectors, SWMP designers, consultants, state inspectors, and contractors with a common basis of how to achieve effective construction management for these projects. Because the class is designed to create consistency in the evaluation of BMP's, any party involved in the design, installation, maintenance or inspection of these BMP's will benefit by attending it.

COURSE DESCRIPTION

Construction activities performed in waterways may impact water quality and therefore Best Management Practices (BMP's) are necessary to minimize these impacts. This course will provide detailed information about the design, installation, maintenance and inspection of BMP's that may be used to prevent or control erosion and sedimentation during construction activities in waterways.

LEARNING OBJECTIVES

Upon completion of the program, participants will be able to:

1. Describe the conditions of the permit (Stormwater Discharges Associated with Construction Activities)
2. Evaluate waterway characteristics
3. Evaluate design considerations for BMP's used in waterways.
4. Select BMP's for construction activities performed in waterways.
5. Describe the installation and maintenance requirements for erosion and sediment control BMP's.
6. Describe the BMP inspection requirements.

Note: the class is designed to be internactive and therefore be prepared to participate with lots of questions and discussion.

QUIZ 1

Name:_____ Date:_____

1. Best Management Practices (BMPs) used to protect waterways include which of the following:

   a) Scheduling of activities
   b) Preserving natural vegetation
   c) Installation of clean water diversions
   d) All of the above

2. The state of Colorado Construction Stormwater Permit requires all of the following except:

   a) Inspection and Maintenance of BMPs
   b) Phasing of the SWMP
   c) Sampling and analysis of stormwater runoff
   d) Recordkeeping

3. Construction dewatering permits cover discharges of:

   a) Groundwater
   b) Stormwater
   c) Form oil
   d) Hydrostatic test water

4. In the context of the construction dewatering permit, DMR stands for:

   a) Distance Meter Reading
   b) Digital Meter Report
   c) Distance Monitoring Report
   d) Discharge Monitoring Report

5. Under 404 nationwide permit general conditions, the following materials can be in fill:

   a) Asphalt
   b) Diesel contaminated soil
   c) Construction site trash
   d) None of the above

6. Double walled tanks are not acceptable secondary containment under the construction stormwater permit?

   True or False

7. A maximum of 4 stream crossings is allowed under the construction stormwater permit.

   True or False

8. Under certain conditions, discharges of concrete wash water and pumped groundwater are allowed under the construction stormwater permit.

   True or False

9. Flexible growth medium must be stapled securely in place.

   True or False

10. The proper selection of rolled erosion control products depends on soil type and time of the year.

    True or False

Module 1

Introduction to the Course
Regulatory Summary for Stormwater Discharges During Construction

Objective: Describe the requirements of the Colorado regulatory program for stormwater during construction

INTRODUCTION TO WATERWAY PROTECTION (Adapted from UDFCD Drainage Criteria Manual V.3 – Section 6.0)

At times construction activities must occur within or immediately adjacent to a waterway, gulch, stream, creek or river (jointly or separately referred to in this *Manual* as "waterway". Whenever this occurs, bottom sediments and the soils adjacent to or/and within the waterway will be disturbed and sediment movement will occur. The goal of these criteria is to minimize the movement of sediments resulting from construction activities that take place immediately adjacent to and within any waterway. When the work is immediately adjacent to a waterway, use of the erosion and sediment control practices described earlier in this chapter should accomplish this goal. As a result, activities such as minimizing disturbed areas adjacent to the waterways, use of surface roughening, properly mulching as quickly as possible disturbed area, silt fencing, temporary slope diversions to direct runoff to sediment basins before runoff enters the waterway and the use of sediment traps or basins are needed to accomplish the stated goal. One thing that may differ from ordinary construction is that the inspection and maintenance of the erosion and sedimentation controls for work adjacent to waterways needs to be more aggressive.

When working within a waterway, temporary facilities can be installed to divert flowing water around the construction activities within a waterway. However, there are times when practical and physical limits exist in the size of temporary diversions that can be installed within the limited confines of urban waterway corridors, especially in retrofit construction activities and restorative and rehabilitative maintenance. The other limitation is in the size of the runoff events and stream flows that can be controlled during construction within waterways. In addition, the installation of controls such as temporary diversions will cause some channel disturbance that cannot be avoided, only minimized.

Some construction activities within a waterway are short lived, namely a few hours or days in duration, and are minor in nature. These are typically associated with maintenance of utilities and stream crossings and minor repairs to outfalls and eroded banks. In these cases, construction of temporary diversion facilities may cause more soil disturbance and sediment movement than the maintenance activity itself. If it can be reasonably determined that any channel work is maintenance related, is of short duration, and will result in only a small disturbance of bottom sediment, it is reasonable to exempt these from the requirement to construct temporary diversion facilities.

Working Within or Crossing a Waterway

Whenever work occurs within a waterway, the following should be considered, as appropriate:

1. ***Construction vehicles should be kept out of a waterway to the maximum extent practicable.*** Where in-channel work is necessary, steps such as temporary channel diversions must be taken to stabilize the work area during construction to control erosion. The channel (including bed and banks) must be restabilized by seeding and mulching (including erosion control matting if required by the SWMP) as quickly as possible after in-channel work is completed.

2. Use a ***temporary water diversion*** to bypass the work areas when work takes place within a channel itself.
3. Whenever possible, ***construction in a waterway should be sequenced*** to begin at the most downstream point and work progressively upstream installing required channel and grade control facilities.
4. ***Complete work in small segments***, exposing as little of the channel at a time as possible.
5. Where possible and feasible, it is best to ***perform all in-channel work between October 1 and March 31,*** the period when the chances of flash floods and flows higher than the 2-year flood peak are least likely to occur.

Temporary Channel Diversions

Limiting construction activities within a waterway will significantly reduce erosion and sediment movement downstream. Use of construction berms on large streams, such as the South Platte River, Sand Creek, etc., to carry water around construction activities in a portion of the channel can be sufficient to accomplish this. The berms should be tall enough to contain at least the 2-year flood peak without being overtopped. Use of temporary diversion channels diverts the entire waterway is appropriate for smaller waterways. Permanent drainage channels and any improvements within them have to be constructed as quickly as possible to reduce the risk of exceeding capacities of temporary facilities during the flood-prone periods.

Temporary Diversion Sizing

Figure C-27 may be used to estimate the minimum design discharge for the sizing of temporary diversion facilities such as pipes, ditches, lined channels, etc. The curves in this figure were developed using annual peak flow data collected at 17 watersheds within the Urban Drainage and Flood Control District (i.e., Denver, Colorado region). These data were collected over periods that ranged from six years to eleven years and, as a result, provide sound statistical basis for it.

Figure C-27 provides a reasonable estimate for the 2-year peak flow the construction site may experience along smaller waterways and for judging the risk of the diversion's capacity being exceeded. Its utility is limited to the maximum tributary catchments of 16 square miles. Keep in mind the recommended design flows represent the minimums, and it the responsibility of the designer and the contractor to assess their risk of having the temporary diversion being exceeded and to evaluate the damages such an event may cause to the project, adjacent properties and others. Consider larger capacities to protect a project if it will require a temporary diversion for more than one year.

The data supporting Figure C-27 were taken during the high flood potential period of April through September. The values take from Figure C-27 represent approximately the 95^{th} percentile event that can occur, on the average, any given year, which means that it is likely that about 95% of runoff peaks during an average year will be less than values take from this chart. This is probably not the case in wetter than average seasons. Each owner and engineer needs to assess the risks of having the temporary diversion system capacity exceeded at the specific construction site. If its capacity is exceeded, significant costs and damages can be incurred and sediment movement off the site will occur.

For larger waterways (e.g., South Platte River, Sand Creek, Bear Creek, etc.), including ones controlled by flood control reservoirs (e.g. Chatfield Dam, Cherry Creek Dam, etc.), specific risk assessment may be appropriate to insure that the work and the waterways are protected. It is also important to recognize that larger floods can and do occur and the use of Figure C-27 or other risk assessment does not insure that the construction work will be 100% safe from high flows in the waterway. It merely provides a reasonable minimum level of flow for the design of temporary diversion channels.

Stability Considerations

Temporary channels are not likely to be in service long enough to establish adequate vegetative lining. Temporary channel diversions must be designed to be stable for the design flow with the channel shear stress less than the critical tractive shear stress for the channel lining material. Unlined channels should not be used unless it can be demonstrated that an unlined channel will not erode during the design flow.

Slides for Module 1

State of Colorado Stormwater Program
Stormwater Discharges Associated with Construction Activity

Colorado's Stormwater Program
Permitting & Compliance

Colorado Department of Public Health and Environment
Water Quality Control Division
www.cdphe.state.co.us/wq/PermitsUnit

Kathy Rosow: 303-692-3521 Matt Czahor: 303-692-3575

Colorado's Stormwater Program

Topics

- **Stormwater regulatory background**
- **Agency roles – EPA and State**
- **Permits: In general**
- **Stormwater Construction Permit – who & how**
- **Stormwater Management Plan (SWMP) - goal & parts**
- **Other permit requirements - Terms and Conditions**
- **Why is this important?**
- **Permit Administration**
- **Inspections**
- **Liabilities**

A. Stormwater regulatory background

- **1972 – Clean Water Act (CWA) established**
- **CWA created the National Pollutant Discharge Elimination System (NPDES) Program.**
  - ***Permit is required to discharge process water***
  - ***Nationwide water pollution control & enforcement***
- **1990 – EPA issued Stormwater Regulations**
  - ***Permit is required to discharge stormwater runoff from storm sewer systems and industrial activities.***
  - ***Construction activity is an industrial activity requiring a stormwater discharge permit***

B. Agency roles – EPA and Colorado

- **EPA's role**
  - ***Implement and enforce the Clean Water Act***
  - ***Grant the authority to individual states to issue and enforce NPDES permits***
  - ***Provide oversight to delegated states***
  - ***Issue NPDES permits to tribal-member and federal facilities***

B. Agency roles – EPA and Colorado

- **State of Colorado's role**
  - ***Issue and enforce NPDES permits***
  - ***Colorado Water Quality Control Act created***
  - ***Renamed NPDES permits***
    CDPS permits
    (Colorado Discharge Permitting System)

C. Permits – Discharge Q & A

- **What types of discharges from a construction site need a State CDPS Permit?**
  - *Any water discharged from a construction site needs a State CDPS Permit*
  - ***Exceptions include water associated with:***
    --emergency fire fighting activities,
    --uncontaminated springs, or
    --landscape irrigation return flow

C. Permits – Beyond stormwater

- **Local Municipality permitting**
- **Construction Dewatering** **Water Quality Control Division**
  Nicole Smith – 303-692-3217
  - ***Exception: on-site discharges of construction dewatering water to the ground may be allowed under the stormwater construction permit, provided specific conditions are met.*** *(Permit change)*

C. Permits – Beyond stormwater

- **Minimal Industrial Discharge** **Water Quality Control Division**
  Nicole Smith – 303-692-3217
- **404 Permitting**
  Army Corps of Engineers
  303-979-412
- **Fugitive Dust** **Air Pollution Control Division**
  303-692-3100

C. Permits – Stormwater Generals

- **Construction activity disturbing 1 acre or more of ground**
- **Sand & Gravel operations**
- **Asphalt and Concrete Batch Plants**
- **Industrial Facilities (based on SIC)**

C. Permits – Issuing agency

- **Who issues these permits in Colorado?**
  - ***The "State" issues all CDPS permits (Colorado Department of Public Health & Environment, Water Quality Control Division)***

D. Stormwater Construction Permit--Q & A

- **What construction activities require a stormwater discharge permit?**
  - ***Effective July 1, 2002;***
  - ***Construction activities disturbing 1 or more acres; or***
  - ***Construction activities - part of a larger common plan of development disturbing 1 or more acres over a period of time,***

Need stormwater construction permit coverage

D. Stormwater Construction Permit--Q & A

- **How do I get a state stormwater discharge permit for construction activity?**
  - *1st step:* ***Develop a Stormwater Management Plan (SWMP) for the site that meets permit requirements and is ready to be implemented (see guidance document).***
  - *2nd step:* ***Complete the 2 page application and send in with original signatures (no faxed copies).***

D. Stormwater Construction Permit--Q & A

- **How long will it take to get my permit?**
  - ***Issued within 10 days, if application is complete.***
- **Do I need to submit a copy of my SWMP with my application?**
  - ***No, but an updated copy of the SWMP must be retained on site.***

D. Stormwater Construction Permit

- **Application requirements**
  - ***Original signatures (2) required -- no faxed copies;***
  - ***Incomplete applications are sent back to the applicant; delays permitting;***
  - ***Use the closest cross streets/geography for sites without a street address;***
  - ***Latitude and longitude required: degrees, minutes, and seconds or three digit decimal;***
    - ***Don't use lat/long on legal description***

D. Stormwater Construction Permit

- **Anticipated end date for the project**
  - ***when Final Stabilization is achieved***
- **Receiving water:**
  - ***State water (stream/dry gulch/ditch etc)***
  - ***if storm drain or retention pond, where do they discharge***
  - ***"N/A" is not an option***

E. Stormwater Management Plan--(SWMP)

- Main Permit Requirement
  - ***Develop and implement a SWMP***
    - ***Describes site stormwater management***
- Goal of SWMP
  - ***Identify potential sources of pollution***
  - ***Select and implement stormwater management controls-- Best Management Practices (BMPs)***
    - ***Structural BMPs***
    - ***Non-structural BMPs***

E. Stormwater Management Plan--(SWMP)

- Structural BMPs
  - ***Silt Fence***
  - ***Retention Basins***
  - ***Inlet Protection***
  - ***Check Dams***
  - ***etc***
  - ***etc***

E. Stormwater Management Plan--(SWMP)

- Nonstructural BMPs – cheap and effective!
  - ***Seeding and mulching***
  - ***Grading techniques – direct – divert - roughen***
  - ***Existing vegetation***
  - ***Maintenance and inspection schedules***
  - *Education*
    Knowledge
    Understanding
    Action

E. SWMP contents (5 parts)

- 1. Site Description
  - ***Clear description of the construction activity that addresses ALL the items (8) required by the permit***

- 2. Site Map
  - ***Legible, complete and up-to-date map that addresses** ALL **the items (8) required by the permit***

E. SWMP contents (5 parts)

- 3. Stormwater Management Controls

  Narrative description of all stormwater management controls: before, during, and after construction.

  Must minimally describe/identify items** ALL **the items (8) required by the permit

  - ***a. SWMP administrator** (Permit change)*
  - ***b. Identification of Potential Pollutant Sources** (Permit change)*

E. SWMP contents (5 parts)

- 3. Stormwater Management Controls **(continued)**
  - ***c. BMPs and associated installation details***

    1. ***Structural BMPs***
    2. ***Non-Structural BMPs***
    3. ***How BMP implementation will be phased***
    4. ***Materials Handling and Spill Prevention***
    5. ***Dedicated Concrete or Asphalt Batch Plants***
    6. ***Vehicle Tracking Control** (Permit change)*
    7. ***Waste management/disposal, including concrete washout** (Permit change)*
    8. ***Groundwater and stormwater dewatering** (Permit change)*

E. SWMP contents (5 parts)

- 4. Plan for Final Stabilization
  - ***All ground disturbing activities complete;** and **all disturbed areas built upon, paved, or hard armored,** or **established uniform vegetative cover with a density of at least 70% of predisturbance levels.***
  - ***More detail than you think:***
    - ***What type of cover will be used?***
    - ***Specific seed mixtures and application rates?***
    - ***Will the soil need to be amended?***
    - ***Special methods on steep slopes/concentrated flow?***

E. SWMP contents (5 parts)

- 5. Inspection and Maintenance
  - ***Procedures to inspect and maintain BMPs***
  - ***Inspections***
    - ***Minimum: every 14 days and within 24 hours after precipitation events or snow melts.** (Permit change)*
    - ***Exception for temporarily idle sites – up to 72 hours following storm event.** (Permit change)*
  - ***Keep an inspection log.***
    - ***Minimum requirements identified.** (Permit change)*

- ***BMP maintenance – <u>immediately</u> in most cases***

E. SWMP Notes

- **Things to keep in mind**
  - ***Do not include Site Maps that are too busy***
  - ***A Site Map is not a SWMP***
  - ***Include: narrative descriptions, installation details, inspection and maintenance schedules***
  - ***SWMP must be on site***
  - ***SWMP must be adjusted to reflect field conditions***
  - ***Guidance:*** *<u>www.cdphe.state.co.us/wq/PermitsUnit</u>*

F. Terms and Conditions of the permit

- **General Limitations**
  - ***Discharge can't cause a water quality standard to be exceeded***
  - ***Don't discharge concrete wash water***
  - ***Bulk storage must have adequate protection (secondary or equivalent)***
  - ***No chemicals can be added to discharge***
  - ***Must manage site waste appropriately***
  - ***Permittee must comply with local requirements***

F. Terms and Conditions of the permit

- **Specific Limitations**
  - ***Adequately design your BMPs***
  - ***Prohibition of Non-Stormwater Discharges***
    - ***Concrete washout water –*** *(Permit change)*
    - ***Construction dewatering water –*** *(Permit change)*
  - ***SWMP Review/Changes – when*** *(Permit change)*
  - ***Inspections – frequency, scope, records*** *(Permit change)*
  - ***BMP maintenance and replacement – when***

G. Why is this important?

- **Stormwater is typically** NOT **treated after it leaves your site – discharged "as is" into State waters.**
- **Pollutants degrade State waters**
  - ***Oil and grease - fuel spills; petroleum misuse***
  - ***Concrete washout water – high pH issues***
  - ***Paints/solvents/other chemicals***
  - *<u>Sediment:</u>*
    - ***Loading can change the physical nature of stream bed***
    - ***Eliminates habitat for aquatic organisms***
    - ***Contributes nutrients/metals to a water body – kills fish***

H. Permit Administration - options

- Transfer
  - ***Entire permit coverage may be transferred***
- Reassignment
  - ***Portions of permit coverage may be reassigned***
- Inactivation
  - ***Permit coverage may be inactivated upon achieving final stabilization***
  - ***Inactivate or billing will continue***
  - ***Removal of temporary BMPs***

H. Permit Administration - options

- Inactivation - **(continued)**
  - ***Final Stabilization***
    - ***all ground disturbing activities completed; and***
    - ***all disturbed areas built upon, paved, or hard armored; or***
    - ***all disturbed areas must have a*** *uniform*, *established*, ***vegetative cover. This vegetative cover must have a density of 70% of pre-disturbance levels.***

H. Permit Administration - tactics

- **3 ways to avoid State stormwater permitting for construction activities at small sites**
  - ***Keep site ground disturbance under 1 acre.***
  - ***Qualify for the Erosivity Waiver***
    - ***Small construction sites only (1 – 5 acres)***
    - ***Waiver based on RUSLE equation's R-Factor***
  - ***Conduct construction activities in a municipality approved as a Qualifying Local Program (QLP)***
    - ***Site disturbance is between 1 and 5 acres***
    - ***Local program is approved by the State***
    - ***Golden, Durango, Lakewood currently***

I. Inspections - who

- **Who might come out to your site to do an inspection?**
  - ***Local Municipality (city, county)***
  - ***The "State" – Colorado Department of Public Health and Environment, Water Quality Control Division.***
  - ***EPA***

I. Inspections - what

- **The following items will be reviewed during an inspection. "No" answers are considered to be permit violations.**
  - ***Do you have a permit?***
  - ***Do you have an adequate SWMP?***
  - ***Is the SWMP on site?***
  - ***Does the SWMP match the site and vice/versa?***
  - ***Has the SWMP been updated as the site changes?***
  - ***Do you have all inspection records?***

I. Inspections - what

- **Inspection items – continued**
  - ***Are BMPs in place and maintained as indicated on the SWMP?***
  - ***Have inspections been conducted every 14 days and after any precipitation or snowmelt event?***
  - ***Are all potential pollution sources indicated on the SWMP? (e.g., sediment, fuels, solvents, chemicals, debris, etc….) If so, spill response plan?***
  - ***Can you say you have had no discharge of sediment and/or pollutants to State Waters?***

I. Inspections - findings

But, that's the way we've ALWAYS done it !!
is not an affirmative defense

J. Liabilities - State

- **State enforcement of permit requirements:**
  - ***Facility inspection***
  - ***Compliance Advisory***
  - ***Notice of Violation/Cease and Desist/Clean-up Order***
    - ***formally informs the permittee of violations;***
    - ***orders the implementation of additional provisions to get the site into compliance;***
    - ***may order the remediation of impacted areas;***
    - ***Includes penalties up to $10,000 per day of violation.***

J. Liabilities - Other

- **Other reasons for maintaining compliance**
  - ***Local Municipality enforcement (stop work orders)***
  - ***EPA (inspections and enforcement)***
  - ***Third party lawsuits (Clean Water Act)***

READ YOUR PERMIT!

The COLORADO STORMWATER REGULATIONS

In Colorado, EPA has given responsibility (called delegation or primacy) for implementing these regulations and permits to the Colorado Department of Public Health and Environment (CDPHE). This training will focus on putting the requirements of the construction management programs into action in the state of Colorado.

CDPHE General Construction Permit

Currently, construction sites, both private and public, that:

- disturb 1 acre or more or;
- are part of a larger common plan of development or sale that will disturb at least 1 acre, are required to apply for a General Construction permit from the Colorado Department of Public Health and Environment (CDPHE).

The General Construction permit requires the permit holder to (refer to the permit itself for the complete requirements):

- Develop a Stormwater Management Plan (SWMP)
- Designate a SWMP Administrator
- File a permit application at least 10 days prior to the start of construction activities.
- Maintain the SWMP and keep it onsite
- Install Best Management Practices (BMPs) according to specifications outlined in the SWMP
- Perform inspections of stormwater and erosion controls following each significant storm event and at least every 14 days
- Maintain inspection records
- Provide SWMP and records to inspector upon request
- Maintain and modify BMPs to reflect current conditions of job site
- Achieve stabilization
- Remove all temporary BMPs
- Inactivate the permit
- Prevent contamination, pollution, or degradation of State Waters

The SWMP must identify appropriate stormwater pollution prevention measures or best management practices (BMPs). A best management practice or BMP is defined as any program, technology, process, practice, operating method, measure, or device which controls, prevents, removes or reduces pollution.

For more specific information about SWMP requirements and General Construction Permit application forms, contact the Water Quality Control Division, Stormwater Program by calling (303) 692-3517 or visit the web site: *http://www.cdphe.state.co.us/wq/PermitsUnit/wqcdpmt.html*.

Site under 5 acres of disturbance may also apply for coverage under the R-Factor Waiver. In general, the waiver is for sites that will be completed and stabilized in a few months and during dry times of the year. Sites that will be seeded for final stabilization will generally not qualify. The application with instructions is located at: *http://www.cdphe.state.co.us/wq/PermitsUnit/wqcdpmt.html*.

Project sites even if they are under an acre can still be required to comply with the requirements.

Local Government Requirements

Many local governments such as cities and counties are required to develop and implement stormwater programs. For example, in Boulder County, the County, Cities of Boulder, Longmont, Louisville and Towns of Erie and Superior are required by federal and state regulations to develop local programs to which meet the requirements for a state storm sewer permit called a Municipal Separate Storm Sewer System (MS4) permit. These Boulder County entities will develop common standards for construction sites, which will be incorporated into individual community ordinances.

Many local government stormwater programs include:

- Training and certification requirements for employees
- SWMP submittal and approval
- Increased site inspection
- Mandatory BMP's
- Financial assurance
- Stop work provisions

Qualified Local Programs

In a few limited situations, the Construction Stormwater permit will actually be granted by the municipality and no application will be required to be sent to the state. This authority is called a ***"Qualified Local Program"***, currently the Cities of Golden, Durango and Lakewood have such authority.

Module 2

Planning and Design Considerations for BMP's

1. The Stormwater Management Plan
2. The Erosion Process
3. Planning and Scheduling
4. Waterway Evaluation

If real estate's matra is "location, location, location", then the matra for working in waterways is "timing, timing, timing."

1. DEVELOPING AND IMPLEMENTING A STORMWATER MANAGEMENT PLAN (SWMP)

Introduction

The key document providing the description of the Best Management Practices (BMPs) for a construction project is the ***Stormwater Management Plan (SWMP).*** The SWMP must include a site description, map, and the BMPs to be used on the project. The SWMP is a requirement of a construction permit for stormwater and must be completed and implemented at the time the project breaks ground. Also, the plan must be revised to reflect the current site conditions. The State of Colorado does not require the SWMP be submitted to the Water Quality Control Division as part of the permit filing process. However, they may ask for a copy and those sites filing for a permit must sign they indeed have a SWMP they will implement. Further, if a state inspector visits a construction site, they will ask to review the plan. As far as the state of Colorado is concerned, no formal revision procedure for a SWMP is required but the plan must reflect the current site conditions. Development and revisions to a SWMP may require specific procedures be followed depending on the project and location.

Some local jurisdictions require the SWMP be submitted for review and approved prior to the issuance of a grading permit. Be sure to check with the local authorities for any specific SWMP requirements. These plans are also known as Stormwater Pollution Prevention Plans and Erosion Control Plans.

Key Points for the SWMP

- Required as the main permit condition
- Must have a designated SWMP Administrator (added 2007)
- Must reflect current site conditions
- Must be available for review by inspectors
- Is a public document

2. THE EROSION PROCESS

The selection and/or the method of installation of the Best Management Practices (BMP's) will vary depending on the expected type and amount of erosion.

Factors influencing erosion include:

- Soil cover
- Soil type
- Soil particle size
- Wind exposure
- Unsheltered distance
- Topography

Erosion and sediment control practices must be selected to protect waterways from the impacts of sedimentation. A key factor determining the type(s) of BMP's required will be the type of construction.

There are 3 main construction activities to focus on:

1. Disturbance in the waterway itself.

2. Disturbance near or adjacent to the waterway in which sediment laden water may enter the waterway,

3. Vehicles and equipment crossing a waterway - Vehicles & equipment crossing waterways may result in the pollutant being washed from the vehicle directly into the waterway.

3. PLANNING AND SCHEDULING

It is best to perform all in-channel work between October 1 and March 31, the period when the chances of flash floods and flows higher than the 2-year flood peak are least likely to occur.

Some planning and scheduling BMPs

- Isolating the work from the water flow in channels
- Leaving portions of the stream active. Complete the work in small segments exposing as little of the channel at a time as possible. Sequence the work starting at the most downstream point and work progressively upstream upstream installing required channel and grade control structures.

Grade Control Structure

- Keeping as much of the existing vegetation as possible for as long as possible
- Adjusting the BMPs as the project progresses
- Scheduling work in such a way to avoid large open or disturbed areas during the time of the year of the heaviest precipitation
- Complete or stabilize areas of the job as soon as possible or at least during the same season
- Be sure drainage features for the job are fully functional as part of the construction process

- Keep slope stabilization, erosion, and sediment control as current as possible with site construction
- Locate and develop borrow pits to minimize sediment
- Place debris, overburden, soil stockpiles and waste materials away from waterways and areas of runoff
- Stabilize the site prior to winter shut down to avoid serious erosion during spring melt down. Remember, it may not be possible to install any erosion or sediment control BMPs because of snowpack.

From UDFCD Drainage Criteria Manual V.3

Proper planning is one of the most important BMPs and can be the most cost effective as well.

1. Site Assessment

Gather information about the site and project plan.

- Topography (identify areas like steep slopes that may require additional protection)
- Soils (identify the types of soils and those more susceptible to erosion)
- Drainage characteristics (where will the water go and where is it designed to go)
- Predominant site features like proximity to waterways, sensitive habitat, and wetlands.
- Existing vegetation including types and coverage. Previous land usage can also be important. For example, was the land previously used for agriculture and is in a disturbed state already.
- Limits of clearing and grading. Determine how much area is planned to be left open at any given time and look at the time of year in which it will be open.
- Boundaries of watershed.

2. Selection of Controls

Determine the limits of clearing and grading. If the entire site will not undergo excavation and grading, or excavation and grading will occur in stages, the boundaries of each cut-and-fill operations should be defined. Buffer strips of natural vegetation may be utilized as a control measure.

Define the layout of buildings and roads. This will have been decided previously as a part of the general development plan. If building layout is not final, the road areas stabilized with pavement and the drainage features related to roads should be defined as they relate to the plan.

Determine permanent drainage features. The location of permanent channels, storm sewers, roadside swales, and stormwater quality controls such as ponds, wetlands, grassed-lined swales, buffer strips, and areas of porous pavement, if known, should be defined.

Determine extent of temporary channel diversions. If permanent channel improvements are a part of the plan, the route, sizing, and lining needed for temporary channel diversions should be determined. Location and type of temporary channel crossings can be assessed

Determine the boundaries of watersheds. The size of drainage catchments will determine the types of sediment controls to be used. Areas located off the site that contribute overland flow runoff must be assessed. Measures to limit the size of upland overland flow areas, such as diversion dikes, may be initially considered at this stage.

Select Erosion Controls. All areas of exposed soil will require a control measure be defined dependent on the duration of exposure. These can be selected based on the schedule of construction.

Select sediment controls. Select the controls needed for each phase of the construction project. Each phase will have different demands for the control of erosion and sedimentation. For example, overlot grading will require controls that may be of little use when individual homes are being built and each lot is being disturbed after the streets and drainage systems are in place. The use of sediment basins becomes an essential part of the total plan when the tributary areas start exceeding one acre.

Determine staging of construction. The schedule of construction will determine what areas must be disturbed at various stages throughout the development plan. The opportunity for staging cut-and-fill operations to minimize the period of exposure of soils needs to be assessed and then incorporated into the final SWMP, at which time the initial sequence for installing sediment controls and erosion controls is defined.

Identify locations of topsoil stockpiles. Areas for storing topsoil should be determined and then proper measures to control their erosion and sediment movement off these sites specified.

4. WATERWAY EVALUATION

Water flow is the driving force behind erosion and sedimentation. The object of BMPs of course is to provide techniques both structural and nonstructural to prevent the release of pollutants. The characteristics of the waterway in which the work is being conducted will determine the type and magnitude of the BMPs. One tool to evaluate the waterway is the ***hydrograph*** (a plot of flow versus time).

Factors influencing the shape and magnitude of a hydrograph include:

- Size of the watershed
- Length of the overland flow
- Roughness and slope characteristics
- Volume and intensity of the precipitation (rainfall or snowmelt)
- Percent imperviousness of surfaces

In addition, conduct your own research to evaluate:

- Waterway baseflow
- Pollutants that may be delivered to the waterway from the surrounding area
- The extent of existing erosion, headcutting or bank sloughing
- Type of vegetation and percent cover
- Sources of surface runoff
- Drainage pattern
- Historic events

- Flow regulation (are there existing upstream structures like reservoirs to regulate flow)
- Nature of the watershed. Is the watershed represented as a two-plane V-shape or is the watershed broken into a series of cascades (overflowing pools)? This is important because in the absence of rainfall and stream flow data, a ***synthetic unit hydrograph (SUH)*** may be used. Synthetic unit hydrograph models are mathematical expressions that relate measurable watershed characteristics to unit hydrograph characteristics.

  The Natural Resource Conservation Service (NRCS) has a method for overland routing of excess rainfall derived from watershed studies in the United States. The NRCS method produces a hydrograph resembling a triangle.

Using Exiting Data to Design BMPs (from UDFCD Drainage Criteria Manual V.3)

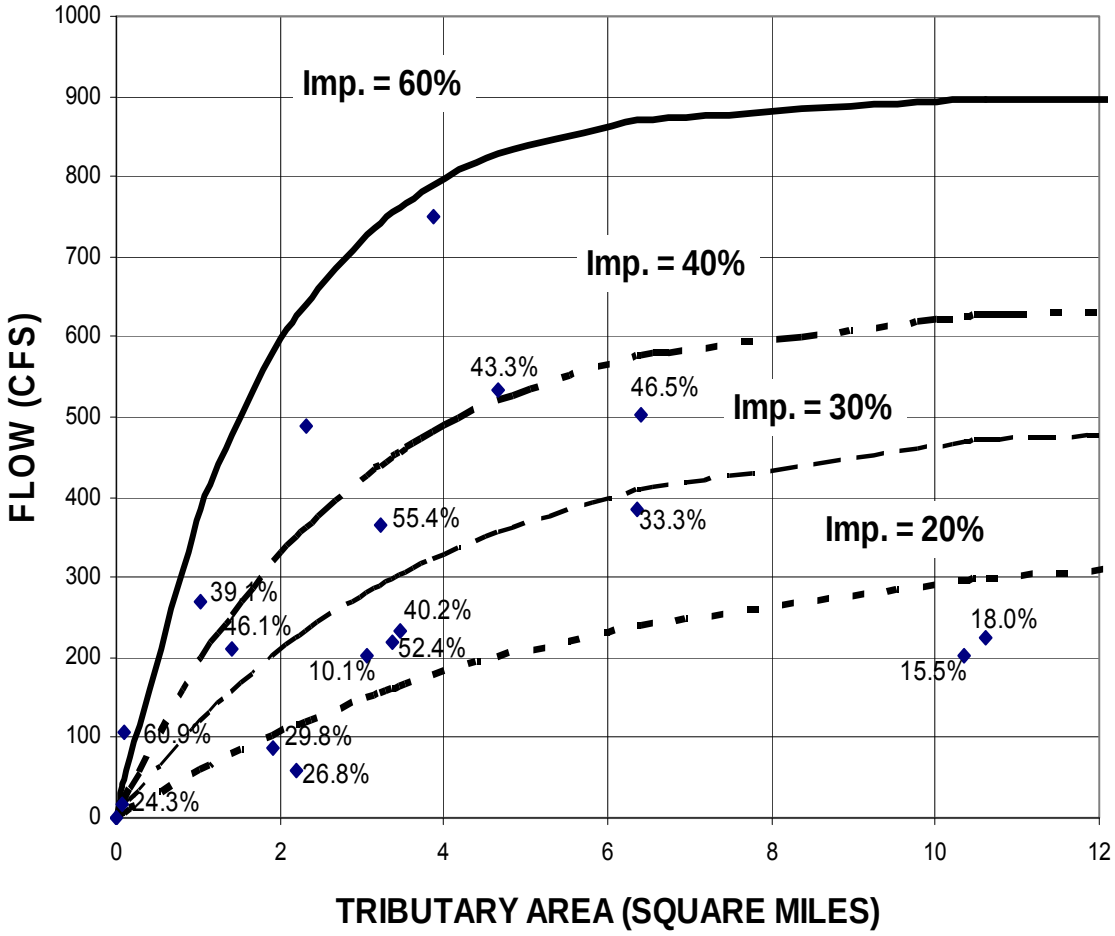


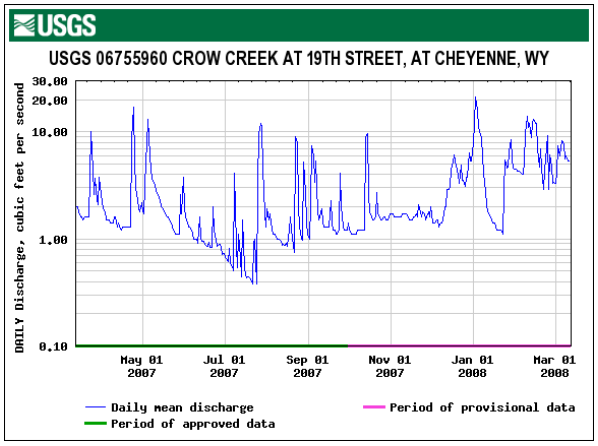
Figure C-27—Temporary Diversion Facility Sizing Nomograph Based on 2-year Peak Flows -Denver Metropolitan and Adjacent Areas

NOTE: Figure C-27 is based on statistical analysis of data taken over six years during April through September period in the Denver metropolitan area. The values from this chart may by used for catchments of up to 16 square miles through linear extrapolation.

This chart is not recommended for use in the sizing of temporary diversions on major perennial streams (e.g., Clear Creek, Cherry Creek, Boulder Creek, etc.) and S. Platte River for which a separate analysis may be more appropriate to assess risks and evaluate the potential effects of water resources diversions, reservoir releases and controls, upstream regional detention facilities, etc.

Module 3

Selecting BMPs to Control Erosion



Selecting Best Management Practices based on Project Phasing

An example like this necessarily requires us to make some assumptions but the bulk of this example is a real project in a large metropolitan area in Colorado. The rest of this student manual is really just back matter to this scenario. We will be flipping through the manual to look at some of the types of BMPs we think we are going to use. Don't expect to go page by page because we will be looking at them as they come up. Also, it is important to remember there are a lot of possible ways to develop a SWMP for this project. Our goal is to talk about the merits of as many ideas as we can realizing you will not be able to execute all of them.

The Construction Stormwater Permit requires the ***SWMP*** be ***PHASED.*** This means developing and revising the plan so at each phase of construction the appropriate BMPs are in place and documented in the plan. Carefully planning the BMPs from start to finish is especially important when working in waterways. You have little margin of error considering the objective of the stormwater program: protect water quality.

This section of the class will examine how to evaluate the necessary BMPs based on construction phasing. The major milestones for any construction project are usually well defined. The problem is pinpointing the date(s) and managing the unknown events/delays. This is where the tale begins:

PROJECT PLANNING & MANAGEMENT

A project has been proposed for channel improvements based on concern by the community over a deteriorating stormwater conveyance system. The system in question has been in place for many years and is:

- A concrete lined channel
- The bottom is 30' wide
- The length of the proposed improvements is 1200'
- The 2:1 side-slopes are also concrete
- There is no existing access
- The channel is surrounded by businesses and homes along it's length

The project was approved by City Council in February and involves the removal of the concrete channel bottom and addition of a rip rap trickle channel down the middle. The rest of the channel bottom is to be restored to a natural condition. The Council and City Engineering expect the job to be completed as quickly as possible. The initial project design was completed in early April. The project engineer has been instructed to begin immediately. The expected project length is 120 days. The SWMP must be developed and the contract documents disseminated.

The above conditions are not controllable or changeable. What BMPs are necessary for this exact point in time and for the phases below? We will take them one at a time and discuss all the possibilities we can think of.

CONTRACTOR MOBILIZES/SETS UP STAGING AND BASE OF OPERATION

FIRST CONSTRUCTION WORK BEGINS – BUILDING AN ACCESS

THE EXISITING CONCRETE BOTTOM IS TO BE REMOVED

THE NATURAL CHANNEL BOTTOM AND RIP RAP TRICKLE CHANNEL ARE TO BE CONSTRUCTED

RESTORATION ACTIVITIES

DEMOBILIZATION

POST CONSTRUCTION ACTIVITIES

Are there any addition questions that remain unanswered?

GRADING TECHNIQUES FOR EROSION CONTROL

Grading techniques for temporary erosion control can be used to minimize erosion and facilitate infiltration and plant growth. For work in waterways, berms may be an effective BMP to prevent run on. These techniques include:

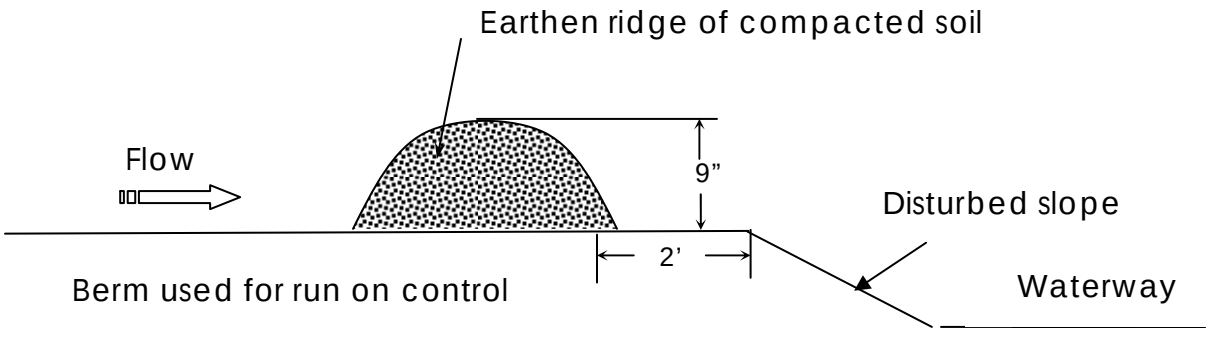
- Surface roughening (or leaving the surface rough)/grooving
- Berms
- Terracing slopes and stockpiles
- Rounding the slope at the tops of cuts, transitions, and roadway ditches
- Avoiding angles in cut-and-fill transition areas by rounding transition line
- Rounded channel bottoms
- Water bars on rough cut roads or to shorten slope lengths

General Earth Work BMPs

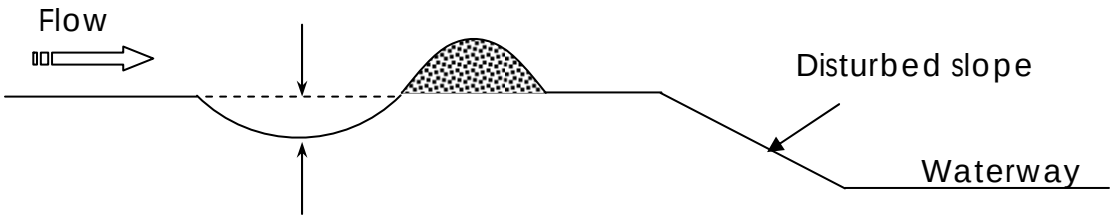
- Keep equipment operators contained in immediate work area.
- Avoid excessive compacting of the soil surface as it inhibits the growth of vegetation.
- Fill slopes should be left with loose, uncompacted fill (4"-6" deep) that can be grooved using a disk. Grooves should be 2"-4" deep and spaced 6" apart. Steeper slopes can be stair stepped (terraced).
- During the process of cut-and-fill, avoid letting side-cast or waste material enter waterways or placing it on unstable areas.
- Efficiently move excavated material to areas needing fill or to a stockpile.
- Remove stumps cleanly and relatively free of soil.

Construction of Run on Control Structures

Run on control features can be constructed with earth moving equipment already on the job site. Construct them along the contour (perpendicular to the slope) and angled slightly to provide drainage. However, keep the slope angled at 1% or less to prevent erosion of the bottom of the diversion. If the diversion is to drain to another structure like a slope drain, be sure the water will flow directly and not by-pass the structure.



Plan for some settlement of the compacted material. Products currently on the market can also be used in place of a constructed berm. For example, a product called a silt dike (triangular piece of foam wrapped in geotextile) can be used. Silt dikes may be useful in areas of public traffic that preclude the use of a construction berm.



Design with a minimum of 6" of freeboard

Run on control device with excavated area

Bladed run on control structure used to capture sheet flow. The same type of construction can be used for a run on control device.

Run on control structures are an excellent BMP because:

- They are easy to construct
- They are relatively inexpensive
- They can be used in a variety of situations
- They are easy to maintain
- They are easy to remove or change

During inspections, check:

- To be sure water is not by-passing the diversion(s)
- No erosion is occurring in the flow line.
- Look for any weakness or breaches along it's length.
- Keep diversions free of trash and debris.
- If the channel is protected with hard or soft armor, inspect the material to see if it is secure and water is not flowing under or around the protection.
- Does the berm block and collect water in places that interferes with construction activities
- Be sure the transition between the existing grade and the slope of the berm is gradual.

Slope Drains for Run On Protection

Slope drains are for those situations requiring runoff to be conveyed from the top of a slope to the bottom to avoid damage to disturbed areas especially on steep slopes. Slope drains can be of flexible or rigid pipe and are typically designed to be temporary features. However, they can also be used as a permanent control with proper design. Rundowns of all types can also be used to convey runoff to the bottom of slopes.

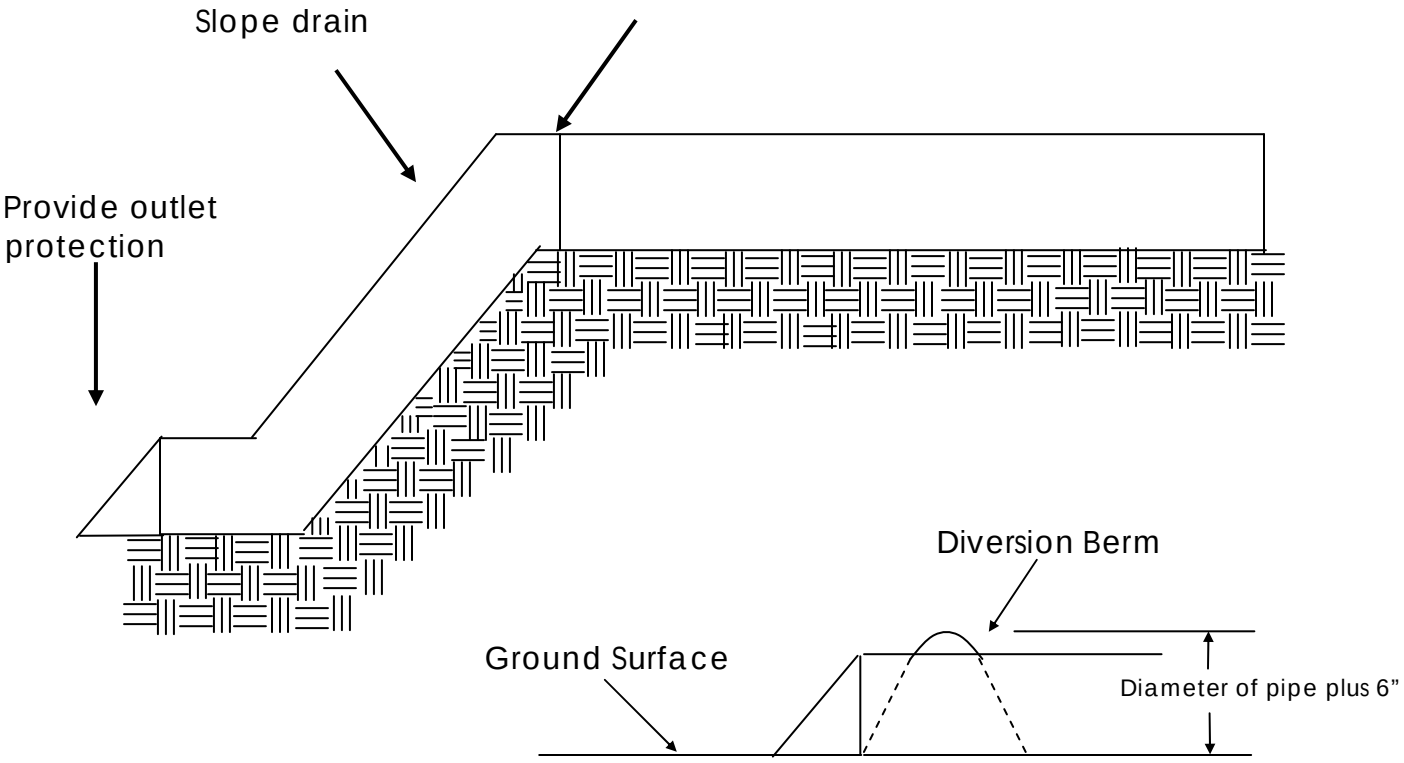
Construction of Slope Drains

If the slope is to collect runoff from diversions, be sure it is placed in the right location. Pipe sizing (from Virginia Soil and Water Conservation Commission, 1985) should be:

12" for drainage areas less than 1.5 acres
18" for drainage areas less than 5.0 acres
24" for drainage areas less than 10.0 acres

Installation Requirements:

- Fasten all pipe sections securely
- Use watertight fittings
- Anchor the pipe to the slope
- The inlet of the pipe should be tapered
- Compact the soil and place rip rap (or other armor) around the inlet for protection
- Proper backfilling around and under the pipe will ensure firm contact with the soil to prevent seepage along the pipe
- Be sure to extend the drain beyond the toe of the slope. Extension collars can be used for this purpose
- Outlet protection must be placed at the discharge end of the pipe
- If using a diversion in conjunction with a slope drain, make the diversion at least 6" above the height of the pipe.



Inlet Side of Slope Drain

PROJECT PHASING, STREAMSIDE MANAGEMENT ZONE (SMZ) OR BUFFER

There will be times in which the project can progress on schedule while portions of the project remain undisturbed. The Project Phasing BMP is a tremendously effective BMP and much underused.

PLAN, PLAN, PLAN!!

A SMZ protects the waterway by maintaining a natural sediment filter between the disturbance and a water body. This BMP requires tremendous planning since portions of the SMZ will ultimately be disturbed. The recommended distance is 50' but the longer the better. If necessary delineate the area with construction fencing. This BMP is really more a BMP of not disturbing the area than a filter or sediment removal BMP.

VEGETATIVE COVER

Introduction

Establishing vegetative cover on disturbed areas is one of the most important BMPs. Vegetative cover:

Protects the soil from rain drop impact
Facilitates infiltration of runoff thus reducing erosion
Helps remove pollutants from runoff
Requires minimal maintenance
May be integral to a drainage structure (e.g. grass-lined swale)
Helps reduce noxious weeds
Provides habitat for wildlife
Returns areas to a natural state
Good public relations

In addition, re-establishing vegetative cover may be mandated by officials. Vegetative cover could include grasses, shrubs, bushes, trees, ground cover and other plants. When planning for re-vegetation, be sure to check on all the requirements that may apply. For example, the city, county or other applicable government agency may require specific types of seed mixes at specific application rates. Other considerations include:

Type of soil
Will the area be irrigated
What watering restrictions may apply
Type of seed mix
Application rate for seed mix
Method of planting (e.g. drill seeding, hydroseeding)
Time of year (season)
Elevation
Project phasing
Long-term maintenance plan
Topography
Maintenance

Establishing Vegetative Cover

The first step to establishing vegetative cover is actually to evaluate the site for existing cover to properly plan re-vegetation activities. Also, save as much of the existing vegetation as possible. For example, leaving vegetative buffer strips especially along water bodies slows the runoff and allows infiltration of the stormwater providing filtering. This filtering effect reduces the amount of pollutants. If necessary, set up barriers so equipment and vehicles do not damage the existing cover. As construction proceeds, establish cover as soon as slopes are worked to completion. In fact, by design, diligently work slopes and once completed re-vegetate. Do everything you can to make the re-vegetation efforts succeed. Temporary cover like rye grass can provide both the benefits of erosion control and shade for the protection of permanent grasses.

- Site Evaluation (prior to construction). Sample soil for analysis as necessary. CSU has a service for this
- Review of existing plans (e.g. drainage plan, landscaping)
- Development of seeding plan or re-vegetation plan
- Site preparation
- Seeding and planting.

Establishing Vegetative Cover

1. Site Evaluation	Review existing cover (types, density, locations) Evaluate soil conditions & slopes.
2. Development of re-vegetation plan	Determine planting method, type of cover (e.g. mulch) fertilizer, soil amendments. Develop plant list and application rates for seed mixes. Determine planting schedule. Blend with other BMPs for the site.
3. Site preparation and planting	Prepare final grades for planting. Verify slopes are ready.
4. Maintenance	Conduct regular inspections. Protect area from vehicle traffic. Water trees and shrubs. Ensure areas remain covered and protected from erosion.

Guidelines for Successful Planting

Phased Seeding
Note grass being established while job is still in progress.

Drill seed when possible.

The drill seeder "opens" the soil with a shank or disc, drops the seed at the desired depth and compacts the soil with a pack wheel providing an effective seeding method. Further, the grooves left behind catch water helping keep valuable moisture for plant growth.

Use proper seed mix and application rate.

For example, adapted species may be more readily available, less expensive, and establish themselves faster than native species. When broadcast seeding, the application rate should be doubled.

Remove plant competition.

The infestation of weeds makes it all the harder to establish the desired cover. In addition, most communities have code requirements for the control of noxious weeds. Establishing a good stand of cover can reduce the cost of weed control programs as well as protect the slopes from erosion.

Prepare a good seed bed.

A seedbed that is too "fluffly" does not provide good seed to soil contact. A seedbed that is too compact interferes with seed germination and growth.

Don't prepare slopes and leave them for extended periods of time.	A crust forms on the surface of the soil requiring reworking. This also gives weeds time to takeover.
Cover seed to the proper depth.	⅓" to ½" for most seed mixes.
Good seed to soil contact.	If broadcast seeding, hand rake lightly into the soil. For larger areas, drag an object over the surface to help seed to soil contact.
Plant at the proper time.	Spring and fall are the best times to plant. Take advantage of the available moisture.
Ensure even seed distribution.	Provide sufficient plant nutrients like nitrogen, phosphorus, and potassium. Soil conditioners and slow-release fertilizers may include humate conditioner and biosol (fertilizer). Any mixture must be thoroughly mixed into the soil.

Note the well established grass and the blanket protection it has grown through.

CHANNEL PROTECTION

During the construction of a channel (temporary or permanent), the embankments must be stabilized for the design flow. During construction, temporary measures may be necessary.

Three critical factors relating to water and water flow must be considered:

1. **Run on**
2. **Rain drop impact**
3. **Flow within the channel itself.**

Rolled Erosion Control Products (RECP)

Guidelines for selecting rolled erosion control products

- Types of expected flows
- Flow velocity
- Shear forces expected (in channels)
- Steepness of slopes
- Local requirements
- Development of vegetative cover
- Durability and longevity (long or short term soil protection).

A rolled erosion control product is a product made up of either natural or synthetic material designed to be rolled onto an exposed area and stapled in place to protect it from erosion and facilitate seed growth. These products provide a good method to protect steeper slopes, drainage ways like roadside ditches, and stream banks.

Erosion Control Blankets: made from natural organic materials like mulch or excelsior (shredded aspen) and manufactured into a blanket. The blanket is formed into a roll for ease of handling and shipping and later placement. These blankets have netting stitched into the material for additional support. The netting may be a natural product or a geosynthetic mesh.

Turf Reinforcement Mats (TRM) are a permanent, nondegradable rolled erosion control product made from stabilized (UV) synthetic materials formed into a reinforcement matrix. These products are three-dimensional meaning they have thickness. TRM's offer an alternative to hard armor materials like rip rap. ***Composite Turf Reinforcement Mats*** (abbreviated C-TRM) are made of the same basic synthetic materials as TRM's but incorporate a natural product, like coconut fiber.

Between the net structure and the natural fiber matrix, a product that can be rolled into place is produced. Successful installations of C-TRM provide extensive interaction between the vegetative root structure of planted grasses and the three-dimensional netting structure.

Installation Guidelines for Rolled Erosion Control Products

These products are only as good as their installation. All are designed to be rolled onto the area and stapled in place. Additional supporting construction practices may be required (e.g. check slots for blankets). Proper installation of all RECP includes:

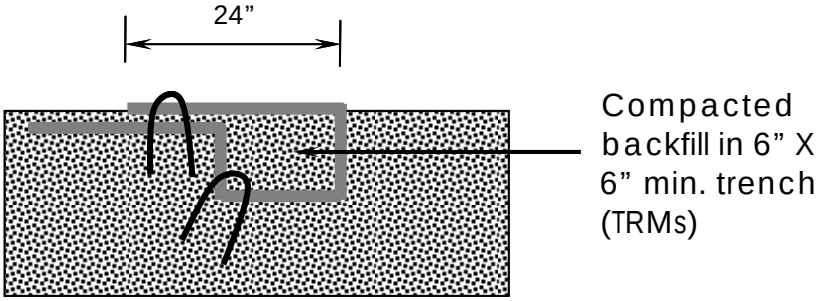
Keys to Proper Installation

- Soil prepared and planted
- Proper placement (orientation)
- Trenching and anchoring of product
- Contact with the ground (avoid "tenting")
- Stapling pattern and number of staples
- Proper overlapping of rolls

1. Start at the top of the slope by excavating a 6" by 6" trench called an *anchor slot*. Allow enough of the roll for placement in the anchor slot with 12" to 24" on top
2. Place the blanket into the trench and anchor with a row of staples or stakes in the bottom
3. Backfill and compact the trench
4. Fold the remaining portion of the blanket or mat back over the compacted trench and staple or stake (12" intervals or as necessary).

Securing blankets and TRM's

Anchor Slot (to secure the blanket at the top of the slope)



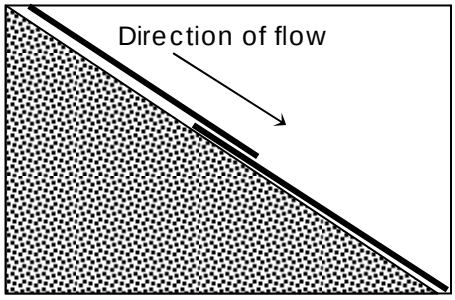
Anchor Slot

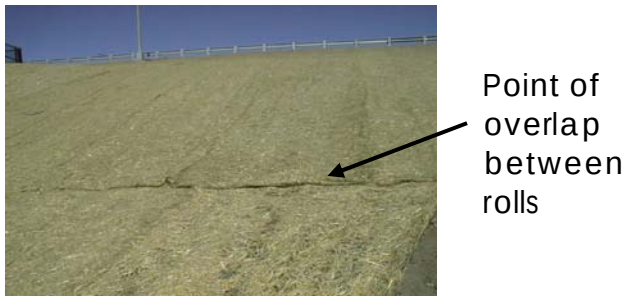
Recent Developments in the Installation of RECP

To help with the labor intensive installation of blankets, attachments for skid-steers and tractors allow for the blanket roll to be placed on the attachment and rolled out as the machine travels. Access to the slope is required. Also, using a track skid-steer is necessary to minimize damage to the slope.

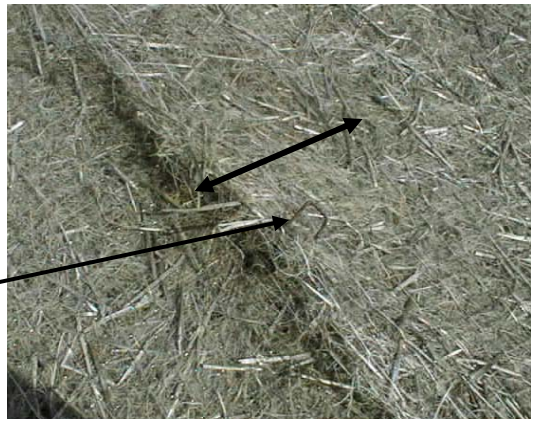
Overlapping Blankets

Overlapping between rolls





Overlapping adjacent rolls



Staples should have good contact with the ground as shown below.

Table C-6—Lining Materials for Temporary Channels [a]

	Maximum Flow Depth	
Slope Range	**1 ft.**	**3 ft.**
0% - 0.005%	Jute Netting	Straw or Wood Fiber Erosion Control Netting or Plastic Membrane
0.005% - 1.0%	Straw or Wood Fiber Erosion Control Netting or Plastic Membrane	Straw or Wood Fiber Erosion Control Netting
1.0% - 2.0%	Geotextile with Overlay of Erosion Control Mat	D_{50} = 4" Rock to Type VL Riprap
2.0% - 3.0%	D_{50} = 3" Rock to Type VL Riprap	Type L Riprap
3.0% - 4.0%	Type VL Riprap	Type M Riprap

[a]See Table C-7 for channel design parameters.

Table C-7—Temporary Channel Design Criteria

Lining Material	Manning's n for Flow Depth 0 ft to 1.0 ft	Manning's n for Flow Depth 1.0 ft to 3.0 ft	Manning's n for Flow Depth 3.0 ft to 5.0 ft
Plastic Membrane	0.011	0.010	0.009
Jute Netting	0.028	n/a	n/a
Straw or Curled Wood Mats	0.035	0.025	0.020
Riprap, Type VL	0.070	0.045	0.035
Riprap, Type L	0.100	0.070	0.040
Riprap, Type M	0.125	0.075	0.045

Notes: Maximum depth is 1 foot for flows less than 20 cfs.

For flows greater than 20 cfs, design temporary diversion channels in accordance with the MAJOR DRAINAGE chapter of the *Manual* except the maximum side-slope steepness shall not exceed 2H:1V unless structurally reinforced.

Determine the channel bottom width required using Manning's Equation and its *n* value given above.

See Table MD-7 in the MAJOR DRAINAGE chapter of the *Manual* for riprap gradation.

Erosion protection should extend a minimum of 0.5 feet above the design water depth.

Other Channel Lining Materials

Plastic membranes provide an impervious lining. However, they can be difficult to secure in place and should be limited to shallower slopes (<1.0%).

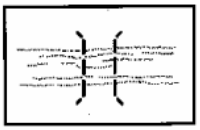
CROSSING A WATERWAY (Adapted from UDFCD Drainage Criteria Manual V.3 – Section 6.0)

Where an actively-flowing watercourse must be crossed regularly by construction vehicles, a temporary crossing should be provided. Two primary methods are available: (1) a culvert crossing and (2) a stream ford.

A ***permit*** is required for placement of fill in a waterway under Section 404 of the Clean Water Act. The U.S. Army Corps of Engineers has issued nationwide general permit Number 14 for Minor Road Crossing Fills. This is defined as placement of less than 200 cubic yards of fill material below the plane of ordinary high water. The local office of the Corps should be contacted about the requirements for obtaining a 404 permit. In addition, a permit from the U.S. Fish and Wildlife Service may be needed if endangered species are of concern in the work area. Typically the USFWS issues are addressed by a 404 permit if one is required. The municipality of jurisdiction should also be consulted and can provide assistance. A further discussion on the need for 404 permits is included in Section 2.1, MAJOR DRAINAGE, of the *Manual.* Other permits to be obtained may include Floodplain Development permit from the local jurisdiction.

A culvert crossing should be designed to pass at least the 2-year design flow (see Figure C-19 for minimum recommended flow), accounting for the headwater and tailwater controls to meet its design capacity. A typical temporary stream crossing is shown on Figure C-17. For additional discussion on design of box culverts and pipes, see Sections 3 and 4, MAJOR DRAINAGE, of the *Manual.*

A ford should be lined with a minimum 12-inch thick layer of Type VL (D_{50} = 6 inches) or Type L (D_{50} = 9 inches) riprap with void spaces filed with 1-1/2 inch diameter rock.



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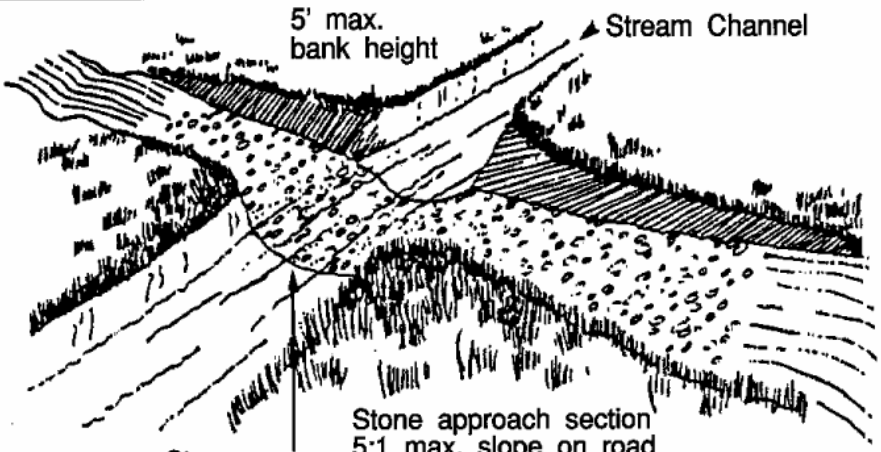
TEMPORARY STREAM CROSSING

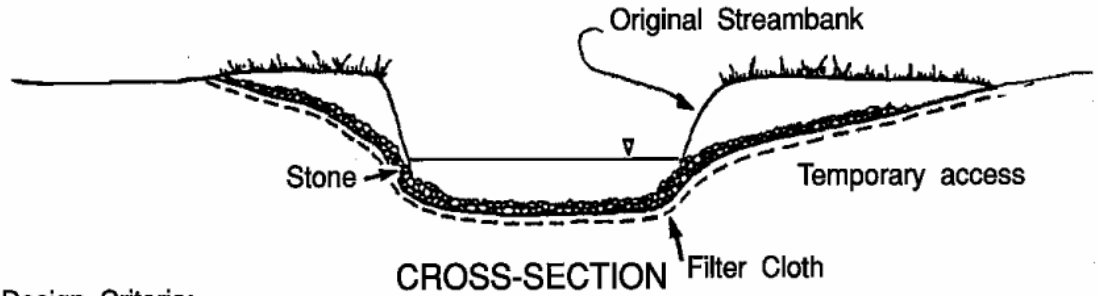
Definition

A temporary at-grade stream crossing installed across a normally dry watercourse for use by construction traffic.

Purposes

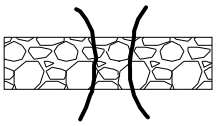
To stabilize stream crossings and reduce erosion created by construction traffic.





Design Criteria:

- As a minimum, design the structure to pass bankfull flow or peak flow, whichever is less, from a 2-year peak storm, without overtopping.
- Ensure that design flow velocity at the outlet of the crossing structure is nonerosive for the receiving stream channel. See Vol. II, Major Drainage, Section 5.3



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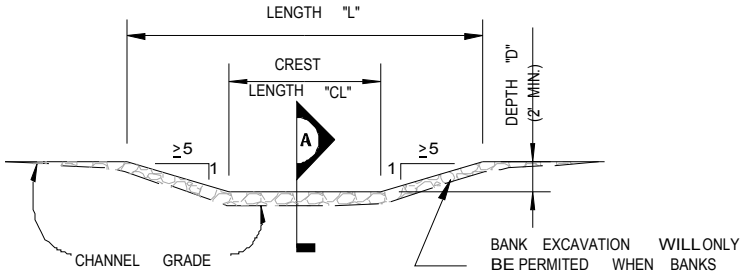
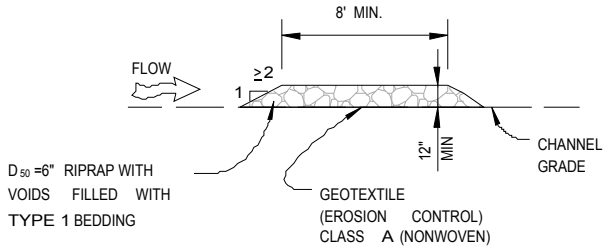


FORD CROSSING



FORD CROSSING - SECTION B

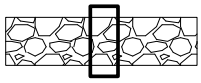
TEMPORARY STREAM CROSSING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATIONS OF TEMPORARY STREAM CROSSING.
   - STREAM CROSSING TYPE (FORD OR CULVERT).
   - FOR FORD CROSSING: LENGTH, "L", CREST LENGTH, "CL", AND DEPTH, "D".
   - FOR CULVERT CROSSING : LENGTH, "L", CREST LENGTH, "CL", CROSSING HEIGHT, "H", DEPTH, "D", CULVERT DIAMETER, "CD", AND NUMBER, TYPE AND CLASS OR GAUGE OF CULVERTS.
2. TEMPORARY STREAM CROSSING DIMENSIONS, D_{50}, AND NUMBER OF CULVERTS INDICATED (FOR CULVERT CROSSING) SHALL BE CONSIDERED MINIMUM DIMENSIONS; ENGINEER MAY ELECT TO INSTALL LARGER FACILITIES. ANY DAMAGE TO STREAM CROSSING OR EXISTING STREAM CHANNEL DURING BASE-FLOW OR FLOOD EVENTS SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
3. SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1 FOR RIPRAP AND TYPE 1 BEDDING GRADATIONS.
4. FOR A TEMPORARY STREAM CROSSING THAT WILL CARRY LOADS, THE TEMPORARY STREAM CROSSING MUST BE DESIGNED BY THE STRUCTURAL ENGINEER.

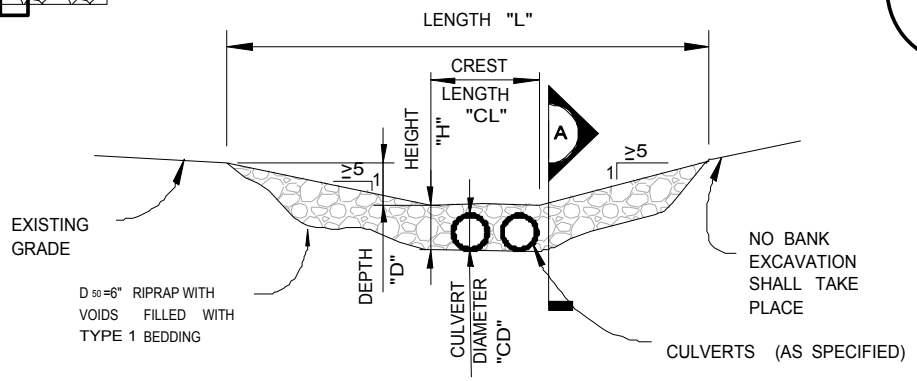
TEMPORARY STREAM CROSSING MAINTENANCE NOTES

1. THE SWMP MANAGER SHALL INSPECT STREAM CROSSINGS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF STREAM CROSSINGS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF FORD CROSSINGS IS WITHIN 6-INCHES OF THE CREST AND FOR CULVERT CROSSINGS IS GREATER THAN AN AVERAGE OF 12-INCHES.
3. STREAM CROSSINGS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED AND SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION.
4. WHEN STREAM CROSSINGS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, DRILL SEEDED AND CRIMP MULCHED AND COVERED WITH EROSION CONTROL BLANKET OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

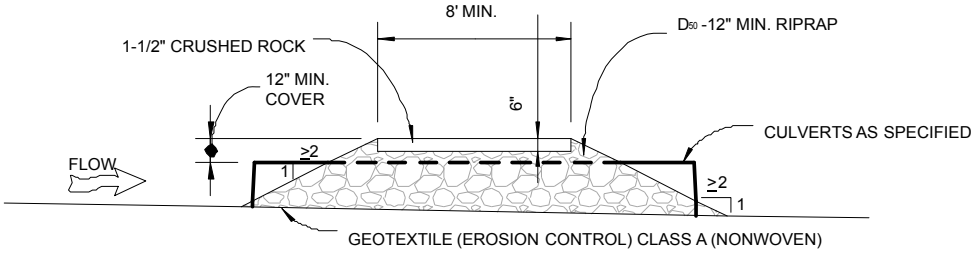
Adapted from GESC Manual (Douglas County, 2004)



TSC C



CULVERT CROSSING



CULVERT CROSSING - SECTION A

TEMPORARY STREAM CROSSING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATIONS OF TEMPORARY STREAM CROSSING.
   - STREAM CROSSING TYPE (FORD OR CULVERT).
   - FOR FORD CROSSING: LENGTH, "L", CREST LENGTH, "CL", AND DEPTH, "D".
   - FOR CULVERT CROSSING : LENGTH, "L", CREST LENGTH, "CL", CROSSING HEIGHT, "H", DEPTH, "D", CULVERT DIAMETER, "CD", AND NUMBER, TYPE AND CLASS OR GAUGE OF CULVERTS.
2. TEMPORARY STREAM CROSSING DIMENSIONS, D_{50}, AND NUMBER OF CULVERTS INDICATED (FOR CULVERT CROSSING) SHALL BE CONSIDERED MINIMUM DIMENSIONS; ENGINEER MAY ELECT TO INSTALL LARGER FACILITIES. ANY DAMAGE TO STREAM CROSSING OR EXISTING STREAM CHANNEL DURING BASE-FLOW OR FLOOD EVENTS SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
3. SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1 FOR RIPRAP AND TYPE 1 BEDDING GRADATIONS.
4. FOR A TEMPORARY STREAM CROSSING THAT WILL CARRY LOADS, THE TEMPORARY STREAM CROSSING MUST BE DESIGNED BY THE STRUCTURAL ENGINEER.

TEMPORARY STREAM CROSSING MAINTENANCE NOTES

1. THE SWMP MANAGER SHALL INSPECT STREAM CROSSINGS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF STREAM CROSSINGS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF FORD CROSSINGS IS WITHIN 6-INCHES OF THE CREST AND FOR CULVERT CROSSINGS IS GREATER THAN AN AVERAGE OF 12-INCHES.
3. STREAM CROSSINGS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED AND SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION.
4. WHEN STREAM CROSSINGS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, DRILL SEEDED AND CRIMP MULCHED AND COVERED WITH EROSION CONTROL BLANKET OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

Adapted from GESC Manual (Douglas County, 2004)

Culvert Stream Crossings

Better armor around the pipe in this example

TEMPORARY CHANNELS (DIVERSIONS)

Options: divert a portion of the flow or the entire waterway.

Limiting construction activities within a waterway will significantly reduce erosion and sediment movement downstream. Use of construction berms on large streams, such as the South Platte River, Sand Creek, etc., to carry water around construction activities in a portion of the channel can be sufficient to accomplish this. The berms should be tall enough to contain at least the 2-year flood peak without being overtopped. Use of temporary diversion channels that divert the entire waterway is appropriate for smaller waterways. Permanent drainage channels and any improvements within them have to be constructed as quickly as possible to reduce the risk of exceeding capacities of temporary facilities during the flood-prone periods. Temporary Channel Sizing (see page 30).

Stability Considerations

Temporary channels are not likely to be in service long enough to establish adequate vegetative lining. Temporary channel diversions must be designed to be stable for the design flow with the channel shear stress less than the critical tractive shear stress for the channel lining material. Unlined channels should not be used unless it can be demonstrated that an unlined channel will not erode during the design flow. Table C-6 gives allowable channel lining materials for a range of slope and flow depth. Table C-7 gives Manning's 'n' values for lining materials. Design procedures for temporary channels are described in detail in the Hydraulic Engineering Circular No. 15 published by the Federal Highway Administration. The methods presented in this section are greatly simplified and are based on information developed using only the most commonly used erosion control materials.

Table C-6—Lining Materials for Temporary Channels [a]

	Maximum Flow Depth	
Slope Range	**1 ft.**	**3 ft.**
0% - 0.005%	Jute Netting	Straw or Wood Fiber Erosion Control Netting or Plastic Membrane
0.005% - 1.0%	Straw or Wood Fiber Erosion Control Netting or Plastic Membrane	Straw or Wood Fiber Erosion Control Netting
1.0% - 2.0%	Geotextile with Overlay of Erosion Control Mat	D_{50} = 4" Rock to Type VL Riprap
2.0% - 3.0%	D_{50} = 3" Rock to Type VL Riprap	Type L Riprap
3.0% - 4.0%	Type VL Riprap	Type M Riprap

[a]See Table C-7 for channel design parameters.

Example: Temporary Diversion Design

A simplified method for designing a non-erosive channel is given as follows:

Step One: Using the tributary area A (in acres) determine peak flow according to Figure C-19.

Step Two: Determine depth of flow, one foot maximum for flows less than 20 cfs and three feet maximum for flows less than 100 cfs. (Flows in excess of 100 cfs should be designed in accordance with the MAJOR DRAINAGE chapter of the *Manual*.)

Step Three: Determine channel slope based on existing and proposed site conditions.

Step Four: Pre-size the channel, determine maximum velocities and select lining material from Table C-6.

Step Five: Determine the channel geometry and check the capacity using Manning's Equation and the "n" value given in Table C-7. The steepest side slope allowable for a temporary channel is two horizontal to one vertical (i.e., 2:1), unless vertical walls are installed using sheet piling, concrete or stacked stone. It is suggested that the design for temporary bypass channels include an additional 0.5 feet of freeboard.

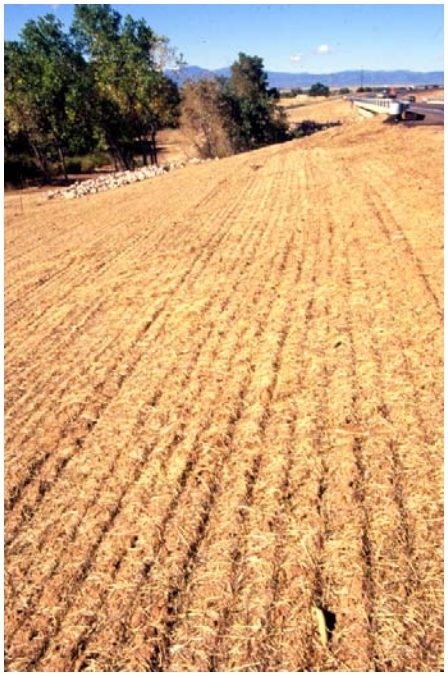
Mulching of adjacent disturbed areas

Mulching with certified weed free straw or hay is a temporary BMP. However, seeding before applying mulch to establish permanent vegetative cover is of course a permanent BMP. The maximum time limit for exposure after the application of mulch (mulch only) is 12 months.

Installation Requirements for Mulching

Considerations:

- Availability of straw or hay (certified weed and seed free)
- Types of slopes to be mulched
- Time schedule
- Equipment availability
- Time area(s) planned to be idle



The long-stemmed straw or hay mulch (hay preferred) should be applied evenly at a rate of ***1-2 tons per acre***. At least 50% by weight of the mulch should be ten inches in length or longer to provide good cover and facilitate crimping. The method of application depends on the slopes to be mulched. For example, using a mechanical crimper is limited to slopes 3:1 and flatter. ***Hydraulic mulching*** may be necessary for steeper slopes, difficult installations, and areas with limited access.

Hydraulic mulching is applied by mixing wood cellulose fibers mixed with water and a tackifying agent (2,000 pounds per acre) and sprayed onto the slopes.

The best way to secure mulch is anchoring by crimping. ***Crimping*** is a mechanical method of anchoring mulch using a weighted roller. The crimping device is drawn behind a tractor over the surface immediately after applying the mulch. The crimper wheels or scalloped discs resemble a sheep's foot and "punches" the mulch into the ground without breaking the fibers. A

Picture Courtesy of Pickaway SWCD Circleville,OH

portion of the crimped straw stands upright among the horizontal straws, creating windrows and preventing migration.

Mulch blowing (power mulching) equipment is usually towed behind large flatbed trucks that carry the mulch bales. Crews remove the baling wires and feed them into the machine, which cuts them into smaller pieces. *Most mulch blowers can apply about seventeen tons of straw per hour*. If planning to use crimping as the anchoring method, mulch blowing may not be the most effective means to apply the mulch as it tends to chop up the fibers into shorter lengths.

Bonded Fiber Matrix

Like other forms of cover, ***bonded fiber matrix*** (also called hydro-matting) is designed to:

- Reduce the amount of runoff by facilitating infiltration.
- Protect the slopes from erosion by providing a protective layer over the soil and;
- Promote seed germination and growth by providing a protective layer.

Bonded fiber matrix (BFM) is a product that is applied hydraulically (liquid slurry) using standard hydraulic seeding equipment. Once dry, the material forms a porous protective cover that adheres to the surface. The matrix of biodegradable fibers is held together by organic tackifiers and other bonding agents that are insoluble in water.

BFM can also be mixed with the other ingredients (seed, fertilizer) for hydroseeding providing the convenience of a one-step application. However, it is important to remember mixing seed with anything that would result in the seed being "bound up" in a topical layer can hurt germination rates. Possible applications for BFM:

- Steeper slopes with uneven surfaces
- Slopes with obstacles like rock formations
- Slopes with stands of existing vegetation
- Slopes exposed to harsh conditions

Installation Requirements

- Mix according to manufacturer's recommendations.
- Apply at a rate of 3,000 to 4,000 pounds per acre or as directed by the manufacturer.
- Spray apply the BFM in layers until soil is evenly covered.
- Don't apply if precipitation is anticipated. Plan so the BFM has an opportunity to cure.
- Apply so there are no gaps between the product and the soil to prevent possible erosion *under* the material.

Bonded Fiber Matrix

Flexible Growth Medium (FGM)

FGM is a spray on product that is mixed with water and sprayed on exposed slopes. It comes in 50 pound bales. The components of FGM (Flexterra™) include:

- Interlocking crimped polyester fibers (5%)
- Wood fiber (85%)
- Crosslinked tackifier (15%)

The product seems to be a good choice for even steeper terrain to help establish growth. Laboratory data indicates a higher percentage efficiency for FGM than BFM and ECB. In addition, a number of field tests on highway projects (slopes 1:1) have reported success. The application rate depends on the slope. For slopes less than 3:1, 3,000 pounds per acre. For slopes greater than 1:1, 4,000 pounds per acre. The tackifier helps the product bond to the surface. For any of the spray on products, over-application may hurt plant growth.

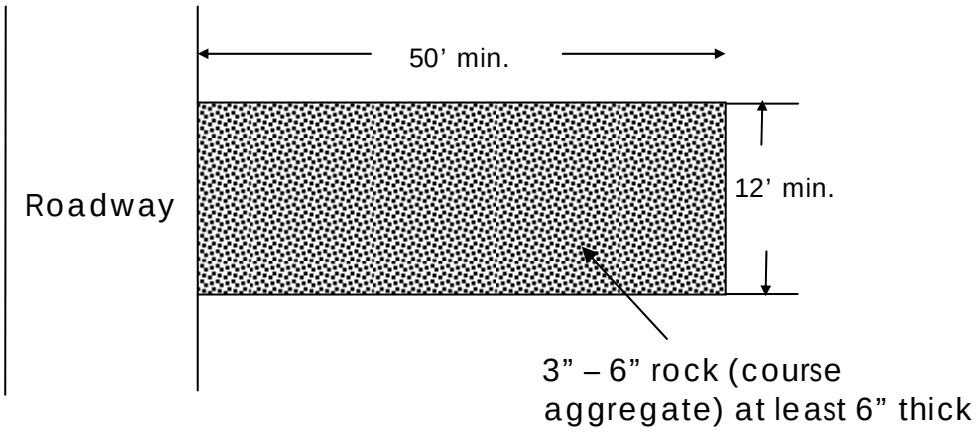
VEHICLE TRACKING CONTROL

Mud tracked from a construction site onto roadways will simply be washed into the storm sewer system if not controlled. A stabilized entrance to a construction site can keep vehicle traffic out of the mud.

A "track pad" constructed of course aggregate can be used at the entrance and parking and loading/ unloading areas for stabilization. In the event sediment is tracked onto roadways, it must be cleaned by shoveling or using equipment to get the bulk of the dirt from the road and then sweeping the remainder. ***Clearly, it is best to keep the dirt where it belongs – on the site.*** On occasion, dirt is placed in the curb flow line to allow access to the site more easily. This will only allow sediment to be deposited into the storm sewer system during times of runoff. Use some other ramp material like a steel plate to allow vehicles to pass over the curb. In some situations, a ***wash rack*** may be necessary. A wash rack is a stabilized pad at the entrance of a site designed to provide a location to clean vehicles before they travel onto a roadway.

Construction of Vehicle Tracking Control Pads

Lay a non-woven geotextile (filter fabric) over the area where the pad will be installed right up to the roadway curb. Place 3" – 6" rock (course aggregate) at least 6" thick for a distance of 50' minimum over the fabric being careful not to damage it. Unroll small sections of fabric at a time and place the rock section by section. The width of the pad will depend on the site but should be at least 12'. If the pad is to be constructed on a grade, build a ridge parallel to the curb to slow runoff and channel water to the side.



"Cattle Guard" Tracking Control

The picture below shows a tracking control device designed to be partially buried at the entry/exit point for a construction site. As vehicles drive across the steel bars, mud is removed from the tires. Multiple units can be placed next to each other to make the tracking control longer. The device must be lifted to clean accumulated sediment from underneath. With this device, no rock will be tracked into the street and replacement material is not necessary.

CHECK DAMS

Introduction

Check dams are temporary dams constructed across a swale, channel or ditch line. ***Check dams work by slowing the velocity of concentrated flow, preventing erosion.*** Check dams will also act as a sediment barrier and will catch sediment from the runoff. However, when too much sediment collects behind check dams, the runoff flows around or passes too quickly over the top of the dam. Design and build check dams with the intent of slowing the flow velocity to prevent erosion of the swale but will still allow water to pass. Check dams can be constructed of a variety of materials including:

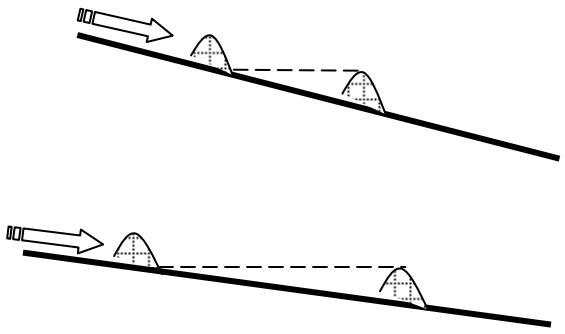
- Rock (preferred)
- Erosion bales or logs
- Straw wattles
- Sandbags
- Logs

Check dams are usually used in small open channels with a contributing drainage area of 2 to 10 acres.

The material of choice will depend on it's availability, schedule, and timing, cost, maintenance considerations, local requirements, and public safety concerns. Although rock may be the more expensive material, overall cost may be lower because of the lower maintenance requirements. The best method to control erosion in drainage swales is to permanently protect it. Lining the channel with blankets, turf reinforcing mats (TRM), sod, or hard armor like riprap virtually eliminates erosion and check dams would not be necessary.

Location and Spacing of Check Dams

Check dams must be used in series spaced at appropriate intervals. They should be spaced such that the base of the upstream dam is at the same elevation as the top of the next downstream dam.



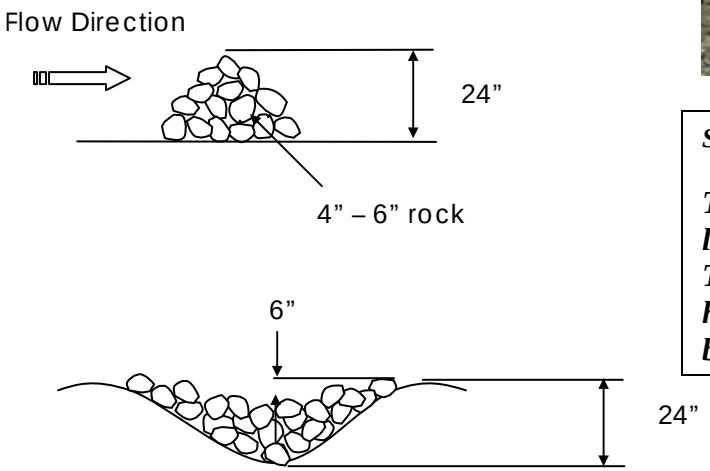
Spacing of check dams

A common installation problem is the spacing is too far apart. This allows runoff to erode the channel between dams as well as fill in each dam with sediment creating lots of maintenance work.

Installation and Construction of Check Dams

In addition to the proper spacing, construction of check dams includes:

- Distance across the swale
- Height
- Configuration



Side slopes should be 2:1 or flatter.

The center of the dam should be at least 6 inches lower than the edges. This design creates a weir effect that helps to channel flows away from the banks.

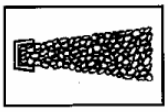
After placement, hand interlock the rock. All check dams should have a maximum height of 3 feet. If necessary, additional stability can be achieved by placing the rock approximately 6 inches into the sides and bottom of the channel. Do not place check dams in live, flowing streams.
removing a check dam. If trash and debris has collected, it must be removed as well. Be sure the center of each check dam is lower than its edges. Erosion or heavy flows cause the edges of a dam to fall. Removal of a check dam should be completed only after the contributing drainage area has been completely stabilized.

Erosion Logs

Securely staked down to prevent undercutting.

OUTLET PROTECTION

To protect discharge areas from erosion due to concentrated flows, a stable outlet or channel is necessary. The outlets of slope drains, culverts, sediment traps, and sediment basins must be protected from erosion and scour. Outlet protection must be provided where the velocity of flow will exceed the maximum permissible velocity of the material of the waterway . This may require the use of a riprap apron at the outlet location and/or other measures to keep the waterway from eroding.



OP

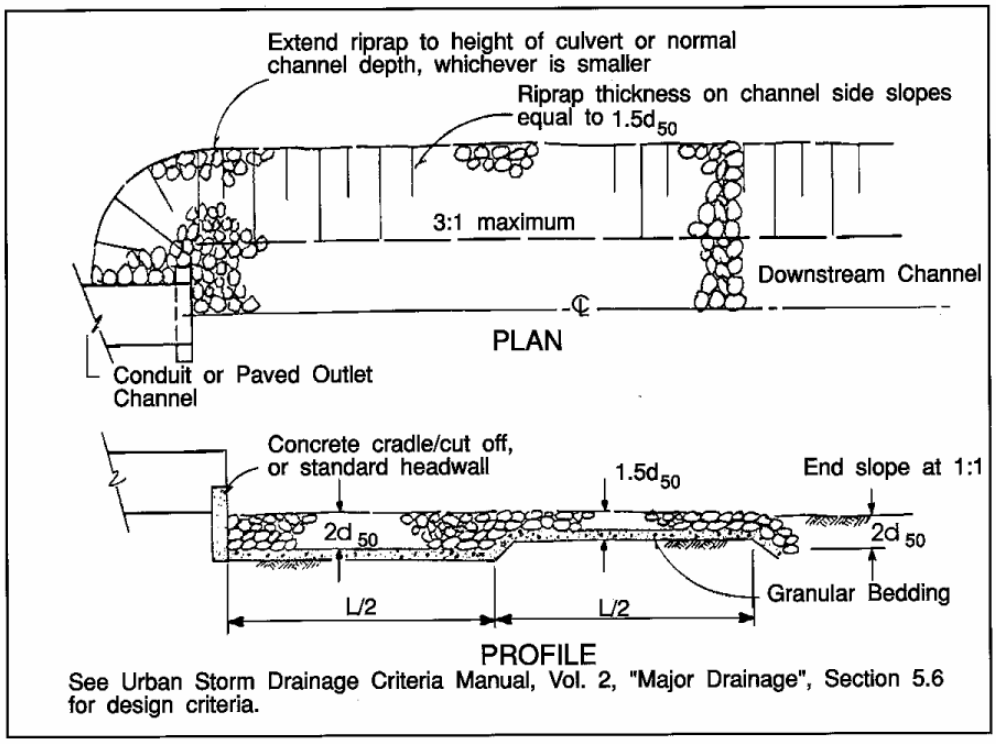
OUTLET PROTECTION

Definition

Structurally lined aprons or other acceptable energy dissipating devices placed at the outlets of pipes or paved channel sections.

Purposes

To prevent scour at stormwater outlets and to minimize the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.



Outlet Protection for a Culvert in a Channel

No outlet protection provided

Module 4

Best Management Practices for Sediment Control

Try these questions

1. Sediment barriers should be placed to capture concentrated flow.

   T or F

2. Sediment barriers should be limited to one quarter acre of drainage area per 100' of fence.

   T or F

3. Sediment barriers fail because_____

   _____

Removing sediment from stormwater runoff

Note the sediment laden water

The object of a sediment barrier regardless of what it is constructed from is to capture sheet flow and pond the water so the sediment can settle while allowing the cleaner water to pass/infiltrate/evaporate.

SILT FENCE

Be sure to check your local authorities for installation specifications that may apply to your job. Many cities and counties have developed their own erosion control guidance documents and/or specifications that have the force of law. Also, there are many guidance documents you can use to develop your own specifications. Or, the manufacture of the product usually has detailed installation requirements. The fabric is a woven geotextile made of polypropylene.

Considerations for use – this is key to using sediment barriers effectively while working in waterways.

Space & location: silt fence requires ponding volume to allow the water time to settle out sediment. The fabric is designed to filter water slowly. However, the fabric gets clogged with sediment and debris and a lack of time may prevent enough water from getting through the fabric before work needs to continue in the area. Further, silt fence must be restricted to approximately:

…one quarter acre per 150' feet of fence.

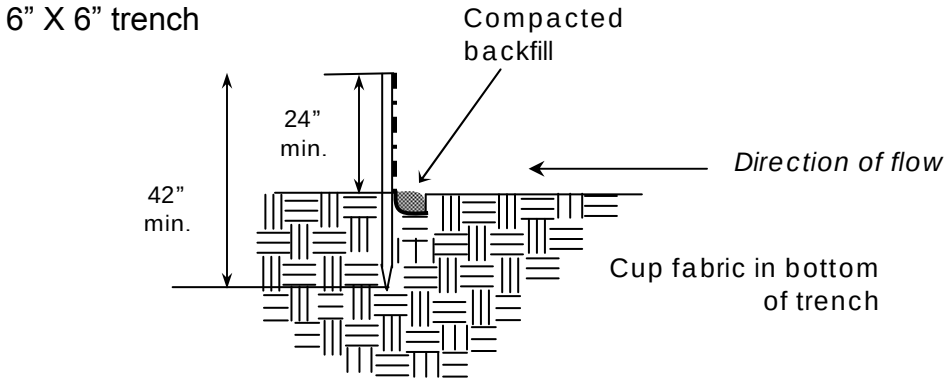
It is best to use silt fence in relatively shallow areas of overland or sheet flow. Supported silt fence (mesh backing) can be used for added strength to expand areas in which it can be used. Finally, fence placed up and down a slope will simply not work. In fact, installations up and down slopes or angled across slopes divert water to places you may not want it to go all the while washing out your silt fence backfill resulting in more maintenance work.

Application in Waterways

There will be limited instances in which a sediment barrier like silt fence will be a good BMP because of the lack of space for ponding and the concentrated flow (see picture below) characteristic of working in waterways. It is possible however to use a sediment barrier around stockpiles space providing or disturbed areas adjacent to the actual work in the waterway. Using silt fence in concentrated flows is not advisable because it is designed to capture sheet flow and is not normally strong enough to handle the force of concentrated flow.

Concentrated Flow in a Waterway with failed silt fence

Installation Specifications



Overlapping sections of silt fence (top view)

Erosion Bales

Like silt fence, straw bales can be used at the base of a slope to pond water and allow the majority of sediment to settle out. Straw bales should only be used for a limited time (weeks or months).

Excavate an area the width of a bale and 4" deep. Place the bales upright in the trench and stake with 2 stakes per bale being sure each stake is at least 12" in the ground. Bales can be staked with metal fence posts or wood stakes but rebar is not allowed. When placing the bales, be sure they are tight against each other. If necessary, wedge loose straw between bales. Wood stakes should be 2" X 2" nominal. Backfill tight against each bale and especially the upslope side as this is the flow direction. Compacted soil will prevent piping underneath the bales.

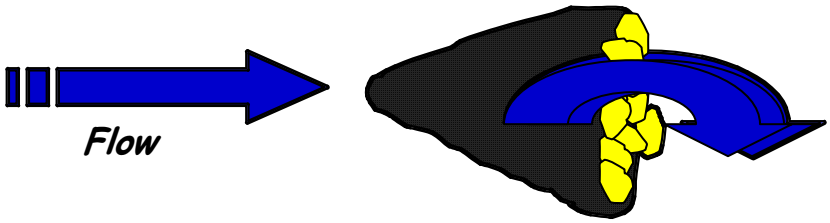
SEDIMENT ENTRAPMENT FACILITIES

Capturing sediment laden water can be done in a sediment trap or a sediment basin. Maintenance, sizing, outlet structure, embankment stabilization are all important considerations in their use and installation.

Sediment Traps

Sediment traps can be constructed with a combination excavation and embankment. The embankments must be stabilized. It is not acceptable to simply berm up loose material. The rock outlet structure must be hard armored and formed into a weir.

Using small sediment traps in series

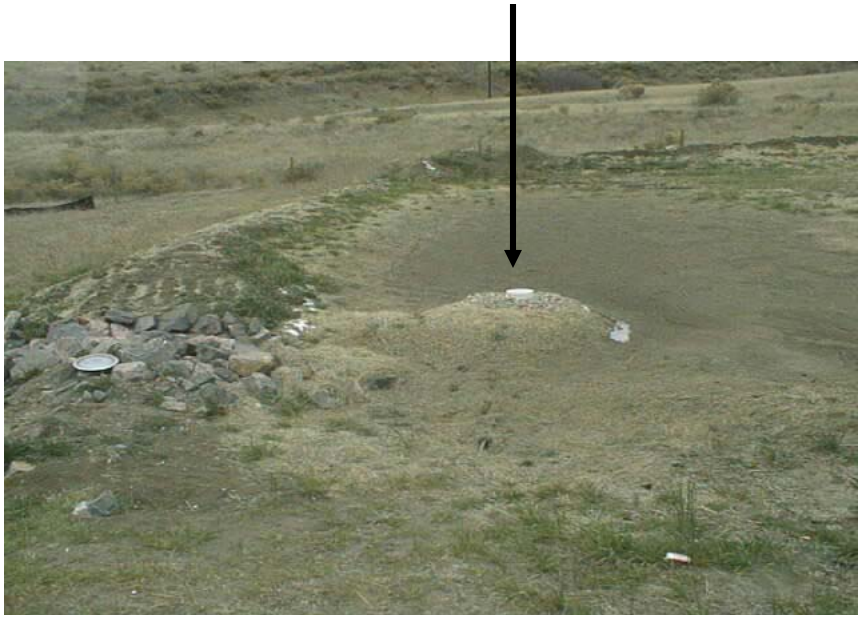


Outlet protected with rip rap

Proper Maintenance is extremely important

Sediment Basins

Sediment basins are constructed with a dewatering riser. In the center of the picture below, look for the cap of the dewatering riser showing just above the gravel pack.



Module 5

Best Management Practices for Materials Management

MATERIALS HANDLING AND WASTE MANAGEMENT

Introduction to Materials Handling and Waste Management

Many products used during construction such as fuels, lubricants, oils, paints and coatings and herbicides and pesticides are classified as hazardous materials. In addition, once these materials are no longer useable, they become a regulated waste. These materials present a potential serious threat to waterways because even very small quantities can have dramatic impacts on aquatic ecosystems. Practices must be implemented on the project to ensure these materials are properly handled and stored to prevent contamination of stormwater runoff. Many of the practices required are mandated by other regulations developed by EPA, OSHA, DOT, CDPHE, and the local fire department. Check with your safety officer and environmental manager to determine what specific practices are required.

Note the proximity of the waste pile to flowing water

Predict where the water will flow and plan storage piles accordingly.

Chemical Handling, Storage, and Spill Clean Up

Safe Work Practices for Chemical Handling – Personal Safety and Spill Prevention

- Consult MSDS or other information about the materials to determine proper handling and safety procedures. All personnel handling hazardous chemicals must be adequately trained.
- Follow all safety procedures and wear proper personal protective equipment. Ensure emergency phone numbers are readily available.
- Secondary containment is required for bulk storage containers like fuel tanks.
- Conduct regular inspections. Chemical storage areas should be part of all stormwater inspections *and* safety inspections.
- No eating, drinking smoking or chewing tobacco when handling chemicals.
- Wash hands thoroughly after handling.
- Complete adequate decontamination procedures for equipment and personnel.
- Do not spread materials in any fashion.
- Do not handle containers of unknown contents, containers that are bulging, bubbling, hissing or have crystallized residue.
- Do not touch your face, eyes or other sensitive areas.
- Report all spills, releases, injuries or dangerous situations immediately.
- Ensure proper spill clean up equipment is easily accessible.
- Do not allow vehicle traffic to travel through spill areas.
- *ATTEND ALL TRANSFERS OF CHEMICALS TO ENSURE PROPER PROCEDURES ARE FOLLOWED BY THE DRIVER AND THERE ARE*

NO SPILLS OR LEAKS HAPPEN AND CONTAINERS AR NOT DAMAGED. LOTS OF CHEMICAL SPILLS HAPPENED DURING TRANSFER.

Container Handling

- Store containers in a secure, protected location out of the way of busy areas and ensure adequate ventilation if stored in a building. Store all containers upright and do not stack. Do not store chemical materials near waterways. Provide some kind of containment in case of a spill. For example, containers can be stored on spill pallets, inside approved lockers equipped with a containment basin, placed in a lined bermed area.
- Ensure packages and containers are intact. Check for leaks, cracks, tears, splits, loose caps and integrity of container.
- Repackage into recovery drum or bucket if necessary.
- Record all label and container information.
- Do not handle containers of unknown contents or origin.
- Do not tip, drop or spill contents.
- Segregate products as required.
- Document all containers and debris packed in recovery drums. Disposable personal protective equipment should be packed with packaged waste for proper disposal.
- For waste material, make arrangements for proper disposal. Store materials for the least amount of time as possible.

Spill Clean Up

Chemical spills present safety hazards to site personnel and may contaminate waterways. If you have not been trained on chemical spill clean up and discover a leaking drum or other spill:

- Contact the responsible person immediately regardless of size or severity. Some spills may require response from emergency responders for hazardous materials
- Stay a safe distance from the spill, upwind.
- Keep people out of the area and if necessary, place cones or barricade tape.
- Place diking material downstream of the spill to prevent spreading. Act in a defensive fashion only. ONLY DO THIS IF IT IS SAFE TO DO SO.
- Wait for responsible party to arrive, maintaining a safe distance.
- Seek prompt medical attention for any injuries no matter how minor they may seem.

After initial discovery, the proper personnel need to complete the spill clean up as soon as possible.

- Contain the release with diking materials and absorb free liquids.
- Place all contaminated debris into an over-pack or recovery drum. This will include the absorbent material from the spill area, other contaminated soil and debris, personal protective equipment used during clean up. Label the containers as to the contents and other required hazard warnings.
- Seek prompt medical attention for any injuries no matter how minor they may seem.
- All hazardous wastes must be packaged, stored and removed according to federal and state law.

Concrete Waste

BMPs are required to prevent the release of concrete waste into stormwater. Concrete waste may be generated from:

- Demolition activities involving concrete materials
- Concrete truck wash out
- Concrete saw cutting
- Concrete batching or mixing

Store any concrete waste sufficient distance from drainage ways, storm sewer inlets, highway right-of-way, or receiving waters. Concrete waste must be placed in a *concrete washout facility*.

Requirements for concrete wash facilities

- Constructed of sufficient size to contain all the concrete waste generated including liquids.
- Located away from receiving waters but easily accessible.
- Comprised of an excavation with a protected perimeter.
- Excavated such that groundwater is not impacted.
- Provided with signage informing site personnel of it's location.
- Maintained in good condition. Remove hardened concrete as necessary.
- Clean out should be conducted when it's approximately three quarters full or sooner.
- Inspections must be conducted regularly.

For concrete saw cutting, utilize equipment that does not allow the discharge of the water or direct the water to a wash facility. For dry cutting, come behind the saw cutting and scoop up the debris and dispose of it in the concrete waste facility. A sweeper will remove any remaining dust and

debris. Adding flocculants or other additives to the wash water is prohibited. Hardened concrete must be disposed of properly.

Vehicle and Equipment Maintenance

Designate locations for conducting equipment maintenance activities. Provide protection from leaking vehicle fluids such as drip pads and pans. Maintain containers for the storage of vehicle fluids as described above. Have fluids for recycling removed as soon as possible. Maintain spill clean up materials and clean up leaks and spills immediately. Do not allow leaking fluids to soak into soils or to migrate.

Sanitary Services

Practices to prevent the spill or leakage of sanitary and septic waste from contacting stormwater are required. In addition to the water quality concerns, sanitary and septic waste presents a potential public health risk. Establish sanitary facilities away from drainage ways, inlets, receiving waters, high traffic areas and areas susceptible to flooding or high winds. Construction activities may encroach on the facilities so be sure they are protected from damage. Sanitary sewer system connections must comply with local health agency requirements including the removal of temporary facilities. In areas of high wind, be sure the facilities are properly secured. Clean up spills or leaks immediately. Be sure to wear the proper personal protective equipment during spill clean up. When in doubt, contact a proper spill clean up company. Use licensed haulers for the waste and ensure it's proper disposal. Have transfers of the waste attended to ensure proper procedures are followed by the driver and no spills or leaks occur. Be sure to conduct regular inspections of sanitary facilities as part of the stormwater management plan and during heavy winds.

Appendix A

Sample Inspection Sheet

COLORADO DEPARTMENT OF TRANSPORTATION STORMWATER MANAGEMENT PLAN FIELD INSPECTION REPORT	(5) Project Name	
	(6) Project Number	(7) Region
	(8) Project Code (SA #)	
(1) Date of Inspection	(9) Reason for Inspection : ❑ Required Maximum 14 Calendar Day Inspection ❑ Required 30 Calendar Day Inspection for Completed Projects ❑ Required Storm Event Inspection ❑ Complaint:_____ ❑ Other:_____	
(2) Contractor Name		
(3) Contractor's Inspector Name (print)		
(4) CDOT's Inspector Name (print)		

(10) CONSTRUCTION SITE ASSESSMENT

❑ Construction site perimeter contained. Offsite tracking minimized.
❑ Disturbed areas contained.
❑ Estimate disturbed area at the time of the inspection._ Acres
❑ Areas used for material and waste storage and fueling contained.

(11) SWMP MANAGEMENT

❑ Changes made to the SWMP during construction? Yes / No
❑ Changes approved and noted on the plans? Yes / No

BEST MANAGEMENT PRACTICES (BMPS)

(12) BMP Type	(13) Practice Req/Used		(14) Reason	(15) Maintenance/ Sediment Removal Required Y/N	(16) Course of Action	(17) Date for Action to be Completed
EROSION CONTROL						
Seeding						
Mulching						
Blankets						
Check Dams						
Earth Berms						
Diversion						
Embankment Protector						
Outlet Protection						
Other:						
Other:						
SEDIMENT CONTROL						
Inlet Protection						
Erosion Bales						
Silt Fence						
Sediment Trap/Basin						

(12) BMP Type	(13) Practice Req/Used		(14) Reason	(15) Maintenance/ Sediment Removal Required Y/N	(16) Course of Action	(17) Date for Action to be Completed
Stabilized Construction Entrance						
Dewatering Structure						
Other:						
MATERIALS HANDLING AND SPILL PREVENTION, WASTE MANAGEMENT AND GENERAL POLLUTION PREVENTION						
Stockpile Management						
Materials Delivery and Storage						
Spill Prevention and Control						
Concrete Washout						
Concrete Saw Water Containment						
Solid Waste						
Sanitary Waste						
Maintenance and Fueling						
Street Sweeping Vacuuming						
Other:						
Other:						

Comments:

(18) INSPECTIONS AND MAINTENANCE PROGRAM	
❑ Inspection occurring at least every 14 calendar days.	Course of Action:
❑ Inspections occurring after storm events that result in runoff.	Course of Action:
❑ Inspections occurring at least every 30 calendar days since project completion.	Course of Action:
❑ Inspection reports retained at the construction project site.	Course of Action:
❑ Corrective measures completed within 7 calendar days of inspection.	Course of Action:

CERTIFICATION

I certify this Stormwater Management Plan Field Inspection Report is complete and accurate.

Contractor's Inspector Name	Date
CDOT's Inspector Name	Date

Stormwater Management Plan Field Inspection Report Instructions

1. Project Name: Indicate the name of the project for which the report is being completed.
2. Project Number: Indicate the project number of the project for which the report is being completed.
3. Region: Indicate the CDOT region in which the project is located.
4. Project Code: Indicate the CDOT project code number for which the report is being completed.
5. Date of Inspection: Indicate the date of the inspection.
6. Contractor Name: Indicate the name of the contractor performing the work being inspected.
7. Contractor's Inspector Name: Indicate the name of the Erosion Control Supervisor designated by the contractor.
8. CDOT's Inspector Name: Indicate the name of the CDOT representative performing the inspection with the contractor. This person should be the Project Engineer or an authorized representative.
9. Reason for Inspection: Indicate the purpose for the inspection. The types of inspections include the following:
   - "Required 14 Calendar Day Inspection". These inspections are required at least every 14 calendar days during the life of the construction project.
   - "Required 30 Day Inspection for Completed Projects". These inspections are required at least every 30 calendar days following the completion of the construction project where final stabilization has not been achieved.
   - "Required Storm Event Inspection". These inspections are required after a storm event that results in runoff.
   - Inspection as a response to a complaint.
   - Inspection for any other reason.

   The first three types of inspections are required to comply with CDOT Standard Specifications and the Colorado Discharge Permit System General Permit for Stormwater Discharges Associated with Construction Activity (CDPS General Permit).
10. Construction Site Assessment: Inspect the noted areas of the construction site and indicate with a "✓" the items which apply.
    - "Construction site perimeter contained". Are the appropriate BMPs in place and offsite sediment tracking minimized? Is there any evidence of pollutants entering a storm drainage system?
    - "Disturbed areas contained". Are the appropriate BMPs implemented to minimize erosion or sediment tracking from the disturbed areas? Is there any evidence of pollutants entering a storm drainage system? Provide an estimate of the disturbed area at the time of the inspection.
    - "Areas used for material and waste storage and fueling contained". Are the appropriate BMPs implemented to prevent and contain spills? Are wastes removed from the site and disposed of properly? Are the storage areas located at least 50 feet from a watercourse? Is there any evidence of pollutants entering a storm drainage system?
11. SWMP Management: Indicate whether changes have been made to the SWMP during construction and whether the changes have been approved and documented.
12. BMP: The BMPs shown may not be a complete list of what is required by the SWMP. Cross out the BMPs not required by the SWMP and add the BMPs that are required. Additional sheets can be inserted to show all the BMPs required by the SWMP.
13. Practice Req/Used: This column can be used as follows:
    - If the BMP is required by the SWMP and implemented, indicate by placing a "✓ " in both the "Req" and "Used" columns.
    - If the BMP is required by the SWMP, but not implemented, indicate by placing a "✓ " in the "Req" column. Indicate the reason for the change in column (14), "Reason".

- If the BMP has been added to the SWMP, indicate with a "✓ " in the "Used " column. Indicate the reason for the change in column (14), "Reason".

14. Reason: Indicate the reason(s) for the deletion, addition, and modification of BMP(s) to the SWMP.
15. Maintenance/Sediment Removal Required: Indicate whether maintenance and sediment removal are required with a Yes or No. If maintenance and sediment removal are required, indicate what the action plan is in column (16), "Course of Action".
16. Course of Action: If maintenance and/or sediment removal is required, describe the action plan.
17. Date for Action to be Completed: Indicate the date for which the course of action will be completed. The course of action must be completed in a timely manner, but in no case more than 7 days after the inspection.

Appendix B

List of Acronyms for Erosion Control

LIST OF ACRONYMS & DEFINITIONS

BMPs	Best Management Practices – physical, structural, and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of stormwater
CCR	Colorado Code of Regulations
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment.
CDPS	Colorado Discharge Permit System – Colorado's version of the NPDES program
CDPS MS4 Permit	Discharge permit issued by the Division that authorizes the discharge of stormwater from the MS4 to state waters
CFR	Code of Federal Regulations
CRS	Colorado Revised Statutes
Division	Water Quality Control Division, which is under the CDPHE.
EPA	U.S. Environmental Protection Agency
ECAT	Erosion Control Advisory Team (CDOT)
ECP	Erosion Control Plan
ECS	Erosion Control Supervisor (CDOT)
Erosivity Waiver	The setting aside of the requirement for a stormwater discharge permit based on the Revised Universal Soil Loss Equation (RUSLE)
General Permit	The broad, non-specific permit issued to the majority of construction sites for stormwater discharges
IECA	International Erosion Control Association
Inactivation Notice	The form required by the WQCD to close out a construction stormwater permit after work has been completed and the site has final stabilization
MINDI	Minimal Industrial Discharge (permit)
Minimum measures	Stormwater management programs that are required under the CDPS MS4 permit. They include public education and outreach, public participation/involvement, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction stormwater management, and pollution prevention/good housekeeping for municipal operations.
MS4	Municipal Separate Storm Sewer System – see more complete definition in Chapter 1, section B
Municipality	A city, town, county, district, association, or other public body created by or under State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes
Notice of Transfer	The form required by the WQCD to convey responsibility for an entire stormwater permit

NPDES	National Pollutant Discharge Elimination System – Section 402 of the federal Clean Water Act
NURP	National Urban Runoff Program
NWP	Nationwide Permit (404 Army Corps of Engineers)
Permittee	The Owner/Operator to whom the CDPS stormwater discharge permit is issued
Phase II	Second stage of the State and Federal stormwater permit regulations (see Chapter I, Introduction)
QLP	Qualifying Local Program
Reassignment	The WQCD stormwater permitting process for transferring responsibility for portions of an original permit
Regulation 61	Colorado Discharge Permit System Regulations – includes stormwater regulations
RECAT	Regional Erosion Control Advisory Team (CDOT)
RECP	Rolled Erosion Control Product
SWMP	Stormwater Management Plan – required under Colorado's industrial stormwater permits
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load – the amount of a specific pollutant that a listed waterbody can assimilate without violating applicable water quality standards
TRM	Turf Reinforcement Mat
UDFCD	Urban Drainage & Flood Control District

Appendix C

List of Contacts for Erosion Control & Stormwater Management

LIST OF CONTACTS

Federal Agencies

www.epa.gov/npdes/stormwater

Environmental Protection Agency (EPA), Region VIII Stormwater Program
Greg Davis……(303) 312-6082
Lee Hanley……(303) 312-6555

Army Corps of Engineers 404 Permitting……....(303) 979-4120

Natural Resources Conservation Service
Colorado State Office
655 Parfet Street Rm E200C
Lakewood CO 80215-5517
PH: 720 544-2810
FAX:720 544-2962

State Agencies

Colorado Department of Public Health and Environment (CDPHE)
Water Quality Permitting for the Construction Industry
Colorado Water Quality Control Division……..(303) 692-3500
Stormwater Program……...(303) 692-3517

http://www.cdphe.state.co.us/wq/PermitsUnit/wqcdpmt.html

Stormwater General Permits
Matt Czahor……..(303) 692-3575
Kathy Rosow……....(303) 692-3521
Nathan Moore……..…(303) 692-3555
Kathy Dolan……..(303) 692-3596

Construction Dewatering, Sand & Gravel and Minimal Industrial Discharge (MINDI) Permits
Nicole Smith…….……(303) 692-3217

Professional Associations

International Erosion Control Association (IECA)
P.O. Box 774904 1355 S Lincoln Ave.
Steamboat Springs, CO 80477-4904
(970) 879-3010
FAX (970) 879-8563

IECA Mountain States Chapter
2480 West 26th Ave. Suite 156 B
Denver, CO 80211

Colorado Chapter, Soil and Water Conservation Society
7866 Marshall Street
Arvada, CO 80003
(303) 422-2440

Other Contacts

Urban Drainage and Flood Control District (UDFCD)
480 West 26th Avenue, Suite
156-B Denver, CO 80211
Phone: (303) 455-6277
FAX: (303) 455-7880

Appendix D

Army Corps of Engineers

2007 Nationwide Permits

1. Aids to Navigation
2. Structures in Artificial Canals
3. Maintenance
4. Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities
5. Scientific Measurement Devices
6. Survey Activities
7. Outfall Structures and Associated Intake Structures
8. Oil and Gas Structures on the Outer Continental Shelf
9. Structures in Fleeting and Anchorage Areas 10. Mooring Buoys
11. Temporary Recreational Structures
12. Utility Line Activities
13. Bank Stabilization
14. Linear Transportation Projects
15. U.S. Coast Guard Approved Bridges
16. Return Water From Upland Contained Disposal Areas
17. Hydropower Projects
18. Minor Discharges
19. Minor Dredging
20. Oil Spill Cleanup
21. Surface Coal Mining Operations
22. Removal of Vessels
23. Approved Categorical Exclusions
24. Indian Tribe or State Administered Section 404 Programs
25. Structural Discharges
26. [Reserved]
27. Aquatic Habitat Restoration, Establishment, and Enhancement Activities
28. Modifications of Existing Marinas
29. Residential Developments
30. Moist Soil Management for Wildlife
31. Maintenance of Existing Flood Control Facilities
32. Completed Enforcement Actions
33. Temporary Construction, Access, and Dewatering
34. Cranberry Production Activities
35. Maintenance Dredging of Existing Basins
36. Boat Ramps
37. Emergency Watershed Protection and Rehabilitation
38. Cleanup of Hazardous and Toxic Waste
39. Commercial and Institutional Developments
40. Agricultural Activities
41. Reshaping Existing Drainage Ditches
42. Recreational Facilities
43. Stormwater Management Facilities
44. Mining Activities

45. Repair of Uplands Damaged by Discrete Events
46. Discharges in Ditches
47. Pipeline Safety Program Designated Time Sensitive Inspections and Repairs
48. Existing Commercial Shellfish Aquaculture Activities
49. Coal Remining Activities 50. Underground Coal Mining Activities
50. Underground Coal Mining Activities

Army Corps of Engineers
Text of 2002 Nationwide Permit General Conditions

1. **Navigation**. No activity may cause more than a minimal adverse effect on navigation.

2. **Proper Maintenance**. Any structure or fill authorized shall be properly maintained, including maintenance to ensure public safety.

3. **Soil Erosion and Sediment Controls**. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

4. **Aquatic Life Movements**. No activity may substantially disrupt the necessary life-cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. Culverts placed in streams must be installed to maintain low flow conditions.

5. **Equipment**. Heavy equipment working in wetlands must be placed on mats, or other measures must be taken to minimize soil disturbance.

6. **Regional and Case-By-Case Conditions**. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state or tribe in its Section 401 Water Quality Certification and Coastal Zone Management Act consistency determination.

7. **Wild and Scenic Rivers**. No activity may occur in a component of the National Wild and Scenic River System; or in a river officially designated by Congress as a "study river" for possible inclusion in the system, while the river is in an official study status; unless the appropriate Federal agency, with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation, or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

8. **Tribal Rights**. No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

9. **Water Quality**. (a) In certain states and tribal lands an individual 401 Water Quality Certification must be obtained or waived (See 33 CFR 330.4(c)). (b) For NWPs 12, 14, 17, 18, 32, 39, 40, 42, 43, and 44, where the state or tribal 401 certification (either generically or individually) does not require or approve water quality management measures, the permittee must provide water quality management measures that will ensure that the authorized work does not result in more than minimal degradation of water quality (or the Corps determines that compliance with state or local standards, where applicable, will ensure no more than minimal adverse effect on water quality). An important component of water quality management includes stormwater management that minimizes degradation of the downstream aquatic system, including water quality (refer to General Condition 21 for stormwater management requirements). Another important component of water quality management is the establishment and maintenance of vegetated buffers next to open waters, including streams (refer to General Condition 19 for vegetated buffer requirements for the NWPs).
   This condition is only applicable to projects that have the potential to affect water quality. While appropriate measures must be taken, in most cases it is not necessary to conduct detailed studies to identify such measures or to require monitoring.

10. **Coastal Zone Management**. In certain states, an individual state coastal zone management consistency concurrence must be obtained or waived (see 33 CFR 330.4(d)).

11. **Endangered Species**. (a) No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will destroy or adversely modify the critical habitat of such species. Non-federal permittees shall notify the District Engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or is located in the designated critical habitat and shall not begin work on the activity until notified by the District Engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that may affect Federally-listed endangered or threatened species or designated critical habitat, the notification must include the name(s) of the endangered or threatened species that may be affected by the proposed work or that utilize the designated critical habitat that may be affected by the proposed work. As a result of formal or informal consultation with the FWS or NMFS the District Engineer may add species-specific regional endangered species conditions to the NWPs. (b) Authorization of an activity by a NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the USFWS or the NMFS, both lethal and non-lethal "takes" of protected species are in

violation of the ESA. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the USFWS and NMFS or their world wide web pages at http://www.fws.gov/r9endspp/endspp.html and http://www.nfms.noaa.gov/prot_res/overview/es.html respectively.

12. **Historic Properties**. No activity which may affect historic properties listed, or eligible for listing, in the National Register of Historic Places is authorized, until the District Engineer has complied with the provisions of 33 CFR part 325, Appendix C. The prospective permittee must notify the District Engineer if the authorized activity may affect any historic properties listed, determined to be eligible, or which the prospective permittee has reason to believe may be eligible for listing on the National Register of Historic Places, and shall not begin the activity until notified by the District Engineer that the requirements of the National Historic Preservation Act have been satisfied and that the activity is authorized. Information on the location and existence of historic resources can be obtained from the State Historic Preservation Office and the National Register of Historic Places (see 33 CFR 330.4(g)). For activities that may affect historic properties listed in, or eligible for listing in, the National Register of Historic Places, the notification must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property.

13. **Notification**. (a) Timing; where required by the terms of the NWP, the prospective permittee must notify the District Engineer with a preconstruction notification (PCN) as early as possible. The District Engineer must determine if the notification is complete within 30 days of the date of receipt and can request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the District Engineer will notify the prospective permittee that the notification is still incomplete and the PCN review process will not commence until all of the requested information has been received by the District Engineer. The prospective permittee shall not begin the activity:
    (1) Until notified in writing by the District Engineer that the activity may proceed under the NWP with any special conditions imposed by the District or Division Engineer; or
    (2) If notified in writing by the District or Division Engineer that an Individual Permit is required; or
    (3) Unless 45 days have passed from the District Engineer's receipt of the complete notification and the prospective permittee has not received written notice from the District or Division Engineer. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) Contents of Notification: The notification must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed project;

(3) Brief description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), Regional General Permit(s), or Individual Permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP (Sketches usually clarify the project and when provided result in a quicker decision.);

(4) For NWPs 7, 12, 14, 18, 21, 34, 38, 39, 40, 41, 42, and 43, the PCN must also include a delineation of affected special aquatic sites, including wetlands, vegetated shallows (e.g., submerged aquatic vegetation, seagrass beds), and riffle and pool complexes (see paragraph 13(f));

(5) For NWP 7 (Outfall Structures and Maintenance), the PCN must include information regarding the original design capacities and configurations of those areas of the facility where maintenance dredging or excavation is proposed;

(6) For NWP 14 (Linear Transportation Projects), the PCN must include a compensatory mitigation proposal to offset permanent losses of waters of the US and a statement describing how temporary losses of waters of the US will be minimized to the maximum extent practicable;

(7) For NWP 21 (Surface Coal Mining Activities), the PCN must include an Office of Surface Mining (OSM) or state-approved mitigation plan, if applicable. To be authorized by this NWP, the District Engineer must determine that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are minimal both individually and cumulatively and must notify the project sponsor of this determination in writing;

(8) For NWP 27 (Stream and Wetland Restoration Activities), the PCN must include documentation of the prior condition of the site that will be reverted by the permittee;

(9) For NWP 29 (Single-Family Housing), the PCN must also include:

(i) Any past use of this NWP by the Individual Permittee and/or the permittee's spouse;

(ii) A statement that the single-family housing activity is for a personal residence of the permittee;

(iii) A description of the entire parcel, including its size, and a delineation of wetlands. For the purpose of this NWP, parcels of land measuring 1/4-acre or less will not require a formal on-site delineation. However, the applicant shall provide an indication of where the wetlands are and the amount of wetlands that exists on the property. For parcels greater than 1/4-acre in size, a formal wetland delineation must be prepared in accordance with the current method required by the Corps. (See paragraph 13(f));

'(iv) A written description of all land (including, if available, legal descriptions) owned by the prospective permittee and/or the prospective permittee's spouse, within a one mile radius of the parcel, in any form of ownership (including any land owned as a partner, corporation, joint tenant, co-tenant, or as a tenant-by-the-entirety) and any land on which a purchase and sale agreement or other contract for sale or purchase has been executed;

(10) For NWP 31 (Maintenance of Existing Flood Control Facilities), the prospective permittee must either notify the District Engineer with a PCN prior to each maintenance activity or submit a five year (or less) maintenance plan. In addition, the PCN must include all of the following:

(i) Sufficient baseline information identifying the approved channel depths and configurations and existing facilities. Minor deviations are authorized, provided the approved flood control protection or drainage is not increased;

(ii) A delineation of any affected special aquatic sites, including wetlands; and,

(iii) Location of the dredged material disposal site;

(11) For NWP 33 (Temporary Construction, Access, and Dewatering), the PCN must also include a restoration plan of reasonable measures to avoid and minimize adverse effects to aquatic resources;

(12) For NWPs 39, 43 and 44, the PCN must also include a written statement to the District Engineer explaining how avoidance and minimization for losses of waters of the US were achieved on the project site;

(13) For NWP 39 and NWP 42, the PCN must include a compensatory mitigation proposal to offset losses of waters of the US or justification explaining why compensatory mitigation should not be required. For discharges that cause the loss of greater than 300 linear feet of an intermittent stream bed, to be authorized, the District Engineer must determine that the activity complies with the other terms and conditions of the NWP, determine adverse environmental effects are minimal both individually and cumulatively, and waive the limitation on stream impacts in writing before the permittee may proceed;

(14) For NWP 40 (Agricultural Activities), the PCN must include a compensatory mitigation proposal to offset losses of waters of the US. This NWP does not authorize the relocation of greater than 300 linear-feet of existing serviceable drainage ditches constructed in non-tidal streams unless, for drainage ditches constructed in intermittent non-tidal streams, the District Engineer waives this criterion in writing, and the District Engineer has determined that the project complies with all terms and conditions of this NWP, and that any adverse impacts of the project on the aquatic environment are minimal, both individually and cumulatively;

(15) For NWP 43 (Stormwater Management Facilities), the PCN must include, for the construction of new stormwater management facilities, a maintenance plan (in accordance with state and local requirements, if applicable) and a compensatory mitigation proposal to offset losses of waters of the US. For discharges that cause the loss of greater than 300 linear feet of an intermittent stream bed, to be authorized, the District Engineer must

determine that the activity complies with the other terms and conditions of the NWP, determine adverse environmental effects are minimal both individually and cumulatively, and waive the limitation on stream impacts in writing before the permittee may proceed;

(16) For NWP 44 (Mining Activities), the PCN must include a description of all waters of the US adversely affected by the project, a description of measures taken to minimize adverse effects to waters of the US, a description of measures taken to comply with the criteria of the NWP, and a reclamation plan (for all aggregate mining activities in isolated waters and non-tidal wetlands adjacent to headwaters and any hard rock/mineral mining activities);

(17) For activities that may adversely affect Federally-listed endangered or threatened species, the PCN must include the name(s) of those endangered or threatened species that may be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work; and

(18) For activities that may affect historic properties listed in, or eligible for listing in, the National Register of Historic Places, the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property.

(c) Form of Notification: The standard Individual Permit application form (Form ENG 4345) may be used as the notification but must clearly indicate that it is a PCN and must include all of the information required in (b) (1)-(18) of General Condition 13. A letter containing the requisite information may also be used.

(d) District Engineer's Decision: In reviewing the PCN for the proposed activity, the District Engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. The prospective permittee may submit a proposed mitigation plan with the PCN to expedite the process. The District Engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed work are minimal. If the District Engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the District Engineer will notify the permittee and include any conditions the District Engineer deems necessary. The District Engineer must approve any compensatory mitigation proposal before the permittee commences work. If the prospective permittee is required to submit a compensatory mitigation proposal with the PCN, the proposal may be either conceptual or detailed. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the District Engineer will expeditiously review the proposed compensatory mitigation plan. The District Engineer must review the plan within 45 days of receiving a complete PCN and determine whether the conceptual or specific proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after

consideration of the compensatory mitigation proposal) are determined by the District Engineer to be minimal, the District Engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP.

If the District Engineer determines that the adverse effects of the proposed work are more than minimal, then the District Engineer will notify the applicant either: (1) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an Individual Permit; (2) that the project is authorized under the NWP subject to the applicant's submission of a mitigation proposal that would reduce the adverse effects on the aquatic environment to the minimal level; or (3) that the project is authorized under the NWP with specific modifications or conditions. Where the District Engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period. The authorization will include the necessary conceptual or specific mitigation or a requirement that the applicant submit a mitigation proposal that would reduce the adverse effects on the aquatic environment to the minimal level. When conceptual mitigation is included, or a mitigation plan is required under item (2) above, no work in waters of the US will occur until the District Engineer has approved a specific mitigation plan.

(e) Agency Coordination: The District Engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

For activities requiring notification to the District Engineer that result in the loss of greater than 1/2-acre of waters of the US, the District Engineer will provide immediately (e.g., via facsimile transmission, overnight mail, or other expeditious manner) a copy to the appropriate Federal or state offices (USFWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will then have 10 calendar days from the date the material is transmitted to telephone or fax the District Engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the District Engineer will wait an additional 15 calendar days before making a decision on the notification. The District Engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency, except as provided below. The District Engineer will indicate in the administrative record associated with each notification that the resource agencies' concerns were considered. As required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act, the District Engineer will provide a response to NMFS within 30 days of receipt of any Essential Fish Habitat conservation recommendations. Applicants are encouraged to provide the Corps multiple copies of notifications to expedite agency notification.

(f) Wetland Delineations: Wetland delineations must be prepared in accordance with the current method required by the Corps (For NWP 29 see paragraph (b)(9)(iii)

for parcels less than (1/4-acre in size). The permittee may ask the Corps to delineate the special aquatic site. There may be some delay if the Corps does the delineation. Furthermore, the 45-day period will not start until the wetland delineation has been completed and submitted to the Corps, where appropriate.

14. **Compliance Certification**. Every permittee who has received NWP verification from the Corps will submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the Corps with the authorization letter and will include:
(a) A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions;
(b) A statement that any required mitigation was completed in accordance with the permit conditions; and
(c) The signature of the permittee certifying the completion of the work and mitigation.

15. **Use of Multiple Nationwide Permits**. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the US authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit (e.g. if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the US for the total project cannot exceed 1/3-acre).

16. **Water Supply Intakes**. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may occur in the proximity of a public water supply intake except where the activity is for repair of the public water supply intake structures or adjacent bank stabilization.

17. **Shellfish Beds**. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWP 4.

18. **Suitable Material**. No activity, including structures and work in navigable waters of the US or discharges of dredged or fill material, may consist of unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.) and material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the CWA).

19. **Mitigation**. The District Engineer will consider the factors discussed below when determining the acceptability of appropriate and practicable mitigation necessary to offset adverse effects on the aquatic environment that are more than minimal.
(a) The project must be designed and constructed to avoid and minimize

adverse effects to waters of the US to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing or compensating) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland impacts requiring a PCN, unless the District Engineer determines in writing that some other form of mitigation would be more environmentally appropriate and provides a project-specific waiver of this requirement. Consistent with National policy, the District Engineer will establish a preference for restoration of wetlands as compensatory mitigation, with preservation used only in exceptional circumstances.

(d) Compensatory mitigation (i.e., replacement or substitution of aquatic resources for those impacted) will not be used to increase the acreage losses allowed by the acreage limits of some of the NWPs. For example, 1/4-acre of wetlands cannot be created to change a 3/4-acre loss of wetlands to a 1/2-acre loss associated with NWP 39 verification. However, 1/2-acre of created wetlands can be used to reduce the impacts of a 1/2-acre loss of wetlands to the minimum impact level in order to meet the minimal impact requirement associated with NWPs.

(e) To be practicable, the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of the overall project purposes. Examples of mitigation that may be appropriate and practicable include, but are not limited to: reducing the size of the project; establishing and maintaining wetland or upland vegetated buffers to protect open waters such as streams; and replacing losses of aquatic resource functions and values by creating, restoring, enhancing, or preserving similar functions and values, preferably in the same watershed.

(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the establishment, maintenance, and legal protection (e.g., easements, deed restrictions) of vegetated buffers to open waters. In many cases, vegetated buffers will be the only compensatory mitigation required. Vegetated buffers should consist of native species. The width of the vegetated buffers required will address documented water quality or aquatic habitat loss concerns. Normally, the vegetated buffer will be 25 to 50 feet wide on each side of the stream, but the District Engineers may require slightly wider vegetated buffers to address documented water quality or habitat loss concerns. Where both wetlands and open waters exist on the project site, the Corps will determine the appropriate compensatory mitigation (e.g., stream buffers or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where vegetated buffers are determined to be the most appropriate form of compensatory mitigation, the District Engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland impacts.

(g) Compensatory mitigation proposals submitted with the "notification" may be either conceptual or detailed. If conceptual plans are approved under the verification, then the Corps will condition the verification to require detailed plans be submitted and approved by the Corps prior to construction of the authorized activity in waters of the U.S.

(h) Permittees may propose the use of mitigation banks, in-lieu fee arrangements or separate activity-specific compensatory mitigation. In all cases that require compensatory mitigation, the mitigation provisions will specify the party responsible for accomplishing and/or complying with the mitigation plan.

20. Spawning Areas. Activities, including structures and work in navigable waters of the US or discharges of dredged or fill material, in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., excavate, fill, or smother downstream by substantial turbidity) of an important spawning area are not authorized.

21. Management of Water Flows. To the maximum extent practicable, the activity must be designed to maintain preconstruction downstream flow conditions (e.g., location, capacity, and flow rates). Furthermore, the activity must not permanently restrict or impede the passage of normal or expected high flows (unless the primary purpose of the fill is to impound waters) and the structure or discharge of dredged or fill material must withstand expected high flows. The activity must, to the maximum extent practicable, provide for retaining excess flows from the site, provide for maintaining surface flow rates from the site similar to preconstruction conditions, and provide for not increasing water flows from the project site, relocating water, or redirecting water flow beyond preconstruction conditions. Stream channelizing will be reduced to the minimal amount necessary, and the activity must, to the maximum extent practicable, reduce adverse effects such as flooding or erosion downstream and upstream of the project site, unless the activity is part of a larger system designed to manage water flows. In most cases, it will not be a requirement to conduct detailed studies and monitoring of water flow.

This condition is only applicable to projects that have the potential to affect waterflows. While appropriate measures must be taken, it is not necessary to conduct detailed studies to identify such measures or require monitoring to ensure their effectiveness. Normally, the Corps will defer to state and local authorities regarding management of water flow.

22. Adverse Effects From Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to the acceleration of the passage of water, and/or the restricting its flow shall be minimized to the maximum extent practicable. This includes structures and

work in navigable waters of the US, or discharges of dredged or fill material.

23. **Waterfowl Breeding Areas**. Activities, including structures and work in navigable waters of the US or discharges of dredged or fill material, into breeding areas for migratory waterfowl must be avoided to the maximum extent practicable.

24. **Removal of Temporary Fills**. Any temporary fills must be removed in their entirety and the affected areas returned to their preexisting elevation.

25. **Designated Critical Resource Waters**. Critical resource waters include, NOAA-designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for Federally listed threatened and endangered species, coral reefs, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment. The District Engineer may also designate additional critical resource waters after notice and opportunity for comment.

(a) Except as noted below, discharges of dredged or fill material into waters of the US are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, and 44 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters. Discharges of dredged or fill materials into waters of the US may be authorized by the above NWPs in National Wild and Scenic Rivers if the activity complies with General Condition 7. Further, such discharges may be authorized in designated critical habitat for Federally listed threatened or endangered species if the activity complies with General Condition 11 and the USFWS or the NMFS has concurred in a determination of compliance with this condition.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with General Condition 13, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The District Engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

26. **Fills Within 100-Year Floodplains**. For purposes of this General Condition, 100-year floodplains will be identified through the existing Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps or FEMA-approved local floodplain maps.

(a) Discharges in Floodplain; Below Headwaters. Discharges of dredged or fill material into waters of the US within the mapped 100-year floodplain, below headwaters (i.e. five cfs), resulting in permanent above-grade fills, are not authorized by NWPs 39, 40, 42, 43, and 44.

(b) Discharges in Floodway; Above Headwaters. Discharges of dredged or fill material into waters of the US within the FEMA or locally mapped floodway,

resulting in permanent above-grade fills, are not authorized by NWPs 39, 40, 42, and 44.

(c) The permittee must comply with any applicable FEMA-approved state or local floodplain management requirements.

27. Construction Period. For activities that have not been verified by the Corps and the project was commenced or under contract to commence by the expiration date of the NWP (or modification or revocation date), the work must be completed within 12-months after such date (including any modification that affects the project).

For activities that have been verified and the project was commenced or under contract to commence within the verification period, the work must be completed by the date determined by the Corps.

For projects that have been verified by the Corps, an extension of a Corps approved completion date maybe requested. This request must be submitted at least one month before the previously approved completion date.