Design Guidance for Final Soil Stabilization

March 18, 2016

Purpose

The purpose of this guidance is to assist Caltrans Design staff in selecting one of three methods to document final soil stabilization, completing the Method Demonstration Form (MDF), and describing the permanent erosion control strategy in the Storm Water Data Report (SWDR). This guidance is based on the permit conditions in the Construction General Permit (CGP) and the Technical Bulletin 2013.1 (Technical Bulletin) which are available on the State Water Resources Control Board - Storm Water Program (State Water Board) web site[1], as well as State Water Board responses to frequently asked questions about the CGP for Caltrans sites[2].

Ultimately, the goal of this guidance will be to incorporate it into the SWDR preparation guidance contained within the Project Planning and Design Guide (PPDG).

This guidance includes the following:

A. Background

The background on the CGP order as it relates to final soil stabilization

B. Methods

A description of methods to demonstrate final soil stabilization

C. Selecting the Method

A description of selection criteria to determine the method to document final soil stabilization

D. Recommended Text for the SWDR

Multiple examples of recommended text to describe the permanent erosion control strategy to achieve final soil stabilization for insertion in the SWDR

E. Required and Optional Attachments to the SWDR

A description of the content and purpose of two attachments to the SWDR, the Method Demonstration Form (MDF) and the Erosion Control and Revegetation Report

F. Roles and Responsibilities

A description of the roles and responsibilities of Design, related to CGP compliance

G. References

A. Background

[1] Order No. 2009-0009-DWQ as amended by 2010-0014-DWQ; NPDES No. CAS000002, pages 1-40 http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml#app3

[2] State Water Resources Control Board, General Construction - Frequently Asked Questions http://www.waterboards.ca.gov/water_issues/programs/stormwater/gen_const_faq.shtml

The Construction General Permit (CGP), Order No. 2009-0009-DWQ, as amended by 2010-0014 DWQ, adopted September 2, 2009 and effective July 1, 2010, requires all construction projects in the state of California that disturb an acre or more of soil (and located outside of the Lake Tahoe Hydrologic Unit) obtain coverage under the CGP. Final soil stabilization of the construction site is a condition of the CGP. The CGP defines "final stabilization" (of soil disturbed by construction activity) to be the condition in which a project site does not pose any additional sediment discharge risk than it did prior to beginning project construction.

In addition, in early 2013, the State Water Resources Control Board issued Technical Bulletin - Issue 2013.1 (Tech Bulletin 2013.1), which reiterated the options for meeting the final soil stabilization criteria stated in the CGP, and emphasized that the options are stand-alone and at the discretion of the permittee (Caltrans). The goal of this guidance is to define the documentation process so that final soil stabilization requirements of the CGP and Tech Bulletin have been met, and to assist in termination of permit coverage. To qualify for termination of permit coverage, all of the conditions of the CGP's "Conditions for Termination of Coverage" in Section II.D1[3] have to be met.

[3] Order No. 2009-0009-DWQ, as amended by 2010-0014-DWQ; NPDES No. CAS000002, page 18-19 Section II D(1) (2) and (3) http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml#app3

B. Methods

The methods are described in the CGP, Section II.D3, and are as follows:

a) "70% Final Cover Method, - no computational proof required."
b) "RUSLE or RUSLE2 Method, - computational proof required."
c) "Custom Method, the discharger (i.e., Caltrans) shall demonstrate in some other manner than (a) or (b), above, that the site will not pose any additional sediment risk than it did prior to the commencement of construction activity."

Additionally, final soil stabilization must be demonstrated with photographs, regardless of the method.

B1. 70% Final Cover Method:

Upon the completion of all construction activities, especially all soil disturbing activities, the CGP allows the 70% Final Cover Method to be used to demonstrate final soil stabilization. Cover is defined as: a uniform (e.g., evenly distributed, without large bare soil areas) long-term, vegetative cover with a density of 70% of the native background vegetative cover[4] for the area that has been established on all unpaved areas and areas not covered by permanent structures, or 100% of disturbed soil areas that are covered with inert materials (i.e., minor paving, rock, gravel).

The Tech Bulletin 2013.1 expands upon this method by allowing final stabilization to consist of planting (i.e., seeds, cuttings, nursery stock, etc.) in combination with short term, degradable erosion control practices (e.g., rolled erosion control products, hydro mulch, fiber rolls, compost, wood mulch, etc.) with the expectation that the permanent vegetation will establish within three years.

B2. RUSLE or RUSLE2 Method:

The CGP allows the RUSLE or RUSLE2 Method to be used to provide computational proof of final soil stabilization.

Caltrans has developed RUSLE2 software to satisfy the RUSLE or RUSLE2 method. This method results in an estimate of post-construction erosion rates and compares this to pre-construction erosion rates, based on climate, soils, topography, and permanent BMP data. The Tech Bulletin 2013.1 expands upon this method by allowing demonstration of final stabilization to consist of less than 70% final cover.[5]

For this method, values are entered into the RUSLE2 software to obtain evaluation results for a typical slope within the project for both the pre-construction and post-construction conditions. To achieve final soil stabilization, the results must indicate that the erosion rate for the completed project condition is less than or equal to the erosion rate prior to beginning construction work. These RUSLE2 calculations are included in the PS&E phase SWDR. The RUSLE2 software and the Erosion Prediction Procedure (EPP) guidance, which will assist in determining anticipated erosion rates, are available on-line, (see section **G. References** for a link to RUSLE 2 software and EPP).

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[4] When native background vegetation will cover less than 100 percent of the ground (e.g., arid areas, beaches), the 70 percent coverage criteria is adjusted as follows: if the native vegetation covers 50 percent of the ground, 70 percent of 50 percent (0.70 X 0.50 = 0.35) would require 35 percent total cover for final stabilization. On a beach with no natural vegetation, no stabilization is required.

[5] http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/bulletin_2013_1.pdf

B3. Custom Method:

A custom method to demonstrate final soil stabilization must be different from the previous two methods and may be used if "the other methods are not suitable to demonstrate final stabilization at the project site." The Tech Bulletin 2013.1 states that this methodology requires a testing and analysis methodology that must be technically accepted by the larger, scientific and academic community and must relate to the concepts of final soil stabilization in the other methods.

This guidance does not recommend use of a Custom Method at this time.

C. Selecting the Method

Selection of the method to document final soil stabilization requires an understanding of the project scope and the existing condition. The following two sections will assist with that understanding. The Method Demonstration Form (MDF) and the RUSLE2 Worksheet are not mandatory and may be attached to the SWDR at the discretion of the PE.

C 1. The 70% Cover Method

Consider the 70% Final Cover Method if:

- The permanent, self-sustaining, native vegetation consists mainly of perennial grasses, forbs and wildflowers, (in the erosion control seed mix, the existing natural vegetation or a combination), and is expected to provide substantial cover after the first rainy season
- The entire disturbed soil area (DSA) will be covered with long-term, non-degradable (inert) materials such as minor paving, rock or gravel
- The DSA will be covered by a combination of both inert materials and permanent perennial vegetation is expected to provide substantial cover after the first rainy season

Documentation Materials:

- MDF (Optional)
- Written summary of materials, methods and/or performance measures specified in the contract in order to provide 100% permanent cover of DSA in Section 4 of the SWDR
- Photos, including existing background vegetation, within project site

C2. The RUSLE or RUSLE2 Method:

Documenting final soil stabilization using RUSLE2 Method is appropriate for many projects as it would allow for termination of permit coverage before the final vegetation establishment has occurred.

Consider the RUSLE or RUSLE2 Method if:

- The permanent vegetation is not expected to be established within three years over a minimum of 70% of the area. This is often true for habitat mitigation projects consisting of tree and shrub planting achieved by the use of container-grown plants, cuttings or a combination.
- The permanent vegetation is not expected to be established within three years over a minimum of 70% of the area. This is often true for roadside landscaping and irrigation work consisting of tree and shrub planting achieved by the use of container-grown plants, cuttings or a combination.

Documentation Materials:

- MDF (Optional)
- RUSLE2 Worksheet
- Photos, including pre-construction slopes, within project site

D. Recommended Text in the SWDR:

While the Project Engineer (PE) signs and seals the SWDR, the Project Manager, District Landscape Architect, Maintenance representative and Design Stormwater Coordinator are also signatories and concur that the SWDR appropriately addresses all stormwater design issues. The licensed professional (LP), typically the Project Landscape Architect, is to provide additional SWDR narrative in Section 6, Permanent BMPs describing final soil stabilization.

Recommended text to describe the permanent erosion control strategy to achieve final soil stabilization for insertion in the SWDR should include:

- Introductory text to describe the final soil stabilization strategy
- Additional text to reflect project specific needs
- Description of the method used to demonstrate final soil stabilization
- Photographs representing of the existing condition of the natural vegetation to substantiate the basis of the permanent erosion control strategy.

Note: Construction will take photographs as part of the Construction Site Monitoring Program. This usually includes pre and post-construction phases, to ensure all permanent BMPs are installed as designed.

D1. **Introductory** SWDR text:

In Section 6 of the SWDR include an introduction to describe final soil stabilization.

"Final soil stabilization will be achieved through the implementation of permanent perennial vegetation or the application of long-term, non-degradable materials to cover 100% of the disturbed soil areas. Upon project completion, the site is not expected to pose any additional sediment discharge risk than it did prior to the commencement of construction activity."

D2. **Project specific** SWDR text:

For roadway projects with paving and erosion control, edit the following paragraphs for the practices used, locations, and percentages of cover expected.

"Long-term, non-degradable materials consist of rock slope protection (80%) and gore paving (20%) of disturbed soil areas and is expected to provide immediate cover."

"Permanent planting consists of hydroseeding with native grasses and forbes. These plants will be installed with short term, degradable erosion control practices consisting of compost, rolled erosion control products, and fiber rolls. The permanent vegetation is expected to establish within three years, with at least 70% cover after the first rainy season."

"The slopes have been roughened, terraced, rounded and/or stepped to minimize erosion."

For typical roadside landscape planting work along state highways, edit the following paragraph for the overall planting strategy, duration to maturity, and supporting systems. (If different work occurs in separate locations, describe each location.)

"Permanent vegetation consisting of trees, shrubs and ground cover, expected to mature over 15 years. An irrigation system will be installed to establish the planting. 100% of the disturbed soil areas are covered with a combination of plantings and wood chip mulch."

For projects with permits, licenses, agreements or certifications (PLAC) required for habitat replacement by US Army Corps of Engineers (US ACOE), CA Fish & Wildlife, Coastal Commission, etc., edit the following paragraph for the overall mitigation planting strategy, duration to maturity, and supporting systems. (If different work occurs in different areas, possibly to create different habitats such as grassland or riparian, describe each area.)

"Permanent vegetation consisting of trees, shrubs and ground cover, expected to mature over 15 years. Also included are willow-cuttings, self-sustaining grasses, forbes and wildflowers expected to establish within 5 years. A temporary irrigation system will be installed to establish the planting."

D3. Method SWDR text:

Describe the method selected to demonstrate final soil stabilization.

If 70% Final Cover Method is used, include one of these text options:

"The project uses 70% Final Cover Method for documenting final soil stabilization with a majority of the DSA stabilized with vegetative cover. Permanent erosion control will provide at least 70% cover at the end of three years. Method Demonstration Form (70% Final Cover Method) is attached.

or

"The project uses 70% Final Cover Method for documenting non-vegetative final stabilization. DSA will be covered with long-term, non-degradable (inert) materials. Method Demonstration Form (70% Final Cover Method) is attached."

If the RUSLE2 Method is used to document final soil stabilization, include this text:

"The project uses Caltrans RUSLE2 software to document final stabilization and evaluate soil loss and sediment delivery for the permanent erosion control and vegetative BMPs proposed. This evaluation of the project slopes provides computational proof indicating final soil stabilization. Method Demonstration Form (RUSLE2 Method) is attached."

E. Required and Optional Attachments to the SWDR

The Method Demonstration Form (MDF) and the Erosion Control and Revegetation Report are attachments to the SWDR. The content and purpose of including these attachments are described below:

E1. Method Demonstration Form (Optional)

A MDF is to be prepared by the LP (licensed professional) for all SWPPP projects. The MDF is a single page summary capturing the final stabilization information and is to be attached to the PS&E phase SWDR. The narrative should describe the method for demonstrating final soil stabilization.

1) If the 70% Final Cover Method is used, identify whether the vegetative or non-vegetative option is used. Include a brief description of the final soil stabilization practices.
2) If the RUSLE2 Method is used, provide calculations showing that the post-construction condition will not generate more sediment than the pre-construction condition. Attach appropriate RUSLE2 calculations and output, typically the RUSLE2 Worksheet or a printout from the program.

Note: This guidance does not include information for installing, using or printing reports from the RUSLE2 software.

E2. Erosion Control and Revegetation Report (Optional)

When it has been determined that a project has slopes with high erosion potential, a more detailed description of the permanent erosion control strategy may be necessary. To determine whether this report should be prepared, the Landscape Architect and Project Development Team (PDT) should consider project factors such as size of DSA, receiving water sensitivity, and the magnitude of slope steepness, length, and soil erosivity. The report should be completed as part of the PS&E and attached to the SWDR.

The Erosion Control and Revegetation Report should include:

1) Strategies for achieving final soil stabilization. If several strategies are needed to meet project challenges, describe each. Refer to Checklist DPP-1, Part 3 in the Project Planning and Design Guide (PPDG) for outlining strategies.
2) RUSLE2 calculations for the pre and post-construction slopes and a comparison showing the sediment loss for each. Evaluated slopes may vary from typical (4:1 to 2:1) to severe (greater than 2:1) and may need additional RUSLE2 evaluations if conditions vary due to steepness, soil type, etc.
3) A description of the reference site, if one was selected as a model for developing erosion control and revegetation strategies. Use a GPS location to identify these sites.
4) If relevant, an explanation that erosion control and revegetation strategies rely on multiple years before the vegetation achieves 70% of background cover.
5) A description of the potential for change in species diversity, from the initial installation of grasses, forbs and wildflower species in the erosion control seed mix, (plus groundcover and other nursery stock, if relevant), to include locally-occurring shrubs and trees through the deposition of seeds by natural processes.

Note: This guidance does not elaborate upon the preparation of an Erosion Control and Revegetation Report. Additional guidance is under development, (see section **G. References** within this guidance for a link to a report template).

F. Roles and Responsibilities

F1. Project Development Team

The Project Engineer is responsible for developing the project and documenting stormwater issues in the SWDR according to the PPDG, ensuring all appropriate functional units are involved (Hydraulics, Geotechnical, Landscape Architecture, Maintenance, Design Stormwater Coordinator) and that the following occurs:

1) Final soil stabilization and erosion control strategies are included in the SWDR narrative, the approach is consistent with the CGP and complies with the NOT requirements for final soil stabilization.
2) The SWDR is reviewed and edited appropriately, to ensure that the permanent BMP strategies are consistent with the concepts of sustainable roadside design.
3) The SWDR describes proposed erosion control, revegetation, and vegetative components of treatment BMPs and design pollution prevention BMPs.
4) The PS&E includes the erosion control, revegetation, and vegetative components of permanent BMPs described in the SWDR and used to calculate soil loss in RUSLE2 when applicable.
5) Cost estimates for performing erosion control, revegetation, and vegetative components of permanent BMPs are adequate for the work described.
6) Site-specific stabilization (non-vegetative) methods are identified for areas that are not expected to achieve vegetative final soil stabilization. These non-vegetated methods may need coordination with other units (Hydraulics, Geotechnical, etc.) and could include rock slope protection, retaining walls, channel lining, etc.
7) A MDF may be developed to document the selected method (70% Final Cover Method or RUSLE2) that will demonstrate how final soil stabilization will be achieved. If developed it will be attached to the SWDR.
8) An Erosion Control & Revegetation Report is developed and attached to the SWDR if necessary.
9) Site visits are conducted before construction to photograph pre-construction site conditions if necessary.
10) The SWDR and all appropriate attachments (e.g., MDF, Erosion Control and Revegetation Report, pre-construction photos) are included in the RE Pending File.

F2. **Construction** (provided for information only)

Filing the Notice of Termination (NOT) requires certification that final soil stabilization has been achieved. The information provided in the SWDR will support Construction in filing the NOT in SMARTS and requesting approval from the State Water Board. The project's Approved Signatory, typically the RE, signs the NOT certifying that final soil stabilization requirements of the CGP have been met and documented.

The RE files the NOT to certify that the following conditions have been met:

1) For the purpose of final soil stabilization, the site will not pose any additional sediment discharge than it did prior to beginning project construction.
2) There is no risk of discharging construction-related pollutants.
3) A method for demonstrating final stabilization has been identified.

4) Final soil stabilization has been reached.

5) All construction-related equipment, materials and any temporary BMPs that are no longer needed have been removed from site.

6) Post-construction photos are taken for documenting final stabilization.

Construction shall follow its procedures to receive appropriate concurrence prior to approving any CCO relating to slope stabilization for temporary erosion control, permanent erosion control, and non-vegetative materials used for coverage requirements

F3. **Maintenance** (provided for information only)

One of the CGP requirements for Termination of Coverage is the existence of a long-term maintenance plan[6]. Caltrans' Division of Maintenance dedicates resources to an ongoing statewide effort that meets requirements of this plan. HQ Division of Maintenance provides guidelines to District Maintenance for conducting periodic slope inspections, maintaining treatment BMPs, and repairing and identifying future action to remedy erosive slopes.

[6] Order No. 2009-0009-DWQ, as amended by 2010-0014-DWQ; NPDES No. CAS000002, page 18 Section II D(1)f http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml#app3

G. References

G1. Key Concepts of Sustainable Erosion Control - Technical Guide (November 2010)

The Key Concepts of Sustainable Erosion Control - Technical Guide was developed by the HQ Landscape Architecture Program to aid in the decision-making process in designing sustainable erosion controls on project sites. Key design considerations to reduce erosion and increase water quality are outlined in this guidance, including:

- Increase infiltration-incorporate organic matter where feasible
- Provide surface protection from raindrop impact
- Incorporate slope breaks, surface roughness, fiber rolls, etc. to slow runoff
- Control runoff to prevent concentrated flows
- Divert run-on at top of slope; stabilize toe of slope

The Erosion Control Technical Guide is available to download from:
http://www.dot.ca.gov/ hq/LandArch/16_la_design/guidance/ec_toolbox/Erosion Control_Technical_Guide_v2.pdf

Guides By Others on Sediment Source Control and Roadside Revegetation:
http://www.dot.ca.gov/hq/LandArch/16_la_design/guidance/ec_toolbox/references/manuals.htm

G2. Revised Universal Soil Loss Equation, Version 2 (RUSLE2) Software (August 2011)

RUSLE2 is a computer-based model of the original RUSLE formula. It is applicable to highway applications and predicts soil loss according to BMP selection. RUSLE2 is an approved tool that Caltrans uses to comply with the Construction General Permit (CGP) issued by the State Water Resources Control Board. The benefits and limitations of RUSLE2 include:

- Caltrans has modified RUSLE2 for highway applications
- RUSLE2 helps document site data needed for analyses
- RUSLE2 can help the designer justify an erosion control strategy
- Selecting BMPs in RUSLE2 is an iterative process
- RUSLE2 doesn't provide BMP specification, cost, or absolute effectiveness indicators

Caltrans RUSLE2 was developed by Caltrans by means of a task order and training was provided by the HQ Office of Storm Water Management Design. The RUSLE2 software, Quick Start Guide and RUSLE2 FAQ are available to download from:
http://www.dot.ca.gov/hq/oppd/stormwtr/rusle2.htm

G3. Erosion Prediction Procedure (EPP) (August 2011)

The EPP manual was developed by the HQ Office of Storm Water Management Design to assist in determining anticipated erosion rates for RUSLE2. This guidance is available to download from: http://www.dot.ca.gov/hq/oppd/stormwtr/rusle2.htm

G4. Erosion Control and Revegetation Report template (July 2012)

A template for use in preparing an Erosion Control and Revegetation Report was developed by the HQ Landscape Architecture Program and is available as an attachment to this guidance.

ATTACHMENT 1.1

METHOD DEMONSTRATION FORM (MDF)
70% Final Cover Method

This form documents the selected method for demonstrating final stabilization as required under Section II.D., "Conditions for Termination of Coverage," of the Construction General Permit (Order No. 2009-0009-DWQ, NPDES No. CAS000002) and Technical Bulletin 2013.1.

Project Description

Project EA/ID: _____
Dist-County-Route: _____
Post Mile Limits: _____
Project Type: _____

Project Risk Level: _____
Sediment Risk: _____
Receiving Water Risk: _____

Caltrans uses the following definition for "70% Final Cover Method:

Upon the completion of all construction activities, especially all soil disturbing activities, the CGP allows the 70% Final Cover Method to be used to demonstrate final stabilization. Cover is defined as: a uniform (e.g., evenly distributed, without large bare soil areas) long-term, vegetative cover with a density of 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or100% of the disturbed soil areas are covered with inert materials (i.e., minor paving, rock, gravel).

The Technical Bulletin provides additional information on this method and indicates that final stabilization may consist of planting (i.e., seeds, cuttings, nursery stock, etc) in combination with short-term, degradable erosion control practices (e.g., rolled erosion control products, hydro mulch, fiber rolls, compost, etc). The selected method for permanent vegetation must establish within three years.

This project has _____ acres of total DSA due to (*describe the type of work, e.g., grading to repair a slope slip-out and construct an access road.*)_____ _____. (*Describe the long-term, non-degradable measure that covers the DSA identified above, e.g., slope slip-out will be covered with rock slope protection and access road will be capped with gravel to provide future maintenance)* _____ _____ _____.

By providing permanent vegetation and/or non-degradable materials for the DSA, the site will not pose any additional sediment discharge risk than it did prior to the commencement of construction activity.

_____
Prepared by (name, title, date)

ATTACHMENT 1.2

METHOD DEMONSTRATION FORM (MDF)
RUSLE2 Method

This form documents the selected method for demonstrating final stabilization as required under Section II.D., "Conditions for Termination of Coverage," of the Construction General Permit (Order No. 2009-0009-DWQ, NPDES No. CAS000002) and Technical Bulletin 2013.1.

Project Description

Project EA/ID: _____
Dist-County-Route: _____
Post Mile Limits: _____
Project Type: _____

Project Risk Level: _____
Sediment Risk: _____
Receiving Water Risk: _____

Caltrans RUSLE2 software was used to evaluate soil loss and sediment delivery for the project. Input criteria and results are summarized in the following tables.

Pre-Construction:

Soil Erodibility (K)	Climate/Rainfall (R)	Location

Typical Slope* (4:1 to 2:1)		Management			Erosion/ Soil Loss (t/ac/yr)	Sediment Delivery (t/ac/yr)
Steepness (%)	Length (ft)	Soil Stab. BMP	Vegetation	Permeable Barriers		
		None		None		

*In addition to typical slope, provide pre and post-construction RUSLE2 calculations for severe slopes (greater than 2:1).

Post-Construction:

Soil Erodibility (K)	Climate/Rainfall (R)	Location

Typical Slope (4:1 to 2:1)		Management			Erosion/ Soil Loss (t/ac/yr)	Sediment Delivery (t/ac/yr)
Steepness (%)	Length (ft)	Soil Stab. BMP	Vegetation	Permeable Barriers		

The post-construction slope(s) shows an equivalent rate or decrease in both the erosion/soil loss and sediment delivery when compared to the pre-construction slope. This provides computational proof indicating final stabilization and demonstrates that the site will not pose any additional sediment discharge risk than it did prior to the commencement of construction activity.

_____
Prepared by (name, title, date)