

EROSION CONTROL 101

An introduction to Erosion and Sedimentation
Policies and Control Methods



Caltrans[®]

**Landscape Architecture Program
Office of Standards & Procedures**



Topics of Discussion

- Definition of Erosion and Sedimentation
- Effects of Erosion and Sedimentation
- Pollution Discharge Laws and Regulation Permits
- The Erosion Control toolbox: Selecting Erosion and Sediment Control Best Management Practices (BMPs)
- Caltrans Standard Specifications
- Review





Definitions

Erosion: The process by which soil particles become detached by water, wind, or gravity and are transported from their original location.



Definitions

Sedimentation: The result of deposition (settling out) of the detached soil particles.



Effects of Erosion and Sedimentation

- 70% of all land erosion in the U.S. derives from construction activities
- Sediment pollution causes \$16 billion in environmental damage annually
- Sediment affects viability of many animals and vegetation
- Sedimentation increases the cost of treating drinking water



Solution

Erosion Control



What is Erosion Control (EC)?

The Environmental
Protection Agency (EPA)
defines Erosion Control as:

“The practice of
incorporating measures
that prevent erosion.”



Federal Water Pollution Control Act (Clean Water Act: 1972)

National Pollution Discharge Elimination
System (NPDES) permit

- Regulated in this state by the
California Water Resources Control
Boards

(comprised of 9 regional water boards)

[https://www.waterboards.ca.gov/water
issues/programs/npdes/](https://www.waterboards.ca.gov/water_issues/programs/npdes/)



Caltrans: Pollution Discharge Laws & Permit Regulations

- The California Department of Transportation (Caltrans) is responsible for the design, construction, management, and maintenance of the State highway system, including freeways, bridges, tunnels, Caltrans' facilities, and related properties, and is subject to the permitting requirements of Clean Water Act section 402(p). Caltrans' discharges consist of storm water and non-storm water discharges from State owned rights-of-way.



Caltrans: Pollution Discharge Laws & Permit Regulations

- The State Water Resources Control Board issued the statewide Permit for Caltrans, which regulates all discharges from Caltrans MS4s (Municipal Separate Stormwater Systems), maintenance facilities, and construction activities.
- MS4s: Municipal Stormwater Separate System of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) owned or operated by a State (40 CFR 122.26 (b)(8)).

For more information, visit

https://www.waterboards.ca.gov/water_issues/programs/stormwater/caltrans.html



Improve Soil Health

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Erosion Control Toolbox

The purpose of the Caltrans Erosion Control Toolbox is to provide Landscape Architects with a single location that contains the information necessary to design successful, cost-effective and sustainable erosion control treatments. This toolbox serves as a one-stop reference for:

- Erosion Control Treatments
- Erosion Control Best Management Practices
- Erosion Control Standards
- Erosion Control Guidance

Sustainable Erosion Control Treatments

The Caltrans Technical Guide to Erosion Control Treatment offers tools to assist in the design of sustainable erosion controls on project sites.

Erosion Control Best Management Practices

The table below provides a general overview of various erosion control Best Management Practices (BMPs). Select the erosion control treatment(s) best suited to address deficiencies identified with a project.

Click on the hyper-link at left to obtain more specific information regarding a BMP.

<https://dot.ca.gov/programs/design/lap-erosion-control-design/tool-1-lap-erosion-control-toolbox>



Erosion and Sediment Control Best Management Practices (BMPs)

- Improve Soil Health
- Provide Soil Cover and Improve Soil Health
- Provide Short Term Soil Cover
- Provide Long Term Soil Cover
- Steep Slope Techniques

<https://dot.ca.gov/programs/design/lap-erosion-control-design>



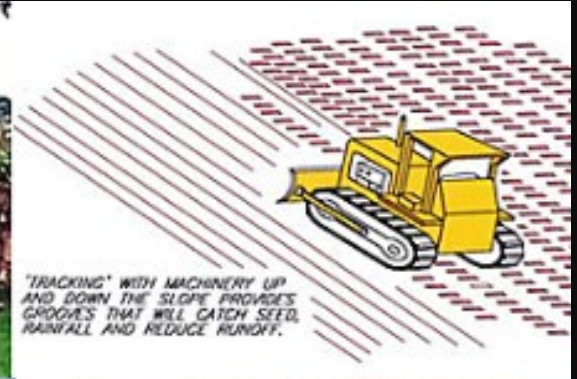
Improve Soil Health

- Roughen Soil
- De-compact Soil
- Stepped Slopes
- Preserve Existing Topsoil
- Imported Topsoil
- Incorporate Materials



Improve Soil Health: Roughen Soil

- Requires the use of Earthwork Equipment
 - Track walk fill slopes
 - Use of a Sheepsfoot roller on fill slope
 - Scarify cut slopes



Improve Soil Health: Decompact Soil

- Requires the use of Subsoiling Equipment
 - Winged subsoiler
 - Grapple rake or excavator bucket
 - Improve soil water holding capacity and rooting depth



Improve Soil Health: Stepping Slopes

- Technique consisting of a series of small benches
 - Typically used on cut slopes
 - Helps reduce erosion by breaking up the slope length
-



Improve Soil Health: Preserve Existing Topsoil & Importing Topsoil

- Preserving Existing Topsoil
 - Includes Excavating, stockpiling and placing existing topsoil on areas disturbed by construction activities
 - Existing topsoil use preserves the original physical, chemical and biological properties to establish vegetation
- Importing Topsoil
 - Obtained from outside the project limits
 - Typically used for planting projects vs. erosion control work



Improve Soil Health: Incorporate Materials

- Involves Tilling:
 - Topsoil
 - Duff
 - Compost
 - Straw
 - Mulch



Improve Soil Health

Improve Soil Health

Erosion Control Treatments	Max Slope (H:V) [See Legend Below]					Cut or Fill?	Benefits [See Legend Below]		
Description	4:1	3:1	2:1	1.5:1	1:1		Soil Cover (1)	Soil Health (2)	Infiltration (3)
Roughen Soil	Recommended	Recommended	Recommended	Recommended	Not Recommended	Cut/Fill	Low	Medium	Medium
Decompact Soil	Recommended	Recommended	Not Recommended	Not Recommended	Not Recommended	Cut/Fill	Low	Medium	High
Stepped Slopes	Not Applicable	Recommended	Recommended	Check with Geotechnical Engineer	Not Recommended	Cut	Low	Medium	Medium
Preserve Existing Topsoil	Recommended	Recommended	Recommended	Check with Geotechnical Engineer	Not Recommended	Cut/Fill	Low	High	Medium
Imported Topsoil	Recommended	Recommended	Recommended	Check with Geotechnical Engineer	Not Recommended	Cut/Fill	Low	Medium	Medium
Incorporate Materials	Recommended	Recommended	Check with Geotechnical Engineer	Not Recommended	Not Recommended	Cut/Fill	Low	High	High



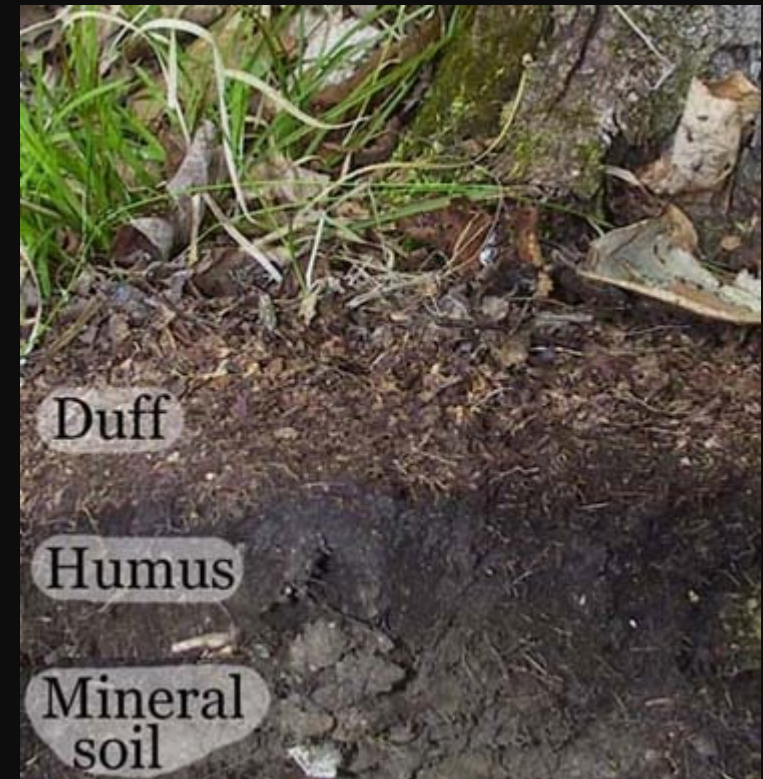
Soil Cover & Improve Soil Health

- Duff
- Mulch
- Compost Blanket



Soil Cover & Improve Soil Health: Duff

- Vegetation removed from the project site that is:
 - Chipped
 - Stockpiled
 - Reapplied



Soil Cover & Improve Soil Health: Mulch

- Involves placing a blanket of organic material on:
 - Fill slopes
 - Cut slopes
 - Other disturbed areas to reduce erosion and weed growth



Soil Cover & Improve Soil Health: Compost Blanket

- Compost blanket types:
 - Mulch-like blanket
 - Incorporate Materials



Soil Cover and Improve Soil Health

Provide Soil Cover and Improve Soil Health

Erosion Control Treatments	Max Slope (H:V) [See Legend Below]					Cut or Fill?	Benefits [See Legend Below]		
	4:1	3:1	2:1	1.5:1	1:1		Soil Cover (1)	Soil Health (2)	Infiltration (3)
Duff	Recommended	Recommended	Recommended	Check with Geotechnical Engineer	Not Recommended	Cut/Fill	Medium	High	Medium
Mulch	Recommended	Recommended	Recommended	Check with Geotechnical Engineer	Not Recommended	Cut/Fill	Medium	Medium	Medium
Compost Blanket	Recommended	Recommended	Recommended	Not Recommended	Not Recommended	Cut/Fill	Medium	High	High



Short Term Soil Cover

- Straw
- Hydroseed
- Bonded Fiber Matrix
- Rolled Erosion Control Product (RECP) Jute Mesh



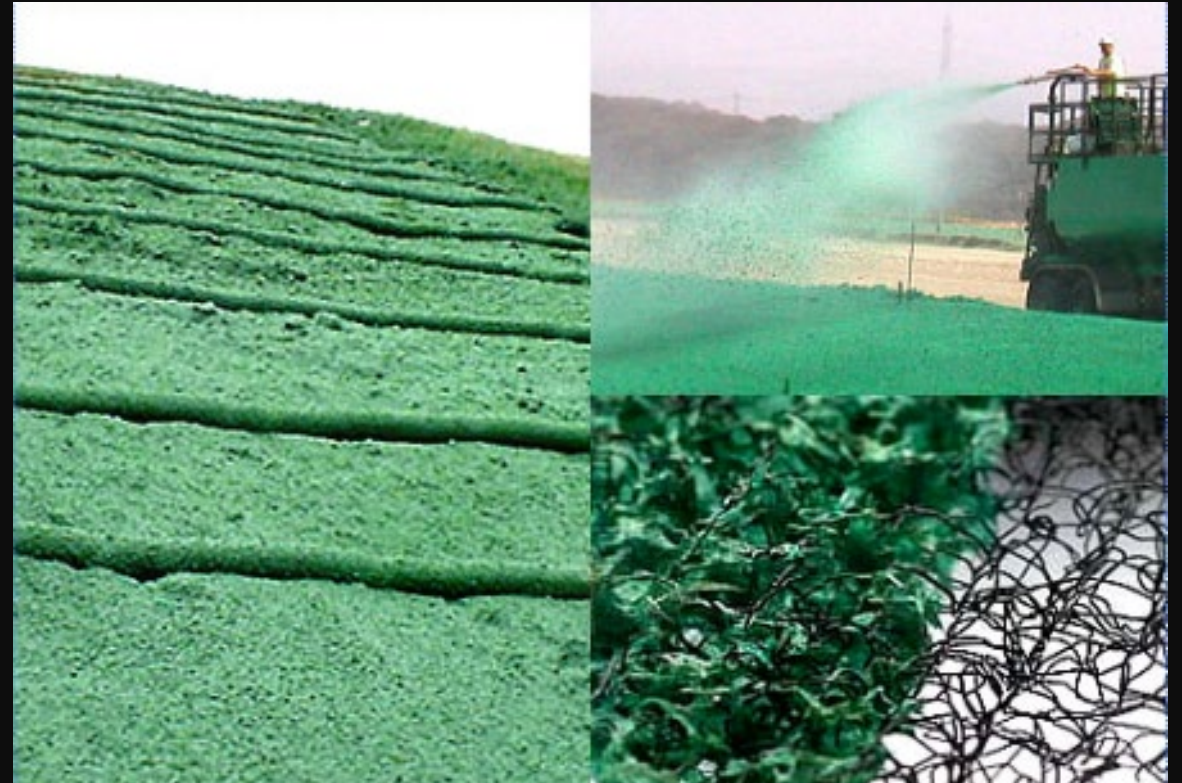
Short Term Soil Cover: Straw

- Applied as a mulch in hydroseeding
- Application rates vary based on:
 - Straw Material
 - Slope roughness
 - Slope steepness



Short Term Soil Cover: Hydroseed

- Hydroseeding is a method of applying:
 - Seed
 - Fiber
 - Tackifier



Short Term Soil Cover: Bonded Fiber Matrix

- Bonded Fiber Matrix:
 - Wood fiber blanket bonded with tackifier
 - Fertilizer



Short Term Soil Cover: RECP Jute Mesh

- RECP Jute Mesh:
 - Open weave textile
 - Lightweight
 - Biodegradable



Short Term Soil Cover

Provide Short Term Soil Cover

Erosion Control Treatments	Max Slope (H:V) [See Legend Below]					Cut or Fill?	Benefits [See Legend Below]		
Description	4:1	3:1	2:1	1.5:1	1:1		Soil Cover (1)	Soil Health (2)	Infiltration (3)
Straw	Recommended	Recommended	Recommended	Not Recommended	Not Recommended	Fill	Medium	Low	
Hydroseed	Recommended	Recommended	Recommended	Not Recommended	Not Recommended	Cut/Fill	Medium	Low	Low
Bonded Fiber Matrix	Recommended	Recommended	Recommended	Recommended	Medium	Cut/Fill	Medium	Low	Low
RECP Jute Mesh	Recommended	Recommended	Recommended	Not Recommended	Not Recommended	Cut/Fill	Medium	Low	Low



Long Term Soil Cover

Rolled Erosion Control Products (RECP)

- RECP Netting
- RECP Blanket
- RECP Turf Reinforcement Mat (TRM)



Long Term Soil Cover: Rolled Erosion Control Product (RECP) Netting: 3-year longevity

- RECP Netting (Type A)
 - High matrix opening (65%)
 - Seed can be applied after its installation
 - RECP Netting (Type B)
 - Moderate matrix opening (50%)
 - Seed application prior to installation
 - RECP Netting (Type C)
 - Small matrix opening (39%)
 - Best for hydroseed application prior to installation
-



Long Term Soil Cover: Rolled Erosion Control Product (RECP) Netting

Provide Long Term Soil Cover

Erosion Control Treatments	Max Slope (H:V) [See Legend Below]					Cut or Fill?	Benefits [See Legend Below]		
Description	4:1	3:1	2:1	1.5:1	1:1		Soil Cover (1)	Soil Health (2)	Infiltration (3)
RECP Netting (Type A)	Recommended	Recommended	Not Recommended	Not Recommended	Not Recommended	Cut/Fill	High	Low	Low
RECP Netting (Type B)	Recommended	Recommended	Recommended	Recommended	Check with Geotechnical Engineer	Cut/Fill	High	Low	Low
RECP Netting (Type C)	Recommended	Recommended	Recommended	Recommended	Check with Geotechnical Engineer	Cut/Fill	High	Low	Low



Long Term Soil Cover: Rolled Erosion Control Product (RECP) Blanket: 1-year longevity

- RECP Blanket (Type A)
 - Double net with a straw and coir (coconut) fiber core
 - RECP Blanket (Type B)
 - Double net with 100% woven coir fiber core
 - RECP Blanket (Type C)
 - Double net with wood excelsior core
-



Long Term Soil Cover: Rolled Erosion Control Product (RECP) Blanket

Provide Long Term Soil Cover

Erosion Control Treatments	Max Slope (H:V) [See Legend Below]					Cut or Fill?	Benefits [See Legend Below]		
Description	4:1	3:1	2:1	1.5:1	1:1		Soil Cover (1)	Soil Health (2)	Infiltration (3)
<u>RECP Blanket (Type A)</u>	Not Applicable	Not Applicable	Recommended	Recommended	Check with Geotechnical Engineer	Cut/Fill	High	Low	Low
<u>RECP Blanket (Type B)</u>	Not Applicable	Not Applicable	Recommended	Recommended	Check with Geotechnical Engineer	Cut/Fill	High	Low	Low
<u>RECP Blanket (Type C)</u>	Not Applicable	Not Applicable	Recommended	Recommended	Check with Geotechnical Engineer	Cut/Fill	High	Low	Low



Long Term Soil Cover: Rolled Erosion Control Product (RECP) Turf Reinforcing Mat (TRM): 3-year longevity

- RECP TRM (Type A)
- RECP TRM (Type B)
- RECP TRM (Type C)



Long Term Soil Cover: Rolled Erosion Control Product (RECP) Turf Reinforcing Mat (TRM)

Provide Long Term Soil Cover

Erosion Control Treatments	Max Slope (H:V) [See Legend Below]					Cut or Fill?	Benefits [See Legend Below]		
Description	4:1	3:1	2:1	1.5:1	1:1		Soil Cover (1)	Soil Health (2)	Infiltration (3)
RECP TRM (Type A)	Not Applicable	Not Applicable	Recommended	Recommended	Not Recommended	Cut/Fill	High	Low	Low
RECP TRM (Type B)	Not Applicable	Not Applicable	Recommended	Recommended	Recommended	Cut/Fill	High	Low	Low
RECP TRM (Type C)	Not Applicable	Not Applicable	Recommended	Recommended	Recommended	Cut/Fill	High	Low	Low



Steep Slope Techniques

Stepping Slopes

Brush layering

RECP Flap

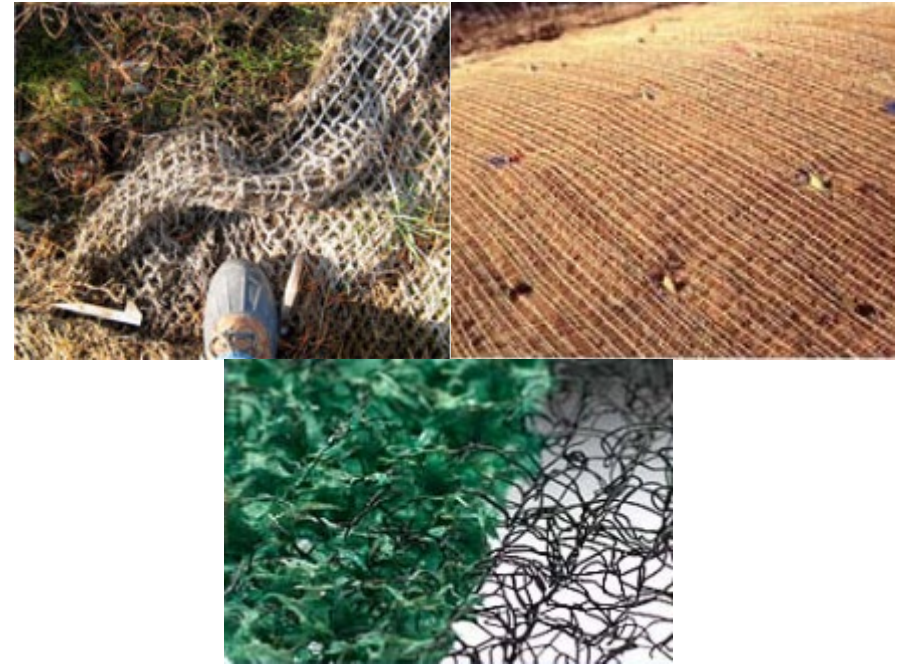
RECP Wrap

Soil Filled RSP

Cellular Confinement

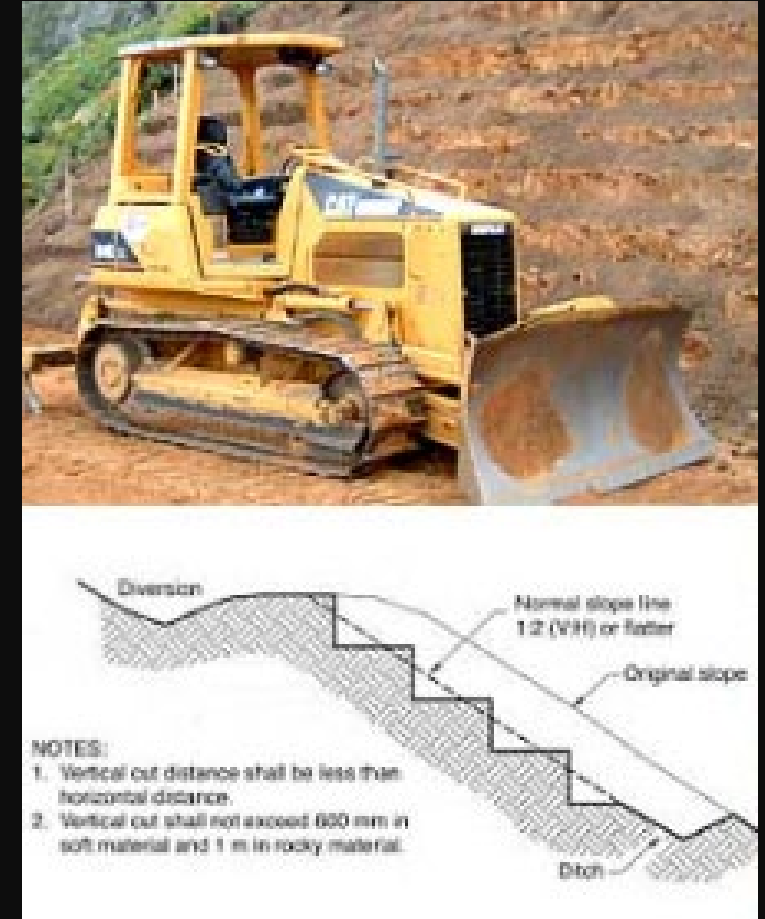
Wire Blanket

Wire Mesh Confinement



1. Steep Slope Techniques: Stepped Slopes

- Use of Heavy Equipment
 - Create a series of small benches (1-2 feet wide)
 - Reduces velocity of runoff
 - Steps promote vegetative cover (installation of topsoil, duff or compost)
-



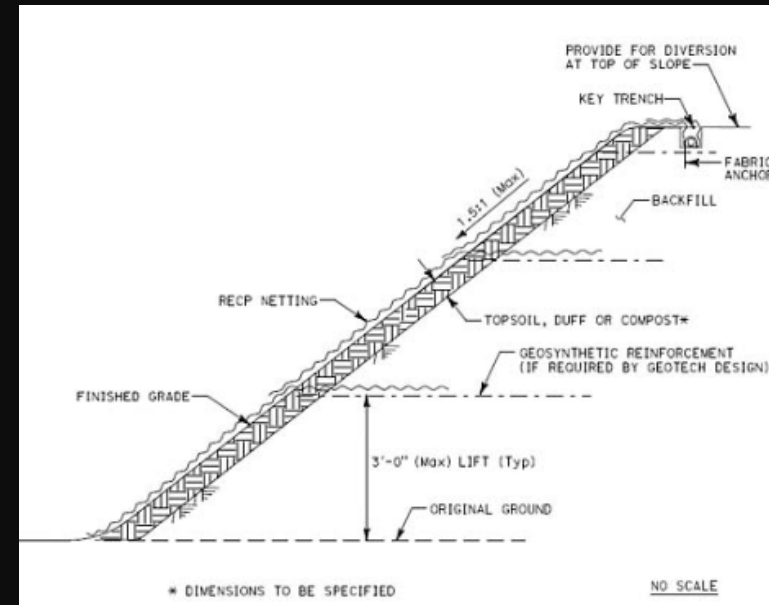
2. Steep Slope Techniques: Brush Layering

- Commonly used to treat embankment slopes
 - Involves embedding cottonwood or willow stands in horizontal layers perpendicular to slope face
 - Provides erosion protection, increases vegetative cover, and helps enhance habitat
-



3. Steep Slope Techniques: RECP Flap

- Built in layers utilizing coir blanket
 - Blanket is topped with compost, or topsoil.
-



4. Steep Slope Techniques: RECP Wrap

- More aggressive approach to control erosion
 - Backfill material is wrapped to the slope with RECP blanket
 - Utilized on slope conditions where there are subsurface water flows
-



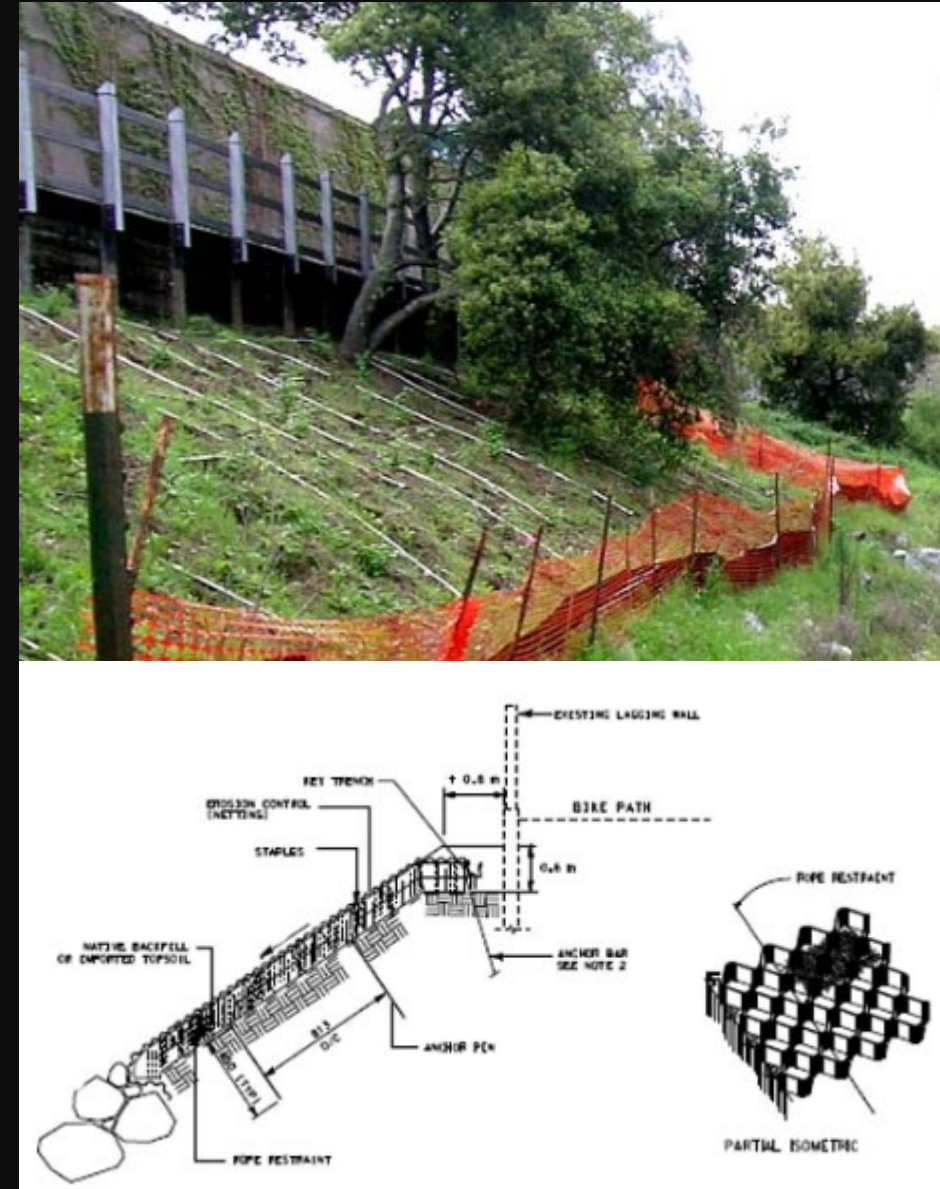
5. Steep Slope Techniques: Soil filled RSP

- Typically used to repair failed cut slopes
 - Involves Placing $\frac{1}{4}$ ton Rock Slope Protection (RSP) on slopes
 - Placing plants between rocks with backfilling with topsoil
-



6. Steep Slope Techniques: Cellular Confinement

- Slope treatment that utilizes Geotextile material
 - Cells are filled with local topsoil and seed/cuttings
 - Provides greater soil volume than traditional hydroseeding
-



7. Steep Slope Techniques: Wire Blanket

- Best for cut slopes between 2:1 and 1.5:1
 - Consists of biodegradable coir netting and welded wire mesh
 - Accommodates hydroseeding of seed, fiber, and fertilizer
-



8. Steep Slope Techniques: Wire Mesh Confinement

- Fill or reconstructed cut slopes between 1.5:1 and 0.5:1
 - Provides additional shear strength necessary to hold fill material in place
 - RECP is placed inside the confinement system to prevent the release of topsoil
-



Steep Slope Techniques

Steep Slope Techniques

Erosion Control Treatments	Max Slope (H:V) [See Legend Below]					Cut or Fill?	Benefits [See Legend Below]		
Description	4:1	3:1	2:1	1.5:1	1:1		Soil Cover (1)	Soil Health (2)	Infiltration (3)
Stepped Slopes	Not Applicable	Recommended	Recommended	Medium	Not Recommended	Cut	High	Medium	Medium
Brush Layering	Not Applicable	Recommended	Recommended	Recommended	Not Recommended	Fill	High	Medium	Medium
RECP Flap	Not Applicable	Not Applicable	Recommended	Recommended	Not Recommended	Fill	High	Medium	Medium
RECP Wrap	Not Applicable	Not Applicable	Recommended	Recommended	Not Recommended	Fill	High	Medium	Medium
Soil Filled RSP	Not Applicable	Not Applicable	Medium	Recommended	Not Recommended	Cut	High	Medium	Medium
Cellular Confinement	Not Applicable	Not Applicable	Recommended	Recommended	Not Recommended	Cut	High	Medium	Medium
Wire Blanket	Not Applicable	Not Applicable	Not Applicable	Recommended	Recommended	Cut	High	Medium	Medium
Wire Mesh Confinement	Not Applicable	Not Applicable	Not Applicable	Recommended	Recommended	Fill	High	Medium	Medium



Standard Specifications

Section 21: Erosion Control

- General (Application)
- Materials
- Construction
- Payment

21 EROSION CONTROL

21-1 GENERAL

21-1.01 GENERAL

Section 21-1 includes general specifications for applying permanent erosion control measures.

21-1.02 MATERIALS

Not Used

21-1.03 CONSTRUCTION

Not Used

21-1.04 PAYMENT

Not Used

21-2 EROSION CONTROL WORK

21-2.01 GENERAL

21-2.01A Summary

Section 21-2 includes specifications for applying permanent erosion control measures{ XE "Erosion control" } to the soil surface.

Move-in/move-out for erosion control includes (1) moving onto the project when the Engineer determines an area is ready to receive erosion control materials, (2) setting up all required personnel and equipment, and (3) moving out all personnel and equipment when work in that area is complete.

21-2.01B Definitions

percent total viability: The sum of the percent germination, percent hard seed, and percent dormant seed.

21-2.01C Submittals

21-2.01C(1) General

Submit a certificate of compliance for straw, fiber, RECP, and fasteners before application.

If weed-free straw is used, the certificate of compliance must include the certificate of quarantine compliance.

Submit records for hydraulically applied erosion control materials that indicate (1) compliance with the specified application rates, (2) areas treated and quantity of materials applied, and (3) application date and time.

21-2.01C(2) Compost

Submit the compost producer's compost technical data sheet including test results and seal of testing assurance certificate before application.

Submit a 1 cu ft compost sample from the compost producer. Obtain authorization before delivering the compost to the job site.

21-2.01C(3) Seed

At least 60 days before seed application, submit proof that the purchase order for seed required for the Contract has been placed and accepted by the seed vendor. Include the seed's botanical names, quantity ordered, and the anticipated date of delivery on the purchase order.

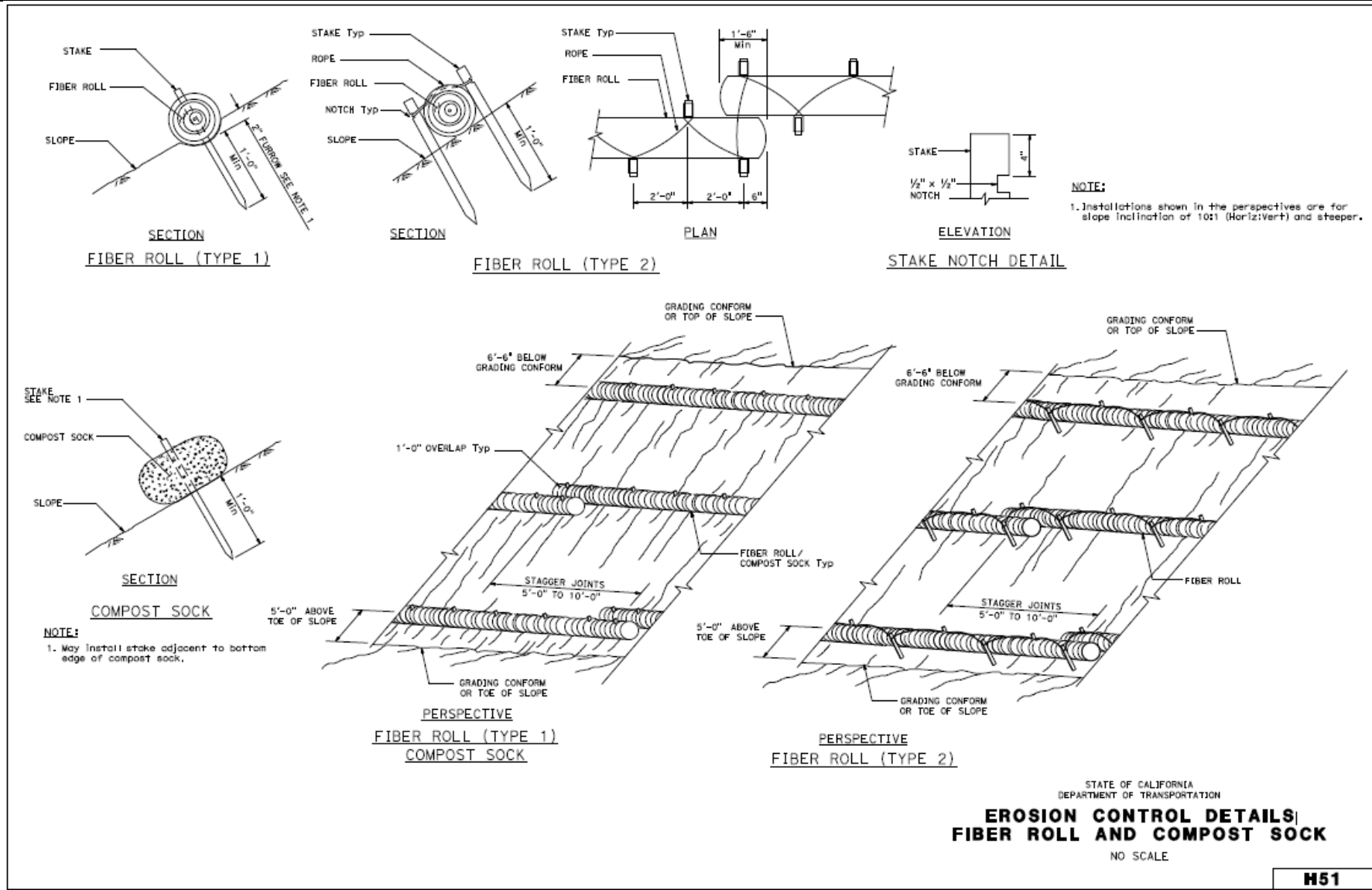
Submit a copy of the supplier's seed analysis report and seed label for each seed species before application.

Seed analysis report must show:

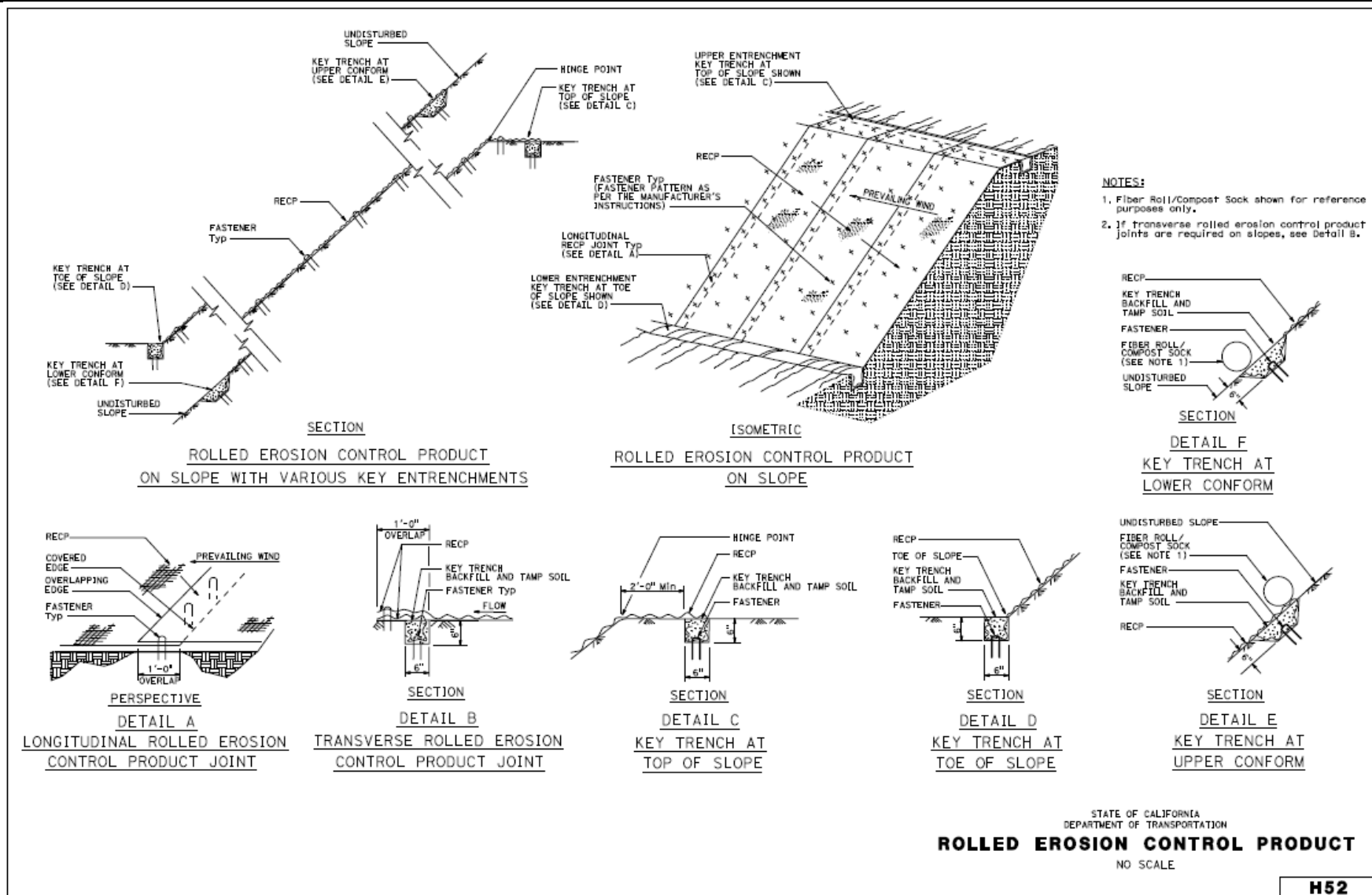
1. Seed variety including botanical name and common name
2. Percent pure live seed
3. Percent by weight inert matter
4. Percent by weight other crop seed



2023 Standard Details: Erosion Control Fiber Roll



2023 Standard Details: Erosion Control (Fiber Roll/Mat/Blanket)



2023 STANDARD PLAN H52



Review

- Definition of Erosion and Sedimentation
- Affects of Erosion and Sedimentation
- Pollution Discharge Laws and Regulation Permits
- The Erosion Control toolbox: Selecting Erosion and Sediment Control Best Management Practices (BMPs)
- Caltrans Standard Specifications



Disclaimer

This course provides basic & general erosion control information and is meant as a guide to help designers select viable erosion control options.

District staff should use their knowledge and experience along with discussing erosion control measures with other district staff subject-matter experts, their supervisor, or their respective LAP design coordinator for more information on selecting the best erosion control measures for a specific project.



Resources

- Federal guidelines for Erosion and Sediment Control Planning and Implementation:
https://search.epa.gov/epasearch/?querytext=erosion+control&areaname=&areacontacts=&areasearchurl=&typeofsearch=epa&result_template=#/
- California Water Boards:
https://www.waterboards.ca.gov/water_issues/programs/stormwater/caltrans.html
- Caltrans Erosion Control Toolbox:
<https://dot.ca.gov/programs/design/lap-erosion-control-design/tool-1-lap-erosion-control-toolbox>



Thank You



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Landscape Architecture Program

