

Water Resource Protection Plan

WDID: 1B171719CHUM

APN(s): 221-201-007 (Humboldt)



Prepared by:

Timberland Resource Consultants

165 South Fortuna Blvd

Fortuna, California 95540

9/12/2017

Revised: 7/12/2018

Purpose

This Water Resource Protection Plan (WRPP) has been prepared on behalf of the property owner for the Humboldt county property identified as parcel numbers 221-201-007 by agreement and in response to the California Water Code Section 13260(a), which requires that any person discharging waste or proposing to discharge waste within any region that could affect the quality of the waters of the state, other than into a community sewer system, shall file with the appropriate regional water board a Report of Waste Discharge (ROWD) containing such information and data as may be required by the Regional Water Board. The Regional Water Board may waive the requirements of Water Code section 13260 for specific types of discharges if the waiver is consistent with the Basin Plan and in the public interest. Any waiver is conditional and may be terminated at any time. A waiver should include monitoring requirements to verify the adequacy and effectiveness of the waiver's conditions. Order R1-2015-0023 conditionally waives the requirement to file a ROWD for discharges and associated activities described in finding 4.

Scope of Report

Order No. R1-2015-0023 states that "Tier 2 Dischargers and Tier 3 Dischargers who intend to cultivate cannabis before, during, or following site cleanup activities shall develop and implement a Water Resource Protection Plan that contains the elements listed and addressed below. Dischargers must keep this plan on site, and produce it upon request by Regional Water Board staff. Management practices shall be properly designed and installed, and assessed periodically for effectiveness. If a management measure is found to be ineffective, the plan must be adapted and implemented to incorporate new or additional management practices to meet standard conditions. Dischargers shall certify annually to the Regional Water Board individually or through an approved third-party program that the plan is being implemented and is effectively protecting water quality, and report on progress in implementing site improvements intended to bring the site into compliance with all conditions of this Order.

Methods

The methods used to develop this WRPP include both field and office components. The office component consisted of aerial photography review and interpretation, existing USGS quad map review, GIS mapping of field data, review of on-site photography points, streamflow calculations, and general planning. The field component included identifying and accurately mapping all watercourses, wet areas, and wetlands located downstream of the cultivation areas, associated facilities, and all appurtenant roads accessing such areas. An accurate location of the Waters of the State is necessary to make an assessment of whether potential and existing erosion sites/pollution sites have the potential to discharge waste to an area that could affect waters of the State (including groundwater). Next, all cultivation areas, associated facilities, and all appurtenant roads accessing such areas were assessed for discharges and related controllable water quality factors from the activities listed in Order R1-2015-0023, Finding 4a-j. The field assessment also included an evaluation and determination of compliance with the Standard Conditions per Provision I.B of Order No. R1-2015-0023. The Water Resource Protection Plans required under Tier 2 are meant to describe the specific measures a discharger implements to achieve compliance with standard conditions. Therefore, all required components of the water resource protection plan per Provision I.B of Order No. R1-2015-0023 were physically inspected and evaluated. A comprehensive summary of each Standard Condition as it relates to the subject property is appended.

Property Description

The property assessed is approximately 46 acres, located in Section 6, T4S, R2E, Humboldt Base & Meridian, Humboldt County from the Ettersburg 7.5' USGS Quad Map. The property is located approximately 1-mile northwest of Ettersburg, California, and is accessed by Dutyville Road. The property has a southwest facing aspect with an elevation range of approximately 600' to 1,240' above sea level. The project area contains unnamed tributaries to Blue Side Creek and the Mattole River.

Project Description

There is currently one cultivation area located on the property. Cultivation Area A is approximately 21,770 sq. ft. and consists of potted plants within greenhouses on a graded flat. Total cultivation area on the property is approximately 21,770 sq. ft. All water used for irrigation and domestic uses is derived from three surface water diversions located on the property via a finalized agreement with California Department of Fish & Wildlife (CDFW). (Notification #1600-2017-0156-R1)

Monitoring Plan

Tier 2 Dischargers shall include a monitoring element in the Water Resource Protection Plan that at a minimum provides for periodic inspection of the site, checklist to confirm placement and efficacy of management measures, and document progress on any plan elements subject to a time schedule. Tier 2 Dischargers shall submit an annual report (Appendix C) by March 31 of each year that documents implementation and effectiveness of management measures during the previous year. Tier 2 annual reporting is a function that may be provided through an approved third-party program.

Monitoring of the site includes visual inspection and photographic documentation of each feature of interest listed on the site map, with new photographic documentation recorded with any notable changes to the feature of interest. At a minimum, all site features must be monitored annually, to provide the basis for completion of the annual re-certification process. Additionally, sites shall be monitored at the following times to ensure timely identification of changed site conditions and to determine whether implementation of additional management measures is necessary to iteratively prevent, minimize, and mitigate discharges of waste to surface water: 1) just prior to October 15 to evaluate site preparedness for storm events and storm water runoff, 2) following the accumulation of 3" total precipitation or by November 15, whichever is sooner, and 3) following any rainfall event with an intensity of 3" precipitation in 24 hours. Precipitation data can be obtained from the National Weather Service Forecast Office (e.g. by entering the zip code of the parcel location at <http://www.srh.noaa.gov/forecast>).

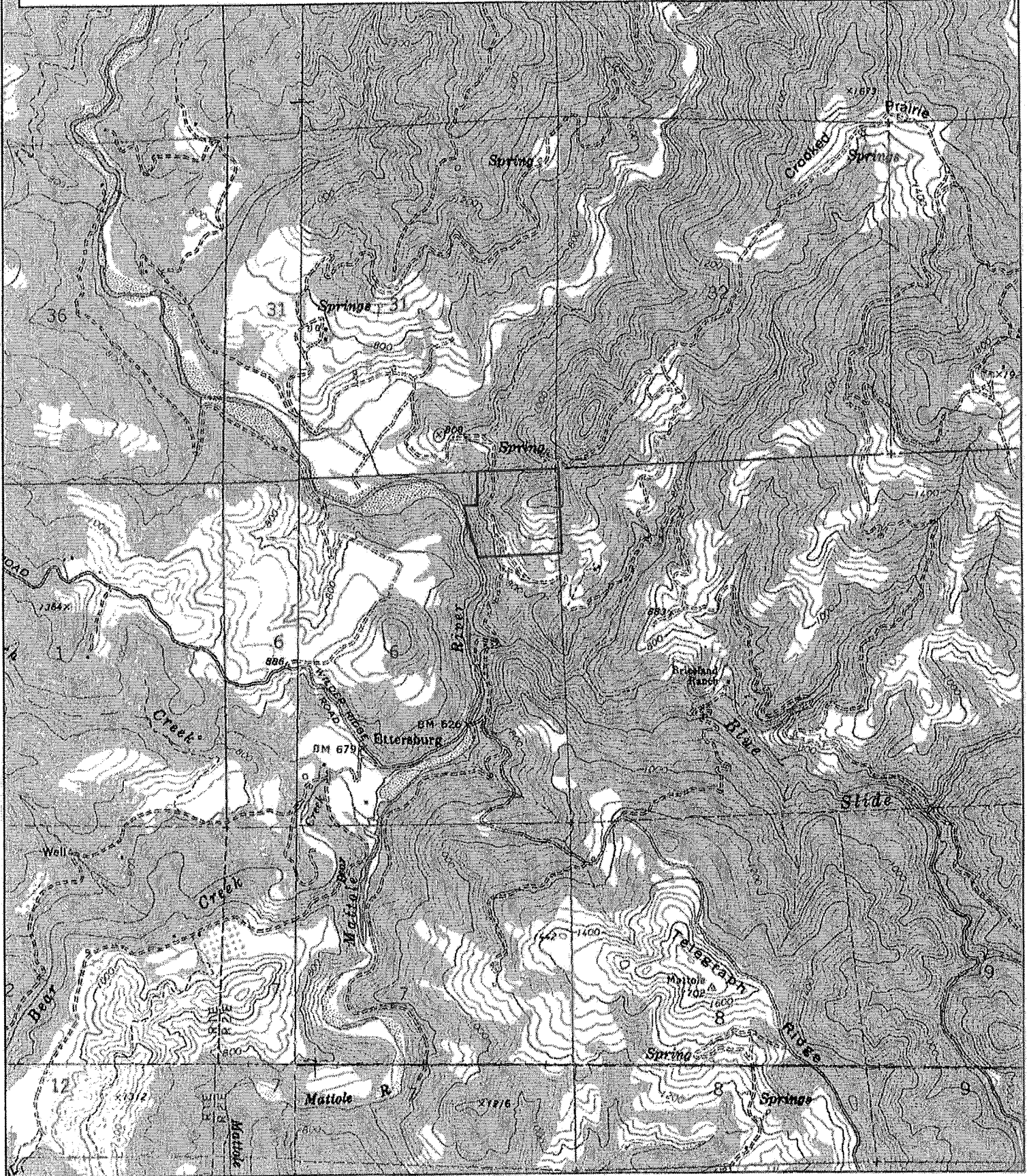
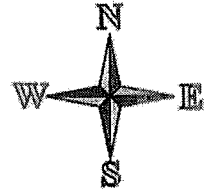
Monitoring Plan Reporting Requirements

Order No. R1-2015-0023, Appendix C must be submitted to the Regional Water Board or approved third party program upon initial enrollment in the Order (NOI) and annually thereafter by March 31. Forms submitted to the Regional Water Board shall be submitted electronically to northcoast@waterboards.ca.gov. If electronic submission is infeasible, hard copies can be submitted to: North Coast Regional Water Quality Control Board, 5550 Skylane Boulevard, Suite A, Santa Rosa, CA 95403.

**Water Resource Protection Plan
General Location Map [WDID: 1B171719CHUM]**

— Property Boundary

Located in Section 6, T4S, R2E, Humboldt Base & Meridian, Humboldt County from the Ettersburg 7.5' USGS Quad Map.
Map Scale 1" = 2,000'
Map Date 5/26/2018



Assessment of the Standard Conditions

Assessment of Standard Conditions consisted of field examinations in the fall and winter of 2017. The examination evaluated areas near, and areas with the potential to directly impact, watercourses for sensitive conditions including, but not limited to, existing and proposed roads, skid trails and landings, unstable and erodible watercourse banks, unstable upslope areas, debris, jam potential, inadequate flow capacity, changeable channels, overflow channels, flood prone areas, and riparian zones. Field examinations also evaluated all roads and trails on the property, developed areas, cultivation sites, and any structures and facilities appurtenant to cultivation on the property. Anywhere the Standard Conditions are not met on the property, descriptions of the assessments and the prescribed treatments are outlined following each associated section below.

Summary of Standard Conditions Compliance

1. Site Maintenance, Erosion Control, and Drainage Features Y/N
2. Stream Crossing Maintenance Y/N
3. Riparian and Wetland Protection and Management Y/N
4. Spoils Management Y/N
5. Water Storage and Use Y/N
6. Irrigation Runoff Y/N
7. Fertilizers and Soil Amendments Y/N
8. Pesticides and Herbicides Y/N
9. Petroleum Products and other Chemicals Y/N
10. Cultivation-Related Wastes Y/N
11. Refuse and Human Waste Y/N

1. Site Maintenance, Erosion Control, and Drainage Features

Roads are being classified as "permanent" (being used year-round), and "seasonal" (being used primarily during summer months).

Permanent roads consist of a main access road to the residence and Cultivation Area A. Permanent roads are adequately surfaced with imported rock and in acceptable condition but with signs of concentrated surface runoff in several locations. Seasonal roads consist of access roads to the cultivation area and water infrastructure. Seasonal roads are adequately surfaced but show signs of concentrated surface runoff in two locations.

No unstable areas, nor evidence of the potential of road/surface related runoff to create unstable areas, was noted during the assessment of the property. Stockpiled construction materials are stored in locations that cannot be transported to receiving waters.

Summary of Standard Conditions Compliance (Cont.)

During inspection of the roads, cultivation areas, and watercourses, seven sites were identified where road surface runoff was not being adequately dispersed, drained, and/or erosion of the road surface was occurring. These sites require the installation or maintenance of drainage features. Further details can be found in the Mitigation Report to follow.

Cultivation Area A is located on a graded pad with slopes of less than 5% and adjoining natural hillslopes varying between 27% to 40%. Surrounding the cultivation area is timberland and savanna grassland with the nearest surface waters being a Class III watercourse approximately 60 feet to the northeast. No drainage or erosion issues were observed within the cultivation area or the graded pad it is on.

However, in the past there have been fillslope slumps and settling movements at Site 16. The section of fillslope at Site 16 was not treated with erosion control measures besides seeding, mulching, and the use of the berm along the edge of the landing. The rest of the fillslope of the landing was treated with erosion control measures including seeding, mulching, staked wattles, jute netting and the installation of the berm along the edge of the landing. The berm is preventing runoff from draining over the edge of the landing and encourages runoff to drain off of the landing via a french drain system installed around and in-between the greenhouses. This french drain system collects and drains into a 12-inch corrugated plastic pipe at Site 18 which drains into a Class III watercourse. Another issue at Site 18 is that a permanent road is located directly adjacent to a Class III watercourse for approximately 40-feet, with the cultivation area's parking area and a seasonal road located upgrade of the permanent road. Further details can be found in the Mitigation Report to follow.

2. Stream Crossing Maintenance

There are three stream crossings located on the property. All of the crossings have existing drainage structures or facilities and require either the installation, replacement, or modification of the existing drainage structure or facility. Further details can be found in the Mitigation Report to follow.

A Lake and Streambed Alteration Agreement with the California Department of Fish and Wildlife has been finalized for the replacement or installation of culverts and drainage facilities in watercourses. (Notification #1600-2017-0156-R1). Any additional guidelines, treatments, or restrictions set forth under the finalized Lake and Stream Agreement shall be followed.

ID#	Existing Culvert (D) Diameter (in)	Headwall (HW) Height (in)	HW/D (ratio)	Selected Discharge Method	Q100 (cfs)	Culvert Capacity (cfs)	Culvert is Undersized	Recommended Culvert Dia. (in)	Recommendation Based On
Site 04	18	0	0.0	RATIONAL	2	6		18	Q100
Site 06	12	0	0.0	RATIONAL	5	0	TRUE	18	Q100
Site 09	12	0	0.0	RATIONAL	8	0	TRUE	24	Q100

Summary of Standard Conditions Compliance (Cont.)

3. Riparian and Wetland Protection and Management

Assessment of the property concluded that cultivation areas are not located or occurring within 100' of any Class I or II watercourse or within 50' of any Class III watercourse or wetland, buffers maintain natural slopes with native vegetation, and buffers are of sufficient width to filter wastes from runoff discharging from production lands and associated facilities to all wetlands, streams, drainage ditches, or other conveyances.

However, per consultation and agreement with CDFW by the discharger, all of the water storage tanks and fertilizers mixing tanks associated with the Points of Diversions located along the Class III watercourse above Site 19 shall be removed and relocated to another location at least 50-feet from any Class III watercourse or 100-feet from any Class II watercourse.

4. Spoils Management

Currently, spoils are stored or placed in or where they can enter surface waters. A cultivation-related spoils pile is located at Site 14 where concentrated runoff from the cultivation area is draining along the edge and around the toe of the spoils pile. This concentrated runoff eventually disperses into a grass hillside downslope of Site 14. A cultivation-related spoils pile is also located at Site 20, where the spoils are being stored alongside a french drain system that drains into a watercourse. Further details can be found in the Mitigation Report to follow.

Any/all spoils shall be adequately contained or stabilized to prevent sediment delivery to surface waters. Any/all spoils generated through development or maintenance of roads, driveways, earthen fill pads, or other cleared or filled areas have not been sidecast in any location where they can enter or be transported to surface waters.

If any further spoiling material is required, such as from stream crossing installation or other grading, the discharger shall follow the BMPs in Appendix B of the Order, under Spoil Management. Spoil sites shall be located outside any standard width riparian area (50' for Class III and 100' for Class III) and shall be stabilized and contained as per the BMPs.

5. Water Storage and Use

All water used for irrigation and domestic uses is derived from three surface water diversions located on the property via a finalized agreement with California Department of Fish & Wildlife. (Notification #1600-2017-0156-R1)

Diversion intake infrastructure at Point of Diversion 1 consists of a screened 1-inch poly-pipe placed in a Class III watercourse. The poly-pipe conveys water to several water storage tanks downstream which are all located within the riparian buffer area of the watercourse. Because this watercourse dries up in late spring the diversion has been historically used for diversion to storage in the winter months.

Summary of Standard Conditions Compliance (Cont.)

6. Irrigation Runoff

During multiple visits to the property, no irrigation runoff, or evidence of such runoff, was observed at any of the cultivation sites.

7. Fertilizers and Soil Amendments

Liquid fertilizers and subsequent mixing tanks were found stored in an inadequate location directly on the banks of a Class III watercourse downstream from Point of Diversion 1, at Site 19. Further details can be found in the Mitigation Report to follow.

The discharger shall ensure that fertilizers, potting soils, compost, and other soils and soil amendments are stored in structures on the property in a manner in which they will not enter or be transported into surface waters and so that nutrients or other pollutants will not be leached into groundwater. Soil and amendment piles shall be either used or contained with staked wattles or earthen berms, yearly, prior to the wet season. Fertilizers and soil amendments shall be applied and used per the manufacturers guidelines.

8. Pesticides and Herbicides

Pesticides and fungicides are adequately stored alongside other fertilizers and soil amendments storage structures adjacent to the residence. The discharger shall ensure that all pesticide and herbicide products on the property are currently used, and stored in closed structures, to ensure that they do not enter or are released into surface or ground waters and that the use of pesticide products is consistent with product labeling.

9. Petroleum Products and Other Chemicals

Currently, there is bulk fuel storage present on the property. Two 500-gallon fuel tanks are located at Site 17. Currently they do not have adequate containment and cover over the secondary containment from precipitation. There are also sealed 5-gallon buckets of oil stored alongside the generator outside. Small quantities of fuel are also adequately stored in canisters within the structures adjacent to the residence, alongside fertilizers and soil amendments. Further details can be found in the Mitigation Report to follow.

All bulk fuel storage or petroleum products, any/all future petroleum products and other liquid chemicals, including but not limited to diesel, biodiesel, gasoline, and oils shall be stored so as to prevent their spillage, discharge, or seepage into receiving waters. Storage tanks and containers shall be of suitable material and construction to be compatible with the substance(s) stored and conditions of storage such as pressure and temperature. Above ground storage tanks and containers shall be provided with a secondary means of containment for the entire capacity of the largest single container and sufficient cover shall be provided to prevent any/all precipitation from entering said secondary containment vessel. Dischargers shall ensure that diked areas are sufficiently impervious to contain discharged chemicals. Discharger(s) shall implement spill prevention, control, and countermeasures (SPCC) and have appropriate cleanup materials available onsite if the volume of a fuel container is greater than 1,300 gallons. Underground storage tanks 110 gallons and larger shall be registered with the appropriate County Health Department and comply with State and local requirements for leak detection, spill overflow, corrosion protection, and insurance coverage.

Summary of Standard Conditions Compliance (Cont.)

10. Cultivation-Related Wastes

Organic cultivation-related wastes are collected from the cultivation areas and composted or burned in the winter. No organic cultivation-related wastes are stored or discarded in a location where these wastes can enter surface waters.

Non-organic cultivation-related wastes are stored in lidded trashcans and garbage bags adjacent to or in the residence, sheds, and cultivation areas and are disposed of regularly. However, non-organic cultivation related wastes are stored and have been discarded along a Class III watercourse at Site 18. Further details can be found in the Mitigation Report to follow. The discharger shall gather and dispose of these wastes and ensure that future wastes are properly, and immediately, contained from scavenging wildlife, concentrated runoff transporting the wastes, and/or from being windblown.

11. Refuse and Human Waste

Garbage and refuse is stored on the property within lidded trash cans and garbage bags and hauled away to a landfill transfer station periodically. However, refuse has been discarded and windblown around Site 18 where these wastes can enter surface waters. The discharger shall gather and dispose of these wastes and ensure that future wastes are properly, and immediately, contained from scavenging wildlife, concentrated runoff transporting the wastes, and/or from being windblown.

Human waste is managed by a septic system attached to the residence. It is the discharger's responsibility to ensure compliance of such action with the Humboldt County Department of Environmental Health and Human Services.

Summary of Standard Conditions Compliance (Cont.)

12. Remediation/Clean-up/Restoration

Currently, nine of the Standard Conditions are not being met; Site Maintenance, Erosion Control, and Drainage Features, Stream Crossing Maintenance, Riparian and Wetland Protection and Management, Spoils Management, Water Storage and Use, Fertilizers and Soil Amendments, Petroleum Products and Other Chemicals, Cultivation-Related Wastes, and Refuse and Human Waste. Sites will be treated in accordance with regulations, following approval of any and/or all necessary permits, and done in accordance with the BMP's listed in Appendix B of the Order and those included in this WRPP. Additionally, several other general recommendations have been made as follows:

General Recommendations

- Fertilizer, soil amendments, and pesticide use is to be recorded in such a manner that cumulative annual totals are recorded for annual reporting.
- Water use shall be designed and metered such that water used for the irrigation of cannabis will be recorded separately from domestic use. Water use for the irrigation of cannabis is to be recorded monthly for annual reporting.
- Frequent use of un-surfaced roads should be avoided, particularly when road surfaces are soft/saturated.
- All culverts should be inspected regularly during the winter months to check for plugging, blockage, or other issues.
- Existing or newly installed road surface drainage structures such as water bars, rolling dips, ditch relief culverts, and intentionally in/out-sloped segments of road shall be maintained to ensure continued function of capturing and draining surface runoff.
- Utilize spill trays when fueling portable generators or water pumps to prevent the potential for leeching, seepage or spillage.

Interim Measures

- Site 01: Interim measure: Clear the inside ditch of fill material as flagged in the field. Seed and mulch and apply jute netting to the failed cutbank and fillslope.
- Site 08: Clear the inlet of vegetation and debris.
- Site 11: Clear the inlet of vegetation and debris.
- Site 18: Install staked wattles along the edge of the road, above the outlet of the french drain culvert, for at least 20 feet on either side of the outlet.
- Site 19: Remove all fertilizers that are in-use, or stored by the mixing tanks, from the mixing tank area and move them to approximately 50-feet away from the watercourse or store them in structures on the property while they are not being used, returning them immediately to their storage location once they have been used. Remove all refuse and cultivation-related wastes within or alongside the watercourse down or upstream from this location.

STATEMENT OF CONTINGENT AND LIMITING CONDITIONS CONCERNING THE PREPARATION AND USE OF WATER RESOURCE PROTECTION PLAN

Prepared by Timberland Resource Consultants

1. This Water Resource Protection Plan has been prepared for the property within APN 221-201-007 in Humboldt County, at the request of the Client.
2. Timberland Resource Consultants does not assume any liability for the use or misuse of the information in this Water Resource Protection Plan.
3. The information is based upon conditions apparent to Timberland Resource Consultants at the time the inspection was conducted. Changes due to land use activities or environmental factors occurring after this inspection have not been considered in this Water Resource Protection Plan.
4. Maps, photos, and any other graphical information presented in this report are for illustrative purposes. Their scales are approximate, and they are not to be used for locating and establishing boundary lines.
5. The conditions presented in this Water Resource Protection Plan may differ from those made by others or from changes on the property occurring after the inspection was conducted. Timberland Resource Consultants does not guarantee this work against such differences.
6. Timberland Resource Consultants did not conduct an investigation on a legal survey of the property.
7. Persons using this Water Resource Protection Plan are advised to contact Timberland Resource Consultants prior to such use.
8. Timberland Resource Consultants will not discuss this report or reproduce it for anyone other than the Client named in this report without authorization from the Client.



Forrest Hansen

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**Water Resource Protection Plan
Site Map [WDID: 1B171719CHUM]**

Property Boundary

Sites

Cultivation

Watercourses

Class I (Mattole River)

Class II

Class III

Roads

Crooked Prairie Road

Dootyville Road

Permanent

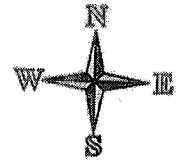
Seasonal

Point of Diversion (POD)

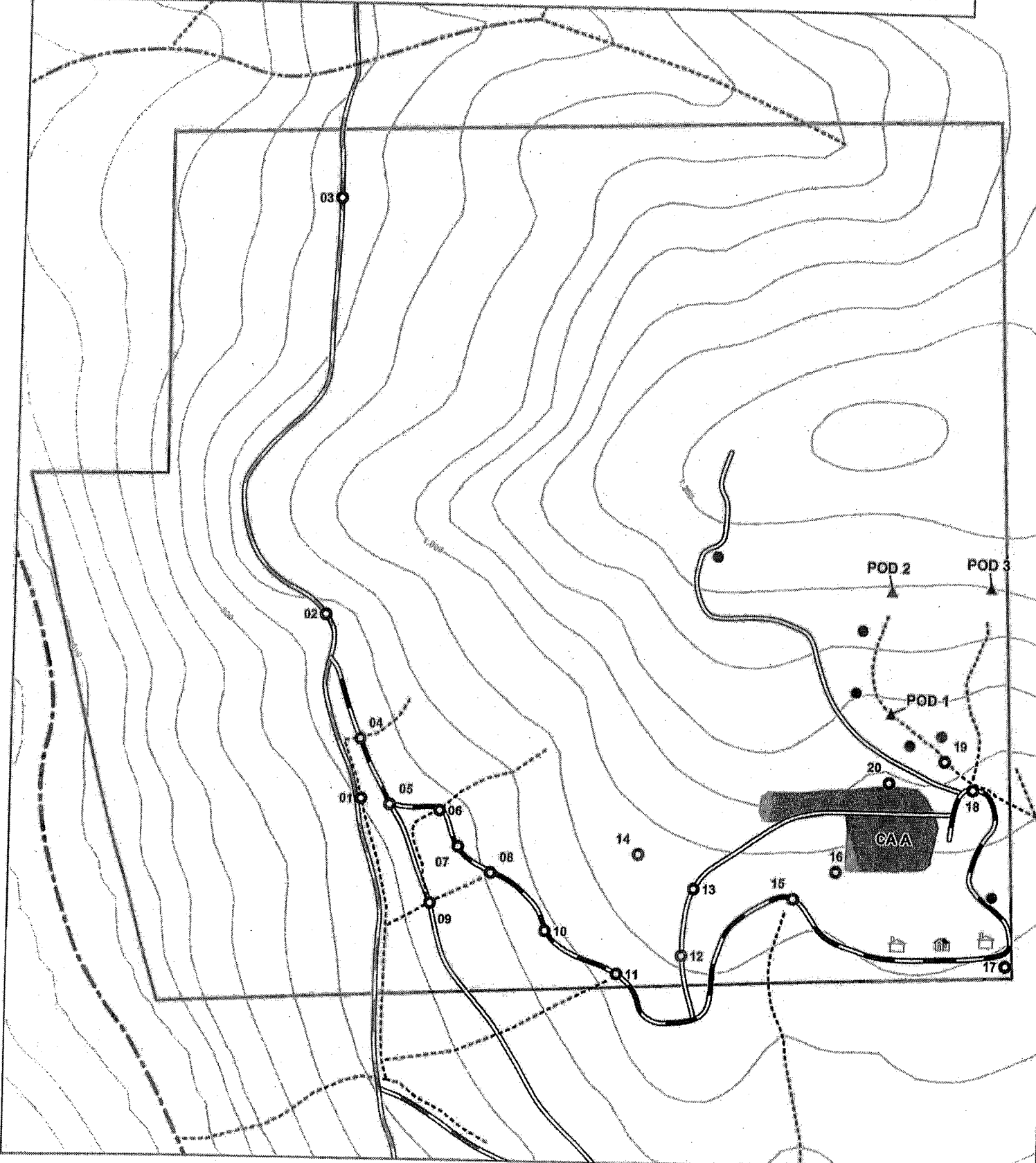
Water storage tanks

Garage/Shed

Residence



40' contour intervals
Map Scale 1" = 200'
Map Date 5/25/2018



**Water Resource Protection Plan
Site Map [WDID: 1B171719CHUM]**

----- Property Boundary

○ Sites

■ Cultivation

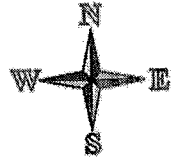
Watercourses

- ==== Class I (Mattole River)
- Class II
- Class III

Roads

- ==== Crooked Prairie Road
- ==== Dootyville Road
- ==== Permanent
- ==== Seasonal

- ▲ Point of Diversion (POD)
- Water storage tanks
- Garage/Shed
- 🏠 Residence



2016 NAIP DOQ
Map Scale 1" = 200'
Map Date 5/25/2018





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WRPP - Mitigation Report

WDID# - 1B171719CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
1	-123.989952 40.147713	Permanent	X	X	-	A.1.	Prior to 10/15/18	

Current Condition: Concentrated road surface runoff is draining over the cutbank and fillslope between roads. This runoff caused the saturation and failure of the cutbank and fillslope. The fill from this failure has plugged the inside ditch and remains in the inside ditch.

Prescribed Action: Interim measure: Clear the inside ditch of fill material as flagged in the field. Seed and mulch and apply jute netting to the failed cutbank and fillslope.
Permanent measures: See Sites 05 & 07.

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
2	-123.990191 40.148497	Permanent	X	X	-	A.1.	Prior to 10/15/19	

Current Condition: Long undrained inside ditch without any drainage feature.

Prescribed Action: Install an 18-inch diameter culvert per attached specifications.

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
3	-123.990198 40.150277	Permanent	X	X	-	A.1.	Prior to 10/15/19	

Current Condition: Long undrained inside ditch without any drainage feature.

Prescribed Action: Install an 18-inch diameter culvert per attached specifications.

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
4	-123.989969 40.147969	Permanent	X	X	X	A.2.	Prior to 10/15/19	

Current Condition: Class III watercourse crossing consisting of an 18-inch diameter corrugated metal culvert. The culvert is adequately sized but is shot gunned and eroding at the outlet.

Prescribed Action: Rock armor the outlet per attached specifications.

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
5	-123.989788 40.14769	Permanent	X	X	-	A.1.	Prior to 10/15/19	

Current Condition: Concentrated road surface runoff is draining onto a fillslope and cutbank in-between the two roads, resulting in their failure into an inside ditch.

Prescribed Action: Install an inside ditch from the inlet of the watercourse crossing at Site 04 to the gate up grade of Site 05. Inslope the road into the inside ditch from Site 04 to the gate up grade of Site 05.



WRPP - Mitigation Report

WDID# - 1B1719CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
6	-123.98951 40.147671	Permanent	X	X	X	A.2.	Prior to 10/15/19	
<p>Current Condition: Class III watercourse crossing consisting of a 12-inch corrugated metal pipe. The culvert is undersized, shot gunned, and is eroding at the outlet. Concentrated road surface runoff is also not being captured by the inside ditch, resulting in erosion of the road pad at this Site and the cutbank and fillslope failure at Site 05. The outlet of this watercourse crossing is also draining alongside and down the road downslope of the outlet into the outlet of the watercourse crossing at Site 09. Causing further erosion of the road pad and fillslope of the watercourse crossing at Site 09.</p>						<p>Prescribed Action: Install a 24-inch diameter culvert per attached specifications. Install an inside ditch to the rocked rolling dip to be installed upgrade at Site 07. Inslope the road into the inside ditch upgrade to the rocked rolling dip.</p>		
7	-123.9894 40.147518	Seasonal	X	X	-	A.1.	Prior to 10/15/19	
<p>Current Condition: Concentrated road surface runoff is not being captured by an inside ditch that has filled with road fill, resulting in erosion of the road pad further downgrade and causing a cutbank and fillslope failure at Site 01.</p>						<p>Prescribed Action: Install a rocked rolling dip that drains into the inside ditch per attached specifications.</p>		
8	-123.989216 40.14741	Seasonal	X	X	-	A.1.	Prior to 10/15/19	
<p>Current Condition: Ditch relief culvert consisting of a 12-inch corrugated metal pipe. The culvert inlet is blocked with vegetation and debris, the outlet is shot gunned and eroding, and the inside ditch draining to the inlet has filled with road fill. Concentrated road surface runoff is not being captured by the inside ditch resulting in the erosion of the road pad.</p>						<p>Prescribed Action: Interim measures: Clear the inlet of vegetation and debris. Permanent measures: Rock armor the inlet and outlet per attached specifications. Install an inside ditch to the rocked rolling dip to be installed at Site 10. Inslope the road into the inside ditch to the rocked rolling dip.</p>		
9	-123.989545 40.147273	Seasonal	X	X	X	A.2.	Prior to 10/15/20	
<p>Current Condition: Watercourse crossing consisting of a 12-inch corrugated metal pipe. The culvert is undersized, plugged, shot gunned, and has failed with flows combining with flows from the watercourse connected to the crossing at Site 06, resulting in the erosion and downcutting of the crossing's fills prism.</p>						<p>Prescribed Action: Upgrade the existing culvert with a 24-inch diameter culvert per attached specifications. Install a rock lined drainage ditch that drains to the inlet of culvert at this site to the outlet of the watercourse crossing at Site 06, as flagged in the field and per the description in the Lake and Stream Alteration Agreement with CDFW.</p>		



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WRPP - Mitigation Report

WDOI# - 1B171719CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
10	-123.988903 40.147168	Permanent	X	X	-	A.1.	Prior to 10/15/19	
Current Condition: Concentrated road surface runoff is bypassing and inside ditch and eroding the road pad.						Prescribed Action: Install a rocked rolling dip that drains into the inside ditch per attached specifications.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
11	-123.988495 40.146994	Permanent	X	X	-	A.1.	Interim measures immediately; Mitigation measures prior to 10/15/19 pending the approval of any required permits	
Current Condition: Ditch relief culvert consisting of a 12-inch corrugated metal pipe. The inside draining to inlet has filled with road fill and vegetation and jumps onto the road. Ditch flows either drain over the edge of the road or continue down the road pad resulting in erosion of the road pad.						Prescribed Action: Interim measures: Clear the inlet of vegetation and debris. Permanent measures: Rock armor the inlet and outlet per attached specifications. Install an inside ditch and inslope the road into the inside ditch.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
12	-123.988138 40.14708	Seasonal	X	X	-	A.1.	Annually prior to 10/15	
Current Condition: Concentrated road surface runoff is eroding the road pad.						Prescribed Action: Interim measures: Install a waterbar per attached specifications.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
13	-123.988083 40.147367	Seasonal	X	X	-	A.1.	Annually prior to 10/15	
Current Condition: Concentrated road surface runoff is eroding the road pad.						Prescribed Action: Interim measures: Install a waterbar per attached specifications.		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
14	-123.988399 40.147507	-	X	X	-	A.4.	Prior to 10/15/19	
Current Condition: A drainage ditch coming from the cultivation area is draining laterally alongside and around the toe of a large cultivation-related soil spoils pile. The flows from the drainage ditch are beginning to erode away at the soil spoils pile and transport soils and perlite away from the pile into the grassy hillside downslope, possibly reaching the road below and draining into a Class III watercourse at Site 06 or 08.						Prescribed Action: Remove the cultivation-related soil spoils from the flow path of the runoff channel. Pull the spoils approximately 5-foot away from the concentrated runoff. Install staked wattles around the downslope edges of the spoils pile, in-between the spoils and the concentrated runoff channel. Seed and mulch in-between the staked wattles and the runoff channel to create a filter strip of vegetation.		



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Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1500	Standard Conditions	Treatment Priority	Date Completed
15	-123.987531 40.147336	Permanent	X	X	-	A.1.	Prior to 10/15/19	
<p>Current Condition: Ditch relief culvert consisting of a 12-inch corrugated metal pipe. The culvert inlet is blocked with vegetation and debris and the outlet is shot gunned and eroding.</p>						<p>Prescribed Action: Interim measures: Clear the inlet of vegetation and debris. Permanent measures: Rock armor the inlet and outlet per attached specifications.</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
16	-123.9873 40.147458	-	X	X	-	A.1.	Prior to 10/15/19	
<p>Current Condition: The fillslope of the landing at this location is lacking erosion control measures and has failed due to runoff from the cultivation area draining over the fillslope. The discharger has installed a berm along the entire edge of the graded pad and a french drain system to drain runoff away from the fillslope. However, failed sections of the fillslope lack erosion control measures, that were used elsewhere on the landing such as jute netting and wattles, and are continuing to erode.</p>						<p>Prescribed Action: Install jute netting on the fillslope where jute netting and staked wattles have not been installed and erosion of the fillslope is occurring. Apply straw and grass seed underneath the jute netting to promote vegetation growth.</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
17	-123.986336 40.147082	-	X	X	-	A.9.	Immediately	
<p>Current Condition: Two 500-gallon fuel tanks do not have secondary containment or cover over the secondary containment from precipitation. Also, across the road from Site 17 is a generator with several 5-gallon buckets of used motor oil without containment.</p>						<p>Prescribed Action: Obtain secondary containment for both fuel tanks, equal in volume to the fuel stored in both tanks. Install cover over the fuel tanks from precipitation so that the secondary tanks do not fill with rainwater. Store the buckets of un-used and used motor oil within their own secondary containment consisting of plastic totes or within the secondary containment used for the fuel tanks.</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
18	-123.98655 40.147831	Permanent	X	X	-	A.1.	Interim measures Immediately; Mitigation measures prior to 10/15/19 pending the approval of any required permits	
<p>Current Condition: French drain outlet consisting of a 12-inch corrugated plastic pipe. The outlet has been placed into a Class III watercourse and the adjacent road shoulder runs directly along the watercourse for approximately 40 feet. The road shoulder around french drain outlet, for approximately 15 feet, is uncompacted and in or along the watercourse. This uncompacted road shoulder lacks rock armoring and is exposed to watercourse flows. The road shoulder will be eroded away by the watercourse, from runoff coming from the adjacent and upslope roads, and the cultivation area's parking area.</p>						<p>Prescribed Action: Interim measure: Install staked wattles along the edge of the road, above the outlet of the french drain outlet, for approximately 20 feet on either side of the outlet. Permanent measure: Rock armor the french drain outlet per attached ditch relief culvert specifications. Apply rock armoring to the entire shoulder of the road along and in the watercourse, approximately 10 feet on either side of the outlet. Apply rock surfacing to exposed ground in the parking area up grade of this site, along the eastern side of the greenhouses, and apply 30 feet of rock surfacing to the seasonal road to the northwest of this site in the direction of the Points of Diversion.</p>		



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Resource
Consultants

WRPP - Mitigation Report

WDID# - 1B171719CHUM

Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
19	-123.986713 40.147949	-	X	X	-	A.3., A.7., A.10.	Interim measures immediately; Mitigation measures prior to 10/15/19 pending the approval of any required permits	
<p>Current Condition: Fertilizers, and their subsequent mixing tanks, were found stored and in-use in an inadequate location directly on the banks of a Class III watercourse. Refuse has also been discarded or windblown into the watercourse and there is a large amount of cultivation-related materials stored directly along side the watercourse.</p>						<p>Prescribed Action: Interim measures: Remove all fertilizers that are in-use, or stored by the mixing tanks, from the mixing tank area and move them to approximately 50-feet away from the watercourse or store them in structures on the property while they are not being used, returning them immediately to their storage location once they have been used. Remove all refuse and cultivation-related wastes within or alongside the watercourse down or upstream from this location. Permanent measures: All fertilizer mixing tanks, located along the Class III watercourse at Site 19, shall be removed and relocated to another location at least 50-feet from any Class III watercourse or 100-feet from any Class II watercourse.</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
20	-123.987017 40.147849	-	X	X	-	A.4.	Annually prior to 10/15	
<p>Current Condition: Cultivation-related soil spoils are being stored alongside a french drain system that drains into a watercourse.</p>						<p>Prescribed Action: Install a staked wattle or a earthen berm along the entire toe of the cultivation-related soil spoils pile that connects up to the cutbank on either side of the pile.</p>		
Unique Point	Lat-Long NAD 83	Road Type	Mitigation Planned	Monitor	1600	Standard Conditions	Treatment Priority	Date Completed
POD 1, 2, & Site 19	-123.9870198 40.1481421	-	X	X	-	A.3.	Prior to 10/15/19	
<p>Current Condition: Numerous water storage tanks and a fertilizer tank is located within the riparian buffer area or directly adjacent to a Class III watercourse.</p>						<p>Prescribed Action: All of the water storage tanks associated with the Points of Diversions, and the fertilizer mixing tanks, located along the Class III watercourse above Site 19 shall be removed and relocated to another location at least 50-feet from any Class III watercourse or 100-feet from any Class II watercourse.</p>		

BMP: General BMPs

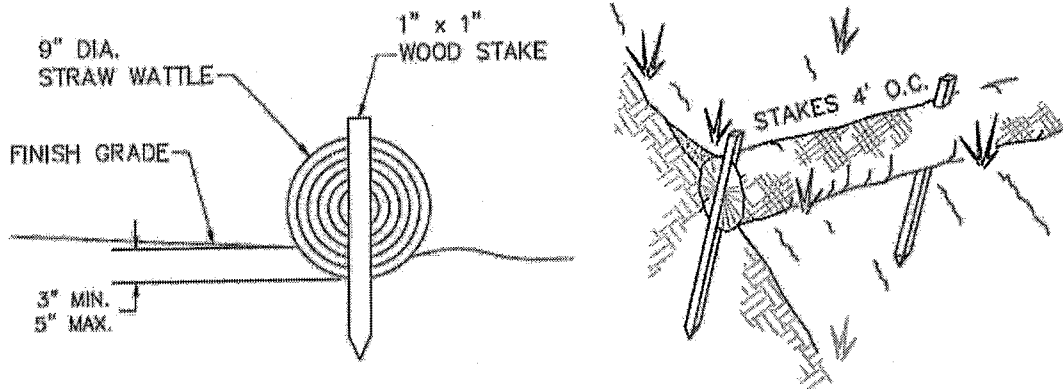
- If operations require moving of equipment across a flowing stream, such operations shall be conducted without causing a prolonged visible increase in stream turbidity. For repeated crossings, the operator shall install a bridge, culvert, or rock-lined crossing.
- During construction in flowing water, which can transport sediment downstream, the flow shall be diverted around the work area by pipe, pumping, temporary diversion channel or other suitable means. When any dam or artificial obstruction is being constructed, maintained, or placed in operation, sufficient water shall at all times be allowed to pass downstream to maintain fish life below the dam. Equipment may be operated in the channel of flowing live streams only as necessary to construct the described construction.
- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. The disturbed portion of any stream channel shall be restored to as near their original condition as possible. Restoration shall include the mulching of stripped or exposed dirt areas at crossing sites prior to the end of the work period.
- Structures and associated materials not designed to withstand high seasonal flow shall be removed to areas above the high-water mark before such flows occur.
- No debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete washing, oil or petroleum products, or other organic or earthen material from any logging, construction, or associated activity of whatever nature shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into waters of the State. When operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the high-water mark of any stream.

BMP: General Erosion Control

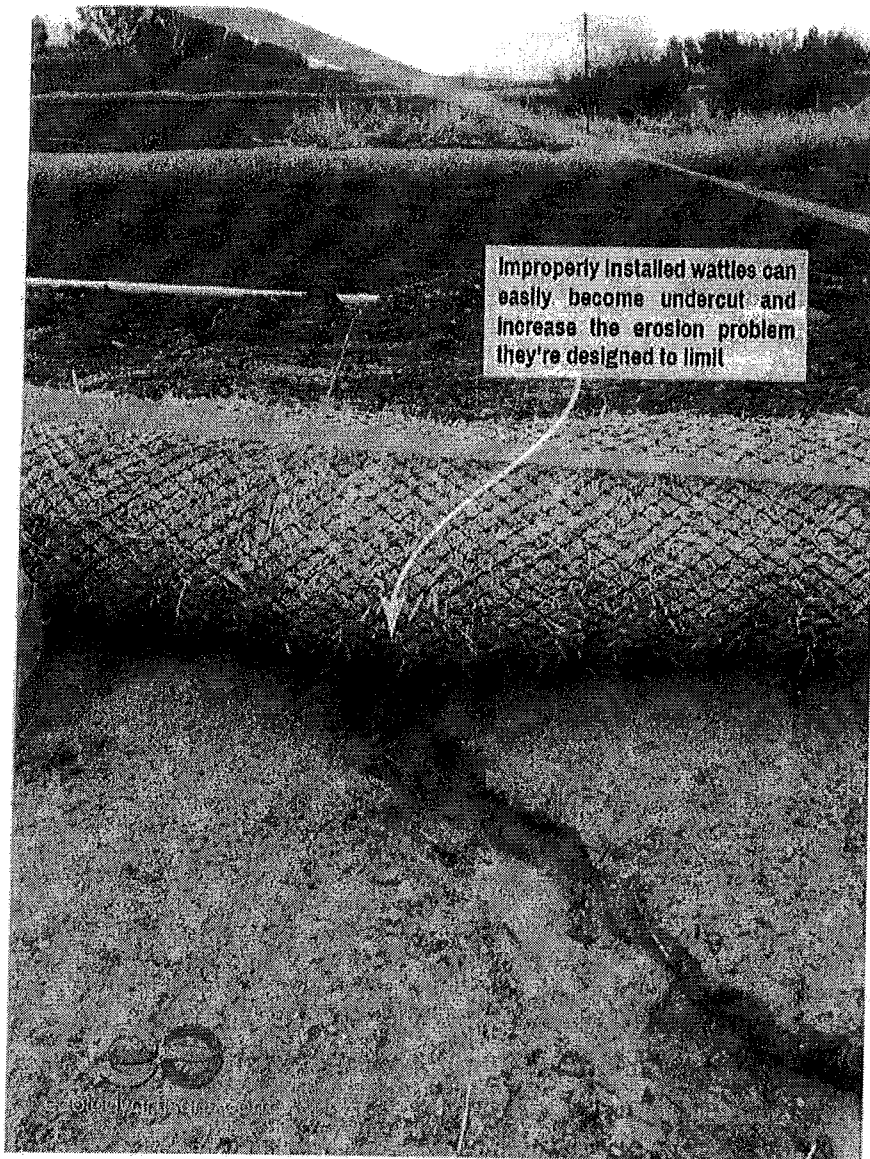
- Timing for soil stabilization measures within the 100 feet of a watercourse or lake: For areas disturbed from May 1 through October 15, treatment shall be completed prior to the start of any rain that causes overland flow across or along the disturbed surface. For areas disturbed from October 16 through April 30, treatment shall be completed prior to any day for which a chance of rain of 30 percent or greater is forecast by the National Weather Service or within 10 days, whichever is earlier.
- Within 100 feet of a watercourse or lake, the traveled surface of logging roads shall be treated to prevent waterborne transport of sediment and concentration of runoff that results from operations. Treatment may consist of, but not limited to, rocking, out sloping, rolling dips, cross drains, water bars, slope stabilization measures, or other practices appropriate to site-specific conditions.
- The treatment for other disturbed areas within 100 feet of a watercourse or lake, including: (A) areas exceeding 100 contiguous square feet where operations have exposed bare soil, (B) approaches to road watercourse crossings out to 100 feet or the nearest drainage facility, whichever is farthest, (C) road cut banks and fills, and (D) any other area of disturbed soil that threatens to discharge sediment into waters in amounts deleterious to the quality and beneficial uses of water, shall be grass seeded and mulched with straw or fine slash. Grass seed shall be applied at a rate exceeding 100 pounds per acre. Straw mulch shall be applied in amounts sufficient to provide at least 2- 4-inch depth of straw with minimum 90% coverage. Slash may be substituted for straw mulch provided the depth, texture, and ground contact are equivalent to at least 2 – 4 inches of straw mulch. Any treated area that has been subject to reuse or has less than 90% surface cover shall be treated again prior to the end of operations.
- Within 100 feet of a watercourse or lake, where the undisturbed natural ground cover cannot effectively protect beneficial uses of water from operations, the ground shall be treated with slope stabilization measures described in #3 above per timing described in #1 above.
- Side cast or fill material extending more than 20 feet in slope distance from the outside edge of a landing which has access to a watercourse or lake shall be treated with slope stabilization measures described in #3 above. Timing shall occur per #1 above unless outside 100 feet of a watercourse or lake, in which completion date is October 15.
- All roads shall have drainage and/or drainage collection and storage facilities installed as soon as practical following operations and prior to either (1) the start of any rain which causes overland flow across or along the disturbed surface within 100 feet of a watercourse or lake protection, or (2) any day with a National Weather Service forecast of a chance of rain of 30 percent or more, a flash flood warning, or a flash flood watch.

BMP: General Erosion Control (Cont.)

- Erosion control and sediment detention devices and materials shall be incorporated into the cleanup/restoration work design and installed prior to the end of project work and before the beginning of the rainy season. Any continuing, approved project work conducted after October 15 shall have erosion control works completed up-to-date and daily.
- Erosion control materials shall be, at minimum, stored on-site at all times during approved project work between May 1 and October 15.
- Approved project work within the 5-year flood plain shall not begin until all temporary erosion controls (straw bales or silt fences that are effectively keyed-in) are installed downslope of cleanup/restoration activities.
- Non-invasive, non-persistent grass species (e.g., barley grass) may be used for their temporary erosion control benefits to stabilize disturbed slopes and prevent exposure of disturbed soils to rainfall.
- Upon work completion, all exposed soil present in and around the cleanup/restoration sites shall be stabilized within 7 days.
- Soils exposed by cleanup/restoration operations shall be seeded and mulched to prevent sediment runoff and transport.
- Straw Wattles (if used) shall be installed with 18 or 24-inch wood stakes at four feet on center. The ends of adjacent straw wattles shall be abutted to each other snugly or overlapped by six inches. Wattles shall be installed so that the wattle is in firm contact with the ground surface.



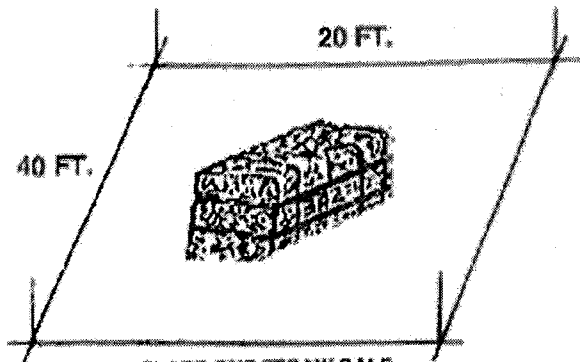
BMP: General Erosion Control (Cont.)



BMP: General Erosion Control (Cont.)

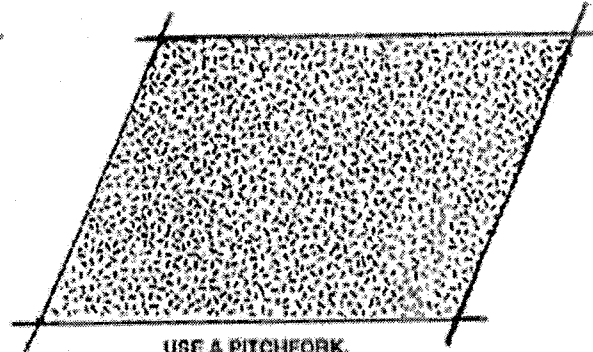
SPREAD THE STRAW

MARK OFF 800 SQ FT. PLOTS



PLACE ONE STRAW BALE PER PLOT (-74 POUNDS). THIS IS EQUIVALENT TO 2 TONS PER ACRE.

SPREAD EVENLY



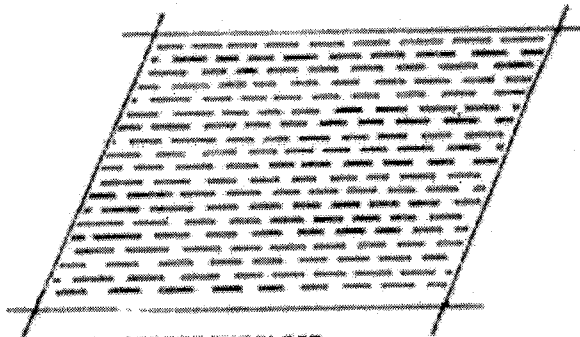
USE A PITCHFORK, SPADING FORK, OR BY HAND

ANCHOR THE STRAW

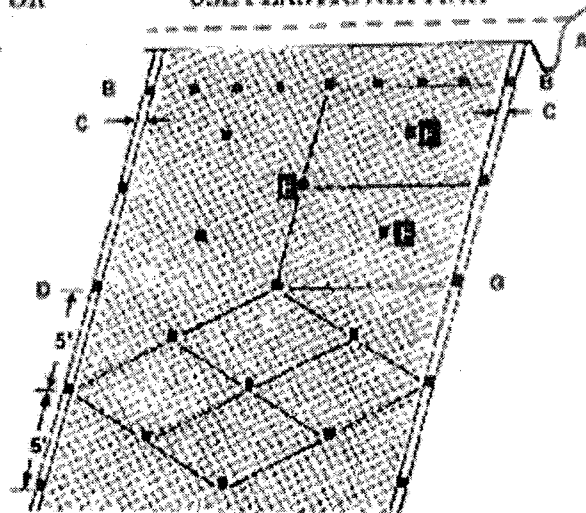
CRIMP BY HAND

OR

USE PLASTIC NETTING



WORK ACROSS THE SLOPE. PUNCH STRAW 4 INCHES DEEP. A SQUARE END SPADE WORKS WELL. MAKE PUNCH EVERY 12 INCHES.



A. LAY BIRD CONTROL NETTING OR SIMILAR MATTING IN STRIPS DOWN THE SLOPE OVER THE STRAW. BURY UPPER END IN 6-8 INCH DEEP AND WIDE TRENCH.. MOST NETTING COMES IN 14 TO 17 FT. WIDE ROLLS.

B. SECURE THE UPPER END WITH STAKES EVERY 2 FEET.

C. OVERLAP SEAMS ON EACH SIDE 4-5 INCHES.

D. SECURE SEAMS WITH STAKES EVERY 5 FEET.

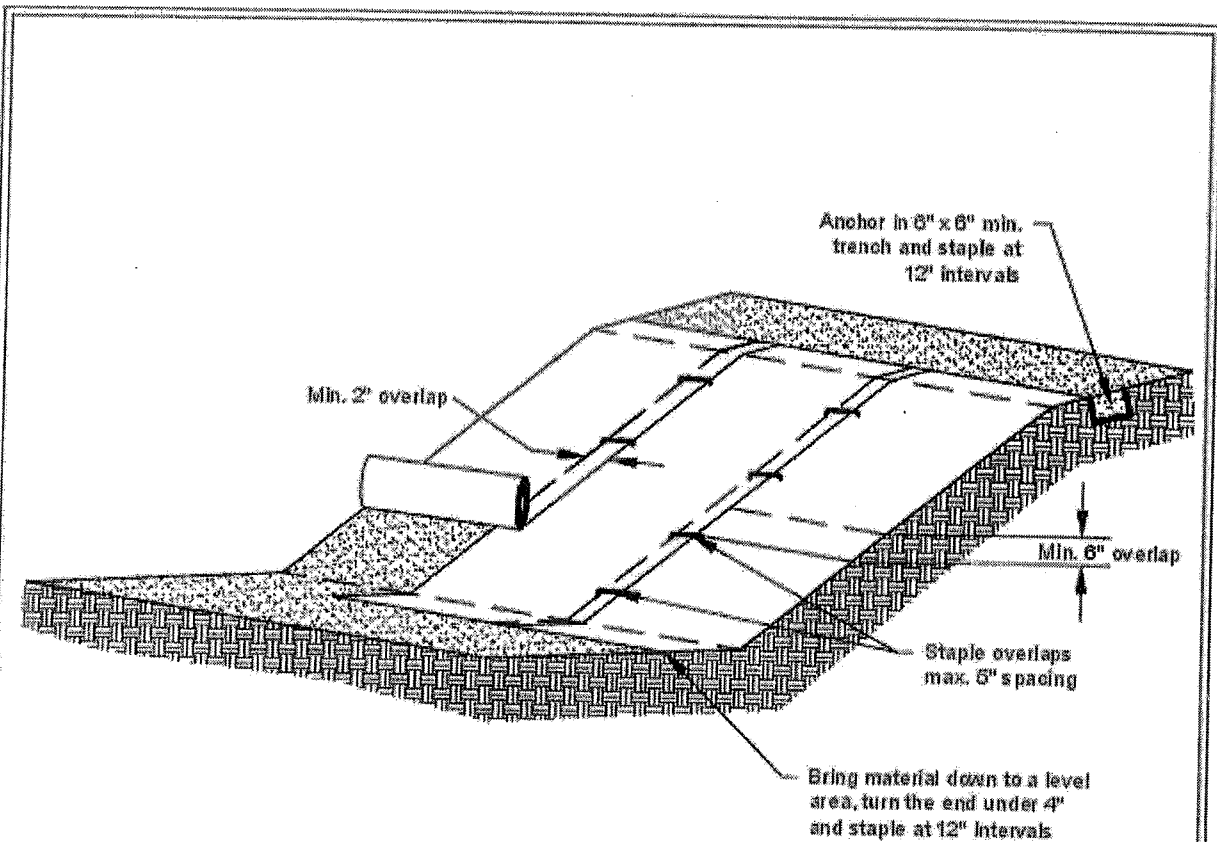
E. STAKE DOWN THE CENTER EVERY 5 FEET.

F. STAKE MIDDLES TO CREATE DIAMOND PATTERN THAT PROVIDES STAKES SPACED 4-5 FEET APART.

G. USE POINTED 1X2 INCH STAKES 8 TO 9 INCHES LONG. LEAVE 1 TO 2 INCH TOP ABOVE NETTING, OR USE "U" SHAPED METAL PINS AT LEAST 9 INCHES LONG.

NOTE: WHEN JOINING TWO STRIPS, OVERLAP UPPER STRIP 3 FEET OVER LOWER STRIP AND SECURE WITH STAKES EVERY 2 FEET LIKE IN "B" ABOVE

BMP: General Erosion Control (Cont.)



Notes:

1. Slope surface shall be smooth before placement for proper soil contact.
2. Stapling pattern as per manufacturer's recommendations.
3. Do not stretch blankets/matting tight - allow the rolls to mold to any irregularities.
4. For slopes less than 3H:1V, rolls may be placed in horizontal strips.
5. If there is a berm at the top of the slope, anchor upslope of the berm.
6. Lime, fertilize, and seed before installation. Planting of shrubs, trees, etc. should occur after installation.

NOT TO SCALE



DEPARTMENT OF
ECOLOGY
State of Washington

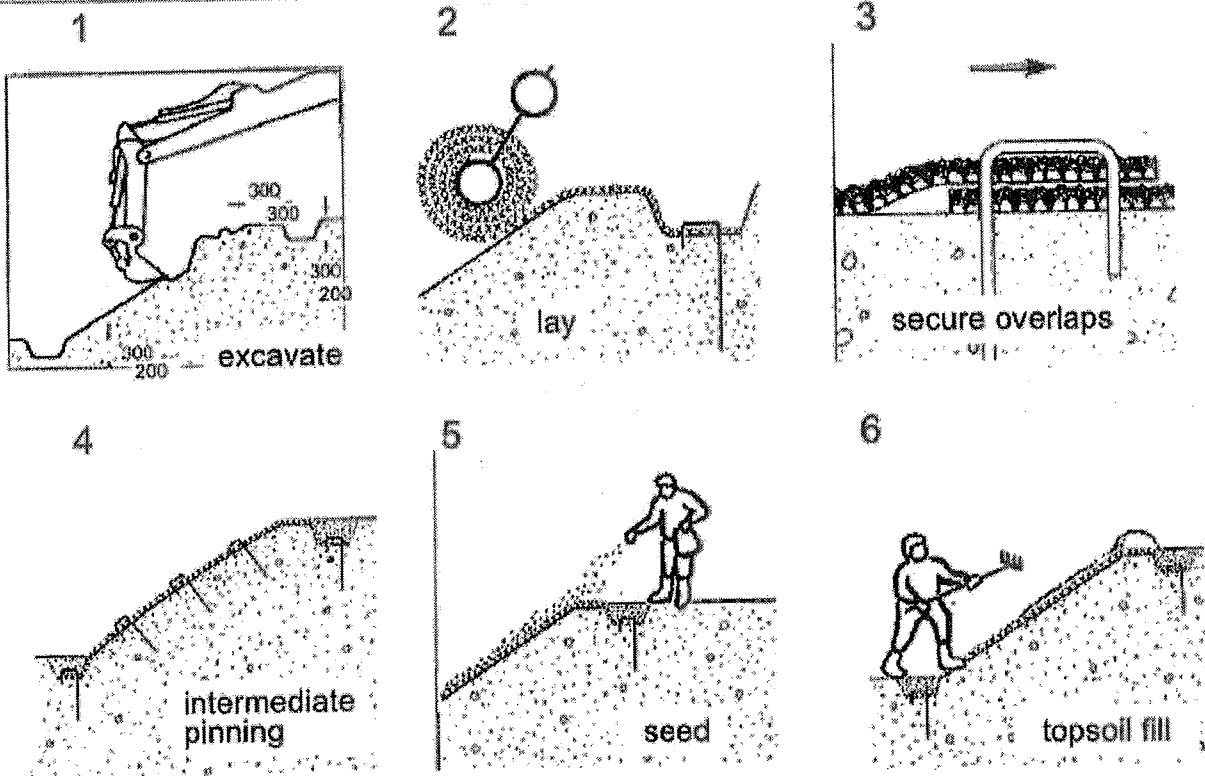
Slope Installation

Revised June 2016

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BMP: General Erosion Control (Cont.)

Installation of a geosynthetic mat - Enkamat



BMP: General Erosion Control Techniques

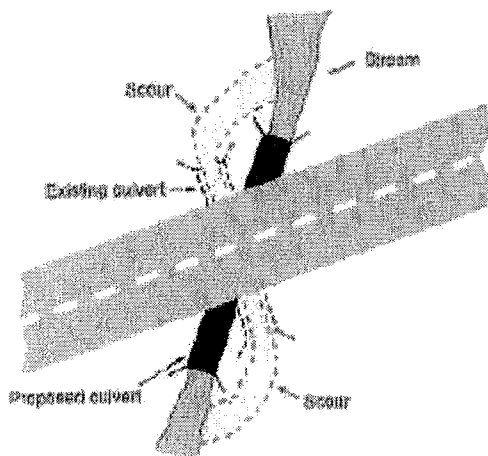
TABLE 34. Guidelines for erosion and sediment control application

Timing of application	Technique	Portion of road and construction area treated
Erosion control during construction	Hydromulching, hydroseeding	Road fill slopes, cut slopes, bare soil areas
	Dry seeding	Road fill slopes, cut slopes, bare soil areas
	Wood chip, straw, Excelsior or tackified mulch	Road fill slopes, cut slopes, bare soil areas
	Straw wattles	Road fill slopes and cut slopes
	Gravel surfacing	Road, landing and turnout surfaces
	Dust palliatives	Road surfaces
	Minimize disturbance (soil and vegetation)	All areas peripheral to construction
Sediment control during construction	Sediment basin	Roadside ditches, turnouts and small stream crossings
	Sediment traps (e.g., silt fences, straw bales barriers, woody debris barriers)	Road fill slopes, cutbanks, bare soil areas and ditches
	Straw bale dams	Ditches and small streams
	Sumps and water pumps	Stream channels and stream crossings
	Streamflow diversions (e.g., temporary culverts, flex pipe, etc.)	Stream channels and stream crossings
	Surface diversion and dispersion devices (pipes, ditches, etc.)	All disturbed bare soil areas
	Road shaping	Road and landing surfaces
	Gravel surfacing	Road, landing and turnout surfaces
	Bituminous or asphalt surfacing	Road surface
	Rolling dips	Road surface
Permanent erosion control	Ditch relief culverts	Roadbed and road fill
	Dovrepouts and berm drains	Road fill slopes
	Waterbars	Road and landing surfaces
	Berms	Road surface and roadside areas
	Ditches	Road and landing surfaces
	Flaprap	Road fill slopes, stream crossing fills, cutbanks, stream and lake banks
	Soil bioengineering	Road fill slopes, cut slopes, stream crossings, streambanks
	Tree planting	Road fill slopes, cutbanks, bare soil areas, stream crossings, streambanks

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

BMP: Permanent Culvert Crossing

- New culvert installations shall be sized to accommodate flows associated with a 100-year storm event.
- If the new culvert is replacing a poorly installed old culvert, the crossing may need to be abandoned to the following standard:
 - When fills are removed they shall be excavated to form a channel that is as close as feasible to natural watercourse grade and orientation, and that is wider than the natural channel.
 - Excavated banks shall be laid back to a 2:1 (50%) or natural slope.
- New culverts shall be placed at stream gradient, or have downspouts, or have energy dissipaters at outfall.
 - Align culverts with the natural stream channel orientation to ensure proper function, prevent bank erosion, and minimize debris plugging. See Figure 97 below.
 - Place culverts at the base of the fill and at the grade of the original streambed or install a downspout past the base of the fill. Downspouts should only be installed if there are no other options.
 - Culverts should be set slightly below the original stream grade so that the water drops several inches as it enters the pipe.
 - Culvert beds should be composed of rock-free soil or gravel, evenly distributed under the length of the pipe.
 - Compact the base and sidewall material before placing the pipe in its bed.
 - Lay the pipe on a well-compacted base. Poor basal compaction will cause settling or deflection in the pipe and can result in separation at a coupling or rupture in the pipe wall.
 - Backfill material should be free of rocks, limbs, or other debris that could dent or puncture the pipe or allow water to seep around the pipe.
 - Cover one end of the culvert pipe, then the other end. Once the ends are secure, cover the center.
 - Tamp and compact backfill material throughout the entire process, using water as necessary for compaction.
 - Backfill compacting will be done in 0.5 – 1.0 foot lifts until 1/3 of the diameter of the culvert has been covered.
 - Push layers of fill over the crossing to achieve the final design road grade, road fill above the culvert should be no less than one-third to one-half the culvert diameter at any point on the drivable surface.
- Critical dips shall be installed on culvert crossings to eliminate diversion potential. Refer to Figure 84 below.
- Road approaches to crossings shall be treated out to the first drainage structure (i.e. waterbar, rolling dip, or hydrologic divide) to prevent transport of sediment.
- Road surfaces and ditches shall be disconnected from streams and stream crossings to the greatest extent feasible. Ditches and road surfaces that cannot be feasible disconnected from streams or stream crossings shall be treated to reduce sediment transport to streams.
- If downspouts are used, they shall be secured to the culvert outlet and shall be secure on fill slopes.
- Culverts shall be long enough so that road fill does not extend or slough past the culvert ends.
- Inlet of culverts, and associate fill, shall be protected with appropriate measures that extend at least as high as the top of the culvert.
- Outlet of culverts shall be armored with rock if road fill sloughing into channel can occur.
- Armor inlets and outlets with rock, or mulch and seed with grass as needed (not all stream crossings need to be armored).
- Where debris loads could endanger the crossing, a debris catchment structure shall be constructed upstream of the culvert inlet.
- Bank and channel armoring may occur, when appropriate, to provide channel and bank stabilization.



HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

FIGURE 97. Culvert alignment should be in relation to the stream and not the road. It is important that the stream enters and leaves the culvert in a relatively straight horizontal alignment so streamflow does not have to turn to enter the inlet or discharge into a bank as it exits. This figure shows a redesigned culvert installation that replaces the bending alignment that previously existed. Channel turns at the inlet increase plugging potential because wood going through the turn will not align with the inlet. Similarly, channel turns at the outlet are often accompanied by scour against the channel banks (Wisconsin Transportation Information Center, 2004).

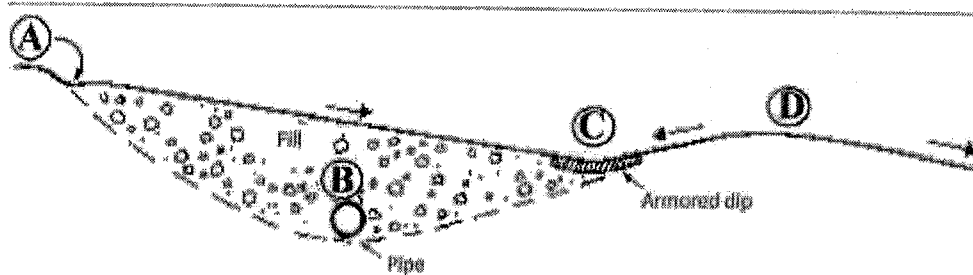
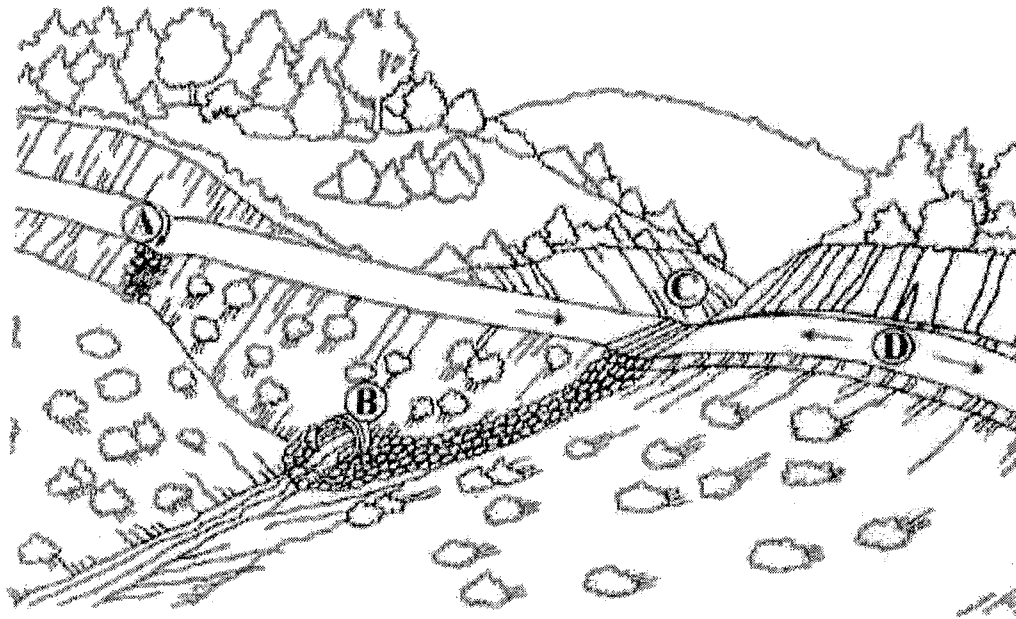
BMP: Permanent Culvert Crossing (Cont.)

FIGURE 34. Critical dips or dipped crossing fills should be centered near a stream crossing's down-road hinge line, not over the centerline of the crossing where overtopping could cause washout or severe erosion of the fill. If the stream crossing culvert (B) plugs, water will pond behind the fill until reaching the critical dip or low point in the crossing (C) and flowing back down into the natural stream channel. The down-road ditch must be plugged to prevent streamflow from diverting down the ditch line. For extra protection in this sketch, diprap armor has been placed at the critical dip outfall and extending downslope to the stream channel. This is only required or suggested on stream crossings where the culvert is highly likely to plug and the crossing fill overtopped. The dip at the hinge line is usually sufficient to limit erosional damage during an overtopping event. Road surface and ditch runoff is disconnected from the stream crossing by installing a rolling dip and ditch relief culvert just up-road from the crossing (A) (Keller and Sberax, 2003).

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

BMP: Permanent Culvert Crossing (Cont.)

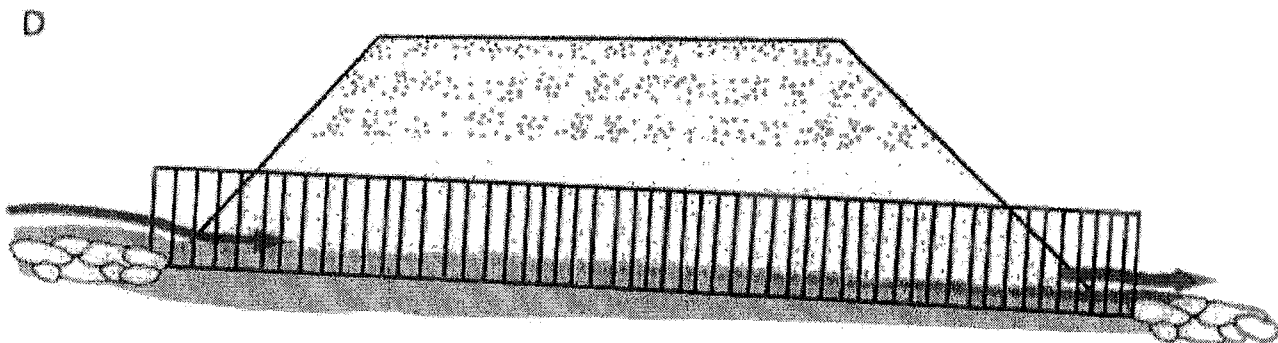
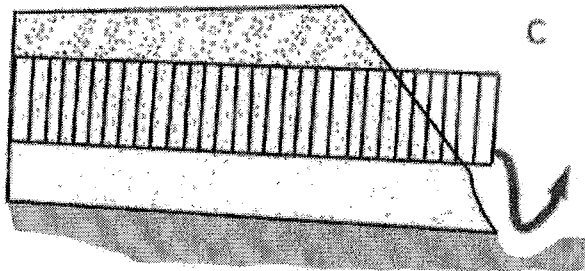
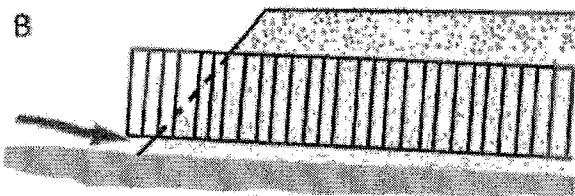
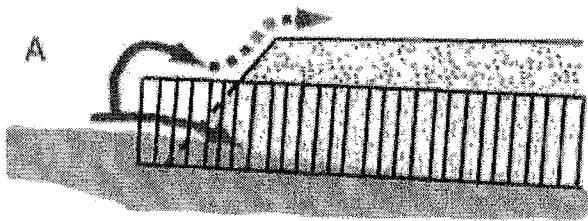
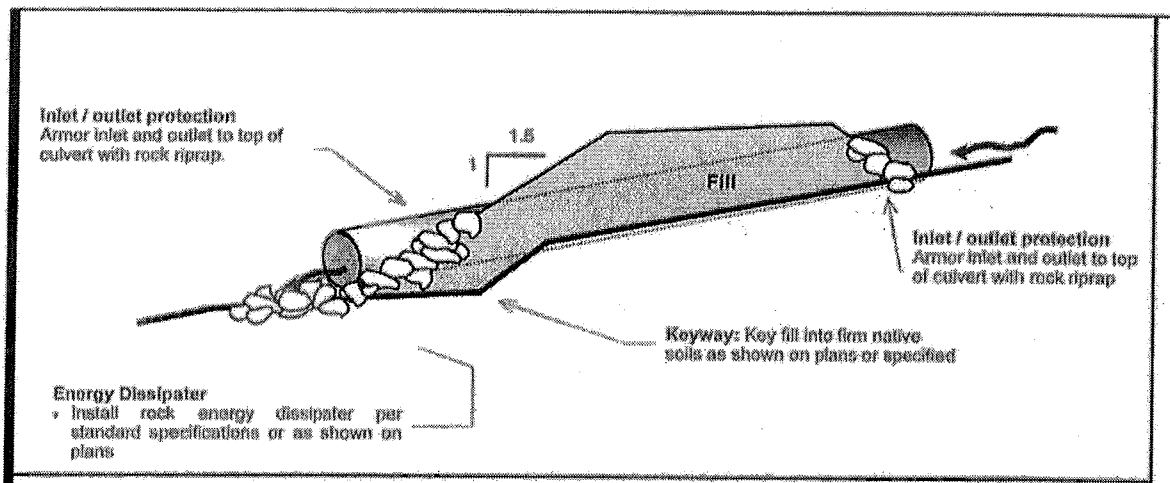
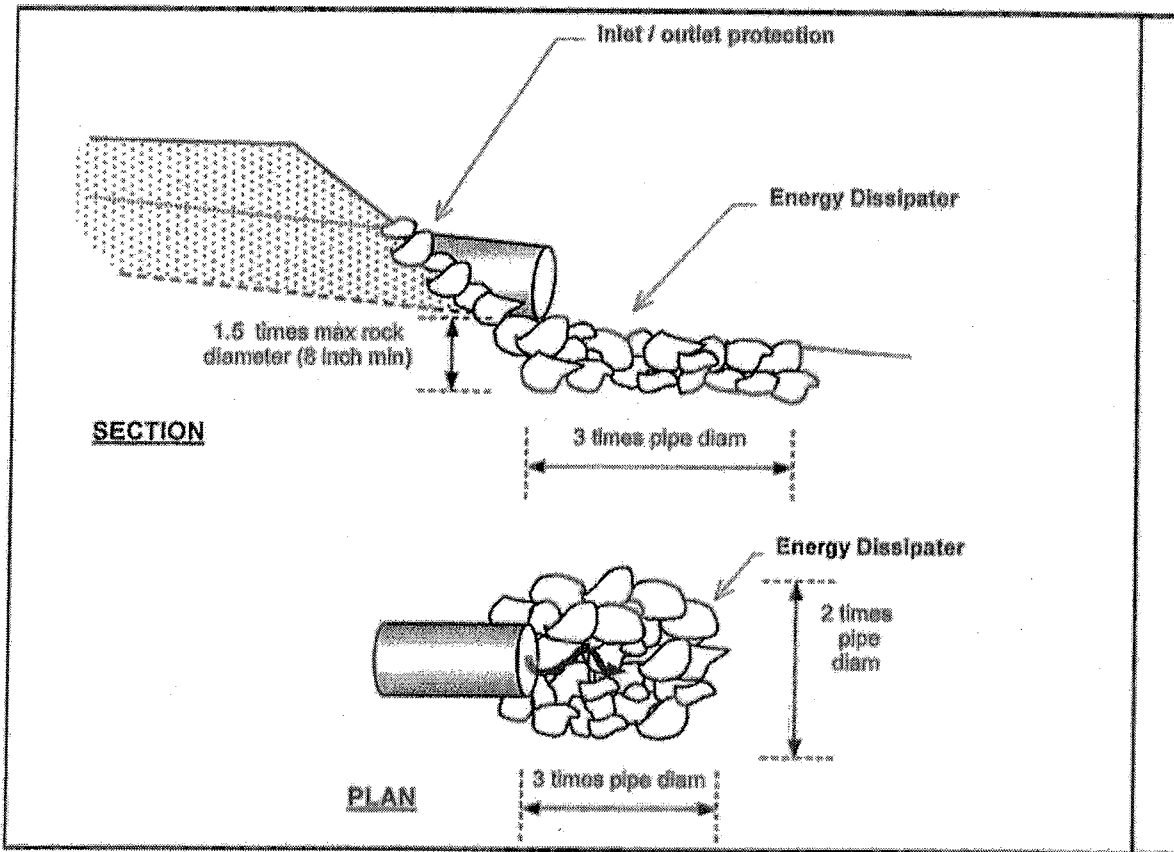


FIGURE 155. Proper culvert installation involves correct culvert orientation, setting the pipe slightly below the bed of the original stream, and backfilling and compacting the fill as it is placed over the culvert. Installing the inlet too low in the stream (A) can lead to culvert plugging, yet if set too high (B) flow can undercut the inlet. If the culvert is placed too high in the fill (C), flow at the outfall will erode the fill. Placed correctly (D), the culvert is set slightly below the original stream grade and protected with armor at the inlet and outlet. Culverts installed in fish-bearing stream channels must be inset into the streambed sufficiently (>25% embedded) to have a natural gravel bottom throughout the culvert (Modified from: MDSL, 1991).

BMP: Culvert Rock Armoring Specifications



Riprap installed to protect the inlet and outlet of a stream crossing culvert from erosion or for energy dissipation should be keyed in the natural channel bed and banks to an approximate depth of about 1.5x the maximum rock thickness. Riprap should be placed at least up to the top of the culvert at both the inlet and outlet to protect them from splash erosion and to trap any sediment eroded from a newly constructed fill slope above.

BMP: Inlet and Outlet Armoring

- Inlets of culverts and associate fills shall be protected with rock armoring that extends at least as high as the top of the culvert.
- Outlets of culverts shall be provided a rocked energy dissipater at the outfall of the culvert.
- Outlets of culverts and associate fills shall be protected with rock armoring that extends at least as high as the top of the culvert if road fill sloughing into channel can occur.
- Prior to inlet and outlet rocking, the inlet and outlets shall be prepared. Preparation will include removal of vegetation and stored materials from the inlet and outlet.
- Inlets may require construction of an inlet basin.
- Slopes at the outlet should be shaped to a 2:1 or natural slope prior to placing rock armor.
- Rock used at culvert inlets and outlets should be a matrix of various sized rocks and rip-rap that range from a 3" dia. to a 2' dia.
- The largest rocks should be places at the base of the culvert or fill. Incrementally smaller rocks shall be placed over the larger rocks at the armoring extend up the slope. Voids and spaces shall be back filled with smaller gravels and rocks.

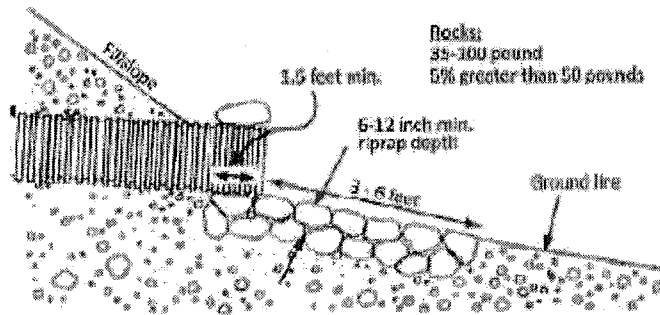


FIGURE 107A. Riprap armor at culvert outlet (Modified from Keller et al., 2011).

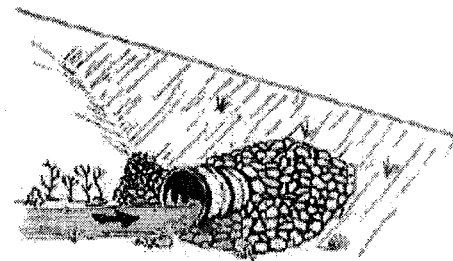


FIGURE 107B. Riprap armor at culvert inlet (Keller and Sharat, 2003).

HANDBOOK FOR FOREST, RANCH AND RURAL ROADS

BMP: Stream Bank Armoring (Riprap)

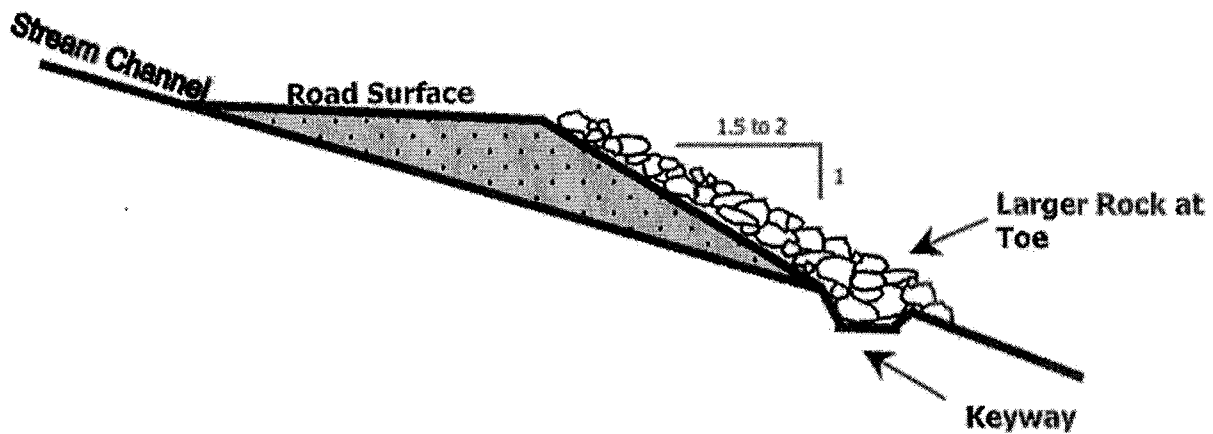
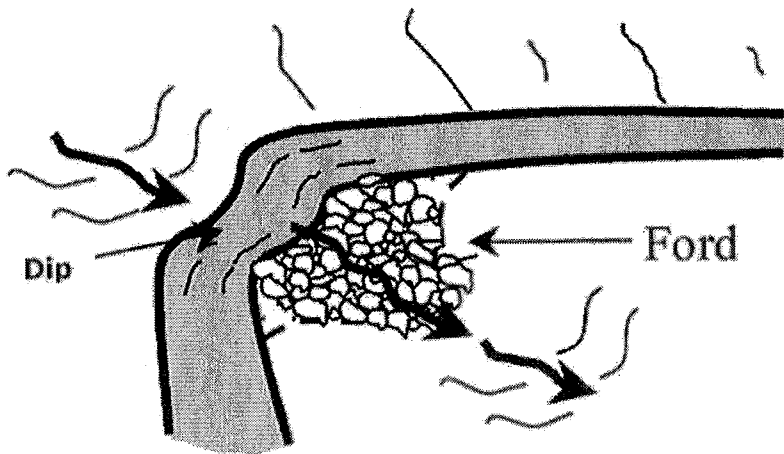
- Riprap should be installed on top of geotextile fabric or a clean mixture of coarse gravel and sand.
- The riprap should be keyed into the streambed and extend below the maximum expected scour depth with an adequately sized key base width at a thickness of a minimum of 2x the median (D50) rock diameter with the largest stone sizes placed at the base of the riprap structure.
- The armor should be set into the streambank so it does not significantly protrude into, or constrict, the natural channel, or otherwise reduce channel capacity.
- The riprap should extend along the length of unstable or over steepened bank and up the bank sufficiently to encompass the existing bank instability and/or design flood elevations.

BMP: Rocked Ford

- Rocked fords are drainage structures designed to carry watercourses across roads with little to no erosion of the road surface or fill.
- Fords constructed in-channel shall be of appropriately sized material that shall withstand erosion or displacement by expected velocities and placed in a broad, U-shaped channel to create a drivable crossing.
 - The road shall dip into and out of the rocked ford to minimize diversion potential. Construct a broad rolling dip across the roadbed, centered at the crossing, which is large enough to contain the expected 100-yr flood discharge while preventing flood flow from diverging down the road or around the rock armor.
- The road surface at the ford shall be constructed with clean rock. The rock shall be applied to a minimum depth of 6 inches.
 - A range of interlocking rock armor sizes should be selected and sized so that peak flows will not pluck or transport the armor off the roadbed or the sloping fill face of the armored fill.
- The ford's outlet shall be rock armored to resist downcutting and erosion.
 - *Excavate the keyway and armored area* - Excavate a two to three-foot-deep "bed" into the dipped road surface and adjacent fillslope (to place the rock in) that extends from approximately the middle of the road, across the outer half of the road, and down the outboard road fill to where the base of the fill meets the natural channel. At the base of the fill, excavate a keyway trench extending across the channel bed.
 - *Armor the basal keyway* - Put aside the largest rock armoring to create the buttresses. Use the largest rock armor to fill the basal trench and create a buttress at the base of the fill. This should have a "U" shape to it and it will define the outlet where flow leaves the armored fill and enters the natural channel.
 - *Armor the fill* - Backfill the fill face with the remaining rock armor making sure the final armor is unsorted and well placed, the armor is two coarse-rock layers in thickness, and the armored area on the fill face also has a "U" shape that will accommodate the largest expected flow.
 - *Armor the top of the fill* - Install a second trenched buttress for large rock at the break-in-slope between the outboard road edge and the top of the fill face.
- Road approaches to rocked fords shall be rock surfaced out to the first drainage structure (i.e. waterbar, rolling dip, or hydrologic divide) to prevent transport of sediment using rock.
- Bank and channel armoring may occur when appropriate to provide channel and bank stabilization.
- Road approach rock and rock ford armoring shall be reapplied following use as needed to maintain a permanent crossing.

BMP: Rocked Ford (Cont.)

FORD: A large dip is graded into the road at the axis of the stream channel. The outside fill face is dished out to form a spillway with large rock. On large watercourses, rock is keyed several feet into firm native soils. The road surface is rocked with 6" of minus rock.



BMP: Armored Ford/Fill

- Armored fords are watercourse crossing fills comprised primarily of rock and designed to carry watercourses across roads without erosion or displacement of installed fill material.
- Armored fords shall have a U-shaped channel to create a drivable crossing.
 - The road shall dip into and out of the armored ford to minimize diversion potential. Construct a broad rolling dip across the roadbed, centered at the crossing, which is large enough to contain the expected 100-yr flood discharge while preventing flood flow from diverting down the road or around the rock armor.
- The road surface at the armored ford shall consist of rock small enough to be easily passable by vehicle, but large enough to not be transported during high flow storm events.
- The ford's inlet shall be rock armored if a threat of head cutting exists.
 - *Excavate the keyway* - Excavate a one to three-foot-deep "bed" into the inboard edge of the road
 - *Armor the basal keyway* - place various sized rock in the constructed keyway to prevent head cutting. Use the largest rock armor to fill the keyway trench and create a buttress along the inboard edge of the road. This should have a "U" shape to it and it will define the inlet where flow leaves the natural channel and enters the road.
- The ford's outlet shall be rock armored to resist downcutting and erosion.
 - *Excavate the keyway and armored area* - Excavate a two to three-foot-deep "bed" into the dipped road surface and adjacent fillslope (to place the rock in) that extends from approximately the middle of the road, across the outer half of the road, and down the outboard road fill to where the base of the fill meets the natural channel. At the base of the fill, excavate a keyway trench extending across the channel bed.
 - *Armor the basal keyway* - Put aside the largest rock armoring to create the buttresses. Use the largest rock armor to fill the basal trench and create a buttress at the base of the fill. This should have a "U" shape to it and it will define the outlet where flow leaves the armored fill and enters the natural channel.
 - *Armor the fill* - Backfill the fill face with the remaining rock armor making sure the final armor is inserted and well placed, the armor is two coarse-rock layers in thickness, and the armored area on the fill face also has a "U" shape that will accommodate the largest expected flow.
 - *Armor the top of the fill* - Install a second trenched buttress for large rock at the break-in-slope between the outboard road edge and the top of the fill face.
- Road approaches to armored fords shall be surface rocked out to the first drainage structure (i.e. waterbar, rolling dip, or hydrologic divide) to prevent transport of sediment using rock.
- Bank and channel armoring may occur when appropriate to provide channel and bank stabilization.
- Armored ford armoring shall be reapplied following use as needed to maintain a permanent crossing.

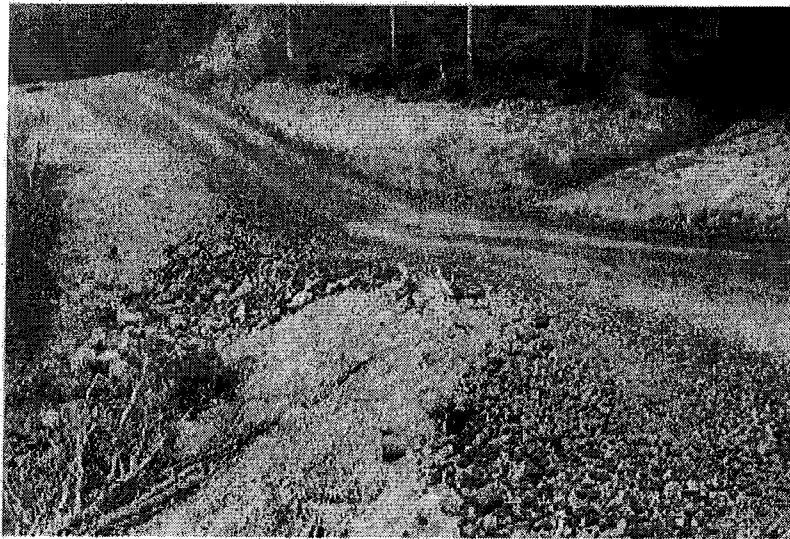


FIGURE 120. This armored fill crossing of a steep, ephemeral stream was constructed to provide a low maintenance crossing. The crossing has been deeply dipped to reduce the volume of road fill and to eliminate the potential for stream diversion. The fill slope has been heavily armored through the axis of the crossing to contain flood flows and prevent downcutting. Armored fills cannot be used on fish bearing streams.

BMP: Armored Ford [Fill] (Cont.)

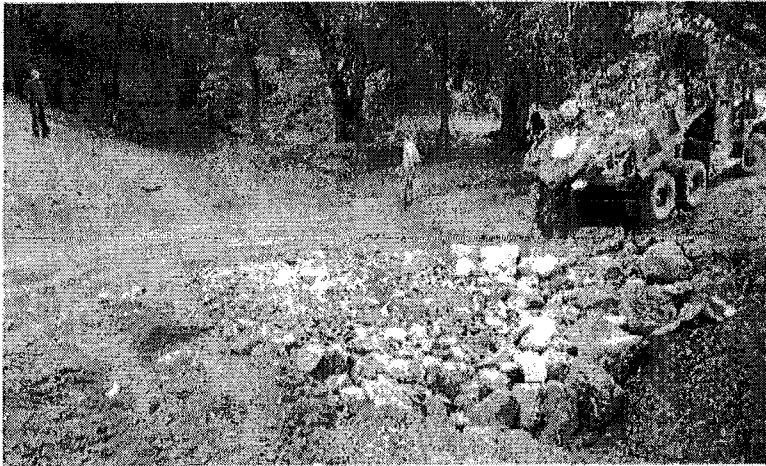


FIGURE 121D. Well graded rock armor is then loaded into the structure and spread across the breadth of the U-shaped stream crossing, and about one-third the way up the roadbed, so that streamflow will only flow over or come in contact with resistant armor material. The armor must be spread and compacted across the design width of the expected flood flow channel width so peak flows will not flank the armored structure.



FIGURE 121E. Two weeks after this armored fill was constructed, a storm flow event occurred and the structure maintained its function and integrity. The road approaches had not yet been compacted or surfaced with road rock.

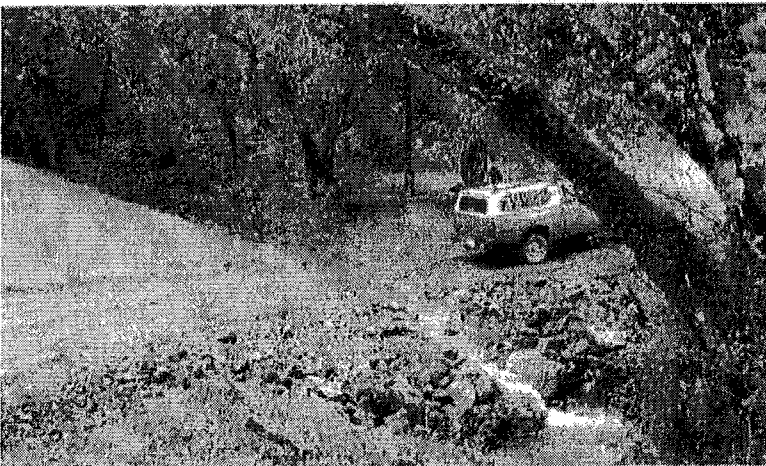
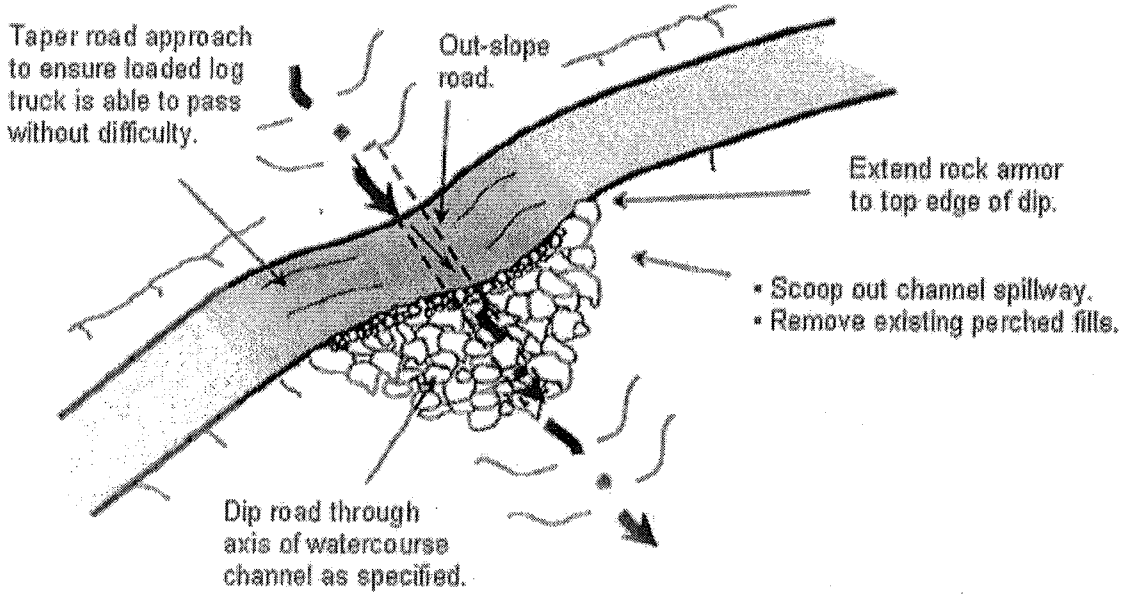


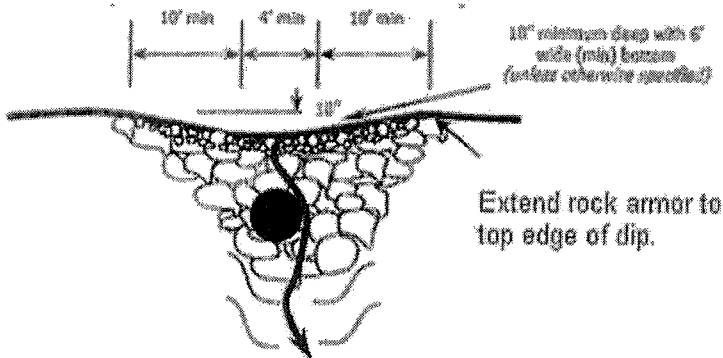
FIGURE 121F. The same armored fill as it appeared after the first winter flood flows. No maintenance was required to reopen the road. It is also clear that no stream diversion is possible at this stream crossing site, and the volume of fill within the crossing has been reduced to the minimum amount needed to maintain a relatively smooth driving surface on this low volume road.

BMP: Vented Ford

Vented Ford

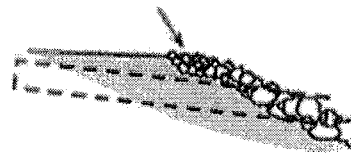


Dip area to accommodate a culvert sized for 100-year flow (minimum dimensions given below).



LIP

- Use smaller rock at lip of ford.
- Fill voids with smaller rock to prevent piping around the larger rock.



BMP: Permanent Crossing Decommissioning Specifications

- When fills are removed they shall be excavated to form a channel that is as close as feasible to natural watercourse grade and orientation, and that is wider than the natural channel.
- Excavated banks shall be laid back to a 2:1 (50%) or natural slope.
- Temporary crossings shall be removed by November 15.
 - Any temporary culvert crossing left in after October 15 or installed between October 15 and May 1, shall be sized to accommodate the estimated 100-year flow.
- Bank and channel armoring may occur when appropriate to provide channel and bank stabilization.

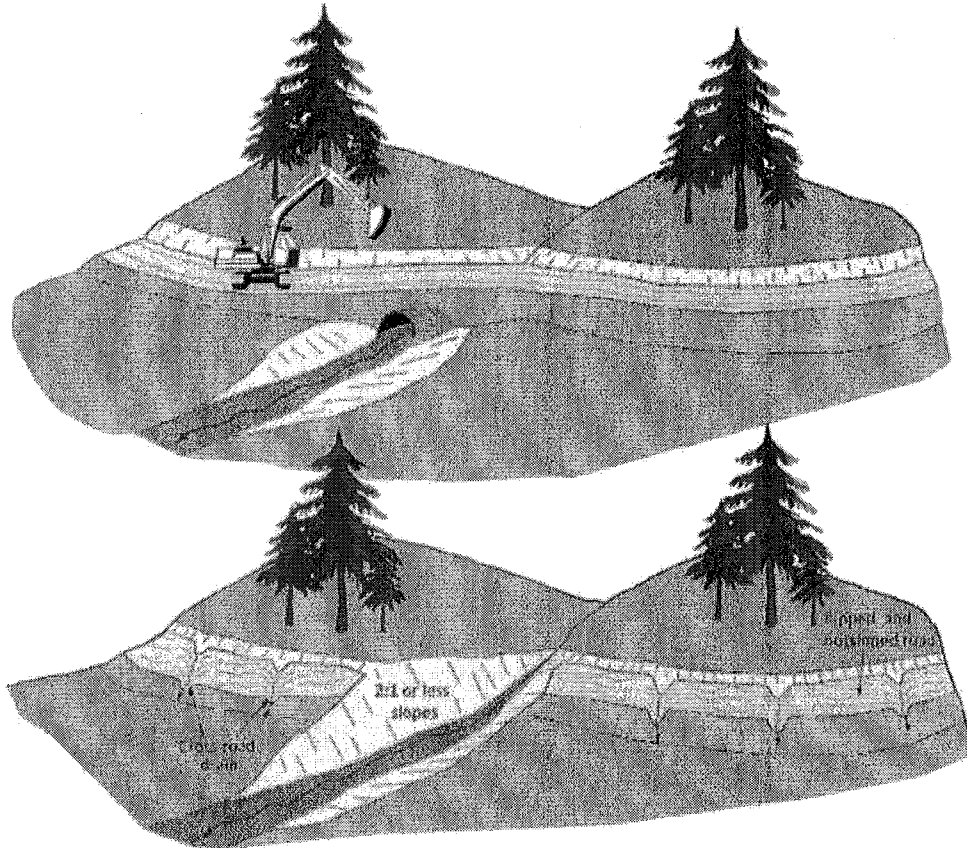


FIGURE 263. On roads that are to be closed (decommissioned), all stream crossing culverts and fills should be removed. Stream crossing excavations are best performed using an excavator. The original channel should be excavated and exhumed down to the former streambed, with a channel width equal or greater than the natural channel above and below the crossing. Sideslopes should be laid back to a stable angle, typically a 2:1 (50%) gradient, or less. Spoil can be endhailed off-site or stored on the road bench adjacent the crossing, provided it is placed and stabilized where it will not erode or fall and enter the stream.

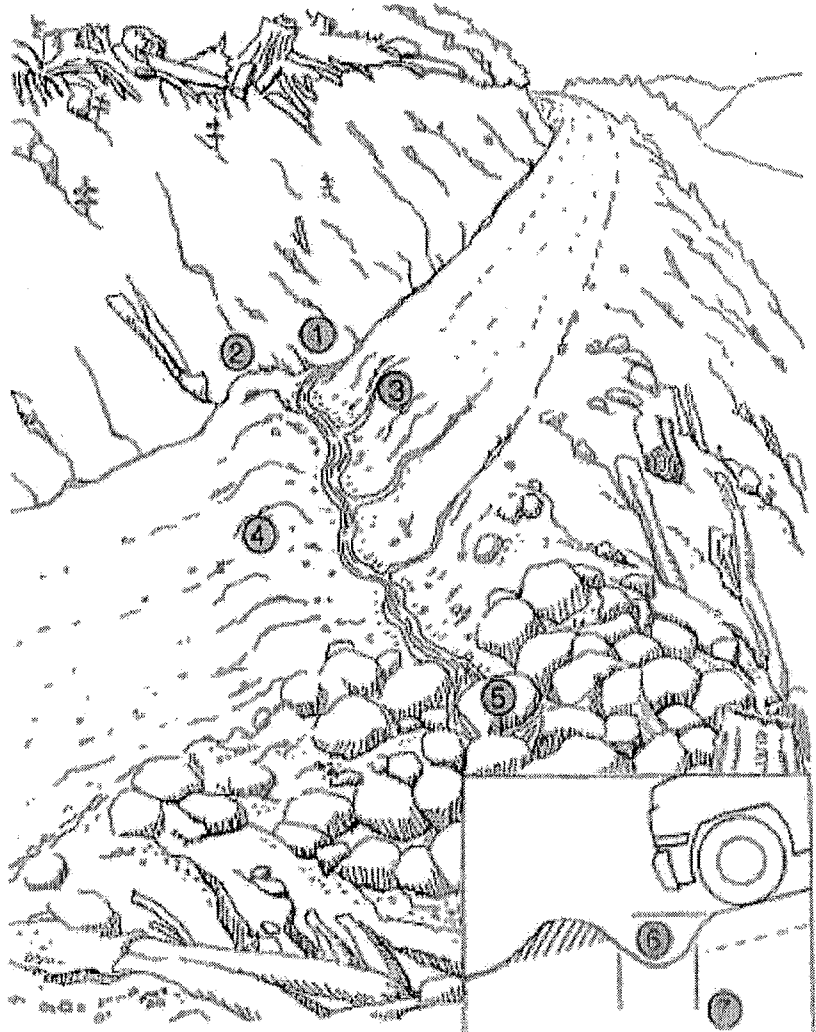
BMP: Permanent Crossing Decommissioning Specifications (Cont.)

- Excavating and removing all fill materials placed in the stream channel when the crossing was originally built.
- Fill material should be excavated to recreate the original channel grade (slope) and orientation.
- The excavated channel bed should be as wide, or slightly wider than, the original watercourse channel.
 - This can be better determined by observing the channel width of the watercourse up slope of crossing to be removed at a point in which the crossing or any other disturbance has not affected the natural channel slope and width.
- If the channel sideslopes were disturbed, they should be graded (excavated) back to a stable angle (generally less than 50% (2:1)) to prevent slumping and soil movement.
- The bare soils should then be mulched, seeded, and planted to minimize erosion until vegetation can protect the surface.
- The approaching, hydrologically connected road segments should be cross-road drained to prevent road runoff from discharging across the freshly excavated channel sideslopes.

BMP: Waterbar Construction

FIGURE 40. Waterbars are constructed on unsurfaced forest and ranch roads that will have little or no traffic during the wet season. The waterbar should be extended to the cutbank to intercept all ditch flow (1) and extend beyond the shoulder of the road. A berm (2) must block and prevent ditch flow from continuing down the road during flood flows. The excavated waterbar (3) should be constructed to be self-cleaning, typically with a 30° skew to the road alignment with the excavated material bermed on the downhill grade of the road (4). Water should always be discharged onto the downhill side on a stable slope protected by vegetation. Rock (shown in the figure) should not be necessary if waterbars are spaced close enough to prevent serious erosion. (5) The cross ditch depth (6) and width (7) must allow vehicle cross-over without destroying the function of the drain. Several alternate types of waterbars are possible, including one that drains only the road surface (not the ditch), and one that drains the road surface into the inside ditch (BCMF, 1991).

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BMP: Rolling Dip

- Rolling dips are drainage structures designed to capture and discharge surface water collected on road surfaces and in inside ditches at a specific location.
- The road shall dip into and out of the rolling dip to eliminate the possibility of water flowing along the road surface or in an inside ditch to bypass the dip structure.
- The rolling dip shall be constructed with clean native materials.
- The rolling dips outlet may be armored to resist downcutting and erosion.
- Do not discharge rolling dips into swales that show signs of instability or active landsliding.
- If the rolling dip is designed to divert both road surface and ditch runoff, block the down-road ditch with compacted fill.

BMP: Rocked Rolling Dip

- Rocked Rolling dips are drainage structures designed to capture and discharge surface water collected on road surfaces and in inside ditches at a specific location.
- The road shall dip into and out of the rolling dip to eliminate the possibility of water flowing along the road surface or in an inside ditch to bypass the dip structure.
- The rocked rolling dips inlet and outlet shall be armored to resist downcutting and erosion.
- The entire length of the rocked rolling dip shall be rock armored to a minimum of 5-feet from the centerline of the dip.
- If a keyway is necessary, the rocked rolling dip keyway shall be constructed at the base of the dip and shall be of sufficient size, depth, and length to support materials used in the rocked rolling dip construction back up to the road crossing interface.
- Do not discharge rolling dips into swales that show signs of instability or active landsliding.
- If the rolling dip is designed to divert both road surface and ditch runoff, block the down-road ditch with compacted fill.
- The rolling dip must be drivable and not significantly inhibit traffic and road use.

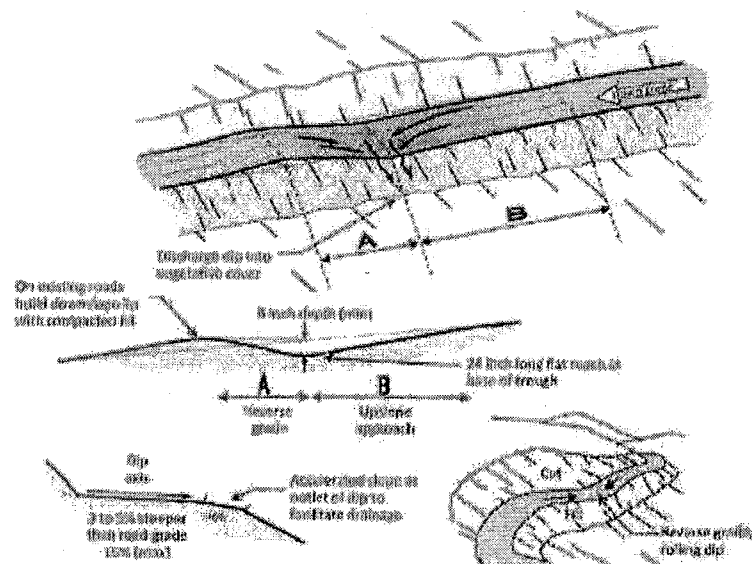


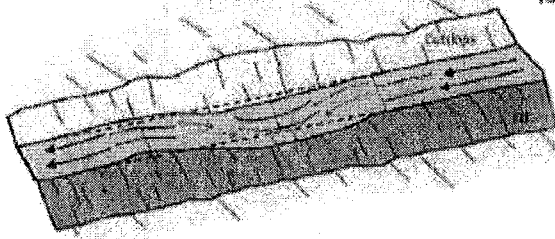
FIGURE 34. A classic Type I rolling dip, where the excavated up-road approach (A) to the rolling dip is several percent steeper than the approaching road and extends for 50 to 80 feet to the dip axis. The lower side of the structure reverses grade (A) over approximately 10 feet or more, and then falls down to regain the original road grade. The dip must be deep enough that it is not obliterated by normal grading, but not so deep that it is difficult to negotiate or a hazard to normal traffic. The outward cross-slope of the dip axis should be 3% to 5% greater than the up-road grade (B) so it will drain properly. The dip axis should be out-sloped sufficiently to be self-cleaning, without triggering excessive downcutting or sediment deposition in the dip axis (Modified from: Best, 2013).

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BMP: Rolling Dip and Rocked Rolling Dip (Cont.)

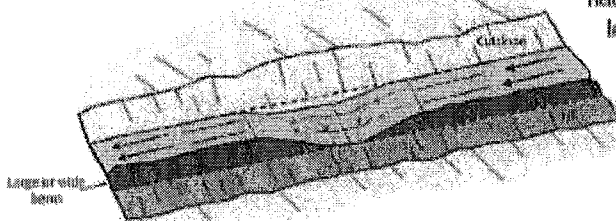
Type 1 Rolling Dip (Standard)

Type 1 rolling dips are used where road grades are less than about 12-14% and road runoff is not confined by a large through cut or berm. The axis of the dip should be perpendicular to the road alignment and sloped at 3-4% across the road tread. Steep roads will have longer and more abrupt dip dimensions to develop reverse grade through the dip axis. The road tread and/or the dip outlet can be rocked to protect against erosion, if needed.



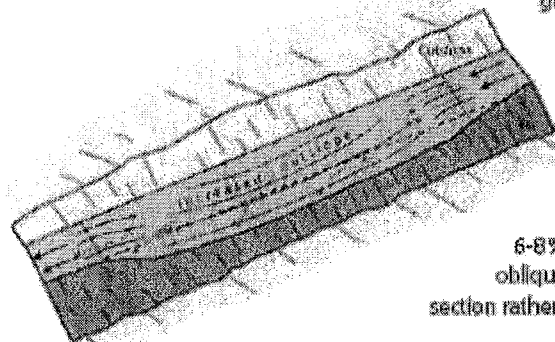
Type 2 Rolling Dip (Through-cut or thick berm road reaches)

Type 2 rolling dips are constructed on roads up to 12-14% grade where there is a through cut up to 3 feet tall, or a wide or tall berm that otherwise blocks road drainage. The berm or native through cut material should be removed for the length of the dip, or at least through the axis of the dip, to the extent needed to provide for uninterrupted drainage onto the adjacent slope. The berm and slope material can be excavated and endhauled, or the material can be sidecast onto native slopes up to 45%, provided it will not enter a stream.



Type 3 Rolling Dip (Steep road grade)

Type 3 rolling dips are utilized where road grades are steeper than about 12% and it is not feasible to develop a reverse grade that will also allow passage of the design vehicle (steep road grades require more abrupt grade reversals that some vehicles may not be able to traverse without bottoming out).



Instead of relying on the dip's grade reversal to turn runoff off the roadbed, the road is built with an exaggerated outslope of 6-8% across the dip axis. Road runoff is deflected obliquely across the dip axis and is shed off the outsloped section rather than continuing down the steep road grade.

FIGURE 36. Rolling dip types

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BMP: Lead out ditch



FIGURE 55. Steep roads that go straight up or down a hillside are very difficult to drain. This steep, fall line road developed a through cut cross section that was drained using lead out ditches to direct runoff off the road and onto the adjacent, vegetated hillside. The road was "outsloped" to drain runoff to the right side, and the lead out ditch was built slightly steeper than the road grade, to be self-cleaning. Four lead out ditches have been constructed at 100-foot intervals to the bottom of the hillside.

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BMP: Ditch Relief Culvert

- Install ditch relief culverts at an oblique (typically 30 degree) angle to the road so that ditch flow is not forced to make a sharp angle turn to enter the pipe. On low gradient roads (<5%), where ditch flow is slow, ditch relief culverts can be installed at right angles to the road.
- Install ditch relief culverts (DRC) to outlet at, and drain to, the base of the fill.
- If it cannot be installed at the base of the fill, install the DRC with a grade steeper than the inboard ditch draining to the culvert inlet, and install a downspout on the outlet to carry the culverted flow to the base of the fillslope.
- Downspouts longer than 20 feet should be secured to the hillslope for stability.
- Ditch relief culverts should not carry excessive flow such that downcutting of the ditchline or gulying below the outlet occur.
- Do not discharge flows from ditch relief culverts onto unstable fill or active landslides.
- If the ditch is on an insloped or crowned road, consider using outsloping to drain the road surface. The ditch and the ditch relief culvert would then convey only spring flow from the cutbanks and hillslope runoff, and not turbid runoff from the road surface.

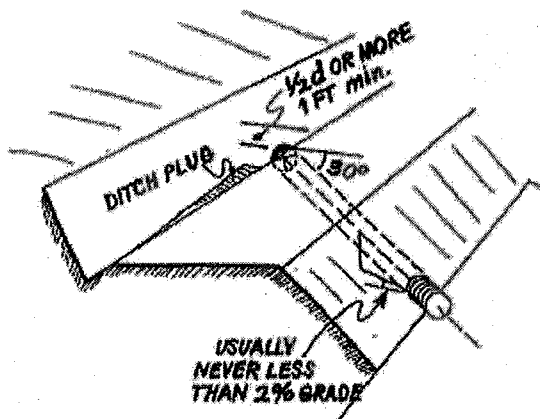
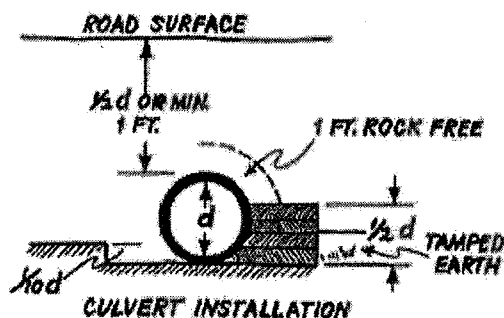
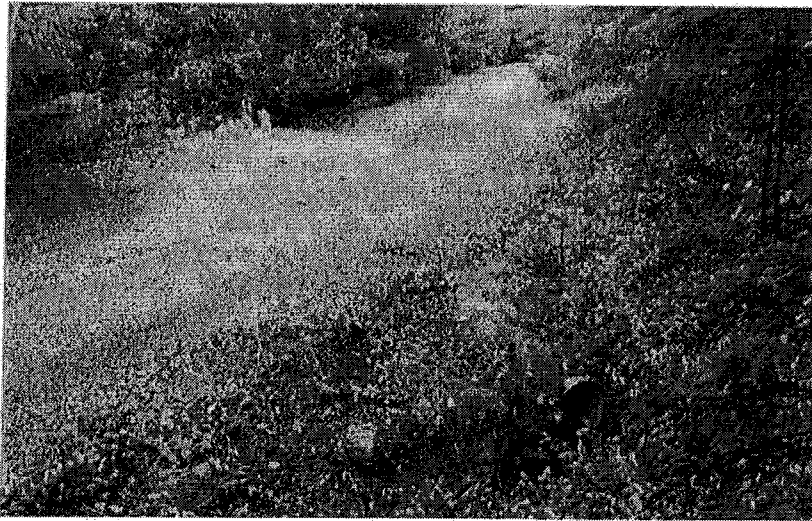


FIGURE 48. The elements of a properly installed ditch relief culvert. The culvert is angled at about 30 degrees to the road alignment to help capture flow and prevent culvert plugging or erosion of the inlet area. It is set at the base of the fill (ideally) or with a grade slightly steeper than the grade of the contributing ditch (but never with a grade less than 2 percent) (USDA-SCS, 1983). At a minimum, the grade of the ditch relief culvert should be sufficient to prevent sediment accumulation at the inlet or deposition within the culvert itself (it should be self-cleaning) (USDA-SCS, 1983).



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BMP: Ditch Relief Culvert (Cont.)**FIGURE 30.**

Waterbars are often used to drain surface runoff from seasonal, unsurfaced roads. Because they are easily broken down by vehicles, waterbars are only used on unsurfaced roads where there is little or no wet weather traffic. In this photo, a waterbar and ditch relief culvert are used to drain all road surface and ditch runoff from the insloped road prism.

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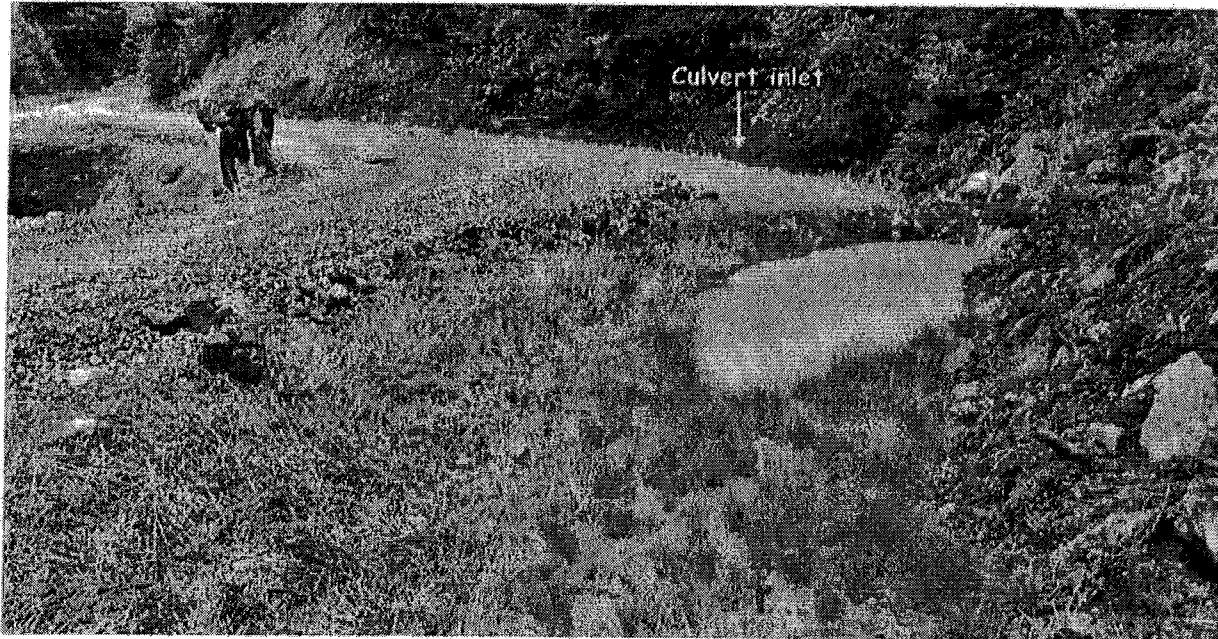


FIGURE 238. Traffic and surface runoff from graveled roads often produces surface erosion, turbid runoff and fine sediment transport that can be delivered to streams. Where ditches can't be eliminated, sediment traps and roadside settling basins can be installed to capture and remove most of the eroded sediment. This settling basin has been constructed along the inside ditch just before a stream crossing culvert inlet (see arrow). Eroded sediment from the road and ditch are deposited in the basin before flow is released to the stream. Fine sediments have filled about 1/3 of this basin and vegetation is now growing. Sediment basins require periodic maintenance to maintain their storage capacity.

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BMP: Storage Bladders

- Location for storage bladder must be sited and planned as to minimize the potential for impacts due to rolling and/or failure. Storage bladders should be stored on flat slopes where stability will not be affected.
- If bladders are stored on slopes the potential for rolling must be assessed and if necessary containment or anchors installed. Options to mitigate the potential for rolling may include a fence, dirt berm, or a tethered anchor.
- Secondary containment is recommended in the form of a dirt berm, containment pit or impermeable material with skeletal support. Dirt berms shall be sculpted to a maximum 1:2 slope ratio. The containment should be capable of holding the contents of the bladder. At the least, secondary containment should be designed to slow the initial force of a failure.
- Bladders should be monitored consistently throughout their use to prevent failure. Inspections for structural weaknesses and other risks that may cause failure should occur a minimum of once per month.



This is an example of a containment pit which will assist in mitigating the impacts if this storage bladder failed.

BMP: Cultivation Site Restoration

- Remove all cultivation and associated materials from designated cultivation site.
 - This includes plant mass, root balls, potting containers, cultivation medium and any materials associated with the preparation, cultivation, and harvest of commercial cannabis.
 - Cultivation medium removed from the site shall be stored/disposed of in compliance with Order conditions related to spoils management.
- All disturbed and/or unstable slopes shall be stabilized and returned to pre-project conditions.
 - Slopes shall be contoured as close as feasible to natural grade and aspect.
 - Temporary erosion control shall be applied to prevent sediment run-off.
- Soil exposed as a result of project work, soil above rock riprap, and interstitial spaces between rocks shall be revegetated with native species by live planting, seed casting, or hydroseeding prior to the rainy season of the year work is completed.
 - Native plants characteristic of the local habitat shall be used for revegetation when implementing and maintaining cleanup/restoration work in riparian and other sensitive areas.
 - Native forbes and graminoids shall be planted to replace sediment stabilization, sediment filtration and nutrient filtration
 - Native trees and shrubs shall be planted to replace bank stabilization, inputs of large woody debris and temperature control within riparian areas.
 - Restoration of the quality/health of the riparian stand shall promote: 1) shade and microclimate controls; 2) delivery of wood to channels, 3) slope stability and erosion control, 4) ground cover, and 5) removal of excess nutrients.

