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WDID
1_12CC420469

Eastern California Cannabis Regulatory Program
Regional Water Quality Control Board
Site Management Plan

January 1, 2019 Version

County:	Humboldt	**Tier:**	2
Operation Name:	FINMARK FARMS	**Risk:**	LOW
Site Name:	Trailer - Wonderland - Taj - Pond	**Disturbed Area (ft²):**	
Site Address:		**Cultivation Area (ft²):**	
APN(s):	218-051-008, 218-081-002. -006, 218-091-004	**Cumulative Disturbed Area (ft²)*:**	
Application ID #:	WDID 1_12CC420469	**Cumulative Cultivation Area (ft²)*:**	

**For sites with multiple enrollments on the same property, report the combined disturbed area and cultivation area of all cannabis cultivation on the property. If this does not apply, leave this section blank.*

This plan describes how the cultivator is implementing the best practical treatment or control (BPTC) measures listed in Attachment A of the Cannabis General Order. Refer to Attachment D of the General Order for further technical report guidance. If the sections below do not provide sufficient space, you may attach additional pages.

~~**Email the completed and saved electronic form along with maps and photos to**~~
~~**Lahontan.Cannabis@waterboards.ca.gov**~~

~~1.~~ Sediment Discharge BPTC Measures

A. Site Characteristics

i. Site Map

Attach a map of the site. The map should contain the following features with labels:

- Access roads
- Vehicle parking areas
- Streams
- Stream crossings
- Cultivation site(s)
- Disturbed areas
- Buildings
- Other site features that are referenced in this plan. (e.g. BPTC measures, pesticide/ fertilizer storage, trash/ refuse storage, etc.)

The map should also include:

- A legend
- A north arrow
- A scale bar
- Topographic lines

ii. Access Road Conditions

a. What is the road surface type(s)? Check all that apply.

☐ Asphalt ☑ Gravel ☑ Dirt ☐ Concrete ☐ Other (describe): _____

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b. Is there evidence of erosion, such as gullies or rills? If yes, describe current conditions and how they will be remediated in the space below.

Yes ✔ No

c. Does any portion of the access road(s) act as a conveyance for water? If yes, describe in the space below.

✔ Yes No

SEE ATTACHED

d. What is the estimated vehicle traffic on these roads?

Commuter vehicles: 8 per Day

Commercial vehicles: 4 per Month

Heavy equipment: 1 per Year

Other _____: _____ per Day

e. How is storm water drained from the roads? Check all that apply. Refer to *The Handbook for Forest Ranch and Rural Roads* for information on the methods listed below. (Available at http://www.pacificwatershed.com/PWA-publications-library.)

☑ Crowned ☑ Out slope ☑ Armored ditch ☑ Culverts ☑ Rolling dips ☐ Other (describe below)

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f. Describe the number, spacing, and discharge location of water drainage features.

SEE LSAA

g. Select the erosion control and sediment capture measures used on the access roads and water drainage features. Check all that apply.

Erosion Control Measures

☐ Erosion control blankets ☐ Geotextiles ☐ Straw mulch ☐ Hydromulch ☐ Wood mulch
☑ Vegetation Preservation ☐ Vegetation Planting ☐ Hydroseeding ☑ Vegetated channels
☐ Check dams ☐ Other: _____

Sediment Capture Measures

☐ Fiber Rolls ☐ Silt fences ☐ Other: _____

Describe the selected measures in the space below:

h. What activities are done to maintain the roads? What activities are done to maintain erosion control measures? What is the maintenance schedule?

Regular inspection and maintenance in accordance with PWA Road Manual, road maintenance generally once per year in in late September or similar.

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iii. Streams

a. Do you have any streams, drainages, or channels on or adjacent to your property?

☑ Yes ☐ No

b. If applicable, provide the name(s) of the stream(s). If the stream, drainage, or channel doesn't have a name, write "Unnamed Stream":

SEE PWA LSAA MAP

c. If there is a stream, what is the distance between the edge of the stream bank and the edge of the disturbed area at the closest point? How did you take this measurement?

_____ feet Measurement method: SEE PWA LSAA

d. Do you have any stream crossings?

☑ Yes ☐ No

e. If yes, what types of crossings are they? If there are multiple crossings, check all that apply.

☐ Bridge ☑ Culvert ☐ Low water ☐ Other, Describe: _____

f. If yes, was the crossing designed by a Qualified Professional (e.g. licensed engineer)?

☑ Yes ☐ No

g. Provide a description of all stream crossings, including who designed them, number of crossings, material, size, frequency of use, and any other relevant details. Indicate the location of stream crossings on your site map. Attach photos of all stream crossings and cross-sectional areas of all engineered flow conveyances (e.g. culverts and ditches) used at crossings.

SEE LSAA

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B. Sediment Erosion Prevention and Sediment Capture

If you are classified as Moderate Risk Tier 1 or Moderate Risk Tier 2 and are submitting a Site Erosion and Sediment Control Plan that includes the following information, you may skip this section.

i. Erosion Prevention BPTC Measures

On your site map, indicate the location of erosion prevention BPTC measures described below. Describe erosion prevention BPTC measures around all disturbed areas and features. Include BPTC measures implemented to address erosion resulting from storm water runoff from impervious surfaces, including but not limited to parking lots and roofs of greenhouses, warehouses, or storage facilities. Attach photos documenting implemented measures and locations for planned implementation.

a. How is storm water drained from buildings, greenhouses, and other structures? How are storm water conveyance systems monitored and maintained to protect water quality?

site grading/slope, french drains, drainage ditches, ditch relief culverts

b. What physical BPTC measures have been implemented to prevent or limit erosion? Check all that apply.

☑ Straw mulch ☑ Wood mulch ☐ Hydromulch ☐ Plastic covers ☐ Slope stabilization ☐ Soil binders
☐ Erosion control blankets ☐ Geotextiles ☑ Culvert outfall armoring ☐ Other:

Describe the physical BPTC measures checked above, including when they are used and where they are placed.

mulch applied to cultivation walkways. culverts rock armor to prevent erosion

c. What biological BPTC measures have been implemented to prevent or limit erosion? (e.g. vegetation preservation/ replacement, hydro seeding, etc.)? Check all that apply.

☑ Vegetation preservation ☐ Vegetation planting ☐ Hydroseeding ☐ Other:

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Describe the biological BPTC measures checked above, including when they are used and where they are employed.

vegetated buffer to attenuate flow and dissapate energy

d. What physical and biological BPTC measures do you plan to implement to prevent or limit erosion? Check all that apply.

Physical BPTC measures:

☐ Straw mulch ☐ Wood mulch ☐ Plastic covers ☐ Slope stabilization ☐ Soil binders
☐ Culvert outfall armoring ☐ Other:

Biological BPTC measures:

☐ Vegetation preservation ☐ Native vegetation planting ☐ Hydroseeding ☐ Other:

Describe the planned BPTC measures and provide an implementation schedule below.

N/A

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ii. Sediment Control BPTC Measures

On your site map, indicate the location of sediment control BPTC measures described below. Describe sediment control BPTC measures around all disturbed areas and features. Attach photos documenting implemented measures and locations for planned implementation.

a. What physical BPTC measures have been implemented to capture sediment that has been eroded? Check all that apply.

☐ Silt fences ☐ Fiber rolls ☑ Settling ponds/ areas ☐ Other:

Describe the physical BPTC measures checked above, including when they are used and where they are placed.

b. What biological BPTC measures have been implemented to capture sediment that has been eroded? Check all that apply.

☑ Vegetated outfalls ☐ Hydro seeding ☐ Other:

Describe the biological BPTC measures checked above, including when they are used and where they are employed.

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c. What physical and biological BPTC measures do you plan to implement to prevent or limit erosion? Check all that apply.

Physical BPTC measures:

☐ Silt fences ☐ Fiber rolls ☐ Settling ponds/ areas ☐ Other:

Biological BPTC measures:

☐ Vegetated outfalls ☐ Hydro seeding ☐ Other:

Describe the planned BPTC measures and provide an implementation schedule below.

n/a. established development

iii. Maintenance Activities- Erosion Prevention and Sediment Control

a. How will erosion prevention BPTC measures, sediment control BPTC measures, and stormwater conveyance systems be monitored and maintained to protect water quality? Describe all required maintenance tasks and a schedule for implementation.

regular inspection and maintenance. site and all culverts are inspected and winterization measures are implemented prior to the rainy season

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b. How will captured sediment be handled? Check all that apply.

☑ Stabilized in place. ☐ Excavated and stabilized on site. ☐ Removed from the site.

Describe the procedure for handling captured sediment below:

revegetation

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2. Fertilizer, Pesticide, Herbicide, and Rodenticide BPTC Measures

A. Product List	
In the sections below, list all products used and describe how they are delivered to the site, how they are stored, and how they are used at the site. Also describe how products will be removed from the site or stored to prevent discharge if they are not consumed before the winter season. If there is not enough space, list remaining products on a separate sheet.	
i. Fertilizers	
Product Name	*Product Description*
Max Sea	NPK 16-16-16
Base Farm Micro	NPK 6-0-0 + Calcium,Boron, Iron, Manganese, Molybdenum
Base Farm Grow	NPK 2-1-6 (derived from ammonium sulfate,potassium nitrate, magnesium phosphate, potassium carbonate)
Base Farm Bloom	NPK 0-6-5 (derived from magnesium phosphate, phosphoric acid, potassium carbonate, potassium sulfate)
Grow More	NPK 30-10-10
Karbo Kandy	
Rebel Rise	NPK 12-6-6 (derived from :Soy protein hydrolysate, Mono potassium phosphate, Di-potassium phosphate, Mono ammonium phosphate, Kelp extract, Boric acid , Copper EDTA, Iron EDTA , Manganese EDTA , Zinc E
Rebel Rush	NPK 5-10-5 derived from Soy protein hydrolysate, Mono potassium phosphate, Di-potassium phosphate, Mono ammonium phosphate, Kelp extract, Boric acid, Copper EDTA, Iron EDTA, Manganese EDTA Zinc EDTA
Symbys Cal Mag	NPK 2-0-0 derived from calcium nitrate, magnesium nitrate, iron edta
ii. Pesticides	
Product Name	*Active Ingredient and Product Description*
Plant Therapy	soy oil, peppermint oil, citric acid, soap, isopropyl alcohol, sodium citrate, water
Sierra Natural Science 203	clove oil, rosemary, water, polyglyceral oleate, lactic acid
Sierra Natural Science 209	rosemary, water, soap bark, humic acid

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iii. Herbicides	
Product Name	*Active Ingredient and Product Description*
Pure Crop	soybean oil, corn oil, water, glycerin, guar gum, citric acid, soap, vanillin
Green Cleaner	soybean oil, sodium laurel sulfate, water, isopropyl alcohol, sodium citrate, citric acid
iv. Rodenticides	
Product Name	*Active Ingredient and Product Description*
Mole Scram	castor oil, citronella oil, garlic oil, hulled peanut shells

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B. Product Storage Location

i. Do you use secondary containment for the storage of fertilizers, pesticides, herbicides, and rodenticides?

☑ Yes ☐ No

ii. Where are products stored on site? Indicate the storage location on your site map.

Shed on site for storage of fertilizers, pesticides, and other regulated products is in accordance with best practices, including storage within an enclosed space to prevent surface water contamination. Shed is indicated on the plot plan (site map) provided and is in appropriate distances from waterways. Shed is kept cool, dry and well ventilated.

C. Bulk Fertilizers and Chemical Concentrates

i. How are bulk fertilizers and chemical concentrates stored, mixed, and applied?

Stored in secondary containment according to best practices.
Fertilizers and chemical concentrates are mixed in a safe and dry indoor space, well ventilated, and brought via 5 gallon buckets with tops secured to place of application (water tanks, garden beds, etc.) PPE is used to ensure safety of applicator. Products used at rates no higher than recommended on label.

ii. How are empty containers disposed of?

Containers are triple rinsed and emptied in the pickle barrel used for application. Containers then immediately placed in dumpsters onsite which are covered and kept in a contained location safe distances from waterways. Dumpsters emptied and brought to appropriate disposal facilities.

D. Spill Prevention and Cleanup Plan

i. What procedures are in place to prevent spills of fertilizers, pesticides, herbicides, and rodenticides?

All applicators use PPE to prevent risks that might occur from product spilling on sensitive areas (skin, eyes, etc.) Use of funnels and measuring equipment that is rinsed throughly between each use. Products always mixed in a safe and secure, well ventilated indoor location.

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ii. What procedures are in place to clean up spills if they occur?

Spill kits are provided at each mixing location onsite and applicators are educated on proper procedures in case of a spill according to each product used. Proper procedures for spills are posted in all sites where products are used.

3. Petroleum Product BPTC Measures

A. Product List

In the sections below, list all products used and describe how they are delivered to the site, how they are stored, and how they are used at the site. Also describe how products will be removed from the site or stored to prevent discharge if they are not consumed before the winter season.

Product Name	*Product Description*
Gasoline	1,000 gallon metal drums onsite, filled by a truck- and used to fill containers.
Diesel	1,000 gallon metals drums onsite, filled by a truck- and used to fill containers.
Motor Oil	Plastic containers of 1 gallon motor oils used for different machinery onsite.

B. Product Storage Location

i. Do you use secondary containment for the storage of petroleum products?

☑ Yes ☐ No

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ii. Where are products stored on site? Indicate the storage location on your site map.

Products are stored in cool, dry, well ventilated shed onsite.

C. Product Use

i. How are fuels, lubricants, and other petroleum products stored, mixed, and applied?

Products are stored in a dry shed, within second containment. Dry shed is kept cool, dry and well ventilated. Fuel is only dispensed in safe areas, flat surfaces with the use of PPE.

ii. How are empty containers disposed of?

Generally speaking, fuel containers are reused and not disposed of. If a container should break, it is immediately disposed of in a covered and contained secondary containment until transported to the proper waste management facility.

D. Spill Prevention and Cleanup Plan

i. What procedures are in place to prevent spills of petroleum products?

Proper use of PPE for all handlers of petroleum products. Machinery is filled on a flat surface in a safe, well ventilated area of dry shed to avoid spills and employee hazards. Containment guidelines regarding capacity of fuel containers are closely followed. Trainings are provided to handlers of petroleum products to insure proper knowledge of usage.

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ii. What procedures are in place to clean up spills if they occur?

Spill kits are provided at all sites where fuel is used and proper guidelines for safe use of petroleum is provided at each site. Training is provided to all handlers of products.

4. Trash/ Refuse, and Domestic Wastewater BPTC Measures

A. Type of Trash/ Refuse

i. What types of trash/ refuse will be generated at the site? Include a description of all solid waste materials (e.g. spent hydroponic growing media, organic materials, plastic, paper, glass, clay, etc.)

Plastics, polypropolene (from drip) , paper

Organic materials - composted

ii. How will trash/ refuse be contained and properly disposed of?

Trash is placed in plastic bags, tightly closed in garbage cans onsite and when full, disposed of into a secured dumpster which is covered and kept in a safe, designated location on property.

iii. Where will trash/ refuse be stored? Indicate the location of trash/ refuse storage on your site map.

All trash/refuse is placed into contractor bags and secured tightly, then placed in a secured and locked dumpster on location. Dumpster location is indicated on Site Map.

Organic materials are disposed of in secured, designated compost area.

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B. Personal Waste

i. How many employees, visitors, and residents will you have at the site?

Employees: 0

Residents: 2

Visitors: per Day

ii. What types of domestic wastewater will be generated at the site? Check all that apply.

☑ Household generated wastewater ☐ Chemical toilet waste ☐ Other:

From dishes and showers in permitted residence.

iii. How will domestic wastewater be disposed? Check all that apply.

☐ Sewer

☑ Permitted onsite wastewater treatment system (e.g. septic tank and leach lines) Provide a schematic and a copy of your permit for the system.

☑ Chemical toilets or holding tank. If so, provide the name of the servicing company and frequency of service:
Six Rivers - every two weeks

☐ Outhouse, pit privy, or similar. (Use of this alternative requires approval from the Regional Board Executive Officer. Attach the approval from the Executive Officer and any conditions imposed if using this alternative. Indicate the location of any domestic wastewater treatment, storage, or disposal areas on your site map, as well as the locations of all water wells (e.g. drinking water, irrigation water, commercial water, etc.) inside or within 0.5 mile of the site boundary.)

5. Winterization BPTC Measures

A. Winterization Activities Performed

What activities will be performed to winterize the size and prevent discharges of waste?

Inspect and maintain all roads, drainages and stream crossings.
Store all tools and equipment appropriately.
Cover and stabilize all soils in place.
Add erosion control as needed.

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B. Maintenance of Drainage and Sediment Capture Features

What maintenance activities will be performed to remove debris and soil blockages from drainage and sediment capture features (e.g. drainage culverts, drainage trenches, settling ponds, etc.) and ensure adequate capacity exists? Include a description of how all solid waste materials are managed.

Refer to LSAA

C. Revegetation Activities

What revegetation activities will occur at the beginning or end of the precipitation season?

N/a established site. Cultivation soils straw and seed with cover crop.

D. Compliance Schedule

If any Winterization BPTC measure cannot be completed before the onset of winter period, contact the Regional Water Board to establish a compliance schedule.

Provide a timeline for implementation of these measures:

N/A

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6. Cannabis Cultivation Details

A. Growing Methods

i. Where is cannabis grown?

☑ Fully outdoor ☐ Hoophouse ☑ Greenhouse with permeable floors ☐ Other (please describe):

ii. What type of container is cannabis grown in? Check all that apply.

☐ In ground ☑ Raised beds ☐ Pots/ grow bags/ trays on the ground
☐ Pots/ grow bags/ trays elevated off the ground ☐ Other (describe):_____

iii. If cannabis is grown in containers elevated off the ground, is irrigation tailwater collected?

☐ Yes ☑ No ☐ A portion of it is collected ☐ N/A

If yes, describe what you do with the captured irrigation tailwater:

B. Irrigation Water Treatment

i. Is irrigation water filtered prior to use?

☐ Yes ☑ No

If irrigation water is filtered, answer the questions below:

ii. What type of filtration is used (i.e. reverse osmosis, ion exchange, etc.)?

iii. What is the maximum volume of water filtered per day?

iv. How are filter residuals (i.e. brines, etc.) disposed of?

v. What is the volume of residual produced?

_____ gallons per Day

7. Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

☐ I have read and accept the above terms.

Operator/Responsible Party _____ DocuSigned by: Mark Finley A26C972E38E842C... Date Prepared 7/17/2020

Mark Finley

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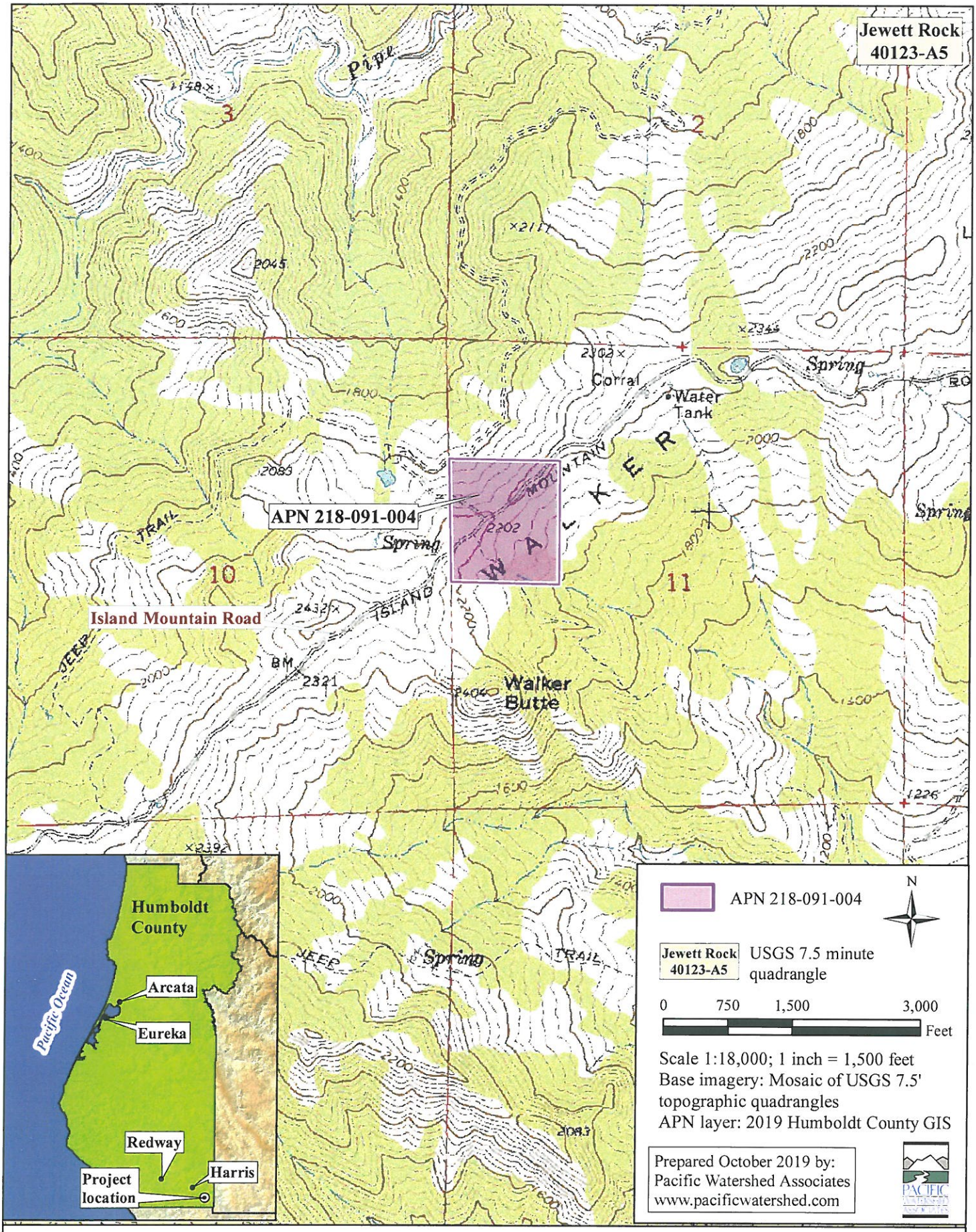

Figure 1. Lake or Streambed Alteration Agreement Location map for APN 218-091-004, located at 6534 Island Mountain Road, Harris, Humboldt County, California.

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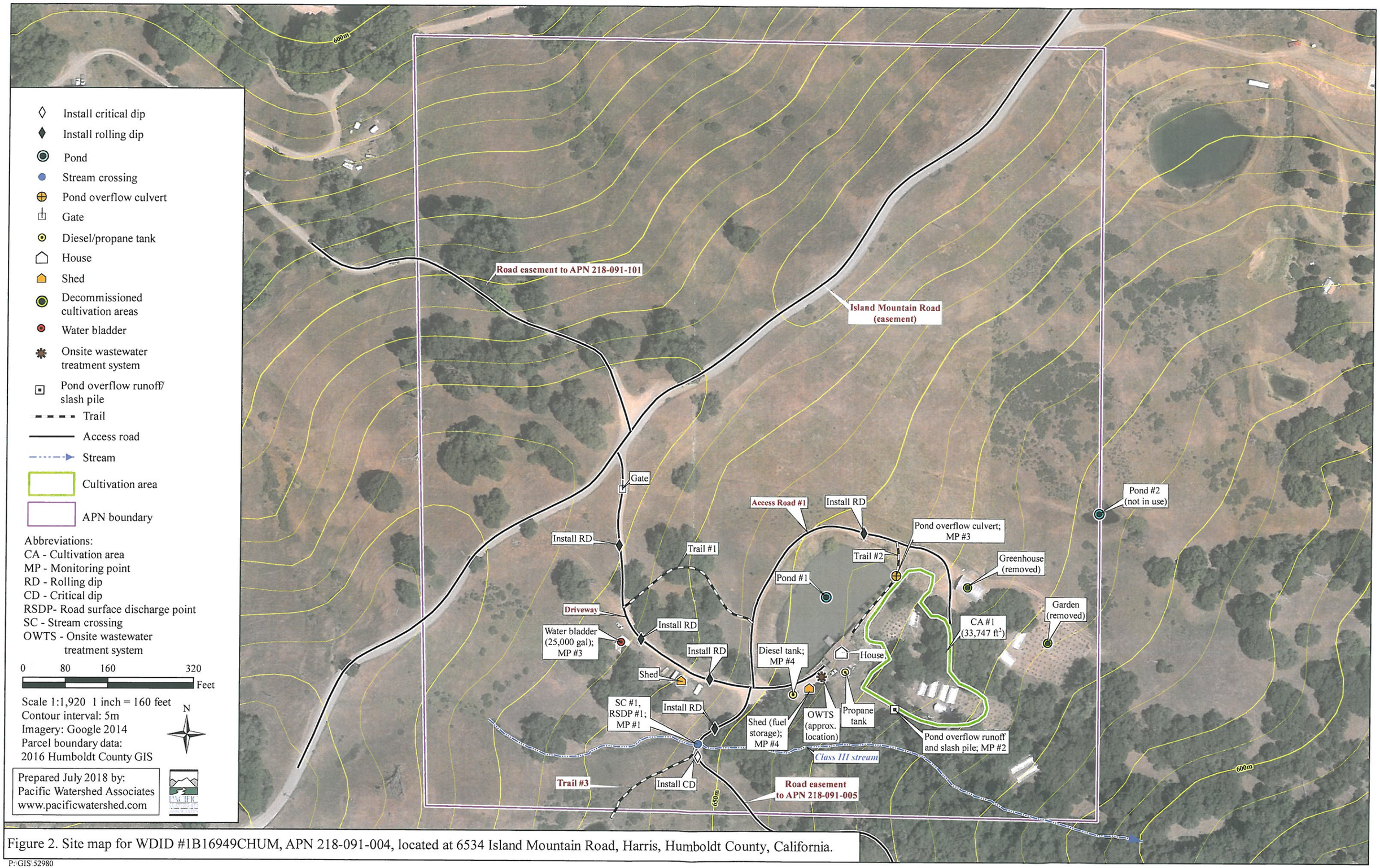

Figure 2. Site map for WDID #1B16949CHUM, APN 218-091-004, located at 6534 Island Mountain Road, Harris, Humboldt County, California.

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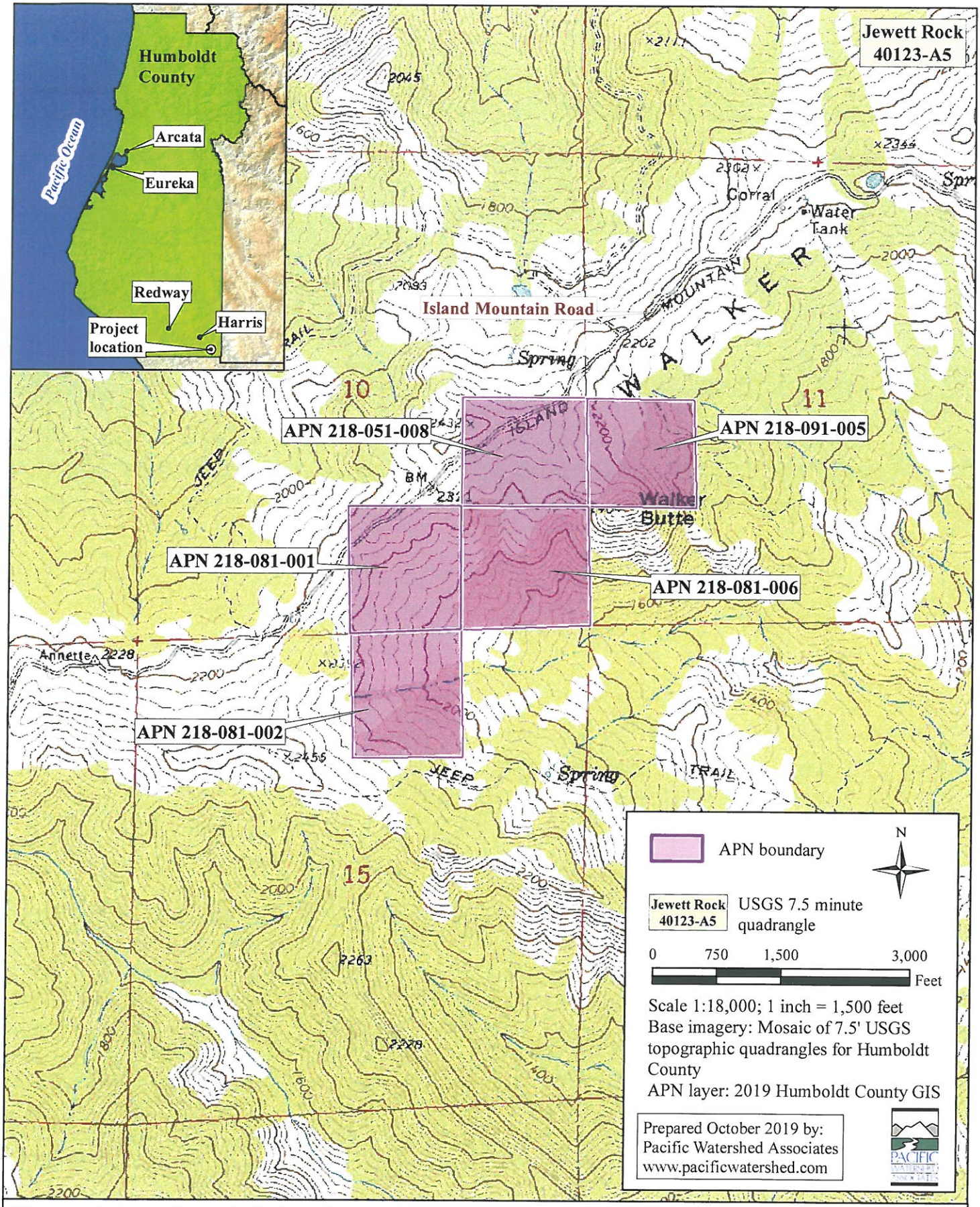

Figure 1. Lake or Streambed Alteration Agreement Location Map for APNs 218-081-001, 218-081-002, 218-081-006, 218-051-008, and 218-091-005, located at 2142 Island Mountain Road, Harris, Humboldt County, California.

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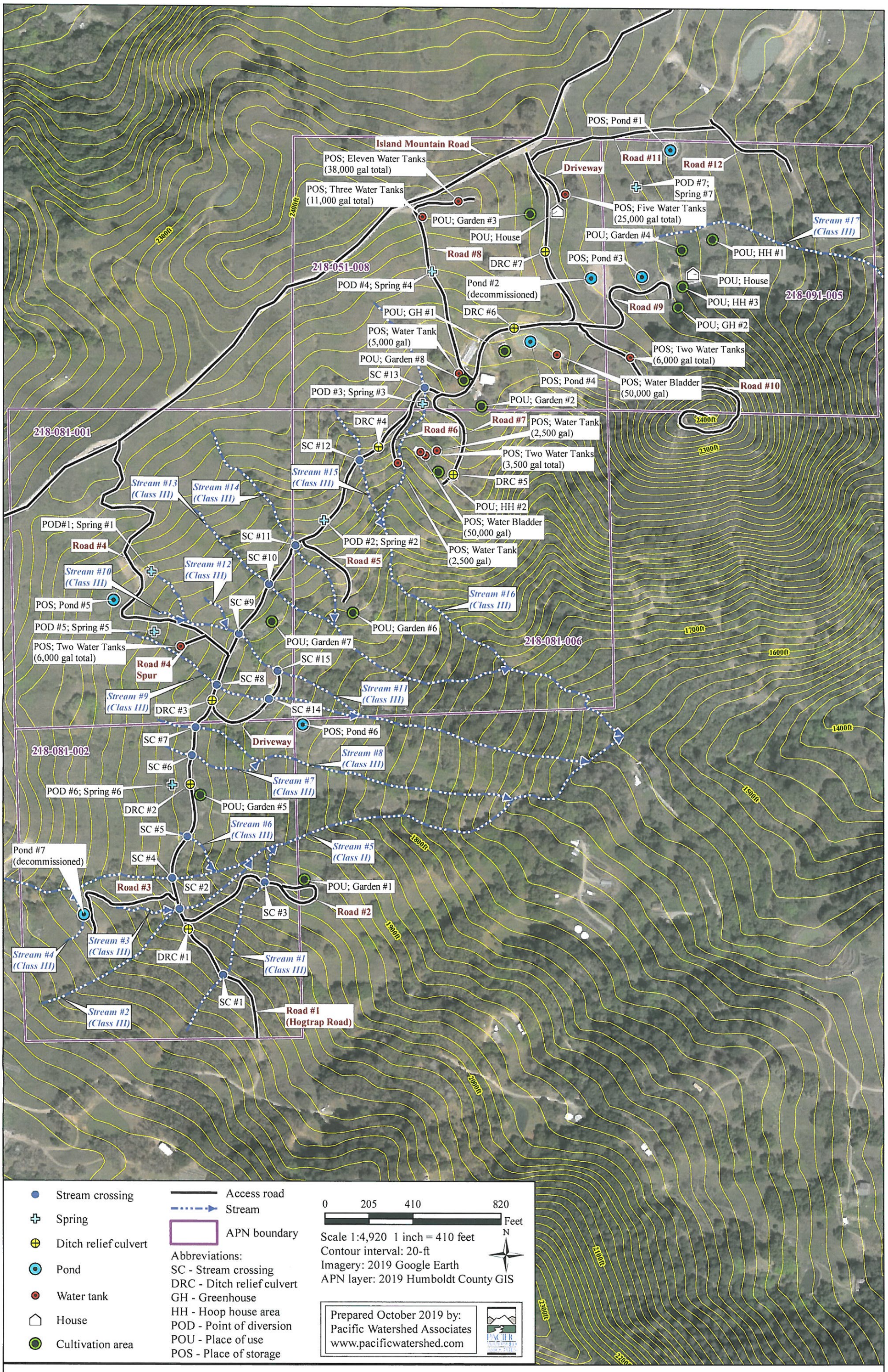

Figure 2. Lake or Streambed Alteration Agreement Site Map for APNs 218-081-001, 218-081-002, 218-081-006, 218-051-008, and 218-091-005, located at 2142 Island Mountain Road, Harris, Humboldt County, California.

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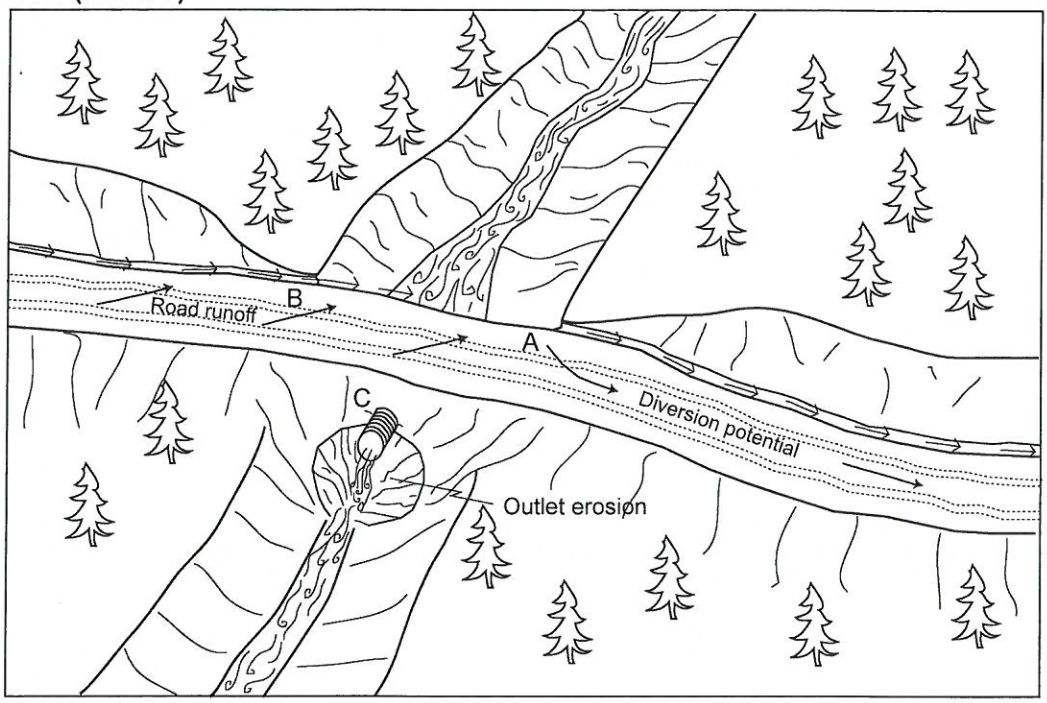
Typical Problems and Applied Treatments for a Non-fish Bearing Upgraded Stream Crossing

Problem condition (before)

A - Diversion potential

B - Road surface and ditch drain to stream

C - Undersized culvert high in fill with outlet erosion

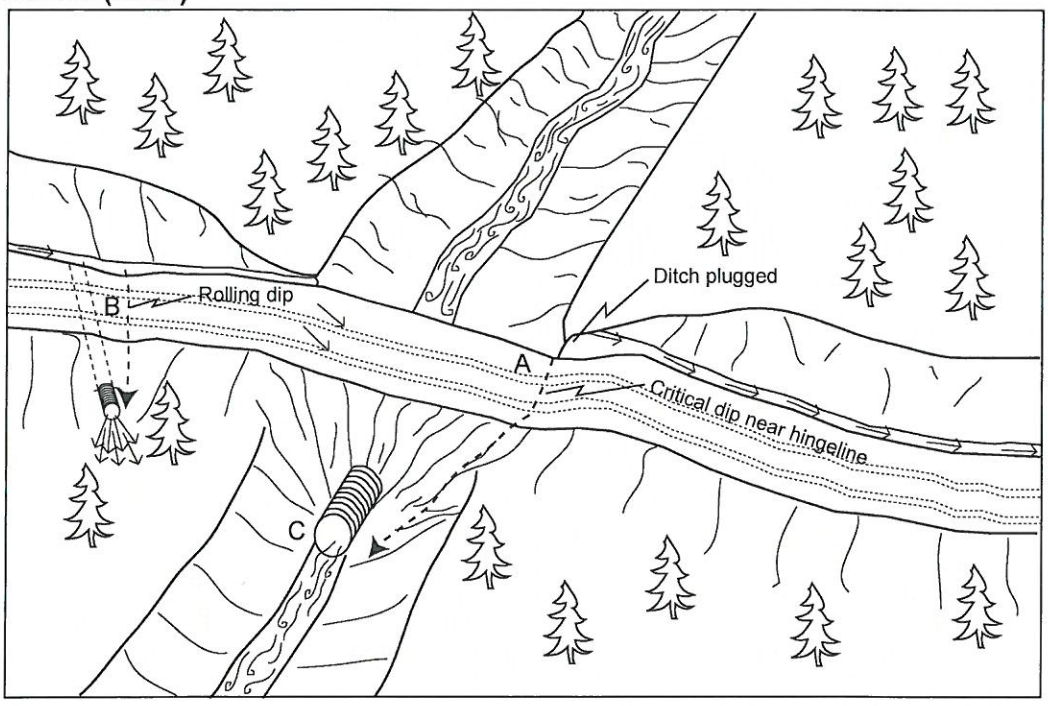


Treatment standards (after)

A - No diversion potential with critical dip installed near hingeline

B - Road surface and ditch disconnected from stream by rolling dip and ditch relief culvert

C - 100-year culvert set at base of fill



Pacific Watershed Associates Inc.
Geologic and Geomorphic Studies • Watershed Restoration • Wildland Hydrology • Erosion Control • Environmental Services
PO Box 4433, Arcata, CA 95518 / Ph: 707-839-5130 / FAX: 707-839-8168 / www.pacificwatershed.com

PWA Typical Drawing #1a

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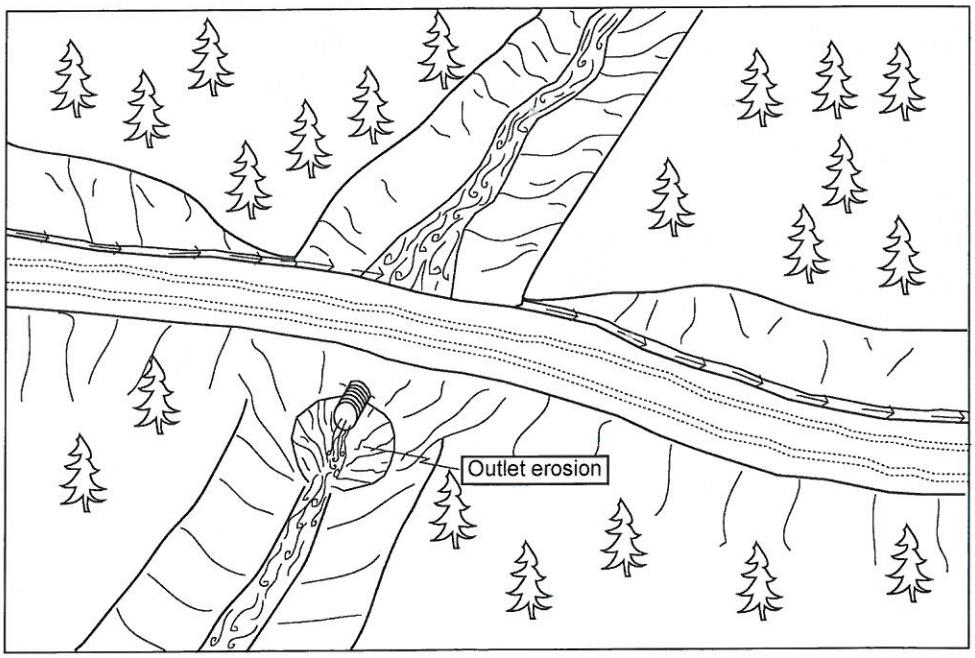
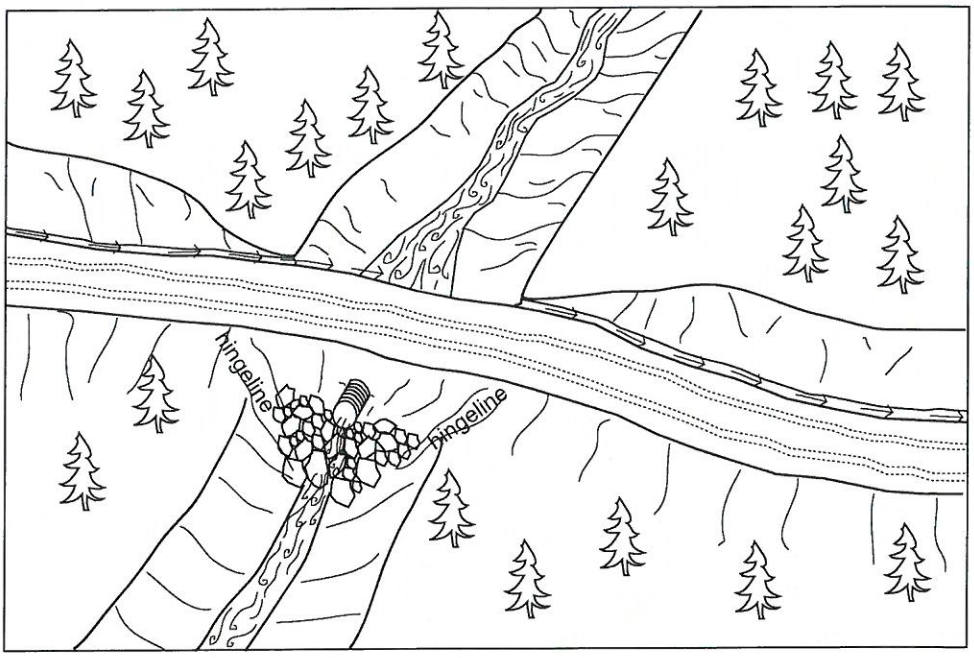
Armoring Fill Faces to Upgrade Stream Crossings



Problem: Culvert set high in outboard fill has resulted in scour of the outboard fill face and natural channel.
Conditions: The existing stream crossing has a culvert sufficient in diameter to manage design stream flows and has a functional life.



Action: The area of scour is backfilled with rip-rap to provide protection in the form of energy dissipation for the remaining fill face and channel.

Treatment Specifications:

1) Placement of rip-rap should be between the left and right hingelines and extend from a keyway excavated below the existing channel base level at the base of the fill slope up and under the existing culvert.
2) Rock size and volume is determined on a site by site basis based on estimated discharge and existing stream bed particle size range (See accompanying road log).

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PWA Typical Drawing #1b

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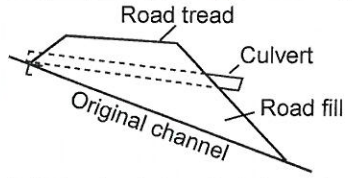
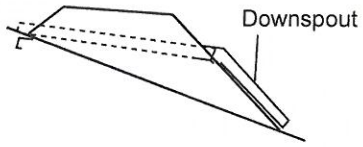
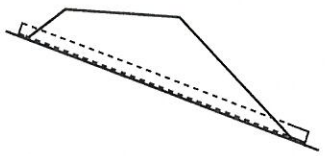
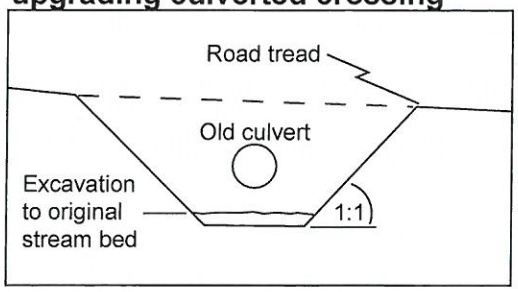
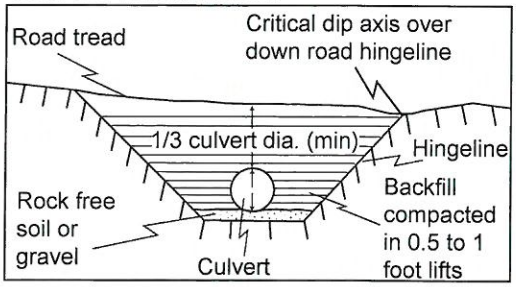
Typical Design of a Non-fish Bearing Culverted Stream Crossing

Existing	Upgraded	Upgraded (preferred)
		
1. Culvert not placed at channel grade. 2. culvert does not extend past base of fill.	1. Culvert not placed at channel grade. 2. Downspout added to extend outlet past road fill.	1. Culvert placed at channel grade. 2. Culvert inlet and outlet rest on, or partially in, the originial streambed.

Excavation in preparation for upgrading culverted crossing



Upgraded stream crossing culvert installation



Note:
Road upgrading tasks typically include upgrading stream crossings by installing larger culverts and inlet protection (trash barriers) to prevent plugging. Culvert sizing for the 100-year peak storm flow should be determined by both field observation and calulations using a procedure such as the Rational Formula.

Stream crossing culvert Installation

1. Culverts shall be aligned with natural stream channels to ensure proper function, and prevent bank erosion and plugging by debris.
2. Culverts shall be placed at the base of the fill and the grade of the original streambed, or downspouted past the base of the fill.
3. Culverts shall be set slightly below the original stream grade so that the water drops several inches as it enters the pipe.
5. To allow for sagging after burial, a camber shall be between 1.5 to 3 incher per 10 feet culvert pipe length.
6. Backfill material shall be free of rocks, limbs or other debris that could dent or puncture the pipe or allow water to seep around pipe.
7. First one end then the other end of the culvert shall be covered and secured. The center is covered last.
8. Backfill material shall be tamped and compacted throughout the entire process:
   - Base and side wall material will be compacted before the pipe is placed in its bed.
   - Backfill compacting will be done in 0.5 - 1 foot lifts until 1/3 of the diameter of the culvert has been covered. A gas powered tamper can be used for this work.
9. Inlets and outlets shall be armored with rock or mulched and seeded with grass as needed.
10. Trash protectors shall be installed just upstream from the culvert where there is a hazard of floating debris plugging the culvert.
11. Layers of fill will be pushed over the crossing until the final designed road grade is achieved, at a minimum of 1/3 to 1/2 the culvert diameter.

Erosion control measures for culvert replacement

Both mechanical and vegetative measures will be employed to minimize accelerated erosion from stream crossing and ditch relief culvert upgrading. Erosion control measures implemented will be evaluated on a site by site basis. Erosion control measures include but are not limited to:

1. Minimizing soil exposure by limiting excavation areas and heavy equipment distrubance.
2. Installing filter windrows of slash at the base of the road fill to minimize the movement of eroded soil to downslope areas and stream channels.
3. Retaining rooted trees and shrubs at the base of the fill as "anchor" for the fill and filter windrows.
4. Bare slopes created by construction operations will be protected until vegetation can stabilize the surface. Surface erosion on exposed cuts and fills will be minimized by mulching, seeding, planting, compacting, armoring, and/or benching prior to the first rains.
5. Excess or unusable soil will be stored in long term spoil disposal locations that are not limited by factors such as excessive moisture, steep slopes greater than 10%, archeology potential, or proximity to a watercourse.
6. On running streams, water will be pumped or diverted past the crossing and into the downstream channel during the construction process.
7. Straw bales and/or silt fencing will be employed where necessary to control runoff within the construction zone.

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Typical Drawing #2

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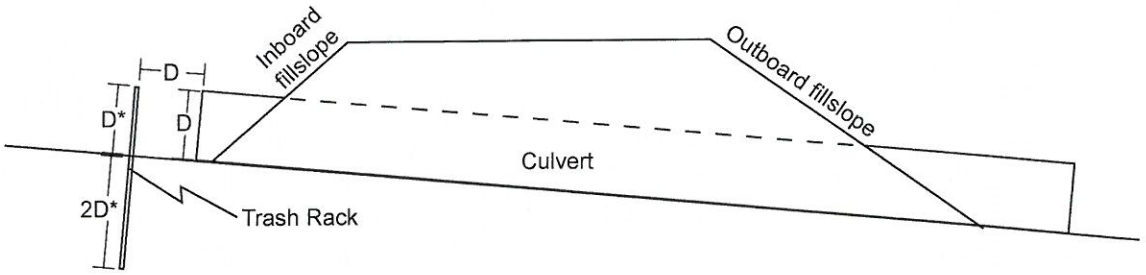
Typical Design of a Single-post Culvert Inlet Trash Rack

Cross section view



D - Culvert diameter

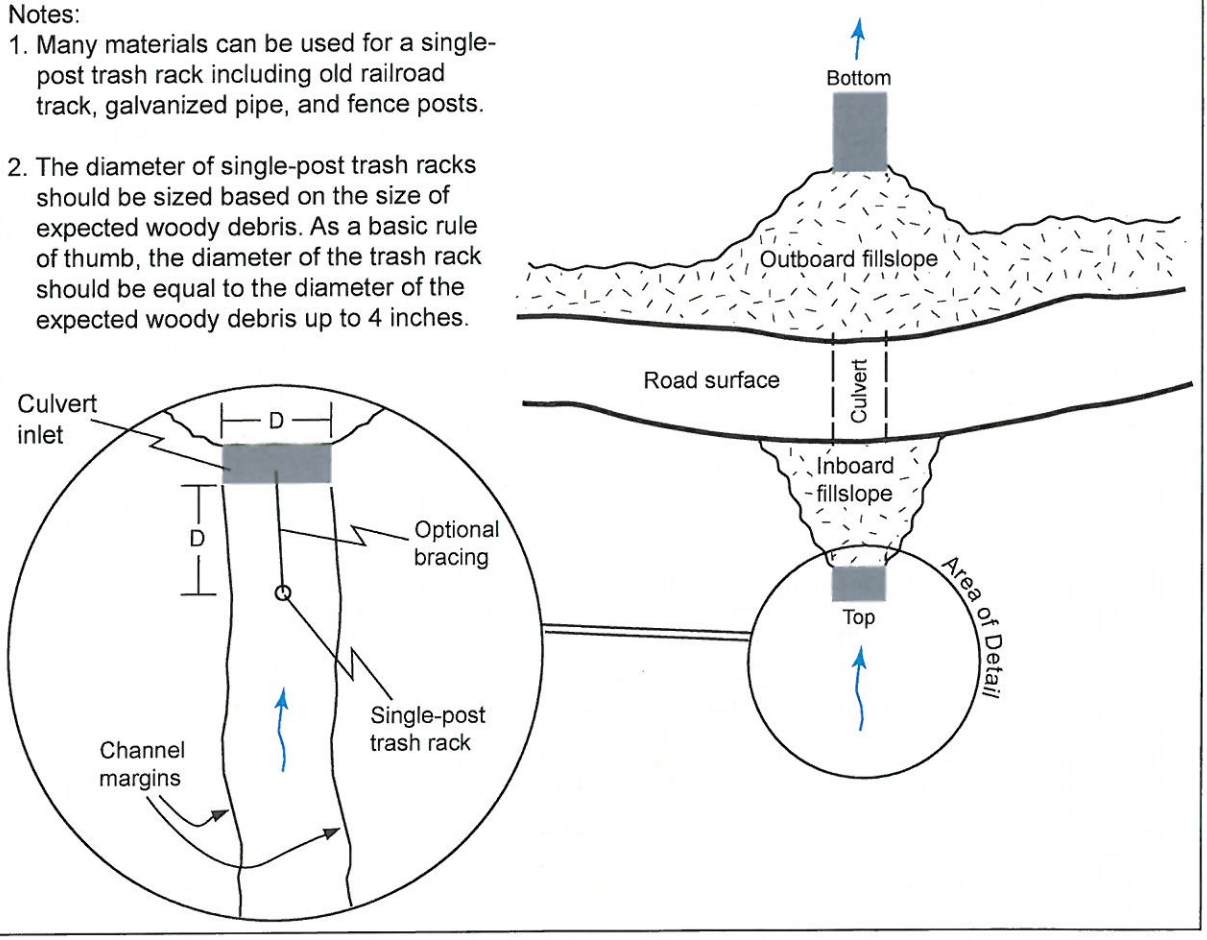
D* - If the culvert is designed for the 100-year peak storm flow, the trash rack height above the streambed should equal D.
If the culvert is undersized, then the trash rack needs to be extended vertically above the streambed to match or exceed the expected headwall height.

Plan view

Notes:

1. Many materials can be used for a single-post trash rack including old railroad track, galvanized pipe, and fence posts.

2. The diameter of single-post trash racks should be sized based on the size of expected woody debris. As a basic rule of thumb, the diameter of the trash rack should be equal to the diameter of the expected woody debris up to 4 inches.



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Typical Drawing #3

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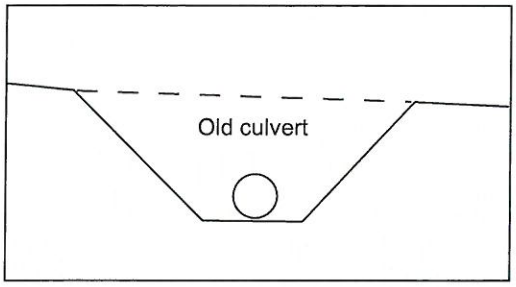
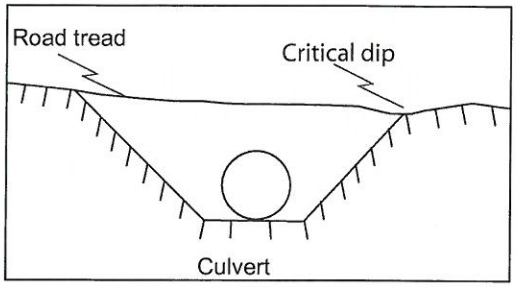
Typical Design of Upgraded Stream Crossings



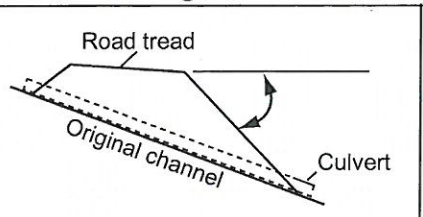
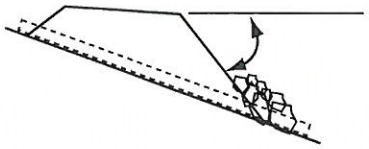
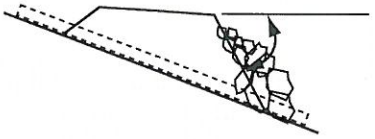


Stream crossing culvert Installation

1. Culverts shall be aligned with natural stream channels to ensure proper function, and prevent bank erosion and plugging by debris.
2. Culverts shall be placed at the base of the fill and the grade of the original streambed or downspouted past the base of the fill.
3. Culverts shall be set slightly below the original stream grade so that the water drops several inches as it enters the pipe.
5. To allow for sagging after burial, a camber shall be between 1.5 to 3 incher per 10 feet culvert pipe length.
6. Backfill material shall be free of rocks, limbs or other debris that could dent or puncture the pipe or allow water to seep around pipe.
7. First one end and then the other end of the culvert shall be covered and secured. The center is covered last.
8. Backfill material shall be tamped and compacted throughout the entire process:
   - Base and side wall material will be compacted before the pipe is placed in its bed.
   - backfill compacting will be done in 0.5 - 1 foot lifts until 1/3 of the diameter of the culvert has been covered. A gas powered tamper can be used for this work.
9. Inlets and outlets shall be armored with rock or mulched and seeded with grass as needed.
10. Trash protectors shall be installed just upstream from the culvert where there is a hazard of floating debris plugging the culvert.
11. Layers of fill will be pushed over the crossing until the final designed road grade is achieved, at a minimum of 1/3 to 1/2 the culvert diameter.

Note:
Road upgrading tasks typically include upgrading stream crossings by installing larger culverts and inlet protection (trash barriers) to prevent plugging. Culvert sizing for the 100-year peak storm flow should be determined by both field observation and calculations using a procedure such as the Rational Formula.

Armoring fill faces

Fill angles ≤ 2:1	Fill angles (between 2:1 & 1.5:1)	Fill angles (between 1.5:1 & 1:1)
 No rock armor needed	 Armor 1/4 up fill face	 Armor 3/4 way up fill face

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PWA Typical Drawing #4

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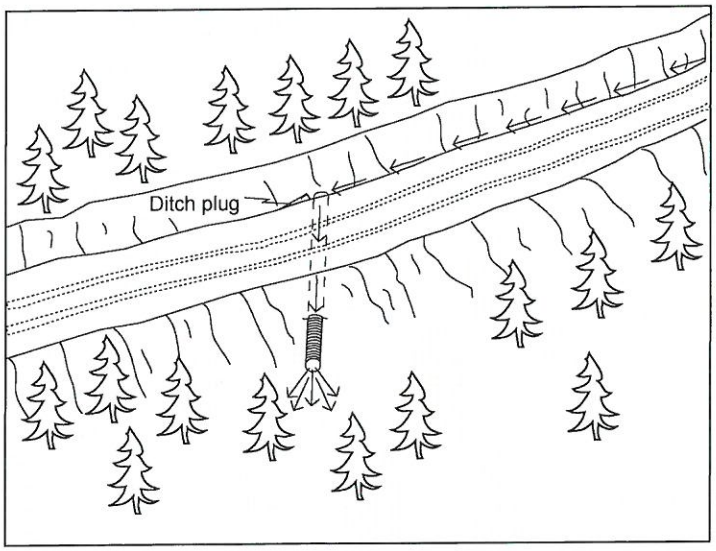
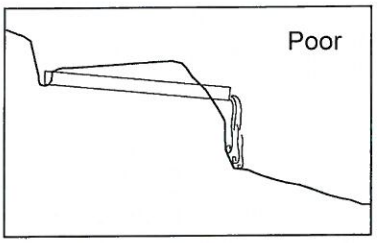
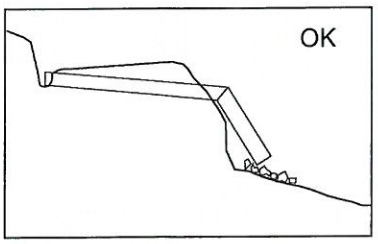
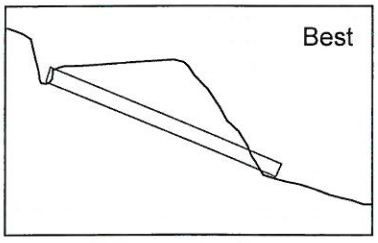
Typical Ditch Relief Culvert Installation









Ditch relief culvert installation

1) The same basic steps followed for stream crossing installation shall be employed.
2) Culverts shall be installed at a 30 degree angle to the ditch to lessen the chance of inlet erosion and plugging.
3) Culverts shall be seated on the natural slope or at a minimum depth of 5 feet at the outside edge of the road, whichever is less.
4) At a minimum, culverts shall be installed at a slope of 2 to 4 percent steeper than the approaching ditch grade, or at least 5 inches every 10 feet.
5) Backfill shall be compacted from the bed to a depth of 1 foot or 1/3 of the culvert diameter, which ever is greater, over the top of the culvert.
6) Culvert outlets shall extend beyond the base of the road fill (or a flume downspout will be used). Culverts will be seated on the natural slope or at a depth of 5 feet at the outside edge of the road, whichever is less.

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Typical Drawing #8

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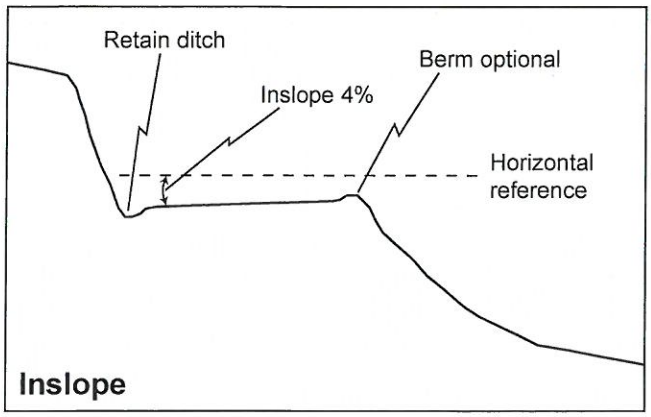
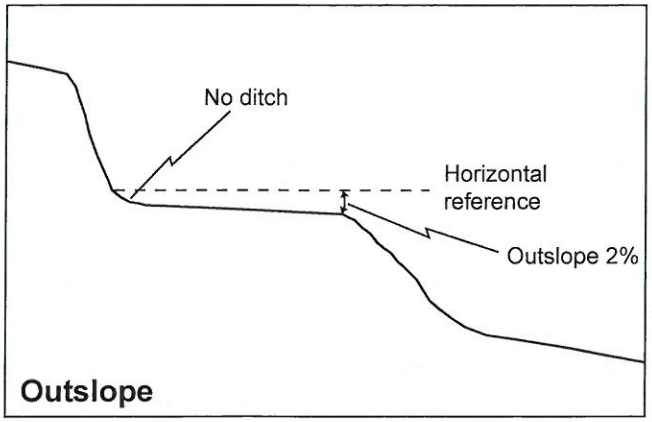
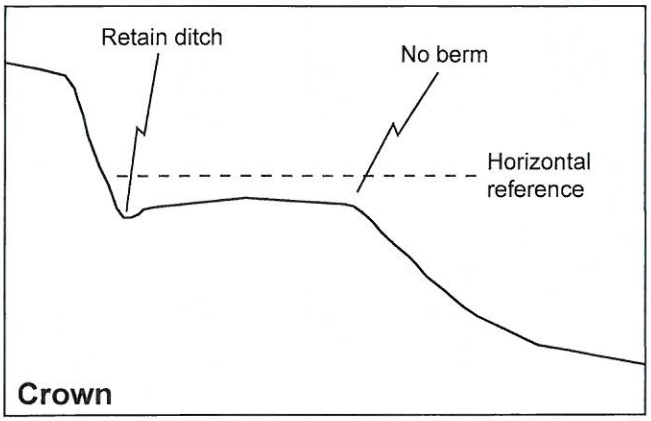
Typical Designs for Using Road Shape to Control Road Runoff







Outsloping Pitch for Roads Up to 8% Grade		
Road grade	**Unsurfaced roads**	**Surfaced roads**
4% or less	3/8" per foot	1/2" per foot
5%	1/2" per foot	5/8" per foot
6%	5/8" per foot	3/4" per foot
7%	3/4" per foot	7/8" per foot
8% or more	1" per foot	1 1/4" per foot

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Typical Drawing #9

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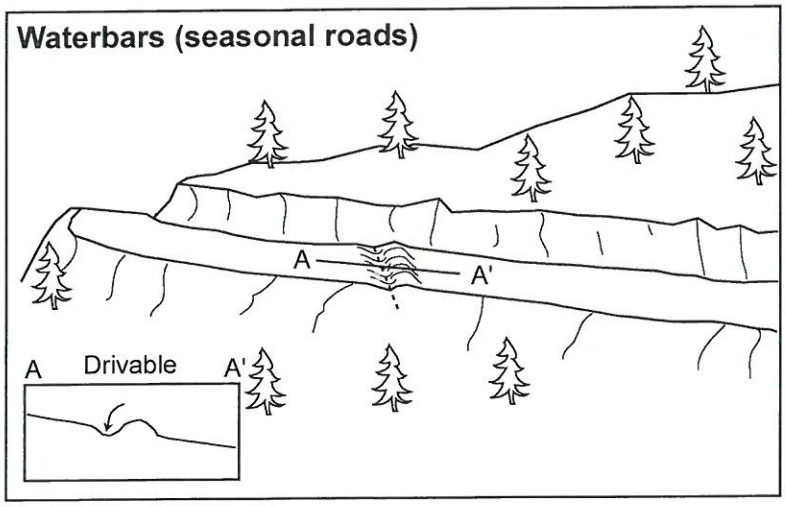
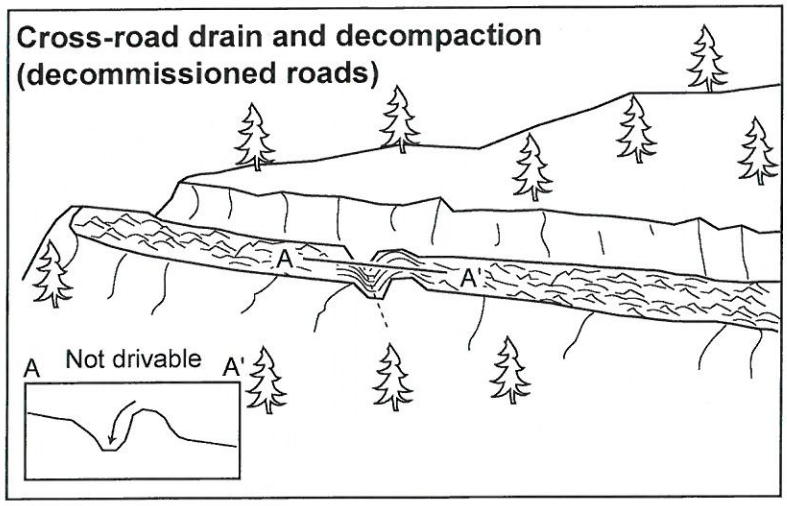
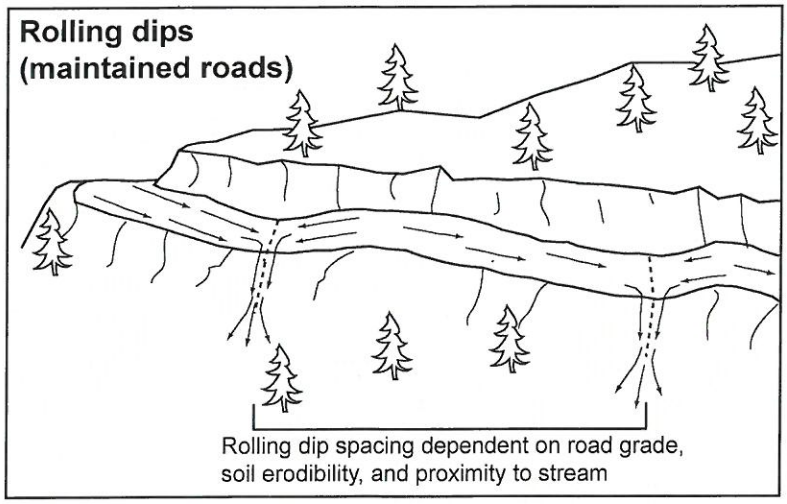
Typical Methods for Dispersing Road Surface Runoff with Waterbars, Cross-road Drains, and Rolling Dips







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Typical Drawing #10

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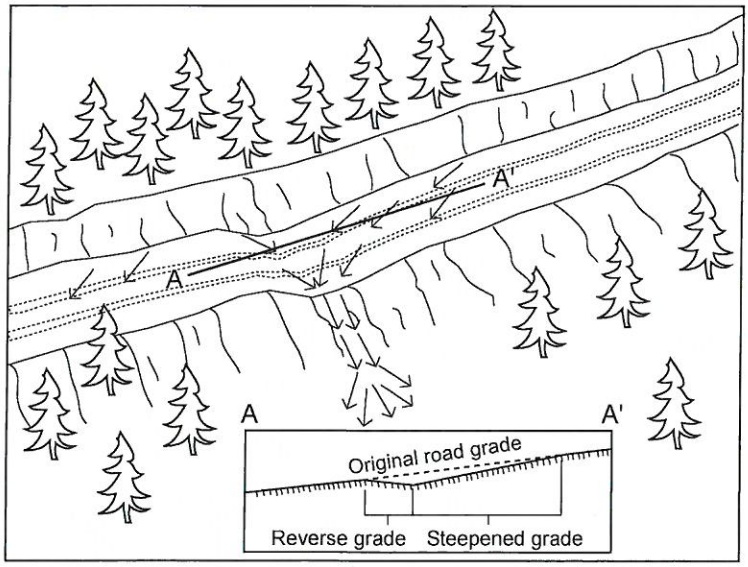
Typical Road Surface Drainage by Rolling Dips



Rolling dip installation:

1. Rolling dips will be installed in the roadbed as needed to drain the road surface.
2. Rolling dips will be sloped either into the ditch or to the outside of the road edge as required to properly drain the road.
3. Rolling dips are usually built at 30 to 45 degree angles to the road alignment with cross road grade of at least 1% greater than the grade of the road.
4. Excavation for the dips will be done with a medium-size bulldozer or similar equipment.
5. Excavation of the dips will begin 50 to 100 feet up road from where the axis of the dip is planned as per guidelines established in the rolling dip dimensions table.
6. Material will be progressively excavated from the roadbed, steepening the grade unitl the axis is reached.
7. The depth of the dip will be determined by the grade of the road (see table below).
8. On the down road side of the rolling dip axis, a grade change will be installed to prevent the runoff from continuing down the road (see figure above).
9. The rise in the reverse grade will be carried for about 10 to 20 feet and then return to the original slope.
10. The transition from axis to bottom, through rising grade to falling grade, will be in a road distance of at least 15 to 30 feet.

Table of rolling dip dimensions by road grade

Road grade %	**Upslope approach distance** (from up road start to trough) ft	**Reverse grade distance** (from trough to crest) ft	**Depth at trough outlet** (below average road grade) ft	**Depth at trough inlet** (below average road grade) ft
<6	55	15 - 20	0.9	0.3
8	65	15 - 20	1.0	0.2
10	75	15 - 20	1.1	0.01
12	85	20 - 25	1.2	0.01
>12	100	20 - 25	1.3	0.01

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Typical Drawing #11

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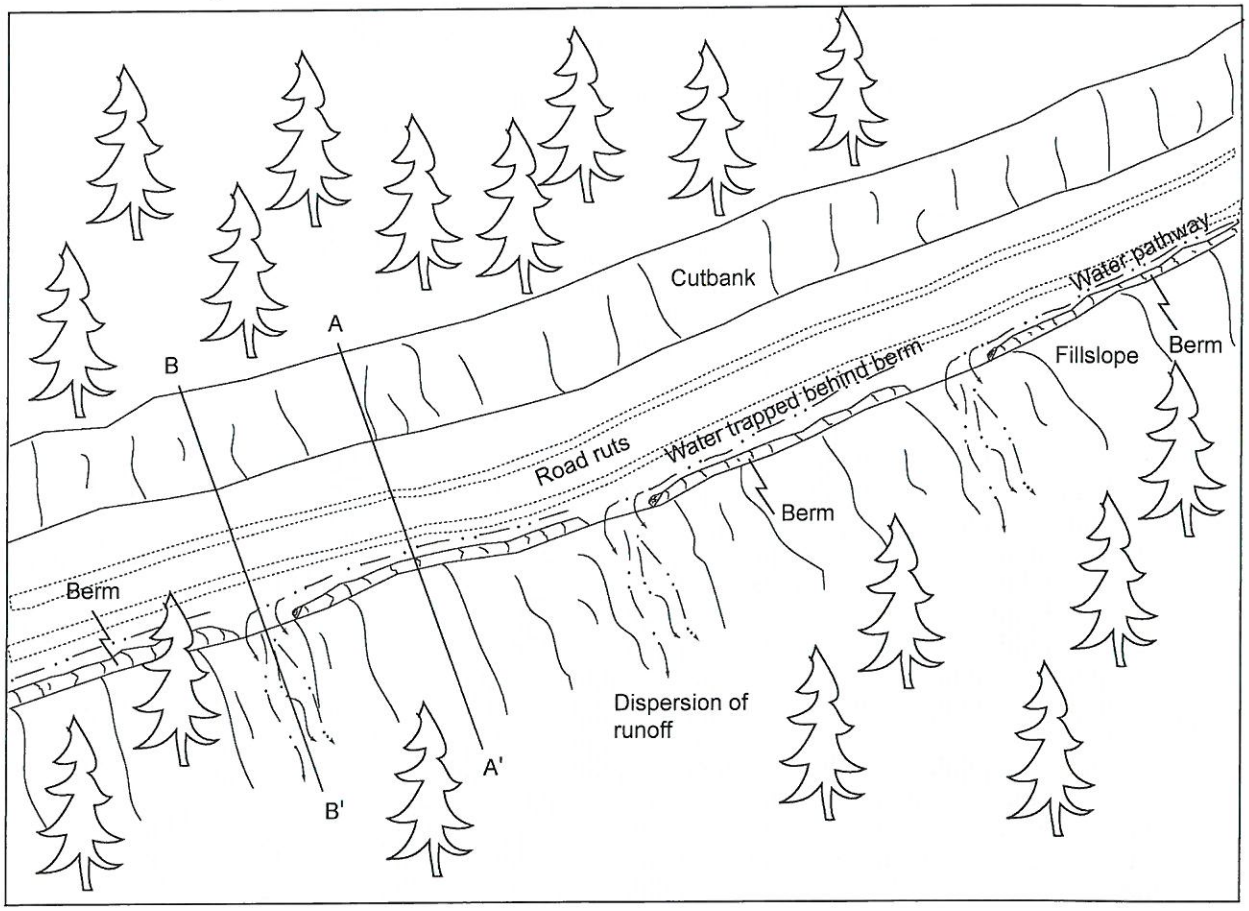
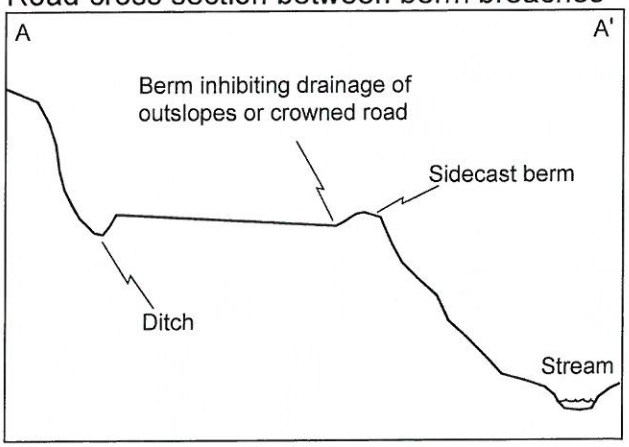
Typical Sidecast or Excavation Methods for Removing Outboard Berms on a Maintained Road

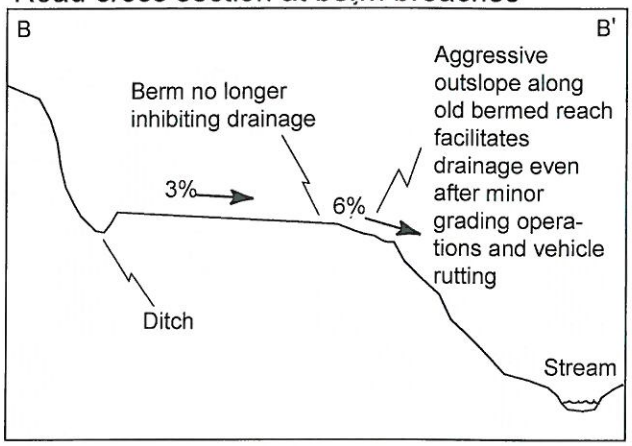
1. On gentle road segments berms can be removed continuously (see B-B').
2. On steep road segments, where safety is a concern, the berm can be frequently breached (see A-A' & B-B') Berm breaches should be spaced every 30 to 100 feet to provide adequate drainage of the road system while maintaining a semi-continuous berm for vehicle safety.



Road cross section between berm breaches



Road cross section at berm breaches



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Typical Drawing #12

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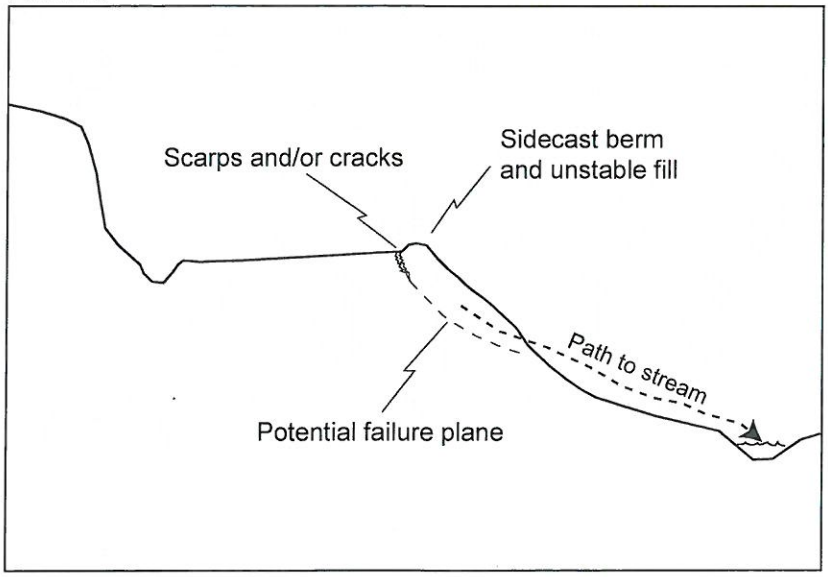
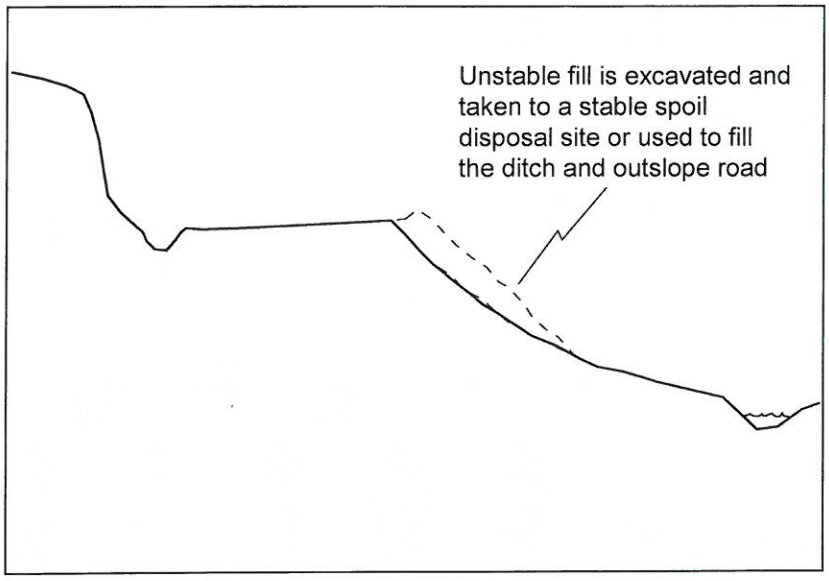
Typical Excavation of Unstable Fillslope on an Upgraded Road

Before



After



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Typical Drawing #13

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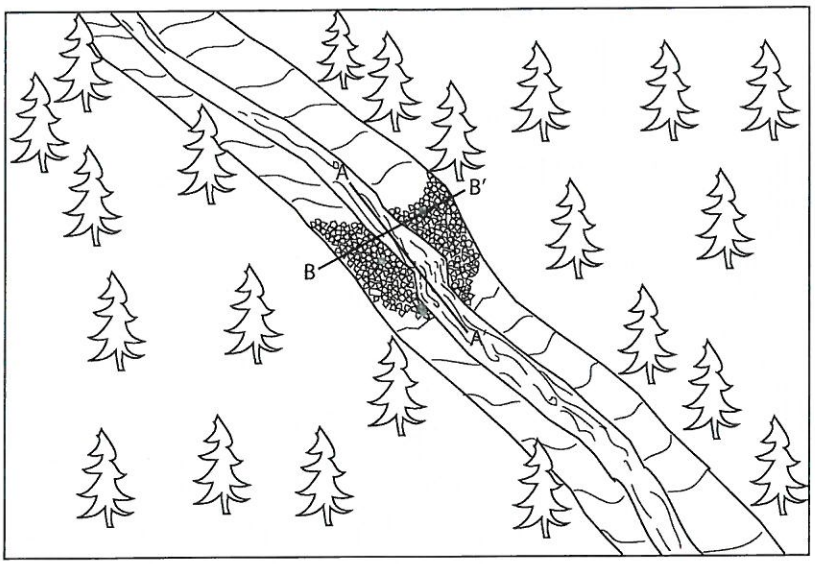
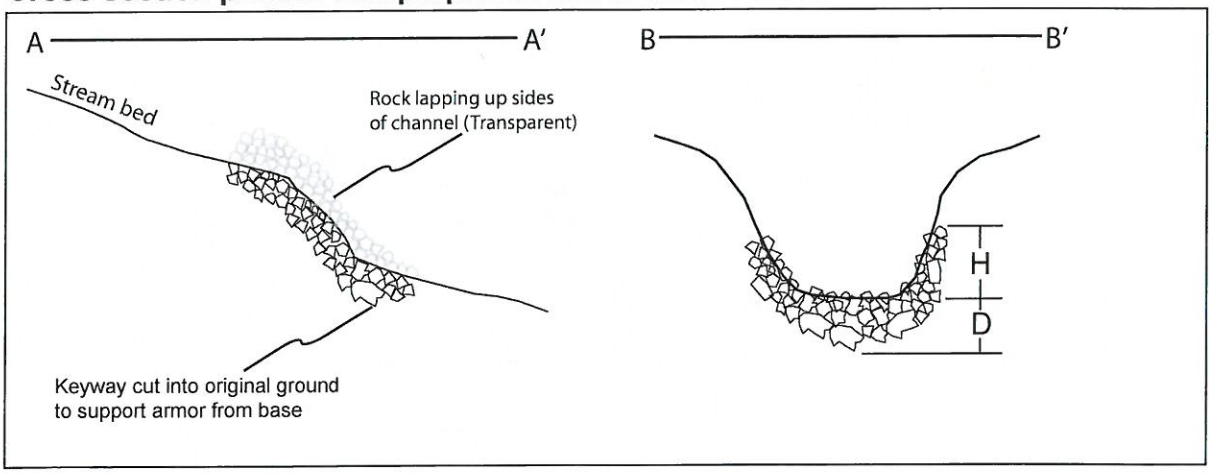
Typical Rock Grade Control Structure Installation in a non-fish bearing Stream Channel



Cross section parallel and perpendicular to watercourse



Notes

The main objective is to create a structure that will not be flanked, undercut, or eroded by the stream

The critical elements of a successful grade control structure are:

1) rock selection- rock should be selected that is resistent to abrasion and pysical disintigration and has a mixture of sizes with the largest size larger than the D100 of the stream.
2) The rock must be placed in a "U" shape that will confine the 100 yr. return interval stream flow and wont restrict the channel
3) The rock must be imbedded into the channel at least two rock diameters thick
4) The largest rock should be used at the base of the grade control structure to butress the other rock

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PWA Typical Drawing #18

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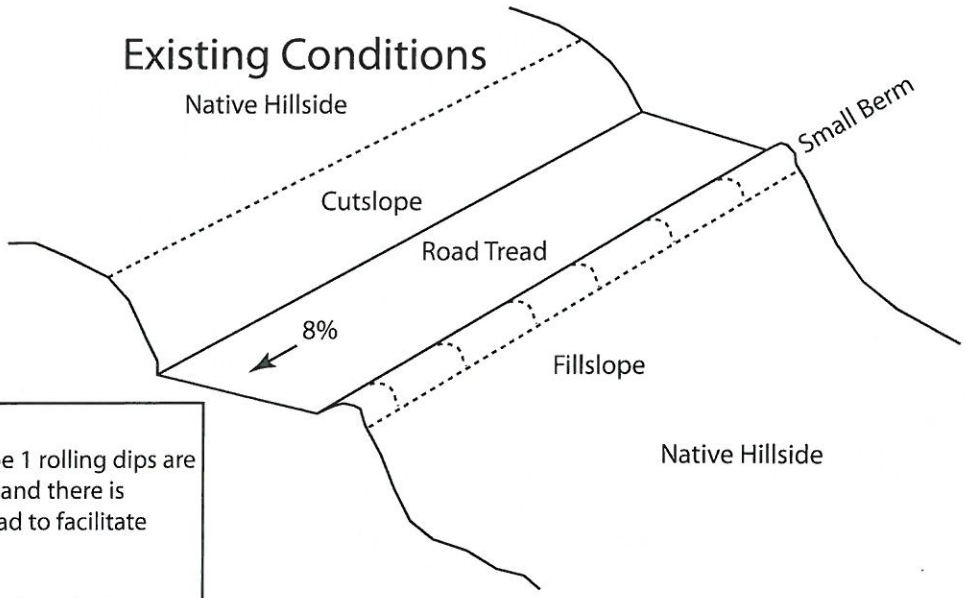
Rolling Dip Construction (Type 1)

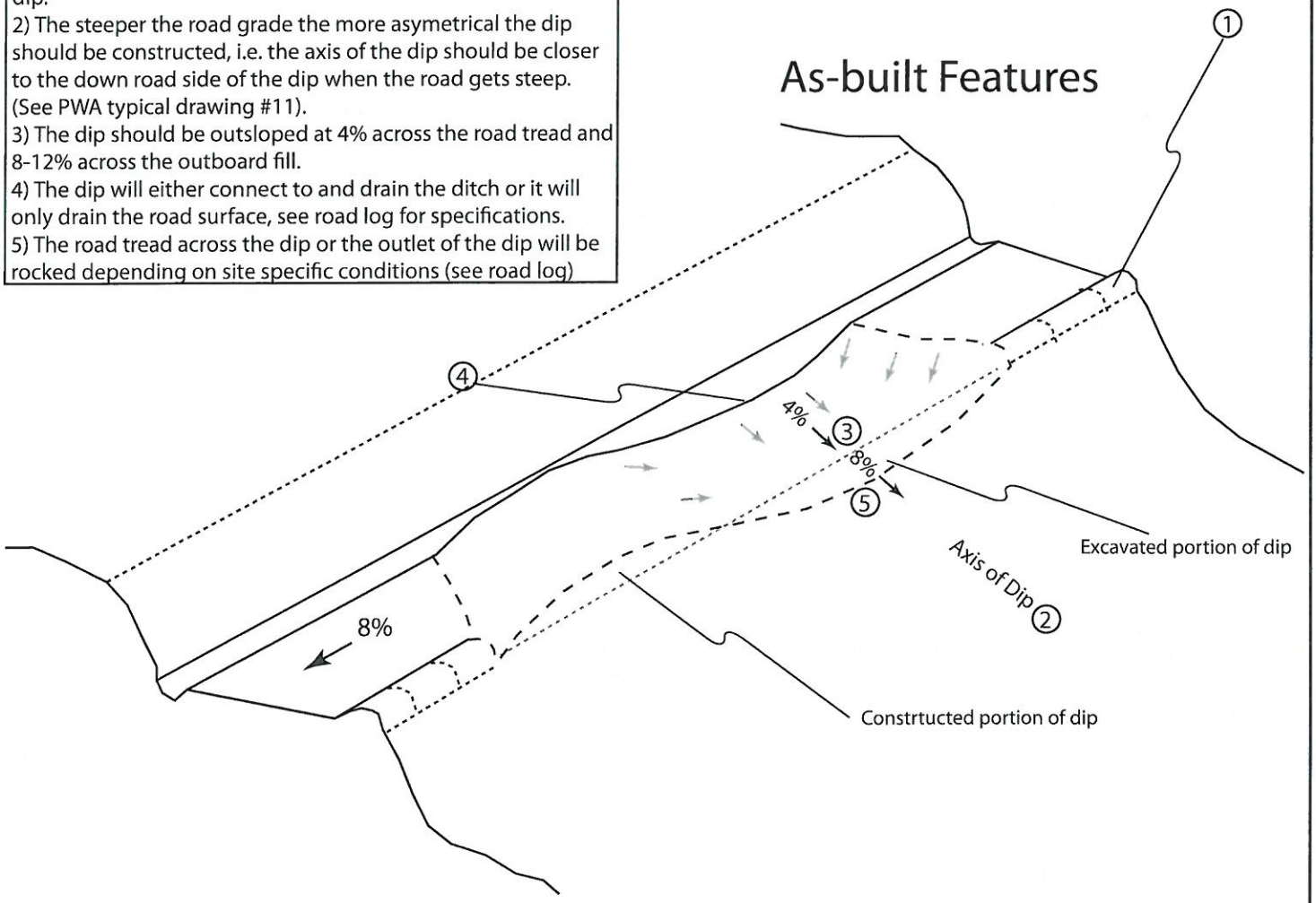


Notes

Rolling dip type 1 existing conditions: Type 1 rolling dips are utilized when roads are less than 12% grade and there is proximal outfall adjacent to the outboard road to facilitate road drainage.

Design Notes:

1) The berm should be removed for the entire length of the dip.
2) The steeper the road grade the more asymetrical the dip should be constructed, i.e. the axis of the dip should be closer to the down road side of the dip when the road gets steep. (See PWA typical drawing #11).
3) The dip should be outsloped at 4% across the road tread and 8-12% across the outboard fill.
4) The dip will either connect to and drain the ditch or it will only drain the road surface, see road log for specifications.
5) The road tread across the dip or the outlet of the dip will be rocked depending on site specific conditions (see road log)



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PWA Typical Drawing #19a

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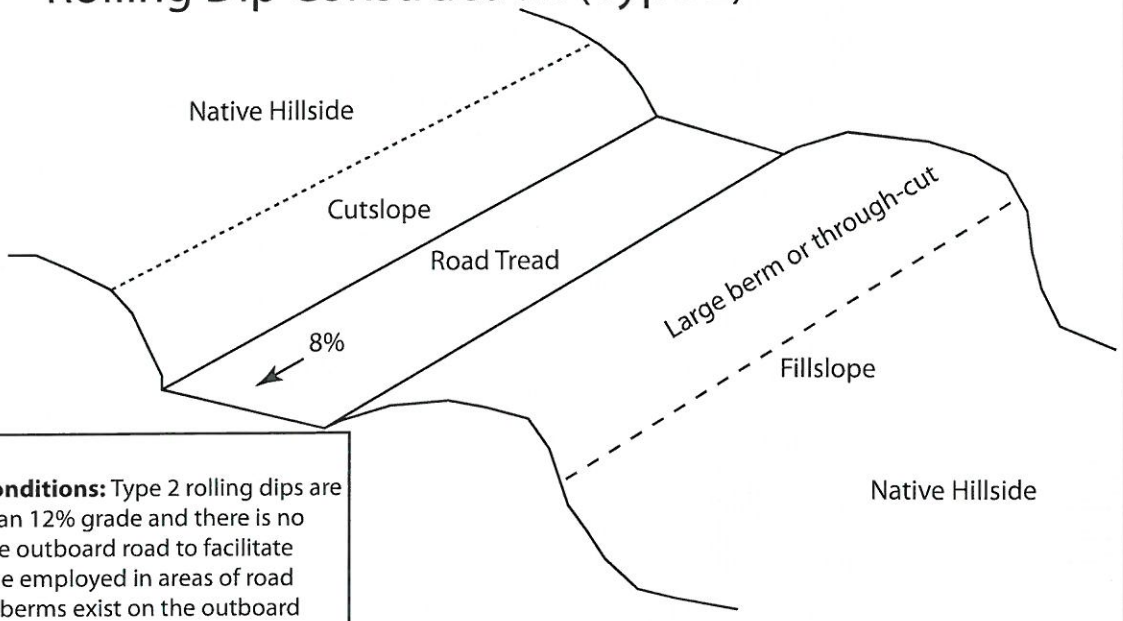
Rolling Dip Construction (Type 2)



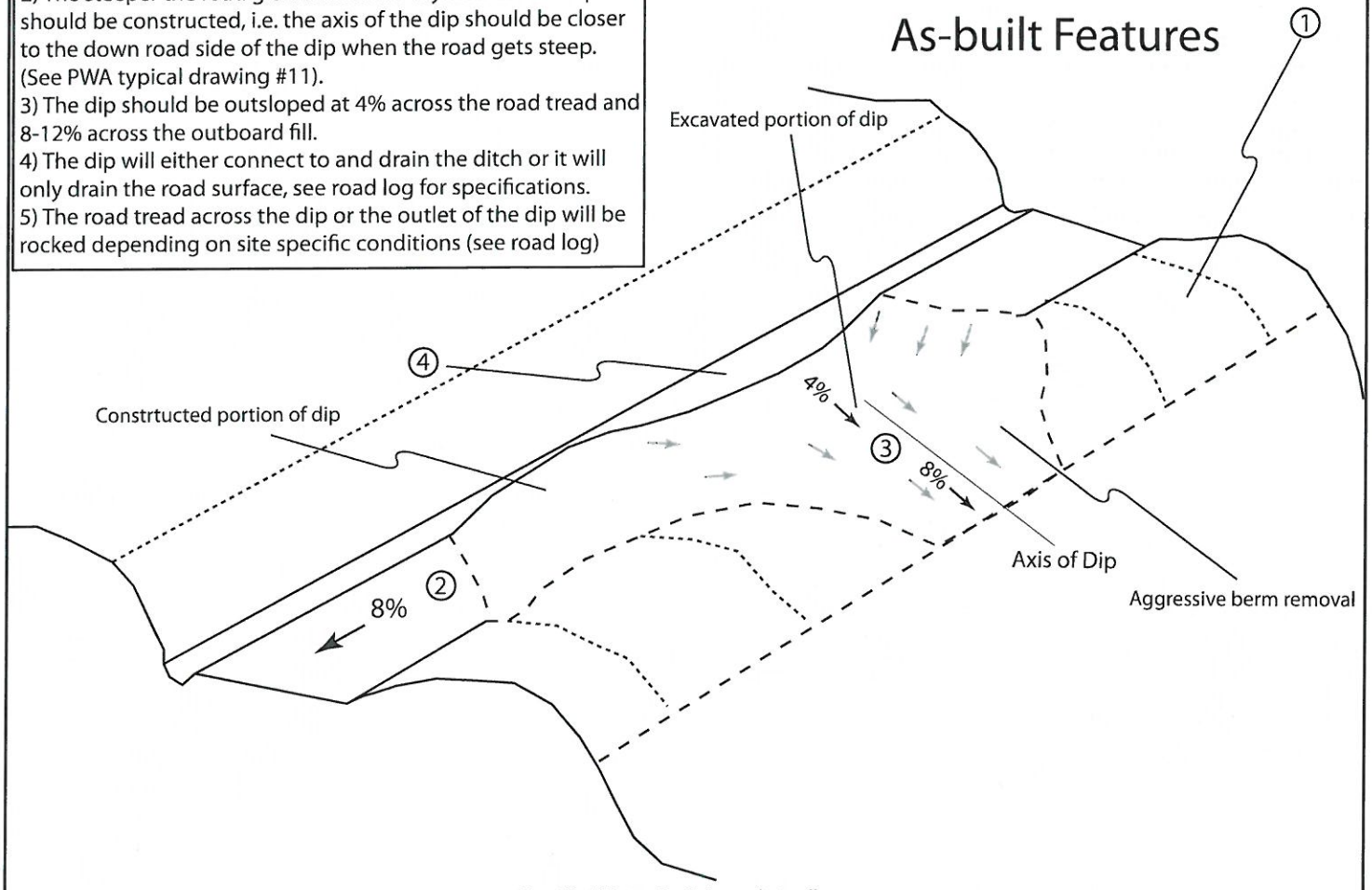
Notes

Rolling dip type 2 existing conditions: Type 2 rolling dips are utilized when roads are less than 12% grade and there is no proximal outfall adjacent to the outboard road to facilitate road drainage. These should be employed in areas of road through-cuts and where large berms exist on the outboard road

Design Notes:

1) The berm should be removed for the entire length of the excavated portion of the dip.
2) The steeper the road grade the more asymetrical the dip should be constructed, i.e. the axis of the dip should be closer to the down road side of the dip when the road gets steep. (See PWA typical drawing #11).
3) The dip should be outsloped at 4% across the road tread and 8-12% across the outboard fill.
4) The dip will either connect to and drain the ditch or it will only drain the road surface, see road log for specifications.
5) The road tread across the dip or the outlet of the dip will be rocked depending on site specific conditions (see road log)

As-built Features



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PWA Typical Drawing #19b

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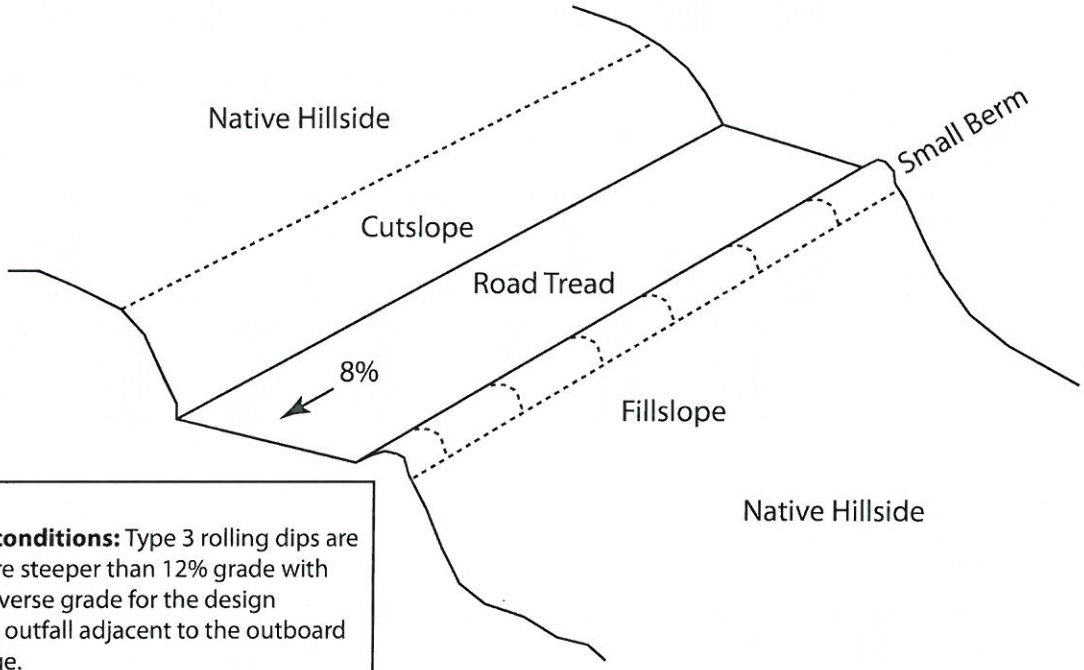
Rolling Dip Construction (Type 3, aggressive outslope)



Notes

Rolling dip type 3 existing conditions: Type 3 rolling dips are utilized when roads grades are steeper than 12% grade with little opportunity to create reverse grade for the design vehicle, and there is proximal outfall adjacent to the outboard road to facilitate road drainage.

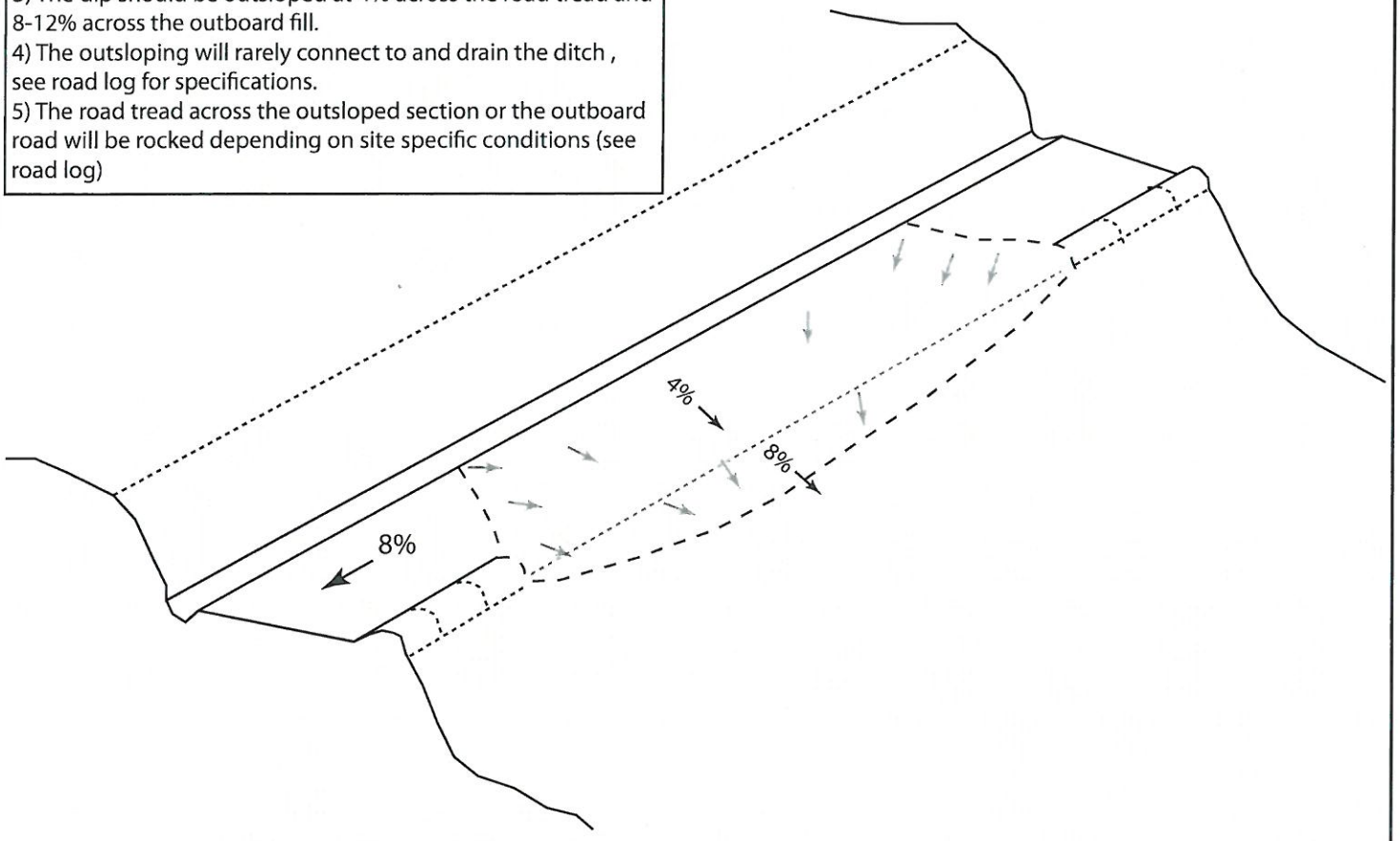
Design Notes:

1) The berm should be removed for the entire length of the outsloped section.

3) The dip should be outsloped at 4% across the road tread and 8-12% across the outboard fill.

4) The outsloping will rarely connect to and drain the ditch , see road log for specifications.

5) The road tread across the outsloped section or the outboard road will be rocked depending on site specific conditions (see road log)



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PWA Typical Drawing #19c

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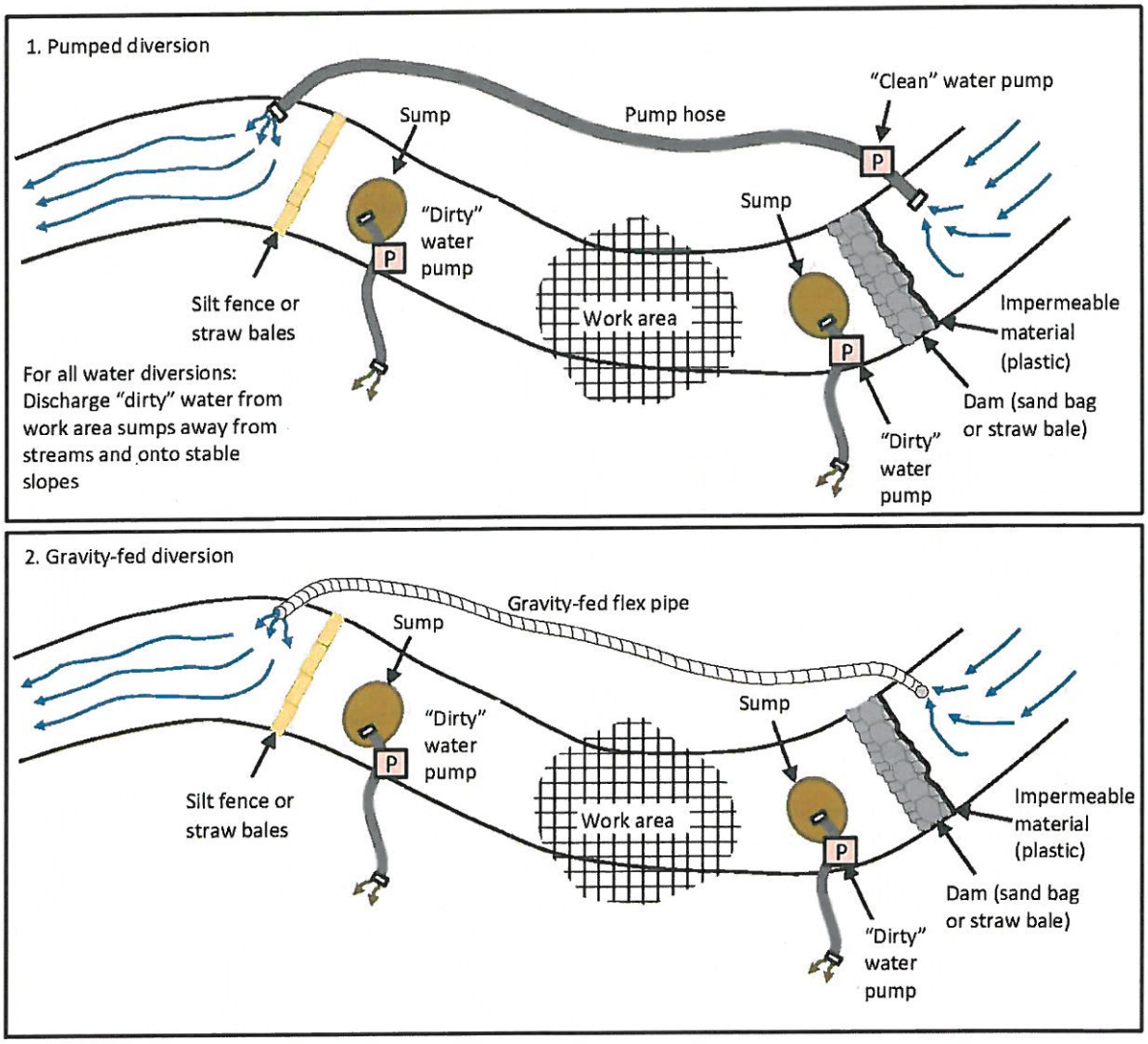
Typical Design for De-watering Streams



Stream crossing de-watering

Prior to working in and around the active stream channel, proper stream dewatering and avoidance of increasing downstream turbidity should be employed. Stream flows will be isolated upstream of the work area using cofferdams and transported downstream / around the work site through either a pumped diversion (Type 1) or by gravity diversion (Type 2) to keep the stream "live" (flowing) below the work area. An additional dam will be installed downstream of the work areas to capture any subsurface flow that might travel through the construction area. Any "dirty" water will be collected at this location and pumped away from the site where it can infiltrate into the ground without the potential to delivery to the stream and/or be used to wet fill being deposited in the spoil disposal areas.

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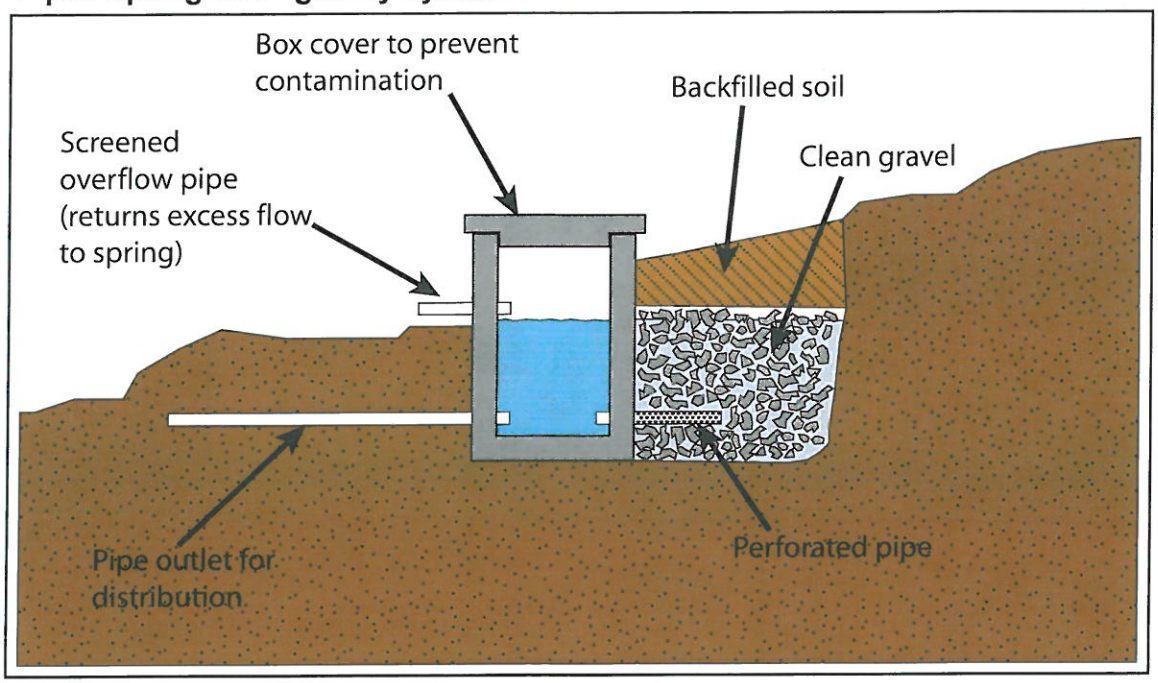
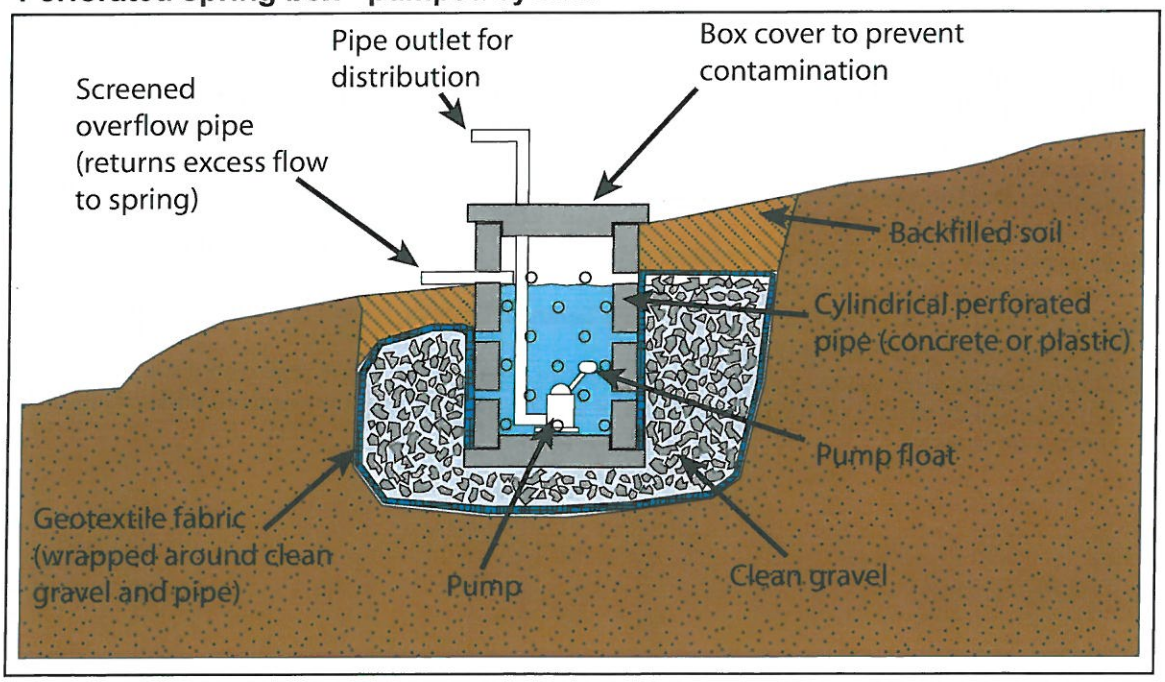
Typical design drawings of spring boxes

Piped spring box - gravity system



Perforated spring box - pumped system



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PWA Typical Drawing #20