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Water Resource Protection Plan & Site Management Plan for Humboldt County APN 222-071-017

Apps# 11945

PREPARED FOR

California Regional Water Quality Control Board
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This document serves as the Water Resource Protection Plan and Site Management Plan on behalf of the discharger, owners of APN 222-071-017, pursuant to Order No. R1-2015-0023 (Waiver of Waste Discharge Requirements and General Water Quality Certification for Discharges of Waste Resulting from Cannabis Cultivation and Associated Activities or Operations with Similar Environmental Effects in the North Coast Region), and/or Order WQ 2017-0023-DWQ (General Waste Discharge Requirements and Waiver of Waste Discharge Requirements for discharges of Waste Associated with Cannabis Cultivation Activities) of the California Water Code Section 13260(a).

1 SEDIMENT DISCHARGE BEST PRACTICAL TREATMENT OR CONTROL (BPTC)

1.1 Site Characteristics and Field Observations

In response to a Notice of Violation from the CA State Water Board, Stillwater Sciences' geologist (Dylan Caldwell) visited APN 222-071-17 on 22 March 2016. During his visit, Mr. Caldwell conducted a general inspection of all roads, road-stream crossings, and cultivation sites. Many mitigation measures previously installed by the landowners were observed including straw waddles, hand-dug waterbars, small riprap placement, and planting of native vegetation.

Based on the field assessment, Stillwater conducted Hydrologic and Hydraulic analyses (see Section 1.1.1 below) and prepared an implementation plan, which was approved by the State Water Board. Construction work was completed in 2016 as described in Section 1.2 below and depicted in photos in Appendix A.

1.1.1 Hydrologic and Hydraulic (H&H) Analyses for Crossing Structure Sizing

To determine the appropriate sizing for each new drainage structures, the Rational Method (also known as the Rational Formula) was used to calculate the design flow for the 100-year storm event. This method is appropriate for determining flow rates for relatively small drainage areas of less than 320 acres according to the California Department of Transportation Highway Design Manual (Caltrans HDM) Section 819.2 (Caltrans 2014). The Rational Formula incorporates a combination of rainfall intensity, drainage area and runoff coefficient to estimate maximum flows and is defined as follows:

$Q = CIA$

Where:

Q = Flow Discharge
C = Runoff Coefficient
I = Rainfall Intensity
A = Area

1.1.1.1 Determining Storm Duration

For the Rational Method analysis, the total drainage area, slope, and longest flow path for the four crossings were determined based on field observations and analyses of a USGS topographic map. Based on these values (summarized on Table 1), flow velocities were estimated using the velocity-slope relationships published in the Caltrans HDM (Figure 2). Subsequently, these velocities were used to determine the "Time to Concentration" for the crossings based on the time

it takes runoff to travel along the longest flow path within the contributing watershed and arrive at crossing. This information is summarized in Table 1.

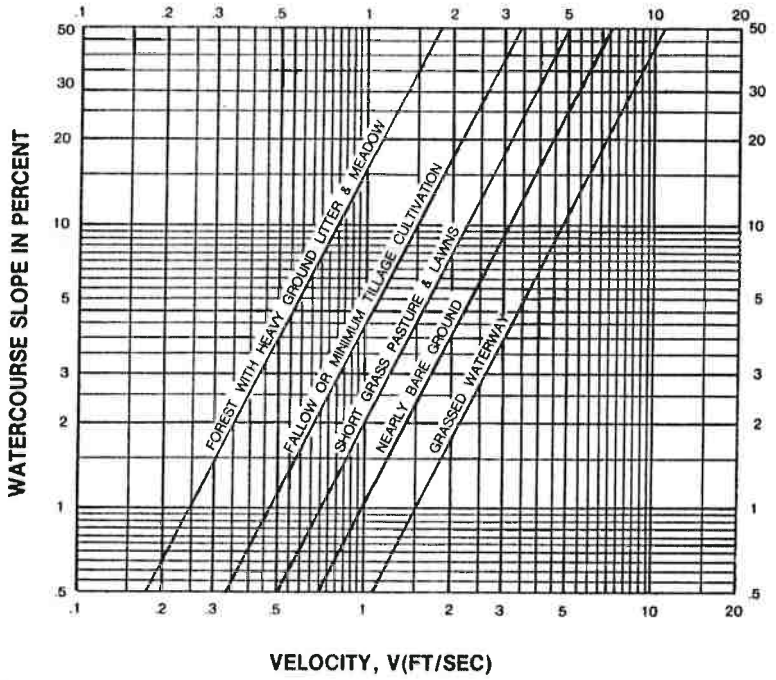


Figure 1. Velocities for upland method of estimating travel time for shallow concentrated flow (adopted from Figure 816.6 of the Caltrans HDM [2014]).

Table 1. Summary of time-to-concentration analyses.

Site #	Type	Drainage Area (ac)	Longest flow path segment length (ft)	Maximum Elevation Change (ft)	Slope (%)	Velocity (from Figure 816.6 Caltrans HDM) (ft/s)	Flow time (min)	100 year rainfall intensity (in/hr)
1	Crossing decommissioning	46.5	2662	700	26%	1.3	34	2.15
2	Pond outflow	0.2	176	50	28%	1.4	2	5.78
3	Crossing decommissioning	52.2	2891	740	26%	1.3	37	2.05
8	Crossing upgrade	0.8	320	80	25%	1.3	4	5.78
9	Crossing upgrade	3.7	674	160	24%	1.3	9	4.40
14	Crossing upgrade	1.4	497	140	28%	1.4	6	5.28
15	Crossing upgrade	1.4	536	140	26%	1.3	7	4.89
17	Crossing upgrade	2.9	673	160	24%	1.3	9	4.41
18	Crossing upgrade	2.2	542	140	26%	1.3	7	4.87
24	Crossing decommissioning	1.7	456	120	26%	1.3	6	5.31

1.1.1.2 Precipitation Data

The intensity-duration-frequency (IDF) curve used for the Rational Method analysis came from National Oceanic and Atmospheric Administration's National Weather Service Hydrometeorological Design Studies Center Precipitation Frequency Data Server (PFDS).[1] Rainfall intensity was determined from the IDF curves for the 100-year recurrence interval for storm durations equivalent to the "Time to Concentration" for the project site. The 100-year rainfall intensity from the PFDS for each site is also shown on Table 1.

1.1.1.3 Runoff Coefficients

The runoff coefficient used in the Rational Formula was determined using the method for un-developed areas in the Caltrans HDM (Figure 3). For this analysis, the site was considered to have high relief, shallow loam soil, fair vegetation cover, and negligible surface storage, resulting in a runoff coefficient of 0.56.

[1] http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

Watershed Types

	Extreme	High	Normal	Low
Relief	.28 -.35 Steep, rugged terrain with average slopes above 30%	.20 -.28 Hilly, with average slopes of 10 to 30%	.14 -.20 Rolling, with average slopes of 5 to 10%	.08 -.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	.12 -.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	.08 -.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	.06 -.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	.04 -.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	.12 -.16 No effective plant cover, bare or very sparse cover	.08 -.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	.06 -.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	.04 -.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface Storage	.10 -.12 Negligible surface depression few and shallow; drainageways steep and small, no marshes	.08 -.10 Low; well defined system of small drainageways; no ponds or marshes	.06 -.08 Normal; considerable surface depression storage; lakes and pond marshes	.04 -.06 High; surface storage, high; drainage system not sharply defined; large floodplain storage or large number of ponds or marshes

Figure 2. Runoff coefficients for undeveloped areas (adopted from Figure 819.2A of the Caltrans HDM [2014]).

1.1.1.4 Storm Discharges

Flow discharges from the Rational Method calculations for 100-year storm events are shown on Table 2.

Table 2. 100-year discharges.

Site #	100-year Discharge (cfs)
1	56
2	1
3	60
8	3
9	9
14	4
15	4
17	7
18	6
24	5

1.1.1.5 Drainage Structure Sizing

Armored ford and culvert dimensions required to carry 100-year discharges were determined through hydraulic modeling using the U.S. Army Corps of Engineers' *Hydrologic Engineering Center's River Analysis System* (HEC-RAS). It is critical that the armored fords and culverts are properly sized so that 100-year flows do not exceed the drainage structure capacity which could lead to erosion of the adjacent outboard edge of the road. Each crossing has been modeled and specific dimensions are defined below in Section 5.

1.1.2 Geology and Soils

The entire property and surrounding vicinity is underlain by Tertiary and Cretaceous marine sedimentary and metasedimentary lithologies (included by some in the Franciscan Complex) (McLaughlin et al. 2000). These rocks consist of sandstone, shale, and minor amounts of conglomerate.[2] The property is located in mountainous terrain with moderate slopes supporting dense conifer and hardwood stands and open grass meadows. Bedrock outcrops are limited and generally located along incised stream-banks. No evidence of large-scale mass wasting was observed on the property.

[2] California Department of Conservation, Geologic Map of California (2010), accessed online at: http://maps.conservation.ca.gov/cgs/gmc/

1.2 Sediment Erosion Prevention and Sediment Control BPTC Measures

Figure 4 shows the surveyed site locations on APN 222-071-017

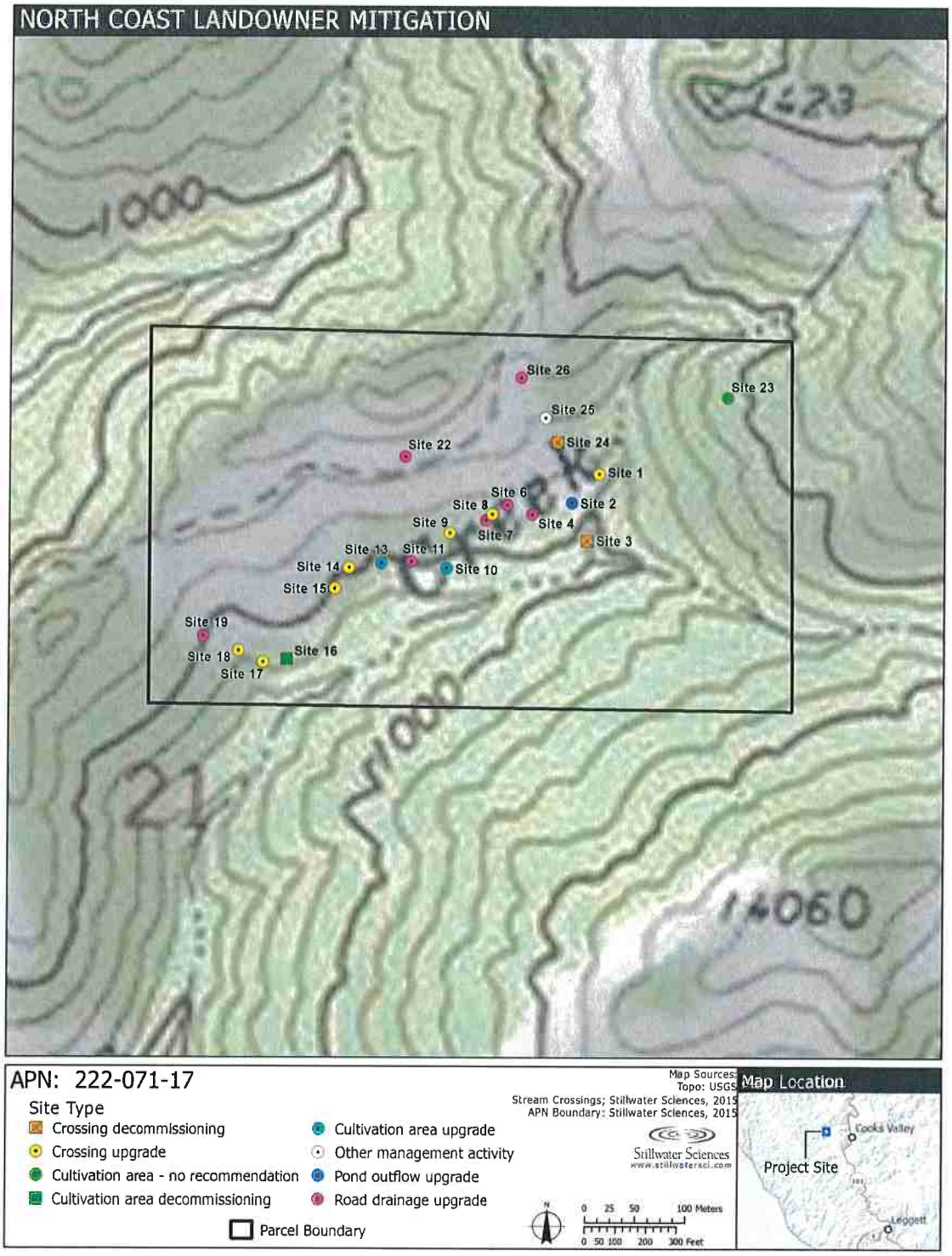


Figure 4. Site locations on APN 222-071-017

1.2 Sediment Erosion Prevention and Sediment Control BPTC Measures

1.2.1 Site Descriptions, Recommendations and As-Builts

SITE 1:
This access road crosses Jones Creek and leads to a cultivation site in the northeast portion of the property (Site 23). The landowners intend to use this as a low-use foot traffic and OHV (i.e. motorcycle/quad) trail. OHV traffic would be primarily in the dry season. The landowners have already begun installation of best management practices (BMP's) including constructing/improving existing water bars and installing straw waddles.

Recommendation: Where the trail crosses Jones Creek, pull back the top edge of the vertical stream banks on both sides to decrease the likelihood of sediment from sloughing and toppling into the creek. Armor the newly excavated bank segments with small rip-rap (i.e. cobbles and boulders). Approximately 3" thickness of road rock should be added to the trail on each approach. The trail segment west of the stream crossing is relatively short (~20 ft) and drains a small area. Continue to maintain BMP's (i.e. straw waddles) on this segment during the rainy season. On the trail east of the stream crossing construct 2-3 water-bars, in addition to the straw waddles, to drain trail-related runoff in the steep segment extending for ~50 ft upslope from Jones Creek. These new water bars must be excavated to a sufficient depth to drain the inboard ditch and the inboard ditch must be plugged to eliminate the concentrated runoff from entering the creek at Site 1. Beyond this relatively steep trail segment, leading up to the cultivation site, continue maintaining the existing BMP's. Prior to each rainy season, the straw wattles must be checked to insure that OHV traffic has not damaged their functionality, and replaced if appropriate.

Install wooden bridge with the following specifications:

- Bottom of bridge shall be a minimum of 4' above channel bottom
- This site carries significant flow so rock armoring needed at this site should be ~1/4 ton size class (1.5' diameter).
- Excavating banks to a minimum slope of 1.5:1.
- Excavate 1' depth toe trench to place the first layer of riprap rock.
- Rock armoring dimensions: 1.5' thickness, 4' height, 15' lengths, both creek banks.
- Total rock armoring volume needed: ~8 cubic yards

As-Built Description: Due to difficult equipment access, weather issues, and goal of reducing construction disturbance, work at this site was conducted by hand. As such, as-built photos reflect the following changes to the initial recommendations: Used +/- 1' diameter cobble for channel bank armoring, excavation of 6" toe trench, no excavation at top of bank, ~1' thickness, 3' height, 10' length rock armoring both sides of creek, total of 2 CY armoring.

SITE 2:
This pond outlet cuts through a narrow ditch incised into the pond berm before turning and flowing onto native soils. A low-use/OHV quad trail runs across the ditch and pond berm.

Recommendation: Excavate and pull back the vertical edges of the ditch to 2:1 (Horizontal : Vertical) slope. Armor the outlet ditch with small riprap rock such that pond has minimum of 1.5' of freeboard. Extend the armoring to dissipate outlet flow where it meets the native soil beyond

the pond berm. However, construction of a rock armored spillway is crucial to prevent erosion and risk of spillway failure. Based on the hydrologic analyses described above, we provide the following site-specific recommendations:

- Excavate spillway so pond has minimum 1.5' of freeboard
- 100-year flows are relatively low, so rock armoring at this site should be backing size class (0.5' diameter)
- Over-excavate channel and banks: bottom channel width = 2', side slopes = 2:1
- Rock armoring dimensions: 1' thickness, 6' total width (channel and banks), 20' length
- Construct energy dissipation/infiltration basin on native ground: 8' width, 8' length, 1' depth
- Total rock armoring volume needed: ~8 cubic yards

As-Built Description: Prior to construction, engineer conducted additional site reconnaissance and discovered that existing pond outflow should be relocated due to erosion and gullying downslope from outflow. As such, outflow was relocated to a more suitable/stable location on the south side of the pond and constructed per recommendations above. Existing outflow was filled with soil, compacted, seeded, and mulched.

SITE 3:
This former access road crosses Jones Creek but does not lead to any cultivation sites. The landowners intend to maintain this as a low-use, foot-traffic trail to access their domestic water source. The slopes where the trail meets Jones Creek are gentle, beginning to re-vegetate, and the landowners have already constructed BMP's to drain water and sediment onto native soils and vegetation.

Recommendation: Continue to maintain existing BMP's, install straw wattle or water bar on eastern approach to prevent runoff concentration.

As-Built Description: Constructed per recommendations.

SITE 4:
The inboard ditch along this road segment has issues with ponding water. Runoff then drains through a small cross road ditch, onto the road shoulder, and then flows onto native soil and vegetation. Some flow is also diverted across an expanded shoulder/pad containing gravel and lumber piles.

Recommendation: Fill existing cross road drain and construct a new rolling dip to the west. The new dip should be deep enough to drain ponding water and broad enough (~15-20 ft) to diffusely drain flow onto native soils and vegetation and avoid diversion onto the expanded shoulder/pad. Gravel road segment with 6" thickness of road rock.

As-Built Description: Constructed per recommendations.

SITE 6:
Regular vehicle traffic has rutted the existing water-bar and it no longer drains the road surface.

Recommendation: Construct a rolling dip that is broad enough (~15-20 ft) to diffusely drain flow onto native soils and vegetation. Gravel road surface across dip with 6" thickness of road rock.

As-Built Description: Constructed per recommendations.

SITE 7:
Poor road-surface drainage and regular vehicle traffic has resulted in a large rutted deposit of fine sediment.

Recommendation: Construct a rolling dip that is broad enough (~15-20 ft) to diffusely drain flow onto native soils and vegetation. Gravel road surface across dip with 6" thickness of road rock.

As-Built Description: Constructed per recommendations.

SITE 8:
An existing culvert with 12" diameter along a small class III tributary carries seasonal flow under a residence-access road and onto native soils and vegetation. The inlet is partially clogged and the outlet is on-grade with minimal armoring and does not contribute to increased sediment production.

Recommendation: Hydrologic analyses for this site determined that the existing 12" diameter culvert has sufficient capacity to carry 100-year flows. Therefore, the only recommendation is to clean the culvert inlet with hand tools.

As-Built Description: Constructed per recommendations.

SITE 9:
An existing undersized 12" diameter culvert carries a class III stream under the residence-access road before entering Jones Creek. The inlet is partially plugged with minimal armoring. The stream frequently overtops the culvert and runs over the road incising a gully into the road surface before re-entering its channel. Lack of armoring and scour around the culvert outlet has led to an increase in sediment production.

Recommendation: Upgrade the crossing with a new 24" diameter culvert along the same alignment. Appropriately armor the inlet/outlet and gravel roadway. In addition to standard culvert replacement activities, one new rolling dip should be installed on the road up-gradient from the culvert to prevent road runoff from concentrating at the culvert site, and road rock should be placed on ~100' of the upslope road segment. In addition, water supply lines that are currently running in the road and through the culvert should buried in their own separate trenches of at least 1' depth so that they are not located on the roadway or in the culvert. Damaged and/or leaking water lines can cause additional erosion and sedimentation.

As-Built Description: Generally constructed per recommendations; less rock armoring used than originally recommended due to use of large logs to stabilize downstream channel.

SITE 10:
Existing cultivation site is located near Jones Creek and a season tributary.

Recommendation: Move all cultivation sites to be a minimum of 50' from the seasonal tributary and 100' from Jones Creek. Construct a bio-swale along the down slope extent (southeastern and southern) of the cultivation area to retain any sediment and/or nutrients derived from the cultivation area surface. Bio-swale dimensions will be approximately 50' length x 2' bottom width x 1' depth with 2:1 side slopes.

As-Built Description: Due to difficult equipment access, weather issues, and goal of reducing construction disturbance, work at this site was conducted by hand. As such, as-built photos reflect the following changes to the initial recommendations: Bio-swale dimensions of approximately 30' length x 1' width x 1' depth.

SITE 11:
A ~100-foot segment of former access road leading west from a residence to a cultivation site is insloped with no inboard ditch and drains to a swale in the road where water ponds and spills across the road surface without properly constructed drainage. The landowners intend to use this road segment as a low-use/OHV trail.

Recommendation: Pull back the over-steepened cutbank along this road segment and use the newly excavated material to re-grade an outsloped road surface profile (~4% side slope) extending west from the residence toward the swale in the road where water currently ponds. Gravel the newly graded road surface with 6" thick road rock.

As-Built Description: Prior to construction, engineer conducted additional site reconnaissance and determined that erosion was due to concentrated runoff along this road segment, and not over steepened cutbank. As such, one waterbar was installed to eliminate runoff concentration and no outsloping or other road surface treatments were conducted.

SITE 13:
An existing cultivation site is located approximately 120 feet from Jones Creek. There is no evidence of slope instability, concentrated runoff, or sediment production related to the site. Minor seasonal runoff originating upslope of the site flows along the back edge (upslope side) of the site before draining onto native soils and vegetation. The landowners wish to keep this as an active cultivation site.

Recommendation: Construct a bio-swale along the down slope sides (southeastern, southern, and southwestern) of the cultivation site to retain any sediment and/or nutrients derived from the cultivation area surface. Bio-swale dimensions will be approximately 100' length x 2' bottom width x 1' depth with 2:1 side slopes. Construct a small drainage ditch (2' bottom width x 1' depth with 2:1 side slopes) along the northern side of the site to direct seasonal runoff westward past the site preventing it from entering the cultivation area. Place approximately 5 cubic yards of small rock armoring in the newly constructed drainage ditch.

As-Built Description: Due to difficult equipment access, weather issues, and goal of reducing construction disturbance, work at this site was conducted by hand. As such, as-built photos reflect the following changes to the initial recommendations: Bio-swale dimensions of approximately 100' length x 1' width x 1' depth. Drainage ditch along north side of site was also constructed by hand with approximately dimensions of 1' width by 1' depth. Due to minimal disturbance of handwork activities, no rock armoring needed to stabilize ditch.

SITE 14:
A small class III watercourse carrying seasonal spring flow crosses a former access road at an un-engineered crossing. The landowners intend to use this as a low-use/OHV trail. The landowners have already constructed straw-waddle BMP's at the crossing to minimize sediment production and delivery associate with the crossing.

Recommendation: Construct an armored ford.

As-Built Description: Generally constructed per recommendations; less rock armoring used than originally recommended due to fact that project was constructed by hand which minimized disturbance of existing vegetation and topsoil.

SITE 15:
A minor class III stream carrying seasonal spring flow crosses a former access road at an un-engineered crossing very similar to Site 14. The landowners intend to use this as a low-use/OHV trail. The landowners have already constructed straw-waddle BMP's at the crossing to minimize sediment production and delivery associate with the crossing.

Recommendation: Construct an armored ford.

As-Built Description: Generally constructed per recommendations; less rock armoring used than originally recommended due to fact that project was constructed by hand which minimized disturbance of existing vegetation and topsoil.

SITE 17:
A seasonal class III watercourse crosses a former access road at an un-engineered crossing. The inlet and outlet flow through standing trees and are choked with sediment and debris. The outboard road surface is gullied and water flow cascades approximately 12 feet to the channel below. The crossing also drains diverted flow from Site 18 (see below). The landowners intend to use this as a low-use/OHV trail.

Recommendation: Construct an armored ford crossing.

As-Built Description: Generally constructed per recommendations; less rock armoring used than originally recommended due to fact that water was routed back to its original course which is armored by existing large woody debris.

SITE 18:
A seasonal class III watercourse crosses a former access road at an un-engineered crossing. The inlet flows through standing trees and is choked with sediment and debris. The outboard road surface is minimally gullied and water flow is directed toward a log pile which causes diversion back onto the road. The diverted flow then travels down the road to Site 17. The landowners intend to use this as a low-use/OHV trail.

Recommendation: Construct an armored ford crossing. Additionally, remove the log pile and construct a channel (3' bottom width x 1.5' depth with 2:1 side slopes) extending from the newly constructed armored ford past the log deck and connecting with the natural channel downslope. Armor the newly constructed channel with 3 grade control structures with a total of 6 cubic yards of small rock armoring.

As-Built Description: Armored ford generally constructed per recommendations; less rock armoring used than originally recommended due to fact that project was constructed by hand which minimized disturbance. However, prior to constructing the new downstream channel, engineer conducted additional site reconnaissance and determined that there is a small active landslide downslope from this crossing and that it is best to let runoff dissipate in the log pile and then sheet flow in multiple directions.

SITE 19:
This former access road is constructed with an inboard ditch which no longer drains the road surface along this segment. Instead, water drains down the rutted road surface to Site 18. The landowners intend to use this as a low-use/OHV trail.

Recommendation: Construct two water bars at 50-foot intervals between this site and Site 18. The uphill water bar will drain to the existing inboard ditch. The downhill water bar will drain to the outboard edge of the road onto native soil and vegetation.

As-Built Description: Constructed per recommendations.

SITE 22: (High priority)
An existing undersized culvert (12" diameter) carries water draining a small vegetated swale and the inboard ditches from both directions under West Moody Lane/Oak Rock Road before entering a downslope gully. Both the inlet and outlet are damaged and rusting. Water exits the culvert through a rusted hole before reaching the outlet. Further failure of this culvert could threaten the road surface and lead to significant additional erosion.

Recommendation: Upgrade the crossing with a new 24" diameter culvert on the same alignment. Appropriately armor the inlet and outlet.

As-Built Description: Constructed per recommendations.

SITE 24: (Low priority)
This small fill crossing is located on a trial no longer used by the landowners. The small class III tributary runs through a small ditch that is approximately 1' to 2' wide, approximately 2' deep, and consists of approximately 1.5' depth of soil (clayey gravel) overlying soft bedrock.

Recommendation: We recommend that the oversteepened banks of one stream crossing are excavated and rock armoring is placed to reduce erosion potential. Soil should be over-excavated to allow space for rock armor placement without encroaching on the channel. Based on the hydrologic analyses described above we provide the following site-specific recommendations:

- This is a very small tributary so rock armoring at this site should be backing size class (0.5' diameter)
- Over-excavate channel and banks: bottom channel width = 2', side slopes = 2:1
- Rock armoring dimensions: 1' thickness, 6' width (channel and banks), 15' length
- Total rock armoring volume needed: ~4 cubic yards

As-Built Description: Prior to construction, engineer conducted additional site reconnaissance and determined that channel bottom and lower 1' of banks were composed entirely of relatively competent bedrock. As such, excavation and armoring of the upper bank only was required and therefore less rock was needed.

1.2.2 Culvert Upgrades Specifications (Sites 9 and 22)

Typical culvert installation and rock armor placement is depicted on Figure 5. Additionally, the following specification should be followed when constructing the culverts:

- Remove existing culvert (if applicable) and excavate a trench at the original channel gradient to place the culvert. Note that on steep channels (as seen on this project) culverts may be installed at a more gentle slope with extensive rock armoring placed under the outlet for channel armoring and energy dissipation as shown on Figure 5.
- If extensive rock armoring is necessary downstream from the culvert, the rock should be placed prior to the installation of the culvert to allow for best equipment access. Begin to place rock from the downstream extent of the culverts spillway with the first row of rock firmly keyed in to the bench at the bottom of the spillway.
- Upon completion of the spillway near to the elevation of the culvert outlet, finalize the trench where the culvert shall be placed. The base of the trench shall be well compacted (minimum 90% RC) and shall be constructed at an even gradient with a minimum width of 4' greater than the culvert diameter to allow for compaction along the sides of the culvert.
- Place culvert in the trench. Compaction around the culvert should occur in 6" to 1' lifts using a Wacker or other approved method. Soils should be wetted or dried for maximum compaction (minimum 90% RC).
- After culvert is covered with fill, begin rebuilding road prism in 1' lifts. Compaction should occur with a Sheepsfoot or other approved method.
- Place final rock armoring around culvert outlet, culvert inlet, and upstream channel as described in Table 3 and in the site-specific specifications. A critical dip will be constructed over new fill. The dip will be constructed of rock armoring that extends from the top of the culvert to the road surface.
- Insure that road surface drainage is controlled with rolling dips upslope from the crossing and armored inboard ditches as necessary.
- Place a minimum of 6" road rock on all disturbed road surface area adjacent to the crossing.

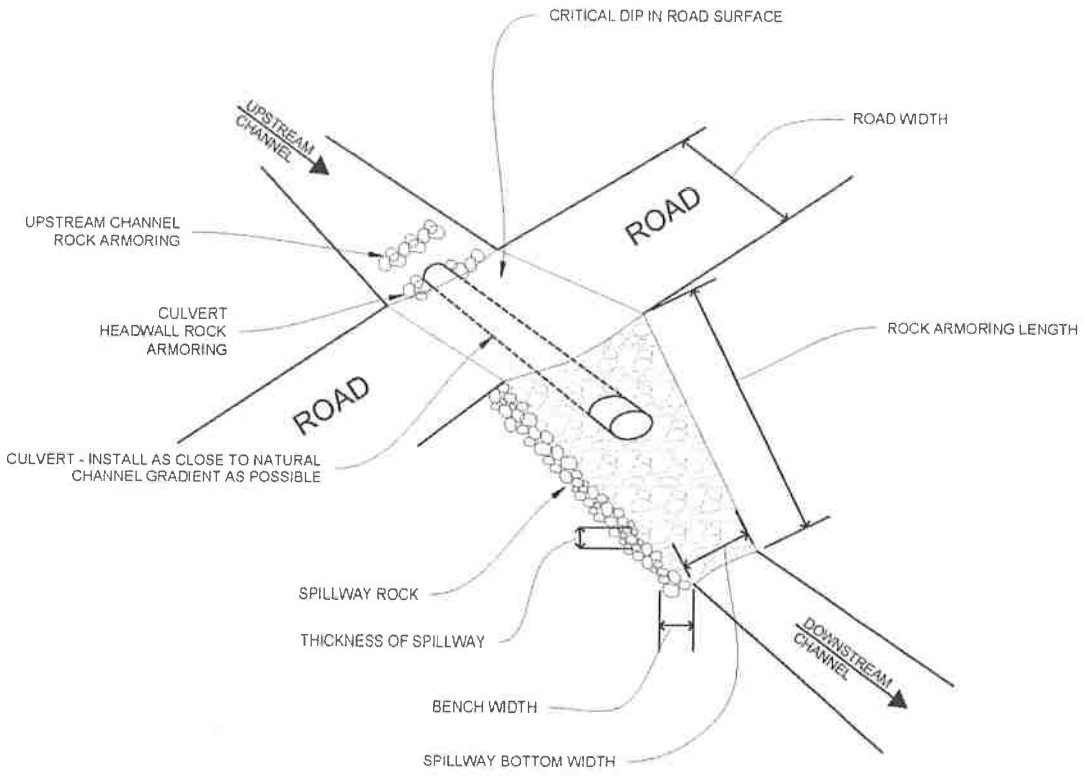


Figure 5. Culvert installation schematic.

1.2.3 Armored Ford Construction (Sites 14, 15, 17, and 18)

Typical armored ford construction is depicted on Figure 6. Additionally, the following specifications should be followed when constructing the armored fords:

- Remove existing culvert (if applicable) and re-compact void with the same material that will be used for the road surface armoring; where feasible, new road surface through armored ford should be at the same elevation as the bottom of the removed culvert.
- Construction should begin from the downstream extent of the ford's spillway with the first row of rock firmly keyed in to the bench at the bottom of the spillway.
- All loose dirt or gravel should be removed from the outboard edge of the road prior to construction of the spillway.
- The spillway should be constructed in lifts with larger rock on the face and smaller rock and gravel compacted behind the larger rock to fill any voids.
- Within the portion of the ford where the spillway meets the road surface rock, contractor shall exercise special care to compact the underlying material and use a variety of rock sizes ranging from small gravel to cobble; this portion of the structure is especially susceptible to failure in the first few winters, especially at sites where culverts are being removed.
- Firmly compact road surface armoring.

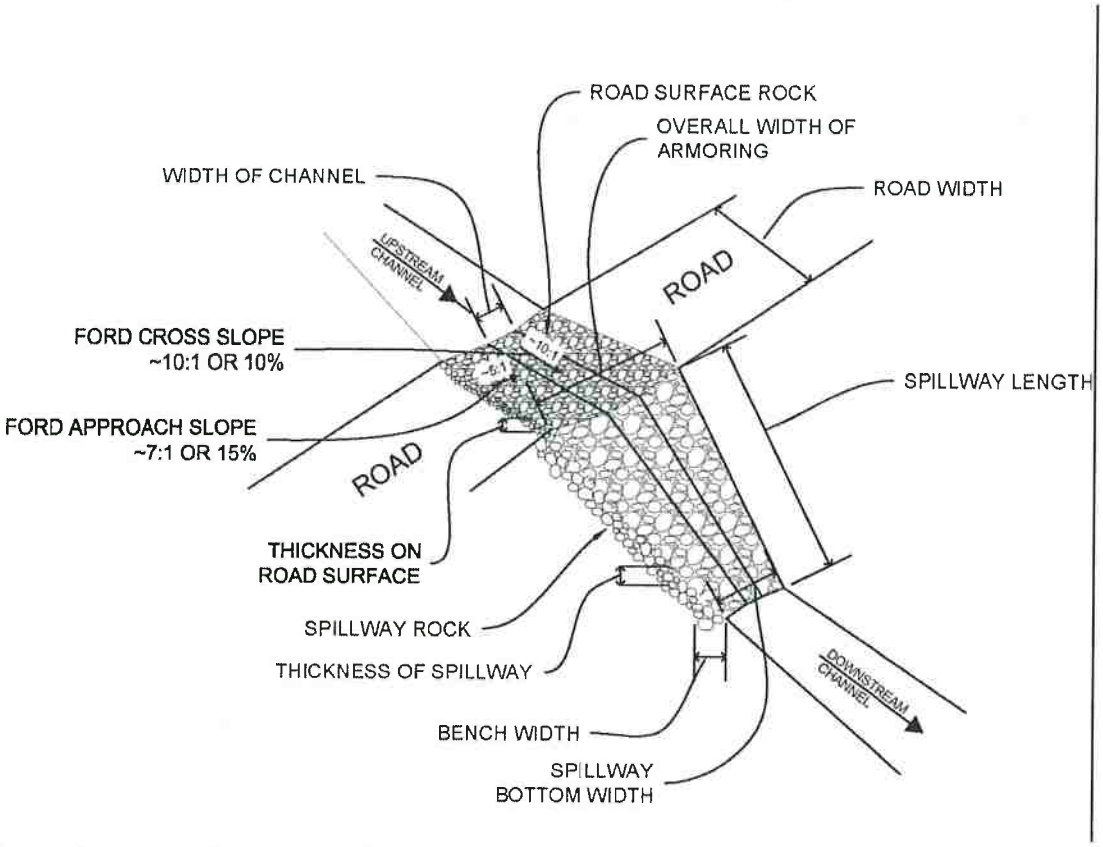


Figure 6. Armored ford schematic.

1.2.4 Bridge Installation (Site 1)

We recommend that one wooden bridge is installed with the following specifications:

- Bottom of bridge shall be a minimum of 4' above channel bottom
- This site carries significant flow so rock armoring needed at this site should be ~1/4 ton size class (1.5' diameter).
- Excavating banks to a minimum slope of 1.5:1.
- Excavate 1' depth toe trench to place the first layer of riprap rock.
- Rock armoring dimensions: 1.5' thickness, 4' height, 15' lengths, both creek banks.
- Total rock armoring volume needed: ~8 cubic yards

1.2.5 Crossing Decommissioning (Sites 24)

We recommend that the oversteepened banks of one stream crossing are excavated and rock armoring is placed to reduce erosion potential. Soil should be over-excavated to allow space for rock armor placement without encroaching on the channel. Based on the hydrologic analyses described above we provide the following site-specific recommendations:

- This is a very small tributary so rock armoring at this site should be backing size class (0.5' diameter)
- Over-excavate channel and banks: bottom channel width = 2', side slopes = 2:1
- Rock armoring dimensions: 1' thickness, 6' width (channel and banks), 15' length
- Total rock armoring volume needed: ~4 cubic yards

1.2.6 Pond outflow upgrade (Site 2)

The small rainwater catchment pond at Site 2 has a very small drainage area and therefore does not have significant flow even during 100-year storm event. However, construction of a rock armored spillway is crucial to prevent erosion and risk of spillway failure. Based on the hydrologic analyses described above, we provide the following site-specific recommendations:

- Excavate spillway so pond has minimum 1.5' of freeboard
- 100-year flows are relatively low, so rock armoring at this site should be backing size class (0.5' diameter)
- Over-excavate channel and banks: bottom channel width = 2', side slopes = 2:1
- Rock armoring dimensions: 1' thickness, 6' total width (channel and banks), 20' length
- Construct energy dissipation/infiltration basin on native ground: 8' width, 8' length, 1' depth
- Total rock armoring volume needed: ~8 cubic yards

1.2.7 Erosion control BMPs (to be used at all sites where soil is disturbed)

- Erosion and sediment control best management practices (BMPs) shall be installed prior to the wet season (October 1 through April 30).
- Sensitive areas and areas where existing vegetation is being preserved shall be protected with construction fencing; fencing shall be maintained throughout construction activities.
- All areas disturbed during grading activities shall be seeded with native grass seed and mulched with rice straw.
- Prior to seeding and straw, disturbed areas should be roughened by track walking with a dozer.
- Straw shall be applied at a uniform rate of approximately 4,000 lbs per acre by hand.
- At the completion of the project, straw wattles shall be placed as directed by the engineer or geologist.
- All sediment control BMPs shall be maintained throughout the wet season until new vegetation has become established on all graded areas.

2 FERTILIZER, PESTICIDE, HERBICIDE, AND RODENTICIDE BPTC MEASURES

2.1 Fertilizer

Fertilizers, potting soils, compost, and other soils and soil amendments are stored in locations and in a manner in which they cannot enter or be transported into surface waters and such that nutrients or other pollutants cannot be leached into groundwater.

If the landowner wishes to keep fertilizers and soil amendments on the Project Site, they should continue to be stored fully under cover, off the ground, and in a stable location not exposed to the elements. If stored outdoors, they should be fully tarped, off the ground, and in a stable location with no chance of nutrient leaching or delivery to surface waters. Fertilizers, potting soils, compost, and other soils and soil amendments should not be stored with petroleum products as they may be incompatible and could potentially react.

Applicant is required to keep detailed records of the type, timing and volume of fertilizers and/or other soil amendments you use in your operations. Observe and monitor soil moisture so watering, fertilizer and chemical applications are made only when necessary and overwatering and excess infiltration is avoided.

To prevent nutrient leaching from cultivation areas, continue to plant dense cover crops in spent pots, holes and beds to enrich soil and lock up nutrients or; 1) fully tarp any exposed soils and growing mediums in beds, pots, holes or piles; or 2) move spent soils and amendments inside or under cover to temporarily store them during the wet season (November 1 – May 15). If dense cover crops cannot be kept alive, all planted areas should be tarped to protect them from rainfall, snowmelt and subsequent infiltration and leaching of nutrients. Winterize all cultivation areas and all disturbed areas on the Project Site by placing straw wattles with biodegradable wrapping on the downslope perimeter and/or by mulching/seeding any bare soil areas on cultivation sites.

2.2 Pesticide, Herbicide, and Rodenticide

To be compliant with the Order, all pesticides, herbicides and related materials (e.g., fungicides) must be used and applied consistent with product labeling. Pesticide and herbicide storage and use on the Project Site must be closely monitored and recorded. Landowner is required to keep records (logs) of the type, timing and volume of pesticides and herbicides used in your operations.

When present, pesticides and herbicides should be stored within enclosed buildings in such a way they cannot enter or be released into surface or ground waters. They should not be stored with petroleum products as they may be incompatible and could potentially react.

2.3 Irrigation Runoff

Irrigation water is applied to cultivation areas at agronomic rates, so runoff is not an issue.

2.4 Spoils Management

All spoils generated by the operations are reused on site. All soil is contained in the beds and amended on site. No soil is stored, discarded, or sidecast in locations that could enter waters.

3 GENERATOR AND PETROLEUM MANAGEMENT

Primary power on the property is supplied by a solar arrays and alternative energy system. Small generators (as shown on site plan in Appendix B) provide backup power sources. Fuel is stored in 5 gallons cans in covered areas with containment.

4 TRASH/REFUSE AND DOMESTIC WASTEWATER BPTC MEASURES

4.1 Trash/Refuse

All garbage and refuse generated onsite is stored in cans and containers that are placed in a secure location. It is important to utilize storage facilities which prevent animals from accessing or disturbing garbage or refuse. Garbage is removed from the property and hauled to approved County collection location at least once per month.

4.2 Human Waste

Human waste is directed from the residence to the existing septic and leach field system.
It is recommended that the applicant begin to work with a professional to start the permit process retroactively permit the existing septic system.

4.3 Cultivation Waste

In the future, plant stalks shall be chipped or shred and composted after harvest. Any additional cultivation-related waste can be easily contained by keeping soils and garbage greater than 200 feet from drainage areas and on gentle slopes, tarping or otherwise covering soil piles, and/or by placing straw wattles or other containment structures around the perimeter of spoil piles. Organic cultivation-related waste should be recycled if possible, and inorganic wastes and garbage should be removed from the property on a regular basis and disposed of at an appropriate facility.

5 WINTERIZATION BPTC MEASURES & SCHEDULE

The applicant should conduct the following activities prior to the onset of measurable rainfall:

1) Ensure that the cultivation areas are either tarped or planted with thick cover crop
2) Make sure that all cultivation related supplies and equipment are in a secure covered location per Sections 2-4 above.
3) Perform yearly maintenance on drainage features as applicable to reduce runoff concentration (i.e. handwork or small equipment work to maintain water bars, ditches, sediment catchment areas, etc.)

6 REFERENCES

Caltrans (California Department of Transportation). 2014. Highway design manual. http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm.

McLaughlin, R.J., S.D. Ellen, M.C. Blake, Jr., A.S. Jayko, W.P. Irwin, K.R. Aalto, G.A. Carver, and S.H. Clarke, Jr. 2000. Geology of the Cape Mendocino, Eureka, Garberville, and Southwestern part of the Hayfork 30 x 60 Minute Quadrangles and Adjacent Offshore Area, Northern California. USGS Miscellaneous Field Studies MF-2336.

Appendix A

Photos of 2016 Remediation Work

Photo 1. Site 1, western approach

Photo 2. Site 1, eastern approach.

Photo 3. Site 1, large waterbar at top of eastern approach.

Photo 4. Site 1, additional large waterbar upslope from eastern approach.

Photo 5. Site 1, channel armoring.

Photo 6. Site 2, new pond spillway.

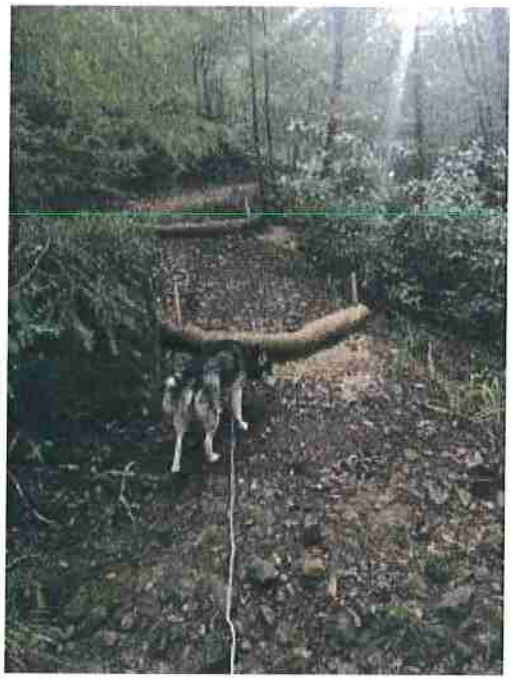


Photo 7. Site 3, new straw wattles.

Photo 8. Site 4, new rolling dip.

Photo 9. Site 6, new rolling dip.

Photo 10. Site 7, new rolling dip.

Photo 11. Site 8, newly cleaned culvert inlet.

Photo 12. Site 9, new culvert inlet.

Photo 13. Site 9, new culvert outlet.

Photo 14. Site 9, new culvert downstream channel.

Photo 15. Site 9, new culvert upslope rolling dip and road surface.

Photo 16. Site 10, bioswale.

Photo 17. Site 11, waterbar.

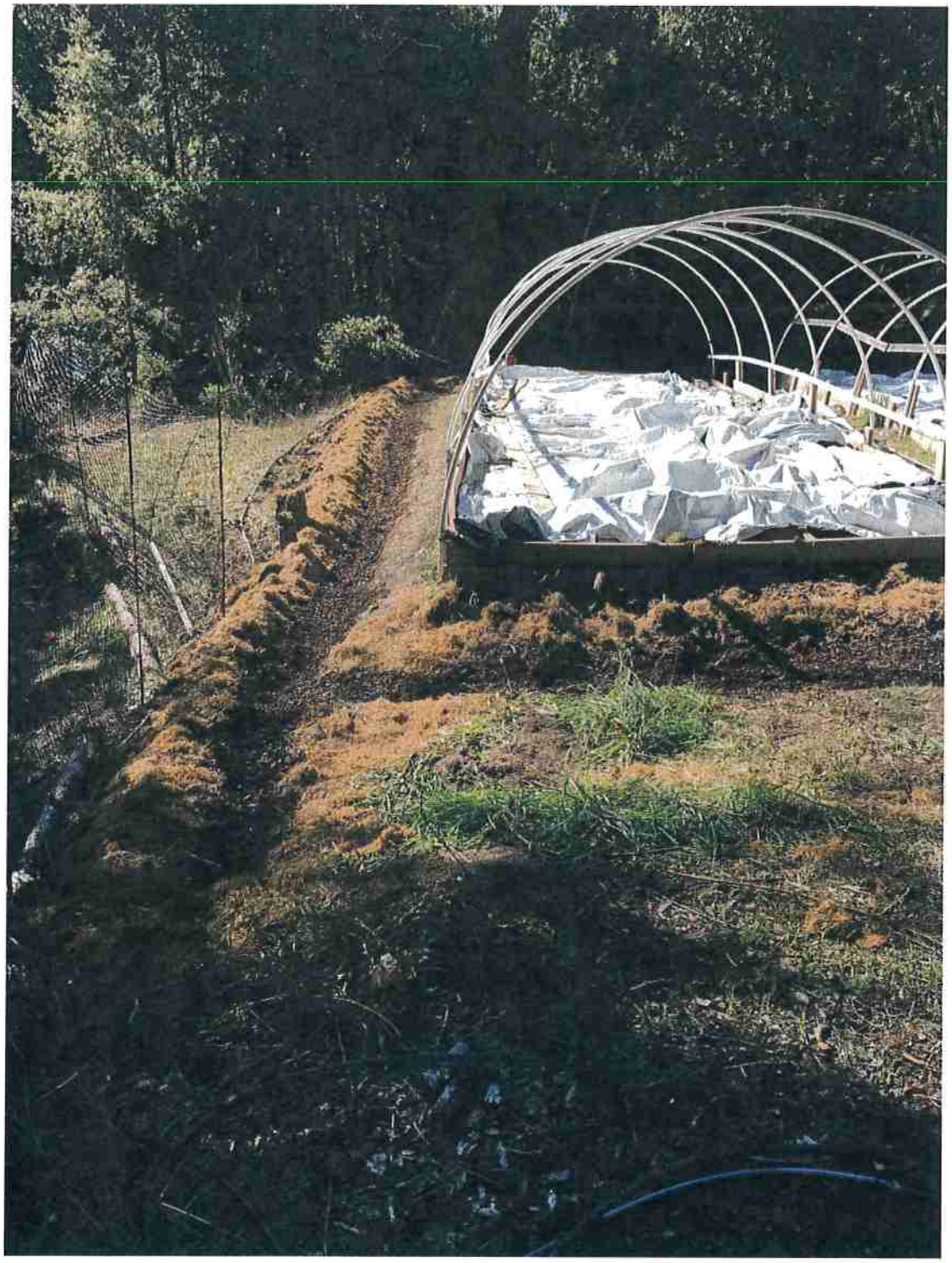


Photo 18. Site 13, bioswale along southern and eastern extent of cultivation site.

Photo 20. Site 13, bioswale along western extent of cultivation site.

Photo 21. Site 13, drainage ditch on northern side of cultivation area to direct surface runoff around site.

Photo 22. Site 14, small armored ford.

Photo 23. Site 15, small armored ford.

Photo 24. Site 17, small armored ford.

Photo 25. Site 18, small armored ford.

Photo 26. Site 19, upper waterbar.

Photo 27. Site 19, lower waterbar.

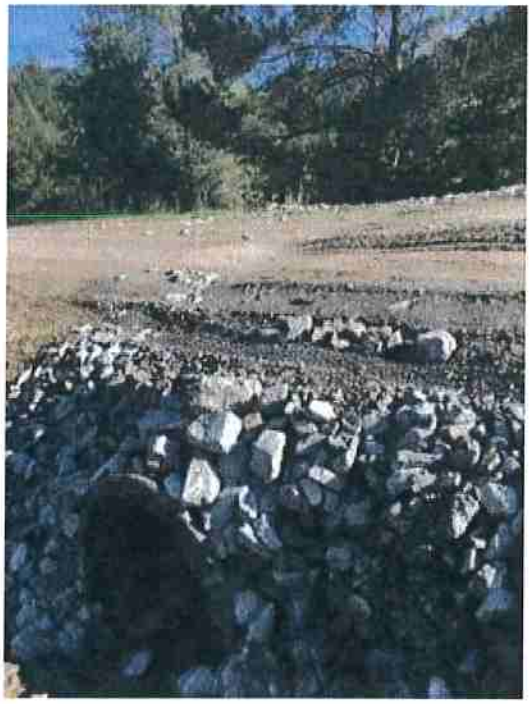


Photo 28. Site 22 culvert inlet.

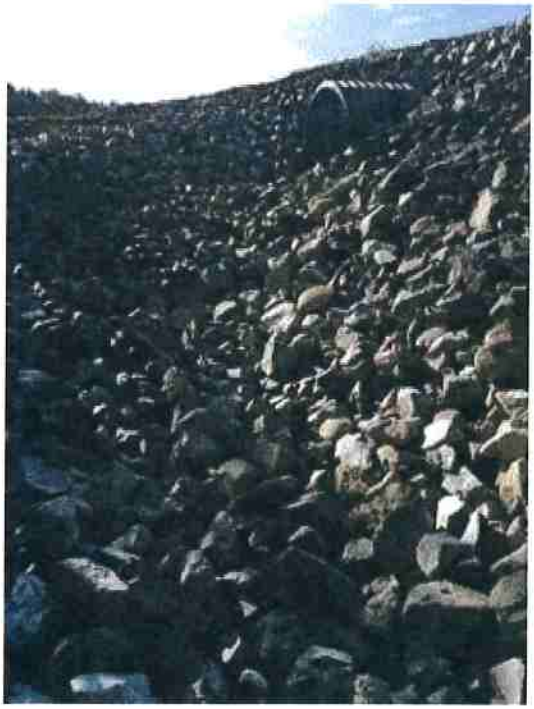


Photo 29. Site 22 culvert outlet.

Photo 30. Site 24 small crossing decommissioning.

Appendix B

Site Plan

PLOT PLAN
APN 222-071-017
HUMBOLDT COUNTY, CA

OWNER:
MCCONNELL-BULLOCK
PO BOX 862
GARBERVILLE, CA 95542
ABULLOCK78@GMAIL.COM
MELISALOU@HOTMAIL.COM

AGENT:
JOEL MONSCHKE PE
STILLWATER SCIENCES
850 G STREET, SUITE K
ARCATA, CA 95521
707-496-7075
JMONSCHKE@STILLWATERSCI.COM

PROJECT NOTES:

APN 222-071-017: <E> 10,000 SF OUTDOOR CULTIVATION AREA

WATER STORAGE NOTES:

91,200 GALLONS IN 29 POLY TANKS

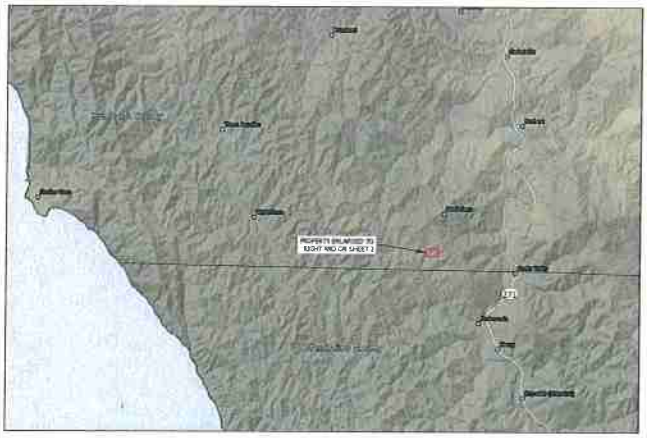
ADDITIONAL NOTES:

1. PARCEL EXTENT TAKEN FROM HUMBOLDT COUNTY GIS AND ASSESSORS PARCEL MAPS; MODIFIED BASED ON FIELD CONDITIONS; APPROXIMATE ONLY.
2. SLOPE DIRECTION AND GRADIENT CAN BE DETERMINED USING SCALE BAR AND UNDERLYING USGS TOPO MAP (40' CONTOUR INTERVALS); SLOPES TYPICALLY RANGE FROM 0% TO 40%.
3. NO SCHOOLS, BUS STOPS, PLACES OF WORSHIP, PUBLIC PARKS, OR TRIBAL CULTURAL RESOURCES WITHIN 600' OF PROPERTY.
4. ALL ROADS AND PARKING AREAS SURFACED WITH GRAVEL, MAIN COMMUNITY ROAD THROUGH PROPERTY ~16 - 20' WIDTH, 0-16% GRADE; PRIVATE DRIVEWAYS ~12' - 14' WIDTH 0-25% GRADE.
5. NO RESIDENCES EXIST WITHIN 300 FEET OF THE SITE.
6. BUILDINGS LABELED ON SHEET 2 IF THEY WILL BE USED FOR ANY CULTIVATION OR PROCESSING ACTIVITY.

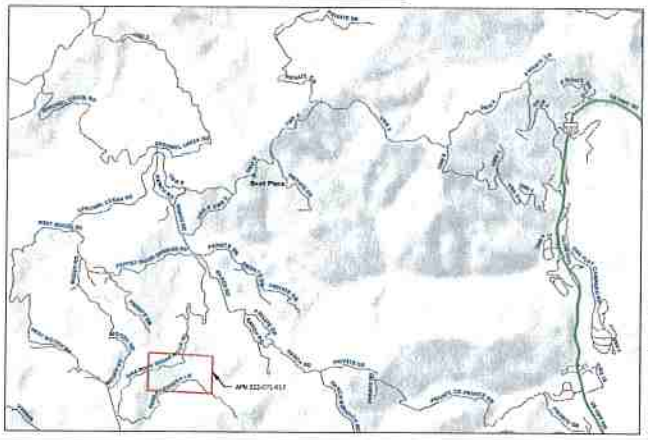
HUMBOLDT COUNTY MAP
NTS

CALIFORNIA MAP
NTS

REGIONAL LOCATION MAP



VICINITY LOCATION MAP



APN 222-071-017
PLOT PLAN

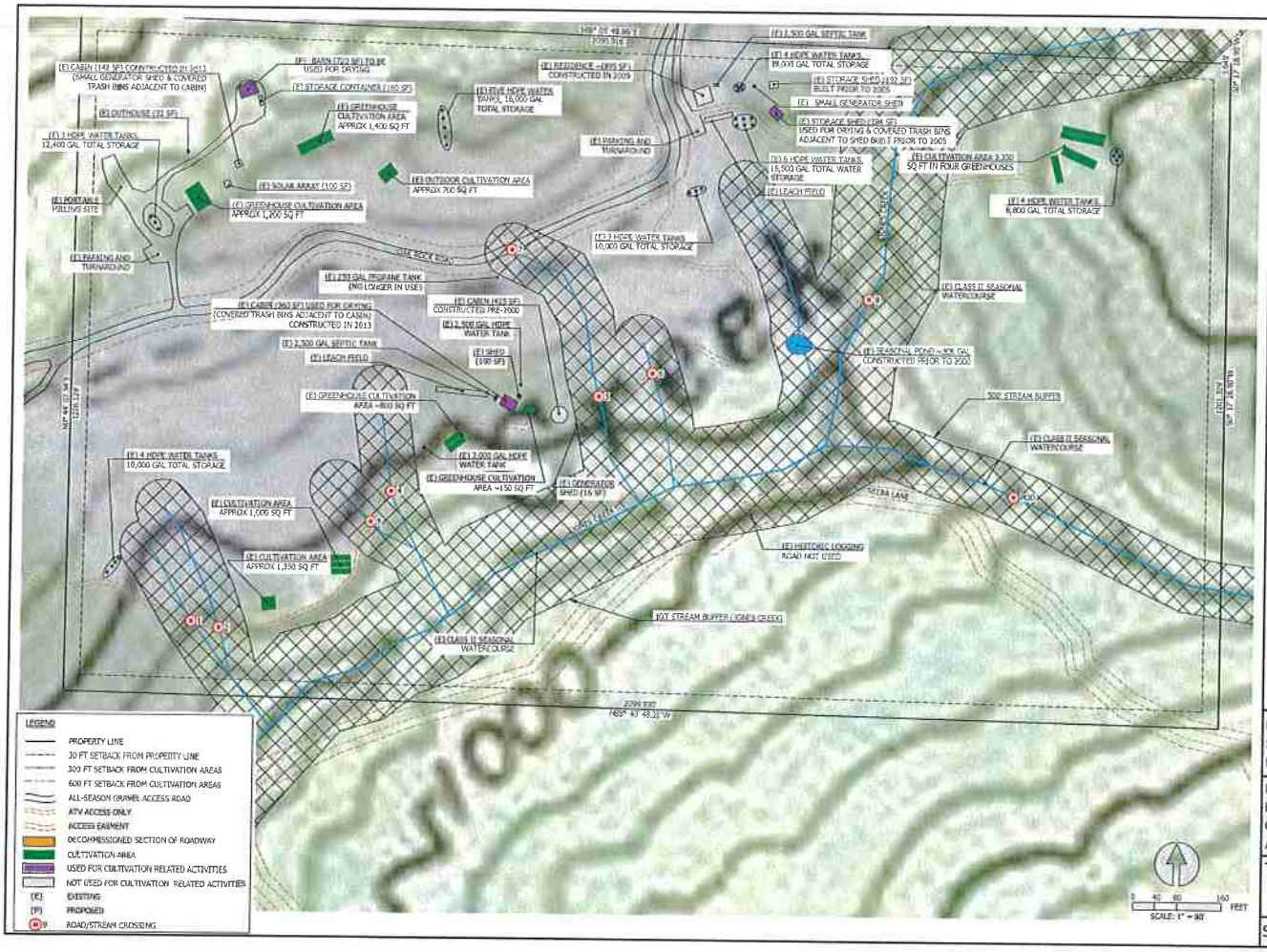
HUMBOLDT COUNTY, CA

Stillwater Sciences

PROJECT NUMBER: 546.08
SCALE: AS NOTED
DATE: 9/19/2018

DESIGN: JM
DRAWN: CL
CHECKED: JM
APPROVED: JM

TITLE SHEET



APN 222-071-017
GRADING PLAN

HUMBOLDT COUNTY, CA

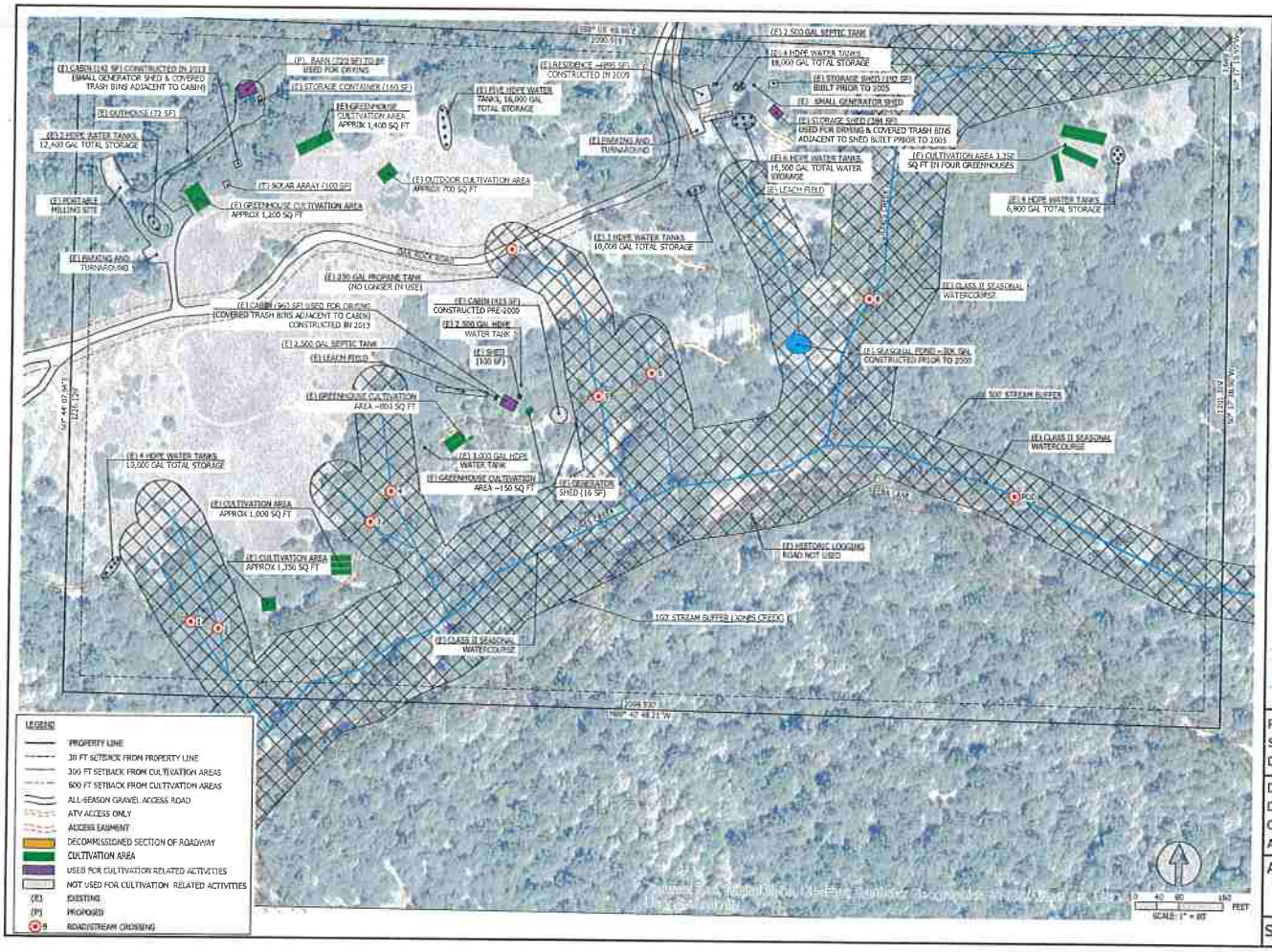
Stillwater Sciences

PROJECT NUMBER: 546.08
SCALE: AS NOTED
DATE: 9/19/2018

DESIGN: JM
DRAWN: CL
CHECKED: JM
APPROVED: JM

TOPO PLOT PLAN

SHEET 2 OF 3



APN 222-071-017
GRADING PLAN

HUMBOLDT COUNTY, CA

Stillwater Sciences
2855 TELEGRAPH AVENUE, SUITE 405
BERKELEY, CA 94705
P (510) 848-8098

PROJECT NUMBER: 546.08
SCALE: AS NOTED
DATE: 9/19/2018

DESIGN: JM
DRAWN: CL
CHECKED: JM
APPROVED: JM

AERIAL PLOT PLAN

SHEET 3 OF 3

Stillwater Sciences

2855 Telegraph Ave, Suite 400, Berkeley, CA 94705
phone 510.848.8098 fax 510.848.8398

TECHNICAL MEMORANDUM

DATE: November 21, 2016

TO: Erin Mustain, CA State Water Quality Control Board; David Manthorne, CDFW

FROM: Joel Monschke, Stillwater Sciences

SUBJECT: APN #222-071-17 Project Completion Report (McConnell-Bullock Property)

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 knowledge and 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.

Joel Monschke 11/30/16

Joel Monschke, P.E. Date
Senior Civil Engineer/Hydrologist
Stillwater Sciences

1 PROJECT OVERVIEW

The owners of APN 222-071-17 contracted Stillwater Sciences to perform a site assessment of roads, road-stream crossings, and cultivation areas to develop an implementation plan that decreases sediment and nutrient delivery to Jones Creek and its tributaries. Following CA State Water Board approval of the implementation plan, Stillwater Sciences has also been retained by the landowners to conduct construction oversight and submit this Project Completion Report.

The property and specific locations of remediation sites are shown on Figure 1 and the site descriptions, original recommendations, and as-build descriptions are listed in Section 2, and photos of each site are included in Appendix A.

We would also like to note some general issue that occurred during the implementation of this project. First, the contractor (John Neill Construction) who was scheduled to complete the work in late September and early October, had a significant change order on a culvert to bridge upgrade project that he was working on prior to this project. Considering the contractor's schedule delay, and the early onset of significant rainfall on October 13th, some changes had to be made to the project design that incorporated a lighter touch approach that allowed certain sites to be implemented using hand work. Considering the small drainages on the property and relatively straight-forward water quality issues being addressed, we believe that the light touch approaches used at several sites were appropriate. However, we will closely monitor all project sites through the 2016/2017 wet season to insure that they are functioning as designed, and make all necessary adjustments/upgrades in the 2017 dry season in collaboration with State Water Board staff.

Please feel free to contact me by email (jmonschke@stillwatersci.com) or phone (707 496 7075) with any questions that you may have regarding this project.

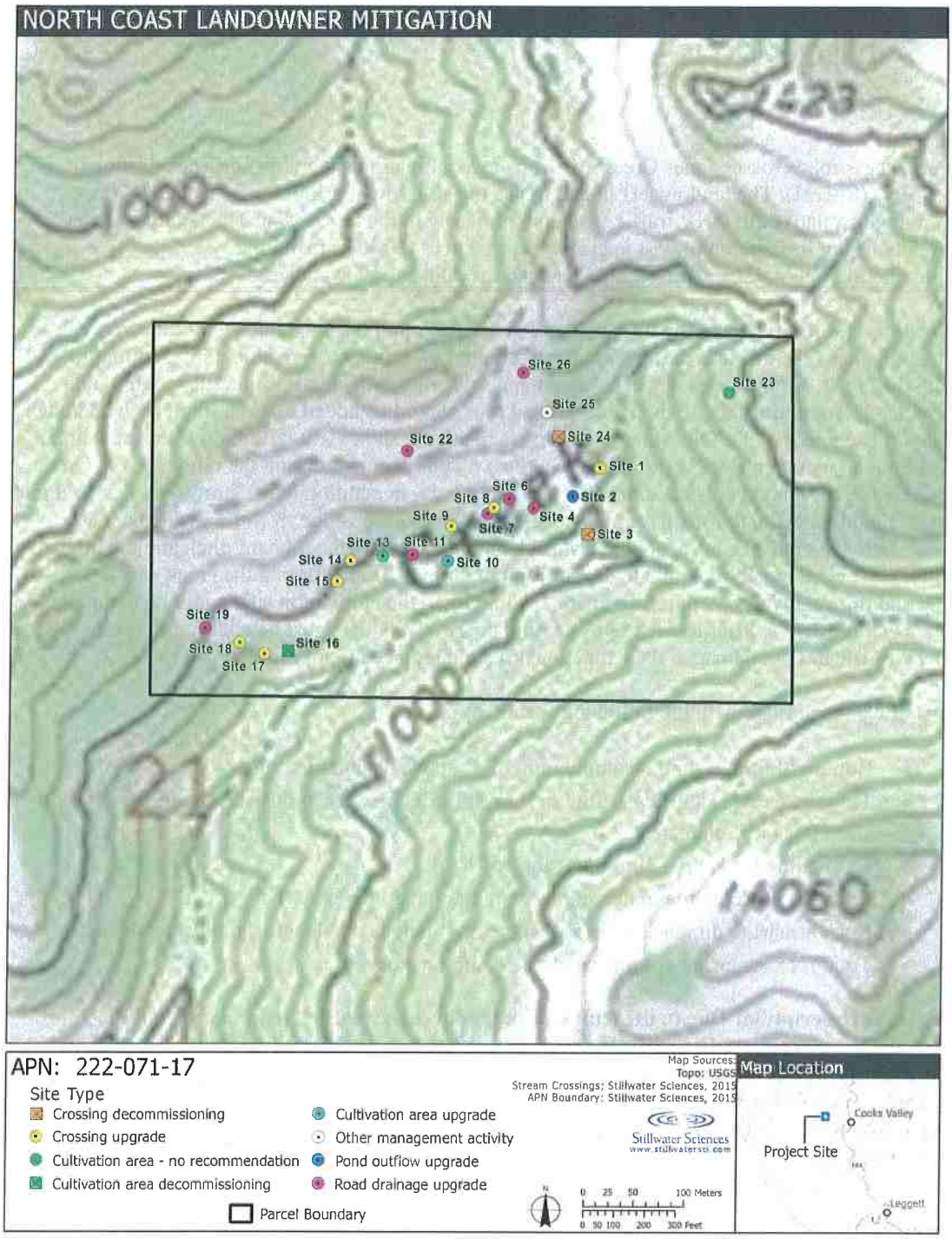


Figure 1. Site locations on APN 222-071-17.

2 SITE DESCRIPTIONS, RECOMMENDATIONS, AND AS-BUILT DESCRIPTIONS

SITE 1:
This access road crosses Jones Creek and leads to a cultivation site in the northeast portion of the property (Site 23). The landowners intend to use this as a low-use foot traffic and OHV (i.e. motorcycle/quad) trail. OHV traffic would be primarily in the dry season. The landowners have already begun installation of best management practices (BMP's) including constructing/improving existing water bars and installing straw waddles.

Recommendation: Where the trail crosses Jones Creek, pull back the top edge of the vertical stream banks on both sides to decrease the likelihood of sediment from sloughing and toppling into the creek. Armor the newly excavated bank segments with small rip-rap (i.e. cobbles and boulders). Approximately 3" thickness of road rock should be added to the trail on each approach. The trail segment west of the stream crossing is relatively short (~20 ft) and drains a small area. Continue to maintain BMP's (i.e. straw waddles) on this segment during the rainy season. On the trail east of the stream crossing construct 2-3 water-bars, in addition to the straw waddles, to drain trail-related runoff in the steep segment extending for ~50 ft upslope from Jones Creek. These new water bars must be excavated to a sufficient depth to drain the inboard ditch and the inboard ditch must be plugged to eliminate the concentrated runoff from entering the creek at Site 1. Beyond this relatively steep trail segment, leading up to the cultivation site, continue maintaining the existing BMP's. Prior to each rainy season, the straw wattles must be checked to insure that OHV traffic has not damaged their functionality, and replaced if appropriate.

Install wooden bridge with the following specifications:

- Bottom of bridge shall be a minimum of 4' above channel bottom
- This site carries significant flow so rock armoring needed at this site should be ~1/4 ton size class (1.5' diameter).
- Excavating banks to a minimum slope of 1.5:1.
- Excavate 1' depth toe trench to place the first layer of riprap rock.
- Rock armoring dimensions: 1.5' thickness, 4' height, 15' lengths, both creek banks.
- Total rock armoring volume needed: ~8 cubic yards

As-Built Description: Due to difficult equipment access, weather issues, and goal of reducing construction disturbance, work at this site was conducted by hand. As such, as-built photos reflect the following changes to the initial recommendations: Used +/- 1' diameter cobble for channel bank armoring, excavation of 6" toe trench, no excavation at top of bank, ~1' thickness, 3' height, 10' length rock armoring both sides of creek, total of 2 CY armoring.

SITE 2:
This pond outlet cuts through a narrow ditch incised into the pond berm before turning and flowing onto native soils. A low-use/OHV quad trail runs across the ditch and pond berm.

Recommendation: Excavate and pull back the vertical edges of the ditch to 2:1 (Horizontal : Vertical) slope. Armor the outlet ditch with small riprap rock such that pond has minimum of 1.5'

of freeboard. Extend the armoring to dissipate outlet flow where it meets the native soil beyond the pond berm. However, construction of a rock armored spillway is crucial to prevent erosion and risk of spillway failure. Based on the hydrologic analyses described above, we provide the following site-specific recommendations:

- Excavate spillway so pond has minimum 1.5' of freeboard
- 100-year flows are relatively low, so rock armoring at this site should be backing size class (0.5' diameter)
- Over-excavate channel and banks: bottom channel width = 2', side slopes = 2:1
- Rock armoring dimensions: 1' thickness, 6' total width (channel and banks), 20' length
- Construct energy dissipation/infiltration basin on native ground: 8' width, 8' length, 1' depth
- Total rock armoring volume needed: ~8 cubic yards

As-Built Description: Prior to construction, engineer conducted additional site reconnaissance and discovered that existing pond outflow should be relocated due to erosion and gullying downslope from outflow. As such, outflow was relocated to a more suitable/stable location on the south side of the pond and constructed per recommendations above. Existing outflow was filled with soil, compacted, seeded, and mulched.

SITE 3:
This former access road crosses Jones Creek but does not lead to any cultivation sites. The landowners intend to maintain this as a low-use, foot-traffic trail to access their domestic water source. The slopes where the trail meets Jones Creek are gentle, beginning to re-vegetate, and the landowners have already constructed BMP's to drain water and sediment onto native soils and vegetation.

Recommendation: Continue to maintain existing BMP's, install straw wattle or water bar on eastern approach to prevent runoff concentration.

As-Built Description: Constructed per recommendations.

SITE 4:
The inboard ditch along this road segment has issues with ponding water. Runoff then drains through a small cross road ditch, onto the road shoulder, and then flows onto native soil and vegetation. Some flow is also diverted across an expanded shoulder/pad containing gravel and lumber piles.

Recommendation: Fill existing cross road drain and construct a new rolling dip to the west. The new dip should be deep enough to drain ponding water and broad enough (~15-20 ft) to diffusely drain flow onto native soils and vegetation and avoid diversion onto the expanded shoulder/pad. Gravel road segment with 6" thickness of road rock.

As-Built Description: Constructed per recommendations.

SITE 6:
Regular vehicle traffic has rutted the existing water-bar and it no longer drains the road surface.

Recommendation: Construct a rolling dip that is broad enough (~15-20 ft) to diffusely drain flow onto native soils and vegetation. Gravel road surface across dip with 6" thickness of road rock.

As-Built Description: Constructed per recommendations.

SITE 7:
Poor road-surface drainage and regular vehicle traffic has resulted in a large rutted deposit of fine sediment.

Recommendation: Construct a rolling dip that is broad enough (~15-20 ft) to diffusely drain flow onto native soils and vegetation. Gravel road surface across dip with 6" thickness of road rock.

As-Built Description: Constructed per recommendations.

SITE 8:
An existing culvert with 12" diameter along a small class III tributary carries seasonal flow under a residence-access road and onto native soils and vegetation. The inlet is partially clogged and the outlet is on-grade with minimal armoring and does not contribute to increased sediment production.

Recommendation: Hydrologic analyses for this site determined that the existing 12" diameter culvert has sufficient capacity to carry 100-year flows. Therefore, the only recommendation is to clean the culvert inlet with hand tools.

As-Built Description: Constructed per recommendations.

SITE 9:
An existing undersized 12" diameter culvert carries a class III stream under the residence-access road before entering Jones Creek. The inlet is partially plugged with minimal armoring. The stream frequently overtops the culvert and runs over the road incising a gully into the road surface before re-entering its channel. Lack of armoring and scour around the culvert outlet has led to an increase in sediment production.

Recommendation: Upgrade the crossing with a new 24" diameter culvert along the same alignment. Appropriately armor the inlet/outlet and gravel roadway. In addition to standard culvert replacement activities, one new rolling dip should be installed on the road up-gradient from the culvert to prevent road runoff from concentrating at the culvert site, and road rock should be placed on ~100' of the upslope road segment. In addition, water supply lines that are currently running in the road and through the culvert should buried in their own separate trenches of at least 1' depth so that they are not located on the roadway or in the culvert. Damaged and/or leaking water lines can cause additional erosion and sedimentation.

As-Built Description: Generally constructed per recommendations; less rock armoring used than originally recommended due to use of large logs to stabilize downstream channel.

SITE 10:
Existing cultivation site is located near Jones Creek and a season tributary.

Recommendation: Move all cultivation sites to be a minimum of 50' from the seasonal tributary and 100' from Jones Creek. Construct a bio-swale along the down slope extent (southeastern and southern) of the cultivation area to retain any sediment and/or nutrients derived from the cultivation area surface. Bio-swale dimensions will be approximately 50' length x 2' bottom width x 1' depth with 2:1 side slopes.

As-Built Description: Due to difficult equipment access, weather issues, and goal of reducing construction disturbance, work at this site was conducted by hand. As such, as-built photos reflect the following changes to the initial recommendations: Bio-swale dimensions of approximately 30' length x 1' width x 1' depth.

SITE 11:
A ~100-foot segment of former access road leading west from a residence to a cultivation site is insloped with no inboard ditch and drains to a swale in the road where water ponds and spills across the road surface without properly constructed drainage. The landowners intend to use this road segment as a low-use/OHV trail.

Recommendation: Pull back the over-steepened cutbank along this road segment and use the newly excavated material to re-grade an outsloped road surface profile (~4% side slope) extending west from the residence toward the swale in the road where water currently ponds. Gravel the newly graded road surface with 6" thick road rock.

As-Built Description: Prior to construction, engineer conducted additional site reconnaissance and determined that erosion was due to concentrated runoff along this road segment, and not over steepened cutbank. As such, one waterbar was installed to eliminate runoff concentration and no outsloping or other road surface treatments were conducted.

SITE 13:
An existing cultivation site is located approximately 120 feet from Jones Creek. There is no evidence of slope instability, concentrated runoff, or sediment production related to the site. Minor seasonal runoff originating upslope of the site flows along the back edge (upslope side) of the site before draining onto native soils and vegetation. The landowners wish to keep this as an active cultivation site.

Recommendation: Construct a bio-swale along the down slope sides (southeastern, southern, and southwestern) of the cultivation site to retain any sediment and/or nutrients derived from the cultivation area surface. Bio-swale dimensions will be approximately 100' length x 2' bottom width x 1' depth with 2:1 side slopes. Construct a small drainage ditch (2' bottom width x 1' depth with 2:1 side slopes) along the northern side of the site to direct seasonal runoff westward past the site preventing it from entering the cultivation area. Place approximately 5 cubic yards of small rock armoring in the newly constructed drainage ditch.

As-Built Description: Due to difficult equipment access, weather issues, and goal of reducing construction disturbance, work at this site was conducted by hand. As such, as-built photos reflect the following changes to the initial recommendations: Bio-swale dimensions of approximately 100' length x 1' width x 1' depth. Drainage ditch along north side of site was also constructed by hand with approximately dimensions of 1' width by 1' depth. Due to minimal disturbance of handwork activities, no rock armoring needed to stabilize ditch.

SITE 14:
A small class III watercourse carrying seasonal spring flow crosses a former access road at an un-engineered crossing. The landowners intend to use this as a low-use/OHV trail. The landowners have already constructed straw-waddle BMP's at the crossing to minimize sediment production and delivery associate with the crossing.

Recommendation: Construct an armored ford.

As-Built Description: Generally constructed per recommendations; less rock armoring used than originally recommended due to fact that project was constructed by hand which minimized disturbance of existing vegetation and topsoil.

SITE 15:
A minor class III stream carrying seasonal spring flow crosses a former access road at an un-engineered crossing very similar to Site 14. The landowners intend to use this as a low-use/OHV trail. The landowners have already constructed straw-waddle BMP's at the crossing to minimize sediment production and delivery associate with the crossing.

Recommendation: Construct an armored ford.

As-Built Description: Generally constructed per recommendations; less rock armoring used than originally recommended due to fact that project was constructed by hand which minimized disturbance of existing vegetation and topsoil.

SITE 17:
A seasonal class III watercourse crosses a former access road at an un-engineered crossing. The inlet and outlet flow through standing trees and are choked with sediment and debris. The outboard road surface is gullied and water flow cascades approximately 12 feet to the channel below. The crossing also drains diverted flow from Site 18 (see below). The landowners intend to use this as a low-use/OHV trail.

Recommendation: Construct an armored ford crossing.

As-Built Description: Generally constructed per recommendations; less rock armoring used than originally recommended due to fact that water was routed back to its original course which is armored by existing large woody debris.

SITE 18:
A seasonal class III watercourse crosses a former access road at an un-engineered crossing. The inlet flows through standing trees and is choked with sediment and debris. The outboard road surface is minimally gullied and water flow is directed toward a log pile which causes diversion back onto the road. The diverted flow then travels down the road to Site 17. The landowners intend to use this as a low-use/OHV trail.

Recommendation: Construct an armored ford crossing. Additionally, remove the log pile and construct a channel (3' bottom width x 1.5' depth with 2:1 side slopes) extending from the newly constructed armored ford past the log deck and connecting with the natural channel downslope. Armor the newly constructed channel with 3 grade control structures with a total of 6 cubic yards of small rock armoring.

As-Built Description: Armored ford generally constructed per recommendations; less rock armoring used than originally recommended due to fact that project was constructed by hand which minimized disturbance. However, prior to constructing the new downstream channel, engineer conducted additional site reconnaissance and determined that there is a small active landslide downslope from this crossing and that it is best to let runoff dissipate in the log pile and then sheet flow in multiple directions.

SITE 19:
This former access road is constructed with an inboard ditch which no longer drains the road surface along this segment. Instead, water drains down the rutted road surface to Site 18. The landowners intend to use this as a low-use/OHV trail.

Recommendation: Construct two water bars at 50-foot intervals between this site and Site 18. The uphill water bar will drain to the existing inboard ditch. The downhill water bar will drain to the outboard edge of the road onto native soil and vegetation.

As-Built Description: Constructed per recommendations.

SITE 22: (High priority)
An existing undersized culvert (12" diameter) carries water draining a small vegetated swale and the inboard ditches from both directions under West Moody Lane/Oak Rock Road before entering a downslope gully. Both the inlet and outlet are damaged and rusting. Water exits the culvert through a rusted hole before reaching the outlet. Further failure of this culvert could threaten the road surface and lead to significant additional erosion.

Recommendation: Upgrade the crossing with a new 24" diameter culvert on the same alignment. Appropriately armor the inlet and outlet.

As-Built Description: Constructed per recommendations.

SITE 24: (Low priority)
This small fill crossing is located on a trial no longer used by the landowners. The small class III tributary runs through a small ditch that is approximately 1' to 2' wide, approximately 2' deep, and consists of approximately 1.5' depth of soil (clayey gravel) overlying soft bedrock.

Recommendation: We recommend that the oversteepened banks of one stream crossing are excavated and rock armoring is placed to reduce erosion potential. Soil should be over-excavated to allow space for rock armor placement without encroaching on the channel. Based on the hydrologic analyses described above we provide the following site-specific recommendations:

- This is a very small tributary so rock armoring at this site should be backing size class (0.5' diameter)
- Over-excavate channel and banks: bottom channel width = 2', side slopes = 2:1
- Rock armoring dimensions: 1' thickness, 6' width (channel and banks), 15' length
- Total rock armoring volume needed: ~4 cubic yards

As-Built Description: Prior to construction, engineer conducted additional site reconnaissance and determined that channel bottom and lower 1' of banks were composed entirely of relatively competent bedrock. As such, excavation and armoring of the upper bank only was required and therefore less rock was needed.

3 MONITORING PLAN

Landowner will monitor all sites to insure that they are functioning as designed and conduct maintenance activities as needed. Site functionality over time shall be documented using photos taken by the landowner at each site. Monitoring will occur as follows:

- During the first winter following construction, sites shall be monitored following any rainfall event with an intensity of 3" precipitation in 24 hours.
- If sites are shown to be functioning well via photographic documentation during the first winter, during years 2-5 monitoring shall occur following any rainfall event with an intensity of 5" precipitation in 24 hours.

Landowner shall save digital copies of all photos and store them by date and site number.

Appendix A

Photos

Photo 1. Site 1, western approach

Photo 2. Site 1, eastern approach.

Photo 3. Site 1, large waterbar at top of eastern approach.

Photo 4. Site 1, additional large waterbar upslope from eastern approach.

Photo 5. Site 1, channel armoring.

Photo 6. Site 2, new pond spillway.

Photo 7. Site 3, new straw wattles.

Photo 8. Site 4, new rolling dip.

Photo 9. Site 6, new rolling dip.

Photo 10. Site 7, new rolling dip.

Photo 11. Site 8, newly cleaned culvert inlet.

Photo 12. Site 9, new culvert inlet.

Photo 13. Site 9, new culvert outlet.

Photo 14. Site 9, new culvert downstream channel.

Photo 15. Site 9, new culvert upslope rolling dip and road surface.

Photo 16. Site 10, bioswale.

Photo 17. Site 11, waterbar.

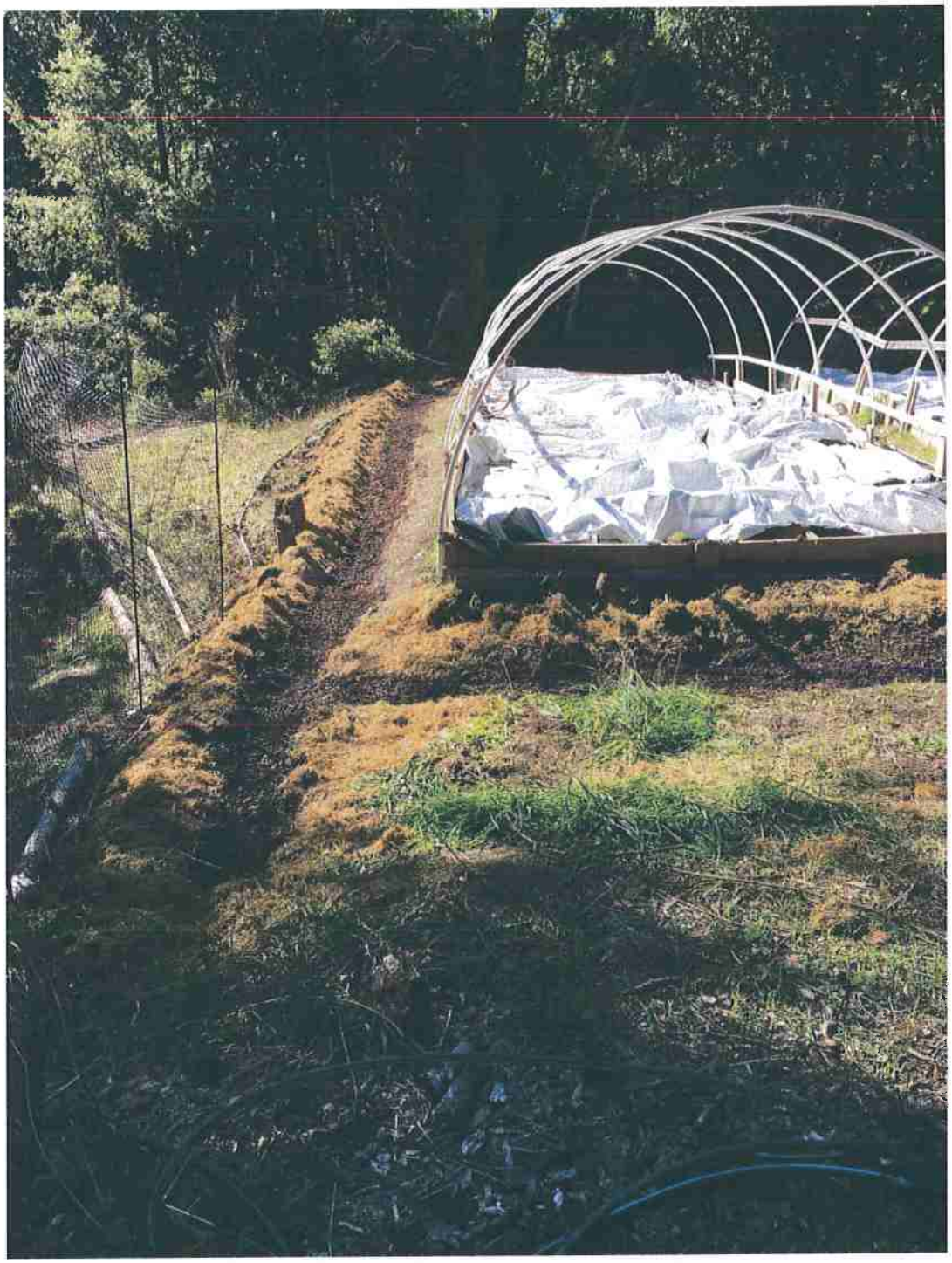


Photo 18. Site 13, bioswale along southern and eastern extent of cultivation site.

Photo 20. Site 13, bioswale along western extent of cultivation site.

Photo 21. Site 13, drainage ditch on northern side of cultivation area to direct surface runoff around site.

Photo 22. Site 14, small armored ford.

Photo 23. Site 15, small armored ford.

Photo 24. Site 17, small armored ford.

Photo 25. Site 18, small armored ford.

Photo 26. Site 19, upper waterbar.

Photo 27. Site 19, lower waterbar.

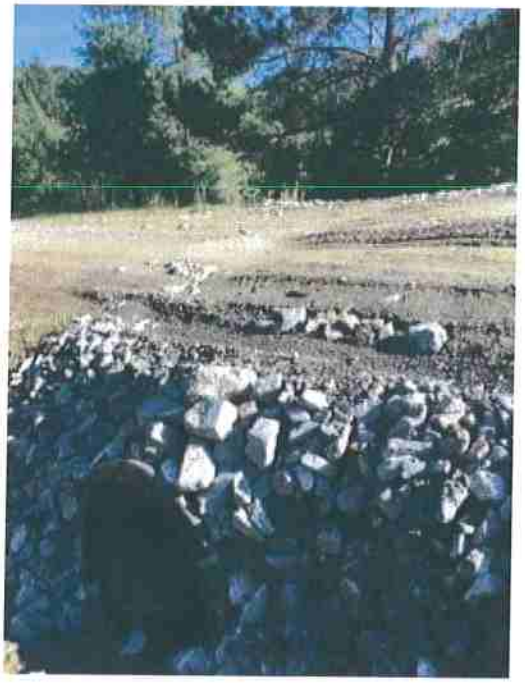


Photo 28. Site 22 culvert inlet.

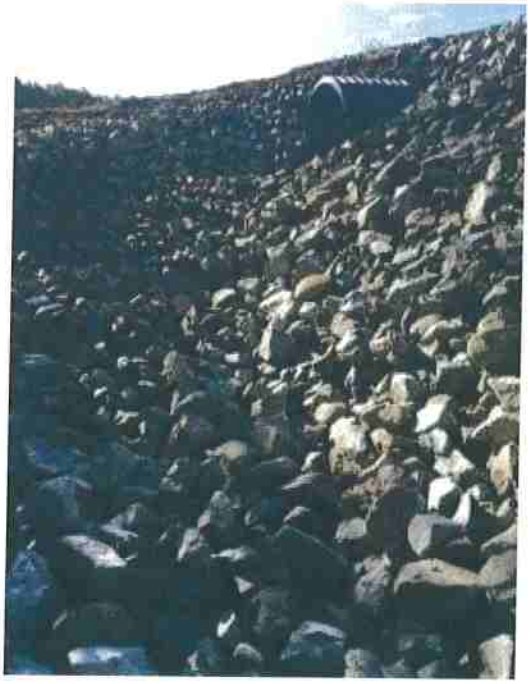


Photo 29. Site 22 culvert outlet.

Photo 30. Site 24 small crossing decommissioning.