Stillwater Sciences

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TECHNICAL MEMORANDUM

DATE: May 30, 2017

TO: David Manthorne and Scott Bauer, CDFW

FROM: Joel Monschke, Stillwater Sciences

SUBJECT: APN 316-071-004 Erosion Remediation (Sexton Property)

I hereby state that all work described in the attached Technical Memorandum for the APN 316-071-004 erosion remediation plan follows accepted engineering practices and was completed under my direction. The project proposes erosion prevention and sediment control improvements and/or upgrades at multiple sites designed to decrease sediment delivery to Willow Creek and tributaries. The property is located on Highway 299 approximately 6.7 miles west of the town of Willow Creek in Humboldt County.

REGISTERED PROFESSIONAL ENGINEER
JOEL MONSCHKE
C 79688
EXP. 9/18
CIVIL
STATE OF CALIFORNIA

Joel Monschke, P.E. Date 5/30/17
Senior Civil Engineer/Hydrologist
Stillwater Sciences

1 INTRODUCTION

The owner of APN 316-071-004 contracted Stillwater Sciences to perform a site assessment of the roads and culverts on the property and develop a remediation plan that decreases sediment delivery to Willow Creek and tributaries. The property is located at 33818 Highway 299, Willow Creek, California. The property and specific locations of remediation sites are shown on Figure 1.

2 GEOLOGY AND SOILS

The entire property and surrounding vicinity is underlain by Quaternary and Jurassic metamorphic and ultramafic lithologies with a small area of Willow Creek pluton (granitic rocks) in the northwest corner of the property (https://ngmdb.usgs.gov/Prodesc/proddesc_542.htm). These rocks consist of greenstone, metagraywacke, slate, phyllitic slate, and minor amounts of agglomerates or volcanic conglomerates. The property is located in mountainous terrain with steep slopes (30–70%) supporting conifer and hardwood stands. There is widespread evidence of slope instability within the Quaternary unit located along the northern extent of the property directly adjacent to Highway 299. Soils consist of the Hungry series (https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

3 FIELD OBSERVATIONS

Stillwater Sciences' engineer/hydrologist (Joel Monschke) visited APN 316-071-004 on March 28, 2017. During the site visit, a full property road assessment was conducted, including an inspection of 13 road/stream crossings and one well location. To provide a basis for determining the adequacy of each crossing site to handle 100-yr discharges, Stillwater staff analyzed the tributary drainage areas and runoff characteristics for each site as described in Section 5.

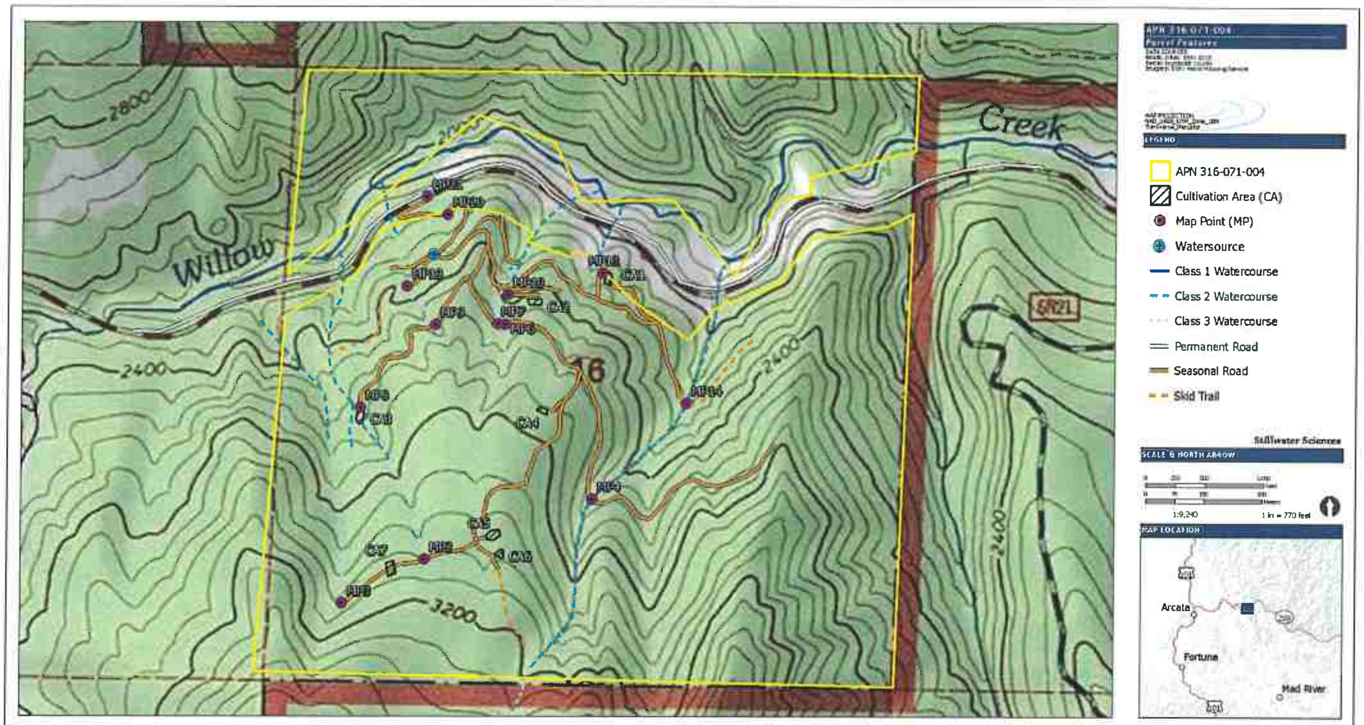


Figure 1. Site overview and sediment source locations on APN 316-071-004.

4 HYDROLOGIC ANALYSIS DRAINAGE STRUCTURE DESIGN

To determine the appropriate sizing for each new crossing structure, 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 200 acres according to the California Forestry Report No. 1, *Designing Watercourse Crossings for Passage of 100-year Flood Flows, Wood, and Sediment*. 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

4.1 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), the "Time to Concentration" was estimated using the Airport Drainage Formula. The "Time to Concentration" is defined as the time it takes runoff to travel along the longest flow path within the contributing watershed and arrive at a site crossing. Per the California Forestry Report No. 1, the Time to Concentration" can be found with the following Airport Drainage Formula:

$$T_c=((1.8)(1.1-C)(D^{0.5}))/(S^{0.33})$$

Where:

T_c=Time of Concentration (minutes)
C=Runoff Coefficient (dimensionless, $0<C<1.0$)
D=Distance (in feet from the point of interest to the point in the watershed from which the time of flow is the greatest)
S = Slope (percent)

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

Site number	Drainage area (ac)	Longest flow path (ft)	Maximum elevation change (ft)	Slope (%)	Time to concentration (min)	100-year rainfall intensity (in/hr)
MP2	8.5	1230	480	39	17	3.5
MP3	21.5	1647	600	36	20	3.2
MP4	110.8	4975	2550	51	31	2.4
MP6	66.3	5303	1440	27	40	2.1
MP7	4.3	810	325	40	14	4.0
MP8	23.8	2708	910	34	26	2.7
MP9	1.6	448	195	44	10	4.8
MP10	72.6	5556	1545	28	40	2.1
MP13	0.5	307	125	41	8	5.1
MP14	91.4	6127	2920	48	35	2.3
MP19	4.8	893	375	42	14	3.9
MP20	6.1	985	440	45	15	3.9
MP21	7.6	1220	505	41	17	3.6

4.2 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.

4.3 Runoff Coefficients

Cafferata et. al. suggests a runoff coefficient ranging from 0.30 to 0.45, depending on the specific location of the crossing. Per Buxton et. al. (1996), as cited in Cafferata et. al., a runoff coefficient value of 0.4 is recommended for North Coast California specifically. Additionally, a runoff coefficient of 0.4 reflects woodland with heavy clay soil, soil with a shallow impeding horizon, or shallow soil over bedrock per Figure 2 taken from Appendix A, Table A-1 of The Handbook for Forest, Ranch and Rural Roads (Weaver et. al. 2015).

However, this property has very gravelly soils and underlying geology. As such, a runoff coefficient of 0.2 was used for all sites representing "cultivated" (or disturbed) conditions for sandy and gravelly soils (from Table 2). Using a runoff coefficient of 0.2, our calculated runoff results and required culvert diameters were consistent with measured channel widths onsite.

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

Soils	Land use or type	C value
Sandy and gravelly soils	Cultivated	0.20
	Pasture	0.15
	Woodland	0.10
Loams and similar soils without impeded horizons	Cultivated	0.40
	Pasture	0.35
	Woodland	0.30
Heavy clay soil or those with a shallow impeding horizon; shallow over bedrock	Cultivated	0.50
	Pasture	0.45
	Woodland	0.40

Figure 2. Runoff coefficients (adopted from Appendix A, Table A-1 of the *Handbook for Forest, Ranch And Rural Roads* (2015).

4.4 Storm Discharges

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

Table 2. 100-year discharges.

Site number	100-year discharge (cfs)
MP2	6.0
MP3	13.6
MP4	54.2
MP6	28.3
MP7	3.4
MP8	12.8
MP9	1.6
MP10	30.8
MP13	0.5
MP14	41.5
MP19	3.8
MP20	4.7
MP21	5.4

4.5 Drainage Structure Sizing

Culvert crossings required to carry 100-year discharges were sized using the FHWA Culvert Capacity Inlet Control Nomograph (Figure A-1 of *The Handbook for Forest, Ranch and Rural*

Roads (2015)) using an HW/D ratio of 1.0, as shown in Figure 3 below. Specific upgrade recommendations are described below in Section 5.

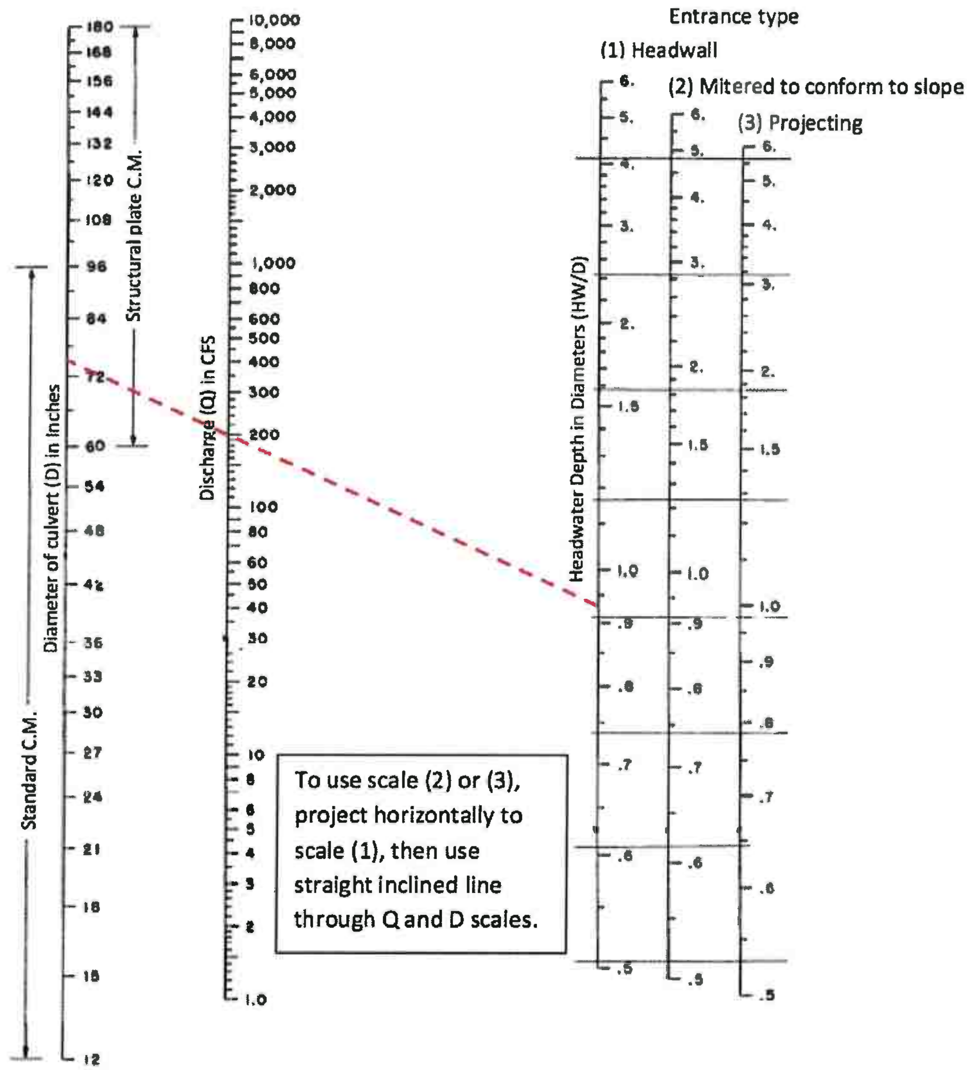


Figure 3. Runoff coefficients (adopted from Appendix A, Table A-1 of *The Handbook for Forest, Ranch and Rural Roads* (2015)).

5 IMPLEMENTATION PLAN

5.1 General Culvert Upgrade Specifications

Typical culvert installation and rock armor placement is depicted on Figure 4. 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 (with diameters specified in Table 4) 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 4 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.
- Ensure 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.
- All sites subject to changes based on field conditions and/or as directed by engineer or watershed scientist.

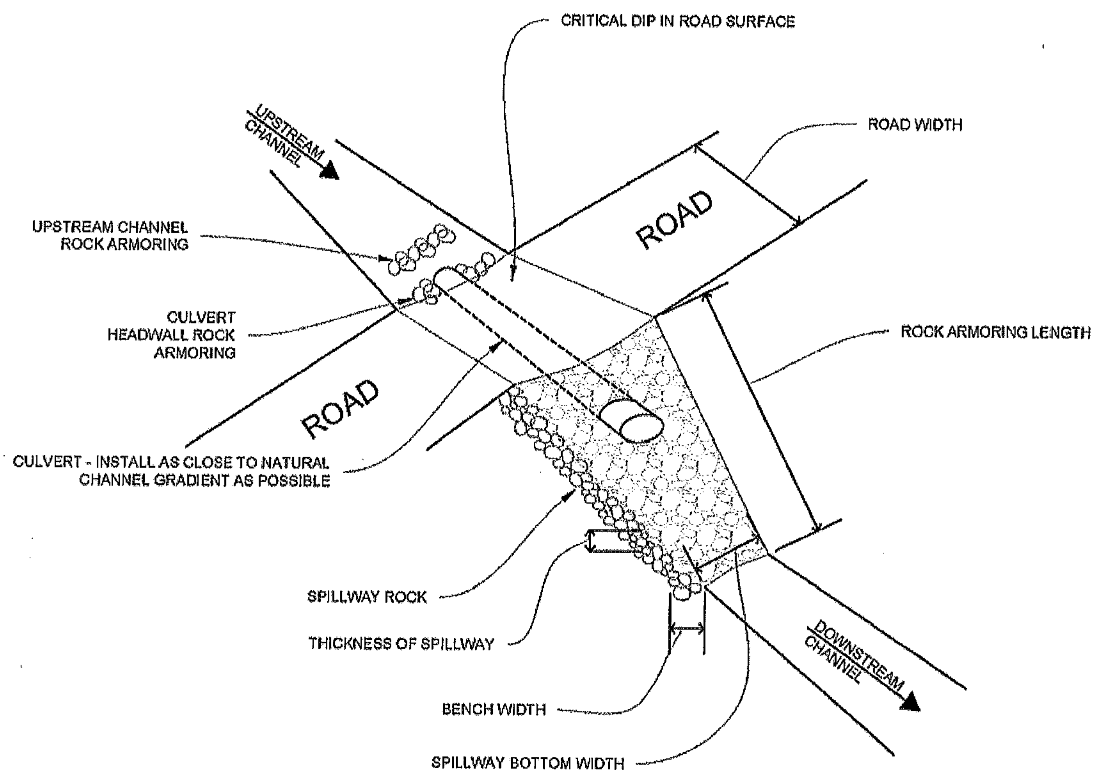


Figure 4. Culvert installation schematic.

5.2 Site-specific Culvert Upgrade Recommendations

Three existing culverts will be installed/replaced and all five sites should be stormproofed with riprap rock armor as described in Table 3.

Table 3. Site-specific culvert upgrade specifications.

Site number	Required culvert diameter (inches)	New culvert length (ft)	Total rock volume (cubic yards)	Rock size range (ft)*
MP3	24**			
MP6	24	40	10	1–2
MP7	18		5	1–2
MP10	30	60	20	1–2
MP13	18			
MP19	15***	40	20	1–2
MP20	18***	40	10	1–2
MP21	18***	40	10	1–2

* Approximate rock size to weight conversion:
- 1–2 ft rock = ¼ ton
- 1–3 ft rock = ¼ ton – 1 ton

** Minimal evidence of surface flow so existing culvert diameter is appropriate
*** Recommend upgrading to 24" diameter to meet CDFW minimum size requirements

- Site MP3 is a seasonal road crossing at the head of a Class III drainage with an existing 18-inch Corrugated Plastic Pipe (CPP). There were no sign of failure and minimal evidence of surface water flow. Culvert appears to be sized correctly. Clean inlet and outlet.
- MP6 is a seasonal road crossing of a Class III drainage. The drainage is being diverted into an inboard ditch for ~50 feett. The drainage is being conveyed to MP7 down a different watercourse creating minor in-channel erosion from the increased flows. Recommend installing a 24-inch culvert with rock armored outlet and critical dip to convey flow to the natural channel.
- MP7 is a seasonal road with an existing 18-inch CPP on a Class III drainage. The stream crossing is in good condition. The culvert will be receiving less flow after MP6 is installed. Rock the outfall and install a critical dip.
- MP10 is a Class III watercourse that is being conveyed approximately 50 ft down an inboard ditch before crossing the roadway through an 18-inch diameter culvert. Install new 30-inch diameter pipe to align with the natural upstream drainage. Due to steep upstream channel gradient and abnormal relative geometry/elevations of current inboard ditch and road prism, special care will need to go into installing and armoring the culvert inlet so that it will be stable and functional. The new culvert will cross two roads just to the east of where they split, so it will need to be a minimum of 60 feet in length. Armor inlet and outlet with 10 CY rock each. Downslope from the location of the proposed culvert outflow, excavate a channel in the existing landing area to direct water toward natural swale located on the eastern extent of the landing. Armor new channel with approximately 10 CY rock.
- MP13 is located on an old graded flat that opened a large spring during construction. The spring was daylighted for ~ 75-ft. The spring flow is contained in a channel with over-steepened western slope that will require the banks to be pulled back to a 2:1 slope. The daylighted spring will be planted to reduce water temperatures and create riparian habitat. Flow from the spring goes under the access road through an existing 18-inch CPP. The culvert is adequately sized, but will need the inlet and outlet cleared out of sediment and debris. The existing flat was used to cultivate and is in the stream buffer. This flat will be

restored and cultivation waste will be removed. The road is used by PG&E and therefore cannot be decommissioned.

- MP19 is a Class III watercourse that is flowing onto an old graded flat, which was likely a surface rock quarry for the logging road. Excavate and armor small channel around east side of flat and install a 24-inch diameter culvert with 10 yards rock armoring at outlet.
- MP20 consists of sediment and other fill from a seasonal access road that is plugging up a Class III seasonal drainage. Remove sediment and install a 24-inch by ~60-foot-long pipe.
- MP21 is a Class III watercourse that crosses the main access adjacent to the gated entrance of the property. A 24-inch diameter culvert is needed to convey the watercourse across the roadway. This section of road **is off the property**, but improvements at this site is necessary.

6 ARMORED FORD CONSTRUCTION

6.1 Rock Armored Ford Sizing

We determined the appropriate dimensions of the fords using the U.S. Army Corps of Engineers' *Hydrologic Engineering Center's River Analysis System* (HEC-RAS). It is critical that the armored fords are properly sized so that 100-year flows do not exceed the capacity of the ford which could lead to erosion of the adjacent outboard edge of the road. The specific dimensions for the armored fords are defined below.

6.2 General Armored Ford Crossing Specifications

Typical armored ford construction is depicted on Figure 5 with the specific dimensions and required rock armoring for the sites are shown on Tables 4 and 5. Additionally, the following specification should be followed when constructing the armored fords:

- 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.
- Firmly compact road surface armoring to the dimensions and slopes shown on Table 4.
- All sites are subject to changes based on field conditions and/or as directed by engineer or watershed scientist.

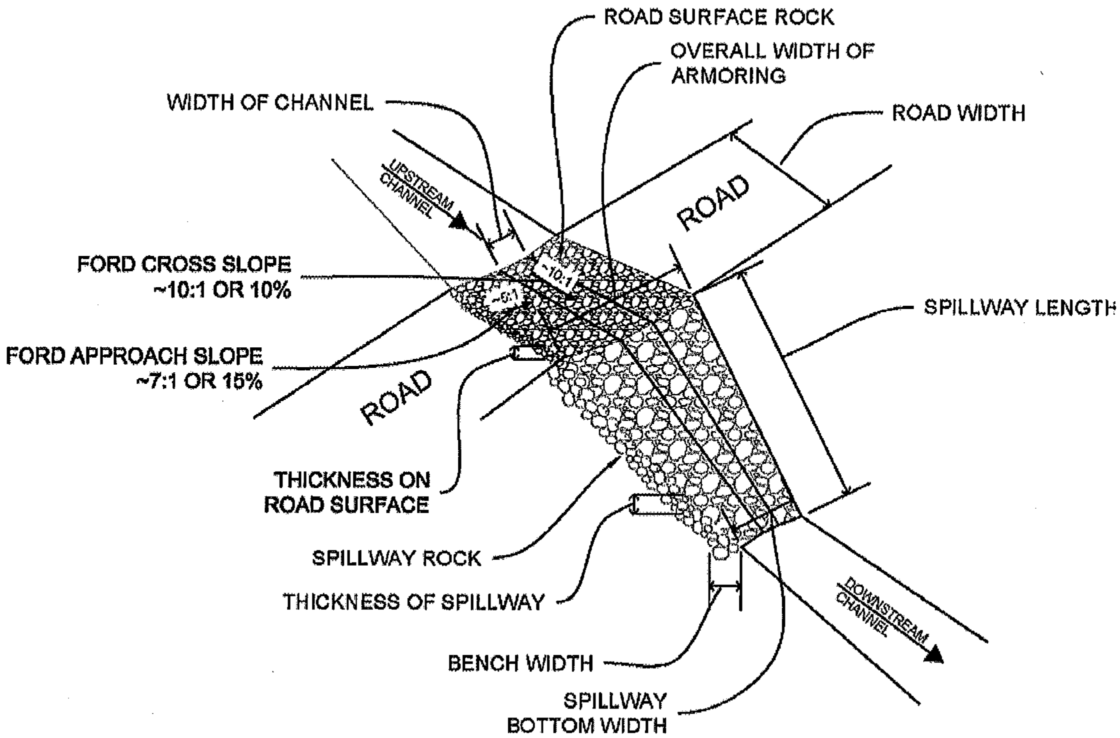


Figure 5. Armored ford schematic.

Table 4. Summary of crossing dimensions.

Site #	Width of channel (ft)	Overall width of armoring (ft)	Road width (ft)	Thickness of road armoring (ft)	Spillway length (ft)	Spillway thickness (ft)	Bench width (ft)	Spillway bottom width (ft)
MP2	1.5	8	12	1	10	1.5	1.5	8
MP4	4	16	15	1.5	15	2	3	10

Table 5. Summary of rock needed for each crossing.

Site #	Spillway rock size range (ft)*	Total spillway rock needed (cubic yards)	Road surface rock size range (ft)*	Total road surface rock size needed (cubic yards)	Total rock volume (cubic yards)
MP2	0.5 to 1.5	4	0.5 to 1	4	8
MP4	1.5 to 2	11	0.5 to 1.5	13	24

* Approximate rock size to weight conversion:

- 2–4 ft rock = 1 to 2 ton
- 1.5–2 ft rock = ½ ton
- 0.5–1.5 ft rock = backing to ¼ ton
- 0.5–1 ft rock = backing

We recommend creating armored fords at sites MP2, MP4, and MP9. The general site characteristics are as follows:

- MP2 is a seasonal road crossing at the head of Class III drainage with a channel width of ~1 foot. It is recommended that a rock ford be installed at this location with 8 CY of rock.
- MP4 is a seasonal road that crosses a Class II stream with a channel width of 36 inches. The stream is diverting down the roadway ~ 15 feet before reconnecting back to natural channel. The road leads to a quarry that was excavated to supply material to rock the roads when the property was being logged. Install an armored ford with 24 CY rock. Also, a spring seep is coming out of cut bank ~ 50 feet to the northwest of site with a 12-inch Corrugated Metal Pipe (CMP). The spring is flowing onto roadway. Remove culvert and construct rock lined inboard ditch to connect spring flow to drainage at MP4.

6.3 Site-specific Armored Ford Crossing Dimensions

Armored fords will be constructed at site MP2, MP4, MP9, and MP19 to the following specifications in Tables 4 and 5 and Figure 5.

7 CROSSING DECOMMISSIONING

7.1 Crossing Decommissioning Channel Sizing

We determined the appropriate dimensions of the decommissioned crossing channels using the U.S. Army Corps of Engineers' *Hydrologic Engineering Center's River Analysis System* (HEC-RAS). It is critical that the decommissioned crossing channels are properly sized so that 100-year flows do not exceed their capacity which could lead to erosion of the adjacent slopes.

7.2 General Crossing Decommissioning Specifications

Typical armored ford construction is depicted on Figure 6 with the specific dimensions and required rock armoring for the sites are shown on Tables 5 and 6. Additionally, the following specification should be followed when constructing the armored fords:

- 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

7.3 Site-specific Crossing Decommissioning Specifications

- MP8 is an old graded landing that exposes a series of spring seeps that are currently flowing around the flat and into a Class II stream. The springs flow all year and the existing drainage ditch has no shade or riparian vegetation. The flow from the spring seeps are conveyed under the roadway through an 18-inch CPP. Discharge from the culvert outfall is impeded by a fence, which splits the flow and then drains to the Class II in two locations. Recommend removing the culvert and fence and creating a 2-foot-wide channel to convey the spring flow to the Class II stream.

  Cultivation activities on the flat are discontinued and cleaned up. A new rock lined channel with 2-foot width and 2:1 side slopes will be dug across the south extent of the flat to connect one of the springs directly to the existing Class II stream. Most the existing channel around the backside of the flat will stay in place. Channel banks will be vegetated to shade and prevent an increase in water temperature.

  Historical construction of the landing included pushing logs and soil over the edge near the Class II watercourse. This perched fill is unstable and could eventually erode and deliver to the Class II watercourse. The fill will be pulled back to a 2:1 slope, stabilized with seed and straw, and logs placed at toe. See conceptual remediation diagram in Appendix B for additional details on recommendations for this site.
- MP9 is a Class III watercourse running down the seasonal road for ~20-ft and creating a gully where it runs off the road. The diverted flow is eroding the roadway and the fill slope of the road. Decommission crossing by excavating approximately 40 cubic yards of fill from the channel and placement of ~20 CY of backing to ¼-ton rock armor. Also, the inboard ditch ~30 above MP9 is capturing a spring seep. Excavate a large waterbar to drain seep across road. Install large waterbars ~100 feet above crossing as flagged to hydrologically disconnect the road from the stream system.
- MP14 is a very large old (>30 years) Humboldt crossing and is located on an old logging road that is not used. The crossing conveys a Class II stream and is not actively eroding. Full removal of the crossing and restoration of the channel could cause significant disturbance that is not warranted. It is recommended that a light touch approach is taken through minor excavation at two locations to insure that stream and adjacent spring doesn't flow onto the road surface for extended lengths. We also recommend planting of native species to widen the riparian corridor.

8 OTHER ROAD TREATMENTS NOT REQUIRING A 1602

- MP1 Install water bars ~50 spacing on legacy logging skid road not used by owner. The skid road had surface erosion with small gullies forming and is not connected to a water course.
- MP5 is a spring seep from the cutslope of a seasonal road above a Class III watercourse. The seep is running onto the roadway creating surface erosion. Install an inboard ditch to capture spring and install an 18-inch ditch relief culvert.
- MP12 Clear inlet and outlet of 12-inch CMP and maintain inboard ditch.
- **Road segment accessing sites MP8 and MP9:** Decommission with outsloping and large waterbars.

There are several additional road/stream crossings on the property on abandoned roads that have revegetated due to lack of use over the past several decades. These sites are difficult to access and treatment would likely cause more negative environmental impacts than benefits.

9 PROJECT IMPACTS

Table 6. Estimated project impacts/

Site number	Length of channel impacted (feet)	Width of impact (feet)	Riparian area of impact (square feet)	Volume of material moved (cubic yards)
MP2	20	4	80	10
MP3	10	4	40	1
MP4	50	10	500	50
MP6	20	6	120	30
MP7	10	6	60	1
MP8	180	8	1440	150
MP9	30	4	120	40
MP10	60	6	360	50
MP13	40	10	400	50
MP14	60	10	600	50
MP19	60	4	240	20
MP20	20	4	80	20
MP21	20	4	80	20
Total	**580**		**4120**	**492**

10 LATITUDE AND LONGITUDE FOR SITES REQUIRING 1602 NOTIFICATION

Table 7. Latitude and longitude for 1602 sites.

Site	Latitude	Longitude
MP2	40.898917	123.733543
MP3	40.897907	123.735983
MP4	40.900386	123.728414
MP6	40.904558	123.731011
MP7	40.904486	123.731301
MP8	40.902431	123.735501
MP9	40.904519	123.733206
MP10	40.905428	123.731385

Site	Latitude	Longitude
MP13	40.905569	123.728040
MP14	40.902583	123.725689
MP19	40.905380	123.734191
MP20	40.907096	123.733008
MP21	40.907405	123.733631

11 CONSTRUCTION COST ESTIMATE FOR SITES REQUIRING 1602 NOTIFICATION

Total construction costs per site and the applicable CDFW permit fee is described on Table 8. The summation of the per site permit fees is $7,579. This property also requires the $5,000 cannabis remediation fee. The total amount due to CDFW is $12,579.

Table 8. Summary of 1602 fees for each site.

Site number	Estimated construction costs	Total CDFW permit fee
MP2	$2,000	$561
MP3	$500	$561
MP4	$4,500	$561
MP6	$4,000	$561
MP7	$500	$561
MP8	$6,500	$704
MP9	$3,500	$561
MP10	$5,500	$704
MP13	$3,000	$561
MP14	$2,500	$561
MP19	$3,000	$561
MP20	$3,000	$561
MP21	$3,000	$561

12 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.

13 WATER SOURCE

The water source is a newly permitted (March 14, 2017) deep groundwater well near site MP19 at the location of the green cross on the map (Figure 1). The 200-foot-deep well is located approximately 900 feet uphill from Willow Creek (345 feet of elevation gain) and was bored into blue sandstone and serpentine. No alluvium was observed during drilling of the well. The bottom of the well is 145 feet above and 835 feet horizontal from Willow Creek. Therefore, it appears that this well is producing groundwater and is not connected to Willow Creek via an underground stream. As such it is not considered a surface water diversion. Please see the well log in the Appendix C for more information.

14 REFERENCES

Buxton, T. H., W. J. Trush, and S. A. Flanagan. 1996. A comparison of empirical and regional peak discharge predictions to actual January 3, 1995 discharge at fifteen Bull Creek, Northwestern California tributary culverts. Unpubl. Rept. Prepared for the Humboldt State Univ. Institute for River Ecosystems Road Stream Crossing Project. Arcata, California.

Cafferata, P., T. Spittler, M. Wopat, G. Bundros, and S. Flanagan. 2004. Designing watercourse crossings for passage of 100-year flood flows, wood, and sediment, California Department of Forestry and Fire Protection, Sacramento, California. Available at: http://www.fire.ca.gov/ResourceManagement/PDF/100yr32links.pdf

California Department of Conservation, Geologic Map of California 2010. Available at: http://maps.conservation.ca.gov/cgs/gmc/

Weaver, W. E., E. M. Weppner, and D. K. Hagans. 2015. Handbook for Forest, ranch and rural roads: a guide for planning, designing, constructing, reconstructing, upgrading, maintaining and closing wildland roads. Revised 1st edition. Mendocino County Resource Conservation District, Ukiah, California. Available at: http://www.pacificwatershed.com/sites/default/files/roadsenglishbookapril2015b_0.pdf

C

Appendices

Appendix A

Photos

Photo 1. MP4 - Road surface at fill crossing.

Photo 2. MP6 - Road surface at location of proposed culvert installation.

Photo 3. MP7 - Culvert inlet.

Photo 4. MP8 - Cultivation debris cleanup in progress.

Photo 5. MP8 - Channel upstream from 18" culvert inlet.

Photo 6. MP8 - Northern spring location and channel.

Photo 7. MP8 - Southern spring location and channel.

Photo 8. MP8 - Ditch excavated along eastern extent of cultivation flat.

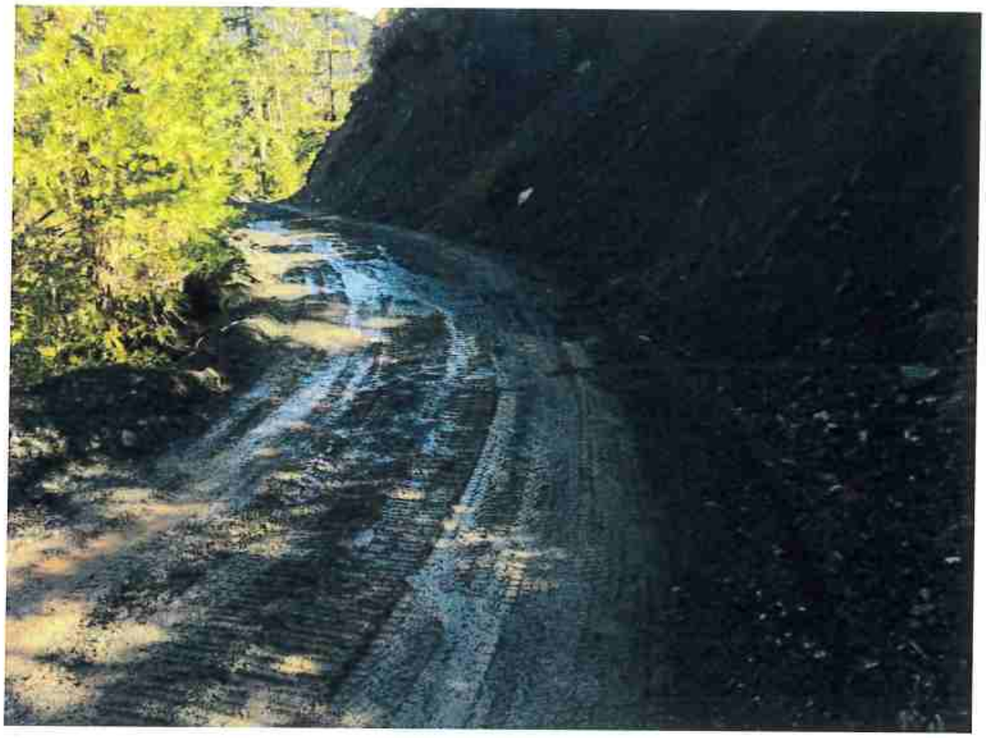


Photo 9. MP9 - Road surface at small fill crossing.

Photo 10. MP10 - Proposed culvert outflow location.

Photo 11. MP13 - Small channel and over-steepened slope.

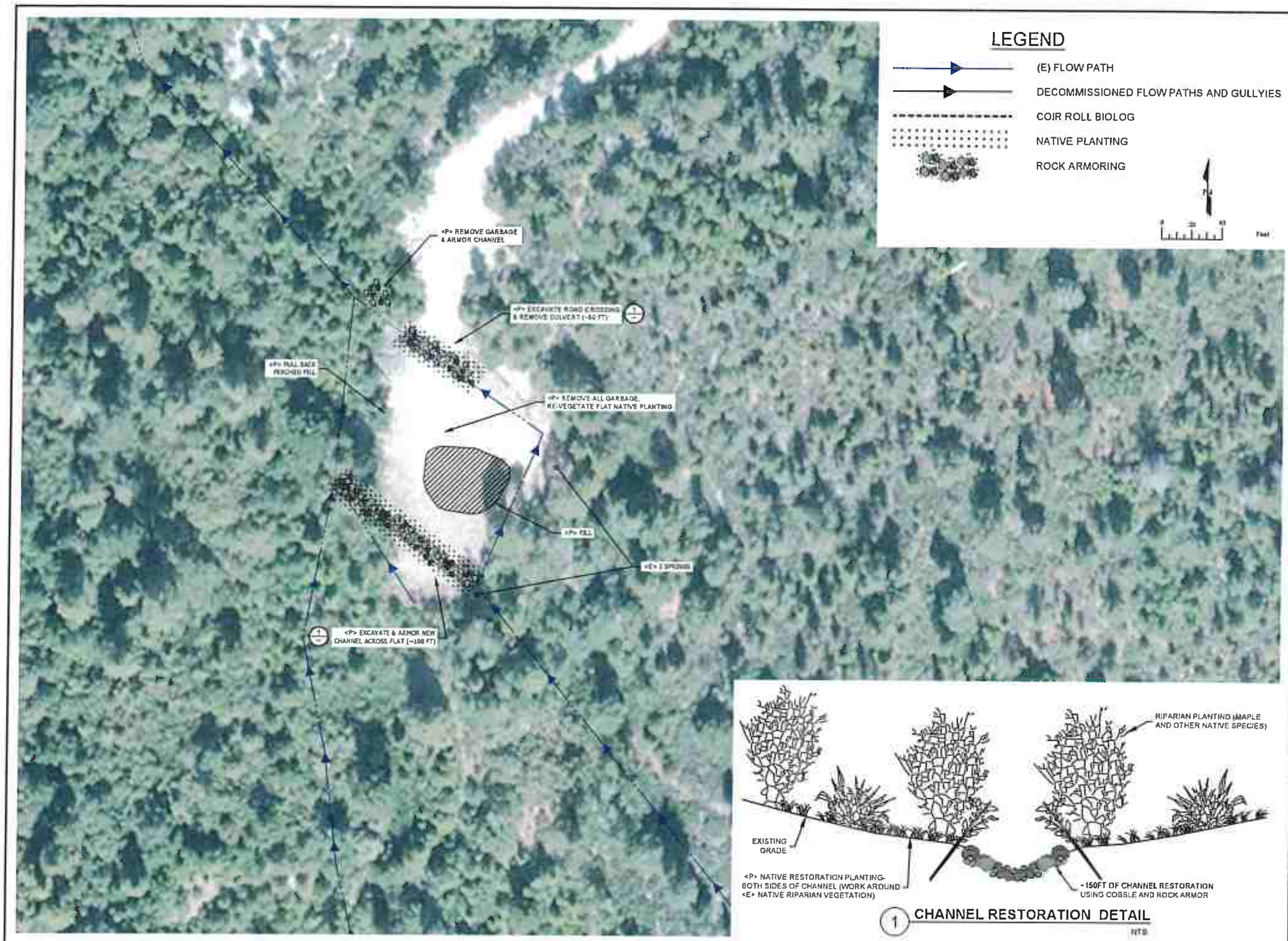
Photo 12. MP14 - Main Class II crossing at termination of road.

Photo 13. MP14 - Springy area located to the northwest of main crossing.

Photo 14. MP20 - Road surface at location of proposed culvert installation.

Appendix B

Conceptual Design Plans for Site MP8



APN 316-071-004
CONCEPTUAL DESIGN

HUMBOLDT COUNTY, CALIFORNIA

Stillwater Sciences

PROJECT NUMBER: 546.34
SCALE: AS NOTED
DATE: 5/5/2017

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

CONCEPTUAL DESIGN

SHEET 1 OF 1

GREEN ROAD CONSULTING

Attachment "1"

Cultivation and Water Usage

Month	Stage of Cultivation			Cultivation Space per Stage (Square Footage)*	Water Usage (gallons/month)
	Vegging	Flowering	Harvesting		
EXAMPLE	X	X		1,200 sq. ft. – Vegging 1,500 sq. ft. – Flowering	5,000 gal/month
January					
February					
March					
April		X		22,000 sq. ft – Flowering	37,125 gal/month
May		X		22,000 sq. ft. – Flowering	42,075 gal/month
June		X		65,560 sq. ft. – Flowering	49,500 gal/month
July		X	X	43,560 sq. ft. – Flowering	56,925 gal/month
August		X		65,560 sq. ft. – Flowering	59,400 gal/month
September		X		65,560 sq. ft. – Flowering	54,450 gal/month
October		X	X	65,650 sq. ft. – Flowering	47,025 gal/month
November					
December					

*with a plant density of 0.85

GREEN ROAD

CONSULTING

Attachment "2"

Name:	Ghost Ship Investments, LLC
APN:	316-071-004
Reporting Year:	
WDID #:	

GREEN ROAD CONSULTING

Name	Type (Fungicide /Pesticide /Fertilizer)	N-P-K or Active Ingredient	Annual Use (lbs or gallons)
Regalia	Pesticide		1 gallon
Double Nickel	Fungicide		1 gallon
Mad Sea	Fertilizer	16-16-16	450 lbs