Logging Road Assessment Report

Proposed Phase 1 Community Forest Acquisition, McKay Tract, Green Diamond Resource Company Property, Humboldt County, California

PWA Report No. 141006601
March 2014

Prepared for:
Humboldt County Department of Public Works
Natural Resources Division
Attn: Hank Seemann,

Prepared by:
Christopher Herbst, Professional Geologist #8433
Eileen Weppner, Professional Geologist #7587
Pacific Watershed Associates, Inc.
P.O. Box 4433, Arcata, CA 95518-4433
chrish@pacificwatershed.com / (707) 839-5130

Table of Contents

List of Appendices (in back of report)

1 INTRODUCTION

This logging road assessment report was developed for the Phase 1 portion of the proposed McKay Tract Community Forest to provide an assessment of the logging roads for their potential to deliver sediment to streams if left untreated. This property is currently owned by Green Diamond Resource Company (GDRCo) who manages the forest for timber production.

The 14.7 mi^2 Ryan Creek watershed in Northern California is a mid-size coastal watershed with cool, year-round stream flow that contains important habitat for anadromous salmonids including coho and Chinook salmon, and steelhead and cutthroat trout. Ryan Creek flows into Freshwater Slough, shortly before entering Humboldt Bay. The majority of the Ryan Creek watershed is privately held and has been intensively managed for over 100 years for timber production. Widespread erosion originating from networks of unmaintained logging roads and harvest-related activities has resulted in the degradation of both water quality and salmonid habitat.

Green Diamond Resource Company has inherited this legacy from previous landowners and has been treating their road networks based on a prioritization of watersheds, site specific treatment immediacy factors, and road networks associated with timber harvest activities. Though some of the roads within the proposed Phase I acquisition have been treated, a significant amount of work remains, to treat the network of aging or legacy roads.

In July 2013, Hank Seemann of the Humboldt County Public Works Department, Natural Resources Division (HCPW/NR) requested information from Pacific Watershed Associates Inc. (PWA) to assist with the proposed Phase 1 Humboldt County Community Forest land acquisition (Phase 1). At the time, a comprehensive field assessment in the Ryan Creek watershed, conducted by Pacific Coast Fish, Wildlife and Wetlands Restoration Association (PCFWWRA) technical staff under the supervision of PWA, was near completion. The assessment covered the portion of the Ryan Creek watershed lying within GDRCo's property (~79% of watershed area). California Department of Fish and Wildlife (CDFW) funded the assessment in 2010 through CDFW's Fisheries Restoration Grant Program (FRGP). The goal of the assessment was to identify and quantify sources of current and potential road related erosion and develop a prioritized treatment plan to reduce or eliminate future sediment delivery in order to improve water quality and protect and restore coho habitat.

This report summarizes the road assessment results obtained from 17.2 mi of road located within the potential Phase 1 land acquisition, the boundaries of which were provided by HCPW/NR. The road mileage within the proposed Phase I area accounts for 17% of the total road mileage (104 mi) assessed for the CDFW funded 2011-2013 Ryan Creek Watershed Assessment and Erosion Prevention Planning Project.

A current road network and accessibility map has been included as Map 1. Map 2 identifies site locations by site type and treatment immediacy for the 17.2 mi of Phase 1 roads. These maps can be found in Appendix B attached to the end of this report. Assessment results and recommended treatments for the 17.2 mi of road within the Phase 1 acquisition area are summarized in Tables 1-5 located in Appendix A.

2 DESCRIPTION OF THE PROJECT AREA

The geology of the area is primarily composed of uplifted marine terraces (sand to sandy-silt beach and near-off-shore marine deposits) overlying much older and more indurated (hard but not well lithified) bedrock of the Wildcat Formation that has been warped and fractured. Based on just a few exposures, the Wildcat in this area tends to be fairly fine grained (siltstone and silty clay). Underlying the Wildcat Formation, bedrock of the Yager Formation is the only well lithified rock in the watershed and exposures in the Phase 1 area are relatively rare. One typically finds thick and wide-spread marine terrace deposits of the Hookton Formation on the ridge tops or high in the watershed, with the Wildcat Formation exposed deeper in the canyons along road cuts. Rock from the Yager Formation within the Phase I area is limited to small outcrops in the stream bed or side-slopes deep in the inner gorge of mainstem Ryan Creek. Most of the hillsides are either blanketed by sandy marine terrace deposits (closer to the ridge-tops) or are colluvium (material derived by hillslope failures/landslides) and are often an unconsolidated mixture of both terrace deposits and Wildcat derived material. Though bare ground in the area is relatively erodible, the thick, fine-grained deposits and abundant rainfall quickly establish vegetation which reduces the rate of surface erosion fairly rapidly (<10 years).

Due to the nature of the terrain, most roads within the Phase 1 acquisition area are either located in valley bottoms along streamside or floodplain settings, or up on the ridge-tops above sometimes relatively steep breaks-in-slope. The hillsides between the ridge-tops and the valley floors have generally been heavily impacted by bulldozers associated with past harvest activities and subsequent mass wasting processes. These slopes can be steep and are densely dissected by first and second order streams and can be a challenge to traverse. A large percentage of the roads in the project area have been unmaintained for years and are partially or completely overgrown with brush and are only accessible by all-terrain vehicles (ATV) or walking.

In general, most sites contained within the proposed Phase 1 land acquisition can be treated in a relatively straightforward manner. Many of the Phase 1 area sites and road segments located along the inner gorge of mainstem Ryan Creek traversed large-scale dormant landslide features, but have recently been treated as part of the 2013 Ryan Creek Sediment Reduction and Habitat Improvement Project (CDFW funded FRGP road decommissioning project Grant Agreement #P1210502). Though some of the remaining untreated sites along the mainstem Ryan Creek have on-going active erosion, the majority have relatively low treatment immediacies. Several of the designated higher treatment immediacy sites are based on fish passage or other fish habitat impacts, rather than erosion and sediment delivery-based impacts. In general, most of the larger stream crossings have aging, rusted culverts that are nearing the end of their life. There are several small, relatively low power streams that do not have culverts and are currently diverting at the road crossings.

Most roads in the Phase 1 acquisition area are native surfaced (dirt) and only suitable as seasonal roads (summer use only) unless rocked in the future. Hard rock is rare in the watershed and due to a lack of quarries in the area, all rock must be imported, which raises costs.

In the proposed Phase 1 acquisition, only 3 road segments are rocked and drivable year round (Map 1):

1) The R-line: The main haul road leading into the McKay Tract off of Harris Avenue. This is the main route used to haul logs out of the majority of GDRCo's holdings in the McKay Tract.
2) The R-1: A short road leading to the small private in-holding located in the northern portion of the proposed acquisition.
3) The segment of the R-13-1 between the R-13 and the R-7 intersections. This short road segment connects the R-Line to the southern-most portion of the proposed Phase 1 acquisition.

Segments of the R-7-2 and R-7-2-3-1 that connect Beechwood Drive with the municipal water tank located on the R-7-2-5 Road are also rocked and drivable. These road segments could provide important administrative access route to the Phase 1 acquisition area from the ridge-top (Map 1).

Because future access points, potential easements, and transportation planning for the Phase 1 acquisition area have not been determined at this time, costs associated with rocking these or additional native road surfaces have not been included in this report. Good candidates for surfacing with road rock include roads that are needed year round, steep road segments, road segments that are wet and/or difficult to drain, streamside roads, and major public trail routes. Rocked roads are also generally preferred by pedestrians and bikers during the wet season. The amount of rock applied should depend on the type of use expected. A light coating of rock to a steep section of a seasonal road may suffice, in comparison to the generally heavy application required to create a solid, year round road.

Over the long term, it may be prudent to rock the main truck roads on the ridge-top in the southern half of the Phase 1 acquisition including the R-7 and R-7-2 roads. The R-7 Road and the R-13-1 road segments that connect the ridge-top to the R-13 Road and R-Line located along the mainstem in the southern portion of the proposed Phase 1 acquisition could also be useful as year round rocked roads.

Segments of the R-6 and R-6-3 roads located on the ridge-top (as well as any future new road alignments associated with these roads) may also be good candidates for surfacing with rock once easements and access routes have been finalized. Other roads recommended for rocking include any streamside roads targeted for upgrading and road segments on approaches to stream crossings on upgraded dirt roads. Finally, the segment of the R-Line (within the GDRCo boundary) that connects the northern and southern Phase 1 areas together is rocked, but if heavily used, would require maintenance.

3 ROAD CONDITION ASSESSMENT

Within the proposed Phase 1 acquisition, a total of 227 individual sediment delivery sites have been recommended for erosion control and erosion prevention treatment on approximately 17.2 mi of road that was inventoried. Results have been summarized in Appendix A, Tables 1-4, which show the number of sites by type and their associated future estimated episodic sediment delivery volumes, as well as estimates of future chronic sediment delivery associated with erosion of hydrologically connected road segments. Each site has been individually prioritized

according to its treatment immediacy (Appendix A: Table 4a and Table 4b). Map 2 depicts the location, site type, and treatment immediacy for each site. Site-specific and road drainage treatments for the 227 sediment delivery sites recommended for treatment are summarized in Appendix A: Table 5.

Many of the roads in the proposed Phase 1 land acquisition lie on ridgetops and either don't have sites or have low priority road surface drainage related problems. Several of the streamside road segments were constructed on or close to the floodplain and have low gradient, very shallow, low-lying road prisms. Even though the roads cross several small low-power streams, the gullies associated with the stream diversions tend to be small and have low future erosion volumes. Most of the roads have been unmaintained for an extended period of time and are covered in duff and vegetation, and therefore surface erosion has dropped to extremely low rates.

3.1 Road Treatment Prioritization

This assessment was driven by the need to identify road related, current and potential sediment delivery sources to the stream network (in addition to other features posing potential impacts to fish habitat). This means that at any location where a "potential" for future erosion and sediment delivery to the stream network was identified, the site was mapped and assigned a treatment immediacy. By definition, all stream crossings, whether designed and constructed well or not, are considered sites. Springs or concentrated road surface run-off locations that are hydrologically connected to the stream network, are also sites. Unstable road prisms with potential for sediment delivery, whether perched on stream-side slopes or located further upslope, have been identified as potential erosion sites. In some cases, road prisms that currently appear stable have been identified as sites that have potential to fail and deliver sediment, based on field indicators such as unstable topography, presence of springs and seeps in conjunction with steep slopes, or stream erosion at the toe of the slope below the road. Site conditions can change quickly from one winter to the next.

On unmaintained roads, low power streams and springs may quickly lose their erosion potential, but not always. Even a relatively small amount of flow can gully and saturate road prisms that may in turn, develop into larger mass wasting features (landslides) if the terrain is steep. These factors have been taken into consideration during the treatment immediacy and prioritization determination. Sites with active or potential problems have been prioritized by treatment immediacy and prescribed specific erosion control treatments to bring them up to current state regulatory standards (i.e. CDFW, Cal Fire, SWRCB). Inventoried sites that meet regulatory standards have not been recommended for treatment.

Treatment immediacy for each mapped site is derived from a variety of factors including site erosion activity, magnitude of potential sediment delivery, proximity and potential impact of site failures to anadromous fisheries and water quality, and how soon the site should be treated to eliminate or reduce the potential for erosion and sediment delivery. For example, a completely rusted out culvert at a collapsing stream crossing located directly above main-stem Ryan Creek would be identified as having a high treatment immediacy because it is actively eroding and delivering sediment into a Class I stream, the road prism is failing, and the site should be treated as soon as possible. In comparison, a moderately rusted culvert that is undersized for a 100-yr

storm event at a shallow stream crossing located on low-gradient slopes far from Class I stream habitat, may only have a moderate treatment immediacy. Though technically not up to current standards, this site poses less of a threat to natural resources and water quality than the previous example and perhaps, could be treated as funds become available at a later time (<10 years).

Numerous streams crossings were identified in this project, several with extremely small drainage areas. Generally, these steam crossings have very low power flow and may not pose a major threat to water quality or fish habitat. These sites would have been recommended for treatment, though have a relatively low treatment immediacy. Though technically not up to current standards, the low potential risk to water quality would place these sites toward the bottom of the priority list and would only be treated once higher priority sites were completed, or if necessary for other road access issues, such as timber harvesting or recreation.

There are 37 high to moderate treatment immediacy sites recommended for upgrading (Table 4a). On open, drivable roads, sites can be individually treated based on treatment immediacy. Sites located on abandoned roads cannot be treated in this fashion, because to access the higher priority sites, one may cross several lower priority sites. The prioritization documented by the road inventory is based on current conditions, which will not apply if a road is re-opened. For example, a small stream diverted down a duff covered road with flow exiting at a low spot along the road with a stable, well established gully down a short fillslope may have been classified with a relatively low treatment immediacy. If the road is opened up by heavy equipment (and the surface scraped clean), the same stream may erode a new gully down the fresh road surface and create a new gully, which would subsequently have a considerably higher treatment immediacy.

<u>The highest priority roads recommended for upgrading include</u>:
1) The R-1 Road stands out as having a few Class I stream crossings with aging, rusty culverts that act as partial fish migration barriers.
2) The segment of the R-Line between the R-2 Road intersection and the first bridge crossing mainstem Ryan Creek at the Phase 1/GDRCo boundary. This road segment crosses the floodplain of Ryan Creek and is inundated by floodwaters, even at moderate rain events during the winter. This road segment is considered high priority for treatment primarily due to the potential to enhance fish habitat and reduce fish stranding, not because of any significant impacts based on erosion.

Similarly, there are a number of other isolated sites that have high treatment immediacy based on fish migration barriers or potential to improve fish habitat rather than urgent sediment delivery issues. In general, the high priority sites located on roads recommended for upgrading are spread out and not clustered. Note that high priority stream crossing site #550 on the R-2 Road is slated for treatment by PG+E in 2014. It will be important for the county to carefully review the PG+E proposed work plan.

Since road decommissioning generally eliminates access, both high and low priority sites are treated along a decommissioned road because it is the last chance to treat the road. Once the road is opened up and road drainage patterns are modified, conditions will change and lower priority sites may likely cause new sites of active erosion if not treated. There are 43 high to moderate

treatment immediacy sites located on roads recommended for decommissioning (Table 4a).

The highest priority roads recommended for decommissioning (road to trail) include:
1) The R-7-3 Road stands out from the rest for the number and density of high priority sites.
2) An additional segment of the R-7.5 Road located on streamside and inner gorge slopes just downstream of the road segment decommissioned in 2013 as part of the CDFW funded FRGP project.
3) The R-6-1 Road, primarily due to fish passage related issues.
4) The upper portion of the R-6 Road. This would require construction of an alternate route to maintain access between the ridge-top and the valley bottom.

Note that there are a number of isolated high priority sites recommended for decommissioning. Several of these are stream crossings acting as fish barriers, or currently Class II (non-fish bearing) stream crossings that were likely historic Class I (fish bearing) stream crossings that can be restored. If the majority of the road adjacent to these sites contained relatively low priority sites, the entire road was left out of the high priority classification in this report.

3.2 Recommended Treatments

For all 227 sites recommended for treatment in the Phase 1 acquisition area, a summary of site specific work as well as associated road drainage treatments has been included in Table 5. In addition to using the results from the road assessment to help designate road treatment recommendations (upgrade versus decommission), we incorporated input from consulting foresters Baldwin, Blomstrom, Wilkinson and Associates (BBW), who designated not only 4 phases of timber harvesting, but also potential methods and road access that would be utilized in different areas. It is generally accepted that limiting a road network to the ridge-tops, away from the stream network, both protects water quality and riparian habitat as well as lowers maintenance and construction costs. Because some of the areas within the proposed Phase I acquisition were inaccessible by any other route, some of the streamside roads have been "recommended" for upgrading. All of the other streamside roads not considered essential for timber harvest management have been recommended for decommissioning (road to trail conversion).

Erosion control and erosion prevention treatments prescribed for the 17.2 mi of road within the Phase 1 acquisition area followed guidelines described in the *Handbook for Forest and Ranch Roads* (Weaver and Hagans, 1994), as well as CDFW's *Salmonid Stream Habitat Restoration Manual*, Parts IX and X (Taylor and Love, 2003; Weaver et al., 2006).

4 SUMMARY

In summary, the majority of the roads contained within the proposed Phase 1 acquisition have several sites needing treatment, but are relatively low priority and will be straightforward to fix. The roads traverse generally stable ground and do not contain sites that will cause long term problems that cannot be dealt with in a straightforward manner. There are a few old rusty culverts on the current primary drive roads that will probably need to be replaced within the next

5-10 years. Many of the roads have been left unmaintained for an extended period of time and have numerous stream diversions and other problems. However, due to the location and nature of the roads, low stream power, and the time since abandonment, most of these roads have a relatively low treatment immediacy based on potential impacts to fish habitat and water quality. The road treatment prioritization may look different once access points, easements, management and transportation plans are finalized and incorporated into the prioritization protocols.

Outside sources of funds may be available to help treat some of the higher priority roads and sites within the Phase 1 area. Both Ryan Creek and Freshwater Creek have been listed as 303d sediment impaired watersheds and may attract funding from EPA and the SWRCB to treat the sediment sources that have been identified in the CDFW funded sediment source road inventory. The Ryan Creek watershed contains very high value habitat for coho salmon (in addition to numerous other species) and contains some unique qualities and opportunities. This will likely attract funding from CDFW, USFW, and others. As an example, funding for the 2013 Ryan Creek Sediment Reduction and Habitat Improvement Project was recently obtained through CDFW's Fisheries Restoration Grant Program (FRGP). This project decommissioned over 1 mile of high priority road and installed several in-stream large woody debris (LWD) structures within the proposed Phase 1 acquisition area.

Though it is impossible to predict how much outside funding may be acquired in the future, there are several good potential projects in the Phase I forest. In general, roads in close proximity to Class I streams along main-stem Ryan Creek and along Bob Hill Gulch or Henderson Gulch would make good candidates for future CDFW FRGP or SWRCB projects. Potential projects can combine some road upgrading with some road decommissioning if roads are located near Class I streams, though decommissioning is favored by the agencies. Factors influencing CDFW funded road projects consider proximity to coho bearing streams and habitat, fish passage issues, treatment immediacy designations of sites on the roads, and the potential to generate LWD for in-stream use, as well as others.

Finally, there are opportunities to get different interest groups (mountain bikers, horseback riding enthusiasts, etc.) to help with trail maintenance, construction and design. They have proven to be a significant resource in the Arcata Community Forest.

5 RECOMMENDATIONS

1) Carry out additional surveys to determine potential new road/and trail alignments to provide access between the northern and southern ends of the Phase 1 area around the private inholding in the northern portion of the Phase 1 area.
2) Analyze the cost benefits of upgrading vs. decommissioning certain road segments leading to stands of timber that may not justify the extra expense.
3) Look for other partners that may be interested in benefiting from the creation of a sustainably managed community forest to help distribute the costs.

Appendix A

Summary data tables for treatment sites

Logging Road Assessment Report,
Proposed McKay Tract Community Forest (Phase I),
Green Diamond Resource Company Property,
Humboldt County, California.

Description	Table #
Assessment results for sediment delivery sites and hydrologically connected road	1
Estimated future sediment delivery for all sites and hydrologically connected road	2
Erosion problems at inventoried stream crossings	3
Treatment immediacy ratings for all sites	4a
Individual upgrade and decommission sites listed by treatment immediacy for all sites	4b
Recommended site and road drainage treatments for all sites	5

Table 1. Assessment results for sediment delivery sites and hydrologically connected road segments, McKay Tract Community Forest Phase 1 area, Ryan Creek, Humboldt County, California.

Sources of sediment delivery	Sediment delivery sites			Hydrologically connected roads adjacent to sites			Total length of roads in Phase 1 project area (mi)
	Inventoried (#)	Sites treated in 2013 (#)	Remaining sites recommended for treatment (#)	Inventoried (mi)	Sites treated in 2013 (mi)	Remaining sites recommended for treatment (mi)	
Stream crossings	177	25	150	6.80	0.75	5.98	-
Landslide	67	23	43	0.24	0.12	0.12	-
Spring	17	0	16	0.51	0.00	0.50	-
Road surface discharge point	13	1	12	1.08	0.03	1.05	-
Ditch relief culvert	4	0	4	0.11	0.00	0.11	-
Bank erosion	2	0	2	0.00	0.00	0.00	-
Total	**280**	**49**	**227**	**8.74**	**0.90**	**7.76**	**17.2**

Table 2. Estimated future sediment delivery for the 227 sites and 7.76 mi of hydrologically connected road segments recommended for treatment, McKay Tract Community Forest Phase 1 area, Ryan Creek, Humboldt County, California.

Sources of sediment delivery	Estimated future sediment delivery (yd^3)	Percent of total
1. Episodic sediment delivery from road related erosion sites (indeterminate time period)		
Stream crossings	30,000	80%
Landslide	6,485	17%
Spring	565	2%
Road surface discharge point	15	<1%
Ditch relief culvert	10	<1%
Bank erosion	335	1%
Total episodic sediment delivery	**37,410**	**100%**
2. Chronic sediment delivery from road surface erosion (estimated for a 10 yr period)[a]		
Total chronic sediment delivery	**995**	
Total estimated future sediment delivery for the project area	**38,405**	

[a]Chronic sediment delivery is calculated for a 10 yr period. It is based on field estimates of hydrologically connected road length and combined road, ditch and cutbank surface width; and assumes 1 of 5 empirical values for road surface lowering/cutbank retreat based on field observations: (1) 0.001 ft/10 yr (low rating); (2) 0.05 ft/10 yr (moderate-low rating); (3) 0.1 ft/10 yr (moderate rating), (4) 0.15 ft/10 yr (high-moderate rating), and (5) 0.2 ft/10yr (high rating).

Table 3. Erosion problems at inventoried stream crossings (excluding the 49 sites treated in 2013), McKay Tract Community Forest Phase 1 area, Ryan Creek, Humboldt County, California.

Stream crossing problem	# Inventoried	Percent of total[a]
Stream crossings with diversion potential	92	61%
Stream crossings currently diverted	80	53%
Crossings with culverts likely to plug[b]	17	11%
Crossings with culverts that are currently undersized[c]	10	7%

[a] Total stream crossings inventoried (excluding stream crossings treated in 2013) = 152
[b]Culvert plug potential is moderate to high.
[c]Culverts in stream channels larger than 3 ft x 1 ft that are too small to convey the calculated 100-year peak storm flow.

Table 4a. Treatment immediacy ratings for the 227 sites and 7.76 mi of hydrologically connected road segments recommended for treatment, McKay Tract Community Forest Phase 1 area, Ryan Creek, Humboldt County, California.

Treatment immediacy	Treatment Sites				Estimated future sediment delivery from inventoried erosion sites[b]		Estimated future sediment delivery from road, ditch, and cutbank surfaces[c]	
	Upgrade sites	Road length (mi)[a]	Decommission sites	Road length (mi)[a]	Volume (yd^3)	Relative percentage	Volume (yd^3)	Relative percentage
High	3 stream crossings	0.55	3 stream crossings	0.29	2,705	7%	150	15%
High-moderate	5 stream crossings 1 landslide 1 ditch-relief culvert	0.23	16 stream crossings 1 landslide	0.81	6,880	18%	205	21%
Subtotal	*10 sites*	*0.78*	*20 sites*	*1.10*	*9,585*	*25%*	*355*	*36%*
Moderate	21 stream crossings 6 landslides	0.73	17 stream crossings 5 landslides 1 spring	0.70	11,140	30%	120	12%
Subtotal	*27 sites*	*0.73*	*23 sites*	*0.70*	*11,140*	*30%*	*120*	*12%*
Moderate-Low	30 stream crossings 7 landslides 3 road surface discharge points 1 spring 2 ditch relief culverts	1.60	22 stream crossings 16 landslides 2 road surface discharge points 2 springs 1 bank erosion	1.02	12,220	33%	340	34%
Subtotal	*43 sites*	*1.60*	*43 sites*	*1.02*	*12,220*	*33%*	*340*	*34%*
Low	28 stream crossings 4 landslides 5 road surface discharge points 7 springs 1 ditch relief culvert 1 bank erosion	1.39	5 stream crossings 3 landslides 2 road surface discharge points 5 springs	0.44	4,465	12%	180	18%
Subtotal	*46 sites*	*1.39*	*15 sites*	*0.44*	*4,465*	*12%*	*180*	*18%*
Total	**126 upgrade sites[d]**	**4.50**	**101 decommission sites[e]**	**3.26**	**37,410**	**100%**	**995**	**100%**

[a]*Road length* refers to hydrologically connected road reaches adjacent to recommended treatment sites.
[b]Episodic sediment delivery for road related sites (indeterminate time period).
[c]Chronic sediment delivery from adjacent hydrologically connected roads and cutbanks (estimated for a 10 yr period).
[d]Upgrade sites (126 total): 87 stream crossings, 8 road surface discharge points, 18 landslides, 4 ditch-relief culverts, 8 springs, and 1 bank erosion site.
[e]Decommission sites (101 total): 63 stream crossings, 25 landslides, 8 springs, 4 road surface discharge point, and 1 bank erosion sites.

Table 4b. Individual upgrade and decommission sites listed by treatment immediacy for the 227 sites and 7.76 mi of hydrologically connected road segments recommended for treatment, McKay Tract Community Forest Phase 1 area, Ryan Creek, Humboldt County, California.

Site type	Upgrade site ID #	Decommission site ID #
High treatment immediacy		
Stream crossing	545, 548.2, 550	477, 547, 558
High-moderate treatment immediacy		
Stream crossing	459, 461, 523, 546, 601	472, 479, 482, 484, 485, 532.1, 532.2, 548.1, 565, 843 – 846, 848, 867.1, 1090
Landslide	460	1096
Ditch relief culvert	548.32	-
Moderate treatment immediacy		
Stream crossing	450, 458, 462, 496, 531, 532, 533, 538, 552, 554, 871, 876, 877, 881, 885, 887, 896, 897, 1576, 1578, 1898	474, 480, 533.1, 548.41, 548.51, 559.9, 561, 566, 571, 572, 851, 852, 853, 859, 1294, 1297, 1298
Landslide	534, 549, 552.1, 875, 895, 1577	447, 476, 564, 847, 1095
Spring	-	1293
Moderate-low treatment immediacy		
Stream crossing	452, 454 – 457, 463, 495, 497, 499, 522, 535, 536, 537, 540, 541, 542, 548, 548.5, 551, 553, 555, 870, 873, 882, 888, 894, 1097, 1579, 1581, 1898.1	440, 443, 448, 453, 479.1, 563, 568, 570, 849, 855, 858, 861, 862, 863, 865, 868, 1087, 1089, 1092, 1094, 1094.2, 1296
Landslide	600, 886, 898, 1097.1, 1107.1, 1107.3, 1580	444, 449, 473, 475, 478, 481, 483, 559, 560, 562, 569, 1088, 1094.1, 1095.1, 1296.1, 1297.1
Ditch relief culvert	525, 539	-
Road drainage discharge point	605, 1100, 1107	854, 1125
Spring	603	864, 866
Bank erosion	-	1094.3
Low treatment immediacy		
Stream crossing	524, 526, 527 - 529, 544, 548.3, 548.4, 548.6, 556, 556.1, 557, 606 – 608, 872, 878 - 880, 881.1, 883, 884, 889, 889.9, 890, 893, 1107.2, 1575	439, 548.31, 856, 1091, 1093
Landslide	498, 602, 604, 1110	567, 850, 1295
Ditch relief culvert	530	-
Road drainage discharge point	1105, 1106, 1108, 1109, 1111	857, 860
Spring	451, 464, 543, 874, 877.1, 892, 1898.2	441, 445, 446, 867, 1095.2
Bank erosion	891	-

Table 5. Recommended treatments for the 227 sites and 7.76 mi of hydrologically connected road segments recommended for treatment, McKay Tract Community Forest Phase 1 area, Ryan Creek, Humboldt County, California.

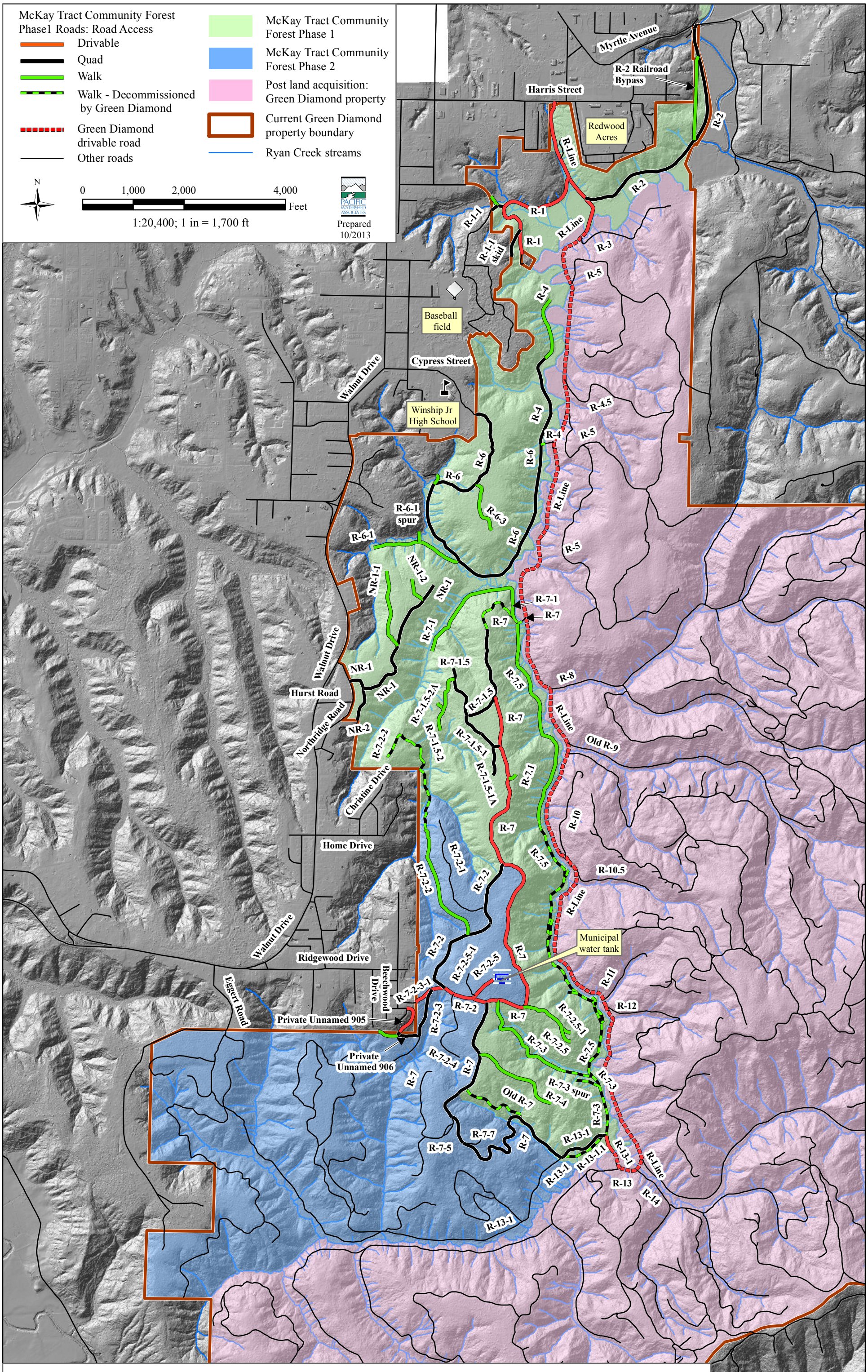
Treatment type			No.	Comments
Site Specific Treatments	Stream crossings	Culvert (install)	67	Install new culvert at crossing with no current drainage structure.
		Culvert (replace)	12	Replace an undersized, poorly installed, or worn out culvert.
		Install bridge	5	Install bridge at Class I stream
		Clean /clear culvert	6	Remove sediment or debris from the culvert.
		Downspout	1	Install to prevent erosion at stream crossing culvert outlets.
		Critical dip	59	Install to prevent stream diversions.
	Other	Rock (armor)	37	At 37 sites, add a total of 640 yd^3 of rock armor on inboard and outboard stream crossing fillslopes, ditches, and headcuts.
		Soil excavation	197	At 197 sites, excavate and remove a total of 102,125 yd^3 of sediment, primarily at fillslopes and stream crossings.
		Miscellaneous treatments	2	Implement other treatments at 2 sites.
Road surface treatments	Road drainage structures	Ditch relief culvert (install or replace)	16	Install or replace ditch relief culverts to improve road surface drainage.
		Ditch relief culvert downspout	7	Install to prevent erosion at ditch relief culvert outlets
		Rolling dip	86	Install to improve road drainage.
		Cross road drain	324	Install on decommission roads to improve road drainage.
	Road shaping treatments	Outslope road and remove ditch	9	At 9 locations, outslope road and remove ditch for a total of 1,940 ft of road to improve road surface drainage
		Outslope road and retain ditch	3	At 3 locations, outslope road and retain ditch for a total of 200 ft of road to improve road surface drainage
		Remove berm	15	At 15 locations, remove berm for a total of 2,550 ft of road to improve road surface drainage.
		Clean or cut ditch	9	At 9 locations, clean or cut ditch for a total of 1,750 ft
	Other	Road rock (for road surfaces)	45	At 46 locations, use a total of 1,426 yd^3 of road rock to rock the road surface at 20 stream culvert installations, 4 DRC installations, 11 rolling dips, 810 ft of outslope and remove ditch, 550 ft of outslope and retain ditch, and at 6 site-specific locations.

Appendix B

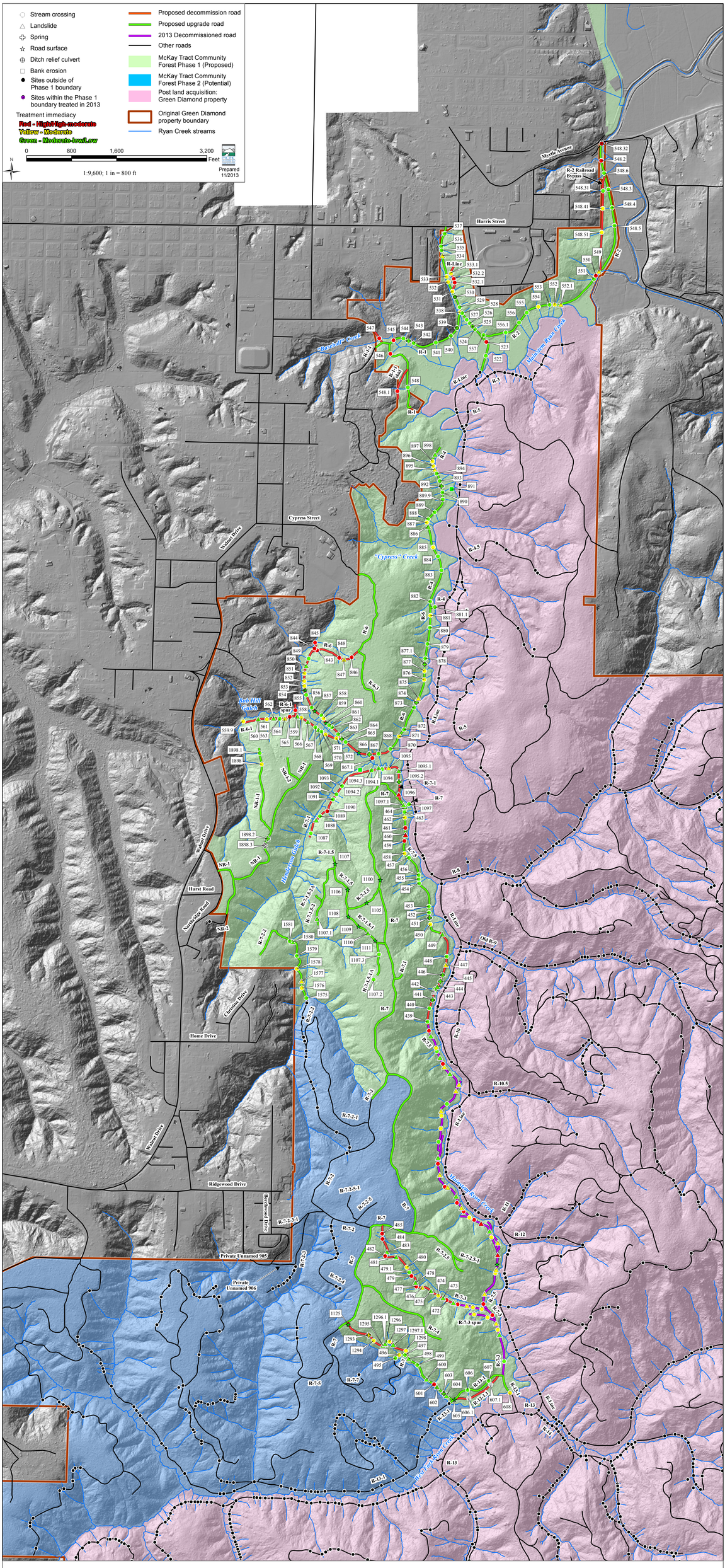
Maps

Logging Road Assessment Report,
Proposed McKay Tract Community Forest (Phase I),
McKay Tract, Green Diamond Resource Company Property,
Humboldt County, California.

Description	Map #
Current road network and accessibility status	1
Sediment delivery sites by site type and treatment immediacy	2



Map 1. Road access, McKay Tract Community Forest and Green Diamond properties, Ryan Creek, California



Map 2. Phase 1 inventoried sites by problem type and treatment immediacy, McKay Tract Community Forest and Green Diamond properties, Ryan Creek, California.