

SUMMARY REPORT

EROSION-CONTROL WORK PERFORMED ON
THE UPPER SLIDE CREEK REHABILITATION UNIT,
Site 81-3

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¹Appendixes are on file at the Arcata and Orick offices.

INTRODUCTION

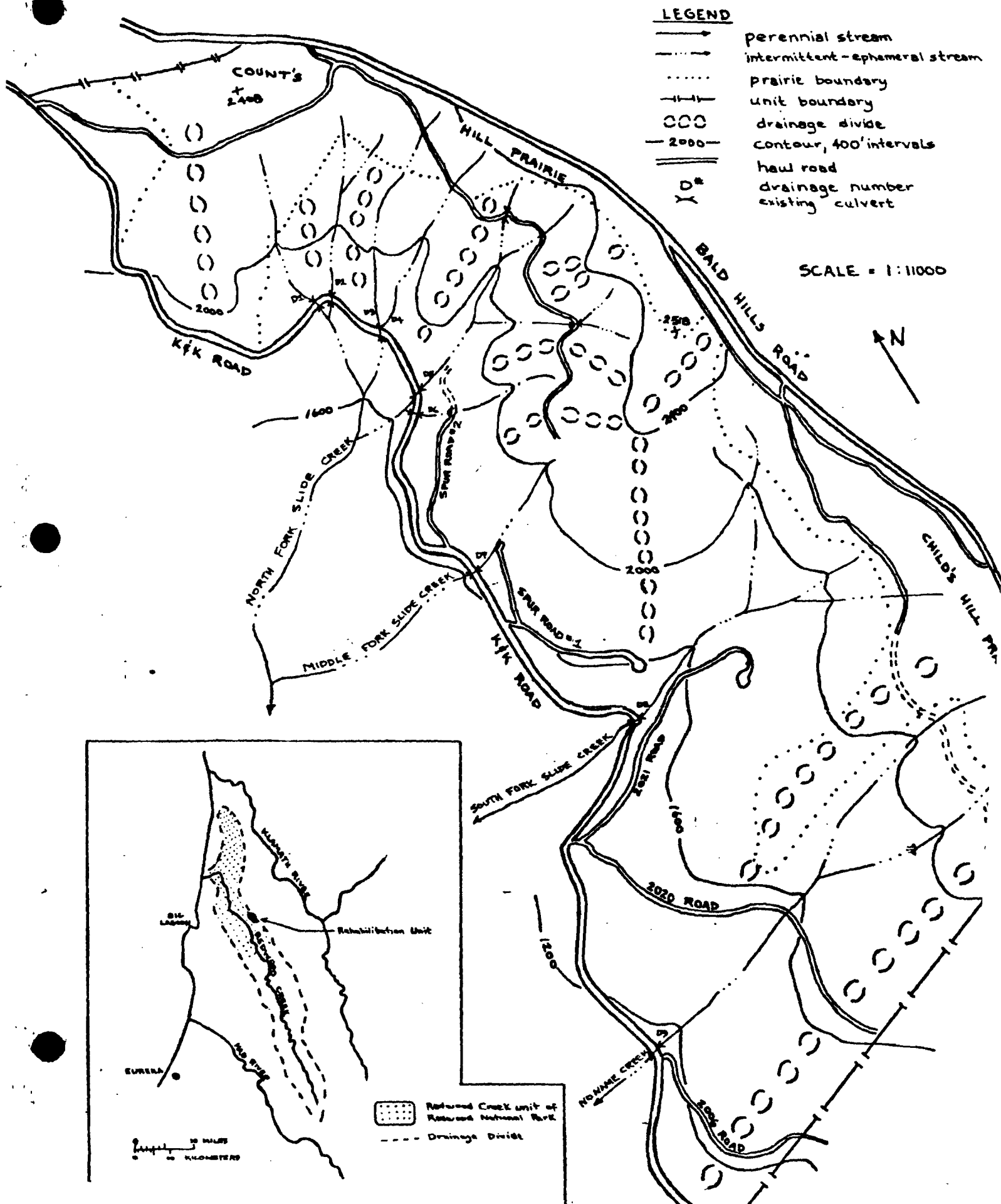
Unit Description

The Upper Slide Creek Rehabilitation Unit, Site 81-3, is located on the east side of the Redwood Creek basin and consists of 183 acres of natural prairies and 405 acres of cutover timber land. It is bordered to the north and east by the ridge-running Bald Hills Road, downslope and to the west by the K & K Road, and to the south by the No Name-Maneze Creek drainage divide (see Map A). All 588 acres of this rehabilitation unit were mapped in detail.

Mass movement has been the dominant sculpting process of hillslopes in the Upper Slide Creek Unit. Relief ranges from approximately 1200 feet at the K & K Road to 2500 feet on the north Count's Hill Prairie ridge top. The average slope of the prairies and upper hillslopes in this unit is approximately 40 percent, with slopes exceeding 70 percent common within drainage basins.

Contained within the rehabilitation unit are the upper drainage areas of Slide and No Name creeks which measure 286 and 124 acres, respectively. One perennial stream (South Fork Slide Creek: drainage #8) and one ephemeral stream (drainage #6) are found on this unit, along with seven streams that are intermittent. Moderately incised first- and second-order streams are most common, with the exception of South Fork Slide and No Name creeks which are deeply incised third-order drainages.

The Bald Hills and K & K roads provided access to a haul road network totaling 3.9 miles. The upper hillslopes contained 2.4 miles of roads, of which 1.9 miles were constructed across Count's Hill and Child's Hill prairies. Prairie roads had no inboard ditches, and contained three buried, non-functional culverts. With the exception of the .2 mile prairie road crossing the southern half of Count's Hill Prairie, road surfaces were not rocked. Three intermittent streams had been crossed by the southernmost segment of the Count's Hill Prairie road system, which extended roughly .5 mile into the forest. Of these three stream crossings only two contained culverts and only one crossing was intact. The lower hillslopes, accessed from the K & K, contained five different haul roads totaling 1.5 miles in length. Of these, the three largest roads were the 2006, 2020, and 2021 roads. The 2020 Road was unrocked, stable, and in relatively good condition with the exception of its one stream crossing, which was unstable. In contrast, the 2021 Road was characterized by numerous rills and gullies, and one major road failure. Constructed low on the hillslope, the 2021 Road intercepted hillslope drainage which had been severely disturbed by recent tractor activity. Adequate waterbars had not been constructed on the road, and the intercepted hillslope drainage and storm runoff concentrated on the road, and gully erosion developed. All roads had been constructed as one-time-use and/or seasonal roads. Only the lower extents of the 2006 and 2020 roads contained inboard ditches.



In summary, the total rehabilitation cost for the Upper Slide Creek Unit was \$69,372. Of the total cost, primary treatments accounted for \$63,559 (92 percent) and secondary treatments accounted for \$6,618 (1 percent). Heavy equipment and manual-labor costs accounted for 76 and 16 percent, respectively, of the total cost. The most significant primary treatments performed on this unit included:

- 1) ripping and completely outslowing 1.5 miles of prairie roads;
- 2) ripping and cross-road draining 2.4 miles of forest roads;
- 3) excavating a total of 1600 yds³ from four haul road stream crossings;
- 4) excavating a total of 1400 yds³ from six skid trail stream crossings; and
- 5) dewatering four gully-landslide features.

Land Use History

Within the Upper Slide Creek Unit, all 405 acres of forested land had been logged by 1971 (see Map B). Of this total acreage, approximately 66 percent (267 acres) was initially harvested by seed-tree-leave and/or selective cutting methods during the seven year period between 1962-1969. By 1971 all but 48 acres of this area had been re-entered and clearcut. The remaining 34 percent (138 acres) of unlogged forested land was clearcut during 1970 and 1971. All harvested areas within this rehabilitation unit were tractor yarded.

As late as 1962, the Ridge Road and north and upper Child's Hill Prairie roads were part of the main Bald Hills Road alignment. They were in use until 1965 when a new road segment was constructed. Between 1956 and 1962, earliest logging entries utilized the K & K and upgraded prairie ranch roads (north Count's Hill and lower Child's Hill prairie roads) for access to timber. By 1962 the 2020 Road had been fully constructed, opening up much of the No Name Creek drainage to selective timber harvest. Concurrently, spur roads #1 and #2 were pioneered and were finally completed by 1965. The three years between 1969 and 1971 were a period of accelerated road building and extensive logging activity in the Upper Slide Creek Unit. By 1971 the southern Count's Hill Prairie road, as well as the 2006 and 2021 roads, had been fully constructed, opening timber access to the remaining hillslope areas.

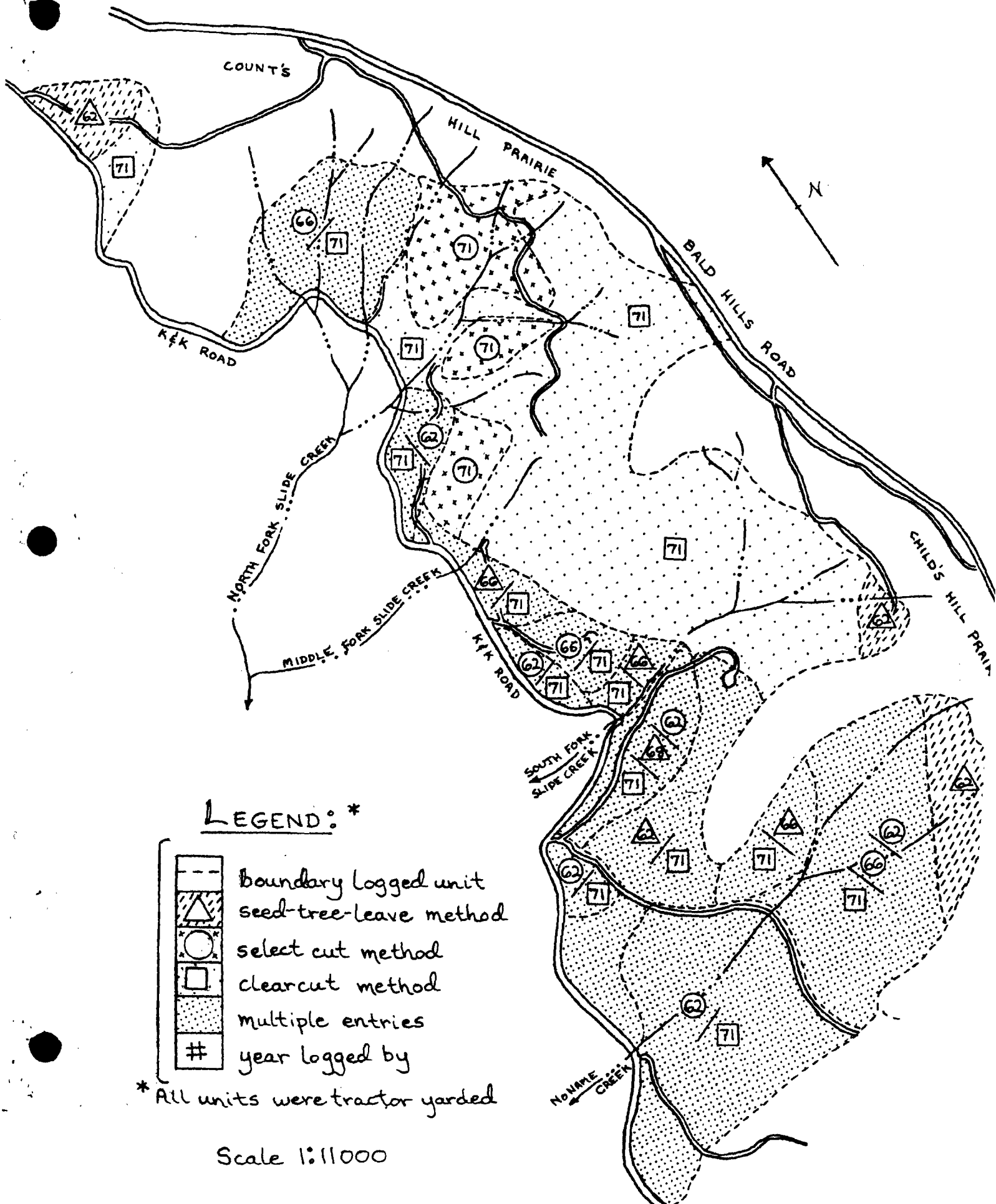
EROSION FEATURES

The types of erosion features found on the Upper Slide Creek Unit ranged from rills to large streamside landslides. This discussion will summarize only the major erosion features and sediment sources found on this unit (see Map C). Complete erosion inventory maps (1:1200) are on file in Orick and Arcata for more detailed reference.

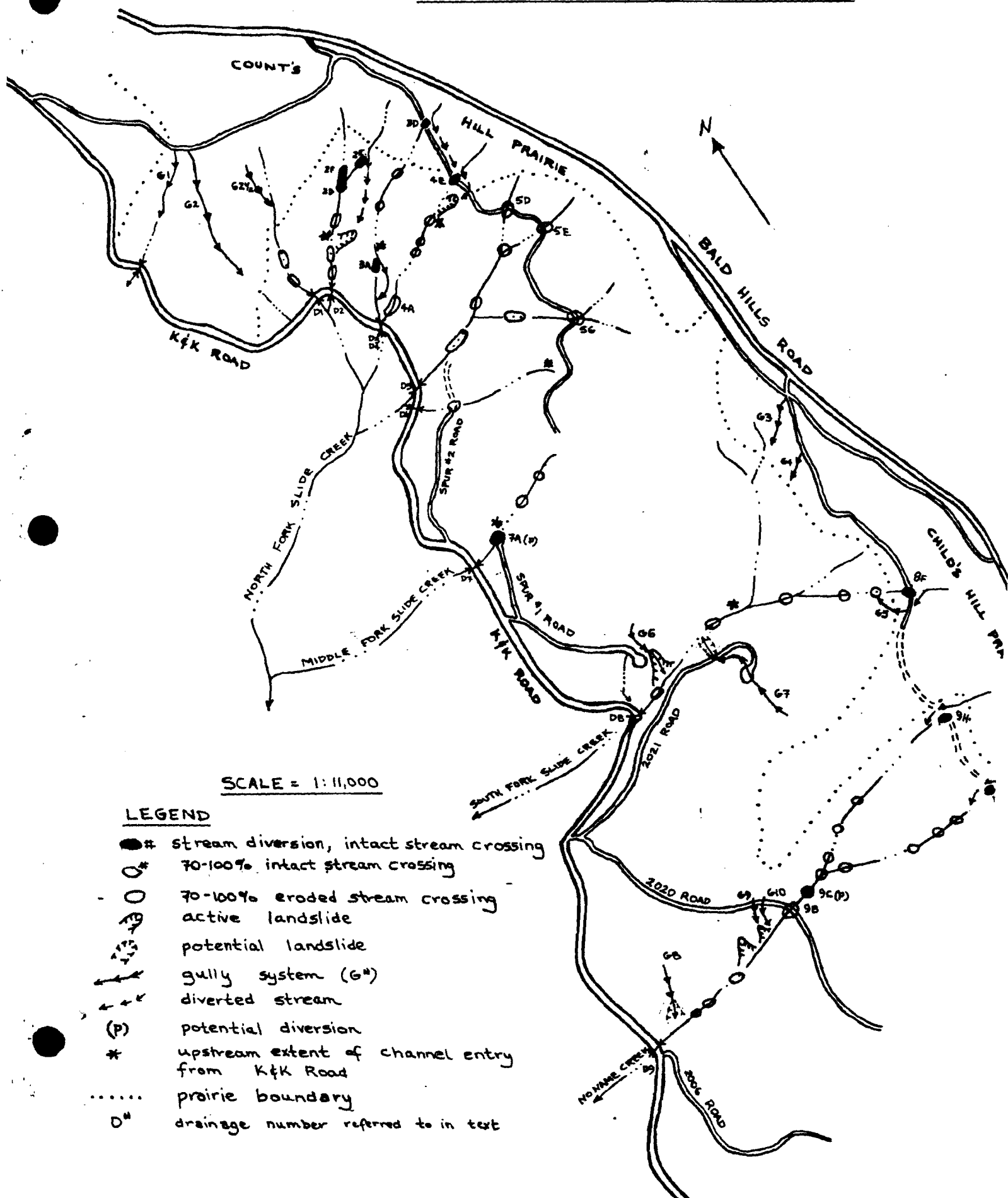
The three main types of erosion features found on this unit were: 1) gullies formed by poor road drainage, 2) gullies and landslides caused by diverted stream courses, and 3) eroding skid trail and haul road stream crossings. Roads on Count's Hill and Child's Hill prairies were deficient or void of culverts, and road maintenance had seldomly been performed. Winter ground-

MAP B: LOGGING HISTORY

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MAP C. EROSION FEATURES



water and storm runoff had concentrated on these prairie roads, eroding approximately 2100 yd³ from the prairies with the formation of gullies #1-#5 (G1-G5). G1 and G3 were fully formed by 1962 as a direct result of concentrated road runoff. The remaining gullies developed in response to the 1964 storm events and, at the time of mapping, had downcut to fairly stable basement material; however, gully banks remained vertical. At this point, the gullies on Count's Hill and Child's Hill prairies were seen as eye sores more than as significant sediment sources.

Five large gully-landslide features had developed on this unit that were caused by stream courses which had been diverted by skid trail and haul road stream crossings. In drainage #2, a small (8 acre) intermittent-ephemeral stream had been diverted at site 2E. The diverted stream traveled along a skid trail and eventually down steep (60 percent) hillslopes which had been heavily impacted by recent tractor activity. Initiated in 1972, this shallow, translational landslide produced approximately 800 yd³ which entirely buried the channel below. The erosion potential for this feature remained high at the time of mapping. In the headwaters of drainage #4, surface and groundwater flow had been diverted by prairie road construction. The runoff produced from approximately 10 acres discharged onto steep (60-75 percent), unstable slopes adjacent to the stream channel. The combination of gully-landslide processes eroded approximately 600 yd³ from the hillslope. This feature initiated in response to 1972 storm events, continued to enlarge in response to the 1975 storm, and remained active up to the time of mapping. In drainage #8, skid trails intercepted storm runoff and groundwater from the headwaters of a small (9 acre) ephemeral stream. As a result, skid trails directed storm runoff onto a log landing which had been constructed on a colluvial bench immediately upslope from the main channel. A large gully-landslide (G6) developed in 1975, delivering approximately 3800 yd³ to the main channel below. Finally, two adjacent gully-rotational landslide systems (G9, G10) had developed in drainage #9 in response to the 1975 storm event. The cause of development is not entirely clear. It appears that the stream crossing at site 9B (which had failed twice since 1962) had plugged and before failing, diverted stream-flow down the 2020 Road and onto the lower hillslopes. Approximately 1000 yd³ were eroded by gully development and, as erosion continued, both gullies breached their original courses. At the time of mapping, G9 no longer fed its original landslide but, instead, fed the adjacent landslide originally fed by G10. Likewise, G10 established a new course on a skid trail, bypassing its original landslide. The most upstream landslide, fed by G9, remained active and had the highest potential for further erosion. Gullies #7 and #8 were smaller features which also directed flow onto potential landslide areas adjacent to streams. Both gullies originated from groundwater discharge areas on hillslopes which had been impacted by tractor activity.

Since the fill and debris contained within stream crossings represents a potential sediment source to stream channels, each stream crossing has been located on Map C. A total of 47 crossings were identified on this unit, of which 7 were haul road stream crossings and 40 were skid trail or skid road stream crossings. Each haul road crossing contained 75-600 yd³ of fill with an average of 450 yd³ per crossing. Skid trail crossings contained 75-900 yd³ and averaged 150 yd³. The years 1970 and 1971, a period of extensive road building and logging activity, were followed by major storm events the succeeding year. The 1972 storms initiated skid trail and haul road stream crossing erosion and, by 1981, approximately 68 percent of all crossings had lost

70-100 percent of their fill. The remaining 32 percent consisted of 10 crossings which were entirely intact and 5 crossings which were partially intact. Of these 15 stream crossings, 8 had diverted and 2 had the potential to divert streamflow from natural channels. These stream channel diversions caused the gully and gully-landslide erosion which has been described above.

Another source of erosion identified on this unit was channel stored sediment. The origin of channel stored sediment varied according to management practices and upstream erosion processes. In many cases, stream channels had been entered and utilized as skid trails and were entirely filled with sediment. The asterisks on Map C indicate the upstream extent of continuous channel entry upstream from the K & K Road. To these points, tractors operated either directly in the channel or to within 50 feet of the channel banks. Gully-landslide processes from hillslopes, debris torrents originating from skid trail and haul road crossing failures, and tractor disturbance to channels have caused extreme cumulative impacts in drainages #2, #4, #8, and #9.

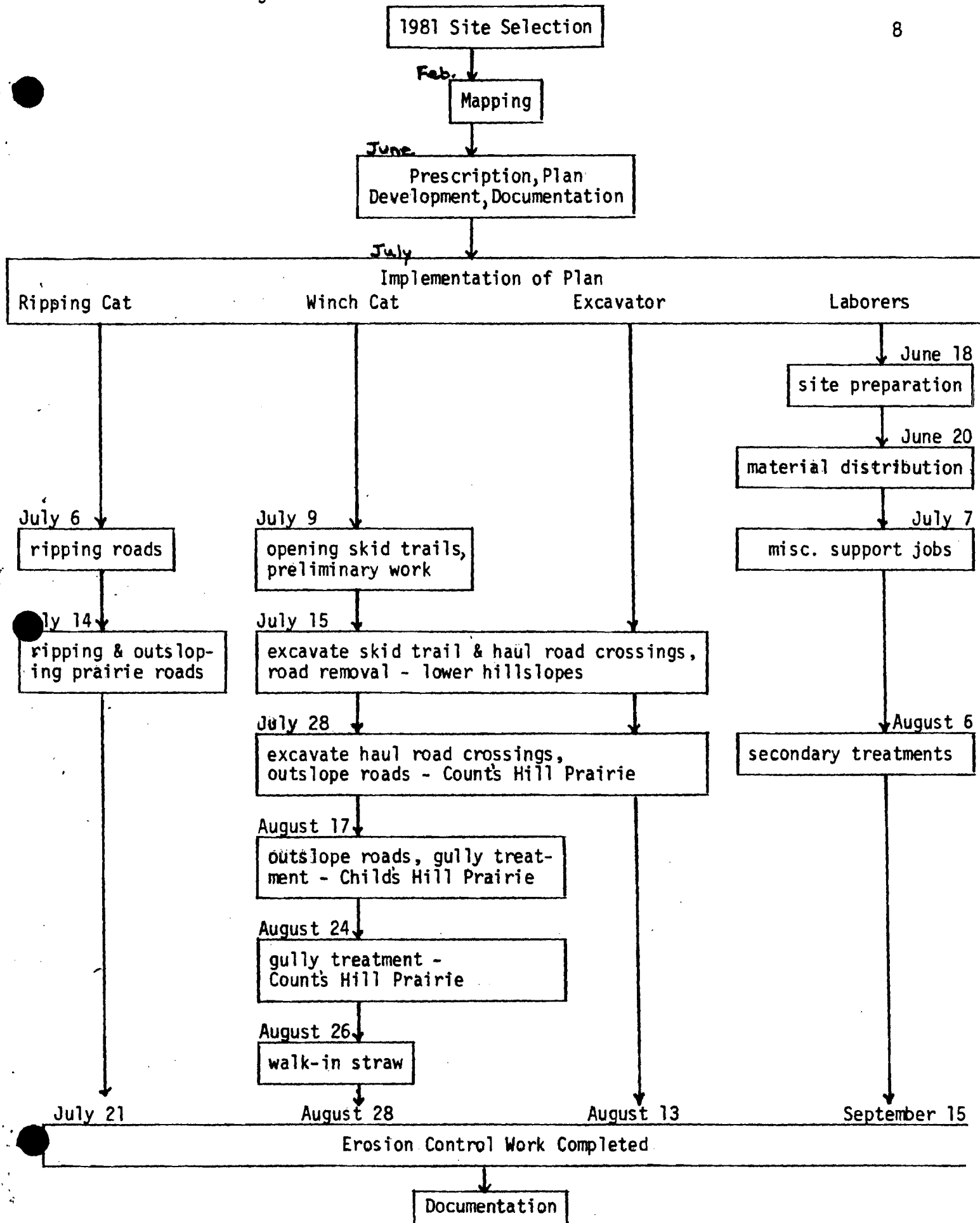
EROSION-CONTROL REHABILITATION WORK

As the first phase of rehabilitation, the Upper Slide Creek Unit was inventoried to identify all erosion processes and sediment sources to stream channels. Aerial photographs were interpreted and detailed field mapping was performed. As a final product, a detailed erosion feature map (1:1200) was compiled, providing a complete scenario of sediment source areas on this unit. Field mapping began in mid-February and continued through May, requiring 43 person-days to complete. Next, the planning phase began and continued into early June. During this time, the entire unit was assessed, sediment sources prioritized, peak discharge estimates computed, treatments prescribed, and equipment scheduled. This phase required 17 person-days to complete. Pre-rehabilitation work site conditions were then documented. From mid-June until early July, photo points were established and stream channel fills were surveyed, requiring 11 person-days to complete. As can be seen in Figure 1, heavy equipment work began July 6 and continued until August 28. During this time, two Redwood National Park Laborers performed labor intensive tasks, all of which were necessary to successfully complete this rehabilitation effort. The project was supervised by Gregory Bundros and Teri Huber. Park laborers included Tim Tanno and Roger Lemstrom. Labor intensive work was also performed by Redwoods United and R.C.D.C.

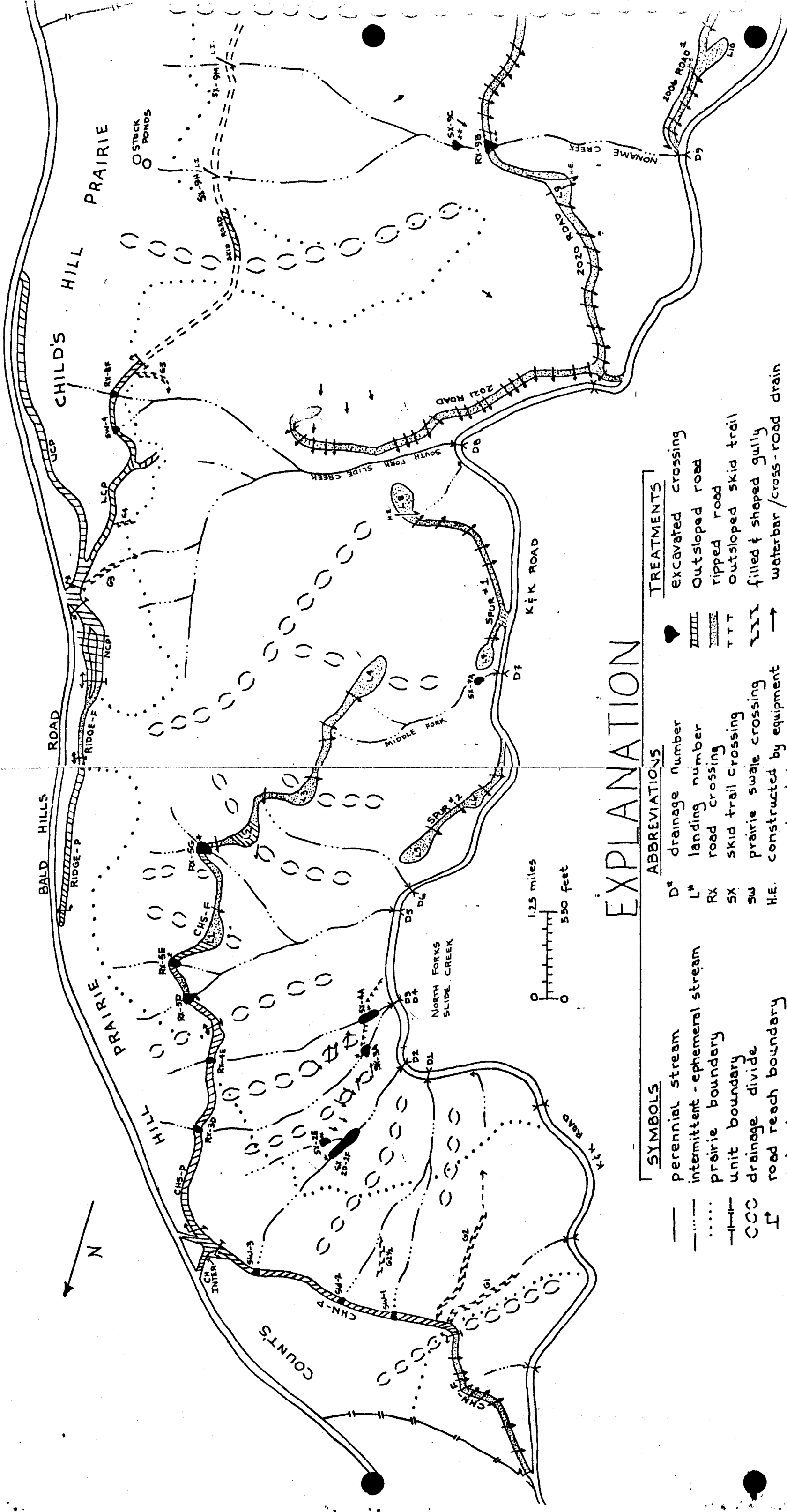
Objectives, Methods and Summary Costs

The objective of rehabilitation was to: 1) remove active and potential sediment sources to stream channels, and 2) restore Count's Hill and Child's Hill prairies to pre-road construction morphologies. Sediment sources were primarily a result of stream diversions and altered hillslope micro-drainages. Since most skid trail stream crossings had almost entirely eroded by 1981, stream channel fills were less significant sediment sources than the potential sediment produced from stream diversions. Therefore, the realignment of drainage networks was the most important primary treatment performed on this unit. The reader is referred to Map D which locates all work sites on the Upper Slide Creek Rehabilitation Unit.

Figure 1. REHABILITATION PHASES AND WORK SEQUENCE



LOCATIONS



The largest, most active, and continuous sediment sources on this unit were gully-landslides (a gully feeding onto a landslide) caused by stream crossings which had diverted streamflow out of natural channels. The treatments prescribed simply removed water from the gully-landslides while ensuring that streamflow could not divert again. Thus, three stream crossings were excavated to dewater two gully-landslides and to realign natural drainages. A skid trail crossing at site 2E and two haul road crossings at prairie swales 3D and 4E were excavated, from which a total of 350 yd³ were removed. Two additional gully-landslide features not associated with stream crossing diversions were dewatered by constructing long drainage ditches. The largest gully-landslide (G6) was a landing failure in drainage #8. As treatment, a 95 foot long ditch was constructed across the landing to capture skid trail runoff and direct it into an ephemeral stream channel. Similarly, a 245 foot long ditch was constructed on the 2020 Road to dewater the gully-landslide, G9.

To reduce gully-landslide potential, waterbars were constructed on hillslopes where micro-drainages had been disturbed by tractor activity. Originating on skid trails, G7 and G8 were fed by groundwater discharge from hillslopes which had been severely disturbed by tractor activity. G7 eroded a course which eventually downcut across the 2021 Road, eroding the entire road bench just upslope from the main channel of drainage #8. G8 eroded its course entirely on skid trails and discharged across and down the break-in-slope into drainage #9. Based on local geology and neighboring mass movement features, the lower reaches of both gully systems were capable of initiating streamside landslides. To cut off gully flows and redirect groundwater discharge, equipment waterbarred skid trails, capturing and directing gully flow to more stable, vegetated hillslope areas.

In addition to the gully-landslide treatments described above, five additional stream diversions which had caused gully erosion of lesser magnitude, and two potential stream diversions were also treated. Skid trail crossings were excavated at sites 2D-2F and 3A where stream diversions had occurred. At site 2D-2F, approximately 170 feet of channel was reconstructed (175 yd³ excavated) and a debris jam was removed from the downstream extent of the channel. At site 8F, a small haul road crossing on Child's Hill Prairie was excavated (75 yd³) which had caused a stream diversion and severe gully erosion to the road and prairie. Minor stream diversions had also occurred where the same skid road crossed the headwaters of the north and south forks of drainage #9. At sites 9H and 9M, manual-labor crews corrected two diversions by excavating broad ditches across the remnant skid road to redirect streamflow. Finally, heavy equipment performed a minor excavation of a skid trail crossing at site 7A (20 yd³) to confine streamflow to its channel, and completely excavated a skid trail crossing at 9C to prevent diversion (150 yd³).

The largest potential sediment sources in this rehabilitation unit were four haul road stream crossings and one skid trail crossing. Of these five crossings, only the haul road crossing at site 5D was entirely intact by the end of 1981. Erosion of stream crossing fill was not continuous, but instead, was more a response to the less frequent, long duration, high intensity storm events characteristic of 1972 and 1975 storms. Of the four haul road crossings, only two contained culverts. Additionally, the haul road crossing at site 9B had been reconstructed in 1980 in order to access the Maneze Creek Unit. To remove these potential sediment sources, heavy equipment excavated haul road crossings at sites 5D, 5E, 5G, and 9B, and a skid trail crossing at 4A. A total of 2365 yd³ were excavated from these channels.

The Upper Slide Creek Unit contained 3.9 miles of haul roads, of which, 2.0 miles were constructed across forested hillslopes and 1.9 miles across Count's Hill and Child's Hill prairies. The stable, forest roads were removed simply by ripping road surfaces and constructing cross-road drains where necessary. In contrast, the failing road segment between site 5E and landing #1 was completely outsloped because of its proximity to a stream channel. There were many erosion problems associated with the prairie roads. Maximum restoration efforts were applied to Count's Hill and Child's Hill prairies because of their highly erosive nature, and because of the high value placed on the aesthetic appearance of prairies in Redwood National Park. All prairie roads were completely outsloped to blend with surrounding slope morphologies. Natural prairie swales and streams were also realigned to their original drainage patterns. As a result of these treatments, all prairie gullies (G1-G5) were completely dewatered of surface runoff generated from roads. As a final treatment, these gullies were filled and shaped with surrounding soils to visually erase these features from the prairies. G1, G2, and G3 were filled and shaped downslope only to the point of known groundwater discharge. In contrast, G2 1/2, G4, and G5 were completely filled and shaped.

The total cost of rehabilitation was \$69,372. Of this total, heavy equipment and labor intensive costs (including supervisory costs) accounted for 76 and 16 percent, respectively. Evaluation costs accounted for the remaining 8 percent (refer to Table 1). Heavy equipment primary and secondary treatments accounted for 60 and 4 percent, respectively, of the total rehabilitation cost. Primary and secondary treatments performed by labor intensive workers accounted for 1 and 5 percent of the total cost. Combining heavy equipment, labor intensive, and supervisory costs, primary treatments accounted for 92 percent and secondary treatments accounted for 1 percent of the total cost of erosion-control rehabilitation work on this unit.

Heavy Equipment Phase

Heavy equipment work - excluding rock quarry and delivery - was performed by three pieces of equipment. Equipment work began July 6 and ended August 28 (see Figure 1, page 8). Tom Coy (owner) operated a Caterpillar D8 ripper tractor (\$80/hr). Whitey Brown (contractor) provided a John Deere 750 crawler tractor with winch and 6-way blade (\$70/hr) and a John Deere 690B hydraulic excavator (\$78/hr). Bill Campbell and David Felt operated the two pieces, respectively. With the exception of the first week, equipment worked concurrently until the D8 completed its work and was released.

The D8 was the first piece of equipment to begin work. First, it upgraded the 2020 Road for rock delivery, then ripped and cross-road drained the lower hillslope roads and landings and performed a small excavation at site 7A. It started ripping at the 2006 Road and worked north towards Count's Hill Prairie. Once on the upper hillslopes, it ripped the Count's Hill Prairie roads and performed preliminary excavations at sites 5D-5G. As its final work tasks, the D8 ripped and outsloped the prairie ridge road and the upper Child's Hill Prairie roads.

Table 1. SUMMARY COSTS OF EROSION-CONTROL REHABILITATION WORK: SITE 81-3

Phase	Task	--RNP Employees-- Geologist & P.S. Tech.	Laborers	Heavy Equipment Rental	Redwoods United	Total Task Costs	% Total Cost	Phase Totals	Phase %
Evaluation Phase	Mapping	\$ 3,409	--	--	--	\$ 3,409	5	\$ 5,813	8
	Prescriptions, Planning, & Documentation	2,404	--	--	--	2,404	4		
Heavy Equipment Phase	Primary Treatments	4,930	--	~~\$36,803~~ 36,773	--	41,733	60	52,353	76
	Secondary Treatments	193	--	2,688	--	2,881	4		
	Access Costs	--	--	3,082	--	3,082	4		
	Miscellaneous Costs	327	--	4,330	--	4,657	7		
Labor Intensive Phase	Primary Treatments	484	\$ 234	--	--	718	1	11,206	16
	Secondary Treatments	31	2,309	--	\$1,397	3,737	5		
	Travel Time	--	2,307	--	811	3,118	5		
	Miscellaneous	298	3,335	--	--	3,633	5		
		\$12,076	\$8,185	~~\$46,903~~ 46,873	\$2,208				
						69,342			
GRAND TOTAL						\$69,372			

The 750 and 690B worked together excavating stream crossings and outsloping prairie roads that were constructed across steeper slopes. The 750 was delivered first to perform preliminary tasks. It opened skid trails, winched debris, performed preliminary excavations at sites 2D-2F, 3A, 4A, and 9C, waterbarred G7 and G8, and cross-road drained the 2021 Road. The 690B was delivered next, and together they excavated stream crossings on the lower hillslopes. Work began at site 9C and progressed north towards Count's Hill Prairie. As work was completed, the 750 constructed waterbars on skid trails and cross-road drains on roads. With the conclusion of lower hillslope work, the 750 and 690B moved to Count's Hill Prairie treating the southern road segment first, followed by the northern road segment. The 690B was terminated with the completion of Count's Hill Prairie and the 750 worked alone to perform the final phase of equipment work. The 750 moved to Child's Hill Prairie where it outsloped the lower road, shaped G3-G5, and outsloped two stock ponds. It then returned to Count's Hill Prairie and shaped G1-G2 1/2. As its final task, the 750 walked-in straw on all treated areas of both prairies.

The total cost of heavy equipment (less supervision) was \$46,903 or 67 percent of the total rehabilitation costs. Primary and secondary equipment treatments accounted for 78 and 6 percent, respectively, of the total heavy equipment costs. Total miscellaneous and access costs came to 9 percent and 7 percent.

Average heavy equipment costs are summarized in Table 2. Summary tables for each work task are included in Appendix A. These tables list specific work sites, equipment used, equipment hours and quantities. The reader is also referred to Appendix B which contains summary tables for each work site. Miscellaneous primary treatment tasks include outsloping the intersection area (archaeological site) on Count's Hill Prairie, excavating a gully headcut on the 2020 Road, constructing unusually long waterbars above G8, and outsloping two stock ponds. Access costs include opening roads, relocating to work sites, and transporting equipment to and from the rehabilitation unit. Miscellaneous costs are broken down into productive and non-productive costs. Productive miscellaneous costs are derived from work tasks which are neither primary nor secondary treatments. Non-productive costs include relocation time to refuel, standby time, break time, and administrative time (billing, safety, and work discussion). Since 60 percent of heavy equipment costs involved stream crossing excavations, prairie road outsloping, and gully shaping, only these treatments will be discussed in detail.

-Haul road stream crossings (Table 3) -- unit costs ranged from \$2.64-6.16/yd³ and were independent of excavation size. The most important factors influencing unit costs were general site conditions (slope, moisture, amount of debris, etc.) and the area in which the equipment had room to operate (determining how much the tractor could excavate). The lowest unit cost (\$2.64/yd³) was at site 5G where the 750 tractor initially excavated approximately 50 percent of the channel fill. In contrast, site 9B was wet, sideslopes were steep, and space was extremely limited. The unit cost at this site was the highest at \$6.16/yd³. The cost of preparing a rock pit as a storage site was included in the excavation costs at 5E. This increased its unit cost from \$2.97/yd³ (without preparation) to \$3.77/yd³ (with preparation).

Table 2. SUMMARY OF AVERAGE HEAVY EQUIPMENT COSTS: SITE 81-3
(continued)

Treatment	# of Work- sites	Total Quantity	Total Cost	Avg. Cost Worksite	Avg. Cost Quantity	Range Cost/Quant.
<u>Access Costs</u>			\$3082.50			
<u>Miscellaneous Costs</u>						
A. Productive Time			\$ 483.00			
B. Non-Productive Time			3847.25			
Total Miscellaneous Costs		=	\$4330.25			
<u>TOTAL HEAVY EQUIPMENT COSTS</u>			=	\$46,903.15		

Table 3. HAUL ROAD CROSSING COSTS

Type of Worksite	# of Sites	Range Volume of Fill	Equip.	Range Hours	Avg. Cost Worksite	Range Cost	Avg. Cost yd ³	Range Cost/yd ³
Small (0-200 yd ³)	1	150 yd ³	D8 690 750	2 1/2 2 3	\$ 566	--	\$3.77	--
Medium (200-500 yd ³)	2	385-420	D8 690 750	0-3/4 13 1/2-17 1/4 13-17 3/4	2305	\$2023 2588	5.73	\$5.25-6.16
Large (500-1500 yd ³)	1	600	D8 690 750	1 1/4 10 3/4 9 1/4	1586	--	2.64	--
Prairie Swales	4	50-200	690 750	(Costs of individual swale crossing excavations are unavailable and are included within the cost of outslowing prairie roads).				

Table 4. SKID TRAIL CROSSING COSTS

Type of Worksite	# of Sites	Range Volume of Fill	Equip.	Range Hours	Avg. Cost Worksite	Range Cost	Avg. Cost yd ³	Range Cost/yd ³
Small (0-200 yd ³)	5	20-175 yd ³	D8 690 750	0-1/4 1 3/4-9 1/2 5 1/4-13 1/4	\$ 699	\$ 20- 1668	\$5.97	\$1.00-9.53
Medium (200-500 yd ³)	0	--	--	--	--	--	--	--
Large (500-1500 yd ³)	1	810	690 750	17 1/2 22 1/2	2940	--	3.63	--

-Skid trail stream crossings (Table 4) -- unit costs ranged from \$1.00-9.53/yd³, reflecting the variety of site conditions encountered during excavations. The cheapest excavation was performed by the D8 at site 7A where it excavated approximately 20 yd³ at a unit cost of \$1.00/yd³ in order to better define the channel. The highest cost was \$9.53/yd³ at site 2D-2F. Debris concentrations were extremely high and the excavation was performed almost entirely by the excavator. The second highest unit cost was \$6.07/yd³ at site 9C. Along with buried debris, large rock was encountered throughout the excavation. Room to maneuver was very limited and access was only from the left bank. This was also the first excavation performed on this unit by this crew of operators. At sites 3A and 4A (\$4.73/yd³ and \$3.63/yd³, respectively) the 750 removed at least one-third of the volume during excavation.

-Prairie road outsliping (Table 5) -- unit costs ranged from \$0.37-4.13/ft. and averaged \$1.85/ft. A primary influence on unit costs was the steepness of the slopes across which the roads had been constructed. The 750 and 690B combination outslipped CHS-P and CHN-P because slope steepness varied and often exceeded 35-40 percent.¹ Unit costs ranged from \$2.85-4.13/ft. The high unit cost associated with CHS-P (\$4.13/ft.) reflected equipment application at two locations, rocked road surfaces, high cutbanks, and wide road benches. The southernmost segment contained a broad pull-out area. The fill retrieved by the excavator at this location was moved an excess of 150 feet by the tractor to outslope road areas to the north. Similarly, the swale (4E) north of the pull-out had been originally filled with ridgeline material from the north. To reconstruct the ridgeline, the 750 pushed earth uphill for 200-250 feet. The CHS-P road surface was rocked, requiring preliminary excavations to be performed by the 750 tractor before outsliping the road. The rock was scraped from the surface and stockpiled against the cutbanks, ensuring complete burial of all road rock. In comparison with CHN-P, a much larger volume of earth was moved per foot of outslipped road because of consistently high cutbanks (deep fillslopes) and wide road benches. On more gentle prairie slopes, either the D8 or 750 outslipped the road, unassisted by the excavator. These unit costs ranged from \$0.37-1.14/ft. The steepest road outslipped by the D8 was NCP where at least two-thirds of its time was spent pushing downslope. Both the ridge road and UCP had been constructed across gentle slopes. Road cutbanks and fillslopes were generally small, leading to lowered unit costs for outsliping.

-Gully shaping (Table 6) -- unit costs ranged from \$0.51-2.26/yd³ and were influenced primarily by slope steepness. The highest unit cost (\$2.26/yd³) at G2 1/2 was attributed to the lack of supervision on the job. The next highest unit cost was \$2.18/yd³ at G4, where work was performed on slopes exceeding 45 percent. The lowest unit costs were at G1 and G5 and were attributed to gentle-moderate slope conditions with ample room to maneuver.

¹See Table 5 for a list of abbreviations.

Table 5. PRAIRIE ROAD OUTSLOPING COSTS

Type	Road ¹ Reach	Avg. Road Width	Avg. Slope	Equip.	Hours	Cost	Cost/Ft.	Avg. Cost/ Ft.
Gentle Slopes (0-15%)	ridge road	15 ft.	10%	D8	4 1/4	\$340	\$0.44	\$0.52
	skid road	8	14	750	2 1/2	175	0.37	
	UCP	18	14	D8 750	12 1/2 3/4	1052	0.58	
Moderate Slopes (15-30%)	NCP ²	25	28	D8	8	640	0.99	1.86
	CHN-P	15	29	690 750	26 1/4 38	4707	2.85	
	LCP	13	30	D8 750	1 1/2 24	1720	1.14	
Steep Slopes (>30%)	CHS-P	25	35	D8 690 750	1 36 41	5728	4.13	4.13

Total Cost = ~~\$14,392~~14362

¹UCP: Upper Child's Hill Prairie Road
NCP: North Child's Hill Prairie Road
CHN-P: Count's Hill North Road, prairie reach
LCP: Lower Child's Hill Prairie Road
CHS-P: Count's Hill South Road, prairie reach

²NCP - consists of two parallel road segments; the lowest road (old Bald Hills Road) had been paved.

Table 6. GULLY SHAPING COSTS

Work-site	Equip.	Hours	Site Cost	Treated Length (volume)	Cost/ Ft. (Yd ³)	Avg. Cost Gully	Avg. Cost Ft.	Avg. Cost Yd ³
G1	750	5 1/4	\$385	441 ft. (414 yd ³)	\$.87 (.93)	\$391	\$1.30	\$1.09
G2	750	11 1/2	805	856 (774)	.94 (1.04)			
G2 1/2	750	5 1/2	385	170 (170)	2.26 (2.26)			
G3	750	4	280	162 (142)	1.73 (1.97)			
G4	750	3	210	65 (96)	3.23 (2.18)			
G5	750	4	280	115 (550)	2.43 (.51)			
Totals =				<u>\$2345</u>	1809 ft. (2146 yd ³)			

Evaluation of Heavy Equipment Application

In general, heavy equipment was applied to:

- 1) dewater gully-landslide features caused by diverted streams and concentrated hillslope drainages;
- 2) excavate stream crossings where potential diversions existed;
- 3) excavate stream crossings which were mostly intact and actively eroding;
- 4) remove forest and prairie roads; and
- 5) fill and shape prairie gullies.

The 750 and 690B, alone or in combination, were well suited for this work. Once familiar with their equipment and job, the operators utilized the equipment effectively and completed each work task according to prescription. All work performed was well within the capabilities of the equipment.

Since the rehabilitation unit was located in the upper hillslopes of the Slide Creek and No Name Creek drainages, stream and hillslope gradients were steep and room to maneuver was always a limiting factor. Because of this, it was assumed that large preliminary tractor excavations would seldomly be productive, and a mid-sized tractor was chosen to support the hydraulic excavator. The assumption was tested by allowing the D8 ripper tractor to perform preliminary excavations at selected sites while ripping roads, and in each case this tractor was found to be ineffective because of its large size and the lack of room to maneuver. For stream crossing excavations, the compact size (length) of the 750 tractor was its greatest asset because it could fit between the excavator and its spoil pile, guaranteeing access to spoil in tight locations. The 6-way hydraulic blade was the 750's greatest asset when constructing cross-road drains on haul roads and waterbars on skid trails, though it was found to be less effective for outsloping prairie roads than originally anticipated. The 690B was extremely versatile, especially with its hydraulic "thumb" which provided a clamshell capability to its bucket. Logs and slash were easily grasped, and rocks could be accurately placed.

Most prescriptions addressing skid trail and haul road crossing excavations were good and provided adequate channel capacity for anticipated storm flows. However, prescriptions and channel design fell short at sites 5E, 9C, and 9B. At 5E, the amount of channel fill was underestimated and the finished channel geometry was too small. During the initial storm events, the stream downcut and widened throughout the excavation. The finished channel should have been an average of 3 feet wider and 3 feet deeper, and the excavation should have extended further upstream to decrease the stream gradient. At site 9C, the rock added to the excavated channel (on-site rock) decreased its channel capacity, permitting storm flows to breach the left bank armament. The upstream reach should have been 2 feet deeper and wider to accommodate both rock and storm flow volumes. At site 9B, the finished channel bottom width was too narrow (5-6 feet) and the left bank was not rocked to a sufficient height. Storm flows breached the rock along the left bank, initiating downcutting and channel widening throughout the upstream and downstream reaches. Channel bottom width should have been at least 8 feet, and 50 yd³ of rock, instead of 30 yd³, should have been placed in the channel.

As a result of peer review and emphasis on the visual appearance of prairies, it was decided to fill and shape all prairie gullies on this unit. In retrospect, however, gullies *2 1/2, *4, and *5 should never have been treated in the above manner. Here, moisture indicators were ignored to perform cosmetic treatments. Formed from road runoff, G2 1/2 was adjacent to an intermittent prairie stream indicating a close proximity to groundwater discharge. G4, formed by a waterbar directing road runoff onto a steep prairie slope, contained a spring. G5, a low gradient gully formed by a diverted stream, was bordered by an abundance of moisture indicating vegetation. Today the fill within these gullies has been eroded to varying degrees by groundwater discharge emerging from within or above the treated gully areas. In the future, it is recommended that unless the cause of gully formation is clearly defined and remedied, and groundwater indicators do not appear within a "reasonable" distance from the gully, prairie gullies should be dewatered if possible and no subsequent cosmetic treatments should be performed. In these cases, when visual appearance is a significant concern, gully banks may be pulled back and shaped without adding fill to the gully.

Labor Intensive Phase

Labor intensive work was performed by Redwood National Park laborers, Redwoods United, and R.C.D.C. Tim Tanno and Roger Lemstron were the park laborers assigned to this rehabilitation unit, and they performed a variety of tasks. As can be seen in Figure 1, page 8, they brushed work sites, distributed materials and performed miscellaneous tasks from June 18 to August 6. Tim and Roger performed primary and secondary treatments after August 6 which included manual excavations, straw mulch application, and channel rocking. Redwoods United provided 4-7 workers from August 17-25, and concentrated entirely on straw mulch application on outsloped prairie roads and gullies. R.C.D.C., a volunteer forest improvement group, provided 4-5 workers from August 17-20 as a training session in erosion-control work. They performed a channel clearance project and a variety of secondary treatments.

The total cost of labor intensive work (less supervision) was \$10,392.94 or 15 percent of the total rehabilitation costs. Primary and secondary labor intensive treatments accounted for 2 and 36 percent, respectively, of the total labor intensive costs. Travel time and miscellaneous costs accounted for 30 and 32 percent, respectively.

Average labor intensive costs are summarized in Table 7. Appendix B contains summary sheets for each work site and describes labor intensive treatments and costs where applicable. Miscellaneous costs are summarized in Appendix A, and are broken down into productive and non-productive categories. Productive miscellaneous costs are derived from work tasks which are neither primary nor secondary treatments. Non-productive costs are non-task related and include administrative and supervisory time. This discussion will now turn to the most significant labor treatments and costs.

Table 7. SUMMARY OF AVERAGE LABOR INTENSIVE COSTS: SITE 81-3

Treatment	Type of Labor	Total Person Hours	Avg. Cost Per Hour	Total Cost	Quantity	Avg. Cost Quantity
<u>Primary Treatments</u>						
channel clearance	RCDC	75	0.00	0.00	--	--
excavation RX-5E	RNP	8	\$8.06	\$64.48	2 yd ³	\$32.24/yd ³
drainage ditches	RNP	12	8.06	96.72	3 yd ³	\$32.34/yd ³
waterbars	RNP	9	8.06	72.54	4 wb.	\$18.14/wb. ¹
Total Primary Treatment Costs				=	<u>\$233.74</u>	
<u>Secondary Treatments</u>						
straw application -	RNP	38	8.06	306.28	.32 ac.	\$957.13/ac.
[stream crossings]	RCDC	12	0.00	0.00	.12 ac.	--
straw application -	RNP	54	8.06	435.24	1.60 ac.	\$272.03/ac. ²
[prairie roads & gullies]	RU	202 1/2	6.90	1397.25	6.10 ac.	\$229.06/ac.
straw distribution	RNP	116	8.06	934.96	--	--
rocking channel	RNP	63 1/2	8.06	511.81	27 yd ³	\$18.96/yd ³ . ³
	RCDC	9 1/2	0.00	0.00	3 yd ³	--
"Curlex" placement	RCDC	20	0.00	0.00	1440 ft ²	--
raking road surface	RNP	12	8.06	96.72	1200 ft. (.55 ac.)	0.08/ft. (175.85/ac.)
grass seeding	RNP	3	8.06	24.18	--	--
Total Secondary Treatment Costs				=	<u>\$3706.44</u>	

Table 7. SUMMARY OF AVERAGE LABOR INTENSIVE COSTS: SITE 81-3
(continued)

Treatment	Type of Labor	Total Person Hours	Avg. Cost Per Hour	Total Cost	Quantity	Avg. Cost Quantity
<u>Travel Time</u>						
	RNP	286 1/4	\$8.06	\$2307.18	--	--
	RU	117 1/2	6.90	810.75	--	--
Total Travel Costs				=	<u>\$3117.93</u>	
<u>Miscellaneous Costs</u>						
A. Productive Time						
	RNP	280 1/2	8.06	\$2206.83	--	--
B. Non-Productive Time						
	RNP	133 1/4	8.06	1074.00	--	--
Total Miscellaneous Costs				=	~~\$3334.83~~ 3780.83	
TOTAL LABOR INTENSIVE COSTS				=	<u>~~\$10,392.94~~</u> <u>\$10,338.94</u>	

$$^1 \text{Range} = \frac{\$165 - 496}{\text{ac.}}$$

$$^2 \text{Range} = \frac{\$9 - 121}{\text{ac.}}$$

³Includes three shallow waterbars constructed on ripped surfaces

- Straw application -- straw was applied at most skid trail and haul road crossings and on all outsloped prairie roads and gullies. Application rates ranged from 4000-6000 lbs/ac. with crossings receiving a higher application rate than prairie areas. Straw was applied on a total of 8.14 acres of which Redwoods United treated 75 percent. Based on data collected in the field, average application rates were calculated at 1.8 bales spread/person-hour for both Redwoods United and Redwood National Park laborers. Therefore, the difference in unit cost reflects only the difference in hourly wages and not work rates.
- Rocking channels -- Redwood National Park laborers spread rock at sites 2D-2F, 3A, 5D, 5E, 5G, 9B, and 9C. At sites 9B and 9C, rock was only repositioned at unit costs ranging from \$8.86-9.66/yd³. At all other sites, rock was collected and carried to the channels where it was placed in the form of rock check dams and aprons. These unit costs ranged from \$28-120/yd³.
- Travel -- 30 percent of the total labor costs were spent by labor crews traveling back and forth from the rehabilitation unit. Out of their total work time, Redwood National Park and Redwoods United spent 28 and 37 percent of their time traveling. This represents an average travel time of 3 hr/day and 3 1/2 hr/day for park laborers and Redwoods United, respectively. Park laborers arrived at the rehabilitation unit by 8:30-9:00 a.m., and left by 4:15 p.m. Redwoods United arrived at the same time and left by 3:30 p.m.
- R.C.D.C. -- at no cost to the government, R.C.D.C. performed a variety of tasks as rehabilitation training sessions. In drainage #2, crews removed by hand large concentrations of slash and log debris from the channel. Logs keyed into the channel were cut at channel level, leaving the buried portions undisturbed. Debris which had been delivered to the channel from the landslide was also removed. The channel clearance project extended from the K & K, upstream to site 2D-2F. At the crossing below 2D-2F, crews removed the center section of a log which crossed the channel and deflected flow into the right bank. At site 4A, crews spread straw, constructed small rock check dams, and applied "Curlex" to selected areas on the left and right banks.

Evaluation of Labor Treatments

Primary erosion control treatments consisted of a channel clearance project in drainage #2, ditch construction at sites 9H and 9M, waterbar construction at selected sites, and a manual excavation at site 5E. These treatments were necessary and, with exception of site 5E, were effective. The channel clearance project reduced the excessively high debris concentration in the channel. This eliminated deflection points which had aggravated stream banks in several locations and greatly reduced the amount of float debris which could plug downstream culverts. Manual ditch construction across skid roads redirected

short stream reaches and eliminated the need to bring in heavy equipment. Though more expensive, the manual excavation did not create the disturbance that would have been caused by tractor excavations. The least effective labor treatment was the manual excavation at site 5E. Once treatment was complete and the site was isolated by equipment work, it was realized that this crossing had been underexcavated. In an attempt to widen and deepen the channel, laborers performed a manual excavation to increase its capacity. Despite this effort, however, the stream downcut an average of four feet throughout its reach in response to the December storms. Fill material continues to be exposed.

Secondary erosion control treatments included straw mulch application, rock check dam and apron construction, and "Curlex" application. Straw mulch application was a necessary and effective treatment, reducing rill and gully erosion potentials on freshly disturbed soils by protecting against soil compaction and encouraging infiltration rates. Of the total channel rocking costs, 32 percent was spent repositioning large rock that had originally been placed by equipment. This, too, was an effective labor application. Rock aprons constructed at sites 3A and 5G accounted for 35 percent of channel rocking costs. After several runoff events, rock aprons remained intact, protecting the channel where stream gradients changed while deterring headcut development. The necessity of these treatments, however, was questionable. Rock check dams were constructed to utilize rock exposed during excavation and to add some protection to the channel. This was the least effective secondary treatment (labor application) as most rocks were well within the transporting capability of the streams. Finally, "Curlex" was applied on 70-75 percent sideslopes at site 4A as a training session for R.C.D.C. Although it appears to have been effective in preventing surface erosion, its necessity was also questionable.

DISCUSSION

Prescriptions

By 1981, 83 percent of the total number of skid trail crossings had washed out, leaving only 0-30 percent of the original volume of fill in each of these crossings. Because of this, excavations were prescribed only at skid trail crossings that had caused or had the potential to cause stream diversions. An exception to this was the stream crossing at site 4A which showed no diversion potential, but contained an excess of 800 yd³ of fill that was actively eroding. Less than 50 yd³ of fill remained in each skid trail crossing that was left untreated.

At excavation sites, channel geometry and capacity were based on calculated peak discharge values using the rational formula. For each treated crossing, peak discharge values were computed for 2-, 10-, and 20-year storm events (see Appendix C).¹ Peak discharge estimates were then used to determine

¹Peak discharges from the 1980 and 1981 storms were not measured, precluding a comparison of actual and calculated discharge values.

finished channel dimensions using an average velocity of 2-5 fps and an average water depth of 1.5-2 feet at peak flow. In addition, actual channel geometries in upstream, undisturbed stream reaches were examined and compared to computed channel dimensions to further assist in stream crossing prescriptions. In general, the computed peak discharges and channel capacities were higher than would be expected from examination of the undisturbed stream reaches. Stream channel excavations, however, reflected the maximum calculated channel dimensions to compensate for the lack of root strength and vegetative cover which protects undisturbed stream reaches from eroding. The problems encountered at sites 9B and 9C were a result of decreased channel capacity following rock placement. Once in position, the rock utilized a greater volume than was originally anticipated, decreasing the capacity of the finished channel.

Complete channel rocking was prescribed only at site 9B. This haul road crossing drained approximately 70 acres and had been constructed across an extremely unstable stream reach. Atwell soils, sheared parent material, and springs were noted during the mapping season. Additionally, the finished stream gradient was anticipated to be fairly steep ($> 30\%$). All other stream crossing areas showed no signs of slope stability problems and drained smaller areas ranging from 4-17 acres. Minimal rock was applied to these channels by manual-labor crews, utilizing rock which was exposed during the excavations.

As a result of peer review and emphasis placed on the aesthetic appearance of prairies, the filling and shaping of all prairie gullies was prescribed (see page 11). Here, moisture indicators identified during field mapping were ignored to perform cosmetic treatments. Gully reaches known to contain groundwater discharge were not filled and shaped, but the close proximity of other groundwater indicators was disregarded. Intense and prolonged rainfall elevated groundwater levels much higher this year than was observed during the relatively dry 1981 mapping season. Areas upslope and adjacent to treated gullies, which had only displayed groundwater discharge potential last winter, provided a continuous discharge of groundwater for many consecutive weeks this winter. As a result, the fill within gullies #2 $\frac{1}{2}$, #4, and #5 has eroded to varying degrees. In contrast, the fill in gullies #1, #2, and #3 remains stable and displays only slight rill erosion. The filling and shaping of large gullies will inevitably result in a concave cross-sectional profile, promoting surficial erosion due to the concentration of surface-generated runoff across unconsolidated fill. From a sediment standpoint, the cosmetic treatment of gullies on this unit was not necessary. Simply dewatering the gullies of concentrated road runoff was a sufficient and effective primary treatment. In the future, the filling and shaping of gullies should proceed only if the cause of gully development is clearly defined and remedied, and groundwater indicators do not appear in close proximity to the gullies. In areas where groundwater discharge potential is indicated, prairie gullies should be dewatered if possible and, if they are a visual concern, gully banks can be pulled back and shaped, creating the appearance of a natural drainage.

Heavy Equipment Application

The 750, a mid-sized tractor, was used extensively on this unit. At road and skid trail crossings it performed preliminary excavations when site conditions permitted, though its main function was to dispose of dirt removed by the hydraulic excavator. On skid trail and road surfaces, it constructed water-bars and cross-road drains. The tractor outsloped prairie roads which crossed slopes ≤ 30 percent, unassisted by the excavator. As support equipment for the excavator, the 750 was extremely versatile and effective due to its compact size, power, and weight. It is highly recommended for future rehabilitation work on units with similar site conditions (steep slopes, narrow and incised stream channels, etc...). Though the larger tractor may have outsloped prairie roads at a faster rate, it was proven ineffective at most stream crossing excavations because of its size.

In general, tractor excavated road crossings consistently show a lower unit cost when compared to excavator-tractor excavations, but the ultimate cost-effectiveness of both methods may actually be quite similar. Tractor excavations often remove more dirt from a stream crossing area than is necessary. Original ground is frequently cut into which may undermine hillslopes and/or cutbanks above the excavation site, initiating slope stability problems. When evaluating and comparing the cost-effectiveness of excavator-tractor and unassisted tractor excavations at stream crossings, comparable unit costs should be calculated (i.e., the total excavation cost divided by only the volume of fill which was necessary to remove). Care must be exercised to prevent slope stability problems adjacent to stream channels, while realizing that unit costs are not always analogous to cost effectiveness.

Labor Travel Costs

On this rehabilitation unit, Redwood National Park Laborers spent 28 percent of their total person-hours traveling back and forth from Orick. Similarly, Redwoods United spent 37 percent of their total person-hours traveling to and from the Arcata area. This corresponds to a daily travel time of 3 hours and 3 1/2 hours for Redwood National Park and Redwoods United, respectively. Redwoods United's high amount of travel time is easily explained (yet hardly justified) because they were paid from the time they left Arcata in the morning to the time they arrived back in Arcata at the end of the day. Our laborers, in comparison, spent nearly the same number of hours per day while traveling approximately one-quarter of the distance. It appears that our laborers did not efficiently organize and dispatch (motivate) themselves, and that this problem needs to be addressed. As camping in the field during the equipment season is not a requirement, our labor crews should be responsible for arriving at the rehabilitation unit at a reasonable time. In addition, their Orick supervisor should be responsible for expediting the laborers' departure from the Orick Operations Center.

VEGETATIVE REHABILITATION - UPPER SLIDE CREEK 1981

1981-3

General Site Description

This slope rehabilitation site is located between the K & K and Bald Hills Road in the Slide Creek drainage. Slopes are generally steep with rocky soils. Forested areas were originally dominated by redwood to mixed evergreen which was clearcut in the late 1960's and 1970's. Prairie areas were grazed from the mid-1800's until the present. Oak woodlands border prairies and are presently being encroached upon by Douglas-fir.

The summer of 1981 slope rehabilitation involved the removal of the haul roads which provided access to conifer stands. In general, the prairie roads were completely outsloped and slopes recontoured, while forested roads were ripped or partially recontoured. Culverts were removed and all stream channel crossings were excavated to somewhere near original channel. The resulting soil for revegetation was almost exclusively decompacted road fill and gravel.

Plant Species Used

Due to problems encountered with propagating the shrubs for 1981 sites, there was not a large variety of species available for planting. Douglas-fir, alder, and redwood seedlings were available in good quantities. A few rooted whippolea and willow cuttings were also available. Species seeded were Bromus mollis, Trifolium subterraneum, and Agrostis tenuis.

Species	Common Name	Method
<u>Alnus rubra</u>	red alder	1.0 containerized seedlings
<u>Agrostis tenuis</u>	Bentgrass	seed
<u>Bromus mollis</u>	Blando brome	seed
<u>Pseudotsuga menziesii</u>	Douglas-fir	2.0 bareroot seedlings
<u>Salix</u> sp.	willow	rooted cuttings
<u>Sequoia sempervirens</u>	coast redwood	2.0 bareroot seedlings 1.0 containerized seedlings
<u>Trifolium subterraneum</u>	Mt. Barker subclover	seed
<u>Whipplea modesta</u>	yerba de selva	rooted cuttings

General Prescriptions

Prairie roads and gully systems were seeded with belly grinders at approximately 31 pounds per acre with the following mix: Blando brome, 25 pounds; Mt. Barker subclover, 5 pounds; and Agrostis tenuis, 1 pound. Seeding was done in early September to insure adequate seed availability prior to the early fall rains.

Forested roads, landings, and excavations were planted at eight foot spacings with a mixture of redwood and Douglas-fir. The 2020 road system was planted with only redwood. This was done to establish conifers early on sites where they may be limited by successional species.

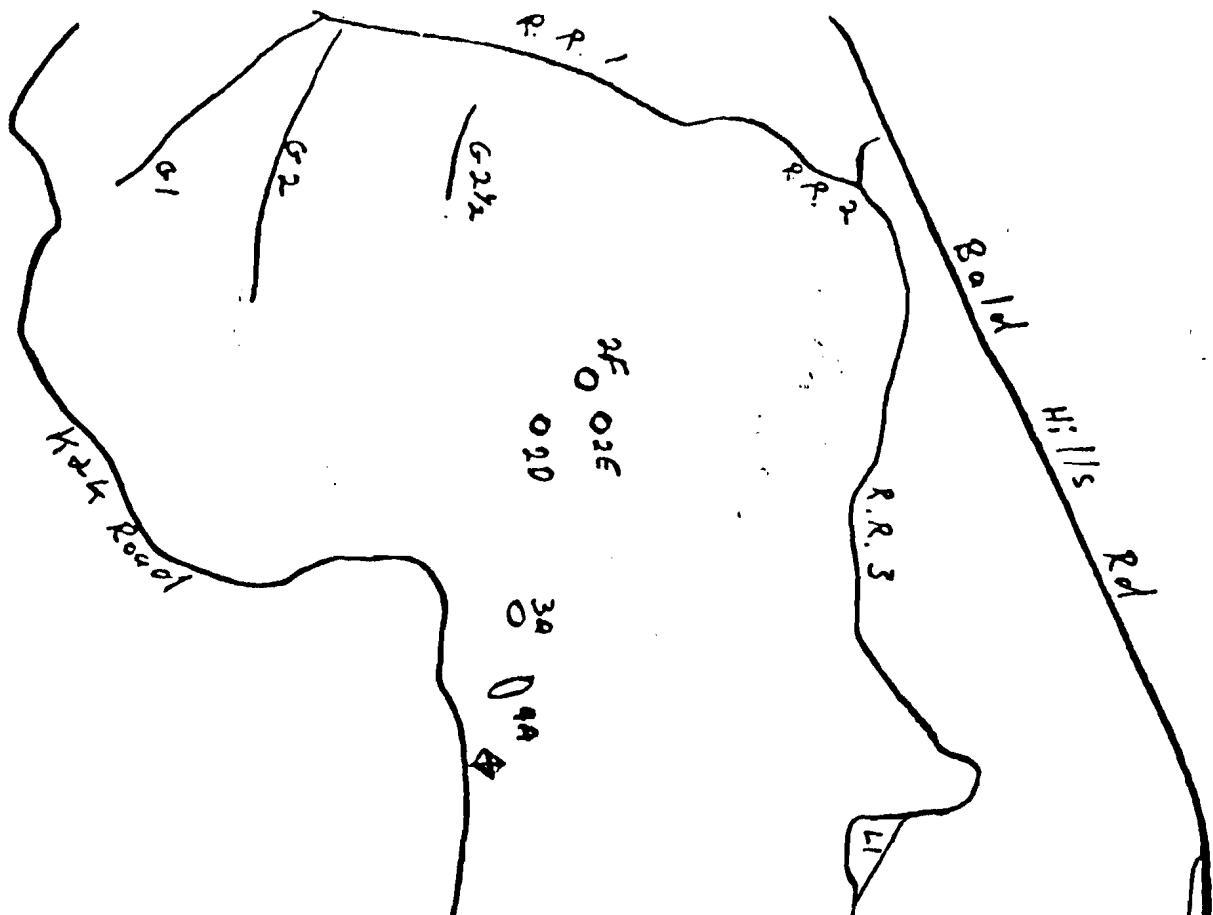
Two untreated slides were planted with red alder seedlings in an effort to rapidly establish woody vegetation on unstable sites. Willow rooted cuttings were planted along the channels of crossings 2F, 3A, and 4A to rapidly reestablish the riparian vegetation.

Specific treatments and control areas are covered on the chart of site treatments and map.

Area	Date Treated	Treatment	Man Days - Type
Spur Road #1	1/13/82	Alternate 2.0 redwood and 2.0 D-fir - 8 ft spacings. Total 600 trees.	1 work leader 1 laborer 1/2 GS-7
Spur Road #2	1/13/82	Alternate 2.0 redwood and 2.0 D-fir - 8 ft spacings. Total 400 trees.	
2021 Road	1/14/82	2.0 Douglas-fir (400) w/ 2.0 redwood (350)	1 WL-3 1 WG-3 1 GS-7
2006 Road	1/14/82	Alternate 2.0 redwood and 2.0 Douglas-fir (450)	
Crossing 2E	1/18/82	9 2.0 redwood 9 2.0 Douglas-fir	1/2 WL-3 1/2 WG-3 1 GS-7
Crossing 2F	1/18/82	100 2.0 redwood 125 2.0 Douglas-fir	
	3/8/82	100 willow	
Crossing 3A	1/18/82	75 2.0 redwood 150 2.0 Douglas-fir	
	3/8/82	100 willow	
Crossing 4A	1/18/82	91 2.0 redwood 116 2.0 Douglas-fir	1 WG-3
	3/8/82	100 willow	
Landing #1	1/18/82	40 2.0 redwood 140 2.0 Douglas-fir	
Landing #2	1/18/82	100 2.0 redwood 100 2.0 Douglas-fir	1 WG-3
Landing #3	1/18/82	50 2.0 redwood 50 2.0 Douglas-fir	
Landing #7	2/3/82	Test plot: 100 2.0 redwood 100 2.0 Douglas-fir 100 1.0 redwood 150 fertilizer tablets	2 GS-7
2 slides below L-7	2/3/82	300 1.0 alder	
2020 Road below L-7	2/4/82	102 1.0 redwood 56 2.0 redwood (bottom)	1 GS-7
2020 Road L-7 to Crossing 9B	2/4/82	50 1.0 redwood	
Crossing 9B	2/4/82	35 1.0 redwood	
Crossing 9B to top(2020)	2/4/82	17 1.0 redwood	
Cutoff to 9C	2/4/82	27 1.0 redwood	
Crossing 9C	2/4/82	18 1.0 redwood	

Area	Date Treated	Treatment	Man Days - Type
Fill below Crossing 4A	1/25/82	Test Plot: 100 2.0 Douglas-fir 50 fertilizer tablets.	1 GS-7
R.R. #1 (1.58 A) (76,725 ft ²)	9/8/81	Blando brome - 37.5 lb Mt. Barker subclover - 7.5 lb <u>Agrostis tenuis</u> - 1.5 lb	0.5 days GS-7
Gulley #1 (16,325 ft ²)	9/8/81	Blando brome - 12.5 lb Mt. Barker subclover - 2.5 lb <u>Agrostis tenuis</u> - 0.5 lb	
Gulley #2 (31,272 ft ²)	9/8/81	Blando brome - 25 lb Mt. Barker subclover - 5 lb <u>Agrostis tenuis</u> - 1.0 lb	
Gulley #2 1/2 (<.25 A)	9/8/81	Blando brome - 6.25 lb Mt. Barker subclover - 1.25 lb <u>Agrostis tenuis</u> - 0.25 lb	
R.R. #2 (20,395 ft ²)	9/8/81	Blando brome - 12.5 lb Mt. Barker subclover - 25 lb <u>Agrostis tenuis</u> - 0.5 lb	
R.R. #3 (65,070 ft ²)	9/8/81	Blando brome - 37.5 lb Mt. Barker subclover - 7.5 lb <u>Agrostis tenuis</u> - 1.5 lb	0.5 days GS-7
R.R. #4 (43,733 ft ² were treated)	9/9/81	Blando brome - 25 lb Mt. Barker subclover - 5 lb <u>Agrostis tenuis</u> - 1 lb	
R.R. #5 (34,478 ft ²)	9/9/81	Blando brome - 25 lb Mt. Barker subclover - 5 lb <u>Agrostis tenuis</u> - 1 lb	
R.R. #6 (35,934 ft ²)	9/9/81	Blando brome - 25 lb Mt. Barker subclover - 5 lb <u>Agrostis tenuis</u> - 1 lb	
Gulley #3 (9,120 ft ²)	9/9/81	Blando brome - 6.25 lb Mt. Barker subclover - 1.25 lb <u>Agrostis tenuis</u> - 0.25 lb	
Gulley #4 (4,500 ft ²)	9/9/81	Blando brome - 6.25 lb Mt. Barker subclover - 1.25 lb <u>Agrostis tenuis</u> - 0.25 lb	0.5 days GS-7
Gulley #5 (10,236 ft ²)	9/9/81	Blando brome - 6.25 lb Mt. Barker subclover - 1.25 lb <u>Agrostis tenuis</u> - 0.25 lb	
R.R. #7 (8,255 ft ²)	9/9/81	Blando brome - 6.25 lb Mt. Barker subclover - 1.25 lb <u>Agrostis tenuis</u> - 0.25 lb	

TOTALS	NUMBER	DATES	MAN DAYS-TYPE
2.0 Rwd	1696		
2.0 D-fir	2015	(1/13 to 1/18,	2 1/2 WL
1.0 Alder	300	1/25, 2/3 to 2/4)	3 1/2 WG
			6 GS-7
1.0 Rwd	350		
willow	300	3/8	1/2 GS-7
Fertilizer tabs.	200		
Blando Brome	231.25 lb.	9/8 - 9/9)	
Mt. Barker subclover	46.25 lb.	9/8 - 9/9)	1.0 GS-7
Agrostis tenuis	9.25 lb.	9/8 - 9/9)	



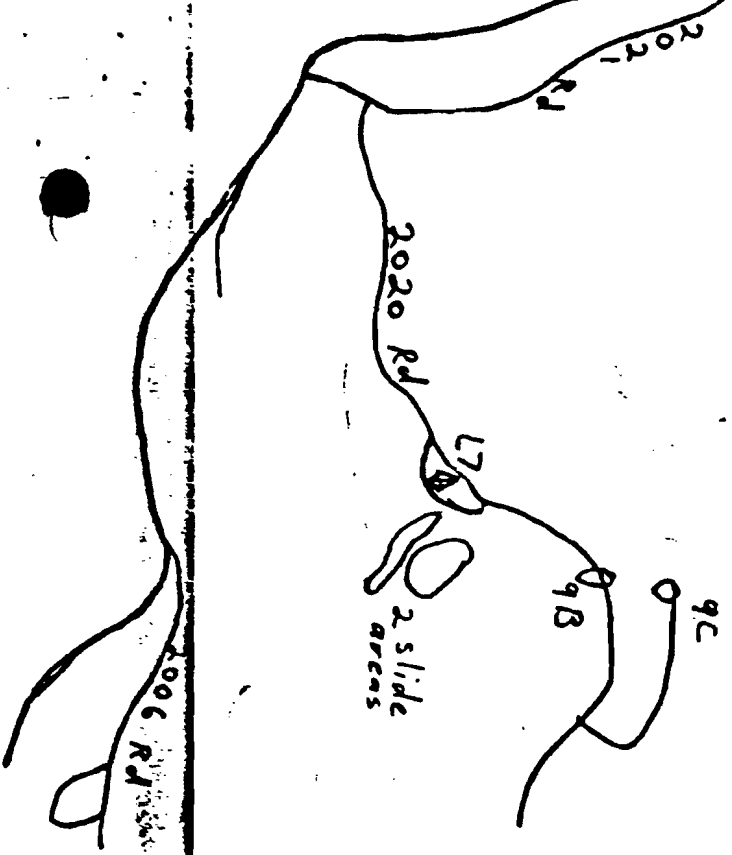
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UPPER SLIDE CREEK REHABILITATION UNIT

A more detailed map of
site treatments is on file
in the vegetation management
office in Oricla.

◆ indicate test plot locations

VEGETATION TREATMENT LOCATIONS



Test Plots Established

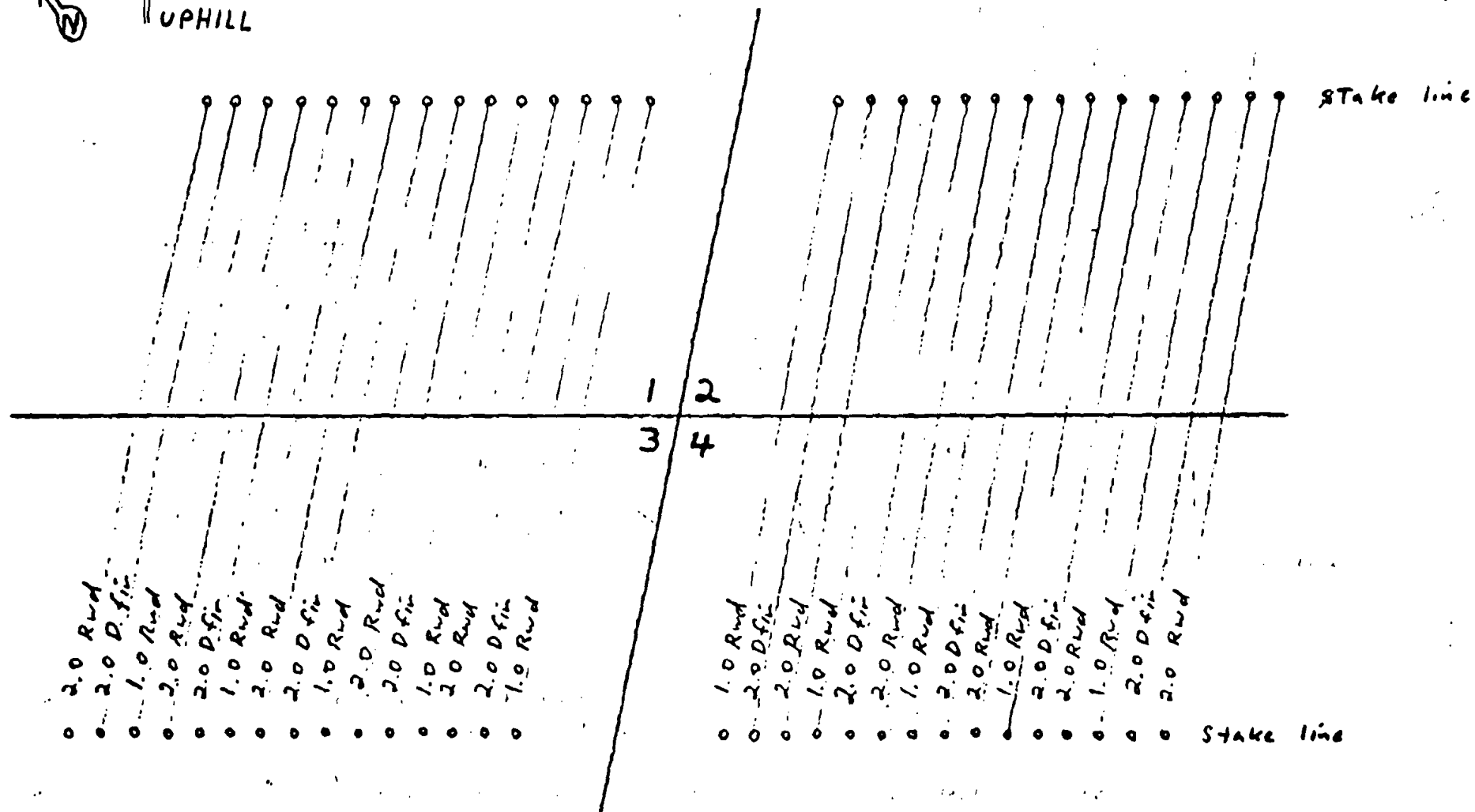
As an effort to assess relative planting stock quality and the effects of fertilizer on seedling survival, two test plots were established. The first was planted with 2.0 Douglas-fir, half of which were fertilized. This is located off the K & K Road on a fill slope below Crossing 4A. The second plot is located on Landing #7 and consists of alternate rows of 2.0 redwood, 1.0 redwood, and 2.0 Douglas-fir. Half of this plot was also fertilized. A test plot to test for seed in topsoil was also set up on Landing #1. This plot is set up as part of a series which includes other 1981 sites.

Diagrams of the actual plot layouts are on the following pages.

Survival Test Plot - Landing #7



↑ UPHILL



Sections 1 and 4 = Unfertilized

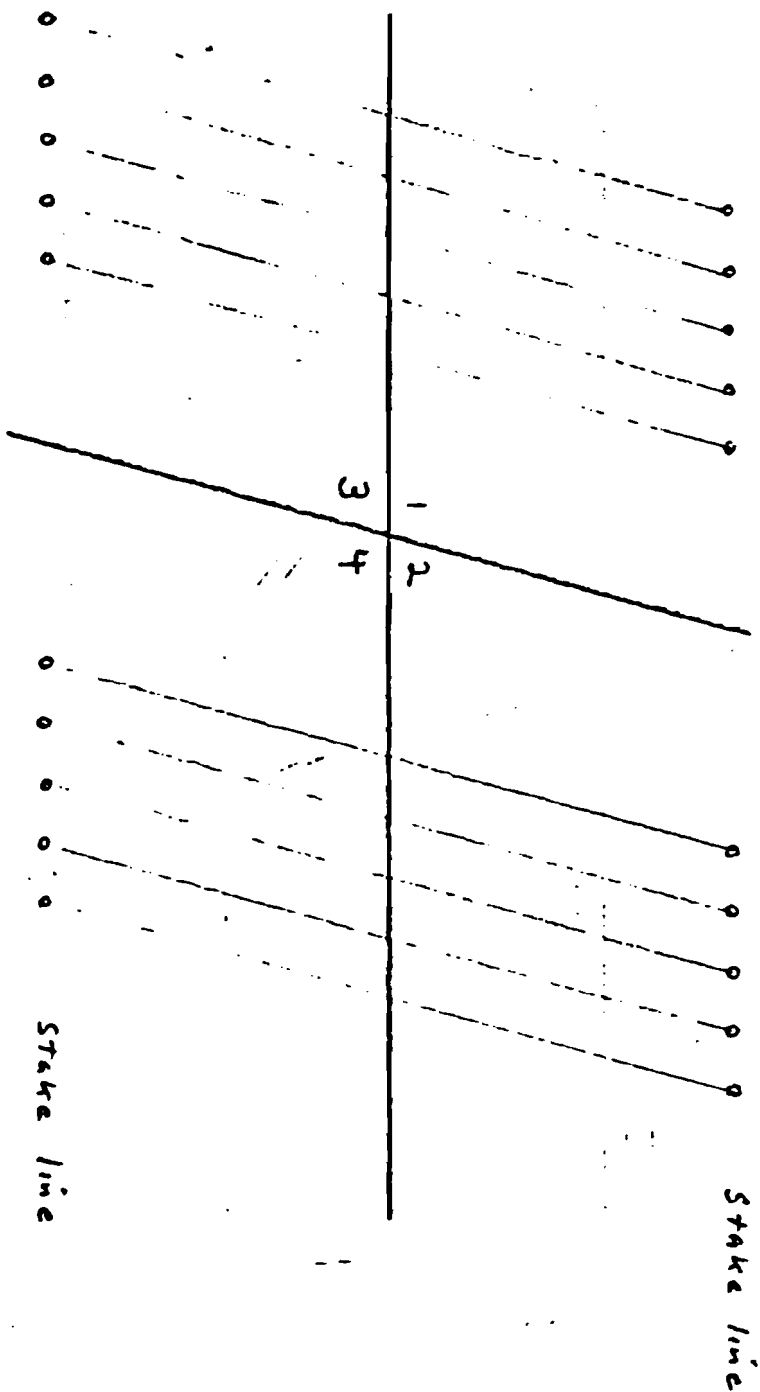
Sections 2 and 3 = fertilized

each row consists of ten trees divided between the two quadrants

Survival Plot - Below Crossing #4A

all 2.0 Douglas fir - Arcata Lumber Co. - Bare Root

↑ uphill



Quadrants 1 and 4 were fertilized
Quadrants 2 and 3 were unfertilized

Each row consists of ten trees divided between
two quadrants.

COST ANALYSIS

Material Costs

A) Seedlings and Rooted Cuttings

Species	Where Purchased	Type	Cost/ 1000	Number	Cost
<u>Alnus rubra</u>	Simpson-Korbel	1.0 cont.	\$150.00	300	\$ 45.00
<u>Pseudotsuga menziesii</u>	Arcata Lumber - Smith River	2.0 B.R.	87.50	2015	176.32
<u>Salix spp</u>	FLAPCO-Phillipsville	B.R. cuttings	500.00	300	150.00
<u>Sequoia sempervirens</u>	Simpson - Korbel	1.0 cont.	150.00	350	52.50
<u>Sequoia sempervirens</u>	U.S.F.S. - McKinleyville	2.0 B.R.	106.00	1696	179.78
<u>Whipplea modesta</u>	FLAPCO-Phillipsville	rooted cuttings cont.			
Fertilizer tablets	Forestry Suppliers	--	72.00	200	14.40
TOTALS				4861	\$618.00

B) Seed

Species	Where Purchased	Number of Pounds	Cost/lb	Total Cost
<u>Agrostis tenuis</u>	Nilsen Feed Company	9.25	\$3.55	\$ 32.94
<u>Bromus mollis</u>	Clyde-Robin Seed Co.	231.25	2.20	508.75
<u>Trifolium subterraneum</u>	Nilsen Feed Company	46.25	1.85	85.57
TOTALS		286.75		\$627.26

COST ANALYSIS (cont.)

Labor

The following figures were used to analyze labor costs:

GS-7 = \$81.15/day
WG-3 = 81.31/day
WL-3 = 89.57/day

(These figures include wages and 6 percent overhead)

Because many of the seedlings were planted together in the same method and seed was spread as a mix only two categories for labor costs are used.

Planting

Total seedlings and cuttings = 4661
Total fertilizer tablets = 200
Planting Total 4861

Planting labor:	Days	Type	Cost
	3.5	WG-3	\$284.59
	2.5	WL-3	223.93
	6.5	GS-7	527.48
	<u>12.5</u>	TOTALS	<u>\$1036.00</u>

Labor Unit Cost = \$0.213/seedling or \$213.00/M

Seeding

286.75 pounds were seeding over approximately nine acres at a labor expenditure of one day GS-7 time (\$81.14) = \$9.00/acre.

TOTAL COSTS

	Materials	Labor	Total	Unit Cost
Seeding	\$177.26	\$81.15	\$258.41	\$28.71/Ac.
Planting	<u>601.60</u>	<u>1036.00</u>	<u>1637.60</u>	337/M
TOTALS	\$778.86	\$1117.15	1896.01	



Unit: 81-3 1-A 6/3/81 PP#2 South, along Rd. M.S.S.



Unit: 81-3 1-B 11/17/81 PP#2 Count's HP Rd. G.B.



Unit: 81-3 1-C 6/16/82 PP#2 R.G.L.



Unit: 81-3 2-A 6/3/81 PP#10 Up Gully 2, M.S.S.



Unit: 81-3 2-B 9/28/81 PP#10 Up Gully 2, G.B.



Unit: 81-3 2-C 6/16/82 PP#10 Upslope, R.G.L.