

Summary Report

WATERSHED RESTORATION UNIT 00-1

A100 and A200

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Redwood National Park

December, 2001

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INTRODUCTION

Background

Redwood Creek drains a 280-square-mile watershed in the mountainous, coastal region of northwestern California. The watershed is characterized by high relief, steep unstable slopes, and narrow valley bottoms. Redwood Creek and its tributary streams are subject to frequent flooding from winter storms, and basin soils are naturally unstable and highly erodible. Landslides and earthflows are widespread, and even under natural conditions streams swelled by winter rains transport large volumes of sediment. With over 90% of the forests in the basin harvested, and 2/3 of the basin in active timber management, sediment levels in Redwood Creek are twice the mean annual erosion rates for the north coast (U.S. Congress, House, Committee on Government Operations 1976). Redwood National Park (RNP) is located in the lower 1/3 of the Redwood Creek watershed.

Public Law 95-250 (March 27, 1978) directed that a watershed restoration program be developed for lands that had been timber harvested prior to becoming part of Redwood National Park. Timber harvesting and road construction that occurred on these lands before they were added to the park had adversely influenced erosion rates, sediment deposition, and water quality within the entire basin. These problems are being addressed in the restoration program. The purpose of the restoration program is to minimize human-induced erosion within Redwood National Park, encourage the return of a natural pattern of vegetation, and protect redwood groves and aquatic communities. Ultimately, these efforts should result in the restoration of natural ecosystems to conditions similar to what would have existed without disturbance by humans. (Redwood National Park, Watershed Rehabilitation Plan, 1981)

It is National Park Service policy to "actively seek to understand and preserve the soil resources of parks and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources..." It is also Park Service policy that "Terrain and plants may be manipulated where necessary to restore natural conditions on lands altered by human activity. Management activities may include, but will not be restricted to, removing constructed features, restoring natural gradients, and revegetating with native park species..." (National Park Service Management Policies, 1988). Management objectives of Redwood National Park are "to restore and/or maintain the natural ecosystems of the park" and "to continue with biological and physical restoration of park lands severely impacted by past land-use practices" (Redwood National Park, Statement for Management, 1992). These policies and objectives provided the guidance and direction for the removal of portions of the A100 and A200 Roads.

Site Description

The project area is located approximately five miles northeast of Orick at an elevation ranging from approximately 960 to 1400 feet above sea level (Figure 1). The A100 and A200 were haul



Figure 1: Project Location

roads that branched off from Geneva Road. The A100 was constructed prior to 1954 and the A200 was constructed between 1954 and 1962. They are located on the east side of the Redwood Creek basin in the Lost Man Creek watershed.

On January 1, 1997, an eleven-year storm hit northern California, including the Redwood Creek basin, after three months of above average precipitation. This storm caused numerous failures, predominately mass movements along the roads in Redwood National Park. Several stream crossings on the A100 and one stream crossing on the A200 partially failed, causing the roads to be undrivable. Redwood National Park received \$7.5 million from the Emergency Supplemental Appropriations Act for Recovery from Natural Disasters (PL 105-18) and \$0.5 million from the Federal Highway Administration's Emergency Relief for Federally Owned Roads (ERFO) to remove roads that had been damaged during the storm. Other roads that were public access or long term administrative access roads also received funds for repair. The A100 and A200 were two of the roads to be removed. The A100 was split into multiple segments for removal. This project covers the northernmost ½ mile of the A100.

The total cost for this project was \$245,910 (see Table 1 for cost summary). The heavy equipment cost of \$219,586 was funded from the Emergency Supplemental Appropriations Act. The salary cost of \$26,324 for implementation was funded by RNP's base operating funds and the Emergency Supplemental Appropriations Act.

Watershed Restoration Unit 00-1 constitutes the first phase of a two-year strategy to remove the A100 and A200. This project removed 0.5 mile of the A100 that included three stream crossings and 0.9 mile of the A200 that included four haul road stream crossings and nine skid road crossings. This project involved the excavation of a total of 47,184 yds³ of fill material, including 22,441 yds³ associated with stream crossings.

Restoration focused on the removal of the stream crossing fill and unstable side cast fill, and placement of this fill against the cutbanks on stable road reaches in order to restore more natural hillslope topography and drainage patterns interrupted by the A100 and A200. The excavation of the stream-crossing fill uncovered the natural channel bed and banks, and excavated fill was used to re-create the natural topography. Buried organic and nutrient rich material was returned to the surface in order to help speed recovery of native vegetation. Trees removed during excavation were dispersed along the finished surface in order to provide habitat and simulate natural forest litter.

Geology

The Redwood Creek basin is almost entirely underlain by the Jurassic-Cretaceous Franciscan formation. Exposures of these rocks typically show closely spaced fractures and/or pervasive shearing. Fractures seem to have resulted from deformation from tectonic emplacement, likely by subduction, and from brecciation along high angle faults. The intensity and style of this disruption seems to be the rock characteristic that most influences differences in the erosion rates and landforms (Janda, unknown). The Grogan fault, which has a surface trace roughly coincident with the valley of Redwood Creek, separates two major lithologies of the Franciscan formation. In

TABLE 1 RESTORATION WORK COST SUMMARY FOR UNIT 00-1, A100/A200 ROADS							
Treatment	Quantity	# of Jobs	Total Costs		% of Grand Total using Actual	Average Unit Costs	
			Actual	H.E.R.E. ^a		Actual	H.E.R.E. ^a
Heavy Equipment							
Stream Crossings	22,441 yds ³	16	\$120,130	\$107,562	49	\$5.35	\$4.79
Export Outslope	8,806 yds ³	6	\$34,419	\$15,010	14	\$3.91	\$1.70
Outslope	15,937 yds ³	13	\$45,986	\$40,002	19	\$2.89	\$2.51
Misc. Bid Items		5	\$19,051	\$14,590	8		
Misc. Non-Bid Items			\$0	\$14,981	0		
Subtotal	47,184 yds ³		\$219,586	\$192,145	89		
Project Implementation ^b							
Planning	12 hrs	NA	\$307		0		
Mapping	172 hrs	NA	\$4,079		2		
Prescriptions and Layout	148 hrs	NA	\$3,556		1		
Surveying	335.5 hrs	NA	\$7,454		3		
Environmental Compliance	29.5 hrs	NA	\$761		0		
Contract Preparation	37.5 hrs	NA	\$959		0		
Heavy Equipment Supervision	413.5 hrs	NA	\$8,317		3		
Photo Documentation	0 hrs	NA	\$0		0		
Report Writing	33.5 hrs	NA	\$892		0		
Subtotal	1027.5 hrs	NA	\$26,324		11		
Grand Total			\$245,910	\$218,469	100		

^a Heavy Equipment Rental Equivalent (H.E.R.E.) is the cost to complete each job based on the actual hours worked. These rates are: John Deere 330 hydraulic excavator @ \$155/hr; John Deere 850 dozer @ \$118/hr; and John Deere 230 hydraulic excavator @ \$146/hr.

^b Project implementation costs are the total number of hours that Redwood National Park employees worked on the project multiplied by their hourly rates. Several employees making different hourly rates worked on this project, so the total hourly rate is not consistent. Terry Spreiter's hours as a site inspector and for mapping were not available before this report was completed, so they are not included. These hours do include Becca Smith's hours preparing the A300 work that was planned but was not completed in 2000.

general, rocks on the west side of the basin consist of quartz-mica schist, whereas unmetamorphosed sedimentary rocks are found on the east side. The Grogan fault is more linear than other major NNW trending faults in the region which suggests a near vertical dip (Hardin et al., 1982).

The north-northwest trend of these units and the younger faults that cut them is a signature of the overall tectonic structure of the northwest. This structure is dominated by north-northwest trending, imbricated thrust faults that dip to the east and accounts for the prominent north-northwest trend of many of the ridges and rivers in the northern Coast Ranges as well as the obvious shearing. The overall amount of shearing in the major units can usually be predicted by the topography because the amount of shearing strongly influences both type and abundance of landslides.

The project area is situated on the east side of the Redwood Creek basin, and is underlain by the Cretaceous Coherent unit of Lacks Creek and the Pliocene and Pleistocene Prairie Creek Formation (Hardin et al., 1982, Kelsey and Trexler, 1989). The Coherent unit of Lacks Creek consists primarily of coherent sandstone and interbedded sandstone and mudstone with minor amounts of conglomerate, chert, and volcanic rock. The sandstone is predominately lithic graywackes and quartzofeldspathic graywackes. The rhythmic bedding and internal sedimentary structures of sandstone-mudstone sequences are typical of turbidites. However, individual beds cannot be traced laterally for more than 100m due to complex folding and faulting within this unit. Sandstone occurs as massive beds up to 10m thick, but most beds are between 0.1m and 3m thick with thinner mudstone interbeds. Mudstone comprises a noticeably lower percentage of the coherent unit of Lacks Creek than of the incoherent unit of Coyote Creek. The graywackes within this unit contain abundant fine volcanic detritus, but large blocks of volcanic rocks and chert are not found.

High sandstone content, presence of massive beds, and less intense shearing and fracturing result in steeper, straighter hillslopes in areas underlain by the coherent unit compared to those in the remainder of the basin (Janda, 1979). Uniformly sharp ridge crests, steep slopes, and narrow V-shaped tributary canyons are characteristic of the landscape developed in this unit. (Hardin et al., 1982).

The Prairie Creek Formation is composed of unconsolidated to weakly consolidated silts, sands, and gravels associated with minor amounts of organic rich mud. The formation records deposition of approximately 550 m of mostly fluvial sediment during a period of subsidence of the southern Cascadia forearc. The formation was deposited by a large braided river, most likely an ancestral Klamath River, that prograded into the forearc. Sedimentation mainly consisted of sand and well-rounded conglomeratic alluvium. However, within the lower half of the section, there occur several thin horizons of coarse angular conglomerate of distinctive lithology. The only likely provenance for this anomalous conglomerate is fault scarps intermittently exposed near the area of deposition. The formation consists of three units; by far the largest portion of the formation is the Gold Bluffs unit. The Prairie Creek sediments were deposited with angular unconformity on the Coherent unit of Lacks Creek. Three major faults disrupt the Prairie Creek Formation rocks: the Grogan fault, the Lost Man fault, and the Surpur Creek fault. With the exception of areas directly adjacent to the above three faults, Prairie Creek strata have uniformly shallow dips. Broad open folds with fold axes that plunge gently to the north characterize folding in the Lost Man Creek watershed. Exposures of this unit on flat ridge tops and summit areas are deeply weathered.

Timber Harvest History

The 1954 air photos covering Lost Man Creek show that the A100 had been constructed and that much of the timber on the hillslopes above and below the road had been harvested (Figure 2). The slopes adjacent to the A100 were primarily cable yarded. An equipment repair shop had been constructed near station 126+00 on the A100. An area east of the southern portion of the A200 had been tractor yarded by 1954, but the A200 had not yet been constructed along its present alignment. By 1962, the A200 had been constructed along its present alignment. All of the slopes east of the A200 up to station 30+00 and on both sides of the remainder of the A200 had been harvested using tractor-yarding techniques. A few small areas were tractor logged between 1962 and 1968. Between 1968 and 1973, the slopes downslope of the A200 up to station 30+00 were tractor logged with a high density of skid roads. Seed-tree leave was the dominant silvicultural practice used prior to 1962 and clearcutting was used between 1962 and 1973. No additional timber harvesting was performed after 1973 and the equipment repair shop on the A100 was removed between 1973 and 1978.

Erosional Features

The most dominant erosional features were partially failed stream crossings. None of the crossings had culverts and were either Humboldt or fill crossings. Two crossings on the A100 were partially failed making the road undrivable. The first two crossings on the A200 were still intact but water ran across the road and down the fill slope. Portions of the fill in these crossings were saturated due to the water flowing across and down the road. During the New Year's storm on January 1, 1997, another crossing on the A200 failed making the road undrivable. A debris flow also occurred during this storm downslope of the A200 and terminated on the B550. This debris flow appears to have been caused by water being diverted down skid roads. During the winter of 1997-1998 a portion of the outboard edge of the A200 failed and slid into the creek just uproad of the crossing that failed on January 1, 1997. There was an old slide which occurred prior to 1954 that began upslope of the A100 and deposited material on the A100.

Threatened and Endangered Species Concerns and Work Schedule

Two bird species that are listed as threatened under the Endangered Species Act occupy areas in or near the project area: the northern spotted owl and the marbled murrelet. On May 6, 1997, coho salmon were also listed as a threatened species. Because old-growth forests serve as critical habitat for these species, Redwood National and State Parks is considered a critical conservation area for their survival.

The U.S. Fish & Wildlife Service (USFWS), as administrator of the Endangered Species Act for northern spotted owl and marbled murrelet, has set noise and habitat modification restriction guidelines designed to reduce human impact, especially to nesting sites during the breeding season. The National Marine Fisheries Service (NMFS) is responsible for administering the Endangered Species Act for protection of the coho salmon.

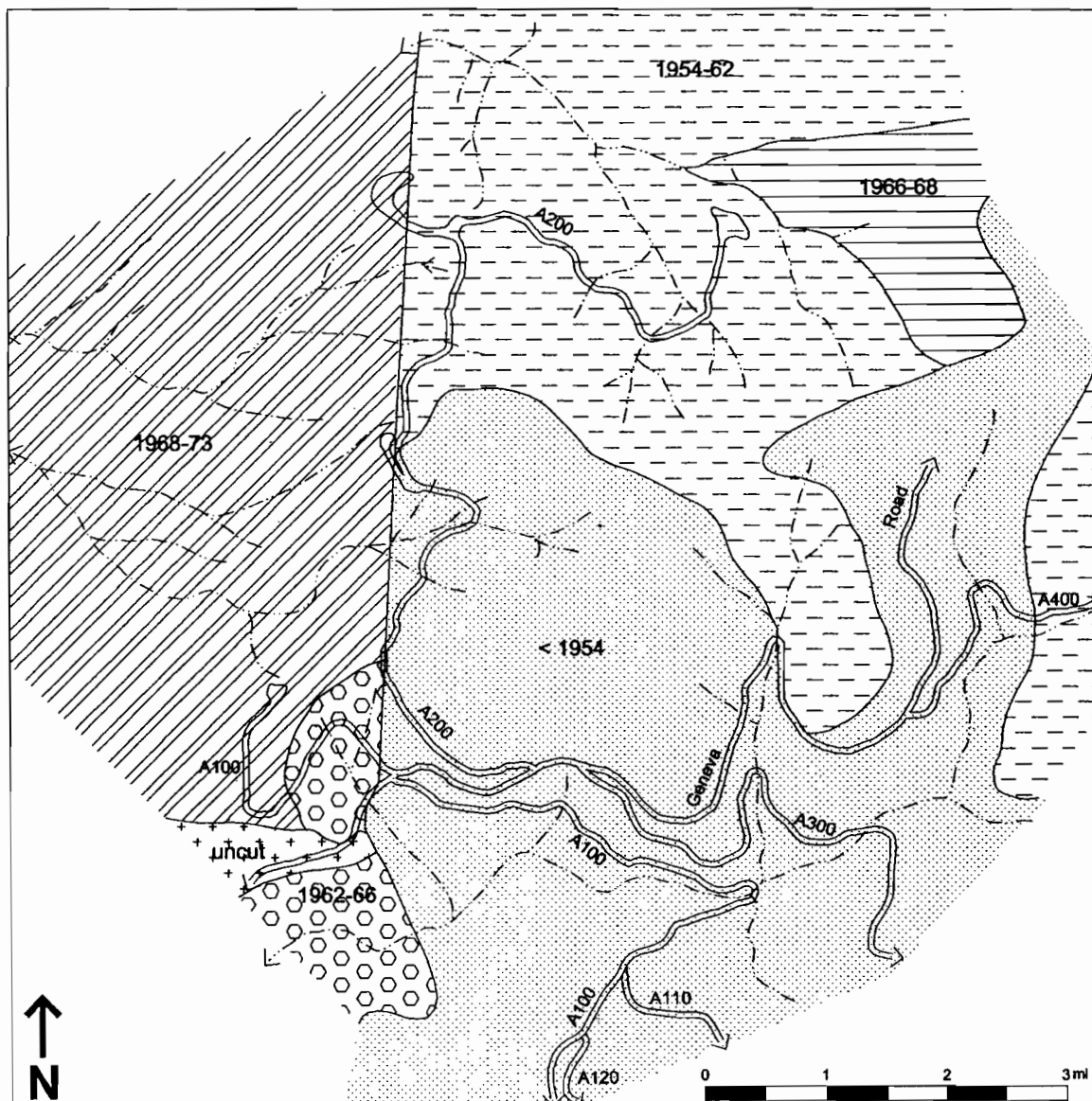


Figure 2: Timber Harvest History

In July, 1998, Biological Assessments (BA) and Biological Opinions (BO) to determine the effects 1997 Storm restoration projects on threatened and endangered species and their critical habitat were completed by RNP, USFWS, and NMFS. The purpose of the BA/BOs was to meet the criteria for formal consultation with the USFWS and NMFS as required under Section 7 of the Endangered Species Act of 1973, as amended. The BA/BOs determined that restoration work on the A100 could begin on June 15 and work on the A200 could begin on July 10. Work on both roads could continue until October 15. Work could continue until Nov. 1 if weather and soil conditions were dry so that the work would not introduce sediment to watercourses.

In addition, areas around the A100 and A200 were surveyed for marbled murrelets in the spring and summer of 2000 in order to provide compliance for future road removal projects. Murrelets were detected within ¼ mile of the A100. Once these detections occurred, limited daily operating periods were instituted by restricting heavy equipment operations to the time period from two hours following sunrise to two hours prior to sunset. Murrelets were not detected within ¼ mile of the section of the A200 that was removed in 2000.

RESTORATION WORK

Project Implementation

Restoration work focused on restoring the land to a condition similar to what would have existed without disturbance by humans. This included complete excavation of road fill out of stream crossings and swales, complete outslowing of the road, and rebuilding of ridges resulting in the road fill being shaped to mimic the natural hillslope topography above and below the road (Figures 3 and 4). Recontouring provides a solid, beneficial foundation morphologically, hydrologically, and aesthetically for landscape evolution.

The project geologist, Becca Smith, mapped geomorphic and hydrologic features, prescribed restoration treatments, surveyed the volumes of all worksites before and after excavation, prepared the contract, oversaw heavy equipment operations as the government technical representative (GTR), photo documented the work, and wrote the final report. Terry Spreiter served as the site inspector in Becca's absence and also mapped the site. Dave Heaton and Phil Freiberg assisted with surveying.

Heavy Equipment Phase

The heavy equipment phase included completion of all primary restoration treatments. A total of 0.5 mile of the A100 and 0.9 mile of the A200 were removed at a total heavy equipment cost of \$219,586. A total of 47,184 yds³ of material was excavated from 7 haul road stream crossings (19,510 yds³), 9 skid road stream crossings (2,931 yds³), 1613 feet of haul road export outslope (6,892 yds³), 150 feet of skid road export outslope (1,914 yds³), 3738 feet of haul road outslope (14,727 yds³), and 780 feet of skid road outslope (1,210 yds³). The haul road surface was ripped prior to placement of fill on fillsites.

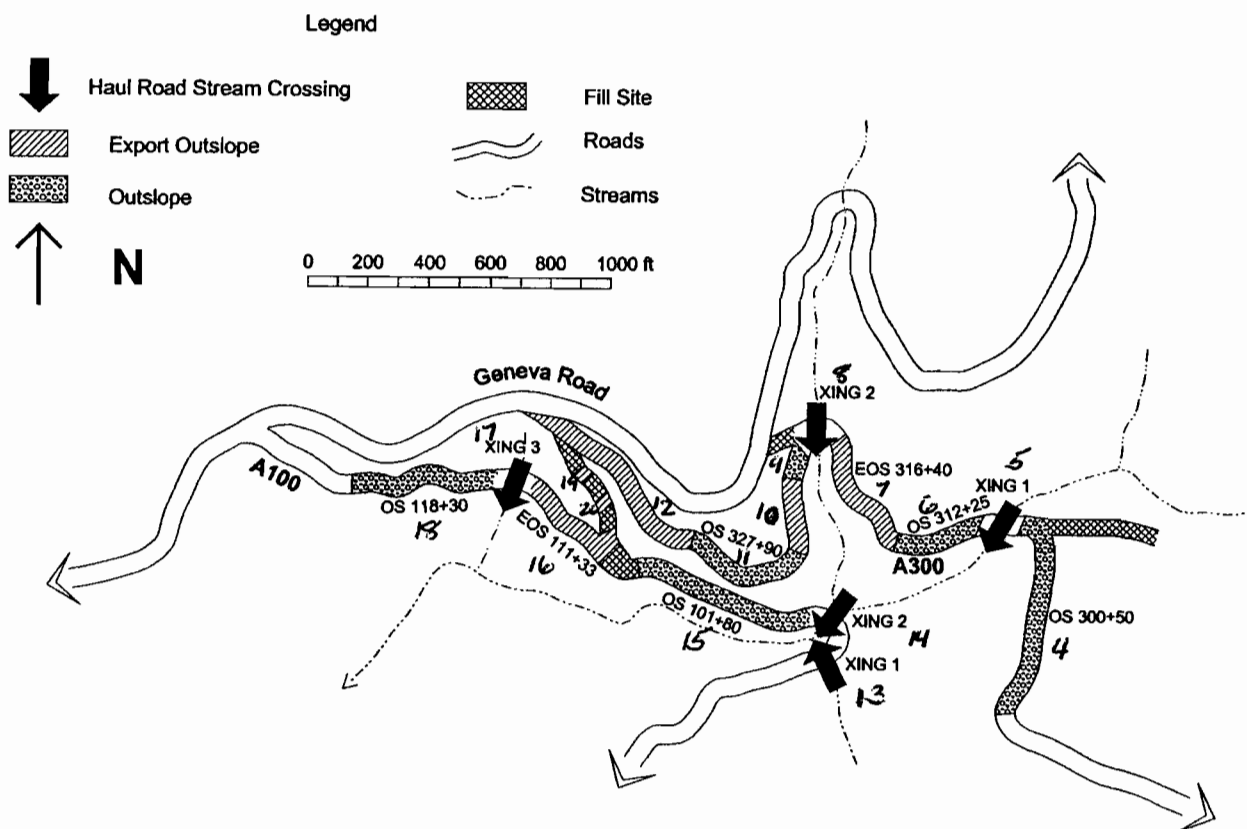


Figure 3: Location of Treatment Types on the A100 and A300. Work on the A300 was not done in 2000.

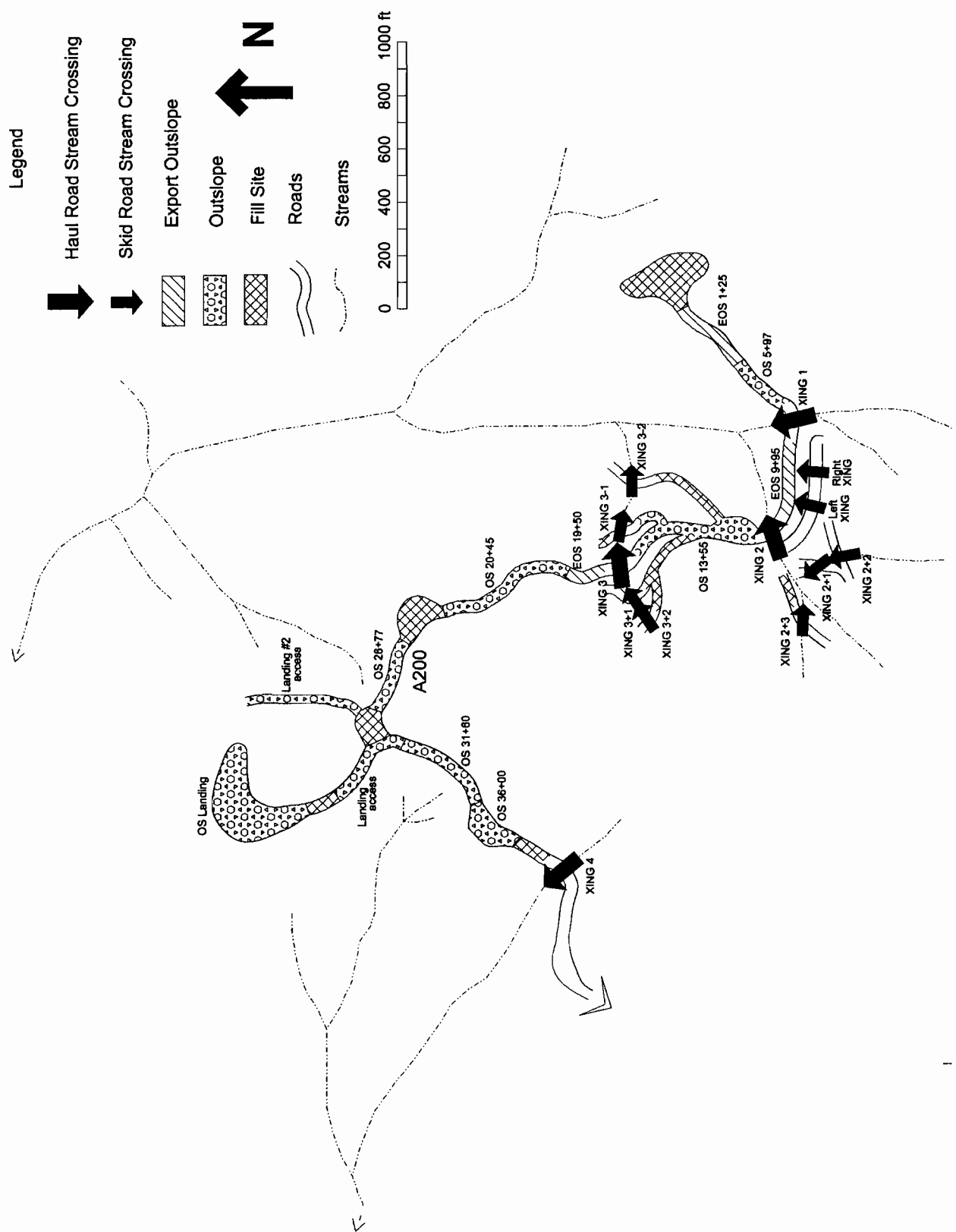


Figure 4: Location of Treatment Types on the A200

The heavy equipment phase was done through a cooperative agreement with the Yurok Tribe. The cooperative agreement was established between Redwood National Park and the Yurok Tribe on June 1, 1999 prior to the start of road removal projects in 1999. The project statement for the A100 and A200 project was issued on July 12, 2000. The heavy equipment work began on July 13, 2000 and was suspended for the winter season on October 16, 2000.

The following equipment was used: a John Deere 330LC excavator with thumb; a John Deere 850C dozer with rippers; and a John Deere 230LC excavator with thumb. The equipment operators were Richard Nelson, 330; Walter Lara III, 850; and Lawrence (Mackey) Nix, 230.

Stream Crossings

A summary of stream crossing excavation costs and production rates is shown in Table 2. A narrative of the excavation of the crossing follows.

A100

XING-1

This stream has a large volume of flow. The center of the crossing was entirely blown out with the stream flowing down the middle of the crossing on its original channel bed. There were two large Humboldt logs visible along the channel bed. This crossing would have required a substantial rebuild with a large culvert or bridge in order to get vehicles or equipment across it. In order to avoid crossing this stream, the right side of the crossing was excavated as part of this project. The left side will be excavated from the other side of the A100. Since we did not cross the stream, the flowing water did not cause any problems. The fill was dry and rocky. The amount of fill removed was small and the fillsites were less than 300 feet away. There was a well developed flood plain adjacent to the stream.

XING-2

This was another small crossing with substantial flow. The outboard edge of this crossing had failed, exposing Humboldt logs. Two streams came together immediately upstream of the A100 at this site. Some fill had been deposited in the channel behind the road fill. The volume of fill was small and the fill was not deep, so the crossing was excavated quickly without the water flow creating a problem. Most of the fill was dry except in the channel bed and in the aggraded area at the top of the crossing. Fillsites were adjacent to the crossing. Both this crossing and Xing-1 were completed on the first day of work.

XING-3

A small amount of water was flowing into the top of this crossing and across the road. As soon as the dozer began dishing down the road, it hit saturated fill. The water flowing across the road also began running into and ponding in the excavation. Rich and Walt decided to get some flex pipe and divert the water that was flowing into the top of the crossing around the excavation. This helped but there was still water flowing through the fill throughout the excavation. A seep was encountered on the upper left side of the crossing so we did not place fill in that area.

A200

XING-1

This crossing included two skid crossings, one immediately above and one immediately below the haul road crossing. The fill from all these crossings interfingered, so they were excavated as a single crossing. The upper portion of the crossing where the skid crossing was, was a large, flat area. The water from the stream flowed onto this area and meandered around it until it went over the edge, flowed across the A200, down the fill slope and across the lower skid crossing. Despite this flow pattern the crossing was largely intact. Brow logs were visible in the outboard edge of the A200.

The fill was surprisingly dry when we began dishing down the outboard edge of the A200 considering that the water had been flowing across the road. The fill and the original ground exposed in the cutbanks were pure sand with occasional pebbles. There was very little wood in much of the fill and the topsoil was poorly defined. This made it difficult to determine original ground in places. There were a lot of rootwads in the channel bottom. The topsoil may have been destroyed when the rootwads were pushed into the channel.

Once we dug through the dry fill under the A200, the rest of the fill was very wet. Nearly all of the fill had to be pushed 600 feet since there wasn't much local fill space. The small dozer was unable to push the mud to the fillsite fast enough to keep up with the excavator. This caused the work to progress slowly with the excavator having to wait for the dozer to return from the fillsite.

The water coming into the top of the crossing was diverted around the work area with flex pipe, but a spring was encountered on the right bank in the push road and a smaller spring was encountered on the left bank. The push road was on the right bank of the crossing. Because the "bedrock" was soft sand and the A200 was not rocked, it was difficult for the equipment operators to feel when they were hitting the road surface under the mud. This resulted in the push road being dug down a little bit during each dozer pass or when the excavator was scooping mud off the road. The road ended up being several feet lower than it originally was. This was subsequently filled in when the push road was outsloped.

XING-2

This crossing included one skid crossing immediately above the haul road crossing. The fill from these crossings interfingered, so they were excavated as a single crossing. The upper portion of the crossing where the skid crossing was, was a large, flat area. The water from the stream flowed over the skid crossing and had cut a channel through the fill down to the A200. The water then flowed across the A200 and down the fill slope. Despite this flow pattern the crossing was largely intact. Brow logs were visible in the outboard edge of the A200.

The primary fill site was located adjacent to the crossing on the left side. There was also some space on the right side of the crossing. However, as the excavation progressed, the EOS to the right of the crossing and the crossing itself ended up being larger than expected. This necessitated searching for and using skid roads as additional fill sites. The water coming into the top of the crossing was diverted around the work area with flex pipe, but the pipe frequently had to be repositioned as the work progressed or repaired when it was broken. Much of the fill was

wet, especially at the upper end of the crossing. Towards the end of the excavation, the fill site became so wet that the dozer could no longer work on it. The excavators finished up the fill site. Several large logs were encountered during this excavation. Mid way through this excavation, a second excavator (JD 230) arrived on site. This excavator greatly facilitated excavation of this crossing and the rest of the bid items.

XING-3

This crossing was much smaller than either Xing 1 or 2 and therefore did not provide as many complications. This crossing did have some water running down it, but since the crossing was small, the equipment did not have to get right down into the saturated fill. This crossing contained lots of sandstone boulders.

XING-4

This was a broad, shallow crossing. It did not have flowing water and was uncomplicated to excavate. The fill was pushed into a small throughcut to the right of the crossing.

SKID XINGS

Nine skid road crossings were excavated in addition to those that were excavated as a part of Xings 1 and 2. The skid road crossings ranged from relatively dry, broad swales, to wet, steep, channels with steep side slopes. Xings 2+1 and 2+2 above Xing 2 were designed as separate skid road crossings. However, as the work progressed, the excavations joined together. The other skid road crossings were identified and excavated while the work was in progress.

Export Outsloping

A summary of export outslope excavation costs and production rates is shown in Table 3. Export outslope treatments were done in four road reaches and two skid road reaches where there was not sufficient space against the cutbank within the item to store all the material. The fill was pushed to other fill sites with the dozers. A narrative of the export outslope excavations follows.

A100

EOS 500+00 and 502+76 were steep and narrow. Original ground was easy to follow in EOS 500+00 but was much more difficult to follow in EOS 502+76. As excavation progressed in EOS 500+00, it appeared that this excavation would connect with a portion of EOS 334+06 on the A300 road. The upper end of EOS 500+00 was left unfinished because we planned to finish it in conjunction with excavating EOS 334+06. Unfortunately EOS 334+06 was not excavated during 2000, so the upper end of EOS 500+00 will have to be finished at a later date.

EOS 111+33 was an outsloped road bench that included two little swales. The swale at station 114+00 was dry but narrow and steep sided. Because of this shape, the excavator got stuck in the narrow channel bottom. A spring was discovered at the base of the cutbank at station 116+00. We decided to fill only about half way up the cutbank at this location due to the spring.

A200

EOS 1+25 was dry and was excavated without incident. EOS 9+95 was originally designed as an outslope. The excavation became wider, deeper, and wetter than expected with fill extending all the way down to the creek. Approximately 20-30 yds³ were left at the base of the slope next to the creek as this fill was not cost effective to excavate. EOS 19+50 was a small export outslope that was excavated without incident.

Outsloping**A100 and A200**

A summary of outslope excavation costs and production rates is shown in Table 4. All of the outsoles with the exception of OS Landing were dry and were excavated without incident. OS Landing involved outsloping the outboard edge of a large landing. The landing contained a large amount of fill and was extremely rocky. The large rocks made ripping the landing difficult and slowed excavation.

Miscellaneous Bid Items

A summary of miscellaneous bid item costs is shown in Table 5. All miscellaneous bid items were lump sum items. Ripping was done by the dozer to decompact the remaining road bench and inboard ditch underneath fillsites. The park paid the Tribe additional money to cover extra costs due to misunderstandings regarding whether the work was in Area 1 or 2 for wage rate determination and for other reasons. These costs are listed as administrative costs in Table 5.

Non-Bid Items

Non-bid items are categorized as jobs that result in non-recoverable costs on the part of the cooperator. These items are distinguished by requiring time that is generally not directly attributable to any specific bid item. Non-bid item times were recorded to compare the costs of the agreement with that of an hourly rental contract. Table 6 provides a cost breakdown for non-bid items.

“Discussion time” is defined as periods of time where equipment operations were interrupted by discussions lasting 15 minutes or more. Several shorter discussion periods were sometimes combined into one when they added up to approximately 15 minutes (time was recorded in 15 minute intervals). Most of the discussion time recorded was when the operators and GTR or site inspector would stop to discuss the progress of a particular phase of a bid item or develop a strategy for the work. On occasion, the GTR or site inspector would interrupt the operators to make sure that the specifications of the agreement were understood and would be met.

“Stuck” refers to a piece of equipment getting stuck in the mud and needing to be pulled out with another piece of equipment. This includes both the time one piece was stuck and the time another piece spent assisting in rescuing the stuck equipment.

“Down time” occurred when equipment was unable to perform at its expected capacity. Down time was most often the result of mechanical failure.

“Idle time” represents the time a piece of equipment was inactive while work proceeded. Idle time differs from down time in that the equipment could be used but the cooperators or operators chose not to use it.

Labor Intensive Phase

Labor intensive restoration and erosion control work usually includes all secondary treatments for surface erosion which, in the past, have typically involved the application of straw mulch to critical areas on finished rehabilitation worksites. Straw mulch was not applied on unit 00-1 for several reasons. Logs and brush were placed on the surface, which helped protect it from surface erosion. After restoration work was completed, redwood fronds and alder leaves naturally dropped from the surrounding second-growth forest onto the finished surface. Natural revegetation, especially initial alder growth, is expected to be excellent. Previous studies indicate that straw may not be good in forest settings since it alters the soil to be more like that of a grassland and it may also introduce exotic species.

No labor-intensive work was done on this project.

Documentation Phase

The final restoration phase is the documentation process. This includes post-heavy equipment volumetric surveys, photo point documentation, cost data compilation, and writing the restoration project report. This work was done by Becca Smith and Dave Heaton, and was completed in December 2001.

DISCUSSION

Project 00-1 met the goals of the watershed restoration program by minimizing human-caused potential erosion and sedimentation from roads into creeks and onto hillslopes. Road fill was removed from stream crossings, swales, and road benches and natural topography and hydrology were restored. Topsoil was uncovered where possible. Woody debris was spread on the finished slopes. A total of 47,184 surveyed yds³ were excavated from potentially unstable areas and moved to stable fillsites at a total heavy equipment cost of \$219,586 which equates to an overall average of \$4.65/yds³.

This work was done under a cooperative agreement with the Yurok Tribe. The equipment operators, especially Richard Nelson and Walter Lara III, were good operators. They were very conscientious about their work and continuously strived to do a top quality job. Working with the Tribe's watershed program managers was frustrating at times. The operators had a difficult time convincing the managers that more equipment was needed on the site. Additional

equipment arrived weeks after it was requested, if it arrived at all. The overall production rate was much slower than was anticipated at the beginning of the season. This agreement covered work on the A100, all of the A200 and a portion of the A300. By October 16, only the A100 work and about half of the A200 had been completed. Misunderstandings regarding whether the work was in Area 1 or 2 for wage rate determination, resulted in the park paying the Tribe additional money to cover the difference in wages between the two areas and for other reasons. Despite these problems, the finished product was very good due to the skill and diligence of the operators.

TABLE 2 STREAM CROSSING EXCAVATION COSTS AND PRODUCTION RATES FOR UNIT 00-1, A100/A200 ROADS											
Worksite	Volume (yds ³)	Heavy Equipment Hours			Total Costs		Unit Costs		Original Price (\$/yd ³)	Average Fillsite Dist. (ft)	Excav. Rate ^b (yds ³ /hr)
		John Deere 330 LC	John Deere 850 C	John Deere 230 LC	Actual	H.E.R.E. ^a	Actual (\$/yd ³)	H.E.R.E. ^a (\$/yd ³)			
A100											
XING 1	589	4.75	1.50	0.00	\$2,297	\$913	\$3.90	\$1.55	\$3.90	50	94
XING 2	531	3.00	3.25	0.00	\$2,071	\$849	\$3.90	\$1.60	\$3.90	50	85
XING 3	2,612	26.25 ^c	26.50 ^c	0.00	\$10,187	\$7,196	\$3.90	\$2.75	\$3.90	450	50
Total/Ave.	3,732	7.75	4.75	0.00	\$14,555	\$8,958	\$3.90	\$2.40			299
A200											
XING 1	7,421	201.00	166.50	0.00	\$57,450	\$50,802	\$7.74	\$6.85	\$4.50	600	20
XING 2	6,216	115.00	107.50	53.00	\$27,972	\$38,248	\$4.50	\$6.15	\$4.00	100	23
XING 3	1,038	1.75	2.50	2.00	\$4,152	\$858	\$4.00	\$0.83	N/A ^d	75	166
XING 4	1,103	2.75	11.75	8.00	\$4,412	\$2,981	\$4.00	\$2.70	\$3.70	75	49
Total/Ave.	15,778	320.50	288.25	63.00	\$93,986	\$92,889	\$5.96	\$5.89			23
A200 - Skid Roads											
Left Xing above EOS	150 ^e	2.00	0.00	0.00	\$555	\$310	\$3.70	\$2.07	N/A ^d	25	75
Right Xing above EOS	300 ^e	6.25	0.00	0.00	\$1,110	\$969	\$3.70	\$3.23	N/A ^d	25	48
XING 2+1	444	0.75	1.00	0.00	\$1,776	\$234	\$4.00	\$0.53	\$4.00	50	254
XING 2+2	518	4.50	3.75	0.00	\$2,072	\$1,140	\$4.00	\$2.20	\$4.00	75	63
XING 2+3	100 ^e	1.00	0.00	0.00	\$400	\$155	\$4.00	\$1.55	N/A ^d	25	100
XING 3+1	250 ^e	1.25	1.25	0.00	\$1,000	\$341	\$4.00	\$1.37	N/A ^d	50	100
XING 3+2	200 ^e	0.50	0.75	0.00	\$800	\$166	\$4.00	\$0.83	N/A ^d	25	160
XING 3-1	148	0.50	0.00	1.50	\$592	\$297	\$4.00	\$2.00	N/A ^d	30	74
XING 3-2	821	8.25	5.75	1.00	\$3,284	\$2,103	\$4.00	\$2.56	N/A ^d	75	55
Total/Ave.	2,931	25.00	12.50	2.50	\$11,589	\$5,715	\$3.95	\$1.95			73

^a Heavy Equipment Rental Equivalent (H.E.R.E.) is the cost to complete each job based on the actual hours worked. These rates are: John Deere 330 hydraulic excavator @ \$155/hr, John Deere 850 dozer @ \$118/hr, and John Deere 230 hydraulic excavator @ \$146/hr.

^b Excavation Rate = volume excavated divided by the total of all equipment time for each worksite.

^c Hours were not recorded for all hours the equipment worked on this crossing. These hours underestimate the actual time worked.

^d These work items were added or the treatment was changed during excavation. Therefore, there was no original bid price.

^e Volume is estimated. Surveys were not conducted.

TABLE 3
EXPORT OUTSLOPE EXCAVATION COSTS AND PRODUCTION RATES FOR UNIT 00-1, A100/A200 ROADS

Worksite	Volume (yds ³)	Heavy Equipment Hours			Total Costs		Unit Costs		Original Price (\$/yd ³)	Average Fillsite Dist. (ft)	Excav. Rate ^b (yds ³ /hr)
		John Deere John Deere John Deere 330 LC 850 C 230 LC			Actual	H.E.R.E. ^a	Actual (\$/yd ³)	H.E.R.E. ^a (\$/yd ³)			
A100											
EOS 111+33	3,956	17.25	16.50	0.00	\$15,428	\$4,621	\$3.90	\$1.17	\$3.90	300	117
A200											
EOS 1+25	1,405	3.75	9.50	0.00	\$5,480	\$1,702	\$3.90	\$1.21	\$3.90	100	106
EOS 9+95	1,229	18.50	17.75	0.00	\$4,793	\$4,962	\$3.90	\$4.04	NA ^c	200	34
EOS 19+50	302	1.00	0.75	0.00	\$1,178	\$244	\$3.90	\$0.81	NA ^c	50	173
Total/Ave.	2,936	23.25	28.00	0.00	\$11,450	\$6,908	\$3.90	\$2.35			57
A100 - Skid Roads											
EOS 500+00	1,146	7.75	8.75	0.00	\$4,469	\$2,234	\$3.90	\$1.95	\$3.90	75	69
EOS 502+76	768	5.00	4.00	0.00	\$3,072	\$1,247	\$4.00	\$1.62	\$4.00	50	85
Total/Ave.	1,914	12.75	12.75	0.00	\$7,541	\$3,481	\$3.94	\$1.82			75

^a Heavy Equipment Rental Equivalent (H.E.R.E.) is the cost to complete each job based on the actual hours worked. These rates are: John Deere 330 hydraulic excavator @ \$155/hr; John Deere 850 dozer @ \$118/hr; and John Deere 230 hydraulic excavator @ \$146/hr.

^b Excavation Rate = volume excavated divided by the total of all equipment time for each worksite.

^c These work items were added or the treatment was changed during excavation. Therefore, there was no original bid price.

**TABLE 4
OUTSLOPE EXCAVATION COSTS AND PRODUCTION RATES FOR UNIT 00-1, A100/A200 ROADS**

Worksite	Volume (yds3)	Heavy Equipment Hours			Total Costs		Unit Costs		Original Price (\$/yd³)	Average Fillsite Dist. (ft)	Excav. Rate ^b (yds³/hr)
		John Deere 330 LC	John Deere 850 C	John Deere 230 LC	Actual	H.E.R.E. ^a	Actual (\$/yd³)	H.E.R.E. ^a (\$/yd³)			
A100											
OS 101+80	3,262	23.75	18.50	0.00	\$9,460	\$5,864	\$2.90	\$1.80	\$2.90	75	77
OS 118+30	3,136	21.50	14.25	0.00	\$8,938	\$5,014	\$2.85	\$1.60	\$2.85	75	88
Total/Ave.	6,398	45.25	32.75	0.00	\$18,397	\$10,878	\$2.88	\$1.70			82
A200											
OS 5+97	568	5.75	0.00	0.00	\$1,647	\$891	\$2.90	\$1.57	\$2.90	50	99
OS 13+55	1,314	4.50	7.75	15.50	\$3,811	\$3,875	\$2.90	\$2.95	\$2.90	50	47
OS 20+45	1,069	2.75	9.25	4.50	\$3,100	\$2,175	\$2.90	\$2.03	\$2.90	50	65
OS 26+65	542	4.00	6.50	4.50	\$1,518	\$2,044	\$2.80	\$3.77	\$2.80	100	36
OS Landing	3,361	24.50	29.75	17.75	\$9,747	\$9,900	\$2.90	\$2.95	\$2.80	150	47
OS Landing access	551	4.50	1.50	13.00	\$1,598	\$2,773	\$2.90	\$5.03	\$2.80	25	29
OS 31+60	774	3.50	9.00	9.75	\$2,245	\$3,028	\$2.90	\$3.91	\$2.90	50	35
OS 36+00	150	3.50	1.75	9.25	\$435	\$2,100	\$2.90	\$14.00	\$2.90	100	10
Total/Ave.	8,329	53.00	65.50	74.25	\$24,100	\$26,785	\$2.89	\$3.22			43
A200 - Skid Roads											
OS Xing 2+2 access	200 ^d	2.25	0.00	0.50	\$560	\$422	\$2.80	\$2.11	NA ^e	25	73
OS Xing 3-1 access	150 ^d	0.00	0.00	2.00	\$435	\$292	\$2.90	\$1.95	NA ^e	25	75
OS Landing #2 access	860 ^d	7.25	4.25	0.00	\$2,494	\$1,625	\$2.90	\$1.89	NA ^e	30	75
Total/Ave.	1,210	9.50	4.25	2.50	\$3,489	\$2,339	\$2.88	\$1.93			74

^a Heavy Equipment Rental Equivalent (H.E.R.E.) is the cost to complete each job based on the actual hours worked. These rates are: John Deere 330 hydraulic excavator @ \$155/hr; John Deere 850 dozer @ \$118/hr; and John Deere 230 hydraulic excavator @ \$146/hr.

^b Excavation Rate = volume excavated divided by the total of all equipment time for each worksite.

^c These work items were added or the treatment was changed during excavation. Therefore, there was no original bid price.

^d Volume is estimated. Surveys were not conducted.

TABLE 5 MISCELLANEOUS BID ITEM COSTS FOR UNIT 00-1, A100/A200 ROADS									
Job	Quantity	Heavy Equipment Hours			Total Costs		Unit Costs		Original Price (\$/unit)
		John Deere 330 LC	John Deere 850 C	John Deere 230 LC	Actual	H.E.R.E. ^a	Actual (\$/unit)	H.E.R.E. ^a (\$/unit)	
Move In	1				\$4,000	\$7,000	NA	NA	\$4,000
Move Out	1				\$2,500	\$7,000	NA	NA	\$2,500
Ripping - A100	2,232	0.00		2.00 ^b	\$1,562	\$236	\$0.70	\$0.11	0.70
Ripping - A200	4,162	0.00		3.00 ^b	\$2,081	\$354	\$0.50	\$0.09	0.50
Administrative Costs	1				\$8,907	NA	NA	NA	
Total					\$19,051	\$14,590			

^a Heavy Equipment Rental Equivalent (H.E.R.E.) is the cost to complete each job based on the actual hours worked. These rates are: John Deere 330 hydraulic excavator @ \$155/hr; John Deere 850 dozer @ \$118/hr; and John Deere 230 hydraulic excavator @ \$146/hr.

^b This is all the hours of ripping that were recorded, however it is likely that more hours of ripping occurred.

TABLE 6 NON-BID ITEM COSTS FOR UNIT 00-1, A100/A200 ROADS					
Job	Heavy Equipment Hours			Total H.E.R.E. ^a Costs	
	John Deere 330 LC	John Deere 850 C	John Deere 230 LC		
Discussions / Breaks	40.25	39.75	15.50	\$13,192	
Scouting	3.25	0.75	0.75	\$702	
Getting supplies from town	0.00	4.25	0.00	\$502	
Walking Equipment	0.50	0.25	0.00	\$107	
Bury Cable	0.00	0.00	0.50	\$73	
Winterizing (slope and drain)	1.00	1.50	0.50	\$405	
Subtotal	45.00	46.50	17.25	\$14,981	
Down	16.50	12.50	4.50	NA	
Idle	7.25	16.25	0.00	NA	
Fueling	3.00	4.00	0.00	NA	
Lunch	5.50	6.00	0.00	NA	
Totals	77.25	85.25	21.75		

^a Heavy Equipment Rental Equivalent (H.E.R.E.) is the cost to complete each job based on the actual hours worked. These rates are: Komatsu 220 hydraulic excavator @ \$150/hr; Caterpillar D8L dozer @ \$200/hr; Komatsu 400 hydraulic excavator @ \$200/hr; and Caterpillar D8H dozer @ \$165/hr.

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