

orig file

FINAL REPORT

Upper Devil's Creek Rehabilitation Unit Site 80-4

Contract #CX 8480-0-0009

Submitted by

Jack Monschke, Contractor

P.O. Box 467

Miranda, CA 95553

February 1, 1981

REDWOOD N. P.
LIBRARY
South Operations Center

ORDER OF EVENTS

Invitation for Proposal	June 13, 1980
Show-Me	June 26, 1980
Proposal Opening	July 24, 1980
Proposal Award	August 29, 1980
Start Work -- Heavy Equipment and Camp Set Up	Sept. 3, 1980
Start Work -- Labor-Intensive	Sept. 12, 1980
Heavy Equipment Work Completed	Sept. 24, 1980
Labor-Intensive Work Completed	Oct. 21, 1980
Start Work -- Winter Maintenance	Dec. 3, 1980
Start Work -- Vegetal	Dec. 14, 1980
Vegetal Work Completed	Jan. 25, 1981
Anticipated Completion of Winter Maintenance	April 30, 1981

INTRODUCTION

The purpose of this Final Report is to document and evaluate the Upper Devils Creek Rehabilitation Project, contract # CX 8480-0-0009, for Redwood National Park. The objective of this project was to rehabilitate this cut-over watershed by restoring the natural drainage network and promoting the recovery of the natural vegetal cover.

The 220-acre unit was divided into three areas in order to make it more manageable: Area I being the cut block logged in 1958 at the top of the unit, bordered by the O-2 Road on the north, Area II being the cut block logged in 1972 lying between the O-2 Road and the O-2-1 Road, and Area III being the cut block logged in 1975 on the bottom of the unit, lying between the O-2-1 Road and the Y-Z Road (see Map 1). The central portion of Area III contains all the perennial streams on the unit and 80% of the rehab work. The streams are lettered from east to west, A-D.

This proposal was prepared by Jack Monschke, and the contract was carried out as a private venture. Although full financial, legal, and organization responsibility and liability rested on the contractor, an effort was made to encourage the workers to share in on-site decision making. Basically, an attempt was made to take the best from both the co-operative structure and the private business structure: to give the workers a strong sense of pride and responsibility in their work and a freedom to implement their own ideas, and simultaneously to have a single individual upon whom final responsibility and decision making rested. This worked well -- the job was carried out efficiently without mega-hours of organizational meetings, the workers did an excellent job, and the Park representatives had a single responsible individual with whom to deal.

The camp and cook are vital aspects of crew morale and thus work quality. A camp co-ordinator was designated, and camp set up and break down crews were paid at the same labor rates as for other labor-intensive work. The camp was set up in a landing on the Y-2 Road at the bottom of the unit, with water coming from Stream A. The camp consisted of a small cook tent with propane stove, a yurt for eating and shelter, and two trailers. Most workers had their own sleeping tents. Gray water was filtered through a leach line excavated by the backhoe and filled with ten yards of aggregate. There was a compost privy. Three features of camp life stand out: 1) great meals prepared by a patient and good-humored cook, 2) a pleasant dining area and shelter in the yurt, and 3) unlimited hot showers.

The crew was a flexible unit of ten workers, each of whom had experience in some aspects of the work and could provide quality control in the areas of their expertise. One individual besides the contractor took a great deal of responsibility and, when logistics demanded it, acted as crew co-ordinator for half the crew while the contractor co-ordinated the other half. Sometimes jobs demanded even smaller units with three or four small groups working on various project sites.

Logistically the project was approached with the priority of finishing the work before the rains set in. Although it would have been preferable to complete the heavy equipment work before the labor-intensive crew arrived, the late date of bid opening and award made it mandatory to overlap the two phases of work. The first attempt to start both phases simultaneously proved logistically unmanageable, so the

labor-intensive crew went home for a week while the contractor, COR, and heavy equipment operators worked together. In the end, it was a good balance to have both heavy equipment and labor-intensive crews on site together; each saw the effectiveness of the other, and the "camp chemistry" (and thus the quality of the field work) thrived on the variety of personalities.

Work was completed on one channel at a time so that in case of rain there wouldn't be four partially finished channels. The heavy equipment work began on channel D at the Y-2 Road and proceeded up D, up B, and up A (there was no heavy equipment work on channel C except at the 0-2-1 Road). The labor-intensive crew began on Stream C to avoid being held up by heavy equipment, and proceeded to D, B, and A. The heavy equipment operators worked straight through, taking time off only to haul in fuel. The labor-intensive crew worked eight days on and five days off, which allowed the heavy equipment to stay far enough ahead to provide continuous work. After the heavy equipment and labor-intensive in-channel work was completed, work on the 0-2 and 0-2-1 Roads, and seeding and mulching was done. Finally, some of the hand waterbars were excavated. During the Winter Maintenance period more waterbars were excavated, conifers were planted, and transplanting was done.

STATEMENT OF WORK -- INTRODUCTION

Following is a site by site description of work tasks performed (with hours) with sites keyed to Map 2. Under each site will be listed the heavy equipment work, physical labor-intensive work, and vegetal work done at that site.

As a general introduction into the heavy equipment work done, it must be stated that the heavy equipment schedule included hauling twenty-four loads of rock with a ten-yard Mack Dump Truck from the Y-line rock pit to all accessible proposed excavation sites before other work began. All excavations and heavy equipment rocking were done with a D-6, six-way blade Caterpillar (D-6) and a Komatsu Track Backhoe Loader (B/L) with a 14-foot backhoe. The 0-2 and 0-2-1 Roads were ripped with a D-8 Caterpillar. It cannot be overemphasized that the success of this project is due in large part to the skill, commitment to quality, and willingness to communicate of the heavy equipment operators.

The physical (labor-intensive) work tasks performed are broken down as follows:

- 1) Hand Rock Work
 - a) Rearrangement of heavy-equipment-placed rock
 - b) Collection and placement of in-channel rock
 - c) Rock rip rap
 - d) Rock steps
- 2) Hand Excavation (which includes all stream channel clearance and shovel work, with the exception of waterbars, cross road drains, and drainage ditches, which are listed separately)

- 3) Other miscellaneous jobs (such as notching, bracing, etc.)
- 4) Special techniques, such as check dams, ravel catchers, rocking and staking, and slide stabilization are listed separately.

Each specific technique will be discussed at the first site where it was implemented.

Finally vegetal treatments are listed. The standard vegetal techniques are given here and are used consistently throughout, unless otherwise noted:

- 1) Seed: A mix of seven parts annual rye, seven parts perennial rye, and one part alder seed was applied with a belly grinder at the rate of 55 lb/acre.
- 2) Mulch: Straw was applied at the rate of 4,000 lb/acre.
- 3) Fertilizer: Chicken manure was applied at the rate of 1 lb/10 ft² in a 15' swath immediately adjacent to stream channels on both banks.
- 4) Conifers: A mix of 50% redwood and 50% Douglas fir was planted at 10' x 10' spacing (approx. 500/acre). An attempt was made to plant a higher percentage of redwoods in wetter areas, fir in drier areas, and to plant extra large redwood seedlings in wet, fertilized areas adjacent to stream channels.

Sites are described starting with Stream D at the Y-2 Road, working upstream in each channel and moving from west to east, as the work was performed in this order. Work site designations are somewhat complicated in that during the work phase -- for simplification -- all crossings were numbered from the bottom (the Y-2 Road) up (as D-1, D-2, D-3, etc.),

while other work sites (non-crossings) are still numbered as they were in the proposal -- by yardage from the 0-2-1 Road down (as D(364), D(255-267), etc.). See Map 2.

Following the description of work done at each site will be brief comment (if any) indicating difficulties, successes, frustrations, why certain things were done, etc.

Note abbreviations:

H.E. = heavy equipment

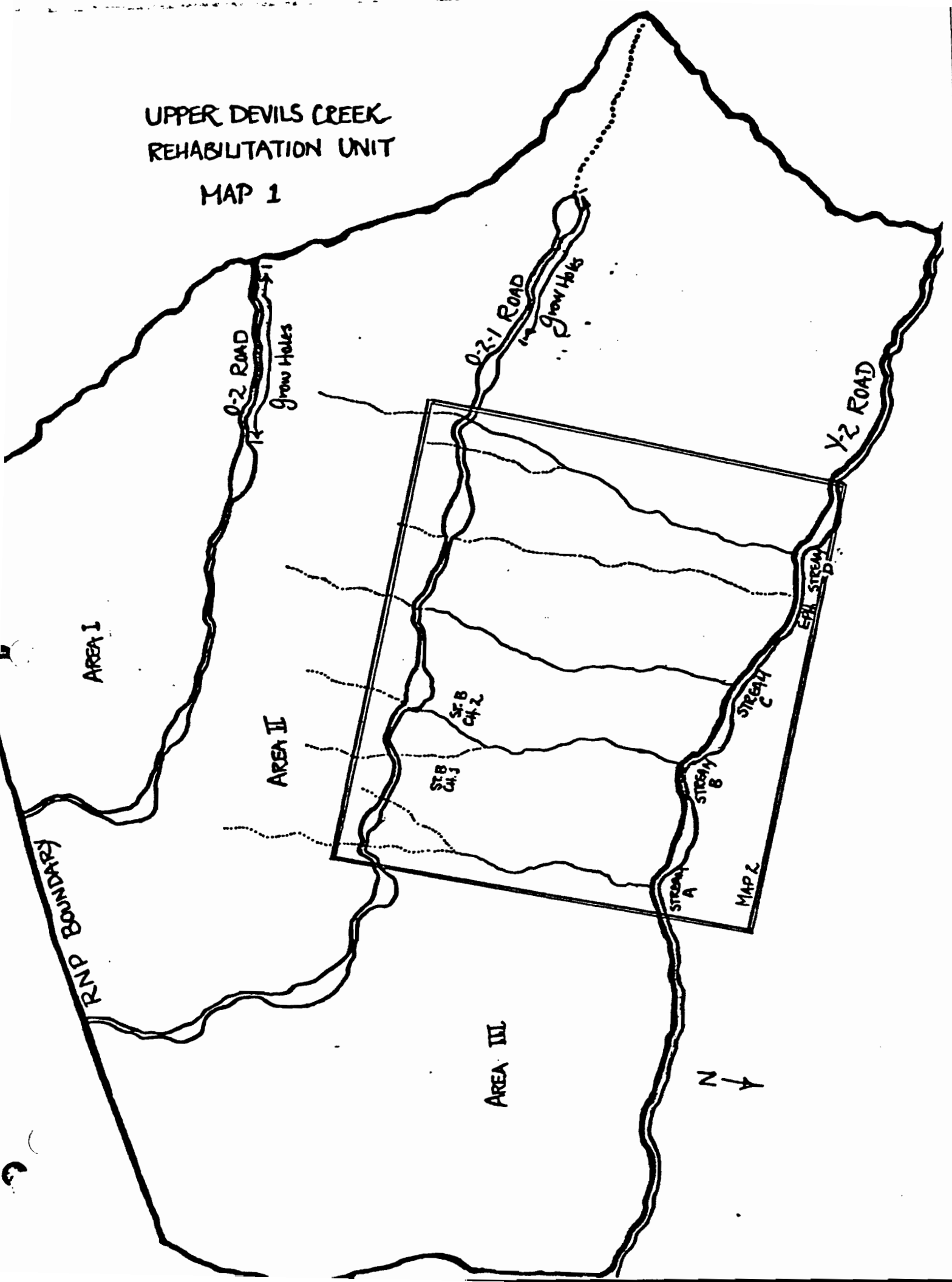
D-6 = D-6 Caterpillar

B/L = Backhoe Loader

Ex = Excavation

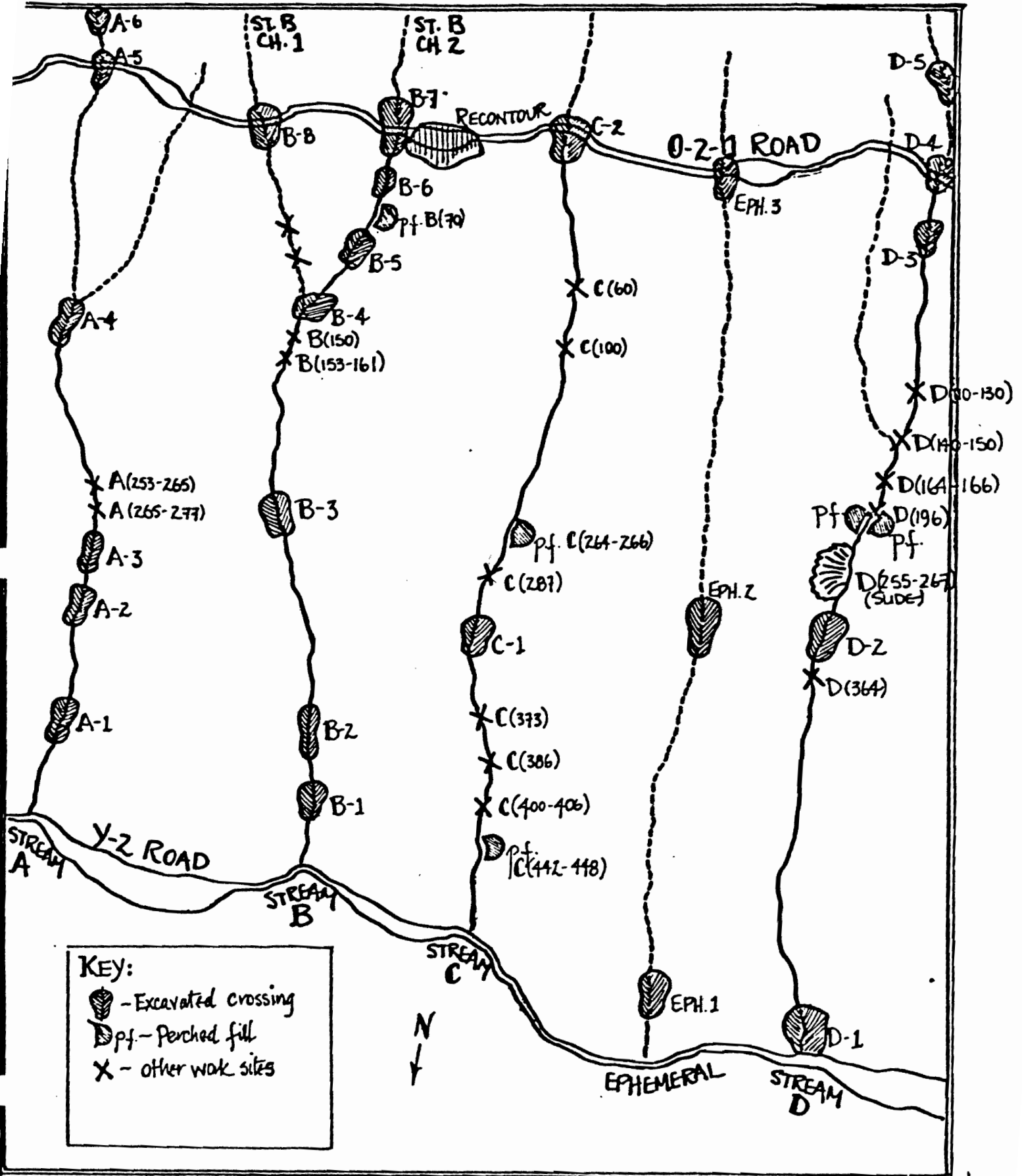
UPPER DEVILS CREEK
REHABILITATION UNIT

MAP 1



UPPER DEVILS CREEK REHABILITATION UNIT

MAP 2

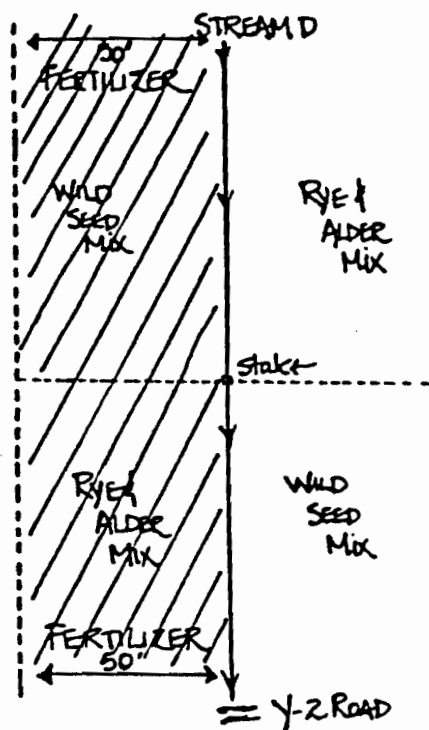


STATEMENT OF WORK

D-1/D(607-630)

H.E.	-- D-6'	Ex	7 hrs.
	B/L	Ex	2.5 hrs.
	B/L	Rock	4 hrs. (262 ft ²)
Physical	-- Hand Rock Work: Rearrangement	10 hrs. (263 ft ²)	
	Ravel Catchers: Milling, etc.	13 hrs.	
	Transport slabs	1 hr.	
	Split stakes	1.5 hrs.	
	Installation	17.5 hrs. (116 lin. ft)	
Vegetal	-- Seed, Mulch, Fertilizer, Conifers,		
	Wild Seed. Test Site.		
	(See diagram.)		

D-1



Note: Mulch applied & Conifers planted on entire crossing-

Comments: This was the first major excavation and is generally typical of work throughout the unit, although the slope of the excavated banks here is greater than on any other site. The channel is well defined at, or very close to, the original stream gradient. Rock (some of which is larger than would be necessary for channel

stabilization) was placed and secured in the excavated banks by the backhoe to provide protection from down-cutting and bank-cutting. The rocking time on this site was higher than average. Most channel rocking on this unit was done from dry banks, whereas at this site rock had to be hauled up the newly excavated and sloppy channel with the loader, which then had to back out, turn around, and back in so that the backhoe could place the rock in position. The highlight of this excavation (as the channel was rapidly turning to goo) was when both operators simultaneously operated the backhoe loader to complete excavation and rocking. Both Park representatives were also actively pitching in, and from this first major excavation on, this spirit of teamwork prevailed.

Ravel catchers were used here on steep fill slopes, although a good mulch and seeding treatment might be sufficient. As a slight variation on RNP specs, the up-channel end of each ravel catcher is sloped slightly downhill so that runoff will run along gently sloped fill behind the boards and exit where the boards are keyed into large rocks near the channel. This prevents water from spilling over the down-channel edge which is on fill. Another point here is that a couple of the original boards were placed so close to the channel that high water could have possibly been diverted into the cut bank behind the boards. This was noticed and immediately changed, but is a point of caution in ravel catcher installations.

The diagram of special application patterns here is self explanatory. General comments on seeding, fertilizer, mulch, and conifer

planting as they apply to the entire project as well as this site:

(1) Seeding: The grass seed is thriving on fertilized areas and in a few random areas where top soil was available. The grass was able to grow and form root systems before heavy rain fell this year and thus did provide protection on excavated slopes. The alder seed appears to be germinating well.

(2) Fertilizer: The chicken manure was very effective where applied, but should be spread immediately to prevent bears from breaking into the bags and hauling them away. As an organic fertilizer it provides mulch, and because it will take longer to break down than chemical fertilizer, it will continue to provide nutrients for conifers and alders as well.

(3) Mulch: This is proving very successful. In fact, a heavier mulch (6,000-8,000 lb/acre -- as heavy as could be applied without impairing the growth of the alder seedlings) without grass seed or fertilizer application might be most effective. The only difficulty came in trying to estimate the amount of mulch (number of bales) needed at various sites so that it could be spread evenly.

(4) Conifers: Extra large redwood and Douglas fir seedlings (some of which were 2' tall with only 6" of roots) were planted extensively at D-1 in hopes that they will be watched carefully by vegetal researchers. They are possibly genetically superior in growth rate, and given ideal conditions they may grow rapidly. On harsher sites their survival rate may be very low, and bare root stock with a one to one ration (12" shoots to 12" roots) would grow more successfully.

The wild seed is germinating well, but its effectiveness cannot be evaluated yet.

D(364)

Physical -- Hand Ex

5 hrs.

Comments: There were a number of sites on Streams C and D where labor-intensive in-channel work was done to stabilize the channel. This work included some minor hand excavation, debris removal, and bank stabilization, usually using rock. Unless there is something of particular interest, no comments will be made on those sites.

D-2/D(326-336)

H.E. -- D-6
B/L

Ex 4.5 hrs.
Ex 4.5 hrs.

Physical -- Rock and Stake:

Hand Ex	5 hrs.
Split stakes	4 hrs.
Collect rock	14 hrs.
Installation	25 hrs. (385 ft ²)
Chain saw	1 hr.

Vegetal -- Seed, Mulch, Conifers

Comments: Heavy equipment work on this site was not up to the standards set on D-1 and carried throughout most of the rest of the work on the unit. The channel was never well-defined, and the original bed was not reached in the central portion of this channel. Although extensive labor-intensive work made up for most of the lacking quality, it proved more difficult and costly than to have done the right job in the first place. The channel capacity is still marginal but will be enlarged during Winter Maintenance.

Rocking and staking is a very good technique when all rock must be hauled by hand, in that it allows the use of smaller rock without sacrificing channel stability.

D(255-267) -- Slide Stabilization

Physical -- Slide Stabilization:

Hand Ex	31	hrs.
Collect rock	16	hrs.
Place rock	12	hrs.
Log rip rap	8	hrs.
Wood braces	8	hrs.
Chain saw	4	hrs.

Approximate footage:

120 ft² of rock steps
60 ft² of rock rip rap
120 ft² of in-channel rock

Vegetal -- Seed, Mulch, Conifers (at 6' x 6' spacing)

Comments: This site was the highlight of the labor-intensive work on the unit. First, minor excavation allowed placement of large log rip rap and split redwood ravel catchers on the right (sliding) bank of the channel, behind which approximately 8 cubic yards of excavated channel fill were placed. Channel bottom and sides were carefully rocked with masonry techniques so that the entire excavated reach was keyed together securely. Finally, log rip rap and ravel catchers were secured by heavy wood braces. There was no surface water in the plugged channel; immediately after excavation there was water running along the entire reach. The channel has collected some fines at the less-steep top of the excavated reach, but as of January 25 there has been no side- or down-cutting. There have also been no new failures on the slide bank. The two braces with the least stream channel clearance will be removed by the end of Winter Maintenance (April 30, 1981), as there is some chance that debris could collect behind these during extremely high flow.

Rock rip rap is a very effective technique to stop bank cutting.

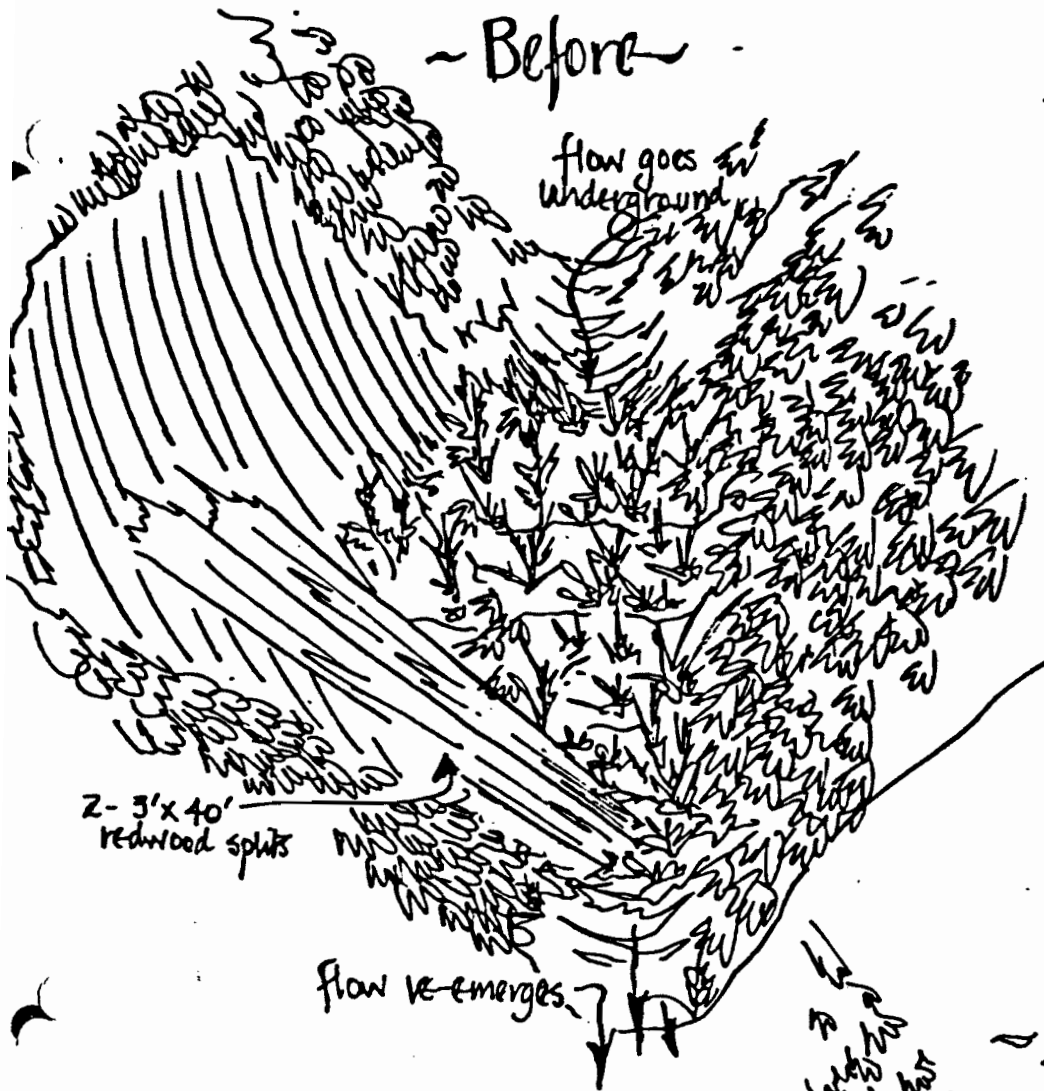
The actual cost of performing loose rock masonry was approximately

~ Before ~

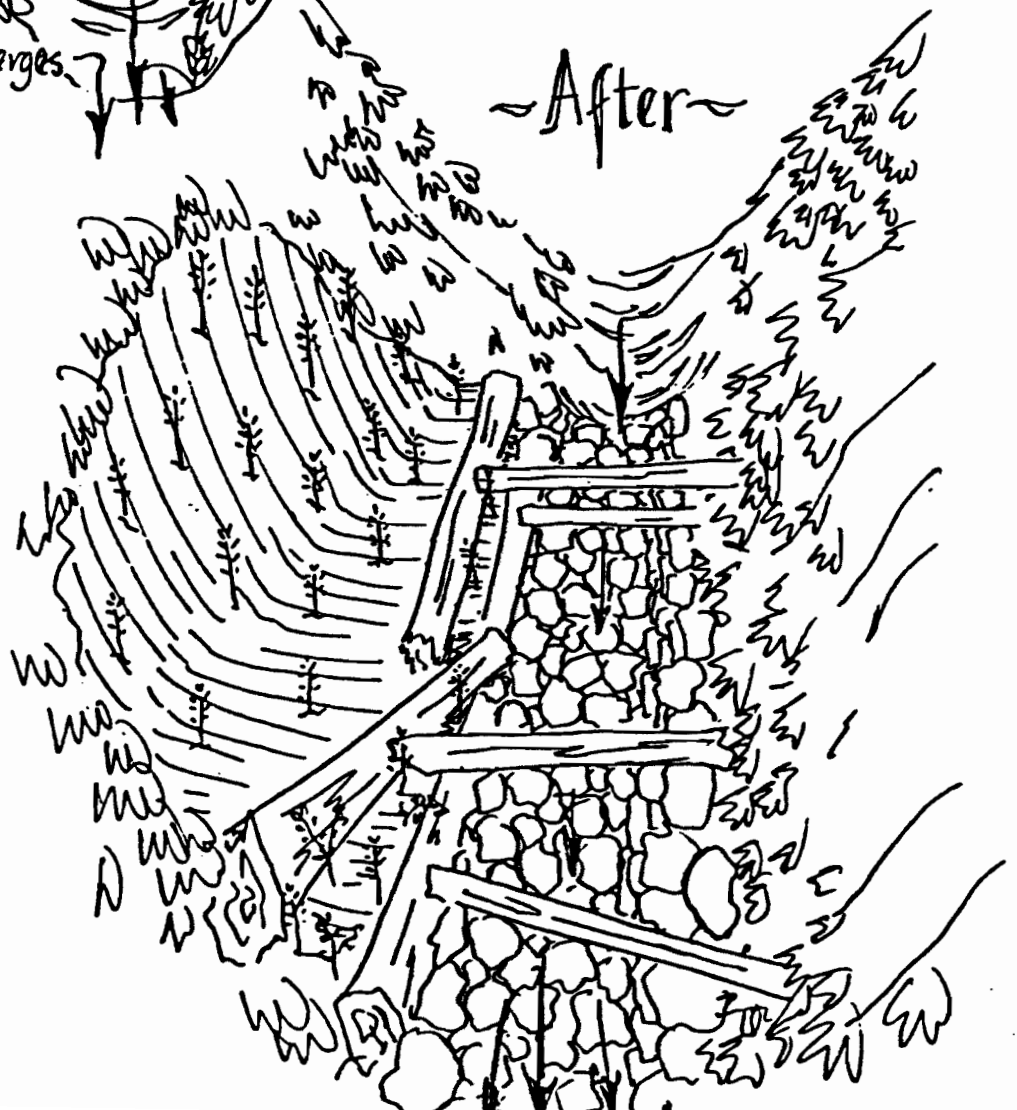
DIAGRAM ~

D(255-267)

SLIDE STABILIZATION



~ After ~



40% of the proposal price, which should make it cost effective. Two things are necessary to make this technique effective: (1) A work crew that can move large (up to 2' diameter) rock efficiently, and (2) individual workers who are skilled at loose rock masonry.

Rock steps are effective in prohibiting channel down-cutting.

The comments above on rock rip rap also apply to rock steps.

D (198-228) -- Perched fill (right bank)

H.E. -- B/L Ex 3 hrs.

Vegetal -- Seed, Mulch, Conifers

Comments: Removal of this perched fill was not proposed as it appeared too difficult. However, at the COR's request, the backhoe successfully took the load off the top of the fill.

D (196) -- Perched fill (left bank)

H.E. -- B/L Ex 2.5 hrs.

Vegetal -- Seed, Mulch, Conifers

Comments: This was the first perched fill removed by the backhoe operator, and, due to inexperience in perched fill removal and backhoe hydraulic malfunctions, some debris fell into the channel. Most of this was stabilized by the root wad removal and labor-intensive channel stabilization at D(196) which follows.

D (196) -- Root wads

H.E.	-- D-6	Winch	1	hr.
Physical	-- Hand Rock Work:	Rip rap	3	hrs. (10 ft ²)
	Hand Ex		4	hrs.
	Chain Saw		1	hr.
	Bracing		1	hr.

Comments: At this point the channel was completely blocked by two large root wads, with a small channel cutting around to the left of the center root wad and into the left bank, which had a perched fill overhand. The D-6 winch pivoted the left root wad out of the center of the channel. Labor-intensive follow-up (indispensable at this site) excavated a well-defined channel which then was rip rapped. The root wads were then securely braced to prevent their collapsing back into the channel.

D (164-166)

Physical	-- Hand Rock Work:	Rip rap	2	hrs. (10 ft ²)
	Hand Ex		3.5	hrs.
	Chain Saw		1	hr.

D (140-150)

Physical	-- Hand Rock Work:	Rip rap	1	hr. (5 ft ²)
	Redwood Board Rip Rap:			
	Chain saw		1	hr.
	Installation		2	hrs.

Comments: As this was the only site on this project where redwood board rip rap was used, a proper evaluation of its effectiveness is not possible. It does appear more susceptible to under-cutting than rock rip rap and takes almost as much time.

D (110-130)

Physical	-- Hand Rock Work:	Rip rap	5	hrs. (16 ft ²)
----------	--------------------	---------	---	----------------------------

D-3/D(20-30) *

H.E. -- B/L Ex 3.5 hrs.

Physical -- Hand Rock Work: Collect & place	3	hrs.
Hand Ex (Cut and remove log)	2	hrs.
Chain Saw	1	hr.

Vegetal -- Seed, Mulch, Conifers

D-4 / D(0-2-1)

H.E.	-- D-6	Ex	9.5 hrs.
	B/L	Ex	5.5 hrs.
	B/L	Rock	2 hrs. (466 ft ²)

Physical -- Hand Rock Work: Rearrange 5 hrs (233 ft²)

Vegetal -- Seed, Mulch, Fertilizer, Conifers

Comments: This was a difficult excavation due to the confinement caused by a stump in the channel, and all the fill was not excavated out of this reach. The combination of large rock from the Y-line rock pit and the relatively light flow this high on the watershed, however, should insure the stability of this channel.

D-5 / (D above 0-2-1)

H.E.	-- D-6	Ex	2 hrs.
	B/L	Ex	1 hr.

Comments: This site was dubbed "the Park" because of the heavy equipment operator's careful excavation around several good-sized alders and the general landscaped quality of the final result. This site should be watched carefully to observe and evaluate the extent of down-cutting in a channel where no physical protection was provided after excavation.

Ephemeral #1

H.E.	-- B/L	Ex	2.5 hrs.
	B/L	Rock	1.5 hrs.

Physical	-- Hand Rock Work: Collect and		
	rearrange	3	hrs.
	Hand Ex	4	hrs.

Vegetal -- Seed, Mulch, Conifers

Comments: This was chosen to be the first heavy equipment work site on this project because it was considered a relatively low risk crossing. The contractor, COR, and heavy equipment co-ordinator spent time at this point discussing the work ahead in an effort to come to a mutual understanding of the problems and how to solve them. This was a very worthwhile session. This first excavation, however, did not remove all the in-channel fill, although with the relatively small flow in this ephemeral channel, problems are not anticipated.

Ephemeral #2

H.E.	-- D-6	Ex	3 hrs.
------	--------	----	--------

Vegetal -- Seed, Mulch, Conifers

Comments: At this point several skid trails intersected and totally diverted the runoff out of its original channel, creating a skid trail gully. As a result of this excavation, the channel is now active again during heavy rains.

Ephemeral #3

Physical	-- Hand Ex	18	hrs.
	Hand Rock Work:		
	Collect and place	4	hrs.

Comments: This excavation was a glorified cross road drain, and this job (as well as work on the skid trail just above it on the 0-2-1 Road)

should have been done by heavy equipment. Because of an oversight on the part of the contractor, the heavy equipment operators were not informed of this until the major stream crossings on the 0-2-1 had already been pulled. Therefore, these excavations were done by hand, which was not nearly as cost-efficient.

C (442-448) -- Perched fill

H.E.	-- B/L	Ex	2.5 hrs.
Vegetal	-- Seed, Mulch, Conifers		

C (400-406)

Physical	-- Hand Rock Work: Rip rap	3	hrs. (18 ft ²)
	Hand Ex (remove log)	2	hrs.
	Chain Saw	1	hr.

C (386)

Physical	-- Hand Rock Work: Rip rap	5	hrs. (25 ft ²)
----------	----------------------------	---	----------------------------

C (373)

Physical	-- Hand Rock Work: Rip rap	4	hrs. (20 ft ²)
	Ex boulder	4	hrs.

Comments: This job was carried out as proposed. The large boulder was partially chipped away, and a solid rock rip rap wall was built opposite it where the bank was failing. Winching the boulder out presented a difficult, if not impossible, job and would have left both banks in need of protection. There now appears to be a stable channel without unnecessary disturbance.

C-1 / C(321-325)

Physical -- Hand Ex	6.5 hrs.
Hand Rock Work: Rip rap	2.5 hrs. (20 ft ²)
Collect & place	5.5 hrs. (105 ft ²)

Vegetal -- Conifers

Comments: Heavy equipment should have been used to pull this crossing, but the stubbornness of the contractor, who wanted to try a manual excavation, prevented it. The channel fill was adequately removed by hand, as it was not extensive. The perched fill on the right bank was partially removed, but a much more complete job could have been done with the backhoe.

C (287)

Physical -- Hand Ex	2 hrs.
Hand Rock Work: Collect & place	1 hr.
Chain Saw	1 hr.

C (264-266) -- Perched fill

H.E. -- B/L	Ex	2 hrs.
-------------	----	--------

Vegetal -- Seed, Mulch, Conifers

C (100)

Physical -- Hand Ex	4 hrs.
---------------------	--------

C (60) -- Deflection board with log check dam

Physical -- Hand Ex	3 hrs.
Placing Log	0.5 hr.
Notching Log (chain saw)	0.5 hr.

C-2 / C(0-2-1)

H.E.	-- D-6	Ex	2 hrs.
	B/L	Ex	4 hrs.
	B/L	Rock	1 hr. (315 ft ²)
Physical	-- Hand Rock Work: Rearrangement		5 hrs. (160 ft ²)
Vegetal	-- Seed, Mulch, Fertilizer, Conifers		

B-1 / B(390-400)

H.E.	-- B/L	Ex	2.5 hrs.
	B/L	Rock	0.5 hr.
Physical	-- Hand Ex		5.5 hrs.
	Hand Rock Work: Collect & place		3.5 hrs.
	Rearrange		1 hr.
	Install Energy Dissipators		4 hrs.
	Notch Log (Chain saw)		1 hr
			} 210 ft ²
Vegetal	-- Seed, Mulch, Conifers		

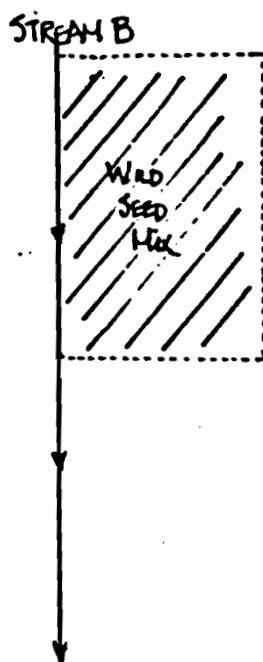
Comments: This was a difficult site due to the quantity of large slash and debris in the channel. The channel appeared basically stable, however, and it was decided not to pull the logs and attempt to return it to its original grade with the risk of de-stabilizing the banks. Perched fill was removed by backhoe, and the labor-intensive follow-up defined the channel, notching in-place logs, and built rock rip rap.

B-2 / B(355-365)

H.E.	-- D-6	Ex	4 hrs.
	B/L	Ex	3.5 hrs.
	B/L	Rock	5 hrs. (418 ft ²)
Physical	-- Hand Rock Work: Collect & place	13	hrs. (418 ft ²)
	Rearrange	2	hrs.
	Ravel Catchers: Milling, etc.	6	hrs.
	Transport slabs	2	hrs.
	Split stakes	1.5	hrs.
	Installation	9	hrs. (56 lin. ft.)

Vegetal -- Seed, Mulch, Fertilizer, Conifers
Wild seed mix (see diagram)...

B-2

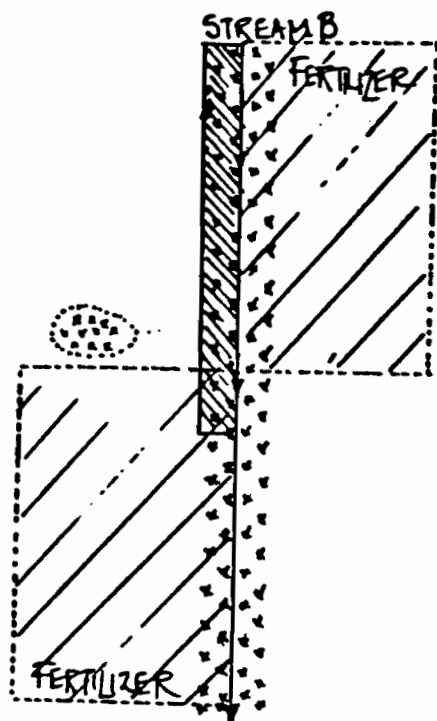


Comments: This was an excellent job by heavy equipment -- a well-defined and well-rocked channel as far as rock from the Y-line rock pit held out. The hours spent in rocking by the backhoe loader are higher than average because of hauling time up from the Y-2. The remainder of the channel was well rocked by hand.

B-3 / B(183-192)

H.E.	-- D-6	Ex	6	hrs.
Physical	-- Hand Ex		8	hrs.
Vegetal	-- Seed, Mulch, Fertilizer, Conifers			
	Transplants		20	hrs.
	Cuttings (40 blackberry)		2	hrs.
	No. and Species Transplanted:			
	33 water bunchgrass	<i>SLIP</i>		
	24 cattail			
	22 alder			
	21 iris			
	10 blackberry			
	10 whiplia			
	9 coltsfoot			
	8 sword fern			
	3 bunchgrass			

B-3



- x - Transplants, a double row on each side of channel - 3' spacing, rows 2' apart, staggered.
- ▨ - Cutting area
- ▤ - Fertilized area
- ⊙ - 10 Whipplea transplanted on dry bank

Comments: This was an excavation done solely by the D-6 and serves as an example of the advantages of extensive dozer excavation. Most of the excavated fill has been pushed up and out of the immediate drainage where it was then recontoured and compacted. This is another site where no physical in-channel protection techniques were used and should be observed to evaluate the ability of a well-excavated channel to stand alone (i.e., are rocking, check dams, etc. always necessary?). There was, however, fairly extensive vegetal work done at this site, with transplants and cuttings lining the banks in a double row immediately adjacent to the channel. (See diagram.) Nine different species were transplanted, two of which have been previously untried in Park rehabilitation -- water bunchgrass (this will be more accurately identified before the end of Winter Maintenance) and wild iris -- and continued observation should prove whether they succeed in spreading to protect the channel.

B (155-161)

Physical -- Hand Rock Work: Collect & place	1	hr.
Hand Ex	1	hr.

B (150)

Physical -- Hand Rock Work: Rip rap	6	hrs. (36 ft ²)
-------------------------------------	---	----------------------------

B-4 / B(127-135)

H.E. -- D-6	Ex	0.5 hr.
B/L	Ex	2.5 hrs.

Physical -- Hand Ex	3	hrs.
Notch Log	2	hrs. (1 hr chain saw)

Vegetal -- Conifers

Comments: This is where the two B channels come together. A large 4' diameter fir log runs perpendicular to both channels under the skid trail crossing. Before notching, this log provided a check dam effect, but with no control over where the stream flowed. After notching at both channel crossings and backhoe and hand removal of fill, water again flows in defined channels.

B-5 / B(100-112)

H.E. -- D-6	Ex	6 hrs.
B/L	Ex	3.5 hrs.

Physical -- Check Dams: Milling, etc.	26	hrs.
Transport slabs	9	hrs.
Split stakes	1	hr.
Transport stakes	1	hr.
Collect rock	8	hrs.
Installation	56	hrs.
Place rock	6	hrs.
Chain saw notching	2	hrs.
Total	109	hrs.

Vegetal -- Seed, Mulch, Fertilizer, Conifers
Transplants (at edges of check dam pools):
14 alder
8 fern

Comments: This was a difficult heavy equipment site, largely because of a very wet right bank. This bank was drained by the excavation of two drainage ditches (one by backhoe, one by hand) on Stream B Channel 1, which returned the flow to its proper channel. B-5 was discussed as a possible site for bringing Stream B Channel 1 drainage into Stream B Channel 2 (this was the post-logging site of their joining), but it was decided to let this confluence occur at its natural point just below B-4.

This was the only site on this unit where redwood check dams were used. Due to a misunderstanding between the worker in charge of this project and the COR, the original layout spaced the dams too far apart. Check dam boards then had to be hauled up from the Y-2 so new dams could be constructed. The energy dissipation was done almost exclusively with rock. In this case the installation of check dams did not seem cost-effective, as careful channel rocking could have adequately protected this channel at a lower cost.

STREAM B, CHANNEL 1

H.E.	-- B/L	Ex	1 hr.
Physical	-- Hand Ex		2 hrs.
	Chain Saw		2 hrs.

STREAM B, CHANNEL 2

H.E.	-- B/L	Ex	1.5 hrs.
------	--------	----	----------

Physical -- Hand Ex	2 hrs.
Vegetal -- Conifers	

B-6 / STREAM B, CHANNEL 2 (30-40)

H.E. -- B/L	Ex	3.5 hrs.
D-6	Winch	1 hr.
Physical -- Hand Ex		14 hrs.
Notching Log		8 hrs.
Hand Rock Work: Collect & place		3 hrs. (150 ft ²)
Rip rap		9 hrs. (40 ft ²)
Rock steps		8 hrs. (47.5 ft ²)

Vegetal -- Seed, Mulch, Conifers

Comments: This was a difficult site for heavy equipment work because of a large boulder on one side of the channel and a large log on the other side running parallel to it. The bottom section of the log could not be winched out, and the backhoe was unable to excavate a well-defined channel. Labor-intensive workers did an excellent job of cutting and notching the log, excavating, and then rocking the channel reach, so that although the channel is confined, failure is unlikely. (See diagram.)

B-7 / STREAM B, CHANNEL 2 (0-2-1)

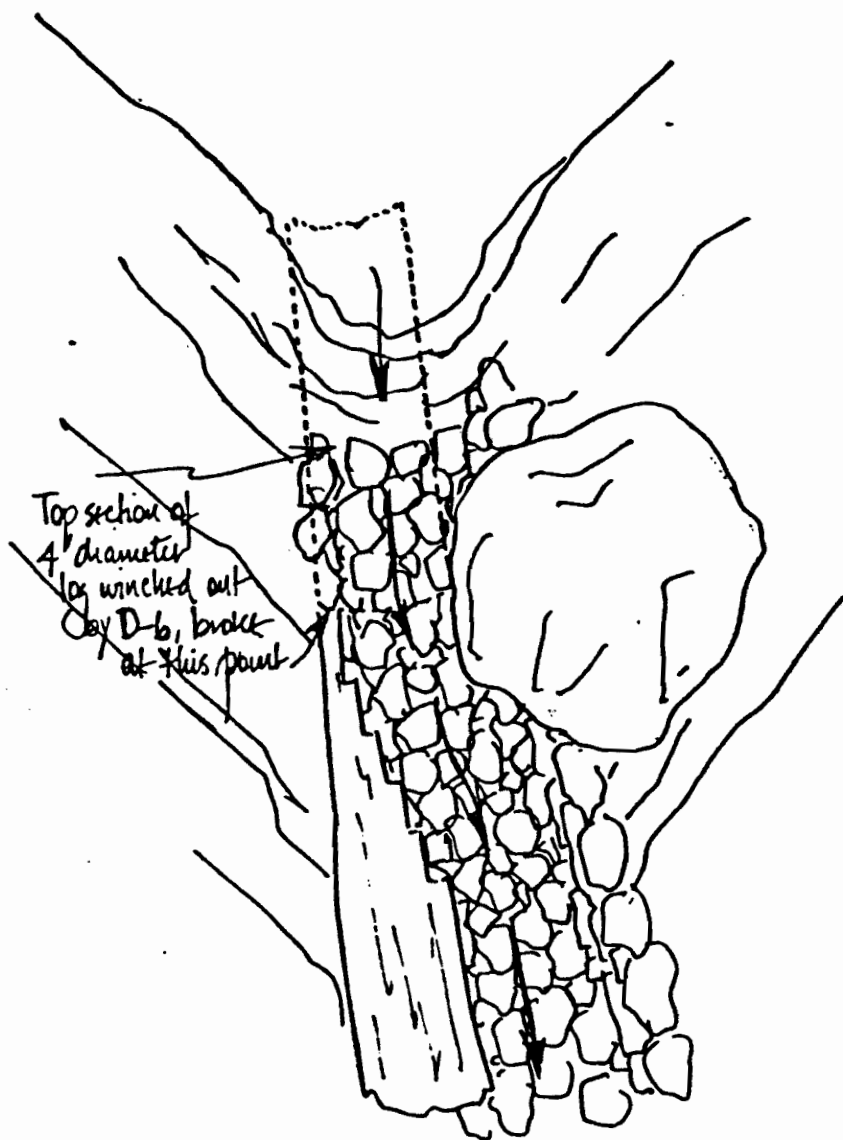
H.E. -- D-6	Ex	13 hrs.
B/L	Ex	5 hrs.
B/L	Rock	5.5 hrs. (778 ft ²)
Physical -- Hand Ex		2 hrs.
Hand Rock Work: Collect & place		23 hrs. (357 ft ²)
Ravel Catchers: Milling, etc.		7 hrs.
Transport slabs		2 hrs.
Installation		4 hrs. (60 lin. ft.)

Vegetal -- Seed, Mulch, Fertilizer, Conifers.

Comments: This was by far the largest excavation of this project.

The original stream gradient was reached, and the channel was armored

B-6



with 1135 ft² of immovable boulders. Most of the credit for this fine job goes to the heavy equipment operators, although the labor-intensive crew wrestled with some of the largest boulders at the bottom of the reach where the backhoe could not work in order to tie in the heavy equipment work to the original channel bed.

B-8 / STREAM B, CHANNEL 1 (0-2-1)

H.E.	-- D-6	Ex	7 hrs.
	B/L	Ex	5.5 hrs.
	B/L	Rock	0.5 hrs. (207 ft ²)
	Choker setting		1 hr.

Physical	-- Hand Rock Work: Rearrangement	6 hrs. (207 ft ²)
	Hand Ex	5 hrs.

Vegetal -- Seed, Mulch, Fertilizer, Conifers

Comments: This heavy equipment excavation was not satisfactorily done for a variety of reasons: anticipated less-than-actual winter flow, vast amount of fill and large debris in channel, miscommunication, etc. Much hand excavation and rock work was done to compensate, and this site is carefully checked during each Winter Maintenance trip. There has been no knickpoint development or down-cutting as of Jan. 25, 1981. (See diagram.)

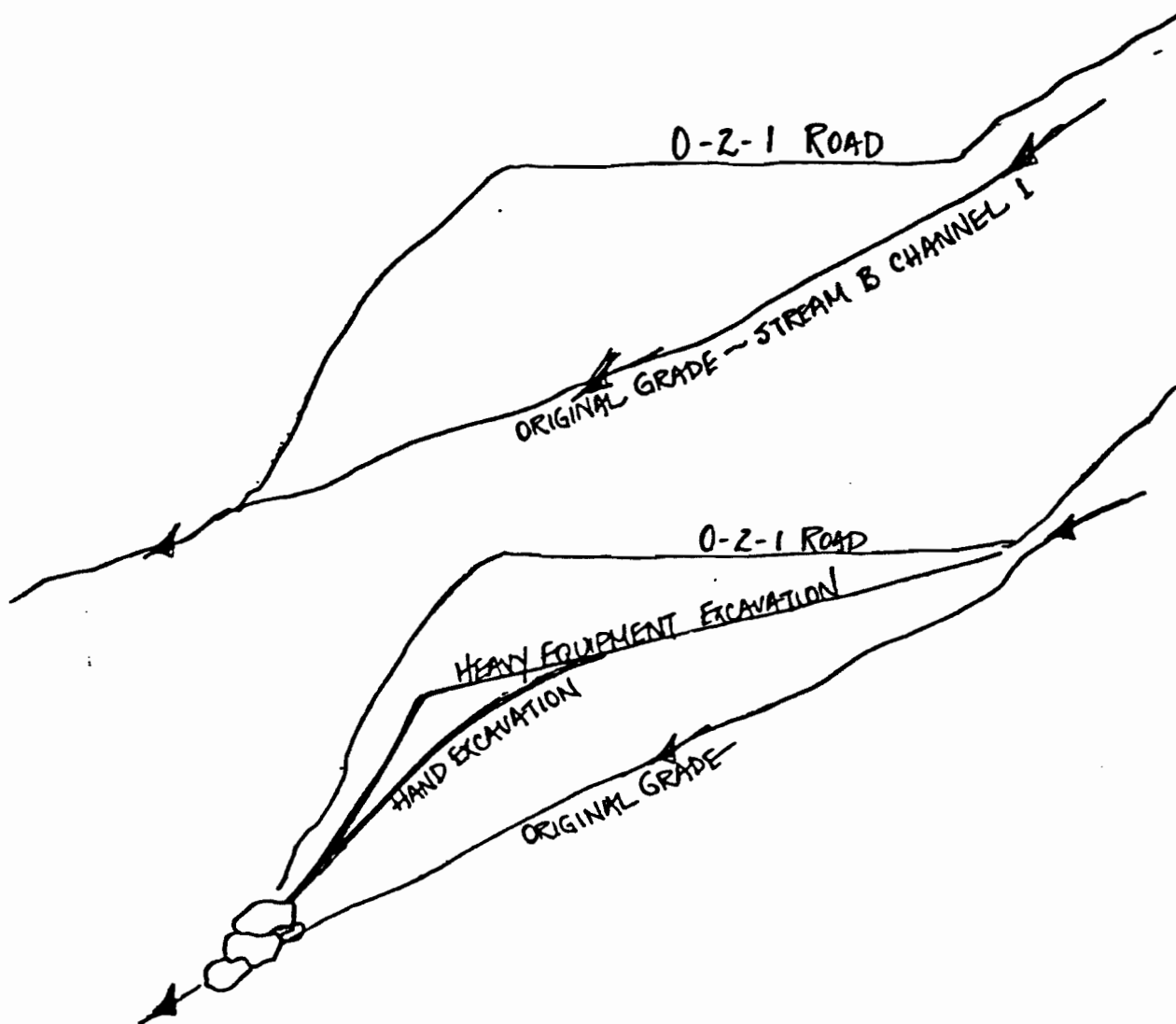
A-1 / A(392-405)

H.E.	-- B/L	Ex	1.5 hrs.
------	--------	----	----------

Physical	-- Hand Rock Work: Collect & place	6 hrs. (110 ft ²)
----------	------------------------------------	-------------------------------

Vegetal -- Seed, Mulch, Conifers

B-8



A-2 / A(311-323)

H.E.	-- D-6	Ex	17	hrs.
	D-6	Rock	3	hrs.
	B/L	Ex	10	hrs.
	B/L	Rock	3	hrs. (345 ft ²)

Physical	-- Hand Rock Work: Collect & place	20	hrs. (345 ft ²)
	Rearrange	10	hrs.

Vegetal -- Seed, Mulch, Conifers

Comments: Because this site was wet and mucky from the start, it was the most difficult heavy equipment excavation. The successful final result is a well-defined channel very close to its original gradient. Rock for this site was gathered by the backhoe loader from nearby (rather than from the Y-line rock pit). If there had been laborers in camp at this time to help in locating and loading rock, this rocking time could have been lowered.

An excellent job of hand rocking was done here -- both in rearrangement of heavy equipment-placed rock and in the gathering and placing of in-channel rock, many of which were 18"-24" diameter and gave stability to the upper reach of this channel which was inaccessible to the backhoe.

A-3 / A(277-301)

H.E.	-- D-6	Ex	2	hrs.
	B/L	Ex	2	hrs.

Physical	-- Rock and Stake: Collect & place	23	hrs. (450 ft ²)
	Staking	4	hrs.
	Transport stakes	2	hrs.
	Chain saw	1.5	hrs.

Vegetal -- Seed, Mulch, Conifers

Comments: The A Channel was so extensively damaged that, short of completely reconstructing the channel from the 0-2-1 Road to the

Y-2 Road, it was impossible to effectively deal with all the problems. On A-3, instead of trying to find the original channel (the location of which no one was certain), the existing channel was better defined and armored with rocks and stakes. This site, therefore, does not have the long-term look of most other excavation sites, but seemed the best solution to the specific problems on this site.

A (265-277)

Physical -- Hand Ex 36 hrs.

A (253-265)

Physical -- Hand Ex 21.5 hrs.

Comments on A(253-265-277): Because these sites were too wet for heavy equipment excavation, hand-ditching was used to collect and stabilize the fragmented runoff in this area. As of Jan. 25, 1981, the ditches have effectively channelized the dispersed flow.

A-4 / A(145-178)

H.E.	-- D-6	Ex	3 hrs.
	B/L	Ex	2 hrs.

Vegetal -- Seed, Mulch, Fertilizer, Conifers

Comments: "The football field" is a flat area where two skid trails came together and crossed the channel. A well defined channel was excavated by the backhoe within the larger dozer excavation.

This area, like B-3 and D-4, was not protected by any physical treatments, and therefore should be watched closely for down-cutting

and bank cutting. As of Jan. 25, 1981, no place in the channel has down-cut more than 8", and in most places, less. Hand excavation during Winter Maintenance has stabilized the supersaturated area on the left bank caused by sub-surface flow, which, if not corrected, could have oozed into the channel.

A-5 / A(0-2-1)

H.E.	-- D-6	Ex	7 hrs.
	B/L	Ex	3.5 hrs.
	B/L	Rock	2.5 hrs. (333 ft ²)
	Choker Setting		1 hr.
Physical	-- Hand Rock Work: Rearrange		5 hrs. (333 ft ²)
	Hand Ex		5 hrs.
Vegetal	-- Seed, Mulch, Fertilizer, Conifers		

A-6 / A(above 0-2-1)

H.E.	-- D-6	Ex	1 hr.
Physical	-- Hand Rock Work: Collect & place		5 hrs. (300 ft ²)
	Hand Ex		5 hrs.
Vegetal	-- Seed, Mulch, Conifers		

0-2-1 ROAD

0-2-1 (960-100) - Recontouring

H.E.	-- D-6		6.5 hrs.
	B/L		5 hrs.
	Choker Setting		6 hrs.

Vegetal -- Seed, Mulch, Conifers

Comments: The removal of this perched landing fill has eliminated the threat of its failing and sliding into Stream B Channel 2.

0-2-1 -- Ripping

H.E. -- D-8

6 hrs.

Vegetal -- Seed, Mulch, Conifers

Comments: This is definitely an effective technique for breaking up a compacted surface, and the care of the D-8 operator in saving large existing vegetation made it even better.

0-2-1 -- Cross Road Drains

H.E. -- D-6
B/L

2.5 hrs.
2 hrs.

Physical -- Hand Ex CRD(0-2-1(700)) 4 hrs.

Comments: In general, ripping the roads made the necessity for many of the cross road drains questionable; that is, most of the runoff is absorbed in the decompacted road before reaching the drains. Where heavy runoff does occur, the drains appear to be working effectively, although some hand shovel work has been done during Winter Maintenance to avoid ponding.

0-2-1 -- Test Sites

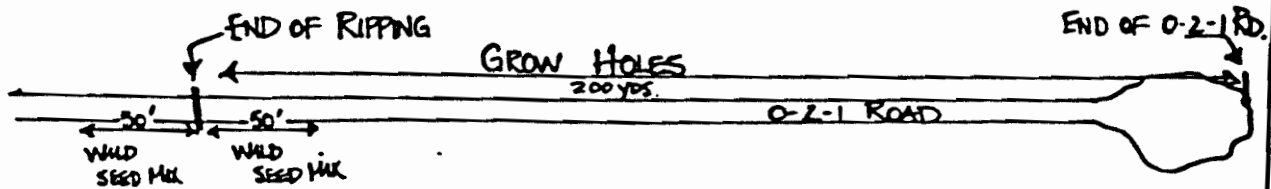
H.E. -- B/L

0.5 hr.

Vegetal -- See diagram.

Comments: The cross road drains are effectively draining the non-ripped section of road. There is no way to effectively evaluate the technique of grow holes until the revegetation of this area can be compared to the revegetation of the ripped road several years from now. At this point a guess is that it might prove effective on smaller, fairly well vegetated roads like the 0-2, but not as effective as ripping on larger haul roads like the 0-2-1.

0-2-1 Test Sites



NOTE: Entire length of 0-2-1 Road is seeded, mulched, & planted with conifers—

0-2 ROAD

0-2 -- Cross Road Drains

H.E.	-- D-6	Ex	1.5 hrs.
	B/L	Ex	3.5 hrs.

0-2 -- Ripping

H.E.	-- D-8	2.5 hrs.
------	--------	----------

Vegetal -- Seed, Mulch, Conifers
Fertilizer applied at landings:
360-420 yds.
900-970 yds.

0-2 -- Test Site

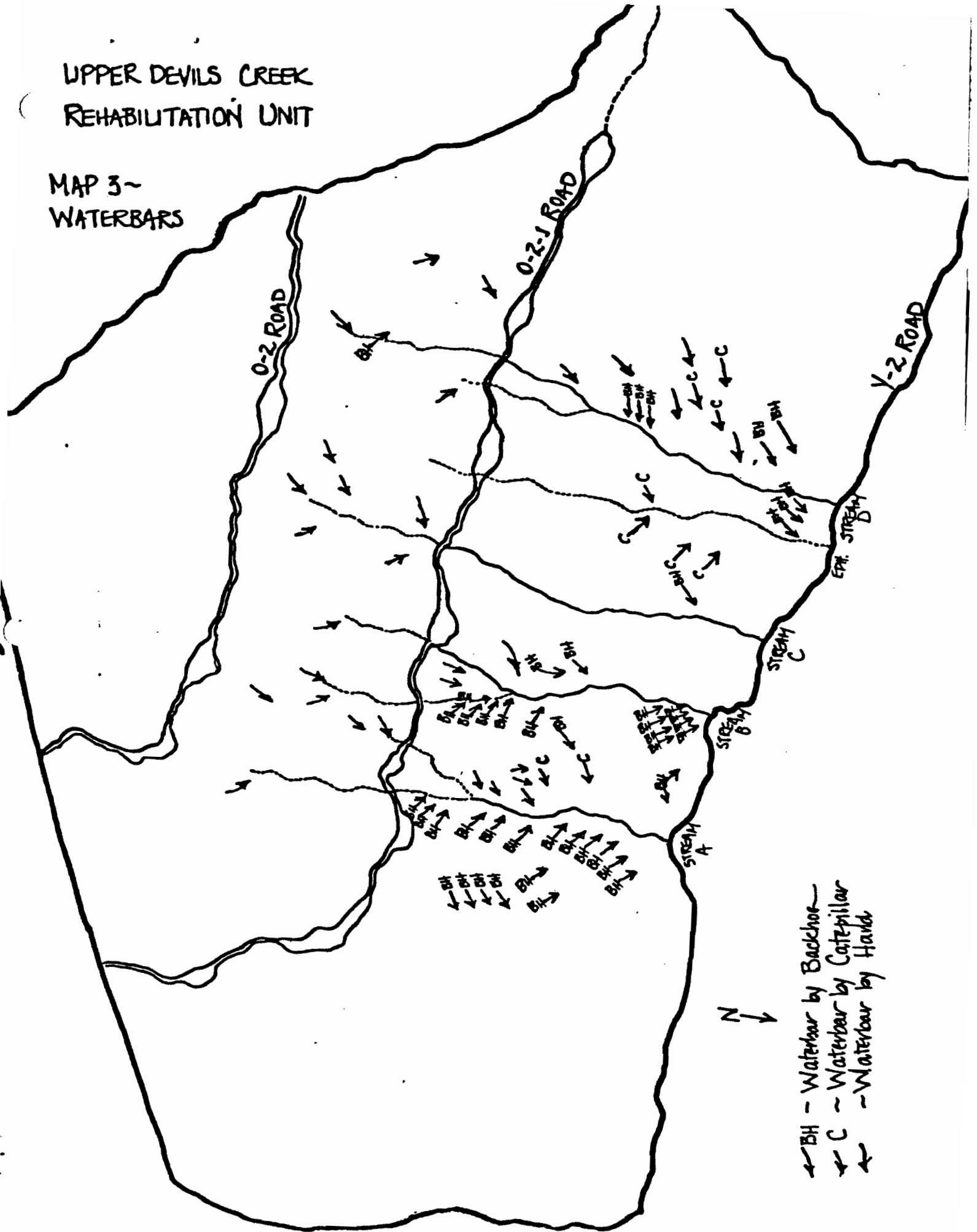
H.E.	-- B/L	0.5 hr.
------	--------	---------

WATER BARS

Following is a map of the water bars completed pre-Winter Maintenance by heavy equipment and by hand. A blue line map of all water bars and a report on the complete water bar program will be included in the Winter Maintenance Report.

UPPER DEVILS CREEK REHABILITATION UNIT

MAP 3~ WATERBARS



- BH - Waterbar by Backhoe
- C - Waterbar by Caterpillar
- Waterbar by Hand

TOTAL HOURS

Heavy Equipment:

D-6

Excavation	94.5 hrs.
Rocking	3 hrs.
Winching	4 hrs.
Recontouring	6.5 hrs.
Waterbars	1.5 hrs.
CRD	4 hrs.
Rock pit	5.5 hrs.
Road work (for Dump Truck)	5 hrs.
Total	124 hrs.

B/L

Excavation	77.5 hrs.
Rocking	25.5 hrs.
Recontouring	5 hrs.
Waterbars	6 hrs.
CRD	5.5 hrs.
Test Sites	1 hr.
Rock pit	6.5 hrs.
Camp	2.5 hrs.
Total	129.5 hrs.

Dump Truck (24 loads) 38 hrs.

D-8 -- Ripping 8.5 hrs.

Truck and Trailer (Nilsen's straw) 8 hrs.

Physical:

Hand Rock Work	
Rearrange	50.5 hrs.
Collect and place	88.5 hrs.
Rip rap	40.5 hrs. (183.5 ft ²)
Rock steps	8 hrs. (47.5 ft ²)

Hand Excavation 162 hrs.

Chain Saw Work 22 hrs.

Bracing 1 hr.

Notching 6 hrs.

Energy Dissipator 4 hrs.

Deflection Board with Check Dam 4 hrs.

Redwood Board Rip Rap	2 hrs.
Ravel Catchers	
Milling, etc.	26 hrs.
Transport slabs	5 hrs.
Split stakes	3 hrs.
Install	30.5 hrs.
Total	64.5 hrs. (232 lin. ft.)
Check Dams	
Milling, etc.	26 hrs.
Split stakes	1 hr.
Transport slabs	9 hrs.
Transport stakes	1 hr.
Install	72 hrs.
Total	109 hrs. (12 dams)
Rock and Stake	
Split stakes	4 hrs.
Transport stakes	2 hrs.
Install	72 hrs.
Total	78 hrs. (850 ft ²)
Slide Stabilization	75 hrs.
CRD (by hand)	4 hrs.
Waterbars and Drainage Ditches (pre-Winter Maintenance)	69 hrs.

Vegetal:

Seed

Total Amount: 150 lb. annual rye
150 lb. perennial rye
20 lb. alder

Transport seed	3 hrs.
Plant seed	14 hrs.
Wild seed mix:	
Collection	8 hrs.
Plant	2 hrs.
Total	27 hrs.

Fertilizer

Total Amount: 95 bags @ 35 lb/bag
(28,500 ft²)

Transport fertilizer	22 hrs.
Spread fertilizer	12 hrs.
Total	34 hrs.

Mulch

Total Amount: 364 bales @
80-90 lbs./bale

Transport straw	68	hrs.
Spread straw	<u>141</u>	<u>hrs.</u>
Total:	209	hrs.

Transplanting

Total No.: 162 transplants

Digging and transporting	14	hrs.
Planting	<u>6</u>	<u>hrs.</u>
Total:	20	hrs.

Cuttings

Total No.: 40 cuttings	2	hrs.
------------------------	---	------

Miscellaneous:

Milling

Locating logs	1.5	hrs.
(Winching (D-6)	2	hrs.)*
Choker setting	2.5	hrs.
Milling	65.5	hrs.
Mill Maintenance	<u>9</u>	<u>hrs.</u>
Total:	78.5	hrs.

Other Choker Setting	8	hrs.
----------------------	---	------

Hand Brushing Road for Dump Truck	11	hrs.
-----------------------------------	----	------

Transporting People and Tools	62	hrs.
-------------------------------	----	------

Organizing Personnel and Determining Procedures	106	hrs.
--	-----	------

Discussion Time with COR	29.5	hrs.
--------------------------	------	------

Worksheets and Records	36	hrs.
------------------------	----	------

Camp Set-Up	106	hrs.
-------------	-----	------

*Also listed under Heavy Equipment Totals.

EVALUATION

The rehabilitation work at Devils Creek, judged from this point in time, is very successful: work progressed ahead of schedule, the heavy equipment and labor-intensive phases of work were completed before the heavy rains. All work sites appear stable, with no down-cutting or signs of bank failure in any of the protected channels. The three sites chosen for no-protection have down-cut an average of less than 6" over the channel reach. There are a number of reasons for the success of this project, but the most basic one is that the COR (Danny Hagans), the Heavy Equipment Co-ordinator (Ken Swinnock), and the contractor were all out there working together, trying to do the best job possible for the watershed -- sharing their expertise, willing to adapt and learn and change when necessary. The clear and open communication between these three vital participants was invaluable.

Some general comments on the heavy equipment aspect of the work follow:

- 1) The contractor had very little experience in the supervision of heavy equipment at the beginning of this contract. This weakness was effectively overcome by the skill and experience of the equipment operators and by the supervision skills of the COR.

- 2) In retrospect, heavy equipment should have been used in several instances where it was not: at C-1 the contractor decided to excavate the crossing by hand (see specific comments on C-1). The COR, with his greater heavy equipment supervision experience, allowed the contractor to make his own mistake on this relatively non-critical site and thus learn a valuable lesson. At Ephemeral #3 heavy equipment was not used

due to a logistical oversight. Most large waterbar construction would be more cost-effective if done by backhoe. The contractor learned how little impact heavy equipment can have on the hillside if operators stay on skid trails and are sensitive to vegetation.

3) Again in retrospect, an even greater effort would have been made to get excavations right (specifically, better defined channels better suited for the planned physical protection, if any) the first time, rather than to rely on labor-intensive follow-up work. This would mean better channel protection for less cost. D-2 is an example of this weakness.

The most common physical technique used on this project was rocking, which seemed to be the best and most cost-effective protection for unstable channels. A few general comments follow:

1) Although the backhoe is indispensable for placing boulders that are too large for people to manipulate and for dumping large quantities of rock in the channel, it cannot do the fine-tuning that ties together the entire reach of disturbed channel. Labor-intensive follow-up is invaluable at all sites where there is any question of channel stability.

2) The skill of the labor-intensive crew in rock masonry was vital, especially on certain difficult sites such as A-2, B-6, B-8 (lower part of reach), and D(255-267).

3) A greater effort could have been made to locate rock on the unit -- both in the form of small quarries (which could have easily been recontoured after use) and in simply using the loader to haul large rock

to each site where needed at the time of excavation because of the difficulty of hauling large rock by hand.

4) There was an overkill on rocking of heavy equipment excavations on the 0-2-1 Road where rock from the Y-line rock pit could easily be dumped and where large and possibly difficult excavations were anticipated. It was not cost-effective, especially in view of the fact that some crossings lower on the watershed were given less or no rock protection. This brings up a dilemma in the planning and logistics of rock work: if the success of excavations could be accurately predicted, then rock could be hauled to those sites where protection was needed (and in the amount needed) before excavations make hauling impossible.

5) As an experiment, three excavated channels (A-4, B-3, and D-5) were left unprotected by rock or wood structures. If future observation proves this to be a successful alternative in certain sites, it would, of course, be very cost effective.

General comments on the vegetal work include 1) the effectiveness of the anticipated success of the alder seeding, and 2) concern over the large size of the conifers (i.e., 6" roots may not be able to support the up-to-24" shoots on harsher sites).

In the end, the completed project was different from and better than the proposed project. Changes were made as they seemed necessary by agreement between the COR and contractor. The two major changes were: 1) Twenty lbs. of alder seed were broadcast with the grass seed on all excavated sites, and 2) more rock was dumped and placed as channel protection. Resulting from these changes, other changes occurred, such

