

INTRODUCTION

The watershed restoration work done in the 210 and 220 haul road vicinity was intended to fulfill Public Law 95-250 and National Park Service management policies (NPS Natural Resource Management Guidelines -NPS 77). Of the 320 acres comprising the area boundaries, 2 miles of haul and skid roads were identified as significant resource threats. The prescribed treatment called for the removal of dirt and debris from road stream crossings and the recontouring of unstable road fills, thereby providing a sound landform for a more natural recovery of the disturbed ecosystem. Approximately 42 acres was recontoured to natural topography (as feasible) with original topsoil being exposed or scattered on half of all disturbed surfaces.

LOCATION:

The 210/220 roads are located on the east facing slopes to the west of Prairie Creek , between Streelow Creek and Davison Road. Access to the 210 road was off the 200 road near the H.A. Blankenship truck shop (formerly the Arcata Redwood cat shop) at an elevation of 90 feet, climbing to 720 feet at station 00+00b on the 220 road. Streams draining the portion of hillslope occupied by the 210 road flow directly into Prairie Creek. The channel associated with RX10 flows onto a wetland at the north end of the Davison property. The slopes typically range from 30% to 70%, well vegetated, heavily occupied by skid roads and large woody debris.

GEOLOGY:

The hillslopes of the 210/220 area primarily composed of a capping Gold Bluff Unit (Prairie Creek Formation) and an underlying Franciscan Assemblage. The 220 road veers to the southwest approximately 2500 feet from leaving the 200 road. The 220 road follows the ridge on the Gold Bluff material for the most part. After the junction of the 220, the 210 maintained a relatively level grade along the contact of the Gold Buffs and Franciscan material. A number of stream crossing excavations encountered the contact zone. A perceptible volume increase in channel flow was typically noticed at the contact (neat eh!).

Other wise, The significance of the contact between Gold Buffs and Franciscan was mainly seen in channel morphology and dynamics. The channel gradient was typically lower above the 210 road, and steeper below the road. Channel forms above the 210 ranged from more swalely morphologies with occasional - pre impact - subsurface features to well defined small gorge like systems. Below the 210, the original channels were typically well incised, mini gorges with steep side slopes blending into the more gradual hillslopes.

An inclusion of an Atwell series soil is located along the lower half of the 210. The inclusion represented approximately 50 feet of roadway near station 47+00. Atwell soils are known for their instability throughout Humboldt county. The presence of the Atwell inclusion was perceptible as a section of road where the outboard edge was sagging most notably.

LAND USE

Joe Romanini says:

210 unit one of first in Davison area to be logged using tractors. still before layouts. area was burned. logged in late 40's. Unit to the south was the last in the area to be harvest using a steam donkey.

CX and Griz observations:

The road building techniques were different for roads above and below the water tank. The guess d'jour was that the area below the water tank had been earlier. there were also variations in types of fill in a couple of crossings. specifically RX9, RX6 and possibly RX7. The center portions of the crossing fills had been filled with an exotic rock, apparently from some local river run source, indicating that the original crossings had blown out in the past.

From the older air photos, it appears that the 210 and 220 roads were used to haul logs from the 230 unit located adjacent to the north. It may have been at that time when the improvements were made to RX6, RX7 and RX9,?. Either that or they were made at another time (duh,).

Harvesting techniques used for the most part in the 210/220 area left a number of residual trees standing. Most likely a seed tree leave. The only exception to the tractor yarding in this unit was the hillslopes below RX5, RX6 and RX7 that were Cable yarded.

EROSIONAL FEATURES:

The primary erosion process occurring on the 210 road was the degradation of the stream crossings and a few stretches of road fill on hillslopes. Our initial guess was that the collapse of the crossings and fills was due to the rotting organics buried in the fill. It was common to have large holes open up with in the fill of a crossing or large road prism. At RX1, RX2, RX7 and RX8 there was also significant settling of the road surface, up to a few feet of downward vertical movement across the span. The presence/abundance of large wood was confirmed during excavations.

The hillslope located on the left bank of RX6 appears to have been a large mass movement feature a very long time ago. There are very large old growth stump on the hillslope indicating that it has been stable long enough for the trees to become old growth (approx. 1000 years). The only impacts to the restoration work caused by the slide feature was seen in morphology of the channel below RX6. The channel was much more constricted and contorted than was typical for similar channels.

The only gully system in the 210/220 unit was located at station 51+50 along the 210. The gully system started at a ditch relief culvert that drained approximately 500 feet of road below RX9. It is also quite likely that drainage through RX9 had plugged in the past, causing the channel flow to utilize the inboard ditch system to find its way down the hill.

other info:::

REHABILITATION WORK

PROJECT IMPLEMENTATION

Approximately one third of the watershed area for the 210 and 220 roads was originally mapped by Bo Dame with help from Peter Armato, Mike Sanders and Paul Measles during 1993 and 1994. The remaining portion of the area was mapped and prescribed by Neal Youngblood in 1995. Surveying was completed by Neal Youngblood, Becca Smith and Keith Richey with assistance from Darci Short and Terry Spreiter. Most of the actions for preparation of the 210/220 project were accomplished between Feb. 1 to June 15 of 1995.

PRIMARY TREATMENTS

There were 10 stream crossings along the 210 haul road. An additional 11 skid road stream crossings were also excavated. All crossings were excavated to original ground surfaces (as close as possible). All woody material (logs, rootwads, large slash..) exhumed during excavation was scattered across the finished surface or placed in the finished stream channel.

All road fill along the 210 was outsloped. Three pieces of the outsloping strayed from the typical cut and fill scenario of outslope treatment. From station 9+00 to 10+50 a landing existed that appeared to be comprised of largely of organic material. There was significant slumping and hole formation. The landing also was situated above a historically mobile hillslope. From station 20+00 to 20+33 the road blended into a large skid road intersection for upslope access and the nose of a ridge that had been used for a cable yarder. The reach from station 29+00 to 30+00 cover a headwater swale and was almost an export outslope.

The only prescribed export outslope (EOS) was located on the 220 road at the headwaters of the channel crossing the 210 at RX7 (labeled channel 7 for the purposes of this contract). The fill from the EOS was used to rebuild the ridge below the EOS site.

The remainder of the treatment for the 220 road was defined as 'scratch and drift'. The scratch and drift treatment was intended to create something similar to series of headwater swales.

Outslope treatments called for the complete translocation of road fill to its most appropriate placement on the remaining road cut. The final slope surface composed of the original topsoil (as feasible), stumps and scattered woody debris.

SECONDARY TREATMENTS

No secondary treatments for erosion control were prescribed for this contract. The disbursement of woody debris on the finished slope could theoretically be considered a secondary treatment. The wood scattering was prescribed for multiple reasons, none of which were erosion control. It was thought that most of the road failure occurring along the 210 was due to the rotting of buried organics. By burying the organics, as had been done in earlier restoration work in the park, we may continue to see slope instabilities (of a much lesser impact, mind you). The presence of woody debris on the surface aids the natural reoccupation of both plant and animal species, facilitating a quicker recovery of the ecosystem - our goal.

DISCUSSION

everything was cool

SUMMARY OF THE HIGHLIGHTS

For the most part, the inherent evil associated with roadways in forested settings was excersized to an omnimagnifique level. Top soil stratum along the 210 and 220 (if intact) was easily identified during excavations. A practical estimation of approximately 50% of recontoured ground surface is now either re-exposed topsoil or an organic rich mix of recovered topsoil and what ever was around. Original contours were re-established for entire length of the 210 road and significant segments of the 220 by excavating all stream crossings, unstable fill slopes and using stable (cut) portion of road bench for fillsites.

Sediment production from the 210 was significantly curtailed, even considering first year adjustment volumes. A visual estimate would suggest that less than one hundred yards moved off site for the entire 210 / 220 unit following the winter rains of the 1995 / 95 season. Out of over 37,500 cubic yards of fill excavated from stream channels, that would be less than one third of a percent adjustment factor. That's pretty dam good for the kind of rainfall that occurred during the winter of '95 / '96. Using Prairie Creek as an indicator, there were at least two significant events (greater than bankfull) occurring in December.

RELATIVE EFFECTIVENESS AND PRODUCTION

Project production rates and heavy equipment rental equivalent rates were well with in the standard for restoration done in Redwood National Park for the past fifteen years. Over 60,00 cubic yards of road fill was moved. Approximately 2 miles of road was removed at relatively standard park costs (\$3.75 / yd³).

As the evolution of watershed rehabilitation at Redwood goes on, the significant changes become more subtle. The multifaceted benefits of recovering / uncovering original topsoil had been discussed for some time, but the '95 season was the first to try and write the topsoil goal in as a specification. Another somewhat subtle tweak on the typical prescription specification was leaving the exhumed woody debris scattered on the finish surface.

For the 210 stream channel crossings, leaving woody debris on the surface created nearly 100% (or greater) ground cover in some locations. The stream channels throughout the 95-4 unit are excessively choked with large woody debris. In an attempt to melt the restored channel reach with the disturbed reaches above and below a site, we placed copious quantities of large wood, randomly in the channel.

The 'overloading' of channel substrate complexity appears to have been very effective, as previously stated. The effectiveness of topsoil recovery will take longer to evaluate, although for the first of unassisted regrowth, the vegetables are bountiful and diverse (at least four kinds of thistle).

OF RATS AND MORONS

The large wood debris that scattered in the finished channel worked very well . An assorted size class of debris dams quickly formed in the excavated channels establishing an effective organic grade control.

THAT WHAT WENT NOT SO SWELL

In-between RX4 and RX5, a fillsite, we left a depression on the surface of the fill. The probable maximal surface area of potential ponded water might be one hundred square feet at a depth of three inches. A ditch feature was left to drain any ponded water, but that is not how things were supposed to be.

The outslope reach, bid item 16, was not completely outsloped. A through cut skid road dropping down to the 210 was intended to be used as a fill site. When it appeared that there would not be enough local fill to eliminate the through cut feature, we decided to export 210 road fill, leaving a drain in the outsloping.

The channel configuration at RX8 ended up having nearly a 90 degree dog leg bend, rather than the gradual bend that was anticipated. The only thing that was influenced by the different channel form was the actual excavated volume. Final slope and channel configurations met or exceed park standards.

Other than that, the excavator fried a battery (down 1/2 day), then a starter not too long there after (down 1 day). Towards the end the excavator broke a bucket pin (down 2 days). The Dozer got stuck three times (down 3 hrs total). No other significant problems or errors occurred (they did manage to break almost all the glass and dent every body panel on the newly rebuilt excavator).

NARRATIVE OF THE DISAPPEARANCE TO THE 210 AND 220 ROADS

The excavator arrived first and was unloaded at the Blankenship truck shop. Chris Cross (contractor) began clearing the road as he walked the excavator into to RX1. The clearing of the road took 6 hours and appeared to be less efficient than it might have been with the dozer (also expensive - a couple of trees fell on the excavator causing minor body damage).

Fill was pushed beyond station 00+00 approximately 50 feet. Station 00+00 was located midway through a ridge that separated the 210 and 230 units. Most of the fill that was placed on the road down station of RX1 came from the middle and outboard edge of the crossing.

RX1 was a narrow valley form with very large rootwads and logs upstream and a large snag in the fill near the bottom. The snag reduced production while the excavator tied into the bottom due to safety concerns. The channel above and below RX1 is overloaded with large woody debris. We ended up leaving a small pond at the bottom of the RX1 excavation due to the configuration of in-channel wood below the crossing fill. After the following wet season, the channel adjustment filled in the pond, but very little sign of much material moving downstream below the excavation.

The left bank of RX1 has a group of trees that were left for 'habitat' concerns. We based our final slope on the tree locations. When we brought the bottom up to the location of the trees, we had left a noticeable lobe on the slope surface. These trees will likely blow over in the near future due to the unstable perch that they are presently occupying. In order to leave the trees we also had to leave the lower portion of the left bank intact. There are a couple of logs that became apparent in the left bank, mid way, at channel bottom depth that should have been excavated.

During the final exit of RX1, swing room became a factor. There is a snag on the outboard edge of the road at the right edge of cut for the crossing. The road is was approximately 20 feet wide at that location with a 12 foot cutbank across from the snag. The excavator could not sit on the exit road and swing the remaining fill back onto the fill site. To finish the slope at the exit point, the excavator had perform a reverse draw maneuver - taking multiple scoops for each bucket of fill.

The reach of road from 1+74 to 3+88 was either a full cut bench or through cut. Much of the last fill from RX1 was placed on this reach, with the initial portion of the RX2 and OS4 fill capping of the remainder. A skid road above the 210, near the left edge of RX2 was also used as a fill site, holding approximately one third on the excavated fill.

During the mid stages of RX2, the dozer began clipping what appeared to be a large block of mudstone along the lower mid right bank. The location of the rock outcrop suggested that there was a knob between RX2 and RX3 causing the channel at RX2 to flow closer to the left bank than we had anticipated. We were able to tie into topsoil along the lower left bank, and indeed, the lower left bank was very steep and farther to the left than we were guessing. This caused the left bank of RX2 to have slightly oversteepened fill left above the upper segment where the road bench had been. No movement had occurred after inspections following the rains.

The bottom of RX2 was left slight higher than what was likely the pre-logged condition due to the presence of another skid road stream crossing downstream. The channel between RX2 and SX2-1 is mostly large wood. Our hope in leaving the material in place was to fragment the amount of continuous channel length disturbed. The depth of material appeared to be relatively shallow, in a narrow V-shaped valley form.

The upper end of the RX2 excavation was tied in below the surveyed top. During the final portion of the top work we decided to leave the large wood intact, rather than go to the surveyed top. The remaining material was approximately 90% large wood with a relatively low channel gradient.

A main skid access road was located on the ridge between RX2 and RX3. The ridge skid and a through cut on the 210 (5+26 to 5+76) were used as fill sites for the final volume of excavated fill from RX2. As with all other fill sites, slopes were shaped to blend into surrounding topography with any significant downed vegetable products scattered across finished surface.

The stream channel crossed by RX3 was crossed by a lower skid road where it confluent with the stream channel from RX2. The lower skid road crossing was identified as SX2-1, although the crossing encompassed both channels.

The bottom portion of the fill from RX3 blended into the upper fill of SX2-1. The stream channel excavation, in this case, was carried all the way through SX2-1. A good topsoil layer was easily identified throughout the excavation of RX3 and the lower segment of SX2-1.

From station 6+31 to 7+09, fill that would have been left perched above the freshly restored channel at RX3 was pulled back and placed in the cut or pushed up station on a full bench segment of the 210 (7+09 to 7+72). The access road to SX2-1 was used as a fillsite for the excavated material from the skid road stream crossing excavation.

The outslope treatment of the road reach from 7+72 to 12+00 included a landing toward the upstation end. The road bench through the landing had significant sags, holes and cracks in various phases. The upland slope above the landing is a broad bowlsh feature that had a skid road heading upslope. The skid road was used as a fillsite. The slope below the landing is very steep (upto 100%), and appears to be relatively mobile. The outboard edge of the landing/road bench appeared to have a high proportion of large wood incorporated in the fill (as evidenced by the sags..). Upon excavation of the material, we estimated that well more than 50% of the volume had been wood.

The road bench from 12+00 to 12+78 was used as a fill site. The small sliver fill near the left edge of RX4 was placed on the cut and blended into the fill from the previous outslope treatment.

At RX4, there was a change in personnel. Randy Younger had been operating the excavator for Chris. Randy had to leave in order to finish a pervious commitment. At this point Chris took both the dozer and excavator upslope to pull three small skid road stream crossings (SX3+1, SX4+1 and SX5+1). Adam Lethbridge came on as Chris finished the slopework, and broke in on RX4. Chris had RX4 dished out as much as he could with the dozer when Adam showed up to run the excavator.

The excavation of RX4 proceeded without incident. Topsoil was easily identifiable as the original slopes were uncovered. Adam picked up the concepts quit readily and developed an efficient working strategy with Chris. A shallow depression was left in the fillsite between RX4 and RX5 (14+05 to 15+55), but no ill-effects were observed during post winter inspections.

The original survey of RX5 had anticipated a possible connection between the top of RX5 and the bottom of SX5+1, (SX5+1 was approximately 150 feet above the 210 road). The excavation of SX5+1 found the original channel form was more of a swale, thus much of the woody debris in the channel below the skid road crossing was left in place. The excavation of the channel bottom for RX5 was brought up to the most obvious break in grade and blended in. We tried to leave a group of trees that had sprouted from some buried debris near the top of the excavation. The trees, that we worked so hard to 'save', proceeded to fall over during the following winter (lesson: either they belong or they don't).

As the dozer was beginning to dish down the heart of RX5, Chris exposed a stump - damn near the middle of the crossing on the outboard edge. The stumps' location prevented the dozer from getting an efficient push road for the outboard edge of the crossing fill. As the excavation proceeded, the centrally located stump indicated that the channel took a bend towards the left bank midway through the excavation with a drop in grade as it rounded the stump. Topsoil was easily identifiable throughout the lower portion of the banks, confirming the channel morphology.

The reach of road from 16+85 to 18+00 was a full cut bench around the nose of a ridge. The reach completely recontoured using RX5 fill and some material from the outsloping upstation of 18+00.

The outslope treatment from 18+00 to 21+33 included a portion of ridge that had been used for a cable yarder setting. This segment required bringing up material from more than 100 feet below the 210 road. As the dozer was dishing down the outboard edge of the road (at the point where the road merged with the landing fill), we began seeing topsoil with stronger swale characters. Typically in the channel bottoms we had been encountering a gray muck that aligned very well with topsoil on the banks and flowing water. The swales tended to have a similar gray muck, in a broader channel form (surprise). The presence of the swale caused a momentary panic since if it had run straight down slope, it would have doubled the volume of an already very chunk of fill (which was bid as a lump sum item). Fortunately, the swale followed the lower edge around the anticipated fill slope. A number of stumps were uncovered and a relatively good topsoil layer was re-exposed along the downstation slope of the ridge. The top of the ridge (21+50), which had been the setting for the yarder, was used as a fillsite for most of the outsloped material as well as RX6.

The outslope segment from 22+00 to 24+93 contained part of an ancient slope failure. Since the portion of road in the slide feature sat above a large bench and it was located next to the ridge and it was unlikely that we would find good topsoil to follow, we counter that portion of the reach to provide a 'natural' drainage pattern and began full recontouring where the road return to a cut and fill in 'normal' terrain. A push road was left through this reach until enough material from RX6 had been disposed of on the ridge (21+55).

The estimated channel morphology at RX6 was one of the hardest to predict of the ten haul road stream crossings done in this unit. The lower left bank had been influenced by the previously mentioned slide. The channel morphology, below the crossing fill, was very narrow compared to the upstream channel. Apparently, a large portion of the hillslope had moved down hill as a single mass, keeping trees and stuff intact. The toe of this mass simply pinched the channel for nearly 200 feet.

We were able to identify residual topsoil along both banks of the lower portion the RX6 excavation. There were also a number of stumps that provided assistance for gauging the placement of the original channel. The middle portion of the channel ended up being much further to the right than had been anticipated, with a very gradual, long sloping left bank. Another conundrum with the RX6 estimate was a lone stump protruding near the right bank at the upper third of the planned excavation. The stump appeared to be in growth position, but had a very deep hole below. The stream flow could be heard and if the light was right, you could actually see the water. Upon excavation of this area we found a large tree (8'+ DBH) that

had fallen over long before timber activities. The tree had fallen across the stream and a sprout had grown from the base. The tree was subsequently buried in fill during crossing and adjacent road building. The sprout was then cut, leaving the afore mentioned stump of mystery.

The ridge between RX6 and RX7 had a number of skid roads criss crossing above the 210 road. These skid roads were designated fill sites. We had agreed to only place fill on the road surface, leaving the trees growing on the skid road fill slopes for wild life benefits (maintaining as much canopy as possible). As the upper portion of channel began to take shape with channel holding closer to the right bank than anticipated, a group of trees - on - fill became perched over the channel in a less than optimal position. During a visit from Howard Sakai (wildlife biologist), it was determined that the small clumps of trees we had been working around were not as significant for wildlife issues as we had assumed. Howard recommended not leaving trees if there was a potential to compromise the integrity of the channel restoration.

It should be noted that up to this point the contractor had been dutifully trying to preserve as many trees as possible for wildlife concerns. Working around the save trees often required less efficient push slots for the dozer and reduced swing room for the excavator. These factors greatly influence production rates which in turn influence the cost of doing the work for the contractor (i.e. profit or loss). Chris had not even complained about the leave trees he was requested to work around. He seemed to be most interested in doing the best possible job to the highest degree of Park standards.

With a new perspective on leave tree priorities, we decided to recontour the whole ridge between RX6 and RX7. Most, if not all of the ridge had been scraped clean of its original topsoil by the skid road building. By using the ridge as a fillsite, instead of just the road surfaces, we were able to distribute 'topsoil' like material across a greater expanse of the ridge reform.

The road stream crossing RX7 was the only channel excavation that had significant problems. A skid road stream crossing immediately above RX7 had been excavated a few days before. The beginning of the excavation (at the bottom) ran into some very large woody debris in a steep, narrow channel form. Instead of wrestling with the rootwads and logs, the excavator abandoned the bottom and started in on the top. Water that had been flowing subsurface through the buried wood in the crossing was brought to the surface - likely due to activity in the channel causing subsurface pathways to become blocked. Not too long thereafter, darkness began to set in. The next day found most of remaining fill in a very mucky state. As a result of the muck being impossible to work on and with, the final channel profile is too high near the bottom. The ramifications of this will be slow in matriculating due to the high density of old growth rootwads and logs that were left in the bottom region.

The outslope reach from 27+73 to 31+64 contained a portion of exported outslope at a swale. As the excavation proceeded, we encountered a similar swale feature to the swale excavated in the outslope at 'the ridge' (bid item 16). A broad bowl of darker soil materials with a swath of gray muck was located near the middle of the road surface at station 29+50. During the winter observations, the swale appeared to have little to no adjustments with the increased flow from the springs.

The road surface from 31+64 to 33+46 was used as a fill site for the exported material from the previous outslope and a majority of the fill from RX8. A large throughcut was filled in just downstation of RX8. This reach also contained the intersection of the 220 road.

Work on the 220 road was limited to an export outlope reach at the headwater swale for the channel crossed by RX7. The material from the export outslope treatment was placed on the road surface downstation of the swale. The fillsite was contoured to match surrounding topography (it was along a ridge - 500 ft in length). Where the fill site ended, the 220 hooked down a smaller ridge to the intersection with the 210. The length of road (1500 feet) was drained by one continuous inboard ditch that flowed to RX8. In order to keep the ditch flow from impacting the restoration work at RX8 or a nearby skid road stream crossing excavation, the remainder of the 220 had a 'scratch and drift' treatment prescribed. Essentially, the scratch and drift was intended to minimize or eliminate any concentrated water flowing down the road surface. The final result looks like a continuous series of outsloped rolling dips. The

scratch and drift treatments appeared to effective during the winter events, but they down look like they belong in a forest.

Three skid road stream crossing excavations were accessed from the 220 road. At least two of the crossings (SX6+1 & SX8+1) were built on the contact between the Gold Bluffs and Franciscan formations. The contact points produced a significant volume increase of surface flow in the channels.

As the dozer was beginning to dish out RX8, a stump was encountered near the outboard edge, at what was anticipated to be the centerline of the channel profile. The dozer then began taking the fill down on the uphill side of the stump, when out of nowhere, a distinct line of topsoil exposed itself. The topsoil confirmed that the original channel bank had been narrower and oriented to the left side of the work area than we had assumed. Topsoil was easy to identify allowing a relatively indisputable restoration of the original channel form. The only mystery was a large stump, apparently in place, that was sitting in the middle of the channel below the top. As we followed the topsoil along the upper banks, both side came right to the base of the stump with the characteristic gray muck above and below the stump. After finishing the slopes around the stump, we were not satisfied with the ponding of water behind the stump. Adam went back in with excavator and started fishing around the impoundment. Within a few minutes of submarine exploration, a pipe was reopened and the stream began flowing underneath the stump through what appeared to be a well established path. During the winter events the channel seemed to be quite content with the sub-stump piping.

The outslope reach from 34+56 to 42+50 was the largest volume and longest stretch treated in the 210 / 220 road work. We had anticipated that the reach would take at least a few days due to the frequency, size and placement of stumps / leave trees. The dozer was able to move much more of the road fill up onto the remaining bench leaving minimal dirt for the excavator to move. Adam spent most of his time cleaning up the topsoil layer or detailing around stumps and finishing the fill surface. The reach was completed in just over a day.

The skid road stream crossings SX8-1 and SX9+1 were accessed near the watertank at station 42+50. During the excavation of SX8-1 the dozer started clipping relatively rocky material on the right side of the channel early into the dishing process. As the excavator moved in, it became more obvious that there was a large rock outcrop within the crossing causing a steep drop near the outboard edge. The access road to SX8-1 was used as a fill site or recontoured as fill was depleted.

The outslope reach between the watertank and RX9 (42+50 to 44+49) ended up having a small segment that was nearly an export outslope. A small swale like depression (Chris found a buried pipe) developed as the equipment followed the topsoil profile. The topsoil in the swale was not as well defined as the previous examples had been there by absolving COTR from any and all malcontentance regarding its prior knowledge.

RX9 was the first stream to be crossed by the 210 in completely Franciscan material. The valley form has much steeper banks and a significantly steeper channel gradient than the stream crossings near the contact zone. The tighter, steeper channel form required an alternative technique than had been used in the previous excavations. The steepness prevented the equipment from working up the channel. Fortunately there had been a skid road that provided access to the lower portion of the crossing fill. While the dozer dished out the upper part of the fill, the excavator was able to move on the bottom, establishing the finish slopes. By trading positions, they were able to finish the slope gradually and keep both pieces of equipment busy.

A small storm over the weekend of September 23 made the finishing of RX9 slightly mucky, but not enough to cause any concern. As Adam finished up the fillsites, Chris was well into the next reach of outsloping.

The next two reaches of outslope (47+00 to 55+50) rounded a point and dropped into the last stream crossing at the rock pit above RX10. The first outslope reach proceeded without incident (except for Chris

getting the dozer stranded on a log). The second reach of outslope included a small swale and the rock pit. Topsoil was prevalent up to the rock pit, at which point there appeared to be many lenses of topsoil like material. Much of the fill from RX10 was placed in the rock pit, not completely recontouring it but providing a reasonable drainage surface.

The original survey of RX10 had the top placed at the upstream edge of what appeared to be a depositional reach of channel. The profile generated during computer work ups of the survey indicated that the upper third of the excavation would be a thin lens of material, so the top was moved down stream to achieve a more beneficial use of time and money. During the excavation the channel ended being wider than had been anticipated. The width increased the volume significantly, and made the blending at the top slightly less than ideal. During the channel adjustments of the first winter, the woody debris in the channel stored most of the initial sediment.

The bottom of the RX10 had to be at a culvert on the 200 road. The 200 road at that point belongs to David Schneider and is being used by H.A. Blankenship trucking. We tied into the drainage structure that was at the 200 road to find that the upper half was an old redwood box type culvert. The box was more than half way plugged and attempts to clear it were unsuccessful. It was determined that restoration of the above channel would likely increase the amount of water that would need to be delivered through the present drainage structure, easily exceeding its capacity. Water that overflowed from the pipe would flow down into the middle of the truck yard and possibly create problems near the fuel storage tank. After several plans to replace the pipe through modifications of the contract, it was decided that Redwood National Park would do the work with in house personnel and equipment.

The section of channel above the pipe had been trenched through natural ground. Our plan was to widen the trench as necessary to mimic natural slopes. Approximately 75 feet upstream of the pipe, we hit buried topsoil and were able to tie into the original channel banks and bottom. From that point on the channel excavation went according to plan. A three day delay was incurred when the excavator broke a pin at the bucket.

HOW WOULD YOU DO IT DIFFERENT? WHY?

The Scratch and Drift treatments met their intended purpose, but they do not fit into the landscape very well. Before the treatment had been complete it seemed obvious that the undulations were extraterrestrial. I personally (Neal) think it was a dumb yet effective idea (I talked TAS into it).

ACKNOWLEDGMENTS

First and foremost, Peter Armato should be given the highest praise. With out Peter's vast expertise in nearly everything, the Park its self would most likely be only a memory.

Bo Dame, Paul Weasels and Mike Sanders all spent time preparing ground work prior to the '95 season. Darci Short, Becca Smith, Mike Sanders and Keith Ritchey helped survey the road fills and provided much education by sharing their diverse perspectives and experience. The Resource Management Support Crew was always available upon request and extremely helpful. Darlene Buckskin, Joel Gordon, Donnie Frazier, Keith Ritchey and Tim Tanno spent time clearing, brushing and giving falling lessons.

The Maintenance Team provided fast turn around times when we salvageable logs were uncovered. Paul Harris and Steve Nova were the primary catskinners / choke setter team, although Dick Mayle did make an appearance with the cat. Thanks needs to go to Tommy Dore, Candy Gibson and Lee Wilson for extra hours on the final culvert installation.

The folks at H.A. Blankenship trucking deserve a case of ear plugs. Steve Frick, Dana Witaker and Kenny Frick were always helpful and saved both the Parks' and Chris' butts more than a few times.

Even though Chris Cross got paid for his effort on the Job site, He often spent more time than he needed to on a bid item, just to insure the best final product possible. The quality of the finished product can be highly influenced by the techniques / skilllevel of the operators. Both Chris and Adam not only demonstrated samurai quality workmanship, but also showed an overwhelming desire to facilitate the return of the disturbed lands of the 210/220 road systems back to a naturally functioning corridor.

Finally, the contributions made by Terry Spreiter & co. can not be over homaged. Terry always had positive input and extended patience for those times when her advice wouldn't sink in as fast as she hoped. Too often, the words "oh, that's why she wanted us to do it that way" were heard. Terry's wisdom and support make a huge difference, not only in moral, but ultimately in the quality of restoration work at Redwood and other parks.