USDA-FOREST SERVICE FS-2500-8 (7/00)

Date of Report: 03/23/03
Modified: 12/04/04

BURNED-AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

A. Type of Report

[ ] 1. Funding request for estimated WFSU-SULT funds
[X] 2. Accomplishment Report
[ ] 3. No Treatment Recommendation

B. Type of Action

[ ] 1. Initial Request (Best estimate of funds needed to complete eligible rehabilitation measures)

[ ] 2. Interim Report
[ ] Updating the initial funding request based on more accurate site data or design analysis
[ ] Status of accomplishments to date

[X] 3. Final Report (Following completion of work)

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Cerro Grande

B. Fire Number: NM SNF 043

C. State: NM

D. County: Los Alamos

E. Region: R-3

F. Forest: Santa Fe

G. District: Espanola

H. Date Fire Started: 05/04/2000

I. Date Fire Contained: 07/20/2000

J. Suppression Cost: 15,813,914

K. Fire Suppression Damages Repaired with Suppression Funds
1. Fireline waterbarred (miles): 38.8
2. Fireline seeded (miles): 55.5
3. Other (identify):

L. Watershed Number: 13020201

M. Total Acres Burned: 42,970
NFS Acres(25,633) Other Federal (15,270) State ( ) Private (2067)

N. Vegetation Types: Ponderosa pine/Douglas fir; Ponderosa pine/oak; Pinyon pine/juniper

O. Dominant Soils: Mollic Eutroboralfs/Andic Ustochrepts/Typic Ustorthents, frigid to mesic in lower sites

P. Geologic Types: Rhyolite/andesite/pumice/tuff/basalt

Q. Miles of Stream Channels by Order or Class: 80 Ephemeral 60 Intermittant 20 Perennial

R. Transportation System

Trails: 50 miles Roads: 100 miles

PART III - WATERSHED CONDITION

A. Burn Severity (acres): 25,034 (low) 3,424 (moderate) 14,512 (high)

B. Water-Repellent Soil (acres): 15,000

C. Soil Erosion Hazard Rating (acres):
25,034 (low) 3,424 (moderate) 14,512 (high)

D. Erosion Potential: 45 – 110***** tons/acre

E. Sediment Potential: 24,000** cubic yards / square mile

******* *Comment: Initial 2500-8 was 225 and subsequently adjusted to 0.45 – 1.1 tons/acre. Soil movement ranged from 2 – 5 cms throughout the burned area. Channel scour was significant.*

***Comment: Intial 2500-8 was 25,000 and subsequently adjusted to 225 cubic yards/square mile. Value of 24,000 based upon actual measurements of sediment delivery into Los Alamos Reservoir from June 2000 – July 2004.*

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period, (years): 5

B. Design Chance of Success, (percent): 40

C. Equivalent Design Recurrence Interval, (years): 25

D. Design Storm Duration, (hours): 1.0

E. Design Storm Magnitude, (inches): 1.9

F. Design Flow, (cubic feet / second/ square mile): 50 - 500

G. Estimated Reduction in Infiltration, (percent): 100

H. Adjusted Design Flow, (cfs per square mile): 75 – 750*****

******* *Initlal 2500-8 was 556 and subsequently adjusted to 35 – 750 cfsm. Many rainfall runoff events were disproportional to measured rainfall. A 25 year one hour storm total of about 1.9 inches was measured on July 2, 2001 with a resulting Pueblo Canyon peak flow of about 625 cfsm. (Note; nested in that event was the equivalent of a 90 year 30 minute storm). Many other measurements approximated 500 cfsm.*

PART V - SUMMARY OF ANALYSIS

A. Describe Watershed Emergency:

An escaped prescribed burn threatened Los Alamos NM on the southeast side of the Jemez Mountains. Fire entered the town of Los Alamos, burning 260 structures, and lands administered by the Los Alamos National Laboratory. The fire also burned 842 acres within the Bandelier National Monument that is east and downstream of the Forest. About 39,000 acres in the headwaters and upper watersheds of Water, Pajarito, Los Alamos, Pueblo, Rendija, Guaje, Sawyer and Santa Clara Canyons burned. These streams enter the Rio Grande approximately 7 miles from the fire boundary, and then drain into Cochiti Reservoir (6 miles downstream), a popular fishing and recreation lake. The waters from Cochiti Reservoir are used primarily for irrigation. The potential exists for massive hill slope erosion with sediment transport and channel scour through the town and the laboratory's infrastructure. Downstream, the town of White Rock and the Santa Clara and San Ildefonso Pueblos would be threatened by floodwaters. Large amounts of sediments may enter the Rio Grande and Cochiti Reservoir.

Slopes within the burned area are predominantly moderately steep-to-steep, with smaller amounts of flat mesas. The tuff and pumice derived soils are very productive but have very high erosion potentials due to the low bulk density of the extrusive volcanic parent material. Channels have not experienced high flows in many years and consequently have large amounts of stored sediments that could entrain easily under peak flows.

Los Alamos' transportation system crosses Los Alamos, Pueblo and Rendija Canyons. Large through- fills that also contain the town's water, sewer, and gas lines are at risk if large peak flows and sediment transport occur. Large portions of the town could be cut off with no access. Several of the LANL structures lie within the floodplains of Los Alamos and Pajarito Canyons and are at risk of flooding and scour. According to the DOE Site Wide Environmental Impact Statement for Los Alamos National Laboratory (1999), there are contaminants in the sediments below National Forest System lands. There is a risk of contaminated sediments moving downstream to the Rio Grande and Cochiti Reservoir.

Bandelier National Monument, National Forest, and Pueblo lands contain extremely high densities of cultural resource sites. Increased flows and sediment pose a threat to archeological sites. In addition, recreational sites and associated infrastructure are threatened on Pueblo lands.

The area contains critical habitat for the Jemez Mountain salamander, and the Mexican spotted owl, and may contain known nesting sites. Preservation of these habitats is tied to protection of site productivity.

B. Emergency Treatment Objectives:

Prevent the loss of life.
Prevent the loss of property, infrastructure, and access.
Reduce erosion and sediment transport from high severity burn areas.
Prevent damage to natural and cultural resources.
Reduce contaminated sediment movement.
Minimize damage to site productivity.
Minimize water quality degradation.

C. Probability of Completing Treatment Prior to First Major Damage-Producing Storm:

Land **60** % Channel **70** % Roads **80** % Other **80** %

D. Probability of Treatment Success (new values in bold – see appendix X)

	Years after Treatment		
	1	3	5
Land	90	80	80
	0 - 90	**10 - 80**	**40 - 80**
Channel	80	80	80
	0 - 90	**0 - 90**	**0 - 5**
Roads	90	90	90

	50	**50**	**50**
Other	80	90	90
	60	**80**	**80**

E. Cost of No-Action (Including Loss): **>1 billion dollars**

F. Cost of Selected Alternative (Including Loss): **105 million (not including loss)**

G. Skills Represented on Burned-Area Survey Team:

[x] Hydrology	[x] Soils	[x] Geology	[x] Range	[ ]
[x] Forestry	[x] Wildlife	[x] Fire Mgmt.	[x] Engineering	[ ]
[x] Contracting	[x] Ecology	[x] Botany	[x] Archaeology	[ ]
[x] Fisheries	[x] Research	[x] Landscape Arch	[x] GIS	

Team Leader: Gregory A. Kuyumjian, Santa Fe National Forest (original team leaders; I.Gasser and W.Patton)

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1) **Treatment Narrative: Edited 12/2004 Text is specific to lead activities on NFS lands**

Land Treatments:

1) Aerial and hand seeding.

Purpose: Seed where appropriate to minimize soil erosion by providing vegetative surface cover. This may help maintain site productivity, protect T & E habitat, and reduce sediment delivery and transport to local drainages, Rio Grande and Cochiti Reservoir.

Treatment: Treat high and moderate severity burn areas with seeding mix using helicopter/fixed wing application on NFS lands. Rate is 50 seeds per sq. ft., pure live seed. The mix was determined to be the same for low and high elevation Pipo/Psme and Pipo/Oak vegetative types.

Seed Mix:	Annual ryegrass	20%
	Cereal barley	20%
	Mountain brome	30%
	Slender wheat grass	30%

Comment: The mix in the BAER Plan specification sheet had 30% annual ryegrass and 10% cereal barley – this may have been the result of transposed numbers, it could have been – 10% annual rye, 30% barley. In either case it is different than what was submitted above. Seed testing of the first year mix was actually about 40% barley, 10% annual rye and 25% each for mountain brome and slender wheat, which is what I remember as the agreed upon seed mix The application rate on the specification sheet for the above mix was 36 pounds/acre (60 seeds/square foot). Thirty six pounds/acre of the tested mix results in 25 seeds/square foot, about 50% of prescribed density. An intense rainfall event on June 28, 2000 washed away a considerable amount of seed on the south side of the fire. Areas were retreated by hand seeding.

This mix is considered native for this part of the Santa Fe National Forest except for annual rye and cereal barley. Experience with annual rye on other projects on Forest indicates that rye will provide quick cover but will not persist beyond a few years.

Comment: The annual rye did better at lower elevations while the barley did better at higher elevation along with the mountain brome. The slender wheat did well at all elevations and aspects and tolerated drought conditions better than the other species. The most successful treatments were on burned areas where seed was applied prior to needle cast or subsequently covered by straw mulch. Harsher aspects had limited, if any, success without needlecast or cover which

may be attributed to desiccation of seeds prior to germination. RAWS temperature probes show soil temperatures easily exceeding 100 degrees F (seed desiccates at around 90 degrees F). The annual rye has persisted, at somewhat less than significant levels, far longer than the barley which essentially disappeared two years after application.

2) Scarification

Purpose: Break up hydrophobicity within the top 2 centimeters of soil. This will increase infiltration, reduce runoff, and reduce erosion. Scarification accelerated recovery of the soil conditions.

Treatment: Manually rake portions of upper and middle watersheds above the town of Los Alamos, furrowing to the depth of 1.5 - 2 cm. Seed and mulch disturbed ground.

Comment: Originally intended as a stand-alone treatment if nothing else could be accomplished. Ended up being concurrent mostly with application of straw mulch. Findings and observations in 2001 include that when applying straw mulch, raking is unnecessary as straw mulch acts to negate surface hydrophobic tendencies. Scarification was not implemented during treatments in 2001.

3) Straw Wattles

Purpose: To capture and retain sediment on slopes, stabilize slopes, reduce soil creep and sheet/rill erosion until vegetation re-establishes. Wattles are flexible and can make contact with irregular slopes.

Treatment: Install wattles to shorten slope length thereby interrupting raveling and development of rills. Wattles are used where log erosion barriers are not feasible due to irregular terrain. Vertical spacing of wattles is determined by site conditions. Two densities have been prescribed for this area based on soil type and slope gradient (30 wattles/acre and 60 wattles/acre).

Comment: This was changed to 20 and 40/acre. Most acres were treated with 20/acre. Transporting straw wattles turned into a logistical nightmare. Little to no use as a large-scale slope treatment due to very limited storage capacity. Some depravation by elk and trapping of rattlesnakes occurred. Highest and best use for a wattle; "stick it under a contour felled log" (on the upstream side). Capacity of straw wattles is limited to about 0.1 cubic yards with a delivery rate of sediment (10% of actual movement) of 25 cubic yards/acre one would need 250 wattles/acre just to capture sediment export. This would cost, at a minimum, 7500/acre. Straw wattles placed in any feature that concentrated flow, washed out, and in some cases, within polygons of low burn severity.

4) Straw mulch and straw barriers

Purpose: Mulch is to provide ground cover and soil protection on landscapes scarified to reduce hydrophobicity. Whole bales will be used as water diversions on slopes directly above homes near national forest boundaries.

Treatment: Manually apply a 2-inch cover of straw mulch after scarification and seeding on areas above town site. Place straw bales contour to slopes above housing areas to divert sheet wash.

Comment: Most successful treatment of this entire BAER effort. Due to inflated bids for ground based hydromulching – treatment switched to manually applying straw mulch. Reported accomplishment includes 300 acres that were re-treated after damaging storms. Volunteers applied mulch on 422 acres in 2000 and 100 acres in 2001. When compared to controls, straw mulch application reduced sediment export by over 90%. In areas immediately treated with mulch prior to damaging rains, the ash is still in place, there is no evidence or rilling or pedestal development, additionally straw mulch had an unexpected benefit, it negated the hydrophobic tendency found in the soil by acting as a wetting agent. Actual 2000 accomplishments were difficult to pin down – as acres were re-mulched – acreages have been adjusted to reflect some, if not all of this conflict.

5) Aerial Hydromulching

Purpose: To rapidly establish grass cover on steep slopes that have potential to contribute water and sediment to flood flows.

Treatment: Hydromulch severely burned steep slopes in Los Alamos Canyon, Pajarito Canyon, Pueblo Canyon, and Rendija Canyon. Mulch rate with tackifier should not exceed 600 lb/ac. Seed mix will be approved mixture of annual rye, mountain brome and slender wheat grass. Application will be with either fixed or rotary wing aircraft. Forest Service costs are for acres on National Forest.

Comment: This previous specification was a serious error – tree boles intercepted up to 40% of the aerial hydromulch. Only immediate successful treatment was the steep north-facing slope of Los Alamos Canyon where the application rate was 1200 lb/acre due to a double application on about 230 acres. Rest of the acreage was by and large a waste of money as it did not have "critical mass" and easily washed away. Seed application rate 21 pounds/acre (62 seeds/square foot) with a mix of 40% "cereal rye", 30% slender wheat and 30% mountain brome. LANL mulch application rate was about 2400 lb/acre with cover still in place two+ years after application.

6) Hazard tree removal

Purpose: to provide public safety.

Treatment: Felling trees damaged or killed by the fire, that pose an immediate threat to public safety or property.

Comment: Four years later, this is still a problem.

7) Contour Felling

Purpose: The primary purpose of the practice is to reduce the overland flow of rainfall, thereby reducing the amount of runoff and potential overland flow to initiate surface soil erosion (rills). Secondary, the contour logs on the ground trap sediments, and aid in vegetation reestablishment.

Treatment: The appropriate tree is fallen parallel to the contour of the slope (perpendicular to the fall line of the slope). The underside of the tree is limbed. Undercuts are added to improve contact between tree and soil.

Comment: This treatment was recommended based upon an assumption, as a function of production rates, that contour felling is 5 times faster than log erosion barriers. This treatment never met its purpose. Little, if any, appreciable benefits were realized from this treatment. Another "harm/foul" outcome. Since only portions of contour felling trees had contact with the ground it actually concentrated flow lines into the "gaps" between the logs and soil surface.

8) Log erosion barriers *(LEBs)*

Purpose: The primary intent is to delay overland runoff long enough so that it can infiltrate into the soil instead of running overland. This can effectively prevent hillslope erosion, rills and loss of ashes. An equally important intent is to store sediments upslope of each log.

Treatment: ~~Log~~ runoff no longer has straight path down the slope. These barriers are an effective treatment for hydrophobic soils, low ground cover density, and high intensity burn areas.

Comment: resulting from higher production rate estimates, log erosion barriers were largely abandoned in favor of contour felling. In a number of places where LEBs were correctly installed one could observe a "field of green ribbons" with grass growing in the sediments stored behind the log erosion barriers. Another limiting factor was a shortage of qualified, experienced resource advisors to oversee installation. As with the previous discussion on wattles, one would need approximately 200/acre to make a significant difference on sediment transport.

9) Land treatments implemented but never formally requested in any previous 2500-8

a. Archeological site stabilization – LA 12700, prehistoric cultural property listed on National Register of Historic Places

Purpose: Protect site through erosion control measures to maintain its integrity and National Register qualities.

Treatment: Remove standing dead trees where windfall would damage features, lay excelsior matting over sensitive areas, lay straw bales in swales to protect structures from sedimentation, lay felled trees and limbs on the contour and place sandbags/hay bales below headwall cuts in the site.

b. Hazard tree cleaning

Purpose: For public safety, clear trees along major travel routes (American Springs, and Camp May Roads).

Treatment: At the direction of the MAC group in July of 2000. Clear all standing trees for a distance of 2 – 3 chains on each side of the above mentioned roads.

c. Re-mulching

Purpose: Re-establish treatments in high priority watersheds per MAC group direction in July 2000.

Treatment: Re-seed and re-apply mulch in Water Canyon, Los Alamos Canyon and Pueblo Canyon watersheds where damaging runoff has washed away straw and seed. Included in the accomplishments of straw mulching, approximately 300 acres re-treated.

Comment; Damaging storms occurred on June 28 and July 9, 2000.

d. Wildlife habitat restoration

Purpose: Create down douglas-fir logs for emergency habitat restoration for the jemez mountain salamander.

Treatment: Fell douglas-fir snags greater than 18 – 24" dbh to achieve a density of five logs/acre. After the tree is felled, cut four disks, 2-6" thick, from the cut end and place flat on the ground in a square pattern in a relatively flat location within 20 yards of the tree stump.

Comment: BAER plan identified the potential for 3,825 acres to be treated. Work commenced but was stopped immediately after it was discovered that this un-authorized and un-approved treatment had been started. Sixty acres of 3825 had been completed. If requested, this treatment would have been denied. These acres are included with the reported acres of contour felling. Fire plan rehabilitation and restoration funds were used to complete this proposal in FY 2001/2.

10) HYDROMULCH

Purpose: To rapidly establish grass cover on steep slopes that have potential to contribute water and sediment to flood flows.

Treatment: Hydromulch severely burned and accessible slopes in Los Alamos Canyon, Pueblo Canyon, Rendija Canyon and along roadways within and adjoining severely burned areas. Mulch rate with tackifier should not exceed 2000 lb/ac. Seed mix will be approved mixture of annual rye, mountain brome and slender wheat grass.

Comment: This ground based hydromulching treatment (approved June 2, 2000) was never implemented. All bids received exceeded cost estimates by 300%. It was decided to use hand crews to continue application of straw as a substitute treatment. LANL treated 125 acres with ground-based hydromulching.

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Channel Treatments:

1) Dredging

Purpose: Reduce peak flows and catch debris from runoff produced by the Los Alamos Canyon watershed and allow for extra time to evacuate facilities in the canyon downstream of the burn.

Treatment: Drain and dredge the Los Alamos reservoir. Deepen and enlarge the reservoir to the extent the valley bottom allows.

Comment: Project taken over by the U.S. Army Corp of Engineers (USACE). Reservoir was never dredged or deepened in 2000 but a LANL contract facilitated dredging in 2001. Forest had obligated fire plan rehabilitation and restoration dollars ($500,000) to the USACE for future dredging, 2003 and beyond. The status of this re-dredging by the Forest is unclear as it appears that the funding was automatically and un-intentionally de-obligated in FY2002. Reservoir surveys and subsequent publications documented post-fire sediment delivery. Successful treatment, in that only one upstream event of consequence (August 9, 2001) flowed through the spillway.

2) Channel Cleaning

Purpose: To remove debris capable of being moved downstream during major runoff events that may clog culverts, cause debris jams and intensity *(intensify)* channel scour, adding to storm flow capacities and flooding effects. To reduce risk of failure to stream crossing and infrastructure.

Treatment: Remove floatable debris within streams. Small debris will be manually removed and placed above flood stage on the first geomorphic terrace. Large debris will be cut into smaller sections and either manually relocated to the terrace

or bundled and lifted by helicopter to an area outside the inner gorge to a pre-selected landing site. Lifting capacity of the helicopter will determine size of large debris airlifted. Used where debris is expected to be large. Manual labor will remove smaller debris first along stream reach and then followed by helicopter for larger debris.

Comment: Based on initial runoff events, this treatment was successful in reducing damage to downstream infrastructure and facilities. A consideration: placing material back into the channel network, after a few years, if large woody debris recruitment is limited. In our case – there is more than sufficient large woody material now in the channels.

3) Catchment Cleanout

Purpose: Removal of debris and sediment deposited within catchment basins after each runoff event to restore capacity for future events as a result of fire in the watersheds.

Treatment: Clean out of debris and sediments from catchment basins after each storm flow event. Estimated 4 storm flow events per year for 1 years for 3 basins located on NFS land.

Comment: In both 2001 and 2002 some culvert cleanouts were completed using Fire Plan Rehabilitation and Restoration funds.

4) Channel treatment implemented but never formally requested in any previous 2500-8

Channel tree felling

Purpose: Mimic natural channel processes in forested watersheds and reduce the amount of woody debris migrating downstream.

Treatment: Trees will be felled across and in a slightly upstream direction in first and second order drainages less than 200 acres in size.

Comment: Some very limited success just north of the Camp May Road. Rather difficult treatment to install due to topographic limitations in deeper drainages. Can be source of catastrophic failure if high flows occurred before the structure is stabilized by partial burial by sediment and debris. This treatment needs very specific conditions that require constant oversight by a qualified resource advisor. Many trees never made it into the drainage way.

Roads and Trail Treatments:

1) Road and trail drainage adjustment

Purpose: To provide unrestricted water movement through or over roads and trails. Many of the culverts now in place on national forest roads are undersized for the water events now predicted to occur.

Treatment: Remove undersized culverts in watersheds significantly affected by high and moderate burned severity. In many cases culvert will not be replaced until watershed is healed. In some cases it may be necessary to replace with an appropriate sized culvert.

2) Cleaning culverts

Purpose: To minimize the threat of debris collecting in the culvert creating debris jams and backwater which could cause water to leave the channel and erode roads.

Treatment: Crews should use hand tools to clean sediment, debris, trash, etc. from around the entrance and exits of all FS road culverts. Crews should use chainsaw to remove small trees and vegetation in channels where applicable. Crews should use engine pump and hose to flush culvert.

Comment: This was done in 2000 after major runoff events but the predominant drainage blockage problems were downstream of the Forest Boundary. Culverts were maintained in 2001 with Fire Plan money

3) Warning signs

Purpose: Public safety signs were developed for immediate *(use)* on roads and trails in the area affected by the fire that are likely to sustain damage from flooding and mudflows generated by the Cerro Grande Fire burned area. The signs are necessary to keep the public out of immediate danger posed by flooding, mudflows, rolling rocks, snags and stump holes.

Treatment: Road signs will be used in 100 locations in a size appropriate for each location.

4) Closure of FS road 442

Purpose: FS Road #442 will be closed for public safety protection due to flooding, hazard trees and falling rocks from steep slopes

Treatment: Closure will be implemented with backhoe, partially burying large boulders to block access.

Comment: Required re-closure in FY 2001 with Fire Plan Rehabilitation and Restoration funds.

Structures:

1) Small lowhead checkdams, grade control structures and catchments

Purpose: The primary intent is to delay overland runoff in first order channels long enough so that it can infiltrate instead of running overland. This can effectively prevent hillslope erosion, rills and loss of ashes. An equally important intent is to store sediments upslope of each log. It is expected that grass seeds washed off hillslopes will be deposited behind these structures. These seeds will grow into grass sediment traps.

Treatment: These structures are constructed of rock; logs or straw wattles in 1st order channels with watersheds less than 300 acres. On the stream reaches where grade structures are needed the frequency of the structure will vary depending on valley bottom gradient and sites where a structure can be keyed into the streambed and stream banks. The criteria for the type of structure depend on the stream gradient, the streambed materials, and the amount and type of natural materials available on each installation site.

Comment: This treatment really got out of hand and I can only speculate how the 300-acre limit was adopted. The limit showed up on an interim 2500-8 dated June 12, 2000. When I left this assignment I recommended that structures not be placed in anything with a contributing watershed greater than 5 acres as hand constructed structures could not be built to withstand the expected flows. This turned out to be true. Some implementation teams started to freelance installation of structures because they thought it was the right thing to do. Most of them washed out after the first storm. In many channels, straw wattles were used. Important lessons were learned: 6 saturated wattles are capable of plugging a 24 inch diameter culvert, once a wattle has traveled more that 1200 feet it becomes unrecognizable, a wattle transported less than 500 feet will still look like a wattle, transported between 500 and 1200 feet it will lose some of its stellar qualities. This treatment should be considered a dismal failure with more than 90% of the structures washing downstream. The mantra of "no harm, no foul" was violated, as in some cases downstream resources and infrastructure were negatively impacted.

2) Trash racks

Purpose: Catch debris from runoff produced by the contributing watershed. Protect infrastructure and downstream residences fro debris related damage.

Treatment: Construct wood structures capable of capturing suspended debris during flow events in 2 locations upstream from State Road 501. Accumulated debris will be periodically removed from behind the structure.

Comment: Not a chance. First wooden trash rack on South Pajarito washed out during first runoff event. Large steel structure installed by NRCS installed on NFS lands in Pajarito Canyon, which functioned perfectly and became somewhat of a grade control structure. Structure dredged at the end of FY2002 with fire plan rehabilitation and restoration funds. Large steel trash rack design has great promise as a grade control structure after a fire. The two large trash racks in North and South Pueblo Canyons were located too close to their respective culvert inlets and as a result did more harm than good and most likely contributed to the overtopping of North Road on more than one occasion. Trash Rack in Rendija Canyon worked but need regular maintenance to keep functioning and when last visited was completely buried. Trash rack in Los Alamos Canyon above TA-41 never really tested but is also too close to the culvert inlet. Pajarito trash rack was the only structure properly located at an elevation above the overtopping elevation of the downstream structure it is suppose to protect.

I. **Monitoring Narrative:**

1) EARLY WARNING SYSTEM

Purpose: To provide signal via satellite when soil moisture conditions or rainfall intensity reaches pre-determined levels. Signal is received by Los Alamos County, pueblos, BIA and Forest Service that may issue stay clear or evacuation order. Seven remote weather stations strategically placed in key locations on National Forest are needed. The National Park Service obtained 6 stations through a rental agreement. The Forest Service purchased three stations, which will return to the BIFC RAWS cache at the end of 2003. *These stations proved invaluable as a monitoring tool for number and duration of storms, soil temperature, etc. They were in placing long enough to provide data on the longer term effectiveness of treatments on reducing runoff.*

Comment: While somewhat immediate to install RAWS, money would have been better utilized if we had purchased self contained fully automated "ALERT" stations at about $3500 each that would have provided real time five minute precipitation data. We would still have the stations vs. being sent back to Boise, Idaho. ALERT stations would have provided NWS with a better platform for flood forecasting. A separate issue rests in the responsibility for providing an maintaining an early warning system. RAWS alert units should be a temporary installation until the responsible party can order and install an "ALERT" network station.

2) HERITAGE RESOURCES

Authorized up to $26,000 to monitor and assess emergency conditions and needs within the Cerro Grande burned area. Funds are authorized to identify sites needing protection, design protection measures, and construct appropriate protection measures. Burn severity, vulnerability, and risk should be taken into account in determining the scope of the assessment. These funds were never utilized for this purpose. National Fire Plan Rehabilitation and restoration funded all heritage resource monitoring and treatments.

3) BAER MONITORING

Three-year position established to monitor BAER effort and results. Position permanently filled in December of 2000. Department of Energy, through a MOU (2001-2004), agreed to contribute 20,000/year to support the position, LANL agreed to supply an office with support (desktop, phone, fax, etc.). Duties include co-ordination and interaction with; other agencies (state, federal and county), universities, research, external interest groups, professional societies. First year monitoring resulted in an additional request for BAER treatments. Position shared with some Fire Plan rehabilitation and restoration duties in FY 2001. Position served as BAER Implementation Team Leader, June - September 2001 in FY 2001. Position co-ordinated with LANL ands its contractors to dredge 41,000 cubic yards of deposits from Los Alamos Reservoir. Still involved in post treatment monitoring to include Los Alamos Reservoir and Pueblo Canyon Watershed.

There are no less than 37 LANL/DOE publications on line at this LANL library web link (this site is in front of the firewall).

http://lib-www.lanl.gov/cgi-bin/getfile?fire.htm

Behind the firewall, at this site, there are additional LANL publications.

A search of scholar.google.com will yield no less than 35 substantive results of publications (many of them peer reviewed) related to post fire effects.

Part VI – Emergency Rehabilitation Treatments and Source of Funds by Land Ownership

Line Items	Units	Unit Cost	# of Units	WFSU SULT $	Other $	# of units	Fed $	# of Units	Non Fed $	Total $
A. Land Treatments										
Aerial hydromulching	acre	2913	1200	$3,495,261	$0	100	$300,000		$0	$3,795,261
Aerial seeding	acre	8.2	13,500	$110,700	$52,000	7580	$812,469		$0	$975,169
Contour felling	acre	700	3,532	$2,472,400		466	$3,519,600	86	$86,000	$6,078,000
Contour raking	acre	300	997	$299,100		329	$316,200	57	$17,100	$632,400
Contour raking (volun)	acre	100	422	$42,200		N/A	$22,000	152	$15,200	$79,400
Straw bale barriers	ea	75	100	$7,500						$7,500
Straw mulch	acre	1200	1,364	$1,636,800		N/A	$1,118,400	34	$40,800	$2,796,000
Straw mulch (volun)	acre	800	522	$337,600	$80,000	N/A	$208,800	113	$90,400	$716,800
Straw mulch 2001	acre	595	500	$297,500	$302,500					$600,000
Log erosion barriers	acre	1200	332	$398,400			$400,000			$798,400
Wattles	acre	1,000	1,293	$1,293,000		256	$847,600	208	$291,200	$2,431,800
Hazard tree removal	ea	170	1,000	$170,000		349	$59,330			$229,330
Hazard tree clearing	acre	400	224	$89,600						$89,600
Stabilize heritage site	ea	67,000	1	$67,000			$34,000			$101,000
LEBs from cf logs 2001	acre		107	$0	$32,100					$32,100
LANL/DOE lands	acre					1075	$3,278,750			$3,278,750
Subtotal Land Treatments				$10,717,061	$466,600		$10,917,149		$540,700	$22,641,510
B. Channel Treatments										
Small check dams	ea	278	1800	$504,000		358	$193,840		$0	$697,840
Directional tree felling	ea	35	500	$17,500	$0		$9,000		$0	$26,500
Debris removal	mi	14,000	22	$308,000		10	$75,000			$383,000
Channel clearing 2001	mi		4	$0	$30,000					$30,000
Grade control 2001	mi		3	$0	$30,000					$30,000
Subtotal Channel Treat.				$829,500	$60,000		$277,840		$0	$1,167,340
C. Road and Trails										
Diamond drive culvert				$0	$0	1	$3,500,000		$0	$3,500,000
NM 501 crossings				$0	$0	4	$1,000,000		$0	$1,000,000
Culvert cleanout	ea	500	28	$14,000						$14,000
Warning signs	ea	125	19	$2,375	$0	81	$10,125		$0	$12,500
Road closure	ea	1450	1	$1,450						$1,450
Drainage improvement	mi	4000	13	$52,000						$52,000
Subtotal Road & Trails				$69,825	$0		$4,510,125		$0	$4,579,950
D. Structures										
Flood retention strct.				$0	$0	1	$10,600,000		$0	$10,600,000
Low head weir				$0	$0	1	$2,500,000		$0	$2,500,000
Los Alamos Res.	ea	10,000	1	$10,000	$0	1	$900,000		$0	$910,000
Trash rack	ea	4,000	1	$4,000		7	$195,000			$199,000
Subtotal Structures				$14,000	$0		$14,195,000		$0	$14,209,000
E. BAER Evaluation										
Salary/travel				$640,000	$0		$960,000		$0	$1,600,000
				$0	$0		$0		$0	$0
Subtotal Evaluation				$640,000	$0		$960,000		$0	$1,600,000
F. Monitoring										
Heritage	ea	26000	1	$26,000	$0		$0		$0	$26,000
BAER	yr	80000	3	$220,000						$220,000
RAWS stations	ea	15000	3	$45,000		6	$192,000			$237,000
Subtotal Monitoring				$291,000	$0		$192,000		$0	$483,000
G. Totals				**$12,561,386**	**$526,600**		**$31,052,114**		**$540,700**	**$44,680,800**

PART VII - APPROVALS

1. _____ _____
Forest Supervisor (signature) Date

2. _____ _____
Regional Forester (signature) Date

Note: Italics underlined comments were prepared by Gregory A. Kuyumjian

Note: Total ducumented expenditures to BAER job codes = $12,478,198, a difference of $83,188 = <0.7%