USDA Forest Service Date of Report: September 20, 2001
(Initial.9/19/01 @ 1430)

REX CREEK FIRE COMPLEX

BURNED-AREA REPORT
(Reference FSH 2509.13, Report FS-2500-8)

PART I - TYPE OF REQUEST

A. Type of Report

[**X**] 1. Funding Request for Estimated WFSU-LT Funds
[ ] 2. Accomplishment Report
[ ] 3. No Treatment Recommendation

B. Type of Action

[**X**] 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 and design analysis
[ ] Status of accomplishments to date

[ ] 3. Final report - following completion of work

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: **Rex Creek Complex** B. Fire Number: **P68091 ***

C. State: **Washington** D. County: **Chelan**

E. Region: **Region 6** F. Forest: **Okanogan &Wenatchee NFs**

G. District: **Chelan Ranger District & North Cascades National Park**

H. Date Fire Started: **8-14-01** I. Date Fire Controlled: **Unknown****

J. Suppression Cost: **$ 8.02 Million (9/10/01 ICS 209 Report)*****

* Rex Creek Complex Fires evaluated here included: Rex Creek Fire (NFS lands) and Glory Fire (NFS and NPS lands)
** Containment: 9/30/01 projection (9/10/01 ICS 209)
*** Projected Final Cost: $10 + Million

K. Fire Suppression Damages Repaired with FFFS-PF12 Funds:

1. Fireline waterbarred (miles) **0 miles (9/10/01 ICS 209 Report)**
2. Fireline seeded (miles) **0 miles (9/10/01 ICS 209 Report)**
3. Other (identify) **Spike camps, base camps & safety zones****

** Rex Creek Fire suppression-rehabilitation guidelines provided.

L. Watershed Number: **17-02-00-09-02 (Lake Chelan)**

M. NFS Acres Burned: **40,371** Total Acres Burned**: 41,136**

Ownership type: **All National Forest system lands except for private in-holdings along the lakeshore. Burn acres estimated from 9/10/01 ICS 209 Report.**

(0)State (0)BLM **(765)PVT**

N. Vegetation Types: **: Low elevations: Mostly Douglas-fir with some Ponderosa Series;**

Upper elevations: Subalpine Fir Series

O. Dominant Soils: **Relatively shallow soils with a surface layer of volcanic ash/pumice over coarse textured subsoils; soils have more than 25% profile rock larger than 2 inches in diameter; some deep coarse textured stony soils on debris fans and lateral glacial till deposits**

P. Geologic Types: **igneous units (Granidiorite) and metamorphic units (Gneiss): landforms are oversteepened glacial troughs developed from continental and alpine glaciation; with debris fans occur at the mouth of each tributary to the lake.**

Q. Miles of Stream Channels by Class:

I & II-45 miles **III-60 miles** **IV- >30 miles**

(small domestic water supplies present on at least 4 tributaries)

R. Transportation System:

Trails: **36** miles Roads: **4** miles

PART III - WATERSHED CONDITION

A. Fire Intensity* (acres): (low-62%) **25,633** (moderate 18%) **7,293** (high-10%) **4,105** (unburned 10%) **4,105**

***Burn intensity and fire size (41,136 acres) was identified from 9/4/01 reconnaissance flight and subsequent GIS report. Expect that high and moderate burn intensity acres will significantly increase due to fuel loadings in the upper watersheds where the fire is continuing to burn. See Burn Intensity map in Appendix A. According to 9/10/01 ICS report, 48,000 acres have burned.**

B. Water-Repellent Soil (acres): **little observed, however volcanic ash has non wettable characteristics when dry.**

C. Soil Erosion Hazard Rating (acres):

765 (low) **40,371** (high) **

**Most of the private land is located on alluvial fans that have slopes less than 20% with relatively low surface erosion rates. The upper watersheds are generally extremely steep with approximately 50% of the watersheds exceeding 60 percent slopes. These upper watersheds have high erosion rates. All of these subwatersheds are lands administered by the Okanogan and Wenatchee NFs. Note acres were based upon 9/04/01 GIS report and subsequent GIS report.

D. Erosion Potential: **161** tons/acre

E. Sediment Potential**:** **41,280** cubic yards / square mile

Assumptions for Erosion and Sediment Potential: The erosion and sediment figures listed above reflect the contribution from reoccurring debris slides that deposit relatively coarse sediment directly into stream channels. These shallow rapid slides are a natural hydrologic process of these glacial trough landforms. This suspended and bedload sediment has been and continues to be transported and deposited into Lake Chelan forming alluvial fans at the mouth of each subwatershed.

These relatively large debris slides trigger pulses of sediment delivery that are episodic in nature. Normally these slides occur in response to dramatic changes in vegetation due to landscape level fires or from intense early summer thunder storms and rain-on-snow events that occur in late fall and early winter (see Part IV). Based upon local fire history, fire induced watershed impairments will substantially elevate the risk of debris slides for at least the next 5 years. The Rex Creek Fire will have a significant effect of increasing the frequency of debris slides. The figures listed above reflect the contribution of delivered sediment from these debris slides over the design frequency (10 years). These figures are considered conservative based upon recent fire induced debris slide occurrence and stream scour of alluvial fans.

The fire area occurs predominately on glacial troughs that also served as melt water drainage during continental and alpine glaciation. Consequently these drainages are very steep and rocky. Natural landform sediment delivery and routing efficiency (90%) is considered very high but episodic. Runoff is routed rapidly into a series of parallel first order channels that form a dense network of tributary streams. Runoff from these tributaries can be flashy in nature. The major source of sediment delivery is in the form of debris slides from these tributary streams or first order debris chutes. These slides deposit debris directly into the main channels of Fish Creek, Meadow Creek, Pioneer Creek, Rex Creek, Prince Creek, Canoe Creek, and Safety Harbor Creek. This delivered sediment has and continues to form alluvial fans at the mouth of each sub watershed. Over the centuries, a considerable amount of suspended and bedload sediment has been deposited into Lake Chelan. Due to the depth of the lake this debris continues to be submerged and has not formed deltas. The larger debris tends to slowly enlarge the alluvial fans.

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period: **5** years

B. Design Chance of Success: **70** percent

C. Equivalent Design Recurrence Interval: **10** years

D. Design Storm Duration: **0.5** hours

E. Design Storm Magnitude: **0.6** inches

F. Design Flow: **<1.0 to 28.0 (*1)** cubic feet/second/square mile

G. Estimated Reduction in Infiltration: **5 to 40% (*2)** percent

H. Adjusted Design Flow: **45 to 273 (*3)** cubic feet/second/square mile

Footnotes
(*1) Design flow assumptions: (a) A short duration, high intensity, convective storm event has been identified as the storm type most likely to cause damage in the burned area. (b) Storm-related flow generated from surface runoff (no significant shallow sub-surface flow), with high likelihood of hail accumulations. (c) Selected a 10 yr RI, 30 minute event--similar to those that have impacted other burns in this area (Silica, Crum Canyon, Dinkleman, Tyee, North 25). (d) Design flow estimate (item F) could vary depending on the assumptions made regarding pre-fire (but not undisturbed) infiltration conditions in the area. However, this example assumes a negligible pre-fire reduction in infiltration (Wilderness).

(*2) Estimated range in reduction in infiltration (item G) in the Rex Creek Fire is as follows: Low intensity (5%), moderate intensity (15%) and high intensity (40%). Estimated reduction of infiltration for this fire is due primarily to non-wettable conditions from dry, volcanic ash soils (minimal, if any, classic hydrophobicity).

(*3) Adjusted Design Flow (item H) for the burned area varies widely based on location. Potential adjusted design flow for a small tributary in the fire interior (high intensity) is 273 csm. The latter flow represents an approximation of a potential short-term flow from an intermittent channel typical of the area--given degraded infiltration conditions. The fire area has had a history of events triggering floods one to three years following wildfires.

PART V - SUMMARY OF ANALYSIS

A. Describe Watershed Emergency:

The following summary describes the conditions that warrant emergency rehabilitation actions, primarily in regard to the Rex Creek Fire. Please refer to Appendices F & G and the analysis file for details on the rationale for each of the proposed treatments. The Glory Mountain Fire Area is included only in Part VI (spreadsheet) for the small amount of trail work being proposed there.

1. ***Loss of Site Productivity*** –

The inherent soil productivity is low for the Rex Creek Complex. Soils are derived from hard crystalline igneous and metamorphic bedrock units (granitic and gneiss). These rock units typically weather into very coarse "sandy soils" with a low nutrient capitol. A layer of volcanic ash forms the surface of most soils as well as varying thickness of pumice in some locations. Continental climatic conditions often limit available soil moisture. Soil moisture (except in valley bottoms) is often a limiting factor on the southern exposures that predominate in the fire area. Glacial erosional and glacial fluvial processes have also had a major role in soil development on the landscape. Soil depths are relatively shallow with abundant rock outcrop on troughwalls and moderately deep on glacial till deposits or alluvial fans.

Fire effects can also have a direct influence on the long and short-term accumulation of organic matter. Most of the Rex Creek Complex experienced low intensity burns. This level of burn intensity is not expected to have an adverse effect on organic matter input in the short term or long term. However, the areas with high burn intensity will likely have a significant adverse effect on nutrient availability in the short and long term. Some of the areas of high burn intensity experienced intensities higher than what occurred naturally. With the exception

of upper Canoe Creek area, the historic natural fire regime in the high intensity burn areas of Fish Creek, Safety Harbor Creek and Round Mountain is considered to be less than 35 years and non-lethal (Leuschen, 2001). These frequent, low-intensity fires seldom resulted in stand replacement fires, particularly on a landscape scale (Everett and others, 1996). However, rigorous fire suppression efforts over the last 80 years have allowed for development of stands with higher density and greater fuel buildup. According to Leuschen, it is very likely that the specific areas listed above have missed more than one fire return interval. The disruption of these fire return intervals strongly suggests that stand composition and structure has been significantly altered predisposing that disturbance events (fire) would be well outside of the range of historic variablility.

The Rex Creek Fire likely had a profound effect in volatilization of nitrogen (N), phosphorus (P) and sulfur (S) in portions of Fish, upper Canoe, and Lower Safety Harbor Creeks. These areas had high and moderate intensity burns that consumed the duff/litter layer, removed most of the foliage and fine twigs from conifers and severely charred larger down woody debris. This level of burn intensity could severely reduce the nutrient capitol of these soils (Hungerford and others, 1990—p. 32; Baird, 1998). Furthermore, since little of the fine coniferous canopy remains (twigs, cones, and needles), there will be a long-term and significant reduction in nutrient and organic matter input on these sites. This loss of future input of fine coniferous litter combined with the loss of the soil litter/duff layer will have a severe impact on the natural soils nutrient capital (Page-Dumroese and Harvey, 1990).

There are numerous snags still standing in the fire area that will in time fall to the forest floor. The decomposition rate of this large downed woody debris is expected to exceed 100 years before becoming incorporated into soil wood as a part of the nutrient capital (Edmonds, 1990-p. 119). However, given the natural fire return interval, it is likely that this downed wood may be exposed to at least three ground fires. Hence, large downed wood on these sites will likely be consumed by fire before becoming soil wood.

Another very unique threat to site productivity and wilderness values is the presence of the Class A noxious weed common crupina (*Crupina vulgaris*) within the burned area. The only populations of this annual European weed in the state of Washington are within the Rex Creek Fire. There is grave concern that the additional open niches provided by the fire will allow this plant to significantly expand its range within the wilderness (further threatening wilderness values) and also increase the potential for this plant to infest adjacent areas. Personnel from the National Park Service were involved in the Rex Creek BAER survey process and are very concerned that this weed may invade the Lake Chelan National Recreation Area. Over one million dollars has already been spent in efforts to control the spread of this weed. In the short term, the fire may cause a reduction in population numbers providing a window of opportunity to make serious progress in this control effort. The proposed multi-year regimen of weed management is critical to help preserve the site productivity and character of this area (see Appendices E and G).

In summary, it is very likely that the following conditions contribute to relatively low inherent soil productivity: hard crystalline bedrock; continental climatic conditions with low precipitation; elevated burn intensities; low amounts of organic matter accumulation; high intensity storm events (with its attendant flooding and debris slides); and the threat of additional noxious weed infestation.

2. ***Loss of Water Quality***

Water quality in the Lake Chelan sub-basin is critical for many uses including municipal/domestic supply, agricultural uses, aquatic habitat, recreation and aesthetics. Lake Chelan is a major recreation destination of national significance. In the Rex Creek fire area, several drainages support small, domestic water supply systems servicing private lands along the lakeshore. Tributaries in the burned area also contain important populations of rainbow and westslope cutthroat trout. Implementation of the Lake Chelan Water Quality Management Plan is an on-going, cooperative effort (Beck, and others, 1991).

Water quality parameters most affected by this fire are sediment loading, nutrient loading and water temperature. Stream sediment loading in fire-affected tributaries is expected to increase as a result of increased surface erosion (via accelerated dry raveling and rill erosion) and as a result of increased debris slide activity. Ash, fine sediment and woody debris delivery and transport will increase during snowmelt runoff and in response to storm events. Episodic delivery of larger bed materials and woody debris will be associated with the event driven debris slide-debris torrents discussed in more detail in the section on Life and Property. Increased sediment loading is expected to persist for at least the next two to three years after the fire and then decline.

Research has documented that wildfire exerts pronounced effects on the nutrient status of ecosystems (Tiedemann, and others, 1978). Nutrient loss via volatilization and solution is described in the section on site productivity. For example, both nitrogen and phosphorus are lost from the system. However, these losses begin to be offset by other processes such as N input from precipitation. Elevated nutrient concentrations in streamflow will persist for a relatively short period of time until the chemical retention capacity of the burned area is reestablished. The rapid development of native plant (and seeded grass cover) in the burned area is critical to the re-establishment of the tight nutrient cycle in these forested watersheds. This nutrient cycling alteration and re-establishment is a natural process associated with the wildfire disturbance.

Water temperatures may increase significantly in many of the fire-affected stream reaches as a result of riparian canopy loss. Even in areas identified as having been subject to low intensity burn, denser riparian vegetation burned at a higher intensity. However, experience suggests that riparian shrubs and herbaceous plants will rapidly re-sprout in those areas as long as root systems have not been damaged. This fire-influenced shift in temperature regime will persist until sufficient riparian canopy is re-established to provide shade during the critical summer months. The planting of woody vegetation in selected riparian areas that burned at moderate-high intensities would accelerate canopy recovery.

Wildlfire naturally influences all of the above water quality parameters. At issue, are the identification and treatment of those areas that may have burned at a greater than normal intensity due to human-caused influences (e.g., elevated fuel loading from past fire suppression activities) and concern for human developments that are now part of the system (e.g., private homes on alluvial fans, recreation sites). The proposed Rex Creek BAER treatments have targeted both of these issues.

Concern has been expressed regarding the proposed application of fertilizer on high and moderate intensity burned areas in order to improve establishment and growth of seeded species and enhance the cover of surviving native plants. The issue involves the potential for water quality impacts in Lake Chelan. Please refer to the discussion of fertilization and water quality in Appendix F for details.

3. ***Threats to Human Life and Property***

The values at risk include houses, trail bridges, campgrounds, trails, and cultural sites. Due to the national attraction of Lake Chelan, homeowners and recreationists will continue to use these facilities following the Rex Creek Fire. Even with temporary campground closures to reduce the threat to recreationists, people will continue to use the alluvial fans that are at risk of severe flooding. Most of the private lands and all of the campgrounds are located on alluvial fans. The upper watersheds are administered by the Okanogan and Wenatchee NFs.

As previously described, the upper watersheds are comprised of extremely steep, rocky glacial trough landforms which are at severe risk for debris slides. Due to impaired watershed conditions, a tremendous amount of windthrow (blow down) is expected. Increased amounts of large woody material, in upper debris tracks and stream channels, will become incorporated in the debris slides which is likely to substantially increase the scouring energy of each slide. Hence post fire debris slides are expected to accelerate the rate of scour in upper

watershed channels which will deliver additional debris into lower stream reaches. This added debris will be swept downstream onto the alluvial fans. This added debris can trigger debris jams which can cause a surge of flood material onto the fans or can cause streams to divert and form new channels on the fans.

These types of flood events occurred on Lake Chelan following the 1970 fires. A surge of flood debris washed out two dock facilities and a campground. Recreationist narrowly escaped this flood event. Unfortunately, four (4) fatalities occurred in the adjoining drainage (Entiat Valley) following the same type of flood event.

The Rex/Pioneer, Canoe, and Meadow Creek alluvial fans pose the greatest threat to homeowner safety and property values (Refer to hazard assessment in analysis files). The Rex Creek channel (on the fan) is undersized for the anticipated flood flows. Storm flows are expected to over top the Rex Creek channel and flow directly into a dwelling and dock facilities. The Canoe Creek fan has multiple channels at the apex of the alluvial fan (upslope) which can divert anticipated storm flows in a number of directions directly into a number of dwellings and dock facilities. The Meadow Creek channel will likely be able to handle increased stream and debris flows without affecting homeowner values; however, the dock facilities are at serious risk.

The campgrounds and dock facilities on alluvial fans at Fish, Cascade, Prince, and Safety Creek all pose a serious threat to recreationists. All of these campgrounds are accessible by boat on Lake Chelan. The campgrounds and dock facilities at Fish, Cascade, and Safety Harbor Creek are at serious risk of being destroyed by flood debris. The Prince Creek Campground is elevated from the expected scour path of flood waters; however, this campground is the primary trailhead for the Lake Shore trail which does cross the anticipated flood path on Prince Creek.

The Natural Resources Conservation Service is working with the owners of the Rex and Pioneer Creek alluvial fans to identify treatments to divert anticipated storm and debris flows from dwellings. Log terracing is not appropriate in most drainages because slopes are too steep or rocky for the treatments to be effective at trapping sediment or reducing concentrated flows. Some log terracing in Safety Harbor Creek will be effective and is planned for installation. Channel treatments are not appropriate for these perennial stream systems. Hence, the only BAER treatment that will have some level of success at reducing the threat to life and property is upland aerial seeding and fertilization. Upland seeding will help provide some ground cover and reduce surface erosion and concentrated runoff beginning in the summer of 2002.

Floating woody debris in the Lake poses a public safety hazard. Following the 1972 storm events, log booms were installed at the mouths of several drainages to control input of floating debris. Following the period of record peakflow in November 1995, public outcry resulted in the emergency expense of over $400,000 to collect and dispose of woody debris that had been flushed into the lake. Log booms are proposed as a proactive solution to this issue.

4. *Wilderness Issues and Values*

The majority of the burned area in the Rex Creek Fire is located within the Chelan-Sawtooth wilderness (see Appendix A map). Only the Safety Harbor-Falls Creek portion of the burn extends outside the wilderness. However, many of the main drainages in the fire area have private land holdings at the mouth at significant risk from flood events. Further these drainages flow into Lake Chelan--noted for its excellent water quality. Issues related to the maintenance of wilderness values were evaluated during the BAER treatment development process. Direction related to wilderness is found in FSM 2323 (specifically FSM 2323.43b) and in FSH 2509.13 section 26.6. Below is a summary of this direction:

FSM 2323.43b: This direction indicates that BAER treatments should only occur to prevent unnatural loss of the wilderness resource or to protect life, property and other resource values outside of wilderness; and that normally hand tools and equipment should be used to install treatments.

FSH 2509.13 (section 26.6):

1. Design treatments to be temporary, short-lived actions
2. Use native materials for structural measures
3. Normally, treatments should be accomplished with hand tools & equipment—if other methods are needed use minimum necessary; use chainsaws, motorized vehicles and aircraft only if other means infeasible or cause unacceptable delays (resulting in significant threat to downstream values)
4. Protect the genetics of endemic plants; choose short-lived ground cover that will not hybridize with locals, displace local native species or offer serious long-term competition to recovery of local plants.

Other portions of the FSM for wilderness (i.e. 2323.26b-Nonstructural Range Improvements; 2323.43a-Watershed Condition Improvement) provide other applicable direction including:

- Seed with indigenous or naturalized species
- Noxious farm weed control by grubbing or chemicals is appropriate when they threaten lands outside wilderness or are spreading within wilderness—as long as control efforts do not cause serious adverse impacts on wilderness values.
- Use fertilization only as an aid to revegetation
- Use non-motorized equipment to accomplish improvement objectives. Only imminent threat to important values downstream justifies use of motorized equipment

B. Emergency Treatment Objectives:

The application of the BAER treatments should assist natural recovery and minimize both on-site and downstream damage to values at risk. The non-structural land treatments proposed for upland erosion control (seeding, fertilizing) are designed to help maintain site productivity, protect water quality and minimize risks to life and property by accelerating ground cover. The non-structural land treatments proposed for weed control are designed to help maintain site productivity and ecosystem function by inhibiting weed establishment and spread. This is done by using a cultural practice (grass seeding) to provide competition for weeds and by manual weed control. Proposed structural treatments (e.g., log terraces, deflector berm, trail drainage) are intended to reduce post-fire increases in accelerated erosion and sedimentation and to reduce threat to life and property.

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

Land **90 %** Channel/Riparian NA % Trails **70 %** Other **80** %

D. Probability of Treatment Success

	<----Years after treatment----->		
	1	3	5
Land	70%	70%	70%
Channel	%	%	%
Roads/Trails	90%	90%	90%
Other	70**%**	**70%**	**70%**

E. Cost of No Action (Including Loss): **$4,130,000**

F. Cost of Selected Alternative (Including Loss): **$3,350,000**

G. Skills Represented on Burned-Area Survey Team:

[**X**] Hydrology	[**X**] Soils	[**X**] Geology	[**X**] Range
[ ] Timber	[**X**] Wildlife	[ ] Fire Mgmt.	[**X**] Engineering
[ ] Contracting	[**X**] Ecology	[ ] Research	[**X**] Archaeology
[X] Recreation/Wilderness			[**X**] Fish Biologist

The BAER survey team also included resource specialists from the National Park Service (Lee Smith) and the NRCS (Gary Mitchell, Dave Kreft, Leigh Nelson, Ron Shavlik, Andrea Mann).

Team Leader: **\s\ Carl Davis**

Phone: **(509) 662-4231** Electronic Address: **cedavis@fs.fed.us**

H. Treatment Narrative:

Overall Goal of Proposed BAER Treatments: To complete a combination of comprehensive treatments to reduce sediment delivery, protect water quality of fire-affected tributaries and Lake Chelan and to minimize the threat to life and property from post-fire events. In addition, the treatment will reduce noxious weed effects to site productivity in the area and enhance natural vegetative recovery.

Land Treatments

Purpose - Upland Treatments: To reduce the post-fire potential for concentrated runoff and erosion on sensitive hillslope soils. To reduce the potential for debris slides and the subsequent threat of debris torrents and flooding of downstream private lands and recreation facilities. To encourage recovery of natural vegetation.

Treatment #L1 Log Terracing: Install log terraces on sensitive, high intensity burn areas in Safety Harbor Creek (350 acres). These sites have slopes less than 60% with no surface rock or bedrock exposed. Install log terracing in strategic areas--where the potential to disperse concentrated runoff is greatest in order to minimize downslope sediment delivery to sensitive stream reaches.

Treatment #L2 Aerial Upland Seeding: Aerial seed high intensity burn areas in Fish Creek, upper Canoe Creek, and lower Safety Harbor Creek (3,898 acres). This treatment is only proposed in at risk drainages where it is expected to be successful and where private lands are at risk from concentrated flows and/or debris slides. Since the majority of the treatment is in wilderness, the seeding treatment will rely on soft white winter wheat. This plant should offer high establishment success and yet be ephemeral in nature (Appendix D & G).

Treatment #L3 Aerial Upland Fertilization: Aerial fertilize sensitive moderate and high intensity burn areas in Safety Harbor, Fish Creek and upper Canoe Cr (5572 acres). Fertilization is proposed in order to stimulate growth in the surviving native plants and the seeded wheat. Treatment will not be applied within 100 yards of main stream channels. Areas proposed for fertilization have low weed infestation levels.

Purpose – Noxious Weed Control Treatments: The whole known population of the Class A noxious weed Common crupina (*Crupina vulgaris*) in the state of Washington is found within the Rex Creek Fire area (Appendix B map). The Okanogan and Wenatchee NFs have already spent approximately one million dollars to keep this weed

from enlarging its population to other areas in the wilderness or North Cascades National Park. It is expected that common crupina will flourish in the fire area. Treatments are intended to maintain ecosystem health by encouraging natural vegetation recovery. In order to be successful, three years of treatment will be necessary which should also include herbicide use. Interim BAER reports will be submitted for 2002 – 2004.

Treatment #L4-Manual Control of Noxious Weeds: Early spring control of known and newly discovered populations of Common Crupina by hand pulling or grubbing followed by hand seeding (600 acres). Seed competitive species to fill open niches created by weed removal (Appendix C, E & G).

Treatment #L5- Aerial Seeding for Noxious Weed Control: Aerial seed of competitive species in Common Crupina potential habitat areas that are below 4000 feet (5,000 acres). This treatment applies native grasses in an attempt to occupy open sites where native plant communities have been adversely affected by fire.

Treatment #L6- Provide Trail Access for Noxious Weed Treatment Work: Log out, tread width and drainage improvement on 12 miles of the Lakeshore Trail. This treatment needed for safe implementation of treatment L4 above.

Treatment #L7- Aerial Seeding for Noxious Weed Control on private lands: Aerial seed of competitive species in Common Crupina potential habitat areas on private lands that are below 4000 feet (200 acres). This treatment applies native grasses in an attempt to occupy open sites where native plant communities have been adversely affected by fire. Completion of treatment is based on getting approval to use federal funds via a Wyden Amendment agreement. Without private land treatment, the treatments on national forest system lands will be compromised.

Channel/Riparian Treatments

Purpose: Plant appropriate woody plants in riparian areas to accelerate recovery, advance succession and maintain woody plant diversity. Targeted planting areas have burned at a greater intensity due to human-influenced fuel buildup.

Treatment #CR1 – Riparian Planting: Plant woody plants in riparian areas in moderate to high burn intensities for stream bank stabilization. Planting would target reaches of Fish Creek (3 miles), Prince Creek (1 mile) and Safety Harbor Creek (1 mile), for a total estimated treatment area of 122 acres.

Trail Treatments

Purpose: Implement actions to minimize the potential for concentration of accelerated surface runoff from Forest Service trails in upper sub-watersheds (excludes Lakeshore Trail). These treatments are intended to reduce the risk to Forest personnel and the public associated with trail use. As noted in Part V-A above, soils in the burned area are primarily derived from glacial till deposits originating from hard crystalline bedrock units. This parent material weathers to bouldery sandy loams. These soils occur on over-steepened slopes (>60%) and are extremely susceptible to slope raveling following fire.

Most of the trails in the burned area in the upper subwatersheds have not experienced a landscape scale fire since their construction. The fire has removed much of the woody material and duff in the moderate and high intensity burn areas, which will result in hillslope raveling (soil, rock, and logs) that is expected to fill trail tread in many locations. In addition, in some trail sections, the trail shoulder has been supported by shrub and tree roots which were severely burned, resulting in anticipated sloughing of the shoulder. As a result of these fire-related impacts, trail drainage features have been rendered non-functional and the tread condition represents a hazard to both Forest personnel and the public.

Treatment #T1 Improve Trail Drainage: Install drain dips on 12.0 miles of trail (excluding Lakeshore Trail)

to reduce the potential for runoff concentration and accelerated surface erosion from anticipated fire effects. Dips will vary from rolling outslope dips to waterbars constructed from peeled and anchored native wood material. This treatment will occur primarily on trail segments within moderate and high intensity burn where the potential for post-fire increases in surface runoff is high.

Treatment #T2 – Improve Trail Tread: Improve 4.0 miles of trail tread (excluding Lakeshore Trail) that has been degraded by the fire. Remove slough and debris that has reduced the width of the trail tread or reconstruct the cut slope of the trail providing additional trail tread. This treatment is needed in order to eliminate safety concerns associated with access for installation of other trail treatments and to reduce the threat to public safety.

Treatment #T3 –Log Out Trail: A number of fire-killed trees are falling and blocking trail access. Trail log out will be necessary on 12 miles of trail (excluding Lakeshore Trail) in order to gain access to the sections of trail that need drainage (T1) and tread improvements (T2).

Structural Treatments

Purpose: Install structural features designed to reduce the threat to life and property from debris slides, flood flows and related hazards.

Treatment #S1 – Flood Deflector Berm: Install one deflector berm on the Rex Creek fan to protect a private residence from flood flows and debris. Structure will be installed using non-Federal funds.

Treatment #S2 – Log Booms: Install log booms at the mouth of the three tributaries in the burn having the greatest potential for fire-influenced debris slides-debris torrents. Floating woody debris has been a major public safety hazard following several flood events (1972 and 1995). Installations designed to provide adequate storage bay and to withstand both severe wave action and drawdown. Approximately 2,500 feet of boom estimated to be needed to create 3 storage bays. See analysis file for details.

BAER Evaluation

BAER Survey Cost: The estimated cost of BAER Survey and preparation of the Initial Burned Area Report is listed in Part VI of the 2500-8. Application of the proposed treatments will require the development of an Implementation Plan. Specifics related to all facets of the noxious weed treatments are shown in Appendices C, E and G. More specific information related to proposed treatments is in the BAER Survey analysis file.

BAER Cultural Resource Survey: Surveys by the Forest Archeologist will be required prior to the implementation of the BAER treatments.

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

	9/19/01 1430 Draft			NFS Lands			Other Lands			All
			Unit	# of	WFSU	# of	Fed	# of	Non Fed	Total
Tmt #	Line Items	Units	Cost	Units	SULT $	units	$	Units	$	$
	A. Land Treatments									
	1) Upland Treatments									
L1	Log Terracing	Ac	$ 300	350	$105,000		$0		$0	$105,000
L2 1/	Aerial Upland Seeding	Ac	$ 33	3898	$128,634		$0		$0	$128,634
L3 1/	Aerial Upland Fertilization	Ac	$ 65	5572	$362,013		$0		$0	$362,013
	2) Noxious Weed Control									
L4 2/	Control & Hand Seeding	Ac	$ 568	600	$340,998		$0		$0	$340,998
L5 2/	Control-Aerial Seeding	Ac	$ 71	5000	$354,600		$0		$0	$354,600
L6 3/	Provide Trail Access	Mi	$ 3,667	12	$44,004		$0		$0	$44,004
L7 4/	Private Land Seeding (Wyden	Ac	$ 71	200	$14,200		$0		$0	$14,200
	Subtotal Land Treatments				$1,349,449		$0		$0	$1,349,449
	B. Channel - Riparian Treatments									
CR1	Riparian Planting	Ac	$ 400	122	$48,800		$0		$0	$48,800
	Subtotal Channel - Rip. Treat.				$48,800		$0		$0	$48,800
	C. Trail Treatments									
	1) Rex Creek Fire									
T1	Improve Trail Drainage	Mi	$ 2,000	12	$24,000		$0		$0	$24,000
T2	Improve Trail Tread	Mi	$ 7,500	4	$30,000		$0		$0	$30,000
T3	Logout Trail	Mi	$ 300	12	$3,600		$0		$0	$3,600
	2) Glory Mountain Fire									
T4 5/	Imp. Tread & Drainage	Mi	$ 28,000	0.26	$7,500	0.7	$20,500			$28,000
	Subtotal Road & Trails				$65,100		$20,500		$0	$85,600
	D. Structures									
S1	Flood Deflector Berm	Ea					$0	1	$60,000	$60,000
S2	Log Booms	Ft	$ 30	2500	$75,000					$75,000
	Subtotal Structures				$75,000					$135,000
	E. BAER Evaluation									
O1	**1) BAER Survey Cost**				$25,000		$4,900		$0	$29,900
O2 6/	**2) BAER Cul Res Survey**				$7,150		$0		$0	$7,150
	G. BAER Monitoring				$0		$0		$0	$0
	H. Totals				**$1,570,499**		$25,400		$0	**$1,655,899**

1/ Refer to Appendix A & B for details on aerial seeding/fertilization of uplands for erosion control. The fertilization item includes all the per acre logistical costs for the erosion control treatments

2/ Refer to Appendices A & C for details on the proposed noxious weed control regimen. Half of the expected logistical costs of fall treatments have been included in the weed control seeding and half in the erosion fertilization. Most ground-based weed control costs are crew or logistics costs.

3/ Total cost of providing safe trail access for weed control work (Lakeshore Trail)--see Appendix XX for details

4/ Funding for this will require approval under the Wyden amendment

5/ Total cost of trail work estimated by NPS Resource personnel (see 8/24/01 NPS Report)

PART VII - APPROVALS

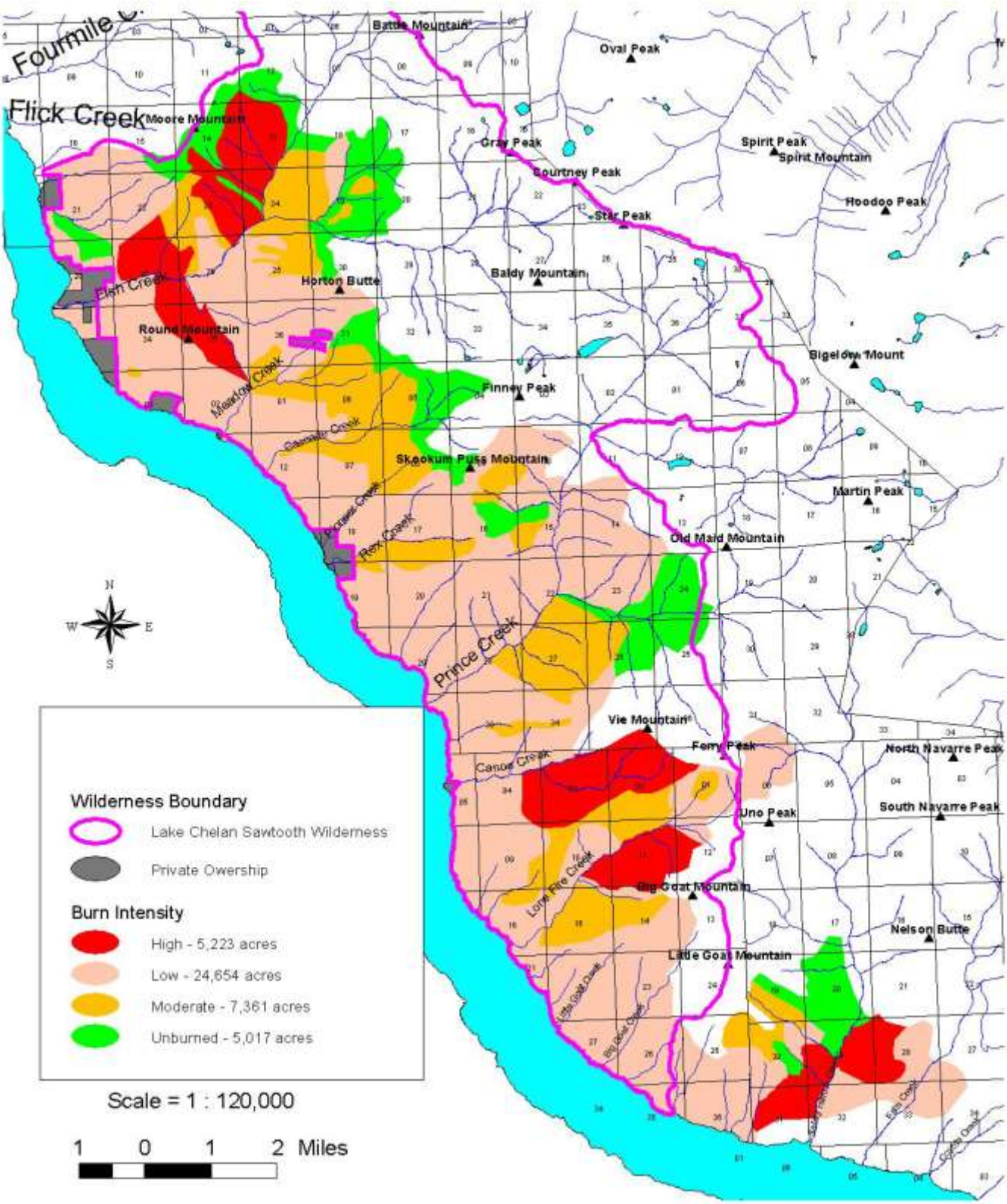
REX CREEK FIRE COMPLEX

Recommended by:

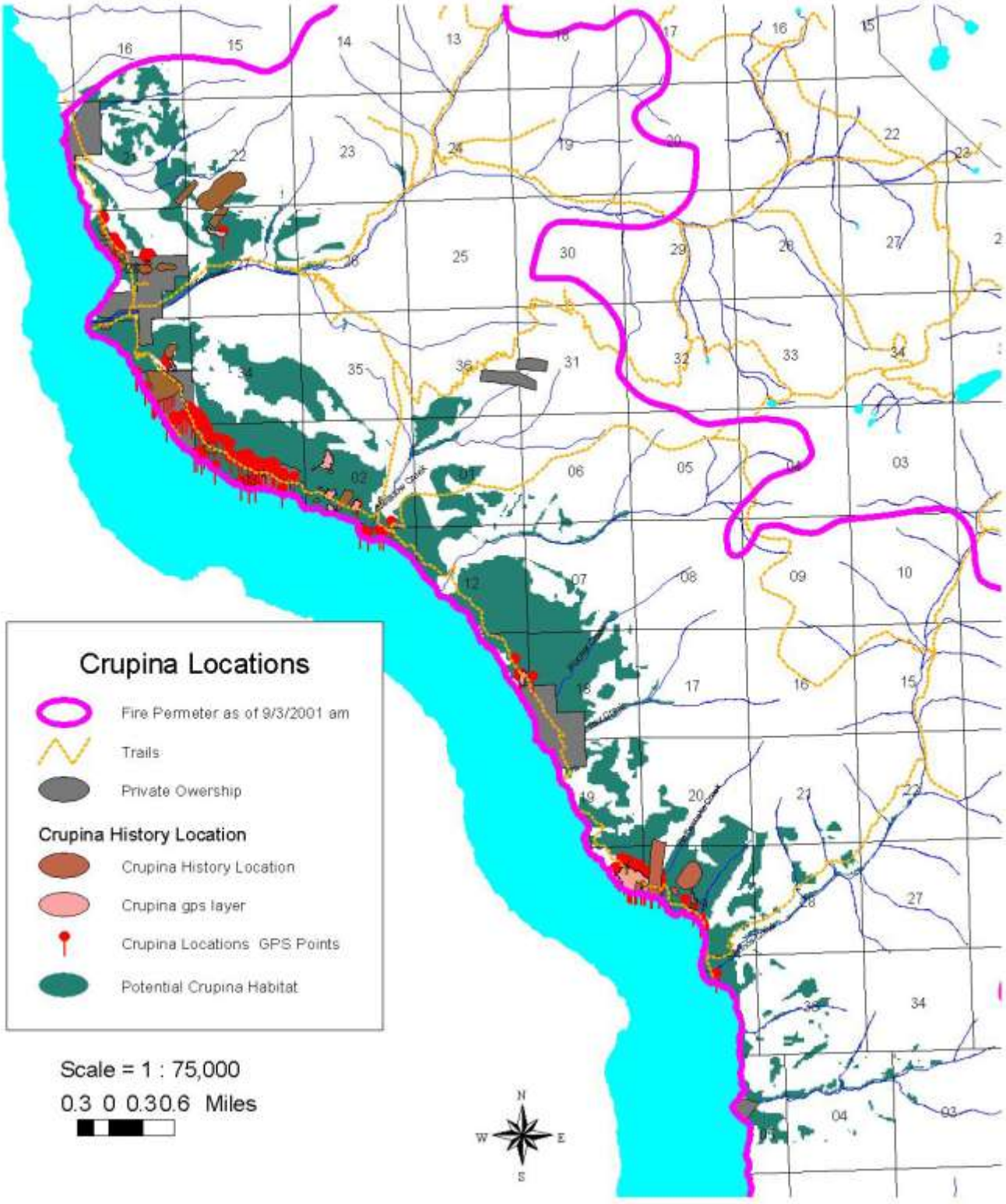
/s/ Sonny J. O'Neal
Sonny O'Neal
Forest Supervisor

Date: September 20, 2001

Appendix A
Rex Creek Complex Fire
Burn Intensity



Appendix B
Potential Habitat Areas for Common Crupina



Appendix C
Noxious Weed & Seed Mix Specifications

The following seed mix is recommended for use as a competitive seeding to combat weeds both for hand and aerial treatments. These costs do not reflect the cost of logistics (See Appendix H).

The pounds/acre is based on a desired broadcast rate of about 100 pure live seeds/square foot (PLS/SQ.FT). All seed must be "Prohibited and Restricted Noxious Weed Free for the State of Washington." All seeding rates should be determined on a pure live seed (PLS) basis. Certified "Blue Tag" seed is preferred. ACCEPT NO SEED WITH ANY NOXIOUS WEED CONTENT!

Note: For the weed control seed mix, other species may be substituted in consultation with the District or Forest vegetation specialists but substitute plants must be natives. This seed mix is prescribed for use in both the fall for aerial seeding of potential and occupied Crupina habitat and for ground application after weed control activities in spring.

Species	**PLS Seeds/lb**	**PLS Rate Lbs/ac**	**Seeds/sq.ft. PLS**	**Cost/lb**	**Total Cost/ac**	**Acres Treated**	**Total Material & Application Cost**
Beardless bluebunch wheatgrass 'Whitmar' *Pseudoroegneria spicata* var. *inerme*	135,000	12	36	$3.00	$36.00	5600	$201,600
Canby bluegrass 'Canbar' *Poa canbyi*	926,000	3	63	$3.50	$10.50	5600	$58,800
--subtotal seed					**$46.50**	**5600**	**$260,400**
Application Cost (aerial or ground)					$20.00	5600	$112,000
Total		**15**	**99**		**$66.50**	**5600**	**$372,400**

Appendix D
Aerial Upland Seed Mix & Fertilization Specifications

Listed below is the seed and fertilizer persciption for the upland aerial erosion control treatments. Costs do not reflect logistics for getting equipment and material up Lake Chelan (See Appendix H).

The sowing of winter wheat and fertilization should increase vegetation cover and thereby better protect the soil resource from accelerated erosion. This should reduce both sheet and rill erosion and sediment delivery.

Upland Seed and Seeding Specifications

Species	**Seeds/lb PLS**	**Rate (PLS) Lbs/ac**	**Seeds /sq.ft. PLS**	**Cost/lb**	**Total Cost/ac**	**Acres Treated**	**Total Cost**
Soft white Winter Wheat (Eltan)*	13,000	20	6	$.15/lb	$3.00	3898	$11,694
Application Cost (aerial or ground)					$30.00	3898	$116,940
Total		**20**	**6**	**$.15**	**$33.00**	**3898**	**$128,634**

- Other species may be substituted with consideration to availability, cost, persistence, native status and invasiveness.

Species*	**Cultivar/Status**	**Attributes**
Soft White Winter Wheat Must be cold & snow mold tolerant	"Eltan" or "Lewjane"; Cold and Snow Mold Tolerant	Non-persistent; rapid upland soil stabilization

FERTILIZER PRESCRIPTION*:

Fertilizer	**Gross lbs/ac**	**N lbs/ac**	**Cost/Ac.**	**Acres** Treated**	**Total Cost**
Ammonium Nitrate Sulfate	83	25	**$11/ac**	5572	$61,292
Application Cost			**$50/ac**	5572	$278,600
Total			**$61/ac**	**5572**	**$339,892**

*Use 75% Ammonium Nitrate and 25% Ammonium Sulfate to get a 30-0-0-6 (N,P,K,S) mixture. Apply at the rate shown above. Fertilization should occur in early spring once seeded grasses are established. Fertilizer cost for mix is $268/ton. Fertilizer will be used in upland treatments only (Appendix D & F).

Appendix E
Noxious Weed Control Treatments

The treatments described here address the need to manage noxious weeds (primarily Common Crupina) in the fire area. Common Crupina is a Class A noxious weed (eradicate when found) and is only known in the state of Washington from this area. Reduction in shading and the increase in open sites will exacerbate the weed problems that already exist in the area. The primary concern related to weeds involves their potential to reduce site productivity and biological diversity. In order to manage these weeds several treatments are planned. These include both manual, chemical and cultural control methods. Cultural methods involve seeding. Chemical methods will be considered where feasible to reduce costs, increase efficiency and possibly get some carryover residual effects into the following years—particularly on Common Crupina. Manual methods will be used in some areas as the primary control means and as a follow-up to chemical treatment. Treatment activities will focus first along trails and population edges. A three-year regimen of treatments are needed to adequately address the watershed impairment that this weed will cause due to the fire's effects. The costs of treatment shown below include the cost of administration and monitoring of BAER treatments but do not include logistics costs (See Appendix H).

In order to complete noxious weed treatments it is necessary to repair the fire-caused damage to the lakeshore trail. This will include logout, drainage; tread repair and construction of a trail bridge. See Part VI of the 2500-8 for costs associated with this activity.

Summary of Noxious Weed Treatment Acres*

AREA **	Seeding for Weed Control***	Manual Weed Control (ac.)	Chemical Weed Control (ac.)
Potential *Crupina* Habitat	5000 (Fall 2001)		
Known Occupied *Crupina* Habitat	600 (yr 1) (Spring 2002)	600 (yr 1) (Spring 2002)	400 (yr 2)**** 200 (yr 3)
TOTAL	**5,600**	**600**	**600**

* Noxious weed treatments may include herbicide use for the occupied habitat if an appropriate NEPA document can be completed. Otherwise manual treatments will be used. Seeding acreage for potential *Crupina* habitat is an estimate based upon the known, historic and modeled habitat for this plant. Occupied habitat acreage is a estimate that includes the known 500 acre area with 20% added for expected additional occupied habitat that will likely be found during the activity period (See Appendix B map).

** Ecosystem values related to sustainability and biodiversity would be of primary concern with the occurrence of weed populations, both within the burn and the adjacent areas. The lakeshore trail is heavily traveled and keeping noxious weeds from spreading to un-infested areas is a critical issue

*** See Appendix C for seed specifications.

**** Multiple year treatments are required to reduce the watershed impairment caused by weeds that resulted from the fire.

Appendix F
Rationale for Fertilizer Treatment

In areas that have had high and moderate intensity burns, many to most of the native vegetation has been killed either through burning of the foliage and/or because of intensive heating of the surface soil horizons. Loss of this vegetation leaves the soil surface unprotected should a high intensity storm event occur. Seeding and fertilization help to establish vegetative cover where the resident plants have been destroyed by fire and consequently will be delayed in re-colonizing the site. Establishing vegetal cover helps to stabilize the soil surface and prevent accelerated soil erosion.

A number of research projects have addressed the efficacy of seeding and fertilization as erosion control measures in north-central Washington (Klock, 1982; Klock and Grier, 1979; Klock and others, 1975; Klock, 1969; Klock and others, 1971, Tiedemann and Klock, 1973; Tiedemann and Klock, 1977; Everett and others, 1990; Baird, 1998; N25 Fire monitoring report, 2000). Further, some work done in north central Washington addressed the effect of fertilization on water quality and stream ecology (Tiedemann and others, 1978, Tiedemann, 1973; Tiedemann and Helvey, 1973). Review of this work, personal communication with a number of the authors and field observations on other fires led to the following conclusions:

- Erosion control seeding can be effective in providing rapid vegetal cover and thereby reduce soil loss;
- Fertilization should result in greater biomass and better root development of seeded and residual native plants;
- Fertilizer application should provide a readily available form of N but avoid phosphorus (a plant macronutrient with more significant water pollution concerns in Lake Chelan);
- Fertilizer should contain some sulfur to ameliorate the lack of that nutrient in the soils of this area;
- Fertilization should not result in detrimental increases in stream nutrients even when fertilization involves the whole watershed with twice the application rate for N than is being proposed for Rex Creek (Tiedemann and others, 1978). Direct application of fertilizer to streams and wet areas can be successfully avoided by use of buffer zones;
- A starter fertilizer is a critical component for seeding success (particularly in reference to fire line stabilization) (Klock, 1969).

Agee in his book on fire ecology concluded that evidence for fertilization was inconclusive and likely not worth the cost (Agee, 1993). Agee's conclusions are plausible given the discussions in a number of the papers listed above. However, personal communication with several of the listed authors (who spent many years conducting site specific research mostly in the Entiat area) and anecdotal information following the Dinkelman Fire (1988), the Tyee and Rat/Hatchery Complexes (1994) and the North 25Mile Fire (1998) suggested that fertilization was a critical step in vegetation re-establishment. For the Rex Creek Fire, although 50 #/acre of actual N was considered, 25#/acre was prescribed. Public concerns over water quality resulted in prescription of the lower application rate.

Some work has been done in this area that addresses the kind, amount and potential effects of fertilization after wildfire. The 1970 Wenatchee fires received a lot of attention by Wenatchee Forestry Science Lab personnel and some work by local scientists prior to the fires is also germane. Art Tiedemann (research range ecologist), and Glenn Klock (research soil scientist-retired) addressed the effects of fertilization on seedling establishment and vegetation development on soils and sites very similar to the current fire area (Klock, 1969; Klock, 1982; Klock and others, 1975; Klock and others, 1971; Tiedemann, 1973; Tiedemann and others, 1978; Tiedemann and Klock, 1976). Although they conceded that their measurement methodology was not sensitive enough to statistically validate the fertilizer's efficacy, they and both Phil McColley (forest soil scientist-retired) and Darlene Zabowski (research soil scientist) were convinced that fertilizer use improved vegetation establishment and vigor. They all suggested that fertilizer was the most effective treatment--even more than seeding.

After the 1994 Chelan County Fires--where over 180,000 acres burned--some research addressed wildfire

effects to nutrient capitals in burned and unburned stands. Nutrient losses to burned soils were estimated at 44% for N and 11% for S (Baird, 1998). These numbers are considerably higher for N than the 5-10% estimated by Tiedemann and others (1978). The volatilization and loss of sulfur on these sites after fire apparently limits plant growth. Klock and others (1971) found that using fertilizer that contains S significantly improved orchardgrass productivity in greenhouse pot studies on various soils.

Additionally, BAER effectiveness monitoring for the 1998 North 25 Fire indicated that fertilizer treatment was the only treatment that resulted in significantly higher vegetation cover. It is expected that fertilization will substantially improve the vigor and growth of seeded and surviving native plants. In addition, upland fertilization will not exacerbate weed problems since the proposed treatment areas generally have low noxious weed population levels or will receive more intensive manual control work.

Fertilization – Water Quality Concerns:

Water quality in the Lake Chelan sub-basin is critical for many uses including municipal and domestic water supply, agricultural uses, aquatic habitat, recreation and aesthetics. Lake Chelan is a major recreation destination of national significance. In the Rex Creek fire area, several drainages support small, domestic water supply systems servicing private lands along the lakeshore. In addition to the valuable lake fishery, tributaries in the burned area contain important populations of rainbow and westslope cutthroat trout. Implementation of the Lake Chelan Water Quality Management Plan is an on-going, cooperative effort targeted at protecting water resources (XX, 1989).

One of the major concerns in the Lake Chelan Water Quality Management Plan is human-caused acceleration of eutrophication. Water quality studies have shown that phosphorus is the principle nutrient limiting primary production in the Lake. The Plan calls for implementation of efforts to reduce human-caused phosphorus loading and requires a minimum level of monitoring to detect any changes in phosphorus levels with respect to established threshold levels of concern (XX, 1989).

Concern has been expressed regarding the proposed application of fertilizer as part of the Rex Creek BAER prescription. BAER fertilizer applications on fires in the area since 1989 have ranged from 20 to 50 lbs of N per acre. The Rex Creek BAER prescription calls for aerial application of ammonium nitrate sulfate (30-0-0-6) on 5,572 acres to improve establishment of seeded species and enhance the cover of surviving native plants (3,898 acres high intensity + 1,674 moderate intensity). The proposed fertilization rate results in application of 25 lbs of actual N per acre—considered a light application. The prescription also calls for a small component of sulfur—a critical limiting nutrient for plant growth in these soils. The fertilizer compound being applied does not contain phosphorus. As with past BAER projects, the direct application of fertilizer to streams will be avoided via the use of buffer zones.

As discussed above, research in the area has documented that, relative to background conditions, wildfire exerts pronounced effects on the nutrient status of ecosystems (Tiedemann, and others, 1978). Nitrogen is lost from the system via volatilization and in solution, with N inputs from precipitation helping to offset some of this loss. This research also indicated that water quality effects from post-fire fertilization for erosion control in response to the 1970 Entiat fires were negligible (no exceedances of EPA drinking water quality criteria). Fertilizer application on burned areas in this research study involved a rate of over 50 lbs of actual N per acre applied using equipment less capable of observing stream buffers (fixed wing aircraft).

In this study, the lack of large increases in nitrogenous constituents in solution that could be attributed to fertilization was considered to be an indication of the relatively high degree of chemical retention capacity in the study watersheds, despite the disturbance of wildfire. The rapid development of native plant and seeded grass cover—and accelerated re-establishment of nutrient cycling---was considered to be primarily responsible for the observed nutrient retention capacity. More recent work evaluating productivity responses from the 1994 Tyee fires indicates that post-fire fertilization with N and S could increase soil productivity where other

environmental factors do not limit growth (Baird, 1998).

Given research findings and field observations, the prescribed fertilizer composition (lacking phosphorus), low rate (25#N/acre), application technique (helicopter) and application constraints (stream buffers) are considered to pose a low risk of water quality degradation from fertilizer use in fire-affected tributaries. This low risk of adverse effects from fertilization is countered by the much greater potential benefit to be obtained in treated areas as a result of the rapid stimulation of vegetative growth. This stimulation will have the beneficial effect of promoting nutrient retention on-site (reduced loss via reduced soil erosion and accelerated uptake). Timeliness of vegetative establishment is a major factor in reducing erosion and nutrient losses, maintaining soil processes and maximizing nutrient cycling (Everett and others, 1990).

Appendix G
Rationale for Seeding Treatments

Aerial Upland Seeding Criteria

There are many grass and herbaceous plants that could be used to provide soil protection. However, criteria used for seed selection to best meet both BAER objectives and land allocation concerns for the Rex Creek Fire included:

- Native or relatively short-lived introduced species (so natives would come back)
- Rapid developing
- Good ground cover
- High energy seeds
- Non-weedy
- Known to have been successful elsewhere
- Available in sufficient quantities
- Adapted to the sites
- Low cost-when compared to other equally effective plants

Past restoration work has sometimes used long-lived exotic pasture grasses for rehabilitation seedings. Often these seedings were successful in providing soil cover and thereby reduce erosion--but the seeded species commonly persisted for many years longer than required for short-term erosion reduction and sometimes inhibited re-vegetation by native plants. For the Rex Creek Fire, only natives or short-lived ephemeral plants were considered due to the wilderness allocation. The use of ephemeral plants or natives has become a standard BAER prescription on the Forest even outside wilderness.

Based upon the above criteria, Forest Service plant materials specialists used literature review and previous experience (particularly from the 1988 Dinkelman fire, 1994 Tyee Complex Fires, 1998 N25 Fire and 2000 Hash Rock Fires) to develop the seed and fertilizer recommendations for the Rex Complex. The process of prescription development involved several iterations with numerous points of review before the final recommendations were developed. The seed mix developed for fall upland erosion control seeding uses one species to provide two to three years of coverage (an appropriate variety of annual soft white winter wheat). Refer to Appendix D for seed specifications and rates.

Noxious Weed Criteria

Noxious weeds are a major concern in the fire area—particularly common crupina. Noxious weeds inhibit natural stand development and reduce natural biological diversity. Noxious weeds can reduce the diversity and abundance of native vegetation, forage, diversity and quality of wildlife habitat, increase erosion and decrease water quality (ICEBMP 1997). Weeds may also inhibit re-establishment of native plants including trees. Common crupina, a Class A weed known only from this area in Washington, is well established in the area and will increase as a result of the open stand conditions (Refer to the distribution map in Appendix B). Seeding the known and potential habitat nearby will help to reduce both weed re-establishment and invasion into new areas.

It is well documented that vegetated sites are more resistant to weed invasion than sites devoid of vegetal cover. Sheley and others (1999) note that establishing perennial grasses to fill open niches with desirable perennial plants can minimize re-invasion by rangeland weeds. Plant competition, grazing and fertilization can favor desirable species. Thill and others (1999) noted that competitive grasses can suppress common crupina and that the selection of grasses should be appropriate to the site. Larson and McInnes (1989) found that certain grasses were particularly effective at inhibiting encroachment of diffuse knapweed including sheep fescue, thickspike wheatgrass and big bluegrass. However, for the Rex Creek Fire, wilderness concerns lead to the use of native grass cultivars including beardless bluebunch wheatgrass and Canby bluegrass.

Much of the same logic and criteria for the upland erosion control seeding were used for selecting plant materials (kind and amount) for competing with weeds on the Rex Creek Fire. However, some other criteria were important as well. It was felt that annual seeded species would be unacceptable due to the need for long-term competition with weeds. Also, fertilization was avoided due to the likelihood that weeds would be favored more than the seeded species. As a result, the prescription for aerial and ground-based seeding for weed competition used native perennial grasses without any fertilization. The higher seeding rate of about 100 seeds/sq. ft. was chosen to improve likelihood of success--especially given the small size of these seeds when compared to wheat. See Appendix C for seed specifications and rates.

Appendix H
Estimated Logistics Costs for Land Treatments

A. SUMMARY OF GROUND-BASED WEED TREATMENT COST

Itemized Costs Category (Current Request)	**Potential Cost w/NEPA**	**Expected Costs**
TOTAL CREW COSTS WITH LEADERS =		$141,000
TOTAL CAMP AND CAMP OVERHEAD COSTS		$151,800
TOTAL BARGE AND ASSOCIATED BOAT COSTS		$17,400
TOTAL SEED COSTS		$27,900
TOTAL EQUIPMENT COSTS		$2,900
TOTAL ALL FY02 (rounded)		*** $341,000**
(Potential Future Request)		
Total for hand control FY03 **		$243,000
Total for hand control FY04 **		$122,000
TOTAL FOR NEPA AND HERBICIDE	$61,626	

* Based upon the $341,000, per acre unit costs represent $568.33. This amount is the only amount for weed control requested.

****Potential Future Requests** The use of herbicides is important in order to be most efficient and effective in completing the BAER treatment for noxious weeds. In order to use herbicides, however, will require environmental analysis. The NEPA costs have not been requested in the current 2500-8. It is expected that the completion of a NEPA and herbicide use would speed up the treatment, reduce costs, improve effectiveness, and provide for a better means of control. The hand control costs for FY 03 and 04 will be requested in a future interim 2500-8 once costs are better validated.

B. *SUMMARY OF AERIAL TREATMENT COSTS*

B1. Fall Aerial Seeding for Weed Control

Grass Species	**Cost/acre**	**Total acres**	**Total Cost**
Seed	$46.50	5000	$232,500
Application Cost (aerial or ground)	$20.00	5000	$100,000
Logistics Cost	$4.42	5000	$22,100
TOTALS	**$70.92**	**5000**	**$354,600**

B2 Fall Aerial Seeding and Spring Fertilization costs

Item	**Cost/acre**	**Total acres**	**Total Cost**
Soft white winter wheat (Eltan)	$3.00	3898	$11,694
Seed Application*	$30.00	3898	$116,940
Subtotal Erosion Seeding	***$33.00***	***3898***	***$128,634***
Ammonium Nitrate Sulfate	$11.00	5572	$61,292
Fertilizer Application	$50.00	5572	$278,600
Logistics Cost	$3.97	5572	$22,121
Subtotal Fertilization	***$64.97***	***5572***	***$362,013***
TOTALS-Fall Aerial Seed; Spring Fert for Erosion Control	**$97.97**		**$490,626**

*Application costs for seeding and fertilization are unusually high due to the long distance from potential helispots to the treatment area and either the great elevation gain or long distances involved.

Logistics Support Costs assumes the use of an incident command type system to implement fall treatments with a base camp at 25mile Creek firecamp and a spike camp approximately 15 miles up Lake Chelan and across from the Rex Creek Complex Fire.

Fertilization was originally planned for fall application due to the logistics concern of being able to do all the erosional treatments at the same time with one staging operation. Further discussions with a local helicopter company suggests that it may be logistically infeasible to try to get the fertilizer applied this fall with the limited helispots available and their distance from the treatment area. Consequently, it now appears that it is best to postpone the fertilizer treatment until early spring (which is the best time phenologically for the plants anyway).

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