Proposed Action for the Angora Fire Restoration Project

USDA Forest Service Pacific Southwest Region
Lake Tahoe Basin Management Unit
El Dorado County, California

I. Background

On the afternoon of June 24, 2007, the human-caused Angora Fire began on National Forest System (NFS) land managed by the Lake Tahoe Basin Management Unit (LTBMU). The Angora Fire burned over 3,100 acres, all within the Wildland Urban Interface (WUI) Defense Zone, and destroyed or damaged more than 250 structures on the South Shore of Lake Tahoe. See Figure 1 for a vicinity map and boundary of the fire perimeter.

The LTBMU strategy for post-fire rehabilitation includes three phases. The first phase was fire suppression rehabilitation that occurred during the "mop-up" of the fire and was completed in November 2007. This was a series of immediate post-fire actions to rehabilitate hand and dozer fire lines, roads, safety zones, and portions of urban lots used during fire suppression efforts.

The second phase of rehabilitation of the area took place under the Burned Area Emergency Rehabilitation (BAER) process where erosion control measures were implemented in preparation for the initial storm events of fall and winter. The BAER work also included noxious weed detection surveys of disturbed areas and subsequent weed abatement, seeding urban lots for erosion control, hand mulching, installing and armoring water bars, culvert maintenance, installing fencing, and aerial hydromulching.

The third phase of rehabilitation is longer-term and includes two stages. The first stage addresses public safety within the burned area. This includes the removal of hazard trees on urban lots (completed in October 2007) and along NFS roads and trails. In March of 2008, the Forest Supervisor signed a Decision Memorandum for the Angora Hazard Tree Removal Project authorizing hazard tree removal and mitigation along 256 acres of roads and trails. This work started in December 2008 and is scheduled for completion in December 2009. The second stage of long-term restoration includes this proposed action, in which an interdisciplinary team of resource specialists addresses a comprehensive approach toward restoring the burned landscape to meet desired social and ecological conditions. Survey work has been completed. From May through June 2008, the Forest Service invited initial public input on restoration opportunities. Approximately 60 people attended a public open house and an additional 15 people submitted written comments or called with verbal input. Based on the direction found within the LTBMU Land and Resource Management Plan (as amended) (Forest Plan) and public input received, the proposal for restoration includes the following five major restoration categories:

1. Fire, Fuels, Vegetation, and Forest Health
2. Wildlife Habitat
3. Aquatic Habitat and Stream Channel Restoration
4. Road and Trail Delineation
5. Noxious Weeds Detection and Removal

During the three phases of rehabilitation, a variety of research and monitoring activities were implemented concerning air quality, upland soils and erosion control effectiveness, stream geomorphology, water quality, and biological resources. These activities will continue through all phases of restoration.

The Forest Plan, through the Sierra Nevada Forest Plan Amendment Record of Decision (SNFPA ROD 2004), provides direction for ecosystem restoration following catastrophic events. These restoration activities are included in all land allocations and call for managing disturbed areas to achieve long-term fuels profiles (decreased fuel loading and resiliency to wildfire), restore habitat, and recover the value of some dead and dying trees (SNFPA ROD 2004, pg. 6). Forest Plan land allocations (through SNFPA) within the Angora Fire boundary are defense zones[1] and riparian conservation areas (RCAs) adjacent to perennial, seasonal, and ephemeral streams. In addition, several neighborhoods surround the burned area boundary and there are multiple points for recreational access to administrative roads and recreational trails.

A combination of tree removal and reforestation in the defense zone is proposed to reduce future fuel loads and restore a forested condition. The Emergency California-Nevada Tahoe Basin Fire Commission Report (May 2008) recommended that the LTBMU undertake steps to facilitate the removal of burned trees. This recommendation includes conducting multi-agency collaboration that would expedite such actions because priority areas for removing burned trees are within the WUI. The Angora Fire Restoration Project would carry-out the necessary planning through the National Environmental Policy Act to be consistent with applicable laws, regulations, and policy.

II. Decision Framework

The decision to be made by the responsible official is two-fold: 1) whether to implement the proposed action, take action through an alternative combination of activities, or take no action at this time, and 2) to make a determination as to the potential for and nature of significant environmental effects.

[1] A *defense zone* is generally defined as a buffer in close proximity to communities, areas with higher densities of residences, commercial buildings, and/or administrative sites with facilities (SNFPA ROD 2004, pg. 40).

III. Existing Conditions

A. Fire, Fuels, Vegetation, and Forest Health

The Angora Fire created a mosaic of dead and live trees. Areas of moderate and high fire intensity and severity have significant tree mortality caused by the fire burning through heavy surface fuels and the crowns of trees. Fire behavior was altered and severity was reduced in areas that were treated prior to the fire with understory thinning and surface fuels reduction.

Prior to the Angora Fire, portions of the area encompassed by this project were not typical of the natural (historical) regime in terms of vegetation characteristics, fuel composition, and fire frequency, severity, and pattern. Historically, fires burned in Jeffrey pine and mixed conifer forest types within the Lake Tahoe Basin on a frequent basis (every 0 to 35 years) and were primarily of low severity. Decades of fire suppression resulted in vegetation that was highly altered from the natural condition, including increased densities, encroachment of shade tolerant species, and large quantities of surface and ladder fuels. As a result of this landscape alteration, the fire regime changed from frequent fires of low-to-mixed severity to infrequent fires of high severity. The Angora Fire is a recent example of this shift. Approximately 60 percent of the Angora Fire area burned at high vegetation severity (greater than 75 percent basal area mortality).

The Angora Fire burned approximately 3,000 acres of Jeffrey pine and mixed conifer forest. The fire affected forest resources such as soil, and riparian and wildlife habitat, and killed thousands of trees. In the areas of high vegetation burn severity and much of the areas that burned at moderate severity (25 percent to 75 percent basal area mortality), the overall fuel loading is now very low (average of less than 7 tons per acre). However, as dead trees fall, over time surface fuels will increase. This, in combination with surface grass, forb, and shrub growth, will contribute to the potential for future high fire severity (Monsanto and Agee 2008) and will affect future fire behavior and suppression capabilities.

The following conditions are expected approximately 10 years post fire if no action is taken:

- Most of the smaller diameter trees (less than 15 inches diameter at breast height [dbh]) will have fallen, and a few of the larger trees (greater than 15 inches dbh) will have fallen.
- Approximately 10 to 15 live trees per acre (tpa) will exist in some areas, mostly surviving Jeffrey pine with diameters averaging more than 20 inches dbh.
- Dead standing trees (snags) will average 80 to 120 tpa; about 10 to 20 tpa will be greater than 20 inches dbh.

- There will be some natural regeneration of conifer species averaging about 100 to 200 tpa with heights varying between 0.5 to 2 feet tall. Tree species will consist primarily of white fir or red fir.
- Shrub regeneration will occur with averages of 40 to 70 percent cover and heights of approximately 1 to 3 feet tall. Shrub species could include green leaf manzanita, whitethorn, huckleberry oak, and species of ceanothus.
- Surface fuels will average 30 to 40 tons per acre.

Jeffrey pine will regenerate naturally only in areas that are sufficiently open and where a seed source is available. In the areas of high and moderate vegetation burn severity, there is a lack of reliable conifer seed sources due to a consumed seed bank and a lack of nearby living seed-producing trees. In higher severity burn areas, minimal-to-no natural regeneration of conifers will occur. On south aspects, a higher shrub component will be present occupying about 50 percent of the area with a patchy distribution of mixed conifer regeneration averaging about 20 tpa. Where lodgepole pine dominated pre-fire, natural regeneration of mainly lodgepole pine will average more than 200 tpa. Hardwood trees such as aspen, alder, and willow will benefit from the lack of conifer competition and thrive initially within some riparian areas.

The following conditions are expected approximately 20 years post fire if no action is taken:

- A few more snags will have fallen adding to the down wood fuel component. Overall, snags will amount to about 80 to 100 tpa.
- Mortality of 20 to 30 percent of the natural conifer regeneration will occur while surviving conifer seedlings will grow to about 2 to 4 feet tall.
- Shrubs will have grown to occupy 60 to 70 percent of the area and will be about 3 to 5 feet tall.
- The increase of surface fuels over time will result in an average of about 60 tons per acre.

Riparian species will be well established with some lodgepole pine and white fir trees beginning to grow adjacent to riparian areas. The burn area will have reverted from mid- and late-seral forest conditions to early-seral forest conditions. It will take at least 100 years to reestablish large trees (>24 inches dbh) and at least 250 years to develop old trees with decadence features beneficial to wildlife (SNFPA FEIS Vol. 1, Ch. 2, pg. 138).

Over time, the excessive (average of over 15 tons per acre) large woody debris and overall high fuel loads will increase probability of future wildland fires to burn at high severities (greater than 75 percent basal area mortality) and provide conditions that will make suppression of wildfires more difficult. The severity of fire effects and difficulty in fire suppression are primarily associated with the total amount of fuel available and consumed (Martin and Brackebusch 1974). In other words, given the same weather and topographic conditions, areas with higher fuel loads will release more energy (burn hotter), exhibit longer flame lengths, have greater potential to convert to crown fires, be

more difficult to contain, pose greater risks to firefighters, kill more vegetation, and damage soils more severely than areas with lower fuel loads. A higher fire severity will impact impaired watersheds, soils, and archeological sites. Excessive small woody debris from small trees and limbs of larger trees increases a fire's rate of spread and fire line intensity, reducing the ability of firefighters to suppress the fire and increasing the ultimate fire size. Fire line construction is significantly slowed where fire lines intersect numerous large logs. This is referred to as "resistance to control" and can lead to larger fires since fire lines have to be relocated to areas of less woody debris or where tractor fire lines can be built (e.g., on flatter ridgetops).

B. Wildlife Habitat

The Angora Fire burned a dense conifer overstory, heavy loadings of downed logs, and continuous ladder fuels to the upper canopy, which allowed aspen stands to accelerate growth. Four different aspen stands were burned totaling approximately 12 acres. Two aspen stands (TM01 [4.87acres] and Sl01 [0.55acres]) burned at a low-to-moderate vegetation burn severity level. These stands are at risk of further conifer encroachment if conifers are not removed. Two aspen stands (ANG03 [3.5 acres] and ANG04 [2.53 acres) are located in the high vegetation burn severity areas where all vegetation was killed (see Figure 2).

A California spotted owl Protected Activity Center (PAC) (ED226), and two northern goshawk PACs (R0519AT01 and R0519AT31) were burned in the Angora Fire. Immediately after the fire (July 1, 2007), an individual(s) northern goshawk auditory detection was recorded in the moderate vegetation burn severity area in one small patch of trees and shrubs along the headwaters of Angora Creek. These birds were known to forage near this area prior to the fire, and the area may have been used after the fire for species refuge because of its proximity to the burned PAC. This area will not be included in the overall long-term restoration goal of the fire area because long-term fuel loading standards would not exceed desired conditions. The burned area no longer provides viable northern goshawk and/or California spotted owl nesting habitat.

The Forest Service delineated new PCAs for northern goshawk and California spotted owl in suitable habitat outside of the burned area. These PACs, which are adjacent to the burned area, will provide potential critical nest stand structure for these species. They will also provide an opportunity to establish new territories outside of the burned area. The burned area will not provide desirable nesting habitat for these species in the foreseeable future (20 years or less).

C. Aquatic Habitat and Stream Channel Restoration

The section of Angora Creek that lies above the current location of the Lake Tahoe Boulevard crossing has undergone considerable change since the early 1900s. During this era, uncontrolled livestock grazing was prevalent throughout the basin and diverting streams was a common associated practice. Stream diversion coupled with overgrazing

in meadow and riparian areas resulted in channel incision and widening. Road crossings have also contributed to channel degradation due to the installation of undersized culverts. Effects from the Angora Fire exacerbated these conditions as most of the fire resulted in a high intensity burn.

Meadow landscapes were historically prevalent throughout the south shore area of Lake Tahoe. Land management practices, such as grazing, fire suppression, logging, road construction, and urban development (late 1890s to early 2000 era) affected the quantity and quality of meadow systems. Conifer encroachment and associated channel degradation are two common relict effects of historic management activities. The Angora Fire burned through two meadows occurring along Angora Creek and the northwest side of Gardner Mountain (Figure 3). Although the fire killed a number of encroaching conifers, there still remains a portion of encroachment that will undoubtedly persist.

Seneca Pond is a human-made water body originally constructed in the early 1960s (Figure 3). Prior to pond construction, this area appears in historic aerial photos to be a wet meadow/Stream Environment Zone (SEZ). The wetland complex functioned as an important source of ground water recharge to Angora Creek, which both buffered water temperatures and provided perennial base flow sources in summer months. In the mid-1990s, the Forest Service undertook a pond modification project that included road decommissioning, restoration of natural drainage to one of the streams diverted into the pond, partial fill of the pond, construction of a small island, and installation of a clay liner to maintain water levels in the pond. Additionally, to maintain water flow into the pond, a perennial stream sourced from an uplands spring was diverted through a constructed ditch to the pond. This restoration stabilized the pond but left the area in a highly altered state and water is no longer available to recharge base flows in Angora Creek. In addition, Seneca Pond provides breeding, rearing, and over-wintering habitat for non-native/invasive bull frogs, which are known to out-compete and displace native amphibians.

Currently, Seneca Pond provides no hydrologic function or water quality benefit; it is not connected to the downstream channel and the clay liner prevents groundwater recharge. Additionally, the banks of the pond are constructed of hard, packed fill that supports very little riparian vegetation. Ecosystem benefits of this pond are minimal as the population of non-native bull frogs precludes the colonization of native amphibian species, such as Western toad. Riparian vegetation (willows) is growing in and along the constructed ditch that diverts water into the pond. However, because this ditch is shallow and runs slightly side slope, this additional material makes the channel vulnerable to breaching and diversion, creating a source of upland erosion.

D. Roads and Trails

Classified roads and trails are under Forest Service jurisdiction and are required to protect, administer, and use the National Forest for administrative and public access. A classified road may be characterized by 1 of 5 maintenance levels depending on the level of service required. Maintenance on level 1 roads is generally minimal and given to

maintaining drainage facility and runoff patterns. Level 5 roads are generally maintained as double-lane paved facilities, have high traffic volumes and speeds with a high degree of user comfort and convenience (FSH 7709.58). There are five Trail Classes, ranging from the least developed (Trail Class 1) to the most developed (Trail Class 5) (FSM 2309.18). Not all classified roads are open for use by the public; some are only available for Forest Service administrative access. All other roads and trails are unclassified. They have features that appear to be that of a classified road or trail. These are generally characterized as non-system and user created. Further they have no other jurisdiction such as an easement tied to them. Motorized use of unclassified roads is generally prohibited.

Currently, there is inadequate administrative access within the Angora Fire area provided by Forest Service System roads. Throughout the project area there is a lack of classified administrative roads for accessing landings for the vegetation restoration, ongoing fuel reduction treatments, forest stand management, and fire suppression. Existing road crossing of streams are in lower capability soils. Stream crossings have widened and eroded due to users avoiding crossings during seasonal wet periods.

Unclassified roads and trails in the project area are in low capability soils and are eroding. Unclassified roads and trails are currently used by the public for non-motorized access to the forest. These routes have a greater erosion risk due to the lack of designed best management practices (BMPs), locations in low capability soils, and steep sections. Road and trail location signage does not exist to guide non-motorized recreation use. Road side parking at Sawmill Pond has resulted in compacted dirt shoulders.

Some classified and unclassified roads and trails are located in SEZs, low capability soils and on steep slopes; impacting water quality, scenic quality, forest productivity, and recreation experience.

The mileage of classified and unclassified roads and trails is shown below in Table 1. Within the project area there are a total of 10.4 miles of classified road and trail while there are 20.5 miles of unclassified road and trail.

Table 1. Mileage of Classified and Unclassified Roads and Trails included in Angora Restoration Project

	Classified	Unclassified
Road	5.0	3.8
Trail	5.4	16.7
Total	10.4	20.5

E. Noxious Weeds

Species considered noxious weeds have been identified in the Lake Tahoe Noxious Weeds Working Group Memorandum of Understanding and Draft Non-Native Invasive Plant Species Management Strategy. Prior to the Angora Fire, there was only one known invasive weed site. The site, located off of Panther Lane, contained 1500 square feet of

tall white top (*Lepidium latifolium*) and was used as a safety zone during fire suppression. Tall white top has spread throughout the safety zone and the tall white top site has expanded to approximately 30,000 square feet. Additionally, a small population of field bindweed (*Convolvulus arvensis)* was discovered at the Panther Lane site. An additional four invasive weed species within the fire perimeter were detected during post-fire surveys. Approximately 25 acres of bull thistle (*Cirsium vulgare*) have been identified throughout the entire burned area with highest densities in wet areas along streams, near springs, in aspen stands, and within meadows. St. Johns wort (*Hypericum perforatum*) was identified within a fen where Forest Service (Region 5) sensitive plant species, three-ranked hump-moss (*Meesia triquetra*), occurs. Ox-eye daisy (*Leucanthemum vulgare*) was identified in a holding basin off Lake Tahoe Boulevard adjacent to a meadow. Teasel (*Dipsacus fullonum*) was also identified within the burn area on adjacent private land (outside NFS lands); this is the first occurrence of this species within the Lake Tahoe Basin.

The noxious weeds crew along with the urban lots crew focused treatment of invasive species within the Angora burn area this past summer. All tributaries to Angora Creek were surveyed and treated for bull thistle in a 1-day event. The Angora burn area was surveyed for a 2-week period; 21 sites were found and treated. All roads, trails, and waterways were surveyed.

IV. Desired Condition

A. Fire, Fuels, Vegetation, and Forest Health

One goal of the restoration project is to move the area toward desired future conditions as defined by the Forest Plan, including the SNFPA (SNFPA ROD, pgs. 36-48). Desired conditions for defense zones (ROD pg. 45-46) are geared to reduce wildland fire behavior under high fire weather conditions (hot, dry summer days); they include flame lengths of less than 4 feet at the head of a fire, reductions in rate of spread at the head of the fire, reduction of hazards to firefighters by removing snags from locations likely to be used for fire suppression, and a doubling of fire line construction rates. To meet these desired conditions for defense zones, stands should be fairly open and dominated by larger, fire-tolerant trees; surface and ladder fuel conditions should reduce the likelihood of crown fire ignition; and crown fuels should be discontinuous, resulting in very low probability of sustained crown fire. Overall, average fuel loading to meet desired conditions is less than 15 tons per acre of various size and decay classes of woody debris (see discussion under "III. Existing Conditions").

In a totally unmanaged forest, lightning can initiate wildfires, killing large numbers of trees. In addition, when forest stand density indices are allowed to exceed levels of about 150 feet^2 of basal area per acre, bark beetle populations are more likely to expand into outbreak levels, killing a large number of trees (Fettig et al. 2007). Under desired conditions for the LTBMU, both fire and insect populations are managed. As evidenced by the Angora Fire, areas that were treated with thinning and surface fuel reduction prior

to the fire have intact stands of living trees. Therefore, preserving what is left of these live trees and stands is important for providing larger fire resilient trees and maintaining the aesthetics they provide.

Management of insect populations is best achieved by creating forests that have better defenses to resist insects by manipulating the stand density. The desired condition is for native insects and pathogens to function in a background role only. Under these conditions, insects and diseases act as agents of diversity. They influence forest composition, structure, and density by selectively killing or slowing the growth of some trees while affecting others to a lesser degree or not at all. They have important roles in creating small canopy gaps, specialized wildlife habitat, and are involved in nutrient recycling. At background levels, they coexist with host plants in a way that permits populations of each to survive.

Post fire conditions will ultimately include an increase in bark beetle activity in the project area since remaining live trees are under stress from current drought conditions and the affects of the Angora Fire. Maintaining lower densities of remaining live trees will increase resistance to bark beetle and other insects and diseases. Optimal levels at which infestation is less likely would be approximately 70 ft^2 of basal area per acre. Lower densities would promote a higher chance of survival due to less competition for water and nutrients, thereby increasing growth and vigor (Fettig et al. 2007).

B. Wildlife Habitat

The desired condition for forest habitat is to provide a diversity of habitat structure, such as snags and downed wood. It is important to maintain sufficient levels of snags and down logs while reducing fuel loads to provide diverse characteristics of forest habitat. Some dead trees left standing today may contribute in the short term to the decaying, fallen log component and will provide habitat for species such as small mammals, which in turn provide prey for other species (i.e. northern goshawk). Decomposing logs are an important element of the structural complexity of old forests, providing habitat for old-forest dependent wildlife species and their prey, and contributing to soil biomass. Meeting the desired conditions described above requires survival and growth of individual trees and forested stands over many years without the occurrence of another stand-replacing wildfire. Treating the dead and dying tree component of the landscape is the first step in reducing long-term fuel loading, thereby reducing the impacts of fires on the future forest. However, in order to meet objectives for forest structural diversity, wildlife habitat management zones were developed that identify a range of vegetation prescriptions (including no treatment) in order to retain snags and down wood.

Riparian habitats occur along stream corridors and wetland and meadow systems. Riparian ecotypes increase wildlife habitat availability for a diverse range of species that utilize aspen stands for nesting, cover, and foraging areas. The desired condition for riparian habitats is to provide aspen stands, and willow, alder, and wetland herbaceous vegetation types. Activities that reduce conifer encroachment of undesirable species,

such as lodgepole pine in riparian corridors and meadow systems, will increase the overall acreage of these habitats.

C. Aquatic Habitat and Stream Channel Restoration

Stream, wetland, and meadow ecosystems within the Angora Fire area function as habitat for a diverse group of aquatic and terrestrial wildlife species and positively influence the quality and quantity of water in the fire area. In addition, the following desired conditions apply to RCAs and have specific application to Angora Creek and its tributaries, including the meadow reach (above Lake Tahoe Boulevard), Gardner Mountain Meadow, and stream reaches that have been impacted by roads and/or trails:

- Water quality meets the goals of the Clean Water Act and Safe Drinking Act; it is fishable, swimmable, and suitable for drinking after normal treatment.
- Habitat supports viable populations of native and desired non-native plant, invertebrate, and vertebrate riparian and aquatic-dependent species.
- Species composition and structural diversity of plant and animal communities in riparian areas, wetlands, and meadows provide desired conditions and ecological functions.
- The distribution and health of biotic communities in special aquatic habitats (such as springs, seeps, vernal pools, fens, bogs, and marshes) perpetuate the unique functions and biological diversity of these habitats.
- The connections of floodplains, channels, and water tables distribute flood flows and sustain diverse habitats.
- Soils with favorable infiltration characteristics and diverse vegetative cover absorb and filter precipitation and sustain favorable conditions of stream flows.
- In-stream flows are sufficient to sustain desired conditions of riparian, aquatic, wetland, and meadow habitats and keep sediment regimes as close as possible to those with which aquatic and riparian biota evolved.
- The physical condition of stream banks and shorelines minimizes erosion and sustains desired habitat diversity.
- The ecological status of meadow vegetation is late seral (50 percent or more of the relative cover of the herbaceous layer is late seral with high similarity to the potential natural community). A diversity of age classes of hardwood shrubs is present and regeneration is occurring.
- Meadows are hydrologically functional. Sites of accelerated erosion, such as gullies and headcuts, are stabilized or recovering. Vegetation roots occur throughout the available soil profile. Meadows with perennial and intermittent streams have the following characteristics: (1) stream energy from high flows is dissipated, reducing erosion and improving water quality; (2) streams filter sediment and capture bedload, aiding floodplain development; (3) meadow conditions enhance floodwater retention

and groundwater recharge; and (4) root masses stabilize stream banks against cutting action.

- The wetland complex in the Seneca Pond area functions to provide a consistent level of ground water recharge and improved water quality to Angora Creek.

D. Roads and Trails

The following desired conditions apply to roads and trails.

- Maintain BMP's on all classified roads and trails within the Angora Fire area according to Forest Service Standards.
- Utilize new road segments and construct road segments to provide access to landings for current and ongoing vegetation treatments, fuel management, and fire suppression needs.
- Limit classified road use to administrative vehicle and over the snow vehicle (OSV) use where currently permitted.
- Control vehicle access on the new road segments from residential areas by gates and fences.
- Provide non-motorized year round access for recreation purposes
- Relocate and/or install BMPs on classified roads and trails to meet Forest Service standards necessary for water quality protection.
- Consider converting unclassified roads and trails to classified status.
- Improve the accessibility of the transportation system by providing way finding signage and install BMP's at existing parking at Sawmill Pond.

E. Noxious Weeds

Noxious weeds do not complete with native upland and riparian vegetation. The desired condition is to control and reduce the current weed populations, which have been exacerbated by the Angora Fire. The long-term goal is to eradicate noxious weed populations.

V. Purpose and Need

A. Fire, Fuels, Vegetation, and Forest Health

There is a need to:

1. Reduce the amount of dead and downed trees killed by the Angora Fire.
2. Reduce the density of live trees in remaining conifer stands.
3. Reforest portions of the burned area.

The purpose of removing dead trees is to reduce long-term fuel loading to reduce future fire severity. The purpose of reducing tree density (thinning live trees) is to increase the resiliency of the remaining live trees from insects and disease. The purpose of reforestation is to expedite stand conditions as described for defense zones with stands that are fairly open and dominated by larger, fire-tolerant trees such as Jeffrey pine and sugar pine, which are resistant and resilient to fire, drought, and insect outbreak. Understory trees would also exist, but at low densities, to maintain minimal fuel ladders.

Meeting the desired conditions requires survival and growth of individual trees and forested stands over many years without the occurrence of another stand-replacing fire. Without removal of some of the standing dead trees, they will fall and contribute to high fuel loads in about 5 to 10 years.

B. Wildlife Habitat

There is a need to:

1. Remove the live, dead, and dying conifers in two aspen stands approximately 6 acres in size in order to perpetuate and increase the vigor and health of aspen stands in the burned area.
2. Plant aspen seedlings and/or root stems along riparian corridor(s) and along meadow edge(s) within eleven ¼ acre plots identified to establish new aspen stands in the burned area.
3. Provide a diversity of terrestrial habitats for wildlife species by maintaining a level of existing snags and downed wood. The level of snags and downed wood retained will vary by prescription type in each wildlife habitat management zone.

The purpose of removing conifers in aspen stands is to increase the health and vigor of aspen stands in the burned area while reducing the risk of fuel loading within these stands, and to provide increased recovery of aspen stands in the Angora Fire area.

The purpose of aspen planting is to increase the distribution of aspen stands within the burned area to increase wildlife habitat availability for a diverse range of species that utilize aspen stands for nesting, cover, and foraging.

C. Aquatic Habitat and Stream Channel Restoration

There is a need to:

1. Restore water quality and aquatic habitat in Angora Creek, including managing for connected floodplains, floodplain/in-channel roughness, stable stream banks, pool habitat, and riparian/wetland vegetation.
2. Provide meadow, wetland, and spring systems to act as natural areas for groundwater recharge.
3. Provide SEZ habitats for aquatic, wildlife, and native plant species that rely on these systems.
4. Maintain or restore soil function.

The purposes of channel reconstruction, large wood placement, and meadow and wetland restoration are to 1) expedite hydrologic and geomorphic processes that result in improved water quality and aquatic habitat conditions; 2) minimize sedimentation from eroding streambanks; 3) increase in-channel roughness to promote floodplain connectivity and improve pool habitat diversity; and 4) improve the capacity of meadows to recharge groundwater and trap sediment.

D. Roads and Trails

There is a need to:

1. Provide a sustainable transportation system that serves FS administrative needs.
2. Provide non-motorized public recreation opportunities.
3. Reduce existing impacts from classified and unclassified roads and trails on hydrologic function, water quality, and soil function.
4. Restore unclassified roads and trails.
5. Decommission classified roads and trails.

The purpose is to lessen the effects of the road and trail system on water quality while providing administrative and recreation access.

E. Noxious Weeds

There is a need to:

1. Conduct detection surveys and early treatment of new noxious weed infestations.
2. Contain and control established noxious weed infestations.

The purpose of noxious weed control is to maintain and restore ecosystem diversity by reducing competition from noxious weeds to allow the natural establishment of native plants.

VI. Proposed Action

The following section describes the proposed action for the Angora Fire Restoration Project. The acres and distances provided are estimates based on surveys and GIS mapping information. The estimated acres recommended under the proposed action for tree removal and planting are the maximum that would be considered. Actual figures may be less when implemented, but would not exceed the stated acres discussed below.

The proposed action is discussed according to restoration category, and includes project design features (elements of the project design that were developed to reduce or avoid environmental effects of the proposed action on forest resources), and an implementation schedule.

It should be noted that trash would be removed in all areas of the project where legacy impacts to resources occur, but not from within identified historic site boundaries.

Other Forest Service projects in the vicinity of this project include the South Shore Fuels Reduction and Healthy Forest Restoration (South Shore) Project, and the Angora/Twin Peaks Access and Travel Management Project. These projects are outside the scope of this proposed action.

A. Fire, Fuels, Vegetation, and Forest Health

Approximately 1,800 acres of the Angora Fire area was initially included for fuels treatment within the South Shore Fuels Reduction and Healthy Forest Restoration (South Shore) Project. Approximately 20 percent of the fire area burned at low severity (less than 25 percent basal area mortality) and was beneficial in reducing surface fuels, including some of those stands identified for fuels reduction treatment. The fire did not result in reduction of fuels sufficient to meet the desired conditions in all of these stands. Approximately 325 acres of the original 1,800 acres (within the fire perimeter) were identified for fuels treatment need and are still included in the South Shore project (see Figure 2).

Treatments to reduce future fuel accumulation will provide an environment where natural disturbance regimes can retain or reestablish some of their historical influence in maintaining the diversity and productivity of regional landscapes. This part of the proposed action includes three groups of activities to meet the purpose and need for areas where the fire burned at moderate-to-high vegetation severities:

1. Fuel removal of standing dead and downed wood with thinning of live trees, based on desired residual basal area of 80 ft^2 per acre, to improve residual tree vigor.
2. Construction of new temporary roads and landings to facilitate fuel removal. Re-construction or opening of existing roads, trails, and landings to facilitate fuel removal.

3. Reforestation through artificial means (planting) and natural processes.

Post-fire fuel removal would occur over approximately a 3-year period primarily in moderate-to-high vegetation severity burn areas. This fuel removal would encompass up to 1,398 acres within the project area (see Figure 2). Maintaining lower stand densities will improve growth and vigor of the residual trees, increasing their resistance to insects and diseases. Equipment used for removal may include chainsaws, harvesters, feller-bunchers, forwarders, skidders, de-limbers, chippers, masticators, de-barkers, helicopters, and other tracked or rubber-tired equipment. Removal operations would occur under appropriate soil moisture or frozen conditions, as determined by a hydrologist or soils scientist, and would require implementation and monitoring of BMPs during and after implementation. In order to provide for public safety during tree removal operations temporary forest closures may be required in portions of the project area. Reforestation would follow after fuel removal and occur over a 3-year period. Wildlife leave islands (snag and live tree retention areas) would consist of 10 to 15 percent of the fuel removal area in irregular shapes and sizes up to 40 acres. Removal systems used in fuel removal areas, road access, landings and staging areas, and reforestation are described below. In the event of any funding limitations, the priority for fuels removal would be given to areas closest to neighborhoods. This includes all ground-based areas and the aerial treatment units to the south of, and adjacent to, South Tahoe High School and west of Lookout Point Circle.

Fuel Removal of Standing and Downed Wood (up to 1,398 Acres) and Thinning of Live Trees

The proposed removal of standing and downed wood is divided into three categories based upon removal method.

1. A ground-based logging system would be employed on up to 951 acres that are located in areas with slopes under 30 percent and would include the following procedures:

- Dead standing trees would be removed.
- All live trees would be retained unless live tree basal area exceeds 80 feet^2 per acre at the stand level. Removal would include trees between 3 inches and 24 inches dbh.
- Outside of wildlife leave islands, an average of four of the largest diameter snags would be retained. Snags would be at least 15 inches dbh in clumped and irregular spacing, depending on the average size class of trees in the stand.
- Activity fuels generated from tree removal would be lopped, scattered, and left up to 5 tons per acre. Amounts greater than this would be manipulated through whole tree removal, chipping, mastication, hand and machine piling/burning, prescribed burning, or removal, leaving a maximum total of 15 tons per acre (total includes down logs for wildlife, below).

- Outside of wildlife habitat management zones, an average of seven larger diameter logs per acre (>15 inches diameter) would be retained in various decay classes on the ground where they are available.
- Mechanical fuel removal within SEZs would take place using cut-to-length or other low ground pressure equipment. The decision to use mechanized removal would be based on a risk assessment similar to that used in South Shore Fuel Reduction and Healthy Forest Restoration Project and would also consider the increased risk of erosion in post-fire conditions.

2. An aerial logging system would be employed on up to 447 acres. The aerial logging system may include a combination of helicopter and skyline yarding systems (e.g., a "yoader system") and would include the following procedures:

- Dead trees greater than 16 inches dbh would be removed.
- All live trees would be retained unless live tree basal area exceeds 80 feet^2 per acre. Removal would include trees between 16 inches and 24 inches dbh.
- Limbs and tops of trees would be lopped and scattered to a maximum of 15 tons per acre to provide for soil cover. In areas of higher surface fuel concentration (>15 tons/acre) fuels would be hand piled and burned. The 15 tons include the down wood log retention as described in the ground-based logging system above.
- Outside of wildlife leave islands, an average of four of the largest diameter snags would be retained. Snags would be at least 15 inches dbh in clumped and irregular spacing, depending on the average size class of trees in the stand.

3. Hand treatment would occur within both aerial and ground-based treatment areas as a primary or follow-up treatment. Hand treatments may be needed to remove smaller size class material to meet the fuel reduction objectives of both ground and aerial treatment. Hand treatments may include hand pile, lop and scatter, or chipping treatments. Hand piling would require follow-up prescribed burning.

It should be noted that trees marked for removal would be based on species, dbh, and an assessment of crown injury and insect activity. These variables are appropriate for determining tree mortality and potential for survival. The marking guidelines developed for the Angora Project (Appendix A) are based on Forest Health Protection, Region 5, USDA Forest Service 2007 Report #R0-07-01 (Smith et al 2007).

Construction of Roads and Landings for Fuel Removal

The following road and landing improvements are proposed to support fuel removal activities (see Figure 4):

- Up to 7.7 miles of temporary road would be constructed, including spurs connecting to existing NFS and non-NFS roads. Procedures would include:
    - Incidental removal of live trees, if necessary, to allow for temporary road construction.

- Restore temporary roads after operations are complete to be consistent with new transportation system as described in transportation proposed action. Restoration may include subsoiling, spreading of chip or masticated material, placement of downed logs and rocks, culvert removal, and re-contouring.

- Existing and new landings and staging areas would be utilized to facilitate removal of fuels for ground-based operations and helicopter operations. This entails approximately 23 new and 27 existing landings and staging areas. Procedures would include:
  - Incidental removal of live trees would primarily occur in new landings and staging areas.
  - Landing and staging area size may range from ¼ to 1½ acres in size to safely facilitate the processing and removal of sawlogs and biomass.
  - Stump wads (stump and parts of the root system) resulting from landing construction would be split and piled to be burned or removed off site.
  - Biomass that is not removed from landings would be piled, firelines constructed around the piles, and the piles burned.
  - Biomass not removed from landings with public access may be available for public and commercial fuelwood permits.
  - Landings and staging areas would be restored following the completion of removal and pile burning. Restoration may include subsoiling to a minimum of 18 inches depth, re-seeding of native grass and shrub species, reforestation, and spreading slash, chip, or masticated material.

Reforestation of up to 1,100 Acres over 3 Years

Reforestation would be accomplished through a combination of planting and natural regeneration (see Figure 2). Areas that burned with moderate-to-high vegetation burn severity resulting in deforested condition would receive preference for planting over natural regeneration.

Planting would be conducted according to the following procedures:

- Planting would take place in areas that are accessible to hand crews, possessing higher site quality (good soils), and in areas near neighborhoods to promote visual recovery of aesthetics and forested conditions.
- Certain areas would be excluded from conifer planting, including areas with rocky soils and higher evapotranspiration potential; that are adjacent to aspen regeneration and proposed planting areas, valley bottom riparian areas, and wildlife leave islands; and that historically supported large numbers of shrubs.
- Approximately 200 tpa, consisting of Jeffrey pine, rust-resistant sugar pine, and incense cedar, would be planted over three seasons.
- There would be an option for public planting and stewardship of larger native species. Planting would be consistent with prescribed spacing described above and would be in areas adjacent to neighborhoods.

Site preparation for planting and release would be conducted as follows:

- Manual grubbing and or removal of competing vegetation down to mineral soil up to 3 feet around the planting site would occur during planting.
- Manual release treatment of competing vegetation (e.g. shrubs) up to 3-foot–diameter seedling/sapling at approximately 5 and 10 years after planting would occur to improve survival.

B. Wildlife Habitat

The proposed restoration plan for wildlife habitat includes the following activities:

- In the low-to-moderate vegetation burn severity areas, remove existing live and dead conifers where conifer removal is still needed for aspen enhancement. Aspen stands in the high vegetation burn severity areas, where no impeding conifers or other vegetation exist, would be left alone (no fuel treatments) to allow the stand to recover on its own.
- Aspen reforestation would be accomplished through a combination of planting and natural regeneration. Planting of aspen would occur within 11, ¼-acre plots over approximately 5 years of planting with both seedlings and root cuttings. Generally, the following guidelines would be followed when planting aspen to ensure successful regeneration:
    - Plant conifers at a distance of at least two times the height of the largest aspen in the stand or a minimum of 100 feet from the root and/or aspen shoot in the stand.
    - Plant aspen on a 5-foot-by-5-foot spacing.
    - Plant aspen under a range of soil moisture conditions but do not plant when soils are saturated.
    - Apply landscaping fabric material to ground surface after planting aspen to prevent the growth of competing vegetation and weeds.

Wildlife Habitat Management Zones

Wildlife habitat management zones were identified as part of the post-Angora Fire snag retention efforts (see Figure 2). They are being retained as habitat for a diverse set of species including black-backed woodpecker. These wildlife zones would receive minimal to no treatment in order to meet the following optimal conditions, including residual tree size class and other criteria for snag dependent species. Refer to Figure 2 for potential leave island locations in non-riparian and non-aspen stands.

1. Maintain leave islands of intact vegetation (no fuel treatments). Include leave patches in the lower, mid-, and higher elevations.

2. Minimal tree size class potential for snag dependent terrestrial species is 12 inches dbh.
3. Minimal size of leave islands (no fuel treatments) of snags is 40 to 50 acres.
4. Retain snags in clumps rather than evenly spaced distributions and retain over 42 to 50 snags per acre of 9 inch or greater dbh.

Conflicting objectives for creating desired stand conditions and fuel loads while meeting the optimal wildlife habitat conditions required the development of four types of snag management zones. In the first two zones, no fuels treatments would occur. The other two zones would include partial fuels treatments due to their proximity to the neighborhoods and expected future fire behavior if no treatment were to occur. In addition to the wildlife zones within the fuel treatment zone, approximately 1300 acres or 42% of the total burned area would be left untreated providing burned area habitat. The four snag management zones are described below.

- **Leave**: Fuel treatments would not occur in this zone.
- **Leave/Plant**: Fuel treatment would not occur; tree planting would occur.
- **Modify/SEZ**: Fuel treatment prescription would be modified to meet desired stand densities in or adjacent to Angora Creek.
    - For both aerial and ground-based logging systems, retain 40 snags per acre of the largest (greater than 20 inch) size classes.
    - Retain an average of 12 larger diameter logs per acre (>15 inches dbh) in various decay classes on the ground where they are available.
    - Activity fuels generated from tree removal would be lopped, scattered, or manipulated through chipping, mastication, hand and machine piling/burning, prescribed burning, or removal, leaving no more than 5 tons per acre in addition to the down wood log retention for wildlife.
    - Reforestation of conifers would occur in areas outside of SEZs.

- **Modify/Subdivision:** Fuel treatment prescription would be modified to meet desired stand densities in close proximity to communities.
    - For both aerial and ground-based logging systems, retain 15 snags per acre of the largest (greater than 15 inch) size classes.
    - Retain an average of 10 larger diameter logs per acre (>15 inches diameter) in various decay classes on the ground where they are available.
    - Activity fuels generated from tree removal would be lopped, scattered, or manipulated through chipping, mastication, hand and machine piling/burning, prescribed burning, or removal, leaving no more than 5 tons per acre in addition to the down wood log retention for wildlife.
    - Reforestation of conifers would occur in areas outside of SEZs.

C. Aquatic Habitat and Stream Channel Restoration

Restoration activities for aquatic habitat and streams are proposed in four areas—the channel above Lake Tahoe Boulevard, portions of Angora Creek and its tributaries, Gardner Mountain Meadow, and the wetland complex at Seneca Pond. Proposed activities are described below.

Channel Reconstruction

Twelve hundred feet of channel through the meadow above Lake Tahoe Boulevard would be reconstructed. The old channel would be filled by utilizing excavated material from the new channel. Sod would be borrowed from various locations within the meadow to vegetate stream banks along the new channel and place over the soil cap of the old channel. Construction of the new channel would utilize heavy equipment (track hoe and a dump truck). Access to the work site would be from Lake Tahoe Boulevard by installing a temporary road, which would be rehabilitated upon completion of the new channel. Other site preparation would involve felling the remaining live and dead conifers from the meadow and placing this material along the floodplain margins and as in-channel grade control. Riparian shrubs (willow and alder) would be planted in strategic areas of the new and old channel to provide soil stability and resistance to scour. The new channel location would be tied in at 50 to 70 feet above the Lake Tahoe Boulevard road crossing structure (bottomless arch).

Large Wood Placement

Large woody debris would be placed in 2 miles of Angora Creek and tributaries. Existing large wood that is currently spanning the channel or along the floodplain margins would be utilized as source material. Wood would be placed in the channel as debris jams. These jams would function to induce fine sediment deposition, control grade, and increase the complexity of aquatic pool and cover habitat. Work would be accomplished with either a spider excavator ("walking backhoe") or hand crews. It is estimated that an average of three structures per 200 feet would be constructed. The project is estimated to be completed in 2010.

Gardner Mountain Meadow (above Highway 89)

Live encroaching conifers within the 13-acre Gardner Mountain Meadow would be removed. The incised channel (1500 feet) would be filled in and plugged with soil material and grade control structures would be installed to maintain the new elevation. Riparian shrub and sod planting would be conducted as needed to stabilize areas of exposed soil.

Restore Wetland Complex

Seneca Pond would be completely drained and partially filled with onsite materials. The clay liner would be left in place to encourage a localized high groundwater table. The

pond banks and earthen dam would be recontoured to decrease height and slope to match the surrounding area. Fill from the area that is currently crossed by the road/trail would be removed and the area would be recontoured to create a hydrologic connection between the pond area and lower SEZ. The upslope stream diversion would be removed, flow would be rerouted back into the natural stream channel (flows to lower SEZ to be connected with pond area), and the diversion ditch would be decommissioned. Riparian willows and alder would be planted throughout construction area where deemed appropriate.

Due to the concern over bull frog presence, bull frog removal may be carried out pre- and post-project implementation and most likely would involve manual removal methods (i.e. netting). Opportunities exist to integrate bull frog control activities with the environmental education and Kids in the Woods programs to help accomplish yearly maintenance surveys and removal efforts.

Replacing Seneca Pond with a functional wetland would decrease the depth of the pond and increase the presence of riparian vegetation while still providing recreation access. Public access to both Seneca Pond and fire area would continue to be provided by means of an upgraded trail system (see "Roads and Trails," below); In addition, the visual experience of being in a wildland/forested environment will continue to be provided and, therefore, it is anticipated that local use from community residents will not change.

D. Roads and Trails

The three major objectives of the proposed action for the transportation system are the following:

1. Maintain, upgrade and develop administrative vehicle access.
2. Address unclassified roads and trails.
3. Upgrade recreation trails.

To meet above objectives and move towards the desired condition, the proposed action includes construction of roads and trails (both new and on existing prisms), decommissioning of classified roads and trails, and restoration of unclassified roads and trails (See Figure 4).

Decommissioning of classified roads and trails means eliminating the facility from forest system status. Decommissioning is a specific administrative term that applies to Forest Classified roads and trails only. Restoration is a specific term that applies to unclassified roads and trails only. Both decommissioning and restoration may include: recontouring, subsoiling, mulching, planting, and adding drainage features. Forest Service engineering or hydrology staff will determine in the field which methods are to be applied to specific roads or trails.

Below in table 2, the mileage of proposed construction, restoration, and decommissioning is shown. This includes re-routing roads and trails out of SEZs and providing

administrative and public access to the area. There are a total of 3.4 miles of decommissioning and 15.6 miles of restoration. It is important to note that out of the 6.2 miles of new constructed road, approximately 3.6 miles are on top of existing prisms (road and trail). Furthermore, of the 7 miles of constructed trail, 2.2 miles are on existing prisms.

Table 2. [1]Proposed Construction, Decommissioning (Classified), and Restoration (Unclassified) of roads and trails shown in miles.

	Construction	Decommission	Restore
Road	6.2	0.8	1.9
Trail	7	2.6	13.7
total	13.2	3.4	15.6

[1]Mileages in Table 2 include small portions of roads and trails that are located outside of the fire perimeter. This accounts for roads and trails where the actions of construction, decommissioning, or restoration are connected to roads and trails within the fire perimeter.

When fully implemented the proposed transportation system would provide administrative road access to areas where it is currently needed. The proposed transportation system would provide recreation access by linking access across classified trails and roads (See Figure 4 and Table 3). Additionally, 0.3 miles of road and 1.4 miles of trail would be relocated out of SEZs as measured by riparian vegetation data from GIS.

All existing classified roads in the project area and all new constructed road segments would be Maintenance Level 1 and for administrative vehicle access and non-motorized and OSV recreation use only. New roads adjoining public streets would have gates and other vehicle access control.

Table 3. [1]Mileage of classified and unclassified roads and trails after implementation of proposed action.

	Classified	Unclassified
Road	10.3	0
Trail	8.4	0
total	18.7	0

[1]Totals come from GIS data that is shown in Figure 5.

In addition, the proposal will include the following actions:

- Install 3 new locked gates with access control fencing.
- Construct 3 road crossing upgrades.
- Construct 2 trail crossing upgrades.
- Install 14 way finding signs at public access points.
- Upgrade shoulder parking with BMPs on Sawmill Road east of Lake Tahoe Blvd.

E. Noxious Weeds

Proposed restoration activities for noxious weeds are designed to meet the following goals:

- Eradicate, or control and contain the occurrences of invasive non-native weed species within the Angora Fire burn area.
- Provide a range of manual treatment methods for all invasive species found within the burn area.
- Treat known and new invasive plant occurrences up to three times each year, and survey for new infestations within the burned area. Treatment is expected to continue for 3 years or longer.

Project planning for the Non-Native Invasive Plant Species Project (NNIPS) is currently under way and has similar goals and objectives. The NNIPS project area is located throughout the LTBMU with a focus on treatment of typical conditions. The Angora Fire burn area differs from NNIPS because proposed actions for the Angora Fire burn area address post-fire conditions. Infestations in the burn area are expanding at rapid rates and new infestations are being found regularly. The high intensity burn areas create gaps in vegetation that can allow invasive species to become established. Additionally, this project proposes ground disturbance as well as the use of heavy equipment, which increases the risk of introducing and spreading invasive weeds. It is important to continue to focus treatments in the burn area, in order to promote a healthy ecosystem.

VII. Project Design Features

Project design features are elements of the project design that are applied in treatment areas. These features were developed based on Forest Plan direction and site specific evaluations in order to reduce or avoid negative environmental effects of the proposed action on forest resources. In order to minimize impacts to water resources from the proposed activities, standard BMPs will be implemented as a design feature across all activities (USDA 2000).

Fuel Removal and Vegetation Treatments

Normal operating period is generally considered to be from May 15 through October 15 each year. However, operable conditions may be present outside of that time period and inoperable conditions may be present within that period. Design features may apply to one or more of the following conditions: dry soils, wet soils, frozen or snow-covered soils. (Note: the normal operating period headings may include design features that apply in wet conditions).

Fuel Removal/Vegetation treatments in uplands (during normal operating <u>period</u>**)**

1. Allow ground based equipment operations only when soil moisture conditions are such that compaction, rilling, and/or rutting will be minimal, or when snow

conditions are at depth and temperatures, as determined by a Watershed Specialist, are suitable for over-the-snow operations (BMP#1-13).

2. Evaluate soil moisture conditions at the 6-10 inch depth; dry to moist soils at this depth, as determined by a USFS Watershed Specialist, will indicate operable moisture conditions (protocol included as part of SEZ Sensitivity Rating).
3. Use mechanical treatments to reduce upland hazardous fuels on slopes less than 30% and less sensitive soils.
4. Use hand treatments, end-lining or equipment reach to reduce hazardous fuels on slopes greater than 30% (BMP#5-2).
5. Where small areas of slopes greater than 30% are present in a unit, hand-fall trees and end-line the logs to a part of the unit where they can be picked up by heavy equipment.
6. No more than 15% of the treatment area shall be left with detrimental soil disturbance by skid trails and landings. If more than 15% of the soil in a given treatment area is detrimentally disturbed by skid trails and landings as estimated by a Watershed Specialist, the contractor shall be responsible for rehabilitating portions of the area to stay below 15% detrimental disturbance (BMP#1-15).
7. Install water bars on skid trails to provide proper drainage and prevent erosion when operations are complete and before large precipitation events (BMP#1-17). Design and spacing of water bars shall be in accordance with the Forest Service Timber Sale Administration Handbook.
8. To the extent practicable, where end-lining occurs on slopes above 10%, end-line material along slope contours (i.e. cross-slope) to avoid creating ruts in the soil that are oriented downhill. Where ruts are created by end-lining, spread slash, chips, or masticated material on disturbed areas.

Roads

1. Temporary roads shall be outsloped to ensure proper drainage.
2. Restore temporary roads after use by ripping where the rock content of the soil allows, as determined by the Sale Administrator (BMP#1-17 and 2-26).
3. Restore temporary roads after use by providing ground cover such as slash, wood chip or masticated material (to a maximum 6 inch depth) and installing water bars as appropriate to prevent accumulating water on the road surface.
4. Construct and remove temporary crossings on ephemeral drainages when the channels are dry (BMP#2-16). Remove ephemeral channel crossings prior to any National Weather Service forecasted large precipitation event and before the winter season begins.
5. Construct and remove temporary crossings on intermittent channels when the channels are dry and install crossings such that water flow and fish passage will not be obstructed (BMP#2-16).
6. Place natural barriers such as large logs and rocks as needed at road entrance points to prevent continued use of the road alignment.
7. Strategically establish barriers along open areas adjacent to road or trail access (boulders, split rail fence, and barriers/signs) to discourage post-treatment establishment of user-created routes that are not designated routes.

Fuel Removal/Vegetation treatments in RCAs and SEZs (during and outside of normal operating periods)

1. Limit work in SEZs to the time of year when soils are dry or when operable winter conditions are present. (BMP #1-13 and 5-6).
2. Limit mechanical equipment operations in SEZs to CTL operations or operations using equipment that has been demonstrated to adequately protect soil and water resources (i.e. equipment that is lighter on the land, rubber-tired equipment, equipment that operates on a bed of slash, or other innovative technologies that reduce impacts to soils).
    a) Treatment areas that exhibit equal or less sensitivity than the Heavenly Valley Creek SEZ Demonstration Project (HSEZ) site based on the Sensitivity Rating System may be treated with ground- based equipment under operable soil moisture conditions.
    b) SEZ stands that rate more sensitive than the HSEZ project site shall be treated by hand crews, endlining, or mechanical over-snow operations.
    c) When stands are rated more sensitive than the HSEZ site, but only a portion of the stand is responsible for the high sensitivity rating, the less sensitive part may be treated with mechanical equipment, but the sensitive portions of these stands must be treated by hand crews, endlining, or mechanical over-snow operations. Areas with wet soils or other sensitive features shall be flagged for hand treatment prior to commencement of mechanical operations.
    d) Within 25 feet of perennial or intermittent streams and other water bodies (e.g. lakes, ponds) avoid tree removal methods that disturb the ground surface.
    e) For burned SEZs, use the Region 5 Erosion Hazard Rating to prescribe adequate ground cover at completion of treatment. Adequate ground cover produces an Erosion Hazard Rating of "low" within SEZs. If adequate ground cover cannot be provided, the SEZ must be treated by hand.
    f) Application of chipped or masticated material to provide adequate ground cover shall stop at the stream buffer (i.e. chip within the SEZ only up to the equipment exclusion buffer). Chip depth shall not exceed an average of 2 inches and a maximum of 4 inches.
    g) The risk assessment rating works best for treatment units of 50 acres or less. Divide larger units and rate them individually. Units would be divided based on relevant stream channel and/or terrestrial geomorphic features.
3. Flag and avoid equipment use in and adjacent to special aquatic features (springs, seeps, vernal pools, fens, and marshes); use hand treatments in these areas (BMP #1-22). See botany prescriptions for specific buffers.
4. Leave existing downed trees and LWD that are in perennial or intermittent stream channels in place unless channel stability needs dictate otherwise, as determined by an LTBMU hydrologist (LRMP Std/Gd 15).

5. Locate and burn slash piles 50 feet from any perennial or intermittent stream channel or standing water, and 10 feet from any ephemeral channel (BMP#1-22, 2-13 and 5-5).
6. Ground based equipment, except as described in design feature #2 above, shall not operate in SEZs or stream channel buffers. Treat SEZ areas with hand crews, leaving the resulting logs in place.
    a) To achieve desired fuel loading in SEZs within units, trees may be end-lined out of the SEZ after consultation with a Watershed Specialist. Slash in excess of 15 tons per acre shall be removed by hand from the 50 ft buffer from stream channels and lakes, piled and burned.
        (i) Prohibit tree removal methods that disturb the ground surface within 25 ft of a perennial or intermittent stream channel or other water body (e.g. lakes, ponds).
        (ii) Provide ground cover adequate to prevent erosion in disturbed areas, such as slash, wood chip, or masticated material.
        (iii) Where implementation monitoring finds potential for sediment delivery, rake in the berms from ruts created by end-lining.

8. Ground based equipment shall not operate within 25 ft from the high water line of lakes and ponds, but may reach in to remove material.
9. Ground based equipment shall not operate within a minimum 25 ft of perennial or intermittent stream channels except at temporary or permanent stream crossings (BMP#1-19), but may reach in to remove material.
10. To avoid removing or altering bank stabilizing vegetation, trees may be marked for removal (live or dead) within 5 ft of the bank edge of perennial or intermittent streams and lakes only where fuel loads or stand densities exceed prescription and where LWD is at or above desired levels.
11. Use directional falling to keep felled trees out of intermittent and perennial streams unless the channel reach is identified as deficient in large woody debris, in which case a FS Fisheries Biologist shall select trees greater than 12 in DBH to be felled directionally into the channel.
12. Where it is necessary to cross an area with inoperable soil moisture conditions, in SEZs, equipment shall operate over a slash mat, landing mat, or other protective material to minimize soil compaction.

Fuel Removal/Vegetation Treatments - Landings

1. Prohibit landings, fuel storage, and refueling in SEZs (BMP#1-12).
2. Prohibit landings in RCAs unless no feasible alternative exists. Allow fuel storage and refueling in RCAs only if no feasible alternative exists.
3. Provide proper drainage from landings; ditching or sloping may be used where needed. (BMP#1-16).
4. Decommission landings after operations are complete in each area using the following methods:
    a) Apply wood chip or masticated material to each landing to a maximum depth of 6 inches (BMP#1-15).

b) After chipping or mastication, subsoil the landing to approximately a 12 inch depth, and seed the area with a native seed mix of grasses, forbs, and shrubs (BMP#1-15). Subsoiling may not be possible in very rocky soils; this determination may be made by the Sale Administrator.
c) Landings located within RCAs, and those that are greater than ¼ acre in size shall be priorities for decommissioning if the soil rock content allows.

Vegetation Treatments in uplands (outside of normal operating period)

1. When working outside of the normal operating period, conditions must be adequate to prevent erosion and detrimental soil compaction.
2. Operable conditions must be present on at least 85% of the treatment unit[2] and generally will include the following:
    a) For frozen soil operations, a minimum 3 inch depth of frozen soil shall be maintained throughout the treatment unit and on all access roads.
    b) For over-the-snow operations, a minimum of 12 inches of compact snow/ice shall be maintained on undisturbed ground, and 6 inches of compacted snow/ice shall be maintained on existing disturbed surface.
    c) Lesser depths may be agreed to by a Watershed Specialist and the Sale Administrator.
    d) Conditions that are likely to result in sediment delivery to a natural water body are not considered operable
3. If operable soil moisture conditions are present beneath a lesser snow depth (i.e. <6 inch), operations may continue until soil moisture conditions become inoperable.
4. Avoid springs, seeps, and other areas that do not freeze well.
5. When working outside of the normal operating period, monitor operations regularly to ensure that adequate snow and frozen soil depths are maintained and that soil and water quality impacts are not occurring.
6. Move equipment and materials to areas near pavement before conditions become inoperable.
7. For over-the-snow and frozen soil operations in SEZs, exclude ground based equipment from the 25 foot buffer around perennial and intermittent channels.
8. Temporary crossings on intermittent or ephemeral channels may be approved on a case by case basis through agreement between the sale administrator and a watershed specialist, and the conditions of the agreement shall be documented, These crossings shall not result in bank damage or water quality impairment

Roads (outside of normal operating period)

1. Unless adequate snow cover or frozen soil conditions exist, where a native surface road meets a paved road, the road intersection must be covered with rock or organic material to prevent tracking of mud onto the paved road.
2. If a native surface road becomes rutted, close the road unless spot-rocking or other mitigation of rutted areas will be effective in preventing road damage.

[2] 85% is consistent with the design feature that no more than 15% of the unit may be left in a detrimentally disturbed condition. These design features are consistent with National and Regional Forest Service policy

Rutting is defined as two-inch deep depressions, over 10% or more of the road surface, on a per mile basis.

3. Rutting of a road, forwarder trail, or any other disturbance that channels sediment into a water body or SEZ must be avoided.
4. During winter operations, paved surfaced roads may be plowed, including turnouts, if the action will not cause damage to the road surface and associated drainage structures.
5. On native surface roads, retain a minimum of 6 inches of compacted snow on 85% or more of the road surface after plowing to facilitate freezing. During road use, a minimum of 6 inches of compacted snow must be present on 85% or more of the road surface, unless the road surface is frozen to a depth of 3 inches or more. Ensure that plowing does not damage drainage structures.
6. Road alignments within the contract area that require snow removal shall be visibly marked on both sides along the entire alignment to facilitate plowing. Excess snow removed during plowing shall not be placed into drainages or riparian areas.
7. Before over-the-snow operations begin, mark existing culvert locations. During and after operations, ensure that all culverts and ditches are open and functional.
8. When roads are plowed, snow berms must be breached to allow drainage during snowmelt. Space outlets so as not to concentrate road surface flows (usually spaced at a minimum of every 300 feet). Erosion control structures may be necessary at outlets to collect road generated sediment, and will be agreed to by the Sale Administrator and Watershed Specialist.

A. Sensitive Plants

1. An LTBMU botanist will be notified prior (minimum of 2 weeks) to any project implementation involving ground disturbance to properly flag sensitive areas. Sensitive plant areas identified during surveys or project implementation will be avoided. Sensitive plant areas are areas that contain Region 5 sensitive plant species, special-interest plant species, or sensitive plant communities (i.e., fens).

2. Depending on the species and habitats identified, fuel reduction or stream restoration could be implemented in buffered areas as long as the level of disturbance will not degrade local hydrology, soils, or the mychorrhizal community.

3. Direct ignition of prescribed fire will be excluded from the sensitive plant buffered zones.

4. Trees will be directionally felled away from sensitive plant populations, sensitive plant communities (fens), or special-interest plant species.

5. No project activities will be allowed within buffered areas unless otherwise specified.

B. Meesia Sites

The following design measures are proposed for both three-ranked hump-moss *(Meesia triquetra)* and broad-nerved hump-moss *(Meesia uliginosa).*

1. Fens will be flagged and avoided, and will include a buffer, determined by LTBMU botanists, that will extend either to the edge of the wet soils and riparian areas that support the hydrology of the fen or 100 feet from fen.

2. An additional 25-foot buffer prohibiting mechanical equipment will be placed around the edge of wet soils to prevent impacts on fen hydrology.

3. No prescribed fire will occur within 100 feet from any fen.

4. LTBMU botanists will be on site around all fens during project implementation.

C. Sphagnum Moss Site

The following design measures are proposed for the sphagnum moss *(Sphagnum sp.)* site.

1. The sphagnum moss site will be flagged and avoided and will include a buffer, determined by LTBMU botanists, that will extend either to the edge of the wet soils and riparian areas that support the hydrology to the site or 100 feet from site.

2. An additional 25-foot buffer prohibiting mechanical equipment will be placed around the edge of wet soils to prevent impacts on hydrology.

3. LTBMU botanists and hydrologists will flag the area and determine boundaries for mechanical or hand thinning.

4. Trees will be directionally felled away from the site and all wet soils.

5. No prescribed fire will occur within 100 feet from this site.

D. Noxious Weeds

The following design measures will be implemented to control impacts due to noxious weeds.

1. Known weed infestations will continue to be monitored and surveyed for new occurrences in portions of the project area with focus on temporary roads and landings prior to implementation. Weed infestations within the treatment area or along travel routes associated with the project area will be manually controlled/removed (i.e. hand pulled) or "flagged and avoided" according to the species present and project constraints. (The entire fire area is infested with bull thistle, so prior to implementation the noxious weed coordinator will be notified

so that the area can be treated by crews or flagged and avoided. Additionally, there is a staging area infested with tall white top that should be avoided).

2. Staging areas (e.g., for equipment, materials, or crews) will not be located in weed infested areas.

3. All off-road equipment used on this project will be washed before moving into the project area to ensure that the equipment is free of soil, seeds, vegetative material, or other debris that could contain or hold seeds of noxious weeds. Off-road equipment includes all logging and construction equipment and brushing equipment such as brush hogs, masticators, and chippers; it does not include log trucks, chip vans, service vehicles, water trucks, pickup trucks. Equipment will be considered clean when visual inspection does not reveal soil, seeds, plant material, or other such debris. When working in known weed-infested areas, equipment will be cleaned at a washing station before moving to other NFS lands that do not contain noxious weeds.

4. All earth-moving equipment, gravel, fill, or other materials are required to be weed-free. Sand, gravel, rock, or organic matter from an approved onsite source will be used when possible. Otherwise, weed-free materials will be obtained from gravel pits and fill sources that have been surveyed and approved by a botanist or ecologist at the LTBMU.

5. The amount of ground and vegetation disturbance in the construction areas will be minimized. Where feasible, vegetation on disturbed bare ground will be reestablished to minimize weed establishment and infestation. Staging areas will be revegetated, as determined by the LTBMU botanist or ecologist.

6. Weed-free mulches and seed sources will be used. Topsoil from the project area will be salvaged for use in onsite revegetation when possible, unless contaminated with noxious weeds. All activities that require seeding or planting must utilize locally collected native seed sources when possible. Plant and seed material should be collected from or near the project area, from within the same watershed, and at a similar elevation when possible. Persistent non-natives such as cultivated timothy (*Phleum pratense*), orchard grass *(Dactylis glomerata*), or ryegrass *(Lolium* spp.) will not be used. This requirement is consistent with the USFS Region 5 policy that directs the use of native plant material for revegetation and restoration for maintaining "the overall national goal of conserving the biodiversity, health, productivity, and sustainable use of forest, rangeland, and aquatic ecosystems." Seed mixes will be approved by a LTBMU botanist.

E. Heritage Resources

The following design measures will be implemented to control impacts on heritage resources.

1. Known heritage sites will be flagged, and equipment operations will be replaced with hand treatments in these areas. Linear features will be evaluated to establish possible crossing areas for mechanized equipment.

2. In the event that any new heritage sites are discovered during project implementation, the LTBMU archaeologist will be notified and procedures in accordance with the 36 CFR Part 800 will be implemented.

VIII. Monitoring

The following is a preliminary list of monitoring items that would be carried forward as part of project implementation.

- Each year, the LTBMU completes evaluations for the Best Management Practices Evaluation Program (BMPEP), as part of the Pacific Southwest Region's effort to evaluate the implementation and effectiveness of BMPs created for protecting soil and water resources associated with timber, engineering, recreation, grazing, and revegetation activities. During the spring, fuel treatment units that were treated the previous field season are evaluated for BMP implementation and effectiveness. The Angora Restoration Project BMPs would be included in the pool for random BMP evaluations under the BMPEP program.
- Implementation monitoring would occur in fuels treatment areas of the Angora Fire burn area. This would include completing a checklist that contains every BMP and design feature contained in the NEPA and contract documents. The checklist may require visits to the field site before, during, and after implementation to ensure that all BMPs and design features are carried out on the ground as they were prescribed.
- Any sensitive plant species, special-interest plant species, or sensitive plant communities that could be affected by project activities, and any areas where project activities could have an impact on local hydrology, would be monitored for 3 years following project implementation.
- The LTBMU noxious weed coordinator would be notified after fuels reduction, aspen stand improvement, stream/meadow restoration, and road trail projects are completed of any project activities that occur on weed sites. Known noxious weed infestations within the project area would be monitored following project implementation to ensure additional weed species do not become established in the areas affected by the project and to ensure that known weeds do not spread.

Other project implementation monitoring maybe required as part of National Pollution Discharge Elimination System (NPDES) permits (e.g., channel reconstruction).

IX. Estimated Project Implementation Schedule

Proposal	Estimated Timeline
Vegetation Management	
Fuels Treatment—Aerial (helicopter and skyline)	Start: October 2009 End: October 2011
Fuels Treatment—Ground-based	Start: October 2009 End: October 2011
Reforestation—General forest	Start: April 2010; 2011; 2012 End: May 2010; 2011; 2012
Riparian/Aquatics	
Channel Reconstruction	Start: July 2011 End: Aug 2011
Large Wood Placement	Start: Sept 2011 End: Oct 2011
Meadow Restoration—Conifer Removal	Start: Aug 2010 End: Nov 2010
Meadow Restoration—Channel	Start: Sept 2010 End: Oct 2010
Aspen—Conifer Removal/ Fuels Treatment	Start: July 2010 End: Oct 2010
Aspen Planting	Start: Nov 2010; 2011 End: May 2011; 2012
Seneca Pond Wetland Restoration	Start: Aug 2012 End: Sept 2012
Engineering/Roads and Trails	
New Road Construction (Level I)	Start: Sep 2009; 2010 End: Oct 2010
Adopt and BMP Existing Roads	Start: Sep 2009; 2010 End: Oct 2010
Trail to Road Conversion	Start: Sep 2009; 2010 End: Oct 2010
Road Crossing BMPs	Start: Sep 2009; 2010 End: Oct 2010
New Gates and Vehicle Access Control Fences	Start: Sep 2009; 2010 End: Oct 2010
New Trail Construction and Trail Reroutes	Start: Sept 2010; June 2011; June 2012 End: Oct 2010; Oct 2011; Oct 2012
Adopt and BMP Existing Trails	Start: Sept 2010; June 2011; June 2012 End: Oct 2010; Oct 2011; Oct 2012

Road to Trail Conversion	Start: Sept 2010; June 2011; June 2012 End: Oct 2010; Oct 2011; Oct 2012
Trail Crossing BMPs	Start: Aug 2011; 2012 End: Oct 2011; 2012
Way-Finding Signage	Start: June 2012 End: Oct 2012
SEZ Restoration - 12N27 Reroute and 12N20D Culvert Removal	Start: July 2011; Aug 2012 End: Oct 2011; 2012
Natural Drainage Restoration	Start: May 2011; 2012 End: Oct 2011; 2012
Road and Trail Restoration/Decommission	Start: May 2011; 2012 End: Oct 2011; 2012

APPENDICES

Appendix A. Angora Fire Post Fire Fuels Reduction Marking Guidelines

The following are post-fire marking guidelines, by species, for use in marking trees to cut within the Angora Fire Project area. Guidelines are based on Forest Health Protection, Region 5, USDA Forest Service 2007 report # R0-07-01 (Smith et al, 2007).

The probability of mortality level used for all species except Jeffrey pine was 0.5 level, which provides the most overall accuracy when applied in the field. Jeffrey pine used 0.8, a more conservative level that may leave a higher number of dead trees, but removes a lower number of trees that may live. Cambium injury determination would improve accuracy in survivability, but was not included as a variable given the timeframe for assessing each tree.

Mark to cut trees if:

Jeffrey Pine

- Trees are less than or equal to 20 inch diameter at breast height (dbh) with less than 30 percent live crown.
- Trees are greater than 20 inch dbh with less than 40 percent live crown.

White Fir

- Trees are less than or equal to 20 inch dbh with less than 25 percent live crown.
- Trees are greater than 20 inch dbh with less than 30 percent live crown.

Red Fir and Incense Cedar

- Trees have less than 15 percent live crown.

Lodgepole Pine

- Trees have less than 50 percent live crown.

Lodgepole Pine that have moderate to deep char all around the bole and are:

- Less than or equal to 15 inch dbh and there is less than 80 percent live crown.
- Greater than 20 inch dbh and there is less than 65 percent live crown.

All Trees

- Boring dust or frass is observed in bark crevices, in webbing attached to the bole, or has accumulated at the base of the tree, and is present over at least 1/3 of the bole circumference. Specifically excludes boring dust or frass associated with wounds, old fire scars, etc (Smith et al, 2007).