Resource Specialty: Urban Lot Hydrologist
Fire Name: Angora
Date: July 7, 2007
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Report

Resource Condition Assessment

1. Resource Setting

In recognition of Lake Tahoe's unique character and national significance, Congress passed the Santini-Burton Act in 1980, which authorized the Forest Service (FS) to acquire environmentally sensitive lands in the Lake Tahoe Basin. The passage marked a major commitment and emphasis by the Lake Tahoe Basin Management Unit (LTBMU) in land acquisition and watershed restoration focused on protecting and restoring the environmental quality of Lake Tahoe. Specific provisions in the Act directed the Forest Service to:

1. acquire environmentally sensitive lands.
2. restore watersheds on acquired National Forest Systems lands.
3. administer erosion control grants to units of local government.

Environmentally sensitive lands include: stream environment zones; lands with steep slopes and erosion potential; lands modified by man that cause unacceptably high rates of sedimentation; and shore zones which are sensitive to cliff or beach erosion, and near-shore instability.

The LTBMU began acquiring environmentally sensitive land in 1982. Many of the environmentally sensitive lands acquired are lots in urban subdivisions located around the lake. The acquired lands in subdivisions are referred to as "urban lots". To date, over 3,500 parcels (referred to as Urban Lots) totaling 13,000 acres valued at $105 million have been acquired under the authority of the Santini-Burton Act.

2. Potential Values at Risk

Potential threats to human life and property.

The area burned included 131 Forest Service urban lots, which consisted of open space areas of natural forest vegetation within developed communities. These areas contain burned and partially burned trees, which pose a hazard to the public, private residences, roads, and utilities. High intensity rainstorms occurring over the burned area adds to the potential for surface erosion and

debris flows increasing the risk to human life and property within the communities.

Potential threats to erosion control projects/resources, county roads, or other investments/properties.

Severely burned conditions have destabilized hillslopes, escalating the probability for accelerated overland flow with increased surface erosion. Even under normal or average precipitation, the above-mentioned resources are susceptible to detrimental impacts from erosion and/or transport of eroded material and debris.

Potential threats to water quality below the burned area.

Often called the jewel of the Sierra's, Lake Tahoe was classified as an Outstanding National Resource Water (ONRW)[1] in the early 1970s. With this designation, Lake Tahoe is provided the highest level of protection under the anti-degradation policy and no further degradation is permitted. The threats from the burned area would come from sediment loading and heavy inputs of ash and nutrients into Lake Tahoe's water system.

Potential loss of soil productivity.

Throughout the majority of the burned area, the fire completely consumed the vegetation canopy and effective ground cover (plant litter and duff). This includes the needle fall and decay of dead plants that replenish the soil nutrient pool. Even with average/normal precipitation, accelerated erosion rates combined with higher surface runoff efficiency may move the exposed soil and nutrient-rich ash off-site decreasing the soils' productivity.

Potential threats to natural resources and local ecosystems.

National Forest urban lots are public lands not to be claimed by individuals for private exclusive use. Unauthorized use of urban lots is a common problem wherever they adjoin developed private lands. These unauthorized uses threaten the damaged soils and remaining vegetation, leading to the degradation of the hydrologic function these lands are intended to protect.

Several physical barriers that restricted OHV (Off Highway Vehicles) were damaged or destroyed during the Angora Fire. The lack of vegetation and these physical barriers has exposed and opened several decommissioned routes and user created trails. These roads and trails pose a threat to the safety of the individuals riding within these unmaintained areas. These roads and trails'

[1] ONRW is a state designated water system of exceptional recreational or ecological significance, usually of a high or pristine water quality.

erosion control measures have been removed. New traffic would increase sediment and nutrient loading.

The disturbed burn area promotes the increase of invasive species and noxious weeds and threatens to alter the biotic diversity by decreasing the natives and losing vulnerable plant species.

3. Findings of the On-The-Ground Survey

Condition of watershed resources as a result of the fire:

Mary Moore, the BAER Urban Lot specialist, surveyed the burned area, focusing on the urban lots and urban interface by air and on ground. Each urban lot was assessed for burn intensity, soil severity and values at risk. The fire completely burned off all effective vegetative cover on the majority of the burned area, with the exception of some of the lower meadow areas along Angora Creek, which in places still have 60% - 70% of the ground coverage. Riparian vegetation along the meadow remains intact. Much of the brush throughout the urban lots was intact with the leaves and small twigs burned. The trees on the urban lots were severely scorched by the radiant heat from the homes. Many of these trees are dead and will soon become hazards. Watershed response to precipitation events is expected to be high during the vegetation recovery period. Storms will greatly reduce effective storage of ash or sediment on slope if materials are entrained and mobilized during runoff events.

Consequences of the fire on values at risk:

The main consequences of the fire will affect life and property in the urban intermix and water quality from the loss of control of water on the hillslopes. The BAER Urban Lot specialist determined that the areas with highest potential risk to values are the burned and partially burned trees on the urban lots, the steep hillslopes along the Lookout Point Road and Mule Deer neighborhood and in the Boulder/Forest Mountain Road area, and 4 lots that have high burn severity and moderate hillslopes in the Mount Diablo neighborhood. Subsequent consequences include the increase of exotics and noxious weeds, additional runoff impacts on erosion control projects and roads, and impacts of OHV intrusions and unauthorized uses occurring on urban lots.

1. Hazard Trees

Fuels reduction, timber stand improvement, and improved defensible space had occurred prior to the fire on 84% of the urban lots affected by the Angora Fire. The remaining 16% were not treated due to regulations that limit the Forest Service from treating within stream environment zones or required no treatment. Most of these lots were located in the Angora Creek and Washoe Meadow State

Park area. Vegetation management in the urban lots has occurred to promote a healthy, diverse forest designed to achieve scenic, water quality, recreation, wildlife habitat, vegetative diversity, pest, fire protection, and hazard tree abatement benefits rather than for wood fiber production. While the soil burn severity in most of the urban lots was moderate to low, the fire intensity was high to moderate with large areas of tree scorching and 75-100% of the canopies burned. High intensity forest fires often result in high tree mortality. "This mortality can be immediate, due to the consumption of living tissue during the fire, or can be delayed, occurring over the course of a few years, as a result of fire injury to the crown, bole, and roots, and subsequent insect activity." (Hood, Smith, and Cluck, 2007) Post-fire management is needed in the urban intermix where the typical lot size is 0.25 acres and most of the trees are now considered a hazard tree due to the proximity to homes, utilities, roads, and the public. Our Urban Lot Program Manager is working on a Hazard Tree Removal Contract. For specific information see Appendix A for Hazard Tree Priority Removal.

Fire Intensity	**# of Lots**	**# of Acres**
High	26	36.3
Moderate	48	140.9
Low	25	9.3
Special Circumstances*	32	23.1

*Special Circumstances are areas with high intensity spot fires that may or may not need treatment.

Imminent hazard trees will need to be dealt with in a timely fashion before and after the Hazard Tree Removal Contract.

2. Erosion Potential and Impacts on Water Quality

Hillsides are more susceptible to erosion following a fire with decreased canopy and surface residue, and in some cases, soil that is water repellent. Water repellency is a process that may occur when volatilized hydrocarbons released by the fire condense and coat soil particles and aggregates. These hydrocarbons repel water, which reduces infiltration rates and increases runoff, erosion and sediment delivery from hillsides. With time, they are dissolved by infiltrating water from rainfall and snowmelt. The reduction in vegetative canopy and surface residue dramatically increases the potential for soil erosion by increasing the area susceptible to raindrop impact and decreasing the potential for sediment deposition. In the years following a fire, vegetation re-growth assists in reducing the likelihood of erosion and sedimentation thru accumulations of organic residues/litter and water-repellent chemicals break down and are washed away.

Changes in vegetative ground cover as affected by the fire were noted and compared to pre-fire conditions. Surface soils were examined for the presence of fine and very fine roots. Water repellency was evaluated by observing the depth and thickness of a water repellent horizon in surface soils and the degree

of water repellency was based on the amount of time a water drop remained beaded on the soil surface. Field data was collected and correlated to corresponding burn severity (low, moderate, high) polygons for the fire area. Appendix B identifies the burn severity within the urban intermix .

Soil Severity	# of Lots	# of Acres	Average Water Repellency (in)	% of Ground Cover Remaining
High	4	1.0	4	16.1
Moderate	46	143.4	2.3	17.3
Low	49	42.2	0.7	50.7
Special Cases	32	23.1	NA	90

The estimated acres of high to moderate water-repellant soil, based on the field transect data collection for the urban lots within the fire perimeter are 144.4 acres with an average water repellency depth of 3.15 inches. The calculations are based on field transect data, using the water repellency percentages for the different burn severity classifications: High – 1%, Moderate – 68%, and Low – 31%. The average post-wildfire effective remaining ground cover percent (based on the field transects) was 16% for high severity, 17% for moderate severity, 51% for low severity, and 90% for unburned (spot fires in grassy meadows).

The areas displayed below of the Lookout Point Road and Mule Deer neighborhood and the Boulder/Forest Mountain Road area are located on steeper slopes ranging from 15% to 40%. These hillslopes in the urban intermix experienced moderate soil burn severity but have high water repellency levels. These areas have less than 10% ground cover remaining to stabilize the steep hillslopes.

Picture: Lookout Point Road and Mule Deer Neighborhood

Before

After

4 urban lots in the Mt. Diablo are of special concern. They received high soil burn severity. They all consist of moderate slopes, but have a water repellent layer of 4 inches. They all have the potential for significant erosion.

Post-fire erosion potential and sediment yields were calculated in tons per acre per year using ERMiT (Erosion Risk Management Tool) (Robichaud, Elliot, Pierson, Hall, and Moffet, 2006.) Soil erosion rates and the effectiveness of erosion control efforts can vary greatly and are highly dependent on climate and weather. "Scientists with the RMRS Moscow Forestry Sciences Laboratory initiated major studies to: 1) measure soil erosion rates following wildfire; and 2) develop ways to incorporate location variability into predicting soil erosion efficacy and control." (USFS WEPP Interface, 2006) An online program called the Erosion Risk Management Tool (ERMiT) was developed to predict post-fire erosion by incorporating local climate variables and estimate the effectiveness of seeding, mulching, and installing waddles or logs on the hillslope.

A number of values were calculated to represent a range of burn severity, soil textures, hillslope gradients and vegetation types. These estimates were then used to determine the amount of post-fire erosion and sediment yield. The average 1st year sediment delivery of untreated urban lots ranges from 22 tons per acres in slopes around 40%, 14 tons per acre in slopes of 20%, and 3.3 tons per acres in slopes of 15%. The total soil erosion potential for all of the urban lots for the first year rain event following the fire is an average of 420 tons if the area remained untreated. ERMiT was also used to estimate reductions in sediment associated with recommended BAER treatments. The Proposed Action includes treating 52 lots, totaling 95 acres of mulching. The proposed 52 lots of treatment release a total of 261.9 tons of sediment if they remain untreated. Mulching at a rate of 1.0 ton per acre ERMiT reduces that total to 67.9 tons of sediment being released into the water system. The prescription for treatment areas is high and moderate burn severity lots with slopes greater than 5% and low burn severity lots with slopes greater than 7%. For specific lots proposed to be treated and exacted reduction rates please see Appendix C.

The primary watershed responses from the effects of the Angora Fire are expected to include: 1) initial flush of fine sediments (ash) and nutrients with normal precipitation; 2) gully and rill erosion on steep slopes in drainages with moderate and high burn severity with normal precipitation due to the loss of litter and the development of water repellent soil conditions; 3) increased nutrient loading into the watershed and eventually into Lake Tahoe, and 4) increases in average winterstorm runoff. Elevated soil erosion, sedimentation, runoff, and stream flows are expected to occur at decreasing rates over five to seven years after the fire, until vegetation has sufficiently recovered to restore the surface soil-hydrologic function and processes of the watersheds that burned at moderate and high severity.

3. Introduction of Exotics and Expansion of Noxious Weed Populations

See Botany Specialist Report and Appendix D for Urban Lots impacted

4. Unmanaged OHV and unauthorized use of public lands

In 2002, the Lake Tahoe Basin Management Unit reported 21,000 riders for that year. Unmanaged off-highway vehicle (OHV) and unauthorized use of public lands in the urban intermix will increase erosion, water-quality degradation, destroy wildlife habitat, spread noxious weeds, and create damage to cultural sites. "Soil impacts commonly occur in this progression: abrasive loss of protecting surface vegetation and root mass, compaction and surface subsidence, hydraulic disruption, breakdown of soil structure, and soil particle erosion and deposition." (Meyers, 2002) The Angora Fire has accelerated this process by destroying the protective surface vegetation and root mass and will create a disruption in the hydrological function of the burned area. In addition the roads have been decommissioned and no longer have the proper measures installed for rider safety and erosion control.

Since 1999 to 2007, the Forest Service has identified 780 unresolved encroachments and 246 resolved encroachments. The effects of encroachments on urban lots are detrimental both publicly and environmentally. Public access is denied anytime National Forest System lands are modified to resemble private property, through landscaping, lawns, and fenced areas. In addition, encroachments often have the potential to cause damage to soils and vegetation, leading to the degradation of the hydrologic function these lands are intended to serve. 248 homes were destroyed and 24 received minor damage. During the debris removal and rebuild stage it is going to be critical to monitor adjacent National Forest Service lands to deter misuse of these unique parcels. See Angora Fire – Dwelling and Urban Lot Damage Map for additional information as to where these lots are located in relation to the damaged or destroyed private homes.

Emergency Determination – Urban Lots

An emergency to human life, property, and water quality exists due to fire killed trees, increased runoff of ash, sedimentation, and nutrients. An emergency exists to erosion control projects/resources, county roads, other investments/properties, natural resources, and local ecosystems due to the degradation of the soils and the native vegetation.

Treatments to Mitigate the Emergency

1. Proposed Treatment

Treatment Type : **Mulching hillslopes** with hand applications on 48 urban lots. Totaling 95 Acres.

Objective: Straw or chip mulch provides immediate ground cover and protects the soil from erosion and loss of nutrients. Mulch can reduce downstream peak flows by absorbing rainfall and allows prewetting of water repellent soil. Straw and chip helps to secure seeds that are stored in the soil, or applied as an emergency treatment. Straw or chip mulch on burned areas helps maintain a favorable moisture and temperature regime for seed germination and growth.

Description: Straw mulch with weed-free straw or chipped slash helps provide temporary cover to erosion-vulnerable areas as a result of the fire. Straw and/or chip is applied by hand with 90% coverage for the smaller urban lot treatment sites. The urban lots above and intermixed with the residential areas where lives and property are potentially at risk from effects from flooding and sedimentation during precipitation runoff events are the primary focus.

Cost: Hand application of chip mulch ~ $800 per acre. Totaling $76,000. (Chip mulch could be available from the Hazard Tree Removal Contract, but it could require manpower to spread the material across the entire lot.)

Cost: If in the Hazard Tree Removal Contract the contractor decides to remove the chip then the purchase of straw mulch would be necessary. Hand application of straw mulch ~ $1600 per acre. Totaling $152,000

*Please note that costs are slightly higher than the average estimated BAER catalog. The Urban Lot Department has several partnerships developed with the Nevada Conservation Corps, Great Basin Institute, and Nevada Division of Forestry. We would like to continue to use our partnerships and potential establish new partnerships for urban lot BAER treatment.

Treatment Type : **Installing log check dams and waterbars** using a hand crew on 4 lots. Installing a total of 8 logs.

Objective: Objectives are to reduce water quality deterioration and encourage recovery of vegetation.

Description: Checkdams are designed to trap and store sediment mobilized from the hillslope and channel. Properly constructed checkdams prevent down cutting and attenuating peak flows as water is routed through a series of small basins created by the checkdams. The moist deposits of soil, ash, and organic material can serve as fertile sites for vegetative recovery. See specs in the BAER Response Treatment Catalog.

Cost: $200 per log x 8 logs. Totaling $1600

Treatment Type : **Seeding** using a hand application on 4 lots. Totaling 1.2 acre.

Lake Tahoe Basin Management Unit's native seed mix should be used if it is available. The Basin's seed mix includes:

Scientific Name	Common Name	Synonym	Life Form; attributes	Quantity pure live seed (pls) per acre
Bromus carinatus	California brome var. carinatus	Brome Mountain brome	Grass	6
Elymus glaucus	Blue wild rye		Grass	6
Poa secunda ssp. Juncifolia	Big Bluegrass	Poa sandbergii or Poa ampla	Grass	6
Achillea millefolium	Western yarrow		Perennial forb; erosion control; insect pollenator	1
Eriogonum umbellatum	Sulfur flower		Perennial forb; good colonizer; insect pollenator	1
Lupinus argenteus	Silver Lupine		Nitrogen-fixing perennial forb	1

Objective: Objectives are to reduce erosion and prevent the introduction or spread of noxious and invasive plants in the 4 lots that had high soil burn severity and moderate slopes in the Mt Diablo area.

Description: Seeding minimizes soil and wind erosion by providing vegetative cover. Seeding may prevent the introduction and increase of noxious and invasive plants. Seeding may help protect threatened and endangered habitat, and reduce sediment delivery and transport to drainages.

Cost: $200 per acre x 1.2 acres = $240 Plus labor = $1500 Totaling $1740

Treatment Type: **Installing Filter Fencing** on 2 lots. Totaling 1.7 acres.

Objective: Silt fences trap sediment and protect areas with high values at risk including heritage resources, water quality, and threats to life and human property.

Description: Silt fences are used to trap sediment. Silt fences will be located on urban lots on the Lookout Point Road in conjunction with other treatments to protect life and property below this areas steep slope.

Cost: $1.75 per foot x 200 ft = $350 Plus labor = $1800 Totaling $2150

Treatment Type : **Hazard Tree Removal** on 3 lots. Totaling 3 trees.

Objective: Objectives are to reduce the risk to human life and property.

Description: Fell Hazard trees, chip slash, and use the slash as mulch for each lot.

Cost: $400 per tree x 3 trees = $1200 Plus misc. supplies. (bar, gas, bar oil) = $150 Totaling $1350

Treatment Type: **Install log/worm fences** at 10 different exposed decommissioned roads on 1 lot and 1 urban interface area.

Objective: Protective fences and barriers help prevent threats to human life in unstable areas. These fences protect treated and recovering areas from vehicles, and other uses that can impede the success of the treatment. Objectives are to reduce OHV intrusion on decommission roads, reduce OHV impacts on erosion, and reduce the risk to human life and property of the riders on unmaintained trails and roads.

Description: Protective fences and barriers provide public safety, protect BAER treatments, and allow natural vegetative recovery of a burned area (BAER Guidance Paper-Gates, Fences, & Barriers). Use the LTBMU specs on building a worm/log fence.

Cost: Materials: 10 foot lodge pole pine, rebar and block, generator, (2) mechanical drill and bit, tape measurer, shovels, pipe benders, extension cords, spray paint, (2) 10' 2x4s, sledge hammers = $15,000 Labor to cut the 10 foot lodge pole pines and install the fences. = $15,000 Totaling = $30,000

Treatment Type: **Interagency Coordinator - The cost of coordination with neighboring land owners will be incorporated into each of the various treatments for urban lots.**

Objective: To ensure that treatment efforts are coordinated and integrated efficiently between the multiple ownerships within the urban intermix for up to 6 months.

Cost: GS-11 for 90 days. $26.78 per hr x 8 hrs per day x 90 days = $19,281.60. Vehicle Rate: 150 miles a week @ $0.35 per mile. Total Vehicle cost for 6 months - $1,260. Total Cost ~ $30,000 (This salary includes overtime).

Treatment Type : **Hazard Tree Detection Surveys**

Objective: Reduce the treat to human life and private property from hazard trees in the urban intermix.

Description: An urgent significant hazard is identified when the collapse or breakdown of the burned or unstable object is "highly likely to occur within the year and could result in property damage, personal injury or death."(BAER Guidance Paper-Hazardous Tree and Rock Removal) The area requiring patrolling includes the urban intermix where the burned urban lots are located and in the urban interface where the general forest borders private property.

Cost: 2 – GS-5 or 7 Hazard Tree Inspectors patrolling two days a week around the burned urban lots and the affected urban interface. Cost of personnel - $200 per person per day. Totaling $800 per week. Total for 6 months = $19,200 Vehicle Rate: 50 miles a week @ $0.45 per mile. Total Vehicle cost for 6 months - $540. Total Cost for protection enforcement - $19,750.

See Treatment Map for exact locations.

Treatment Type	**Cost**
Hand Mulching Hillslopes	$152,000*
Installing Log Check Dams & Waterbars	$1600
Seeding	$1740
Installing Filter Fencing	$2150
Hazard Tree Removal	$1350
Installing Log/Worm Fences	$30,000
Interagency Coordinator	$30,000
Hazard Tree Detection Surveys	$19,750
Proposed Action Total Cost:	**$238,590**

*This cost could be less if the chip material is available on site and we don't have to purchase straw mulch.

2. Alternative #1

Alternative #1 reduces the number of lots treated with hand mulching from 52 to 20 and reduces the total # of acres to 64 acres of mulching. The prescription for treatment areas would treat all high burn severity lots and moderate and low burn severity lots with slopes greater than 15%. This prescription only includes the high priority lots and would not address any of the minor sediment accumulations on gentler slopes adjacent to private property. The 20 lots of hand mulching treatment would release a total of 563.2 tons of sediment if they remain

untreated. Mulching at a rate of 1.0 ton per acre ERMiT reduces that total to 190.1 tons of sediment being released into the water system. For specific lots proposed to be treated and exacted reduction rates please see Appendix E.
I propose to keep all other treatments in place.

Treatment Type	**Cost**
Hand Mulching Hillslopes	$102,400*
Installing Log Check Dams & Waterbars	$1600
Seeding	$1740
Installing Filter Fencing	$2150
Hazard Tree Removal	$1350
Installing Log/Worm Fences	$30,000
Interagency Coordinator	$30,000
Hazard Tree Detection Surveys	$19,750
Alternative #1 Total Cost:	**$188,990**

*This cost could be less if the chip material is available on site and we don't have to purchase straw mulch.

Reductions in mulching treatments would increase the amount of sediment that would have the potential to enter into Lake Tahoe by 124 tons.

3. Alternative #2 - No Action

Discussion/Summary/Recommendations

A number of values at risk were identified by the BAER Urban Lot Specialist within the urban intermix. While treatment will be effective in reducing the amount of sediment and nutrients onto private property and into the waterways and eventually into Lake Tahoe, no single treatment or combination of treatments could reduce that number to zero. With effective ground cover treatments ERMiT predicted a reduction in sediment by approximately two-thirds. The bare soil is expected to be reduced to 15-40% within the first year following natural vegetation canopy recovery. Dependant on rainfall amounts; it will 1-3 years for the grasses, 2-5 years for the shrubs, and 10+ years for the timber to recover to pre-burn condition.

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Appendices:

Map – Angora Fire – Burn Intensity and Priority Treatments

Appendix A: 2007 Angora BAER Urban Lots Hazard Tree Removal Priority List

Appendix B: 2007 Angora BAER Urban Lot Soil Severity

Appendix C: 2007 Angora BAER Recommended Urban Lot Treatments – Proposed Action

Appendix D: 2007 Angora BAER Noxious Weed Populations Impacted on Urban Lots

Map – Angora Fire – Dwelling and Urban Lot Damage

Appendix E: 2007 Angora BAER Recommended Urban Lot Treatments – Alternative #1