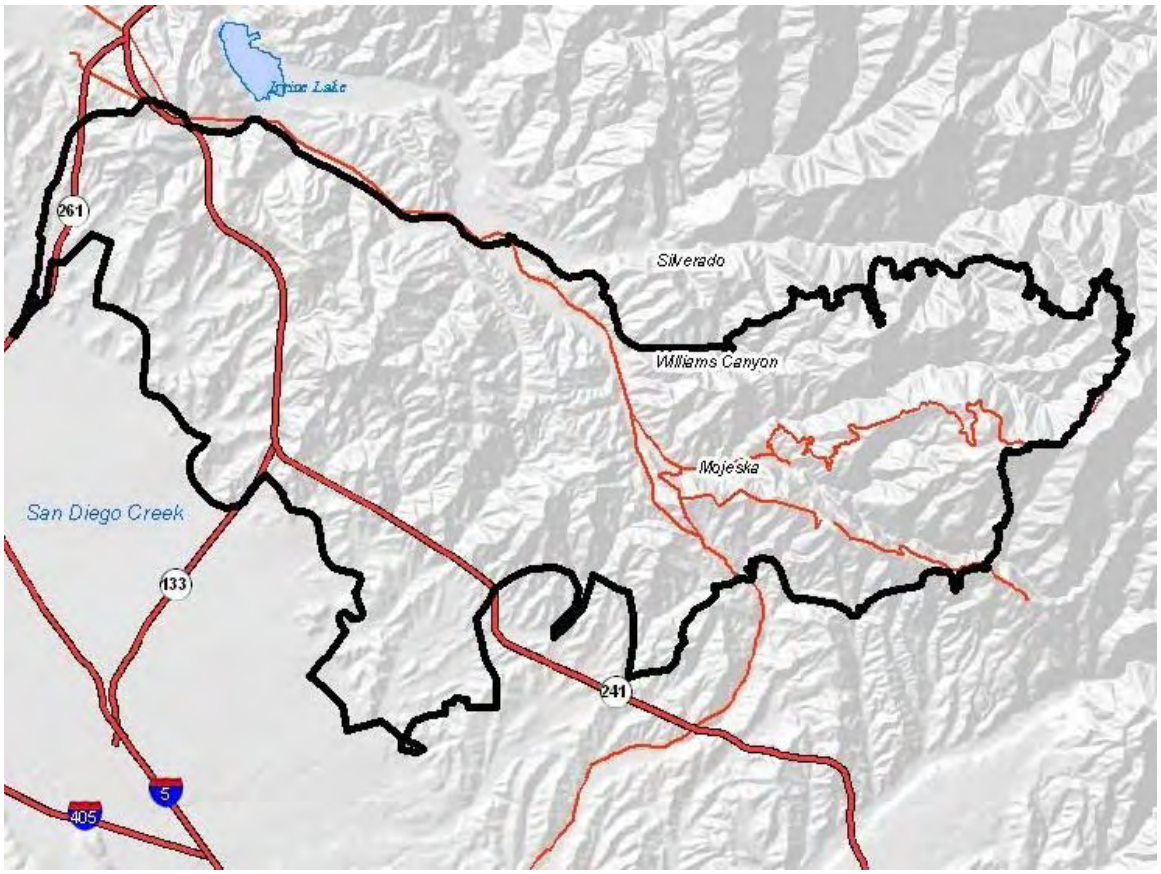
Santiago Fire

CA-ORC-068555



Interagency State Burned Area Emergency Response (BAER) Report

DRAFT

Non Confidential

Affecting Watersheds in Orange County California

INTERAGENCY STATE
BURNED AERA EMERGENCY RESPONSE
(BAER) REPORT

November 15, 2007

EXECUTIVE SUMMARY

SANTIAGO FIRE CA-ORC-068555

Affecting watersheds in Orange County California

Introduction

An initial Burned Area Emergency Response (BAER) assessment has been completed for the 2007 Santiago Fire CA-ORC- 068555. The State BAER assessment had four key objectives:

- Identify on-site and downstream threats to public health or safety and property from landsliding, debris torrents, flooding, road hazards, and other fire related problems.
- Identify threats to watershed resources including excessive erosion; impaired water quality; threats to wildlife, botanical values, or fisheries; and threats to cultural resources.
- Identify any other values at risk not previously identified, for example recreational resources.
- Determine measures needed to prevent or mitigate identified threats.

BAER teams conduct surveys promptly on burned areas to determine if emergency rehabilitation treatment is needed to minimize the risk of threats to human life or property. These surveys also assess if emergency rehabilitation treatment is needed to minimize or prevent deterioration of water quality, minimize loss of soil productivity due to erosion, minimize or prevent degradation of wildlife and botanical habitat, and minimize or prevent degradation of cultural resources. These surveys also facilitate identification of other potential values at risk (for example recreational resources), and determination if emergency rehabilitation treatment is needed.

The recommendations (treatments) found in this report fall into one of two broad categories. Those treatments which can be considered temporary (short-term) measures designed to be quickly and relatively inexpensively implemented; and long-term treatments designed to facilitate the recovery of the watershed at an accelerated pace while concurrently minimizing the exposure of the values at risk to the threats identified.

The following information summarizes key findings contained in the initial Santiago Fire State BAER assessment. Note, supplemental BAER reports will be written, if necessary.

Loss of Human Life and Property

The principal concern with the Santiago fire is loss of human life and property due to an increase in the potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. Houses and communities near or within stream channels (Modjeska, Williams Canyon, Upper reach of Silverado Canyon, Santiago Canyon) appear to be in positions where significant in-channel floods, hyperconcentrated floods, debris torrents, and debris flows are possible. In addition, possible loss of life resulting from localized debris sliding, debris flows, and sediment laden floods onto individual homes beyond the areas described previously is also possible. For locations of Values at Risk for human life and property see figures E-1 through E-11.

Watershed Evaluation

The Santiago Fire encroached upon five watersheds as defined by a HUC-6 identification. These watersheds are Arroyo Trabuco, San Diego Creek, Santiago Creek/Irvine Lake, Santiago Creek/Silverado Canyon, and Upper Aliso Creek. Of these watersheds, Santiago Creek/Silverado Canyon suffered the greatest amount of high burn severity with 1,395 acres, or 14% of the watershed located within the fire perimeter.

The principal concern with the Santiago fire is an increase in the potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. The primary mechanisms for this are the loss of mechanical support of hillslope materials that was provided by vegetation and vegetative litter and the increase in runoff resulting from reductions in interception and infiltration, from the simplification of surficial runoff patterns, and from the loss of mechanical support along stream channels where riparian vegetation was burned. Where fires burn moderate to high, such as in the upper portions of Santiago Canyon, Bear Trap Canyon, Harding Canyon, Williams Canyon, Arroyo Trabuco, Pine Canyon, and Halfway Canyon, the reduction in interception may be affected by the development of hydrophobic soils where waxy substances released by plant materials during hot fires follow thermal gradients into the soil and congeal as continuous surfaces.

It is our understanding that the USDA Forest Service, in concert with the US Geological Survey and CAL FIRE are developing models to assess the potential magnitudes of post-fire events.

Values at Risk

In general, as a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, there is an increased risk for storm events to result in flooding, debris torrents, and debris flows. As storm intensity or duration rises, there will be a increased elevation in risk for the storm event to trigger flooding, debris torrents, and debris flows.

A. Threats to Human Life, Property, and Infrastructure

As discussed previously, a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation is that houses and the associated human occupancy, other property (e.g. barns, stables, water tanks, etc.) and infrastructure (e.g. roads, bridges, culverts) located within or adjacent to the fire perimeter are at an increased risk to the threat of flooding, debris torrents, and debris flows. This threat includes the loss of life and property. This risk is greatest in the Modjeska, Williams Canyon, and the upper reaches of Silverado Canyon (Pine Canyon) areas.

B. Threats to Water Quality

As a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, reservoirs, streams, and other water resources located within or near the fire perimeter are at an increased risk to the threat of flooding, debris torrents, and debris flows. The risk is greatest to Irvine Lake, which provides a source of drinking water for Villa Park and some parts of the City of Orange.

C. Threats to Recreational Resources

As a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, recreational resources such as hiking and biking trails are at an increased risk to the threat of flooding, debris torrents, and debris flows. Additionally, the removal of vegetation due to the fire or the associated suppression activities may result in the creation of new, unofficial trails in the burn area. These new trails, if not monitored or prevented, could result in increased erosion. This risk is greatest on County Park lands and other lands within the fire perimeter where public access is not controlled.

D. Threats to Wildlife, Botanical Values, and Fisheries

As a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, biological, botanical, and fisheries habitat is at an increased risk to the threat of flooding, debris torrents, and debris flows. Suppression activities (e.g. "dozer lines") have also contributed to the current risk to biological, botanical, and fisheries habitat. The risk is greatest for those areas of the Santiago Fire which contain habitat for state and federally listed rare, endangered, or threatened species, state species of special concern, and "covered species" identified in the Central Subregion of the Natural Communities Conservation Plan of Orange County.

E. Threats to Cultural Resources

As a result of the fire and the impact to the processes previously discussed in the section on watershed evaluation, cultural resources are at an increased risk to the threat of flooding, debris torrents, and debris flows. Additionally, there is an increased risk of the exposure of cultural sites as a result of the fire or the associated suppression activities removing protective vegetative cover. The risk from the fire is greatest to those cultural sites that have been exposed as a result of the fire or the associated suppression activities that could be vandalized or otherwise compromised.

Area Burned

The Santiago Fire perimeter encompasses 28,464 acres. Ownership is as follows:

Services, Schools, & Water Dist	636
US Govt - El Toro Marine Base	1,181
Private - Large (inc Toll Roads)	2,690
Orange County (parks, flood, beaches)	3,446
Private - Small	3,834
Cleveland National Forest	5,995
Irvine Company	10,682
Total Fire Acreage	**28,464**

Soil Burn Severity

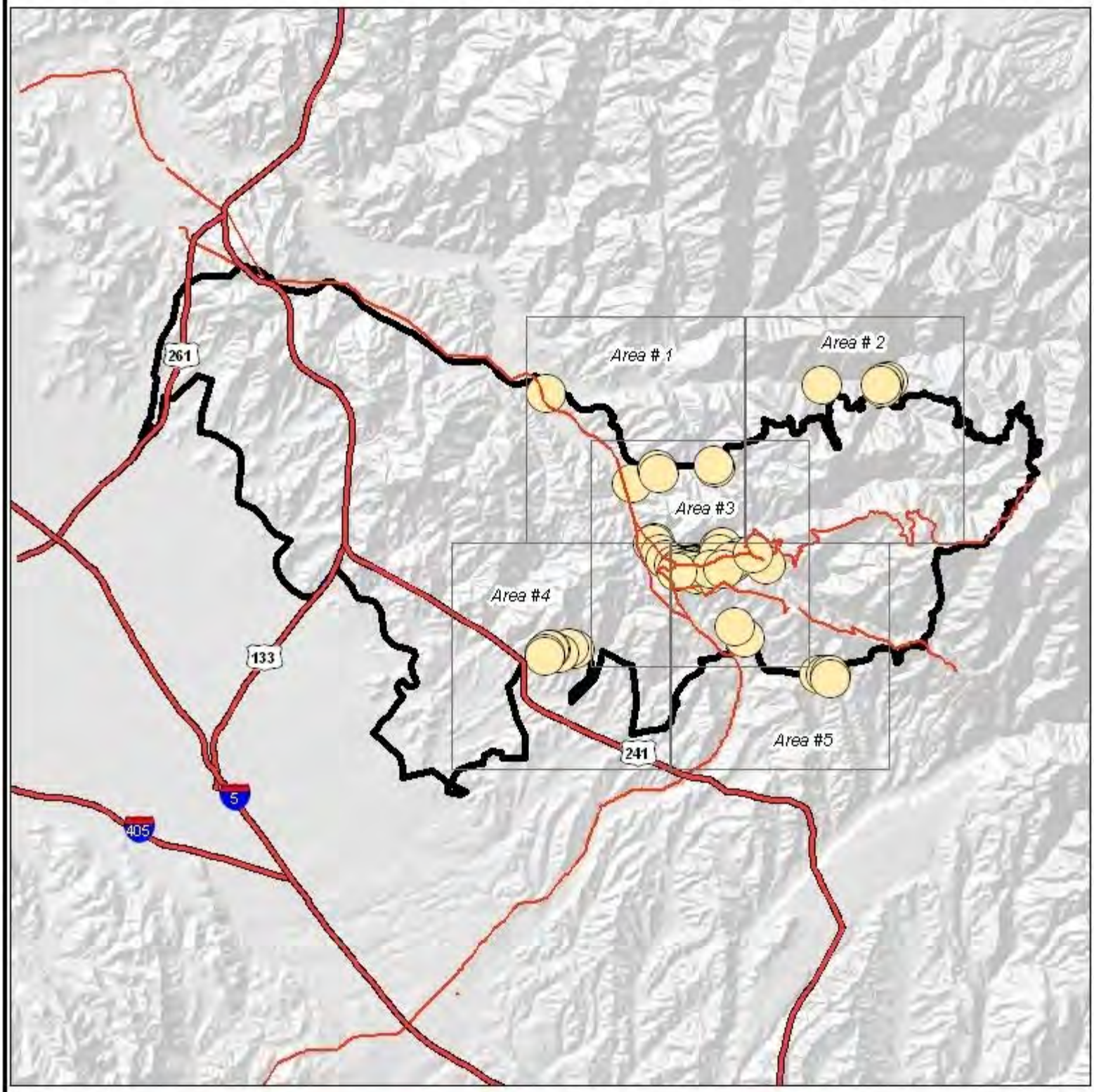
Soil burn severity is the amount of heat that is released by a fire and how it affects other resources. Soil Burn Severity on the Santiago Fire has been determined to be as follows:

High:	1,797 acres	/ (6%)
Moderate:	8,216 acres	/ (29%)
Low:	11,875 acres	/ (42%)
Very low to Unburned:	6,575 acres	/ (23%)

Summary

The fire and the resultant impact to the processes previously discussed in the section on watershed evaluation has resulted in an increased risk for storm events to result in flooding, debris torrents, and debris flows. As storm intensity or duration rises, there will be a increased elevation in risk for the storm event to trigger flooding, debris torrents, and debris flows. The threat posed by flooding, debris torrents, and debris flows includes the loss of life and property. All values at risk identified could be adversely affected.

Santiago Fire - BAER
Burn Site Evaluation - Risk to Lives or Property - Map Index



Legend

Sites at Risk

Fire Perimeter

N
W E
S

Scale

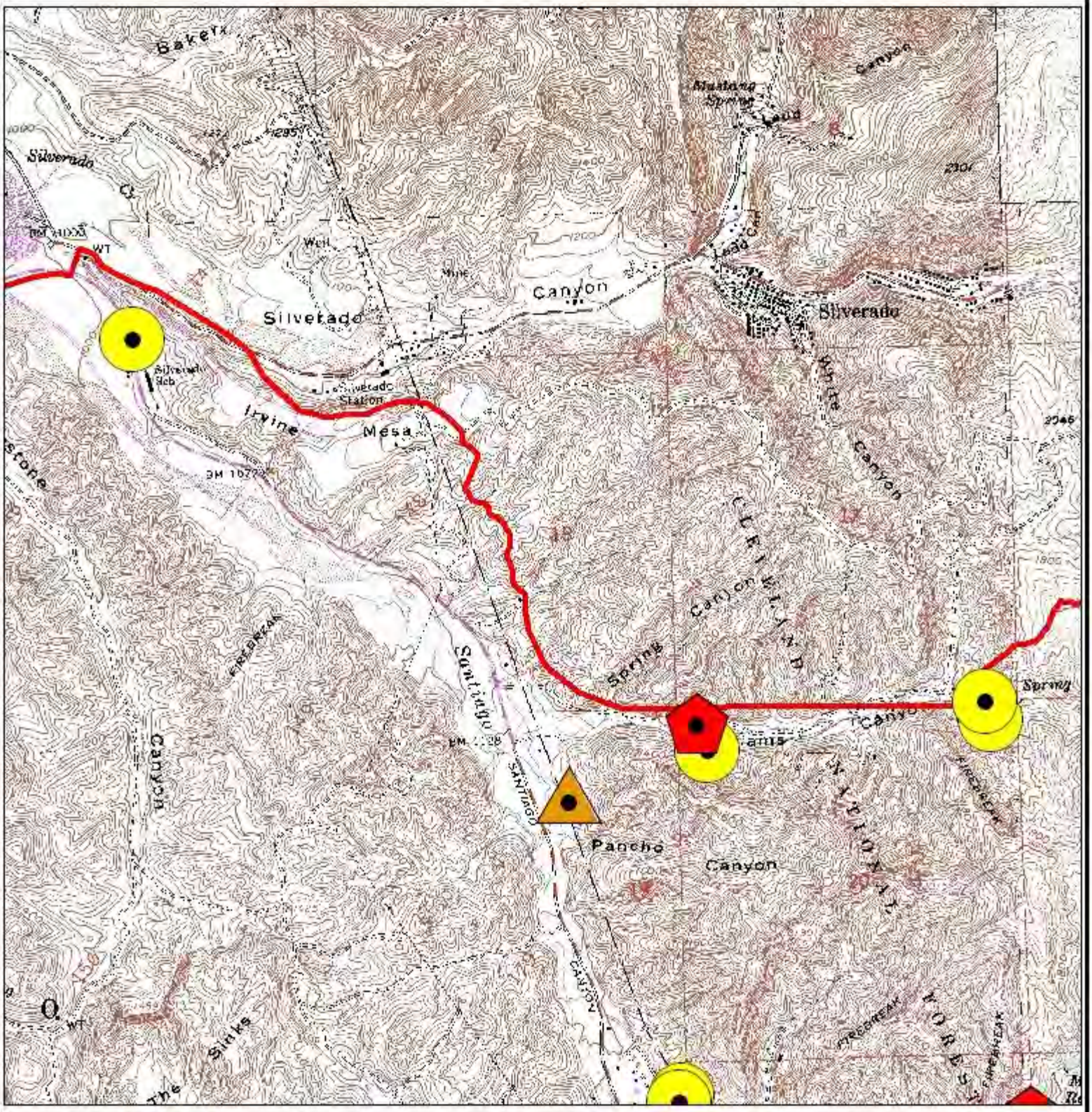
0 0.5 1 2 3 4 Miles

0 750 1,500 3,000 4,500 6,000 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, OES, USFS, 11/14/07
NAD27, California Teale Albers

Figure E1

Santiago Fire - BAER
Burn Site Evaluation - Risk to Lives - Area #1



Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

0 0.125 0.25 0.5 0.75 1 Miles

0 187.5 375 750 1,125 1,500 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E2

Santiago Fire - BAER
Burn Site Evaluation - Risk to Lives - Area #2

Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

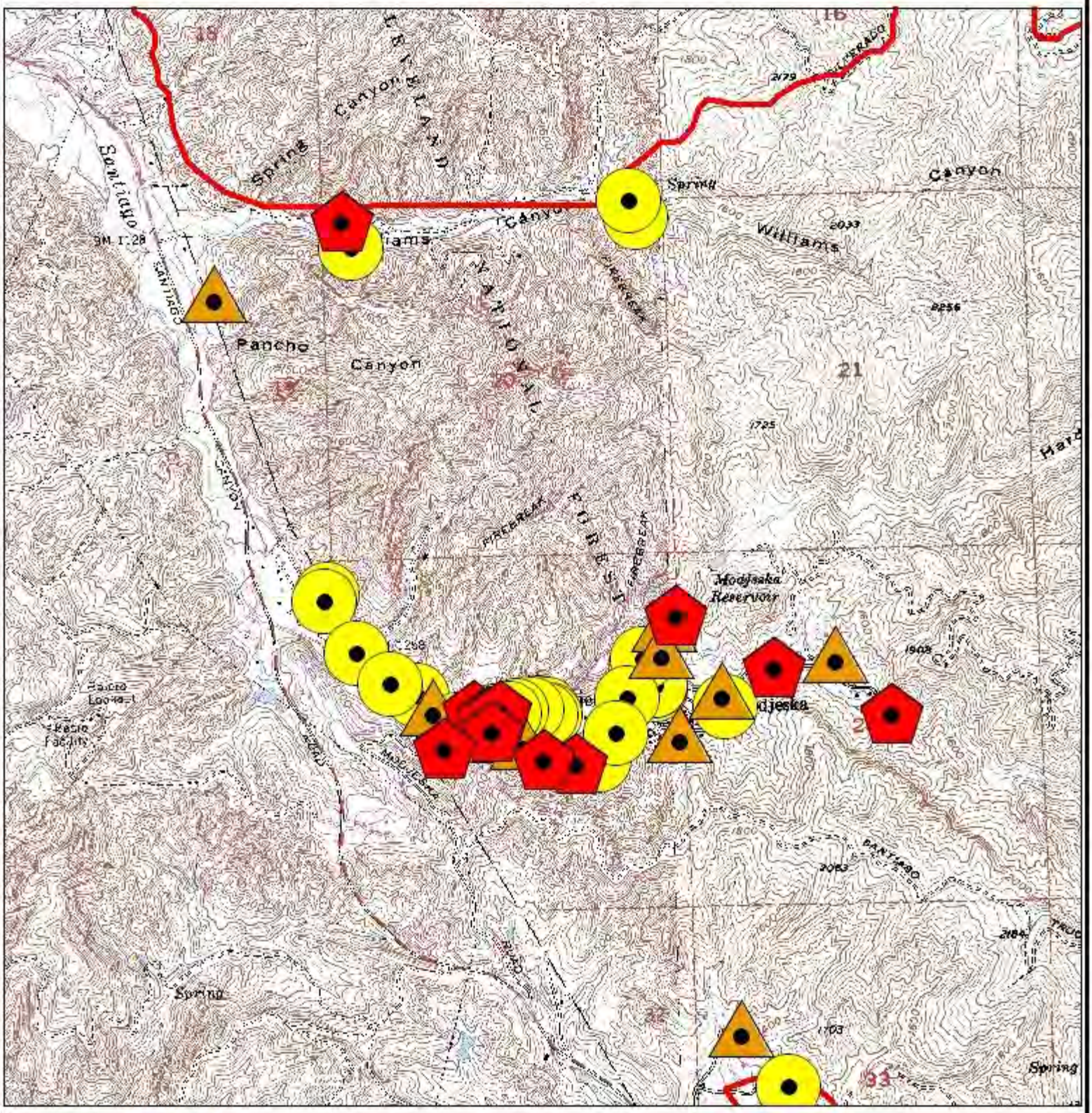
0 0.125 0.25 0.5 0.75 1 Miles

0 187.5 375 750 1,125 1,500 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E3

Santiago Fire - BAER
Burn Site Evaluation - Risk to Lives - Area #3



Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

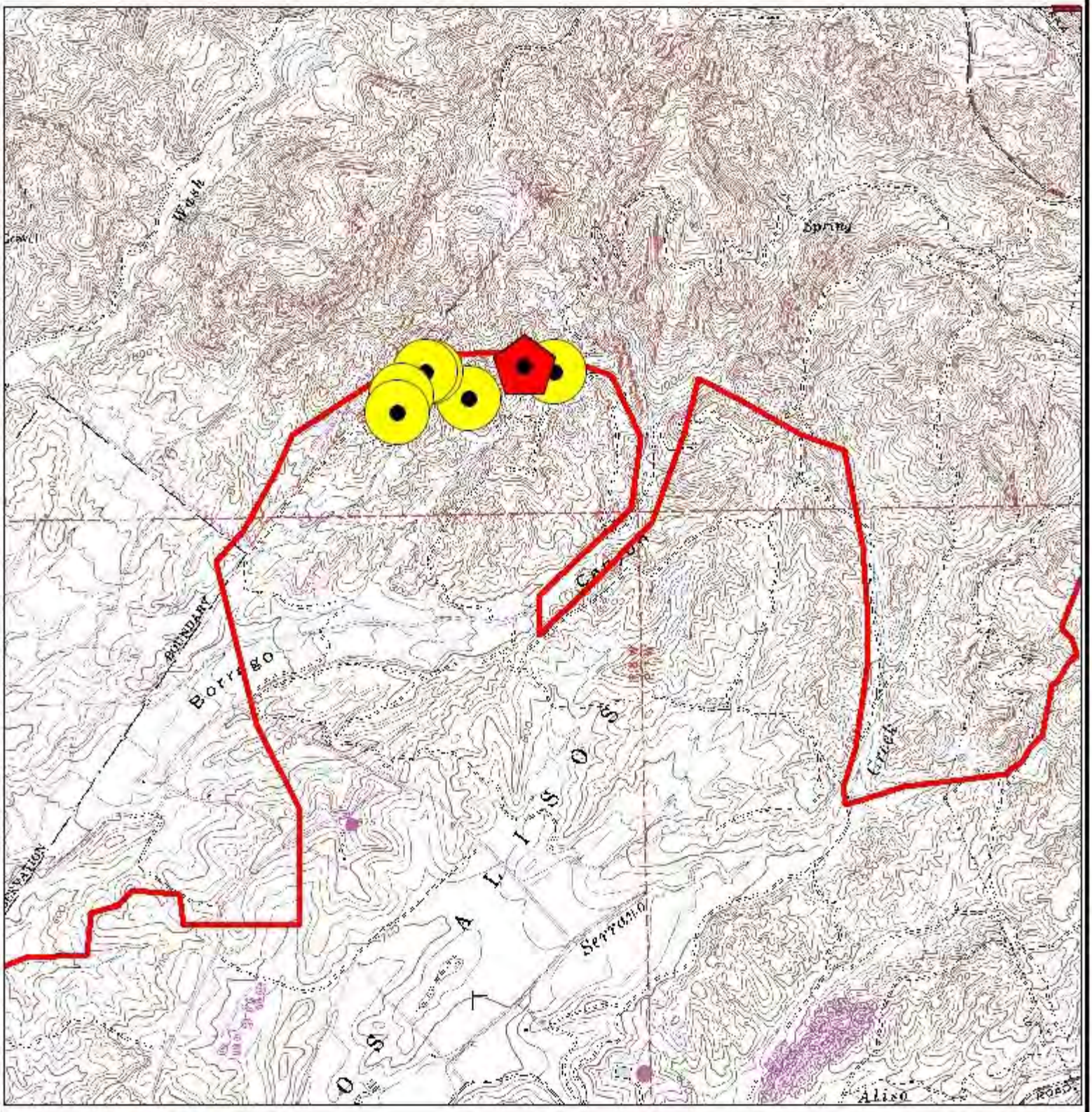
0 0.125 0.25 0.5 0.75 1 Miles

0 190 380 760 1,140 1,520 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E4

Santiago Fire - BAER
Burn Site Evaluation - Risk to Lives - Area #4



Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

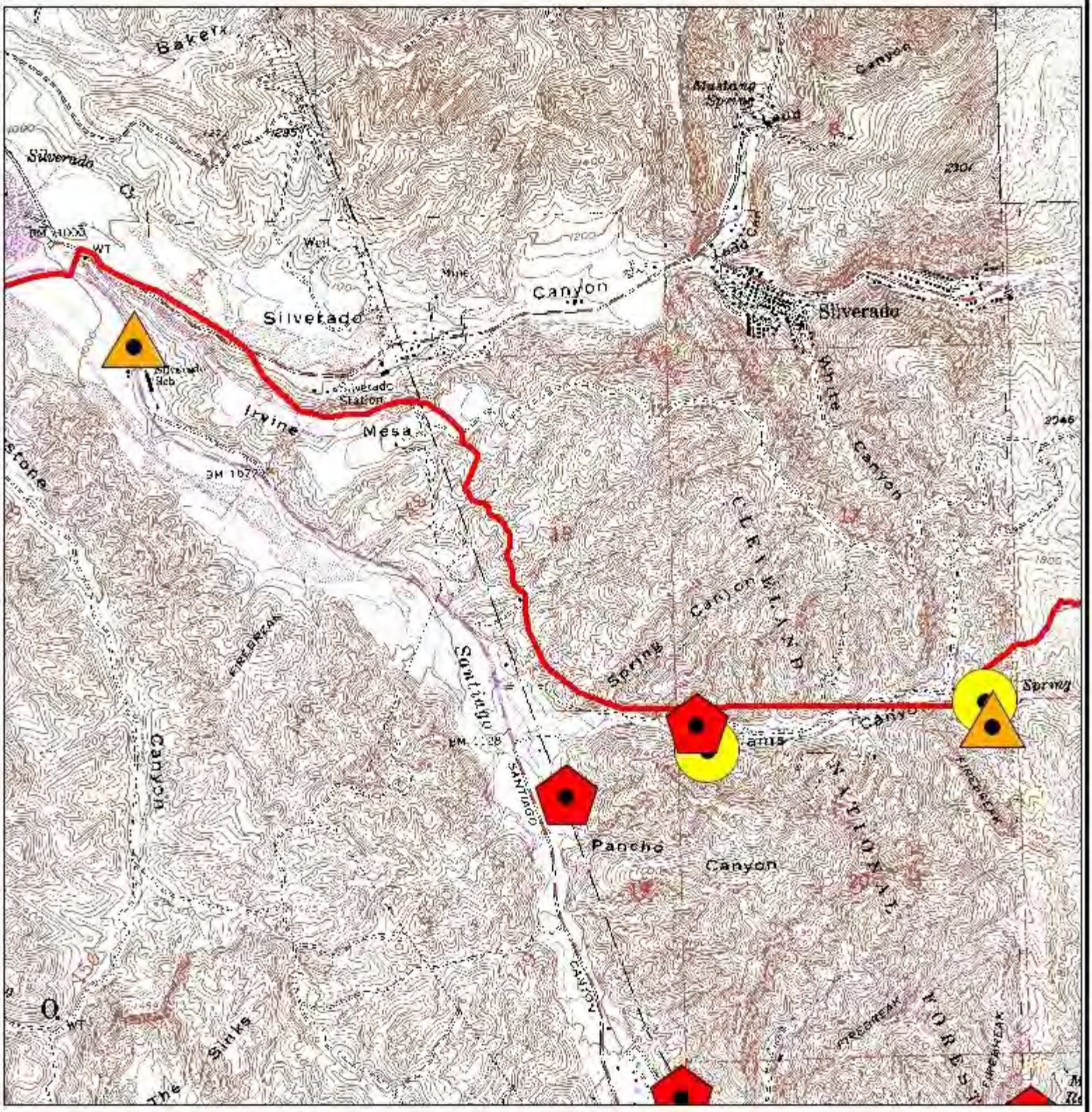
0 0.125 0.25 0.5 0.75 1 Miles

0 190 380 760 1,140 1,520 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E5

Santiago Fire - BAER
Burn Site Evaluation - Risk to Property - Area #1



Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

0 0.125 0.25 0.5 0.75 1 Miles

0 190 380 760 1,140 1,520 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E7

Santiago Fire - BAER
Burn Site Evaluation - Risk to Property - Area #2

Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

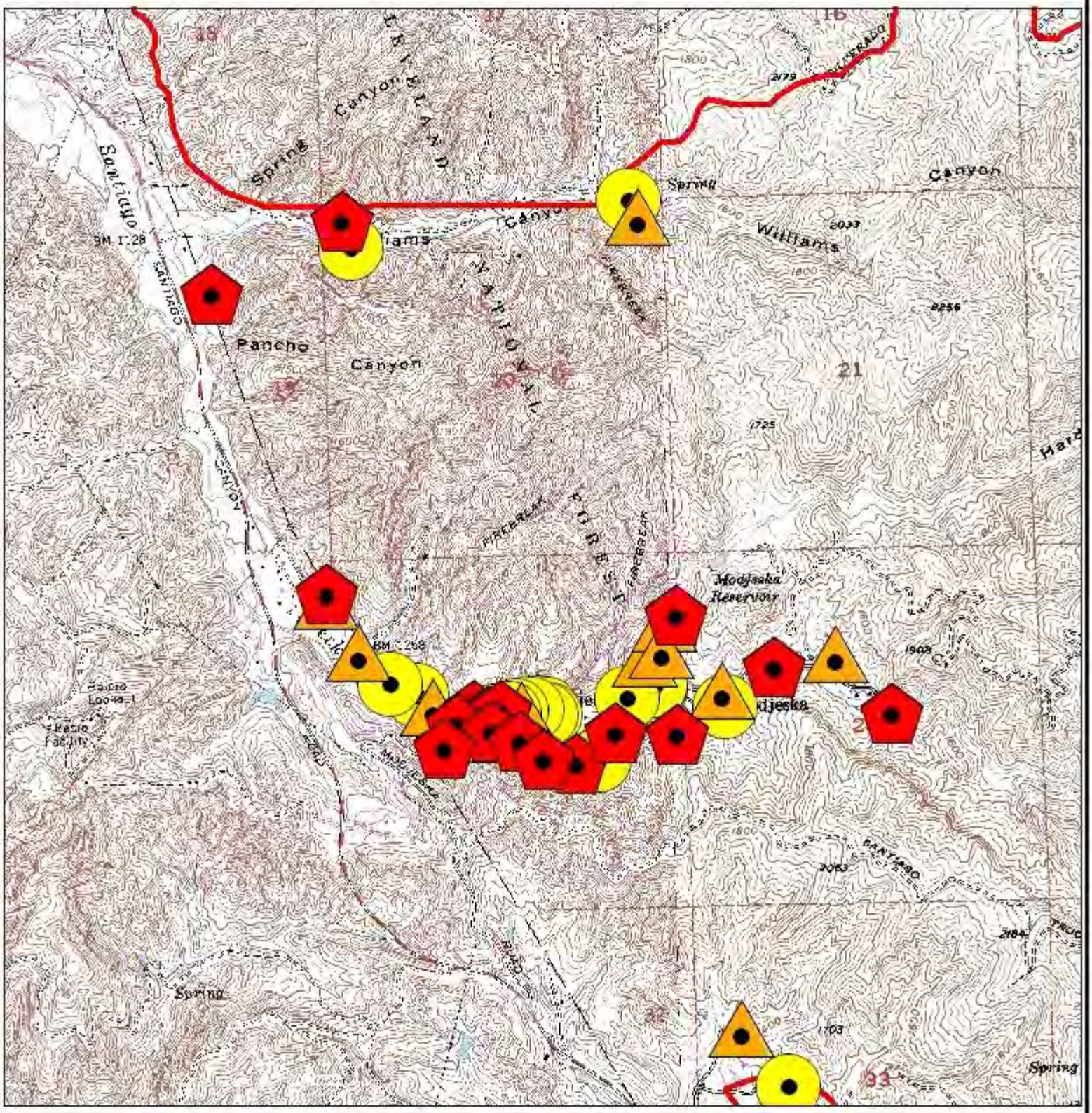
0 0.125 0.25 0.5 0.75 1 Miles

0 190 380 760 1,140 1,520 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E8

Santiago Fire - BAER
Burn Site Evaluation - Risk to Property - Area #3



Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

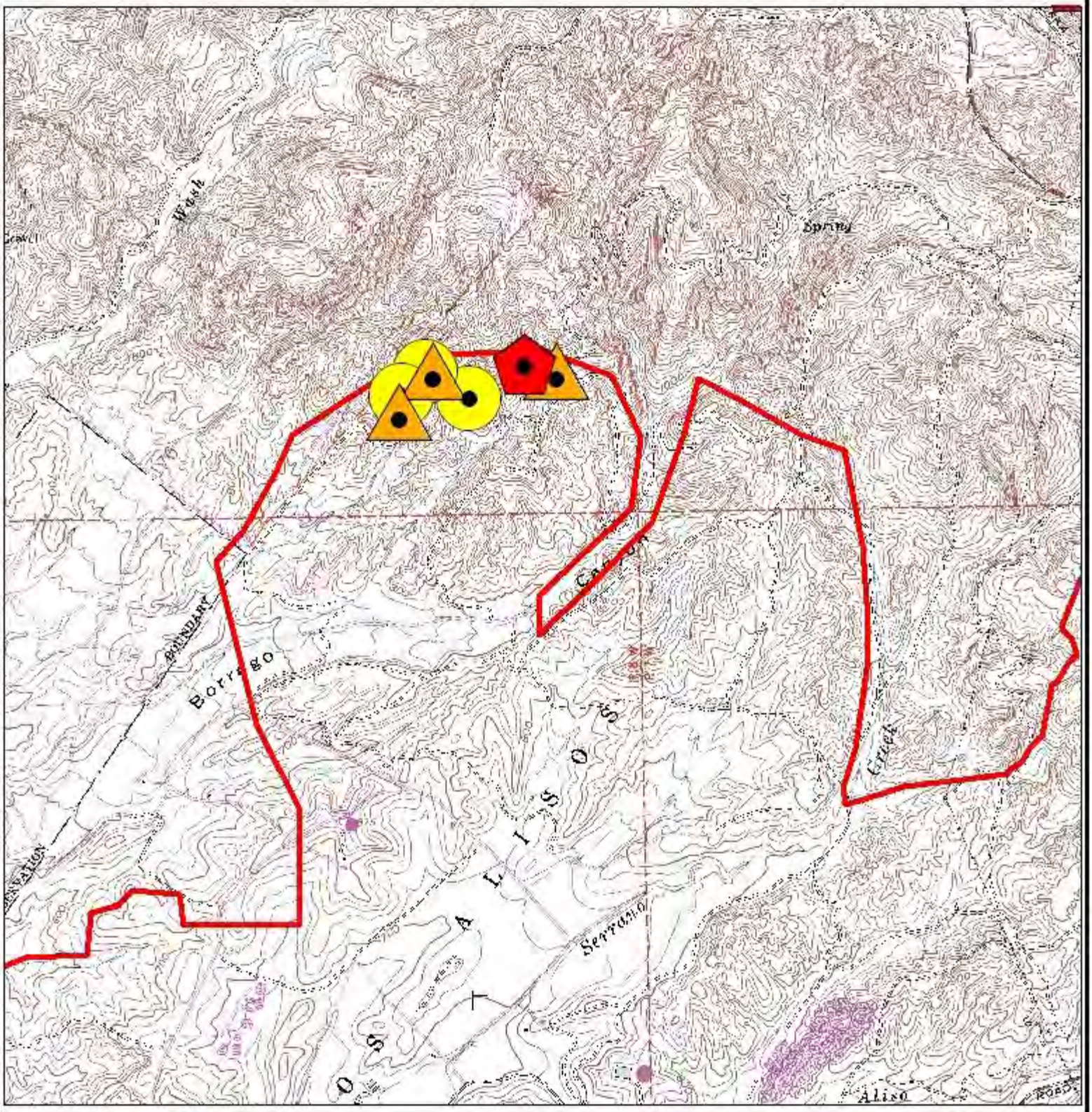
0 0.125 0.25 0.5 0.75 1 Miles

0 190 380 760 1,140 1,520 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E9

Santiago Fire - BAER
Burn Site Evaluation - Risk to Property - Area #4



Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

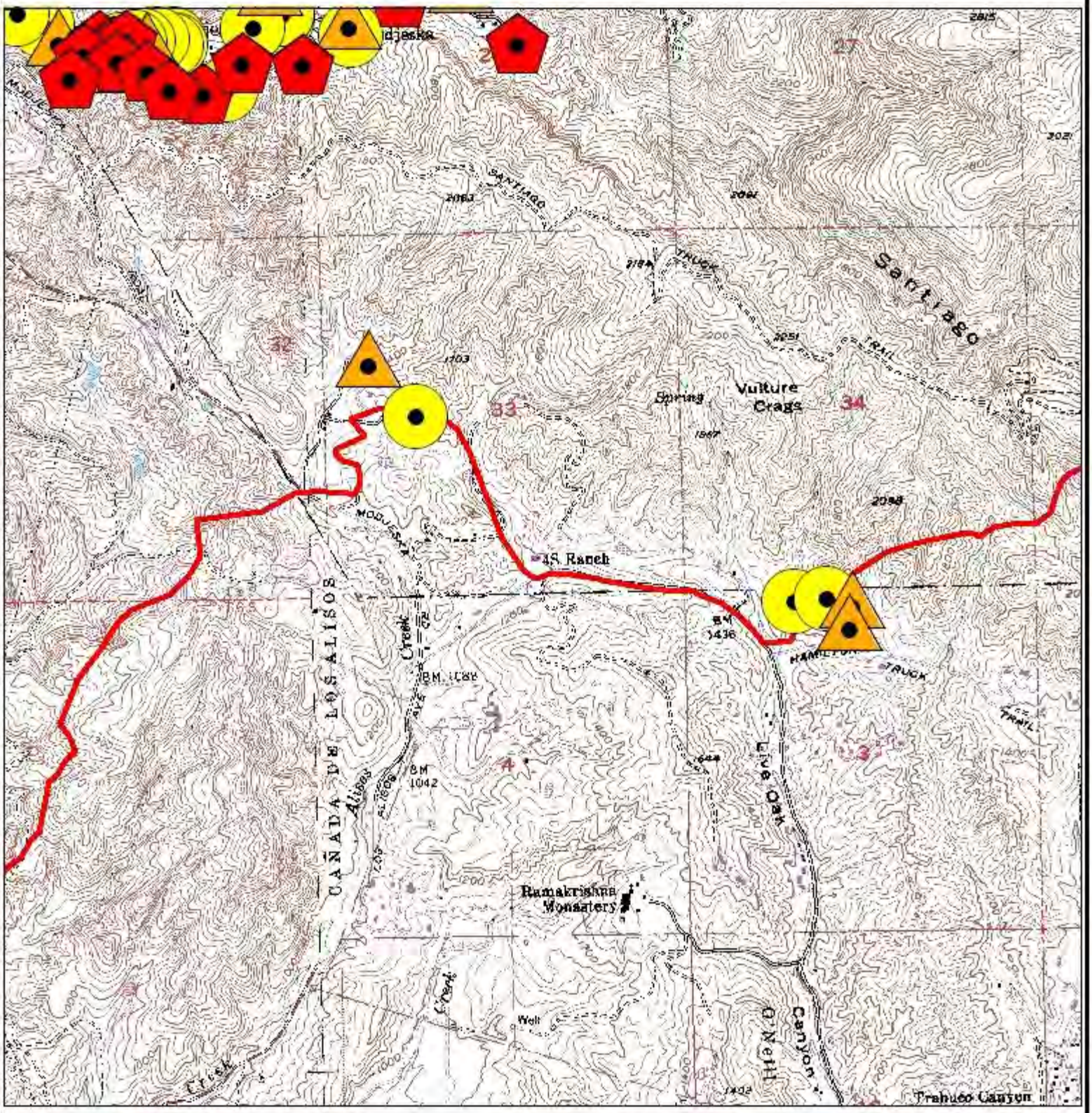
0 0.125 0.25 0.5 0.75 1 Miles

0 195 390 780 1,170 1,560 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E10

Santiago Fire - BAER
Burn Site Evaluation - Risk to Property - Area #5



Legend

Level of Risk

Higher - Moderate - Lower

Fire Perimeter

N
W E
S

Scale

0 0.125 0.25 0.5 0.75 1 Miles

0 190 380 760 1,140 1,520 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure E11

Santiago State BAER Team Members

Team Members:

Anthony Lukacic
Registered Professional Forester, Team Leader
California Department Forestry and Fire Protection

Len Nielson
Registered Professional Forester, Assistant Team Leader
California Department of Forestry and Fire Protection

Dave Longstreth
Certified Engineering Geologist
California Geological Survey

John Schlosser
Certified Engineering Geologist
California Geological Survey

Jeremiah McNeil, P.E.
Engineer Water Resources
Department of Water Resources
Flood Management/Hydrology Branch

Abiodun Aderonmu
Engineer Water Resources
Department of Water Resources

Robert Fastenau
Soils Specialist
Department of Water Resources

Erinn Wilson
Wildlife Biologist
California Dept. of Fish and Game

Kelly Schmoker
Botanist
California Dept. of Fish and Game

Christopher Corey
Associate State Archaeologist
California State Parks

Rob Rutland
Registered Professional Forester
California Department of Forestry and Fire Protection
Geographic Information System Specialist

Advisors

Ron Slimm
Park Ranger, Advisor to BAER Team
Orange County Parks

Kevin Oxford
Operations and Maintenance, Advisor to BAER Team
Orange County Resource Development Management Department

Aaron Buck
Environmental Scientist, Advisor to BAER Team
Santa Ana Regional Water Quality Control Board

Contacts made during the preparation of Santiago State BAER report.

Name	Affiliation
Aaron Buck	Santa Ana Regional WQ Board
Alex Ortega	Resources and Development Management Department
Bill Hisey	Resources and Development Management Department
Bob Hewitt	Natural Resources Conservation Service
Brian R. Stephens	Orange County Fire Authority
Catherine Litchfield	Orange County Fire Authority
Chirtine Medak	U.S. Fish and Wildlife Service
David Olsen	Irvine Ranch Conservancy
Fletcher Linton	U.S. Forest Service BAER Team
George Ewan	Orange County Fire Authority
Ignacio Ocohoa	Resources and Development Management Department
Jay Lee	Natural Resources Conservation Service
Jenifer Nagaege	Orange County Parks Harbors and Beaches
Kevin Oxford	Resources and Development Management Department
Lyn McAfee	Nature Reserve of Orange
Marilyn Foms	Resources and Development Management Department
Marilyn Smith	Irivne Ranch Water District
Randy Westmoreland	U.S. Forest Service BAER Team
Richard Dreager	Department of Water Resources
Ron Slim	Orange County Parks Harbors and Beaches
Scott Tremor	San Diego Natural History Museum
Trish Smith	The Nature Conservancy (contract to NROC)
Vicki Malton	Orange County Parks Harbors and Beaches
Will Nieman	Resources and Development Management Department

Introduction

For the first time, the State of California implemented a Burned Area Emergency Response (BAER) assessment in response to the fires of October/November 2007. The BAER teams were composed of representatives of multiple State agencies and disciplines.

An initial Burned Area Emergency Response (BAER) assessment has been completed for the 2007 Santiago Fire. The State BAER assessment had four key objectives:

- Identify on-site and downstream threats to public health or safety and property from landsliding, debris torrents, flooding, road hazards, and other fire related problems.
- Identify threats to watershed resources including excessive erosion; impaired water quality; threats to wildlife, botanical values, or fisheries; and threats cultural resources.
- Identify any other values at risk not previously identified, for example recreational resources.
- Determine measures needed to prevent or mitigate identified threats.

The BAER team assigned to the Santiago Fire conducted surveys on burned areas prior to fire containment. The purpose of the surveys was to determine if emergency rehabilitation treatment are needed to minimize the risk of threats to human life or property. These surveys also assess if emergency rehabilitation treatment is needed to minimize or prevent deterioration of water quality, minimize loss of soil productivity due to erosion, minimize or prevent degradation of wildlife and botanical habitat, and minimize or prevent degradation of cultural resources. These surveys also facilitate identification of other potential values at risk (for example recreational resources), and determination if emergency rehabilitation treatment is needed.

As part of its assessment, the BAER team did not evaluate that part of the fire located on the Cleveland National Forest. This task was accomplished by a United States Forest Service (USFS) BAER team. However, contact amongst the two teams did occur, including the sharing of information. It is acknowledged the USFS BAER team provided valuable assistance to the State BAER.

Area Burned

The Santiago Fire perimeter encompasses 28,464 acres. Ownership is as follows:

Services, Schools, Water Dist, Openspace	636
Private - Large (inc Toll Roads)	3,871
Orange County (parks, flood, beaches)	3,723
Private - Small	3,834
Cleveland National Forest	5,995
Irvine Company	10,682
Total Fire Acreage	28,464

As part of the assessment, the BAER team did not evaluate impacts to the Cleveland National Forest.

Soil Burn Severity

Soil burn severity is the amount of heat that is released by a fire and how it affects other resources. Soil Burn Severity on the Santiago Fire has been determined to be as follows:

High:	1,798 acres	(6%)
Moderate:	8,216 acres	(29%)
Low:	11,875 acres	(42%)
Very low to unburned:	6,575 acres	(23%)

Values at Risk

As a part of the assessment process, values at risk were identified. Values at risk are simply those resources, including human life and property, as well as water quality and other natural resources to name a few, which could be adversely affected by post fire conditions. The values at risk identified by this assessment include:

- Threat to human life and property
- Threat to infrastructure (e.g. roads, bridges, culverts, etc.)
- Threat to water quality, including Irvine Lake, a source of drinking water
- Threat to soil productivity
- Threat to recreational values, including hiking and biking trails
- Threat to biological, botanical, and fisheries, including State or Federally listed threatened, endangered, or sensitive species
- Threat to cultural resources
-

For locations of Values at Risk for human life and property see figures E-1 through E-11.

The following discussions provide further detail regarding values at risk.

Geology

<u>Resource Condition Assessment:</u>

A. Resource Setting

The 28,464-acre Santiago fire burn area is underlain by Mesozoic to Quaternary sedimentary, volcanic and shallow intrusive rocks (Morton and Miller). The older rocks form the core of the Peninsular Ranges in the burn area, with rocks becoming progressively younger to the west. Topography within the burn area ranges from gentle to very steep, with elevations ranging from about 200 above mean sea level along the western margin of the fire to a high of over 4400 feet where the fire burned near Santiago Peak. Much of the mountainous portion of the burn area drains into west-flowing watercourses that are tributary to Santiago Reservoir (Irvine Lake). The lower slopes along the southwest portion of the burn drain into numerous southwest-flowing watercourses that debouch onto channelized alluvial fans between Trabuco and Santiago canyons.

B. Findings

The principal concern with the Santiago fire is Fire an increase in the potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. The primary mechanisms for this are the loss of mechanical support of hillslope materials

that was provided by vegetation and vegetative litter and the increase in runoff resulting from reductions in interception and infiltration, from the simplification of surficial runoff patterns, and from the loss of mechanical support along stream channels where riparian vegetation was burned. Where fires burn hot, such as in the upper portions of Santiago Canyon, Bear Trap Canyon, Harding Canyon, Williams Canyon, Arroyo Trabuco, Pine Canyon, and Halfway Canyon the reduction in interception may be affected by the development of hydrophobic soils where waxy substances released by plant materials during hot fires follow thermal gradients into the soil and congeal as continuous surfaces.

Houses and communities near or within stream channels (Modjeska, Williams Canyon, Upper reach of Silverado Canyon, Santiago Canyon) appear to be in positions where they may be affected by significant in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. The magnitude of post-fire damage will be determined by the intensity and duration of storms that impact the area. CGS understands that the assessment of potential flood, and hyperconcentrated flood hazards is currently being conducted by hydrologists with the USDA Forest Service and CALFIRE.

In addition to the near-channel sites described above the California Geological Survey inspected houses and other high-value sites within and down slope from the burn area to evaluate potential risks from near-site (localized) debris flow, rock fall, floods, and other geologic hazards that may not be identified in the regional evaluation. Sixty eight (68) at-risk sites, some with multiple homes, identified as having potential risks to lives or property are identified and listed in the Technical Specialist Geology Report.

Emergency Determination

The values at risk considered in this assessment include the possible loss of life and property due to landsliding, debris flow, rock fall, debris torrents, and flooding from increased surface water runoff. In general, the risk from landslides, debris flows and rock falls are possible where roads, residences or other development are located within and/or adjacent to canyon stream channels or on alluvial fans, colluvial footslopes and debris flow deposits. It should be noted that these hazards are part of the natural processes in this environment, and that these risks were present under pre-fire conditions. Many existing structures in the burn area have been and will continue to be at risk from these hazards. The potential for these processes to be exacerbated by fire is primarily dependent upon burn severity and slope steepness, both of which are highly variable in the Santiago fire area. In general, where the burn severity is moderately high, the slopes are steep, and the potential for increased hazard is greatest in the Modjeska, Williams Canyon, Santiago Canyon, and Pine Canyon areas.

Treatments/Recommendations

1. The site-specific observations included with the Technical Specialist Geology review should be considered in any emergency response plan develop by emergency agencies.
2. Post-fire flooding potential information developed by the U.S.D.A. Forest Service should be used to evaluate risks to lives and properties near stream channels in and near the Santiago fire burn area.
3. The existing road drainage systems should be inspected by the appropriate controlling agency to evaluate potential impacts from floods, hyperconcentrated floods, debris

torrents, debris flows and sedimentation resulting from winter rains. It is understood that Santiago Canyon Road, Silverado Canyon Road, Modjeska Canyon Road, Modjeska Grade, Jackson Ranch, Crystal Canyon, and Hidden Ridge are all roads controlled by Orange County. It is also understood that Orange County has already begun to implement erosion control measures for Santiago Canyon Road. It is understood that Williams Canyon Road is a private road. Whoever controls Williams Canyon Road should be contacted and informed of potential risks to the road system.

4. The U.S.D.A. Forest Service, the Orange County Flood Control District, Department of Public Works, Fire Department, and Office of Emergency Services, the Natural Resources Conservation Service, and any other responsible party should be made aware of the potential hazard to lives and property in and downstream from the fire area, especially the Modjeska and Williams Canyon communities.
5. Campgrounds and hiking trails should be signed and closed as needed by the responsible agencies and/or private organizations to protect campers and hikers.
6. The sites identified in Appendix 2 of the Technical Specialist Geology review should be evaluated by Professional Geologists or Professional Engineers with experience in slope stability and debris flow hazard identification and mitigation to fully document the scope of the problems at each site.

Discussion:

There are two main risks to lives from a geologic perspective; 1.) possible loss of life resulting from catastrophic debris flows onto communities built at the bottom of large drainages (for example Modjeska, Williams Canyon, Santiago Canyon, Harding Canyon, and Pine Canyon), and 2.) possible loss of life resulting from localized debris sliding, debris flows, and sediment laden floods onto individual homes identified in Appendix 2 of the Technical Specialist Geology review. Risks to property and infrastructure include roads, water systems, and residential property. The primary recommendation to mitigate these risks is to inform and educate the individual homeowners, affected communities, local emergency agencies (Orange County), and policy makers of the risks at hand. Mitigations such as evacuation procedures, warning systems, and site specific mitigations can then be developed and implemented.

References

Morton, D.M., and Miller, F.K., 1986, *Geologic Map of San Bernardino and Santa Ana 30'x60' Quadrangles, California*: U.S. Geological Survey), Scale 1:250,000.

Hydrology/Engineering

Resource Condition Assessment

A. Resource Setting

The 28,000-acre Santiago Fire burn area crosses multiple watersheds and encompasses both Irvine Lake nd Mojdeska Reservoir.

B. Findings of the On-The-Ground Survey

Water resources, roads, trails, culverts and bridges within and adjacent to the State Responsibility Area (SRA) burn perimeter are at risk of damage from flooding and debris flows.

Describe Condition of Values at Risk

Generally, water resources, roads, trails, culverts, and bridges in the burned area were not directly impacted by the fire and appear to be in satisfactory condition. However, many of the watersheds in the burn area suffered high burn severity in the upper elevations.

Emergency Determination

The possibility and likelihood of increased runoff and debris flow during rain events puts all resources at risk.

Treatments to Mitigate the Emergency

Treatment Type

Early warning systems/Evacuation plans
Vegetation thinning in specified areas
Monitoring before and after rain events for debris flow on all resources listed

Treatment Objective

Protect life, property, and natural resources

Discussion/Summary/Recommendations

Expect higher than normal flows with possible debris flow in all rain events. The higher the rainfall intensity the higher the risk for flooding and debris flow throughout all Santiago Fire burned area basins.

References – See attached Hydrology/Engineering Tech. Report

Appendices – See attached Hydrology/Engineering Tech. Report

Soils

Resource Condition Assessment

A. Resource Setting

This assessment focuses on the soil condition of the upslope areas close to people, property, schools, domestic water sources and county parks located in Modjeska, Harding, Williams, Silverado and Santiago Canyons.

B. Findings of the On-The-Ground Survey

On inspection of the burn areas, the amount of vegetation lost ranged from low to high. Eighty percent of the areas evaluated were at a moderate to high burn severity.

The slopes observed on the burn areas ranged for 20 percent to over 50 percent which combined with high hydrophobic and coarse textured soil will have a high potential for erosion and flooding.

Emergency Determination

The values at risk include the possible loss of life and property caused by erosion and flooding from the steep hillsides greater than fifty percent which are located in close proximity to homes.

Recommendations

Homeowners at moderate to high risk of erosion and flooding should contact Orange County Resources and Development Management Department (OCRDMD) to help implement BMPs.

References

- Erosion/sediment Control: Watershed Conf. 96, EPA
- OCRDMD – www.ocrdmd.com/services/fireinfopropertyowners.aspx

Recreation

Resource Condition Assessment

A. Resource Setting

The 28,464-acre Santiago Fire area consists of recreational opportunities with variable topography. Within the fire area, burn severity ranges from unburned to High. Fire related impacts within the burn area are expected to have a direct impact on recreational opportunities within open spaces and County Parks.

B. Findings of the On-The-Ground Survey

Values at Risk

Values at risk include dirt roads, trails, ingress and egress for the public, and aesthetics in the burned area.

Describe Condition of Values At Risk

Generally, recreational resources in the burned area were not directly impacted by the fire and appear to be in satisfactory condition. However, many of the roads and trails are expected to have an increase in erosional damage from the expected increase in run off.

Emergency Determination

The possibility and likelihood of increased runoff and debris flow during rain events puts all resources at risk.

Treatments to Mitigate the Emergency

Treatment Types

Erosion control
Habitat restoration
Road and trail maintenance

Treatment Objective

Protect life, property, natural resources, and preserve recreational opportunities.

Discussion/Summary/Recommendations

Implement appropriate BMPs upstream of sensitive riparian habitats to minimize sediment load.

Emergency evacuation routes should be established and cleared of all dangerous vegetation.

A plan should be developed and approved by appropriate agencies to remove hazardous vegetation from creeks within the public accessible open spaces to promote forest health and prevent debris dams.

Public open space recreation areas should be closed to the public for two (2) years.

Parks and open spaces are encouraged to construct firebreaks and fuel management to reduce the potential for catastrophic fires.

All dirt roads and trails should be safely monitored for washout and debris flows during in rain events.

Prohibit new roads and trails from being created to increase natural revegetation.

References – See attached Recreation Tech. Report

Appendices – See attached Recreation Tech. Report

Wildlife

Resource Condition Assessment

A. Resource Setting

The Santiago Fire area contains habitat for several state and federally listed endangered or threatened species, state species of special concern, and “covered species” identified in the Central Subregion of the Natural Communities Conservation Plan of Orange County.

B. Findings of the On-The-Ground Survey

Wildlife and fisheries resources have been heavily impacted by the Santiago Fire, fire suppression efforts, and post-fire conditions.

Emergency Determination

Wildlife species that depend on coastal sage scrub, cactus scrub, chaparral, and riparian habitats burned by the fire are at risk from extirpation from the area due to an expected loss of habitat and increase in sedimentation.

Treatments to Mitigate the Emergency

- Erosion control
- Habitat restoration
- Population surveys, monitoring
- Interagency coordination

Treatment Objective

The treatments objectives are to monitor wildlife populations effected by the fire to identify potential decline in populations and encourage adaptive management.

Treatment Description

- Survey and monitor bird, small mammal, and mesopredator populations
- Install adequate and appropriate BMPs
- Minimize further native habitat disturbance
- Restore native habitats when appropriate

References

Department of Fish and Game, http://www.dfg.ca.gov/wildlife/species/

County of Orange, Natural Community Conservation Plan and Habitat Conservation Plan, Orange County Central and Coastal Subregion, December 7, 1995.

Mitrovich, J. Milan and Hamilton A., Robb, Status of the Cactus Wren (Campylorhynchus brunneicapillus) with the Coastal Subregion of Orange County, California, May 2007.

O'Brian, John, Department of Fish and Game, Unpublished survey report on Harding Canyon and Santiago Creek.

U.S. Fish and Wildlife Service, Personal Conversation with Christine Medak, November 9, 2007.

Botany

Resource Condition Assessment

A. Resource Setting

Several Rare, Threatened and Endangered plants and communities occur within the burn and fire suppression footprint. The burn area consists of numerous shrub, riparian, oak, and grassland communities.

B. Findings of the On-The-Ground Survey

Rare, Threatened and Endangered plant communities are at risk from spread of invasive weed species facilitated by ground disturbance. Overall, the fire burned with a low to moderate severity, all species of chaparral shrubs, forbs, and grasses are well adapted to regenerate rapidly after fire

Emergency Determination

Invasive weed management is critical to ensure native species can recover in disturbed areas post fire. Impacted sensitive plants may be at risk from weed introduction or further ground disturbing activities.

Treatments to Mitigate the Emergency

Short and long term weed monitoring and eradication around all roads, dozer lines, and staging areas disturbed by fire suppression activities. Restoration and monitoring of sensitive habitats to ensure associated assemblages return.

Due to the short recurrence interval of fires, coupled with weeds known from the area, sensitive communities (oak, riparian, cactus scrub, coastal scrub, chaparral, perennial grassland, etc.) should be monitored over the long term for regeneration and recovery.

Discussion/Summary/Recommendations

Additional recommendations included recommendations not to seed/hydroseed or mulch/hydromulch the burn area. Fire adapted communities recover rapidly after a fire, without treatment. However, weeds do have the potential to affect recovery and should be monitored.

References

California Natural Diversity Database. 2005. RareFind 3, Version 3.1.0 (April, 2007, update). Sacramento, CA: California Department of Fish and Game.

California Native Plant Society. 1995. Statement of Policy: Seeding After Wildfire. Accessed at
http://www.cnps.org/archives/seeding.pdf on November 10 2007.

California Native Plant Society (CNPS). 2006. Inventory of rare and endangered plants of California

(seventh edition). Rare Plant Scientific Advisory Committee, David P. Tibor (convening ed.). Sacramento, CA: California Native Plant Society.(http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi).

Hickman, J. C. (ed.). 1993. The Jepson manual. Berkeley, CA: University of California Press.

Keeler-Wolf, T. 1995. Post-Fire Emergency Seeding and Conservation in Southern California Shrubs. In:
Wildfires in California Brushlands: Ecology and Resource Management. J.E. Keeley and T. Scott
(eds.) International Association of Wildlands Fire, Fairfield, WA.

Keeley, J.E. 1977. Seed production, seed populations in soil, and seedling production after fire for two
congeneric pairs of sprouting and non-sprouting chaparral shrubs. Ecology 58:820-829.

Cultural Resource

Resource Condition Assessment

A. Resource Setting

The 28,000-acre Santiago Fire burn area contains hundreds of known cultural resources, both prehistoric and historic.

B. Findings of the On The-Ground Survey

Cultural resources within and adjacent to the State Responsibility Area (SRA) burn perimeter are at risk of damage or destruction from fire affects, rehabilitation of affected areas, and vandalism.

Condition of Values At Risk

The impacts of fire appear to have been minimal to the sites visited and condition overall was determined to be good.

<u>Emergency Determination</u>

The values at risk considered in this assessment include the possible loss of cultural resources due to erosion from increased surface water runoff.

<u>Treatments to Mitigate the Emergency</u>

Treatment Type
Restrict access and deter visitation to known cultural resources.
Treatment Objective
Protect cultural resources within the fire affected area.
Treatment Description
Fence, conceal, and/or restrict access to cultural resources.

Discussion/Summary/Recommendations

In areas of increased exposure, known cultural resource sites should be fenced, concealed, and/or signed to restrict access by the public until such time as vegetation has recovered sufficiently to conceal surface artifacts or features.

Prior to any additional rehabilitation or new construction efforts in or near known cultural resources, the landowner shall retain the services of an archaeologist qualified under the Secretary of the Interior's Standards, to monitor soil-disturbing activity.

In the event of soil-disturbing activities in or near known cultural resource sites, the Native American Heritage Commission (NAHC) shall be consulted to determine whether there are concerns to the Native American community in or near the area of activity.

A member of the local Native American community, as designated by the NAHC, may be called upon to participate in the construction monitoring at the discretion of the archaeologist.

References

Site records on file at the South Central Coastal Information Center, California State University, Fullerton.

The Secretary of the Interior's Standards and Guidelines, Code of Federal Regulations, 36 CFR Part 61.

Instructions for Recording Historical Resources, Office of Historic Preservation
P.O. Box 942896 Sacramento, CA 942196-0001.

Native American Heritage Commission, 915 Capitol Mall, Room 364 Sacramento, CA 95814.

Recommendations

The recommendations (treatments) found in this report fall into one of two broad categories. Those treatments which can be considered temporary (short-term) measures designed to be quickly and relatively inexpensively implemented; and long-term treatments designed to facilitate the recovery of the watershed at an accelerated pace while concurrently minimizing the exposure of the values at risk to the threats identified. The following is a comprehensive list of the recommendations that resulted from the BAER assessment. For detailed discussion regarding the purpose and need, see the Technical Specialist's reports located in the appendices.

Note these recommendations are only applicable to the non-federal land within the fire perimeter. For recommendations and treatments being proposed by the USFS BAER team, contact the Cleveland National Forest.

Geology Recommendations

General Recommendations:

The site-specific observation included with this review should be considered in any emergency response plan develop by emergency agencies.

Post-fire flooding potential information developed by the U.S.D.A. Forest Service should be used to evaluate risks to lives and properties near stream channels in and near the Santiago fire burn area.

The existing road drainage systems should be inspected by the appropriate controlling agency to evaluate potential impacts from floods, hyperconcentrated floods, debris torrents, debris flows and sedimentation resulting from winter rains. It is understood that Santiago Canyon Road, Silverado Canyon Road, Modjeska Canyon Road, Modjeska Grade, Jackson Ranch, Crystal Canyon, and Hidden Ridge are all roads controlled by Orange County. It is also understood that Orange County has already begun to implement erosion control measures for Santiago Canyon Road. It is understood that Williams Canyon Road is a private road. Whoever controls Williams Canyon Road should be contacted and informed of potential risks to the road system.

The U.S.D.A. Forest Service, the Orange County Flood Control District, Department of Public Works, Fire Department, and Office of Emergency Services, the Natural Resources Conservation Service, and any other responsible party should be made aware of the potential hazard to lives and property in and downstream from the fire area, especially the Modjeska and Williams Canyon communities.

Campgrounds and hiking trails should be signed and closed as needed by the responsible agencies and/or private organizations to protect campers and hikers.

Specific Observations:

The sites identified in Appendix 2 should be evaluated by Professional Geologists or Professional Engineers with experience in slope stability and debris flow hazard identification and mitigation to fully document the scope of the problems at each site.

Hydrology/Engineering Recommendations

Expect higher than normal flows with possible debris flow in all rain events. The higher the rainfall intensity the higher the risk for flooding and debris flow throughout all Santiago Fire burned area basins.

Damming of debris flow on either Harding or Santiago Creek's could have catastrophic effects on the town of Modjeska. An early warning monitoring system with various monitoring points in both basins upstream of the confluence to each respective peak is recommended.

Emergency evacuation plans should be implemented for the town of Modjeska.

Any dead/fire burned trees and vegetation, and live standing trees larger than 3 inches in diameter breast height in the bankfull channel and 5 feet horizontally above the bankfull channel (see diagram #1) of Santiago Creek from 100 feet downstream of home located at 29456 Modjeska Canyon to ¼ mile upstream of said home (see diagram #2) that could cause damming or choking of debris in the creeks should be removed immediately. A plan should be developed and approved by appropriate agencies to remove hazardous vegetation for the remaining downstream creek to Santiago Canyon Road to promote expected increase in debris flows.

The downstream channel of the Harding Canyon Dam should be protected with additional rip-rap to dissipate energy of falling flow over the crest. Further investigation is required to determine size of the rip-rap, extent of protection and structural integrity and stability of the dam.

All County, Private, and State roads and trails should be safely monitored during rain events.

Irvine Lake should be safely monitored for debris and sediment flows during rain events as large amount of debris may flow into the reservoir.

All other Debris/Sediment/Detention Dams should be monitored during rain events

Soils Recommendations

The homes designated as moderate to high risk for erosion and flooding should consider contacting the Orange County Resources and Development Management Department (OCRDMD). Orange County has compiled a list of Best Management Practices (BMPs) that can be implemented by property owners after a fire and when rain is expected. The BMPs are as follows:

Fiber Rolls (straw, flax or other material)
Gravel Bag Berms
Sand Bag Barriers
Geotextiles and Mats (Erosion Control Blankets)

The description, installation and operation of these practices are from the California Stormwater BMP Handbook (www.cabmphandbooks.com).

Recreation Recommendations

Expect higher than normal flows with possible debris flow in all rain events. The higher the rainfall intensity the higher the risk for flooding and debris flow throughout all Santiago Fire burned area.

Emergency evacuation plans should be implemented to increase public safety. Emergency evacuation routes should be cleared of all dangerous vegetation, including hazard trees that may impede ingress and egress for the public and emergency vehicles.

Seeding/hydroseeding of the burn area should not be conducted.

Public open space recreation areas should be closed to the public for two (2) years to allow vegetation to recover undisturbed and for trail and road improvement and maintenance.

Prefire management is encouraged to reduce fire damage along trails, roads, Parks and open spaces. Parks and open spaces are encouraged to construct firebreaks and fuel management to reduce the potential for catastrophic fires.

A plan should be developed and approved by appropriate agencies to remove hazardous vegetation from creeks within the public accessible open spaces to promote forest health and prevent debris dams.

All dirt roads and trails should be safely monitored for washout and debris flows during in rain events.

Wildlife Recommedations

Erosion Control

Stabilize slopes over between 20 and 50 percent, where feasible, with biodegradable matting to limit slope erosion while also limiting impacts to recovering native vegetation and wildlife habitat.

Avoid use of hydroseed and hydromulch. Hydromulch and hydroseed are ineffective as there is a lack of soil moisture for them to be efficient, they inhibit natural recruitment from the native seed bank, and they introduce exotic weed species into the native habitat.

Vegetation important to sensitive species (e.g., cactus wren, California gnatcatcher), especially unburned habitat in known nesting or foraging territories, should be avoided to the greatest extent feasible.

Use appropriately sized culverts as determined by an appropriate agency when replacing or improving drainage structures.

Vegetation clearing should be limited to smallest area feasible to accomplish activities safely. Vegetation important to sensitive species (e.g., cactus wren, California gnatcatcher, and least Bell's vireo), especially unburned habitat in known nesting or foraging territories, should be avoided to greatest extent possible. Please see Hydrology/Engineering BAER report for further details.

Revegetation of Native Habitat

Revegetate riparian habitats in burn areas to encourage habitat regrowth. Riparian vegetation will promote soil stabilization as well as provide refugia for wildlife species. Natural revegetation is expected occur with the same native species that occurred before the fire.

Plant cactus scrub in burn areas of known cactus wren occurrences to promote faster restoration of habitat for the cactus wren. Attempt to expand the area of suitable habitat to reestablish the wren population size

Population surveys and long term monitoring

Conduct long-term bird monitoring for Coastal California gnatcatcher, coastal cactus wren, and Southern California rufus-crowned sparrow throughout the burn area to evaluate the likelihood of direct mortality, the extent of duration of displacement, and the rate and extent of recovery of lost habitat.

Conduct spring Santa Ana speckled dace surveys in Santiago Canyon, Harding Canyon, and Silverado Canyon to determine if the Santa Ana speckled dace population has been impacted or even extirpated.

Conduct long-term small mammal monitoring throughout the burn area to evaluate mortality rates from the fire.

Monitor mountain lion, deer, and -mesopredator populations and movement patterns in the burn area to monitor use of habitat and population size and health.

The Department of Fish and Game should be consulted regarding the protocols and season of wildlife surveys.

Document unburned habitat and monitor for use of sensitive species.

Local agency Coordination

Local agencies and jurisdictions should coordinate activities with Nature Reserve of Orange, Irvine Ranch Conservancy, and Wildlife Agencies to avoid, minimize, and mitigate impacts to sensitive species during post-fire recovery efforts.

Coordinate local jurisdiction and private landowner activities within riparian areas and in listed and "covered species" habitat to address wetland permitting (including, but not limited to Department of Fish and Game, Regional Water Quality Control Board, and U.S. Army Corps of Engineers) and California and Federal Endangered Species issues.

Resource Agencies including Department of Fish and Game and U.S. Fish and Wildlife Service should be consulted regarding the suite of species, appropriate vegetation protocols, and season for re-vegetation efforts.

Recommend the above-mentioned government and non-government groups mutually staff and participate on a Santiago Fire recovery and remediation Team, commencing with the ending of the BAER Team. This will facilitate coordination, timeliness and environmental sensitivity of the projects that have been/will be proposed for the burned area's watershed.

Botany Recommendations

Specific Recommendations

The following measures are proposed to mitigate the physical disturbance to sensitive plant communities and impacts to rare, threatened, and endangered plant species resulting from fire suppression activities;

Santiago/Irvine Mesa – dozer tracks impacted perennial and mixed grasslands, cactus sage scrub, and riparian habitat. Restoration of these areas as well as noxious weed control (short and long term) and monitoring are recommended.

Bee and Round Canyons – existing dirt roads were widened for dozer access. Monitor and control weeds around disturbed roads to prevent widespread establishment and introduction into new areas.

Upper Agua Chinon - existing dirt roads were widened for dozer access. Monitor and control weeds around disturbed roads to prevent widespread establishment and introduction into new areas. Intermediate mariposa lily (*Calochortus weedii var. intermedius*) has been mapped along the access road and adjacent slopes within this impact area. Care should be taken to not impact this species during weed removal and monitoring.

Limestone Canyon – widened existing dirt road and created safety zones impacting native perennial grassland, mixed native/non-native grassland, cactus sage scrub, and stream habitat. Restoration of these habitats should occur as well as weed control and monitoring along all disturbed areas.

General Recommendations

The following measures are general recommendations for the burn area to mitigate the impact of the burn on sensitive plant communities and impacts to rare, threatened, and endangered plant species resulting from fire suppression activities;

Conduct rare plant surveys and mapping annually within the burn area to assess long term impacts from frequent fires on sensitive plant recovery.

Conduct oak regeneration studies in areas where oak woodlands were burned to assess post fire recruitment.

Conduct native grassland regeneration studies to assess long term impacts from frequent fires and assess impacts from non-native grass competition.

Monitor recovery of cactus sage scrub over the long term to ensure recovery of coastal cactus wren habitat.

Conduct annual weed mapping to determine any type conversion from native habitat to weed dominated habitat after the fire. Develop an eradication program for any areas where weeds are inhibiting natural post fire recovery of native habitats.

Seeding/hydroseeding of the burn area should not be conducted.

Mulch should not be applied to open space areas within the burn area. Mulch may introduce weed seed as well as suppress germination and growth of native species.

If clearing chokepoints within channels is necessary to reduce risk to life and property, only the minimum amount of vegetation should be cleared that enables this goal to be met. Vegetation smaller than 3" dbh should be left in the channel, and only the bankfull channel should be cleared. Channels should be surveyed for *Arundo donax* prior to any clearing and if found, should be carefully removed in a manner to prevent spread of this invasive species.

Open space recreation areas should be closed to the public for two (2) years to allow vegetation to recover undisturbed.

Archaeology Recommendations

Note These appendices contain confidential information regarding archeological site locations, portions of this report have been removed from public copies in accordance with the policy of the Office of Historic Preservation as adopted by the State Historical Resources Commission under the authority of Public Resources Code 5020.4.

Prior to any additional rehabilitation or new construction efforts in or near known cultural resources, the landowner shall retain the services of an archaeologist qualified under the Secretary of the Interior's Standards, to monitor soil-disturbing activity.

In the event of soil-disturbing activities in or near known cultural resource sites, the Native American Heritage Commission (NAHC) shall be consulted to determine whether there are concerns to the Native American community in or near the area of activity.

A member of the local Native American community, as designated by the NAHC, may be called upon to participate in the construction monitoring at the discretion of the archaeologist.

Summary

The fire and the resultant impact to the processes previously discussed in this report has resulted in an increased risk for storm events to result in flooding, debris torrents, and debris flows. As storm intensity or duration rises, there will be a simultaneous elevation in risk for the storm event to trigger flooding, debris torrents, and debris flows. These events could result in the loss of human life and property. All values at risk identified could be adversely affected.

List of Figures

Figure E 1 Santiago Site Evaluation Map Index
Figure E 2 Santiago Site Evaluation Map Life Area 1
Figure E 3 Santiago Site Evaluation Map Life Area 2
Figure E 4 Santiago Site Evaluation Map Life Area 3
Figure E 5 Santiago Site Evaluation Map Life Area 4
Figure E 6 Santiago Site Evaluation Map Life Area 5
Figure E 7 Santiago Site Evaluation Map Property Area 1
Figure E 8 Santiago Site Evaluation Map Property Area 2
Figure E 9 Santiago Site Evaluation Map Property Area 3
Figure E 10 Santiago Site Evaluation Map Property Area 4
Figure E 11 Santiago Site Evaluation Map Property Area 5

Figure 1: Geologic Index Map Morton and Miller, 2006;
Figure 2: Burn Site Evaluation Index Map
Figure 3: Burn Site Evaluation - Area 1
Figure 4: Burn Site Evaluation - Area 2
Figure 5: Burn Site Evaluation - Area 3
Figure 6: Burn Site Evaluation - Area 4
Figure 7: Burn Site Evaluation - Area 5

Figure 8: Bank Full Diagram
Figure 9: Vegetation Thinning Area
Figure 10: Soil Burned Severity Classification
Figure 11: Potential Species Affected Between Santiago and Trabuco Creeks
Figure 12: Potential Species Affected in Upper Agua Chinon
Figure 13: Potential Species Affected in Black Star Canyon and Santiago Creek.
Figure 14: Potential Species (valley needlegrass in purple) Irvine/Santiago Mesa.
Figure 15: Santiago Fire BAER General Location Map
Figure 16: Santiago Fire BAER Watershed Hydrologic Unit Code 6

List of Tables

Table 1: Values at Risk
Table 2: Rare, Threatened and Endangered Plants in the Santiago Fire Area
Table 3. Invasive Weeds Observed In and Adjacent to the Santiago Fire

List of Abbreviations

CA-ORC-068555 – Orange County, California, Fire # 068555
State Responsibility Area (SRA)
United States Forest Service (USFS)
California State University at Fullerton (SCCIC)
Native American Heritage Commission (NAHC)
Department of Water Resources (DWR)
Orange County Resources and Development Management Department (OCRDMD).
Best Management Practices (BMPs)
California Native Plant Society (CNPS)
Hydrologic Unit Codes (HUC-6)

Geology Appendixes
Appendix 1: Legend to Geologic Index Map
Appendix 2: California Geologic Burn Site Evaluation Summary

Definitions

Bank Full – (1978, Dunne and Leopold) provided a generally accepted definition of bankfull discharge: The bankfull stage corresponds to the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels.

INTERAGENCY STATE BURNED AREA
EMERGENCY RESPONSE (BAER)
Report

Santiago Fire: CA-ORC-068555

Appendices

Appendix 1: Geological Technical Report
Appendix 2: Hydrology / Engineering Technical Report
Appendix 4: Soils Technical Report
Appendix 5: Wildlife Technical Report
Appendix 6: Recreation Technical Report
Appendix 7: Botany Technical Report
Appendix 8: Archeology Technical Report
Appendix 9: Maps and other information

FINAL TECHNICAL SPECIALTIST'S
Burned Area Emergency Response Report

Resource: Geology

Fire Name: Santiago Fire CA-ORC-068555 November 2007

Author Name: Dave Longstreth, Certified Engineering Geologist
California Geological Survey,
17501 North Highway 101,
Willits, CA 95490
Office (707) 456-1814 Cell (707) 738-4118

John Schlosser, Certified Engineering Geologist
California Geological Survey
801 K St., MS 13-40, Sacramento, CA 05814

I. Resource Condition Assessment

A. Resource Setting

The 28,400-acre Santiago fire burn area is underlain by Mesozoic to Quaternary sedimentary, volcanic and shallow intrusive rocks (Morton and Miller, 2006; Figure 1). The older rocks form the core of the Peninsular Ranges in the burn area, with rocks becoming progressively younger to the west. A description of the geologic units within the Santiago fire area is included in the legend to the Geologic Index Map (Appendix 1)

Morton and Miller (2006, Figure 1) map landslide deposits throughout the burn area. These slope-failure deposits include chaotic mixtures of soil and rubble and displaced bedrock blocks; most are debris slides and rock slumps or earth slumps. Landslides may or may not be active, but they may be adversely affected over the long term as a consequence of the Silverado fire removing intercepting and transpiring chaparral canopy and the loss of the reinforcing effect of roots as that may occur until the vegetative cover recovers.

Topography within the burn area ranges from gentle to very steep, with elevations ranging from about 200 above mean sea level along the western margin of the fire to a high of over 4400 feet where the fire burned near Modjeska Peak. The burn area lies below the elevation generally subject to rain-on-snow events, although snow may occasionally fall near the higher peaks. Much of the mountainous portion of the burn area drains into west-flowing watercourses that are tributary to Santiago Reservoir (Irvine Lake). The lower slopes along the southwest portion of the burn drain into numerous southwest-flowing watercourses that debouch onto channelized alluvial fans between Trabuco and Santiago canyons.

B. Survey Methods

To evaluate the risk to life and property helicopter reconnaissance was conducted November 4, 2007. The entire burn area was inspected to identify where high-value sites may be present that need on-site reviews, concentrating on developed residential areas. Road and foot inspections were conducted in the areas with high value sites on November 5, 6, and 7, 2007.

Areas of the Cleveland National Forest and elsewhere where no houses, businesses or other high-value risks were identified were not surveyed on the ground. Road-related features, such as culverts and bridges, were also not surveyed. CGS understands that CAL FIRE is working with CalTrans and Orange County Public Works to identify road-related high-value sites.

The values at risk are possible loss of life and property due to in-channel floods, hyperconcentrated floods, debris torrents, and debris flows, and slope-generated landslides, debris flows, rock fall, and associated slope movement.

II. Observations

A. General observations

The principal concern with the Santiago fire is Fire an increase in the potential for in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. The primary mechanisms for this are the loss of mechanical support of hillslope materials that was provided by vegetation and vegetative litter and the increase in runoff resulting from reductions in interception and infiltration, from the simplification of surficial runoff patterns, and from the loss of mechanical support along stream channels where riparian vegetation was burned. Where fires burn hot, such as in the upper portions of Santiago Canyon, Bear Trap Canyon, Harding Canyon, Williams Canyon, Arroyo Trabuco, Pine Canyon, and Halfway Canyon the reduction in interception may be affected by the development of hydrophobic soils where waxy substances released by plant materials during hot fires follow thermal gradients into the soil and congeal as continuous surfaces.

Houses near or within stream channels in the Modjeska residential area and houses near or within channels elsewhere in the Santiago Creek and Williams Creek watersheds appear to be in positions where they may be affected by significant in-channel floods, hyperconcentrated floods, debris torrents, and debris flows. It is our understanding that the USDA Forest Service, in concert with the US Geological Survey and CAL FIRE are developing models to assess the potential magnitudes of post-fire events.

Houses and other high-value features may be affected by local floods and slope failures as identified below. The magnitude of post-fire damage will be determined by the intensity and duration of storms that impact the area.

B. Specific Observations

In addition to the near-channel sites identified by USDA Forest Service and US Geological Survey modeling, the California Geological Survey inspect houses and other high-value sites within and down slope from the burn area to evaluate potential risks from near-site debris flow, rock fall floods, and other geologic hazards that may not be identified in the regional evaluation. Sixty eight (68) at-risk sites, some with multiple homes, identified as having potential risks to lives or property are listed and briefly described below and summarized in Appendix 2 to this. The locations of the site are shown on Figures 2, 3, 4, 5, 6, and 7.

III. Emergency Determination

The values at risk considered in this assessment include the possible loss of life and property due to landsliding, debris flow, rock fall, debris torrents, and flooding from increased surface water runoff. In general, the risk from landslides, debris flows and rock falls are possible where roads, residences or other development are located within and/or adjacent to canyon stream channels or on alluvial fans, colluvial footslopes and debris flow deposits.

It should be noted that these hazards are part of the natural processes in this environment, and that these risks were present under pre-fire conditions. Many existing structures in the burn area have been and will continue to be at risk from these hazards. The potential for these processes to be exacerbated by fire is primarily dependent upon burn severity and slope steepness, both of which are highly variable in the Santiago fire area. In general, where the burn severity is moderately high, the slopes are steep, and the potential for increased hazard is greatest in the Modjeska, Williams Canyon, Santiago Canyon, and Pine Canyon areas. The burn severity was generally low to moderate south of Loma Ridge in the western portion of the Santiago fire. Risks to cultural, soils and biologic assets are covered in other specialist reports. Areas with moderate to high potential risks to life and property from slope instabilities exist elsewhere in the vicinity of the Santiago fire, but the assessment of sites that were not affected by the fire is beyond the scope of this evaluation.

IV. Recommendations

A. General Recommendations:

1. The site-specific observation included with this review should be considered in any emergency response plan develop by emergency agencies.
2. Post-fire flooding potential information developed by the U.S.D.A. Forest Service should be used to evaluate risks to lives and properties near stream channels in and near the Santiago fire burn area.
3. The existing road drainage systems should be inspected by the appropriate controlling agency to evaluate potential impacts from floods, hyperconcentrated floods, debris torrents, debris flows and sedimentation resulting from winter rains. It is understood that Santiago Canyon Road, Silverado Canyon Road, Modjeska Canyon Road, Modjeska Grade, Jackson Ranch, Crystal Canyon, and Hidden Ridge are all roads controlled by Orange County. It is also understood that Orange County has already begun to implement erosion control measures for Santiago Canyon Road. It is understood that Williams Canyon Road is a private road. Whoever controls Williams Canyon Road should be contacted and informed of potential risks to the road system.
4. The U.S.D.A. Forest Service, the Orange County Flood Control District, Department of Public Works, Fire Department, and Office of Emergency Services, the Natural Resources Conservation Service, and any other responsible party should be made aware of the potential hazard to lives and property in and downstream from the fire area, especially the Modjeska and Williams Canyon communities.

5. Campgrounds and hiking trails should be signed and closed as needed by the responsible agencies and/or private organizations to protect campers and hikers.

B. Specific Observations:

1. The sites identified in Appendix 2 should be evaluated by Professional Geologists or Professional Engineers with experience in slope stability and debris flow hazard identification and mitigation to fully document the scope of the problems at each site.

References

Morton, D.M., and Miller, F.K., 1986, *Geologic Map of San Bernardino and Santa Ana 30'x60' Quadrangles, California*: U.S. Geological Survey), Scale 1:250,000.

The California Geological Survey (CGS) Burn Site Evaluation Summaries present the results of our reconnaissance of sites that may be at risk to life and property from geologic hazards such as landslides, debris flows, rock falls, and localized debris torrents, floods, and hyperconcentrated floods. These summaries do not include an assessment of potential risks from increased surface runoff along the major stream channels, and must be used in combination with hydrologists' assessments of those areas to grasp the magnitude of risks to high-value sites. CGS's expedited reconnaissance evaluations were part of the post-fire emergency response activities. As such, there are likely to be areas within the burn perimeter and other locations of potential values at risk that were not observed or assessed, and other areas where the potential risks are either higher or lower than our initial reconnaissance-level reviews.

Appendix 1: Legend to Geologic Index Map, Santiago Fire (Morton and Miller, 2006)

Qya	Young axial-channel deposits	Slightly to moderately consolidated silt, sand, and gravel deposits. Includes fluvial deposits along canyon floors.
Qyf	Young alluvial-fan deposit	Unconsolidated to moderately consolidated silt, sand, pebbly cobbly sand and bouldery alluvial-fan deposits having slightly to moderately dissected surfaces.
Qls	Landslide deposits	Slope-failure deposits of chaotically mixed soil and rubble and (or) displaced bedrock blocks; most are debris slides and rock slumps or earth slumps. Landslides may or may not be active.
Tpsq	Puente Formation, Soquel Member	Gray to yellowish-gray, massive to well-bedded, medium- to coarse-grained, poorly sorted sandstone and siltstone interbedded with matrix-supported pebbly sandstone..
Tplv	Puente Formation, La Vida Member	Light-gray to black, massive to well-bedded siltstone and subordinate, generally friable sandstone. Locally consists of porcellaneous siltstone or shale.
Tt	Topanba Group	Marine sandstone, siltstone, and shale with abundant conglomerate and minor volcanic rocks
Tv	Vaqueros Formation	Brownish-gray, massive- to thick-bedded sandstone and sandy siltstone, with interbeds of siltstone and shale, mudstone, and minor conglomerate.
Ts	Sespe Formation	Massive, thick-bedded, nonmarine conglomerate, conglomeratic sandstone and claystone, and silty sandtone.
Tvs	Sespe and Vaqueros formations, undifferentiated	Interbedded marine and nonmarine sandstone and conglomerate.
Tsa	Santiago Formation	Continental and marine sandstone and conglomerate.

Tsi	Silverado Formation	Nonmarine and marine sandstone, siltstone and conglomerate.
Kwps	Williams Formation, Pleasant Sandstone Member	Marine sandstone: upper part poorly bedded, coarse-grained sandstone; lower part thin-bedded sandstone.
Klhs	Ladd Formation, Holz Shale Member	Marine shale, siltstone, and sandstone.
Klhsc	Ladd Formation, Holz Member Conglomerate	Conglomerate
Klbc	Ladd Formation, Baker Canyon Conglomerate member	Marine and nonmarine(?) conglomerate derived from granitic and volcanic rocks; lower part is gray, upper part is brown.
Kd	Diorite, undifferentiated	Mine-to medium-grained, massive, dark gray to black hornblende diorite
Kvsp	Santiago Peak Volcanics volcanic rocks	Heterogeneous and discontinuous basaltic andesite, andesite, dacite, rhyolyte, volcaniclastic breccia, and welded tuff; hydrothermally altered.
Kvspi	Intrusive rocks of Santiago Peak Volcanics	Shallow porphyritic intrusive principally of intermediate composition.
Jbc	Bedford Canyon Formation	Black and gray shale, mudstone, greywacke, conglomerate, quartzite with scattered limestone. Highly fractured

Appendix 2 California Geological Survey Burn Site Evaluation Summary
Fire Name : Santiago **Bold where risks are high**

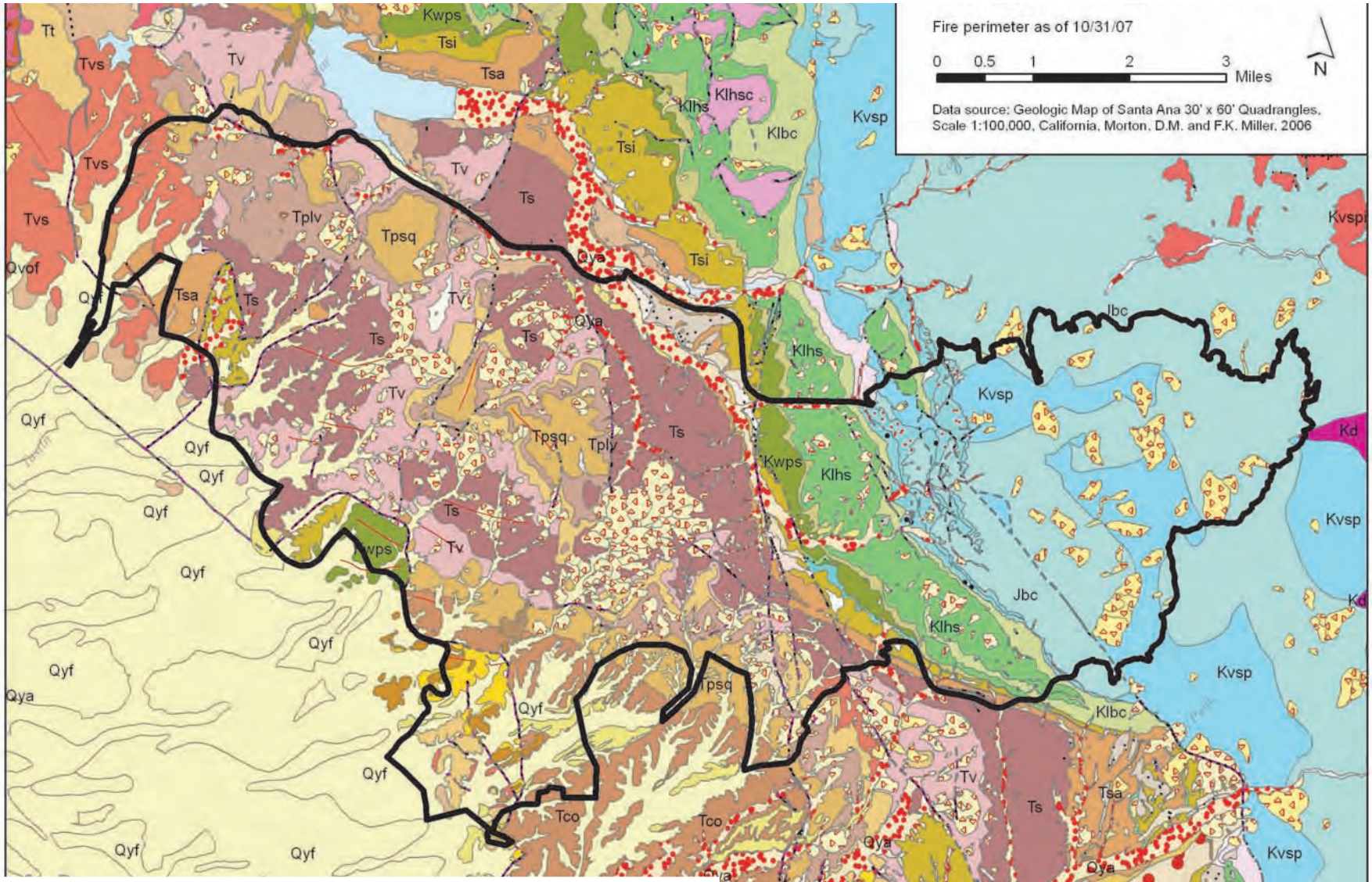
Site number	At-risk Feature	Street address	GPS Location - NAD27 Latitude N	Longitude W	Hazard	Likeli-hood	Risk to lives fire	Risk to lives pre-exist	Risk to property fire	Risk to property pre-exist
12 101	**Water Tanks**	Confidential	**33.71395**	**117.64165**	**Debris Flow/ Flood**	**High**	**Low**	**Low**	**High**	**Low**
12 102	House		33.71365	117.64176	Flood	High	Low	Low	Mod	Low
12 103	Homes, culvert		33.71152	117.64027	Debris Flow/ Flood	Mod	Low	Low	Mod	Low
12 104	House		33.71019	117.63864	Debris Flow/ Flood	High	Low	Low	Low	Low
12 105	Homes, Road		33.70918	117.63672	Debris Flow/ Flood	High	Mod	Low	Mod	Low
12 106	Homes		33.70807	117.63567	Flood	High	Mod	Low	Mod	Low
12 107	**Bridge**		**33.70845**	**117.63541**	**Debris Flow**	**High**	**Low**	**Low**	**High**	**Low**
12 108	**Homes**		**33.70815**	**117.63373**	**Debris Flow**	**High**	**High**	**High**	**High**	**high**
12 109	House		33.70801	117.63275	Debris Flow/ Flood	High	Mod	Low	Mod	Low
12 110	**House**		**33.70773**	**117.63234**	**Debris Flow**	**High**	**Mod**	**Low**	**High**	**Low**
12 111	**House**		**33.70676**	**117.62963**	**Debris Flow**	**High**	**High**	**Mod**	**High**	**High**
12 112	**House**		**33.70693**	**117.63125**	**Debris Flow**	**High**	**High**	**Mod**	**High**	**Mod**

12	113	House	Confidential	33.70689	117.62852	Debris Flow/ Flood	High	Low	Low	Low	Low
12	**114**	**Bridge**		**33.70798**	**117.62766**	**Debris Flow**	**High**	**Low**	**Low**	**High**	**Low**
12	115	House		33.70897	117.62234	Debris Flow/ Flood	High	Low	Low	Low	Low
12	116	Homes		33.70958	117.62254	Debris Flow/ Flood	High	Mod	Low	Mod	Low
12	**117**	**House**		**33.70849**	**117.61419**	**Debris Flow**	**High**	**High**	**Mod**	**High**	**Mod**
12	**118**	**Homes**		**33.70784**	**117.62468**	**Debris Flow/ Flood**	**High**	**Mod**	**Low**	**High**	**Low**
12	119	Homes		33.71095	117.61700	Flood	Mod	Mod	Low	Mod	Low
12	**120**	**House**		**33.72629**	**117.64688**	**Sediment Flood**	**High**	**Mod**	**Low**	**High**	**Low**
12	**121**	**House**		**33.72912**	**117.64043**	**Rockfall, Landslide**	**Mod**	**High**	**High**	**High**	**high**
12	122	House		33.72803	117.64001	Debris Flow/ Flood	Low	Low	Low	Low	Low
12	123	School preschool		33.74537	117.66759	Flooding	Mod	Low	Low	Mod	Low
12	**124**	**House water tank**		**33.74623**	**117.58259**	**Debris Flow**	**Mod**	**High**	**Low**	**High**	**Low**
12	**125**	**House**		**33.74588**	**117.58361**	**Debris Flow**	**Mod**	**High**	**Low**	**High**	**Low**
12	**126**	**House**		**33.74471**	**117.58403**	**Debris Flow**	**Mod**	**High**	**Low**	**High**	**Low**
12	**127**	**House**		**33.74539**	**117.58438**	**Debris Flow**	**Mod**	**High**	**Low**	**High**	**Low**
12	**128**	**H2O Tank, Camp**		**33.74579**	**117.59889**	**Debris Flow**	**Mod**	**High**	**Low**	**High**	**Low**

12	129	**Homes**	Confidential	**33.70751**	**117.63607**	**Debris Flow/ Flood**	**Mod**	**High**	**Low**	**High**	**Low**
12	130	House		33.69336	117.61967	Debris Low	Mod	Low	Low	Low	Low
12	131	Horse Stables		33.69577	117.62201	Deris Flow	Mod	Mod	Low	Mod	Low
JS	**132**	**House**		**33.70900**	**117.63460**	**Debris Slide/ Rockfall**	**High**	**High**		**High**	
JS	**133**	**House**		**33.70880**	**117.63390**	**Debris Flow/ Flood**	**High**	**High**		**High**	
JS	**134**	**House**		**33.70900**	**117.63330**	**Debris Flow/ Flood**	**High**	**High**		**High**	
JS	135	House		33.70900	117.63240	Flooding	Mod	Low		Mod	
JS	136	House		33.70910	117.63180	Debris Flow	High	Low		Low	
JS	137	House		33.70910	117.63140	Debris Flow	Low	Low		Low	
JS	138	House		33.70900	117.63100	Denris Flooding	Mod	Low		Low	
JS	139	House		33.70880	117.63090	None	Low	Low		Low	
JS	140	House		33.70880	117.63110	None	Low	Low		Low	
JS	141	House		33.70900	117.63180	None	Low	Low		Low	
JS	142	House		33.70900	117.63250	None	Low	Low		Low	
JS	143	House		33.70890	117.63290	None	Low	Low		Low	
JS	144	House		33.70880	117.63360	None	Low	Low		Low	

JS	145	House	Confidential	33.7097	117.6257	None	Low	Low	Low
JS	146	House		33.7099	117.6257	None	Low	Low	Low
JS	147	House		33.7099	117.6257	None	Low	Low	Low
JS	148	House		33.711	117.6263	Debris Flow	High	Low	Mod
JS	149	House		33.7094	117.6271	Debris Flow	Mod	Low	Low
JS	150	Mobile Home		33.7124	117.6253	Debris Flow	High	Mod	Mod
JS	151	**House**		**33.7127**	**117.6246**	**Debris Flow, Debris Slide**	**High**	**High**	**High**
JS	152	House		33.7113	117.6255	Debris Flow	High	Mod	Mod
JS	**153**	**House**		**33.7105**	**117.6199**	**Debris Flow**	**High**	**High**	**High**
JS	154			33.7094	117.637				
JS	155	House		33.7097	117.6374	Debris Flow	Mod	Low	Low
JS	156	House		33.729	117.6261	Debris Flow	High	Low	Mod
JS	157	House		33.7297	117.6264	Debris Flow	High	Low	Low
JS	158	House		33.6854	117.6014	Debris Flow Flooding	Mod	Low	Low
JS	159	House		33.6855	117.5998	Debris Slide	Mod	Low	Low

JS	160	House	Confidential	33.6854	117.5987	Debris Flow Flooding	High	Low		Mod	
JS	161	House		33.6845	117.5988	Debris Flow Flooding	High	Mod		Mod	
JS	162	24" Culvert		33.6921	117.6619	Flooding, plugging	High	Low		Mod	
JS	**163**	**Homes**		**33.6924**	**117.6633**	**Landslide/ Debris Flow**	**High**	**High**		**High**	
JS	164	Homes		33.6911	117.6661	Debris Flow	Mod	Low		Low	
JS	165	House		33.6922	117.6679	Debris Flow	High	Low		Mod	
JS	166	Culvert		33.6922	117.6682	Debris Flow/ Plugging	High	Low		Low	
JS	167	Culvert		33.6913	117.6694	Debris Flow/ Plugging	Mod	Low		Low	
JS	168	House		33.6906	117.6696	Debris Flow	Mod	Low		Mod	



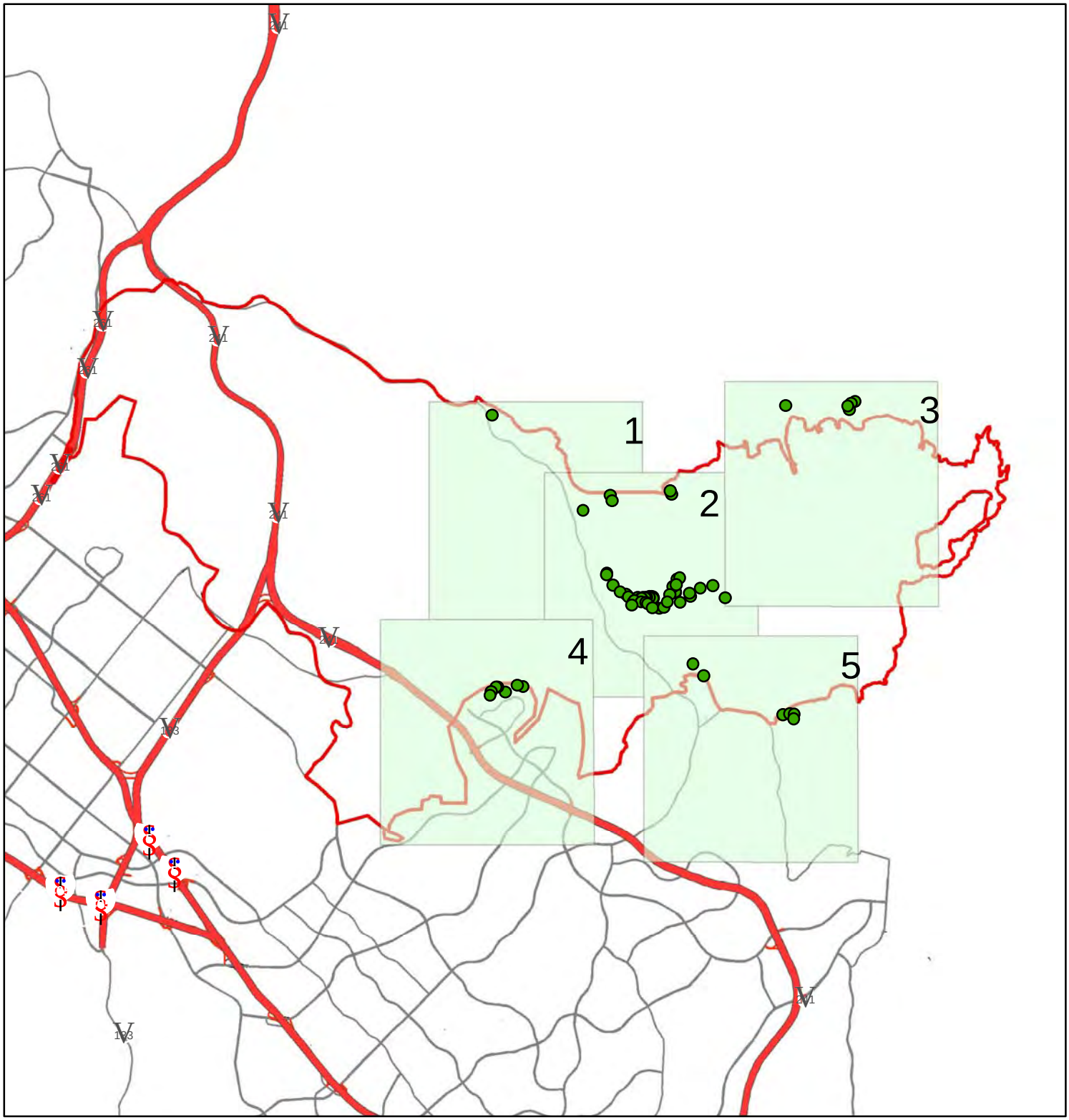
NOTE: See Appendix 1 for Explanation

N

Date: Nov 2007	Regional Geologic Map To Accompany Emergency Geologic Review of Santiago Fire	Figure: 1

Base Map: Modified from Morton, D.M., and Miller, F.K., 1986, Geologic Map of San Bernardino and Santa Ana 30'x60' Quadrangles, California: U.S. Geological Survey), Scale 1:250,000.

Santiago Fire, 2007
Burn Site Evaluation - Index Map



LEGEND

Contour Interval = 10, 25, and 50 feet

Sites At Risk

Fire Perimeter - November 7, 2007

Kilometers
0 0.5 1 2 3 4 5 6 7

Miles
0 0.5 1 2 3 4

Date: November 8, 2007
Projection: NAD 1983 California Teale Albers

Figure 2

Created By: W. Kallio, ESRI
Data Sources: OES, USGS, CGS, StreetMap

Santiago Fire, 2007
Burn Site Evaluation - Area 1

LEGEND

Contour Interval = 10, 25, and 50 feet

Sites At Risk

Fire Perimeter - November 7, 2007

Kilometers: 0 0.5 1 2

Miles: 0 0.25 0.5 1

Date: November 8, 2007

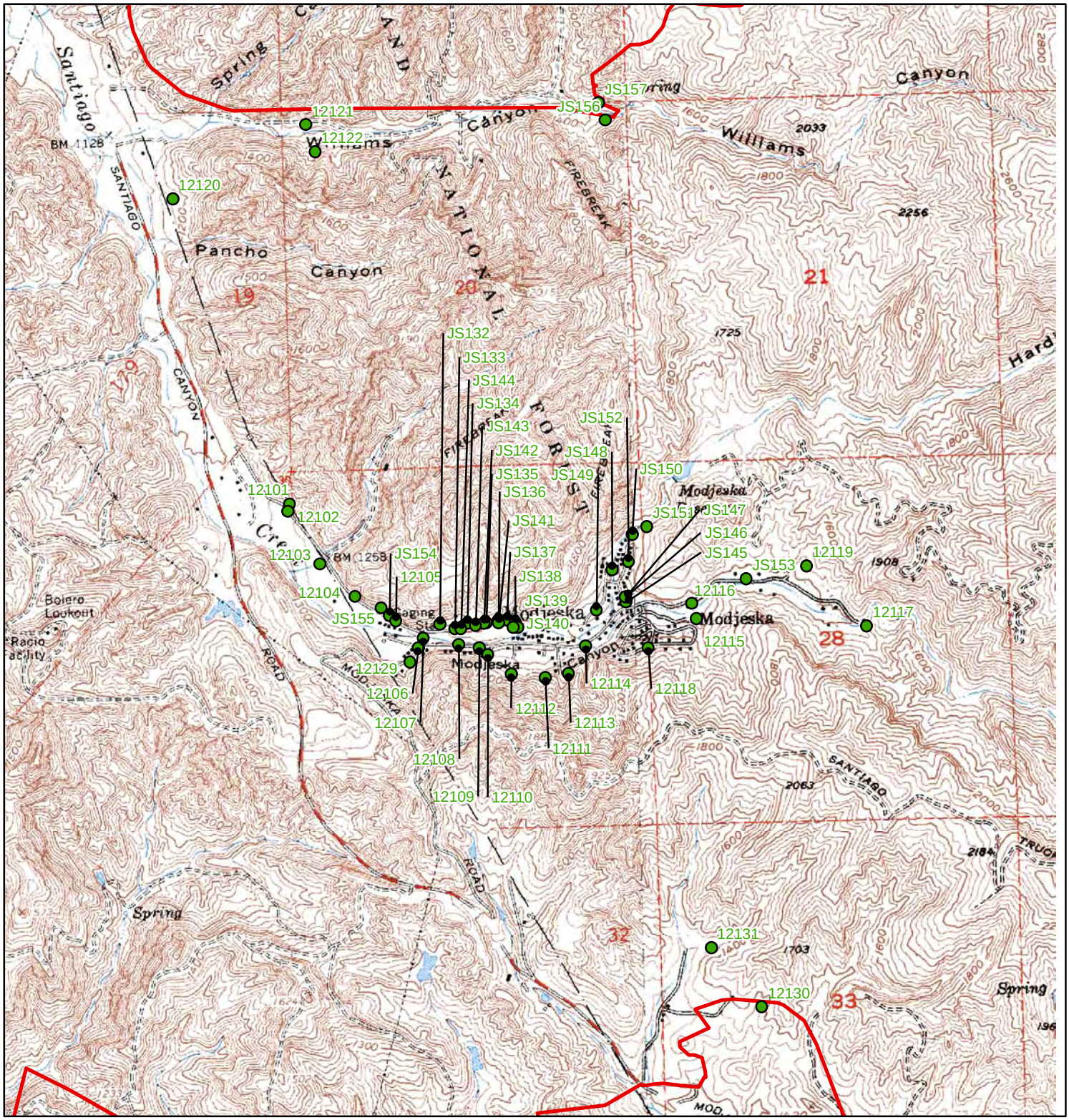
Projection: NAD 1983 California Teale Albers

Figure 3

Created By: W. Kallio, ESRI

Data Sources: OES, USGS, CGS, StreetMap

Santiago Fire, 2007
Burn Site Evaluation - Area 2



LEGEND

Contour Interval = 10, 25, and 50 feet

Sites At Risk

Fire Perimeter - November 7, 2007

Kilometers: 0, 0.5, 1, 2

Miles: 0, 0.25, 0.5, 1

Date: November 8, 2007

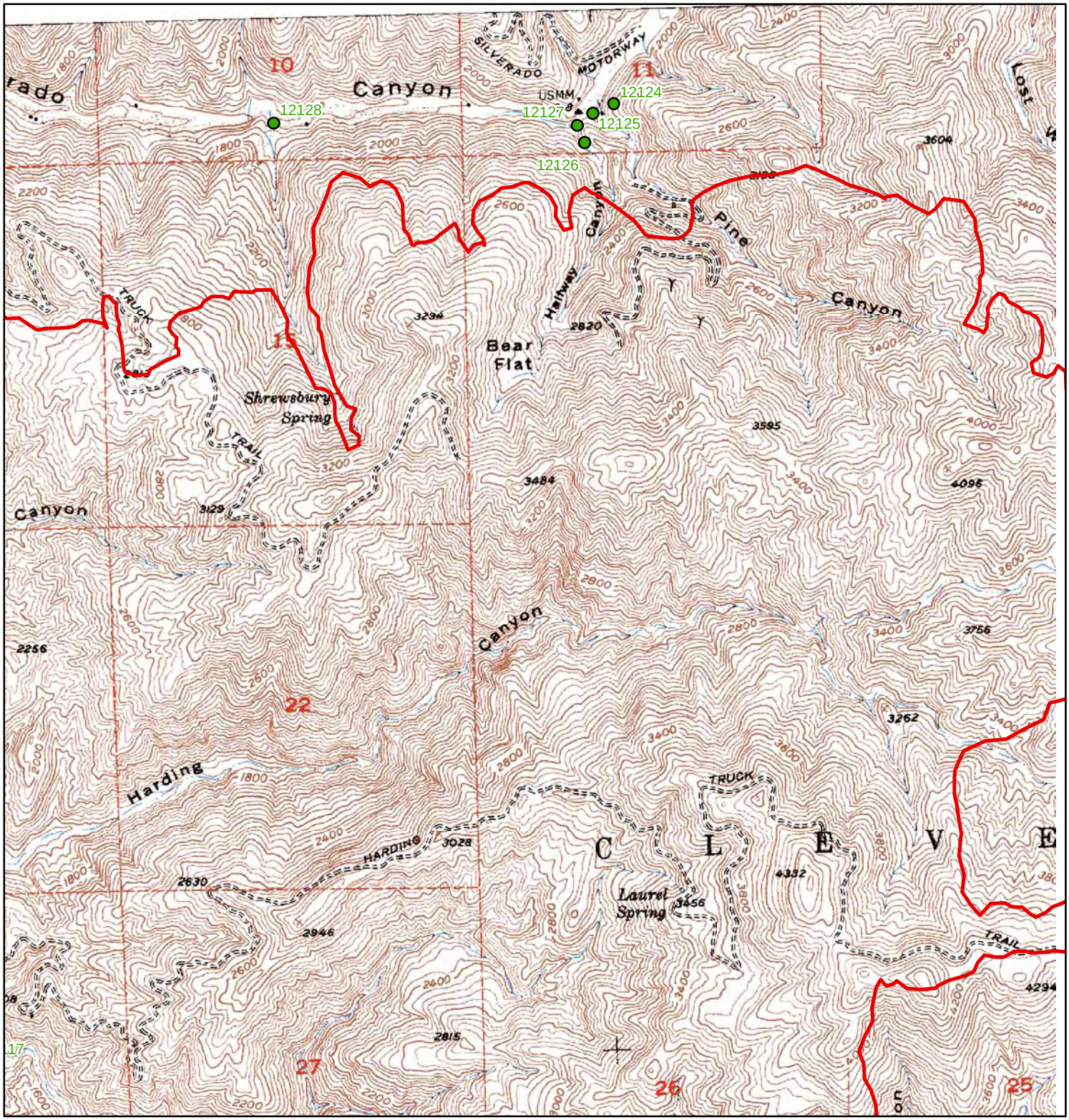
Projection: NAD 1983 California Teale Albers

Figure 4

Created By: W. Kallio, ESRI

Data Sources: OES, USGS, CGS, StreetMap

Santiago Fire, 2007
Burn Site Evaluation - Area 3



LEGEND

Contour Interval = 10, 25, and 50 feet

Sites At Risk

Fire Perimeter - November 7, 2007

Kilometers: 0, 0.5, 1, 2

Miles: 0, 0.25, 0.5, 1

Date: November 8, 2007

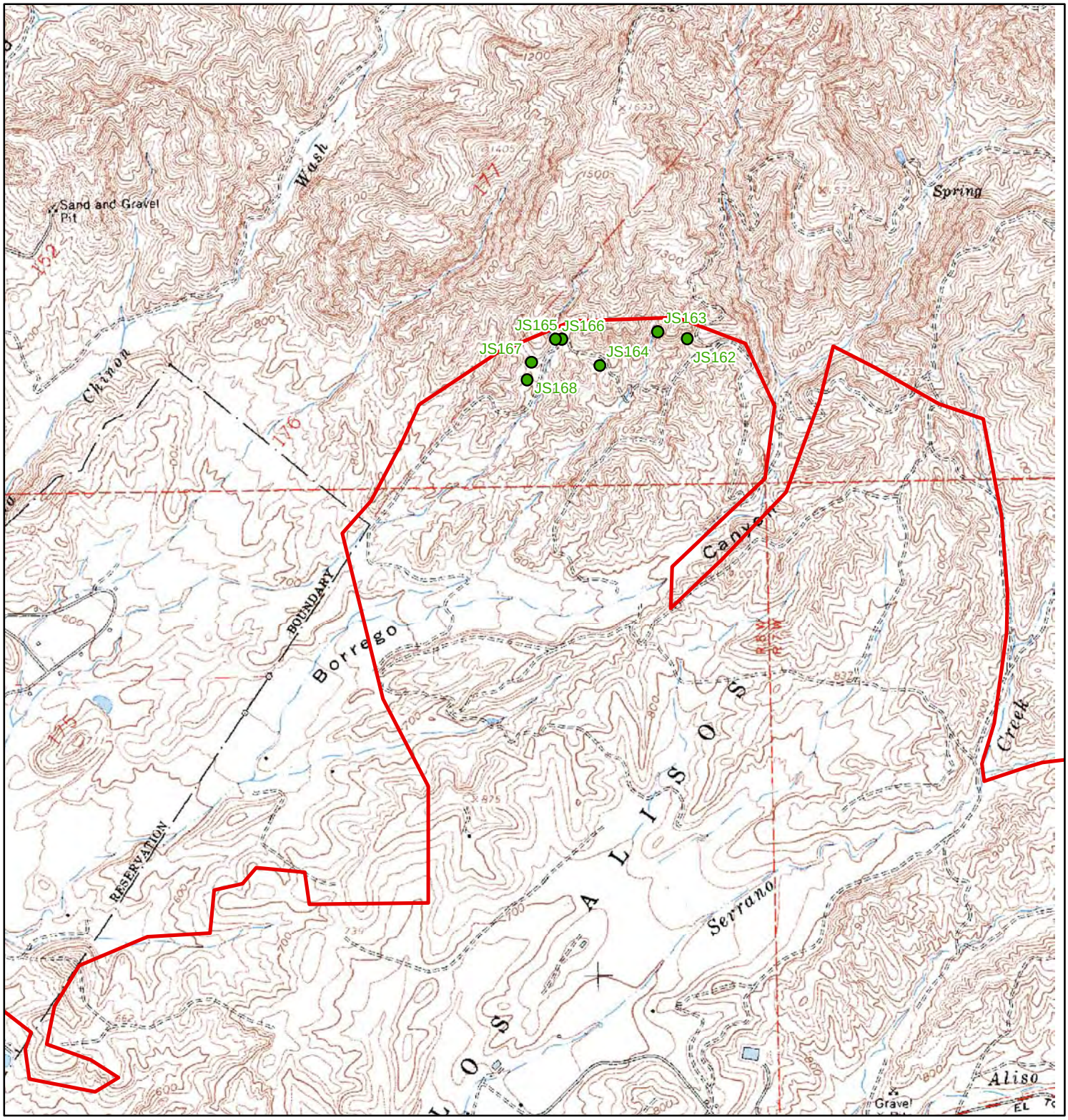
Projection: NAD 1983 California Teale Albers

Figure 5

Created By: W. Kallio, ESRI

Data Sources: OES, USGS, CGS, StreetMap

Santiago Fire, 2007
Burn Site Evaluation - Area 4



LEGEND

Contour Interval = 10, 25, and 50 feet

Sites At Risk

Fire Perimeter - November 7, 2007

Kilometers: 0, 0.5, 1, 2

Miles: 0, 0.25, 0.5, 1

Date: November 8, 2007

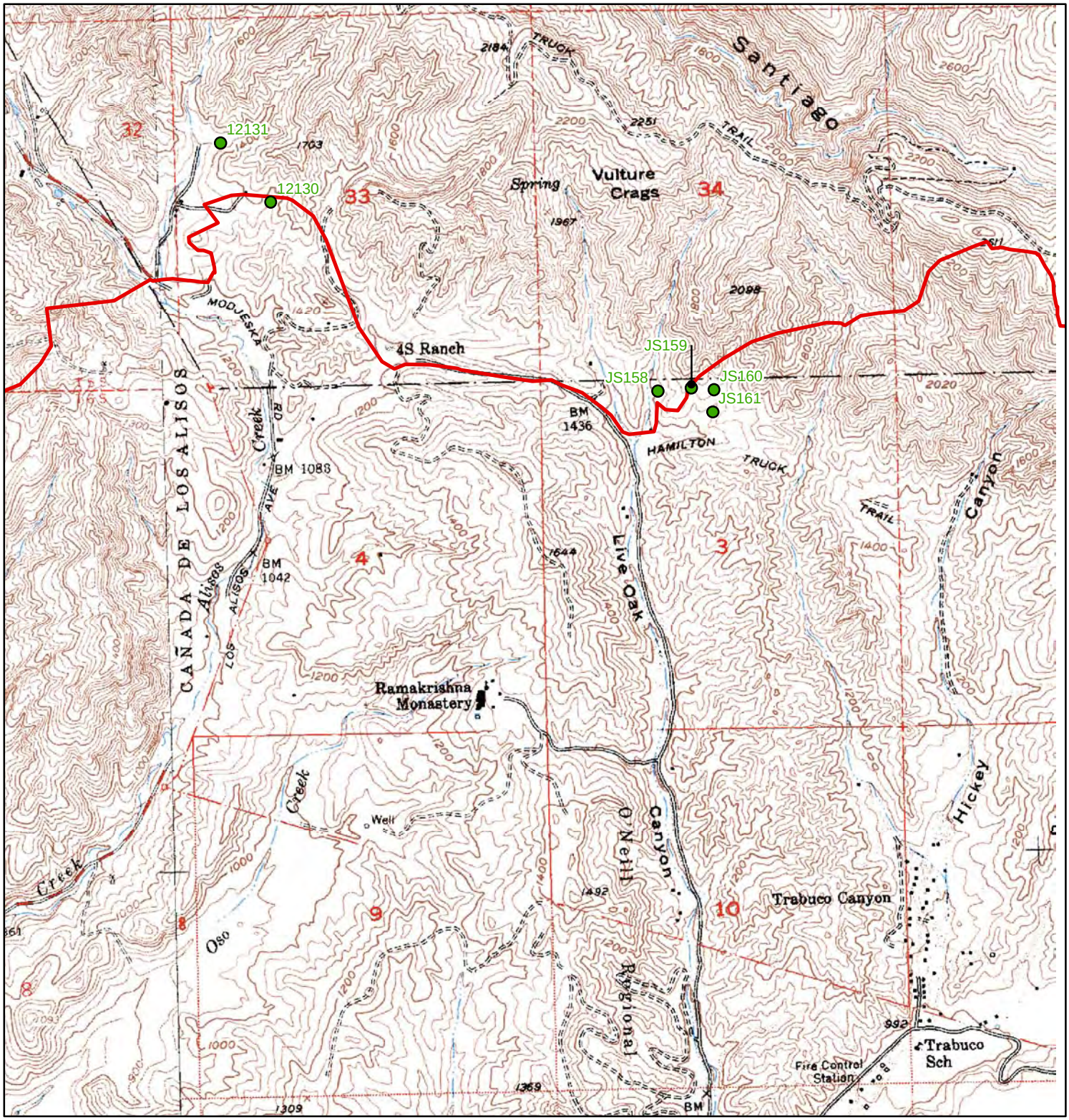
Projection: NAD 1983 California Teale Albers

Figure 6

Created By: W. Kallio, ESRI

Data Sources: OES, USGS, CGS, StreetMap

Santiago Fire, 2007
Burn Site Evaluation - Area 5



LEGEND

Contour Interval = 10, 25, and 50 feet

Sites At Risk

Fire Perimeter - November 7, 2007

Kilometers: 0, 0.5, 1, 2

Miles: 0, 0.25, 0.5, 1

Date: November 8, 2007

Projection: NAD 1983 California Teale Albers

Figure 7

Created By: W. Kallio, ESRI

Data Sources: OES, USGS, CGS, StreetMap

FINAL TECHNICAL SPECIALIST'S
Burned Area Emergency Response Report

Resource: Hydrology/Engineering

Fire Name: Santiago Fire CA-OSC-068555 November 2007

Author Name: Jeremiah McNeil, P.E., Engineer Water Resources
Department of Water Resources
Flood Management/Hydrology Branch
3310 El Camino Ave., Suite 200
Sacramento, CA 95821-9000

Abiodun Aderonmu, Engineer Water Resources
Department of Water Resources
Southern District
770 Fairmont Avenue,
Glendale, CA 91203

I. Potential Values at Risk

The values at risk identified in this assessment are the possible loss of life and property that may occur due to anticipated increase debris flows and potential flooding in the burned areas. Additionally, roads, bridges, culverts, and water supply may also be at risk due to increased flow in the creeks and potential clogging of culverts drainage structures by debris.

II. Resource Condition Assessment

A. Resource Setting

The 28,400-acre Santiago Fire burn area consists of mild-to very-steep slopes with annual rainfall variability averaging 23.0 inches in Modjeska Canyon to over 34.0 inches at Santiago Peak.

The 40,384-acre Santiago Creek watershed consists of several smaller watersheds, including but not limited to Silverado, Pine, Halfway, and Harding. Harding Creek and Santiago Creek converge in the town of Modjeska. The watershed above the confluence with Santiago Creek in Modjeska measures 3079-acres and Santiago Creek above the confluence measures 4895-acres.

The topography of the area ranges from 200 feet above mean sea level along the western edge of the fire to a high of approximately 4400 feet just below Modjeska Peak. Snow occasionally falls near the higher peaks in the basin, however a rain-on-snow event is unlikely. The Santiago Creek watershed drains to Irvine Lake. The lower slopes along the south and southwest portion of the burn area drain into numerous south and southwest flowing creeks from Trabuco to Santiago Canyons.

Irvine Lake operates as a water supply and irrigation reservoir. It was built in 1931, consists of an 810 foot high earth dam with a capacity of approximately 28,000 acre-feet and a drainage area of 40,384 acres or 63.1 square-miles.

Modjeska Reservoir (Harding Canyon Dam) is a concrete arch dam approximately 45 feet high that sits at the bottom of the Harding Creek watershed. The Reservoir has completely silted in over the years and is currently used as a groundwater source.

B. Findings of the On-The-Ground Survey

1. Resource condition resulting from the fire

The watersheds generally range from low- to moderate-burn severity on the west side of State Route 18 with occasional high burn spots to moderate- to high-burn severity on the east side of State Route 18. The highest burn severity occurred in the higher elevations of the Harding Creek watershed. Near Santiago Peak in the Santiago Creek watershed the burn severity ranged mainly from moderate to high with the higher burn areas around the higher elevations in the watershed.

Generally, roads, bridges, and culverts in the burned area were not directly impacted by the fire and appear to be in satisfactory condition. In the Whitting Ranch Park area, burn severity ranges from a few unburned areas to high severity. The roads in the park consist of dirt roads and hiking trails and are generally in the same condition as prior to the fire.

There were no burn areas observed in the immediate vicinity of the Modjeska Reservoir. According to Irvine Ranch Water District, owner of the dam, a visual inspection is performed on a weekly/monthly basis during their patrols. These visual assements are without documentation. The reservoir was filled with sedimentation due to a heavy rainfall in 1970's and there is no standing water body behind the dam. Since the reservoir has no capacity to store water, the Department of Water Resources (DWR) considers the dam outside of their jurisdiction and does not have it in its listing of dams.

During this BAER assessment, a preliminary inspection of the dam was conducted with the following findings:

- Access to the site is questionable during severe weather conditions.

- Crest - No visible cracks were observed on the crest or the downstream face of the dam. The crest appears to be in satisfactory condition.

- Abutments/Toe of Dam - No visible erosion observed on either side. Shrubs and trees were observed adjacent to the abutments.

- Seepage - None observed except for the leak at the bottom outlet pipe.

- Outlet Works - Appears to be in satisfactory condition.

III. Emergency Determination

The result of the intense burn in many areas of the Santiago Creek watershed left high potential for large scale flooding and debris flow during only light to moderate rainfall events. Many other smaller watersheds in the burn area could experience similar flooding and debris flow in the event of similar rainfall.

Irvine Lake will constitute the catchment for all the large debris flow and flooding in the Santiago Creek watershed. Along the south and southwest burn area the debris and flooding will flow down creeks to numerous catchments along their respective watersheds.

There are several moderate-to high-risk areas in the various smaller watersheds on the south potion of the burn between Trabuco Canyon and Agua Chinon Wash. Most of these entail single-family homes and property.

Pine Canyon and Halfway Canyon lie at the southeast side of Silverado Canyon. Both experienced high burn severity in the upper watersheds. Property and residences are located at the bottom of both respective watersheds at the far east end of Silverado Canyon. The immediate area around the property was not burned. However, high burn severity in the upper watershed makes flooding and debris flow likely with a rain event located in the upper watershed.

There are several properties in the town of Modjeska and Williams Canyon that could also have flooding and debris flow from smaller and even steeper watersheds immediately behind the respective properties.

The town of Modjeska sits at the confluence of both Harding and Santiago Creeks. The two high flow events of record in 1969 and 1998 both brought over 6,000 cfs flows through the town. The Harding Creek watershed area is almost entirely burned, at moderate to high intensity, with steep slopes. The Santiago Creek watershed above the confluence with Harding Creek also constitutes a high risk of flooding and debris flow. Although the watershed was not burned as heavily as the Harding Creek watershed, it was burned at a moderate-to high-severity. A significant percentage of the overall watershed was burned. Both watersheds come to a confluence in the town of Modjeska. This confluence constitutes an extreme risk with catastrophic consequences in the case of high rain, damming of the two stream channels, large debris flows, along with general flooding throughout a large portion of the town. The chance of flooding and debris flow in both watersheds is highly likely with very little rain. The greater the intensity of the rain event the higher the chance of flood and debris flows.

The Modjeska Dam has zero capability of storing surface water. Any debris flow from the watershed into the reservoir will flow almost vertically down into the downstream channel with the crest acting as a weir. The fall will impart substantial energy to the flow with potential for damage downstream.

County Parks on the west and southwest side of the burn area have high potential for trails and roads being washed out by only a small rain event. These are dirt roads and trails with limited ingess and egress.

All State and County roads in the burn area including State Route 18 are in danger of washout from flooding and jamming of culverts with debris flow.

IV. Treatments

Treatments for the burn area will be very difficult because of the topography of the burn area, the location of property throughout the burn area, the fact that many of the symptoms were pre-existing, and the likelihood of rain in the coming months.

Some of the roads in the Whitting Ranch Wilderness Park may need realignment and/or relocation as these may be washed out in the event of a debris slide, significant surface runoff or both. Further detailed investigation by the appropriate qualified professional will be required.

V. Discussion/Recommendations

Expect higher than normal flows with possible debris flow in all rain events. The higher the rainfall intensity the higher the risk for flooding and debris flow throughout all Santiago Fire burned area basins.

1. Damming of debris flow on either Harding or Santiago Creek's could have catastrophic effects on the town of Modjeska. An early warning monitoring system with various monitoring points in both basins upstream of the confluence to each respective peak is recommended.

2. Emergency evacuation plans should be implemented for the town of Modjeska.

3. Any dead/fire burned trees and vegetation, and live standing trees larger than 3 inches in diameter breast height in the bankfull channel and 5 feet horizontally above the bankfull channel (see Figure 8) of Santiago Creek from 100 feet downstream of home located at 29456 Modjeska Canyon to ¼ mile upstream of said home (see Figure 9) that could cause damming or choking of debris in the creeks should be removed immediately. A plan should be developed and approved by appropriate agencies to remove hazardous vegetation for the remaining downstream creek to Santiago Canyon Road to promote expected increase in debris flows.

4. The downstream channel of the Harding Canyon Dam should be protected with additional rip-rap to dissipate energy of falling flow over the crest. Further investigation is required to determine size of the rip-rap, extent of protection and structural integrity and stability of the dam.

5. All County, Private, and State roads and trails should be safely monitored during rain events.

6. Irvine Lake should be safely monitored for debris and sediment flows during rain events as large amount of debris may flow into the reservoir.

7. All other Debris/Sediment/Detention Dams should be monitored during rain events.

VI. References

USGS National Weather Information System
Peak Stream Flow for the Nation
http://nwis.waterdata.usgs.gov

Irvine Ranch Water District
http://www.irwd.com/

USGS Publications Database
http://pubs.usgs.gov/wri/wri934076/stations/11075800.html

Drinking Water Source Assessment and Protection Program
http://swap.ice.ucdavis.edu/surface/sources

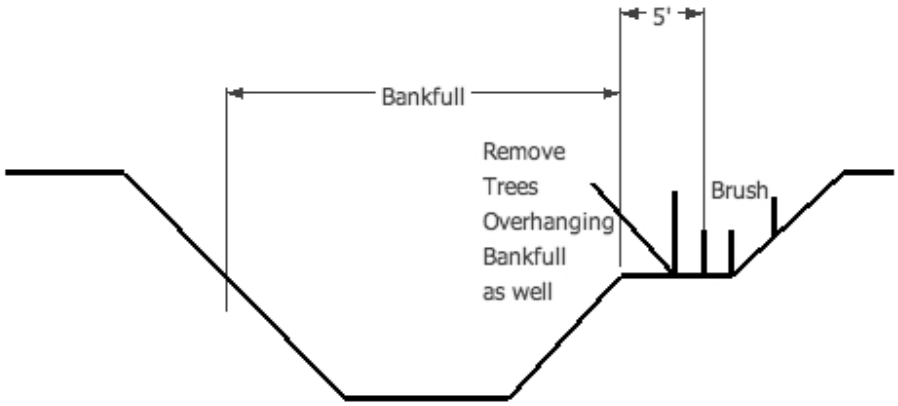
California Department of Water Resources, Division of Safety of Dams
http://damsafety.water.ca.gov/damlisting.cfm

Natural Resources Conservation Service
http://wmc.ar.nrcs.usda.gov/technical/HHSWR/Sugarcreek/regionalcurve.html

Definitions

(a) Bank Full – (1978, Dunne and Leopold) provided a generally accepted definition of bankfull discharge: The bankfull stage corresponds to the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels.

Figure 8: Bank Full Sketch



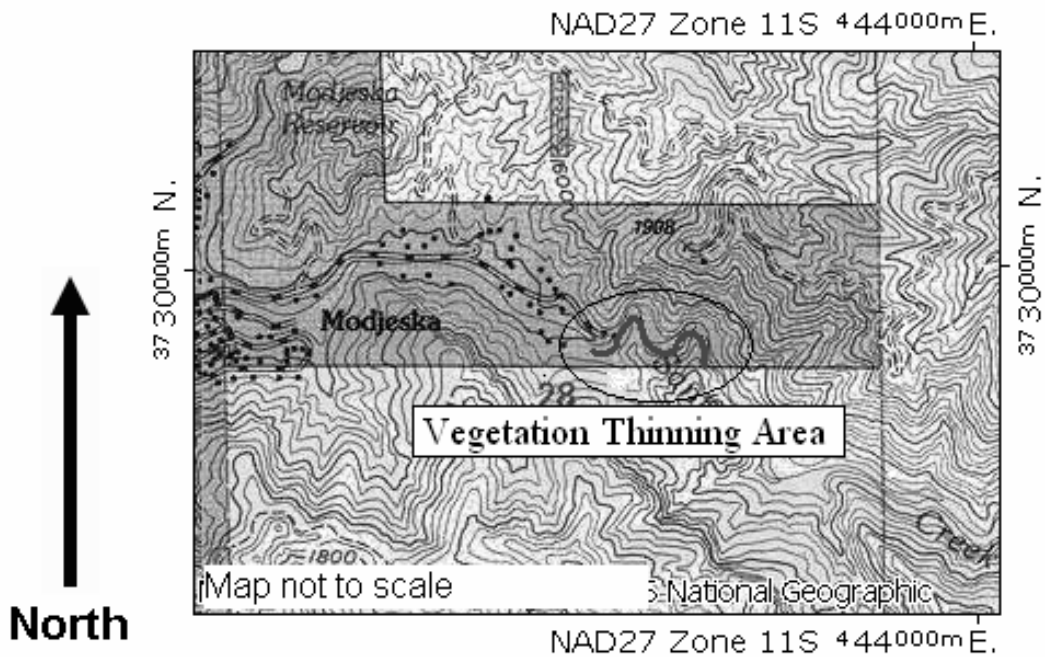


Figure 9: Vegetation Thinning Area

FINAL TECHNICAL SPECIALIST'S
Burned Area Emergency Response Report

Resource: Soils

Fire Name: Santiago Fire CA-ORC-068555 November 2007

Author Name: Robert Fastenau, Soils Specialist
Department of Water Resources
770 Fairmont Avenue, Suite 102
Glendale, CA 91203-1035
Office: (818) 500-1645 ext. 243

I. Potential Values at Risk

The 28,400-acre Santiago Fire burn area includes Federal, State, and private lands. This report focuses only on soils located in state and private lands. The potential values at risk identified by the BAER team include homes and people, schools, domestic water supplies, and county parks (recreational faculties).

II. Resource Condition Assessment

A. Resource Setting

The primary concentration of this assessment was the evaluation of soil condition on upslope areas close to the values at risk listed in the previous section. The areas evaluated are located in Modjeska, Harding, Williams, Silverado, and Santiago Canyons, and Hamilton Road, Portola Hills, and City of Lake Forest.

B. Findings

On inspection the burn areas, the fire resulted in low to high vegetation loss ranging over 80 percent of the burn area indicating a moderate to high burn severity.

Resource condition resulting from the fire:

The burn severity of the vegetation relates directly to effects of fire on the soil condition. Fire can impact a variety of physical properties including loss of soil structure, soil organic matter and reduced porosity. These changes can result in various indirect impacts including increased hydrophobicity (water repellency) which results in decreased infiltration and increased runoff that often results in increased erosion. Hydrophobic soils are created as fire breaks down organic matter and chemicals in the soils, releasing a gas which coats soil particles and reduces water penetration. The hydrophobic layer is generally one-half to-three inches beneath the soil surface and is commonly as much as one inch thick. The hydrophobicity of the soils investigated was determined to be high.

Consequences of the fire on values at risk

Loss of vegetation typically resulting in erosion following a fire. The severity of erosion is influence by topography including slope, and climactic factors, such as rate and amount of precipitation. The slopes observed while investigating the values at risk areas ranged from 20 percent to greater than 50 percent. Other factors such as soil texture can influence the erosion potential of a burn area. The soil texture observed during the assessment was determined to be medium-coarse to coarse indicating a high potential for erosion. The type of erosion that can occur includes sheet and rill erosion, soil creep, and mass wasting.

III. Emergency Determination

The value at risk in this assessment should include the possible loss of life and property caused by erosion and flooding from the steep hillsides (>50%) which are located in close proximity to the homes. There will be an increased risk of flooding depending on number and intensity of winter storm event. Erosion and flooding mudflows are considered by some to be naturally occurring phenomenon during pre-fire conditions. Burn severity combined with the slope steepness accelerates these events.

IV. Recommendation

The homes designated as moderate to high risk for erosion and flooding should consider contacting the Orange County Resources and Development Management Department (OCRDMD). Orange County has compiled a list of Best Management Practices (BMPs) that can be implemented by property owners after a fire and when rain is expected. The BMPs are as follows:

- Fiber Rolls (straw, flax or other material)
- Gravel Bag Berms
- Sand Bag Barriers
- Geotextiles and Mats (Erosion Control Blankets)

The description, installation and operation of these practices are from the California Stormwater BMP Handbook (www.cabmphandbooks.com).

V. References

Fire Effects on Soils Fact Sheet Series. Ministry of Agriculture and Lands, BC
www.agf.gov.bc.ca/range/publications/documents/**fire**2.htm

Erosion and Sediment Control: Preventing Additional Disasters After Southern California Fires. Watershed 96 Conference Proceedings, EPA

Orange County Resources and Development Management Department
www.ocrdmd.com/services/FireInfoPropertyOwners.aspx

FINAL TECHNICAL SPECIALIST'S
Burned Area Emergency Response Report

Resource: Recreation

Fire Name: Santiago Fire CA-ORC-068555 November 14, 2007

Author Name: Len Nielson, Registered Professional Forester #2792
California Department of Forestry and Fire Protection
118 Fortuna Blvd.
Fortuna CA, 95540
707-726-1258

I. Potential Values at Risk

Values at risk identified in this assessment include natural resources, roads, trails bridges, culverts, and scenic views. The affects of the fire have reduced ground cover and vegetation due to low to high burn severity. This condition is expected to result in an increase in runoff, down slope movement of fine ash and sediment, rock fall, exposed views, new trail trespass and debris flows until vegetation can reestablish.

II. Resource Condition Assessment

A. Resource Setting

The 28,464-acre Santiago Fire area consists of variable recreational opportunities and variable topography. The burn area is comprised of Private, Federal, State and County stake holder's, parks, and public open space. The County Parks, and public open spaces provide recreational opportunities in the form of hiking trails, bike trails, and wildlife observation to name a few. Within these areas, burn severity ranges from unburned to high. A majority of the high burn severity areas are located in Harding, Modjeska, Santiago, and Williams Canyon along the east side of the fire. Most of the High burn severity is owned by the Cleveland National Forest (USFS). Recreational related impacts within the USFS area are not addressed in this report. Within the remaining areas exist in a scattered mosaic pattern of burn severity as depicted by the Burn Severity Map (Figure 10).

B. Findings of the On-The-Ground Survey

Generally roads, trails, bridges, and culverts in the burned area were not directly impacted by the fire and appear to be in reasonable condition. In the Whitting Ranch and County Park areas, burn severity ranges from a few unburned areas to high severity. The dirt roads and trails in the public open spaces are generally in the same condition as prior to the fire. Many dirt roads and trails within the public open spaces are expected to have an increase in run off, causing erosion. Due to the range in burn severity in the public open spaces new trails and dirt roads are likely to be established. New dirt roads and trails should be

discouraged though fencing and warnings signs to the public. New trails will impact the seed bank within the soils and inhibit or decrease the reestablishment of native vegetation. Several roads and trails bisect creeks and are near the heads of swales and creeks that will erode into the prism of the road or trail. Fencing and erosion control structures should be placed at these locations to protect the public from falling hazards and to decrease erosion.

Weeds are likely to encroach within the recreational areas. Weed species are opportunistic and are effective at becoming established in disturbed soils, effectively displacing native habitat. The introduction of these weeds may affect the structure and function of the native plant communities and their ability to recover. Artificial seeding with any species is not likely to produce significantly better results than allowing natural vegetative recovery (CNPS, 1995). Hydo-mulching and hydro-seeding is discouraged.

III. Emergency Determination

The result of the intense burn in many areas of the fire left high potential for large scale flooding and debris flow during even only light to moderate rainfall events. High burn severity in the upper watersheds makes flooding and debris flow likely with rain events located in the upper watersheds. Within the High and Moderate burn severity, immediate erosion is anticipated to create potential hazards to the public. Members of the public utilizing the dirt roads and trails should be warned of the danger of increased flooding potential and rapid erosion along dirt roads and trails from light to moderate rainfall events.

IV. Treatments

Treatments for the burn area will be difficult because of the topography of the burn area, public usage, the location of dirt roads and trails throughout the burn area. Roads and trails designated as moderate to high risk for erosion and flooding should consider contacting the Orange County Resources and Development Management Department (OCRDMD). Orange County has compiled a list of Best Management Practices (BMPs) that can be implemented by property owners after a fire and when rain is expected. The BMPs are as follows:

- Fiber Rolls (straw, flax or other material)
- Gravel Bag Berms
- Sand Bag Barriers
- Geotextiles and Mats (Erosion Control Blankets)

The description, installation and operation of these practices are from the California Stormwater BMP Handbook (www.cabmphandbooks.com).

V. Recommendations

Expect higher than normal flows with possible debris flow in all rain events. The higher the rainfall intensity the higher the risk for flooding and debris flow throughout all Santiago Fire burned area.

1. Implement appropriate BMPs upstream of sensitive riparian habitats to minimize sediment load.

2. Emergency evacuation plans should be implemented to increase public safety. Emergency evacuation routes should be cleared of all dangerous vegetation, including hazard trees that may impede ingress and egress for the public and emergency vehicles.

3. Seeding/hydroseeding of the burn area should not be conducted.

4. Public open space recreation areas should be closed to the public for two (2) years to allow vegetation to recover undisturbed and for trail and road improvement and maintenance.

5. Prefire management is encouraged to reduce fire damage along trails, roads, Parks and open spaces. Parks and open spaces are encouraged to construct firebreaks and fuel management to reduce the potential for catastrophic fires.

6. A plan should be developed and approved by appropriate agencies to remove hazardous vegetation from creeks within the public accessible open spaces to promote forest health and prevent debris dams.

7. All dirt roads and trails should be safely monitored for washout and debris flows during in rain events.

VI. References

Orange County Resources and Development Management Department
www.ocrdmd.com/services/FireInfoPropertyOwners.aspx

California Native Plant Society. 1995. Statement of Policy: Seeding After Wildfire. Accessed at
http://www.cnps.org/archives/seeding.pdf on November 10 2007.

FINAL TECHNICAL SPECIALIST'S
Burned Area Emergency Response Report

Resource: Wildlife

Fire Name: Santiago Fire CA-ORC-068555 November 2007

Author Name: Erinn Wilson, Wildlife Biologist,
California Department of Fish and Game
4665 Lampson Avenue,
Los Alamitos California, 90720
Office: (818) 500-1645 ext. 243

Resource Setting

The 28,400-acre Santiago Fire burn area consists of the western foothills of the Santa Ana Mountains and the Cleveland National Forest. Most of the area east of the Santiago Canyon road belongs to the Cleveland national Forest and hads been evaluated by the Federal BAER team. The foothill areas west of Santiago Canyon Road consist of mostly private and County-own land that has been placed in conservation (Reserve System) under the Central / Coastal Natural Communities Conservation Plan (NCCP) to allow for the conservation of 47 "covered species" and their habitats. Several "covered species" are known to occur within the section of the Reserve System burned by the fire including; Whiting's Ranch, Limestone Canyon, Loma Ridge, Hicks Canyon, El Toro, Agua Chinon Canyon, Rattlesnake Canyon, and Serrano Creek.

I. Potential Values at Risk

This report assesses the effects of the Santiago Fire and the proposed effects of the Burned Area Emergency Response (BAER) treatments for the following state and federally listed as endangered or threatened species, State Species of Concern, and "Covered Species" (California Department of Fish and Game website) of the Central Coastal Natural Communities Conservation Plan (NCCP).

Table 1 – Values at Risk

Common Name	Scientific Name	Status
Arroyo toad	*Bufo californicus*	Federal Endangered
Coastal cactus wren	*Campylorhynchus brunneicapillus*	State Species of Concern NCCP Target Species
Coast horned lizard	*Phyrnosoma coronatum*	State Species of Concern NCCP Target Species
Coyote	*Canis latrans*	NCCP Target Species
Coastal California gnatcatcher	*Polioptila californica californica*	Federal Endangered NCCP Target Species
Grey fox	*Urocyon cinereoargenteus*	Federal Endangered State Species of Concern NCCP Target Species
Least Bell's vireo	*Vireo Bellii pusillus*	State and Federal

		Endangered NCCP Target Species
Mountain lion	*Felis concolur*	State Fully Protected
Red diamond rattlesnake	*Crotalus ruber ruber*	State Species of Concern NCCP Target Species
San Diego woodrat	*Neotoma lepida intermedia*	State Species of Concern NCCP Target Species
Southern California rufus crowned sparrow	*Aimophila ruficeps canescens*	State Species of Concern NCCP Target Species
Southwestern pond turtle	*Actinemys marmorata pallida*	State Species of Concern
Santa Ana speckled dace	*Rhinichthys osculus*	State Species of Concern
Western spadefoot toad	*Spea hammondii*	State Species of Concern
Two-striped garter snake	*Thamnophis hammondii*	State Species of Concern
Orange throated whiptail	*Aspidoscelis hyperythra*	State Species of Concern NCCP Target Species

.

II Resource Condition Assessment

A. Resource Setting

The Santiago Fire occurred in the southwestern portion of the Santa Ana Mountain foothills. The habitats of the burn area can approximately be divided into two sections of lower and high elevation. Coastal sage scrub, cactus scrub, and native and nonnative grasslands with extensive riparian drainages dominate the lower elevation habitats. Lower montane mixed chaparral and chamise chaparral (chaparral) dominate the higher elevation lands with dense oak/sycamore riparian drainages. Wildlife affected by the fire includes coastal sage scrub species, cactus scrub species, chaparral species, and riparian species (oak, sycamore, and/or willow dominated). Severity of the burn varied throughout the burn area. Low severity burn areas include El Toro, Lower Agua Chinon, Bee Canyon. Moderate severity burn areas include Siphon Reservoir, portions of Loma Ridge and Limestone Canyon, Santiago Canyon, and riparian corridors along Modjeska Canyon. High severity burn areas include Whitting's Ranch, portions of Limestone Canyon, Rattlesnake Reservoir, Upper Agua Chinon, Hicks Canyon and the steeper areas of the east fire line.

One cactus scrub species of special interest is the coastal cactus wren.

Coastal sage scrub/chaparral species of special interest include:
Bobcat
Coyote
Coastal California gnatcatcher
Grey fox
Red diamond rattlesnake
San Diego woodrat
Southern California rufus crowned sparrow
Two striped garter snake
Orange throated whiptail
Western mastiff bat

Riparian and Fisheries Species:
Arroyo toad
Least Bell's vireo
Santa Ana speckled dace
Southwestern pond turtle
Western spadefoot toad
Two striped garter snake

B. Findings of the On-the-Ground Survey

1. Resource condition resulting from the fire

Upland species

Coastal sage scrub and cactus scrub habitats generally burned at a moderate to high severity. Irregular burn patterns along the western edge near Portola Drive created a mosaic of low severity burn patterns. Direct impacts to coastal sage scrub/cactus scrub were of moderate to high severity. Chaparral habitats of high elevation along the eastern perimeter of the fire burned at a higher severity.

Riparian Habitats

Riparian habitats generally burned moderate throughout the fire perimeter. Several large oak/sycamore riparian systems including Santiago and Modjeska Canyons burned at a low severity while Serrano Creek, Rattlesnake Canyon, and Limestone Canyon sustained heavy mortality to oaks. Generally, willow riparian drainages throughout the fire sustained high severity burns.

2. Potential Consequences of the fire on values at risk

Upland species

Bird species including coastal California gnatcatcher and southern California rufus crowned sparrow recover quickly from fire as the coastal sage scrub recovers within one to five years after the fire. El Toro and Whiting's Ranch accounted for approximately two thirds (Central Coastal NCCP, 1995) of the cactus wren and coastal gnatcatcher populations for the Central Subregion. Coastal cactus wren, a cactus scrub dependant species, recover much slower. Cactus scrub must be taller then three feet to support wrens. Data from the Laguna Fire of 1993 revealed a 58 percent decline in the wren populations 13 years following the Laguna Fires (Mitrovich and Hamilton, 2006).

Reptile species including red diamond rattlesnake, San Diego woodrat, two-striped garter snake, and orange-throated whiptail likely sustained high mortality as a direct result of the fire.

Mountain lions, deer, and mesopredators including bobcat, coyote, and grey fox will typically survive the initial fire event, only to starve in the following year, as food resources are scarce. Based on the severity and the extent of the burn, mortality of mountain lion, deer, and mesopredators is anticipated. However, it is likely that

mountain lion, deer, and mesopredator populations will rebound as small mammal populations recover. The fire significantly devastated wildlife movement corridors throughout the burn areas by removing vegetation cover.

Riparian Species

The Santa Ana speckled dace is the only native fish species known to be extant within the Santa Ana Mountains (O'Brien, 2006 and Harmsworth 1998). Populations are known to occur in Harding Canyon, Santiago Canyon, and Silverado Creek. The Santa Ana Speckled Dace has a high risk of extirpation because of the intensity and severity of the burn in the riparian area. There is a limited amount of ponded water available to support fish, and contamination from ash and sedimentation is likely. Potential populations within the fire perimeter may have survived the fire, but will continue to be threatened by potential heavy sedimentation.

The state and federally listed endangered Least Bell's vireo is a spring migrant to several willow riparian vegetated reservoirs and detention basins within the burn area. Known nesting territories have been documented at Rattlesnake Reservoir, Siphon Reservoir, and Agua Chinon detention basin. Willow riparian habitat in these areas burned at a moderate to high severity. Because least Bell's vireo is a spring migrant, no direct impacts to the species occurred during the fire. Indirect impacts will result when least Bell's vireo return in spring 2008 and find minimal or no suitable nesting habitat to produce offspring. The U.S. Fish and Wildlife Service estimated 12 territories of known least Bell's vireo were burned in the Santiago fire (Medak, personal comm.). In addition, nesting habitat of larger populations of vireo is known to have burned in other California fires in October 2007.

Riparian reptile and amphibian species including arroyo toad, southwestern pond turtle, western spadefoot toad, and two-striped garter snake species survivorship depended on the severity of the burn in the riparian drainages. Arroyo toads in Silverado Canyon likely survived the fire if riparian areas burned at a low intensity, but could be impacted by extensive sedimentation after the fire. Reptiles and amphibians in Harding Canyon likely experienced high mortality due to the higher severity burns. However, western spadefoot toad, known to occur on El Toro (observed in recent surveys for County of Orange, Alton Parkway Expansion project), potentially survived the fire due to the low severity of the burn in vernal pool locations.

III. Emergency Determination

The fire burned a significant portion of the NCCP Reserve System managed by Irvine Ranch Land Conservancy, Nature Conservancy, and Nature Reserve of Orange County. The goal of the NCCP Reserve is for long-term protection of three target species (coastal California gnatcatcher, coastal cactus wren, and western whiptail) and 47 other "covered species" indicated by an asterisk above. Because over 67 percent of the Reserve System burned in the Santiago Fire, several species may be at risk from long-term displacement or extirpation from fire area.

IV. Treatments to Mitigate the Emergency

A. Treatment Type

Methods of treatments for burn areas include:

- Implement appropriate BMPs upstream of sensitive riparian habitats to minimize sediment load.
- Conduct revegetation efforts where appropriate to promote rapid recovery of native habitats.
- Conduct post fire population surveys for wildlife species.
- Conduct long-term monitoring of key species to document long-term population trends as a result of the fire.
- Coordinate local agency activities during maintenance activities to avoid, minimize, and mitigate additional impacts to species.

B. Treatment Objective

The treatments objectives are to monitor wildlife populations and encourage adaptive management of sensitive wildlife species both within the NCCP Reserve System (Irvine Ranch Conservancy, and County Parks Land) and on private land.

1. Treatment Description

Erosion Control

- Stabilize slopes over between 20 and 50 percent, where feasible, with biodegradable matting to limit slope erosion while also limiting impacts to recovering native vegetation and wildlife habitat.

- Avoid use of hydroseed and hydromulch. Hydromulch and hydroseed are ineffective as there is a lack of soil moisture for them to be efficient, they inhibit natural recruitment from the native seed bank, and they introduce exotic weed species into the native habitat.

- Vegetation important to sensitive species (e.g., cactus wren, California gnatcatcher), especially unburned habitat in known nesting or foraging territories, should be avoided to the greatest extent feasible.

- Use appropriately sized culverts as determined by an appropriate agency when replacing or improving drainage structures.

- Vegetation clearing should be limited to smallest area feasible to accomplish activities safely. Vegetation important to sensitive species (e.g., cactus wren, California gnatcatcher, and least Bell's vireo), especially unburned habitat in known nesting or foraging territories, should be avoided to greatest extent possible. Please see Hydrology/Engineering BAER report for further details.

Revegetation of Native Habitat

- Revegetate riparian habitats in burn areas to encourage habitat regrowth. Riparian vegetation will promote soil stabilization as well as provide refugia for wildlife species. Natural revegetation is expected occur with the same native species that occurred before the fire.

- Plant cactus scrub in burn areas of known cactus wren occurrences to promote faster restoration of habitat for the cactus wren. Attempt to expand the area of suitable habitat to reestablish the wren population size

Population surveys and long term monitoring

- Conduct long-term bird monitoring for Coastal California gnatcatcher, coastal cactus wren, and Southern California rufus-crowned sparrow throughout the burn area to evaluate the likelihood of direct mortality, the extent of duration of displacement, and the rate and extent of recovery of lost habitat.

- Conduct spring Santa Ana speckled dace surveys in Santiago Canyon, Harding Canyon, and Silverado Canyon to determine if the Santa Ana speckled dace population has been impacted or even extirpated.

- Conduct long-term small mammal monitoring throughout the burn area to evaluate mortality rates from the fire.

- Monitor mountain lion, deer, and -mesopredator populations and movement patterns in the burn area to monitor use of habitat and population size and health.

- The Department of Fish and Game should be consulted regarding the protocols and season of wildlife surveys.

- Document unburned habitat and monitor for use of sensitive species.

Local agency Coordination

- Local agencies and jurisdictions should coordinate activities with Nature Reserve of Orange, Irvine Ranch Conservancy, and Wildlife Agencies to avoid, minimize, and mitigate impacts to sensitive species during post-fire recovery efforts.

- Coordinate local jurisdiction and private landowner activities within riparian areas and in listed and “covered species” habitat to address wetland permitting (including, but not limited to Department of Fish and Game, Regional Water Quality Control Board, and U.S. Army Corps of Engineers) and California and Federal Endangered Species issues.

- Resource Agencies including Department of Fish and Game and U.S. Fish and Wildlife Service should be consulted regarding the suite of species, appropriate vegetation protocols, and season for re-vegetation efforts.

- Recommend the above-mentioned government and non-government groups mutually staff and participate on a Santiago Fire recovery and remediation Team, commencing with the ending of the BAER Team. This will facilitate coordination, timeliness and environmental sensitivity of the projects that have been/will be proposed for the burned area’s watershed.

V. References

Department of Fish and Game, http://www.dfg.ca.gov/wildlife/species/

County of Orange, Natural Community Conservation Plan and Habitat Conservation Plan, Orange County Central and Coastal Subregion, December 7, 1995.

Mitrovich, J. Milan and Hamilton A., Robb, Status of the Cactus Wren (Campylorhynchus brunneicapillus) with the Coastal Subregion of Orange County, California, May 2007.

O'Brian, John, Department of Fish and Game, Unpublished survey report on Harding Canyon and Santiago Creek.

U.S. Fish and Wildlife Service, Personal Conversation with Christine Medak, November 9, 2007.

FINAL TECHNICAL SPECIALTIST'S
Burned Area Emergency Response Report

Resource: Botany

Fire Name: Santiago Fire CA-ORC-068555 November 2007

Author Name: Kelly Schmoker, Botany
California Department of Fish and Game
3602 Inland Empire Blvd, C220
Ontario, CA 91764
Office: (909) 980-8607

I. Potential Values at Risk

The 28,400 acre Santiago Fire burned many different vegetation communities on a combination of Federal, State, County and private land. This report will focus on impacts to plant communities including sensitive and listed species on State, County and private land.

The major plant communities found within the fire burn area include: coastal sage scrub, chaparral, oak woodland, cactus scrub, riparian mixed hardwood (alder, sycamore, willow, cottonwood), annual grasses and forbs, and perennial grasses and forbs.

Table 2. Rare, Threatened and Endangered Plants in the Santiago Fire Area

Scientific Name	Common Name	Location within Fire
Baccharis malibuensis	Malibu baccharis	Whiting Ranch (Freemont Cyn.)
Brodiaea filifolia	thread-leaved brodiaea	Cleveland National Forest
Calochortus plummerae	Plummer's mariposa lily	Cleveland National Forest
Calochortus weedii var. intermedius	intermediate mariposa lily	Round Canyon, Agua Chinon, Silverado Canyon, Santiago Creek,
Cupressus forbesii	Tecate cypress	Cleveland National Forest
Dudleya cymosa ssp. ovatifolia	Santa Monica Mountains dudleya	Cleveland National Forest
Dudleya multicaulis	many-stemmed dudleya	Hicks and Rattlesnake Canyons
Lepechinia cardiophylla	heart-leaved pitcher sage	Cleveland National Forest
Lepidium virginicum var. robinsonii	Robinson's pepper-grass	Cleveland National Forest
Monardella hypoleuca ssp. lanata	felt-leaved monardella	Cleveland National Forest
Monardella macrantha ssp. hallii	Hall's monardella	Cleveland National Forest

Nama stenocarpum	mud nama	Mouth of Round Cyn.
Nolina cismontana	chaparral nolina	The Sinks, Black Star Canyon
Phacelia suaveolens ssp. keckii Southern Coast Live Oak Riparian Forest Southern Cottonwood Willow Riparian Forest Southern Riparian Scrub Southern Sycamore Alder Riparian Woodland Valley Needlegrass Grassland	Santiago Peak phacelia	Cleveland National Forest Multiple Locations Modjeska Canyon, Multiple Locations Santiago Creek Santiago Creek, Modjeska Canyon Limestone Canyon, Irvine/Santiago Mesa

II. Resource Condition Assessment

A. Resource Setting

Sensitive plant locations were overlaid with new dozer line construction areas that resulted from the fire suppression activities. Based on this analysis, certain plant populations were identified as possibly being disturbed during suppression activities. The four areas identified with possible sensitive plant conflicts were:

- Valley needlegrass grassland - Dozer Lines at Limestone Canyon and Irvine/Santiago Mesa
- Intermediate mariposa lily – Dozer Line at upper Aqua Chinon
- Intermediate mariposa lily, Santa Monica Mountains dudleya – Dozer Line between Santiago and Trabuco Creeks
- Intermediate mariposa lily, southern sycamore alder riparian woodland, chaparral nolina – Dozer Line in Black Star and Santiago Canyon

Maps of these areas showing known sensitive plant locations and the dozer lines are included in Appendix A.

B. Findings

Several direct impacts from dozer lines to sensitive plant communities did occur on non-Federal land, though several more occurred on Federal land. Restoration and monitoring of these areas will be recommended as a treatment.

Seeding/hydroseeding of the burn area should not be conducted. Studies have shown that native vegetation should recover rapidly after the fire, without any further treatment (Keeley, 1977). Introduction of non-local “native” seed may alter or genetically dilute the phenotypes suited for the local ecotype. Seeding may change the dominance of species within a habitat type thereby altering the density, structure, and function of the habitat for local wildlife (food, breeding, cover, etc.) (Keeler-Wolf, 1995). Artificial seeding with any species is not likely to produce significantly better results than allowing natural vegetative recovery (CNPS, 1995).

III. Emergency Determination

The fire suppression and rehabilitation efforts have the potential to introduce and spread weed populations. Weed species are opportunistic and are effective at becoming established in disturbed soils, effectively displacing native habitat. The introduction of these weeds may affect the structure and function of the native plant communities and their ability to recover. During the BAER team limited survey, several weed species were observed occurring within the Santiago Fire area (Table 3).

Table 3. Invasive Weeds Observed In and Adjacent to the Santiago Fire

Scientific Name	Common Name
Centaurea solstitialis	Yellow Star Thistle
Foeniculum vulgare	Wild Fennel
Salsola tragus	Russian Thistle
Spartium junceum	Spanish Broom
Cynara cardunculus	Artichoke Thistle
Ricinus communis	Castor Bean
Avena sp.	Oat
Brassica Nigra	Black Mustard
Bromus spp.	Annual Grasses

This burn, coupled with a highly altered local fire regime, may favor the establishment and spread of exotic weed species over large portions of the burn area.

IV. Treatments to Mitigate the Emergency

A. Specific Recommendations

The following measures are proposed to mitigate the physical disturbance to sensitive plant communities and impacts to rare, threatened, and endangered plant species resulting from fire suppression activities;

- Santiago/Irvine Mesa – dozer tracks impacted perennial and mixed grasslands, cactus sage scrub, and riparian habitat. Restoration of these areas as well as noxious weed control (short and long term) and monitoring are recommended.
- Bee and Round Canyons – existing dirt roads were widened for dozer access. Monitor and control weeds around disturbed roads to prevent widespread establishment and introduction into new areas.
- Upper Agua Chinon - existing dirt roads were widened for dozer access. Monitor and control weeds around disturbed roads to prevent widespread establishment and introduction into new areas. Intermediate mariposa lily (*Calochortus weedii var. intermedius*) has been mapped along the access road and adjacent slopes within this impact area. Care should be taken to not impact this species during weed removal and monitoring.
- Limestone Canyon – widened existing dirt road and created safety zones impacting native perennial grassland, mixed native/non-native grassland,

cactus sage scrub, and stream habitat. Restoration of these habitats should occur as well as weed control and monitoring along all disturbed areas.

B. General Recommendations

The following measures are general recommendations for the burn area to mitigate the impact of the burn on sensitive plant communities and impacts to rare, threatened, and endangered plant species resulting from fire suppression activities;

- Conduct rare plant surveys and mapping annually within the burn area to assess long term impacts from frequent fires on sensitive plant recovery.
- Conduct oak regeneration studies in areas where oak woodlands were burned to assess post fire recruitment.
- Conduct native grassland regeneration studies to assess long term impacts from frequent fires and assess impacts from non-native grass competition.
- Monitor recovery of cactus sage scrub over the long term to ensure recovery of coastal cactus wren habitat.
- Conduct annual weed mapping to determine any type conversion from native habitat to weed dominated habitat after the fire. Develop an eradication program for any areas where weeds are inhibiting natural post fire recovery of native habitats.
- Seeding/hydroseeding of the burn area should not be conducted.
- Mulch should not be applied to open space areas within the burn area. Mulch may introduce weed seed as well as suppress germination and growth of native species.
- If clearing chokepoints within channels is necessary to reduce risk to life and property, only the minimum amount of vegetation should be cleared that enables this goal to be met. Vegetation smaller than 3" dbh should be left in the channel, and only the bankfull channel should be cleared. Channels should be surveyed for *Arundo donax* prior to any clearing and if found, should be carefully removed in a manner to prevent spread of this invasive species.
- Open space recreation areas should be closed to the public for two (2) years to allow vegetation to recover undisturbed.

V. References

California Natural Diversity Database. 2005. RareFind 3, Version 3.1.0 (April, 2007, update). Sacramento, CA: California Department of Fish and Game.

California Native Plant Society. 1995. Statement of Policy: Seeding After Wildfire. Accessed at http://www.cnps.org/archives/seeding.pdf on November 10 2007.

California Native Plant Society (CNPS). 2006. Inventory of rare and endangered plants of California (seventh edition). Rare Plant Scientific Advisory Committee, David P. Tibor (convening ed.). Sacramento, CA: California Native Plant Society.(http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi).

Hickman, J. C. (ed.). 1993. The Jepson manual. Berkeley, CA: University of California Press.

Keeler-Wolf, T. 1995. Post-Fire Emergency Seeding and Conservation in Southern California Shrubs. In:
Wildfires in California Brushlands: Ecology and Resource Management. J.E. Keeley and T. Scott
(eds.) International Association of Wildlands Fire, Fairfield, WA.

Keeley, J.E. 1977. Seed production, seed populations in soil, and seedling production after fire for two
congeneric pairs of sprouting and non-sprouting chaparral shrubs. Ecology 58:820-829.

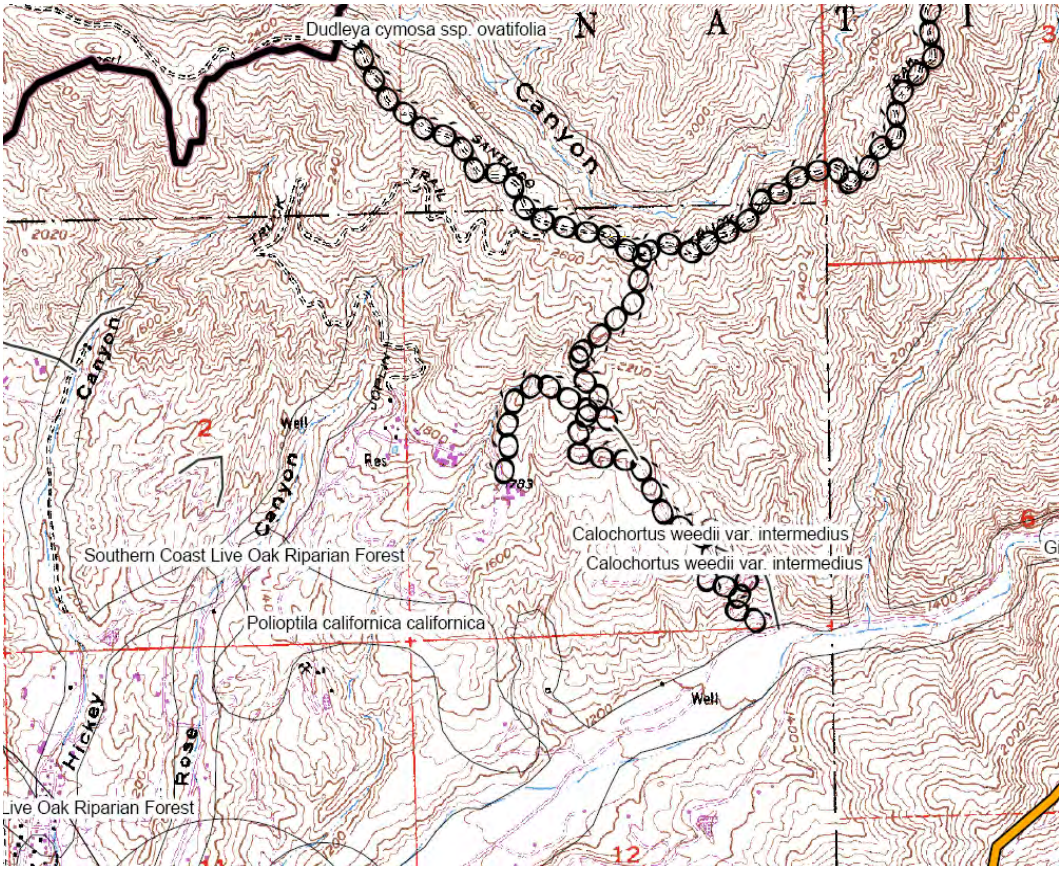


Figure 11. Potential Species Affected Between Santiago and Trabuco Creeks.

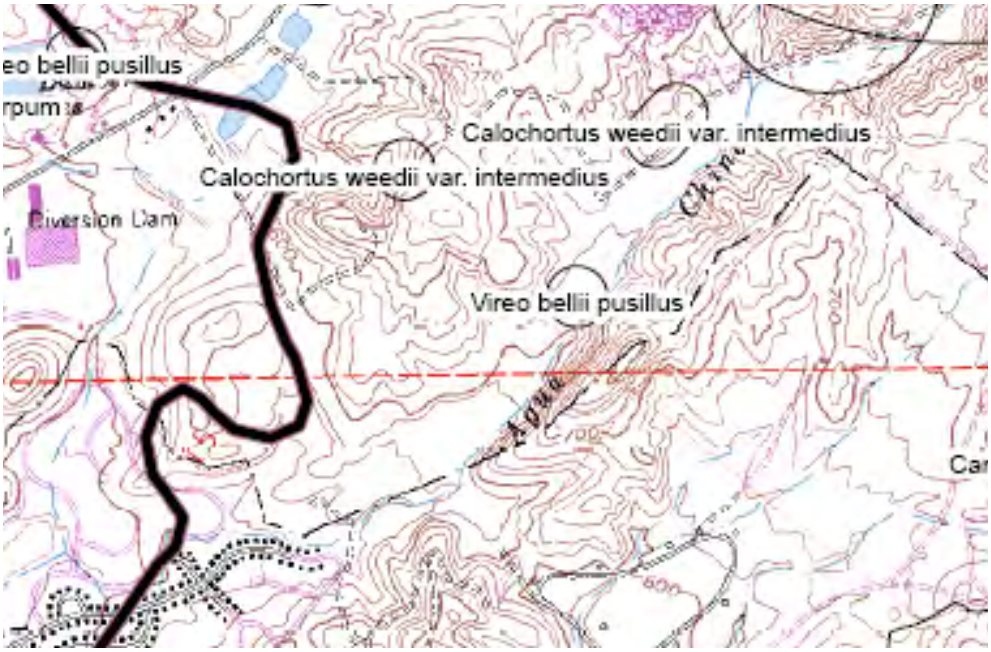


Figure 12. Potential Species Affected in Upper Agua Chinon.

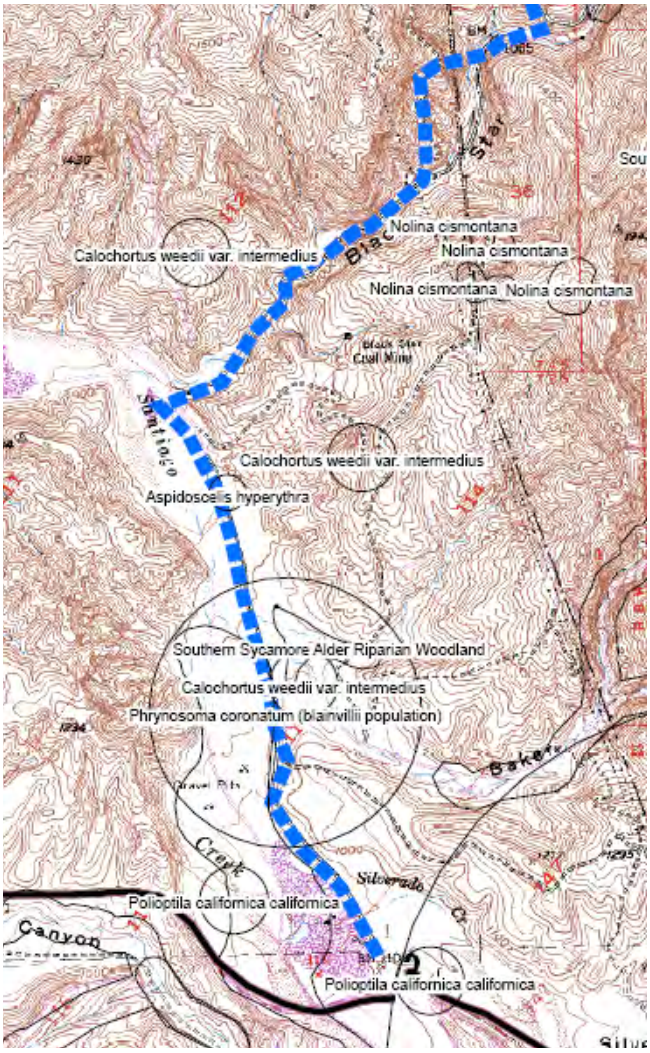


Figure 13. Potential Species Affected in Black Star Canyon and Santiago Creek.

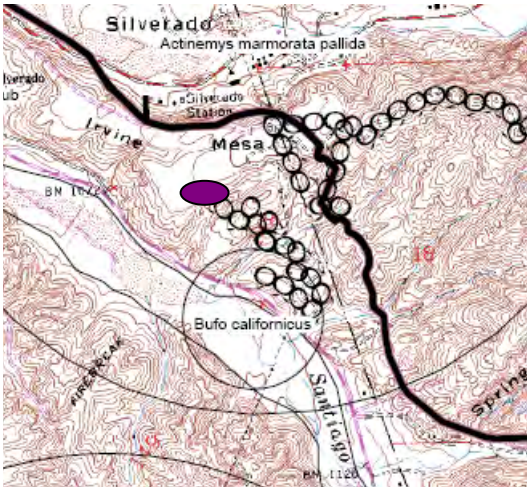


Figure 14. Potential Species (valley needlegrass in purple) Irvine/Santiago Mesa.

FINAL TECHNICAL SPECIALTIST'S
Burned Area Emergency Response Report

Resource: Cultural Resources

Fire Name: Santiago Fire CA-ORC-06855 November 11, 2007

Author Name: Christopher Corey, Associate State Archaeologist
California State Parks, 1416 9Th Street, Sacramento, CA 95814
Office (916) 653-9538

Note These appendices contain confidential information regarding archeological site locations, so have been removed from public copies of this report in accordance with the policy of the Office of Historic Preservation as adopted by the State Historical Resources Commission under the authority of Public Resources Code 5020.4.

I. Resource Condition Assessment

A. Resource Setting

The 28,400-acre Santiago Fire burn perimeter includes over 100 previously recorded cultural resources. Much of the area has not been systematically surveyed for cultural resources. This report addresses the cultural resources in the burn area west of Santiago Canyon Road; the State Responsibility Area (SRA). The area of the burn to the east of Santiago Canyon Road is primarily within Cleveland National Forest and was evaluated by the United States Forest Service (USFS). Cultural resources within the SRA affected by the Santiago Fire include prehistoric and historic sites.

B. Survey Methods

To evaluate the potential risk to cultural resources, a pedestrian reconnaissance survey was conducted between November 7 and November 9, 2007. Survey was restricted to areas of concern identified by the Burned Area Emergency Response (BAER) team technical specialist-archeology. Areas within the Cleveland National Forest were not surveyed by the State BAER Team. A federal BAER team surveyed and assessed cultural resources within the Cleveland National Forest. Once values at risk had been established for life and property concerns, a records search for cultural resources was conducted at the South Central Coastal Information Center (SCCIC) at California State University at Fullerton. Site maps and cultural resource records were reviewed and made available for field use. The cultural values at risk include: possible loss of resources due to flooding, erosion, fire suppression activities, construction or maintenance staging areas, vandalism, and increased visitation of exposed sites previously concealed by vegetation. Affects of fire can damage fragile resources by spalling portions of rockshelters and associated features, and may also damage or destroy artifacts and historic structures.

II. Observations

A. General observations

The principal concern with respect to cultural resources in the Santiago Fire SRA is an increase in the potential loss of cultural resources due to erosion. Secondary concerns include fire-suppression activities in and near cultural resources, vandalism, and effects of burning on fragile components of the cultural resource. Sites formerly concealed by dense vegetation may become exposed after a fire, thus exposing them to increased visitation and potential data loss.

B. Specific Observations

III. Emergency Determination

The values at risk considered in this assessment include the possible loss of cultural resources due to erosion from increased surface water runoff.
The potential for erosion and subsequent loss of cultural resources are present under pre-fire conditions, and cultural resources in the burn area have been and will continue to be at risk from these hazards. The risk increases with increased burn severity and slope steepness. Though habitation and other site types are rarely found on steep slopes, they may be found at the bases of such slopes, in areas along water courses, and confluences of waterways.

The areas in and near Modjeska Canyon, Williams Canyon, Santiago Canyon, and Pine Canyon are among the high burn severity areas. Very few prehistoric or historic resources have been identified in these areas. The burn severity was generally low to moderate south of Loma Ridge, in the western portion of the Santiago fire. Assessment of sites unaffected by the fire, or recording of previously unrecorded sites is beyond the scope of this evaluation. No previously unrecorded sites were identified during the pedestrian reconnaissance survey. No attempt to update, or re-record sites was made during the survey.

IV. Recommendations

Discussion/Summary/Recommendations

1. Prior to any additional rehabilitation or new construction efforts in or near known cultural resources, the landowner shall retain the services of an archaeologist qualified under the Secretary of the Interior's Standards, to monitor soil-disturbing activity.

2. In the event of soil-disturbing activities in or near known cultural resource sites, the Native American Heritage Commission (NAHC) shall be consulted to determine whether there are concerns to the Native American community in or near the area of activity.

3. A member of the local Native American community, as designated by the NAHC, may be called upon to participate in the construction monitoring at the discretion of the archaeologist.

References

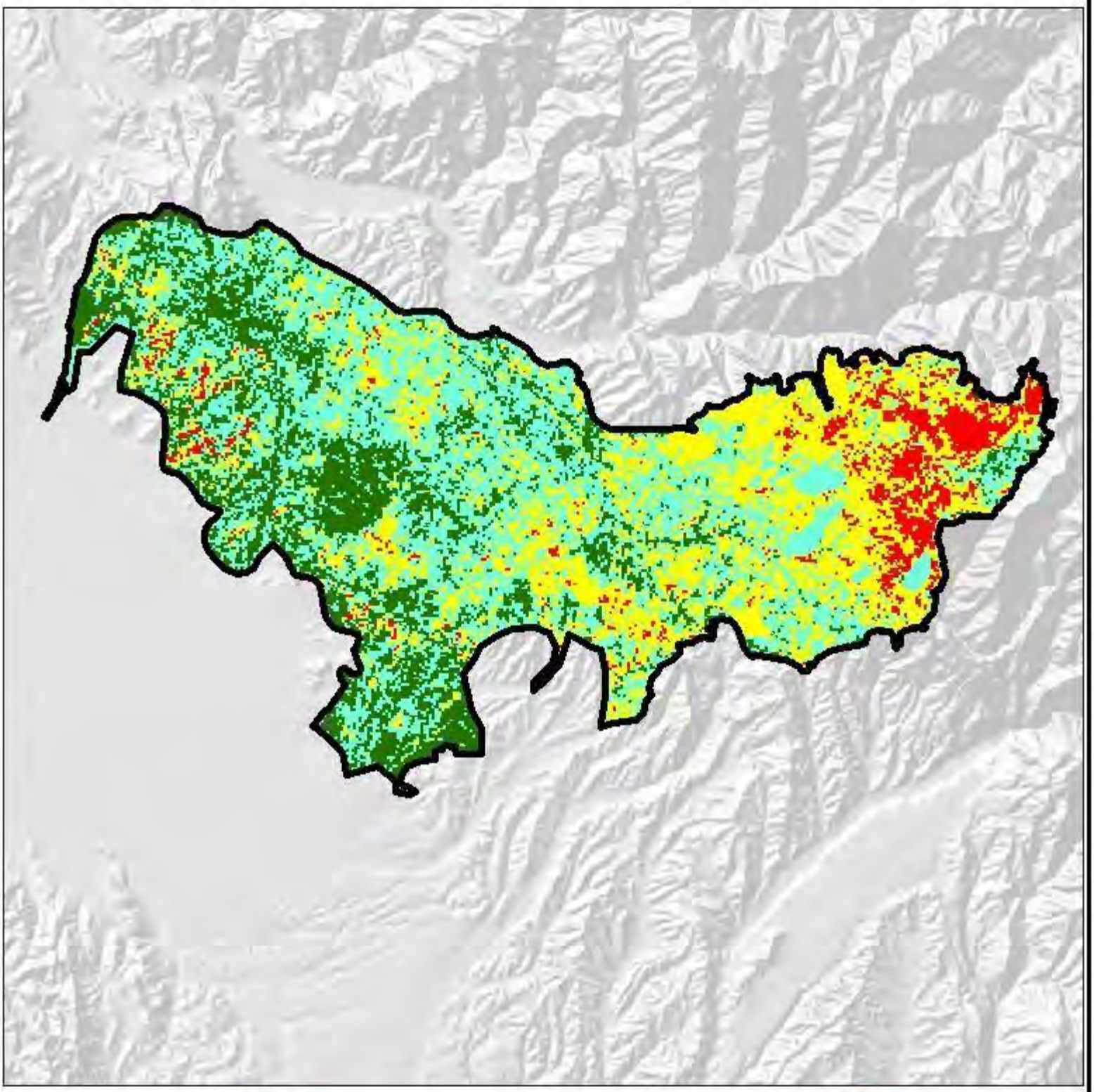
Site records on file at the South Central Coastal Information Center, California State University, Fullerton.

The Secretary of the Interior's Standards and Guidelines, Code of Federal Regulations, 36 CFR Part 61.

Instructions for Recording Historical Resources, Office of Historic Preservation
P.O. Box 942896 Sacramento, CA 942196-0001.

Native American Heritage Commission, 915 Capitol Mall, Room 364
Sacramento, CA 95814.

Santiago Fire - BAER
Soil Burned Serverity Classification



Legend

Soil Burned Serverity

- Unburned
- Low
- Moderate
- High
- Fire Perimeter

N
W E
S

Scale

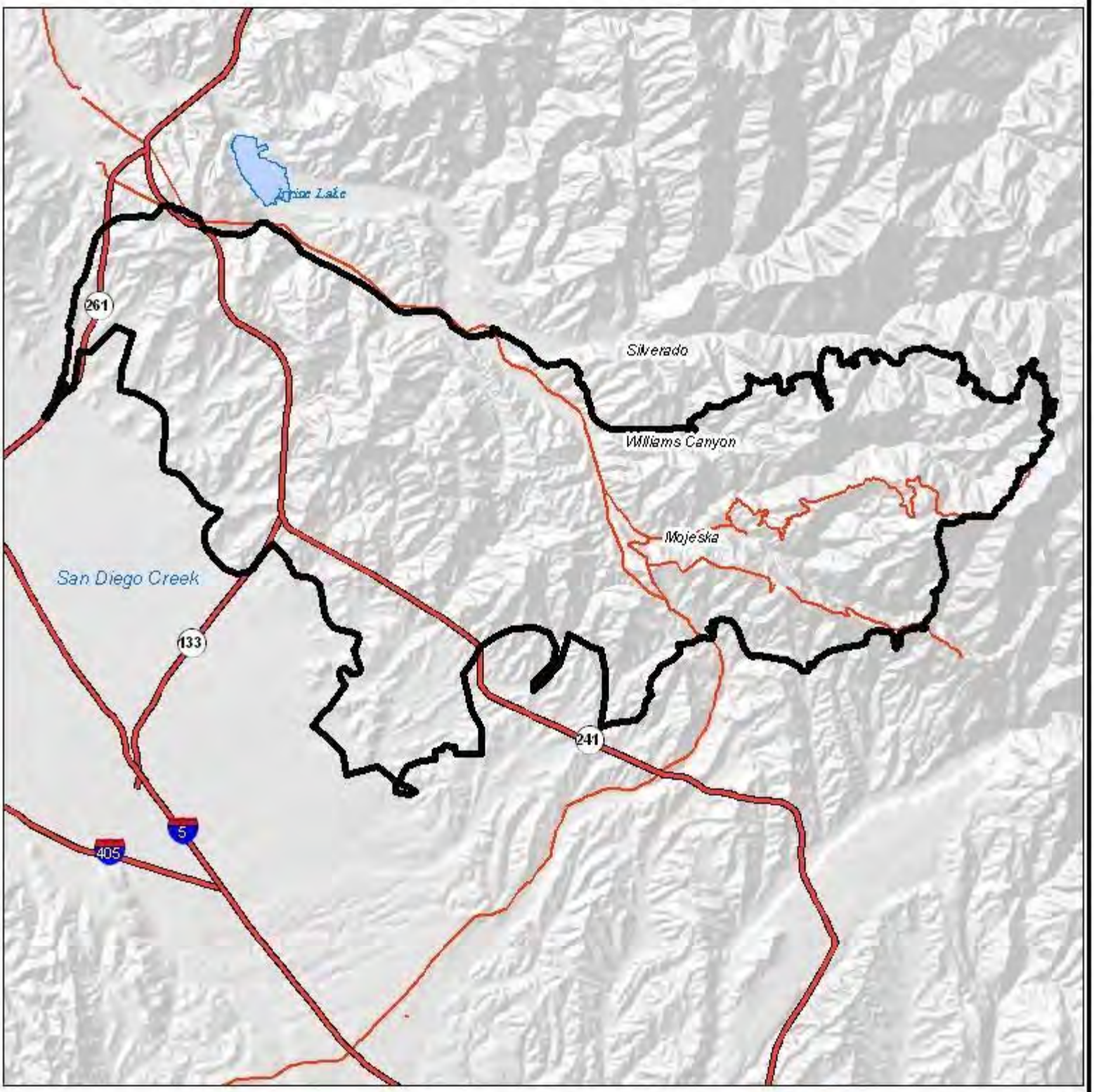
0 0.5 1 2 3 4 Miles

0 6251,250 2,500 3,750 5,000 Meters

Figure 10

BAER Team #6, R. Rutland, GISS, CALFIRE, USFS, CGS, FRAP, OES, 11/10/07, NAD 27, California Teal Albers

Santiago Fire - BAER
General Location Map



Legend

Fire Perimeter

Roads

N
W E
S

Scale

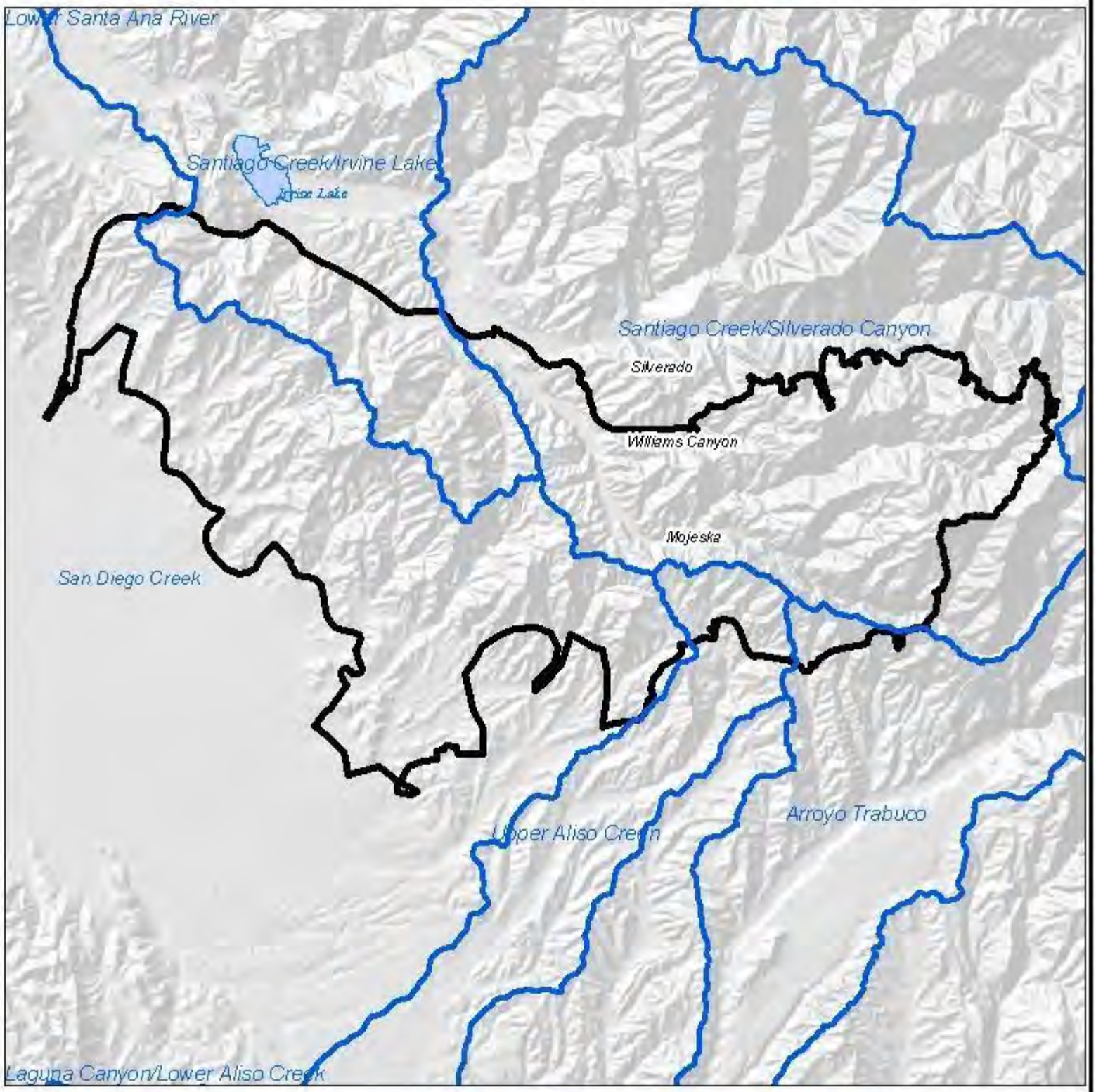
0 0.5 1 2 3 4 Miles

0 750 1,500 3,000 4,500 6,000 Meters

BAER Team 6#, R. Rutland, GISS - CALFIRE
Data Sources, CALFIRE, CGS, USFS, OES, 11/14/07
NAD27, California Teale Albers

Figure 15

Santiago Fire - BAER
Watersheds - Hydrological Unit Code 6



Legend

Watersheds - HUC6

Fire Perimeter

N
W E
S

Scale

0 0.5 1 2 3 4 Miles

0 750 1,500 3,000 4,500 6,000 Meters

BAER Team #6, R. Rutland, GISS, CALFIRE, USFS, CGS, FRAP, OES, 11/10/07, NAD 27, California Teal Albers

Figure 16