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Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

Power Fire Nexus
Eldorado National Forest, California

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

Power Fire Nexus
El Dorado National Forest, California

Funded by National Fish and Wildlife
Grant ID: 0809.19.064824

July 30, 2021

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TABLE OF CONTENTS PAGE

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ARD	Amador Ranger District
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CNDD	California Natural Diversity Database
ENF	Eldorado National Forest
FRAP	CAL FIRE and Resource Assessment Program
FYLF	Foothill Yellow Legged Frog
GIS	Geographic Information System
HASP	Health and Safety Plan
JJ&A	Jacobson James & Associates, Inc.
LIDAR	Light Detection and Ranging
MB&G	Mason Bruce & Girard
MCWRA	Mountain Counties Water Resources Association
NEPA	National Environmental Protection Act
NFWF	National Fish and Wildlife Foundation
PAC	Protected Activity Center
PG&E	Pacific Gas & Electric Company
RF	Registered Forester
SNYLF	Sierra Nevada Yellow Legged Frog
USFS	United States Department of Agriculture Forest Service

EXECUTIVE SUMMARY

Jacobson James & Associates (JJ&A) prepared this *Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan* (Strategic Plan) for the 2004 Power Fire Nexus located within the Eldorado National Forest (ENF) along the western slope of the Sierra Nevada in northern California (Figure ES-1). Funding for the work was provided through a *Spring 2019 National Fish and Wildlife Northern California Forests and Watersheds Program (NFWF)* grant (MCWRA/JJ&A, 2019) to the Mountain Counties Water Resources Association (MCWRA). JJ&A partnered with MCWRA and Mason, Bruce & Girard, and collaborated with the United Stated Department of Agriculture Forest Service (USFS) Amador Ranger District (ARD) to perform the work.

In 2004, the Power Fire burned approximately 17,000 acres in the ENF and adjacent private timber lands. The Strategic Plan focuses on the Power Fire Nexus, defined as approximately 39,320 acres on ENF land within the Panther Creek, Bear River, and Cole Creek watersheds. This Strategic Plan provides a landscape-scale prioritization of 30,437 acres (based on exclusion of the water body acreage) within the Power Fire Nexus with recommended fuel reduction approaches.

Development of the Strategic Plan included a data compilation task to assemble available and relevant Geographic Information System (GIS) and Light Detection and Ranging (LIDAR) data files. Field reconnaissance activities provided additional information, particularly with respect to stand conditions and fuel density. Additionally, ARD provided important information and data regarding current conditions, prior fuel reduction projects implemented, and fuel reduction projects selected and approved for implementation. As such, this Strategic Plan reflects prior actions and decisions made as compared to a Strategic Plan that would be developed for a location not previously evaluated for landscape-scale forest fuel reduction.

AREA PRIORITIZATION

Evaluation of the 30,437 acres of forestland, results in the definition of 405 discreet areas based on changes in vegetation composition, access, physical setting, and potential constraints (e.g., very steep slopes, landscape features such as ridge lines and reservoirs). Application of a weighted decision matrix to prioritize these areas identifies 78 low priority areas (1,905 acres), 248 medium priority areas (15,589 acres), and 79 high priority areas (12,944 acres) as summarized below. The low, medium, and high priority areas are shown on Figure ES-2.

AREA PRIORITY			TOTAL ACRES
High (acres) (percent)	**Medium** (acres) (percent)	**Low** (acres) (percent)	
12,944 43%	15,589 51%	1,905 6%	30,437

The matrix weighting factors include treatment difficulty, size of area, condition class, surface water resources, roads, infrastructure (e.g., power lines, structures, etc.), and status of projects already planned by the USFS.

FUEL REDUCTION ANALYSIS AND RECOMMENDATIONS: FOREST THINNING AND BIOMASS MANAGEMENT

The initial step in the fuel reduction analysis is based on a decision tree approach to identify the Power Fire Nexus areas that require a fuel reduction recommendation. First, areas were identified that don't require a fuel reduction recommendation because they either already meet desired conditions or are addressed in an existing USFS planned project. Where a planned project exists, it is carried forward as the treatment recommendation for that specific area.

The areas requiring a fuel reduction recommendation were evaluated for forest thinning and biomass management options using separate decision matrices. The forest thinning option matrix designates one or more of the following general approaches for each area: no treatment, manual treatment, prescribed burn, or mechanical treatment. Criteria used to select appropriate thinning treatment approaches include access, terrain, and proximity to protected habitats for sensitive species, cultural/archaeological resources.

The biomass management matrix also considers access, terrain, and proximity to protected habitats or resources. The biomass management options considered in the Strategic Plan include removal and sale of marketable materials, volume reduction by mechanical methods, and decomposition or burn methods as the final step to address the volume reduction materials. Burn methods includes air curtains to burn biomass in a controlled manner with fewer emissions than open pile burns, with and without conversion to biochar for application on the forest floor or for off-site use.

FUEL REDUCTION RECOMMENDATIONS

Figure ES-3 illustrates the fuel treatment recommendations for areas within the Power Fire Nexus. It is recognized that the thinning and biomass management recommendations are general in nature, allowing for final decision and refining to occur by the land manager to reflect considerations such as season, weather, local biomass beneficial use options, staffing and funding. Treatment recommendations are summarized below:

- No treatment for areas that are at or near desired conditions and where there is no access due to extreme terrain.
- Proceeding with USFS planned treatment (Hazard Tree NEPA Analysis Complete) along 224 miles of roadways where the hazard tree NEPA analysis is completed for previously defined projects.
- Manual treatment for areas based on proximity to protected species (e.g., Protected Activity Centers (PACs) for the California Spotted Owl or Northern Goshawk).
- A combination of mechanical treatments and prescribed burn for the remaining areas; this is the recommended approach in most of the low, medium, and high priority areas. The rationale for this recommendation is based on the ability to reduce fuel loads efficiently on a landscape scale.
- Mechanical treatments are prescribed as needed in advance of prescribed burns to establish conditions for a safe and effective controlled burn.
    - Approaches for steep terrain may incorporate use of a skid steer, yarder/cable system, and/or helicopter to fell and move trees.

  - Mechanical treatment approaches for areas in less steep terrain may incorporate use of a feller/buncher, masticator/mulcher, dozer, excavator to fell and pile timber and slash.

- It is understood that the ability to perform controlled burns on a landscape scale is limited based on available personnel, equipment, and allowable burn windows.

For areas where a controlled burn is not feasible and biomass is generated through thinning approaches, the following treatment options are recommended for the biomass:

- Utilize a mobile air curtain burner – this approach can treat biomass during a longer burn window. However, access limitations can preclude use of this technology;
- Pile and burn – when feasible;
- Chip and scatter – along roadways; and
- Lop and scatter – in steep terrain where access is limited for equipment.

Use of emerging and innovative technologies is recommended for evaluation at the time of project refinement and implementation. This includes biomass utilization such as:

- Chip and haul to offsite user/vendor for beneficial use in material production; and
- Air curtain burner with biochar conversion capability, with biochar used on-site for soil enhancement and/or with biochar sold offsite for agricultural use.

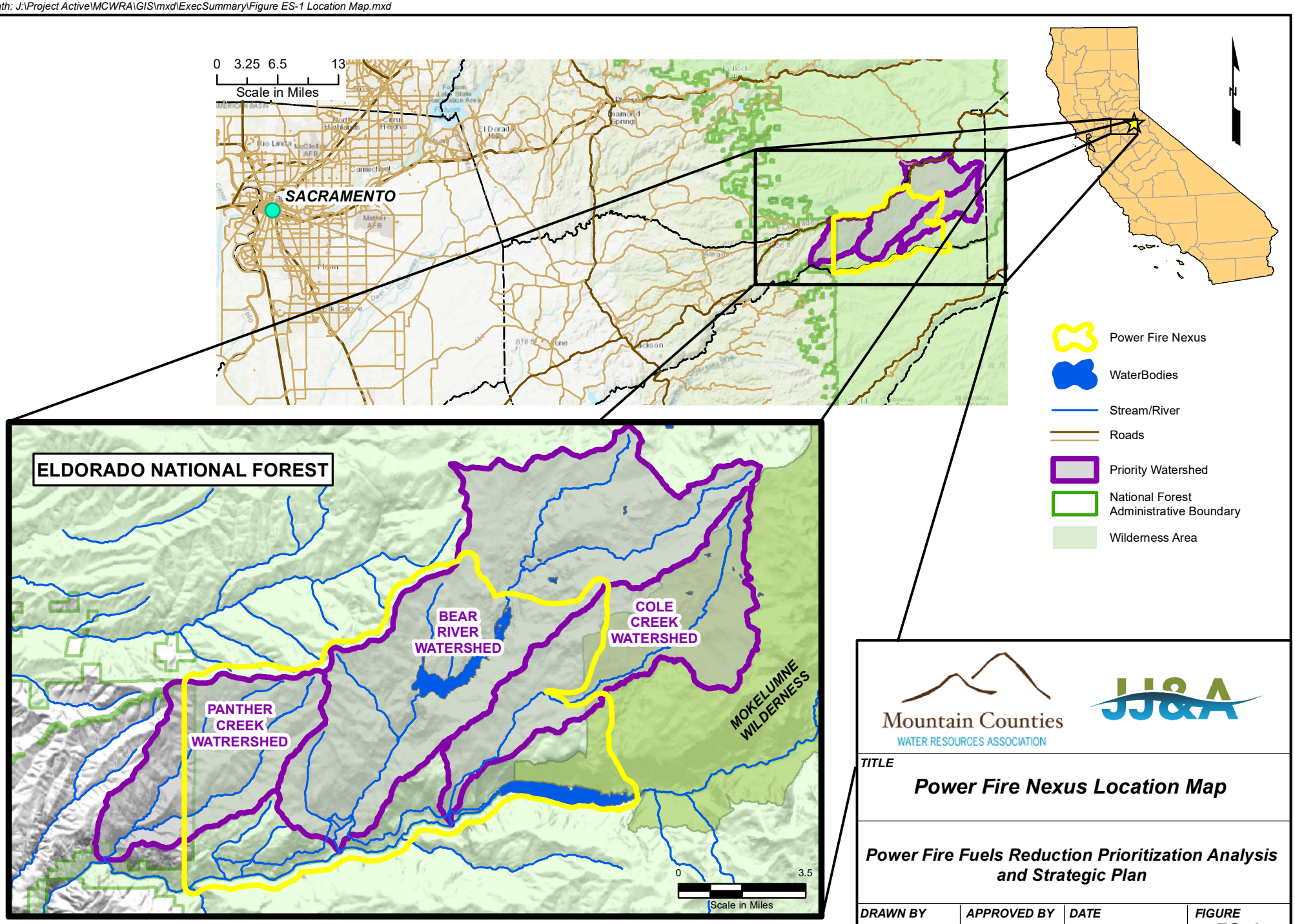
Off-site beneficial uses to be considered for biomass material include, but are not limited to, dimensional lumber, animal bedding, biochar, cross-laminated timber, mulch, oriented strand-board, pulp, post, shredding, and veneer products.

TRANSFERABILITY AND CONTINUOUS IMPROVEMENT OPPORTUNITIES

The immediate benefit of the Strategic Plan is that it sets the stage for selecting, funding. and implementing fuel reduction work in the three priority watersheds of the Power Fire Nexus. The Strategic Plan provides recommendations but is designed to be flexible and envisions fine tuning the specific approaches at the time of project planning, funding, and implementation.

The spatial prioritization ranking matrix is an adaptive tool that can be further refined for prioritizing and selecting optimal forest fuel reduction strategies at other watersheds. In addition, the forest thinning and biomass management matrices included in the Strategic Plan can be adapted to evaluate other forested areas where hazardous fuel loading is a concern, by replacing or modifying the Power Fire Nexus specific criteria used. Simplified matrices are provided as figures in the Strategic Plan to illustrate the approach for communication purposes. The more detailed Excel tools used to prioritize areas and rank and assign treatment processes and companion templates with instructions are available for download via a Cloud Share Site.

Path: J:\Project Active\MCWRA\GIS\mxd\ExecSummary\Figure ES-1 Location Map.mxd



Mountain Counties WATER RESOURCES ASSOCIATION

JJ&A

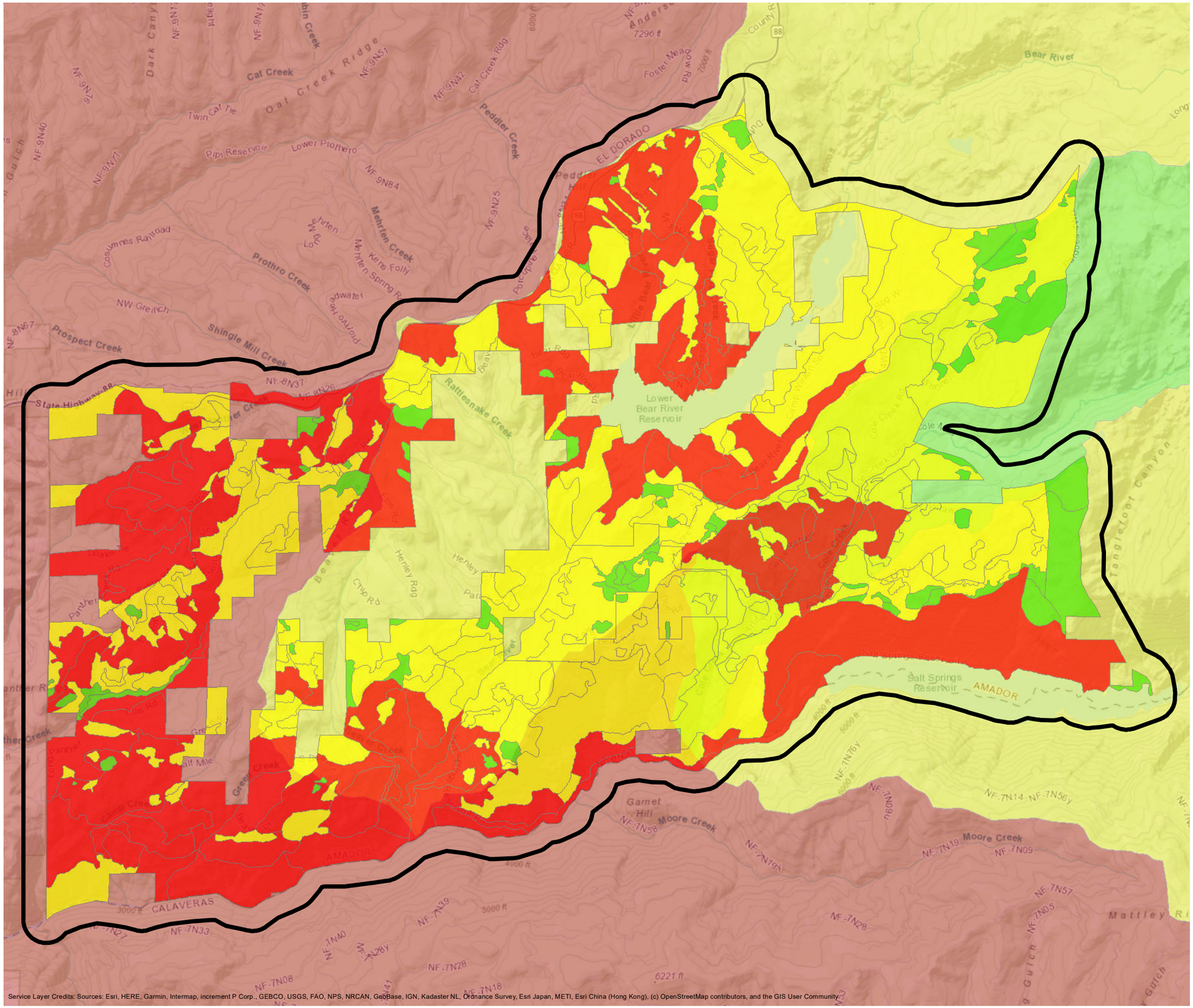
TITLE

Power Fire Nexus Location Map

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
DPG	LM	5/12/2021	ES-1

AERIAL SOURCE: NATIONAL AGRICULTURE IMAGERY PROGRAM, FEBRUARY 2011



LEGEND

Power Fire Nexus

Power Fire Nexus Treatment Area Priority

- High
- Medium
- Low

CALFIRE Fire and Resource Assessment Program (FRAP) Priority Landscapes, Reducing Wildfire Risk to Forest Ecosystems[1]

- High
- Medium
- Low

[1] Data Source: https://www.arcgis.com/apps/MapSeries/index.html?appid=f767d3f842fd47f4b35d8557f10387a7

0 2 Miles

N

Mountain Counties WATER RESOURCES ASSOCIATION

JJ&A

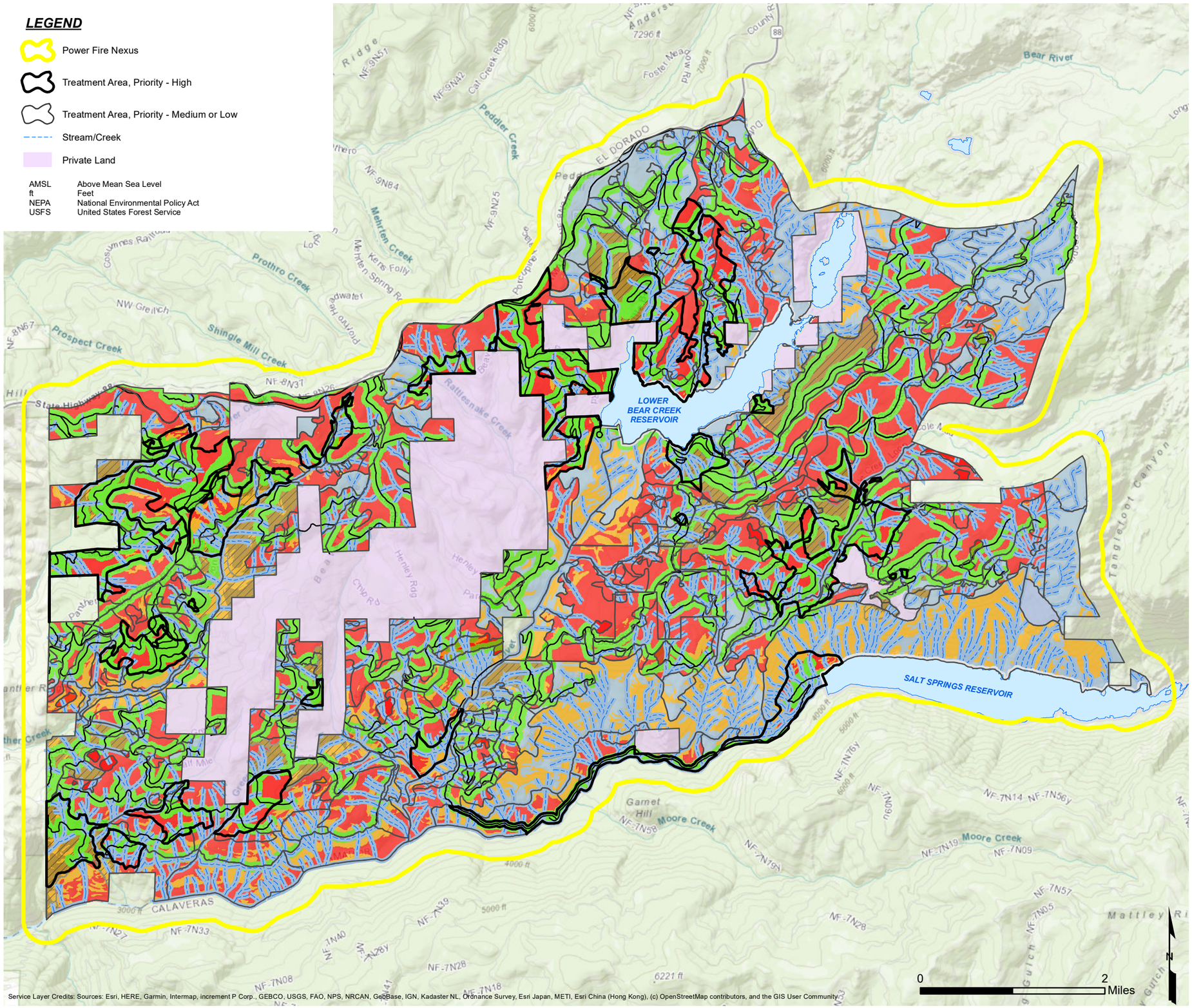
TITLE

Power Fire Nexus Treatment Area Prioritization Map

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
DPG	LM	7/28/2021	ES-2

Path: J:\Project Active\MCWRA\GIS\mxd\ExecSummary\Figure ES-2 Treatment Area Prioritization.mxd



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

LEGEND

- Power Fire Nexus
- Treatment Area, Priority - High
- Treatment Area, Priority - Medium or Low
- Stream/Creek
- Private Land

AMSL	Above Mean Sea Level
ft	Feet
NEPA	National Environmental Policy Act
USFS	United States Forest Service

TREATMENT OPTIONS

- No treatment - Area meets desired condition or is not accessible, or is protected aquatic habitat.
- Proceed with Amador Ranger District Planned Treatment [1,2] (Hazard Tree Removal Project - NEPA Complete)
- Mechanical treatment followed by controlled burn (where and when feasible. Mechanical treatment approach may utilize feller/buncher, masticator/mulcher, dozer, excavator
- Mechanical treatment with helicopter or yarder/ cable system. steep slope)
- Manual Treatment Only (Spotted Owl Protected Activity Center)

Note: there are no public files available regarding Northern Goshawk locations, and as such they are not addressed in this figure. Surveys and location specific adjustments should be made when Northern Goshawks are present.

[1] Field surveys prior to implementation may identify locations within areas that cannot be treated: (1) areas flagged during Sensitive Plant Survey; (2) less than 50 feet from Perennial/Intermittent Streams or Special Aquatic Features; and (3) areas flagged during an Archeological/Cultural resource survey.

[2] Areas with this stippled pattern have seasonal limitations as follows:
CA SPOTTED OWL BREEDING SEASON
Limited Operation Period- March 1 to Aug 15
1/4-mile radius from Protected Activity Center (PAC) (unless cleared by District Biologist)

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TITLE

Treatment Approach Recommendations

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
DPG	LM	7/28/2021	ES-3

Path: J:\Project Active\MCWRA\GIS\mxd\ExecSummary\Figure ES-3 Treatment Approach.mxd

1.0 INTRODUCTION

The ***Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan*** (Strategic Plan) prioritizes areas and recommends measures to reduce fuel loads within the 2004 Power Fire Nexus -located in the Eldorado National Forest (ENF) of Northern California, as shown on Figure 1. The Power Fire burned approximately 17,000 acres of the ENF and adjacent private timber lands. The Power Fire Nexus is shown on Figure 2, and includes portions of the Bear Creek, Panther Creek and Cole Creek watersheds. These three watersheds are identified as priority watersheds by the United States Department of Agriculture Forest Service (USFS) and National Fish and Wildlife Foundation (NFWF) in the *Northern California Forests and Watersheds Restoration Strategy* (NorCal Strategy), (NFWF, USFS, 2018). The Strategic Plan represents a landscape-scale approach to implement one of the NorCal Strategy highest priority activities identified in the NorCal strategy: fuels management. The approach reflects the scope of work defined in the *Mountain Counties Water Resources Association (MCWRA)/Jacobson James & Associates (JJ&A) 2019 Proposal* and the *Grant Agreement* executed on October 15, 2019, between MCWRA and NFWF (NFWF Grant ID 0809.19.064824) (MCWRA/JJ&A, 2019). JJ&A partnered with the MCWRA and Mason, Bruce & Girard, and collaborated with the USFS Amador Ranger District (ARD) to perform the work.

1.1 Goals and Objectives

The Strategic Plan approach reflects the overall purpose of the *Spring 2019 NFWF Northern California Forests and Watersheds Program* to reduce fuel loads, as this will result in ecological improvements and benefits to the forest and watersheds affected by the Power Fire. The Strategic Plan goals and objectives are as follows.

Goal 1: Prioritize Areas for Fuel Reduction

Rank areas that comprise the Power Fire Nexus for prioritization of fuel reduction on a landscape scale to achieve optimal benefits.

> Objective: Present information and site reconnaissance data obtained for the Power Fire Nexus to support the area prioritization.
>
> Objective: Describe the criteria and approach used to prioritize areas and presents the prioritization results in graphic and tabular format.

Goal 2: Identify, Evaluate and Select Recommended Fuel Reduction Approaches for Landscape Scale Implementation

Describe the analysis and selection of methods for a recommended landscape scale fuel reduction approach within the Power Fire Nexus.

> Objective: Identify the fuel load removal and biomass management alternatives to be evaluated; and describe the evaluation process approach and criteria including, but not limited to (1) improvements to Panther Creek, Bear River and Cole Creek watersheds (2) sustainable and lasting ecological benefits

to the forest and watersheds, (3) efficiency and innovation to improve forest health, and (4) protection of cultural and tribal resources where necessary.

Objective: Identify specific approaches evaluated and recommended for implementation of innovative, efficient, and cost-effective fuel load removal and biomass management.

Goal 3: **Provide a Transferrable Tool**

Objective: Conduct a training session at ARD headquarters with a guidebook so that property owners, managers and consortiums can use and refine the Excel/GIS based tools to: (1) prioritize areas for fuel reduction; and (2) evaluate fuel reduction strategies.

1.2 Project Plan Organization

This Strategic Plan is organized as follows:

Section	Description
1.0	Introduction
2.0	Background
3.0	Data Acquisition and Compilation
4.0	Power Fire Nexus Area Delineation and Prioritization
5.0	Fuel Reduction Alternatives Analysis and Recommendations
6.0	Transferable Tool Description
7.0	Summary and Considerations for Continuous Improvements
8.0	References

2.0 BACKGROUND

2.1 Location and Setting

The Power Fire occurred in 2004 and burned 17,005 acres along the north side of the Mokelumne River canyon approximately 17 miles east of Pioneer, California. The Power Fire Nexus includes the Bear Creek, Panther Creek, and Cole Creek watersheds; all of which are identified as priority watersheds by the USFS and NFWF (NFWF, USFS, 2018). The three Priority Watersheds drain to the North Fork Mokelumne River Watershed which is an important municipal water supply for the nearby communities of Pioneer, Jackson, and other areas of Amador County, as well the primary source of drinking water for communities in the East San Francisco Bay area, including Oakland and Berkeley. In addition, Pacific Gas & Electric Company (PG&E) operates a Federal Energy Regulatory Commission license (Project 137) on the North Fork Mokelumne River providing hydropower electricity to their customers.

2.2 Power Fire Nexus Conditions and Projects

As identified in the *2017 Decision Memo: Power Fire Fuels Maintenance Study* (USFS; 2017a), *"Historically, the Power Fire area experienced frequent low to mixed-severity fires that consumed fuels, killed small trees, and pruned the boles of residual trees (Perry et al. 2011; Van de Water and Safford 2011). In contrast, current fire regimes and fuel conditions in the Power Fire's mixed conifer stands and many forest stands in the Sierra Nevada have deviated from historical patterns. These forests are at high risk of fire-related mortality due to high fuel loading (Agee and Skinner 2005, North et al. 2012)"*.

As of 2017, the USFS had determined that most of the Power Fire Nexus was not meeting desired forest conditions for a variety of reasons, including the return of highly competitive vegetation which can result in the failure of plantation investments (e.g., competing non-desirable vegetation may consume the limited water and nutrients resulting in the death of plantation seedlings) (USFS, 2017b).

Multiple projects have been defined to address the 2004 Power Fire impacts, reduce fuel loading and improve forest resilience. Some of these projects have been completed, and others are in various stages of implementation the collective goal of the pre-defined projects is to ensure key ecosystem processes and natural disturbances support future ecosystem development and improve the forestland resiliency. These projects are summarized in Table 1 (Power Fire Nexus Pre-Defined Projects). The following lists the types of approaches implemented by these projects.

- Prescribed burn
- Reforestation treatments
- Stand improvements
- Control of invasive species

The Strategic Plan considers the projects completed to date and planned in the near future to inform the prioritization of areas for treatment and the thinning and biomass management approach analysis and recommendations.

3.0 DATA ACQUISITION AND COMPILATION

A combination of data download and field reconnaissance activities provided the data and information required to: (1) delineate and prioritize fuel reduction treatment areas, and (2) evaluate and recommend the forest thinning and biomass management options.

3.1 DATA COMPILATION AND DOWNLOAD

As a first step, Geographic Information System (GIS) and Light Detection and Ranging (LIDAR) files were obtained from sources including the USFS, California Department of Fish and Wildlife (CDFW) Natural Diversity Database (CNDD) (California Department of Fish and Wildlife, 2020), California Energy Commission (CEC) and other sources. Data compiled included locations for cabins and developed areas, critical infrastructure, roadways, sensitive species, and areas where the USFS has recently completed or plans to complete fuel management projects. A detailed summary of the data downloaded for this project is provided in Table 2.

3.2 FIELD RECONNAISANCE

During July 2019, a JJ&A geologist and a Registered Forester (RF) with Mason, Bruce & Girard (MB&G) conducted field reconnaissance activities in the Power Fire Nexus to supplement the data obtained remotely. Field observations provided information pertaining to stand conditions, vegetation type, fuel density and access considerations.

4.0 POWER FIRE NEXUS AREA DELINEATION AND PRIORITIZATION

The process used to delineate and prioritize areas within the Power Fire Nexus for fuel reduction treatment is summarized in this section of the Strategic Plan.

4.1 Area Delineation

The Power Fire Nexus was divided into 405 areas ranging in size from 0.4 to 727 acres to be ranked for treatment. The areas were delineated based on natural boundaries including ridgelines and water bodies, along with constructed access points and roadways. The delineation of areas was further refined based on field observations that considered stand and fuel composition and density. The delineated areas are shown on Figure 3. These 405 defined areas were then prioritized as described in the following section. In the prioritization step, some of the areas were consolidated where warranted.

4.2 Area Prioritization

Areas were prioritized for treatment based on the following criteria:

- condition class;
- distance to surface water; and
- status of projects in the planning stage with respect to the National Environmental Protection Act (NEPA).

The following criteria were initially considered but then eliminated from the matrix because scoring values would be relatively the same for each area and thus not affect the outcome:

- distance to the nearest biomass energy facility;
- regional economic costs and benefits; and
- air quality.

A scoring system using values of 1 to 3 was developed for each of the criteria, which were then weighed to reflect the project objectives and priorities and the NFWF grant program goal to strategically address impacts to wildfire impacted watersheds. The scoring system and weights chosen for the Power Fire Nexus are shown in Table 3. The total scores for each area were then used to prioritize the areas for fuel reduction treatments within the Power Fire Nexus. Areas with a final score less than 1.75 were assigned as low priority, a score from 1.75 to 2.5 was assigned as medium priority, and scores greater than 2.5 were assigned as high priority.

In developing a map to delineate low, medium and high priority areas for treatment, further consideration was given to economies of scale related to combining adjacent areas and optimizing benefits from natural fuel breaks. JJ&A further considered the recently completed 2021 CAL FIRE *Fire and Resource Assessment Program (FRAP) Wildfire Risk to Forest Ecosystems (Cal Fire, 2021)* priority area mapping in the final area prioritization map, provided as Figure 4.

The breakdown of high, medium, and low priority areas identified for the Power Fire Nexus is provided below.

AREA PRIORITY			TOTAL ACRES
High (acres) (percent)	**Medium** (acres) (percent)	**Low** (acres) (percent)	
12,944 43%	15,589 51%	1,905 6%	30,437

* Based on Power Fire Nexus total acreage of 39,320 minus water body acreage.

5.0 FUEL REDUCTION ALTERNATIVES ANALYSIS AND RECOMMENDATIONS

The process to evaluate and identify the fuel reduction treatment approach for each area in the Power Fire includes the following components:

- Fuel Reduction Approach Scoping (Figure 5)
- Forest Thinning Approach Evaluation (Figure 6 – Matrix I)
- Biomass Management Approach Evaluation (Figure 7 – Matrix II)

5.1 Fuel Reduction Approach Scoping

The first step for the Power Fire Nexus was a scoping evaluation, to identify the areas that require evaluation and a fuel reduction approach recommendation. Figure 5 illustrates the decision tree approach used. As shown, the areas were evaluated to determine if an area meets or is near the desired condition. If the area does not, then it was determined if there is an existing treatment plan in place. Areas that do not meet desired conditions and do not have a treatment plan in place were carried forward for evaluation and recommendation of a fuel reduction approach.

Desired conditions for young plantations reflect the specifications in the ENF Plan (USFS, 1989), as amended by the Sierra Nevada Forest Plan Amendment (USFS, 2004) and aligned with ENF plans to conduct a Pre-Commercial Thinning Project within the southern portion of the Power Fire Nexus (USFS, 2019b). Specifically, conditions are desired that will over time:

- Reduce inter-tree competition for moisture, sunlight and nutrients in each stand and reducing each stand's susceptibility to western pine beetle;
- Increase stand variability and spatial heterogeneity;
- Promote retention of hardwoods;
- Reduce risk of loss to wildfire; and
- Improve stand health.

A forest stand that promotes the conditions may have 110 to 150 conifers per acre, spaced from 17 to 20 feet apart, with lower branches pruned and woody shrubs removed. If an area is determined to be at or near this condition class, then no treatment is prescribed at this time.

5.2 Forest Fuel Thinning Approach Evaluation and Recommendations

A step-based forest fuel thinning approach matrix was developed for the Power Fire Nexus that aligns with the following NorCal Forest and Upland Restoration Management Strategy pertaining to fuel reduction treatments :*"Fuels reduction mechanisms such as prescribed burns, biomass removal, or forest stand thinning may help some areas replicate the natural process of wildfire. Natural wildfire benefits include reducing fuels, removing competitive invasive species, promoting germination of fire adapted species, and increasing*

diversity and age structure in vegetative environments. Prescribed burns, biomass removal, or thinning may have particular applications in maintaining riparian corridor and aspen regeneration. Fuels management can help reduce tree and leaf litter buildup thereby decreasing the potential amount of wildfire habitat damage. Additionally, fuels management can decrease the amount of potential debris and sediment run-off that enters headwaters due to a wildfire. Furthermore, the technique could also increase the potential for protecting habitat critical to the survival of the California spotted owl." This matrix is provided as Figure 6 – Matrix I. This matrix reflects the process used to select one of the following forest fuel thinning approaches for each area:

- No treatment;
- Manual treatment only; and
- Mechanical treatment; followed by where and when feasible a controlled burn.

The criteria used to determine which treatment approach is appropriate for a particular area includes the following:

- Risk (particularly with respect to a controlled burn);
- Access roads and terrain;
- Protected habitat for plant species, aquatic or terrestrial wildlife;
- Proximity to surface water; and
- Proximity to cultural or archeological resources.

As described in the preceding section, areas that meet desired conditions or have pre-defined treatment plans were not evaluated for forest thinning treatments. The first step in the treatment selection approach for the remaining areas is to identify areas where no treatment is prescribed due to extreme access limitations or to protect habitat for the Sierra Nevada Yellow Legged Frog (SNYLF) or the Foothill Yellow Legged Frog (FYLF). It is noted that there are also seasonal limitations for treatment avoid disturbing a Protected Activity Center (PAC) for the California Spotted Owl or Northern Goshawk during the nesting season for each of these species. It is noted that for this selection process to be applied outside of the Power Fire Nexus, protected habitat for additional or different species may warrant consideration.

The next step is to identify areas where only manual treatment with hand tools, such as chain saws is recommended. In addition, manual treatments are recommended to create a buffer around no-treatment areas designated to protect the FYLF.

Fuel reduction treatments for the remaining areas include prescribed burn, and mechanical treatments. Criteria to consider when evaluating these two approaches are generally related to risks and seasonal restrictions associated with a controlled burn. Where mechanical treatments are prescribed, equipment used may include a skid steer or excavator equipped to cut or masticate trees designated for removal. A description of these and other fuel reduction tools is provided in Table 4.

The area recommendations for each approach are shown on Figure 8. The Excel file and related data files used to apply this decision process to the Power Fire Nexus along with a companion Excel template have been made available to the USFS, MCWRA and other interested parties via a Cloud File Share Site.

It is noted that the Figure 6 matrix reflects the Power Fire Nexus location specific considerations and is heavily guided by the significant number of projects already implemented or approved for implementation. As such, potential future users of the Figure 6 – Matrix I approach would need to review and modify the steps and criteria to ensure the site and condition specific factors associated with other locations area accurately represented. However, the general approach and guideline remains appropriate for such use.

5.3 Biomass Management Approach Evaluation and Recommendations

Other than areas where no treatment has been selected or a prescribed or controlled burn has been or will be the forest thinning approach, additional steps are required to manage the biomass remaining after fuel thinning procedures are completed. Figure 7 – Matrix II presents the following considerations for selection of a biomass management approach:

- Identify merchantable biomass for removal and sale;
- Identify firebreak delineations and areas encompassed;
- Select an approach to reduce the volume of the remaining biomass; and
- Determine a final biomass treatment step: to burn, leave in place to decompose or send off-site for beneficial uses.

The decision matrix identifies the following criteria to be considered when evaluating and selecting a preferred biomass treatment approach:

- Biomass demands and economic factors including biomass market value and haul distances;
- Road access and terrain;
- Specifications associated with equipment used to process biomass such as chippers;
- Benefits to water quality; and
- Greenhouse gas emissions.

The following treatments are options for biomass management following thinning:

- Utilize a mobile air curtain burner – this approach has the advantages of reduced greenhouse gas emissions and a longer operational window then prescribed burns and open burn piles. However, access limitations can preclude use of this technology;
- Pile and burn – when feasible;
- Chip and scatter – along roadways; and
- Lop and scatter – in steep terrain where access is limited for equipment.

Use of emerging and innovative technologies is recommended for evaluation at the time of project refinement and implementation. This includes biomass utilization such as:

- Chip and haul to offsite user/vendor; and
- Air curtain burner with biochar conversion capability, with biochar used on-site for soil enhancement and/or with biochar sold offsite for agricultural use.

Off-site beneficial uses to be considered for biomass material include, but are not limited to, dimensional lumber, animal bedding, biochar, cross-laminated timber, mulch, oriented strand-board, pulp, post, shredding, and veneer products.

The Excel file and associated data files used to apply this decision process to the Power Fire Nexus along with a template Excel file will be provided to the USFS, MCWRA and other interested parties via a Cloud File Share Site.

5.4 Area Prioritization and Fuel Reduction Recommendations Summary

The 30,437 acres Power Fire Nexus was broken down into 405 areas based on changes in vegetation composition, topographical breaks, and/or access points. The priority ranking of these areas resulted in the designation of 79 high, 248 medium and 78 low priority areas. This equates to 12,944, 15,589 and 1,905 acres of high, medium and low priority land within the Power Fire Nexus respectively, as summarized below.

Figure 8 illustrate the fuel treatment recommendations for the high, medium, and low priority areas, respectively – including listing of biomass management options. It is recognized that the thinning and biomass management recommendations are general in nature, allowing for final decision and refining to occur by the land manager to reflect considerations such as season, weather, local biomass beneficial use options, staffing and funding. Treatment recommendations are summarized below:

- No treatment for areas that are at or near desired conditions and where there is no access due to extreme terrain.
- Proceeding with USFS planned treatment (Hazard Tree NEPA Analysis Complete) along 224 miles of roadways where the hazard tree NEPA analysis is completed for previously defined projects.
- Manual treatment for areas based on proximity to protected species (e.g., Protected Activity Centers (PACs) for the California Spotted Owl) or Northern Goshawk.
- A combination of mechanical treatments and prescribed burn for the remaining areas; this is the recommended approach in most of all low, medium, and high priority areas. The rationale for this recommendation is based on the ability to reduce fuel loads efficiently on a landscape scale. Mechanical treatments are prescribed as needed in advance of prescribed burns to establish conditions for a safe and effective controlled burn.
    - Approaches for steep terrain may incorporate use of a skid steer, yarder/cable system, and/or helicopter to fell and move trees.

- Mechanical treatment approaches for areas in less steep terrain may incorporate use of a feller/buncher, masticator/mulcher, dozer, excavator to fell and pile timber and slash.
- It is understood that the ability to perform controlled burns on a landscape scale is limited based on available personnel, equipment, and allowable burn windows.

For areas where a controlled burn is not feasible and biomass is generated through thinning approaches, alternative methods for biomass management are available as summarized in Figures 7 and 8. Selection of alternative approaches are dependent on access, terrain, weather conditions and market options for biomass utilization. They include: a mobile air curtain burner; pile and burn; chip and scatter; and lop and scatter. Biomass utilization options include biochar generation for on-site soil enhancement or off-site agricultural use, and other biomass commercial opportunities such as dimensional lumber, animal bedding, biochar, cross-laminated timber, mulch, oriented strand-board, pulp, post, shredding, and veneer products.

6.0 TRANSFERABLE TOOL DESCRIPTION

A training module was presented to the USFS personnel remotely via Microsoft Teams when convenient for the USFS. Electronic materials were provided to the training module attendees, including Excel matrix files used for evaluation of the Power Fire Nexus, and template files that can be used to prioritize areas and select fuel management approaches. The more detailed Excel tools used to prioritize areas and rank and assign treatment processes and companion templates with instructions are available for download via a Cloud Share Site.

7.0 SUMMARY AND CONSIDERATIONS FOR CONTINUOUS IMPROVEMENTS

The development of the Strategic Plan reflects the distillation of forest fuel reduction guidance published by the USFS, CAL FIRE and other experts into a set of decision tools that are used in this application to recommend a land-scape scale area prioritization and fuel reduction strategic plan for the Power Fire Nexus. The Strategic Plan features:

- Prioritization of the Power Fire Nexus areas into high, medium, or low priority of fuel reduction treatments (Figure 4).
- A Fuel Reduction Analysis Approach Flowchart (Figure 5).
- Forest Thinning Approach Evaluation Matrix (Figure 6);
- Biomass Management Approach Evaluation Matrix (Figure 7); and
- Fuel reduction recommendations for the Power Fire Nexus high, medium, and low priority areas (Figure 8).

The immediate benefit of the Strategic Plan is that it sets the stage for selecting, funding and implementing fuel reduction work in the three priority watersheds of the Power Fire Nexus. The Strategic Plan provides recommendations but is designed to be flexible and envisions fine tuning the specific approaches at the time of project planning, funding, and implementation.

The spatial prioritization ranking matrix is an adaptive tool that can be further refined for prioritizing and selecting optimal forest fuel reduction strategies at other watersheds. In addition, the forest thinning and biomass management matrices included in the Strategic Plan can be adapted to evaluate other forested areas where hazardous fuel loading is a concern, by replacing or modifying the Power Fire Nexus specific criteria used. Simplified matrices are provided as figures in the Strategic Plan to illustrate the approach for communication purposes. The more detailed Excel tools used to prioritize areas and rank and assign treatment processes and companion templates with instructions are available for download via a Cloud Share Site.

While the focus of this Strategic Plan is on the Power Fire Nexus Matrices, the tools can be adapted to evaluate fuel management approaches in other forested areas. Further, the USFS can further refine these tools for general use and training purposes.

8.0 REFERENCES

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USFS, 2019b. *Decision Memo, 2019 Power Fire Pre-Commercial Thinning Project, Amador Ranger District, Eldorado National Forest, Amador County, California*. September 4.

Van de Water K, and Safford HD, 2011. A summary of fire frequency estimates for California vegetation before Euro-American settlement. Fire Ecology 7(3):26-58.

TABLES

LIST OF TABLES

TABLE 1
POWER FIRE NEXUS PRE-DEFINED PROJECTS
Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan
2004 Power Fire Nexus
Eldorado National Forest, California

Project Name	Status	Description	NEPA Reference
Power Fire Fuels Maintenance Study - Phase I	NEPA Complete	Project comprised of prescribed fire and supporting activities on 1,500 acres within and adjacent to the Power Fire perimeter. Treatments will include low intensity prescribed fire, installation of hand or dozer line to limit extent of prescribed burn, use of hand and aerial ignition techniques, and reduction or rearrangement of fuel using manual and/or mechanical treatments.	United States Department of Agriculture Forest Service (USFS), 2017. *Decision Memo, Power Fire Fuels Maintenance Study, Phase II, Amador Ranger District, Eldorado National Forest, California.* June 23.
Power Fire Fuels Maintenance Study - Phase II	NEPA Complete	Project comprised of prescribed fire and supporting activities on 2,500 acres within and adjacent to the Power Fire perimeter. Treatments will include low intensity prescribed fire, installation of hand or dozer line to limit extent of prescribed burn, use of hand and aerial ignition techniques, and reduction or rearrangement of fuel using manual and/or mechanical treatments.	USFS, 2017. *Decision Memo, Power Fire Fuels Maintenance Study, Phase II, Amador Ranger District, Eldorado National Forest, California.* September 11.
Power Fire Reforestation Project	NEPA Complete	Hand planting and inter-planting on approximately 1,580 acres in three arrangements designed to: a) accelerate development of old growth conditions, b) establish habitat suitable for California spotted owl, and c) accelerate development of more open forest conditions.	USFS, 2017. *Final Environmental Impact Statement, Power Fire Reforestation Project* . August.
Panther Forest Health Project	NEPA Complete	Conduct a fuels reduction and forests health improvement project on approximately 3,350 acres of National Forest System (NFS) lands. Objectives are to reduce unnaturally high fuel loadings, decrease the likelihood of future large scale wildfire, improve forest health, and maintain/improve roads to their planned maintenance level.	USFS, 2017. *Decision Notice and Findings of No Significant Impact, Panther Fuels Reductions and Forest Health Project, Eldorado National Forest, Amador Ranger District, California.* November 2.
Pacific Gas & Electric Integrated Vegetation Management Project	NEPA Complete	Use of mastication and herbicides on 26 miles of electric transmission line corridor and approximately 591 acres along the French Meadows-Middle Fork Right of Way, to maintain the required clearance from power lines and to clear vegetation from around the base of structures.	USFS, 2017. *Decision Notice and Findings of No Significant Impact, Pacific Gas & Electric Company's Integrated Vegetation Management Program for Transmission Line Rights-of-Way, Eldorado National Forest.* October 17.
Cat-Ex Hazard Tree Removal	NEPA Complete	Conduct a tree removal project to fell and remove hazard trees along 224 miles of National Forest System Roads and County Roads within the Power Fire nexus on the Amador Ranger District. Maintenance activities include 1) Logging out - Fallen trees, snags and trees greater than 10 inches in diameter. 2) Hazard Removal and Cleanup - Removing and disposing of hazard trees. 3) Remove and End Haul Materials - Work consists of ordered loading, hauling and placing materials to designated disposal sites.	USFS 2018, *Categorical Exclusion Checklist for Power Fire Nexus Hazard Tree Removal Project, Amador Ranger District,* March 1.
Power Fire Pre-Commercial Thinning Project	NEPA Complete	Pre-commercially thin approximately 11,354 acres of young plantations and natural regeneration for forest stand improvement to: 1) accelerate the development of old forest characteristic, 2) increase stand variability, 3) promote hardwoods, 4) reduce risk of loss to wildfires, and 5) improve stand health.	USFS, 2019. *Decision Memo, 2019 Power Fire Pre-Commercial Thinning Project.* September 4.

TABLE 2
PROJECT DATA SUMMARY TABLE
Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan
2004 Power Fire Nexus
Eldorado National Forest, California

Data Need	Data Source Entity	Data Source	Data Source Link(s)	Notes
Topography	USDA Forest Service	General: USFS - LiDAR Bare Earth DEM		
Access Considerations	1. USFS 2. Amador County	1. USFS 2. Amador County GIS File		
Development(s) Proximity	1. USFS 2. Amador County	1. USFS 2. Zoning/parcel data		
Surface Water Bodies/Hydrology	United States Geological Survey	NHD - National Hydrography Dataset		
Biological and Cultural Resources: 1. Sensitive Habitat 2. Cultural Resources	1. USFWS 2. USFS	1. Critical Habitat Maps	https://ecos.fws.gov/ecp/report/table/critical-habitat.html	1. Foothill yellow-legged frog and CA spotted owl habitat in our project area
Vegetation Type	USDA Forest Service	Landscape Fire and Resource Management Planning Tools (LANDFIRE)	https://www.landfire.gov/	
Fuel Inventories	1. USDA Forest Service 2. CALFIRE	1. USDA Forest Service - hazardous fuel treatment reduction areas 2. Timber Harvest Plans		
Wildland Urban Interface – residences	USDA Forest Service	Wildland Urban Interface: 2010	https://enterprisecontentnew-usfs.hub.arcgis.com/datasets/wildland-urban-interface-2010	
Critical infrastructure	CEC	Open Data	https://cecgis-caenergy.opendata.arcgis.com/	
Abandoned mine sites	DoC	Mines and Mineral Resources	https://spatialservices.conservation.ca.gov/arcgis/rest/services/MOL/MOLMines/MapServer	Data do not show any abandoned mines in the project area
Contaminated sites	1. SWRCB 2. DTSC	1. GeoTracker 2. EnviroStor	1. Geotracker: Peddler Hill Maintenance Station: https://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0600500004 PG&E Facility: https://geotracker.waterboards.ca.gov/profile_report.asp?global_id=T0600900063	1. Geotracker: Oil release: Peddler Hill Maintenance Station, Pioneer, CA (Case Closed 2009) Gasoline release: PG&E facility, Salt Springs Reservoir, CA (Case Closed 1997) 2. Envirostor: No sites in project vicinity
Topographic and Canopy Characteristics	USFS	Landfire	https://www.landfire.gov/	

Abbreviations:
CA = California
CEC = California Energy Commission
DEM = Digital Elevation Model
DoC = California Department of Conservation
DTSC = California Department of Toxic Substances Control
GIS = Geographical Information System
LiDAR = Light Detection and Ranging
NHD = National Hydrography Dataset
PG&E = Pacific Gas & Electric Company
SWRCB = State Water Resources Control Board
THP = Timber Harvest Plan
USFS = United States Department of Agriculture Forest Service
USFWS = United States Fish & Wildlife Service
USGS = United States Geological Survey

TABLE 3
AREA PRIORITIZATION WEIGHTING AND RANKING
Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan
2004 Power Fire Nexus
Eldorado National Forest, California

Criteria	Difficulty	Size of Area	Condition Class	Watershed	Infrastructure	Road Access	Permitting/Compliance	Infrastructure	
Metric	Difficulty Factor (Based on Slope/Access)	Acreage	How Much Fuel Reduction Work Has Already Been Completed? Condition Class	Distance to Surface Water	Critical Infrastructure Distance (feet) ('Transmission Lines/Dams/Canal)	Distance to Roads (feet)	National Environmental Protection Act (NEPA) Status	Wild Urban Interface (WUI)	
	1 = Not Difficult	1 = Less than 50 acres	1 = At or near desired condition class	1 = Greater than 1000 ft	1 = Greater than 250 ft	1 = Greater than 500 feet	1 = NEPA Not Started	1 = Not WUI	TOTAL WEIGHT
	2 = Typical Difficulty	2 = 50 to 250 acres	2 = Requires work to restore or maintain desired condition	2 = 250 to 1000 ft	2 = 50 to 250 ft	2 = 100 to 500 ft	2 = NEPA Started	2 = WUI Threat Zone (0.25 to 1.5 miles from structure/roadway)	
	3 = More Difficult	3 = Greater than 250 acres	3 = Not at desired condition, high fuel loading and/or stand density	3 = Less than 250 ft	3 = Less than 50 ft	3 = Less than 100 ft	3 = NEPA Complete	3 = WUI Defense Zone (0.25 from structure/roadway)	
Weight[1,2]	0	20	10	10	10	20	15	15	100.0

Notes:

1. The criteria shown reflects appropriate considerations for evaluating forestland areas. The criteria with a weight of zero assigned were determined to not be distinguishing metrics for the Power Fire Nexus but have been left on this table for consideration for future refinement or for use at other locations where they can be assigned a weight.

2. The weights shown in the table above were selected to prioritize areas within the Power Fire Nexus for fuel reduction treatment based on the National Fish and Wildlife Foundation Northern California Forests and Watersheds Grant Program objectives and USDA Forest Service Amador Ranger Distric priorities. The weighting system can be used to prioritize areas for treatment in other forested areas, based on area-specific priorities and concerns. A weighting of zero was applied to Access Difficulty, because within these areas the USFS has options such as helicopters, skid steer, and a yarder/cable system.

3. A detailed spreadsheet containing the scores assigned to each area within the Power Fire Nexus for each of the criteria categories is saved as an electronic file on the JJ&A Cloud Share Site.

TABLE 4
FOREST FUEL REDUCTION EQUIPMENT DESCRIPTIONS
Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan
2004 Power Fire Nexus
Eldorado National Forest, California

Category	Equipment	Description
Hand Tool	Chainsaw	Used for felling, limbing, and cutting trees and brush.
Hand Tool	Pulaski	Features and axe on one side for chopping saplings and brush and a grubbing blade to remove roots and small stumps.
Hand Tool	McLeod	Used for fireline construction to scrape and rake away vegetation, leaving only bare mineral soil.
Hand Tool	Drip Torch	Used for prescribed fires. Ignites vegetation by dripping flaming fuel onto ground.
Hand Tool	Terra Torch	Throws a stream of flaming liquid that rapidly ignites surrounding fuels.
Heavy Equipment	Skid Steer	With attachments, can cut, masticate small and medium sized trees, remove and pile brush, move piles of cut material to central location for pile burning or removal.
Heavy Equipment	Excavator	Effective for creating shaded fuel break. Can maneuver in steep terrain and atop heavier fuels where skid steers are not able to go. Fitted with masticator/mulcher attachment, large brush and trees of up to 25 feet in height and large diameter trees can be turned into small chunks and left on site. Just like chipping, this creates a break in horizontal and vertical fuel continuity.
Heavy Equipment	Chipper	Can be tracked or towed. Change size, shape, and distribution of fuels. Towed used for roadside. Tracked for beyond roadside or in steep terrain.
Heavy Equipment	Dozer	Used to crush brush by pulling a chain or ball and chain over the brush. When fitted with brush rake, dozers effective at removing and piling brush prior to burning. Also used to clear fuels for fire breaks, move large logs, and emergency access. When used for fuel reduction, dozer blade is lifted and chain pulled behind the machine to crush brush and prep area for controlled burn.
Heavy Equipment Attachment	Tethered Logging System	Utilizes a cable winch systems on loaders and skidders to assist equipment operations on steep slopes, while enhancing traction on gentle grades.
Heavy Equipment Attachment	Brush Rake	Has a large scoop and forks that can be used to clear brush and form piles. Can also clear ground to bare mineral soil around brush piles prior to burning.
Heavy Equipment Attachment	Feller Buncher	A feller buncher is a self-propelled machine with a cutting head that is capable of holding more than one stem at a time. The cutting head is used strictly for cutting, holding, and placing the stems on the ground. Feller bunchers do not have processing capabilities.
Heavy Equipment Attachment	Grapple Attachment	Can pick up and cut tree stems longer than what can be done by hand and move for pile burning or chipping.
Heavy Equipment Attachment	Masticator/ Mulcher	Mulchers cut and chop or grind vegetation into particles that are usually left on-site as mulch. The primary purpose of mulching is to lower the vertical height of fuels, as an alternative to chemical treatment of competitive species, for aesthetic treatments, right-of-way maintenance, and range rehabilitation.
Aerial Equipment	Helicopter	Versatile approach due to ability to avoid obstacles that encumber ground based and skyline systems, including site sensitivity, urgency to remove or deliver the product, lack of access, and slope of the terrain. Advantages of helicopter logging include: reduced mpacts on the ground, not limited by terrain or lack of access roads, high volume log production. Planning is critical due to the high costs.
Aerial Equipment	Helitorch	Effective for igniting prescribed fire over a large area.
Heavy Equipment	Portable Sawmill	Can be used at a central location where suitable logs have been staged. Appropriate for use at sites where some trees qualify as quality timber, but not enough to justify hauling to a sawmill. Sawn logs can be used to make picnic benches, siding, window frames for donation to local agencies or charities.
Heavy Equipment	Air Curtain Burner	Works by pushing high velocity air over top of burn chamber, creating a curtain of air which rising smoke cannot penetrate. Unburned particulates are pushed back down into chamber where they reburn until they are light enough to rise through the air curtain. Used when leaving debris/slash behind or broadcast/pile burning is not an option. Produces nearly smokeless burn, reduces particulate matter. Can be used on days when broadcast/pile burning is not an option due to air quality limits. Can burn 5 to 7 tons per hour.
Chip Transport	Trailer	Transporting chips requires a trailer that can safely carry chips without losing material d. Open top trailers are used where chips will be loaded either by a chipper or grinder with a conveyor capable of pushing the chips over the top of the trailer, or by a loader capable of dumping loads of chips over the top of the trailer. Rear loading trailers have a rear door that contains an opening for the chute of a chipper to blow chips in through the rear. Open top trailers must have a tarp to cover the load when it is full.

Sources:

CALFIRE, 2021. *Fuels Reduction Guide.*

USDA Forest Service, 2021. *Equipment Catalogue: https://www.fs.fed.us/forestmanagement/equipment-catalog/tethered.shtml. Accessed on June 21, 2021.*

FIGURES

LIST OF FIGURES

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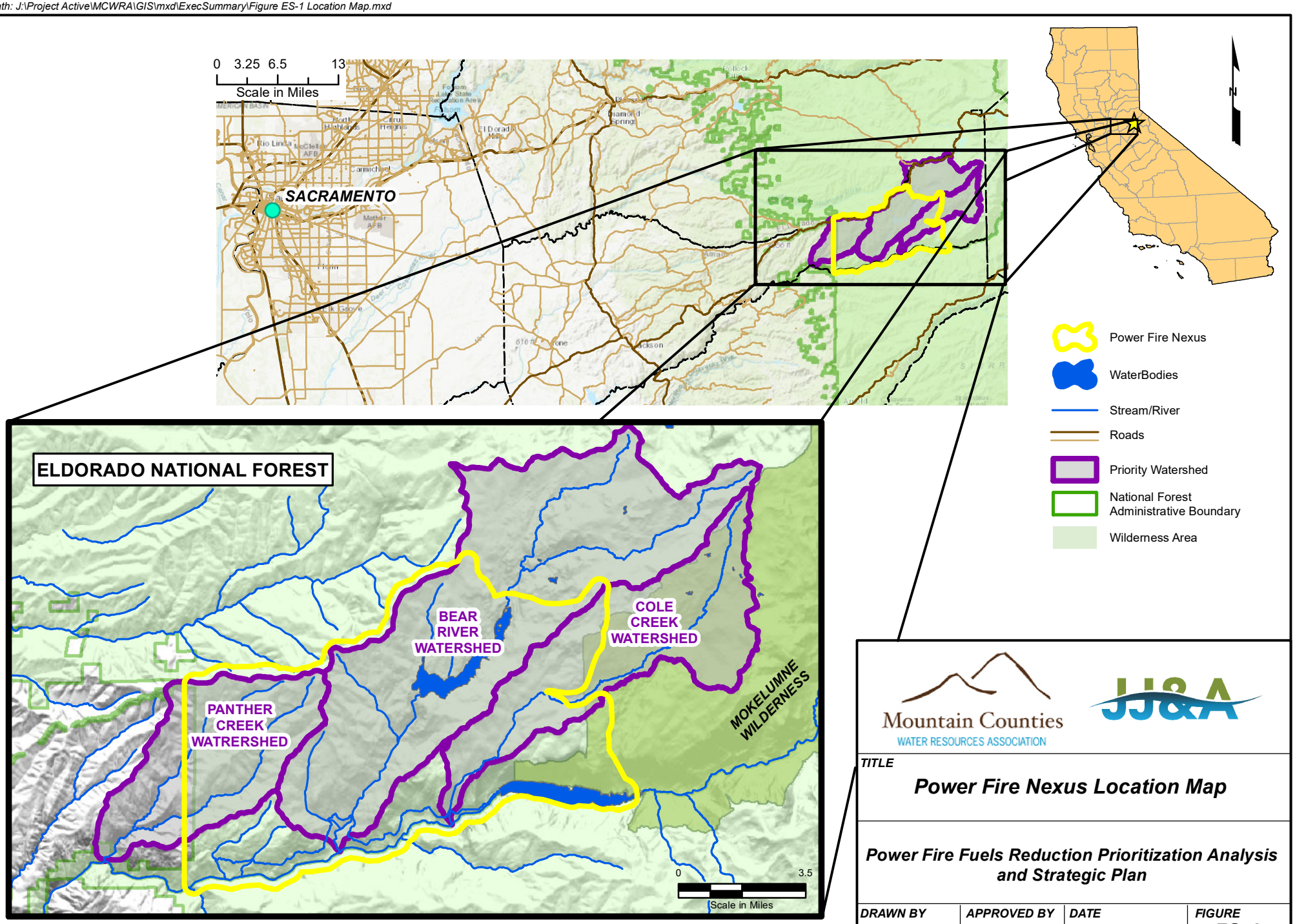


Mountain Counties WATER RESOURCES ASSOCIATION

JJ&A

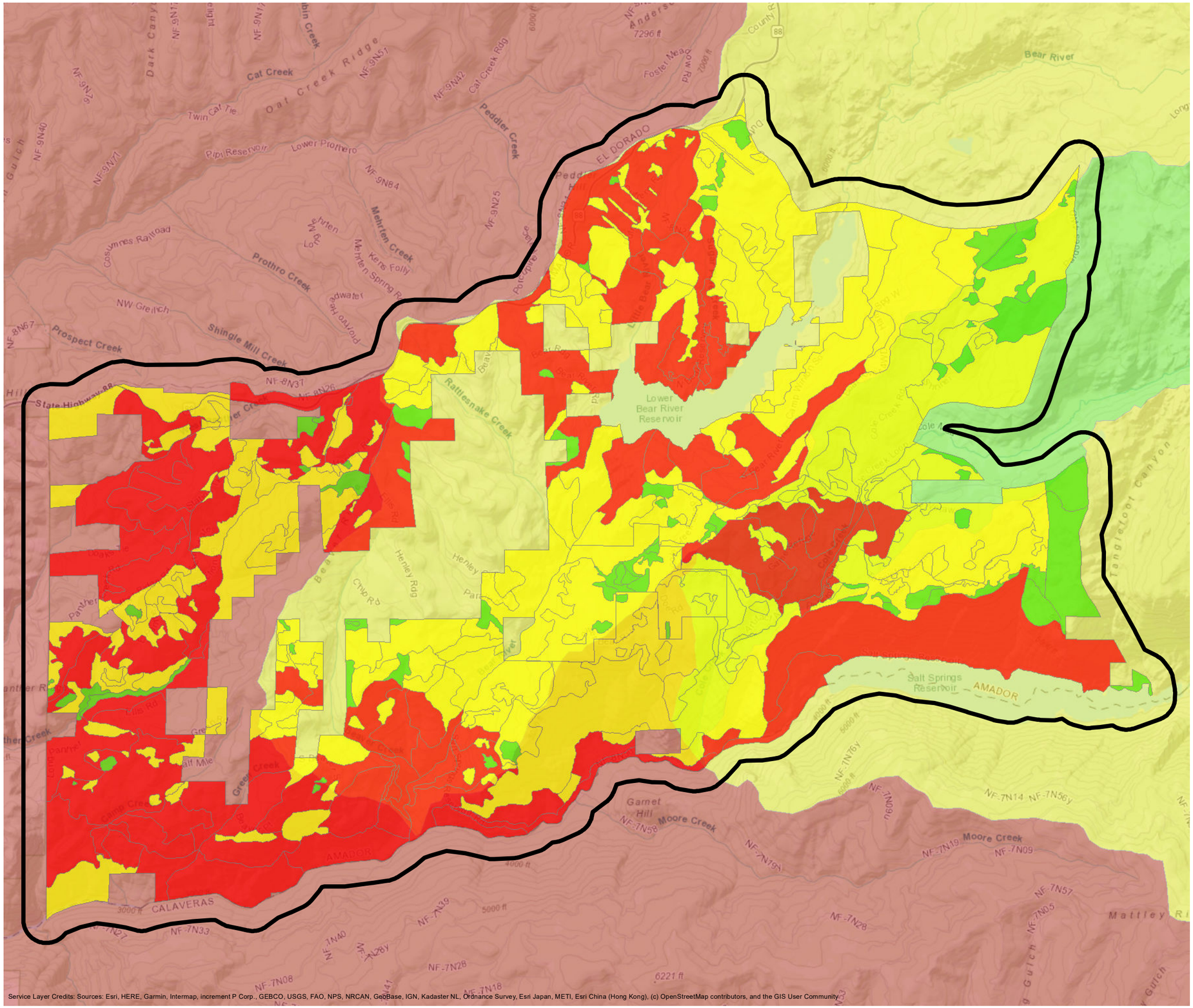
TITLE

Power Fire Nexus Location Map

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
DPG	LM	5/12/2021	ES-1

AERIAL SOURCE: NATIONAL AGRICULTURE IMAGERY PROGRAM, FEBRUARY 2011



LEGEND

Power Fire Nexus

Power Fire Nexus Treatment Area Priority

- High
- Medium
- Low

CALFIRE Fire and Resource Assessment Program (FRAP) Priority Landscapes, Reducing Wildfire Risk to Forest Ecosystems[1]

- High
- Medium
- Low

[1] Data Source: https://www.arcgis.com/apps/MapSeries/index.html?appid=f767d3f842fd47f4b35d8557f10387a7

0 2 Miles

N

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TITLE

Power Fire Nexus Treatment Area Prioritization Map

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

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DPG	LM	7/28/2021	ES-2

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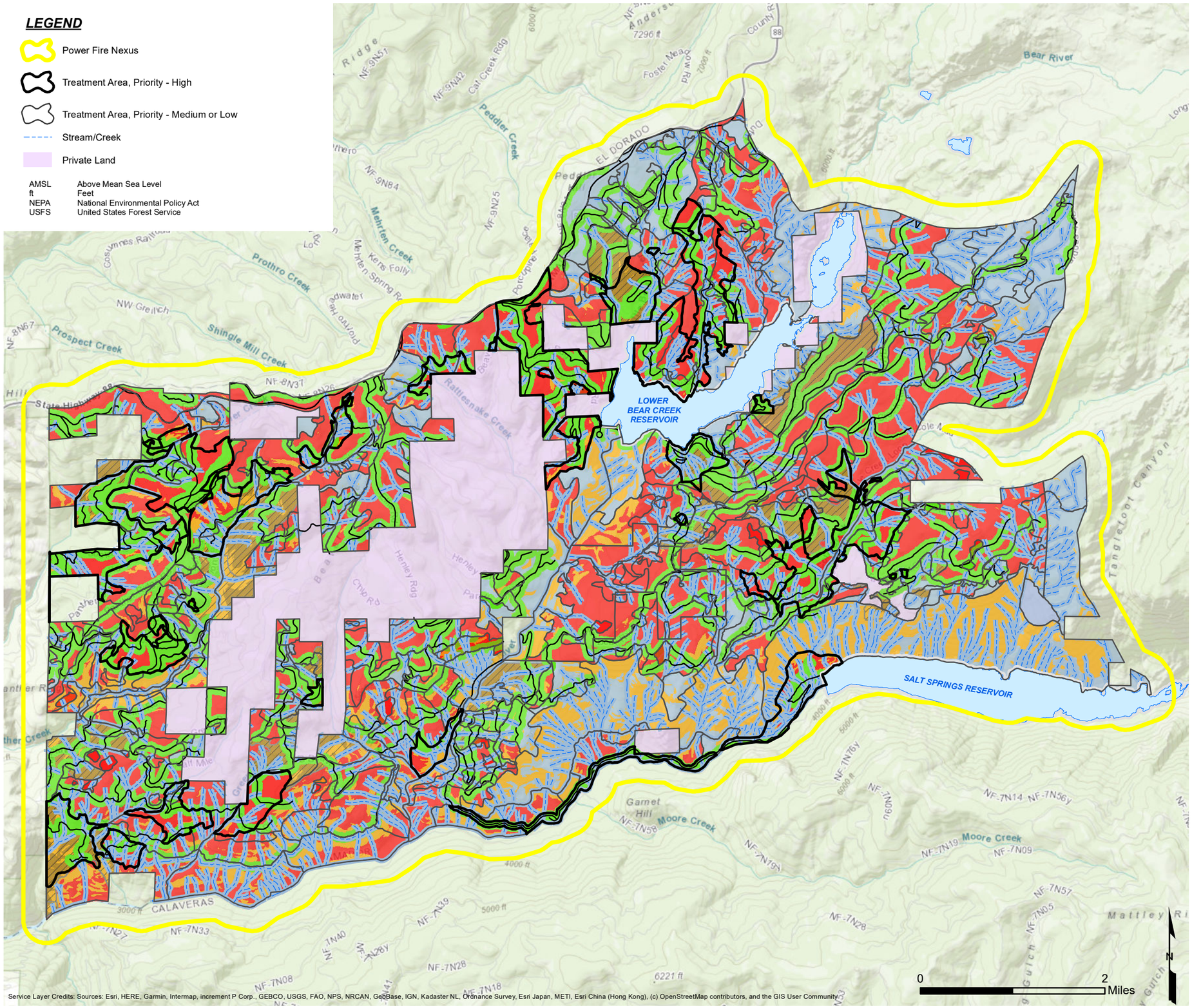

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

LEGEND

- Power Fire Nexus
- Treatment Area, Priority - High
- Treatment Area, Priority - Medium or Low
- Stream/Creek
- Private Land

AMSL	Above Mean Sea Level
ft	Feet
NEPA	National Environmental Policy Act
USFS	United States Forest Service

TREATMENT OPTIONS

- No treatment - Area meets desired condition or is not accessible, or is protected aquatic habitat.
- Proceed with Amador Ranger District Planned Treatment [1,2] (Hazard Tree Removal Project - NEPA Complete)
- Mechanical treatment followed by controlled burn (where and when feasible. Mechanical treatment approach may utilize feller/buncher, masticator/mulcher, dozer, excavator
- Mechanical treatment with helicopter or yarder/ cable system. steep slope)
- Manual Treatment Only (Spotted Owl Protected Activity Center)

Note: there are no public files available regarding Northern Goshawk locations, and as such they are not addressed in this figure. Surveys and location specific adjustments should be made when Northern Goshawks are present.

[1] Field surveys prior to implementation may identify locations within areas that cannot be treated: (1) areas flagged during Sensitive Plant Survey; (2) less than 50 feet from Perennial/Intermittent Streams or Special Aquatic Features; and (3) areas flagged during an Archeological/Cultural resource survey.

[2] Areas with this stippled pattern have seasonal limitations as follows:
CA SPOTTED OWL BREEDING SEASON
Limited Operation Period- March 1 to Aug 15
1/4-mile radius from Protected Activity Center (PAC) (unless cleared by District Biologist)

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TITLE

Treatment Approach Recommendations

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
DPG	LM	7/28/2021	ES-3

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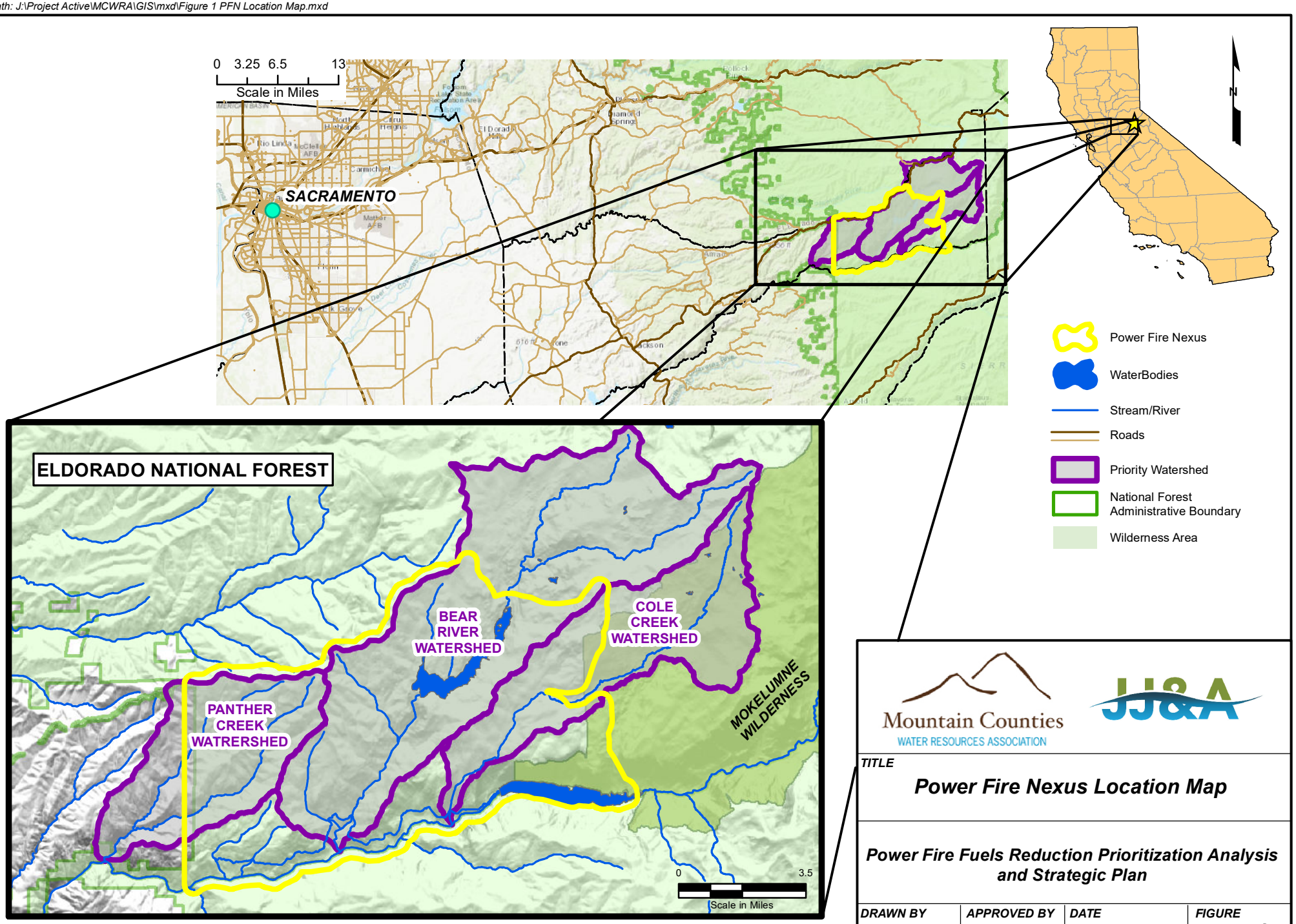

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TITLE

Power Fire Nexus Location Map

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

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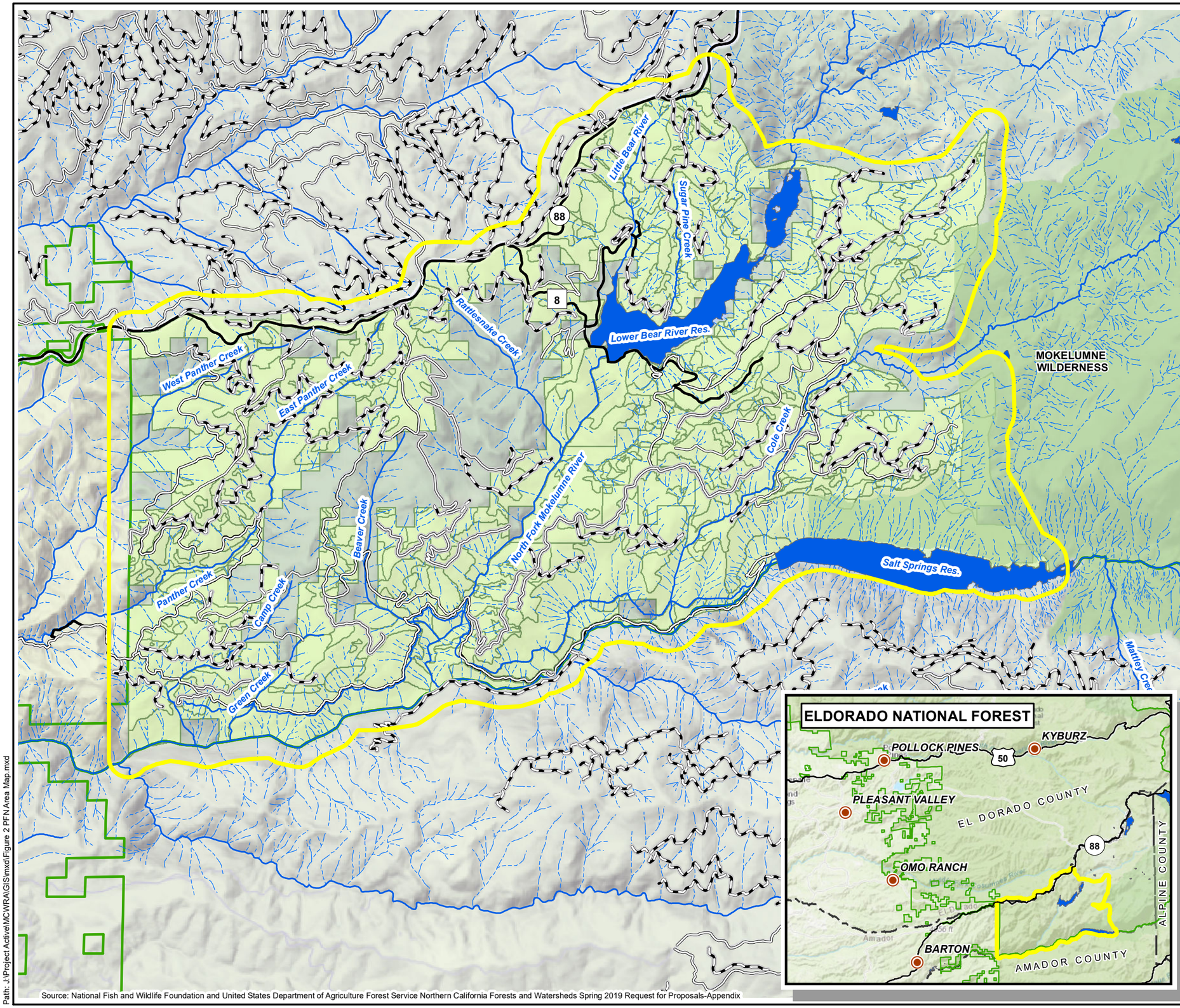
DPG	LM	5/12/2021	1



Source: National Fish and Wildlife Foundation and United States Department of Agriculture Forest Service Northern California Forests and Watersheds Spring 2019 Request for Proposals-Appendix

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LEGEND

- Power Fire Nexus
- WaterBodies
- Stream/River
- Ephemeral Streams
- Roads Open to All vehicles - Yearlong
- Roads Open to All Vehicles - Seasonal
- Roads Open to Highway Legal Vehicles - Seasonal
- Roads Open to Highway Legal Vehicles - Yearlong
- National Forest Administrative Boundary
- Wilderness Area
- City/Community location

0 2.5 Miles

N

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TITLE

Power Fire Nexus Area Map

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
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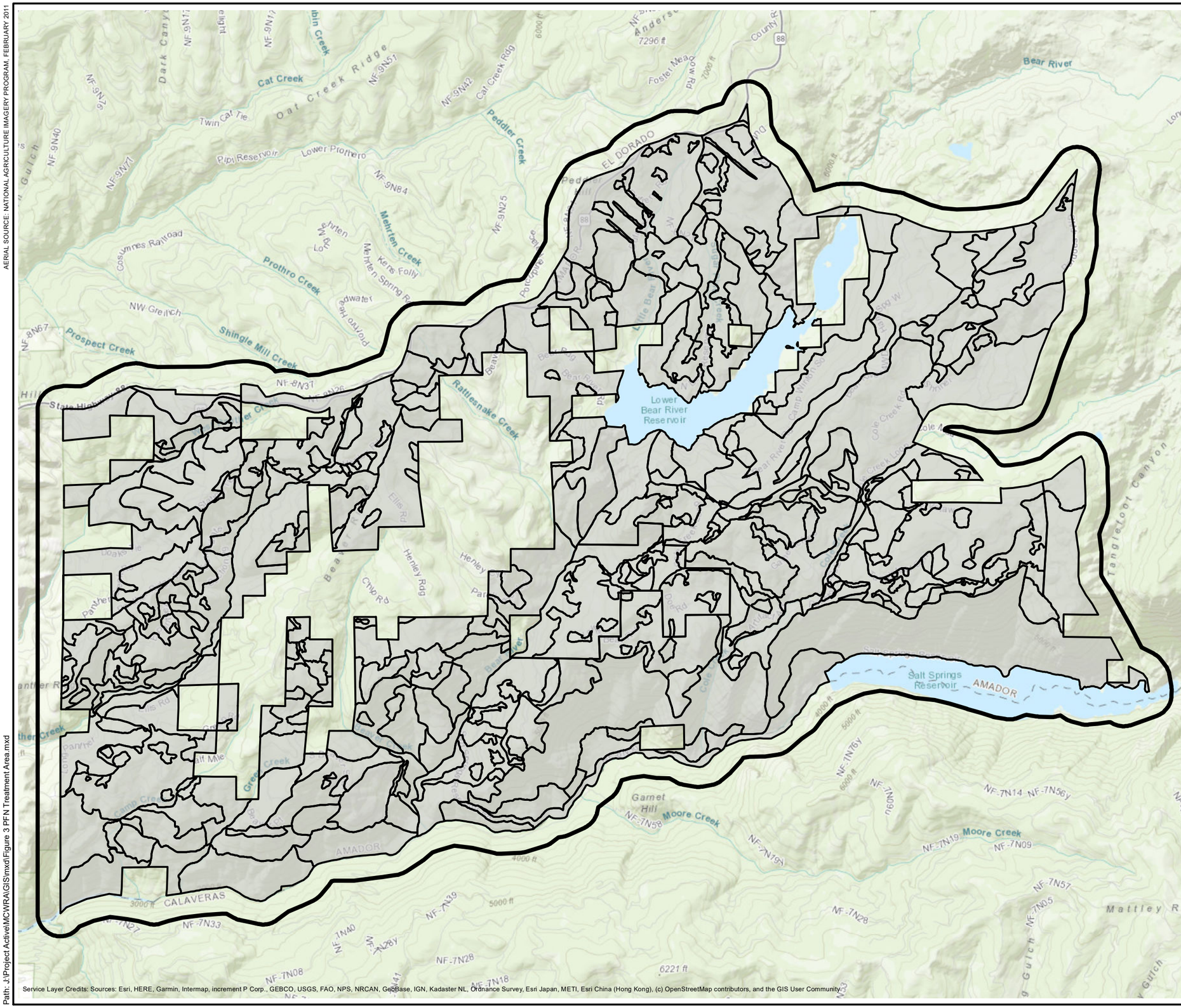
AERIAL SOURCE: NATIONAL AGRICULTURE IMAGERY PROGRAM, FEBRUARY 2011



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LEGEND

Power Fire Nexus

Treatment Area

0 2 Miles

N

Mountain Counties WATER RESOURCES ASSOCIATION

JJ&A

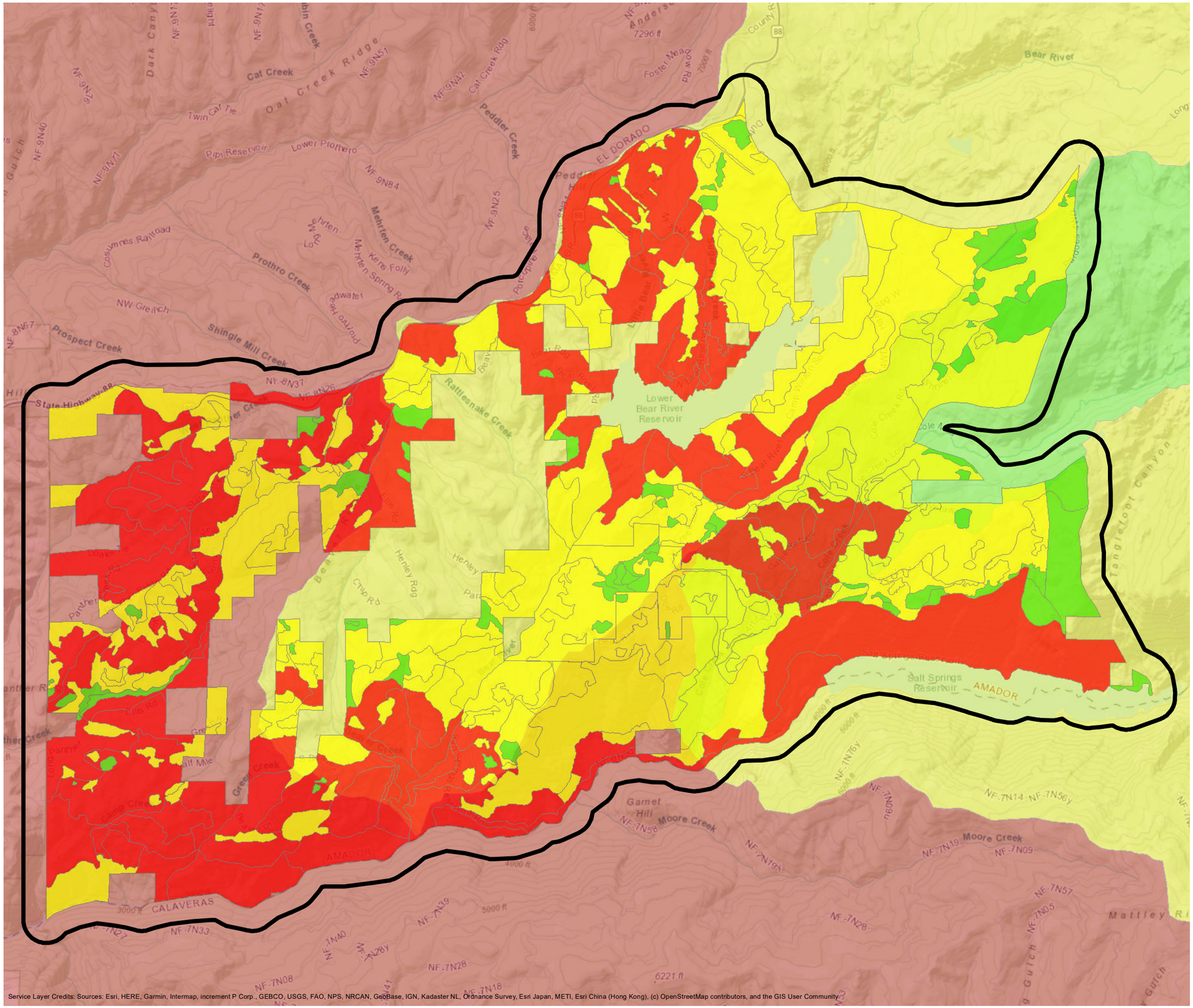
TITLE

Power Fire Nexus Treatment Areas Delineation Map

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
DPG	LM	5/12/2021	3

AERIAL SOURCE: NATIONAL AGRICULTURE IMAGERY PROGRAM, FEBRUARY 2011



LEGEND

Power Fire Nexus

Power Fire Nexus Treatment Area Priority

- High
- Medium
- Low

CALFIRE Fire and Resource Assessment Program (FRAP) Priority Landscapes, Reducing Wildfire Risk to Forest Ecosystems[1]

- High
- Medium
- Low

[1] Data Source: https://www.arcgis.com/apps/MapSeries/index.html?appid=f767d3f842fd47f4b35d8557f10387a7

0 2 Miles

N

Mountain Counties WATER RESOURCES ASSOCIATION

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TITLE

Power Fire Nexus Treatment Area Prioritization Map

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
DPG	LM	7/20/2021	4

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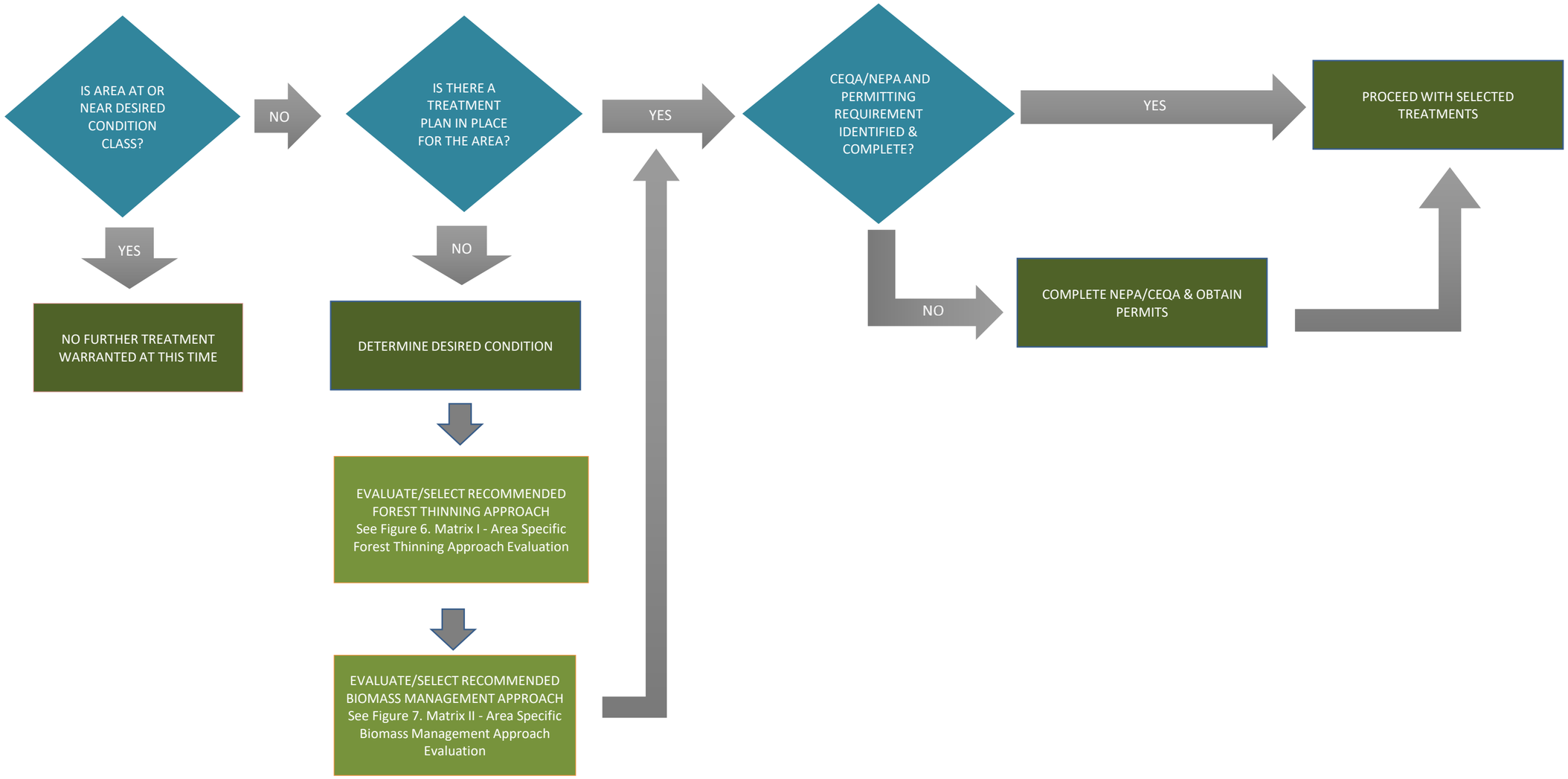
FIGURE 5
FUEL REDUCTION ANALYSIS APPROACH FLOW CHART
Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan
2004 Power Fire Nexus
Eldorado National Forest, California



Abbreviations:
CEQA = California Environmental Quality Act
NEPA = National Environemental Protetcion Act

FIGURE 6

MATRIX I: AREA SPECIFIC FOREST THINNING APPROACH EVALUATION[1]

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

2004 Power Fire Nexus

Eldorado National Forest, California

EVALUATION CRITERIA	AREA SPECIFIC FOREST THINNING APPROACH EVALUATION STEPS[1]								
	STEP 1: IDENTIFY AREAS WHERE NO TREATMENT (NO ACTION) IS PRESCRIBED	→	STEP 2: IDENTIFY AREAS WHERE TREATMENT WITH HAND TOOLS IS PRESCRIBED	→	STEP 3: IDENTIFY REMAINING AREAS (WHERE MECHANICAL THINNING IS PRESCRIBED)	→	STEP 4: IDENTIFY AREAS (POST-MECHANICAL THINNING WHERE CONTROLLED BURNING IS FEASIBLE)	→	STEP 5: FOR AREAS WHERE A CONTROL BURN IS NOT PRESCRIBED, PROCEED TO FIGURE 7 - MATRIX II TO SELECT BIOMASS MANAGEMENT METHOD
RISK							Per CAL FIRE guidelines[2], consider: -Assets at risk (WUI, power lines) -Escape potential/technical difficulty -Air quality -Stakeholder concerns		
FEASIBILITY							-Consider burn window, lead time required, and personnel/equipment needs.		
ACCESS / TERRAIN	No access.				-Options for steep terrain include skid steer, yarder/cable system, helicopter. -Options for accessible areas in less steep terrain include feller/buncher, masticator/mulcher, dozer, excavator.		-Access/egress -Containment		

FIGURE 6

MATRIX I: AREA SPECIFIC FOREST THINNING APPROACH EVALUATION[1]

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

2004 Power Fire Nexus

Eldorado National Forest, California

EVALUATION CRITERIA	AREA SPECIFIC FOREST THINNING APPROACH EVALUATION STEPS[1]				
	STEP 1: IDENTIFY AREAS WHERE NO TREATMENT (NO ACTION) IS PRESCRIBED	STEP 2: IDENTIFY AREAS WHERE TREATMENT WITH HAND TOOLS IS PRESCRIBED	STEP 3: IDENTIFY REMAINING AREAS (WHERE MECHANICAL THINNING IS PRESCRIBED)	STEP 4: IDENTIFY AREAS (POST-MECHANICAL THINNING WHERE CONTROLLED BURNING IS FEASIBLE)	STEP 5: FOR AREAS WHERE A CONTROL BURN IS NOT PRESCRIBED, PROCEED TO FIGURE 7 - MATRIX II TO SELECT BIOMASS MANAGEMENT METHOD
AQUATIC WILDLIFE[3]	**SIERRA NEVADA YELLOW-LEGGED FROG** Area is Above 4,500 ft AMSL AND Less Than 82 ft from Stream or Special Aquatic Feature **FOOTHILL YELLOW-LEGGED FROG** Area is Below 4,500 ft AMSL AND Less Than 25 ft from Stream or Special Aquatic Feature	**FOOTHILL YELLOW-LEGGED FROG** Area is Below 4,500 ft AMSL AND Less Than 50 ft from Stream or Special Aquatic Feature			
TERRESTRIAL WILDLIFE[3]	**CA SPOTTED OWL BREEDING SEASON** **Limited Operation Period- March 1 to Aug 15** 1/4-mile radius from Protected Activity Center (PAC) (unless cleared by District Biologist) **NORTHERN GOSHAWK BREEDING SEASON** **Limited Operations Period - Feb 15 to Sept 15** 1/4-mile radius from PAC (unless cleared by District Biologist)	**CALIFORNIA SPOTTED OWL** -Within PAC Boundaries **NORTHERN GOSHAWK** -Within PAC Boundaries		**CALIFORNIA SPOTTED OWL** Underburning is permitted, but fire can not be set within PAC. **NORTHERN GOSHAWK BREEDING SEASON** Underburning is permitted, but fire can not be set within PAC.	

FIGURE 6

MATRIX I: AREA SPECIFIC FOREST THINNING APPROACH EVALUATION[1]

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

2004 Power Fire Nexus

Eldorado National Forest, California

EVALUATION CRITERIA	AREA SPECIFIC FOREST THINNING APPROACH EVALUATION STEPS[1]								
	STEP 1: IDENTIFY AREAS WHERE NO TREATMENT (NO ACTION) IS PRESCRIBED	→	STEP 2: IDENTIFY AREAS WHERE TREATMENT WITH HAND TOOLS IS PRESCRIBED	→	STEP 3: IDENTIFY REMAINING AREAS (WHERE MECHANICAL THINNING IS PRESCRIBED)	→	STEP 4: IDENTIFY AREAS (POST-MECHANICAL THINNING WHERE CONTROLLED BURNING IS FEASIBLE)	→	STEP 5: FOR AREAS WHERE A CONTROL BURN IS NOT PRESCRIBED, PROCEED TO FIGURE 7 - MATRIX II TO SELECT BIOMASS MANAGEMENT METHOD
BOTANY			Areas flagged during Sensitive Plant Survey						
HYDROLOGY			Less than 50 feet from Perennial/Intermittent Stream or Special Aquatic Feature.						
ARCHEOLOGICAL & CULTURAL	Areas identified and flagged during archeological/cultural survey		Areas identified and flagged during archeological/cultural survey						

NOTES:

[1] For the Power Fire Nexus, specific approaches had been predefined for many of the area in the Eldorado National Forest Land and Resource Management Plan (USFS, 1989) and Sierra Nevada Forest Plan Amendment (USFS, 2004). The criteria and approach for application to other geographic locations outside of the Power Fire Nexus should be modified to reflect any location specific Management Plans and criteria relevant and specific to those areas. If no approaches have been selected yet, the Evaluation Criteria can be modified to reflect the location specific considerations which may or may not be similar to those of the Power Fire Nexus.

[2] CAL FIRE, 2019. *CAL FIRE Prescribed Fire Guidebook.* September.

ABBREVIATIONS:

AMSL = Above Mean Sea Level
ft = feet
PAC = Protected Activity Center
USDA = United States Department of Agriculture
WUI = Wildland Urban Interface

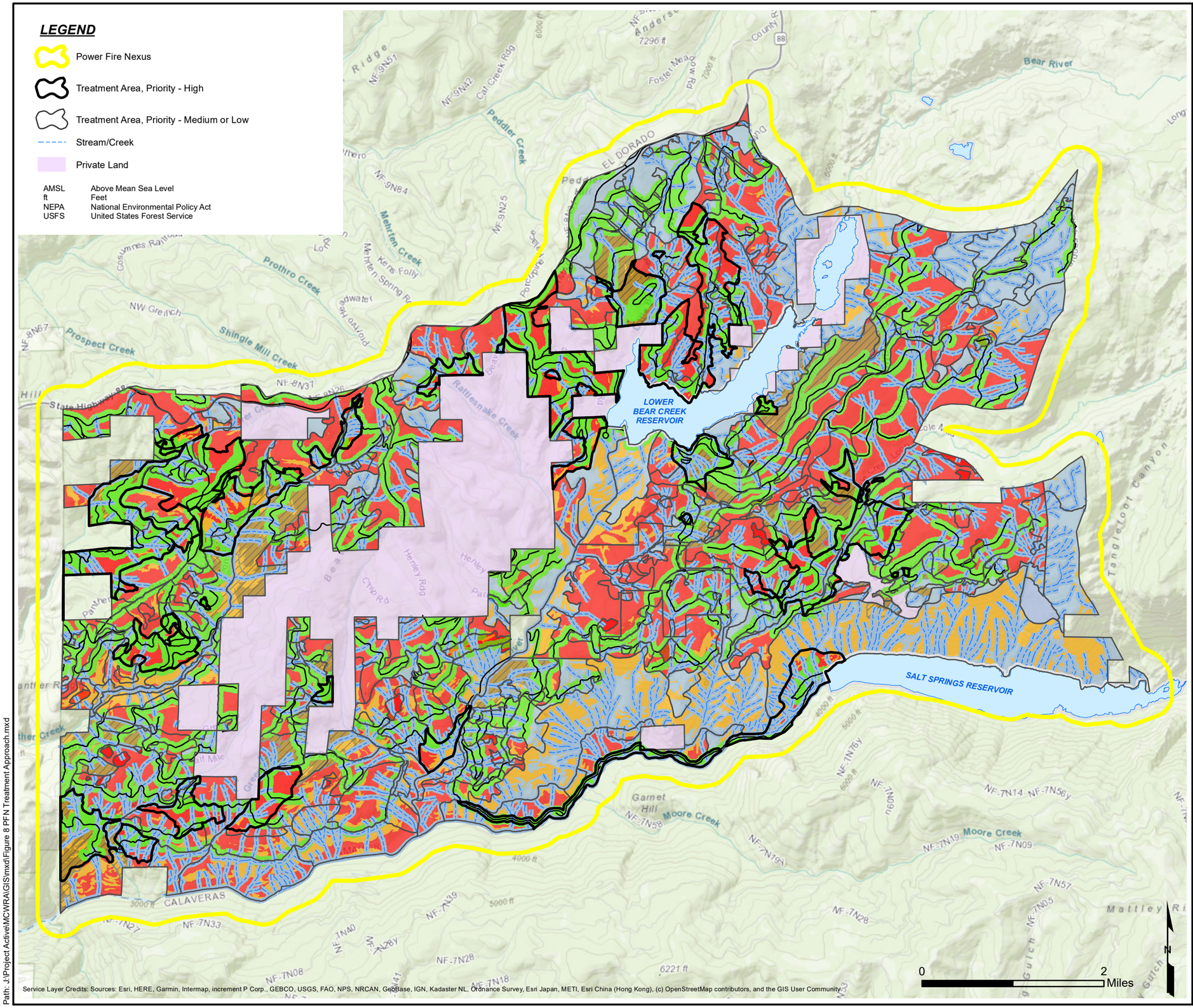
FIGURE 7
MATRIX II: AREA SPECIFIC BIOMASS MANAGEMENT APPROACH EVALUATION
Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan
2004 Power Fire Nexus
Eldorado National Forest, California

	POST-THINNING BIOMASS MANAGEMENT EVALUATION STEPS		
EVALUATION CRITERIA	STEP 1: IDENTIFY MERCHANTABLE BIOMASS FOR REMOVAL AND SALE [1] →	STEP 2: SELECT APPROACH TO REDUCE RESIDUAL BIOMASS VOLUME →	STEP 3: SELECT APPROACH FOR RESIDUAL BIOMASS MANAGEMENT
COST/ FEASIBILITY	Considerations: -Haul distance -Unit price -Biomass energy demand (Note: a biomass plant is in the planning stage in Wilsyville; approximately 40 miles from the Power Fire Nexus).	-Consider equipment and personnel costs and availability. -For prescribed burn, consider scheduling restraints due to seasons, weather and other conditions.	Consider: -Equipment and personnel costs -Potential off-site beneficial uses and demand (for chips, biochar)
TERRAIN/ ACCESS	-Options for steep terrain include skid steer, yarder/cable system, helicopter. -Options for other areas include feller/buncher, masticator/mulcher, dozer, excavator.	Where access permits: -Mastication for non-merchantable trees. -Chipping for slash Otherwise: -Build burn piles, OR -Lop and scatter	-Where accessible and feasible, utilize air curtain burner or chipper, -If access by equipment is not feasible, pile and burn or lop and scatter.
SPECIFICATIONS	**SAWTIMBER:** Minimum diameter at breast height (DBH) = 10-inches at 4.5 feet above ground. **BIOMASS ENERGY:** Minimum DBH = 2-inches	**NON-MERCHANTABLE TREES:** -Mastication where feasible -Otherwise, leave downed trees in place **SLASH:** -Use chipper where feasible. Otherwise scatter	**CHIPS:** - off-site beneficial use[2] - incinerate using air curtain with or without conversion to biochar; biochar use on-site or for off-site agricultural applications, OR -spread evenly to maximum depth of 6 in. -do not spread within 4 ft of tree boles OR -haul to off-site vendor/user[2] **SLASH:** -incinerate using air curtain with or without conversion to biochar; biochar use on-site or for off-site agricultural applications, OR -Pile and burn **SCATTERED MATERIALS:** Depth less than 12" -No slash within 10" of boles of remaining trees or drip line, whichever is larger. **BIOCHAR:** May be applied on-site as soil amendment of hauled to off-site vendor/user.

Notes:

[1] United States Department of Agriculture Forest Service, 2007. *Woody Biomass Utilization Desk Guide* . September.

[2] Off-site beneficial uses to be considered for biomass material include, but are not limited to, dimensional lumber, animal bedding, biochar, cross-laminated timber, mulch, oriented strand-board, pulp, post, shredding, and veneer products



TREATMENT OPTIONS

No treatment - Area meets desired condition or is not accessible, or is protected aquatic habitat.

Proceed with Amador Ranger District Planned Treatment [1,2] (Hazard Tree Removal Project - NEPA Complete)

Mechanical treatment followed by controlled burn (where and when feasible. Mechanical treatment approach may utilize feller/buncher, masticator/mulcher, dozer, excavator

Mechanical treatment with helicopter or yarder/ cable system. steep slope)

Manual Treatment Only (Spotted Owl Protected Activity Center)

Note: there are no public files available regarding Northern Goshawk locations, and as such they are not addressed in this figure. Surveys and location specific adjustments should be made when Northern Goshawks are present.

[1] Field surveys prior to implementation may identify locations within areas that cannot be treated: (1) areas flagged during Sensitive Plant Survey; (2) less than 50 feet from Perennial/Intermittent Streams or Special Aquatic Features; and (3) areas flagged during an Archeological/Cultural resource survey.

[2] Areas with this stippled pattern have seasonal limitations as follows:
CA SPOTTED OWL BREEDING SEASON
Limited Operation Period- March 1 to Aug 15
1/4-mile radius from Protected Activity Center (PAC) (unless cleared by District Biologist)

Mountain Counties WATER RESOURCES ASSOCIATION

JJ&A

TITLE

Treatment Approach Recommendations

Power Fire Fuels Reduction Prioritization Analysis and Strategic Plan

DRAWN BY	APPROVED BY	DATE	FIGURE
DPG	LM	7/28/2021	8

Path: J:\Project Active\MCWRA\GIS\mxd\Figure 8 PFN Treatment Approach.mxd