



Photo 1: Mt Tam & Worn Springs Fire Rd.

# Vegetation Management Report

## Fiscal Year 2024



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# TABLE OF CONTENTS

## Table of Contents

<b>Executive Summary</b> .....	<b>1</b>
<b>1 Coordination to Reduce Wildfire Risk</b> .....	<b>1-1</b>
1.1 Red Flag Warnings .....	1-2
1.2 Coordination with PG&E .....	1-3
1.3 Coordination with Lessees .....	1-4
1.4 Wildfire Coordination .....	1-5
1.5 Watershed Volunteer Coordination .....	1-6
<b>2 Planning, Monitoring and Environmental Compliance</b> .....	<b>2-7</b>
2.1 Biodiversity, Fire and Fuels Integrated Plan .....	2-8
2.2 Non-Native Invasive Species Mapping .....	2-9
2.3 Early Detection & Rapid Response (EDRR) .....	2-9
2.4 Rare Plant Complinace .....	2-9
2.5 Spotted Owl, Osprey, Wildlife and Migratory Bird Surveys .....	2-11
2.6 Resilient Forest Monitoring & Forest Restoration Planning .....	2-12
2.7 Foothill Yellow Legged Frog Monitoring .....	2-13
2.8 Watershed Fuel Modeling .....	2-13
2.9 Cultural Resource Study .....	2-16
2.10 Wildlife Picture Index .....	2-16
<b>3 Vegetation Management</b> .....	<b>3-17</b>
3.1 Cyclical Maintenance of Fuelbreaks .....	3-18
3.2 New Fuelbreak Construction-MA 21 .....	3-24
3.3 Initial Forest Fuel Reduction-MA 23 .....	3-26
3.4 Improve Grassland and Oak Woodlands-MA 23 .....	3-30
<b>4 Compliance Verification and Monitoring in FY24</b> .....	<b>4-37</b>
4.1 Requirements Implemented by Management Action .....	4-37
4.2 Compliance and Monitoring Considerations and Findings .....	4-40
<b>5 BFFIP Review &amp; Work Plan</b> .....	<b>5-1</b>
5.1 Review of BFFIP Management Actions .....	5-1
5.2 Review of BFFIP Years 1 – 5 .....	5-4
5.3 Work Plan for Fiscal Year 2025 (BFFIP Year 6) .....	5-7
<b>6 Appendices</b> .....	<b>6-8</b>

## TABLE OF CONTENTS

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## Executive Summary

Each year, the Marin Municipal Water District (district) plans, monitors, and performs actions to reduce the risk of wildfire and improve the resiliency and biodiversity of its lands. Vegetation management activities are tracked and monitored so the district may adapt its actions and adjust to new information. This report is part of that adaptive management cycle. The Biodiversity, Fire, and Fuels Integrated Plan (BFFIP) is being implemented under an adaptive management framework. Per the BFFIP and Environmental Impact Report “The district will evaluate the effectiveness of annual management actions based on the findings from monitoring results. An annual board report will include the findings from monitoring and any recommendations made by District staff for modifications to methods and/or the schedule of preservations and restoration actions”.

The first section covers coordination and planning to reduce wildfire risk, such as watershed closures during Red Flag Warnings; working with PG&E, lessees, and neighbors on defensible space; and coordinating with County Fire. The second section details planning, inventorying, monitoring and compliance work to support vegetation management. The third section shows the results of on-the-ground actions taken for fuel reduction and biodiversity and habitat enhancement. The fourth section describes the district’s verification and monitoring of compliance with mitigation measure requirements. The fifth section lays out the work planning and recommendations for fiscal year (FY) 2025. Table 1 below provides a summary of the district activities that occurred in FY24. Map 1 (Page ES-5) provides a summary showing the locations of vegetation management activities.

## EXECUTIVE SUMMARY

**Table 1 Overview of Vegetation Management Activities**

Completed Work	Outcome	Approximate Cost <sup>a</sup>	Description
Community Coordination for Fire Risk Reduction		<b>\$8,502</b>	
Red Flag Warnings	Watershed Closures	N/A	<ul style="list-style-type: none"> <li>• Closed Watershed for 0 days due to Red Flag Warnings.</li> <li>• Community outreach for red flag and other critical fire weather events through signage and social media.</li> </ul>
Coordination with PG&E	53 Acres	\$1,000	<ul style="list-style-type: none"> <li>• Managed PG&amp;E access through permits to support cyclical vegetation maintenance around and under transmission lines.</li> <li>• PG&amp;E surveyed and cleared vegetation along 9.5 miles of power lines across the watershed.</li> <li>• PG&amp;E repaired/replaced 31 pieces of hardware maintenance along the Distribution system throughout the watershed. See section 1.2 for detail.</li> </ul>
Coordination with Lessees and Neighbors on Defensible Space	12 Acres	\$7,502	<ul style="list-style-type: none"> <li>• Coordinating under existing lease agreement to prioritize maintenance funding for vegetation maintenance around infrastructure.</li> <li>• Coordinated with Marin Wildfire Prevention Authority around fuels treatment along the Greater Ross Valley Shaded Fuelbreak.</li> </ul>
County Fire Coordination	County and Watershed Wide	N/A	<ul style="list-style-type: none"> <li>• Burned 2 Rx Units near Rock Springs in Coordination with MCFD.</li> <li>• Provided direction and support for development of Marin’s Community Wildfire Protection Plan in collaboration with Marin County Fire and FIRESafe Marin.</li> <li>• Attended monthly FIRESafe Marin Meetings.</li> <li>• Submitted two cross jurisdictional grant applications to NOAA Climate Resiliency Program and California’s Office of Planning and Research ICARP for forestry restoration and vegetation management work.</li> </ul>
Watershed Volunteer Coordination	Wildfire Resilience	N/A	<ul style="list-style-type: none"> <li>• Expanded Defensible Space.</li> <li>• Contributed to EDRR Efforts.</li> <li>• Improved Forest Health.</li> <li>• Broom Removal.</li> </ul>

## EXECUTIVE SUMMARY

<b>Planning, Compliance and Monitoring</b>		<b>\$312,936</b>	
Biodiversity, Fire, and Fuels Integrated Plan (BFFIP)		N/A	<ul style="list-style-type: none"> <li>Implemented BFFIP Year 5 Targets.</li> </ul>
Non-Native Invasive Species Mapping	Updated Records	N/A	<ul style="list-style-type: none"> <li>1,068 invasive plant records updated.</li> </ul>
Rare Plant Surveys	Rare plant compliance surveyed	\$79,772	<ul style="list-style-type: none"> <li>380 acres surveyed for rare plants ahead of vegetation management projects.</li> <li>242 Rare Plant Records Created.</li> </ul>
Northern Spotted Owl Surveys	Nesting compliance	\$33,510	<ul style="list-style-type: none"> <li>Completed environmental compliance survey work for northern spotted owl to support watershed vegetation and construction related projects.</li> </ul>
Bat Surveys	Roosting bat habitat surveys	N/A	<ul style="list-style-type: none"> <li>In FY24 the District did not encounter any internal situations requiring Bat Roost Surveys.</li> <li>District required PG&amp;E to comply with Bat Roost Surveys and related BMPs.</li> </ul>
Bird Surveys	Nesting Birds	\$96,436	<ul style="list-style-type: none"> <li>Completed environmental compliance survey work for nesting birds to support vegetation management work.</li> </ul>
Tri-Annual Land Bird Survey	Nesting Birds	\$11,811	<ul style="list-style-type: none"> <li>This line item represents carry over costs incurred in FY24 from the Tri-Annual Survey initially conducted in FY23.</li> </ul>
Nesting Bird Response to BFFIP Treatment Monitoring	Annual Monitoring	\$4,938	<ul style="list-style-type: none"> <li>Correlated FYE vegetation data against historical nesting data to determine impact of BFFIP implementation on nesting birds.</li> </ul>
Osprey Monitoring	Annual Monitoring	\$4,576	<ul style="list-style-type: none"> <li>Completed annual Osprey monitoring at Kent Lake.</li> </ul>
Forest Restoration Monitoring and Mapping	Maintenance of Existing Areas	NA	<ul style="list-style-type: none"> <li>Routine Maintenance of 14 acres of Forest Habitat in the Resilient Forest Project Area. Costs for this activity are contained in the Vegetation Management section.</li> </ul>
Foothill Yellow Legged Frog	Annual Monitoring	\$44,169	<ul style="list-style-type: none"> <li>Completed annual monitoring of foothill yellow legged frogs at select watershed locations with known occurrences.</li> </ul>
Wildlife Picture Index	Data Processing	\$11,039	<ul style="list-style-type: none"> <li>Processed photos and analyzed data from thousands of wildlife photos taken on District Land.</li> </ul>
Cultural Resource Surveys	Cultural Resource Surveys	\$26,685	<ul style="list-style-type: none"> <li>Completed Cultural Resource Surveys on all remaining Burn Plans.</li> </ul>
<b>Vegetation Management</b>	<b>FY24 BFFIP Implementation</b>	<b>\$3,495,905</b>	

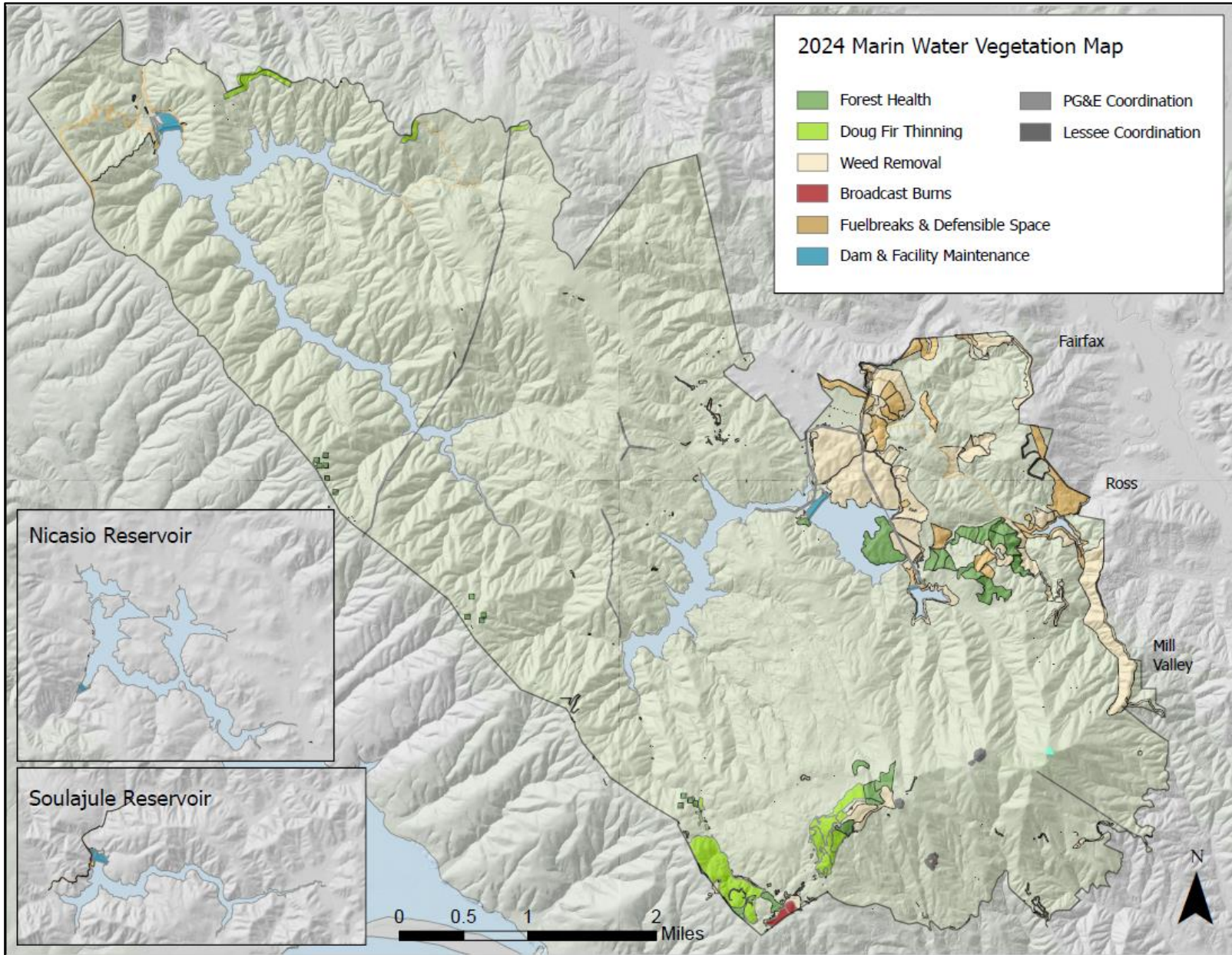
## EXECUTIVE SUMMARY

<b>Cyclical Maintenance of Fuelbreaks</b>	<b>1,161 acres</b>	<b>\$1,358,122</b>	<ul style="list-style-type: none"> <li>• <b>All fuelbreaks maintained at appropriate intervals</b></li> </ul>
	193 acres	\$523,682	<ul style="list-style-type: none"> <li>• Fuelbreak maintenance, cutting of woody vegetation &amp; pile burns.</li> </ul>
	48 acres	\$41,012	<ul style="list-style-type: none"> <li>• Mowed fine fuels around structures, roadsides and parking areas.</li> </ul>
	829 acres	\$735,864	<ul style="list-style-type: none"> <li>• Pulled/mowed broom.</li> </ul>
	49 acres	\$28,722	<ul style="list-style-type: none"> <li>• Mowed non-fuelbreak roadsides.</li> </ul>
	42 acres	\$28,842	<ul style="list-style-type: none"> <li>• Managed vegetation on dams and spillways.</li> </ul>
<b>New Fuelbreak Construction</b>	<b>14 acres</b>	<b>\$73,829</b>	<ul style="list-style-type: none"> <li>• <b>Contractors expanded defensible space at Taylor Trail Fuelbreak</b></li> </ul>
<b>Forest Restoration and Fuel Management</b>	<b>217 acres</b>	<b>\$1,069,943</b>	<ul style="list-style-type: none"> <li>• <b>Forest and Woodland Thinning to Promote Resilience</b></li> </ul>
	98 acres	\$725,833	<ul style="list-style-type: none"> <li>• Initial Forest Fuel Reduction.</li> </ul>
	115 acres	\$339,799	<ul style="list-style-type: none"> <li>• Maintenance of Forest Restoration sites &amp; Pile Burning in Forests.</li> </ul>
	4 acres	\$4,310	<ul style="list-style-type: none"> <li>• Broadcast burn in forest at Ridgecrest site.</li> </ul>
<b>Priority Habitat Restoration &amp; Fuel Reduction</b>	<b>391 acres</b>	<b>\$994,011</b>	<ul style="list-style-type: none"> <li>• <b>Removal of target invasive weeds within forest and woodlands</b></li> </ul>
	198 acres	\$902,132	<ul style="list-style-type: none"> <li>• Douglas fir thinning in Oak Woodlands and Grasslands (OW&amp;G).</li> </ul>
	7 acres	\$4,310	<ul style="list-style-type: none"> <li>• Broadcast burn in grassland at Ridgecrest site.</li> </ul>
	19 acres	\$10,193	<ul style="list-style-type: none"> <li>• Goatgrass reduction in OW&amp;G.</li> </ul>
	123 acres	\$35,629	<ul style="list-style-type: none"> <li>• Yellow Starthistle management in OW&amp;G.</li> </ul>
	45 acres	\$30,910	<ul style="list-style-type: none"> <li>• Control of other priority weeds in OW&amp;G.</li> </ul>
<b>Early Detection Rapid Response</b>	<b>N/A</b>	<b>One Tam Contribution</b>	<ul style="list-style-type: none"> <li>• 34 miles of roads and trails surveyed.</li> <li>• 286 patches of invasive weeds treated in FY24.</li> </ul>
<b>Experiment with New Invasive Species Control Methods</b>	<b>2 Trials</b>	<b>\$978</b>	<ul style="list-style-type: none"> <li>• Bark Peeling of Blackwood Acacia. 14 Individuals &amp; 7 stumps.</li> <li>• Mt Tam Thistle Maintenance &amp; Monitoring</li> </ul>
<b>Implementation Supplies</b>		<b>\$84</b>	<ul style="list-style-type: none"> <li>• Flagging Tape</li> </ul>



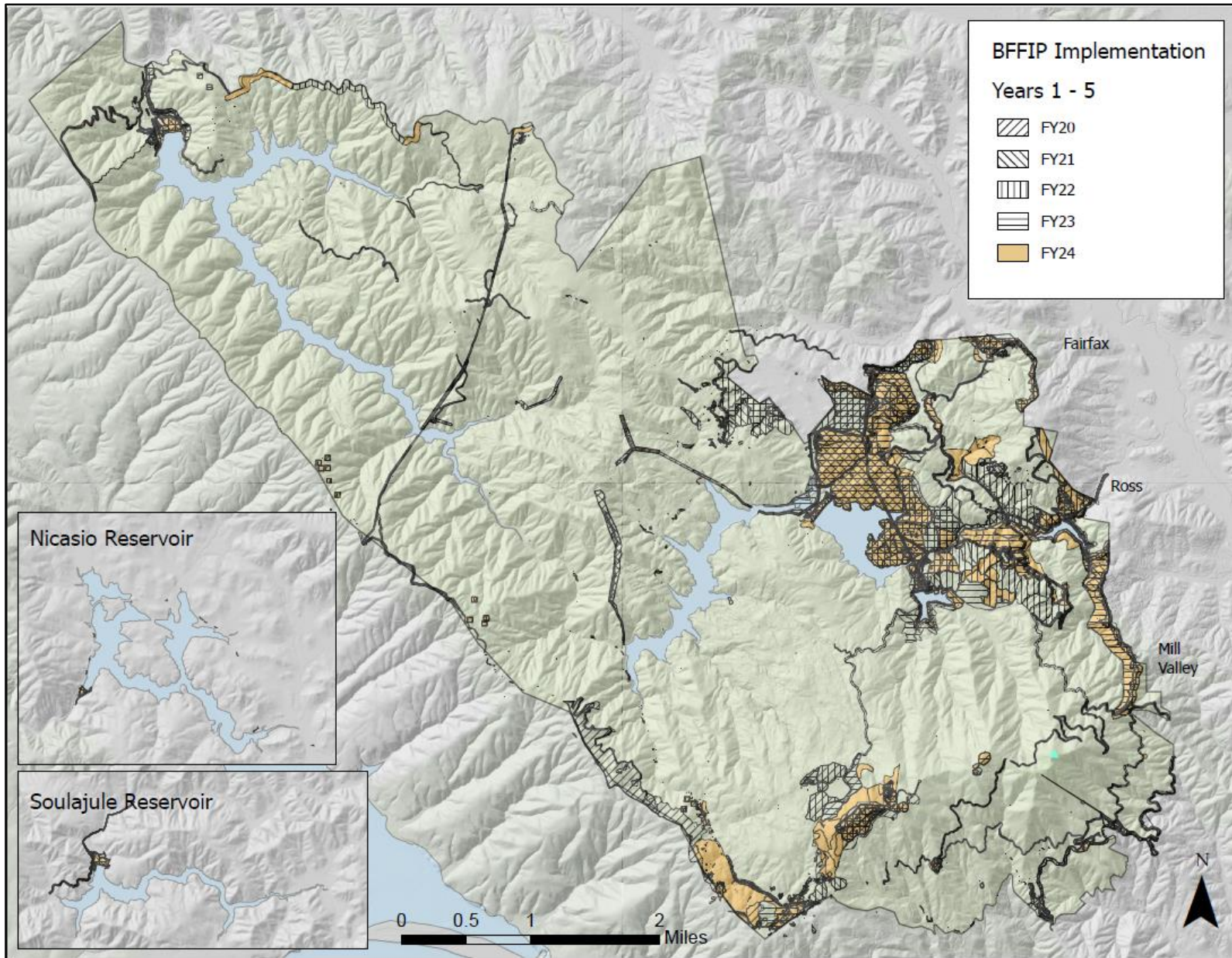
# EXECUTIVE SUMMARY

Map 1: FY24 Vegetation Treatments by Management Action



# EXECUTIVE SUMMARY

Map 2: BFFIP Implementation Years 1 - 5



# 1 Coordination to Reduce Wildfire Risk

The district is responsible for managing its watershed lands, which includes minimizing the risk of wildfires. Over 25,000 structures housing approximately 45,000 residents are within two miles of district lands along a WUI that has a CalFire Fire Hazard rating of “High” to “Very High.” Wildfire also poses a threat to water quality and distribution, and to the ecosystem functions and values provided by watershed lands. Climate change, forest diseases, and the proliferation of weeds increase the potential for large wildfires.

This section details approaches to reduce the potential for fire ignitions and hazards through coordination with other agencies and landowners, as well as continuing best management practices to minimize ignition potential particularly during high-risk events. Adjacent to the watershed there are approximately 300 private properties, the remainder of the district’s lands are surrounded by State, Federal and other local agencies lands. Vegetation management actions are summarized in Section 3 Vegetation Management.

Work	Outcome	Approximate Cost	Description
<b>Community Coordination for Fire Risk Reduction</b>		<b>\$8,502</b>	<ul style="list-style-type: none"> <li>Wildfire risk mitigation</li> </ul>
Red Flag Warnings		N/A	<ul style="list-style-type: none"> <li>Zero Red Flag Warning Closures in FY24.</li> <li>Continued community outreach for red flag and other critical fire weather events through signage and social media.</li> <li>Coordinating county wide signage with Fire Safe Marin and other Fire agencies.</li> </ul>
Coordination with PG&E	9.5 Miles of Lines Maintained (53 Acres)	\$1,000	<ul style="list-style-type: none"> <li>Coordinating to ensure cyclical vegetation maintenance around and under transmission &amp; distribution lines.</li> <li>Maintained Vegetation along 9.5 miles of PG&amp;E transmission and distribution lines, totaling 53 acres.</li> <li>PG&amp;E repaired/replaced 31 pieces of hardware along the Distribution system throughout the watershed. See section 1.2 for detail.</li> <li>Worked with PG&amp;E to ensure that pre-project environmental surveys are completed before vegetation management work is conducted.</li> </ul>
Coordination with Lessees and Neighbors on Defensible Space	12 acres	\$7,502	<ul style="list-style-type: none"> <li>Coordinating under existing lease agreement to prioritize maintenance funding for vegetation maintenance around infrastructure.</li> <li>Conducted assessments of fuelbreak infrastructure and defensible space to inform annual maintenance activities.</li> </ul>

County Fire Coordination	NA	NA	<ul style="list-style-type: none"> <li>Conducted Two Rx Broadcast Burns on Watershed Land.</li> <li>Provided direction and support for development of Marin's Community Wildfire Protection Plan in collaboration with Marin County Fire and FIRESafe Marin.</li> <li>Collaborated on Watershed Prescribed Fire Report.</li> <li>Attended monthly FIRESafe Marin Meetings.</li> </ul>
Watershed Volunteer Coordination	Wildfire Resilience	N/A	<ul style="list-style-type: none"> <li>Expanded Defensible Space</li> <li>Contributed to EDRR Efforts</li> <li>Improved Forest Health</li> <li>Broom Removal</li> </ul>

## 1.1 Red Flag Warnings

Small fire events have occurred on district lands between 2006 and 2024. To reduce the potential for ignition during severe weather events the district coordinates with County Fire, and California State Parks to close sections of the watershed to automotive traffic during red-flag warnings. It is, therefore, imperative that the district be prepared to respond to fire events that occur on district lands. As such the district maintains operational readiness for initial attack and wildfire support services. The district currently has 14 trained and Red Carded wildland fire fighters. Ranger and Watershed Maintenance staff conduct monthly trainings.

The target is to regularly (annually or more frequently, as needed) train staff in Red-Flag Day protocols, ignition prevention BMPs, wildland firefighting techniques, and firefighting equipment maintenance.

- Continued community outreach for red flag and other critical fire weather events through community signage and social media.
- Participated in County wide red-flag sign coordination.
- Installed and operating additional wildfire danger signs.

Outcome	Total Closures
Watershed Closures	0



Photo 2: Fire Danger Signs at Main Entrance.



Photo 3: Fire Danger Signs posted in picnic areas.

## 1.2 Coordination with PG&E

PG&E-owned transmission lines and transformers are located within district lands. PG&E is responsible for maintaining clearance around transmission lines to minimize the potential for wildfires. The district will facilitate PG&E access for the purpose of vegetation management associated with their distribution and transmission lines and transformers. The target is to coordinate annually (or more frequently, as needed) with PG&E to ensure cyclical and emergency vegetation management occurs as needed under power lines and transformers.

- Coordinated vegetation management treatments along 9.5 miles of PG&E lines totaling 53 acres.
- PG&E performed 31 hardware maintenance activities on Distribution & Transmission Lines throughout the Watershed: See Table.

Activity	Sum
<b>Install</b>	<b>3</b>
High Sign	1
Damper	2
<b>Repair</b>	<b>16</b>
Conductor	3
Crossarm	1
Pole	1
Anchor	2
Guy Wire	7
Insulator	1
Structure	1
<b>Replace</b>	<b>12</b>
Structure	4
Conductor	1
Connector	2
Crossarm	2
Insulator	1
Pole	2
<b>Grand Total</b>	<b>31</b>



Photo 4: PG&E Sub prepping for veg work near Sky Oaks Rd.

Outcome	Approximate Cost
Coordinated vegetation management along 9.5 miles of Transmission & Distribution Lines totaling 53 acres.	\$950

### 1.3 Coordination with Lessees

The district has entered into leases or easements with other parties that own facilities that are located within district lands. It is the responsibility of these other parties to conduct vegetation management activities around those facilities. The district performs annual inspections of leased areas and works with lessees to ensure vegetation management work is completed. The target is to coordinate annually (or more frequently as needed) with other parties that have entered into a lease or easement with the district, to ensure cyclical maintenance of fuelbreaks and other vegetation management activities occur around these facilities on district lands.

- West Point Inn
- Marin Stables
- EIP II Holdings LLC (Middle Peak & Building 402)

Outcome	Approximate Cost
12 acres*	\$7,502

\* 12 acres of Coordination with Lessees has been carved out from MA 20.1 Fuelbreak Maintenance

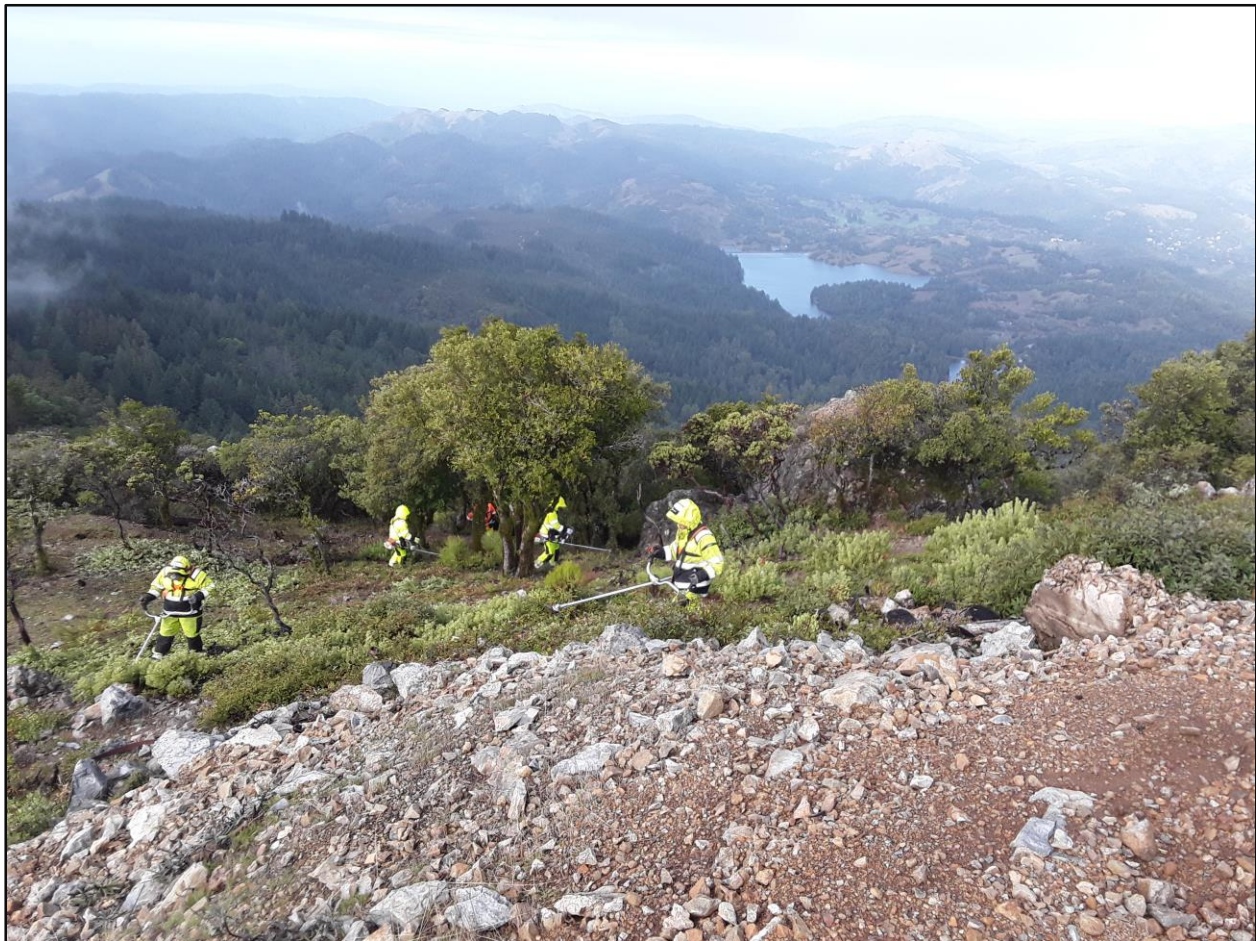


Photo 5: Fuelbreak Maintenance at the Middle Peak Communications Lease.

## 1.4 Wildfire Coordination

The district is located adjacent to lands that are managed by other agencies, including private, county, state, and federal agencies. The district partners with these agencies and local fire departments to encourage the adequate management of fuels along common borders. District personnel attend monthly FIRESafe Marin meetings and participate in countywide Community Wildfire Protection Plan annual work plans and plan updates. Through the year district staff are coordinating with local fire departments to improve community education regarding defensible space, ongoing vegetation maintenance, and ongoing emergency response. Additionally, the districts Ranger staff and Watershed Maintenance staff carry out regular trainings relating to wildfire preparedness. The District is continuing to coordinate fuels management work with Marin Wildfire Prevention Authority (MWPA) agency through ongoing involvement in the Technical Advisory committee. This coordination is helping facilitate cross jurisdictional planning and management. In an effort to scale vegetation management effort the district is also working with the One Tam collaborative and County Fire to leverage the County Wide Vegetation Map to create an updated fuels profile for vegetated lands across Marin County, which will help to inform and prioritize fuel reduction efforts. In FY 2024 agency partners collaborated on the One Tam Forest Health Strategy to develop multi-benefit forest restoration priorities.

### Ongoing wildfire coordination efforts:

- Marin Wildfire Prevention Authority (MWPA)
- Prescribed fire planning with MCF and BAAQMD
- MMWD/MCF Mutual Aid Agreement, including Tam Fire and Fire Foundry Crews
- Fire Safe Marin Board
- Marin Prescribe Fire Cooperative
- Defensible space with SMF & RVF
- Ongoing wildland fire trainings with MCF
- One Tam Forest Health Strategy
- TOGETHER Bay Area's Wildfire Data Working Group
- Working with OneTam partners to coordinate Resource Advisor readiness and standards for post-wildfire rehabilitation.



Photo 6: Marin County Fire Briefing at Ridgecrest Rx Burn.

## 1.5 Watershed Volunteer Coordination

The Watershed Volunteer Program hosted several events in FY24 focused on Wildfire Fuels Reduction. Results as follows:

- Expanded Defensible Space through Volunteer Efforts
  - Annual Bald Hill Broom Bust: A collaboration between the volunteer programs run by Marin County Parks & Open Space and Marin Water. In April, 30 volunteers donated 90 hours to the removal of French and Scotch broom, extending the fuel break from Sky Ranch Open Space to Worn Spring Fire Rd.
  - In April the District Coordinated Volunteer work with Marin Stables. 33 volunteers pulled broom on Canyon and Moore Trails reducing fuels beyond the required buffer.
  - Phoenix Lake broom pull areas have been extended further uphill.
- Volunteer contributions to EDRR weed control treatments:
  - 2 independent volunteers target Ox-Eye daisy, Douglas-firs, Foxglove, and Montbretia. Volunteers removing these target EDRR species free up staff time.
- Improved Forest Stand Structure: Broadcast Burn planning with GrizzlyCorps
  - The Rock Spring prescribed burn took place during the GrizzlyCorps fellow's first month on the job. Following that event, the fellow led several weekend outreach events on site to educate the public on the importance of forest health, especially as it relates to watershed health and beneficial fire.
  - Two self-guided walks were created to highlight the forest health work we have done in very different landscapes (Lake Lag & Rock Spring). These printed maps are in Spanish and English.
  - Grizzly fellow assisted 3 days of pile burns.
- Oak Woodland and Grassland Improvement: Volunteer Hand Removal of Broom and Douglas-fir.
  - Young Douglas-fir trees removed by hand during Trail Stewardship events for the restoration of grassland habitat.
  - 170 individual volunteers spent 533 hours removing broom by hand from priority areas on the Watershed.



Photo 7: Phoenix Lake Broom Pull Volunteer Event.



## 2 Planning, Monitoring and Environmental Compliance

Another charge of the district is to protect important biological resources and ecosystem functions on the district’s lands. Enhancing ecosystem resiliency is a key strategy for the district to pursue. Resiliency is defined as an ecosystem’s ability to absorb shocks or perturbations and still retain desirable ecological functions, such as the ability to provide breeding and foraging habitat for wildlife; the ability to support significant biological resources such as rare, threatened, or endangered species; the ability to regenerate desired plant communities following a disturbance such as wildfire; the ability to cycle nutrients; and the ability to protect water quality. As part of the district’s vegetation management actions environmental compliance surveys are completed to ensure the district’s work doesn’t negatively impact sensitive resources.

The work in this section focuses on planning for vegetation management actions, inventorying and monitoring key natural resources, and performing actions related to environmental compliance.

Completed Work	Outcome	Approximate Cost	Description
<b>Planning and Monitoring</b>		<b>\$312,936</b>	
BFFIP Implementation		N/A	<ul style="list-style-type: none"> <li>Implemented BFFIP Year 5 Targets.</li> </ul>
Non-Native Invasive Plant Species Mapping	Updated Records	N/A	<ul style="list-style-type: none"> <li>1,068 Invasive Plant observations in FY24.</li> </ul>
Rare Plant Compliance	380 Acres Surveyed	\$79,772	<ul style="list-style-type: none"> <li>MMWD Contractors and staff conducted 380 acres of rare plant surveys in potential project areas.</li> </ul>
Northern Spotted Owl Surveys	Compliance	\$33,510	<ul style="list-style-type: none"> <li>Completed environmental compliance survey work for northern spotted owl to support watershed vegetation and construction related projects.</li> </ul>
Bat Surveys	Roosting Bat Habitat Surveys	N/A	<ul style="list-style-type: none"> <li>Removing trees &gt; 10” DBH requires Bat Roost Surveys.</li> <li>In FY24 the District did not encounter any internal situations requiring Bat Roost Surveys.</li> <li>The District required PG&amp;E to conduct appropriate Bat Surveys prior to removing trees &gt; 10” DBH on multiple occasions in FY24.</li> </ul>
Bird Surveys	Nesting Birds	\$96,436	<ul style="list-style-type: none"> <li>Completed environmental compliance survey work for nesting birds to support vegetation management work.</li> </ul>

Tri-Annual Land Bird Survey	Nesting Birds	\$11,811	<ul style="list-style-type: none"> <li>This line item represents carry over costs incurred in FY24 from the Tri-Annual Survey initially conducted in FY23.</li> </ul>
Osprey Monitoring	Annual Monitoring	\$4,576	<ul style="list-style-type: none"> <li>Annual Osprey monitoring at Kent Lake.</li> </ul>
Forest Restoration Monitoring and Mapping	Maintenance of Existing Areas	NA	<ul style="list-style-type: none"> <li>Routine Maintenance of 14 acres of Forest Habitat in the Resilient Forest Project Area. See Vegetation Management Section for Costs.</li> </ul>
Foothill Yellow Legged Frog	Annual Monitoring	\$44,169	<ul style="list-style-type: none"> <li>Annual monitoring of foothill yellow legged frog at select watershed locations.</li> </ul>
Wildlife Picture Index	Data Processing	\$11,039	<ul style="list-style-type: none"> <li>Input and analyzed thousands of wildlife photos taken on District Land.</li> </ul>
Nesting Bird Response to BFFIP Treatments	Annual Monitoring	\$4,938	<ul style="list-style-type: none"> <li>Analyzed FYE Vegetation Data against historical nesting activity data to determine impact of BFFIP implementation on nesting birds. Analysis is ongoing.</li> </ul>
Cultural Resource Study	Surveys	\$26,685	<ul style="list-style-type: none"> <li>Coordinated with FIGR and SSU in preparation for Rx burns at multiple Watershed sites.</li> </ul>

## 2.1 Biodiversity, Fire and Fuels Integrated Plan

In an effort to expand vegetation management work to reduce fuel loads and wildfire hazards on watershed lands the district has developed the Biodiversity, Fire and Fuels Integrated Plan (BFFIP). The BFFIP supersedes the 1995 Vegetation Management Plan (VMP), which the District operates under from 1995-2019. The BFFIP was approved by the District’s Board of Directors and as such, is considered a discretionary action and subject to the California Environmental Quality Act (CEQA). As part of the CEQA process the district held a public meeting to inform the community and circulated the Draft Environmental Impact Report for public review from March 21, 2019 through June 19, 2019. The Plan and EIR were adopted on October 16, 2019.

- BFFIP adopted in October of 2019
- Addendum adopted in 2023.

Outcome	Approximate Cost
Implementation of Year 5	N/A

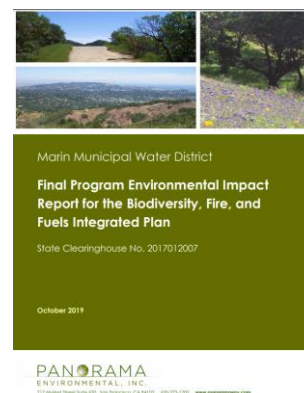


Figure 1: BFFIP EIR adopted in October of 2019.

## 2.2 Non-Native Invasive Species Mapping

To support the vegetation management actions that will be conducted by the district, the district needs to properly understand the location of invasive species and the extent that invasive species have spread on district lands. The district will continue to regularly update invasive species map. The target is to annually update the maps of invasive species. This information helps to inform vegetation management priorities and annual work plans.

The District completed a French Broom mapping update in FY 2018/2019 and is continuing with watershed wide Early Detection Rapid Response surveying as well as management of priority weeds.

Outcome	Approximate Cost
1,068 Records Updated	One Tam Contribution & MMWD Staff

## 2.3 Early Detection & Rapid Response (EDRR)

In FY24 Marin Water coordinated with an experienced EDRR team at Golden Gate National Parks Conservancy to conduct surveys on 34 miles the Marin Watershed’s roads and trails. Results as follows:

- 149 New Detections of Invasive Weeds in FY24.
  - 9 of the new records are listed as Priority 1, including gorse (*Ulex europaeus*), barbed goatgrass (*Aegilops triuncialis*), purple starthistle (*Centaurea calcitrapa*), and stinkwort (*Dittrichia graveolens*).
  - 1 new detection of thoroughwort (*Ageratina adenophora*), a species only recorded three other times on MMWD land (all since removed).
  - 1 new detection of licorice plant (*Helichrysum petiolare*), a species only recorded two other times on MMWD land (all since removed).
- 8.5 miles of supplemental searching for stinkwort along roads and trails.
- 9.85 acres of supplemental searching for thoroughwort.
- 15.8 acres of serpentine barrens monitored for rare plants.
- 0.5 acres of Marin dwarf flax (*Hesperolinon congestum*) monitoring.

Vegetation management and construction projects have the potential to introduce, spread, or create conditions for the spread of invasive plant species. Experience has shown that proactive efforts to catch these plant infestations early are key to protecting the integrity of the habitat. The District plans to follow up with EDRR work in FY25 at the Concrete Pipe Tank Replacement project.

## 2.4 Rare Plant Compliance

To support the district’s goal to preserve existing significant biological resources, including rare plants and sensitive natural communities, the district collects field data and updates watershed data on an ongoing basis. The objective is to ensure that all management actions taken on the Watershed have no significant

negative impact on rare plants or sensitive natural communities. This information also helps the district track long-term trends and changes on the watershed and guides restoration planning efforts.

In FY19 the District completed a Rare Plant Inventory which is identified as a Monitoring Management Action in the BFFIP for year one. Since that time the district focused on rare plant compliance surveys to facilitate vegetation management and other watershed projects over the next 5 years.

In FY24 380 acres were surveyed for rare plant Compliance across the following locations:

- Yolanda Trail to Shaver (YOSH)
- Blithedale Fuelbreak Expansion
- Fern Tank Fuelbreak Expansion
- Hogback Fuelbreak Expansion
- Indian Crown Fuelbreak Expansion
- Eldridge Grade to Lakeview Project
- Concrete Pipe
- Bon Tempe Peninsula
- Mid Lag Rock Springs Rd
- West Meadow Club Unit 6

Outcome	Approximate Cost
380 Acres	\$79,772



Photo 8: *Amphora californica* var. *napensis* (Napa False Indigo) at the Above Filter Plant project.

-Sherry Adams

## 2.5 Spotted Owl, Osprey, Wildlife and Migratory Bird Surveys

To facilitate vegetation management activities on the watershed the district carries out a number of pre-project biological surveys to minimize potential impacts. The survey results determine the mitigation or avoidance measures the district applies while carrying out vegetation management work. It's also a good way for the district to collect valuable biological data to monitor the long-term trends associated with biological resources on watershed lands. Surveys and monitoring work ensures that the district is complying with the regulations lined out in the Endangered Species Act and the Migratory Bird Treaty Act.

- Comprehensive district-wide northern spotted owl nesting surveys conducted.
- Nesting bird project surveys conducted in advance of all new vegetation work.
- Completed annual monitoring of Osprey at Kent Lake.
- Carry-over Costs from FY23's Tri-annual Land Bird Survey
- BFFIP Treatment Impact Study



Photo 9:  
Compliance Photo  
showing location of  
Dark Eyed Junco  
Nest Location.

-Mark McCaustland,  
Kleinfelder, 2024.



Photo 9: Northern Spotted Owl  
 -www.usgs.gov, Public Domain

Outcome	Approximate Cost
Compliance surveys (combined)	\$151,270

## 2.6 Resilient Forest Monitoring & Forest Restoration Planning

The District is collaborating with the U.S. Forest Service, Cal Poly, and UC Davis to monitor greenhouse gas balance and water yield in Forest Restoration sites through pre-treatment and post-treatment data collection within a pilot treatment area. Monitoring was paused in FY21 due to COVID, but maintenance of the sites continues. The District is also working with One Tam Partners to develop a regional Forest Health Strategy through leveraging data from the recently complete County Wide Vegetation Map to identify opportunities for future forest restoration efforts. One Tam recently published the Forest Health Strategy.

- Mapping of forestry restoration projects to support Cal Fire Forest Health Grant and future work areas.
- Working with One Tam on Forest Health Strategy to guide multi-benefit forestry restoration work.

Outcome	Approximate Cost
Maintenance of 14 Resilient Forest Sites	N/A (See Section 3.3)

## 2.7 Foothill Yellow Legged Frog Monitoring

Since 2004, MMWD has conducted annual population monitoring of foothill yellow legged frogs (FYLF) on the Mt. Tamalpais Watershed. The FYLF is designated as a Federal and Species of Concern. The California Department of Fish and Wildlife also designates the FYLF as a California Species of Special Concern. Monitoring sites for FYLF are conducted at two known breeding sites within the Mt. Tamalpais Watershed, Little Carson Creek and Big Carson Creek, both of which flow into Kent Lake. The annual monitoring of FYLF populations informs district vegetation work within their known habitats.

In FY23 the District thinned the vegetation around the intersection of Carson Creek and Pine Mt Rd to allow additional daylight into the creek bed and improve FYLF habitat.

Outcome	Approximate Cost
Annual Monitoring & Veg Maintenance	\$39,480



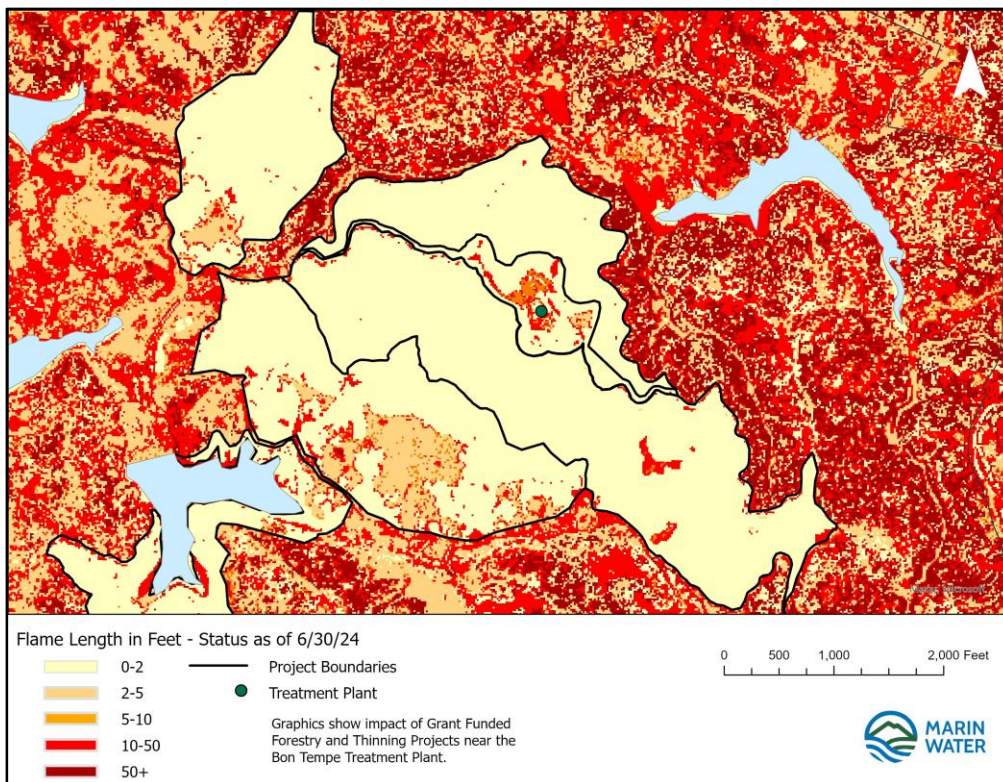
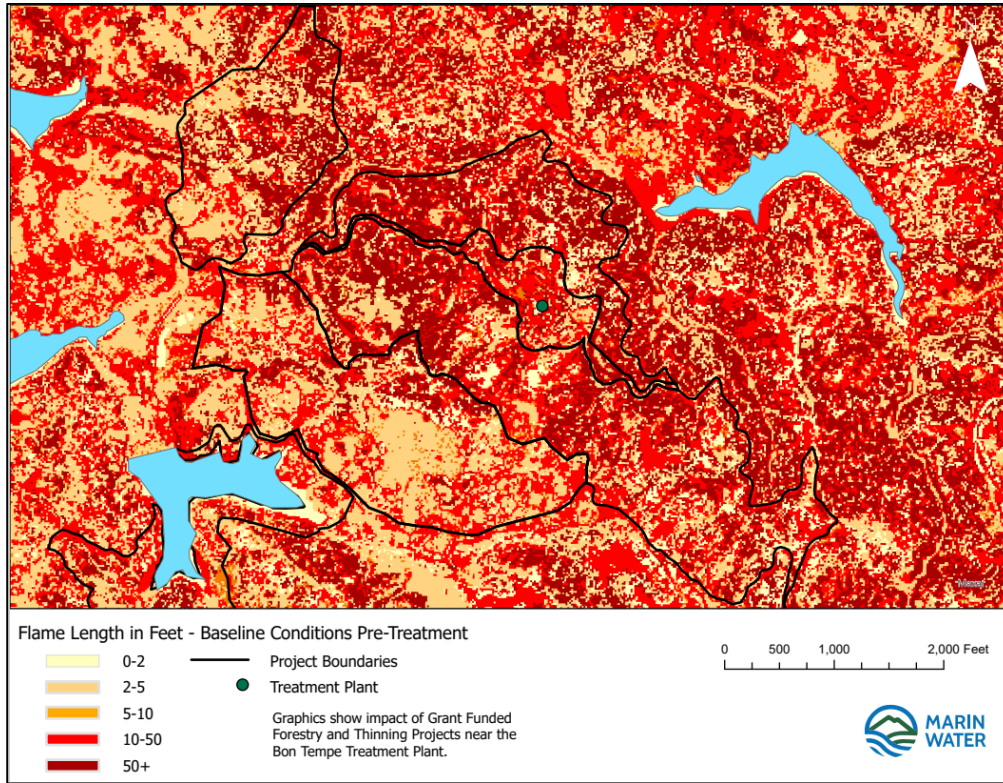
Photo 10: Foothill Yellow-legged Frog

## 2.8 Watershed Fuel Modeling

In FY23 Marin Water contracted with Tukemean Geospatial to perform watershed-wide fuel modeling to evaluate the efficacy of existing and proposed fuel treatments. This wildland fire behavior modeling informs effective methods and locations for watershed fuel treatments needed to protect critical infrastructure and communities, as well as reduce severity and improve suppression response efforts.

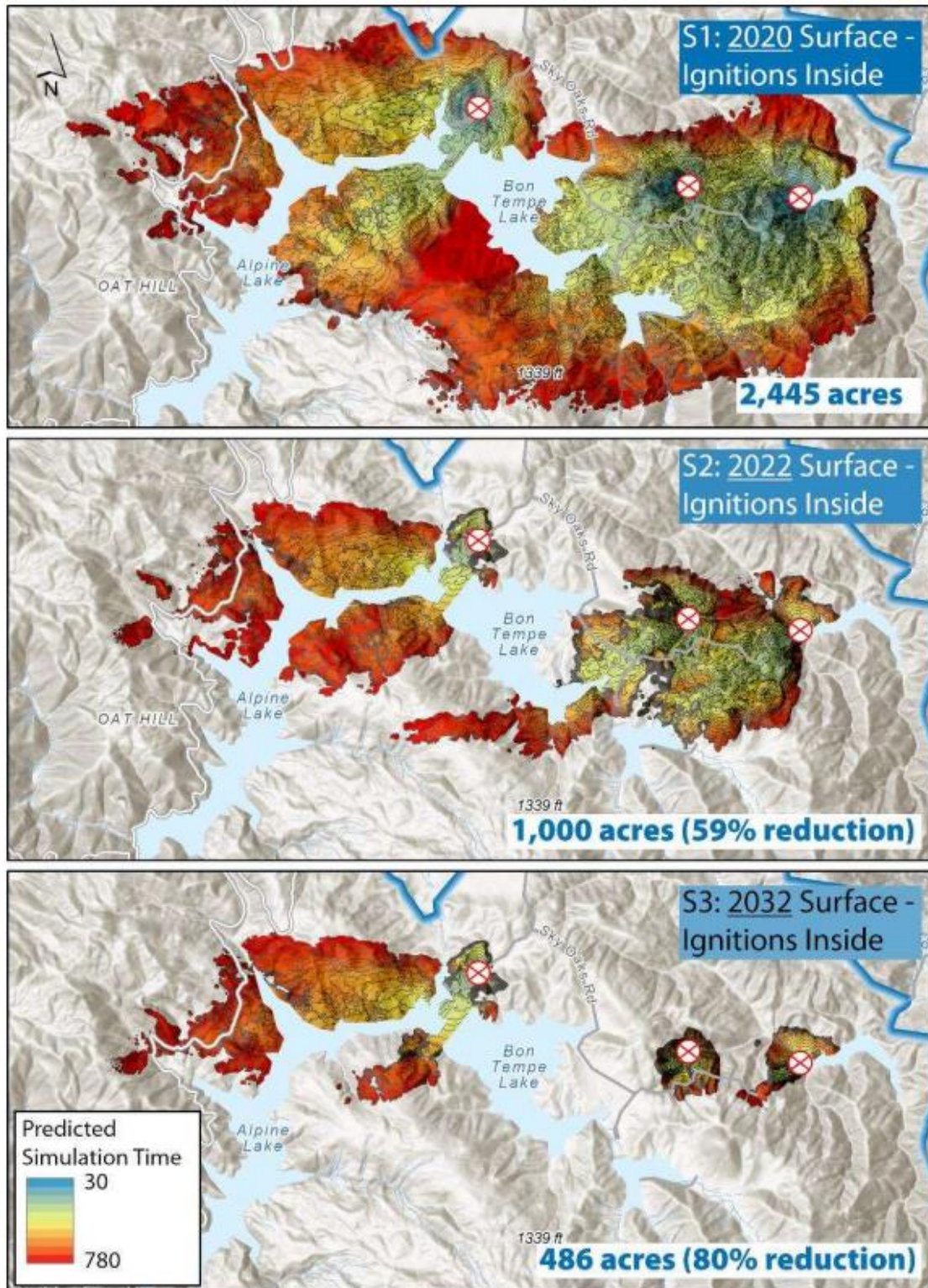
In FY24 the fuels work included in the initial analysis was completed and an updated map of conditions at 6/30/24 is included below. The District incurred no costs for analysis in FY24. Costs for implementation of the fuel reduction work is captured in Section 3.3.

Maps 3 & 4 (Below): Examples of Flame Length models before and after fuels treatments around Bon Tempe Treatment Plant. Models below reflect conditions if entire mapped area were burning in a wildfire.





Maps 5, 6, & 7 (Below): Examples of wildfire spread / coverage in the event of ignition based on pre-treatment (2020), BFFIP Year 3 (2022), and expected future conditions as of 2032.



## 2.9 Cultural Resource Study

Marin Water contracted with Sonoma State University, in consultation with the Federated Indians of Granton Rancheria, to conduct a cultural resources study for proposed prescribed burns across multiple locations on the Watershed. As part of the One Tam Forest Health Strategy agency partners integrated FIGR’s input into the final document to help guide work on public lands.

Outcome	Approximate Cost
8 New Cultural Surveys Conducted	\$26,685

## 2.10 Wildlife Picture Index

Wildlife Picture Index Project (WPI) is a method that combines statistical analysis of photos from wildlife cameras with other environmental data to help land managers learn about the presence of wildlife in our parks and open spaces.

The purpose of this project is to acquire statistically-viable wildlife data over a large geographic area on Mt. Tamalpais and adjacent public lands. While public land managers are aware of many of the species (bobcats, coyotes, badgers, etc.) that occupy these lands, much is still unknown regarding their abundance, how they move about, and how they use these lands at different times of the year. Understanding trends and patterns in wildlife use and behavior is essential to taking better care of our public wildlands.

In FY24 the District contracted with Golden Gate National Parks Conservancy to process the backlog of wildlife photos and analyze the data.

Outcome	Approximate Cost
Wildlife Picture Index Data	\$11,039

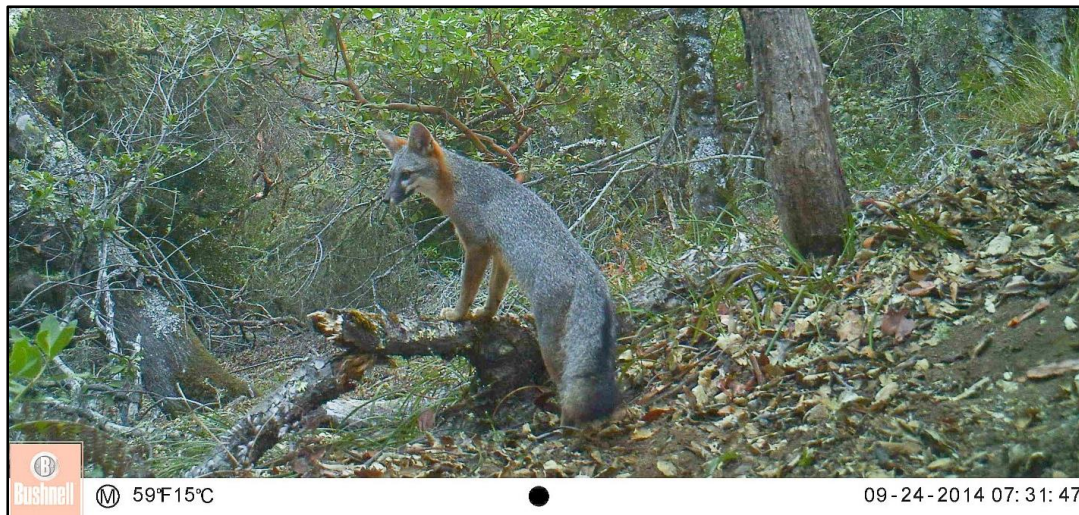


Photo 11: Wildlife Photo Index - Photo Example (Fox)

### 3 Vegetation Management

The district has been proactively managing vegetation to reduce wildfire hazards and preserve and enhance significant biological resources by implementing measures that were recommended in the 1995 VMP, as well as actions suggested by research and monitoring over the past decades. This section details actions undertaken to reduce wildfire risk, improve forest health, increase ecosystem resiliency and the status and function of other key natural systems and species. These actions primarily involve fuelbreak maintenance and construction, resilient forest projects, invasive plant management and restoration of native plant communities through reducing woody species encroachment.

Completed Work	Outcome	Approximate Cost	Description
<b>Vegetation Management</b>	<b>1,838 acres</b>	<b>\$3,495,905</b>	
Cyclical Maintenance of Fuelbreaks	1,161 acres	\$1,358,122	<ul style="list-style-type: none"> <li>Fuelbreaks maintained at appropriate intervals.</li> <li>Cut woody vegetation in established fuelbreaks.</li> <li>Burned 67 acres of piles of cured vegetation in Fuelbreaks.</li> <li>Mowed fine fuels around structures, along roadsides and parking areas.</li> <li>Pulled broom from fuelbreaks.</li> <li>Mowed non-fuelbreak roadsides.</li> <li>Managed vegetation on dams and spillways.</li> </ul>
New Fuelbreak Construction	14 acres	\$73,829	<ul style="list-style-type: none"> <li>Contractors and staff expanded defensible near Sky Oaks Headquarters.</li> </ul>
Early Detection Rapid Response	34 Miles & 149 New Detections.	One Tam Contribution	<ul style="list-style-type: none"> <li>34 miles of roads and trails surveyed.</li> <li>149 new weed populations identified.</li> </ul>
Forest Fuel Management	98 acres	\$725,833	<ul style="list-style-type: none"> <li>Completed 98 acres of initial forest fuel reduction treatments near Rock Springs and the Bon Tempe Treatment Plant.</li> </ul>
	115 acres	\$339,799	<ul style="list-style-type: none"> <li>Maintained 115 acres of forest fuels including the burning of 39 acres of piled &amp; cured vegetation across the Watershed.</li> </ul>
	4 acres	\$4,310	<ul style="list-style-type: none"> <li>Conducted a 4 acre Prescribed Burn in Forest land.</li> </ul>
Priority Habitat Restoration and Fuel Reduction	391 acres	\$994,011	<ul style="list-style-type: none"> <li>Improved grassland and oak woodland in the ecosystem restoration zones through Douglas fir thinning and management of priority non-native weeds.</li> </ul>
Experiment with New Invasive Species Control Methods	2 Trials	\$978	<ul style="list-style-type: none"> <li>Acacia Peeling Treatment</li> <li>Mt Tam Thistle Monitoring</li> </ul>
Implementation Supplies	TBD	\$84	<ul style="list-style-type: none"> <li>Flagging Tape</li> </ul>

### 3.1 Cyclical Maintenance of Fuelbreaks

#### Fuelbreak Maintenance & Cutting of Woody Vegetation

A fuelbreak is a built asset requiring periodic maintenance to operate as intended. Fuelbreaks are strategically located blocks or strips of land where vegetation has been altered so that it has a low fuel volume and/or reduced flammability. Maintenance work is intended to maintain reduced fuel loads and stand structure that will slow fire spread and reduce flame lengths. Fuel reduction areas are maintained by re-cutting vegetation as warranted.

The target is for each fuelbreak to be re-treated on a cyclical basis, as needed to maintain desired fuel characteristics; each fuelbreak will be re-treated at least once every five years. Fuelbreaks remain effective only if they are continually maintained.

Fuelbreaks maintained in FY24 include:

- Ross Reservoir
- Scott Tank
- Fawn Ridge
- Marin Stables
- West Point Inn
- Communications Leases at W. Peak and Middle Peak.
- Phoenix Lake Shore

Outcome	Approximate Cost
193 Acres	\$523,682



Photo 12: Fuelbreak Maintenance at West Point Inn.

Pile Burn Operations are included in Fuelbreak Maintenance acreage when those piles are located in Fuelbreaks or Defensible Space. Of the 193 acres of Fuelbreak Maintenance in FY24, 67 acres consisted of pile burns at:

- Taylor Trail
- Sky Oaks Broom
- Above Filter Plant
- New Pumpkin Ridge

Of the \$524K used for Fuelbreak Maintenance, \$300K was used specifically for pile burning with an approximate cost of \$162 per pile across 1,845 piles.



Photo 13: Pile Burning at Taylor Trail Fuelbreak.

## Fine Fuel Reduction

Managing vegetation in the most risk-prone area, including parking lots, picnic areas, and defensible space around structure is a top priority. These areas, which are most risk-prone, are maintained by re-cutting vegetation, as warranted to keep grasses at 4 inches or less in height. The work is performed primarily with power tools such as string cutters, the district also uses heavy equipment with mowers. The vegetation is shredded and scattered on site as part of the cutting process with no additional treatment required. Soils are not disturbed.

All annual grass (fine fuel) defensible space maintained around Watershed facilities.

- Completed fine fuel reduction around all watershed facilities.

Outcome	Approximate Cost
48 acres	\$41,012



Photo 14: Fine Fuel Reduction at Keys Creek Parking Lot

## Broom Work

On-going management and reduction of mature broom improves habitat quality for native flora and fauna. After the initial removal of a mature population of broom, maintenance occurs every one to two years. After two to three maintenance cycles the time and resources required to maintain that population decrease significantly. Similarly, after two to three maintenance cycles the District observes significantly more bio diversity in those locations. While the broom seed bank can persist for decades, a well maintained area effectively re-populates with a mixture of plant species from adjacent units. Examples of locations under management that were once dominated by Broom include Sky Oaks Meadow, Indian Crown Fuelbreak, and Fawn Ridge Fuelbreak.

In FY24 the Management Actions for Broom in Fuelbreaks, Broom Maintenance, and Initial Broom Removal were combined into a single Management Action (i.e. Broom Work) to allow greater flexibility to maintain treated areas and more sustainably reduce the coverage of mature populations of broom.

In FY24 Broom was treated at 45 different Vegetation Management Units (VMUs) across the Watershed totaling 829 acres.

Outcome	Approximate Cost
<b>829 acres</b>	<b>\$735,864</b>



Photos 15 - 16: French Broom Pulling at Pine Point



Photos 17: CCNB Pulling Spanish Broom near Pine Mt Fire Rd.

## Roadside Mowing (Non-Fuelbreak)

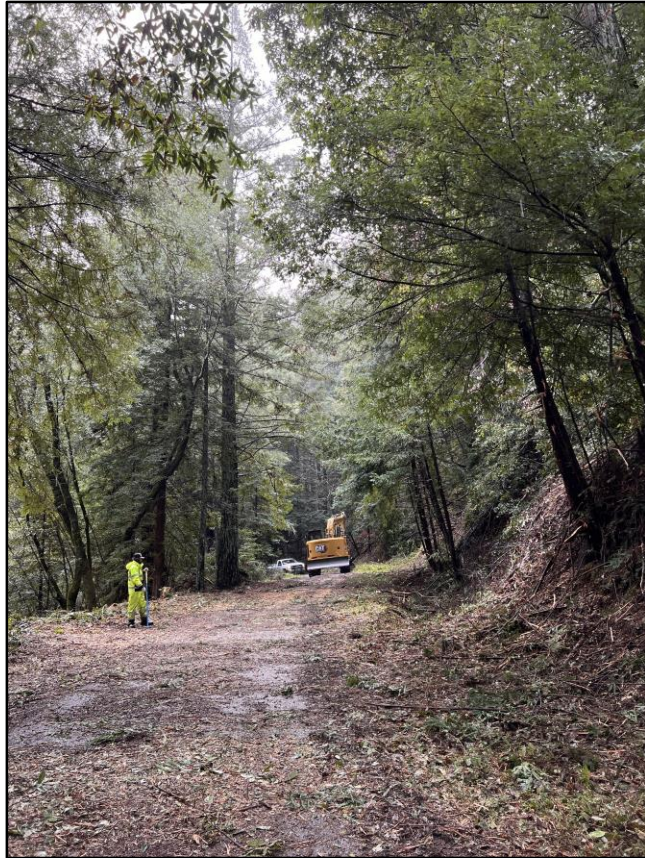
Vegetation management around roadsides is necessary to ensure the integrity of the infrastructure. The district continues to conduct roadside mowing on an as-needed basis to maintain unobstructed access for district vehicles and a clear line of sight for both district staff and recreationists. The work is performed with a combination of heavy equipment with cutting or masticating heads mounted on articulating arms and with power tools including chainsaws and brushcutters.

Roadside mowing sites:

- Pine Mt. Fire Rd.
- Shafter Grade Rd.
- Concrete Pipe Rd.
- Lower Shaver Grade Rd.
- SoulaJule & Peters Dam Roads



Outcome	Approximate Cost
49 Acres	\$28,722



Photos 18 - 19: Roadside Mowing at Shafter Grade

## Dam Maintenance

Per CA Department of Water Resources – Division of Safety of Dams (DSOD), all woody vegetation was removed from district earthen dams. Cutting and disposing of any woody shrubs or trees on earthen dams protects the structural integrity, facilitates annual DSOD inspections and compliance with State regulations.

Dam maintenance sites:

- Phoenix Dam
- Lagunitas Dam
- Bon Tempe Dam
- Peters Dam
- Nicasio Dam
- Soulajule Dam

Outcome	Approximate Cost
42 acres	\$28,842



Photo 20: Facility Maintenance at the Soulajule Dam

### 3.2 New Fuelbreak Construction-MA 21

To facilitate firefighter access in the event of an ignition, the district has removed dead material, thinned canopies, and cleared brush along areas designated as fuelbreaks. Fuelbreaks infrastructure has been strategically designed based on detailed analyses of existing vegetation, fuel loads, slopes, slope aspect, and local climate data. The vast majority of proposed future construction is the widening or expansion of existing fuelbreaks to maximize their utility. Fuelbreak widening will be performed as crews are in the area performing cyclical maintenance in the existing system.

For FY24 new Fuelbreak construction focused primarily on the last remaining acres of the Taylor Trail Fuelbreak just below the main Sky Oaks Office. In FY24 Marin Water partnered with Marin Wildfire Prevention Authority to build out the Fuelbreak along the Wildland Urban Interface between Deer Park and Marin Stables. The district’s plan to build new fuelbreak around Liberty Gulch Tank will continue into FY25, after the FY24 plans were delayed due to nesting birds.

Outcome	Approximate Cost
14 acres	\$73,829



Photo 21: MWPA Contractors building Fuelbreak adjacent to Marin Stables.

### 3.2 Early Detection Rapid Response (EDRR)-MA 22

Eliminating new colonies of weeds is the most effective action aside from prevention that the district can take to preserve biodiversity (as well as reduce fuelbreak maintenance). EDRR includes regular surveys of parts of the watershed where weed invasion is most likely, and periodic surveys in remote areas where new weed invasions are likely to be less frequent. EDRR staff pull, cut, or dig out newly discovered invasions that area less than 100 square meters (0.02) in size; larger populations are flagged for later treatment by the district using watershed aides or contractors.

This fiscal year 34 miles of Roads & Trails were surveyed and 286 patches were managed by the EDRR team which is led by our One Tam Partners. 149 new invasive weed populations were identified

Outcome	Approximate Cost
286 Populations & 34 Miles	One Tam Contribution



Photo 22: Gorse (*Ulex europaeus*) removal at Double Bow Knot.

-Gina Galang, One Tam

### 3.3 Initial Forest Fuel Reduction-MA 23

#### Reduce Accumulated Fuels and Brush Density

The district will reduce accumulated fuels and brush density in conifer and mixed hardwood forest to reduce wildfire risk and improve overall forest function. Thinning brush is an established means of promoting the growth of retained native trees by reducing the competition for light, nutrients, and water. The district is carrying out this work because over 10,000 acres of forests on district lands have been impacted by Sudden Oak Death (SOD) this has increased the fuel loads within the forest. Tanoak-dominated forest types have been the most heavily impacted: as the disease progresses, tanoaks drop out of the canopy resulting in fuel load build up, large openings in the canopy and an overall simplification in forest diversity and structures.

Forestry Fuel Reduction Sites in FY24 included:

- Below Filter Plant
- South Potrero Meadow
- East Potrero Meadow

Outcome	Approximate Cost
<b>98 Acres</b>	<b>\$725,833</b>

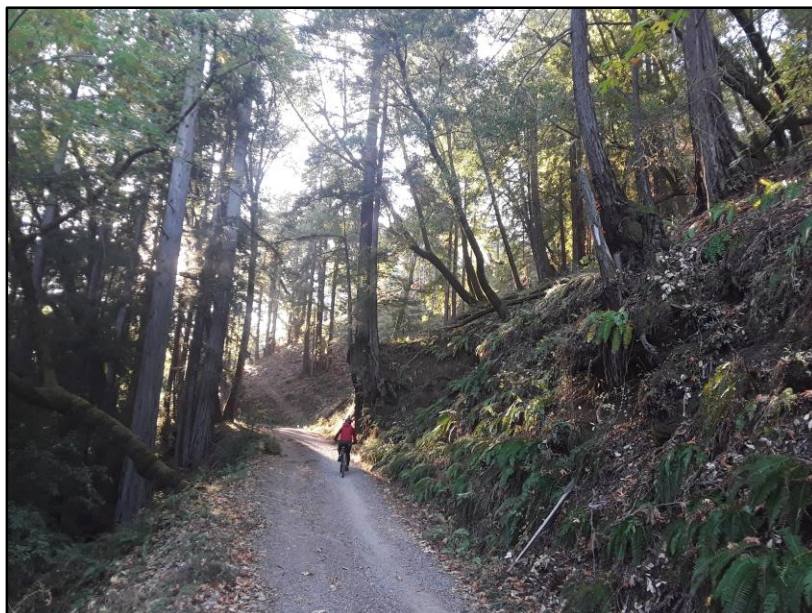


Photo 23: Below Filter Plant Forestry Project post treatment showing an open tree canopy.

One of the challenges the District faced in FY24 related to Initial Forest Fuel Reduction was the prolific year for nesting birds in the planned Forestry sites. For example the above photo was taken in the Ridgecrest Rx Burn Project, and burn prep was paused in that site after a Coopers Hawk was found nesting. The District will evaluate timing future Forestry Project such that the majority of work is complete prior to the start of nesting season.



Photo 24: Contractor conducting forestry work at Ridgecrest Rx Burn Site 2.

Monitoring of Forest Fuel Reduction work on understory herbs and tree recruitment is performed at multiple transects established within the Initial Forestry Project areas.

Preliminary results of the monitoring indicate the District’s Forestry Work is not impacting abundance or richness of native understory plants in the first two years post treatment. There is good regeneration of tree species not vulnerable to Sudden Oak Death, especially Madrone. The District will continue to monitor the sites. See Appendix C for a summary document of this monitoring protocol.

## Forest Fuel Maintenance

Ongoing maintenance of areas where fuels and brush density were reduced and where trees were planted is necessary to improve overall forest stand structure. Maintenance of existing Resilient Forest sites promotes long-term ecosystem resilience and function.

Forest Fuel Maintenance:

- Pine Point
- Resilient Forest Sites
- Pilot Knob Units 1, 2, & 4

Outcome	Approximate Cost
115 Acres	\$339,799



Photo 25: Pile Burn Operations along W. Ridgecrest Blvd.

Pile Burn Operations are included in Forest Maintenance acreage when those piles are located in Forests away from Fuelbreaks or Defensible Space. Of the 115 acres of Forest Maintenance in FY24, 39 acres consisted of pile burns at:

- Ridgecrest Blvd.
- Upper Cataract Project Area
- Pilot Knob Units 5, 6, & 7

Of the \$400K used for Forest Maintenance, \$265K was used specifically for pile burning with an approximate cost of \$192 per pile across 1,380 piles.

## Prescribed Broadcast Burning in Forests

Broadcast burning is a specific activity in which fire is applied to most or all of a well-defined

Outcome	Approximate Cost
4 Acres	\$4,310

area with discrete boundaries for the combined purpose of fuel load reduction and habitat improvement

Broadcast burning helps to improve forest stand structure by suppressing the re-establishment of brush in the understory that competes with native trees and by stimulating seed germination of fire-dependent native species.

In FY24 the District completed one broadcast burn in forest land at Ridgecrest Rx Burn Unit 1 totaling 4 acres. The burn was implemented by Marin County Fire under a plan drafted by Marin Water, and in coordination CA State Parks and neighboring fire agencies. The District continues to monitor all fire effects and natural resource objectives related to fuel reduction and forest health.



Photos 26 and 27: Prescribed Rx Forest Burn at Ridgecrest Site 1.

### 3.4 Improve Grassland and Oak Woodlands-MA 23

#### Reduce Encroachment in Oak Woodlands & Grasslands

In the absence of wildland fires, native Douglas fir trees invade oak woodland and grassland habitat on Mt. Tamalpais. On the watershed, both woodland and grassland habitats have significantly declined in area due to the encroachment of Douglas fir trees. Using a combination of hand crews and heavy equipment to remove young fir trees growing within grasslands and mixed hardwoods slows the rate that these plant communities are lost and retains the unique habitat and biodiversity that each provides.

Oak woodland and grassland preservation:

- W. Ridgecrest
- Above Filter Plant
- New Pumpkin Ridge
- Pilot Knob
- San Geronimo Ridge

Outcome	Approximate Cost
198 Acres	\$902,132



Photo 28: Chipping material that had been thinned out at the East Potrero Meadow Project Area.





Phots 29 and 30: Pilot Knob Unit 1 Before/After sequence showing effective habitat type conversion from Conifer dominant forest back into an Oak Woodland.

## Prescribed Burn in Grasslands & Oak Woodlands

Broadcast burning in grasslands helps to improve grassland and oak woodland by minimizing the spread of invasive species.

The FY24 seven acre grassland burn took place adjacent to and on the same day as the broadcast forest burn mentioned above.

Rare Plant Surveys were performed in advance of the FY24 grassland burn, and the District is monitoring the site's response and fire effects post burn. EDRR work and monitoring are also ongoing.

Outcome	Approximate Cost
<b>7 Acres</b>	<b>\$4,310</b>



Photo 31: Prescribed Rx Burn in Grassland at Ridgecrest Rx Burn Unit 3.

### Goatgrass Reduction

This species is targeted because of its ability to invade serpentine habitat – one of the least-invaded and rare plant-rich habitats on the Watershed. At present, barbed goatgrass is restricted to three known locations, and though one is large, it remains discrete enough to fully manage. Extirpating these populations benefits watershed biodiversity and reduces future management costs. The goatgrass infestation on district lands is centered on the intersection of Bolinas-Fairfax Road and Pine Mountain Road, though two additional populations were found within the last five years: one near Bullfrog Quarry and the other on San Geronimo Ridge. The target is to treat all infestation annually with a long-term target of extirpation of this species from the watershed.

Goat grass manually removed at priority sites:

- Azalea Hill
- Pine Mt. Fire Rd.
- Bullfrog Rd

Outcome	Approximate Cost
<b>18 Acres</b>	<b>\$10,193</b>

In FY24 the District received an additional 52.2 hours of grant funded labor valued at \$12,280 through Golden Gate National Parks Conservancy and Marin Dept. of Agriculture to assist with the removal of Goatgrass on Watershed land.



Photo 32: Barbed goat grass (*Aegilops triuncialis*) removal near Pine Mt. Fire Rd.

## Yellow Starthistle Reduction

Yellow starthistle is second only to broom in the amount of the watershed that it has invaded. Eliminating this weed before it spreads further will benefit biodiversity and reduce future management costs. The district treats infested areas multiple times each year to achieve 25 percent reduction in percent cover at existing infested sites and the district will initiate treatment of incipient populations as detected. The target is to achieve containment at the 2015 extent of yellow starthistle and a 10% reduction in the level of effort needed to prevent seed set.

Yellow star thistle removed at priority sites:

- Deer Park
- Sky Oaks Meadow,
- Ridgecrest Blvd
- MVAFB
- Peters Dam
- Fawn Ridge
- Cataract Trail



Photo 33: Yellow starthistle (*Centaurea solstitialis*) at Worn Springs North.

Outcome	Approximate Cost
<b>123 Acres</b>	<b>\$35,629</b>

## Control of Other Priority Weeds

Invasions of other high priority weeds are limited and generally are scattered throughout the watersheds. The species targeted are known or suspected to negatively impact rare plants or sensitive natural communities.

Priority weeds manually removed across the watershed with priority placed at:

- Yolanda Trail
- West Peak / Mill Valley Air Force Base
- Peters Dam
- Ridgcrest
- Rock Springs
- Cataract Trail

Outcome	Approximate Cost
45 Acres	\$41,747



Photo 34: Oxeye Daisy (*Leucanthemum vulgure*) removal at Rock Springs.

## Experimental Weed Treatment

### Trial 1 - Acacia Peeling:

Blackwood acacia (*Acacia melanoxylon*) is an invasive tree that grows sporadically across the Watershed, the largest population being around Phoenix Lake. It is known for creating large clonal populations and root suckering when damaged, and the seeds are adapted to sprout after a fire. This makes blackwood acacia a very real threat to the Watershed in the event of a fire because without the use of herbicide, there is no current method to permanently control these trees.

Peeling bark off of the tree from about three feet up to the ground has been demonstrated in other countries as an effective way to control blackwood acacia without the use of herbicide. Bark peeling

removes the phloem and cambium of the tree leaving only the xylem, which effectively slowly starves the roots of the tree and removes adventitious buds within the bark and cambium.

Trees were peeled in the late winter and early spring of 2024 in three different locations. At one location where live blackwood acacia stumps were actively resprouting, tarps were used to solarize and smother any live stumps. In total, 14 blackwood acacia were peeled and 7 stumps were tarped for a total of 0.05 acres treated.

Treatments are monitored monthly. All individuals peeled are showing signs of stress such as yellowing leaves. 50% of treated individuals have resprouted, but are only producing sprouts from areas where the cambium could not be removed fully. Only one individual has managed to begin regrowing its cambium in the peeled area and only one resprout has been observed from the tarped stumps where the tarp was not layered enough. The weed trial will be considered successful if 70% of treated individuals are confirmed dead two years after treatment and if tarped stumps are dead three years after treatment when the tarps will be removed.

Outcome	Approximate Cost
Acacia Bark Peeling	\$603



Photos 35 & 36: Experimental Blackwood Acacia Treatments near the Sky Oaks Residence.

## Trial 2 - Mt. Tam Thistle Monitoring Sites

Potrero Meadow is a serpentine influenced wet meadow that hosts Mt. Tamalpais thistle (*Cirsium hydrophilum* var. *vaseyi*). Mt Tam Thistle is considered threatened in California and is endemic to Mt. Tamalpais. Potrero Meadow has also been invaded by two aggressive invasive plants, including velvet grass (*Holcus lanatus*) and tall fescue (*Festuca arundinacea*). This project serves two functions: 1) Protect the rare native thistle from aggressive grass competitors, and 2) determine if digging out these grass competitors is a viable treatment for the invasion in Potrero Meadow.

Eleven one-meter-square plots have been visited every fall since 2021 to record the number of Mt. Tam thistle plants, record the abundance of invasives within the plot, and remove velvet grass and tall fescue from the plot. In the past three years, there has been a slight decrease of tall fescue cover, and a significant increase in Mt. Tam thistle rosettes. Manual removal of tall fescue appears effective at promoting Mt Tam Thistle, but it will take many years of treatment to make a significant impact in the larger meadow.



Photo 37: Mt Tam Thistle *Cirsium hydrophilum* var. *vaseyi*.

Robert Steers 2022

Outcome	Approximate Cost
Mt Tam Thistle Monitoring	\$376

## 4 Compliance Verification and Monitoring in FY24

The district developed the BFFIP to plan the management of district lands to minimize fire hazards and maximize ecological health. The district prepared a Program EIR for the BFFIP in accordance with CEQA, which requires the implementation of mitigation measures to avoid or lessen the significant environmental impacts of the district's vegetation management activities. The Final Program EIR for the BFFIP was adopted in October of 2019. This section summarizes the district's fiscal year 2024 verification and monitoring activities conducted in compliance with the BFFIP EIR mitigation measure.

### 4.1 Requirements Implemented by Management Action

Mitigation compliance is tracked on a project-by-project basis. Projects fall within several Management Actions or MAs. The MAs with environmental compliance components include:

- MA-20: Perform cyclical maintenance throughout the infrastructure zone with sufficient frequency to maintain design standards.
- MA-21: Construct the remainder of the fuelbreak system
- MA-22: Expand EDRR to identify, report, and treat new populations of invasive species
- MA-23: Improve conifer and mixed hardwood forest stand structure and function in the ecosystem restoration zone
- MA-24: Improve grasslands and oak woodlands in the ecosystem restoration zone
- MA-25: Reintroduce or enhance historic populations of special-status plant species
- MA-26: Develop and implement 10-year restoration plans for Potrero Meadow, Sky Oaks Meadow, and Nicasio Island
- MA-27: Conduct experiments and trials to identify suitable methods for control of invasive species

The projects that were implemented under each management action and the mitigation measures that were implemented in fiscal year 2024 are summarized in Table 2.

**Table 2 Management Actions, Projects, and Mitigation Measure Compliance**

Management Action	Projects Completed under Management Action	Mitigation Measures Implemented	
<b>All MAs with environmental compliance components</b>		<b>See Appendix A</b>	
MA-20 Perform cyclical maintenance throughout the infrastructure zone with sufficient frequency to maintain design standards	<ul style="list-style-type: none"> <li>• Fuelbreak maintenance and cutting of woody vegetation</li> <li>• Fine fuel mowing</li> <li>• Broom removal in fuelbreaks</li> <li>• Roadside mowing</li> <li>• Dam maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• MM Air-3</li> <li>• MM Air-4</li> <li>• BMP-1</li> </ul>	<ul style="list-style-type: none"> <li>• MM Hazards-3</li> <li>• MM Hydrology-1</li> <li>• MM Noise-1</li> </ul>
MA-21 Construct the remainder of the fuelbreak system	<ul style="list-style-type: none"> <li>• New fuelbreak construction</li> </ul>	<ul style="list-style-type: none"> <li>• MM Air-3</li> <li>• MM Air-4</li> <li>• BMP-1</li> <li>• BMP-5</li> <li>• MM Biology-2</li> <li>• MM Biology-11</li> <li>• MM Biology-12</li> <li>• MM Cultural-3</li> </ul>	<ul style="list-style-type: none"> <li>• MM Cultural-4</li> <li>• MM Hazards-1</li> <li>• MM Hazards-2</li> <li>• MM Hazards-7</li> <li>• MM Hydrology-1</li> <li>• MM Noise-1</li> <li>• MM Recreation-1</li> <li>• MM Transportation-1</li> </ul>
MA-22 Expand EDRR to identify, report, and treat new populations of invasive species	<ul style="list-style-type: none"> <li>• Road, disturbed areas, and trail surveys</li> <li>• Control of small weed patches</li> </ul>	<ul style="list-style-type: none"> <li>• BMP-7</li> <li>• MM Biology-2</li> <li>• MM Biology-11</li> <li>• MM Biology-12</li> <li>• MM Biology-17</li> <li>• MM Cultural-1</li> <li>• MM Hazards-1</li> </ul>	<ul style="list-style-type: none"> <li>• MM Hazards-6</li> <li>• MM Hazards-7</li> <li>• MM Hydrology-1</li> <li>• MM Noise-1</li> <li>• MM Recreation-1</li> <li>• MM Transportation-1</li> </ul>



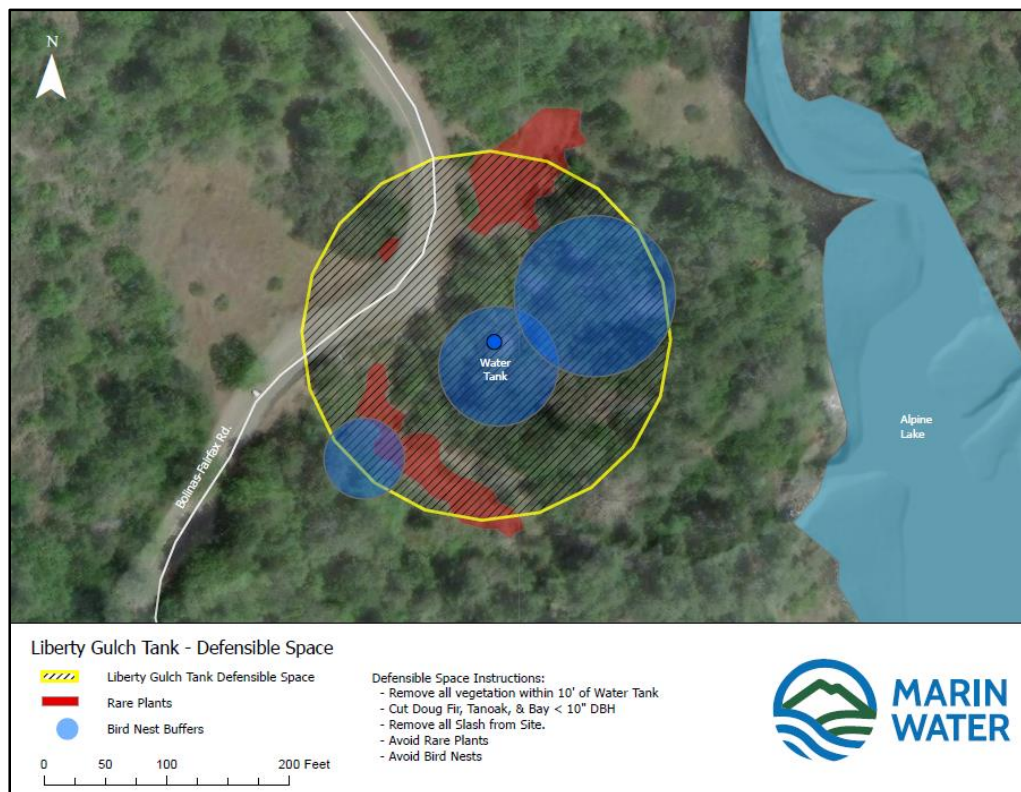
<p>MA-23 Improve conifer and mixed hardwood forest stand structure and function in the ecosystem restoration zone</p>	<ul style="list-style-type: none"> <li>• Initial forest fuel reduction</li> <li>• Forest fuel maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• MM Air-1</li> <li>• MM Air-3</li> <li>• MM Air-4</li> <li>• BMP-1</li> <li>• BMP-4</li> <li>• BMP-5</li> <li>• BMP-6</li> <li>• BMP-7</li> <li>• MM Biology-2</li> <li>• MM Biology-17</li> <li>• MM Cultural-1</li> <li>• MM Cultural-3</li> </ul>	<ul style="list-style-type: none"> <li>• MM Cultural-4</li> <li>• MM Geology-2</li> <li>• MM Hazards-1</li> <li>• MM Hazards-2</li> <li>• MM Hazards-3</li> <li>• MM Hazards-4</li> <li>• MM Hazards-5</li> <li>• MM Hazards-7</li> <li>• MM Hydrology-1</li> <li>• MM Noise-1</li> <li>• MM Recreation-1</li> <li>• MM Transportation-1</li> </ul>
<p>MA-24 Improve oak woodlands and grasslands (OW&amp;G) in the ecosystem restoration zone</p>	<ul style="list-style-type: none"> <li>• Douglas fir thinning in OW&amp;G</li> <li>• Maintenance of Douglas fir</li> <li>• Broom removal in OW&amp;G</li> <li>• Broom maintenance in OW&amp;G</li> <li>• Goatgrass reduction in OW&amp;G</li> <li>• Yellow star thistle management in OW&amp;G</li> <li>• Control of other priority weeds in OW&amp;G</li> </ul>	<ul style="list-style-type: none"> <li>• MM Air-1</li> <li>• MM Air-3</li> <li>• MM Air-4</li> <li>• BMP-1</li> <li>• BMP-4</li> <li>• BMP-5</li> <li>• BMP-6</li> <li>• BMP-7</li> <li>• MM Biology-2</li> <li>• MM Biology-11</li> <li>• MM Biology-12</li> <li>• MM Biology-17</li> <li>• MM Cultural-1</li> </ul>	<ul style="list-style-type: none"> <li>• MM Cultural-3</li> <li>• MM Cultural-4</li> <li>• MM Geology-2</li> <li>• MM Hazards-1</li> <li>• MM Hazards-2</li> <li>• MM Hazards-3</li> <li>• MM Hazards-4</li> <li>• MM Hazards-5</li> <li>• MM Hazards-7</li> <li>• MM Hydrology-1</li> <li>• MM Noise-1</li> <li>• MM Recreation-1</li> <li>• MM Transportation-1</li> </ul>

## 4.2 Compliance and Monitoring Considerations and Findings

The district was able to effectively carry out the BFFIP mitigation measures for all Management Actions completed through the use of technical staff, partner agencies and professional environmental consultants. The district has integrated new mapping technologies to help identify avoidance zones within project sites which help guide field activities. This was especially effective for the district's forestry restoration work in the vicinity of Pilot Knob and Above Filter Plant, which allowed district staff and contractors to use GPS enabled devices to avoid nesting birds and other sensitive resources within the work areas. The Ridgecrest Rx Burn Compliance Map shown below was used to avoid disturbance to culturally sensitive areas within the burn area.

The overall level of effort to carry out BFFIP compliance is significant and requires professionals with specific technical expertise. As the district scales up implementation of vegetation management under the BFFIP compliance costs will increase due to the need for additional compliance surveys. The compliance work is critical to ensuring that the district can effectively avoid sensitive cultural and natural resources and protects the biodiversity of the district's watershed lands while reducing wildfire hazards. The number of total hours spent completing pre project surveys will increase in subsequent years as the acres of implementation increase.

The district carries out compliance trainings with contractors working on the watershed before work is initiated.



Map 8: Compliance Map of the Liberty Gulch Defensible Space Project.

# 5 BFFIP Review & Work Plan

## 5.1 Review of BFFIP Management Actions

As part of implementing the BFFIP the district conducts an annual review of project activities. As the district continues to scale up work to reduce the risk of wildfire, preserve and enhance important biological resources and ecosystem functions, the district will review and revise its work in response to changing conditions.

The below table compares BFFIP Year 5 Targets to actual completed work for FY 2024, and outlines BFFIP Targets for Year 6.

Management Actions	Year 5 Targets	Year 5 Completed	Year 6 Thresholds
MA-20.1 Maintain existing fuel breaks	200 acres	193 Acres	200 acres
MA-20.2 Mow fine fuels	50 acres	48 Acres	50 acres
MA-20.3 Broom Work*	765 acres	829 Acres	765 acres
MA-20.4 Roadside mowing	50 acres	49 Acres	50 acres
MA-20.5 Dam maintenance	50 acres	42 Acres	50 acres
MA-21 New fuelbreak construction	15 acres	14 Acres	10 acres
MA 22.1 EDRR surveys	150 miles	66 Miles	150 miles
MA 22.2 EDRR weed treatments	100 patches	186 patches	100 patches
MA 23.1 Forest fuel reduction**	100 acres	98 Acres	100 acres
MA 23.2 Forest maintenance**	300 acres	115 Acres	300 acres
MA 23.3 Forest Rx burn	2 Rx units	1 Units	2 Rx unit
MA 24.1 Douglas fir thinning	200 acres	198 Acres	200 acres
MA 24.2 Oak & grassland Rx burn	3 units	1 Unit	3 units
MA 24.5 Goatgrass removal	35 Acres	18 Acres	35 Acres
MA 24.6 Yellow star removal	120 Acres	123 Acres	120 Acres
MA 24.7 Priority weeds	-- acres	45 acres	-- acres
MA 25.1 Planting	3 projects	0 project	3 projects
MA 25.2 Habitat restoration	3 projects	3 projects	3 projects
MA 27 Weed control trials	3 project	2 projects	3 projects

\*In Year 5 the three Broom related MAs 20.3, 24.3, & 24.4 were be combined as a single Management Action.

\*\*In Year 5 MAs 23.1 & 23.2 were increased above originally approved thresholds as part of the BFFIP Addendum.

For FY24 the district met the majority and in some cases surpassed BFFIP year five targets. For example, The District completed 115 acres of Forest Maintenance out of an available 300 acres, but in FY23 the threshold for Forest Maintenance was increased from 100 to 300 acres with the understanding that the new limit was to be treated as an upper limit only, rather than a target. The District anticipates that in the future as more and more acres of previously treated forest land mature that up to 300 acres may need maintenance in a single year.

The actual treated acres of Goatgrass will vary from year to year based on the efficacy of ongoing treatments. Annual variations in Yellow Starthistle treatments MA 24.6 are directly related to seasonality of the plant and whether the treatment window falls in June or July (i.e. Prior vs Current FY) of each season.

In FY24 the District over performed on treatment of Broom primarily because FY24 included many locations with very low density which require significantly less time and funding to re-treat. That low density is a direct result of consistent retreatment every 2 years which prevents the majority of broom plants from reseeding.

In FY24 the district treated 1,836 acres for \$3,504,490 for an average cost of \$1,908/acre. After including \$312,936 in Compliance costs the total cost increased to \$3,817,426 with a per acre cost of \$2,079/acre. As a percentage of total costs, compliance costs were 8.2% of the total. Costs referenced in this report reflect direct costs for vegetation work only, and do not include administrative support, planning, contract negotiation, etc.

Compliance costs in FY24 were lower than FY23 both in absolute costs and cost per acre, because FY23 included a number of expensive non-recurring items such as Fuel Modeling, BFFIP Addendum Consulting, and Tri-Annual bird nest surveys.

FY24 Total BFFIP expenses were partially funded with \$734,010 in direct grant funding provided by the California Coastal Conservancy, and the Cal Fire Forest Health Project. In FY24 the district also received an estimated \$295K worth of Labor hours for removal of weeds. Direct Grant Funding plus grant funded labor comprised approximately 25% of the total FY24 BFFIP Expense.

The below table summaries cost per acre for vegetation management activities completed during FY24.

Cost per Acre by Management Action		
Management Action	Description	Cost/Acre
MA-8	Coordination with PG&E	\$19
MA-9	Coordination with Lessees	\$612
MA-20.1	Maintain fuelbreaks	\$2,715
MA-20.2	Mow fine fuels	\$854
MA-20.3	Remove broom from fuelbreaks*	\$887
MA-20.4	Roadside mowing (non-break)	\$582
MA-20.5	Dam maintenance	\$686
MA-21	Construct new fuelbreak	\$5,156
MA-23.1	Initial Forest Fuel Reduction	\$7,427
MA-23.2	Maintenance of forest fuels	\$2,949

MA-23.3	Prescribed Burning in Forests	\$1,114
MA-24.1	Reduce fir encroachment in grasslands and oak woodlands	\$4,559
MA-24.2	Prescribed Burning in Oaks Woodlands and Grasslands	\$624
MA-24.5	Reduce goatgrass	\$548
MA-24.6	Reduce yellow starthistle	\$289
MA-24.7	Control Other Priority Weeds	\$937
MA-27	Experimental Weed Treatment*	N/A
<hr/>		
Total Vegetation Treatment Costs / Acre		\$1,909
Total Compliance Costs		\$312,936
Combined Veg & Compliance Cost / Acre		\$2,079

\* Experimental Weed Treatment is typically measured based on number of projects for BFFIP compliance rather than acres, but for the purposes of this analysis we've included the cost for MA-27 in the total cost per acre calculation

Initial Forest Fuel Reduction stands out as particularly costly Management Action on a unit basis due to the nature of the work, i.e. removal of heavily overgrown vegetation on challenging steep terrain, which requires highly skilled teams of Sawyers and Heavy Equipment Operators. When compared year over year though the District notes an improvement in the cost of this Management Action. FY23 cost per acre for Initial Forestry was \$12,429, while FY24 cost per acre was \$7,428. That improvement was driven primarily by lighter vegetation density in the FY24 sites compared to FY23, but also by improvements to process and management, such as taking advantage of access to roads and the ability to quickly chip material or pile for mastication, rather than the slower process of constructing piles specifically for burning.

Alternatively the annual cost per acre for Forest Maintenance increased significantly in FY24 compared to FY23 because of the inclusion of pile burning work in this Management Action. Pile burning is far more costly per acre than a mechanical treatment with brush cutters.

## 5.2 Review of BFFIP Years 1 – 5

### Vegetation Accomplishments

Veg work around the Bon Tempe Treatment Plant and Rock Springs to improve forest health and wildfire resilience were significant achievements during the first five years of BFFIP implementation. In total roughly 330 acres of forest and shrublands near the treatment plan and 215 acres around Rock Springs have been thinned out. The Fuels Reduction work reduces wildfire risk, improves forest health consistent with the One Tam Forest Health Plan, and provides better habitat for native flora and fauna.

In October 2024 the District implemented the first Prescribed Burn in Forest land in over 10 years at the Ridgecrest Site. The burn was implemented by Marin County Fire under a plan drafted by Marin Water, and in coordination CA State Parks and neighboring fire agencies. The District continues to monitor all fire effects and natural resource objectives related to fuel reduction and forest health.

Over the course of BFFIP Years 1 -5 the District completed 7,192 acres of vegetation treatments across all Management Actions.

### Ecological Accomplishments

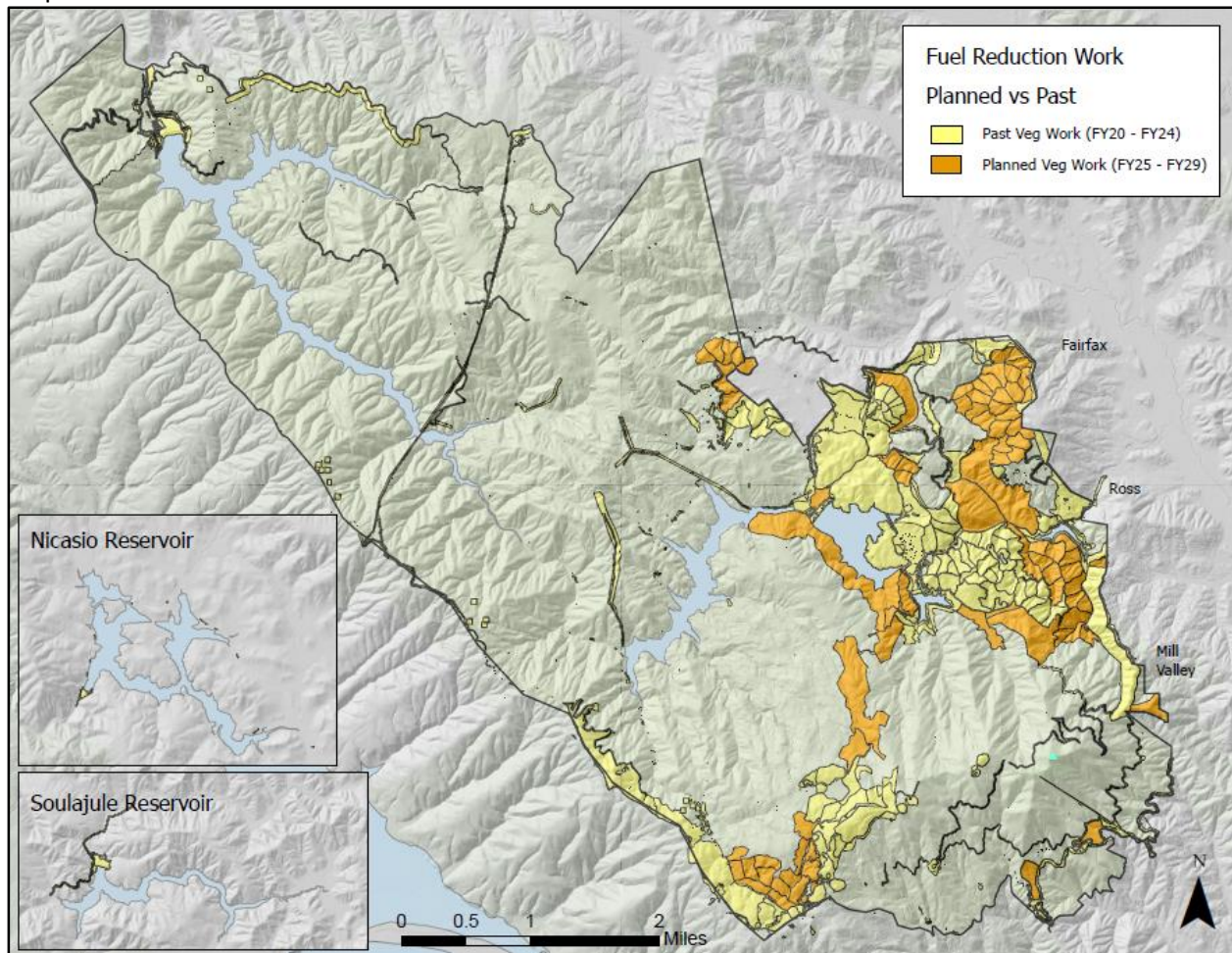
Pre and Post Monitoring of the District's Forest Thinning treatments revealed that *Amorpha californica* var. *napensis*/Napa false indigo thrives in the more open understory. Across several forestry treatment locations the Napa false indigo was previously completely overtopped and hidden by the more common *Vaccinium ovatum*/California huckleberry, but is now thriving and flowering as shown below.



Photo 38: Napa false indigo in the Above Filter Plant project area.

2,854 acres of Watershed lands were surveyed for Rare Plants in BFFIP Years 1 – 5. Those surveys have and will continue to provide sufficient area to conduct new vegetation work for the immediate future. Map 9 below shows planned grant funded work vs past work. All planned work has a rare plant survey in place and has been included in an implementation schedule.

Map 9: Fuel Reduction Planned vs Past.



## Ongoing Inventorying, Monitoring, and Planning Management Actions

The District has identified Management Actions that will continue beyond the initial 5 years of the plan. The District will continue to Inventory / Monitor the following items:

- Invasive Species
- Special Status & Presumed Extirpated Species of Plants
- Forest Pathogens and Pests
- Mapping of Grassland Communities
- Wetlands, Seeps, and Riparian Habitat
- Bryophytes
- Fungi
- Landscape Scale Vegetation Maps
- Monitor management actions on Greenhouse Gas Balance and Water Yield.

## BFFIP Grant Funding and Progress

During the first five years of BFFIP implementation the District has been successful in securing and utilizing approximately \$3.9M in direct grant funding from CalFire and the State Coastal Conservancy (SCC), plus approximately \$283K worth of Grant Funded Labor through California Conservation Corps North Bay (CCNB). CalFire and SCC grant objectives focused on improvement of Forest Health and Wildfire Resiliency. The CCNB Forestry Core grant also focused on Forest Health objectives, but also included some components of youth work force development and ecological education. Additionally in FY24 the District, in collaboration with Golden Gate Parks Conservancy received 52 grant funded labor hours through the Marin Dept. of Agriculture specifically for the removal of Goatgrass on District land. Those labor hours have an estimated value of at \$12K.

The District has already secured approximately \$6M in additional grant funds from CalFire and Wildlife Conservation Board to continue with BFFIP implementation through FY29 (See Map #9). The District will continue to apply for grants as opportunities arise.



Photo 39: Field Training for CCNB Forestry Corps Members.



## 5.3 Work Plan for Fiscal Year 2025 (BFFIP Year 6)

The district conducts year end reviews of BFFIP activities to inform project planning for the following year. For year six of BFFIP implementation the district will rely on newly secured grant funds from The Wildlife Conservation Board and CalFire. These funds will be allocated over a 3 to 4 year period to help meet the BFFIP targets and goals of reducing wildfire fuels while enhancing biodiversity and ecosystem function. Below is a brief summary of BFFIP priorities for year six.

### Planning and Monitoring

- Continue collaborating with One Tam on implementing the Regional Forest Health Strategy.
- Collaborate with Marin Wildfire Prevention Authority on the Technical Advisory Committee.
- Continue to monitor vegetation responses to BFFIP forestry treatments
- Continue mapping and treating non-native invasive plants.
- Continue to develop forestry restoration outreach materials to educate watershed users of the multi-benefit forestry restoration work underway.
- Continue Prescribed fire planning with MCF and BAAQMD, as well as with FIGR for additional cultural resource surveys.

### Vegetation Management

- Complete BFFIP Year 6 vegetation management plan.
- Collaborate directly with MWPA Vegetation crews to treat portions of the Greater Ross Valley Shaded Fuelbreak that extend into the Marin Watershed.
- Expand the Blithedale Fuelbreak by approximately 17 acres.
- Complete remaining acres of forest restoration work around Potrero Meadow for the Cal Fire Forest Health Grant.
- Collaborate with Marin County Fire to conduct Prescribed Broadcast Burns across the Watershed.
- Focus new Broom work around Worn Springs and Fish Grade.
- Continue to expand the Initial Forest Fuel Reduction work around Rock Springs and Lag Rock Springs Rd.
- Continue removal of invasive weeds.

# 6 Appendices

## Appendix A – Mitigation Measures List

The following mitigation measures were implemented for all Management Actions (MAs) with environmental compliance components (MA-20 to MA-27):

MM Air-2 (Asbestos)	MM Biology-8 (Northern Spotted Owl; nesting season)
MM Air-3 (Air Pollutants)	MM Biology-9 (Western Pond Turtles)
MM Air-4 (Smoke)	MM Biology-10 (CA Red-Legged Frog)
BMP-1 (Operations)	MM Biology-12 (Foot-Hill Yellow Legged Frog)
BMP-2 (Pre-work Assessment/Planning)	MM Biology-13 (Mollusks)
BMP-3 (Import fills, rock & plants)	MM Biology-14 (Northern Spotted Owl, avoidance buffer)
MM Hazards-1 (Spills)	MM Biology-15 (Wetlands)
MM Hazards-3 (Fire Risk)	MM Biology-16 (Native Grasslands)
MM Hazards-4 (Prescribed Burn Plan)	MM Cultural-2 (Cultural Resources)
MM Hazards-7 (Fire Ignition)	MM Geology-1 (Erosion Control)
MM Hydrology-1 (Water Quality)	
MM Noise-1 (Noise Reduction)	
MM Recreation-1 (Roads & Trails)	
MM Transportation-1 (Emergency Access)	
MM Biology-1 (Worker Training)	
MM Biology-2 (Special-Status Plants)	
MM Biology-3 (Invasive Species)	
MM Biology-4 (Forest Diseases)	
MM Biology-5 (Roosting Bats)	
MM Biology-6 (Badgers)	
MM Biology-7 (Nesting Birds)	

# Appendix B – Volunteer Program Forest Walk Guides for Lake Lagunitas & Rock Springs Areas.



**THANKS FOR TAKING A WALK IN THE WOODS WITH US!**  
Let us know what you thought of the self-guided experience by emailing [one.tam@tceq.texas.gov](mailto:one.tam@tceq.texas.gov)

**HOW YOU CAN HELP**  
**LEARN MORE** - get a card at [www.one.tam@tceq.texas.gov](http://www.one.tam@tceq.texas.gov) or visit our website at [www.one.tam@tceq.texas.gov](http://www.one.tam@tceq.texas.gov)  
**BECOME A VOLUNTEER** - join our volunteer program to help support our work and make a real difference.  
**CLEAR YOUR SCHEDULE** - scheduling a walk with us is easy. We have a lot of other things going on, so we can help you find the best time to visit and get the most out of your experience.

**GREASEY SCORPIONS**  
The Texas Greasely Scorpion is a venomous arachnid. It is found in the state capital building and other public buildings. It is a small, dark, spider-like creature with a long, thin tail. It is not dangerous to humans but can be a nuisance. It is found in the state capital building and other public buildings.

**GLOSSARY**  
**Bioindicator** - An organism that can be used to monitor the health of an ecosystem. For example, the presence of certain species of birds or insects can indicate the health of a forest.  
**Fire adaptation** - The ability of a plant or animal to survive and thrive in a fire-prone environment. This can include traits like thick bark, fire-resistant leaves, or the ability to regenerate after a fire.  
**Forest health** - A measure of the overall condition of a forest, taking into account factors like tree growth, biodiversity, and the presence of pests and diseases.  
**Healthy forest** - A forest that is in good health and able to provide the ecosystem services it is capable of. This includes a diverse mix of tree species, a healthy understory, and a resilient ability to recover from disturbances.  
**Map** - A visual representation of a geographic area, showing features like trails, landmarks, and terrain. In this guide, it shows the route of the self-guided walk.  
**Native plant** - A plant species that is indigenous to a particular region. These plants are often adapted to the local climate and soil conditions.  
**Native animal** - An animal species that is indigenous to a particular region. These animals are often adapted to the local environment and play a role in the ecosystem.  
**Native bird** - A bird species that is indigenous to a particular region. These birds are often adapted to the local environment and can be important indicators of forest health.  
**Native insect** - An insect species that is indigenous to a particular region. These insects are often adapted to the local environment and can play a role in the ecosystem.  
**Native fish** - A fish species that is indigenous to a particular region. These fish are often adapted to the local environment and can be important indicators of water quality.  
**Native reptile** - A reptile species that is indigenous to a particular region. These reptiles are often adapted to the local environment and can play a role in the ecosystem.  
**Native amphibian** - An amphibian species that is indigenous to a particular region. These amphibians are often adapted to the local environment and can be important indicators of water quality.

## ONE TAM

### WHAT IS A HEALTHY FOREST?

**A SELF-GUIDED WALK AT LAKE LAGUNITAS, MT. TAMALPAIS**

The self-guided Lake Lagunitas offers a glimpse into the forest's health and the role of the forest in the ecosystem. This walk is designed to help you understand the forest's health and the role of the forest in the ecosystem. It is a self-guided walk that is designed to help you understand the forest's health and the role of the forest in the ecosystem.

**MAP INSIDE!**

**ONE TAM**  
One Tam is a program of the Texas Department of Transportation (TxDOT) that promotes the benefits of walking and hiking in the state capital building and other public buildings. It is a self-guided walk that is designed to help you understand the forest's health and the role of the forest in the ecosystem.


## LAKE LAGUNITAS PARKING LOT

### INTERSECTION WITH LAGUNITAS ROCK SPRING RD

### THE JUNCTION

### PILOT KNOS OVERLOOK

### FIRST FOOTBRIDGE



**1 LAKE LAGUNITAS PARKING LOT**  
This is the starting point for the self-guided walk. It is a paved area with several parking spaces. The walk begins here and follows the trail around the lake.

**2 INTERSECTION WITH LAGUNITAS ROCK SPRING RD**  
This is the intersection of the trail and the road. The trail continues to the right of the road. The road is paved and has a shoulder.

**3 THE JUNCTION**  
This is the junction of the trail and the road. The trail continues to the right of the road. The road is paved and has a shoulder.

**4 PILOT KNOS OVERLOOK**  
This is the Pilot Knos Overlook. It is a paved area with a view of the lake and the surrounding forest. The overlook is a good place to take a break and enjoy the view.

**5 FIRST FOOTBRIDGE**  
This is the first footbridge. It is a wooden bridge that crosses a small stream. The stream is a tributary of the lake. The bridge is a good place to take a break and enjoy the view.

**6 TOP OF THE SPILLWAY**  
This is the top of the spillway. It is a paved area with a view of the lake and the surrounding forest. The spillway is a good place to take a break and enjoy the view.

**7 ROCK SPRING TRAILHEAD**  
This is the Rock Spring Trailhead. It is a paved area with a view of the lake and the surrounding forest. The trailhead is a good place to take a break and enjoy the view.

**8 BENTEN TRAIL**  
This is the Benten Trail. It is a paved area with a view of the lake and the surrounding forest. The trail is a good place to take a break and enjoy the view.

**9 LAGUNITAS ROCK SPRING FIRE ROAD AND MOUNTAIN TOP TRAIL**  
This is the Lagunitas Rock Spring Fire Road and Mountain Top Trail. It is a paved area with a view of the lake and the surrounding forest. The trail is a good place to take a break and enjoy the view.

**10 MOUNTAIN THEATER FIRE TRAIL**  
This is the Mountain Theater Fire Trail. It is a paved area with a view of the lake and the surrounding forest. The trail is a good place to take a break and enjoy the view.



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**DI DID YOU KNOW?**  
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**MAP INSIDE!**

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## ONE TAM

### WHY DO FORESTS NEED BENEFICIAL FIRE?

**A SELF-GUIDED WALK AT ROCK SPRING TRAILHEAD, MT. TAMALPAIS**

This self-guided walk at Rock Spring Trailhead is designed to help you understand why forests need beneficial fire. It is a self-guided walk that is designed to help you understand why forests need beneficial fire. It is a self-guided walk that is designed to help you understand why forests need beneficial fire.

**MAP INSIDE!**

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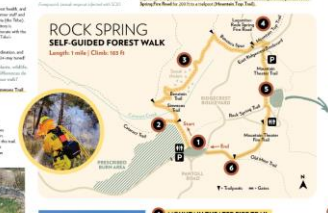
## ROCK SPRING TRAILHEAD

### RETURN OF BENEFICIAL FIRE

### WHAT'S MISSING WITH THESE TREES?

### LAGUNITAS ROCK SPRING FIRE ROAD AND MOUNTAIN TOP TRAIL

### MOUNTAIN THEATER FIRE TRAIL




**1 RETURN OF BENEFICIAL FIRE**  
This is the return of beneficial fire. It is a paved area with a view of the lake and the surrounding forest. The return of beneficial fire is a good place to take a break and enjoy the view.

**2 WHAT'S MISSING WITH THESE TREES?**  
This is the 'What's Missing with These Trees?' area. It is a paved area with a view of the lake and the surrounding forest. This area is a good place to take a break and enjoy the view.

**3 LAGUNITAS ROCK SPRING FIRE ROAD AND MOUNTAIN TOP TRAIL**  
This is the Lagunitas Rock Spring Fire Road and Mountain Top Trail. It is a paved area with a view of the lake and the surrounding forest. The trail is a good place to take a break and enjoy the view.

**4 MOUNTAIN THEATER FIRE TRAIL**  
This is the Mountain Theater Fire Trail. It is a paved area with a view of the lake and the surrounding forest. The trail is a good place to take a break and enjoy the view.

# Appendix C – Forestry Treatment Monitoring Results



## Impact of forest fuels treatments on understory herbs and tree recruitment

Shehrezade N Adams, Marin Water  
sadams@marinwater.org, 415.945.1184  
Marinwater.org, 220 Nellen Ave, Corte Madera, CA 94925

### Introduction

Marin Water manages 20,000 acres in the San Francisco bay area, mostly forested with a long history of indigenous burning.

**Management challenges include:**

- Recent history of fire exclusion: fuel buildup and vegetation community shifts
- Changing climate: drought-stressed vegetation and increased wildfire intensity, tractability and size
- Introduced forest pathogens: widespread tree mortality
- Development patterns: adjacent communities concerned about wildfire

We mechanically remove small diameter shade-tolerant trees and shrubs in select stands to change fuel structure in hopes of minimizing the negative impacts of the next wildfire for ecosystems and communities.

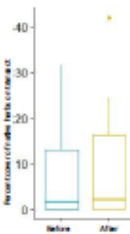
This project aims to provide information about these management actions on forest understory

- Is there recruitment (seedlings, saplings and resprouting) of trees and of what species?
- Is there an impact on forest understory plant community, and does this differ for native and introduced plants?

### Results

Two years after treatment

#### No change in native understory herbs

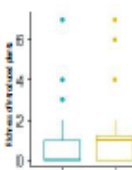


Cover of native herbaceous plants on the 25 m transects before and after fuels treatments

Before: mean=7.6, sd=10.5  
After: mean=8.1, sd=11.1  
paired t-test P=0.6, t=-0.5, df=24

#### Small increase in introduced understory herbs

Richness of introduced species increased, especially in the locations that already had some before treatment. These are widespread species and native species continue to dominate.

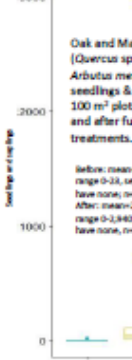


Richness of introduced plants in 50m² before and after fuels treatments

Before: mean=0.8, sd=1.68, n=24  
After: mean=1.42, sd=1.82, n=24  
Wilcoxon signed rank P=0.02

#### Big increase in tree recruitment

Oak and Madrone (*Quercus* sp. & *Arbutus menziesii*) seedlings & saplings in 100 m² plots before and after fuels treatments.



Before: mean=6, sd=45, range 0-24, seven plots have none, n=24  
After: mean=226, sd=726, range 0-2,440, two plots have none, n=24

### Conclusions

- No evidence that our forestry work at these sites is impacting abundance or richness of native understory plants in first 2 years.
- There has been an increase in introduced understory plants, especially in sites that had some before treatment.
- These weeds are widespread, wildland hygiene has been effective, we have not seen weeds new to the watershed at these sites.
- Our forest understory continues to be native-dominated.
- There is good regeneration in these locations of trees species not vulnerable to Sudden Oak Death/*Phytophthora ramorum*, especially madrone trees (*Arbutus menziesii*).

### Recommendations

- There is sufficient natural regeneration on site, no need to install nursery-grown plants.
- Continue the emphasis on good wildland hygiene to reduce weed problems.
- Continue early detection rapid response (EDRR) program in treated sites for weeds novel to watershed
- Continue understory monitoring, outstanding questions:
  - Will weeds decrease through time?
  - Will tree recruitment continue through age classes?

### Methods



Marin Water conducts forest monitoring treatments each year in different forested locations within our watershed lands on Mount Tamalpais in Marin County California. In 2020, 2022 and 2023, 8 monitoring transects were placed within that year's treatment stands. Specific treated locations within the treated area were selected in a grid using a GIS. First a grid of 100 m² squares was superimposed on the treatment area. If this resulted in more than 8 complete squares, 8 were selected at random.

Transects were run in each stand using a string compass from the start location which was a fixed distance from a tree not slated for cutting. Along a 20-meter transect, each 10m² plot was collected every 50 cm, with only the top 10 below 1m in height recorded. In addition any species not encountered in 20m² plot but seen within a 1 meter band of either side of the transect was noted (presence-absence only) yielding a total species count for the 100 m². All trees less than 1.3m in diameter at 1.38 m from the ground were counted. If that stem was located within 2 m of the transect (eg. 100 m² area) scanned for seedlings, saplings and recorded. All plants encountered were identified to species and categorized as herbaceous, vine, shrub or tree, and native or introduced per the Jepson eFlora (<http://calphotos.berkeley.edu/eflora/>)

All analyses were conducted in R studio using R version 4.2.1. For each variable of interest, the difference between before and after treatment values was checked for normality using Shapiro-Wilk test and normal distribution further analyzed using a paired t-test. For otherwise Wilcoxon signed rank test was conducted. 0.05 was used as a significance level for all tests.

### Rare plant surprise

*Napa false Indigo* (*Fabaceae*: *Amorpha californica* var. *napanensis*) is an occasional understory subshrub of limited range, with a California Rare Plant Rank of 1B.2 (rare, threatened, or endangered in CA and elsewhere). After fuels treatments, this species has become much more visible in locations where it was previously overtopped and surrounded by the common understory shrub California huckleberry (*Ericaceae*: *Vaccinium californicum*)

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