NOTICE OF THE AMENDED AGENDA - WATERSHED COMMITTEE MEETING/SPECIAL MEETING OF THE BOARD OF DIRECTORS

Thursday, September 19, 2024 at 9:30 AM

AGENDA

LOCATIONS:
Open Session to start at or after 9:30 a.m.
Marin Water Board Room – 220 Nellen Avenue, Corte Madera, CA 94925

ADDED TO AGENDA: Outside location for Director Monty Schmitt - 3 Glenaire Drive, San Rafael, CA 94901

Public Participation:
The public may attend this meeting in-person or remotely using the following methods:
On a computer or smart device, go to: https://marinwater.zoom.us/j/81071577373
By phone, dial: **1-669-444-9171** and use Webinar ID: **810 7157 7373**

HOW TO PROVIDE PUBLIC COMMENT:

During the Meeting: Typically, you will have 3 minutes to make your public comment, however, the board president may shorten the amount of time for public comment due to a large number of attendees. Furthermore, pursuant to Government Code, section 54954.2 (the Brown Act), the Board may not take action or discuss any item that does not appear on the agenda.

-- In-Person Attendee: Fill out a speaker card and provide to the board secretary. List the number/letter (ex: 6a) of the agenda item(s), for which you would like to provide a comment. Once you're called, proceed to the lectern to make your comment.

-- Remote Attendee: Use the "raise hand" button on the bottom of the Zoom screen. If you are joining by phone and would like to comment, press *9. The board secretary will use the last four digits of your phone number to call on you (dial *6 to mute/unmute).

In Advance of the Meeting: Submit your comments by email in advance of the meeting to boardcomment@marinwater.org. To ensure that your comment is provided to the Board of Directors prior to the meeting, please email your comment 24 hours in advance of the meeting start time. Comments received after this cut off time will be sent to the Board after the meeting. Please do not include personal information in your comment such as phone numbers and home addresses.

AGENDA ITEMS:

1. **Call to Order and Roll Call**
2. **Adoption of Agenda**
3. **Public Comment on Non-Agenda Matters**

   This is the time when any person may address the Board of Directors on matters not listed on this agenda, but which are within the subject matter jurisdiction of the Board.

4. **Regular Items** (9:50 a.m. – Time Approximate)

   a. Dedication of Memorial Plaque in Honor of Roger E. Roberts

   RECOMMENDATION: Approve the installation of a new bench along Azalea Hill Trail with a memorial plaque for Roger E. Roberts

   b. Minutes of the Watershed Committee Meeting/Special Meeting of the Board of Directors' Meeting on June 20, 2024

   RECOMMENDATION: Approve the minutes

   c. 2024-2027 Forestry Services Contract

   RECOMMENDATION: Review and refer the proposed Forestry Services General Services Agreement (GSA) contract to a future regular meeting of the Board of Directors for award of the contract to the lowest qualified bidder

   d. Abundance Patterns of Landbirds on the District Lands

   RECOMMENDATION: Receive report

   e. FY 2024 Annual BFFIP Vegetation Management Report

   RECOMMENDATION: Receive report

   f. Update on Lagunitas Creek Coho Habitat Enhancement Project Phase 1A Construction, and Review and Refer Contract MA-6356 with O'Connor Environmental Inc.

   RECOMMENDATION: Receive update; and Review and refer MA-6356 with O'Connor Environmental Inc. for Lagunitas Creek sediment and streambed monitoring to support WR95-17 compliance and guide ongoing restoration planning in the amount of $154,443

5. **Upcoming Meeting**

   The next Watershed Committee Meeting/Special Meeting of the Board of Directors will take place on Thursday, October 17, 2024, at 9:30 a.m.

6. **Adjournment** (11:15 a.m. – Time Approximate)

ADA NOTICE AND HEARING-IMPAIRED PROVISIONS

In accordance with the Americans with Disabilities Act (ADA) and California Law, it is Marin Water's policy to offer its public programs, services, and meetings in a manner that is readily accessible to everyone, including those with disabilities. If you are an individual with a disability and require a copy of a public hearing notice, an agenda, and/or agenda packet in an appropriate alternative format, or if you require

other accommodations, please contact the Board Secretary/ADA Coordinator at 415.945.1448, at least two business days in advance of the meeting. Advance notification will enable Marin Water to make reasonable arrangements to ensure accessibility.

Information agendas are available for review at the Civic Center Library, Corte Madera Library, Fairfax Library, Mill Valley Library, Marin Water Administration Building, and marinwater.org.

Originally Posted: 09-13-2024

Amendment Posted: 09-16-2024

STAFF REPORT

Meeting Type:	Watershed Committee/Board of Directors
Title:	Dedication of Memorial Plaque in Honor of Roger E. Roberts
From:	Shaun Horne, Director of Watershed Resources
Through:	Ben Horenstein, General Manager
Meeting Date:	September 19, 2024

TYPE OF ACTION: X Action Information Review and Refer

RECOMMENDATION: Approve the installation of a new bench along Azalea Hill Trail with a memorial plaque for Roger E. Roberts

SUMMARY: The District allows for memorial plaques to be placed on the Watershed on benches and picnic tables in developed areas as they are available. At the request of the Marin Conservation League (MCL) and in honor of Roger E. Roberts, the District will install a plaque on a bench in the Azalea Hill vicinity in his memory. In compliance with Board Policy 7 (H) in order to place a memorial plaque along a trail the Board must approve by a majority vote of the Board. Staff is requesting the Board to approve the installation of a new bench along Azalea Hill Trail with a memorial plaque for Roger E. Roberts.

DISCUSSION: Roger was highly engaged in various Marin Water community workshops and regularly participated in District Watershed Committee and Board Meetings, as well as provided voluntary service on District Community Advisory Committees. Roger was especially interested in the fiscal sustainability of the District and the protection of the District watershed's biodiversity and rare plants, and he regularly provided his insightful and thoughtful comments on those topics to staff and the Board. In memory of Roger and in appreciation of all his involvement with the District, the District will install a memorial plaque on a bench along the Azela Hill Trail in the District's watershed.

The plaque language was developed by Roger's family and MCL. It will read as follows:

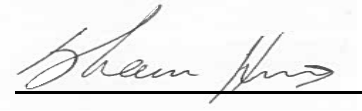
Roger's View
Remembering Roger E. Roberts for his enduring care of the watershed.
1936-2023

In compliance with Board Policy 7 (H) in order to place a memorial plaque along a trail the Board must approve by a majority vote of the Board. Staff is requesting the Board to approve the installation of a new bench along Azalea Hill Trail with a memorial plaque for Roger E. Roberts.

ENVIRONMENTAL REVIEW: Not applicable.

FISCAL IMPACT: Not applicable.

ATTACHMENT(S): None.

DEPARTMENT OR DIVISION	DIVISION MANAGER	APPROVED
Watershed		
	Shaun Horne **Watershed Resources Director**	**Ben Horenstein** **General Manager**

STAFF REPORT

Meeting Type:	Watershed Committee/Board of Directors
Title:	Minutes of the Watershed Committee Meeting/Special Meeting of the Board of Directors' Meeting on June 20, 2024
From:	Terrie Gillen, Board Secretary
Through:	Ben Horenstein, General Manager
Meeting Date:	September 19, 2024

TYPE OF ACTION: X Action Information Review and Refer

RECOMMENDATION: Approve the minutes

SUMMARY: The Watershed Committee Meeting/Special Meeting of the Board of Directors' Meeting took place on June 20, 2024. The minutes of that meeting are attached.

DISCUSSION: None.

ENVIRONMENTAL REVIEW: Not applicable.

FISCAL IMPACT: None.

ATTACHMENT(S):

1. Draft June 20, 2024 Meeting Minutes

DEPARTMENT OR DIVISION	DIVISION MANAGER	APPROVED
Communications & Public Affairs Department	Terrie Gillen Board Secretary	Ben Horenstein General Manager

Attachment 1

NOTICE OF THE WATERSHED COMMITTEE MEETING/SPECIAL MEETING OF THE BOARD OF DIRECTORS

Thursday, June 20, 2024 at 9:30 AM

MINUTES

LOCATIONS:
Open Session to start at or after 9:30 a.m.
Marin Water Board Room – 220 Nellen Avenue, Corte Madera, CA 94925

Public Participation:
The public attended this meeting in-person or remotely using the following methods: on a computer or smart device, https://marinwater.zoom.us/j/81071577373, or by phone, 1-669-444-9171, using Webinar ID: No. 810 7157 7373.

AGENDA ITEMS:

1. **Call to Order and Roll Call**

   Chair Matt Samson called the meeting to order at 9:30 a.m.

   DIRECTORS PRESENT
   Ranjiv Khush
   Larry Russell
   Jed Smith
   Monty Schmitt (*arrived at 9:32 a.m.*)
   Matt Samson

2. **Adoption of Agenda**

   A motion was made by Director Smith and seconded by Director Khush to adopt the agenda.

   There were no public comments.

   Voting Yea: Directors Khush, Russell, Smith, and Samson

Absent: Vice Chair Schmitt

3. Public Comment on Non-Agenda Matters

There were no public comments.

4. Regular Items

a. Minutes of the Watershed Committee Meeting/Special Meeting of the Board of Directors on March 21, 2024

RECOMMENDATION: Approve the meeting minutes

A motion was made by Director Khush and seconded by Director Smith to approve the minutes.

There were no public comments.

Voting Yea: Directors Khush, Russell, Smith, and Samson

Absent: Vice Chair Schmitt

Vice Chair Schmitt arrived at 9:32 a.m.

b. Wildfire Pathway Modeling Presentation

RECOMMENDATION: Receive a Guest presentation relating to Wildfire Pathway Modeling

Watershed Resources Director Shaun Horne introduced Dave Winnaker, Fire Chief of the Moraga-Orinda Fire Protection District, who gave the presentation on Wildfire Pathway Modeling.

Discussion ensued.

There were five (5) public comments.

This was an information item. No formal action was taken.

c. Watershed Recreation Management Planning Feasibility Study Update

RECOMMENDATION: Receive an update on the Watershed Recreation Management Planning Feasibility Study Strategic Opportunities and the development of the pilot programs

Watershed Resources Director Horne, Watershed Chief Ranger Don Wick, and Natural Resources Programs Manager Carl Sanders presented this item.

Discussion followed.

There were 19 public comments.

This was an information item. No formal action was taken.

Natural Resources Program Manager Sanders unintentionally presented agenda item 4e before agenda item 4d.

e. Amendments to BFFIP Contracts No. 1967 and No. 1948

RECOMMENDATION: Review and refer Amendment No. 3 to Contract No. 1948 with Forester and Kroeger and Amendment No. 2 to Contract No. 1967 with Bay Area Tree Services to a future regular meeting of the Board of Directors for the Board to consider approval

There were no public comments.

A motion was made by Director Khush and seconded by Vice Chair Schmitt to refer these contracts to the Board to consider for approval at a future meeting.

Natural Resources Program Manager Sanders then presented item 4d.

d. Forestry Services Contract (CN 2034)

RECOMMENDATION: Review and refer the 'Forestry Services' General Services Agreement (GSA) to a future regular meeting of the Board of Directors for award of the contract to the lowest qualified bidder

Discussion followed.

There were no public comments.

A motion was made by Vice Chair Schmitt and seconded by Director Khush to refer this item to the Board to consider for approval at a future meeting.

5. Upcoming Meeting

The Board Secretary announced that the next Committee meeting was scheduled for September 19 at 9:30 a.m.

6. Adjournment

There being no further business, the Watershed Committee Meeting/Special Meeting of the Board of Directors adjourned on June 20, 2024, at 11:48 a.m.

_____

Board Secretary

STAFF REPORT

Meeting Type:	Watershed Committee/Board of Directors
Title:	2024-2027 Forestry Services Contract
From:	Shaun Horne, Director of Watershed Resources
Through:	Ben Horenstein, General Manager
Meeting Date:	September 19, 2024

TYPE OF ACTION: Action Information X Review and Refer

RECOMMENDATION: Review and refer the proposed Forestry Services General Services Agreement (GSA) contract to a future regular meeting of the Board of Directors for award of the contract to the lowest qualified bidder

SUMMARY: The District is currently in year six of implementation of the Biodiversity, Fire and Fuels Integrated Plan (BFFIP) that was adopted in 2019. The current contract with Hanford ARC expired on June 30, 2024. Staff propose using a three year 'Forestry Services' contract to provide labor and equipment necessary to further implement treatments outline in the 2019 BFFIP vegetation Management Actions. Assuming satisfactory contractor performance during the initial three-year term, the GSA contract allows the District the option to execute two subsequent one-year contract extensions.

Staff is requesting that the Watershed Committee review and refer the Forestry Services GSA contract for approval at a future regularly scheduled Board of Directors meeting for award of contract to the lowest qualified bidder, and to authorize the General Manager to execute any and all future amendments to this contract, which is deemed necessary, so long as they do not exceed 10% in total of the contract amount.

DISCUSSION: In October of 2019, the District adopted the BFFIP, and associated Programmatic Environmental Impact Report (PEIR), which describes the actions the District will implement to reduce wildfire hazards and to maintain and enhance ecosystem function. Vegetation management under the BFFIP aims to reduce fuel loads, maintain fuelbreak infrastructure, preserve defensible space, and reduce invasive weed species. Vegetation management is conducted continuously throughout the year with the chief goal of reducing fuel loads and maintaining the watershed's biological diversity.

Over the last four years, Hanford ARC has successfully assisted the District under contract CN1938 with implementation of BFFIP vegetation Management Actions. On June 30, 2024 CN1938 expired and the District is now seeking bids for a new forestry contract in order to continue critical BFFIP implementation. For the past five years, Watershed Staff and contractors have successfully implemented vegetation Management Actions (MA) outlined within the BFFIP. Implementation of management actions requires multiple contractors with a range of technical skills to conduct over 1,500 acres of annual vegetation treatments described in the BFFIP under MA-20, 'Fuelbreak Construction', MA-21 'Fuelbreak Construction', MA-23, 'Forest Stand Structure Improvement' and MA 24, 'Grassland and Oak Woodland Improvement'. This new Forestry GSA will provide skilled hand and operator labor, as well as heavy equipment masticators necessary to continue planned BFFIP Management Actions. In addition, this new Forestry GSA will also support maintenance of the Lagunitas Creek Watershed Enhancement Project that is currently being constructed.

Proposal Selection Process:

On August 23, 2024, the District released a notice inviting bids for a three-year Forestry Services GSA contract. The notice was published in the local newspaper and posted on the District's external bid posting website to inform contractors of the opportunity. Sealed bids will be received and reviewed by the District and the lowest qualified bidder will be selected.

ENVIRONMENTAL REVIEW: The District as the Lead Agency, has prepared a Programmatic Environmental Impact Report (PEIR) pursuant to the provisions of CEQA for the Biodiversity, Fire and Fuels Integrated Plan (BFFIP) which was adopted in 2019 and covers all work being proposed under this 'Forestry Services' GSA contract.

FISCAL IMPACT: Staff estimate the costs to perform the Forestry Services over the initial three years, during FY25, FY26 & FY27, will be $3,600,000**.** Funds for this contract will be paid out of a combination of District BFFIP Operations and Capital funding, as well as with a secured Wildlife Conservation Board Grant and Cal Fire Forest Health Grants.

ATTACHMENT(S): None.

DEPARTMENT OR DIVISION	DIVISION MANAGER	APPROVED
Watershed	**Shaun Horne** **Watershed Resources Director**	**Ben Horenstein** **General Manager**

STAFF REPORT

Meeting Type:	Watershed Committee/ Board of Directors
Title:	Abundance Patterns of Landbirds on the District Lands
From:	Shaun Horne, Director of Watershed Resources
Through:	Ben Horenstein, General Manager
Meeting Date:	September 19, 2024

TYPE OF ACTION: Action X Information Review and Refer

RECOMMENDATION: Receive report

SUMMARY: Point Blue Conservation Science has monitored the abundance of landbirds in the Marin Municipal Water District (Marin Water) watershed lands from 1996 to 2022. Using this monitoring data, Point Blue analyzes trends in abundance of 56 species of birds during the breeding season. Staff will provide a presentation of the 2022 Report on the Abundance Patterns of Landbirds (Report).

DISCUSSION: The Marin Municipal Water District (Marin Water) encompasses over 21,000 acres of land in Marin County, including 18,900 on Mt. Tamalpais, and 2,700 adjacent to Nicasio and Soulajule Reservoirs. These lands include a diversity of habitat types and wildlife. In 1996, Point Blue Conservation Science (Point Blue; formerly PRBO) and Marin Water implemented a three-year project to assess the status and distribution of landbird populations on watershed lands managed by Marin Water (Holmes et al. 1998). This initial project was followed by the establishment of a long-term monitoring program, where it was determined that all 337 point count stations would be surveyed every third year beginning in 2001 (with a subset of points surveyed in 1999 for a different purpose and not included in long-term trend analysis). An additional 25 points were added in 2019 in grassland habitat (DiGaudio and Humple 2019), with six of those points selected for continued monitoring in 2022 and beyond, after evaluating their potential contribution to our understanding of grassland birds in the region. The principal goal of this long-term study is to monitor the abundance of landbird populations on Marin Water lands over time in order to provide land managers with information on the overall status of this natural resource, which will in turn provide guidance on when management actions are warranted and additional research is needed.

In this Report, Point Blue analyzed trends in abundance for 56 species of birds present during the breeding season (55 native species, and the introduced European Starling). The Report scored species population trends using an established protocol by Partners in Flight, and then translated those scores to categories of concern: Least Concern, Uncertain/Caution, Caution, and Significant Concern. Twenty-eight or 51% of the 55 native species exhibited increasing trends or were considered stable (Least

Concern); six or 11% of the native species had either uncertain trends or small decreases (Uncertain/Caution); four or 7% of the native species showed moderate to possible large decreases (Caution); and 17 or 31% of native species exhibited large decreases (Significant Concern). The non-native European Starling also exhibited a large decrease. The Report evaluated trends for species grouped by their primary habitat association on Marin Water lands. The Report found that species primarily associated with forested habitat types (conifer and mixed hardwood, oak woodland, and species that used multiple forest types) had the highest proportion of species that were increasing or stable. The habitat guilds with the highest proportion of declining species were the generalists (species that used three or more habitat types on Marin Water lands) and riparian/wetland-associated species. The shrub/chaparral guild was only represented by four species and their trend results were mixed. Point Blue established additional grassland points in 2019 to increase our ability to assess birds in this habitat type, but due to limited data they are not yet able to evaluate trends in grassland birds.

The populations of many of the landbird species found on Marin Water lands during the breeding season have remained stable or are increasing since 1996, confirming that Marin Water lands continue to provide valuable habitat for many birds. However, the populations of over a third of the species we analyzed have declined over the course of the 26-year study. Local bird populations are affected by changes in habitat and environmental conditions beyond the boundaries of Marin Water lands. In particular, climate change is predicted to, either independently or together with other threats, exacerbate widespread declines in landbird populations (Tingley et al. 2009, Jongsomjit et al. 2013, Seavy et al. 2018). Given this expectation, effective land stewardship is important for protecting, enhancing, and managing high quality habitat, and the ability to detect changes in natural resources will continue to be essential to adaptive management. The long-term landbird dataset from Marin Water monitoring has played an important role in our understanding of local landbird populations, including in the One Tam region (Gardali et al. 2016; Humple et al. *in press*), where it is central to the understanding of how birds in the region are doing and is combined with data from other regional jurisdictions to inform the One Tam Peak Health Report. This dataset has also been used for the Marin County Compass project (2021), a new performance management program in the County of Marin where the landbird data was one of the metrics of ecological health for the County. The extensive amount of diverse and protected habitat types on Marin Water lands contribute to the health of regional landbird populations beyond their boundaries, and for migratory species, can contribute to populations spanning the Pacific Flyway.

Work on the next tri-annual monitoring report will be carried out in 2025.

ENVIRONMENTAL REVIEW: Not applicable.

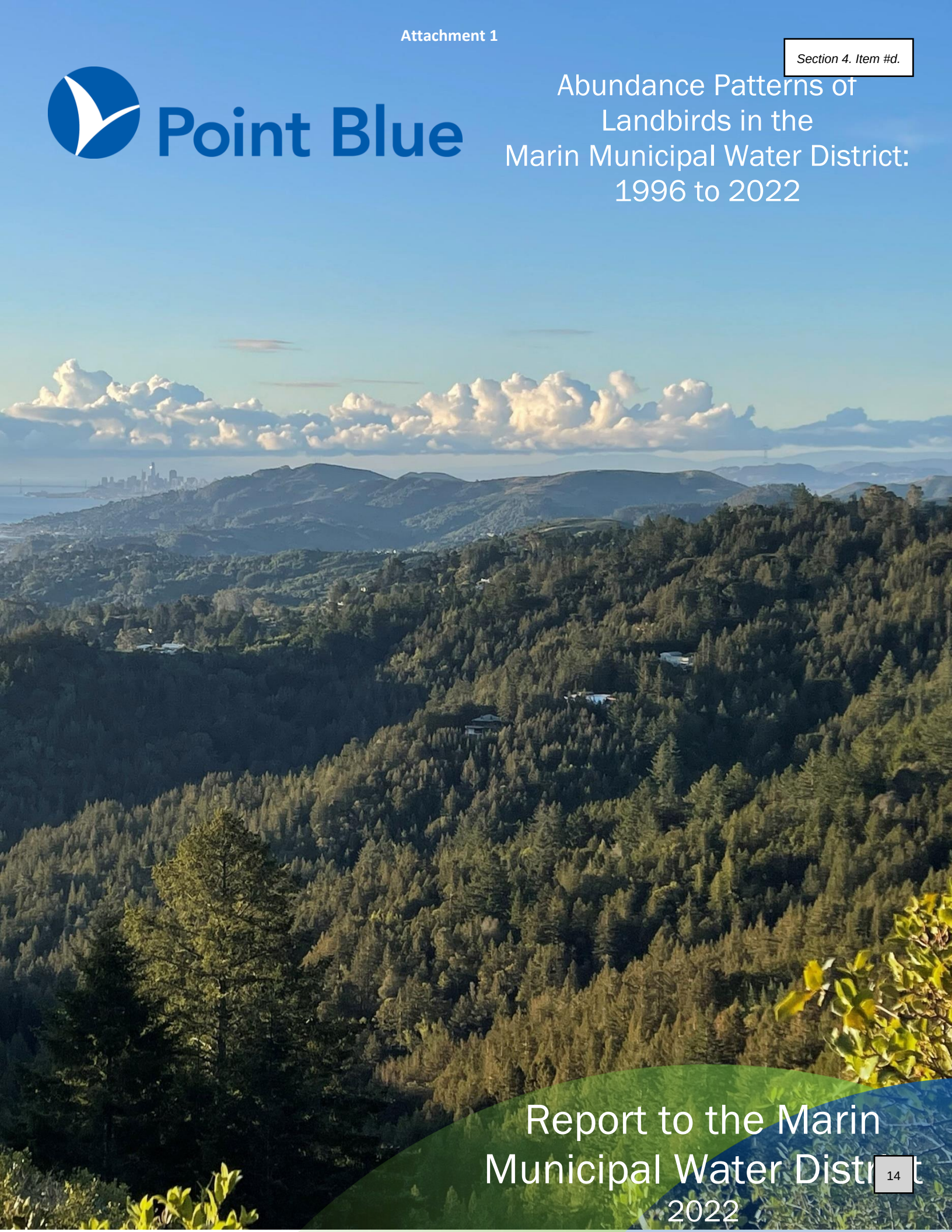
FISCAL IMPACT: Not applicable.

ATTACHMENT(S):

1. Abundance Patterns of Landbirds in the Marin Municipal Water District: 1996-2022

Point Blue

Abundance Patterns of Landbirds in the Marin Municipal Water District: 1996 to 2022



Report to the Marin Municipal Water Distr

2022

Abundance Patterns of Landbirds in the Marin Municipal Water District: 1996 to 2022

Report prepared for the Marin Municipal Water District

January 2023

Prepared by

Point Blue Conservation Science
Renée L. Cormier
Diana L. Humple
Kristen E. Dybala

Suggested citation:
Cormier, R. L., D. L. Humple, K. E. Dybala. 2023. Abundance patterns of landbirds in the Marin Municipal Water District: 1996 to 2022. Point Blue Conservation Science (Contribution No. 2434), Petaluma, CA.
*Corresponding author: rcormier@pointblue.org

Cover Photo by Mark Dettling / Point Blue.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Many species of birds, including those once considered common, have declined in recent decades. Therefore, monitoring programs that can detect changes in bird populations are important because they can help inform land managers when additional management action or research may be warranted to protect these species. Point Blue Conservation Science monitored the abundance of landbirds in the Marin Municipal Water District (Marin Water) from 1996 to 2022. Using these data, we analyzed trends in abundance for 56 species of birds present during the breeding season (55 native species, and the introduced European Starling). We used a different modelling approach from our previous analyses, which allowed us to evaluate an additional 15 species, and to be more likely to detect trends for species overall. We scored species population trends using an established protocol by Partners in Flight, and we then translated those scores to categories of concern: Least Concern, Uncertain/Caution, Caution, and Significant Concern. Twenty-eight (51%) of the 55 native species exhibited increasing trends or were considered stable (Least Concern); six species (11%) had either uncertain trends or small decreases (Uncertain/Caution); four species (7%) showed moderate to possible large decreases (Caution); and 17 species (31%) exhibited large decreases (Significant Concern). The non-native European Starling also exhibited a large decrease. We also evaluated trends for species grouped by their primary habitat association on Marin Water lands. We found that species primarily associated with forested habitat types (conifer and mixed hardwood, oak woodland, and species that used multiple forest types) had the highest proportion of species that were increasing or stable. The habitat guilds with the highest proportion of declining species were the generalists (species that used three or more habitat types on Marin Water lands) and riparian/wetland-associated species. The shrub/chaparral guild was only represented by four species and their trend results were mixed. We established additional grassland points in 2019 to increase our ability to assess birds in this habitat type, but we are not yet able to evaluate trends in grassland birds. Future analyses could be incorporated into these monitoring efforts to specifically evaluate response of birds to habitat changes as a result of management actions for Marin Water's Biodiversity, Fire, and Fuels Integrated Plan (which are mostly concentrated in forested habitats), including if there are differences in treated versus untreated areas. We recommend continued assessment of shrub/chaparral-associated species – whether or not it is their primary habitat affiliation – including for species that rely on shrubs in forested habitats. Finally, we recommend continued monitoring of the avian community at the long-term Marin Water monitoring sites in order to provide information to land managers about the status of these bird populations, what they indicate about habitat types on Marin Water lands, and determine if management action is warranted.

INTRODUCTION

In recent decades, many bird species have declined, including species that are considered common (Inger et al. 2015, Rosenberg et al. 2019). The declines may be attributed to multiple factors, including habitat loss and degradation, climate change, pesticide use, domestic or feral cat predation, and other causes (Calvert et al. 2013, Mineau and Whiteside 2013, Pearce-Higgins et al. 2015, Xu et al. 2019). In addition to studying birds because of concerns over these large declines, the sensitivity of birds to changing conditions makes them good indicators of ecological change (Carignan and Villard 2002). Monitoring programs are essential components to providing early warning of resource change and can be used to identify species of local or regional conservation concern. Furthermore, when changes are detected through monitoring, recommendations for management or further research may be identified (e.g., Strong et al. 2004).

The Marin Municipal Water District (Marin Water) encompasses over 21,000 acres of land in Marin County, including 18,900 on Mount Tamalpais, and 2,700 adjacent to Nicasio and Soulajule Reservoirs. These lands include a diversity of habitat types and wildlife. In 1996, Point Blue Conservation Science (Point Blue; formerly PRBO) and Marin Water implemented a three-year project to assess the status and distribution of landbird populations on watershed lands managed by Marin Water (Holmes et al. 1998). This was followed by the establishment of a long-term monitoring program, where it was determined that all 337 point count stations would be surveyed every third year beginning in 2001 (with a subset of points surveyed in 1999 for a different purpose and not included in long-term trend analysis). An additional 25 points were added in 2019 in grassland habitat (DiGaudio and Humple 2019), with six of those points selected for continued monitoring in 2022 and beyond, after evaluating their potential contribution to our understanding of grassland birds in the region. The principal goal of this long-term study is to monitor the abundance of landbird populations on Marin Water lands over time in order to provide managers with information on the overall status of this natural resource, which will in turn provide guidance on when management actions are warranted and research is needed.

In this report we present results from trend analysis for 56 passerine and near-passerine species (hereafter collectively called landbirds) within the study area using data from 1996 to 2022. We have updated the analysis approach used in previous reports in order to increase our ability to detect trends for all species, and to increase the number of species in the analysis; the most recent previous analysis of this dataset (1999-2019) included trends for 41 species (Cormier et al. 2020). Additionally, we assess trends for species grouped by their primary habitat association on Marin Water lands.

METHODS

Study area

In 2022, Point Blue Conservation Science biologists conducted bird surveys at 343 point count stations throughout Marin Water lands (Figure 1; Appendix A). Point count survey locations were first established for 337 of the points in 1996 by Point Blue, in collaboration with Marin Water. Points were placed on trails and fire roads throughout the Mount Tamalpais watershed with the goal of covering the major habitat types and geographic extent of the study area. General habitat types covered include conifer (including coast redwood) and mixed evergreen hardwood forest, oak woodland/savannah, scrub/chaparral, and grassland; a small portion of points are included in riparian or wetland (e.g., along lake edges) areas. In 2019, 25 additional point count survey locations were established in grassland habitat across Marin Water lands to assess grassland bird species in the One Tam footprint (DiGaudio and Humple 2019), and six of those points were selected for continued monitoring and surveyed in 2022, but not included in this analysis as there is not yet long-term data available for them.

The original 337 point count locations were selected by first randomly selecting locations that were distributed evenly throughout the study area. From each random location, the nearest unpaved fire road or trail was used for the first point count survey location of each transect. The direction of travel from the first established point of the transect was random when possible, and subsequent points for the transect were placed on the fire road or trail, generally spaced 200-400 m apart from one another (Figure 1). The new grassland point count survey locations were selected based on available grassland habitat and patch size, and were placed at least 50 m from the nearest non-grassland habitat edge and at least 250 m apart from other points (DiGaudio and Humple 2019).

Point Count Surveys

Point count surveys were conducted following the standardized point count protocol described in Ralph et al (1993 and 1995). At each point count location, an observer recorded all birds detected within a 5-minute survey window. The species of bird, type of detection (song, visual, or call), and the estimated distance of the bird from the observer were all recorded. Any individual that was determined to be juvenile was coded as such. Methods for recording distance have varied depending on the year and adhered to either a Fixed Radius method or the Variable Circular Plot (VCP) point count method. The Fixed Radius method was used in 1996 and for some sites in 1997 and 1998, where each bird was classified as being less than 50 m or greater than 50 m from the observer. For the VCP method, the distance to each bird is estimated to the nearest “distance band” from the observer. For the remaining points in 1997 and 1998, and for 2001, the VCP method was used with distance bands every 10 m out to 100

m; since 2004 we have used slightly broader VCP distance bands of 0-10 m, 10-20 m, 20-30 m, 30-50 m, 50-100 m, and greater than 100 m. Beginning in 2004, biologists used range finders to assist in the accurate determination of distance estimations; during all years, biologists regularly recalibrated their distance estimations. We were able to compare all years of this study by lumping all detections within 50 m of the observer into one distance band (0-50 m). In addition, birds detected flying over and not using the site were placed in a different category, flyovers, not in a distance band.

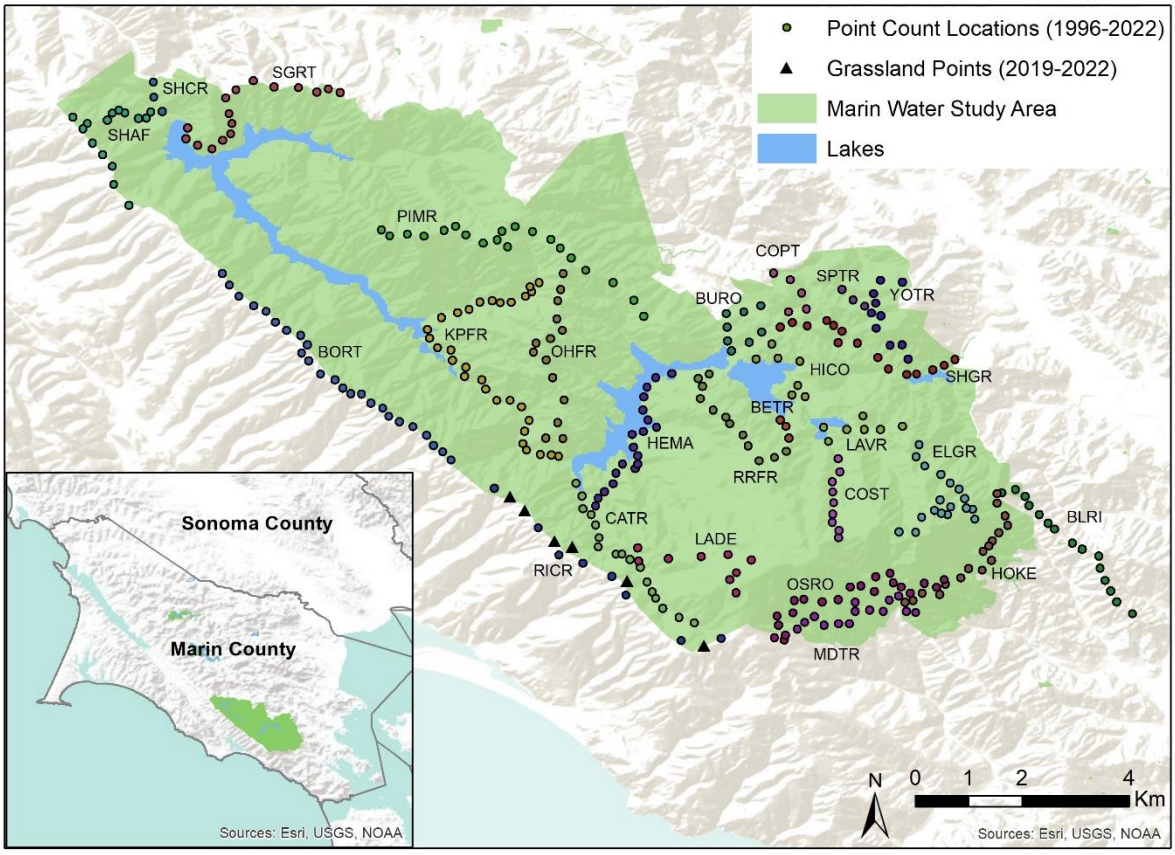


Figure 1. Map of 2022 point count locations conducted by Point Blue Conservation Science in the Marin Municipal Water District, Marin County, California. On top of the long-term point count stations (n=337) additional grassland point count stations (n=6) established in 2019 were also surveyed, but new grassland points are not included in the analysis. For the long-term points, each transect is represented by a different color.

Surveys began 15-30 minutes after local sunrise and were completed within four hours of sunrise to restrict the survey to peak singing hours. Counts were not conducted during rainy, excessively foggy, or windy conditions, where bird activity levels or detection probability was reduced. In most years, two surveys were conducted each year from mid-April through mid-July, and generally occurred in May and June, with the current protocol being to conduct the

first survey in May and the second in June (see Appendix A for survey dates in 2022); see statistical methods for how we addressed the few instances of one or three surveys being conducted in year.

Data Management

All 2022 data were collected on data sheets and entered online. All years of data can be accessed at the password protected California Avian Data Center (CADC; http://data.prbo.org/cadc2/) by Point Blue staff and by Marin Water staff upon password request. CADC is a node of the Avian Knowledge Network (AKN), whose goal is to share observational bird data with as wide an audience as possible, while assuring data quality, validity, and metadata documentation, and simultaneously respecting the rights of data contributors and resource managers. All users of any AKN dataset are instructed to acknowledge the contribution of the data contributors. Each data set contributed to the AKN has an associated level of access to that data that can allow or restrict access (Ballard et al. 2008). The landbird data for the Marin Water project, post data-validation by a Point Blue data manager or project leader, is made available at a moderate level (Level 3, from 1-5). Level 3 availability allows the data to broadly be included with regional or national summaries of bird data (e.g., available for meta-analyses and range-wide maps and graphs). At the same time, it requires researchers or members of the public to request permission to access the detailed dataset itself, which will allow its uses to be tracked; Point Blue staff will receive any data requests and share those requests with Marin Water staff. This access level was determined based on the interests of Marin Water and can be increased or decreased at any time.

Personnel

Point Blue staff biologists trained in the songs and calls of the birds of the Marin Water study area conducted all surveys in 2022. They were Renée Cormier, Mark Dettling, Preston Duncan, Megan Elrod, and Diana Humple.

Statistical Analysis

Data cleaning and analysis were conducted in R version 4.1.3 (R Core Team 2022), primarily using the core “tidyverse” packages for data cleaning and “lme4” for modeling (Wickham et al. 2019, Bates et al. 2015). We included data from surveys conducted in 1996, 1997, 1998, 2001, 2004, 2007, 2010, 2013, 2016, 2019, and 2022; data from 1999 were excluded because sites surveyed were not consistent with other years. We analyzed individual species, excluding all waterbirds (e.g., ducks, herons, coots, grebes), shorebirds, owls, non-breeding migratory species, and other species not well sampled with the point count method such as non-territorial species, flocking species, and species with very large territories (e.g., swallows, ravens, crows, raptors; see Appendix B for common and scientific names of all species included in the

analysis). We also excluded species with only a few detections (e.g., Blue Grosbeak, Brewer's Blackbird, California Thrasher, Lark Sparrow). We excluded Allen's Hummingbirds because it is not possible to visually distinguish most individual Allen's Hummingbirds from their close relative the Rufous Hummingbird (a migrant bird that does not breed in Marin County but is present during the survey period). We only analyzed data from 2004 to 2022 for Swainson's and Hermit thrushes because we suspect that one observer who conducted surveys during the earlier years of the study was not always distinguishing these species accurately.

We used data from two visits for each year. In 1997, three surveys were conducted, so we eliminated all data from one of the three visits for each transect; we excluded whichever visit (the first or third) was an outlier when compared to dates the same transect was surveyed in all other years. We dropped all individuals coded as juveniles from the analysis, and those that were coded as flyovers.

For every survey point, we used the maximum number of detections within 50 m of the survey point, for each species per year, across both visits included in the analysis; because the probability of detection of any species is not 100% during any given survey, we assumed that if a higher count occurred during one of the two visits in a year, then that represented a more accurate count of the true number of individuals in the area. This gave us one per-point-per-year abundance value for each species. There were a few points that were only surveyed once in a given year (22 instances across all points and years), so the number of detections on that single visit was used as the maximum count.

We evaluated the trend in abundance over time for each species by fitting a generalized linear mixed model with a Poisson error distribution to the per-point bird counts, with point ID (identification by transect and point number within the transect) as a random intercept (Bolker et al. 2009, Zuur et al. 2009). For each model, we confirmed model convergence, selecting alternate optimizers or increasing the number of iterations as needed. This analysis approach is different from our approach in previous years (e.g., Cormier et al. 2020) in that (1) we used the maximum count across the two visits at each point rather than the average count and (2) we modeled the average trend in the counts at each point (approximately 337 data points per year) rather than modeling the trend in the average count across all points (1 data point per year). This new modeling approach allowed us to include (and account for) survey data from points that were not surveyed every year, as well as model the trends for less common species that were absent from all points in one or more years, and ultimately resulted in a more sensitive model (i.e., more likely to detect changes). For each species, model results included the average annual growth rate, defined as the average percent change in abundance per year (positive or negative), across all points and years surveyed.

To interpret our model results and determine which species to consider as increasing, decreasing, or having no evidence of a trend, we adapted an established peer-reviewed approach to evaluating population trends used by Partners in Flight (PIF; Panjabi et al. 2020, Beissinger et al. 2000, Carter et al. 2000). The PIF species assessments incorporate several criteria to evaluate the regional and continental conservation status of bird populations and inform bird conservation strategy, including data on population trends as well as relative abundance, distribution, and known threats. Here, we adapted their protocol for evaluating population trends, which incorporates the direction and estimated total magnitude of population change over 50 years, as well as the precision and reliability of the trend results to rank species on scale of 1 to 5 (Panjabi et al. 2020). The advantage of adopting this PIF approach and its trend classification system is that it allows us both to apply a vetted interpretation of these model results, and to use the same language when comparing our trends to those at larger geographic scales. To apply this protocol to the results of our analyses, we used the models to predict the total % population change that would occur if the estimated trends continued over 50 years, combined with the p-values indicating whether the average annual growth rate was statistically different from zero, to assign each species to one of the population trend scores (Table 1). In this framework, p-values < 0.1 were considered statistically significant trends and p-values < 0.33 were considered to indicate possible trends. Importantly, this approach allows distinguishing stable population trends (score = 2) from those with uncertain population change (score = 3), based on whether the trend estimate is considered Reliable, meaning there were sufficient data to detect a trend.

Adapting the PIF criteria to our model results, we considered a trend estimate Reliable if the average count of the species per point was > 0.1 (indicating sufficient detections) and the precision of the average annual growth rate (half-width of the 95% confidence interval) was < 3% (indicating we should have been able to detect a trend of greater than +/- 3% growth). For interpretation purposes, we translated each population trend score to an assessment category for Marin Water that ranked species from Least Concern (score = 1 or 2) to Significant Concern (score = 5; Table 1). We note that these species assessment categories were based solely on population trend scores for the purposes of interpreting long-term population trends on Marin Water lands. However, they do not necessarily reflect the overall conservation status of each of these species in the region, because a very small population that is increasing or stable can still be a higher conservation concern than a very large population that is declining; a more complete conservation status assessments would also incorporate data on population size, distribution, known threats, and other factors (Panjabi et al. 2020).

Table 1. Population trend score descriptions and criteria used to assess species trends in the Marin Municipal Water District from 1996-2022, adapted from the Partners in Flight Avian Conservation Assessment Database Handbook (Panjabi et al. 2020). Total population change thresholds are based on the total magnitude of change if the average annual growth rates continued for 50 years; we also present the equivalent Annual Population Change (growth rate) that would be needed to reach the 50-year Total Population Change thresholds. Trend estimates were considered Reliable if the average count of the species per point was > 0.1 and the precision of the average annual growth rate was < 3%. The Assessment for Marin Water field puts the Trend Scores into context.

Trend Score	Description	P-value	Total Population Change (%)	Annual Population Change (%)	Reliable Trend[1]	Assessment for Marin Water
1	Statistically significant large increase	≤ 0.1	≥ 50	≥ 0.814	NA	Least Concern
2	Statistically significant small increase, or	≤ 0.1	0 to 50	0 to 0.814	NA	Least Concern
	Possible small or large increase, or	> 0.1 & ≤ 0.33	> 0	> 0	NA	
	Stable	> 0.33	> -15	> -0.325	Yes	
3	Statistically significant small decrease, or	≤ 0.1	-15 to 0	-0.325 to 0	NA	Uncertain / Caution
	Possible small decrease, or	> 0.1 & ≤ 0.33	-15 to 0	-0.325 to 0	NA	
	Uncertain population change (currently stable, leaning negative), or	> 0.33	< -15	< -0.325	Yes	
	Uncertain population change (insufficient data)	> 0.33	any value	any value	No	
4	Statistically significant moderate decrease, or	≤ 0.1	-50 to -15	-1.377 to -0.325	NA	Caution
	Possible moderate or large decrease	> 0.1 & ≤ 0.33	< -15	< -0.325	NA	
5	Statistically significant large decrease	≤ 0.1	≤ -50	≤ -1.377	NA	Significant Concern

[1]Only necessary to assess when P-value was > 0.33.

Finally, we assigned each species to a primary (dominant) habitat affiliation on Marin Water lands. Habitat types included 1) conifer forest that may include a mixed hardwood component; 2) forest (mixed) for species that use more than one type of forest; 3) oak woodland; 4) riparian and/or wetland, and 5) scrub/chaparral. If a species was known to use three or more habitat types on Marin Water lands, and one type was not predominantly used, we assigned that species to a sixth "generalist" category. See Appendix B for the habitat designations for each of the 56 species used in the analysis. To assess if there were any general population patterns by habitat type, we calculated the percent of species in each of the five population trend categories by habitat.

For the habitat trends, and for the trends summarized for all species grouped by population trend score, we present results for the 55 native species included in the analysis and exclude European Starling (an introduced species from Europe) from the community level assessments. We provide the results for the starling separately.

RESULTS

From the 55 native species analyzed, just over half (51%) were classified as increasing or stable and considered to be in the Least Concern categories (scores = 1 or 2; Figure 2; Appendix C). Thirty-one percent of species were classified as showing large declines (Significant Concern; score = 5), while another 7% of species were classified as having moderate or possibly large declines (Caution; score = 4). The remaining 11% of species either had relatively small declines, or there was not enough certainty in the model to determine if there was a trend (Uncertain/Caution; score = 3).

Of the 15 new species that were added to the analysis this year (all of which occur in relatively low numbers on Marin Water lands and were entirely absent in at least one survey year), four were increasing or stable (Least Concern; score = 1 or 2; Lesser Goldfinch, Pygmy Nuthatch, White-breasted Nuthatch, and Western Bluebird), seven were exhibiting large decreasing trends (Significant Concern; score = 5; American Goldfinch, Brown-headed Cowbird, Chipping Sparrow, European Starling, Lazuli Bunting, Red-winged Blackbird, and Western Wood-Pewee) and one was showing a possible moderate or large decrease (Caution; score = 4; Black-headed Grosbeak). The remaining three of the 15 newly-added species were classified as Uncertain/Caution (score = 3; Black Phoebe, Cassin's Vireo, and Nuttall's Woodpecker).

When comparing trends by habitat associations, the percent of species with large increases (score = 1; Least Concern) was higher for species associated with forested habitat types, including species that used conifer/mixed hardwood (50%), multiple forest types (42%), and oak woodland (56%), than species associated with riparian/wetland habitat (13%; relatively uncommon habitat types on Marin Water lands), and scrub/chaparral species (25%; Figure 3). The category with the most concerning pattern was the Generalist category, where all but Anna's Hummingbird (score = 1; Least Concern) exhibited large declines (score = 5; Significant Concern). The introduced European Starling, a non-native species in North America not included in Figures 2 and 3, had a large decreasing trend (Appendix C), and was designated as using multiple forest types ("Forest [mixed]") for its habitat affiliation.

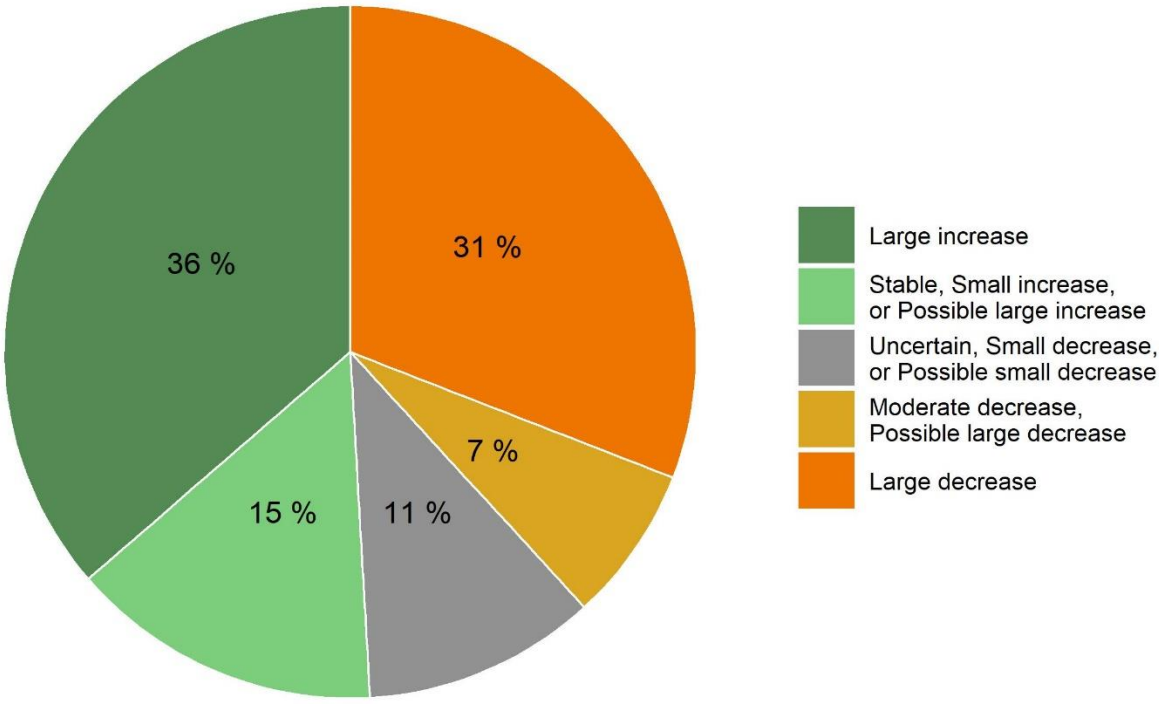


Figure 2. Percent of native breeding landbird species (n=55) on Marin Municipal Water District lands that were classified in the following population trend categories: 1) large increase, 2) small increase / possible increase / stable, 3) uncertain population change / possible small decrease / small decrease, 4) moderate-possible large decrease, and 5) large decrease. Trend categories are as defined in the Partners in Flight Avian Conservation Assessment Database Handbook (Panjabi et al. 2020). Data are from point count surveys conducted by Point Blue conservation Science, 1996-2022.

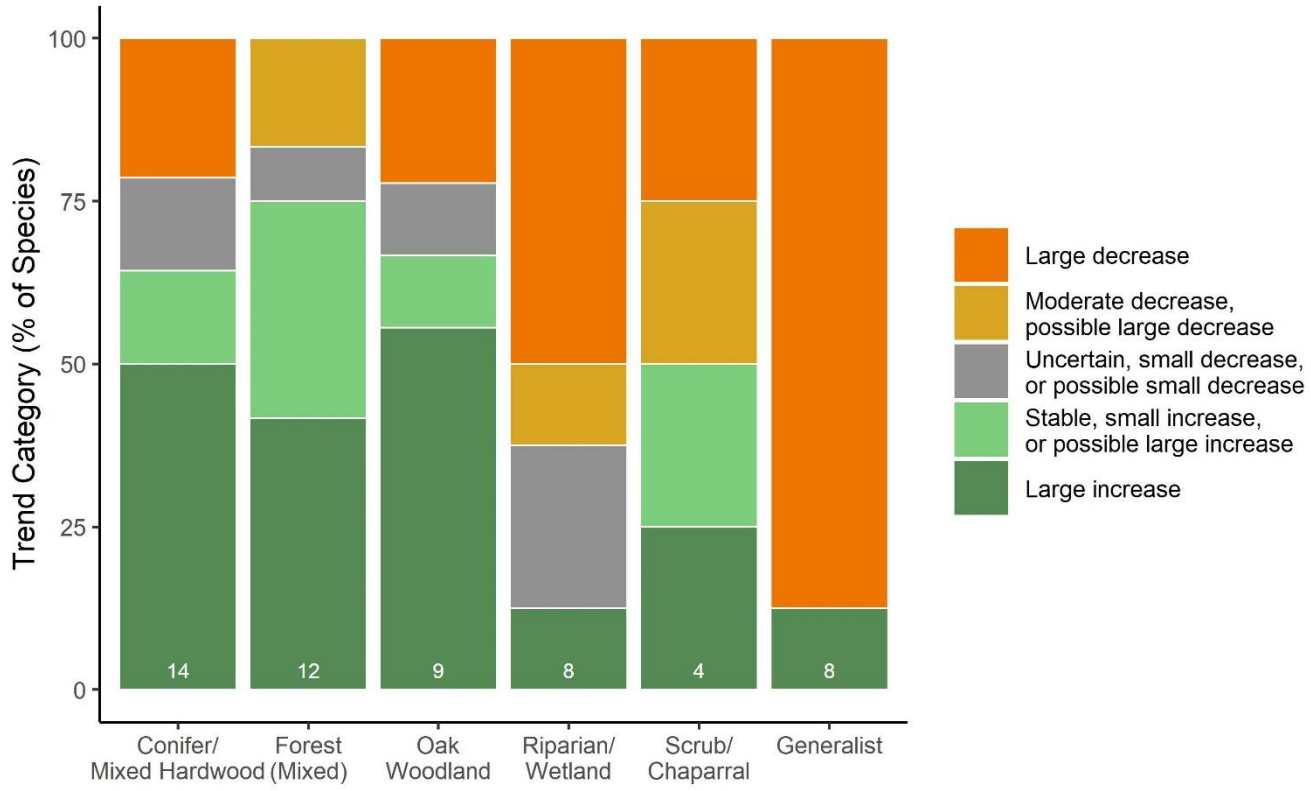


Figure 3. Percent of native breeding landbird species (n=55) by primary habitat affiliation on Marin Municipal Water District lands that were classified in the following population trend categories: 1) large increase, 2) small increase / possible increase / stable, 3) uncertain population change / possible small decrease / small decrease, 4) moderate-possible large decrease, and 5) large decrease. Trend categories are as defined in the Partners in Flight Avian Conservation Assessment Database Handbook (Panjabi et al. 2020). Data are from point count surveys conducted by Point Blue conservation Science, 1996-2022. Sample size (number of species) included in each habitat category is at the base of each bar.

DISCUSSION

Based on monitoring results from 1996 to 2022 for the 56 species included in the analysis, we found that approximately half of the species either were stable or exhibited increasing trends in abundance (Least Concern). Thirty-one percent of native species exhibited large declines (Significant Concern), and another 7% had moderate or possibly large declines (Caution). While there are more significant trends (both positive and negative) in 2022 than in previous analyses of this dataset (e.g., Cormier et al. 2020), this analysis included one additional year of data, and the new modeling approach allowed us to assess trends for 15 additional species, and increased our ability to detect trends for all species. During our last analysis with 41 species, 12% were considered to be decreasing or marginally decreasing (Cormier et al. 2020), which is roughly comparable to our Significant Concern or Caution scores, and all of those species are still decreasing in the current analysis; all species that were increasing or marginally increasing in the previous report (22% of 41 species) are all exhibiting large increases in the current analysis.

And although 66% of the 41 species were considered stable in Cormier et al. (2020) based on the lack of a statistically significant trend, we are now able to distinguish 17% with a score of 2 (stable or possible increase) and 7% with a score of 3 (uncertain or possible decrease); the remaining species that were considered stable in the last analysis are now roughly evenly split between exhibiting large increases (20%) and large (15%) or moderate to possible large (7%) decreases. For the 15 new species included in the analysis, there was a higher proportion decreasing species, with eight (53%) exhibiting moderate to large decreases (score of 4 or 5), four (27%) increasing or stable (score of 1 or 2), and three (20%) whose trends were uncertain (score of 3).

The population trends we identified, positive and negative, reflect the combined influence of a range of local, regional, and even continental factors, and the relative importance of each factor will vary depending on a species' life history, including their diet, habitat requirements, and migratory status. Thus, by comparing species with similar characteristics, or comparing these trend estimates to trends identified from other analyses, we can gain insights into some of the factors that may be contributing to these results. For example, if trends on Marin Water lands are similar to results from Breeding Bird Survey (BBS) data collected on a larger geographic scale than our study, the local trends may indicate that similar changes in habitat and/or environmental conditions are occurring on Marin Water lands as elsewhere throughout the region, while if trends are different between datasets, it might indicate that local conditions are playing a different or larger role. While we do not discuss trend results for all 56 species individually, the following sections include comparisons of Marin Water trends to other studies and some potential causes for the trends we have observed (the list is not exhaustive), with examples for select species.

Increasing Species. It is encouraging that at least half of the species were increasing or stable, and there are some notable species in this list. The Olive-sided Flycatcher is a California Bird Species of Special Concern (Shuford and Gardali 2008); this species is increasing in Marin Water lands (score = 1) but exhibited a large decreasing trend in the long-term (1970-2015) BBS data from the Bird Conservation Region (BCR32) that includes Marin Water lands (Partners in Flight 2021). The Olive-sided Flycatcher is also declining in riparian habitat in coastal Marin County (Dettling et al. 2021). Similarly, the Oak Titmouse and Swainson's Thrush both had large increases on Marin Water lands, but large decreasing trends in the BBS dataset (Partners in Flight 2021). Dettling et al. (2021) also found Swainson's Thrushes to be increasing at coastal Marin County riparian sites but did not evaluate Oak Titmouse. The growth in local abundance, especially for species that are declining elsewhere, suggests local habitat and environmental conditions for these species remain suitable or have improved since 1996.

Decreasing Species. Most of the species for which we estimated large decreasing trends are species that occur in the study area at relatively low numbers – and have occurred at a low abundance since the beginning of the study period – including seven of the 15 newly-added species to the analysis. Thus, these are likely species with habitat requirements that were not widely available on Marin Water lands in 1996, and have become even less common. For example, a small number of Lazuli Buntings used to be detected each year, but we have not detected any in the two most recent survey years; this species has also been documented as having long-term declines from the BBS dataset noted above (Partners in Flight 2021), suggesting the local declines may be part of a broader regional pattern of declining habitat quality or quantity for this species. Chipping and Rufous-crowned sparrows are two species that are typically only found in very localized areas within Marin Water lands and were also found to be declining. In the BBS dataset, Chipping Sparrows also exhibited large decreases, while Rufous-crowned Sparrows were increasing throughout BCR32 (Partners in Flight 2021), suggesting the local declines of this species may be more reflective of local habitat and environmental change. However, we also note that sparrows contributed significantly to the total cumulative loss of birds in North America in a recent analysis that estimated a net loss of nearly 3 billion birds (Rosenberg et al. 2019).

There were also relatively abundant species on Marin Water lands that have exhibited large declines since 1996. Both the California Scrub-Jay and Steller's Jay exhibited decreasing trends in the current analysis, in agreement with previous Marin Water analyses (Cormier et al. 2020, Cormier and Humple 2017, Cormier et al. 2014). Both species were either stable or had small increasing trends (PIF score=2) in the BBS dataset starting in 1970 (Partners in Flight 2021), but when looking at more recent abundance trends from eBird from 2007-2021, results for the jays in California were mixed depending on region (Fink et al. 2021), suggesting multiple factors are contributing to the variation in these trends. This may include impacts from Sudden Oak Death (see next section), or other factors (e.g., disease outbreaks such as West Nile Virus for which jays and other corvids are particularly susceptible; Wheeler et al. 2009). Additionally, California Scrub-Jays were found to be stable in riparian habitat of coastal Marin County (Dettling et al. 2021). Mourning Dove is another common species exhibiting decreasing trends on Marin Water lands that were also decreasing in the BBS dataset and range-wide in the eBird dataset (Fink et al. 2021, Partners in Flight 2021).

Sudden Oak Death. Sudden Oak Death (SOD; *Phytophthora ramorum*) has caused the mortality of many oak (*Quercus* sp.) and tanoak (*Notholithocarpus densiflorus*) trees in Marin County during the study period (McPherson et al. 2005), which has resulted in changes in the relative abundance of these tree species, and, in some cases, dramatic changes to the structure of the forests on Marin Water lands. The acorns provided by these species are an important food

source for jays, particularly during winter (Greene et al. 1998, Curry et al. 2002). While SOD is impacting forests throughout California, some areas are more impacted than others (UC Berkeley Forest Pathology and Mycology Lab 2020) and declines mentioned above in California Scrub-Jays and Steller's Jays – both year-round residents in Marin – may be impacted by this disease. This may also explain why their populations were stable in the nearby coastal riparian areas of Marin County (Dettling et al. 2021) where SOD is less prevalent. However, acorns are also an important food source for other species that haven't shown the same pattern; for example, Acorn Woodpeckers have increased over the course of the study. Thus, if SOD is causing the decline in jays, it has not affected all bird species associated with acorns in the same way. On the other hand, changes in vegetation structure as a result of SOD may also explain some of the increasing trends for some species. For example, Olive-sided Flycatchers have been found to be positively associated with disturbance and fire (Bock and Lynch 1970, Fontaine et al. 2009) and forest openings in general (Altman and Sallabanks 2012), and therefore the many forest openings caused by SOD on Marin Water lands may have had a positive effect on Olive-sided Flycatcher or other species. This could also explain the differing pattern between Olive-sided Flycatchers in forests on Marin Water lands compared to the declines observed at Marin County coastal riparian sites (Dettling et al. 2021), as noted above.

Climate and Weather. Local climate and weather patterns may also be impacting the abundance of species on Marin Water lands. Rainfall has varied over the course of the study period and could be having either direct or indirect effects on population trends (e.g., via food availability, Dybala et al. 2013). In the early years of this study (late 1990s), winter rainfall amounts were generally at or above average levels in Marin County, while in the past 15 years, there have been more years with below-average rainfall (Marin Water 2022). Thus, increasing frequency of local drought may contribute to local population declines of many species.

***Food*.** Widespread declines in aerial insectivores have also been documented (Nebel et al. 2010), and Ash-throated Flycatchers and Western Wood-Pewees are aerial insectivores that breed locally and are both exhibiting large declines in this study. There are other aerial insectivores that breed on Marin Water lands that are not declining (e.g., Olive-sided Flycatcher, Pacific-slope Flycatcher), so if a decline in food availability is the cause, it is possible that they are not foraging on the same species of insects as the other flycatchers that breed in Marin. Furthermore, it is possible that the reduced rainfall in the latter years of the study (see above) influenced the timing of flowering and fruiting of plants, which can happen earlier in dry years (Oliff-Yang et al. 2020), impacting either the timing or availability of food resources for some species.

Annual Cycle. For migratory species such as the insectivores noted above, their populations are impacted by events and conditions happening throughout their annual cycle, and not only when they are in Marin County (Small-Lorenz et al. 2013). Additionally, the different migratory species that breed in Marin do not necessarily use the same stopover or wintering sites (e.g., Humple et al. 2020, Saracco et al. 2022). Differences among migratory species trends that we observed locally may by driven by factors occurring during other parts of their annual cycle. Among all species in the analysis, migratory and resident species had very similar proportions of species with moderate or large decreasing trends (scores 4 or 5).

Habitat. Marin Water lands are dominated by a mix of forested habitats, and species associated with forested habitat comprised more than half of the species represented in the dataset. While the trends for these species were predominantly positive, with most species in the Least Concern categories (score = 1 or 2), there were a few declining species. Several of the forest-associated species were declining on Marin Water lands and increasing in the BBS dataset, including the jays (see above), Ash-throated Flycatcher, and Pileated Woodpecker. It is possible the declines may be attributed to factors such as those noted above for the jays (SOD) and flycatcher (food, annual cycle), or that Marin Water forest habitat is not meeting the specific needs of these forest-associated species, even while it appears to successfully support the populations of many other forest-associated species. The Pileated Woodpecker is a species associated with older coniferous forests and have relatively large territories compared to many other species in our analysis; targeted research would be needed to understand what may be limiting this and other species, and whether declines are related to habitat or other factors.

Habitat conversion from grassland to shrub, and shrub to forest, has occurred along the central coast of California, including in Marin County, with causes including fire suppression and changes in grazing patterns, combined with climatic variables (Startin 2022, Hsu et al. 2012). In mapping the history of wildfires of Marin County, Dawson (2021) found that wildfire extent (number of acres) had decreased over time – particularly over the last century – and that the time in between fires that burned the same areas (fire return interval) had increased. Dawson (2021) documented the highest frequency of fire in the Mount Tamalpais area from 1852-2020, thus, an increase in fire suppression likely impacted these lands more than any other area in Marin County. In their study, Hsu et al. (2012) found that forested habitats expanded more broadly than any other habitat, and this may help to explain the general pattern of increasing forest species on Marin Water lands. Through their Biodiversity, Fire and Fuels Integrated Plan (BFFIP), Marin Water has been actively managing vegetation on their lands with the primary goal of protecting water quality, and also to reduce the risks of catastrophic wildfire (Panorama Environmental, Inc. 2019). Current activities through the BFFIP include fuelbreak construction and maintenance, forest fuel reduction, and Douglas fir thinning (in addition to projects

involving invasive plant removal); much of this work is aimed at restoring vegetative conditions that would have occurred during an historic low intensity/high frequency fire regime. The vegetation management that has occurred in the past three years has mostly been concentrated in the southern edge of Marin Water lands along Ridgecrest Boulevard (RICR) and the LADE point count transect, and in the northeast around the BURO, COPT, HICO, and LAVR transects (Figure 1). While we do not yet have the capacity to assess trends in grassland bird species, the maintenance of grassland habitat around Ridgecrest should allow the potential for continued (and possibly enhanced) grassland birds in that area.

For species associated with scrub/chaparral, another relatively common habitat type on Marin Water lands, trend results were mixed but this habitat type was only represented by four species. There is understory/shrub removal occurring in some of the vegetation management plots by Marin Water; the one species with scrub/chaparral as their primary habitat with a large decreasing trend (Rufous-crowned Sparrow) is not found in the areas with active vegetation management, thus is unlikely to have been impacted. The Bewick's Wren, which was also decreasing to a lesser extent (score = 4; Caution), is found in shrubby areas throughout Marin Water lands, and may have responded to the changes in local vegetation management; alternatively, the lack of disturbance to most shrub habitat and the resulting habitat succession of both shrub and forested habitats may also be playing a role in the trends we observed for these and other species. The Bewick's Wren was also decreasing in both the BBS and eBird datasets (Partners in Flight 2021, Fink et al. 2021), so their local declines may be caused by larger scale factors, although they were found to be stable in riparian areas of coastal Marin County (Dettling et al. 2021). Like other declines noted above, these may also be attributed to other factors, such as drought or food availability, and while there were only four species with scrub/chaparral as their primary habitat in our analysis, many other species in the study area use shrubs or shrub habitats to some extent, and may be responding to vegetation changes.

Species associated with riparian/wetland habitat and generalist species (i.e., using at least three different habitat types) were more likely to be classified as Significant Concern or Caution. This result for generalist species was surprising, since we often associate generalist species with the ability to adapt and obtain resources from multiple habitats. However, Rosenberg et al. (2019) also found declines in habitat generalists and introduced species (we also found a decline in the one introduced species examined, the European Starling, which we ascribed as a mixed forest user but not an overall generalist). These local and continent-wide declines of generalists, and species considered common, show that the challenges faced by bird populations are not limited to rare and specialized species.

None of the species associated with riparian/wetland habitat have been very abundant in the study area over the course of the study – the habitat itself is not prevalent on these lands – but half of those species still exhibited declining trends. While riparian and wetland habitats generally have a relatively small footprint in any landscape, and that is particularly true on Marin Water lands (where these habitats have also been relatively stable during the study period, with little encroachment or other disturbances), they are biodiversity hotspots that play a disproportionately large role in supporting bird species and other wildlife in California (Knopf and Samson 1994), as well as contribute to water quality and other ecosystem services. With only a fraction remaining from historic levels (RHJV 2004), much attention has been given to birds associated with these habitats (e.g., Gardali et al. 2006, Dettling et al. 2021), and common reasons for declines in riparian habitat quality include changes in streamflow and vegetation structure and diversity, such as through conifer encroachment or the spread of invasive species. Western Wood-Pewee (riparian) and Red-winged Blackbird (wetland) are exhibiting large decreasing trends both in our study and in the longer-term BBS dataset, while Downy Woodpecker (riparian) showed marginal increases in the BBS dataset (Partners in Flight 2021). However, it should be noted that these species, while primarily considered riparian associates locally, do occur in other habitats on Marin Water lands. The decline of Downy Woodpecker on Marin Water lands – particularly while the Hairy Woodpecker, more strongly associated with conifer and mixed conifer habitats (Shuford 1993) is increasing – suggests that habitat succession has created conditions more favorable to the Hairy Woodpecker on Marin Water lands, and/or there may be some competition between the two species (e.g., Leighton et al. 2018).

Conclusions and Recommendations: The populations of many of the landbird species found on Marin Water lands during the breeding season have remained stable or are increasing since 1996, confirming that Marin Water lands continue to provide valuable habitat for many birds. However, the populations of over a third of the species we analyzed have declined over the course of the 26-year study. While there are many possible factors contributing to these population increases and decreases, vegetation management goals and decisions made by Marin Water will directly impact local habitat quality and quantity for bird species. Since 1996, habitat conditions have increasingly favored bird species associated with forested habitat, supporting large increases in many of their population sizes, and in alignment with the documented expansion of forested habitat (Hsu et al. 2012). However, implementation of the Biodiversity, Fire and Fuels Integrated Plan (BFFIP) may begin to alter this long-term trajectory, and while some forest-associated species may begin to decline or stabilize as a result of BFFIP implementation, others may respond positively. We expect that by creating a more diverse mosaic of habitat types and forest structure, Marin Water lands will ultimately be able to support a more diverse bird community.

We recommend continued long-term monitoring of landbirds on Marin Water lands (by species, and by habitat guild) to continue to inform vegetation management efforts. We also recommend the continuation of nesting bird surveys prior to vegetation management activities to avoid direct negative impacts to nests when management activities cannot be confined to the non-nesting season (Allen and Cormier 2021). Analyzing the response of birds to specific vegetation management practices occurring near each point was beyond the scope of this report, but could be incorporated into future monitoring efforts and analyses (e.g., to compare bird abundances treated versus untreated areas, and before versus after implementation of the BFFIP). And, while this monitoring program is focused on birds during the breeding season, a seasonally-shifting community of birds relies on Marin Water lands year-round, and an assessment of fall or wintering species could increase our understanding of the impacts of vegetation management on bird populations during other seasons.

In addition to the impacts of local vegetation management goals and decisions, local bird populations are also affected by changes in habitat and environmental conditions beyond the boundaries of Marin Water lands. In particular, climate change is predicted to, either independently or together with other threats, exacerbate widespread declines in landbird populations (Tingley et al. 2009, Jongsomjit et al. 2013, Seavy et al. 2018). Given this expectation, effective land stewardship will be even more important for protecting, enhancing, and managing high quality habitat, and the ability to detect changes in natural resources will continue to be essential to adaptive management. The long-term landbird dataset from Marin Water monitoring has played an important role in our understanding of local landbird populations, including in the One Tam region (Gardali et al. 2016; Humple et al. *in press*), where it is central to the understanding of how birds in the region are doing and is combined with data from other regional jurisdictions. This dataset has also been used for the Marin County Compass project (2021), a new performance management program in the County of Marin where the landbird data was one of the metrics of ecological health for the County. The extensive amount of diverse and protected habitat types on Marin Water lands contribute to the health of regional landbird populations beyond their boundaries, and for migratory species, can contribute to populations spanning the Pacific Flyway. Further research may be warranted for some of the habitats and species showing declines thus far. Continued monitoring of the avifauna of Marin Water will keep track of the status of individual species and the overall bird community, providing information needed for land managers to understand how this natural resource is doing and determine if additional monitoring, new research, or management action is warranted.

ACKNOWLEDGEMENTS

We are grateful to Marin Water for their partnership and their support of these monitoring efforts. We would especially like to acknowledge Carl Sanders, Shaun Horne, and Sabrina Gonzales for their support and for logistical and administrative assistance. We are also grateful to numerous previous Marin Water and Point Blue staff for their roles in the project since its inception. We thank the past and present Point Blue biologists for their efforts and careful attention to detail during the bird surveys across all years of this study.

LITERATURE CITED

Allen, H. A., and R. L. Cormier. 2021. Nesting Landbird Surveys in the Marin Municipal Water District, 2021 Report. Point Blue Conservation Science, Petaluma, CA.

Altman, B., and R. Sallabanks. 2012. Olive-sided Flycatcher (*Contopus cooperi*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/502 doi:10.2173/bna.502

Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, and D. Stralberg. 2008. The California Avian Data Center. [web application]. Petaluma, California. www.prbo.org/cadc. (Accessed: Date [e.g., February 2, 2009]).

Bates D., M. Mächler, B. Bolker, and S. Walker. 2015. Fitting Linear Mixed-Effects Models Using lme4. Journal of Statistical Software 67: 1-48. Version 1.1-30. doi:10.18637/jss.v067.i01.

Beissinger, S. R., J. M. Reed, J. M. Wunderle Jr., S. K. Robinson, and D. M. Finch. 2000. Report of the AOU conservation committee on the partners in flight species prioritization plan. Auk 117: 549-561.

Bock, C. E., and J. F. Lynch. 1970. Breeding bird populations of burned and unburned conifer forest in the Sierra Nevada. Condor 72: 182-189.

Bolker, B. M., M. E. Brooks, C. J. Clark, S. W. Geange, J. R. Poulsen, M. H. H. Stevens, and J. S. White. 2009. Generalized linear mixed models: a practical guide for ecology and evolution. Trends in Ecology and Evolution 24: 127-135.

Calvert, A. M., C. A. Bishop, R. D. Elliott, E. A. Krebs, T. M. Kydd, C. S. Machtans, and G. J. Robertson. 2013. A synthesis of human-related avian mortality in Canada. Avian Conservation and Ecology 8: 11. http://dx.doi.org/10.5751/ACE-00581-080211.

Carignan, V., and M. A. Villard. 2002. Selecting indicator species to monitor ecological integrity: A review. Environmental Monitoring and Assessment 78: 45-61.

Carter, M. F., W. C. Hunter, D. N. Pashley, and K. V. Rosenberg. 2000. Setting conservation priorities for landbirds in the United States: the Partners In Flight approach. Auk 117: 541-548.

Cormier, R. L., H. A. Allen, D. L. Humple. 2020. Abundance patterns of landbirds in the Marin Municipal Water District: 1996 to 2019. Point Blue Conservation Science (Contribution No. 2309), Petaluma, CA.

Cormier, R. L., and D. L. Humple. 2017. Abundance patterns of landbirds in the Marin Municipal Water District from 1996 to 2016: a progress report. Point Blue Conservation Science, Petaluma CA.

Cormier, R. L., N. E. Seavy, and D. L. Humple. 2014. Abundance patterns of landbirds in the Marin Municipal Water District from 1996 to 2013. Point Blue Conservation Science, Petaluma CA.

Curry, R. L., A. T. Peterson, and T. A. Langen. 2002. Western Scrub-Jay (*Aphelocoma californica*). *In* The Birds of North America, No. 712 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Dawson, A. 2021. Marin County wildfire history mapping project, review draft. Glen Ellen, CA.

Dettling, M. D., K. E. Dybala, and D. L. Humple. 2021. Protected areas safeguard landbird populations in central coastal California: Evidence from long-term population trends. Ornithological Applications 123, https://doi.org/10.1093/ornithapp/duab035.

DiGaudio, R., and D. Humple. 2019. Landbird monitoring in One Tam 2018 and 2019: Final Report to the Golden Gate National Parks Conservancy. Point Blue Report.

Dybala, K. E., J. M. Eadie, T. Gardali, N. E. Seavy, and M. P. Herzog. 2013. Projecting demographic responses to climate change: adult and juvenile survival respond differently to direct and indirect effects of weather in a passerine population. Global Change Biology 19:2688-2697, doi: 10.1111/gcb.12228.

Fink, D., T. Auer, A. Johnston, M. Strimas-Mackey, O. Robinson, S. Ligocki, W. Hochachka, L. Jaromczyk, C. Wood, I. Davies, M. Iliff, and L. Seitz. 2021. eBird Status and Trends, Data Version: 2020; Released: 2021. Cornell Lab of Ornithology, Ithaca, New York. https://doi.org/10.2173/ebirdst.2020.

Fontaine, J. B., D. C. Donato, W. D. Robinson, B. E. Law, and J. B. Kauffmann. 2009. Bird communities following high-severity fire: Response to single and repeat fires in a mixed evergreen forest, Oregon, USA. Forest Ecology and Management 257: 1496-1504.

Gardali, T., A. L. Holmes, S. L. Small, N. Nur, G. R. Geupel, and G. H. Golet. 2006. Abundance patterns of landbirds in restored and remnant riparian forests on the Sacramento River, California, USA. Restoration Ecology 14: 391-403.

Gardali, T., L. Edson, R. Cormier, and A. Fish. 2016. Birds, pp 194-203 *In* Edson, E., S. Farrell, A. Fish, T. Gardali, J. Klein, W. Kuhn, W. Merkle, M. O'Herron, and A. Williams, eds. Measuring the Health of a Mountain: A Report on Mount Tamalpais' Natural Resources.

Greene, E., W. Davison, and V. R. Muehter. 1998. Steller's Jay (*Cyanocitta stelleri*). *In* The Birds of North America, No. 343 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Holmes, A. L., G. R. Geupel, and G. Ballard. 1998. Distribution, abundance, and diversity of songbirds on watershed lands managed by the Marin Municipal Water District. PRBO unpublished report.

Humple, D. L., R. L. Cormier, T. W. Richardson, R. D. Burnett, N. E. Seavy, K. E. Dybala, and T. Gardali. 2022. Migration tracking reveals geographic variation in the vulnerability of a Nearctic-Neotropical migrant bird. Scientific Reports 10:5483, https://doi.org/10.1038/s41598-020-62132-6.

Humple, D., R. Cormier, M. Dettling, K. Dybala, R. DiGaudio, T. Gardali, L. Edson, and A. Fish. *In press*. Birds Chapter, *In* Peak Health: An Update on the Status of Mt. Tamalpais' Natural Resources. One Tam.

Hsu, W., A. Remar, E. Williams, A. McClure, S. Kannan, R. Steers, C. Schmidt, and J. W. Skiles. 2012. The changing California coast: relationships between climatic variables and coastal vegetation succession. ASPRS 2012 Annual Conference, Sacramento CA.

Inger, R., R. Gregory, J. P. Duffy, I. Stott, P. Vorisek, and K. J. Gaston. 2015. Common European birds are declining rapidly while less abundant species' numbers are rising. Ecology Letters 18: 28-36.

Jongsomjit, D., D. Stralberg, T. Gardali, L. Salas, and J. A. Wiens. 2013. Between a rock and a hard place: the impacts of climate change and housing development on breeding birds in California. Landscape Ecology 2: 187-200.

Knopf F. L., and F. B. Samson. 1994. Scale perspectives on avian diversity in western riparian ecosystems. Conservation Biology. 8(3):669–676. doi:10.1046/j.1523-1739.1994.08030669.x.

Leighton, G. M., A. C. Lees, and E. T. Miller. 2018. The hairy-downy game revisited: an empirical test of the interspecific social dominance mimicry hypothesis. Animal Behaviour 137: 141-148.

Marin County Compass. 2021. Bird Population Monitoring. https://data.marincounty.org/stories/s/Marin-Ecosystem-Health-Bird-Population-Monitoring/gqac-xnau

Marin Municipal Water District (Marin Water). 2022. Marin Municipal Water District Rainfall History, 1878-2022. Available at https://www.marinwater.org/waterwatch. Accessed on December 10, 2022.

McPherson, B. A., S. R. Mori, D. L. Wood, A. J. Storer, P. Svihra, N. M. Kelly, and R. B. Standiford. 2005. Sudden oak death in California: Disease progression in oaks and tanoaks. Forest Ecology and Management 213: 71-89.

Mineau, P., and M. Whiteside. 2013. Pesticide acute toxicity is a better correlate of U. S. grassland bird declines than agricultural intensification. PLoS One 8: e57457. doi: 10.1371/journal.pone.0057457.

Nebel. S., A. Mills, J. D. McCracken, and P. D. Taylor. 2010. Declines of aerial insectivores in North America follow a geographic gradient. Avian Conservation and Ecology - Écologie et conservation des oiseaux 5: 1. [online]: http://www.ace-eco.org/vol5/iss2/art1/. http://dx.doi.org/10.5751/ACE-00391-050201.

Oliff-Yang, R. L., T. Gardali, and D. D. Ackerly. 2020. Mismatch managed? Phenological phase extension as a strategy to manage phenological asynchrony in plant-animal mutualisms. Restoration Ecology 28: 498-505.

Panjabi , A. O., W. E. Easton, P. J. Blancher, A. E. Shaw, B. A. Andres, C. J. Beardmore, A. F. Camfield, D. W. Demarest, R. Dettmers, R. H. Keller, K. V. Rosenberg, T. Will, and M. A. Gahbauer. 2020. Avian Conservation Assessment Database Handbook, Version 2020. Partners in Flight Technical Series No. 8.1. http://pif.birdconservancy.org/acad.handbook.pdf.

Panorama Environmental, Inc. 2019. Marin Municipal Water District Biodiversity, Fire, and Fuels Integrated Plan. San Francisco, CA.
Partners in Flight. 2021. Avian Conservation Assessment Database, version 2021. Available at http://pif.birdconservancy.org/ACAC. Accessed on November 14, 2022.

Pearce-Higgins, J. W., S. M. Eglington, B. Martay, and D. E. Chamberlain. 2015. Drivers of climate change impacts on bird communities. Journal of Animal Ecology 84: 943-954.

R Core Team. 2022. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Version 4.1.3. URL https://www.R-project.org/.

Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, and D. F. DeSante. 1993. Field methods for monitoring landbirds. USDA Forest Service publication, PSW-GTR 144, Albany, CA.

Ralph, C. J., J. R. Sauer, and S. Droege. 1995. Monitoring bird populations by point counts. USDA Forest Service publication, PSW-GTR 149, Albany, CA.

RHJV (Riparian Habitat Joint Venture). 2004. The riparian bird conservation plan: A strategy for reversing the decline of riparian associated birds in California, version 2.0. California Partners in Flight. http://www.prbo.org/calpif/pdfs/riparian_v-2.pdf.

Rosenberg. K. V., A. M. Dokter, P. J. Blancher, J. R. Sauer, A. C. Smith, P. A. Smith, J. C. Stanton, A. Panjabi, L. Helft, M. Parr, and P. P. Marra. 2019. Decline of the North American avifauna. Science 366: 120-124.

Saracco, J. F., R. L. Cormier, D. L. Humple, S. Stock, R. Taylor, and R. B. Siegel. 2022. Demographic responses to climate-driven variation in habitat quality across the annual cycle of a migratory species. Ecology and Evolution 12: e8934, https://doi.org/10.1002/ece3.8934.

Seavy, N. E., D. L. Humple, R. L. Cormier, E. L. Porzig, and T. Gardali. 2018. Evidence of the effects of climate change on landbirds in western North America: A review and recommendations for future research. *In* Trends and Traditions: Avifaunal Change in Western North America (W. D. Shuford, R. E. Gill Jr., and C. M. Handel, Editors). Studies of Western Birds 3. Western Field Ornithologists, Camarillo, CA, USA. pp. 331–343.

Shuford, W. D. 1993. The Marin County Breeding Bird Atlas: A Distributional and Natural History of Coastal California Birds. California Avifauna Series 1. Bushtit Books, Bolinas, CA.

Shuford, W. D., and T. Gardali, editors. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Small-Lorenz, S. L., L. A. Culp, T. B. Ryder, T. C. Will, and P. P. Marra. 2013. A blind spot in climate change vulnerability assessments. Nature Climate Change 3: 91-93.

Startin, C. R. 2022. Assessing woody plant encroachment in Marin County, California, 1952-2018. Master's thesis, University of Southern California.

Strong, C. M., L. B. Spear, T. P. Ryan, and R. E. Dakin. 2004. Forster's Tern, Caspian Tern, and California Gull colonies in San Francisco Bay: habitat use, numbers and trends, 1982-2003. Waterbirds 27: 411-423.

Tingley, M. W., W. B. Monahan, S. R. Beissinger, and C. Moritz. 2009. Birds track their Grinnellian niche through a century of climate change. Proceedings of the National Academy of Sciences of the United States of America 106: 19637-19643.

UC Berkeley Forest Pathology and Mycology Lab. 2020. SODmap Project: www.sodmap.org.

Wheeler, S. S., C. M. Barker. Y. Fang, M. Veronica Armijos, B. D. Carroll, S. Husted, W. O. Johnson, and W. K. Reisen. 2009. Differential impact of West Nile virus on California birds. The Condor, 111: 1-20.

Wickham H., M. Averick, J. Bryan, W. Chang, L. D. McGowan, R. François, G. Grolemund, A. Hayes, L. Henry, J. Hester, M. Kuhn, T. L. Pedersen, E. Miller, S. M. Bache, K. Müller, J. Ooms, D. Robinson, D. P. Seidel, V. Spinu, K. Takahashi, D. Vaughan, C. Wilke, K. Woo, and H. Yutani. 2019. Welcome to the tidyverse. Journal of Open Source Software 4(43), 1686. Version 1.3.2. doi:10.21105/joss.01686.

Xu, Y., Y. Si, Y. Wang, Y. Zhang, H. H. T. Prins, L. Cao, and W. F. de Boer. 2019. Loss of functional connectivity in migration networks induces population decline in migratory birds. Ecological Applications 29: e01960. https://doi.org/10.1002/eap.1960.

Zuur, A. F., E. N. Ieno, N. J. Walker, A. A. Saveliev, and G. M. Smith. 2009. Mixed effects models and extensions in ecology with R. Springer. Berlin, Germany.

APPENDICES

Appendix A. Dates and number of points for all point count transects surveyed by Point Blue Conservation Science in the Marin Municipal Water District in 2022.

Transect Name	Code	Number of Points	Visit 1	Visit 2
Berry/Bon Tempe Trail	BETR	3	6-May	6-Jun
Blithdale Ridge Road	BLRI	15	25-May	14-Jun
Bolinas Ridge Trail	BORT	25	21-May	19-Jun
Bull Frog/Bon Tempe Road	BURO	8	9-May	1 & 2-Jun
Cataract Trail	CATR	17	23-May	16-Jun
Concrete Pipe Trail	COPT	5	2-May	2-Jun
Colier Springs Trail	COST	9	18-May	10 & 15-Jun
Eldridge Grade	ELGR	18	27-May	23-Jun
Helen Mark Trail	HEMA	19	14-May	9-Jun
Hidden Cove/Pine Point	HICO	6	9-May	1-Jun
Hoo-Koo-E-Koo Road	HOKE	17	27-May	23-Jun
Kent Pump Road	KPFR	30	12-May	10 & 17-Jun
Laurel Dell/ Lagunitas-Rock Spring Road	LADE	9	17-May	22-Jun
Lakeview Road	LAVR	6	18-May	10-Jun
Matt Davis Trail	MDTR	14	17-May	13-Jun
Oat Hill Road	OHFR	13	9-May	7-Jun
Old Stage Road	OSRO	21	27-May	24-Jun
Pine Mountain Road	PIMR	20	21-May	15-Jun
Ridgecrest Blvd.[1]	RICR	8 + 6	25-May	22-Jun
Rocky Ridge/Lagunitas-Rock Spring Road	RRFR	12	6-May	6-Jun
San Geronimo Ridge Trail	SGRT	16	19-May	19-Jun
Shafter Grade/Peter's Dam	SHAF	15	21-May	22-Jun
Shafter Creek	SHCR	3	19-May	19-Jun
Shaver Grade	SHGR	15	19-May	3-Jun
Six Points Trail	SPTR	3	2-May	2-Jun
Yolanda Trail	YOTR	10	5-May	2-Jun

[1] The list of survey locations includes 6 new points established in 2019 in grassland habitat in the Ridgecrest Boulevard transect; new points were not included in this analysis.

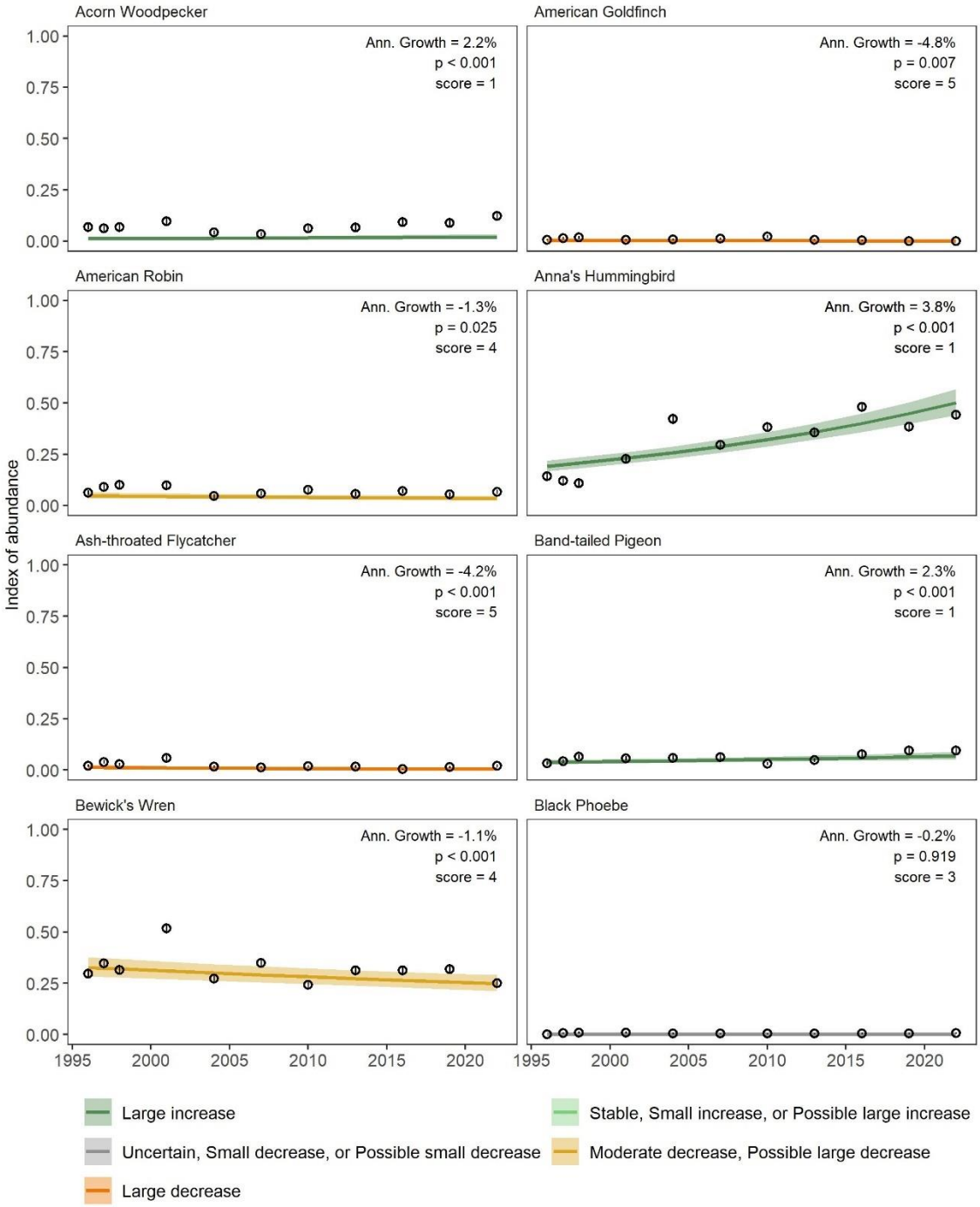
Appendix B. Common and scientific names, and assigned primary habitat affiliations, of bird species included in the analysis conducted by Point Blue Conservation Science for the Marin Municipal Water District (1996-2022).

Common Name	Latin Name	Primary Habitat Affiliation
Acorn Woodpecker	*Melanerpes formicivorus*	Oak Woodland
American Goldfinch	*Spinus tristis*	Generalist
American Robin	*Turdus migratorius*	Forest (Mixed)
Anna's Hummingbird	*Calypte anna*	Generalist
Ash-throated Flycatcher	*Myiarchus cinerascens*	Oak Woodland
Band-tailed Pigeon	*Patagioenas fasciata*	Forest (Mixed)
Bewick's Wren	*Thryomanes bewickii*	Scrub/Chaparral
Black Phoebe	*Sayornis nigricans*	Riparian/Wetland
Black-headed Grosbeak	*Pheucticus melanocephalus*	Riparian/Wetland
Black-throated Gray Warbler	*Setophaga nigrescens*	Forest (Mixed)
Blue-gray Gnatcatcher	*Polioptila caerulea*	Oak Woodland
Brown Creeper	*Certhia americana*	Conifer Forest-Mixed Hardwood Forest
Brown-headed Cowbird	*Molothrus ater*	Riparian/Wetland
Bushtit	*Psaltriparus minimus*	Generalist
California Quail	*Callipepla californica*	Generalist
California Scrub-Jay	*Aphelocoma californica*	Oak Woodland
California Towhee	*Melozone crissalis*	Generalist
Cassin's Vireo	*Vireo cassinii*	Conifer Forest-Mixed Hardwood Forest
Chestnut-backed Chickadee	*Poecile rufescens*	Forest (Mixed)
Chipping Sparrow	*Spizella passerina*	Generalist
Dark-eyed Junco	*Junco hyemalis*	Forest (Mixed)
Downy Woodpecker	*Picoides pubescens*	Riparian/Wetland
European Starling	*Sturnus vulgaris*	Forest (Mixed)
Golden-crowned Kinglet	*Regulus satrapa*	Conifer Forest-Mixed Hardwood Forest
Hairy Woodpecker	*Picoides villosus*	Conifer Forest-Mixed Hardwood Forest
Hermit Thrush	*Catharus guttatus*	Conifer Forest-Mixed Hardwood Forest
Hermit Warbler	*Setophaga occidentalis*	Conifer Forest-Mixed Hardwood Forest
House Finch	*Haemorhous mexicanus*	Riparian/Wetland
Hutton's Vireo	*Vireo huttoni*	Forest (Mixed)
Lazuli Bunting	*Passerina amoena*	Generalist
Lesser Goldfinch	*Spinus psaltria*	Oak Woodland
Mourning Dove	*Zenaida macroura*	Generalist
Northern Flicker	*Colaptes auratus*	Forest (Mixed)
Nuttall's Woodpecker	*Picoides nuttallii*	Oak Woodland
Oak Titmouse	*Baeolophus inornatus*	Oak Woodland
Olive-sided Flycatcher	*Contopus cooperi*	Conifer Forest-Mixed Hardwood Forest
Orange-crowned Warbler	*Oreothlypis celata*	Forest (Mixed)
Pacific Wren	*Troglodytes pacificus*	Conifer Forest-Mixed Hardwood Forest

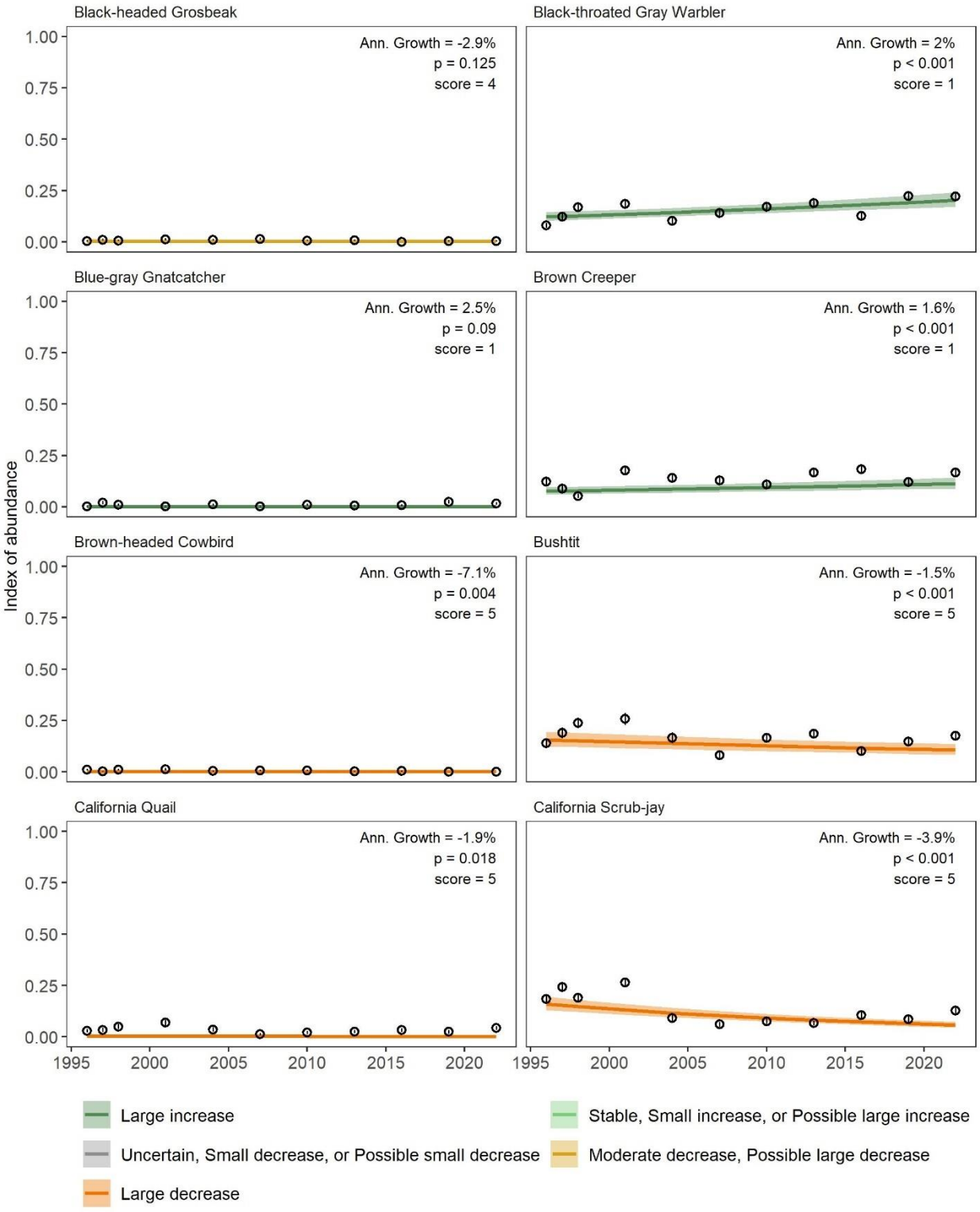
Appendix B (Continued).

Common Name	Latin Name	Habitat Affiliation
Pacific-slope Flycatcher	*Empidonax difficilis*	Conifer Forest-Mixed Hardwood Forest
Pileated Woodpecker	*Dryocopus pileatus*	Conifer Forest-Mixed Hardwood Forest
Purple Finch	*Haemorhous purpureus*	Forest (Mixed)
Pygmy Nuthatch	*Sitta pygmaea*	Conifer Forest-Mixed Hardwood Forest
Red-breasted Nuthatch	*Sitta canadensis*	Conifer Forest-Mixed Hardwood Forest
Red-winged Blackbird	*Agelaius phoeniceus*	Riparian/Wetland
Rufous-crowned Sparrow	*Aimophila ruficeps*	Scrub/Chaparral
Song Sparrow	*Melospiza melodia*	Riparian/Wetland
Spotted Towhee	*Pipilo maculatus*	Scrub/Chaparral
Steller's Jay	*Cyanocitta stelleri*	Conifer Forest-Mixed Hardwood Forest
Swainson's Thrush	*Catharus ustulatus*	Forest (Mixed)
Warbling Vireo	*Vireo gilvus*	Forest (Mixed)
Western Bluebird	*Sialia mexicana*	Oak Woodland
Western Wood-Pewee	*Contopus sordidulus*	Riparian/Wetland
White-breasted Nuthatch	*Sitta carolinensis*	Oak Woodland
Wilson's Warbler	*Cardellina pusilla*	Forest (Mixed)
Wrentit	*Chamaea fasciata*	Scrub/Chaparral
Yellow-rumped Warbler	*Setophaga coronata*	Conifer Forest-Mixed Hardwood Forest

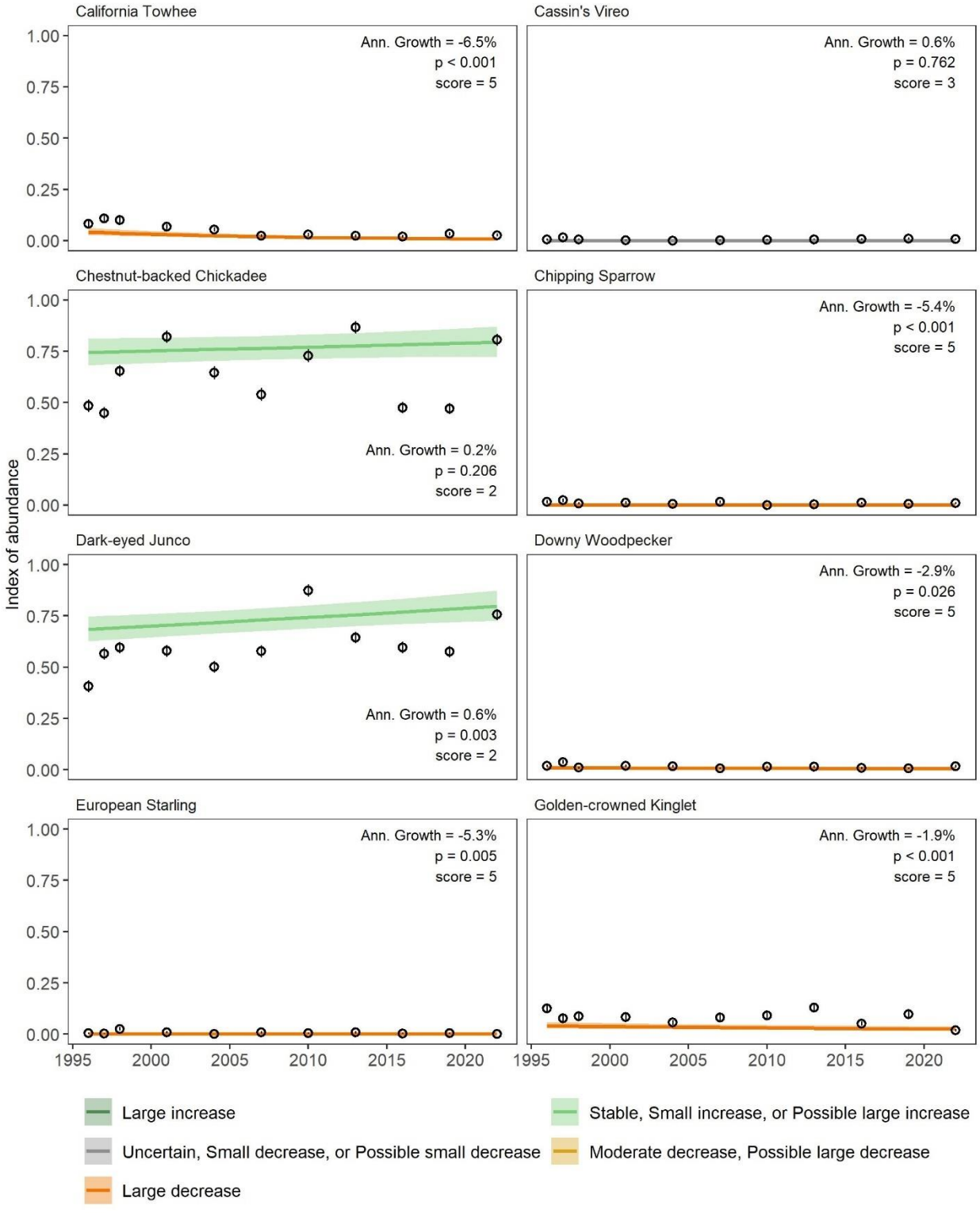
Appendix C (Panel 1 of 7). Annual growth rate estimates (% change per year) and 95% upper and lower confidence limits for each of the 56 species included in our analysis. Trend categories are color coded by score from dark green to dark orange: 1) large increase, 2) small increase / possible increase / stable, 3) uncertain population change / possible small decrease / small decrease, 4) moderate-possible large decrease, and 5) large decrease, adapted from the Partners in Flight Avian Conservation Assessment Database Handbook (Panjabi et al. 2020). P-values, average annual growth rate, and trend scores (1-5) are shown in the upper or lower right of each plot. To facilitate trend visualization, points and error bars represent the annual mean and standard error of the number of individuals counted at each point surveyed that year (n = 337 in most years), but note that models were fit to the underlying count data at each point.



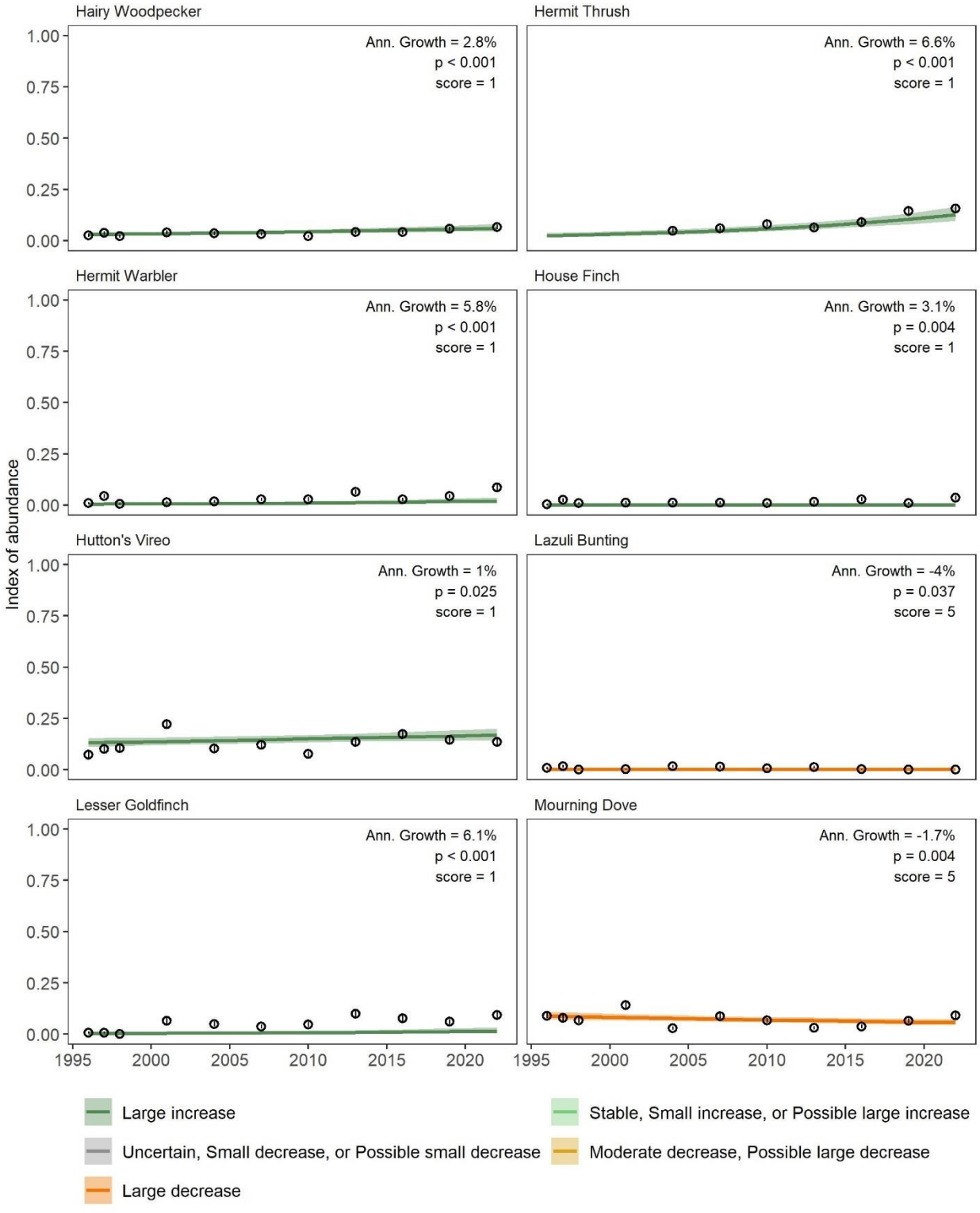
Appendix C (Continued, Panel 2 of 7).



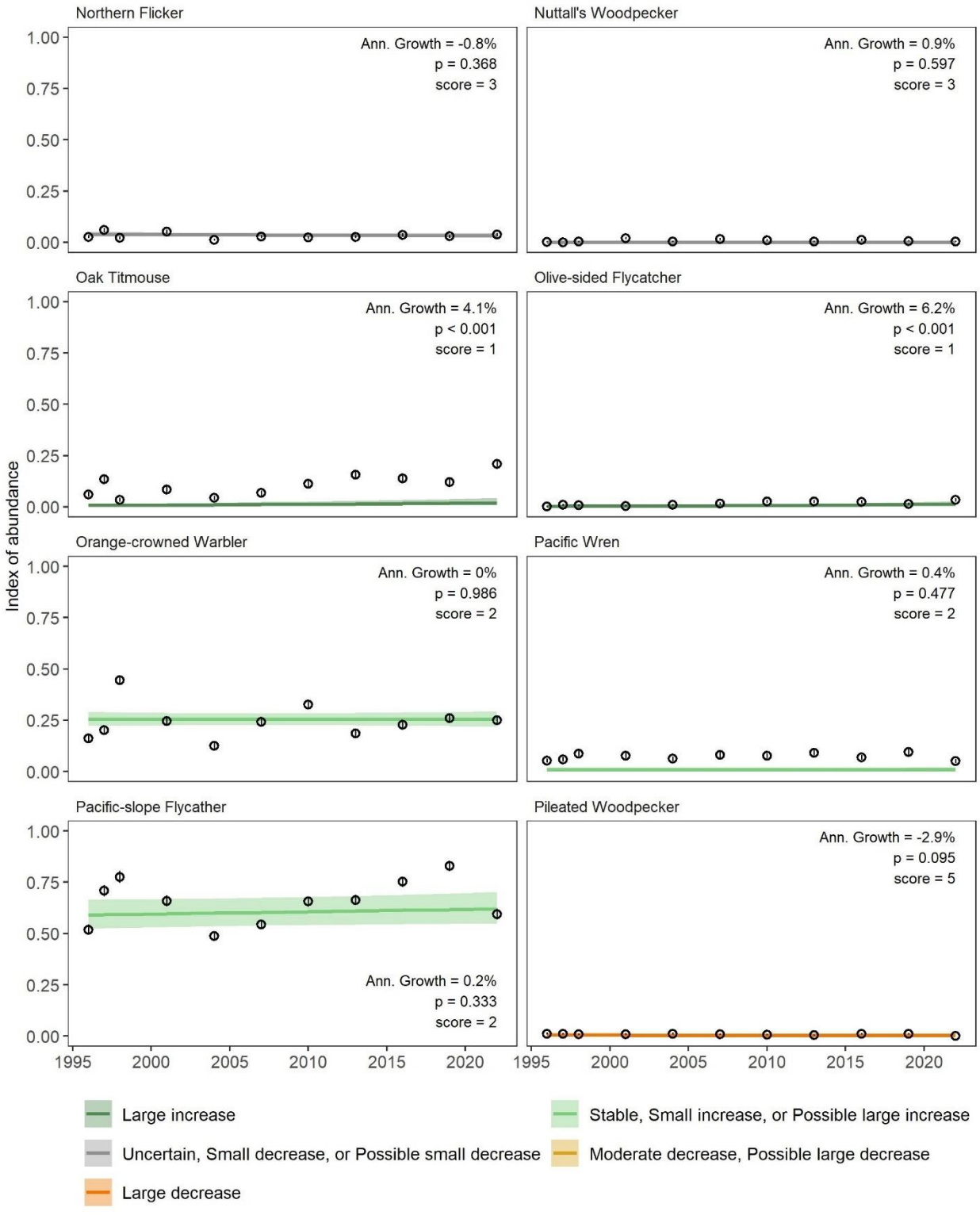
Appendix C (Continued, Panel 3 of 7).



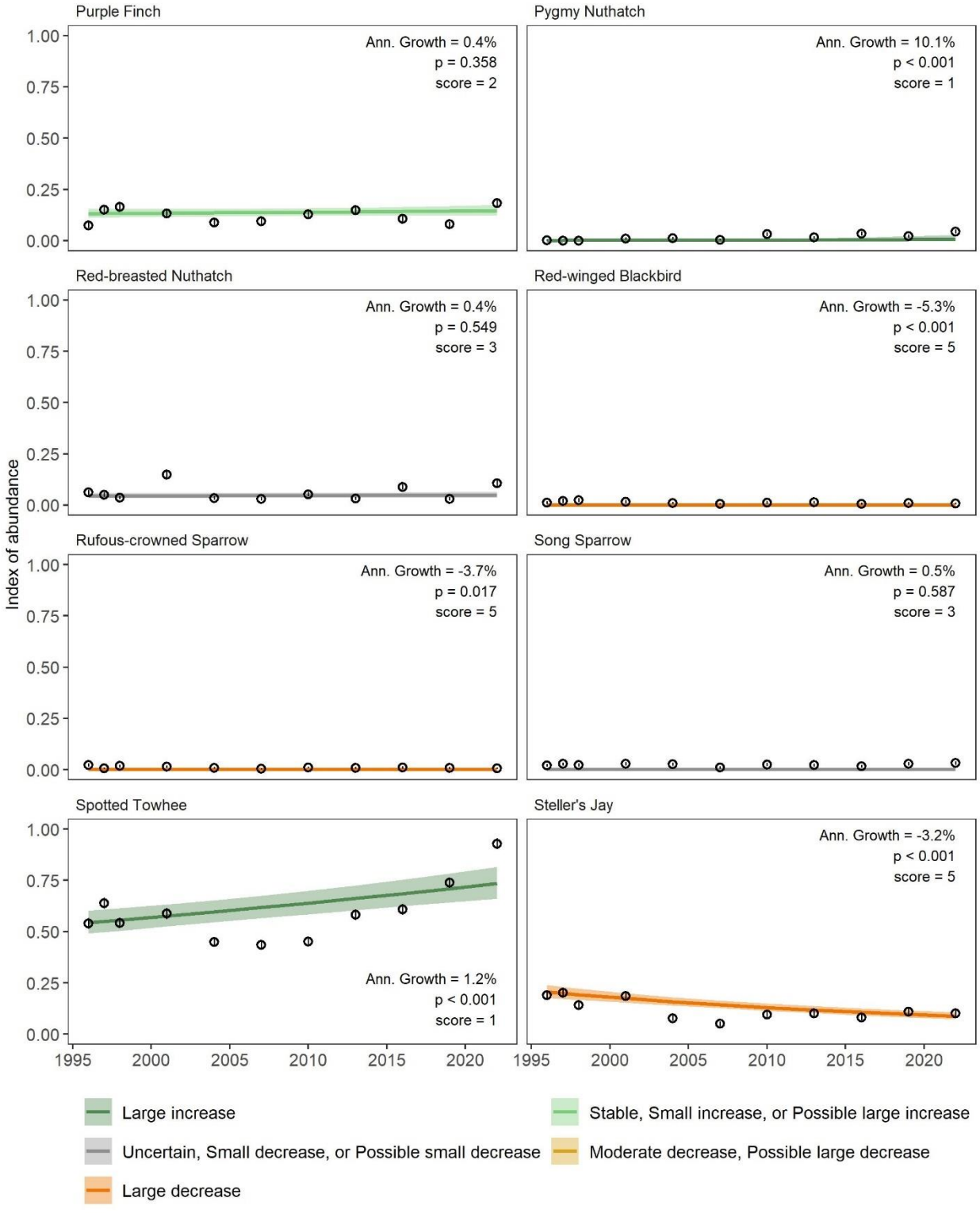
Appendix C (Continued, Panel 4 of 7).



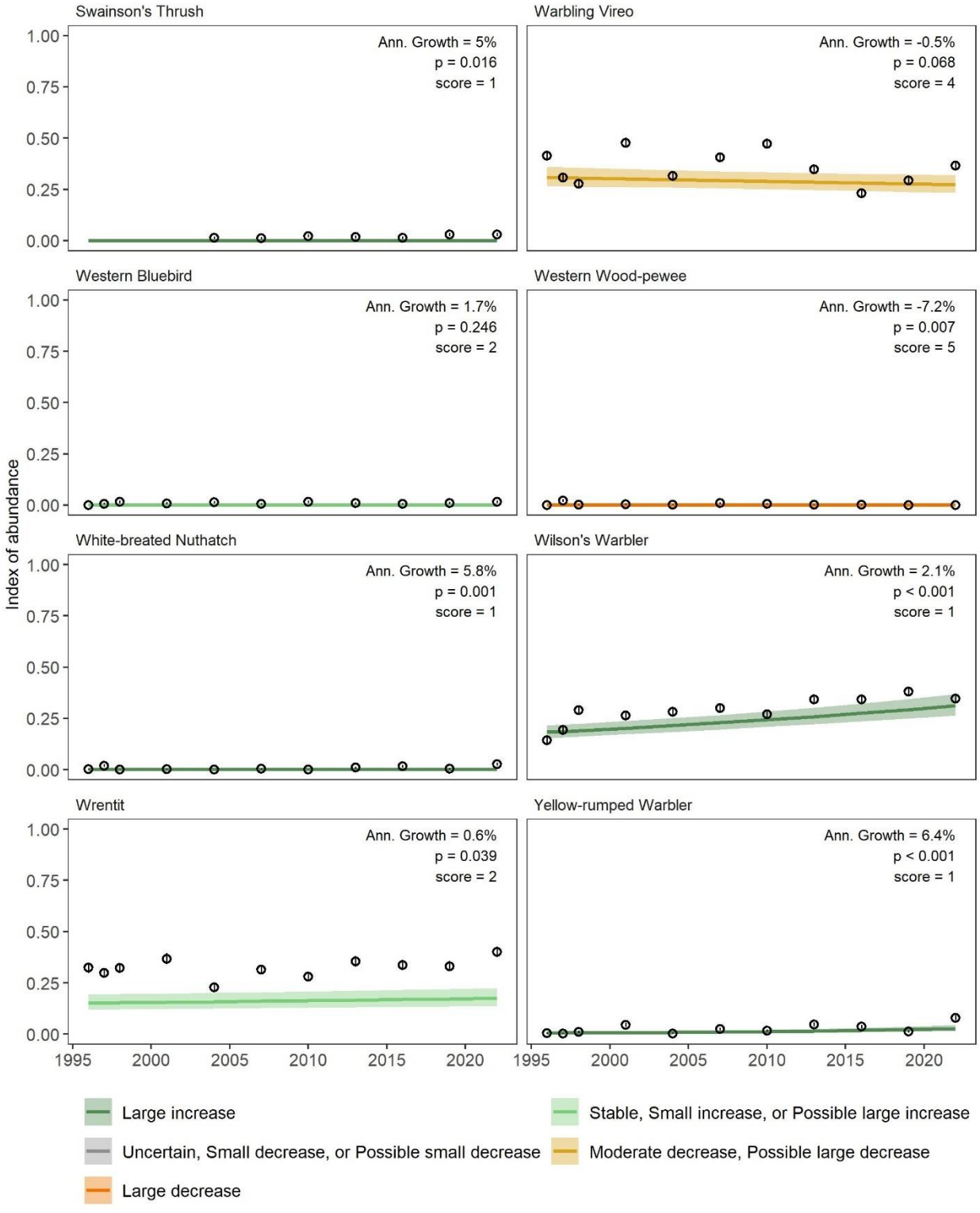
Appendix C (Continued, Panel 5 of 7).



Appendix C (Continued, Panel 6 of 7).



Appendix C (Continued, Panel 7 of 7).



STAFF REPORT

Meeting Type:	Watershed Committee/Board of Directors
Title:	FY 2024 Annual BFFIP Vegetation Management Report
From:	Shaun Horne, Director of Watershed Resources
Through:	Ben Horenstein, General Manager
Meeting Date:	September 19, 2024

TYPE OF ACTION: Action X Information Review and Refer

RECOMMENDATION: Receive report

SUMMARY: The District conducts vegetation management work on watershed lands throughout the year under the Biodiversity, Fire, and Fuels Integrated Plan (BFFIP), which was adopted in October of 2019. Staff has prepared a BFFIP Annual Vegetation Report detailing work completed in Fiscal Year (FY) 2024. Staff will provide a presentation with an overview of work completed to address wildfire hazards and to enhance biodiversity on the District's watershed lands.

DISCUSSION: As outlined in the BFFIP and associated 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 attached BFFIP Annual Report summarizes the District's vegetation management work, wildfire coordination, biological monitoring, and planning activities.

The District adopted its first vegetation management plan in 1995. The District's principal management concern at the time was reducing wildfire hazards on its lands, while minimizing impacts on natural resources. The plan included the creation of a series of fuelbreaks and access roads along major ridges, and the maintenance of the fuelbreak infrastructure. In October of 2019, the District adopted the BFFIP which described the actions the District would implement to reduce wildfire hazards and to maintain and enhance ecosystem function. Under the BFFIP, 27 management actions are being implemented to fulfill the goals and approaches described in the plan. To implement the inventorying, planning, and monitoring management actions, the District conducts surveys, manages data, and creates maps. To implement the vegetation management actions, the District uses a combination of manual and mechanical techniques to achieve the BFFIP management actions targets. On a regular basis, the District evaluates the effectiveness of its various techniques and progress towards meeting the BFFIP targets, and annually it reports its findings to the Board and public.

Vegetation management under the BFFIP aims to reduce fuel loads, maintain fuelbreak infrastructure, preserve defensible space, and reduce invasive weed species. Vegetation management is conducted continuously throughout the year with the chief goals of reducing fuel loads and maintaining the watershed's biological diversity, which reduce risks to District infrastructure and promote improved water quality. To document the District's annual vegetation management work, staff has prepared the BFFIP Annual Report for the fifth year of implementation. The report summarizes the District's implementation activities carried out during FY 2024, from July 1, 2023 through June 30, 2024. It includes information on vegetation treatment types, total acres managed, and vegetation management costs. Also included in the report is an overview of the District's environmental compliance and biological monitoring activities. The final section reviews progress towards meeting the BFFIP year 5 targets, and priorities for the upcoming year.

Table 1 Overview of Vegetation Management Targets

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.

ENVIRONMENTAL REVIEW: The District, as the Lead Agency, prepared a Programmatic Environmental Impact Report (PEIR) pursuant to the provisions of CEQA for the Biodiversity, Fire and Fuels Integrated Plan (BFFIP) which was adopted in 2019 and covers all work reviewed in this Annual Report.

FISCAL IMPACT: For FY24, District budgeted BFFIP implementation costs in the Capital Program AE107 and from Operation Budgets 2044 and 2045. Additionally, District continued to utilize grant funding

from the California Coastal Conservancy and the CalFIRE Forest Health Program for forestry restoration work.

In FY24, the District treated 1,836 acres for $3,504,490 resulting in 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.

FY24 total BFFIP expenditures were partially funded with $734,010 in direct grant funding provided by the California Coastal Conservancy, and the Cal Fire Forest Health Project, plus an additional $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.

ATTACHMENT(S):

1. Annual FY24 BFFIP Vegetation Management Report

Photo 1: Mt Tam & Worn Springs Fire Rd.

Vegetation Management Report

Fiscal Year 2024

MARIN WATER

This Page is Intentionally Left Blank

Table of Contents

TABLE OF CONTENTS

This page is intentionally left blank.

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.

Table 1 Overview of Vegetation Management Activities

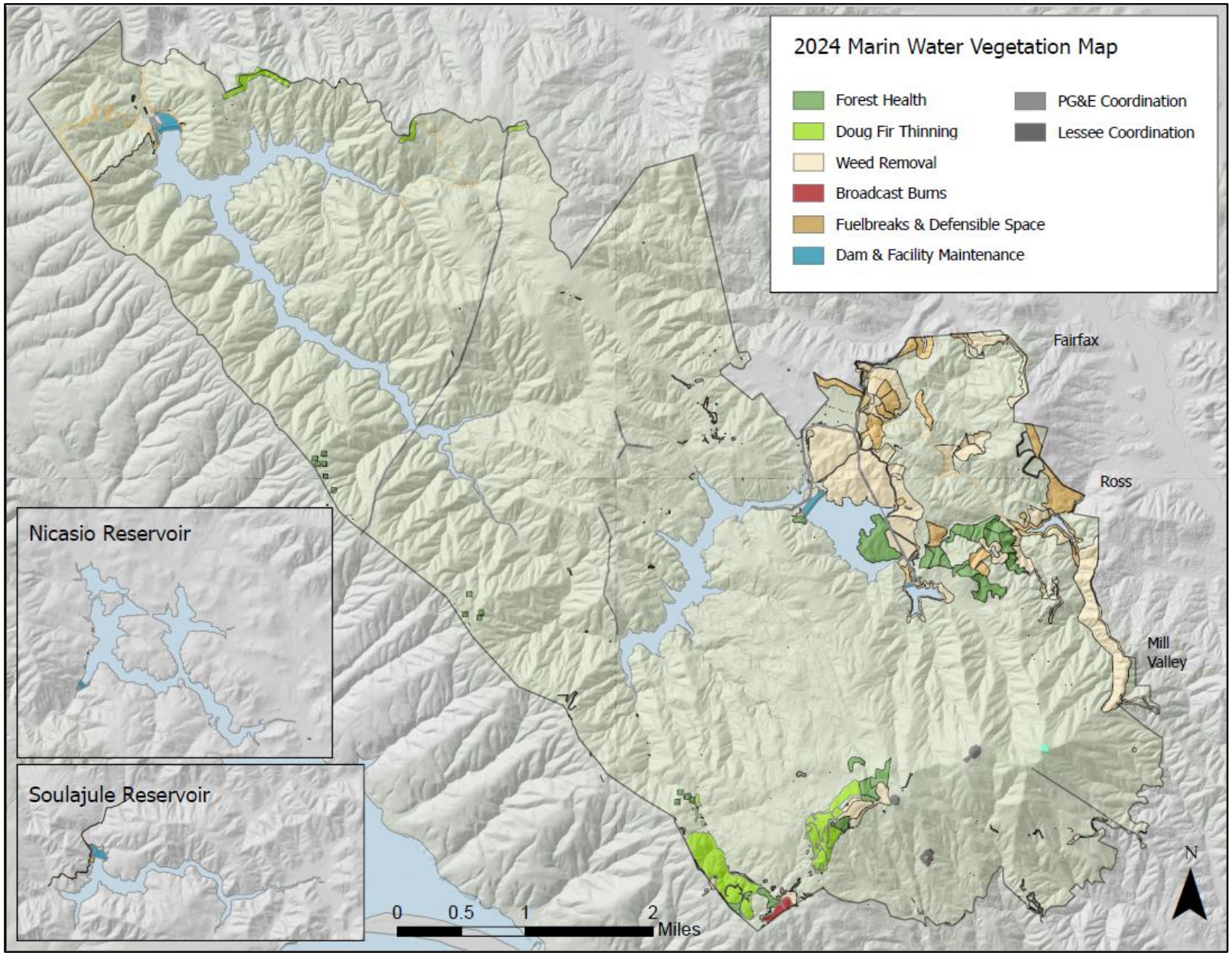
Completed Work	Outcome	Approximate Cost [a]	Description
Community Coordination for Fire Risk Reduction		**$8,502**	
Red Flag Warnings	Watershed Closures	N/A	• Closed Watershed for 0 days due to Red Flag Warnings. • Community outreach for red flag and other critical fire weather events through signage and social media.
Coordination with PG&E	53 Acres	$1,000	• Managed PG&E access through permits to support cyclical vegetation maintenance around and under transmission lines. • PG&E surveyed and cleared vegetation along 9.5 miles of power lines across the watershed. • PG&E repaired/replaced 31 pieces of hardware maintenance along the Distribution system throughout the watershed. See section 1.2 for detail.
Coordination with Lessees and Neighbors on Defensible Space	12 Acres	$7,502	• Coordinating under existing lease agreement to prioritize maintenance funding for vegetation maintenance around infrastructure. • Coordinated with Marin Wildfire Prevention Authority around fuels treatment along the Greater Ross Valley Shaded Fuelbreak.
County Fire Coordination	County and Watershed Wide	N/A	• Burned 2 Rx Units near Rock Springs in Coordination with MCFD. • Provided direction and support for development of Marin's Community Wildfire Protection Plan in collaboration with Marin County Fire and FIRESafe Marin. • Attended monthly FIRESafe Marin Meetings. • 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.
Watershed Volunteer Coordination	Wildfire Resilience	N/A	• Expanded Defensible Space. • Contributed to EDRR Efforts. • Improved Forest Health. • Broom Removal.

Planning, Compliance and Monitoring		**$312,936**	
Biodiversity, Fire, and Fuels Integrated Plan (BFFIP)		N/A	• Implemented BFFIP Year 5 Targets.
Non-Native Invasive Species Mapping	Updated Records	N/A	• 1,068 invasive plant records updated.
Rare Plant Surveys	Rare plant compliance surveyed	$79,772	• 380 acres surveyed for rare plants ahead of vegetation management projects. • 242 Rare Plant Records Created.
Northern Spotted Owl Surveys	Nesting compliance	$33,510	• Completed environmental compliance survey work for northern spotted owl to support watershed vegetation and construction related projects.
Bat Surveys	Roosting bat habitat surveys	N/A	• In FY24 the District did not encounter any internal situations requiring Bat Roost Surveys. • District required PG&E to comply with Bat Roost Surveys and related BMPs.
Bird Surveys	Nesting Birds	$96,436	• Completed environmental compliance survey work for nesting birds to support vegetation management work.
Tri-Annual Land Bird Survey	Nesting Birds	$11,811	• This line item represents carry over costs incurred in FY24 from the Tri-Annual Survey initially conducted in FY23.
Nesting Bird Response to BFFIP Treatment Monitoring	Annual Monitoring	$4,938	• Correlated FYE vegetation data against historical nesting data to determine impact of BFFIP implementation on nesting birds.
Osprey Monitoring	Annual Monitoring	$4,576	• Completed annual Osprey monitoring at Kent Lake.
Forest Restoration Monitoring and Mapping	Maintenance of Existing Areas	NA	• 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.
Foothill Yellow Legged Frog	Annual Monitoring	$44,169	• Completed annual monitoring of foothill yellow legged frogs at select watershed locations with known occurrences.
Wildlife Picture Index	Data Processing	$11,039	• Processed photos and analyzed data from thousands of wildlife photos taken on District Land.
Cultural Resource Surveys	Cultural Resource Surveys	$26,685	• Completed Cultural Resource Surveys on all remaining Burn Plans.
Vegetation Management	**FY24 BFFIP Implementation**	**$3,495,905**	

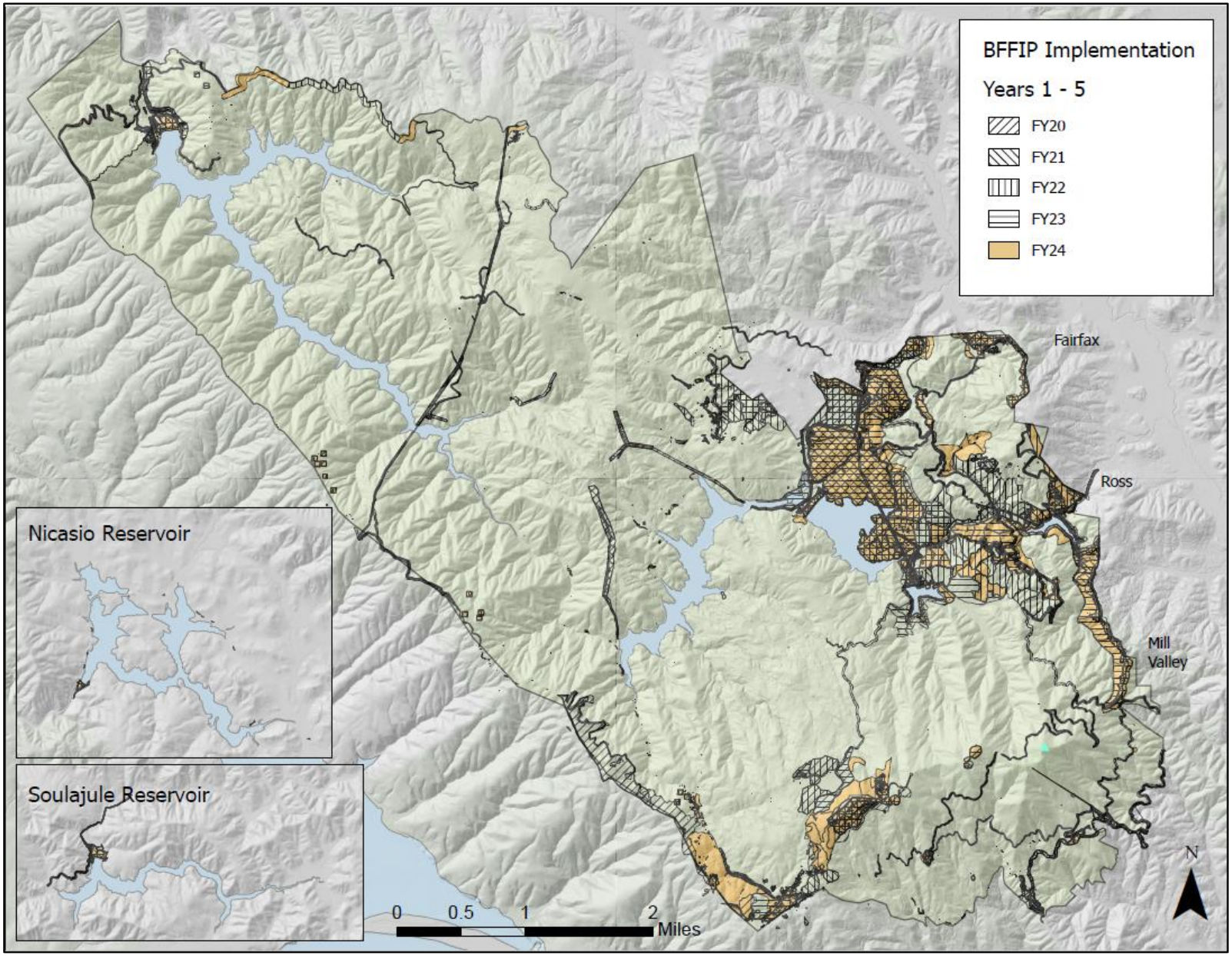
EXECUTIVE SUMMARY

Cyclical Maintenance of Fuelbreaks	**1,161 acres**	**$1,358,122**	• **All fuelbreaks maintained at appropriate intervals**
	193 acres	$523,682	• Fuelbreak maintenance, cutting of woody vegetation & pile burns.
	48 acres	$41,012	• Mowed fine fuels around structures, roadsides and parking areas.
	829 acres	$735,864	• Pulled/mowed broom.
	49 acres	$28,722	• Mowed non-fuelbreak roadsides.
	42 acres	$28.842	• Managed vegetation on dams and spillways.
New Fuelbreak Construction	**14 acres**	**$73,829**	• **Contractors expanded defensible space at Taylor Trail Fuelbreak**
Forest Restoration and Fuel Management	**217 acres**	**$1,069,943**	• **Forest and Woodland Thinning to Promote Resilience**
	98 acres	$725,833	• Initial Forest Fuel Reduction.
	115 acres	$339,799	• Maintenance of Forest Restoration sites & Pile Burning in Forests.
	4 acres	$4,310	• Broadcast burn in forest at Ridgecrest site.
Priority Habitat Restoration & Fuel Reduction	**391 acres**	**$994,011**	• **Removal of target invasive weeds within forest and woodlands**
	198 acres	$902,132	• Douglas fir thinning in Oak Woodlands and Grasslands (OW&G).
	7 acres	$4,310	• Broadcast burn in grassland at Ridgecrest site.
	19 acres	$10,193	• Goatgrass reduction in OW&G.
	123 acres	$35,629	• Yellow Starthistle management in OW&G.
	45 acres	$30,910	• Control of other priority weeds in OW&G.
Early Detection Rapid Response	**N/A**	**One Tam Contribution**	• 34 miles of roads and trails surveyed. • 286 patches of invasive weeds treated in FY24.
Experiment with New Invasive Species Control Methods	**2 Trials**	**$978**	• Bark Peeling of Blackwood Acacia. 14 Individuals & 7 stumps. • Mt Tam Thistle Maintenance & Monitoring
Implementation Supplies		**$84**	• Flagging Tape

Map 1: FY24 Vegetation Treatments by Management Action



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
Community Coordination for Fire Risk Reduction		**$8,502**	• Wildfire risk mitigation
Red Flag Warnings		N/A	• Zero Red Flag Warning Closures in FY24. • Continued community outreach for red flag and other critical fire weather events through signage and social media. • Coordinating county wide signage with Fire Safe Marin and other Fire agencies.
Coordination with PG&E	9.5 Miles of Lines Maintained (53 Acres)	$1,000	• Coordinating to ensure cyclical vegetation maintenance around and under transmission & distribution lines. • Maintained Vegetation along 9.5 miles of PG&E transmission and distribution lines, totaling 53 acres. • PG&E repaired/replaced 31 pieces of hardware along the Distribution system throughout the watershed. See section 1.2 for detail. • Worked with PG&E to ensure that pre-project environmental surveys are completed before vegetation management work is conducted.
Coordination with Lessees and Neighbors on Defensible Space	12 acres	$7,502	• Coordinating under existing lease agreement to prioritize maintenance funding for vegetation maintenance around infrastructure. • Conducted assessments of fuelbreak infrastructure and defensible space to inform annual maintenance activities.

County Fire Coordination	NA	NA	• Conducted Two Rx Broadcast Burns on Watershed Land. • Provided direction and support for development of Marin's Community Wildfire Protection Plan in collaboration with Marin County Fire and FIRESafe Marin. • Collaborated on Watershed Prescribed Fire Report. • Attended monthly FIRESafe Marin Meetings.
Watershed Volunteer Coordination	Wildfire Resilience	N/A	• Expanded Defensible Space • Contributed to EDRR Efforts • Improved Forest Health • Broom Removal

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
Install	**3**
High Sign	1
Damper	2
Repair	**16**
Conductor	3
Crossarm	1
Pole	1
Anchor	2
Guy Wire	7
Insulator	1
Structure	1
Replace	**12**
Structure	4
Conductor	1
Connector	2
Crossarm	2
Insulator	1
Pole	2
Grand Total	**31**

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 hosed 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 or 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
Planning and Monitoring		**$312,936**	
BFFIP Implementation		N/A	• Implemented BFFIP Year 5 Targets.
Non-Native Invasive Plant Species Mapping	Updated Records	N/A	• 1,068 Invasive Plant observations in FY24.
Rare Plant Compliance	380 Acres Surveyed	$79,772	• MMWD Contractors and staff conducted 380 acres of rare plant surveys in potential project areas.
Northern Spotted Owl Surveys	Compliance	$33,510	• Completed environmental compliance survey work for northern spotted owl to support watershed vegetation and construction related projects.
Bat Surveys	Roosting Bat Habitat Surveys	N/A	• Removing trees > 10" DBH requires Bat Roost Surveys. • In FY24 the District did not encounter any internal situations requiring Bat Roost Surveys. • The District required PG&E to conduct appropriate Bat Surveys prior to removing trees > 10" DBH on multiple occasions in FY24.
Bird Surveys	Nesting Birds	$96,436	• Completed environmental compliance survey work for nesting birds to support vegetation management work.

Tri-Annual Land Bird Survey	Nesting Birds	$11,811	• This line item represents carry over costs incurred in FY24 from the Tri-Annual Survey initially conducted in FY23.
Osprey Monitoring	Annual Monitoring	$4,576	• Annual Osprey monitoring at Kent Lake.
Forest Restoration Monitoring and Mapping	Maintenance of Existing Areas	NA	• Routine Maintenance of 14 acres of Forest Habitat in the Resilient Forest Project Area. See Vegetation Management Section for Costs.
Foothill Yellow Legged Frog	Annual Monitoring	$44,169	• Annual monitoring of foothill yellow legged frog at select watershed locations.
Wildlife Picture Index	Data Processing	$11,039	• Input and analyzed thousands of wildlife photos taken on District Land.
Nesting Bird Response to BFFIP Treatments	Annual Monitoring	$4,938	• Analyzed FYE Vegetation Data against historical nesting activity data to determine impact of BFFIP implementation on nesting birds. Analysis is ongoing.
Cultural Resource Study	Surveys	$26,685	• Coordinated with FIGR and SSU in preparation for Rx burns at multiple Watershed sites.

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**

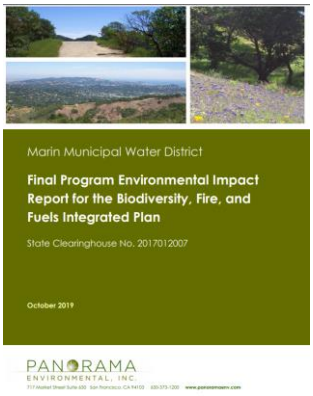


Figure 1: BFFIP EIR adopted in October of 2019.

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**

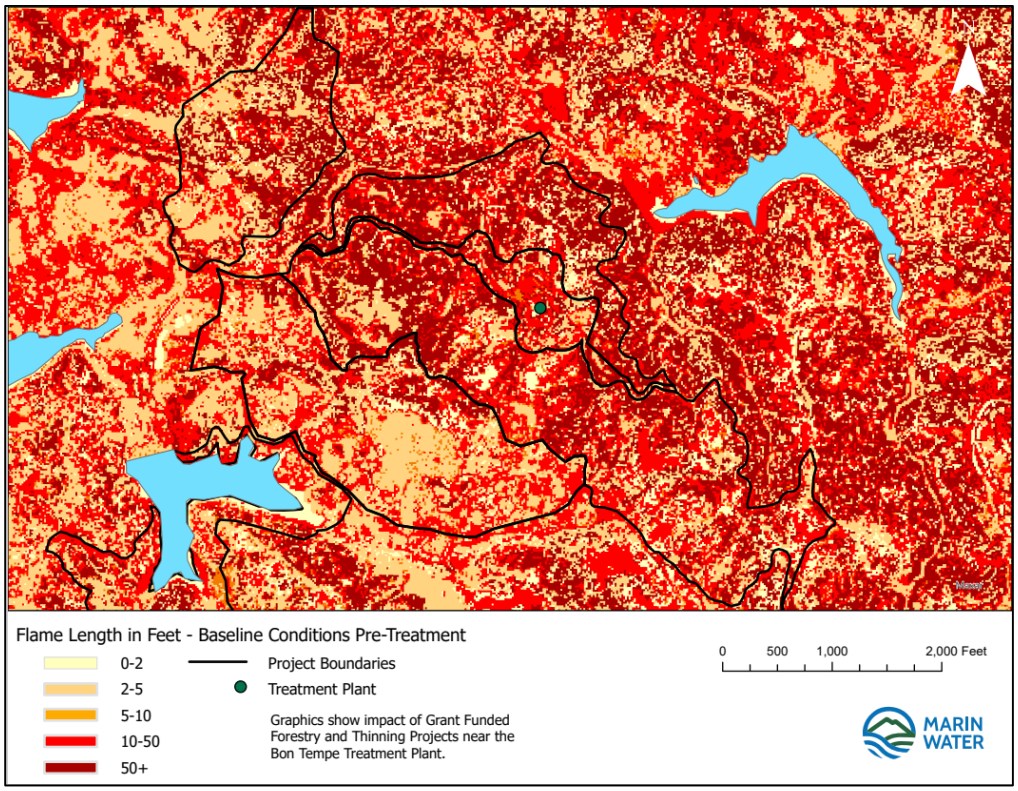
Photo 10: Foothill Yellow-legged Frog

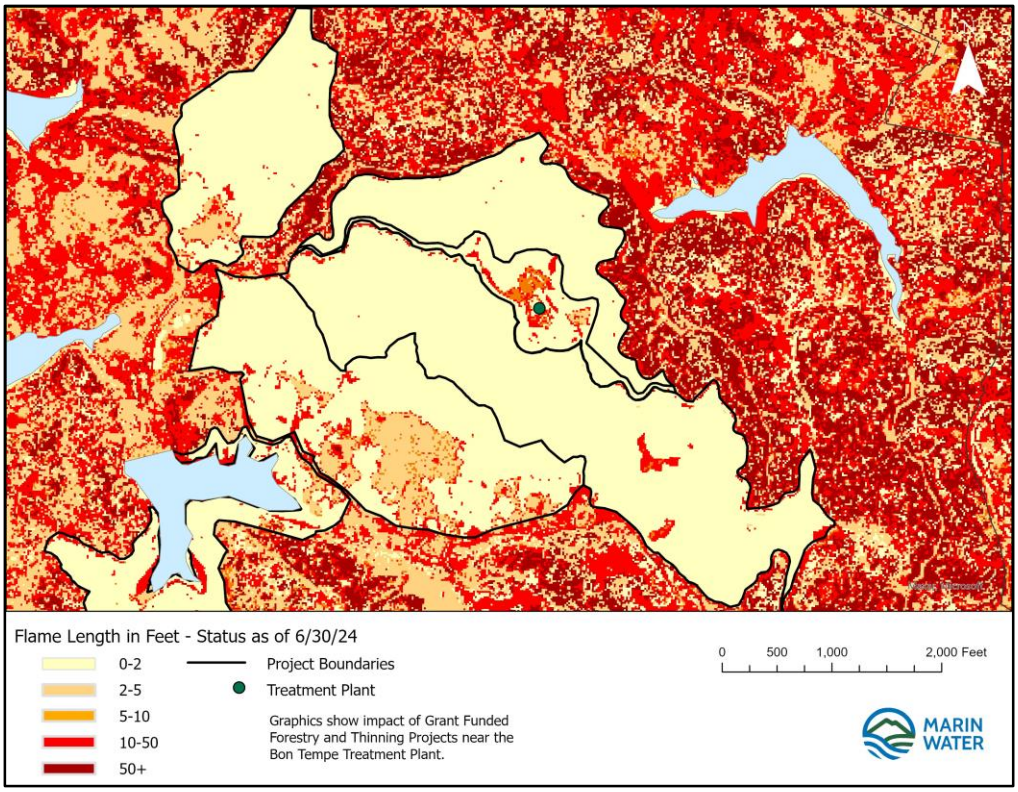
2.8 Watershed Fuel Modeling

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.

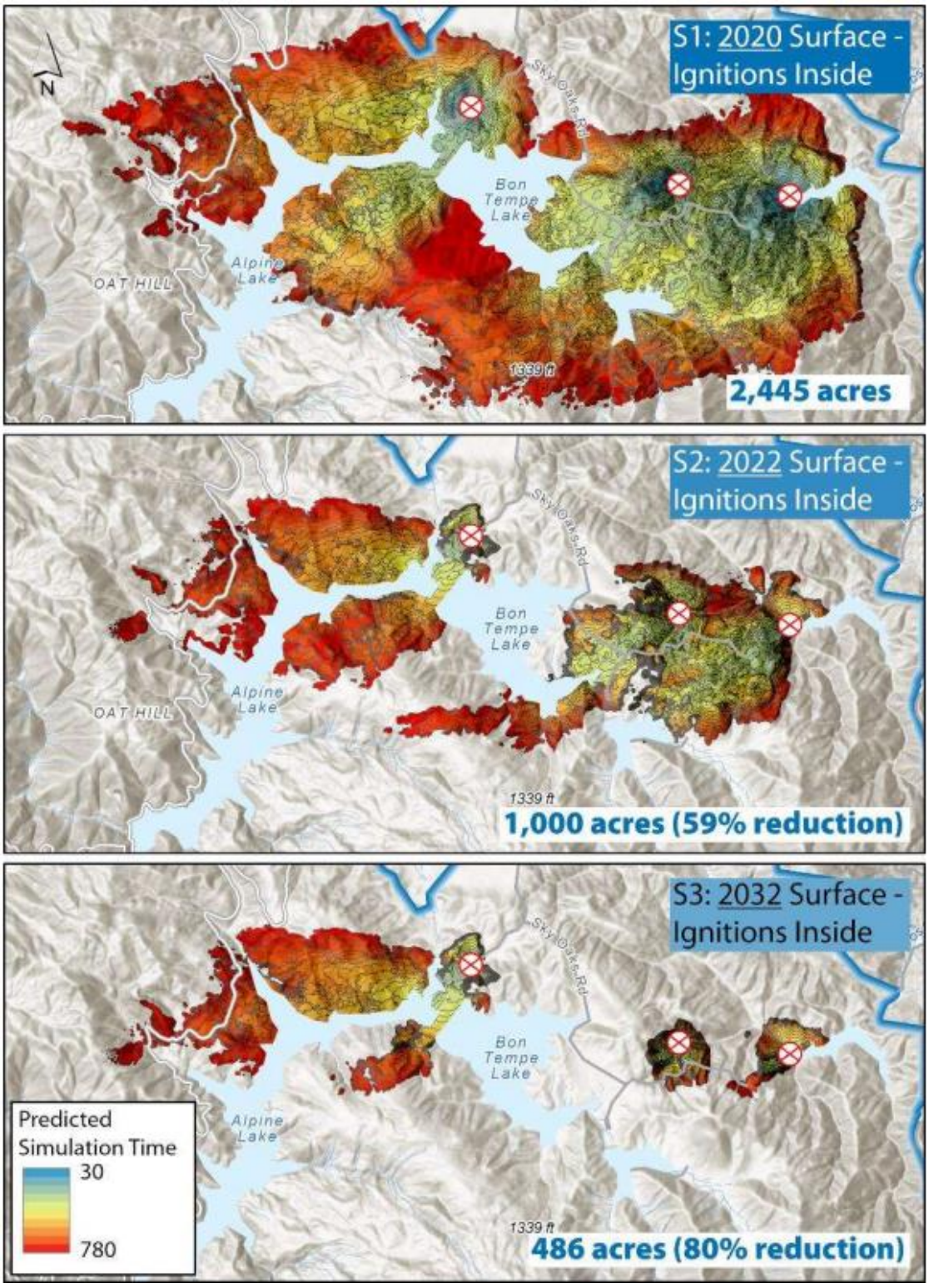
In FY24 the fuels work included in the initial analysis was completed and an updated map of conditions at 6/30/24 is included below. The District incurred no costs for analysis in FY24. Costs for implementation of the fuel reduction work is captured in Section 3.3.

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
Vegetation Management	**1,838 acres**	**$3,495,905**	
Cyclical Maintenance of Fuelbreaks	1,161 acres	$1,358,122	• Fuelbreaks maintained at appropriate intervals. • Cut woody vegetation in established fuelbreaks. • Burned 67 acres of piles of cured vegetation in Fuelbreaks. • Mowed fine fuels around structures, along roadsides and parking areas. • Pulled broom from fuelbreaks. • Mowed non-fuelbreak roadsides. • Managed vegetation on dams and spillways.
New Fuelbreak Construction	14 acres	$73,829	• Contractors and staff expanded defensible near Sky Oaks Headquarters.
Early Detection Rapid Response	34 Miles & 149 New Detections.	One Tam Contribution	• 34 miles of roads and trails surveyed. • 149 new weed populations identified.
Forest Fuel Management	98 acres	$725,833	• Completed 98 acres of initial forest fuel reduction treatments near Rock Springs and the Bon Tempe Treatment Plant.
	115 acres	$339,799	• Maintained 115 acres of forest fuels including the burning of 39 acres of piled & cured vegetation across the Watershed.
	4 acres	$4,310	• Conducted a 4 acre Prescribed Burn in Forest land.
Priority Habitat Restoration and Fuel Reduction	391 acres	$994,011	• Improved grassland and oak woodland in the ecosystem restoration zones through Douglas fir thinning and management of priority non-native weeds.
Experiment with New Invasive Species Control Methods	2 Trials	$978	• Acacia Peeling Treatment • Mt Tam Thistle Monitoring
Implementation Supplies	TBD	$84	• Flagging Tape

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
829 acres	**$735,864**

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 structurally 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
98 Acres	$725,833

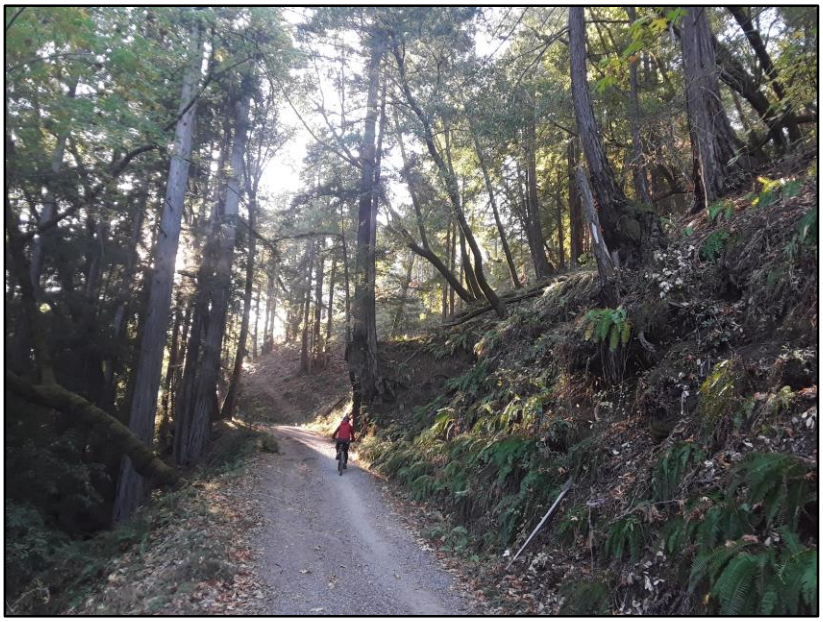


Photo 23: Below Filter Plant Forestry Project post treatment showing an open tree canopy.

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
7 Acres	**$4,310**

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
18 Acres	**$10,193**

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
123 Acres	**$35,629**

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
- Ridgecrest
- 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 thee 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	
All MAs with environmental compliance components		**See Appendix A**	
MA-20 Perform cyclical maintenance throughout the infrastructure zone with sufficient frequency to maintain design standards	• Fuelbreak maintenance and cutting of woody vegetation • Fine fuel mowing • Broom removal in fuelbreaks • Roadside mowing • Dam maintenance	• MM Air-3 • MM Air-4 • BMP-1	• MM Hazards-3 • MM Hydrology-1 • MM Noise-1
MA-21 Construct the remainder of the fuelbreak system	• New fuelbreak construction	• MM Air-3 • MM Air-4 • BMP-1 • BMP-5 • MM Biology-2 • MM Biology-11 • MM Biology-12 • MM Cultural-3	• MM Cultural-4 • MM Hazards-1 • MM Hazards-2 • MM Hazards-7 • MM Hydrology-1 • MM Noise-1 • MM Recreation-1 • MM Transportation-1
MA-22 Expand EDRR to identify, report, and treat new populations of invasive species	• Road, disturbed areas, and trail surveys • Control of small weed patches	• BMP-7 • MM Biology-2 • MM Biology-11 • MM Biology-12 • MM Biology-17 • MM Cultural-1 • MM Hazards-1	• MM Hazards-6 • MM Hazards-7 • MM Hydrology-1 • MM Noise-1 • MM Recreation-1 • MM Transportation-1

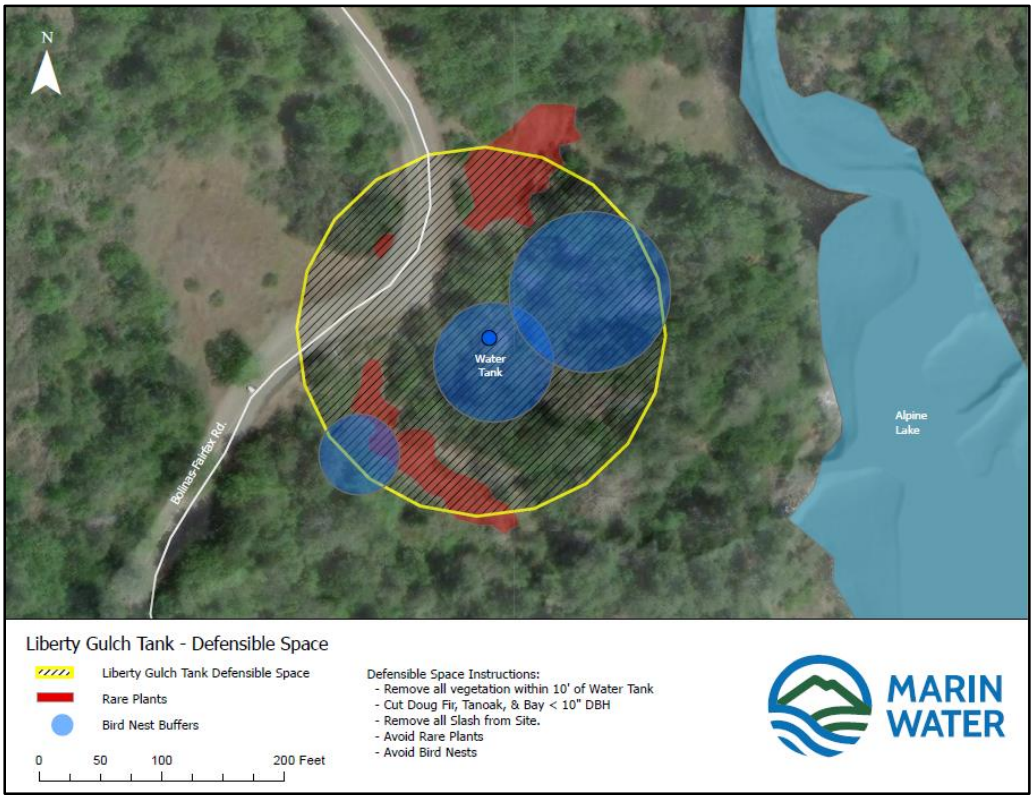
MA-23 Improve conifer and mixed hardwood forest stand structure and function in the ecosystem restoration zone	• Initial forest fuel reduction • Forest fuel maintenance	• MM Air-1 • MM Air-3 • MM Air-4 • BMP-1 • BMP-4 • BMP-5 • BMP-6 • BMP-7 • MM Biology-2 • MM Biology-17 • MM Cultural-1 • MM Cultural-3	• MM Cultural-4 • MM Geology-2 • MM Hazards-1 • MM Hazards-2 • MM Hazards-3 • MM Hazards-4 • MM Hazards-5 • MM Hazards-7 • MM Hydrology-1 • MM Noise-1 • MM Recreation-1 • MM Transportation-1
MA-24 Improve oak woodlands and grasslands (OW&G) in the ecosystem restoration zone	• Douglas fir thinning in OW&G • Maintenance of Douglas fir • Broom removal in OW&G • Broom maintenance in OW&G • Goatgrass reduction in OW&G • Yellow star thistle management in OW&G • Control of other priority weeds in OW&G	• MM Air-1 • MM Air-3 • MM Air-4 • BMP-1 • BMP-4 • BMP-5 • BMP-6 • BMP-7 • MM Biology-2 • MM Biology-11 • MM Biology-12 • MM Biology-17 • MM Cultural-1	• MM Cultural-3 • MM Cultural-4 • MM Geology-2 • MM Hazards-1 • MM Hazards-2 • MM Hazards-3 • MM Hazards-4 • MM Hazards-5 • MM Hazards-7 • MM Hydrology-1 • MM Noise-1 • MM Recreation-1 • MM Transportation-1

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
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.

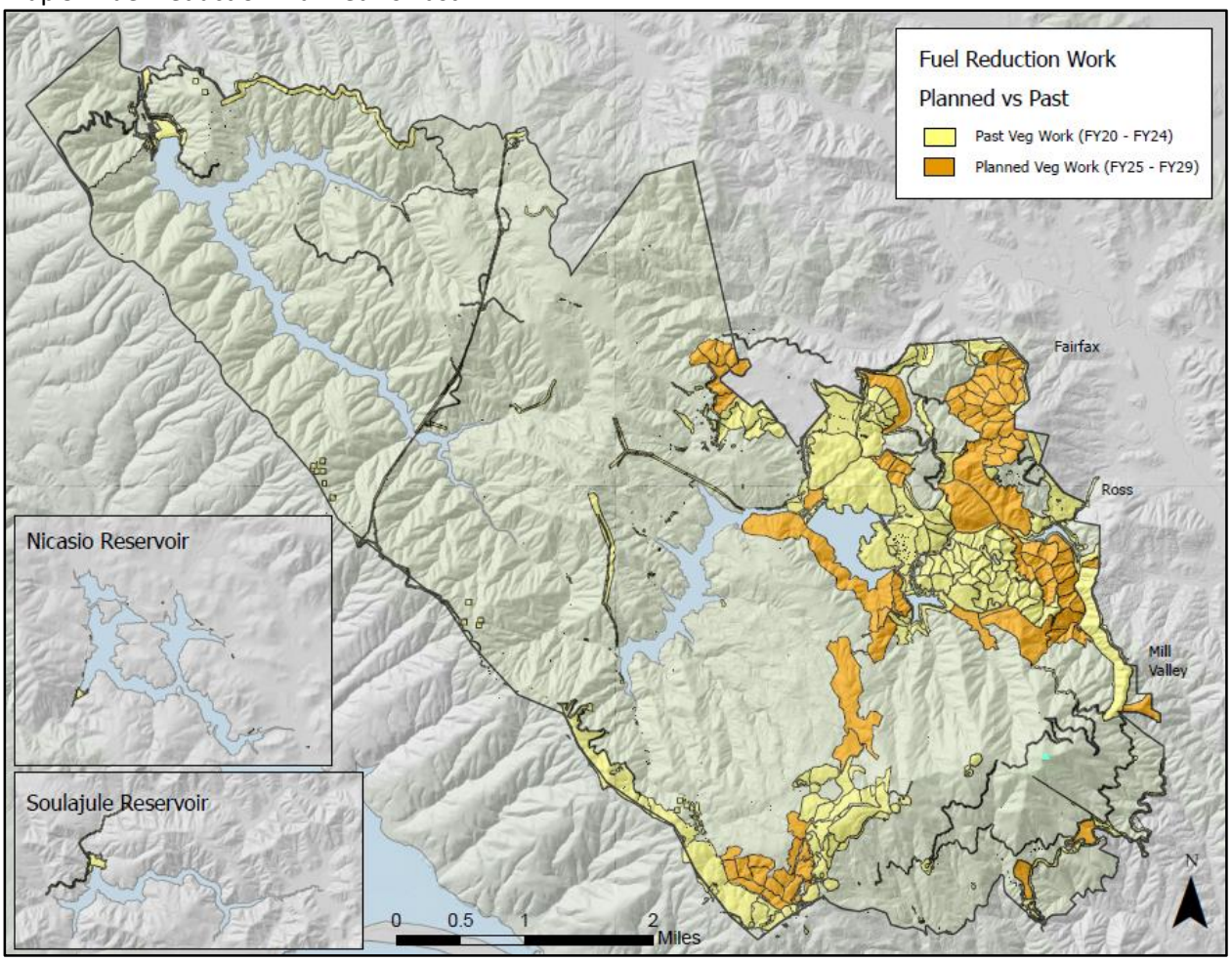
Ecological Accomplishments

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 to 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.

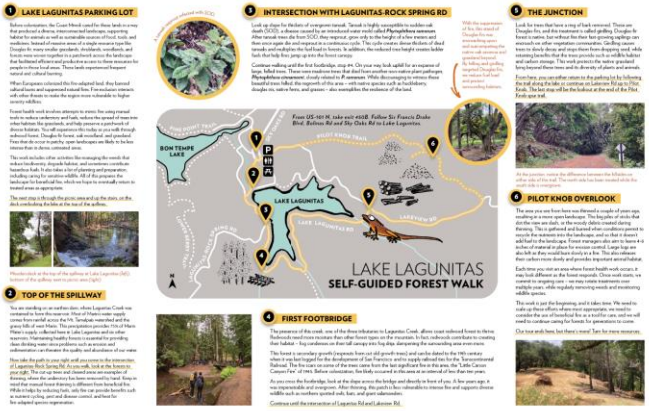
6 Appendices

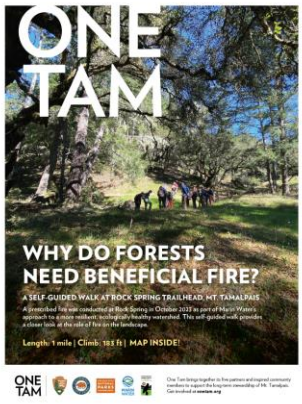
Appendix A – Mitigation Measures List

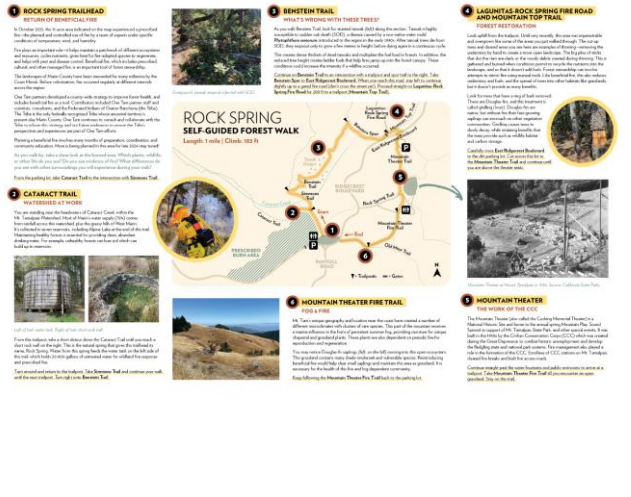
The following mitigation measures were implemented for all Management Actions (MAs) with environmental compliance components (MA-20 to MA-27):

- MM Air-2 (Asbestos)
- MM Air-3 (Air Pollutants)
- MM Air-4 (Smoke)
- BMP-1 (Operations)
- BMP-2 (Pre-work Assessment/Planning
- BMP-3 (Import fills, rock & plants)
- MM Hazards-1 (Spills)
- MM Hazards-3 (Fire Risk)
- MM Hazards-4 (Prescribed Burn Plan)
- MM Hazards-7 (Fire Ignition)
- 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)
- MM Biology-8 (Northern Spotted Owl; nesting season)
- MM Biology-9 (Western Pond Turtles)
- MM Biology-10 (CA Red-Legged Frog)
- MM Biology-12 (Foot-Hill Yellow Legged Frog)
- MM Biology-13 (Mollusks)
- MM Biology-14 (Northern Spotted Owl, avoidance buffer)
- MM Biology-15 (Wetlands)
- MM Biology-16 (Native Grasslands)
- MM Cultural-2 (Cultural Resources)
- MM Geology-1 (Erosion Control)

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







Appendix C – Forestry Treatment Monitoring Results

Impact of forest fuels treatments on understory herbs and tree recruitment

Sheherezade 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

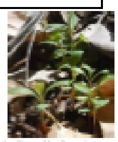
- Is there recruitment (seedlings, saplings and resprouting) of trees and of what species?
- Is there an impact on forest understory plant community, and does this differ for native and introduced plants?

Methods

Marin Water conducts forest restoration treatments each year in different forested locations within our watershed lands on Mount Tamalpais in Marin County, California. In 2020, 2021 and 2022, 8 monitoring transects were placed within that year's treatment stands. Specific transect locations within the treated area were selected a priori using a GIS. First a grid of 100 m^2 squares was superimposed on the treatment area. If this resulted in more than 8 complete squares, 8 were selected at random.

Transects were run due east using a sighting compass from the start location which was a fixed distance from a tree not slated for cutting. Along a 25-meter transect, point intercept data was collected every 10 cm, with only the top hit below 1m in height recorded. In addition any species not encountered in the point-intercept but seen with a 1 meter band of either side of the transect was noted (presence/absence only) yielding a total species count for the 50 m^2. All trees less than 1 cm in diameter at 1.35 m from the ground were counted if their stem was centered within 2 m of the transect (e.g. 100 m^2 area surveyed for seedlings, saplings and resprouts). All plants encountered were identified to species and categorized as herbaceous, vine, shrub or tree, and native or introduced per the Jepson eFlora (https://ucjeps.berkeley.edu/eflora/).

All analyses were conducted in R studio using R version 4.3.1. For each variable of interest, the difference between before and after treatment values was checked for normality using Shapiro Wilk test and normal data was further analyzed using a paired t-test. For others a Wilcoxon signed rank test was conducted. 0.05 was used as a significance level for all tests.



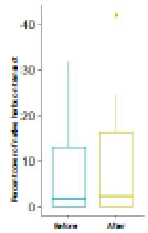
Seedlings of Pacific madrone (Ericaceae: *Arbutus menziesii*). This transect had 23 before treatment and 2,940 after treatment.

Broad-leaved helleborine (Orchidaceae: *Epipactis helleborine*) is an introduced understory herb that is found in and out of treatment areas.

Results

Two years after treatment

No change in native understory herbs

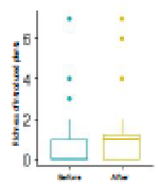


Cover of native herbaceous plants on the 25 m transects before and after fuels treatments

Before: mean=7.6, sd=10.5
After: mean=8.18, sd=11.1
paired t-test P=0.6; t=-0.5, df=23

Small increase in introduced understory herbs

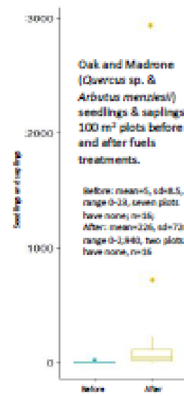
Richness of introduced species increased, especially in the locations that already had some before treatment. These are widespread species and native species continue to dominate.



Richness of introduced plants in 50m^2 before and after fuels treatments

Before: mean=0.8, sd=1.69; n=24
After: mean=1.42, sd=1.82; n=24
Wilcoxon signed rank P=.001

Big increase in tree recruitment



Oak and Madrone (*Quercus* sp. & *Arbutus menziesii*) seedlings & saplings in 100 m^2 plots before and after fuels treatments.

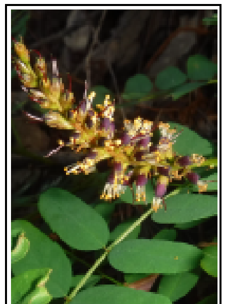
Before: mean=5, sd=8.5, range 0-23, seven plots have none; n=16;
After: mean=226, sd=726, range 0-2,940, two plots have none, n=16

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*).

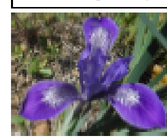
Recommendations

- 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?



Rare plant surprise

Napa false indigo (Fabaceae: *Amorpha californica* var. *napensis*) 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*)



Douglas iris (Iridaceae: *Iris douglasiana*) is a native herb found in many transects.

Acknowledgements

Thank you to all the Marin Water staff who helped with data collection: Charlie Martin, Leah Lord, Dianne Dallanda, Angie Pollard, Max Parsons, Molly Stuberg, Jay Nelson, Emily Leggitt, Dylan Mathias; and who provided feedback on project design: Carl Sanders, Suzanne Whelan.

STAFF REPORT

Meeting Type:	Watershed Committee/Board of Directors
Title:	Update on Lagunitas Creek Coho Habitat Enhancement Project Phase 1A Construction, and Review and Refer Contract MA-6356 with O'Connor Environmental Inc.
From:	Shaun Horne, Director of Watershed Resources
Through:	Ben Horenstein, General Manager
Meeting Date:	September 19, 2024

TYPE OF ACTION: Action Information X Review and Refer

RECOMMENDATION: Receive update; and Review and refer MA-6356 with O'Connor Environmental Inc. for Lagunitas Creek sediment and streambed monitoring to support WR95-17 compliance and guide ongoing restoration planning in the amount of $154,443

SUMMARY: At the May 21, 2024 Board of Directors meeting, the Board approved Contract No. 2022 with Hanford ARC, to begin construction of Phase 1A of the Lagunitas Creek Coho Habitat Enhancement Project. Phase 1A construction activities started in July of 2024 and are continuing through October. Restoration activities include installation of large wood and boulder structures and additions of spawning gravel to support endangered Coho Salmon and freshwater shrimp, and threatened steelhead populations. Staff will provide a project update and overview of the construction schedule.

The District conducted a request for proposals (RFP) in 2020 for sediment and streambed monitoring in accordance with the Lagunitas Creek Stewardship Plan under State Water Board Order WR95-17. The District received four proposals and selected O'Connor Environmental Inc. (OEI) based on cost, qualifications, and previous work history in the watershed. OEI was contracted under agreement MA-5858 for $70,980, which expired in December 2021 and was extended through June 2023. Staff are recommending that OEI's services be retained through a new professional services agreement to continue sediment and streambed monitoring for compliance with Order WR95-17 and to guide ongoing restoration planning and assess effectiveness.

DISCUSSION: In July 2024, following a four-year planning and permitting process, the District broke ground on the first phase (Phase 1A) of the Lagunitas Creek Habitat Enhancement Project. Phase 1A encompasses three sites (Sites 4, 5, 6) within Samuel P. Taylor State Park, where additions of wood structures and spawning gravel will be made to improve conditions for endangered Coho Salmon and

California freshwater shrimp, and threatened steelhead. Implementation of Phase 1A is being funded primarily through a CDFW grant with internal support from District staff.

Hanford ARC, the District's construction contractor, is currently on-schedule and making measureable progress on all project features. Daily site inspections are being performed by District staff with oversight from the design engineers, Environmental Science Associates (ESA), and construction management provided by Anchor. In-stream construction is scheduled to be completed during the final week of October. Staff will provide an update on the project schedule and all completed and in-progress elements to date.

O'Connor Environmental Inc. (OEI) has been conducting sediment and streambed monitoring in the Lagunitas Creek watershed since 2012. OEI was selected by the District during a request for proposal (RFP) process in 2020 to provide monitoring services in accordance with the Lagunitas Creek Stewardship Plan under State Water Board Order WR95-17. OEI's contract MA-5858 expired in December 2021 and was extended through June 2023. At the request of District Fisheries staff, OEI developed a scope of work and budget to continue Lagunitas Creek streambed and sediment monitoring in Lagunitas Creek through 2026. OEI's sediment and streambed surveys in Lagunitas Creek will be focused in Samuel P. Taylor State Park, where the District is currently implementing restoration work. The primary focus of this two-year monitoring contract is to develop data sets describing streambed conditions related to the District's instream habitat enhancement work in 2024 and 2025. The habitat structures being installed, comprised of large logs and boulders, are expected to affect streambed morphology and sediment dynamics. OEI's monitoring approach is intended to measure and quantify these effects following implementation and provide a baseline dataset for long term comparison.

Streambed and sediment monitoring data will include pre- and post-construction streambed conditions as characterized by sediment facies, spawning gravel size distributions, and volume of large wood material. In addition, streambed scour will be monitored to evaluate the effect of the instream habitat structures on spawning habitat. Large woody material data will be compared to assess attainment of targets set forth in the Lagunitas Creek Sediment TMDL.

Staff recommends that the Watershed Committee review and refer MA-6356 with O'Connor Environmental Inc. for Lagunitas Creek sediment and streambed monitoring, to support WR95-17 compliance and guide ongoing restoration planning, in the amount of to a future regularly scheduled Board meeting for approval.

ENVIRONMENTAL REVIEW: Staff has reviewed the Project pursuant to the California Environmental Quality Act (CEQA) and has found that the Project is Statutorily Exempt pursuant to Section 21080.56 of the California Public Resources Code, known as the Statutory Exemption for Restoration Projects (SERP). The Project qualifies for exemption pursuant to Section 21080.56 inasmuch as project is a restoration project for fish and wildlife meeting the conditions of SERP as stated in Section 21080.56.

FISCAL IMPACT: The total cost to complete Phase 1A of the Lagunitas Creek Coho Enhancement Project is estimated at $3,958,000, which includes construction, construction management services, biological compliance, and District labor. The District has secured grants from CDFW, USBR, and DWR to fully fund implementation of Phase 1A in 2024 and Phase 1B in 2025.

The total cost of OEI's proposed streambed and sediment monitoring is $154,443, to be spread across FY25 and FY26. Funding for this contract is allocated in the FY25 Fisheries operations budget and will be included in the FY26 Fisheries operations budget request.

ATTACHMENT(S): None.