Attachment 1

Mt. Tamalpais Watershed E-Bike Class I Trial Program

Year 1 Report

July 2026

I. Introduction

Marin Municipal Water District's (Marin Water or District) mission is to manage the lands, water, and facilities in our trust to provide reliable, high-quality water and sustain these precious resources for the future. As of 2024, the District serves more than 190,000 people and manages more than 22,000 acres of Watershed lands. Approximately 75 percent of this water is sourced from Marin Water's Mt Tamalpais watershed lands. Marin Water operates five municipal reservoirs within the Lagunitas Creek watershed, which flows from Mt Tamalpais to Tomales Bay.

The District established a comprehensive plan to manage road and trail systems within the 22,000-acre Mt. Tamalpais watershed to meet the District's mission of managing water and natural resources. The Mt. Tamalpais Watershed Road and Trail Management Plan (RTMT) was adopted in 2005. In recent years, the District partnered with the Golden Gate National Parks Conservancy (GGNPC) to engage District Board members, executive leadership, stakeholders, and constituents in the development of a Watershed Recreation Management Planning Feasibility Study. Since June 2022, the District hosted six (6) community workshops, two (2) site visits, and completed an updated watershed census survey to solicit input relating to watershed operations and visitor management. The Board adopted the Watershed Recreation Management Planning Feasibility Study (Feasibility Study) at the April 16, 2024 Board of Directors Meeting. A priority Strategic Opportunity Identified in the Feasibility Study was the establishment of an E-Bike Class I Trial for a two year period.

At the May 6, 2025 Board of Directors meeting, the Board approved the revised E-Bike Class I Trial Program. The objective of the E-Bike Class I Trial Program is to evaluate E-Bike Class I usage and how the inclusion of Class I E-Bikes influences visitors' watershed experience. Evaluating the inclusion of Class I E-Bikes on existing fire roads within the watershed will provide critical data to inform future watershed management and policy decisions.

In accordance with the E-Bike Class I Trial Program implementation plan and settlement agreement commitments, the District will prepare reports summarizing monitoring activities, data collection efforts, and implementation progress associated with the Trial Program during the two-year Trial period. The reports are intended to document Trial Program findings and provide transparency regarding implementation activities and observed trends.

II. Multi-Modal Trail Counters (Fire Road Visitor Counts)

Consistent with the E-Bike Class I Trial Program implementation plan, the District maintained eight Eco-Counter multi-modal trail counters throughout the reporting period to monitor visitor use on watershed fire roads. Monitoring locations included Sky Oaks Meadow, Deer Park, Natalie Coffin/Phoenix Lake, Pine Mountain Road at Bolinas-Fairfax Road, Old Railroad Grade, Eldridge Grade, Pine Mountain, and Concrete Pipeline Fire Road.

The counters remained operational throughout the reporting period and were regularly maintained to ensure continuous data collection. Data were periodically downloaded, reviewed, and analyzed to track visitor use patterns, including hiking and bicycling activity. Information collected through the trail counter network supports the District's evaluation of watershed recreation trends and E-Bike Class I Trial Program implementation.

Methods: Eight Eco-Counter multi-modal trail counters were deployed along watershed fire roads to monitor visitor use. The counters recorded visitor activity and differentiated between pedestrian and bicycle use. During the reporting period, the counters were maintained and routinely checked to ensure proper operation and data collection. Data was downloaded periodically, reviewed for quality assurance, and compiled for analysis. Annual monitoring results are summarized in this report as attachment A, “Eco-Counter Multi-modal Trail Counter Data - Year 1”.

Task	Data Colleciton Schedule	Report Schedule
Fire Road Data Year 1	July 1, 2025-July 1, 2026	July 30, 2026
Fire Road Data Year 2	July 1, 2026-June 30, 2027	August 31, 2027

Year 1 Summary: Year 1 trail counter data and summary findings are provided as **Attachment A**, Mt Tamalpais Watershed Multi-Modal Annual Report.

III. Northern Spotted Owl Monitoring

Consistent with the E-Bike Class I Trial Program implementation plan, the District continued annual monitoring of Northern Spotted Owl (NSO) nesting sites throughout the Mt. Tamalpais watershed during the reporting period, including known nesting sites located along Concrete Pipeline Fire Road. Monitoring was conducted in cooperation with Point Blue Conservation Science as part of the District's long-term NSO monitoring program.

The monitoring program evaluates site occupancy, nesting status, and reproductive success to assess long-term population trends and breeding activity within the

watershed. Survey results are used to identify annual activity centers and document changes in occupancy and nesting behavior over time.

Methods: Survey crews evaluated known NSO nesting sites to determine occupancy, nesting status, and reproductive success. For each site, surveyors documented owl detections, age class, nesting outcomes, and supporting observations. Activity centers, representing the best-known location associated with each monitored site during the reporting year, were identified in accordance with established monitoring protocols. Monitoring included known nesting locations along Concrete Pipeline Fire Road. Monitoring results were compiled and summarized for inclusion in this year 1 report.

Task	Data Collection Schedule	Report Schedule
NSO Monitoring 2025	January 1, 2025-December 31, 2026	February 12, 2026
NSO Monitoring 2026	January 1, 2026-December 31, 2027	January 14, 2027

Year 1 Summary: During 2025 surveys on Marin Water lands, surveyors documented NSO pairs at most known sites, though pair occupancy rates were lower than the study average. Nesting rates and the proportion of successful nests in 2025 were below average, but the latter was not statistically different from previous years. Fecundity in 2025 was also below the study average, though the study did not find evidence for a significant trend over time in fecundity. The study detected three Barred Owls in 2025 near MCP and Marin Water lands at long-term NSO sites included in this report, and at least five additional Barred Owls were detected elsewhere in the county throughout the year. The known number of Barred Owls is still low in Marin County compared to other parts of the NSO range; that combined with the many protected forested areas in the region likely explains the relatively stable NSO population here compared to other parts of their range. Monitoring NSO in Marin County during the breeding season is an essential component to evaluating their population health and ensuring that management activities do not negatively impact owls, including where management activities are slated to occur. Full report attached to this report as **Attachment B**, Northern Spotted Owl Monitoring on Marin County Parks and Marin Water Lands, 2025 Report.

IV. Visitor Intercept Surveys

The District will carry out visitor intercept surveys as set forth in **Attachment C**, E-Bike Trial Visitor Survey Questions" to gather information from watershed visitors about their experience on the watershed.

Methods: The in-person survey will be carried out at select locations along fire roads with busy to moderate use throughout the watershed. The District will utilize paper and digital survey forms to ensure visitors can easily and efficiently answer questions. All paper survey forms will be entered into the digital form to support data tracking and analysis. The survey platform Qualtrics will be used to support data analysis and reporting. The District will set up survey posts at five (5) locations for a two (2) hour period on one (1) busy weekday and one (1) weekend twice a month over a two month period between August-October of each year for a total of eight (8) survey days. Intercept surveys will be done twice over the E-Bike Trial Period and findings summarized in a report.

Task	Data Collection Schedule	Report Schedule
Intercept Survey 2025	August 1, 2025-October 31, 2026	February 12, 2026
Intercept Survey 2026	July 1, 2026-October 31, 2027	July 31, 2027

Year 1 Summary: During the fall of 2025, Marin Water conducted visitor survey as part of the E-Bike Trial Study, collecting 483 responses from watershed visitors. The survey reflected input from a highly engaged user base, with nearly two-thirds of respondents visiting the watershed at least weekly. Walking, hiking, and running were the most common recreational activities 80%, while 38% reported using standard bicycles, 15% reported using Class I E-bikes, and just 1% reported horseback riding. Overall, visitors expressed high levels of satisfaction with the condition of Marin Water's fire roads, reported frequent wildlife sightings, and described overwhelmingly positive interactions with other visitors and bicyclists, with 95% rating interactions with other visitors as good or great and 74% rating interactions with bicyclists as good or great. Respondents also indicated they feel very safe while using the watershed's fire roads, with 98% reporting they felt either slightly safe or very safe. Regarding shared use, 75% of respondents indicated they were either slightly or very comfortable sharing fire roads with Class I E-bike users, while approximately 23% expressed some level of discomfort. When asked whether Class I E-bikes should be considered bicycles and allowed on watershed fire roads, 76% of respondents answered yes, compared to 14% who opposed the change and 10% who were unsure. Collectively, the survey results indicate that visitors value the watershed's natural environment, appreciate the quality and safety of the fire road system, and generally support a positive shared-use recreational experience, including the use of Class I E-bikes on Marin Water fire roads.

V. Fire Road Early Detection Rapid Response

The District will continue its current practice of monitoring and documenting the current occurrence and spread of District identified priority invasive plant species along Fire Roads over the duration of the Revised E-Bike Trial Program.

Methods: The Early Detection Rapid Response (EDRR) program includes conducting regular surveys of those 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. The surveys are performed by trained surveyors, including District staff, contractors/consultants and volunteers. A database of all EDRR populations is maintained and used to facilitate follow-up visits and stewardship actions. This protocol focuses on the early detection of incipient patches of weeds to prevent the establishment of new, entrenched infestations. The District will carry out EDDR surveys along fire roads to gather data on priority invasive species. Survey results will be summarized in a technical memo at the end of the E-Bike Trial Period.

Task	Survey Schedule	Report Schedule
EDRR Survey 2025	July 1, 2025-August 30, 2025	September 30, 2025
EDRR Survey 2026	March 1, 2026-August 30, 2027	October 31, 2027

Year 1 Summary: Early Detection-Rapid Response (EDRR) invasive plant surveys were completed on 20 miles of select fire roads during the first year. Surveys were conducted on foot over four days in mid-summer (July 22 and 23, 2025 August 4 and 5, 2025), when priority species were likely to be in bloom and identifiable. All observations of priority invasive plant species were documented using CalFlora's Observer Pro app for mobile devices.2 Small populations of priority weeds that could be treated in 5 minutes or less were removed by hand, and all biomass removed from the site.

While some priority 1 weed populations were found, most weed populations observed were of priority 2 or 3 species. Notable concentrations of multiple weed species and populations are found around the Marin County Fire station, the filter plant, and Peters Dam. Due to the position at the entrance to the fire road network, populations near the fire station may pose an increased risk of dispersal as an unintended consequence of firefighting activity or road maintenance. A similar dynamic may be at play near the filter plant, which is periodically visited by large vehicles. Lastly, frequent public access to trails around Peters Dam may simultaneously contribute to the increased diversity and abundance of invasive species and pose a risk of spreading propagules to new locations. Common velvetgrass was by far the most widespread and abundant species,

frequently occurring in large populations in wet seeps, fields, riparian areas, and ruderal areas. Many populations of panic veldtgrass, pampas grass, and tall reed fescue were also quite large and dense. The treatment of some smaller, isolated occurrences of these highly invasive species may be warranted to prevent local population growth to an unmanageable level in the future. Most other species were observed in limited numbers and moderate patch sizes. The full memorandum is provided as **Attachment D**, Early Detection Rapid Response Invasive Species Surveys 2025.

VI. Enhanced Signage

The District will establish an improved method of incident reporting, which will include additional signage at the trailhead kiosk at primary entrances that provides information on ways to report incidents.

Methods: Incident reporting signage will be installed at Sky Oaks Pay Station, Lake Lagunitas Parking Lot, Natalie Coffin Green, Deer Park, Rock Springs, Bon Tempe Parking Lot, Rock Springs, Azalea Hill Parking Lot.

Task	Installation Schedule	Report Schedule
Enhanced Signage	July 1, 2025	July 31, 2027

Year 1 Summary: During the first year of the E-Bike Class I Trial Program, the District implemented the enhanced incident reporting process identified in the implementation plan, including installation of fifteen (15) incident reporting signs at primary watershed trailheads. Between July 1, 2025, and June 30, 2026, the District received a total of 21 public submissions related to the Trial Program. The table below summarizes the primary themes identified in those submissions. All public submissions were documented and reviewed as part of the District's ongoing monitoring and evaluation of the Trial Program.

Theme of Public Submission	**Number of Submissions**
Safety-related concerns	14
Trail conditions	1
Regulations, signage, or implementation	4
Positive feedback	2
Total Public Submissions	**21**

Examples of Incident reporting signage (Cerkel 2026)

VII. Watershed Bat Study

Consistent with the E-Bike Class I Trial Program implementation plan, the District initiated a two-year bat monitoring study in June 2025 to evaluate bat activity within the Mt. Tamalpais watershed. The Year 1 study was completed in spring 2026 and included acoustic monitoring at eight monitoring stations distributed throughout the watershed. Monitoring locations were selected to evaluate bat activity in areas adjacent to both high-use and low-use fire roads, as well as remote locations removed from road influences. Acoustic surveys were conducted seasonally between June 2025 and May 2026.

A summary of the Year 1 monitoring methods, findings, and preliminary observations is provided in **Attachment E**, Mt. Tamalpais Bat Monitoring: Year 1, Summer 2025–Spring 2026.

Task	Data Collection Schedule	Report Schedule
Bat Survey 2025	July, fall, winter and spring	July 2026
Bat Survey 2026	July, fall, winter and spring	August 2027

Year 1 Summary (Summer 2025 – Spring 2026): Monitoring conducted across four seasonal survey periods between summer 2025 and spring 2026 recorded approximately 31,000 bat call files and documented 15 bat species, including seven special-status species. Of the total call files recorded, 16,424 could be confidently identified to the species level. Table 3 summarizes species detections by season, while

Figure 4 presents activity intervals (five-minute periods during which at least one call for a given species was detected), which serve as an index of seasonal bat activity. The total number of activity intervals recorded per monitoring season was relatively consistent, ranging from 393 to 490.

Common Name (*Scientific Name*)[1]	Status[2]	Proportion of recorded call files (number of call files)[3]				
		Total	Season			
			Summer 2025	Fall 2025	Winter 2026	Spring 2026
California myotis (*Myotis californicus*)	--	59% (9,680)	40.0% (2,187)	56.9% (1,514)	73.0% (1,695)	71.6% (4,284)
Mexican free-tailed bat (*Tadarida brasiliensis*)	--	22% (3,590)	39.3% (2,148)	14.9% (397)	9.9% (229)	13.6% (816)
Big brown bat (*Eptesicus fuscus*)	--	4% (698)	9.0% (493)	3.2% (85)	0.6% (14)	1.8% (106)
Silver-haired bat (*Lasionycteris noctivagans*)	--	3% (411)	4.6% (252)	2.7% (71)	0.7% (16)	1.2% (72)
Yuma myotis (*Myotis yumanensis*)	BLM: Sensitive	2% (407)	1.2% (68)	4.7% (126)	3.7% (87)	2.1% (126)
Hoary bat (*Lasiurus cinereus*)	--	2% (375)	0.6% (31)	2.9% (76)	1.0% (24)	4.1% (244)
Western red bat (*Lasiurus frantzii*)	CDFW: Species of Special Concern	2% (354)	1.0% (56)	3.1% (83)	5.1% (118)	1.6% (97)
Fringed myotis (*Myotis thysanodes*)	BLM: Sensitive; FSS: Forest Service Sensitive	2% (258)	0.9% (50)	3.3% (89)	2.6% (60)	1.0% (59)
Townsend's big-eared bat (*Corynorhinus townsendii*)	CDFW: Species of Special Concern; BLM: Sensitive; USFS: Sensitive	1% (158)	0.8% (46)	3.0% (79)	0.7% (17)	0.3% (16)
Canyon bat (*Parastrellus hesperus*)	--	1% (114)	0.2% (10)	2.1% (57)	1.2% (29)	0.3% (18)
Little brown bat (*Myotis lucifugus*)	--[6]	1% (109)	0.8% (43)	1.1% (28)	0.4% (9)	0.5% (29)
Western small-footed bat (*Myotis ciliolabrum*)	BLM: Sensitive	1% (92)	0.4% (21)	0.5% (14)	0.1% (3)	0.9% (54)
Long-eared myotis (*Myotis evotis*)	BLM: Sensitive	1% (85)	0.4% (21)	1.0% (27)	0.7% (17)	0.3% (20)
Pallid bat (*Antrozous pallidus*)	CDFW: Species of Special Concern; BLM: Sensitive; USFS: Sensitive	0.4% (59)	0.5% (27)	0.4% (10)	0.0% (1)	0.4% (21)
Long-legged myotis (*Myotis volans*)	--	0.2% (34)	0.2% (9)	0.2% (4)	0.1% (2)	0.3% (19)

Condensed Bat Species Documented in Year 1 (Table 3 Mt. Tamalpais Bat Monitoring Year Summer 2025–Spring 2026)

VIII. Stakeholder Meeting Schedule

During the reporting period, the District met quarterly with stakeholder representatives, including MCL, Marin CNPS, Marin Audubon, MCBC, Access4Bikes (A4B), and E-Bike Access, to share updates on Trial Program activities and the protection of watershed natural resources and to receive feedback on the Revised E-Bike Trial Program.

June 19, 2025	September 23, 2025	February 25, 2026	July 29, 2026	October 14, 2026	January 14, 2027	April 15, 2027	July 31, 2027
Meeting 1 *Complete*	Meeting 2 *Complete*	Meeting 3 *Complete*	Meeting 4 Scheduled	Meeting 5	Meeting 6	Meeting 7	Meeting 8

Attachment A

Eco-Counter Multi-modal Trail Counter Data - Year 1

Eco-Counter Multi-modal Trail Counter Data - Year 1

Carly Blanchard

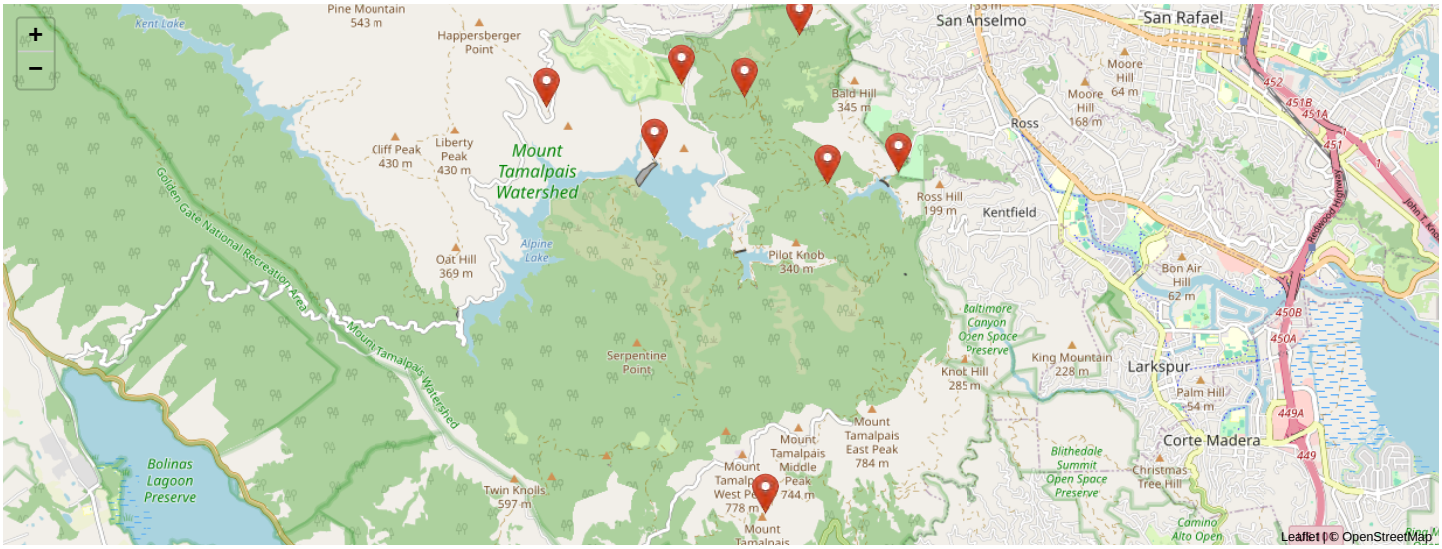
07/22/2026

Mt. Tamalpais Watershed Multi-Modal Trail Counters Annual Report

Marin Municipal Water District

July 1, 2025 → July 1, 2026

Eco-Counter Site Map



Annual Total All Users

date_range 07/01/2025 → 07/01/2026

Total

639,663

Pedestrian Peak Day

date_range 07/01/2025 → 07/01/2026

Peak Day

Sunday
Oct 12, 2025

5,819

Cyclist Peak Day

date_range 07/01/2025 → 07/01/2026

Peak Day

Sunday
Nov 9, 2025

1,113

Pedestrian and Cyclist Peak D...

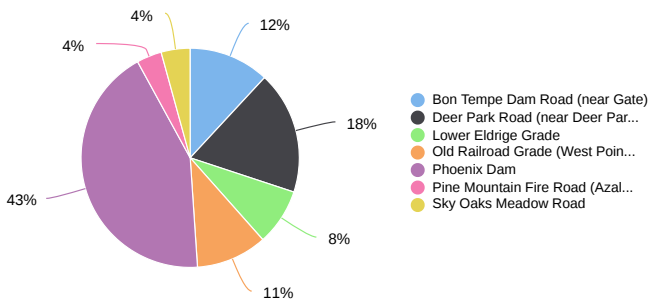
date_range 07/01/2025 → 07/01/2026

Peak Day

Sunday
Oct 12, 2025

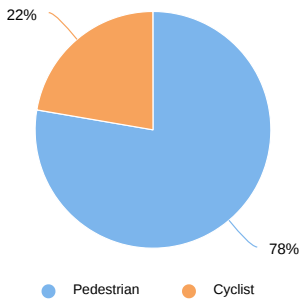
6,563

All Site Distribution



Average Annual Trail Use by User Type

date_range 07/01/2025 → 07/01/2026



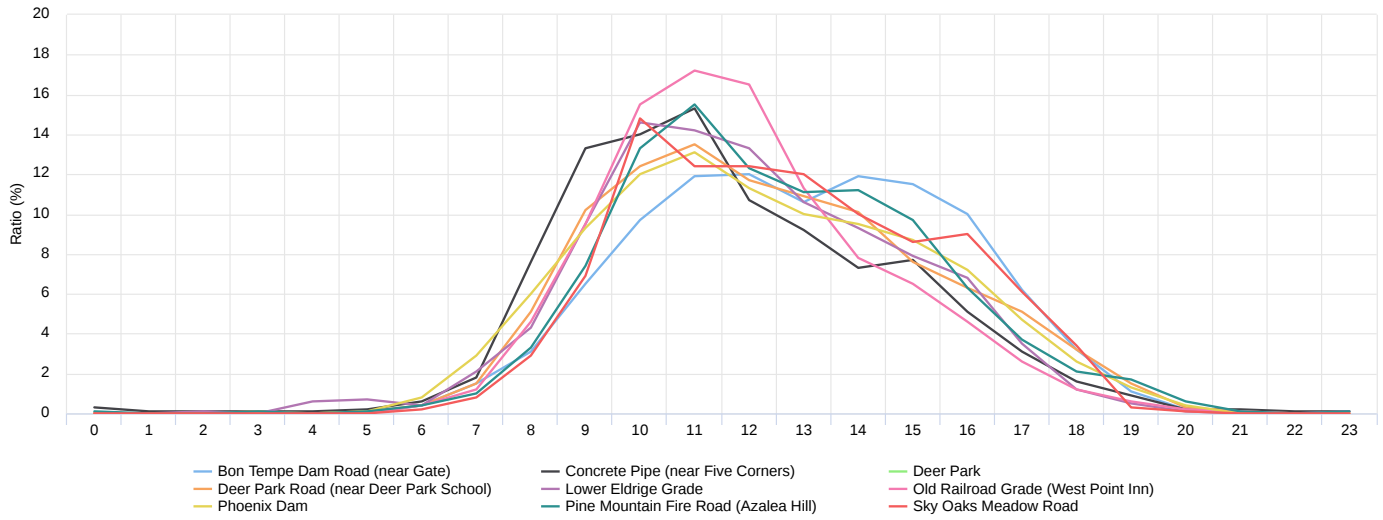
Mt. Tamalpais Watershed Multi-Modal Trail Counters Annual Report

Marin Municipal Water District

July 1, 2025 → July 1, 2026

Hourly Profile - Weekend

date_range 07/01/2025 → 07/01/2026



Hourly Profile - Weekdays

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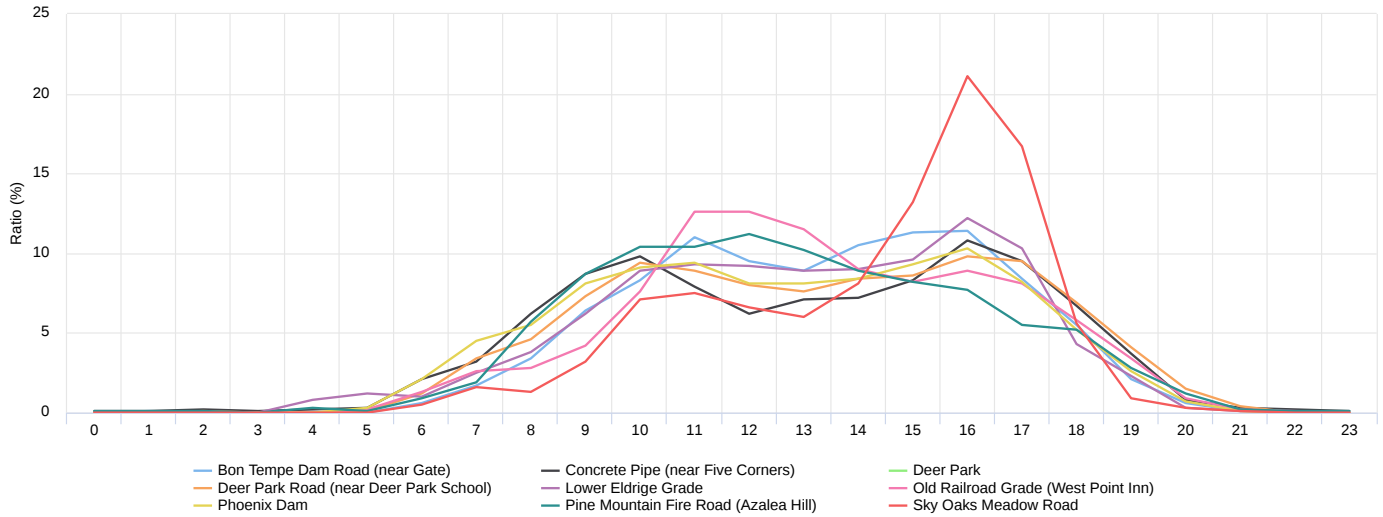
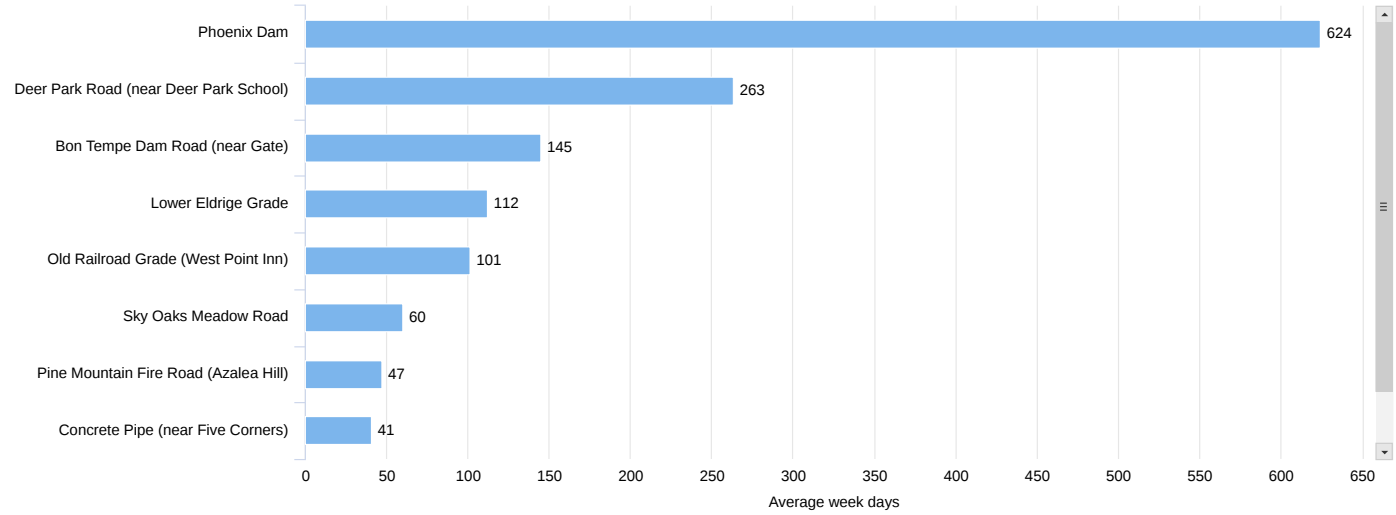


Mt. Tamalpais Watershed Multi-Modal Trail Counters Annual Report

Marin Municipal Water District

July 1, 2025 → July 1, 2026

Average Annual Trail Use Weekdays



Average Annual Trail Use Weekends

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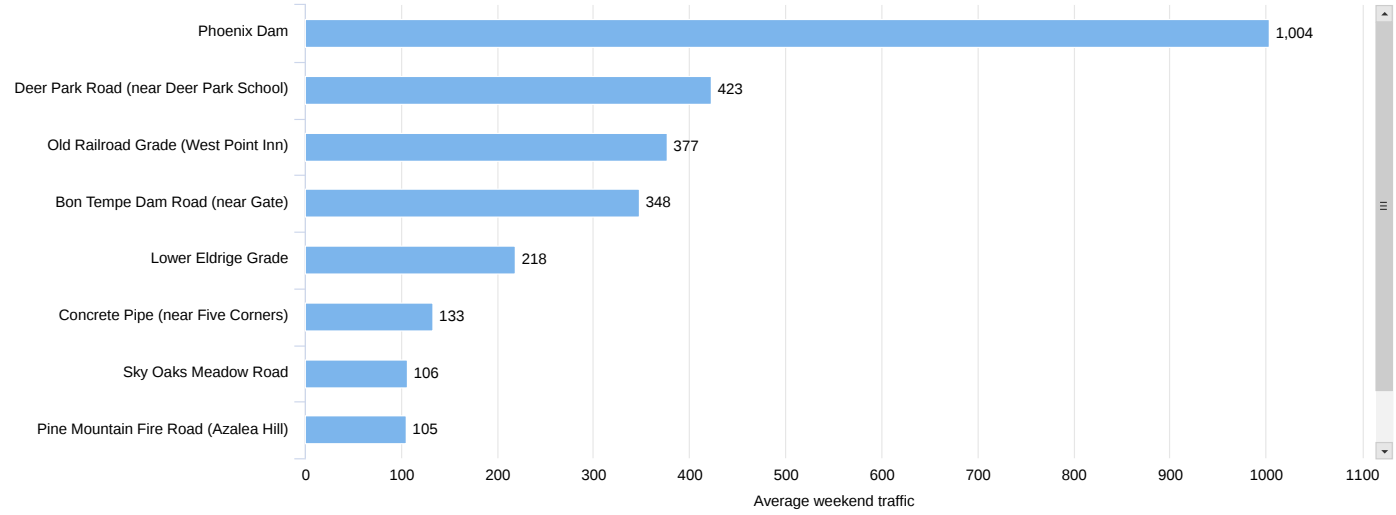


Mt. Tamalpais Watershed Multi-Modal Trail Counters Annual Report

Marin Municipal Water District

July 1, 2025 → July 1, 2026

Key Figures For All Sites - Cyclist

date_range 07/01/2025 → 07/01/2026

Site	Total	Daily Average	Peak Day	Peak Count	Peak day of the week
Deer Park Road (near Deer Park School) Cyclist	41,140	112	Sun Nov 9, 2025	416	Sunday
Phoenix Dam Cyclist	28,809	79	Sun Oct 19, 2025	219	Sunday
Lower Eldrige Grade Cyclist	28,416	88	Sun Nov 9, 2025	289	Sunday
Old Railroad Grade (West Point Inn) Cyclist	18,560	52	Sat Aug 9, 2025	220	Sunday
Concrete Pipe (near Five Corners) Cyclist	8,337	23	Sun Oct 19, 2025	85	Sunday
Bon Tempe Dam Road (near Gate) Cyclist	7,548	21	Sun Oct 19, 2025	72	Sunday
Pine Mountain Fire Road (Azalea Hill) Cyclist	6,332	17	Thu Nov 27, 2025	200	Sunday
Sky Oaks Meadow Road Cyclist	3,479	10	Sat May 30, 2026	58	Sunday
Deer Park Cyclist					

Mt. Tamalpais Watershed Multi-Modal Trail Counters Annual Report

Marin Municipal Water District

July 1, 2025 → July 1, 2026

Key Figures For All Sites - Pedestrians

date_range 07/01/2025 → 07/01/2026

Site	Total	Daily Average	Peak Day	Peak Count	Peak day of the week
Phoenix Dam Pedestrian	239,067	653	Sun May 10, 2026	1,296	Sunday
Deer Park Road (near Deer Park School) Pedestrian	71,717	196	Thu Jun 11, 2026	382	Sunday
Bon Tempe Dam Road (near Gate) Pedestrian	66,775	182	Sat May 30, 2026	1,141	Saturday
Old Railroad Grade (West Point Inn) Pedestrian	45,560	127	Sun Oct 12, 2025	3,729	Sunday
Sky Oaks Meadow Road Pedestrian	23,210	63	Fri Jun 5, 2026	616	Sunday
Lower Eldrige Grade Pedestrian	17,534	54	Sun Mar 8, 2026	137	Sunday
Pine Mountain Fire Road (Azalea Hill) Pedestrian	16,897	46	Sat Mar 21, 2026	301	Saturday
Concrete Pipe (near Five Corners) Pedestrian	16,282	44	Sun Oct 19, 2025	212	Sunday
Deer Park Pedestrian					

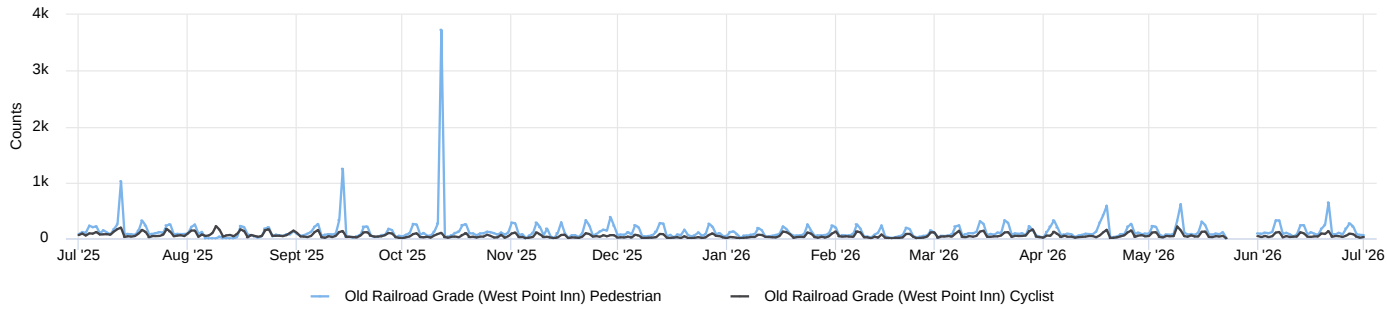
Mt. Tamalpais Watershed Multi-Modal Trail Counters Annual Report

Marin Municipal Water District

July 1, 2025 → July 1, 2026

West Point Inn Daily Counts by User Type

date_range 07/01/2025 → 07/01/2026

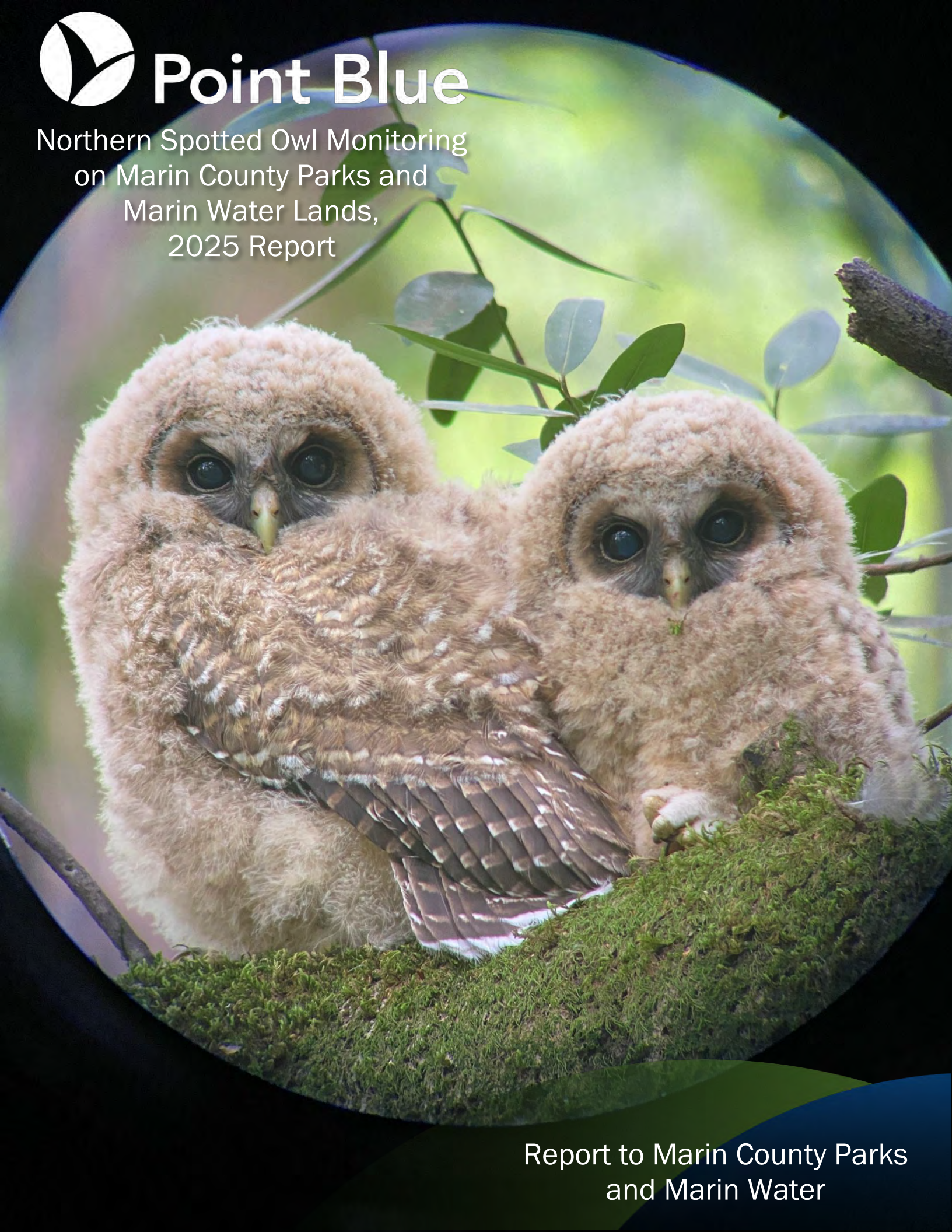


Attachment B

Northern Spotted Owl Monitoring on Marin County Parks and Marin Water Lands, 2025 Report

Point Blue

Northern Spotted Owl Monitoring on Marin County Parks and Marin Water Lands, 2025 Report



Report to Marin County Parks and Marin Water

Northern Spotted Owl Monitoring on Marin County Parks and Marin Water Lands, 2025 Report

Report prepared for Marin County Parks and Marin Water

December 2025

Prepared by

Point Blue Conservation Science
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Kristen E. Dybala

Suggested citation:
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*Corresponding author: rcormier@pointblue.org

Cover Photo: Northern Spotted Owl (*Strix occidentalis caurina*) fledglings in Marin County by Maggie Brown.

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INTRODUCTION

The Northern Spotted Owl (NSO; *Strix occidentalis caurina*), is one of three subspecies of the Spotted Owl. Its historic range extends from southern British Columbia to Marin County, California, though it is now extirpated or very uncommon in BC and parts of Washington (USFWS 2025). It is a year-round resident found primarily in older, coniferous forests. The NSO was listed by the U.S. Fish and Wildlife Service (USFWS) as a federally threatened subspecies in 1990, with declines mostly attributed to habitat loss. Due to continued declines (Forsman et al. 2011, Dugger et al. 2016), the NSO was also approved for listing as threatened under California's State Endangered Species Act in 2016. The USFWS identifies the incursion of the Barred Owl (*Strix varia*) as the current stressor with the largest negative impact on NSOs (USFWS 2025). The historic range of the Barred Owl was once limited to the forests of eastern North America, but after a range expansion westward that now includes the entire range of the NSO, their presence has caused displacement of NSOs, competition with NSOs for space and food, and negative impacts on NSO demographics (Gutiérrez et al. 2007, USFWS 2011, Wiens et al. 2014, Franklin et al. 2021).

In Marin County, NSOs are currently most vulnerable to the threats of climate change, competition with Barred Owls, and high-severity wildfire (Cormier et al. 2024). An increase in extreme temperatures and weather events as a result of climate change could have direct and indirect impacts on NSO demographics (i.e. survival, recruitment, fecundity), habitat quality, and prey populations (Dugger et al. 2016, Franklin et al. 2000). Unlike other parts of their range, NSOs in Marin County are not impacted by commercial tree harvesting operations, but other potential threats to their habitat include urban development and high-severity wildfire. The risk of high-severity wildfire, which may be exacerbated by climate change, threatens NSOs by significantly altering forest structure and composition, thus limiting the availability of suitable NSO habitat and prey (Hysen et al. 2023). In addition, while the invasion of Barred Owls in Marin County has not yet reached the high densities documented in other parts of the NSO range (Jennings et al. 2011, Cormier et al. 2023, Hobart et al. 2025), an increase in Barred Owl numbers would pose a serious threat to the stability of the NSO population in Marin through competition and displacement (e.g., Franklin et al. 2021, Wiens et al. 2021). Other stressors to NSOs in Marin County include noise and/or other disturbance by humans (e.g., construction, landscaping noise, traffic), rodenticide poisoning, disease, vehicle strikes, and genetic isolation (Barrowclough et al. 2005, Stralberg et al. 2009, Ganey et al. 2017, Cormier et al. 2024). Sudden Oak Death (*Phytophthora ramorum*) may also impact NSOs by changing forest structure and food availability; the dusky-footed woodrat (*Neotoma fuscipes*), a primary prey of the NSO in Marin County, depends on oaks for food and shelter, and their abundance has been found to be negatively correlated with Sudden Oak Death (Swei et al. 2011).

Since 1997, biologists from Point Blue Conservation Science (hereafter Point Blue) have been monitoring NSOs in Marin County. Marin County Parks (MCP) and Marin Water have contracted Point Blue to survey NSOs annually since 1999. Surveys are primarily on Marin Water and MCP lands, but can also include sites on nearby private, municipal, state, and national park lands, because protections for NSOs may extend beyond land ownership boundaries. The purpose of these surveys is (1) to monitor the population for trends in occupancy and reproductive success over time and (2) to determine occupancy and nesting status at sites where proposed management activities may occur, so that disturbance to NSOs is avoided.

In 2025, Point Blue biologists continued to monitor occupancy, nesting, and reproductive status for known NSO sites (i.e., sites that have been surveyed in the past and that have had resident pairs of NSO) on MCP, Marin Water, and nearby lands. We also conducted inventory surveys at sites that have not been previously surveyed or have been surveyed in prior years but were not determined to be occupied by NSO pairs. Here, we report on the results for occupancy, nesting status, and reproductive status of all sites surveyed on Marin Water, MCP, and nearby lands in 2025.

METHODS

Study sites

In 2025, we surveyed a total of 58 survey areas: 51 known sites, 1 new incidental site (a NSO pair was detected in an area not planned for surveys), and 6 inventory areas on or adjacent to MCP or Marin Water lands in Marin County. In this report, a “known site” includes sites that have been occupied by a pair of NSOs in at least one previous year. Inventory surveys are conducted in areas with proposed management activities that are in or near potential NSO habitat, or where the land manager had an interest in knowing the status of NSOs in an area that had not been previously classified as being occupied by a NSO pair. The inventory area surveyed for MCP in 2025 was surveyed previously from 2018 - 2019 and in 2024, two new areas were surveyed for Marin Water, and the other three inventory areas surveyed for Marin Water in 2025 were surveyed previously in 2000 only, 2010 and 2024 only, and since 2018, respectively.

Because NSO are sensitive to disturbance, we do not present specific site names or location information in this report. Instead, results from each NSO site are provided to Marin Water and MCP (as well as to USFWS and California Department of Fish and Wildlife [CDFW]) in supplemental tables to this report, and in annual Geographic Information System (GIS) files.

Data Collection

At all known sites and inventory areas, we assessed occupancy (if owls were present and resident/territorial), nesting status (nesting versus non-nesting since not all pairs nest every year), and reproductive status (number of young produced); see Status Designations below for more details. For every survey, we completed a site search form (including weather, survey times, owl detection information, and a detailed narrative) and a map showing the search area and location(s) of any owl(s) detected, including non-NSO owl species. For each site and inventory area, we completed a status form detailing occupancy, nesting, and reproductive outcome for the year, age of owls detected, and supporting information. For every site or inventory area with a detection of a NSO, we determined the activity center for the year. An activity center is the best-known location to represent each NSO site in a given year (e.g., nest tree, roost location; CDFW 2019). For every known nest tree, we collected vegetation measurements of the tree and the surrounding area. Annual status data, including spatial information, are submitted to MCP and Marin Water. Data are also submitted to the CDFW's California Natural Diversity Database by National Park Service (NPS) staff after Point Blue and NPS data have been merged into one county-wide database. NPS conducts independent surveys from Point Blue, including at Point Reyes National Seashore, Golden Gate National Recreation Area, Muir Woods National Monument, Mount Tamalpais State Park, and Samuel P. Taylor State Park (Ellis 2020).

Status Designations

Occupancy refers to whether an owl is detected or not at a given site or inventory area. Occupancy surveys in 2025 followed the USFWS protocol (USFWS 2012) to determine whether owl(s) were present. For sites where owl(s) were detected at least once in 2025 (occupied), we determined residency status – whether owls were territorial – based on Marin and USFWS protocols (Press et al. 2010, USFWS 2012). For sites or inventory areas where NSOs were not detected early in the season, we added 5 minutes of Barred Owl playback to our 10-minute NSO nighttime calling stations on the fifth and sixth visits to determine if Barred Owls may be present (USFWS 2012). There are slight differences between the Marin and USFWS protocols, and results from the Marin Protocol are presented in this report including in figures; however, occupancy status differences between the two protocols are noted below. Occupancy categories are summarized as follows (for more details see Press et al. 2010, and USFWS 2012):

- Territorial Pair (hereafter, Pair) = male and female heard in close proximity and/or nesting is confirmed (male and female detections must be on the same visit for the USFWS protocol, and for the Marin protocol detections must occur on at least one daytime or two nighttime occasions, but not necessarily on the same visit);

- Resident Single = response by a single owl on three or more occasions in the same year or over subsequent years, with no response by an owl of the opposite sex (same definition for both protocols);
- Two Birds/Pair Status Unknown ("Pair Unknown") = male and female detected but pair status not confirmed (i.e., does not meet the above criteria for Pair) and at least one owl meets Resident Single requirements (same definition for both protocols);
- Single Unknown = a single owl is detected but does not meet the above criteria for Resident Single (this category is specific to the Marin protocol and not part of USFWS protocol; in the USFWS protocol, these sites would be classified as Unknown);
- Unknown = male and/or female detected but did not meet the criteria above for other occupancy designations; in the USFWS protocol, this category includes the Single Unknown classifications from the Marin protocol (above).
- Unoccupied = a site is considered unoccupied after 2 years of surveys consisting of 6 nighttime visits each year with no NSO response (USFWS 2012). However, for sites surveyed for disturbance-only management projects (e.g., no planned habitat modification), 6 visits with no response in one year is sufficient, and the management action can take place until the start of the next breeding season, but the site is still officially classified as "Unknown" until after a second year with no detections (USFWS 2012). A minimum of three nighttime visits per year over two consecutive years with no NSO detections is required to designate a site unoccupied in the Marin protocol (Press et al. 2011). For Point Blue occupancy surveys, we follow the updated USFWS protocol (2012) to determine that a site is unoccupied, since the additional visits required by that protocol account for reduced NSO detectability if Barred Owl(s) are present.

Occupancy

Occupancy is presented from 1999 to 2025 as the percentage of sites with each status: Pair, Resident Single, Unknown Combined (includes sites with Pair Unknown, Single Unknown, and Unknown status), or Unoccupied (based on a two-year survey with a minimum of three visits per year). Because not all sites have been surveyed each year, and because in some years we surveyed more areas where pairs are less likely to occur (e.g., inventory surveys in marginal habitat), only sites that met Pair status at least once (this year or historically) are included in the occupancy breakdown. To check whether the proportion of sites occupied by pairs in 2025 was statistically different from previous years (1999-2024), we fit a logistic regression with year group as a predictor and the number of sites surveyed as weights (to account for the different number of sites surveyed each year).

Nesting Status

For occupied sites, we used the Marin protocol to determine nesting and reproductive status, and whenever possible we attempted to gather nesting and reproductive information without the use of mice (Press et al. 2010). The Marin protocol attempts to minimize "mousing" owls to avoid habituating them to being fed, since the owls in Marin County are often in close proximity to humans, residential areas, and heavily used trails and roads.

To compare nesting status for sites with pairs from 1999 to 2025, we determined the percentage of pairs that nested successfully, had a failed nest, had a nest with unknown outcome, were non-nesting, or where nesting status was unknown, per the Marin Protocol (Press et al. 2010). Nesting status was usually the same between Marin and USFWS protocols. However, there are two common scenarios when status designations differed between the two protocols: 1) for nests suspected as failed, the USFWS protocol requires mousing mature NSO(s) to confirm they do not have young, and the Marin protocol only includes mousing to confirm a nest failure in specific situations, and 2) to confirm a pair is non-nesting without the use of mice, the USFWS protocol requires watching the female roost (not on a nest) on two occasions in April, with the two visits separated by 3 weeks, while the Marin protocol requires watching a female roost on one visit anytime between April 15 and May 1; these mostly-overlapping periods are both when nesting females would be incubating eggs or brooding small young except that not all Marin nests have been initiated by the first few days of April, so the first of the two USFWS roost watches is never used as sole evidence of non-nesting (see protocols for more detail, Press et al. 2010 and USFWS 2012). To check whether the proportion of sites with owls that attempted nesting and the proportion of nest attempts that were successful in 2025 were statistically different from all prior years, we fit a logistic regression with year group as a predictor and the number of sites surveyed as weights (to account for the different number of sites surveyed each year). We used data from 1999-2024 for the proportion of pairs that attempted nesting and 2000-2024 for the proportion of pairs with successful nests out of those that were confirmed to attempt nesting, excluding 1999 due to a high proportion of nests with unknown outcomes.

Fecundity

Fecundity is a productivity measure commonly used with NSO data that can be compared across studies (e.g., Franklin et al. 2021); it is defined here as the total number of female young produced per territorial female. Fecundity was calculated by dividing the total number of young that fledged by 2 (assuming a 1:1 sex ratio of young) and then dividing that number by the total number of territorial females (paired and resident single females). We calculated fecundity from 2000 to 2025, excluding 1999 when a large proportion of nesting pairs had unknown nesting outcomes.

To evaluate the trend over time, we used Poisson regression to describe any relationship between the number of young produced offset by the log number of females and year, such that the slope (β) of the line represented the change in fecundity. We used $\alpha = 0.05$ to evaluate if the slope was statistically different from zero for this and other statistical tests described above.

Autonomous Recording Units (ARUs)

Passive acoustic monitoring using autonomous recording units (ARUs) has been adopted in certain study areas throughout the range of the NSO and has proven effective for detecting NSOs and Barred Owls, as well as estimating population trends (Duchac et al. 2020, Lesmeister et al. 2021). While there are limitations to the information they can provide, we are interested in the potential use of ARUs to complement our current NSO surveys in Marin. In a pilot effort, we deployed 10 AudioMoth ARUs in 2025 at sites we monitor on MCP and Marin Water lands to assess the utility of passive acoustic monitoring for confirming occupancy status at known NSO sites or to help detect Barred Owls in areas where they had been reported but not confirmed by surveys.

Wildlife Rehabilitation

Due to the regular occurrence (typically 1-5 individuals per year) of NSOs in Marin County being taken to the local wildlife rehabilitation center (WildCare in San Rafael) by members of the public, we present the number of NSO collected since the last report (9 December 2024 through 9 December 2025) from Marin Water or MCP lands. If NSOs are collected from Marin Water or MCP lands, Point Blue communicates to the agency staff as soon as possible after we are notified. Point Blue works with WildCare personnel to band NSO before release whenever feasible, if individuals are releasable and have fully grown legs.

Permit Requirements

Activities presented in this report were conducted under USFWS Native Endangered & Threatened Species Recovery permit ES807078-20, and under a Memorandum of Understanding with CDFW that is connected to Point Blue's scientific collecting permit S-193120001-18312-001. For reporting requirements of our permits, we also present the number of birds banded this year, planned future activities, and report any incidental take. Supplemental information will also be provided to CDFW and USFWS, including a map of activity centers, and coordinates for each owl detection in 2025.

Personnel

All 2025 surveys were conducted from March through August by Point Blue personnel trained in NSO survey protocols: Margaret Brown, Renée Cormier, Oulana Dobrin, and Asher Leeming.

RESULTS

Occupancy at Inventory Areas

NSO were detected on at least one occasion at three of the six inventory areas surveyed in 2025. At one inventory area surveyed for Marin Water, a NSO of unknown sex was detected on only one occasion in 2025 and therefore classified as Unknown by the USFWS protocol and Single Unknown by the Marin protocol. Similarly, at a new inventory area surveyed for Marin Water, a male NSO was detected on only one occasion in 2025 and therefore also classified as Unknown by the USFWS protocol and Single Unknown by the Marin protocol. At another inventory area surveyed for Marin Water, a male NSO was detected on multiple visits with no response from NSO of the opposite sex, meeting requirements for Resident Single status by the USFWS and Marin protocols. For the remaining two inventory areas on Marin Water land and the only inventory area on MCP land, we conducted 6 nighttime visits at each in 2025 and did not detect any NSO.

Occupancy at Known Sites

Of the 52 non-inventory sites surveyed in 2025, 40 (77%) were occupied by pairs, 3 (6%) by a Resident Single, 8 (15%) were Unknown, and 1 (2%) was classified as Unoccupied by the Marin and USFWS protocols after four consecutive years of no NSO detections. The percentage of sites occupied by pairs in 2025 (77%) was below the 1999-2024 study average (90%) and statistically different from previous years (logistic regression coefficient = -1.039; SE = 0.350; P-value = 0.003); Figure 1).

Nesting and Reproduction

Of the 40 sites that were occupied by pairs in 2025, 17 (43%) were known to attempt nesting, which is below the 1999-2024 study average (62%), and this difference was statistically significant (logistic regression coefficient = -0.764; SE = 0.329; P-value = 0.020; Figure 2). Thirteen (76%) of 17 nests were successful (i.e., produced at least one fledgling), which is slightly below the 2000-2024 study average (78%) but not statistically significant (logistic regression coefficient = -0.083; SE = 0.384; P-value = 0.829; Figure 2). Fecundity was 0.28 in 2025, which is below the 2000-2024 study average (0.40; Figure 3). The estimated trend in fecundity over time is slightly negative, but not statistically significantly different from zero (Poisson regression coefficient = -0.008; SE = 0.006; P-value = 0.143).

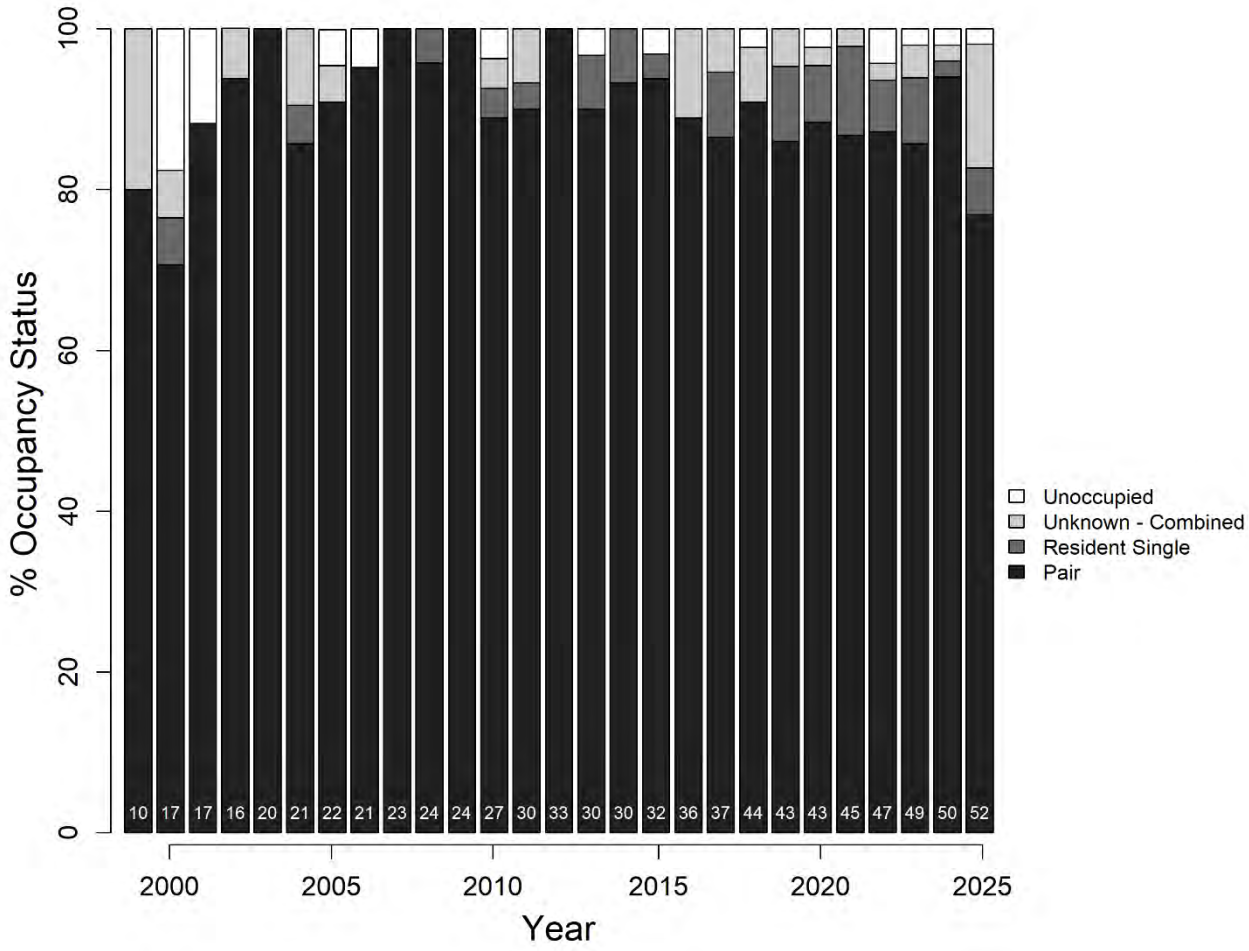

Figure 1. Northern Spotted Owl occupancy status for sites surveyed by Point Blue Conservation Science in Marin County (1999 to 2025). Because not all sites have been surveyed each year, and because in some years we survey more areas where pairs are less likely to occur, only sites that have been occupied by a pair at least once during the study period, including the current year, are included. Sample size for each year is shown at the base of each bar. The *Unknown - Combined* category includes sites classified as Pair Unknown, Single Unknown, and Unknown (see methods for detail).

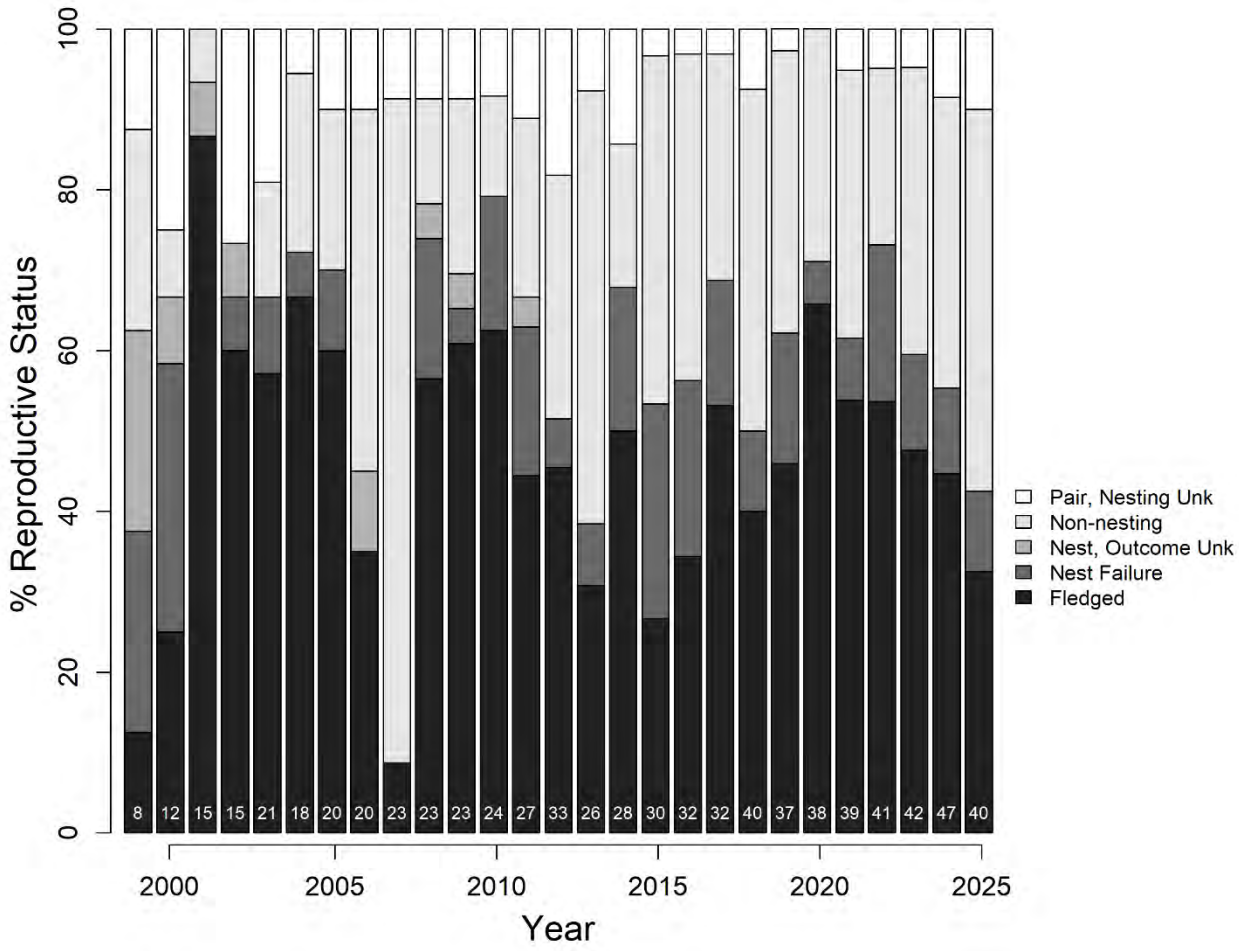

Figure 2. Nesting and reproductive status for Northern Spotted Owl pairs surveyed by Point Blue Conservation Science in Marin County (1999 to 2025). Sample size for each year is shown at the base of each bar. The three darkest shades of black and/or gray of the five colors represent the proportion of pairs with confirmed nesting attempts.

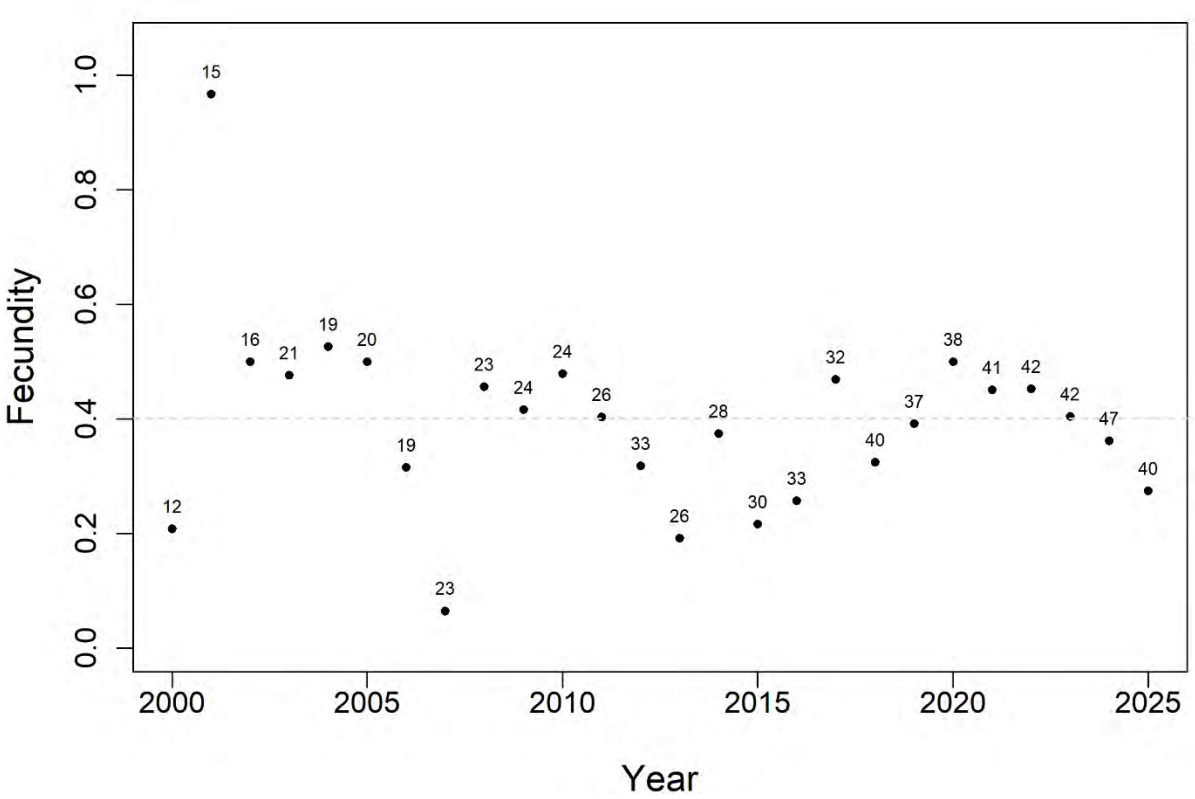

Figure 3. Annual fecundity (number of female young produced per territorial female) for Northern Spotted Owls as a function of year (2000-2025), monitored by Point Blue Conservation Science in Marin County. Annual sample size of territorial females is shown above each annual data point. The dashed line represents the 2000-2024 study average.

Autonomous Recording Units (ARUs)

We deployed 4 AudioMoth ARUs at sites on MCP lands and 6 at sites on Marin Water lands. ARUs were deployed for a range of 13-27 days and programmed to collect data for 10 hours every night. The ARUs collected data over a range of only 2-7 days, likely due to battery capacity limitations. Preliminary analysis has indicated that ARU results are in agreement with NSO results from our surveys (i.e., detected presence of NSO(s) where standard surveys also detected NSO(s)). Analysis is ongoing, but from preliminary analysis on a subset of the units, we did not confirm the presence of any Barred Owls.

Wildlife Rehabilitation

From 9 December 2024 through 9 December 2025, three NSO from Marin County locations were admitted to WildCare wildlife rehabilitation center; none were from Marin Water lands, one was from an MCP open space preserve, and the other two were from areas outside of MCP and Marin Water lands (WildCare, unpublished data). The NSO from MCP lands was a fledgling

found in August on the side of a trail in Corte Madera at one of the known NSO sites included in this report. The fledgling was taken to WildCare where it was euthanized due to severe trichomonosis and emaciation. Of the two NSO admitted to WildCare from areas outside of MCP and Marin Water lands, the first was a mature NSO found in early March at a residence in Ross (roughly 1 km from the nearest site we monitor); this NSO was very emaciated and died upon arrival. The other individual was an adult NSO found in November in San Rafael (about 2km from the nearest known NSO territory) and brought to WildCare with wet feathers and a large abscess; this NSO was also euthanized due to a poor prognosis.

Barred Owls

Three Barred Owls were detected on properties adjacent to MCP or Marin Water lands in 2025. In April, Point Blue biologists detected a pair of Barred Owls at a long-term NSO site on City of Mill Valley land. The pair was collected from this location in May as part of a research project led by the University of Wisconsin; objectives of this ongoing project are to study Barred Owl genetics, diet, and exposure to rodenticides, and to investigate how NSOs respond to Barred Owl removals (Hofstadter, unpublished data). In May, another Barred Owl was reported by a private landowner at a long-term NSO site adjacent to MCP land. This Barred Owl was also collected in May as part of the same research project. We know of at least five additional Barred Owls that were detected in Marin County in 2025 on both private and public lands, away from Marin Water and MCP lands (through 29 December); all five of those individuals were also collected (Hofstadter, unpublished data).

Recovery Permit Activities

This section details information required for Point Blue's USFWS Recovery Permit and our Memorandum of Understanding with CDFW (additional data will be submitted to the California Natural Diversity Database [CNDDB], per permit requirements of both agencies; and this report and components from it will also be submitted to the USFWS Recovery Office and CDFW Department Contacts).

Banding activities. In 2025, no NSO were banded under Point Blue's permits.

Planned future activities. We plan to conduct the same work in 2026 with some shifts in sites monitored based on agency needs, although most sites will remain the same.

Incidental Take. There was no incidental take under our permit in 2025.

Dead NSO collected. Four dead NSOs were found by Point Blue biologists, or by members of the public and transferred to Point Blue, in 2025. One dead NSO nestling was collected by Point

Blue personnel in May at the base of the nest tree at an MCP site in Novato (CNDDB site MRN0138) and submitted to CDFW for necropsy. Necropsy findings were consistent with a fall from the nest being the likely cause of death (K. Rogers, CDFW, pers. comm.). In July, a dead adult NSO was collected on the side of the road in Inverness by a member of the public and transferred to Point Blue personnel for submission to CDFW for necropsy. A few weeks later, in August, a second dead adult NSO was found headless on the side of the same road in Inverness by a Point Blue biologist and also submitted to CDFW for necropsy. Necropsy results revealed that both individuals exhibited multiple fractures, but further findings were limited due to the condition of the specimens as both had likely been struck by vehicles; results also indicated that both individuals were adult males in fair nutritional condition and overall appeared healthy aside from their injuries (K. Rogers, CDFW, pers. comm.). In December, a third adult NSO was found by a Point Blue biologist along the same road in Inverness and will be submitted to CDFW for necropsy in January 2026. All NSO remains have been or will be transferred to the California Academy of Sciences after necropsy by CDFW.

DISCUSSION

Occupancy. The proportion of sites occupied by pairs of NSO in 2025 was below the 1999-2024 study average, and this difference was statistically significant. Of the twelve known sites that did not meet pair status in 2025, four were sites at which two NSOs were detected throughout the season, but the detections did not meet the requirements to achieve Pair status by the Marin protocol (see Status Designations above for more details). It is possible that there were NSO pairs present at these sites and potentially less responsive during surveys due to certain factors, such as reduced territorial behavior from non-nesting individuals or the presence of Barred Owls suppressing NSO response (Crozier et al. 2006), especially since a Barred Owl pair was detected at one of these sites (see section on Barred Owls for more details). Several of the sites with 'Pair Unknown' status had confirmed male detections with a second individual that made calls that are not used to confirm sex; since territorial calls, such as the four-note location call, are more commonly given by male owls, it is possible that the females were present, but could not be confirmed under the current protocols due to their more frequent use of other 'non-sexable' call types. At two sites, this is the first year of surveys in which a pair was not detected; however, one of those sites has only been surveyed since 2024 so our knowledge of pair occupancy there is limited. The final six sites are those at which pairs have been detected in some but not all survey years; these sites may be of marginal quality (e.g., in habitat or landscape characteristics) for NSOs, and more likely to transition in and out of pair occupancy (Blakesley et al. 2005).

We detected NSO(s) on at least one occasion at three of six inventory areas we surveyed in 2025. Detections of NSOs in new survey areas can increase our understanding of the local

population, and the habitats and other landscape features associated with them. For one inventory area on Marin Water land, we detected a male NSO on multiple nighttime surveys with no detections of NSO of the opposite sex, indicating the presence of a single resident male at that location. For the other two inventory areas at which NSO were detected, both had only one nighttime detection each after a full season of surveys. We suspect that these could be detections of transient individuals, or potentially younger NSOs moving between territories. All of these detections highlight the importance of NSO surveys in areas with appropriate habitat where proposed management activities are planned, including in certain forest types not typically associated with NSOs in other parts of their range. In some cases, it can take more than one survey year to make precise occupancy determinations (e.g., not an Unknown status) at a site. Thus, when large management projects are planned, long-term or multiple-year data collection near the project area can help increase precision in early-season status determinations during the year of the management action because Spotted Owls are central place foragers (Rosenberg and McKelvey 1999) and can even reuse roosts and nests.

Nesting and Reproduction. The proportion of NSO pairs that attempted nesting in 2025 was below the study average and statistically different from previous years. The proportion of nest attempts that were successful was also below average, though not statistically different from prior years' data. Fecundity in 2025 (0.28) was below the study average (0.4) but we did not find a significant trend in fecundity over time. Northern Spotted Owls, including the Marin population, experience high variability from year-to-year in fecundity, and while 2025 was a below average year, it is not outside of the expected range of variability (Figure 3).
The likelihood of a successful nest and the number of young produced can depend on a variety of factors, including predator abundance, food availability (Courtney et al. 2004), weather (North et al. 2000, Olson et al. 2004), or a combination of these or other factors (Franklin et al. 2000, Rosenberg et al. 2003). In a previous broader NSO analysis, fecundity ranged from 0.306 to 0.560 depending on geographic region, and on the California coast – including Marin County and this monitoring program – it averaged 0.442 (Anthony et al. 2006). In a more recent analysis of many of the same study areas, excluding Marin County, Franklin et al. (2021) found fecundity to vary over time and to be negatively impacted by Barred Owls. Long-term monitoring of reproductive success can help to put a single bad or good year into context.

Autonomous Recording Units (ARUs). Ten ARUs were deployed on MCP and Marin Water lands in 2025 and preliminary findings were consistent with results from NSO surveys. From this pilot effort, we became familiar with the AudioMoth recording units, learned protocols for ARU deployment, and were able to troubleshoot issues that arose, such as limitations of certain battery types. ARUs may be a useful tool to complement our current NSO surveys to help meet protocol requirements for determining occupancy, especially at sites where NSOs are less

responsive to playback during surveys (e.g., if Barred Owls are present). Additionally, though we did not detect any Barred Owls with the ARUs we deployed this year, ARUs may also be useful for confirming Barred Owl presence in areas where they are reported but not yet confirmed by surveys.

While ARUs are effective at detecting NSOs and Barred Owls, there are limitations to the amount of information we can gather from these detections, such as higher-level information on nesting status, nest tree locations, and reproductive outcome. In order to estimate trends in reproductive success, and for time-sensitive management activities that require information on nesting and reproduction, active NSO monitoring remains necessary.

Wildlife Rehabilitation and Dead NSO. In 2025, three NSOs from Marin County locations were admitted to WildCare wildlife rehabilitation center (WildCare, unpublished data) and four dead NSOs were found by Point Blue biologists, or by members of the public and transferred to Point Blue. We include information on NSOs admitted for wildlife rehabilitation and dead NSOs in this report to highlight some of the stressors that NSOs face in Marin. For instance, three out of the four dead NSOs included in this report were found deceased along the same road in Inverness between July and December 2025, and were likely victims of vehicle strikes based on necropsy findings (K. Rogers, CDFW, pers. comm.). This indicates that there is a potentially increased risk of fatality for NSOs in close proximity to roads with frequent and/or high-speed traffic, and public outreach in these areas may help prevent future vehicle strikes of NSOs and other wildlife.

Barred Owls. Eight Barred Owls were detected and removed in Marin County in 2025 (Hofstadter, unpublished data), and three of those individuals were near MCP and Marin Water lands at NSO sites monitored by Point Blue. After the removal of a pair of Barred Owls in Mill Valley in May, we continued NSO surveys at this site and detected NSOs on two occasions at night but were unable to locate them during the day. The Barred Owls' presence may have temporarily displaced the NSOs or at least reduced our ability to detect them consistently throughout this season, even after the Barred Owls were removed. Previous studies have documented a negative effect of Barred Owl presence on NSO detection probability and responsiveness during surveys (Olson et al. 2005, Crozier et al. 2006) which may have contributed to our limited NSO detections at this site this year. The other Barred Owl detected at one of our long-term NSO sites was also removed in early May. We confirmed this site was occupied by a non-nesting NSO pair this year.

We expect that an increase in Barred Owls would threaten the local NSO population through competition for space and food, as has been well-documented in other parts of its range (Wiens

et al. 2014, Dugger et al. 2016, Franklin et al. 2021). Barred Owl presence has been found to negatively impact NSO occupancy, fecundity, apparent survival, and overall rates of population change (Kelly et al. 2003, Olson et al. 2004, Olson et al. 2005, Anthony et al. 2006, Forsman et al. 2011, Wiens 2012, Dugger et al. 2016, Weins et al. 2021, Franklin et al. 2021). Additionally, Barred Owls produce more young than NSOs, have higher survival, and tend to have a more diverse diet, likely reducing their sensitivity to declines in one prey species (Wiens et al. 2014). Barred Owl range expansion could also have significant direct and indirect effects on local food webs within the NSO range, putting pressure on a larger array of prey species than NSOs, including sensitive or threatened native prey species, as well as increasing competition for resources among other native predators (Holm et al. 2016, Arenas-Viveros et al. 2025).

We continue to follow the USFWS NSO protocol (USFWS 2012) to increase our ability to detect Barred Owls by conducting late-season playback surveys for Barred Owls when NSOs were not detected. However, because we detect NSOs at most sites that we monitor, Barred Owl-specific surveys are therefore not triggered at most sites, potentially limiting our ability to detect Barred Owls (Wiens et al. 2011). Additional surveys – using playback, or with automated recording units – that are specific to Barred Owls may increase our detection likelihood of this species. Barred Owl inventory surveys may be useful to gather baseline data throughout Marin Water lands – including in forested areas not currently surveyed for NSOs where data are lacking – similar to previous surveys on MCP lands in 2020 (Duncan and Cormier 2020); repeated surveys may also be useful on MCP lands. Because several sites around the county have been colonized by different individuals of Barred Owls over the years – likely the highest quality sites for the species – we recommend annual Barred Owl surveys at those sites so that newly established individuals are detected early.

Removal of Barred Owls from NSO territories has been successful at reversing NSO declines in previous studies (Wiens et al. 2021, Hofstadter et al. 2022, Hobart et al. 2025) and is currently the only known effective solution to address this threat. In the final Barred Owl Management Strategy (USFWS 2024), the USFWS states that Barred Owls may be removed from the land of willing landowners and land managers anywhere within Marin County and that immediate action to prevent further Barred Owl invasion of this area will secure Marin County as a refuge for NSO. In study areas like Marin County where pressure from Barred Owls is lower relative to other parts of the NSO range, it is likely that Barred Owl removals to date have slowed the spread of Barred Owls by preventing these individuals, some of which included established pairs, from breeding, and helped to maintain a higher occurrence of NSO than in a no-removal scenario (Hobart et al. 2025). Any lethal removal of Barred Owls in Marin County should evaluate the ethics of such a program (Lynn 2018), follow protocols outlined by the USFWS

(2024) to be as humane as possible, and be evaluated on a regular basis, especially if any viable non-lethal options are developed.

Conclusions. During 2025 surveys on Marin Water and MCP lands, we documented NSO pairs at most known sites, though pair occupancy rates were lower than the study average. Nesting rates and the proportion of successful nests in 2025 were below average, but the latter was not statistically different from previous years. Fecundity in 2025 was also below the study average, though we did not find evidence for a significant trend over time in fecundity. We detected three Barred Owls in 2025 near MCP and Marin Water lands at long-term NSO sites included in this report, and at least five additional Barred Owls were detected elsewhere in the county throughout the year. The known number of Barred Owls is still low in Marin County compared to other parts of the NSO range; that combined with the many protected forested areas in the region likely explains the relatively stable NSO population here compared to other parts of their range. Monitoring NSO in Marin County during the breeding season is an essential component to evaluating their population health and ensuring that management activities do not negatively impact owls, including where management activities are slated to occur.

ACKNOWLEDGEMENTS

We are grateful to Marin County Parks and Marin Water for funding this project. Staff at Marin Water, especially Carl Sanders, Shaun Horne, and Sabrina Gonzalez and at MCP, especially Serena Hubert, helped with project administration and logistics. We thank Bree Hardcastle at California State Parks, and staff at the Town of Ross, and Cities of Mill Valley, and Novato, and the many private landowners for access to their lands and the lands they manage for the 2025 field season. We also thank Taylor Ellis and Kirk Sherrill at NPS for maintaining the county-wide database and for data submission to CNDDB. We thank Melanie Piazza at WildCare for sharing their annual NSO patient data and for their continued collaboration. Thanks to NPS, and the City of San Rafael for providing access to their lands in previous years, data from which are used in this report. We thank the USFWS Recovery Permit staff, CDFW staff, the US Bird Banding Lab, and Point Blue Administrative and Finance staff for support. Point Blue staff Jette Saukkonen and other Point Blue Administrative and Finance staff provided much assistance. We are grateful to Oulana Dobrin and Asher Leeming for their hard work with data collection in 2025, as well as biologists from previous years.

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Attachment C

E-Bike Trial Visitor Survey Questions and Results

Pilot Project Survey Questions – English

Welcome to the Marin Municipal Water District - Pilot Project Survey! This survey will be used to help gauge the success of the e-bike pilot program overtime and to gauge sentiments about the program from district visitors. This brief survey will take about 5 minutes to complete and will help the District better understand how sentiments around the pilot project changes evolve over the life of the project.

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1. How do you get around inside the Watershed? (Circle all that apply)
    a. Walking/Hiking/Running
    b. E-Bike
        i. Did you convert from a traditional bike to an e-bike in the last two years? Yes / No
    c. Standard bike
    d. Horseback riding
    e. Other (Please explain)
    f. Prefer not to say

2. How often do you visit the Watershed? (Circle one)
    a. Daily
    b. Two to three times per week
    c. Weekly
    d. Two to three times per month
    e. Monthly
    f. A few times per year
    g. Prefer not to say

3. How would you rate the condition of Fire Roads on the Watershed? (Circle one)
    a. Poor
    b. Fair
    c. Satisfactory
    d. Good
    e. Great
    f. Not sure or prefer not to say

4. While visiting the Watershed, how often do you see wildlife? (Circle One)
    a. Every time I use the Watershed
    b. More than half the time
    c. Less than half the time

d. Never
e. Not sure or prefer not to say

5. How would you rate your interactions with other visitors on the Watershed?
   (Circle One)
   a. Poor
   b. Fair
   c. Good
   d. Great
   e. Not applicable – I don't interact with other visitors.

6. How was your interaction with bicyclists on the watershed today?
   a. Poor
   b. Fair
   c. Good
   d. Great
   e. Not applicable – I didn't see a bicyclist today.

7. How safe do you feel while using the Fire Roads on the Watershed? (Circle one)
   a. Very Unsafe
   b. Somewhat Unsafe
   c. Somewhat Safe
   d. Very Safe
   e. Not sure or Prefer not to say

8. How comfortable are you with sharing the Fire Roads with people using E-bikes? (Circle one)
   a. Very uncomfortable
   b. Somewhat uncomfortable
   c. Somewhat comfortable
   d. Very comfortable
   e. Not sure or prefer not to say

9. California state law considers a Class I e-bike as a bike. (A Class I e-bike is an e-bike that requires to user to pedal, and where the motor does not assist over 20 mph).
   Bikes are currently allowed on Fire Roads within the watershed. Do you think Class l e-bikes should be considered bikes within the watershed and allowed on Fire Roads?

a. Yes

b. No

Thank you for your participation in this survey!

Pilot Project Survey Questions – Spanish

¡Bienvenido a la encuesta del proyecto piloto del Distrito Municipal de Agua de Marin! Esta encuesta se utilizará para evaluar el éxito del programa piloto de bicicletas eléctricas a lo largo del tiempo y para conocer la opinión de los visitantes del distrito sobre el programa. Esta breve encuesta tomará aproximadamente 5 minutos para completarse y ayudará al Distrito a comprender mejor cómo evolucionan los sentimientos en torno a los cambios del proyecto piloto a lo largo de la vida del proyecto.

---

1. ¿Cómo te mueves dentro de la Watershed? (Seleccione todas las que apliquen)
    a. Caminando/Excursionismo/Corriendo
    b. Bicicleta eléctrica
        i. ¿Dejaste de usar una bicicleta tradicional y comenzaste a usar una bicicleta eléctrica en los últimos dos años? Sí / No
    c. Bicicleta estándar
    d. Montar a caballo
    e. Otra (por favor explique)
    f. No estoy seguro(a) o prefiero no decirlo

2. ¿Con qué frecuencia visita la Cuenca? (Seleccione una opción)
    a. A diario
    b. 2-3 veces por semana
    c. Una vez a la semana
    d. Una vez al mes
    e. Unas cuantas veces al año
    f. No estoy seguro(a) o prefiero no decirlo

3. ¿Cómo describiría el estado de los caminos de fuego en la Watershed? (Seleccione una opción)
    a. Pobre
    b. Justo
    c. Satisfactorio
    d. Bien
    e. Excelente
    f. No estoy seguro(a) o prefiero no decirlo

4. Cuando visita la Watershed, ¿Con qué frecuencia observa fauna? (Seleccione una opción)
    a. Cada vez que uso la Watershed
    b. Más de la mitad del tiempo
    c. Menos de la mitad del tiempo
    d. Nunca
    e. No estoy seguro(a) o prefiero no decirlo

5. ¿Cómo son tus interacciones con otros visitantes en la Watershed? (Seleccione una opción)
    a. Pobre
    b. Justo
    c. Bien
    d. Excelente
    e. No aplicable - No interactúo con otros visitantes

6. ¿Cómo fue tu interacción con los ciclistas en la Watershed hoy? (Seleccione una opción)
    a. Pobre
    b. Justo
    c. Bien
    d. Excelente
    e. No aplica, no vi un ciclista hoy

7. ¿Qué tan seguro te sientes al usar los Caminos de Fuego en la Watershed? (Seleccione una opción)
    f. Muy inseguro(a)
    g. Un poco inseguro(a)
    h. Un poco seguro(a)
    i. Muy seguro(a)
    j. No estoy seguro(a) o prefiero no decirlo

8. ¿Qué tan cómodo te sientes compartiendo los Caminos de Fuego con personas que usan bicicleta eléctrica? (Seleccione una opción)

k. Muy incómodo(a)
l. Un poco incómodo(a)
m. Un poco cómodo(a)
n. Muy cómodo(a)
o. No estoy seguro(a) o prefiero no decirlo

9.La ley de California considera una bicicleta eléctrica de Clase I como una bicicleta. (Una bicicleta eléctrica de Clase I es una bicicleta eléctrica que requiere que el usuario pedalee y donde el motor no supera las 20 mph). Actualmente, las bicicletas están permitidas en los Caminos de Fuego dentro de la Watershed. ¿Crees que las bicicletas eléctricas de Clase I deberían ser consideradas bicicletas dentro de la Watershed y permitidas en los Caminos de Fuego?

a. Sí
b. No

Gracias por su participación en esta encuesta.

Pilot Project Survey Results

12/2/2025

To: Shaun Horne, Carly Blanchard, Marin Municipal Water District

From: Brian Burchfield, Cole Peiffer, Alta Planning + Design

Re: Marin Water District - Pilot Project Survey #1 Results

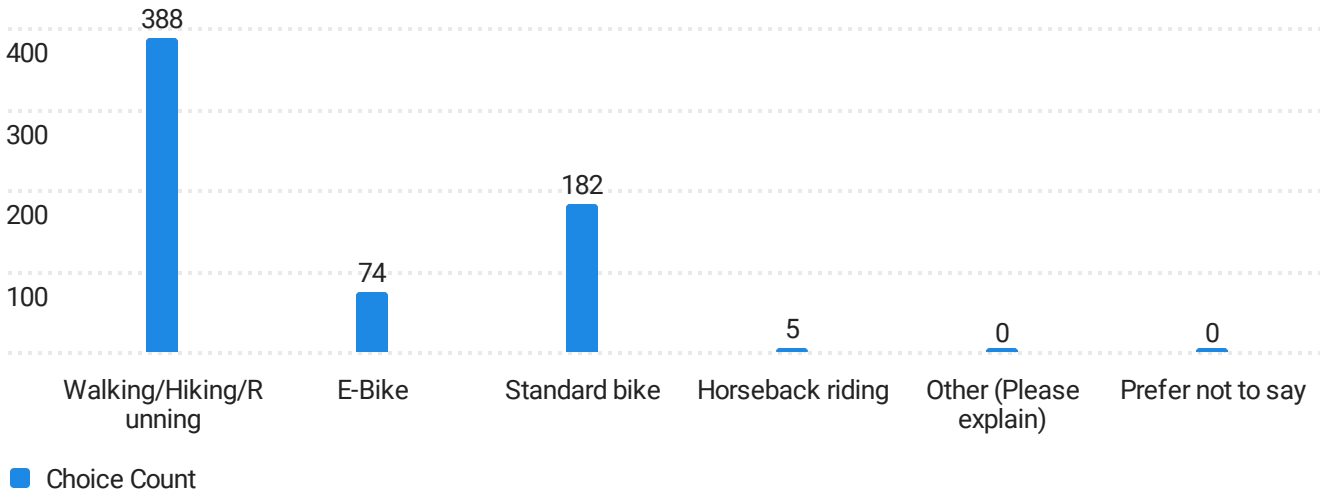
Introduction

This memo summarizes the survey responses collected by Marin Water District staff as part of the Trail Feasibility Pilot Study during fall of 2025. Surveys responses were collected in-person within the District during typical peak periods across weekdays and weekends in October, 2025 (Study dates include October 2nd, 4th, 21st, and 25th). A total of 483 survey responses were collected during this effort. The results for each of the nine questions are shown below.

Survey Results

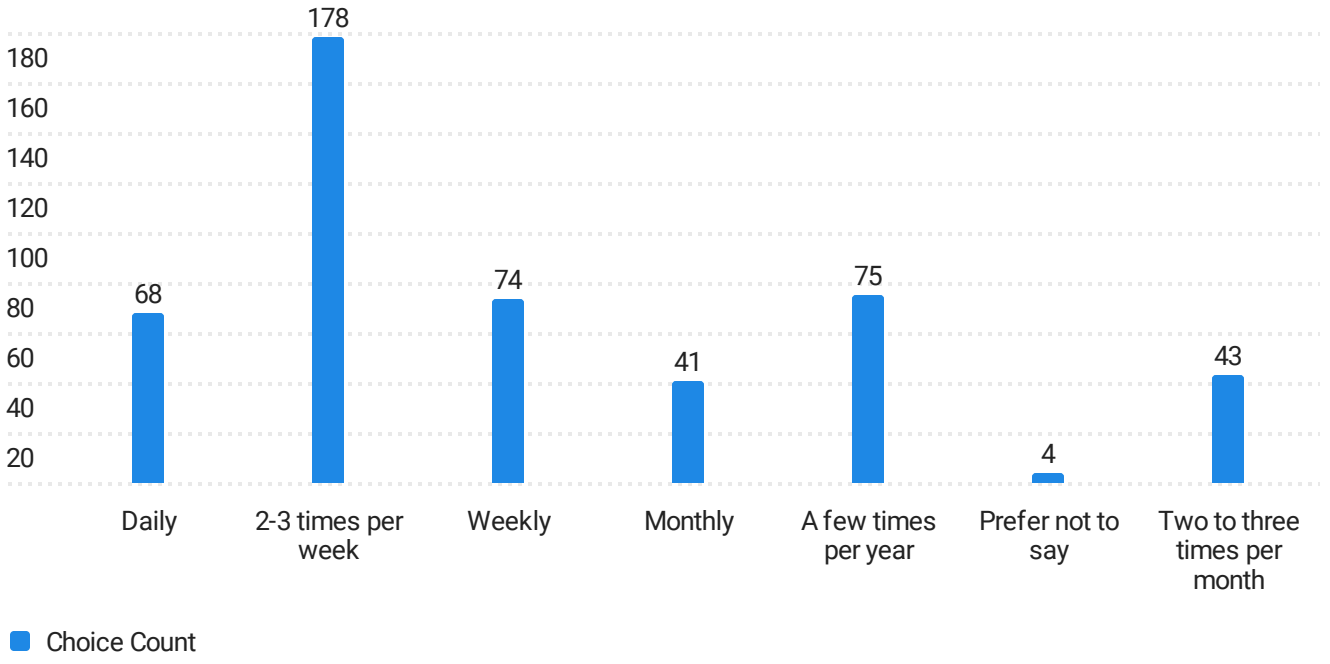
Q1 - How do you get around inside the Watershed? (Select all that apply) - Selected Choice

483 Responses



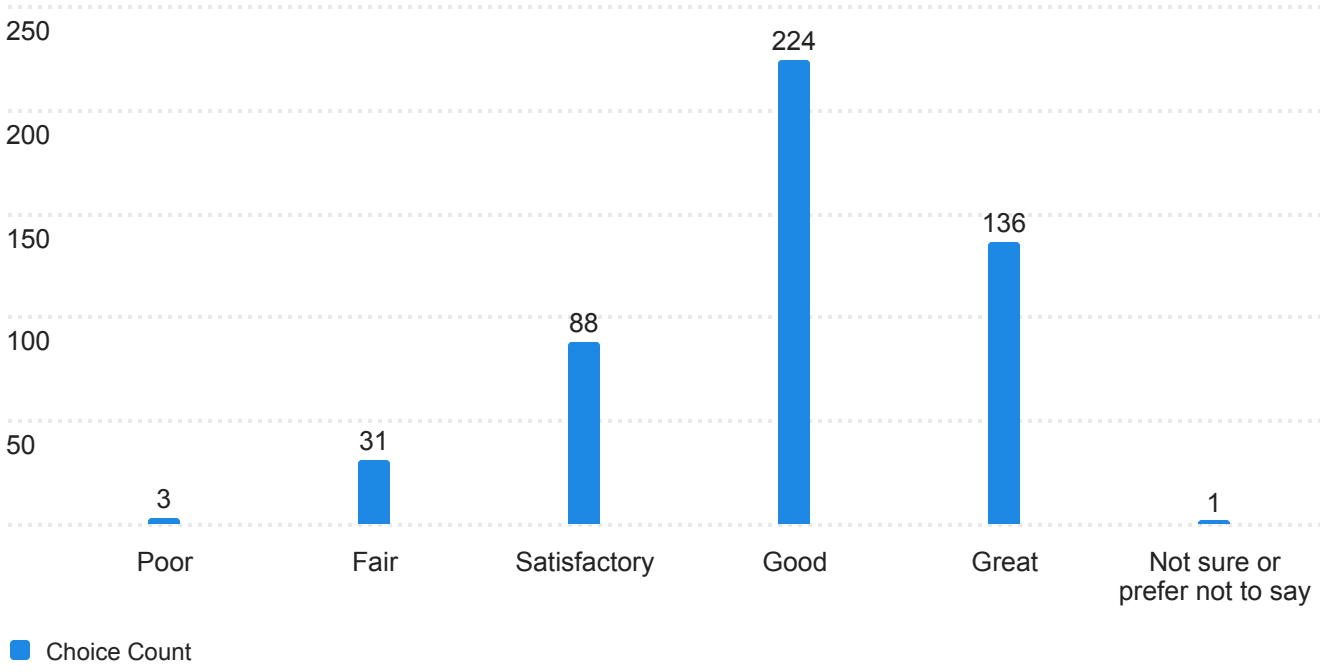
Q2 - How often do you visit the Watershed? (Select One)

483 Responses



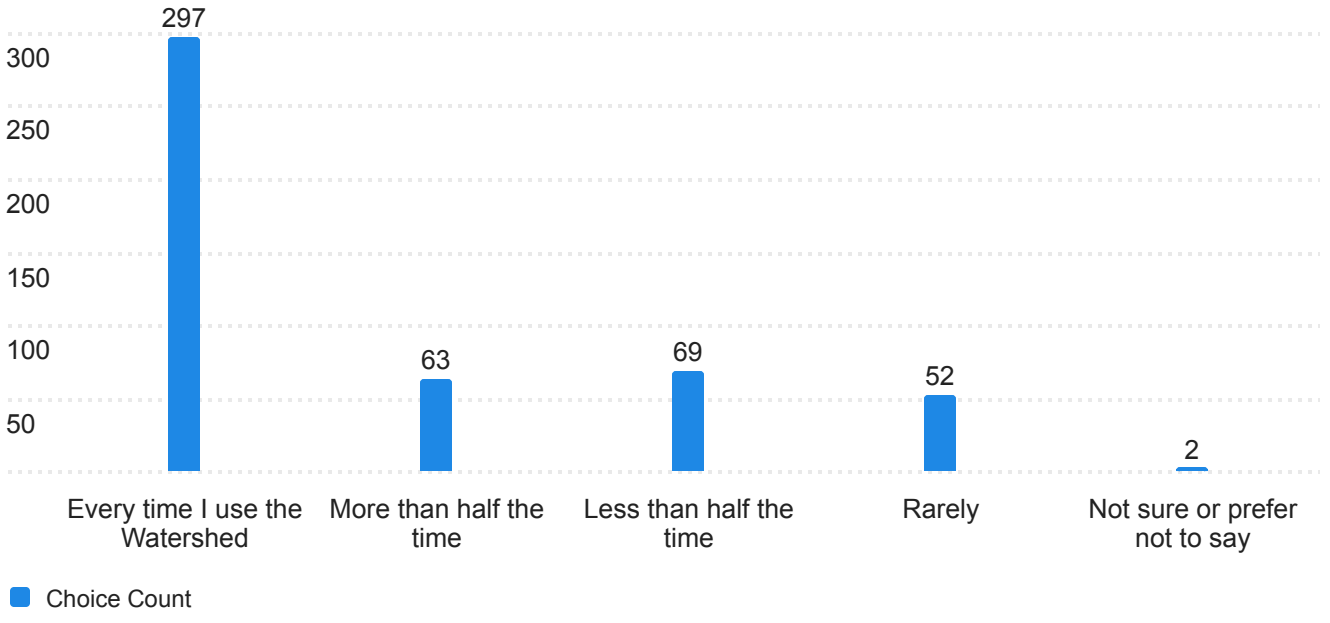
Q3 - How would you rate the condition of Fire Roads on the Watershed? (Select One)

483 Responses



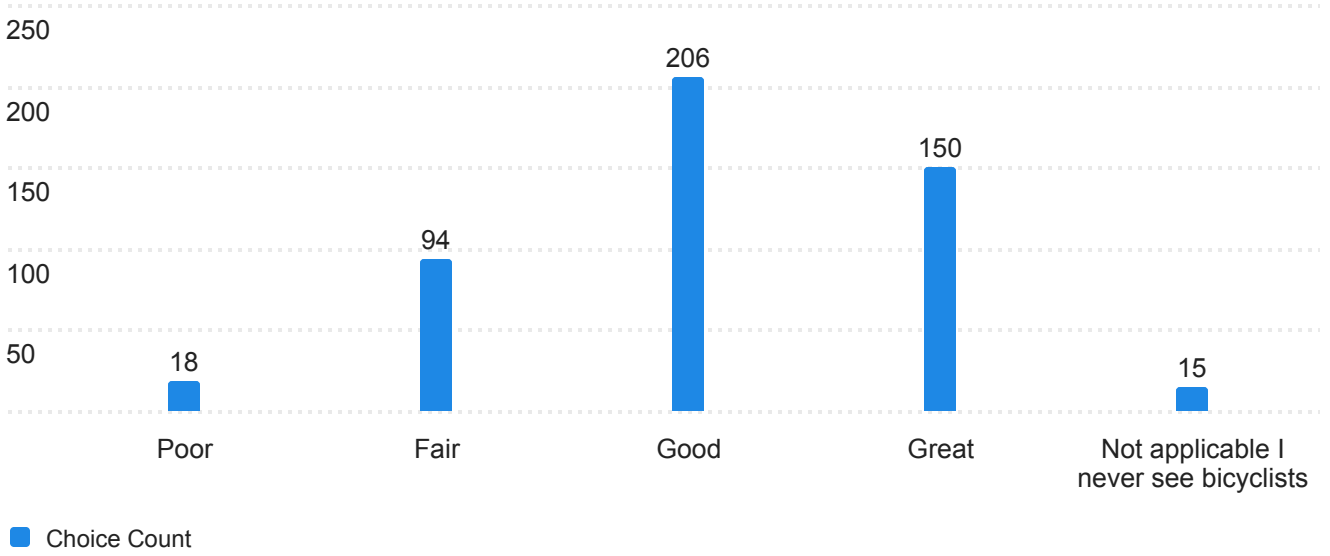
Q4 - While visiting the Watershed, how often do you see wildlife? (Select One)

483 Responses



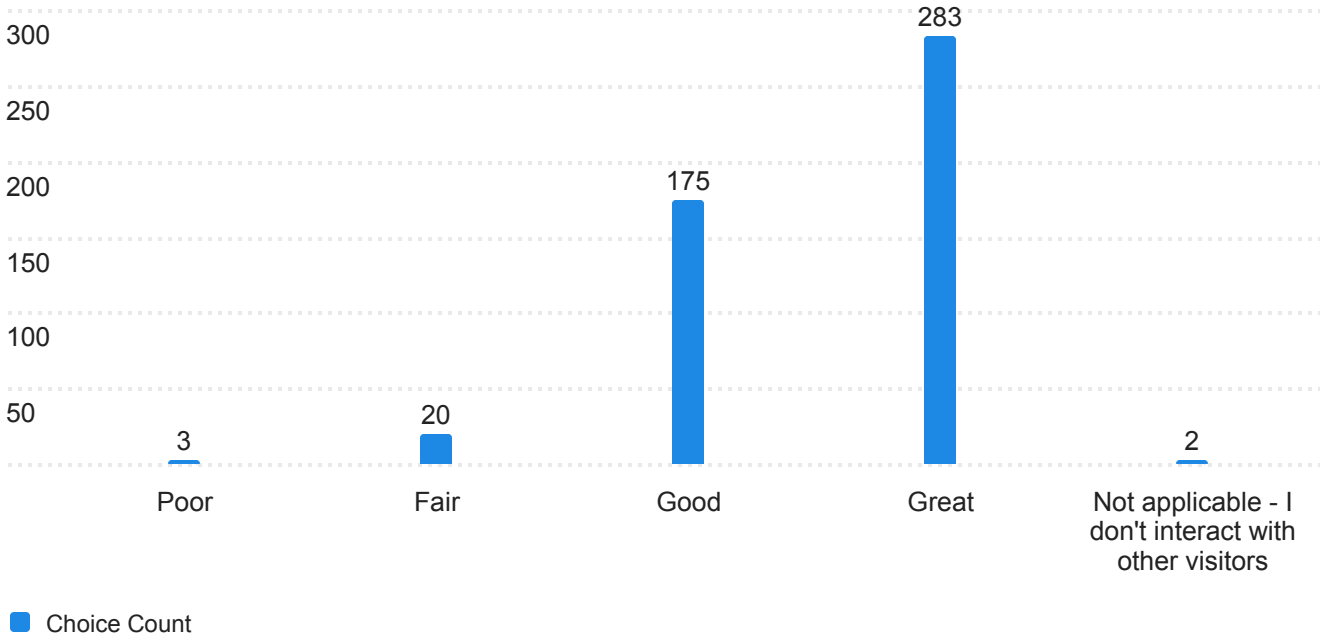
Q5 - How would you rate your interactions with bicyclists on the Watershed?

483 Responses



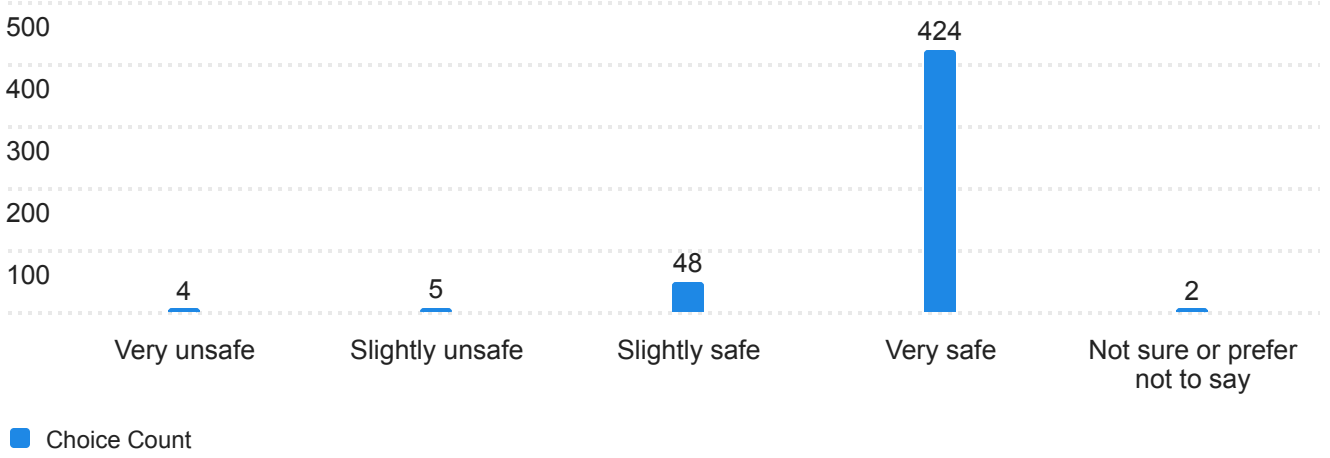
Q6 - How would you rate your interactions with other visitors on the Watershed? (Select One)

483 Responses



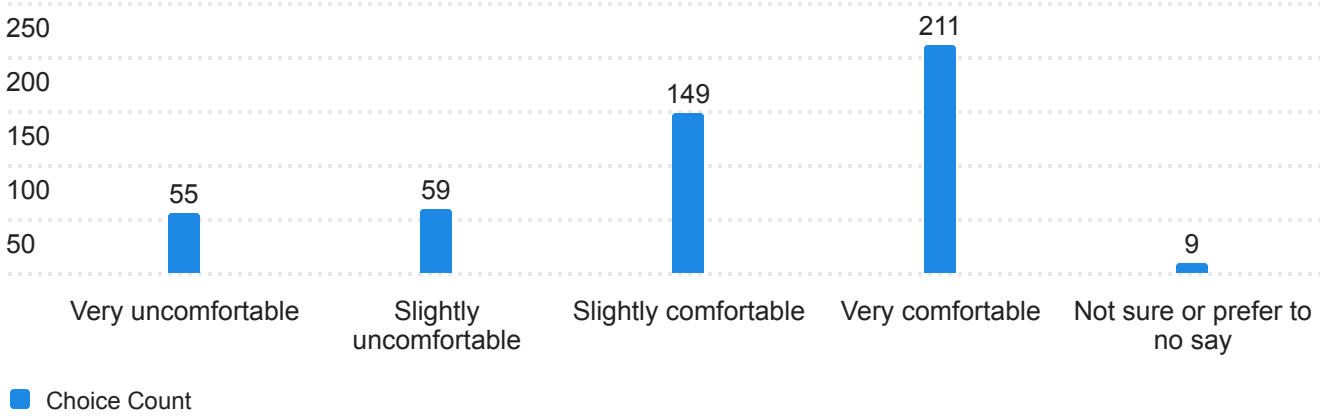
Q7 - How safe do you feel while using the Fire Roads on the Watershed? (Select One)

483 Responses



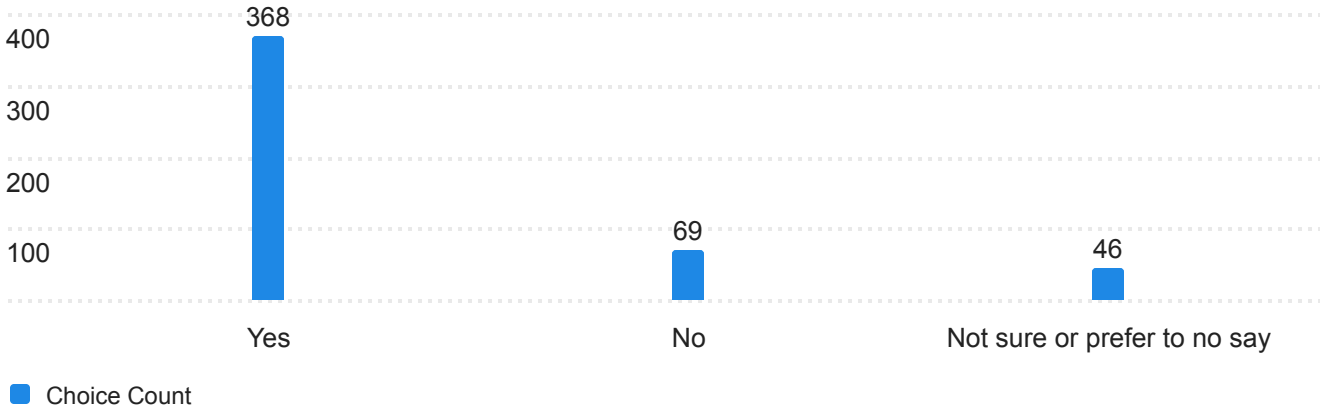
Q8 - How comfortable are you with sharing the Fire Roads with people using Class I E-bikes? (A Class I e-bike is an e-bike that requires to user to pedal, and where the motor does not assist over 20 mph). (Select One)

483 Responses



Q9 - California state law considers a Class I e-bike as a bike. Bikes are currently allowed on Fire Roads within the watershed. Do you think Class I e-bikes should be considered bikes within the watershed and allowed on Fire Roads?

483 Responses



Attachment D

Early Detection Rapid Response Invasive Species Surveys 2025

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memorandum

date	September 18th, 2025
to	Sherry Adams – Senior Ecologist, Marin Municipal Water District
cc	Elizabeth Hill – Project Manager, ESA
from	Noah Teller – Senior Botanist, ESA
subject	Early Detection Rapid Response Invasive Species Surveys 2025

Introduction

The following memorandum summarizes the results of Early Detection-Rapid Response (EDRR) invasive plant surveys completed for Marin Municipal Water District (Marin Water) on approximately 20 miles of select fire roads and staging areas within the Mt. Tamalpais watershed by Environmental Science Associates (ESA) in 2025 (**Figure 1**). **Attachment A** includes documentation of species' occurrence location, and that the data was reviewed and uploaded to Calflora.

Methods

ESA botanists Nicole Ibañez, Amanda Segura-Moon, Natalie Lamas, and Noah Teller conducted target invasive plant species surveys to identify, map and treat priority invasive weed species, per the Tamalpais Lands Collaborative's Early Detection of Invasive Plants Protocol.[1] After a one day in person training with a OneTam botanist, ESA conducted surveys on foot over four days in mid-summer, when priority species were likely to be in bloom and identifiable:

- July 22 and 23, 2025
- August 4 and 5, 2025

All observations of priority invasive plant species were documented using CalFlora's Observer Pro app for mobile devices.[2] Small populations of priority weeds that could be treated in 5 minutes or less were removed by hand, and all biomass removed from the site. The documented attributes of weed populations included a GPS feature of a point, line, or polygon; plant species; phenology; number of plants; and treatment information. Population size was estimated in categories of 0; 1; 2-10; 11-50; 51-100; 101-

[1] Tamalpais Lands Collaborative, 2022. Early Detection of Invasive Plants Protocol.

[2] Calflora: Observer Pro [Mobile application]. (2025). Berkeley, California: The Calflora Database. From https://www.calflora.org/

1,000; 1,001-10,000; and 10,000+. A species detail photograph and a general area photograph were taken and attached to the observation.

Summary of Findings

Table 1 lists the observations for 54 Marin Water-designated priority species that were observed during the survey. Observation data were processed to determine the average Detailed information of the populations by species is provided after Table 1.

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TABLE 1
SPECIES INDICATED AND/OR OBSERVED FOR EARLY DETECTION AND RAPID RESPONSE

Common Name	Scientific Name	Priority	Observed[1]	Populations Found vs. (Not Found)	# of Treated Populations (Stems)	Average Population Size	Total # of Plants Observed	Avg. Pop. Area (m^2)	Total Invaded Area (m^2)
Jointed Goatgrass	*Aegilops cylindrica*	1	No	-	-	-	-	-	-
Crofton Weed	*Ageratina adenophora*	1	No	-	-	-	-	-	-
Tree of Heaven	*Ailanthus altissima*	1	No	-	-	-	-	-	-
Garlic Mustard	*Alliaria petiolata*	1	No	-	-	-	-	-	-
Meadow Foxtail	*Alopecurus pratensis*	1	No	-	-	-	-	-	-
Cape Weed	*Arctotheca prostrata/calendula*	1	No	-	-	-	-	-	-
False Brome	*Brachypodium sylvaticum*	1	No	-	-	-	-	-	-
Smooth Brome	*Bromus inermus*	1	No	-	-	-	-	-	-
Drooping Sedge	*Carex pendula*	1	No	-	-	-	-	-	-
Woolly Distaff Thistle	*Carthamus lanatus*	1	No	-	-	-	-	-	-
Diffuse Knapweed	*Centaurea diffusa*	1	No	-	-	-	-	-	-
Old Man's Beard	*Clematis vitalba*	1	No	-	-	-	-	-	-
Cape Ivy	*Delairea odorata*	1	No	-	-	-	-	-	-
Yellow Fleabane	*Dittrichia viscosa*	1	No	-	-	-	-	-	-
Paterson's Curse	*Echium plantagineum*	1	No	-	-	-	-	-	-
Japanese Knotweed	*Fallopia japonica*	1	No	-	-	-	-	-	-
Licorice Plant	*Helichrysum petiolare*	1	No	-	-	-	-	-	-
English Holly	***Ilex aquifolium***	**1**	**Yes**	**2**	**-**	**1-10**	**11-50**	**8**	**15**
Mayten Tree	*Maytenus boaria*	1	No	-	-	-	-	-	-
Pokeweed	*Phytolacca sp.*	1	No	-	-	-	-	-	-

Common Name	Scientific Name	Priority	Observed[1]	Populations Found vs. (Not Found)	# of Treated Populations (Stems)	Average Population Size	Total # of Plants Observed	Avg. Pop. Area (m^2)	Total Invaded Area (m^2)
Karo	*Pittosporum crassifolium*	1	No	-	-	-	-	-	-
Sweet Pittosporum	*Pittosporum undulatum*	1	No	-	-	-	-	-	-
Myrtle-leaf Milkwort	*Polygala myrtifolia*	1	No	-	-	-	-	-	-
Spanish False Fleabane	*Pulicaria paludosa*	1	No	-	-	-	-	-	-
Variegated Thistle	*Silybum marianum*	1	No	-	-	-	-	-	-
Kangaroo Apple	*Solanum aviculare*	1	No	-	-	-	-	-	-
Gorse	*Ulex europaeus*	1	Searched	(1)	-	0	0	0	0
Portuguese Broom	*Cytisus striatus*	1	Searched	(1)	-	0	0	0	0
Sun Spurge	*Euphorbia helioscopia*	1.5	No	-	-	-	-	-	-
Leafy Spurge	*Euphorbia virgata*	1.5	No	-	-	-	-	-	-
Common Myrtle	*Myrtus communis*	1.5	No	-	-	-	-	-	-
Smilo Grass	*Stipa miliacea var. miliacea*	1.5	Searched	(1)	-	0	0	0	0
Mexican Feather Grass	*Stipa tenuissima*	1.5	No	-	-	-	-	-	-
Barbed Goatgrass	*Aegilops triuncialis*	1.5	No	-	-	-	-	-	-
Acacia	***Acacia dealbata***	**2**	**Yes**	**8**	**-**	**1-10**	**50-100**	**36**	**255**
Purple Starthistle	*Centaurea calcitrapa*	2	No	-	-	-	-	-	-
Yellow Starthistle	***Centaurea solstitialis***	**2**	**Yes**	**2** (4)	**1 (1)**	**51-100**	**180**	**80**	**160**
Stinkwort	*Dittrichia graveolens*	2	Searched	(2)	-	0	0	0	0
Medusahead	*Elymus caput-medusae*	2	No	1	-	11-50	25	3	3
Cheatgrass	*Bromus tectorum*	3	No	-	-	-	-	-	-
Poison Hemlock	***Conium maculatum***	**3**	**Yes**	**3**	**-**	**1-10**	**11-50**	**1**	**1**
Pampas Grass	***Cortaderia jubata***	**3**	**Yes**	**2**[2]	**-**	**11-50**	**11-50**	**10**	**30**
Hawthorn	***Crataegus monogyna***	**3**	**Yes**	**4**	**-**	**1-10**	**11-50**	**32**	**129**
Panic Veldtgrass	***Ehrharta erecta***	**3**	**Yes**	**15**	**-**	**1,001-10,000**	**>10,000**	**926**	**13890**
Eggleaf Spurge	***Euphorbia oblongata***	**3**	**Yes**	**8**	**-**	**11-100**	**101-1,000**	**86**	**517**
Tall Fescue	***Festuca arundinacea***	**3**	**Yes**	**13**	**-**	**101-1,000**	**1,001-10,000**	**175**	**1930**
Fennel	***Foeniculum vulgare***	**3**	**Yes**	**5**	**-**	**1-10**	**31**	**311**	**932**

Common Name	Scientific Name	Priority	Observed[1]	Populations Found vs. (Not Found)	# of Treated Populations (Stems)	Average Population Size	Total # of Plants Observed	Avg. Pop. Area (m^2)	Total Invaded Area (m^2)
French Broom	***Genista monspessulana***	**3**	**Yes**	**2**	**1 (5)**	**11-100**	**30**	**10**	**20**
Algerian Ivy	***Hedera canariensis***	**3**	**Yes**	**1**	**-**	**1**	**1**	**1**	**1**
English Ivy	***Hedera helix***	**3**	**Yes**	**25**	**-**	**11-50**	**101-1,000**	**102**	**2,350**
Common Velvetgrass	***Holcus lanatus***	**3**	**Yes**	**45**	**8 (27)**	**1,001-10,000**	**>100,000**	**1252**	**53826**
Tangier Pea	*Lathyrus tingitanus*	3	No	-	-	-	-	-	-
Glossy Privet	*Ligustrum lucidum*	3	No	-	-	-	-	-	-
Firethorn	*Pyracantha sp*	3	No	-	-	-	-	-	-

NOTES:

1. Species with observations from prior surveys that were not found are noted as “Searched” in the Observations column. The number of prior observations visited but not found are presented in (parentheses). Bolded text denotes at least one population of the species was observed.
2. Several observations of bear grass (*Xerophyllum tenax*) were initially misidentified as pampas grass; these observations have been removed. The remaining populations were evaluated with a high degree of confidence in the field by ESA biologists.

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Observation Details

Holly (*Ilex aquifolium*)

Two populations of holly were found; one to the North of the Marin County Fire station along Gravity Car Rd, and another to the Northwest at the intersection of Miller Trail and Old Railroad Grade. Two prior observations were visited but not found. Populations were small, moderately-spaced clusters. All populations were fruiting at the time of the survey.

Silver wattle (*Acacia dealbata*)

Seven populations of silver wattle were found; six spread out along Old Railroad Grade, and one to the east of the Marin County Fire station on Gravity Car Rd. Populations were generally small, dense clusters, or individual trees. All populations were fruiting at the time of the survey.

Yellow star thistle (*Centaurea solstitialis*)

Two populations of yellow star thistle were found. One large population of 101-1,000 stems was found next to Quarry Parking Lot, to the North of E Ridgecrest Blvd. A single stem was found and removed along Lower Peters Dam Rd. Four prior observations were visited but not found. All populations were flowering or fruiting at the time of the survey.

Poison hemlock (*Conium maculatum*)

Three populations of poison hemlock were found around Lower Peters Dam Rd. and along the Lagunitas Creek Trail. A fourth prior observation nearby was searched for but not found. All populations were flowering or fruiting at the time of the survey.

Pampas grass (*Cortaderia jubata*)

Two populations of pampas grass were found near the intersection of Old Railroad Grade, Gravity Car Rd, and the Double Bow Knot trailhead. Thirteen prior observations were visited but not found. All populations were vegetative or flowering at the time of the survey.

Hawthorn (*Crataegus monogyna*)

Four populations of hawthorn were found to the east of Lake Lagunitas along Lake Lagunitas Rd. One prior observation was visited but not found. Populations were single plants or small, diffuse patches. All populations were fruiting at the time of the survey.

Panic veldtgrass (*Ehrharta erecta*)

Eighteen populations of panic veldtgrass were found, 15 of which were spread out along Gravity Car Rd. and Old Railroad Grade to the North of the Marin County Fire station. Populations varied from a few plants, moderate diffuse patches, and large dense patches. Three prior observations were visited but not found. All populations were fruiting at the time of the survey.

Eggleaf spurge (*Euphorbia oblongata*)

Six populations of eggleaf spurge were found along Gravity Car Rd to the East of the Marin County Fire station. Three prior observations were visited but not found. Populations were generally small patches of a few plants. All populations were flowering or fruiting at the time of the survey.

Tall fescue (*Festuca arundinacea*)

Eleven populations of tall fescue were found, 10 of which were concentrated along Lagunitas Rock Spring Rd. near the intersection with Laurel Dell Rd., and one was found along Gravity Car Rd. East of the Marin County Fire station. Eight prior observations were visited but not found. All populations were flowering or fruiting at the time of the survey.

Fennel (*Foeniculum vulgare*)

Three populations of fennel were found, two along Lagunitas Creek and Lower Peters Dam Rd, and the third along the Nora Trail near the West Point Inn. Two prior observations along Peters Dam Rd. were visited but not found. All populations were flowering or fruiting at the time of the survey.

French broom (*Genista monspessulana*)

At the direction of Marin Water, very large and widespread populations of French broom were not mapped or recorded. Surveys for French broom focused on small, isolated populations that could be efficiently removed to prevent extensive colonization of new territory. Two such populations were recorded.

The first population was found along Lake Lagunitas Rd, to the North of Lake Lagunitas. The second population was found at the intersection of Shaver Grade, Fish Grade, and Phoenix Lake Rd., and was small enough to be treated, with all biomass removed at the time of the survey. The remaining population was fruiting at the time of the survey.

Algerian ivy (*Hedera canariensis*)

One population of Algerian ivy was found along Eldridge Grade to the East of the filter plant. It is a single, large plant that was not possible to efficiently remove. Six prior observations were visited but not found. The population was fruiting at the time of the survey.

English ivy (*Hedera helix*)

Twenty-three (23) populations of English ivy were found, with a cluster of eight along Shafter Grade below Peters Dam, another cluster of eight along Gravity Car Rd to the east of the Marin County Fire station. Four were spread out along Old Railroad Grade, and one was on the east shore of Lake Lagunitas. Most populations were large and dense, with well-established vines growing in dense carpets on the ground or on surrounding trees. Twenty-seven (27) prior observations were visited but not found. All populations were vegetative at the time of the survey.

Common velvetgrass (*Holcus lanatus*)

Forty-five (45) populations of common velvetgrass were found, with nineteen spread along Lagunitas Rock Spring Rd, twenty two along Lake View Fire Rd. and Eldridge Grade near the filter plant, one on Gravity Car Rd near the Double Bow Knot trailhead, and one on Gravity Car Rd. near the Marin County Fire station. Four prior observations were visited but not found. All populations were fruiting at the time of the survey.

Conclusions

While some priority 1 weed populations were found, most weed populations observed were of priority 2 or 3 species. Notable concentrations of multiple weed species and populations are found around the Marin County Fire station, the filter plant, and Peters Dam. Due to the position at the entrance to the fire road network, populations near the fire station may pose an increased risk of dispersal as an unintended consequence of firefighting activity or road maintenance. A similar dynamic may be at play near the filter plant, which is periodically visited by large vehicles. Lastly, frequent public access to trails around Peters Dam may simultaneously contribute to the increased diversity and abundance of invasive species and pose a risk of spreading propagules to new locations.

Common velvetgrass was by far the most widespread and abundant species, frequently occurring in large populations in wet seeps, fields, riparian areas, and ruderal areas. Many populations of panic veldtgrass, pampas grass, and tall reed fescue were also quite large and dense. The treatment of some smaller, isolated occurrences of these highly invasive species may be warranted to prevent local population growth to an unmanageable level in the future. Most other species were observed in limited numbers and moderate patch sizes, many of which could be efficiently treated by hand pulling or light application of herbicide.

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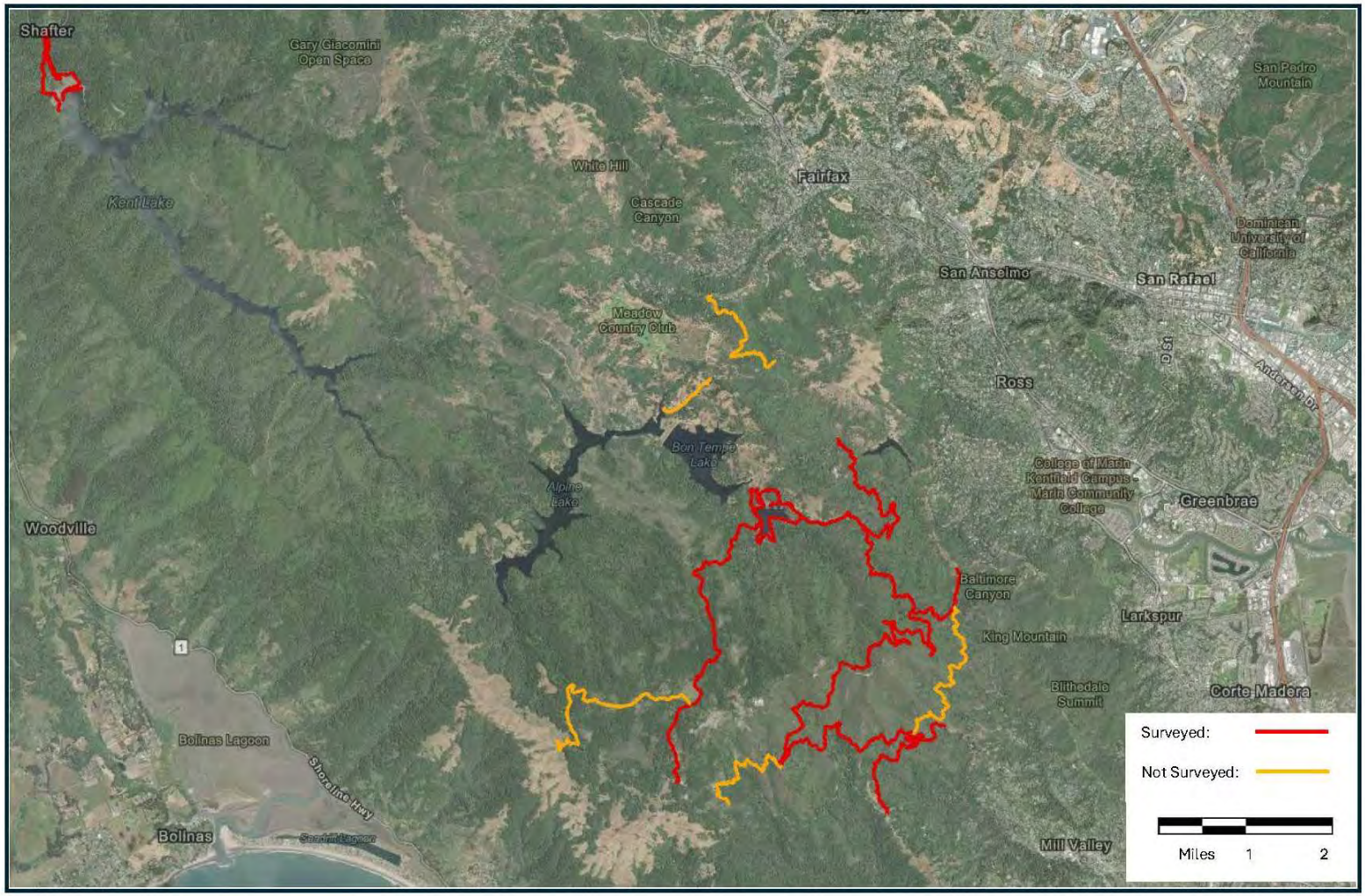

SOURCE: USGS, 2025, GOOGLE, 2025; MWD, 2025

Mt. Tamalpais Early Detection Rapid Response Surveys 2025

Figure 1
Regional Location

ESA

Attachment A
Calflora Observations

Note: The CalFlora ID records below include present and absent populations

CalFlora ID	Taxon	Common Name	Observer	Location Description	Latitude	Longitude
mg285985	*Festuca arundinacea*	Reed fescue	Nicole Ibanez		37.927563	-122.60614
mg285984	*Festuca arundinacea*	Reed fescue	Nicole Ibanez	LAGUNITAS ROCK SPRING	37.927094	-122.60672
mg288087	*Holcus lanatus*	Common velvetgrass	Noah Teller	LAGUNITAS ROCK SPRING	37.926927	-122.60668
mg285983	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez	LAGUNITAS ROCK SPRING	37.926963	-122.60684
mg285982	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez	Potrero Meadow	37.926509	-122.60713
mg288086	*Festuca arundinacea*	Reed fescue	Noah Teller	LAGUNITAS ROCK SPRING	37.9266	-122.60691
mg285981	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez	Potrero Meadow	37.926069	-122.6072
mg288085	*Festuca arundinacea*	Reed fescue	Noah Teller	Potrero Meadow	37.92543	-122.60641
mg288084	*Festuca arundinacea*	Reed fescue	Noah Teller	Potrero Meadow	37.925503	-122.6064
mg285980	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez	Potrero Meadow	37.925745	-122.60701
mg285979	*Festuca arundinacea*	Reed fescue	Nicole Ibanez	Potrero Meadow	37.925741	-122.60697
mg285978	*Festuca arundinacea*	Reed fescue	Nicole Ibanez	Potrero Meadow	37.924875	-122.6061
mg288083	*Holcus lanatus*	Common velvetgrass	Noah Teller	Potrero Meadow	37.923739	-122.60737
mg288082	*Holcus lanatus*	Common velvetgrass	Noah Teller	Potrero Meadow	37.924443	-122.60661
mg288081	*Holcus lanatus*	Common velvetgrass	Noah Teller	Potrero Meadow	37.923541	-122.60805
mg285977	*Festuca arundinacea*	Reed fescue	Nicole Ibanez		37.923616	-122.60784
mg285976	*Festuca arundinacea*	Reed fescue	Nicole Ibanez		37.923629	-122.60819
mg288080	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.923873	-122.60771
mg288079	*Festuca arundinacea*	Reed fescue	Noah Teller	LAGUNITAS ROCK SPRING	37.92339	-122.60882
mg285975	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez		37.923414	-122.60904
mg288078	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.923209	-122.60938
mg285974	*Festuca arundinacea*	Reed fescue	Nicole Ibanez	LAGUNITAS ROCK SPRING	37.923381	-122.60938
mg288077	*Festuca arundinacea*	Reed fescue	Noah Teller		37.92307	-122.60954
mg288076	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.922743	-122.60999

mg285973	*Festuca arundinacea*	Reed fescue	Nicole Ibanez		37.922408	-122.60995
mg285972	*Festuca arundinacea*	Reed fescue	Nicole Ibanez	LAGUNITAS ROCK SPRING	37.921818	-122.61013
mg285971	*Festuca arundinacea*	Reed fescue	Nicole Ibanez	LAGUNITAS ROCK SPRING	37.921365	-122.61033
mg288075	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.921428	-122.61033
mg285970	*Ehrharta erecta*	Upright veldt grass	Nicole Ibanez	Lag Rock mostly on east side of road.	37.920143	-122.61125
mg288074	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.920814	-122.61084
mg288073	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.920064	-122.61119
mg288072	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.919784	-122.61116
mg288071	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.919153	-122.61107
mg288070	*Elymus caput-medusae*	Medusa head	Noah Teller		37.919182	-122.61101
mg288069	*Holcus lanatus*	Common velvetgrass	Noah Teller	Continues far up drainage/creek	37.91662	-122.60976
mg288068	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.914727	-122.60958
mg288067	*Centaurea solstitialis*	Yellow starthistle	Noah Teller	LAGUNITAS ROCK SPRING	37.914942	-122.60955
mg285966	*Centaurea solstitialis*	Yellow starthistle	Nicole Ibanez	Mountain Top Quarry	37.91462	-122.60959
po280286	*Euphorbia oblongata*	Eggleaf spurge	Natalie Lamas	Downhill of Lag Rock	37.944973	-122.59888
po280287	*Holcus lanatus*	Common velvetgrass	Natalie Lamas	LAGUNITAS ROCK SPRING	37.940569	-122.60479
po280288	*Festuca arundinacea*	Reed fescue	Natalie Lamas	LAGUNITAS ROCK SPRING	37.93266	-122.60425
mg285897	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.945992	-122.59091
mg285880	*Crataegus monogyna*	Hawthorn	Natalie Lamas		37.945759	-122.59127
mg285879	*Holcus lanatus*	Common velvetgrass	Natalie Lamas	LAKE LAGUNITAS	37.945698	-122.59171
mg285896	*Genista monspessulana*	French broom	Noah Teller		37.947608	-122.59225
mg285878	*Cortaderia jubata*	Andean pampas grass	Natalie Lamas	Bank of Lake Lagunitas immediately on edge of water. Entangled in alder roots	37.946292	-122.59512
mg285877	*Hedera helix*	English ivy	Natalie Lamas	LAKE LAGUNITAS	37.944874	-122.59531
mg285895	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.945289	-122.58124

mg285894	*Holcus lanatus*	Common velvetgrass	Noah Teller	Eldridge to Lake Lagunitas	37.945522	-122.58137
mg285893	*Holcus lanatus*	Common velvetgrass	Noah Teller	Culvert	37.946222	-122.58222
mg285965	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez	AFP7	37.946988	-122.58312
mg285912	*Holcus lanatus*	Common velvetgrass	Amanda Segura-Moon	Lake edge	37.944277	-122.59694
mg285964	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez	LAKE LAGUNITAS	37.945802	-122.58561
mg285963	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez		37.945505	-122.58742
mg285892	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.94562	-122.58829
mg285891	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.945699	-122.58884
mg285890	*Holcus lanatus*	Common velvetgrass	Noah Teller	Ruderal	37.945806	-122.58942
mg285889	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.946048	-122.58964
mg285888	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.946458	-122.5906
mg285911	*Cortaderia jubata*	Andean pampas grass	Amanda Segura-Moon	LAGUNITAS LAKESHORE	37.945198	-122.59669
mg285876	*Cortaderia jubata*	Andean pampas grass	Natalie Lamas	LAGUNITAS LAKESHORE	37.945112	-122.59661
mg285887	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.94656	-122.59097
mg285910	*Hedera helix*	English ivy	Amanda Segura-Moon	LAKE LAGUNITAS	37.945574	-122.59681
mg285886	*Holcus lanatus*	Common velvetgrass	Noah Teller		37.946837	-122.59116
mg285909	*Holcus lanatus*	Common velvetgrass	Amanda Segura-Moon	LAKE LAGUNITAS	37.945725	-122.59697
mg285962	*Crataegus monogyna*	Hawthorn	Nicole Ibanez		37.947194	-122.59201
mg285885	*Holcus lanatus*	Common velvetgrass	Noah Teller	LAKEVIEW RD	37.947152	-122.59198
mg285908	*Festuca arundinacea*	Reed fescue	Amanda Segura-Moon	LAKE LAGUNITAS	37.946747	-122.59781
mg285884	*Crataegus monogyna*	Hawthorn	Noah Teller		37.947572	-122.59276
mg285961	*Crataegus monogyna*	Hawthorn	Nicole Ibanez	LAGUNITAS LAKESHORE	37.947669	-122.59284

mg285960	*Crataegus monogyna*	Hawthorn	Nicole Ibanez	LAKEVIEW RD	37.947711	-122.59306
mg285883	*Holcus lanatus*	Common velvetgrass	Noah Teller	Drainage leading to lake	37.947739	-122.59273
mg285907	*Hedera helix*	English ivy	Amanda Segura-Moon	LAGUNITAS ROCK SPRING	37.948357	-122.59831
mg285906	*Hedera helix*	English ivy	Amanda Segura-Moon	LAGUNITAS LAKESHORE	37.949197	-122.59844
mg285875	*Foeniculum vulgare*	Fennel	Natalie Lamas	Peters Dam	37.998741	-122.70694
mg285959	*Hedera helix*	English ivy	Nicole Ibanez		38.000954	-122.70809
mg285905	*Hedera helix*	English ivy	Amanda Segura-Moon	PETERS DAM	38.001197	-122.70821
mg285958	*Hedera helix*	English ivy	Nicole Ibanez		38.001566	-122.70824
mg285957	*Hedera helix*	English ivy	Nicole Ibanez	PETERS DAM	38.001197	-122.70821
mg285956	*Centaurea solstitialis*	Yellow starthistle	Nicole Ibanez	PETERS DAM	37.999338	-122.70593
mg285955	*Centaurea solstitialis*	Yellow starthistle	Nicole Ibanez	Marin County county near Lower Peters Dam Rd Forest Knolls CA 94933 USA	37.999422	-122.7047
mg285874	*Conium maculatum*	Poison hemlock	Natalie Lamas		37.999346	-122.70411
mg285904	*Hedera canariensis*	Canary ivy	Amanda Segura-Moon	PETERS DAM	37.99924	-122.7041
mg285954	*Hedera canariensis*	Canary ivy	Nicole Ibanez	PETERS DAM	37.99924	-122.7041
mg285953	*Hedera helix*	English ivy	Nicole Ibanez	PETERS DAM	37.999146	-122.70422
mg285873	*Conium maculatum*	Poison hemlock	Natalie Lamas	PETERS DAM	37.998794	-122.70371
mg285952	*Centaurea solstitialis*	Yellow starthistle	Nicole Ibanez	PETERS DAM	37.99845	-122.70349
mg285951	*Ehrharta erecta*	Upright veldt grass	Nicole Ibanez	PETERS DAM	37.997828	-122.70301
mg285950	*Conium maculatum*	Poison hemlock	Nicole Ibanez	PETERS DAM	37.997802	-122.70303
mg285949	*Foeniculum vulgare*	Fennel	Nicole Ibanez		37.997813	-122.70312
mg285948	*Stipa miliacea var. miliacea*	Smilo grass	Nicole Ibanez	Growing out of gravel pile next to woodpiles/pullout. Lookalike Lachnagrostis filiformis (Agrostis	37.997762	-122.70293

				avenacea) also found in the area.		
mg285872	*Foeniculum vulgare*	Fennel	Natalie Lamas	PETERS DAM mostly on downhill side of road	37.997862	-122.70456
mg285903	*Foeniculum vulgare*	Fennel	Amanda Segura-Moon	PETERS DAM	37.997671	-122.70515
mg285947	*Dittrichia graveolens*	Stinkwort	Nicole Ibanez	Plants located in draw down slope between road and lake.	37.996262	-122.70587
mg285871	*Cortaderia jubata*	Andean pampas grass	Natalie Lamas	PETERS DAM	37.996316	-122.70702
mg285902	*Hedera helix*	English ivy	Amanda Segura-Moon	Along upper bank of road climbing open face	37.997396	-122.70868
mg285946	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez		37.996949	-122.70855
mg285945	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez	South side of fire road	37.997061	-122.70947
mg285870	*Hedera helix*	English ivy	Natalie Lamas	Near fork in road on uphill side of road up redwood	37.997373	-122.70911
mg285869	*Hedera helix*	English ivy	Natalie Lamas	Under tan oak trees off the road	37.999464	-122.70891
mg285944	*Hedera helix*	English ivy	Nicole Ibanez		38.000034	-122.70924
mg285901	*Ehrharta erecta*	Upright veldt grass	Amanda Segura-Moon	SHAFTER GRADE	38.000072	-122.7093
mg285900	*Hedera helix*	English ivy	Amanda Segura-Moon	in and above draw (5 plants pulled 9mos prior to new assessment)	38.000326	-122.70942
mg285943	*Hedera helix*	English ivy	Nicole Ibanez		38.000471	-122.70928
mg285942	*Hedera helix*	English ivy	Nicole Ibanez	PETERS DAM	38.000634	-122.70917
mg285899	*Hedera helix*	English ivy	Amanda Segura-Moon	Downhill side of trail	38.000845	-122.70879
mg285941	*Hedera helix*	English ivy	Nicole Ibanez	Creek side of trail right next to trail and up slope in between trails	38.001348	-122.70875
mg285868	*Conium maculatum*	Poison hemlock	Natalie Lamas		38.00169	-122.70886
mg285940	*Hedera helix*	English ivy	Nicole Ibanez	Right next to creek on lower side of bank	38.002937	-122.70866
mg285939	*Hedera helix*	English ivy	Nicole Ibanez	path down from shafter grade to creekside	38.003434	-122.70877
mg285867	*Ehrharta erecta*	Upright veldt grass	Natalie Lamas	Lwr peters dam rd in and below erosion fabric.	38.004154	-122.70844

mg285938	*Hedera helix*	English ivy	Nicole Ibanez	West bank lagunitas creek just south of bridge	38.00446	-122.70881
mg285005	*Holcus lanatus*	Common velvetgrass	Noah Teller	Uphill on road shoulder	37.945293	-122.57697
mg285004	*Acacia melanoxylon*	Blackwood acacia	Noah Teller	Downhill side	37.947403	-122.5759
mg285003	*Acacia melanoxylon*	Blackwood acacia	Noah Teller	LOWER ELDRIDGE	37.947281	-122.57588
mg285937	*Euphorbia oblongata*	Eggleaf spurge	Nicole Ibanez	Uphill side of Eldridge grade about 1-2m from road	37.944679	-122.57662
mg285002	*Holcus lanatus*	Common velvetgrass	Noah Teller	Both sides of road mostly a thin strip in road shoulder	37.949962	-122.58162
mg285001	*Ilex aquifolium*	Holly	Noah Teller	LOWER ELDRIDGE	37.950137	-122.58178
mg285936	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	LOWER ELDRIDGE	37.950573	-122.58226
mg285935	*Hedera canariensis*	Canary ivy	Nicole Ibanez	LOWER ELDRIDGE. At base of redwood 10ft up from culvert outflow	37.950245	-122.58212
mg285934	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	LOWER ELDRIDGE	37.950519	-122.58183
mg285000	*Hedera helix*	English ivy	Noah Teller	LOWER ELDRIDGE uphill	37.954216	-122.58334
mg284999	*Holcus lanatus*	Common velvetgrass	Noah Teller	Both sides of road	37.950898	-122.58186
mg284998	*Holcus lanatus*	Common velvetgrass	Noah Teller	Uphill of Eldridge grade roadside	37.951021	-122.58208
mg284995	*Holcus lanatus*	Common velvetgrass	Noah Teller	Both sides of the road following the creek	37.952266	-122.58289
mg285933	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	LOWER ELDRIDGE	37.952628	-122.58223
mg284993	*Hedera canariensis*	Canary ivy	Noah Teller	LOWER ELDRIDGE	37.955074	-122.58456
mg284992	*Hedera helix*	English ivy	Noah Teller		37.95477	-122.58431
mg285932	*Hedera canariensis*	Canary ivy	Nicole Ibanez	LOWER ELDRIDGE	37.955074	-122.58456
mg284991	*Hedera helix*	English ivy	Noah Teller		37.955799	-122.58483
mg284990	*Hedera helix*	English ivy	Noah Teller	FISH GRADE	37.955799	-122.58464
mg284989	*Genista monspessulana*	French broom	Noah Teller	Between fish gulch trailhead and creek	37.95579	-122.58479
mg285931	*Hedera helix*	English ivy	Nicole Ibanez	LOWER ELDRIDGE	37.95566	-122.5847
mg285898	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	UPPER RAILROAD GRADE	37.917665	-122.59324

mg285254	*Foeniculum vulgare*	Fennel	Natalie Lamas		37.916237	-122.59373
mg284806	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	GRAVITYCAR-THRKMTN-HOGBACK	37.921555	-122.58474
mg284805	*Dittrichia graveolens*	Stinkwort	Nicole Ibanez	UPPER RAILROAD GRADE	37.916759	-122.59422
mg284772	*Cynodon dactylon*	Bermuda grass	Noah Teller	In cracks between stones below the West Point Inn sign	37.916487	-122.59382
mg284804	*Acacia melanoxylon*	Blackwood acacia	Nicole Ibanez	WEST POINT INN	37.916691	-122.59406
mg284771	*Lathyrus latifolius*	Sweet pea	Noah Teller	Around the base and front steps of West Point Inn	37.916536	-122.59375
mg284770	*Ehrharta erecta*	Upright veldt grass	Noah Teller	West Point Inn growing in and around the front entrance steps/rockwork	37.916528	-122.59384
mg284803	*Centaurea calcitrapa*	Purple star thistle	Nicole Ibanez	LOWER RAILROAD GRADE very small plants with strong roots due to continuous mowing check picnic benches and nora trail sign too	37.916155	-122.59373
mg284802	*Acacia dealbata*	Silver wattle	Nicole Ibanez		37.917649	-122.59255
mg284801	*Bromus inermis*	Smooth brome	Nicole Ibanez	Old Railroad Grade between Fern Creek and West Point Inn. Patch located on south side of road on shoulder.	37.919644	-122.58978
mg284800	*Cytisus striatus*	Portuguese broom	Nicole Ibanez	Culvert R1 36. Old RR Grade in sunny shoulder with Diplacus aurantiacus	37.919674	-122.58992
mg284829	*Cortaderia jubata*	Andean pampas grass	Amanda Segura-Moon	Old RR	37.91844	-122.58703
mg284799	*Ehrharta erecta*	Upright veldt grass	Nicole Ibanez	Uphill side of trail	37.92089	-122.58679
mg284769	*Hedera helix*	English ivy	Noah Teller	Old RR grade at West fork Fern Creek & Miller Tr. intersection	37.9211	-122.58662
mg284798	*Ilex aquifolium*	Holly	Nicole Ibanez	Downhill side by large redwood across trail entrance	37.921051	-122.58665
mg284828	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	Old RR Grade	37.919969	-122.58421
mg284797	*Hedera helix*	English ivy	Nicole Ibanez	Old RR grade	37.919849	-122.5838
mg284796	*Acacia dealbata*	Silver wattle	Nicole Ibanez	Uphill side of trail	37.919647	-122.58311
mg284768	*Ehrharta erecta*	Upright veldt grass	Noah Teller	Both sides of road at base of redwoods next to a seep	37.919809	-122.58376
mg284795	*Acacia dealbata*	Silver wattle	Nicole Ibanez	Downhill off road	37.919575	-122.58293

mg284754	*Hedera helix*	English ivy	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK	37.918859	-122.575
mg284753	*Hedera canariensis*	Canary ivy	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK	37.918167	-122.57535
mg284767	*Holcus lanatus*	Common velvetgrass	Noah Teller	Downhill slope in grassy/ferny clearing	37.919068	-122.5747
mg284794	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	GRAVITYCAR-THRKMTN-HOGBACK	37.918972	-122.57485
mg284752	*Ehrharta erecta*	Upright veldt grass	Natalie Lamas	Road side edge intermixed with ferns.	37.918115	-122.57526
mg284793	*Hedera helix*	English ivy	Nicole Ibanez	GRAVITYCAR-THRKMTN-HOGBACK	37.918859	-122.575
mg284766	*Ehrharta erecta*	Upright veldt grass	Noah Teller	GRAVITYCAR-THRKMTN-HOGBACK	37.919079	-122.57483
mg284751	*Ageratina adenophora*	Thoroughwort	Natalie Lamas		37.917856	-122.57533
mg284792	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	GRAVITYCAR-THRKMTN-HOGBACK	37.918938	-122.57434
mg284791	*Hedera helix*	English ivy	Nicole Ibanez	GRAVITYCAR-THRKMTN-HOGBACK	37.91881	-122.57303
mg284790	*Ilex aquifolium*	Holly	Nicole Ibanez	Double Bow Knot	37.9188	-122.573
mg284750	*Hedera helix*	English ivy	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK	37.917072	-122.57607
mg284789	*Acacia melanoxylon*	Blackwood acacia	Nicole Ibanez	Double Bow Knot	37.918791	-122.5731
mg284788	*Acacia melanoxylon*	Blackwood acacia	Nicole Ibanez	GRAVITYCAR-THRKMTN-HOGBACK	37.918766	-122.5733
mg284827	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	Downhill of Gravity Car Road two mature trees both 8-12 inch dbh and ~30ft tall surrounded by seedlings galore	37.917075	-122.57637
mg284826	*Ehrharta erecta*	Upright veldt grass	Amanda Segura-Moon	GRAVITYCAR-THRKMTN-HOGBACK	37.917082	-122.57616
mg284749	*Carex pendula*	Hanging sedge	Natalie Lamas		37.917073	-122.57618
mg284787	*Acacia dealbata*	Silver wattle	Nicole Ibanez	Right off roadside	37.91924	-122.57303
mg284748	*Festuca arundinacea*	Reed fescue	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK	37.91729	-122.5768
mg284825	*Ehrharta erecta*	Upright veldt grass	Amanda Segura-Moon	GRAVITYCAR-THRKMTN-HOGBACK	37.917406	-122.57708
mg284764	*Helichrysum petiolare*	Licorice plant	Noah Teller	Uphill above drainage	37.921461	-122.56825
mg284747	*Hedera helix*	English ivy	Natalie Lamas		37.917509	-122.57798

mg284824	*Ehrharta erecta*	Upright veldt grass	Amanda Segura-Moon	Along side of drainage uphill from the road	37.917443	-122.57796
mg284746	*Hedera canariensis*	Canary ivy	Natalie Lamas		37.917485	-122.57797
mg284823	*Ehrharta erecta*	Upright veldt grass	Amanda Segura-Moon		37.917393	-122.578
mg284763	*Hedera helix*	English ivy	Noah Teller	This is an old eradicated population. The local H. helix population is now on the south side of the road mixed into the fence.	37.920944	-122.57016
mg284786	*Ehrharta erecta*	Upright veldt grass	Nicole Ibanez	Both sides of road at base of slope	37.919966	-122.57008
mg284762	*Hedera helix*	English ivy	Noah Teller	Concentrated and woven into chain link fence.	37.920727	-122.57001
mg284785	*Carex pendula*	Hanging sedge	Nicole Ibanez	across from chain link fence gate	37.920091	-122.5696
mg284761	*Hedera helix*	English ivy	Noah Teller		37.920103	-122.56953
mg284784	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	RR grade above roadcut	37.919866	-122.56965
mg284745	*Hedera helix*	English ivy	Natalie Lamas		37.916039	-122.57907
mg284783	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	Edge of road on north side	37.919765	-122.56976
mg284760	*Acacia melanoxylon*	Blackwood acacia	Noah Teller	Old Railroad Grade	37.919652	-122.5699
mg284782	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	Double bowknot	37.919628	-122.56981
mg284759	*Ulex europaeus*	Gorse	Noah Teller		37.919612	-122.57002
mg284781	*Acacia melanoxylon*	Blackwood acacia	Nicole Ibanez	Off roadside behind stump	37.919585	-122.57054
mg284780	*Acacia melanoxylon*	Blackwood acacia	Nicole Ibanez	DBK	37.919278	-122.57171
mg284822	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	Along side of road	37.914935	-122.57908
mg284744	*Hedera helix*	English ivy	Natalie Lamas		37.91492	-122.57906
mg284779	*Acacia dealbata*	Silver wattle	Nicole Ibanez	Double Bow Knot Old RR and Gravity Car roadside	37.91948	-122.57131
mg284821	*Ehrharta erecta*	Upright veldt grass	Amanda Segura-Moon	GRAVITYCAR-THRKMTN-HOGBACK	37.915692	-122.57916
mg284778	*Hedera helix*	English ivy	Nicole Ibanez		37.919508	-122.57201

mg284743	*Acacia*		Natalie Lamas		37.914452	-122.5786
mg284742	*Euphorbia oblongata*	Eggleaf spurge	Natalie Lamas	Side of road- uphill.	37.914053	-122.57863
mg284820	*Ilex aquifolium*	Holly	Amanda Segura-Moon	GRAVITYCAR-THRKMTN-HOGBACK	37.914276	-122.57875
mg284819	*Hedera helix*	English ivy	Amanda Segura-Moon	Uphill side of road growing out of rock	37.914402	-122.57873
mg284741	*Hedera helix*	English ivy	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK	37.913966	-122.57859
mg284818	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	Downhill a few meters from Gravity Car Road. Plants found in North portion of polygon in 2024 and South portion in 2021.	37.914265	-122.57869
mg284777	*Cortaderia jubata*	Andean pampas grass	Nicole Ibanez	old railroad grade	37.919876	-122.57247
mg284740	*Euphorbia oblongata*	Eggleaf spurge	Natalie Lamas	Edge of roadside.	37.914059	-122.57857
mg284817	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	Downhill a few meters from Gravity Car Road. Plants found in North portion of polygon in 2024 and South portion in 2021.	37.913994	-122.57869
mg284739	*Hedera helix*	English ivy	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK	37.913762	-122.57844
mg284816	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	GRAVITY CAR	37.91366	-122.57851
mg284815	*Euphorbia oblongata*	Eggleaf spurge	Amanda Segura-Moon		37.913767	-122.57848
mg284814	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	GRAVITYCAR-THRKMTN-HOGBACK	37.913326	-122.5786
mg284775	*Acacia melanoxylon*	Blackwood acacia	Nicole Ibanez	UPPER RAILROAD GRADE	37.918946	-122.57693
mg284813	*Euphorbia oblongata*	Eggleaf spurge	Amanda Segura-Moon	Uphill side of road near drainage up on cliff in poison oak	37.913241	-122.57869
mg284738	*Hedera helix*	English ivy	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK- Near base of redwood tree cluster.	37.913302	-122.57862
mg284774	*Ehrharta erecta*	Upright veldt grass	Nicole Ibanez	UPPER RAILROAD GRADE	37.919405	-122.57735
mg284737	*Hedera helix*	English ivy	Natalie Lamas		37.913116	-122.57835

mg284812	*Festuca arundinacea*	Reed fescue	Amanda Segura-Moon	GRAVITYCAR-THRKMTN-HOGBACK mostly in downhill side of road	37.913075	-122.57844
mg284811	*Acacia dealbata*	Silver wattle	Amanda Segura-Moon		37.913135	-122.57847
mg284736	*Hedera helix*	English ivy	Natalie Lamas	Top of slope edge between ferns.	37.913098	-122.57841
mg284755	*Acacia dealbata*	Silver wattle	Noah Teller	UPPER RAILROAD GRADE	37.919817	-122.57838
mg284810	*Euphorbia oblongata*	Eggleaf spurge	Amanda Segura-Moon		37.913138	-122.57821
mg284773	*Euphorbia oblongata*	Eggleaf spurge	Nicole Ibanez	In manzanita on uphill side of old rr	37.918394	-122.58086
mg284735	*Hedera helix*	English ivy	Natalie Lamas	Seen along edge of road within leaf litter and grass.	37.912561	-122.57841
mg284734	*Hedera helix*	English ivy	Natalie Lamas		37.912241	-122.5783
mg284809	*Euphorbia oblongata*	Eggleaf spurge	Amanda Segura-Moon	GRAVITYCAR-THRKMTN-HOGBACK	37.912412	-122.57842
mg284733	*Hedera helix*	English ivy	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK	37.91196	-122.578
mg284732	*Hedera helix*	English ivy	Natalie Lamas	GRAVITY CAR	37.91163	-122.57764
mg284808	*Ehrharta erecta*	Upright veldt grass	Amanda Segura-Moon	GRAVITYCAR-THRKMTN-HOGBACK	37.912787	-122.57831
mg284731	*Hedera helix*	English ivy	Natalie Lamas	GRAVITYCAR-THRKMTN-HOGBACK	37.912001	-122.57782
mg284807	*Holcus lanatus*	Common velvetgrass	Amanda Segura-Moon		37.911436	-122.57752
mg284312	*Carex pendula*	Hanging sedge	Amanda Segura-Moon	along side of bank	37.94741	-122.5937
mg284311	*Ehrharta erecta*	Upright veldt grass	Amanda Segura-Moon	Lag residence along house wall by hose reel and in rock wall opposite (Still along base of house July 2025)	37.947672	-122.59599
mg284617	*Ehrharta erecta*	Upright veldt grass	Nicole Ibanez	Lag residence garage N side of building above cement retaining wall	37.947808	-122.59581
mg284616	*Ehrharta erecta*	Upright veldt grass	Nicole Ibanez	Lag residence along house wall by hose reel and in rock wall opposite	37.947672	-122.59599
mg284615	*Holcus lanatus*	Common velvetgrass	Nicole Ibanez	LAKE LAGUNITAS	37.949048	-122.59647

mg284310	*Acacia melanoxylon*	Blackwood acacia	Amanda Segura-Moon	LAKE LAGUNITAS	37.949005	-122.59687
mg284313	*Acacia*		Noah Teller	LAKE LAGUNITAS	37.948936	-122.59696
mg284614	*Acacia melanoxylon*	Blackwood acacia	Nicole Ibanez	LAKE LAGUNITAS	37.948965	-122.59696
mg284613	*Ehrharta erecta*	Upright veldt grass	Nicole Ibanez	Lake lag parking lot under wooden guardrail under redwood	37.94891	-122.59729
mg285985	*Festuca arundinacea*	Reed fescue	Nicole Ibanez		37.927563	-122.60614

Attachment E

Mt. Tamalpais Bat Monitoring
Year 1, Summer 2025–Spring 2026

SUMMARY REPORT

Mt. Tamalpais Bat Monitoring Year 1, Summer 2025–Spring 2026

JUNE 2026

PREPARED FOR
Marin Municipal Water District
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Cover photo: Redwood forest habitat at Monitoring Site NW-2-L.

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Acronyms and Abbreviations

BLM	USDI Bureau of Land Management
CDFW	California Department of Fish and Wildlife
°F	degrees Fahrenheit
m	meter
MMWD	Marin Municipal Water District
NABat	North American Bat
USFS	USDA Forest Service
USGS	U.S. Geological Survey

1 BACKGROUND

Marin Municipal Water District (MMWD) entered into a Final Settlement Agreement with the California Native Plant Society, Marin Audubon Society, and Marin Conservation League (dated April 30, 2025), which, among other mandates, describes a bat study (Exhibit A to the agreement) that "aligns with the broader One Tam monitoring efforts but with a focus on periodic monitoring and data collection pre-project and during the term of the e-bike pilot." This memorandum summarizes the first year of data collected, which spans summer 2025 through spring 2026, and is referred to as Year 1.

2 CONSULTATION

Consultation activities conducted in support of this study have included a meeting on June 18, 2025, where Stillwater biologists presented the methods and results of the Mt. Tamalpais Bat Monitoring Site Selection (Stillwater Sciences 2025) to the Settlement Agreement parties. Two action items resulted from that meeting:

- Review available U.S. Geological Survey (USGS) data in the North American Bat Monitoring Program (NABat) database, including the locations of previously collected data, the types of data collected, and species composition relevant to the current study. This information is summarized in Sections 3.2, 4.2, and 4.3 below.
- Relocate Site SW-2-R farther from the existing trail. This change was implemented during the first sampling event.

3 METHODS

3.1 MMWD Acoustic Study

3.1.1 Site Selection

The Study Area is located in Marin County, California and covers the area within MMWD's Watershed Boundary that overlaps with NABat Grid 108254 (Figure 1). Eight bat acoustic monitoring sites were identified (Figure 1, Table 1; Stillwater Sciences 2025), which included the following site selection criteria based on the Settlement Agreement and further considerations:

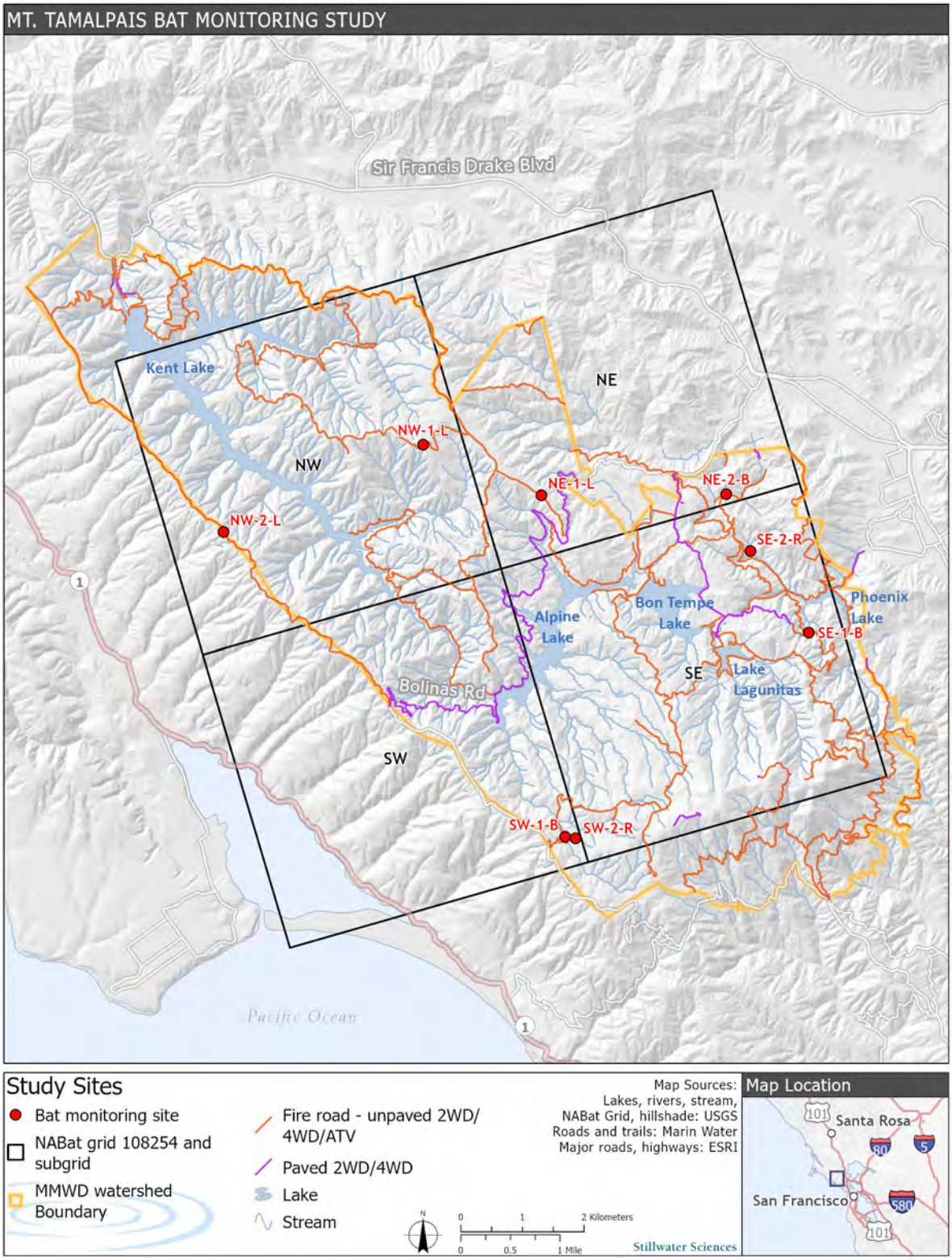
- Placement of two detectors within each of the four subgrids (see Figure 1) of the Study Area, for a total of eight detectors.
- Placement of three detectors along "busy fire roads," three detectors along "low-use fire roads," and two detectors at least 100 meters (m) from a fire road ("remote"). Fire roads are un-paved roads. Busy and low-use roads were identified based on bicyclist use of the roads, as identified in the Mt. Tamalpais Watershed Visitor Survey (Alta Planning and Design, Inc 2024) and in coordination with MMWD staff.
- Placement of sites where "it would be expected that e-bike users would engage their electric motors," which includes all fire roads.

- Placement of all sites within or adjacent to suitable foraging and/or roosting habitat. Foraging areas include habitats such as open water bodies, riparian and forest habitats, and chaparral and grasslands. Roosting habitat includes trees with cavities and crevices formed from scars, lifting bark, and decadence; and anthropogenic (human-made) structures that are known or have potential to support roosting.
- Placement of one busy fire road site and one remote site in habitat favorable for roosting.
- Placement of detectors within 2 meters of the road for all busy and low-use fire road sites.
- Placement of detectors within habitats that best support bat species, including species known to be most sensitive to higher-frequency noise (i.e., sounds not audible to humans, within the range of bat hearing, and corresponding to frequencies produced by e-bikes) [1],[2].
- Additional considerations include safety and accessibility for detector deployment and data retrieval over the two-year survey period, as well as security (and therefore longevity) of the detectors and associated equipment.

Selected sites fell within four major habitat types—California laurel/oak woodland, redwood forest, Douglas-fir/oak woodland, and chaparral/open meadow/grassland (Table 1, Figure 2). Representative photos are provided in Appendix A.

[1] An assessment conducted in support of an e-bike noise study for Midpeninsula Regional Open Space District (2021), in consultation with H. T. Harvey & Associates, indicate that bats in the 40-kHz phonic group likely hear more sound from e-bikes than bats within other phonic groups. This is because sounds within the 40-kHz phonic group frequency attenuate to ambient levels over greater distance (231 feet) than sounds at lower or higher frequencies (100–134 feet). Based on MROSD (2021), bat species whose hearing overlaps with the 40 kHz phonic group may be more prone to disturbance from e-bikes than other bat species: long-legged myotis (*Myotis volans*), little brown bat (*Myotis lucifugus*), and western red bat (*Lasiurus frantzii*). Additional species within this phonic range include western small-footed bat (*Myotis ciliolabrum*) and long-eared myotis (*Myotis evotis*) (Szewczak 2018). Bats in the 20-, 30-, and 50-kHz phonic groups may also be affected, while e-bike sounds within these frequencies attenuate to ambient levels over shorter distances for those groups (MROSD 2021).

[2] We anticipate that all sites in this study provide habitat for species that may be affected by high-frequency noise. Long-legged myotis roost primarily in forests, within large-diameter snags, and forage in forest and over open water (Pierson and Rainey 1998). Little brown bats are generalists and roost in trees, bat houses, and caves, and forage along water bodies (lakes, streams, adjacent woodlands) (USFWS n.d.). Western red bats roost in forest and riparian habitat (sycamore, cottonwood) near water (Bat Conservation International n.d.[a]) and forage over a variety of habitats including grasslands, shrublands, open woodlands, and forest (Harris 2023); Schulze (2025) identified that they forage in shrub/grassland habitat at small scales (0–0.5 km radius) surrounded by substantial forested areas (radius of 1.5 to 3 km or more). Western small-footed bat roost in caves, buildings, mines, crevices, and occasionally under bridges and bar and forage among trees and over water (Harris 2026a). Long-eared myotis roost in buildings, crevices, spaces under bark, and snags and forage among trees and over water and shrubs (Harris 2026b).



Notes: Sites ending in L indicate sites are along low-use roads, B indicates sites are along busy roads, and R indicates remote sites located at least 100 m from a road.

Figure 1 **Mt. Tamalpais bat monitoring site locations**

Table 1 Mt. Tamalpais bat monitoring site locations

Site (Subgrid[1]-#-road use[2])	Subgrid[1]	Fire road name	Road use[2]	Detector placement	Suitable habitat (foraging, roosting)	Dominant habitat type(s)
NE-1-L	NE	Pine Mountain Road	Low-use	Within 2 m of road	Foraging	Chaparral/open meadow
NE-2-B	NE	Deer Park Road	Busy	Within 2 m of road	Foraging/ Roosting	California laurel/ oak woodland
NW-1-L	NW	Pine Mountain Road	Low-use	Within 2 m of road	Foraging	Chaparral/grassland
NW-2-L	NW	Bolinas Ridge Road	Low-use	Within 2 m of road	Foraging/ Roosting	Redwood forest
SE-1-B	SE	Eldridge Grade	Busy	Within 2 m of road	Foraging/ Roosting	Redwood forest
SE-2-R	SE	Shaver Grade	Remote site off of busy road	At least 100 m from road	Foraging/ Roosting	California laurel/ oak woodland
SW-1-B	SW	Laurel Dell Road	Busy	Within 2 m of road	Foraging/ Roosting	Douglas-fir/oak forest
SW-2-R	SW	Laurel Dell Road	Remote site off of busy road	At least 100 m from road	Foraging/ Roosting	Oak woodland/ Douglas-fir forest

[1] Subgrid of NABat grid 108254 represented by orientation: northwest (NW), northeast (NE), southeast (SE), southwest (SW).

[2] Low-use (L) and busy (B) sites identified using Alta Planning and Design, Inc (2024) in coordination with MMWD staff; remote (R) sites placed at least 100 m from the fire road.

Figure 2 **Representative habitat types at monitoring site locations**

3.1.2 Sampling Timeframe

Seasonal acoustic monitoring was conducted to capture bat activity under comparable sampling conditions throughout the year. Each sampling effort spanned four consecutive days and nights per season and included two weekdays and two weekend days (Table 2). Seasons were defined as summer (June–August), fall (September–November), winter (December–February), and spring (March–May). Biologists considered forecasted weather conditions and avoided sampling during potentially inclement weather or storm events, when bat activity would likely be reduced. During each effort, all eight sites were sampled simultaneously, with detectors deployed, operating continuously for 24 hours per day, and retrieved on the same schedule across two weekdays and two weekend days.

Table 2 Bat acoustic monitoring schedule and climatic conditions in Year 1, summer 2025–spring 2026

Season	Survey Dates	Week/Weekend Days	Weather[1]
Summer 2025	June 27–30, 2025	Friday–Monday	High: 84–91 °F Low: 54–55 °F Precipitation: 0 inches
Fall 2025	October 17–20, 2025	Friday–Monday	High: 77–81 °F Low: 47–51 °F Precipitation: 0 inches
Winter 2025/2026	January 23–26, 2026	Friday–Monday	High: 52–68 °F Low: 38–44 °F Precipitation: 0 inches
Spring 2026	May 8–11, 2026	Friday–Monday	High: 77–87 °F Low: 49–52 °F Precipitation: 0 inches

[1] Weather obtained from National Weather Service National Oceanic and Atmospheric Administration closest gaging station at San Rafael-Civic Center (https://www.weather.gov/wrh/Climate?wfo=mtr)

3.1.3 Sampling and Analysis

A SM4BAT full-spectrum ultrasonic recorder[3] from Wildlife Acoustics (Maynard, MA, USA), equipped with an SMM-U2 Ultrasonic Microphone placed at a height of about 3 meters, was set up at each of the eight monitoring sites (Figure 3).

Figure 3 Bat acoustic detector setup at Site SE-1-B, 2025

[3] The detectors were programed to recorded call files greater than 1.5 milliseconds to ensure adequate quantity of call pulses, at a frequency at or greater than 16 kHz to document species known to likely be in the area, and at a sample rate of 256 kHz.

Call files were identified at the species level (or taxon group) using SonoBat Version 30.1 software (SonoBat, Arcata, CA, USA) using Region Pack USw[c20250317]/US West. In preparation for batch classifying the anonymous data, default values in SonoBat were applied[4]. Call files were then manually vetted (reviewed) with a focus on special-status species and species with few call files, and as a manual check on Sonobat's automated classification.

During the manual vetting of the call files, species groups were identified for calls that were not able to be identified to the species level. These groupings included 40-kHz myotis species, 50-kHz myotis species, and low- and high-frequency bats. For the analysis described in this report, we excluded files in these generalized groups that could not be definitely identified to species.

In this report, we summarize the acoustic data using two complementary metrics—(1) number of call files and (2) activity levels as described below. We report both because they answer different questions: call-file counts document the extent of the recorded dataset, whereas active-interval counts more accurately characterize how active each species was at the site. Because these metrics represent different calculations, they should be interpreted separately.

- Number of **call files** reflects the total volume of bat calls recorded and classified during the survey, and provides a measure of overall sampling output and detection frequency for each species. (Since the number of call files does not necessarily reflect the relative abundance of a species, as a single individual repeatedly foraging near a detector can result in a high volume of recorded files, activity levels were also analyzed, as described below.) Both the MMWD and NABat data included this analysis.

- **Activity-intervals** or activity levels reflect an index of relative activity. Species-specific activity levels are defined as the proportion of the total number of 5-minute interval during which at least one call for a given species was recorded. Because multiple species can be recorded within the same 5-minute window, and because intervals from different sites are treated as independent opportunities for occurrence, the sum of all species' proportions can exceed 100%. The result reflects the relative proportion of species' occupancy. Only the MMWD data included this analysis; activity level metrics were not able to be calculated for NABat data due to missing timestamps.

Further summary is provided for species that may be most susceptible to e-bike disturbance. An assessment conducted in support of an e-bike noise study for Midpeninsula Regional Open Space District (MROSD 2021), in consultation with H. T. Harvey & Associates, indicated that bats in the 40-kHz[5] phonic group likely hear more sound from e-bikes than bats within other phonic groups. This is because e-bike sounds within the 40-kHz phonic group range attenuate to ambient levels over a greater distance (231 feet) than sounds at lower or higher frequences (100–134 feet). Based on MROSD (2021), bat species

[4] Default values included an acceptable call quality value of 0.6, a sequence decision threshold value of 0.9, and a maximum number of 16 calls in each file.

[5] The 20 kHz phonic group includes the frequency from 18–26 kHz; the 30 kHz group, 27–35 kHz; the 40kHz group, 36–44 kHz; and the 50 kHz group, 45–55 kHz (MROSD 2021).

whose hearing overlaps with the 40-kHz phonic group may be more prone to disturbance than other species, including long-legged myotis (*Myotis volans*), little brown bat (*Myotis lucifugus*), and western red bat (*Lasiurus frantzii*). Additional species within this phonic range include western small-footed bat (*Myotis ciliolabrum*) and long-eared myotis (*Myotis evotis*) (Szewczak 2018). Bats in the 20-, 30-, and 50-kHz[5] phonic groups may also be affected, while e-bike sounds within these frequencies attenuate to ambient levels over shorter distances for those groups (MROSD 2021). For this analysis, we assume that e-bike noise could affect all bats, while focus on comparing activity levels for species most likely to be affected—those within the 40 kHz phonic range.

3.2 NABat Assessment

The NABat database was queried to obtain previously collected data, sourced from a USGS project, within the grid covered by this MMWD acoustic study. The goal was to identify the location of prior collected data, the type of data collected, and information on species composition that may contribute to the current study.

Information provided for the USGS dataset within the NABat database included:

- Date; time stamps were not available for call files
- Method (stationary acoustic)
- Site—grid level (Grid 108254); geo-referenced site-specific data were not available
- Species identification[6]

NABat acoustic data were analyzed by totaling the number of species call files (as described in Section 3.1.3) and comparing the proportion of call files among sampling efforts (season, year).

4 RESULTS

4.1 MMWD Acoustic Study

Monitoring of the Mt. Tamalpais watershed across four consecutive seasonal surveys from summer 2025 through spring 2026 recorded about 31,000 call files and documented 15 bat species (in 16,424 call files that could be confirmed to the species level), seven of which were special-status species (Table 3, Figure 4). Table 3 presents the data in terms of the number of call files per species per season, whereas Figure 4 summarizes activity intervals (5-minute intervals during which at least one call for a given species was detected), an index of seasonal activity (see explanation of these separate metrics in Section 3.1.3). Because multiple species are commonly detected within the same interval and intervals from different sites are treated as independent opportunities for occurrence, these proportions sum to more than 100% within a survey. The total number of activity intervals per monitoring season was similar among seasons, ranging from 393 to 490.

[6] Not all acoustic data on NABat were vetted.

California myotis (*Myotis californicus*) was the most active species in every season, present in the large majority of active intervals—90% in summer 2025, 67% in fall 2025, 69% in winter 2026, and 92% in spring 2026 (Figure 4). Mexican free-tailed bat (*Tadarida brasiliensis*) was consistently the second-most active species each season, occurring in 25% to 62% of active intervals depending on season, with its highest activity in summer. Together, these two species dominated the community year-round (Table 3, Figure 4); all other species each accounted for less than 5% of the total number of calls (Table 3).

Although California myotis and Mexican free-tailed bat remained dominant throughout, the relative contribution of other bat species varied seasonally. Big brown bat (*Eptesicus fuscus*) and silver-haired bat (*Lasionycteris noctivagans*) were relatively active in summer (representing 34% and 29% of active intervals, respectively) but declined in the cooler seasons, with silver-haired bat falling to 4% by winter 2026. In fall and winter, activity shifted toward greater representation by special-status species, particularly Yuma myotis (*Myotis yumanensis*) and western red bat. Hoary bat (*Lasiurus cinereus*) showed the opposite pattern, peaking in spring 2026 (33% of active intervals), as compared with 5–6% in other seasons (Figure 4). These patterns indicate a seasonally dynamic assemblage despite consistent dominance by the two most active species.

Several species that were rare or absent in the historical NABat acoustic summaries were detected regularly in the recent MMWD surveys (see Sections 4.2 and 4.3). Species detected in the MMWD surveys that were not represented in the historical summaries included canyon bat (*Parastrellus hesperus*), western small-footed bat, and long-eared myotis. Townsend's big-eared bat (*Corynorhinus townsendii*)—identified only once in the entire historical dataset—occurred in 4% to 12% of active intervals across all four seasons (Figure 4). Western red bat, long-eared myotis, and western small-footed bat were recorded consistently during the MMWD surveys. Historical data were not available for the winter season, while the MMWD surveys documented that bat activity persisted through winter, with 13 species identified in winter 2026, indicating year-round bat use of the watershed. The broader species list and more consistent detection of uncommon taxa likely reflect both the rigor of manual review and consistent survey effort across all seasons.

Activity levels among species potentially most susceptible to e-bike noise disturbance—those within the 40 kHz phonic group—were generally low, with the exception of western red bat (Figure 4). Western red bat, a California Department of Fish and Wildlife Species of Special Concern, was the third-most active species in winter and the fourth-most active in fall, while maintaining moderately high activity in spring and summer. Activity levels for other bats within the 40-kHz phonic group were low overall, while seasonal trends indicated that little brown bat and long-eared myotis were most active in summer, western small-footed bats were most active in spring, and long-legged myotis exhibited consistently low activity across all seasons.

Although detectors were deployed for 24-hour periods, no bat activity was detected during daylight hours.

Table 3 Bat species documented in summer 2025 through spring 2026 (in descending order of proportion), proportion of recorded call files by season, habitat, and characteristic call frequencies.

Common Name (*Scientific Name*)[1]	Status[2]	Proportion of recorded call files **(number of call files)**[3]					Roosting and foraging habitat	Species-specific frequency (khz) range[5]
		Total	Season					
			Summer 2025	Fall 2025	Winter 2026	Spring 2026		
California myotis (*Myotis californicus*)	--	59% (9,680)	40.0% (2,187)	56.9% (1,514)	73.0% (1,695)	71.6% (4,284)	A crevice-roosting species that prefers rock-walled canyons, buildings, tree bark, caves and mines. Forages low over fields, brushy habitats, open woodlands, and water bodies.	43–58
Mexican free-tailed bat (*Tadarida brasiliensis*)	--	22% (3,590)	39.3% (2,148)	14.9% (397)	9.9% (229)	13.6% (816)	Roosts in a variety of habitats, including caves, abandoned mines, bridges, culverts, and bat houses. Colonies tend to be large, reaching hundreds of thousands or even millions of bats. Forages over agricultural fields and grasslands.	18–36
Big brown bat (*Eptesicus fuscus*)	--	4% (698)	9.0% (493)	3.2% (85)	0.6% (14)	1.8% (106)	Roosts in loose bark, tree cavities, buildings, barns, bridges, and bat houses. Generalist forager over water and land, forests, and clearings.	23–37
Silver-haired bat (*Lasionycteris noctivagans*)	--	3% (411)	4.6% (252)	2.7% (71)	0.7% (16)	1.2% (72)	Roosts in tree cavities and hollows, exfoliating bark, wood piles, and crevices on cliff faces. Forages over disturbed areas, small clearings, along roadways, and water courses.	23–32
Yuma myotis (*Myotis yumanensis*)	BLM: Sensitive	2% (407)	1.2% (68)	4.7% (126)	3.7% (87)	2.1% (126)	Commonly found roosting in buildings, bridges, and tree cavities but are also known to roost in mines and caves, with some bachelor males found roosting in abandoned cliff swallow nests. Forages over water bodies and riparian zones in forested areas.	43–58
Hoary bat (*Lasiurus cinereus*)	--	2% (375)	0.6% (31)	2.9% (76)	1.0% (24)	4.1% (244)	Roosts among tree foliage, at the edge of clearings, both dense and open woodlands, and treed urban areas. Forages above treetops, riparian zones, stream and lake shores, and urban areas with abundant trees.	16–32
Western red bat (*Lasiurus frantzii*)	CDFW: Species of Special Concern	2% (354)	1.0% (56)	3.1% (83)	5.1% (118)	1.6% (97)	Roosts in foliage, primarily in riparian trees such as sycamores and cottonwoods; woodlands near streams, fields, and orchards; feeds over a wide variety of habitats including grasslands, shrublands, open woodlands and forests, and croplands.	36–53
Fringed myotis (*Myotis thysanodes*)	BLM: Sensitive; FSS: Forest Service Sensitive	2% (258)	0.9% (50)	3.3% (89)	2.6% (60)	1.0% (59)	Roosts in crevices, cavities, and on foliage in a wide variety of habitats including rock crevices, caves, mines, buildings, and bridges, and early to mid-stage large-diameter snags; forages in meadows and thick vegetation along streams and rivers.	21–32
Townsend's big-eared bat (*Corynorhinus townsendii*)	CDFW: Species of Special Concern; BLM: Sensitive; USFS: Sensitive	1% (158)	0.8% (46)	3.0% (79)	0.7% (17)	0.3% (16)	Roosts in cavities, most often in tunnels, caves, mines, and buildings, but also rock shelters, preferentially close to water; forages in the riparian zone along creeks and rivers.	18–32
Canyon bat (*Parastrellus hesperus*)	--	1% (114)	0.2% (10)	2.1% (57)	1.2% (29)	0.3% (18)	Roosts in boulders, cracks and crevices on rock faces, mines and caves, and may use burrows made by kangaroo rats and other rodents. Relies on aquatic habitats and riparian areas for foraging.	41–51
Little brown bat (*Myotis lucifugus*)	--[6]	1% (109)	0.8% (43)	1.1% (28)	0.4% (9)	0.5% (29)	Typically roosts in caves and mines in the winter; trees, artificial structures, including bat houses, under rocks and in piles of wood in the summer. Forages over bodies of water, riparian areas, and woodlands near water.	35–48
Western small-footed bat (*Myotis ciliolabrum*)	BLM: Sensitive	1% (92)	0.4% (21)	0.5% (14)	0.1% (3)	0.9% (54)	Roosts in caves, rock crevices, and human-made structures; may also roost at ground level. Forages close to water sources or rocky bluffs.	38–48
Long-eared myotis (*Myotis evotis*)	BLM: Sensitive	1% (85)	0.4% (21)	1.0% (27)	0.7% (17)	0.3% (20)	Roosts in tree cavities and beneath exfoliating bark on live or dead trees, and pregnant females may roost at ground level in rock crevices, fallen logs, and the cracks of tree stumps, but do not rear young in these locations. Forages primarily in coniferous forest in flight and also by gleaning insects from foliage or the ground.	29–43
Pallid bat (*Antrozous pallidus*)	CDFW: Species of Special Concern; BLM: Sensitive; USFS: Sensitive	0.4% (59)	0.5% (27)	0.4% (10)	0.0% (1)	0.4% (21)	Roosts in rock crevices, cavities in live or dead trees, mines, caves, bridges, and a variety of vacant and occupied buildings; feeds in a variety of upland habitats, most frequently in riparian, open oak savannah, and open mixed deciduous forest.	23–34
Long-legged myotis (*Myotis volans*)	--	0.2% (34)	0.2% (9)	0.2% (4)	0.1% (2)	0.3% (19)	Roosts in old-growth tree crevices and exfoliating bark, rock crevices, cliffs, and buildings. Forages over streams, ponds, water tanks, and forest clearings.	34–50

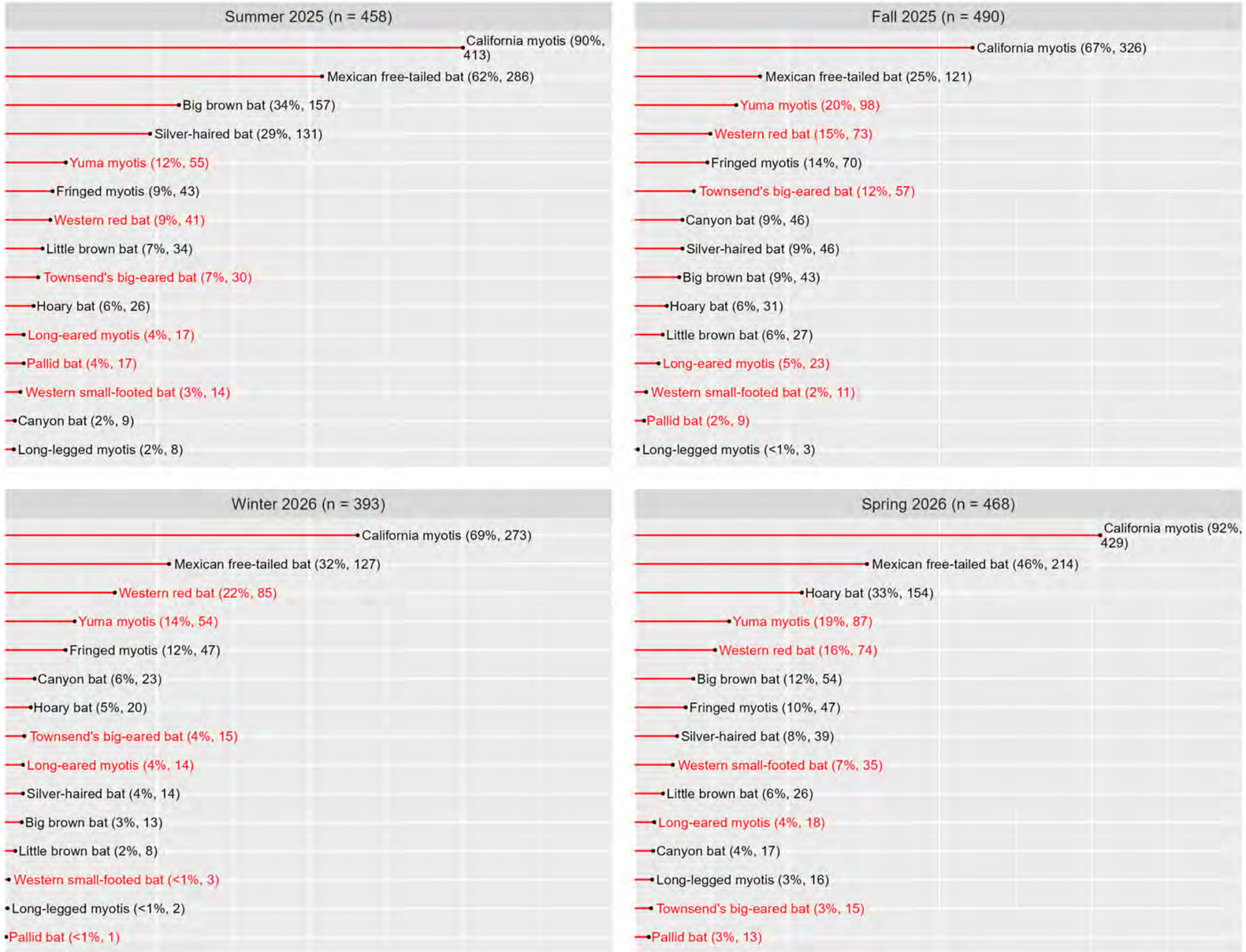
[1] Bold species hear within the 40-kHz phonic group and may be more prone to disturbance from e-bikes than other species (Midpeninsula Regional Open Space District 2021), including western red bat, little brown bat, and long-legged myotis. Additional species within this range also include western small-footed bat and long-eared myotis (Szewczak 2018).

[2] Special-status designations: USFS – USDA Forest Service; BLM – USDI Bureau of Land Management; CDFW – California Department of Fish and Wildlife

[3] Values give the proportion of total recorded call files for each species and, in parentheses, the number of call files, summed across the eight sampling sites and four seasons.

[4] Source: Szewczak (2018)

[5] Little brown bat (*Myotis lucifugus*) is on the USFWS National Domestic Listing Workplan for Fiscal Year 2024–2028, meaning that the UFWS will make a listing determination under the Endangered Species Act, based on the best available scientific and commercial data.



Note: Species ordered in descending proportion. Values give the proportion of total activity intervals each species and, in parentheses, the number of activity intervals, summed across the eight sampling sites and four seasons (multiple species are commonly detected within the same interval and because intervals from different sites are treated as independent opportunities for occurrence, the sum of all species' proportions can exceed 100%). Red designates special-status species.

Figure 4 Seasonal bat activity (5-minute activity intervals in which at least one call for a given species was recorded) in summer 2025 through spring 2026.

4.2 NABat Assessment

Historical acoustic monitoring conducted by the USGS produced automated species classifications across nine survey periods, spanning summer 2017 to summer 2024, plus one fall sampling season in 2017 (Figure 5, tiles 1–3). Identified call files per sampling effort ranged from 82 (fall 2017) to 1,194 (summer 2018), with summer surveys consistently yielding the largest sample sizes. Across all periods, 11 bat species were identified. The community was dominated by a small number of species—primarily California myotis, Mexican free-tailed bat , silver-haired bat, and big brown bat—though their relative proportions shifted considerably among years and seasons.

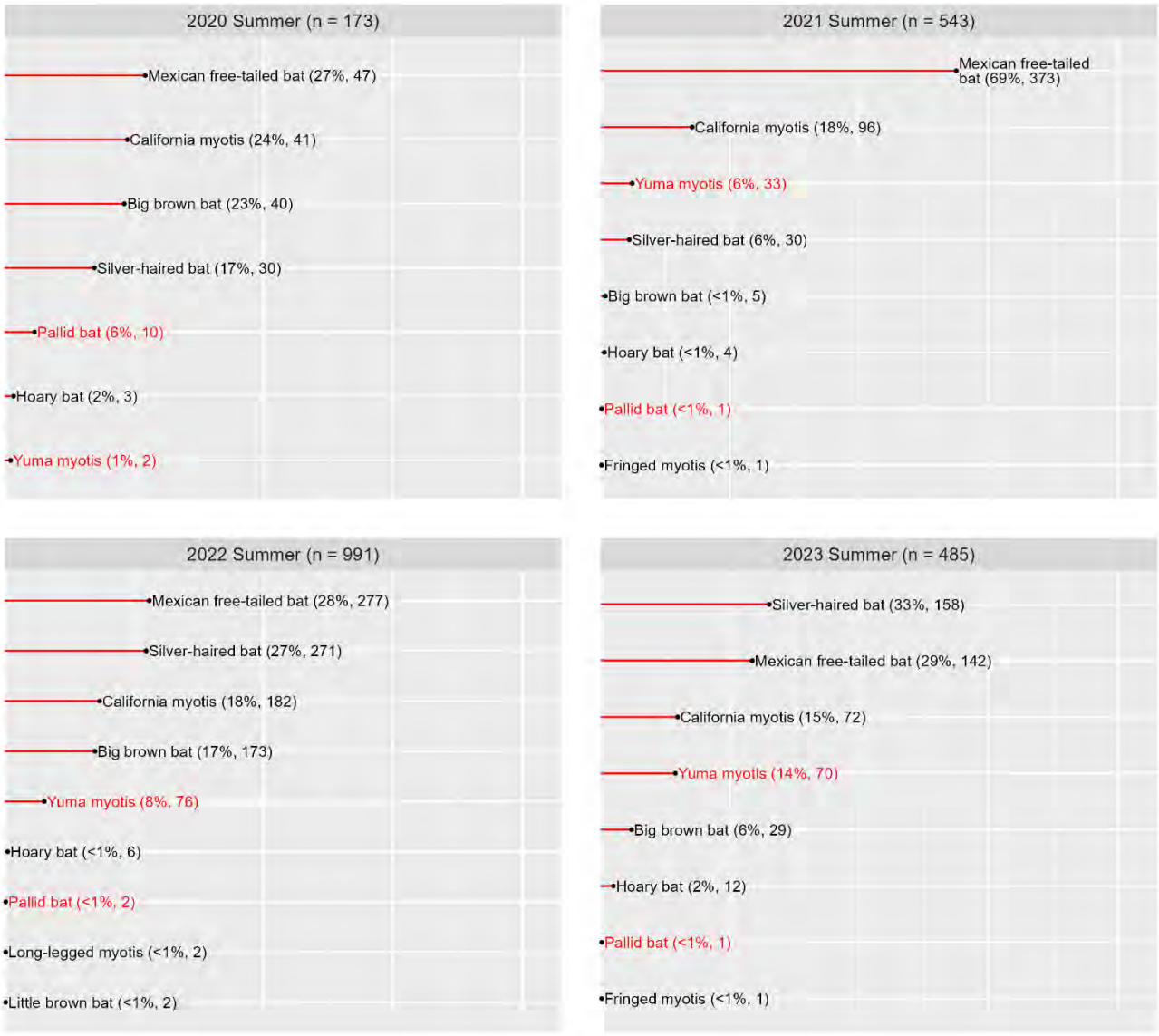
California myotis frequently accounted for the largest proportion of call files during summer surveys, comprising the majority of calls in 2017 (51%) and 2018 (57%); however, its proportion of call files declined substantially in later years, falling to 15–24% in 2020 through 2024. Mexican free-tailed bat was the other major contributor, ranging from 16% (2018) to 29% (2023) in most summers, but reaching notably higher proportions in the fall 2017 survey (77%) and the summer 2021 survey (69%), suggesting seasonal or year-specific variation in detections for this species.

Silver-haired bat showed a marked increase in the proportion of call files over the monitoring period. After comprising roughly 9–11% of call files in 2017–2018, this species became one of the dominant taxa in several later surveys, reaching 27% in 2022, 33% in 2023, and 48% in 2024, when it accounted for the largest proportion of any species. Big brown bat remained a consistent component of the assemblage throughout, generally ranging from 4% to 23% of calls, while hoary bat and Yuma myotis were regularly present at lower proportions.

Several species were identified only rarely, each typically comprising less than 1% of total call files in any given period. These included pallid bat (*Antrozous pallidus*), western red bat, fringed myotis (*Myotis thysanodes*), little brown bat, and long-legged myotis. Townsend's big-eared bat was the rarest classification recorded, appearing only once across the entire dataset (summer 2024).

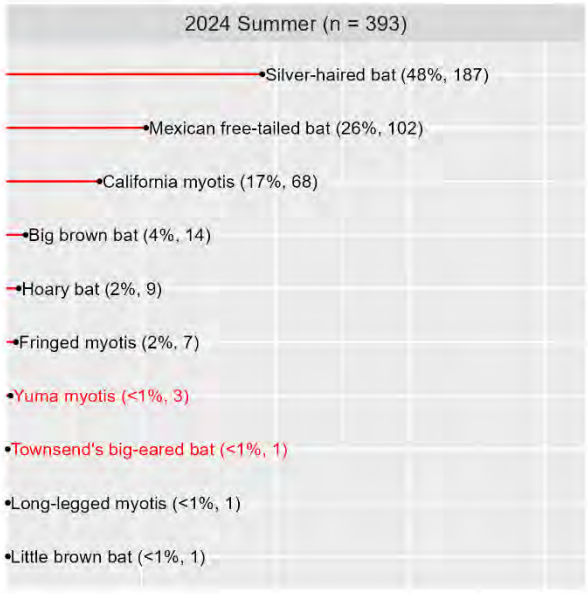
Note: Species ordered in descending proportion; red designates special-status species. Values in parentheses give the proportion and the number of call files. Panel sample sizes (n) indicate the total number of call files per survey period. Proportions may not sum to exactly 100% within a panel due to rounding.

Figure 5 **Historical bat species calls files in Grid 10825 based on USGS automated acoustic classifications, by season, 2017–2024 (Tile 1 of 3).**



Note: Species ordered in descending proportion; red designates special-status species. Values in parentheses give the proportion and the number of call files. Panel sample sizes (n) indicate the total number of call files per survey period. Proportions may not sum to exactly 100% within a panel due to rounding.

Figure 5 **Historical bat species call files in Grid 10825 based on USGS automated acoustic classifications, by season, 2017–2024 (Tile 2 of 3).**



Note: Species ordered in descending proportion; red designates special-status species. Values in parentheses give the proportion and the number of call files. Panel sample sizes (n) indicate the total number of call filesper survey period. Proportions may not sum to exactly 100% within a panel due to rounding.

Figure 5 Historical bat species call files in Grid 10825 based on USGS automated acoustic classifications, by season, 2017–2024 (Tile 3 of 3).

4.3 Comparison of NABat and MMWD Data

The recent MMWD surveys represented a substantially larger sampling effort than the historical NABat dataset: approximately 16,000 call files were recorded and classified to species across the four 2025–2026 seasons, compared with roughly 2,400 call files in the historical NABat dataset spanning 2017–2024. This greater volume of recordings, together with comprehensive manual review, likely contributes to the more complete assemblage documented in the recent surveys. The historical NABat call files dataset (Figure 5) was compared with the more recent MMWD activity interval dataset (Figure 4). Even though a direct comparison cannot be made between the two datasets due to the differing metrics, a general comparison of seasonal patterns can be observed. California myotis and Mexican free-tailed bat were the dominant taxa throughout both datasets, and species such as big brown bat, silver-haired bat, hoary bat, and Yuma myotis were consistently present in the community.

The clearest difference is in detected richness of uncommon species. The recent MMWD surveys identified 15 species—including canyon bat, western small-footed bat, and long-eared myotis, that did not appear in the NABat historical summaries. The recent MMWD surveys also documented species such as Townsend's big-eared bat far more consistently than the NABat historical record, in which it was identified only once. The recent MMWD surveys also extended across all four seasons, confirming year-round activity (including 13 species in winter), whereas the historical summaries were concentrated in summer with a single fall survey.

Taken together, the recent manually vetted MMWD data corroborate the long-standing dominance patterns in the historical record while also revealing a more diverse and persistently active assemblage

than automated summaries alone indicated, likely reflecting the greater sensitivity of manual review and more even seasonal effort.

5 FUTURE ACTIVITES

This technical memorandum summarizes Surveys 1–4, conducted in summer 2025, fall 2025, winter 2025/2026, and spring 2026. Four additional surveys will be completed as part of this study: Survey 5 in summer 2026 (June–August 2026), Survey 6 in fall 2026 (September–November 2026), Survey 7 in winter 2026/2027 (December 2026–February 2027), and Survey 8 in spring 2027 (March–May 2027). Results from all surveys will be synthesized in a final report, anticipated in July 2027. The final report will summarize two years of monitoring and will focus on species diversity, distribution, activity levels, seasonal trends, and habitat use. The final report will also incorporate information for context from the USGS NABat data along with existing data from the *One Tam Peak Health: An Update on the Status of Mt. Tamalpais' Ecosystems* (One Tam 2023).

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APPENDIX A

Site Location Photos

Figure A-1 Site NE-1-L

Figure A-2 Site NE-2-B

Figure A-3 Site NW-1-L

Figure A-4 Site NW-2-L

Figure A-5 Site SE-1-B

Figure A-6 Site SE-2-R

Figure A-7 Site SW-1-B

Figure A-8 Site SW-2-R