Moran Lake Monarch Butterfly Habitat Management Plan Update

prepared with the assistance of

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1 Introduction

Rincon Consultants, Inc. (Rincon) has prepared this report in conjunction with Park Planning staff from the Santa Cruz County Department of Parks, Open Space & Cultural Services (County Parks) as an update to the 2010 Moran Lake Monarch Butterfly Habitat Management Plan (MBHMP). The 2010 MBHMP integrated previous reports and studies regarding monarch butterfly overwintering habitat surrounding Moran Lake in Santa Cruz County, California. This updated MBHMP details the most recent monarch population data, describes current monarch overwintering conditions at Moran Lake, and provides updated monarch habitat management recommendations. This plan includes content that is consistent with the 2022 Monarch Overwintering Grove Management Plan Template. The template was developed for land managers of overwintering sites by the following agencies and organizations: Xerces Society for Invertebrate Conservation,[1] Groundswell Coastal Ecology,[2] California Department of Parks and Recreation, and the U.S. Fish and Wildlife Service (USFWS).

The 2010 MBHMP integrated the Management Plan for the Monarch Habitat at Moran Lake County Park (Joni L. Janecki & Associates 2004), the Management Plan for the Monarch Habitat at the D.A. Porath [Lode Street] Sanitation Facility of the Santa Cruz County Sanitation District (Joni L. Janecki & Associates, Inc. 2006), and portions of the Moran Lake Water Quality Study & Conceptual Restoration Plan prepared for the Santa Cruz County Redevelopment Agency (John Gilchrist & Associates and Fall Creek Engineering 2005). This plan, unlike the 2010 plan, does not address improvements to County Parks' facilities (trails, amenities, etc.) or to the structure of the lake (bank stabilization). A separate project addressing those elements is being developed presently.

Land ownership of the overwintering habitat surrounding Moran Lake is shared between County Parks and the Santa Cruz County Sanitation District (Sanitation District). The overwintering habitat includes the eucalyptus groves within Moran Lake County Park and surrounding the Sanitation District's D.A. Porath Sanitation Facility. Under the terms of a memorandum of understanding between the Sanitation District and County Parks that was approved by the Board of Supervisors on September 30, 2025, County Parks is responsible for managing the entirety of the monarch habitat.

County Parks was awarded a grant from the USFWS Coastal Program for Central California Coast. The USFWS agreement contains two objectives for County Parks to meet:

- Objective 1 – Create an updated site assessment and set of management recommendations, based on monitoring of the overwintering monarch site, to be referenced and considered in a future Monarch Butterfly Habitat Management Plan
- Objective 2 – With stakeholder and community input, prepare an updated Monarch Butterfly Habitat Management Plan for Moran Lake County Park, prepare environmental review document in accordance with the California Environmental Quality Act, and present

[1] The Xerces Society for Invertebrate Conservation is an international nonprofit organization that protects the natural world through the conservation of invertebrates and their habitats. As a science-based organization, they both conduct their own research and rely upon the most up-to-date information to guide their conservation work. Key program areas include pollinator conservation, endangered species conservation, and reducing pesticide use and impacts (Xerces 2023a).

[2] Groundswell Coastal Ecology is a 501(c)(3) dedicated to building healthy coastal ecosystems through education and community-based ecological restoration and research. The organization partners with land managers, agencies, stakeholder groups, and the public to identify, prioritize, plan, and implement projects that enhance biodiversity and the long-term health of coastal habitats (Groundswell Coastal Ecology 2023).

to the County Board of Supervisors for review and adoption, allowing subsequent objectives to be completed.

To meet these objectives, County Parks contracted a qualified entomologist specializing in migratory monarchs to assess the site, complete an updated report, and provide a set of recommendations for monarch habitat management at Moran Lake County Park. Entomologist Dr. Stu Weiss's findings and recommendations are presented in the 2022 Moran Lake Monarch Butterfly Habitat Existing Conditions Report (Appendix A). Recommendations were modified in 2024 based on additional available information and written as an addendum to the Moran Lake Monarch Butterfly Overwintering Habitat Existing Conditions Report prepared in 2022. Data and management recommendations from the 2024 Addendum have been incorporated into this plan, and are in Appendix A. Recommendations were further modified in 2025 based on a wind study conducted by Althouse and Meade and Dr. Stu Weiss. Data and management recommendations from the 2025 wind study have been incorporated into this plan, and are included as a 2025 Addendum to the Moran Lake Monarch Butterfly Overwintering Habitat Existing Conditions Report in Appendix A.

County Parks orchestrated stakeholder and community input over a three-year period that was used to complete this Monarch Butterfly Habitat Management Plan for Moran Lake County Park. In addition, County Parks has contracted with consultants to prepare an environmental document in accordance with the California Environmental Quality Act. The final Habitat Management Plan and environmental document will be presented to the County Board of Supervisors for review and adoption, which would facilitate completion of the USFWS grant objectives.

2 Background and Purpose

Available reports regarding the origin of the blue gum eucalyptus forest that provides the monarch butterfly overwintering habitat include the 1980 Environmental Baseline Study for the Moran Lake Enhancement Plan Santa Cruz, California, and the 2005 Santa Cruz County Redevelopment Agency's Moran Lake Water Quality Study & Conceptual Restoration Plan, and the 2010 Moran Lake Monarch Butterfly Habitat Management Report (MBHMP) The consensus is that the blue gum eucalyptus growing around Moran Lake were likely planted as windbreak trees in the late 1800's or early 1900's. An analysis of aerial photos showed that the trees were well-established by 1929. Two adjacent woodlots were planted north of the lake. The main eucalyptus grove is likely the remains of one of the woodlots and now surrounds the Sanitation District's D.A. Porath Sanitation Facility, which was constructed in 1953.

The 1980 Environmental Baseline Study (Study) was prepared for the first phase of the Moran Lake Enhancement Plan. The Study notes that surveys were conducted that year for water quality in relation to biological abundance and diversity. Biological inventories included vegetation, birds, aquatic invertebrates (benthic and planktonic), fish and mammals. The stated intent of the Study was for the baseline information to be used for comparison, with post-restoration monitoring at Moran Lake. No known monitoring reports are available at the time of the drafting of this document. The Study notes that Moran Lake supported an extremely impoverished fauna of estuarine organisms at that time. No data regarding monarch butterflies is provided.

The Redevelopment Agency's Restoration Plan discusses Moran Lake historically as a pocket beach heavily influenced by seasonal tides that was filled with soil and materials in the early 1960s when Wood's Lagoon was expanded and converted into the Santa Cruz Yacht Harbor. The 2005 Plan describes the area being colonized primarily by non-native plants at that time, including by the dominant trees of blue gums (*Eucalyptus globulus*) and Monterey cypress (*Cupressus macrocarpa*).

In 1997, the Xerces Society, a volunteer citizen scientist group, began recording monarch butterfly overwintering counts in the State. In 1997, the organization recorded approximately 70,000 overwintering monarchs at the Moran Lake site. In 2016, the Xerces Society listed the Moran Lake site as one of the top 10 highest priority overwintering sites in the region. The western population of monarch butterflies has fluctuated greatly in recent years. An annual count of monarchs at Moran Lake in 2020 recorded just 50 overwintering monarchs; 7,050 were recorded in 2023 (Xerces Society 2023b).

In 2010, Moran Lake County Park's MBHMP was prepared to include the most recent monarch population use and habitat information and provide County Parks with an updated, comprehensive, and certified monarch management plan. The MBHMP provided goals and management recommendations for all monarch overwintering habitat surrounding Moran Lake. Since that time, County Parks has struggled with the funding to implement such a plan, and thus, management actions were constrained.

Over the past decade much of the monarch overwintering habitat at Moran Lake, comprised of eucalyptus groves, has been altered by drought. The long-term drought has negatively affected monarch overwintering habitat along the California coast as it has at the Moran Lake site. The drought, plus permitted and non-permitted tree removals, non-holistic tree maintenance, and poorly draining soil resulting in multiple tree failures of windbreak trees are contributing to the declining habitat.

The purpose of this updated MBHMP is to describe the current habitat conditions on-site and provide updated management recommendations based on current monarch overwintering observations and existing habitat conditions that will aid in the restoration, preservation, and future enhancement of monarch overwintering habitat at Moran Lake.

2.1 Monarch Butterfly Habitat Listing Status

2.1.1 Federal

In 2014, the Center for Biological Diversity petitioned the USFWS to list the monarch butterfly as a threatened species under section 4(d) of the federal Endangered Species Act (ESA; Center for Biological Diversity 2014). The USFWS updated their status assessment on December 15, 2020 (USFWS 2020), finding that listing of the western monarch population was warranted but precluded. The finding stated that the USFWS could not identify Evolutionary Significant Units (ESU) for monarchs, because, as defined in the ESA, when invertebrates, including butterflies, are evaluated, they are evaluated across the entire range. The evaluation was based on the global population that includes monarchs that occur east of the Rocky Mountains and on multiple continents. Monarchs were ranked at priority level #8 on the species list (USFWS 2022). Monarchs were proposed for listing as Threatened under the ESA by the USFWS on December 12, 2024. In addition, the USFWS proposed the Moran Lake habitat area as one of the five designated critical habitat areas in Santa Cruz County. A final decision by the USFWS is expected in early 2026.

2.1.2 State

Monarchs are included on the California Department of Fish and Wildlife (CDFW) Terrestrial and Vernal Pool Invertebrates of Conservation Priority list with a State Ranking of S2S3, Imperiled/Vulnerable (CDFW 2017). The monarch is also listed as a Species of Greatest Conservation Need on California's State Wildlife Action Plan (CDFW 2015). The Sacramento Superior Court ruled in *Almond Alliance of California v. California Department of Fish and Wildlife,* Sacramento Superior Court No. 34-2019-80003216 (Nov. 13, 2020) that insects are not protected under the California Endangered Species Act (CESA). On May 31, 2022, an appellate court ruled that the CESA does in fact cover terrestrial invertebrates, thereby reversing the previous ruling (Sacramento Superior Court No. 34-2019-80003216CUWMGDS). Currently, monarchs are not listed under the CESA, though there is potential for the overwintering population to be listed in the future, based on the May 2022 ruling. Monarchs do have protection under California Fish and Game Code (Section 1002), which prohibits the take or possession of wildlife and California Code of Regulations Title 14 Sections 650(a) and (b), which requires a valid Scientific Collection Permit issued by CDFW for "handling monarchs, removing them from the wild, or otherwise taking them for scientific or propagation purposes, including captive rearing."

The California Coastal Act (CCA) defines Environmentally Sensitive Habitat Areas (ESHA) as "any area in which plant or animal life or their habitats are either rare or especially valuable because of their nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments." Wetlands, including the estuarine habitat in and near Moran Lake, are protected under Section 30233 of the Coastal Act. Additionally, marine resources, including the marine habitat that occurs in the southwestern portion of the Project Area, below the high tide line of the Pacific Ocean, are protected under Section 30230 of the Coastal Act. The Santa Cruz County Local Coastal Program (LCP) Implementation Plan (IP) (County Code/IP Section 16.32.040) definition of sensitive habitat includes unique plant habitats, rare and endangered plant and animal habitats,

wetlands, coastal streams, rocky points, sea cliffs, intertidal areas, and kelp beds. Therefore, according to the Santa Cruz County LCP, the riparian corridors within the Coastal Zone are also considered ESHAs and the riparian vegetation associated with Moran Creek is an ESHA. Areas which provide habitat for rare, endangered, or threatened species are also considered ESHA. The eucalyptus groves within Moran Lake County Park which provide overwintering habitat for the monarch butterfly are therefore also ESHAs.

2.1.3 Regional

The Santa Cruz County Code's Chapter 16.32 Sensitive Habitat Protection, section 16.32.040 defines ESHAs as Sensitive Habitat. Habitat is considered sensitive if it provides habitat for plant or animal species or communities that are locally unique or are recognized by the State or Federal Resource Agencies as being rare, threatened endangered, or a species of special concern (County of Santa Cruz 2024). The definition of sensitive habitat also included unique plant habitats, wetlands, coastal streams, rocky points, sea cliffs, intertidal areas, and kelp beds. Therefore, according to the Santa Cruz County LCP, the riparian corridors within the Coastal Zone are also considered ESHAs and the riparian vegetation associated with Moran Creek is an ESHA. Additionally, the marine and estuarine habitat that occurs in the southwestern portion of the Project Area, below the high tide line of the Pacific Ocean is also considered an ESHA. Areas which provide habitat for rare, endangered, or threatened species are also considered ESHA. The eucalyptus groves within Moran Lake County Park which provide overwintering habitat for the monarch butterfly are therefore also ESHAs.

County Code Chapter 16.34 Significant Trees Protection preserves significant trees and forest communities on private and public property in the County's Coastal Zone to protect and enhance the County's natural beauty, property values, and tourist industry. The ordinance prohibits the removal of significant trees without a Significant Tree Removal Permit. Significant trees include any tree, sprout clump, or group of trees, as follows:

(A) Within the urban services line or rural services line, any tree which is equal to or greater than 20 inches d.b.h. (approximately five feet in circumference); any sprout clump of five or more stems each of which is greater than 12 inches d.b.h. (approximately three feet in circumference); or any group consisting of five or more trees on one parcel, each of which is greater than 12 inches d.b.h. (approximately three feet in circumference).

(B) Outside the urban services line or rural services line, where visible from a scenic road, any beach, or within a designated scenic resource area, any tree which is equal to or greater than 40 inches d.b.h. (approximately 10 feet in circumference); any sprout clump of five or more stems, each of which is greater than 20 inches d.b.h. (approximately five feet in circumference); or, any group consisting of 10 or more trees on one parcel, each greater than 20 inches d.b.h. (approximately five feet in circumference).

(C) Any tree located in a sensitive habitat as defined in Chapter 16.32 SCCC. Also see SCCC 16.34.090(C), exemption of projects with other permits.

Tree removal exemptions listed in Section 16.34.080 include allowances for emergency tree work that require immediate action to abate hazards to safety of life or property. 16.34.090 of the ordinance includes exemptions for tree removals authorized pursuant to a valid discretionary permit.

Biological and water resources are protected by the County of Santa Cruz General Plan and the Local Coastal Plan (LCP) policies outlined in *Chapter 5: Conservation and Open Space* of the General Plan.

Relevant policies for the Moran Lake County Park Improvement Project include those outlined under the following General Plan and Local Coastal Plan objectives: *5.1 Biological Diversity, 5.2 Riparian Corridors and Wetlands, 5.3 Aquatic and Marine Habitats, 5.4 Monterey Bay and Coastal Water Quality,* and *5.7 Maintaining Surface Water Quality*.

2.2 Consistency with Other County Plans

The MBHMP is in the jurisdiction of two local land use plans: the Pleasure Point Community Plan and the Santa Cruz County 1994 General Plan and LCP. The Pleasure Point Community Plan was adopted in May 2010 through County ordinances and focuses primarily on design standards and public improvements in the Pleasure Point/26th Avenue area (Santa Cruz County 2010). Since the MBHMP does not propose development as a part of the plan, the Pleasure Point Community Plan does not apply and is not evaluated further within this document. However, the Santa Cruz County 1994 General Plan and LCP includes several policies that serve to protect sensitive habitat areas, and thus, avoid or mitigate potential impacts to sensitive habitat that may occur as a result of development in the County. The MBHMP's consistency with these policies is discussed below.

Table 1 MBHMP Consistency with the 2024 General Plan and Local Coastal Program

County of Santa Cruz LCP Policy and Programs	Consistency Discussion
Agriculture, Natural Resources, and Conservation Element	
ARC-3.1.4 Sensitive Habitat Protection Ordinance (LCP). Implement protection of sensitive habitats and of ESHA through SCCC Chapters 16.32 Sensitive Habitat Protection, 16.30 Riparian Corridor and Wetlands Protection, and 13.20 Coastal Zone Regulations. Any amendments to this ordinance shall require a finding that sensitive habitats shall be afforded equal or greater protection by the amended language.	**Consistent.** The MBHMP in itself serves to protect the monarch butterfly overwintering habitat by setting forth management actions consistent with Policy ARC-3.1.4.
ARC-3.1.6 Development within Sensitive Habitats (LCP). Sensitive habitats shall be protected against any significant disruption of habitat values, and any proposed development within or adjacent to these areas must maintain or enhance the functional capacity of the habitat. Reduce in scale, redesign, or, if no other alternative exists, deny any project that cannot sufficiently mitigate significant adverse impacts on sensitive habitats unless approval of a project is legally necessary to allow a reasonable use of the land.	**Consistent.** The MBHMP in itself serves to protect the monarch butterfly overwintering habitat by setting forth management actions consistent with Policy ARC-3.1.6.

County of Santa Cruz LCP Policy and Programs	Consistency Discussion
ARC-3.1.7 Site Design and Use Regulations (LCP). Protect sensitive habitats against any significant disruption or degradation of habitat values in accordance with the Sensitive Habitat Protection ordinance. Utilize the following site design and use regulations on parcels containing these resources. excluding existing agricultural operations: (1) Structures, when allowed, shall be placed as far from the habitat as feasible. (2) Delineate development envelopes to specify location of development in minor land divisions and subdivisions. (3) Consider use of conservation or open space easements, deed restrictions, Conditions of Approval or equivalent measures to protect that portion of a sensitive habitat on a project parcel which is undisturbed by a proposed development activity or to protect sensitive habitats on adjacent parcels. (4) Limit or restrict outdoor access of domestic animals where they threaten sensitive habitats. Santa Cruz County General Plan Page 5-50 3/18/2024 (5) Limit removal of native vegetation to the minimum amount necessary for structures, landscaping, driveways, septic systems and gardens. (6) Maintain regulations and impose development permit conditions of approval as warranted, to limit landscaping with invasive or exotic species and to strongly encourage or require the use of characteristic native species, as well as consistency with the Water Efficient Landscaping Ordinance.	**Consistent.** The plan would not result in disruption or degradation of a sensitive habitat and would incorporate native plants as appropriate to improve habitat for monarchs and other native species at Moran Lake**.**
ARC-3.1.9 Biotic Assessments (LCP). Within the following areas, require a biotic assessment as part of normal project review to determine whether a full biotic report should be prepared by a qualified biologist, and require biotic permits as part of application reviews as may be needed: (1) Areas of biotic concern, mapped; (2) Sensitive habitats, mapped and unmapped; and (3) For sites within the coastal zone, for the presence of ESHA.	**Consistent.** The MBHMP serves as a biotic assessment of the monarch habitat of Moran Lake. The primary goal is to enhance the function of Moran Lake through restoration activities which would better sustain a native monarch population.
ARC-3.1.10 Species Protection (LCP). Recognize that habitat protection is only one aspect of maintaining biodiversity and that certain wildlife species, such as migratory birds, may not utilize specific habitats. Require protection of these rare, endangered, and threatened species and continue to update policies as new information becomes available.	**Consistent.** The MBHMP provides updated management recommendations based on current data that will aid in the restoration, preservation, and enhancement of monarch overwintering habitat at Moran Lake. Implementation of the plan would improve habitat protection for monarchs.
ARC-3.2.4 Removal of Invasive Plant Species (LCP). Encourage the removal of invasive species and their replacement with characteristic native plants, except where such invasive species provide significant habitat value and where removal of such species would severely degrade the existing habitat. In such cases, develop long-term plans for gradual conversion to native species providing equal or better habitat values. Support the responsible use of herbicides to assist with the removal of invasive plant species.	**Consistent.** While blue gum eucalyptus, cape ivy, and english ivy can be considered invasive species, they provide critical habitat value to monarchs at Moran Lake. Therefore, within the core habitat zone , these species will be managed to provide habitat benefit to monarchs. Outside of the core habitat zone, recommended replacement trees include native species to the extent feasible to provide biodiversity and to facilitate a long-term transition toward more native species. Replacement trees will be selected based on the specific soil, water, sunlight, and need for wind protection at each location.

County of Santa Cruz LCP Policy and Programs	Consistency Discussion
ARC-3.3.3 Activities Within Riparian Corridors and Wetlands (LCP). Development activities, land alteration, and vegetation disturbance within riparian corridors and wetlands and required buffers shall be prohibited unless an exception permit is granted per the Riparian Corridor and Wetlands Protection ordinance. As a condition of a riparian exception permit, require evidence of compliance with applicable permit or review requirements of the U.S. Army Corps of Engineers, California Department of Fish and Wildlife, and other federal or state agencies that may have regulatory authority over activities within riparian corridors and wetlands.	**Consistent.** The project site contains Moran Lake: the coastal lagoon and associated wetlands. Recommended tree planting would occur directly adjacent to these areas. However, removal and replanting of trees and other management activities contemplated under this plan would be required to comply with all applicable laws and regulations and the protective measures outlined in this plan. These actions would limit any adverse effects on water quality in Moran Lake and associated waterways. Finally, the approval of this plan will include a Biotic Approval permit to cover management activities included in the plan.
ARC-3.3.8 Environmental Review for Riparian Corridor and Wetland Protection (LCP). Require environmental review of all proposed development projects affecting riparian corridors or wetlands and preparation of a Biotic Report for projects that, as proposed, may have a significant effect on the corridors or wetlands. Compliance with County regulations is generally considered to prevent the possibility of significant environmental impacts, and any biotic and/or riparian exception permit process may involve project specifications and/or conditions that would also prevent the possibility of significant environmental impacts.	**Consistent.** The MBHMP in itself is a biotic report which identifies sensitive habitats on the project site and sets forth management actions and associated protective measures to improve and protect the habitat. Future management plan actions proposed under the plan would not have adverse effects on Moran Lake nor its associated wetlands.
ARC-5.1.9 Significant Tree Removal Ordinance (LCP). Maintain the standards in the County's regulations that require a permit for removal of significant trees and other major vegetation located within the Coastal Zone, and provide appropriate protection for significant trees and other major vegetation in other areas of the County.	**Consistent**. The trees at Moran Lake are within sensitive habitat and are therefore considered significant. This plan provides specific recommendations for tree management, including regular assessment by a certified arborist, protective measures for tree work, removals, and replacement plantings to maintain sensitive monarch butterfly overwintering habitat. The plan requires mitigation for tree removals and that the mitigation be guided by a certified arborist and monarch butterfly specialist in order to enhance monarch habitat. Therefore, future management plan actions proposed under this plan will not have an adverse effect on the sensitive habitat and will be covered by a Biotic Approval and Riparian Exception, thereby meeting the requirements of the Significant Tree Removal Ordinance.

LCP = Local Coastal Plan; MBHMP = Monarch Butterfly Habitat Management Plan

Source: Santa Cruz County 1994

2.3 Community and Stakeholder Engagement

County Parks orchestrated significant stakeholder and community input over a three-year period during the development of the Moran Lake Monarch Butterfly Habitat Management Plan Update. Stakeholder and community input directly influenced the content and recommendations of the habitat management plan (HMP). Community and stakeholder engagement consisted of direct outreach to local regulatory agencies and monarch experts including the USFWS, the California Department of Fish and Wildlife, John Dayton, the Xerces Society, the California Coastal Commission, and Santa Cruz County Environmental Planning during development of the draft

habitat management plan in 2023 and 2024 to solicit feedback on the plan and to ensure that site-specific data on historic monarch roost locations and activities were incorporated in the plan.

In addition, County Parks shared a public draft of the HMP at a community meeting on July 23, 2024 and via email to neighbors, stakeholders, and other interested parties. The draft HMP was also posted on the County Parks website. Comments were collected during the public meeting, and the public comment period was open until August 16, 2024. Most of the public comments focused on the need for increased tree management and assessment and the need to prioritize public safety while protecting monarch habitat. Some commenters did not agree with recent tree planting at the park and expressed concern that private views were impacted, open space was being lost, and that County Parks did not conduct sufficient public comment prior to the planting. Other commenters expressed support for the recent tree planting and requested additional tree planting. Several commenters suggested that only California native species be planted. Other comments focused on the need to protect the existing eucalyptus trees, and some comments requested preservation of the trees on the 40 Moran Way parcel.

Based on feedback provided during the community meeting and in subsequent comments, County Parks, in partnership with the Sanitation District and First District Supervisor Manu Koenig, contracted with Althouse and Meade and Dr. Stu Weiss to prepare a wind study to analyze the relationship between the height of the existing eucalyptus trees and the wind protection that they provide to the monarch overwintering habitat. The wind study was completed in June 2025. Recommendations from the wind study, proposed changes to the habitat management plan that were informed by the wind study, as well as plans for conducting tree management in Summer 2025, were presented at a community meeting on June 24, 2025. The community meeting presentation was posted on the County Parks website, and the public comment period was open until July 11, 2025.

Most of the public comments expressed support for the increased management actions outlined in the presentation. Comments from neighbors expressed concern that eucalyptus trees along Placer Street and in the Southeast Grove were not scheduled for tree work in Summer 2025. Several commenters expressed concern that the management actions would not receive sufficient funding. Some comments noted the statewide significance of the monarch habitat at Moran Lake and expressed disagreement with the wind study results showing that removal of trees around the lake would not negatively impact overwintering habitat and expressed concern that the wind study did not take into account impacts to the fall roost sites in the South Creekside area. Other commenters noted that the findings of the wind study suggested that no additional trees needed to be planted around the lake and requested that planting locations prioritize the preservation of views from private residences and that County Parks conduct a robust public comment process prior to planting additional trees in the park. Some comments requested that Parks prioritize drainage improvements to the 40 Moran Way parcel and around areas of the lagoon with historic ponding.

3 Site Description

3.1 Location

The site is located in and around Moran Lake County Park in the unincorporated Live Oak area of the County, approximately 0.25-mile west of Soquel Point and directly northeast of the Pacific Ocean (Figure 1). The site is surrounded by residential neighborhoods to the west, north, east, and south, as well as Moran Lake Beach to the southwest (Figure 2). The site is depicted on the *Soquel, California* United States Geological Survey (USGS) 7.5-minute topographic quadrangle map and is located in Township 11 South, Range 1 West, Section 21.

The site is located within the Central Coast geographic subregion of California (Baldwin et al. 2012). The climate in this region is characterized by warm, dry summers and mild, wet winters. The average high temperature during summer months (June through September) is 75 degrees Fahrenheit (°F) and the average low temperature is 50 °F. The average high temperature during the winter months (December through March) is 62 °F and the average low temperature is 40 °F. Average annual precipitation is 29.3 inches, with the majority of rainfall occurring during November through March (Western Regional Climate Center 2022). Topography on-site is generally flat, with elevations ranging from approximately 10 to 50 feet above mean sea level.

The management area[3] for this MBHMP update includes the monarch butterfly overwintering habitat which is the eucalyptus groves within Moran Lake County Park and surrounding the Sanitation Facility, Moran Lake and Creek (the coastal lagoon and associated wetlands), the sandy beach around the lake, and the vegetation that comprises the windbreak at the site. It also includes a small rectangular parcel at 40 Moran Way, which previously contained additional eucalyptus grove habitat. A separate plan and project addressing the Moran Lake County Park amenities (trails, picnic tables, the restroom, etc.) and the culvert at East Cliff Drive will be prepared to address those features. Sensitive habitat on private properties immediately adjacent to the management area contributes important windbreak for the site. While the County cannot manage the private land, the designation of the parcels as sensitive habitat will function to conserve the habitat.

3.2 Soils

The U.S. Department of Agriculture, Natural Resources Conservation Service (USDA NRCS) Web Soil Survey identifies three soil map units within the management area: Watsonville loam, 0 to 2 percent slopes; Watsonville loam, thick surface, 0 to 2 percent slopes; and Watsonville loam, thick surface, 2 to 15 percent slopes. Watsonville loam soils are derived from alluvium and formed on marine terraces from 0 to 1,200 feet in elevation. The depth to the water table is more than 80 inches. The frequency of flooding and ponding is none. The available water supply is very low (about 2.9 inches), and the soils are somewhat poorly drained (USDA NRCS 2022a). Watsonville loam soils are included on the NRCS list of hydric soils (USDA NRCS 2022b). The soils in many areas of the site, particularly on the northern edge of the lagoon, and within the 40 Moran Way parcel, suffer from poor drainage and are prone to ponding. This has led to the failure of large eucalyptus trees due to windthrow.

[3] "Management area" and "Moran Lake site" will be used interchangeably throughout this report to refer to the outlined area depicted in Figure 2 and described in Section 3.1.

Figure 1 Regional Location

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Management Area

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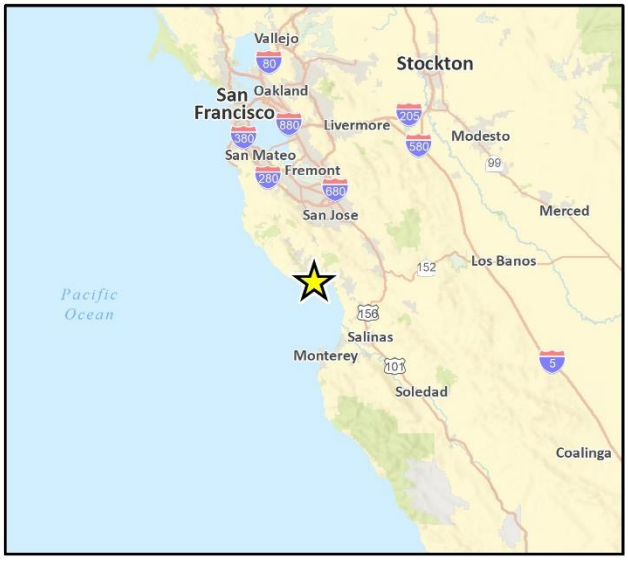

Fig 1 Regional Location

Figure 2 Monarch Habitat Management Area

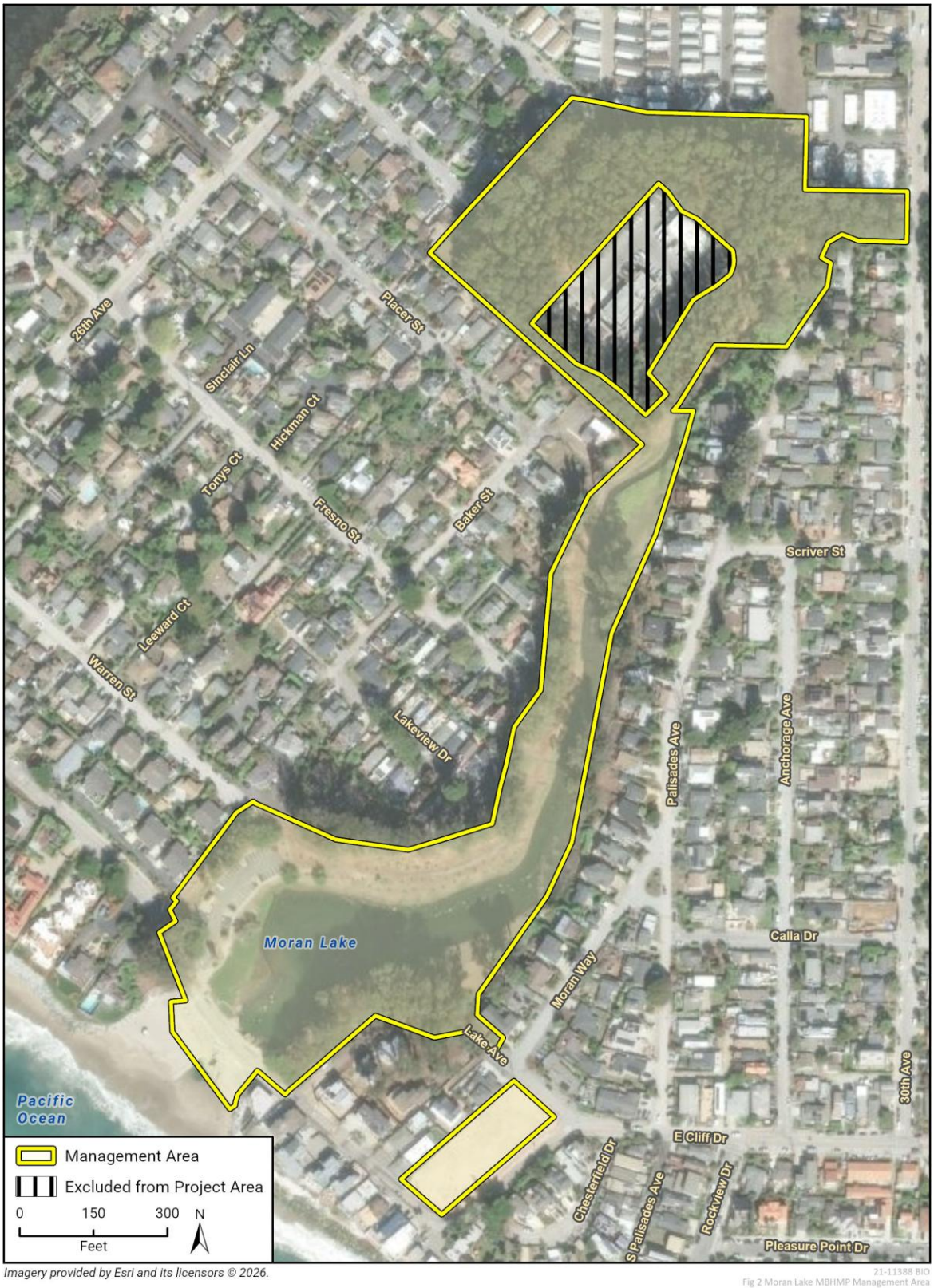

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Fig 2 Moran Lake MBHMP Management Area

3.3 Dominant Tree Community: Eucalyptus Grove

The eucalyptus groves in the management area currently most closely resemble the Eucalyptus spp. Woodland Semi-Natural Alliance (*Eucalyptus globulus* Association) described by Sawyer et al. (2009). Eucalyptus trees are dominant in this alliance and preclude most other plant species from growing in the understory. Eucalyptus groves were planted as windbreaks throughout California and have also been naturalized in many areas adjacent to streams and lakes.

Eucalyptus groves cover approximately 8.18 acres of the management area, with dense stands growing around the border of the D.A. Porath Sanitation Facility in the northern portion of the management area, along the western edge of the lagoon near the center of the management area, along the southeastern corner of the lagoon, and previously within the 40 Moran Way Parcel in the easternmost portion of the management area (Figure 2). The understory of the eucalyptus groves is generally scarce. Poison oak (*Toxicodendron diversilobum*) dominates the shrubby understory, forming low density and coverage thickets, and the herbaceous understory is generally absent, except for patches of English Ivy (*Hedera helix*). Although eucalyptus groves are non-native, they do comprise the important overwintering habitat for monarch butterflies on-site.

Rincon prepared the Moran Lake Arborist Report in 2022, which details the findings from the tree survey conducted by International Society of Arboriculture (ISA) certified arborist Casey Clark and Rincon Biologist Kate Ludwig on June 7 and June 8, 2022. During the survey, the location, species, diameter at breast height (DBH), height, canopy spread, general health condition, and any relevant notes (particularly pertaining to structural integrity) were recorded for each tree. A tree tag was also assigned to each tree surveyed. The 2022 Arborist Report is included in Appendix A.

3.4 Other Vegetation Communities

In addition to eucalyptus groves, the management area includes a coastal lagoon (Moran Lake) and its surrounding wetlands, which have been heavily modified by urban development and the introduction of non-native plant species. The 2005 Redevelopment Agency document discussed the trend/transition of vegetation on-site to dominant non-natives as “somewhat disturbing” when they compared the number of native shrubs and herbaceous plants then, to the 1980 Environmental Baseline Study for the Moran Lake Enhancement Plan. Upland native vegetation species identified in 1980 but not in 2004 include deerweed (*Lotus scoparius*), sky lupine (*Lupinus nanus*), bush lupine (*Lupinus arboreus*), coyote brush (*Baccharis pilularis*), California poppy (*Eschscholzia californica*), coast hedge nettle (*Stachys chamissonis*), seaside dandelion (*Agoseris apargioides*), loosestrife (*Lythrum hyssopifolia*), slough sedge (*Carex obnupta*), and bulrush (*Scirpus americanus*).

The following vegetation communities and land cover types exist within the management area: eucalyptus groves, pickleweed mats, disturbed riparian scrub, ice plant mats, sandy beach, annual grassland, ruderal, and developed. The Biological Resources Assessment Report prepared in 2022 provides a full discussion regarding vegetation communities and other biological resources and is included as part of Appendix A.

3.5 Current Management

A Memorandum of Understanding (MOU) for management of the monarch butterfly habitat surrounding the Sanitation Facility was approved between Parks and Sanitation in September 2025. Under the MOU, Parks is responsible for managing the habitat on Sanitation property in accordance

with the approved HMP. Previously, the monarch habitat on the two properties was managed independently, and general management activities within the two properties are described below. This new approach, whereby Parks manages the entire habitat, will lead to a more holistic and better coordinated management of monarch habitat.

3.5.1 County Parks Management

Regular vegetation maintenance is conducted at Moran Lake County Park, including annual high weed mowing along the east and west bank walkways, trimming of eucalyptus tree limbs upon County Parks' consulting arborist's recommendation (not more than one third of the new growth), and removal of small saplings that sprout from trunks of previously failed or removed eucalyptus trees. Parks' certified arborist conducts hazard tree assessments and identifies trees to be pruned or removed for the safety of the public and infrastructure. Potential removals are reviewed by a biologist/monarch butterfly specialist. Drainage features are maintained along the edges of Moran Lake to reduce the amount and duration of ponding water at the base of eucalyptus trees. Tree saplings are planted on an as-needed basis to fill in gaps in the windbreak and improve monarch habitat.

3.5.2 Sanitation District Management

Ongoing maintenance activities within the eucalyptus grove surrounding the D.A. Porath Sanitation Facility have been conducted to reduce the risk of falling limbs or trees, fire, and unauthorized encampment activities at the Sanitation Facility and adjacent properties. Regular maintenance consists of brush clearing, vegetation removal, and debris removal in the undergrowth of the grove. Vegetation management is carefully conducted to preserve nectar sources for monarchs. In addition, tree trimming is conducted on an as-needed basis to reduce the risk of tree failure into the Sanitation Facility, towards adjacent homes and trails. An ISA-certified arborist and Biologist/monarch butterfly specialist provided guidance and recommendations for all tree trimming and vegetation removal activities. Tree planting is conducted on an as-needed basis to fill in gaps in the canopy and improve monarch habitat within the grove, and saplings are irrigated and maintained to ensure survival. Saplings are flagged so they are not negatively impacted by vegetation clearing activities. Drainage features including ditches and storm drain pipes, are regularly maintained to prevent flooding and erosion within the grove.

3.5.3 Sensitive Habitat on Privately Owned Property

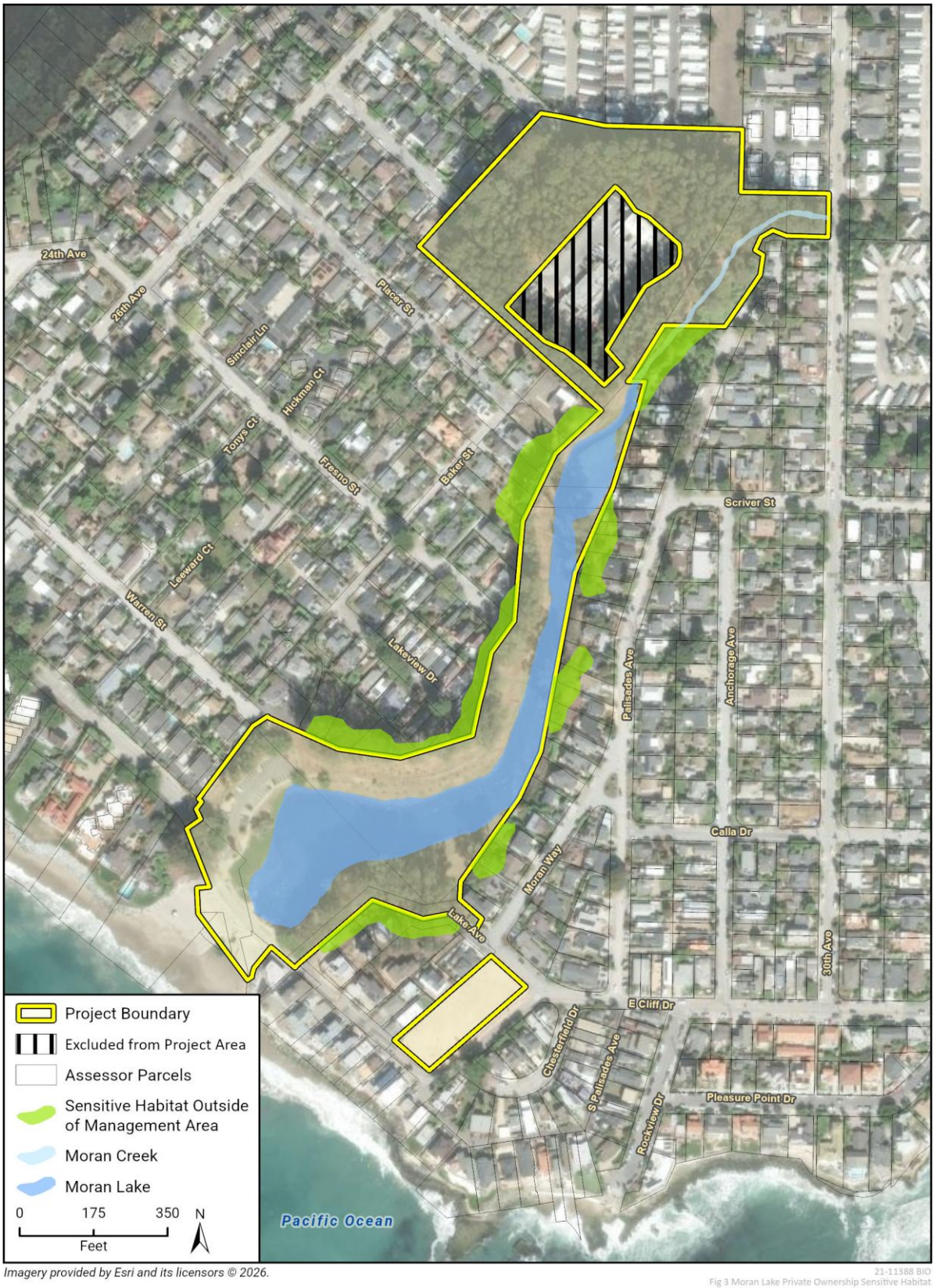
The hillsides, vegetation (including trees) and structures on private property immediately adjacent to the management area, provide critical windbreak to the habitat. Figure 3 displays the location of the sensitive habitat on private land. The County Board of Supervisors required that the sensitive habitat be designated and mapped through an amendment at the 2011 adoption of the 2010 Plan. These areas should be managed consistent with the actions described for the wind shelter and in coordination with the butterfly specialist.

3.6 Overwintering Habitat Zones

This plan update implements the USFWS Western Monarch Butterfly Conservation Recommendations (February 2023) to manage coastal California overwintering habitat as three zones.. The zones are the core zone (cluster area), shelter zone (wind protection and outer site

boundaries surrounding core zone) and support zone (area within 500 feet of an overwintering site that provides nectar, hydration, and microclimate protection). and are shown on Figure 4

Figure 3 Moran Lake Sensitive Habitat on Private Land



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21-11388 BIO
Fig 3 Moran Lake Private Ownership Sensitive Habitat

Figure 4 Moran Lake Monarch Buttterfly Overwintering Habitat Zones

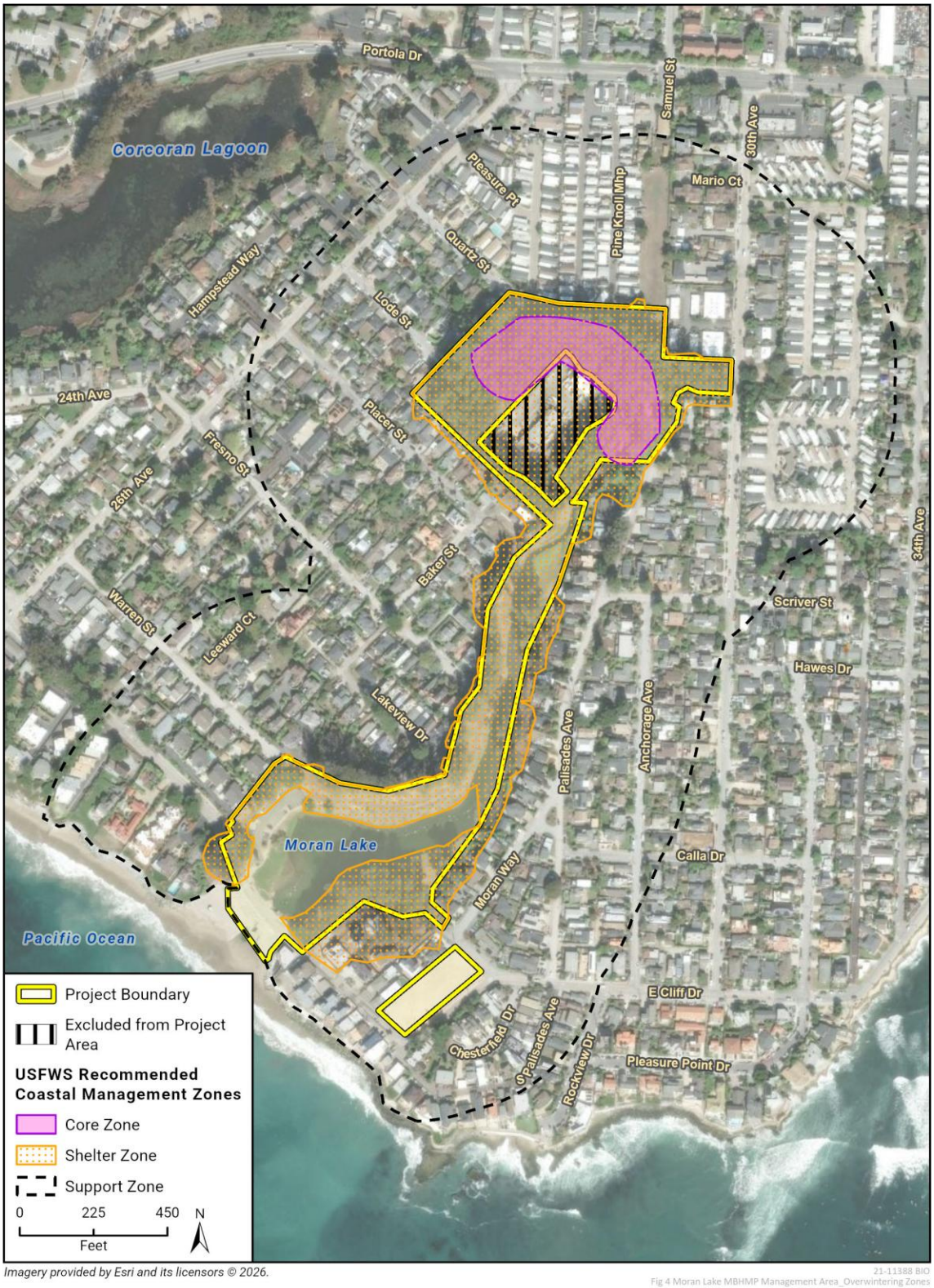

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Fig 4 Moran Lake MBHMP Management Area_Overwintering Zones

3.7 Climate Change

Climate change and sea level rise is impacting all coastal communities around the world. In the past century, average global temperatures have increased by about 1.4 °F, and average global sea level has increased by 17 to 21 centimeters (7 to 8 inches) (Intergovernmental Panel on Climate Change 2013). Western monarchs are particularly vulnerable to climate change, due to their reliance on coastal overwintering habitat and their dependence on environmental cues to trigger reproduction, migration, and hibernation (Advani 2015). Increased temperatures, wildfires, and drought conditions are impacting eucalyptus grove habitat along the California coast, resulting in degraded or destroyed monarch overwintering habitat in multiple locations (Xerces Society 2020). Drought has impacted the health of the eucalyptus trees surrounding Moran Lake in recent decades, and climate change will likely continue to exacerbate both drought conditions and intense, episodic storm events. This plan serves to guide the management actions of the habitat to accommodate current and future climate change impacts, for example by adjusting the approach for tree replacement planting from requiring tree replacements at a 2:1 ratio to requiring replanting that supports the functional need of the habitat.

Coastal Santa Cruz County is already experiencing the impacts of climate change, and coastal lagoons in the county, including Moran Lake, are predicted to become more vulnerable to tidal inundation and coastal flooding in the coming years (Central Coast Wetlands Group 2017). Sea-level rise could alter salinity in Moran Lake and potentially impact the eucalyptus grove habitat surrounding Moran Lake. These impacts are most likely to occur during large swell and/or high-tide events, when the ocean inundates the lagoon and surrounding area and could affect eucalyptus trees directly and/or increase the soil salinity in and around the groves. For example, if winter storms cause the ocean to overtop and spill into Moran Lake with relative regularity, higher salinity inputs may negatively affect vegetation that cannot survive in higher saline environments. Around Moran Lake, if the water level rises, the salinity and saturated soils will rise with it and could cause trees and other vegetation to die off and retreat from the water line. Management recommendations provided in Section 5 below will aid in protecting and enhancing monarch overwintering habitat in the face of changing climatic conditions.

The Climate Action and Adaptation Plan (CAAP) developed by the County in December 2022 includes a number of strategies and objectives for responding to climate change. One of the strategies outlined in the CAAP is to increase the urban tree canopy (County 2022). The recommendations outlined in this MBHMP (e.g., improving the health of existing eucalyptus trees and planting new trees within eucalyptus groves at the Moran Lake site) will directly align with the objectives laid out in the CAAP for increasing the urban tree canopy in the county.

4 Monarch Overwintering Information

4.1 History of Counts

Xerces notes on their website that the past 25 years of data demonstrate that overwintering western monarchs have undergone a greater than 90 percent decline since the 1980s. Western monarch butterfly population numbers have generally seen a downward trajectory, since the inception of the Western Monarch Count in 1997, and counts have fluctuated widely over the years throughout California. The Moran Lake overwintering population is typically the third largest in Santa Cruz County, behind the Natural Bridges State Beach and Lighthouse Field sites.

The Moran Lake Overwintering Site boundary defined by the Xerces Society is roughly the same as the management area depicted in Figure 2, except for the inclusion of a small portion of the residential neighborhood around the lake. Monarch butterflies are present in the Moran Lake overwintering habitat from October through February in most years, and small numbers of monarchs have been observed as early as mid-August and as late as April in some years. Based on its continual occupation by monarch butterflies throughout the wintering period, the habitat at Moran Lake is classified as full-term overwintering habitat.

The current and historic estimated overwintering population numbers for the Moran Lake site were obtained through the Western Monarch Count (Xerces Society 2022). The Western Monarch Count is a citizen scientist-powered organization that is sponsored by the Xerces Society. The Western Monarch Count conducts annual population counts at overwintering sites throughout California each Thanksgiving and at the start of each new year (Xerces Society 2022). These data are used by many agencies and conservation organizations to aid in conservation efforts and estimate population trends for the western monarch butterfly.

Table 2 below provides the estimated monarch count at the Moran Lake site, along with every other overwintering site in the county, since the inception of the Western Monarch Count in 1997. Additionally, Table 2 provides the total number of overwintering monarchs in the county and California since 1997, the percentage of overwintering monarchs at the Moran Lake site each year in comparison to the total population of overwintering monarchs in the county, the percentage of overwintering monarchs at the Moran Lake site each year in comparison to the total number of overwintering monarchs in California, the yearly average of overwintering monarchs at each overwintering site, the county, and California since 1997, and the 10 year average of overwintering monarchs at each overwintering site, the county, and California (Xerces Society 2022).

These numbers help to identify regional and statewide fluctuations, to understand if fluctuations in the Moran Lake overwintering counts are consistent with the regional and state-wide changes, and to determine how the regional and statewide importance of Moran Lake as an overwintering site has changed since 1997.

Table 2 Western Monarch Count Statistics for Santa Cruz County Since 1997

Count Year	Overwintering Sites in Santa Cruz County				Santa Cruz County Total	California Total	% in Comparison to Santa Cruz County	% in Comparison to California
	Moran Lake	Natural Bridges State Beach	Lighthouse Field	Seascape Golf Course, Aptos				
1997	70,000	120,000	70,000	--	260,000	1,235,490	27%	5.7%
1998	8,000	60,000	50,000	240	119,898	564,349	7%	1.4%
1999	4,500	15,000	9,500	280	31,958	267,574	14%	1.7%
2000	4,000	20,000	35,000	1,050	62,961	390,057	6%	1.0%
2001	1,500	3,000	--	1,400	6,123	209,570	24%	0.7%
2002	1,000	6,000	3,200	4	10,234	99,353	10%	1.0%
2003	6,000	5,700	11,000	--	22,704	254,378	26%	2.4%
2004	4,500	9,600	9,600	950	25,276	205,085	18%	2.2%
2005	3,400	3,900	14,000	--	22,045	218,679	15%	1.6%
2006	6,600	7,300	10,300	2,000	28,271	221,058	23%	3.0%
2007	2,200	2,700	5,700	48	10,675	86,437	21%	2.5%
2008	4,023	3,500	2,607	1,560	12,127	131,889	33%	3.1%
2009	2,276	1,300	4,000	23	7,674	58,468	30%	3.9%
2010	3,000	2,300	4,000	1,000	10,332	143,204	29%	2.1%
2011	4,500	3,000	18,100	--	25,600	222,525	18%	2.0%
2012	2,500	500	3,200	2,500	9,316	144,812	27%	1.7%
2013	790	4,600	4,500	0	11,497	211,275	7%	0.4%
2014	4,300	3,400	7,000	--	15,981	234,731	27%	1.8%
2015	5,800	8,000	12,000	1,800	29,870	292,888	19%	2.0%
2016	4,000	3,500	12,000	1,000	28,101	298,464	14%	1.3%
2017	5,400	9,000	12,000	100	29,918	192,624	18%	2.8%
2018	1,373	1,120	1,802	--	5,043	27,721	27%	5.0%
2019	400	1,997	3,402	0	6,057	29,436	7%	1.4%
2020	50	550	50	0	711	1,899	7%	2.6%
2021	1,100	2,100	410	700	5,418	247,237	20%	0.4%
2022	5,701	7,500	3,365	500	17,861	335,479	32%	1.7%
2023	7,050	6,500	10,000	252	25,967	233,394	27%	11%
Average Count Since 1997	6,073	11,558	11,731	571	31,171	242,892	21%	2.1%
10-Year Average	2,856	3,842	5,430	733	14,525	183,324	20%	1.6%

It is important to note that the number of sites monitored fluctuates any given year. Over the past 7 years, more than 200 sites were monitored, whereas in years prior less than 200 sites were monitored.

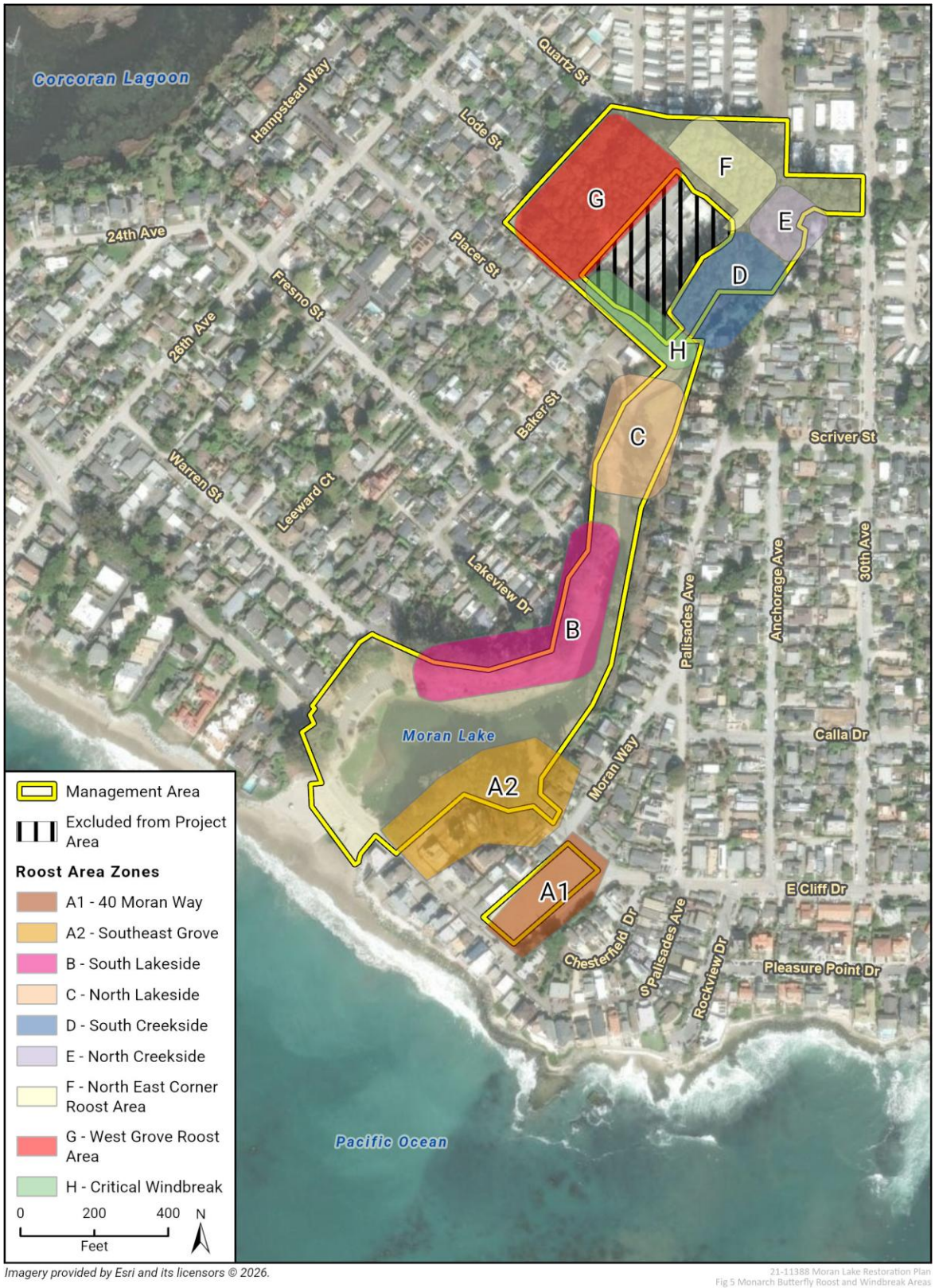
4.2 Monarch Activity History

The 2010 MBHMP provides a summary of historical patterns of monarchs at Moran Lake. See Figure 5 for a map of roost areas and windbreak areas, and that was adapted and updated from the 2010 MBHMP. Names of roost areas and windbreak areas used throughout this document are shown on this map. The text below was taken from the 2010 MBHMP:

> "Monarch butterflies are present in the Moran Lake wintering habitat from October through February in most years, and small numbers have been observed as early as mid-August and as late as April in some years. Based on its continual occupation by monarch butterflies throughout the wintering period, the habitat at Moran Lake is classified as a full-term overwintering habitat.
>
> In the past (1980s), monarchs typically began to congregate along the northwestern shore of Moran Lake during early October, and formed clusters in the North and South Lakeside roost areas. As the population increased during October, clusters also formed in the North and South Creekside roost areas and the lakeside butterflies gradually shifted north into the more sheltered Creekside roost areas (Figure 5). Then around mid-November the population shifted its clusters into the Primary Roosting area where they remained until warming temperatures initiated the spring migration sometime in February.
>
> The North Lakeside roost area usually supported clusters of roosting monarchs throughout the month of October, whereas the South Lakeside roost area typically supported clusters only intermittently during the fall. Thus the North Lakeside roost area historically functioned as an autumnal roost area and the South Lakeside roost area functioned as refuge/bivouac habitat. Tree and limb loss in these habitats has since reduced wind protection and eliminated many of the lower roost limbs that once supported clusters. Currently both roost areas function as refuge/bivouac habitats.
>
> Tree and limb losses in the North Creekside roost area have degraded this habitat over the past ten years resulting in less frequent occupation of the North Creekside roost area and a gradual shift of occupation to the South Creekside roost area. In March/April of 1999, residents on the property adjacent to the South Creekside roost area removed all the eucalyptus trees on their property along the east side of the creek and in that process eliminated all of the eastern windbreak/shade trees that sheltered the South Creekside roost area. During the winter preceding the tree removal (1998-99) the entire wintering population at Moran Lake (approximately 18,000 monarchs) occupied the South Creekside roost area from early October through most of November. During the winter of 1999-2000, no clusters were observed in the South Creekside roost area. Both North and South Creekside roost areas now function only intermittently as refuge/bivouac habitat.
>
> The Primary Roosting area, despite several significant tree removal events, has consistently supported mid-winter monarch populations for at least the past twenty years. With the loss of suitable autumnal habitat in the Lakeside and Creekside roost areas, the Primary Roosting area has now begun to function additionally as autumnal roost habitat. The Primary Roosting area is the only consistently occupied roost area remaining in the Moran Lake monarch wintering habitat.
>
> The grove of eucalyptus at the southeastern end of Moran Lake—the Southeastern Grove, which includes the Moran Way Windrow—in addition to providing critical wind protection for

the lake area, functions intermittently as refuge/bivouac habitat and occasionally supports small clusters during periods when monarchs are migrating and winds are relatively calm."

Figure 5 Monarch Butterfly Roost and Windbreak Areas



4.3 Roosting and Basking Sites

The entire management area and adjacent sensitive habitat provide the overwintering habitat for the monarch butterflies, which has been broken into distinct roost and windbreak areas for ease of discussion (Figure 5). The southeast eucalyptus grove provides a wind protected zone close to the coast which may help draw migrating monarchs to the area. The areas around the southeastern grove function intermittently as refuge/bivouac habitat and occasionally support small clusters during periods when monarchs are migrating and when winds are relatively calm (J. Dayton, personal communication, December 2023). The eucalyptus trees and structures on either side of the lake provide windbreak to the site. The eucalyptus trees provide upper canopy windbreak, and the higher topography along the southeastern side of the lake provides low and mid-level wind break. Figure 6 shows an overview of the core zone/roosting sites.

North of Moran Lake, the main eucalyptus grove surrounds the Santa Cruz Sanitation District's D.A. Porath Facility and comprises the primary roosting areas. Within the main grove, there are three distinct roost areas where the monarchs cluster and overwinter during the coldest and most inclement weather of the year and are shown in Figure 6: the creek side roost area (CSRA), the northeast corner roost area (NECRA), and the west groove roost area (WGRA) (J. Dayton, personal communication, December 2024). CSRA serves as an autumnal roost area, and NECRA and WGRA serve as the two winter roost areas, where the most protection is provided. Each roost area includes both trees that support clusters and that are typically located in the interior of the groves with the most wind protection, and trees that support basking aggregations and that are typically located on the edges of the grove where more sunlight is available. Monarchs bask in the sun to get warm and to reach the temperature at which they are able to fly. The basking areas are located toward the inner edge of the roost area adjacent to the Sanitation District facility, where more sunlight is available. (Note that basking aggregations may become clusters during appropriate weather conditions.) The interior roost (cluster) trees at NECRA and WGRA are not necessarily both used each year; typically, interior clusters form only in one of the two areas each year (J. Dayton, personal communication, December 2023). For example, the interior roost trees at the WGRA were not used in the 2021–22 wintering period, whereas the WGRA basking aggregation trees were used, even though most of the population remained clustered at NECRA, mostly above the road, but also including some clusters in the interior area (J. Dayton, personal communication, December 2023).

Figure 6 Moran Lake Monarch Buttterfly Roosting Site/Core Zone

Source: John Dayton, 12/2023.

4.4 Current Habitat Condition

An ideal overwintering site should have trees in good condition that are evenly spaced out and have healthy foliage and good vigor. An ideal overwintering site will also have saplings in the understory to replace trees as they die and a continuous, well-stratified canopy at the outer edges to offer wind protection. However, the canopy will not be so dense to prevent the entry of the necessary amount of direct and dappled insolating light. Insolation is primarily a factor on the southerly exposures.

Tree health was assessed and reported in the 2022 Arborist Report. This plan addresses the trees, habitat, management area, and the grove as a whole. When discussing the condition of the habitat, individual tree health is always considered, but equally and possibly more important is the management of the trees collectively. The creek's wet soils, ponds and puddles provide the water for the monarchs to drink. The late fall and winter blooming eucalyptus tree flowers provide critical nectar for the monarchs to consume while they overwinter.

In 2024, Weiss (2022) provided a habitat assessment using hemispherical photography, LiDAR, and wind measurements to understand canopy structure and resultant microclimates within the grove. Key conclusions regarding canopy structure and monarch use from that study include:

The primary cluster zone within the grove north of the sanitation yard (North East Corner Roost Zone in Figure 5) has good insolation exposure through the south edge facing the open yard but also has good wind shelter from the trees across the yard along Placer Street.

The main vulnerability of the primary cluster zone is wind exposure from the "Boneyard" to the north. The open trail/road into the grove from this edge allows northerly winds to penetrate into the cluster zone. When strong northerly winds occur, monarchs tend to leave this zone and move to Creekside. The assessment recommended planting a row of cypress in the Boneyard to block this gap into the primary cluster zone.

At Creekside, there is high morning insolation exposure, but also high wind exposure to the east and southeast. Monarchs will cluster in this zone early in the season before storms occur, and during calm sunny periods, but will move to the primary cluster zone when winds become too strong.

In 2025, an additional study (Weiss and Matley 2025) was conducted to answer specific questions about the effects of grove modifications on wind exposure within the primary cluster zone. This study used LiDAR and wind modeling with Eddy 3D to simulate wind patterns within the complex grove. Several scenarios regarding tree height reductions and tree removals were explored. Estimating the height of the Placer Street trees necessary for maintaining wind shelter from southwest winds at the primary cluster zone was a major goal. But other tree removal and height reduction scenarios were also explored.

Selected results of the 2025 wind study are interspersed in this document at the appropriate spots. (especially Critical Windbreak along Placer Street – Area H below).

Both full reports are attached as Appendix D.

4.4.1 Roosting and Basking Habitat (Sanitation District and County-Owned Land)

The north, northeastern, and northwestern portion of the main eucalyptus grove on Sanitation Facility property that is home to the Northeast Corner Roost Area (NECRA), the Creekside Roost Area (CSRA), and the West Grove Roost Area (WGRA) is well-established with spaced-out trees that are generally in good health. Young saplings are distributed naturally throughout. Blue gums to the south and western sides of the grove are generally in fair health. The nature of blue gums includes shedding bark and branch and limb loss, and it is not unusual for the species to be rated with fair to poor health.

One area near the southern corner of the Sanitation Facility immediately south of the small pump station in the Critical Windbreak Area H is missing a tree canopy wind break. This gap in canopy creates the opportunity for wind and cold temperatures to blow into the roosting and basking areas and should be filled. Additionally, there are gaps in the Critical Windbreak Area H along Placer Street that should be planted with replacement trees. The narrowness of this area presents a particular challenge because there is limited space to plant windbreak trees.

Grove specific measurements, including, but not limited to, an assessment of wind measurements, light exposure, and canopy height and structure derived from hemispherical photographs and LiDAR are provided in Appendix A. These measurements represent why the main cluster site is suitable for overwintering monarchs.

Currently, the Creekside Roost Area (CSRA) is one of the areas most in need of repair and to enhance with mitigation planting. Recent tree failures and removals have exposed this area to disturbance by east-southeast winds and excessive sun exposure. Approximately 1,000 monarchs roosted in this area during much of November 2021 (J. Dayton, Personal Communication, December 2023).

4.4.2 North and South Lakeside Habitat (County-Owned Land)

As mentioned, the eucalyptus trees, hillside, vegetation, and structures along the southeastern and eastern side of the lake provide an important wind break to the management area, as do the trees, vegetation and structures on the western side of the lake.

Eucalyptus trees have died or have been removed in the past in the North and South Lakeside areas, without replacement, which has led to reduced wind protection and stands that are comprised of mostly mature trees with minimal mid-level wind protection and high canopies that are exposed to windthrow. Eucalyptus along the North and South Lakeside areas have experienced die back likely related to ponded water and saturated soils in low areas along the trail and at the base of the trees. This area is in need of drainage improvements and replacement plantings to enhance the windbreak and ensure long-term survival of the trees.

A portion of the North Lakeside habitat on the east side of the creek, where eucalyptus trees are absent, is comprised of a low-lying riparian meadow where a bed of grasses and other herbaceous species are present and offers the potential for nectar planting.

4.4.3 Southeast Grove and 40 Moran Way Habitat (County- and Privately Owned Land)

The Southeast Grove is located on the southeast side of the County-owned Moran Lake property, and on private parcels along Moran Way and the recently built Ryan's Way. As development of the private property in this area has progressed over the years, this area has lost many of its trees. The remaining portion of the grove still functions in providing wind protection—though substantially diminished—for the surrounding habitat. However, it only very rarely provides wind protected roost habitat for Fall migrants; it is currently too open to wind and sun to support roosting monarchs in the Fall (J. Dayton, Personal Communication, December 2023).

More recently, during development of this HMP update, the February 2024 high-wind event resulted in the failure of 20 eucalyptus trees on the 40 Moran Way parcel, which further degraded the ability of this area to function as a windbreak. This widespread failure of trees on the 40 Moran Way parcel left the remaining trees more exposed to winds and therefore more vulnerable to windthrow. In response, the County's ISA-certified consulting arborist recommended that the remaining eucalyptus trees on the parcel be removed to reduce the risk of additional failures. The County's consulting arborist and monarch butterfly specialist determined that the 40 Moran Way property no longer functioned as a viable windbreak and approved the removals. The trees were removed in Summer of 2025. The property was re-graded in Fall 2025 to improve drainage in preparation for future re-planting of the parcel with native trees and shrubs. Planting is currently scheduled for Fall 2026.

4.5 Nectar Sources

Monarchs are less likely to use nectar plants in deep shade, so the forest understory near the main clustering sites are poor places for nectar plants. The most important nectar plants are those that bloom in the fall (October through November), because they help retain monarchs at the site, which in turn attracts more butterflies that are passing by.

The main sources of nectar plants for monarchs at Moran Lake are the blue gum eucalyptus flowers. Nectar for early to mid-fall is from introduced plants. The most common introduced nectar plants on-site, along with their bloom periods, are listed in order of abundance in Table 3 below. English ivy (*Hedera helix*) and Cape ivy (*Delairea odorata*) are found growing throughout the understory of the eucalyptus groves, and some have climbed up the trunks of trees where they function as important nectar sources for the monarchs. Ivy on the ground has limited utility as a monarch nectar source due to heavy shade. Ice plant (*Carpobrotus edulis*) and pride-of-Madeira (*Echium candicans*) are found growing adjacent to the parking lot and the Park's hiking trail.

Bermuda sorrel is present on the site, but is rarely used by monarchs when other, preferable nectar sources are present. Wild radish and jointed charlock are present near the Moran Lake Park parking area—and are often used as nectar sources by monarchs at other sites—but are too far from the roost areas for practical use at Moran Lake (J. Dayton, personal communication, December 2023).

Table 3 Fall and Winter Monarch Nectar Plants in the Management Area

Species	Bloom Period
Blue gum eucalyptus (*Eucalyptus globulus*)	December through March
English ivy (*Hedera helix*)	October through November

Cape ivy (*Delairea odorata*)	Variable bloom period depends on sun/shade availability, usually December-January
Ice plant (*Carpobrotus edulis*)	Typically October-March
Pride-of-Madeira (*Echium candicans*)	Late February-March

The existing Cape ivy, English ivy, ice plant, and pride-of-Madeira within the management area provide an important and abundant supply of nectar for fall returning and overwintering monarchs, which is currently not supplied in the management area, or its vicinity, by native plants (See Table 3). Due to its importance as a nectar supply, Ivy requires careful management, rather than wholesale removal. Both species of Ivy only bloom when they receive sufficient sun exposure. English Ivy only blooms when it has climbed up a structure (tree).

4.6 Hazardous Trees

The eucalyptus trees provide the overwintering habitat, but all trees have risk or liability. An ISA certified arborist with the ISA's Tree Risk Assessment Qualification assessed the trees in the management area for risk in 2022, using the diagnostic techniques developed by ISA. A tree risk assessment is conducted to identify and manage the risk of trees for safety. The results of the assessment are included in the Arborist Report. Risks are evaluated based on a number of elements, including structural deficiencies and visible presence of disease or rot, etc. The locations of all potentially hazardous trees, as well as specific notes regarding each potentially hazardous tree and their removal or hazard pruning recommendation as of 2022, are provided in the appendix of the Existing Conditions Report which is Appendix A of this Habitat Management Plan.

County Parks' consulting arborist has been implementing routine risk assessments of all trees on County Parks and Sanitation District property since Fall 2025 to comply with recommendations of this Plan. The Tree Risk Assessment from January 2026 supersedes the 2022 Risk Assessment, and is included in Appendix H. The document includes identification of potential risk categories, identifies specific trees of concern, and provides recommendations to mitigate risks.

4.7 Fire Risk Assessment

Managing the habitat and fire risk should be done in coordination with the fire department and the monarch butterfly specialist or entomologist. Research conducted in California show that species that produce oily resins, such as blue gum, are far more ignitable than those that do not. On a scale of 1 to 10 for ignition potential, with 1 representing species most easy to ignite and 10 most difficult, blue gum scored 1 to 2 (very high ignition potential). For comparison, oak/bay woodland received a score of 6 to 8, redwood 8, scrub vegetation 4 to 8, and annual grassland vegetation 1 to 3 (LSA Associates 2009).

Ladder fuels are one of the most important considerations for the spread of fire. The monarch habitat contains very little ladder fuel, and the understory is generally sparse and contains poison oak, Cape ivy, and English ivy, when present. These are evergreen species and are generally nonflammable. Due to the lack of ladder fuels within the management area (as a result of ongoing site management by the Sanitation District), the urban/developed surroundings, and the persistent summer coastal fog, the risk of a severe crown fire spreading into or originating within the site is relatively low.

4.8 Monarch Predators

While the monarch's distinctive colors are known to display to others that they are distasteful and toxic, predators affect monarchs as eggs, caterpillars, and adults. Predators include ants, spiders, and wasps, as well as birds and rats. Predators at the Moran Lake site are not well documented or understood. However, it is likely that they are present and impact the overwintering adult population to some degree. When winds blow the monarchs onto the ground, overnight or during cool temperatures, their bodies are not warm enough to fly and predation increases. Understory brush and vegetation located beneath aggregation and transitory sites can be instrumental in limiting predation by catching the monarchs prior to landing on the ground and providing structure for them to climb off the ground.

5 Management Plan Actions

The management actions recommended here focus on the preservation of the overwintering habitat, trees, and features that create them. The continued recommendations are to maintain the grove's spatial configuration and size and preserve and/or enhance windbreak trees, appropriate nectar and water sources and understory vegetation within the management area. A general recommended timeline to implement each action is provided in the tables at the end of each section. In the tables, Year 1 means the action is recommended for action now; Ongoing means now and each year after unless otherwise stated in the section, and As-Needed means that actions will be taken if identified as necessary by County staff or consultants following the guidelines established in this plan.

5.1 Monarch Surveys

Assessing overwintering monarchs' use of the management area will be crucial to assessing the effectiveness of this site management plan and to adapting habitat restoration and enhancement techniques. Volunteers and biologists monitor the overwintering clusters at Moran Lake, as well as other local overwintering sites and collect important data as part of the Xerces Western Monarch Thanksgiving Count and New Year's Count.

Additional monitoring (ideally twice monthly from October through March) for a minimum of 1 year after major management actions would provide the information needed to track how monarchs respond to changes in grove conditions. Recording monarch clusters' size and location over the course of the overwintering season will help refine the current understanding of monarchs' use of the site and can directly inform management actions in future years.

An approach for conducting surveys is to train and use the County's maintenance staff, who are on-site regularly, to conduct the twice-monthly surveys. Staff would need to be trained to:

- Know where historic roosting and basking sites are located
- Know how to conduct counts by attending the virtual trainings for the Western Monarch Count at the Xerces' Help Count Monarchs website
- Coordinate with the Xerces Regional Coordinator once annually, in the early part of the overwintering season, to calibrate counting with Xerces
- Record information for each count in a consistent way and post the results so that the public can access the information

Action	Year 1	Ongoing	As-Needed
Monarch Surveys and Monitoring		X	

5.2 Monarch Habitat Monitoring

Annual monitoring of the grove's suitability for monarchs will be conducted to identify potential grove issues as soon as possible. Any additional threats or conservation issues (e.g., new tree fall, pest infestations) will be added to the management records and incorporated into the management

plan. This will help managers plan future management actions (at both short-and long-term time scales) and obtain funding as needed.

County Parks' monarch specialists and ISA-certified arborists will continue to assess the management area at least once a year to identify any potential issues and develop strategies for planting or replanting of trees that comprise the habitat.

The management area will be monitored for a change in predators, such as increased rat dens and observations of Steller's jays. If predators increase the County will consult with the monarch specialist regarding changes that can be made. The management area will continue to be kept clear of trash and food.

Tools that can be used as the standard protocols and data sheets for assessing grove health (Habitat Assessments) are available at www.westernmonarchcount.org and are included in Appendix D.

Action	Year 1	Ongoing	As-Needed
Monarch Habitat Monitoring		X	

5.3 Habitat/Forest Management

Habitat and Forest Management will be planned and implemented to achieve the following goals:

- Prioritization of public safety
- Protection and improvement of monarch habitat
- Restoration of native species and habitat for biodiversity

The most important forest management action is to regularly assess trees for risk of failure and to mitigate that risk through trimming or removals. Tree failure poses a hazard to the public and to monarch habitat. Hazardous trees will be addressed as quickly as possible by trimming or removing the trees to alleviate risk to the public and the roosting and basking sites. Trimming or removal recommendations will be made by a certified arborist. Hazardous trees and proactive risk assessment are addressed in more detail in Section 5.3.2.

The monarch overwintering season at Moran Lake is loosely defined as October through March.

- No tree work will occur within the **core habitat zone** (Figure 4) between October 1 through March 31 unless a true emergency arises.
- Outside of the core habitat zone and within the **shelter habitat zone** (Figure 4), no tree work will occur between October 15 through March 15 unless a true emergency arises.

If a hazardous tree must be removed during either of these times, then a certified arborist and qualified monarch butterfly specialist will be retained by the County to monitor and provide input regarding the tree maintenance activities prior to and during the removal.

Management of the overwintering habitat will be approached as a forest versus single trees and in compliance with Section 2.1.3. above. The forest is comprised of thousands of trees; it is dynamic and changes continually due to a number of factors, including weather and storm events. As discussed in Section 4.3, the spacing and composition of the tree canopy is what creates the overwintering habitat and wind protection for the monarchs. Because of this, replacing trees that have been removed or succumb to die-off with another single tree or trees may or may not be advisable. Whether to plant replacement trees will be determined in collaboration with a certified

arborist and the County's monarch specialist. This will be done in alignment with the three goals noted above. To protect and improve monarch habitat, tree planting is recommended in certain areas to add or replace canopy that was previously lost or is absent in the eucalyptus groves and windbreaks. See section 5.3.1 for more information on tree planting and management.

Nectaring plants will be planted to boost overwintering population numbers; see section 5.3.4 for more information on nectaring plants.

Drainage improvements were installed by County Parks staff in Fall 2024 at the northern edge of the southeastern windrow, at the 40 Moran Way parcel, and in other problematic areas around the margins of the lagoon in the North and South Lakeside areas to reduce ponding water and saturated soils at the tree bases. These areas should continue to be maintained to reduce ponding water. See section 5.3.5 for more information on drainage.

Tortoise beetles and eucalyptus long-horned beetles are two major pests that can damage or kill blue gum eucalyptus trees. While an effective control for these pests has not yet been developed, the County should proactively remove dead wood from the eucalyptus groves, since the presence of dead wood has been shown to increase infestations. The County Parks staff should be informed about how to identify these and other local pests and the damage they can cause. County Parks staff should report observations of infestations observed to their supervisor and the information should be shared with the County-approved arborist immediately.

The recommendations in subsections below for timing of implementation of management actions have been developed in collaboration with County Parks staff, the County's ISA-certified arborists, and the County's monarch butterfly specialists after viewing the management area conditions and dynamics as a group during development of the HMP. Figure 7 shows the general approach for planting replacement trees and nectaring plants, and locations where drainage management is needed.

A summary of all recommended habitat/forest management actions and their required protective measures are outlined in Table 6 at the end of this section. The protective measures outlined in Table 6 will be required for all management actions in order to avoid and minimize impacts to the maximum extent feasible.

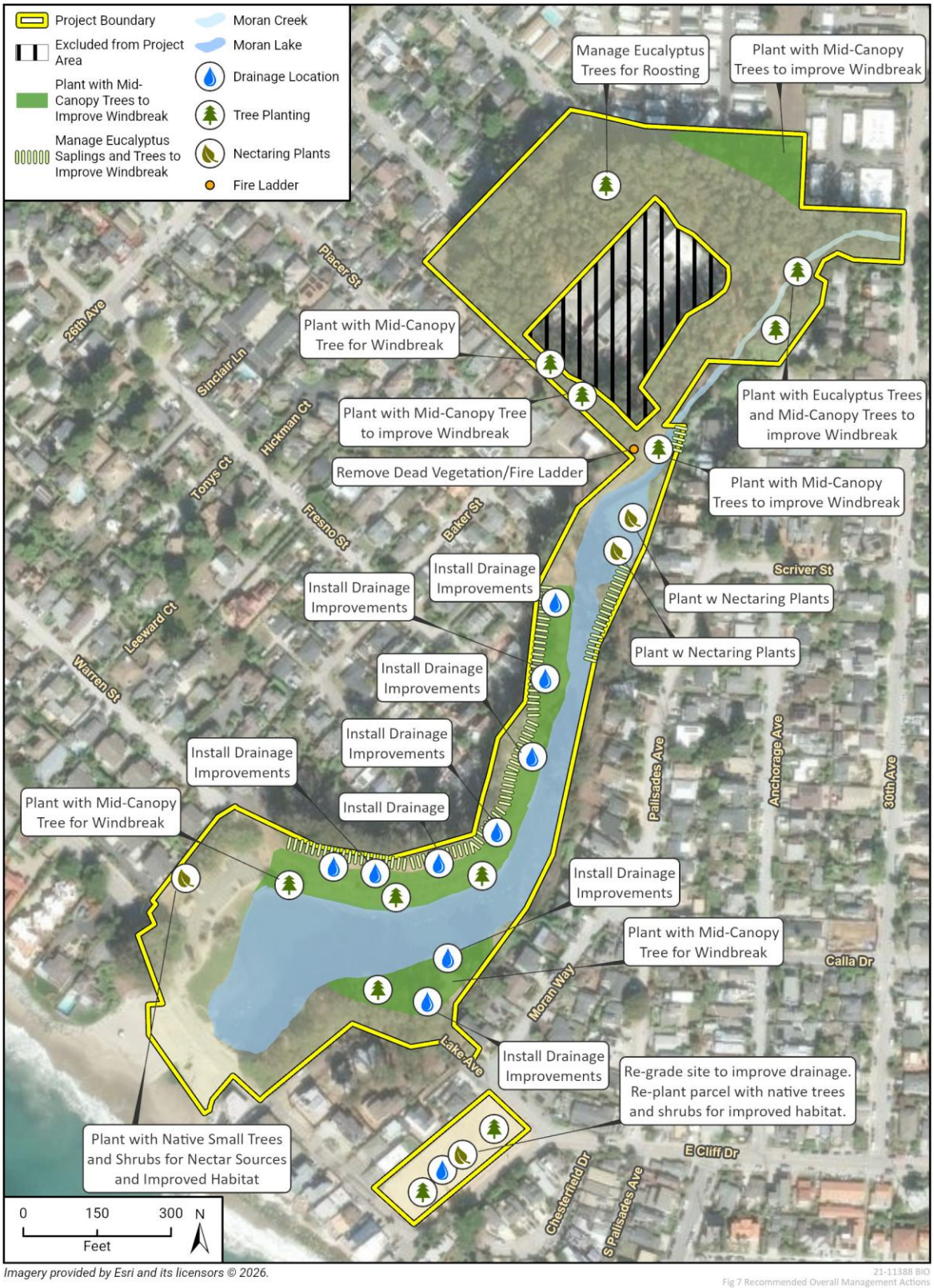
Overwintering Habitat on Private Property

Trees and vegetation on private property adjacent to the management area, shown in Figure 3, will be designated by the County as Sensitive Habitat. This will serve to clarify where Sensitive Habitat restrictions are to be applied for adjacent development. This clarification was required by the County Board of Supervisors by amendment at the 2011 adoption of the 2010 Plan.

Action	Year 1	Ongoing	As-needed
Habitat & Forest Management*		X	

*General habitat & Forest Management will be conducted every year. Refer to subsequent sections for specific actions and frequencies.

Figure 7 Recommended Overall Management Actions



5.3.1 Tree Planting and Management

Recommendations for tree planting were developed by Creekside Science's Dr. Stu Weiss in collaboration with County staff and the County's consulting team of certified arborists and biologists. Past reports with recommendations from the County's arborist and monarch specialist also address issues discussed in this section and applicable recommendations from past documents are included in this section for continuity. Appendix D provides past studies and reports for the management area. Tree planting location recommendations are shown in Figure 7, and recommended tree species to be planted in each habitat area (Areas A-H, as defined in Figure 5) are shown in Table 4, and discussed in greater detail below. Some of the recommendations are based on addressing existing deficiencies and are expected to improve monarch habitat over time. Other recommendations are to address replacements for potential failures or removals that could occur in the future.

When existing trees or branches fail, or become hazardous and need to be removed, their removal can negatively impact the monarch habitat. Failures and removals will be assessed by a certified arborist and the County's monarch specialist, and will include a recommendation for replacement, or a justification for why replacement is not recommended. The number, location, and species of the replacement tree(s) will be determined in collaboration with a certified arborist and the County's monarch specialist. The recommendations above will be based on achieving the three overarching goals of forest/habitat management described by this Plan:

- Prioritization of public safety
- Protection and improvement of monarch habitat
- Restoration of native species and habitat for biodiversity

Determining what tree species **not** to plant is as important as outlining recommended species. Section 7 of this plan contains a table documenting the species, location, and observations for tree species which have been planted at Moran Lake and which have failed (Table 7). The County should systematically track this information so that it can be used to inform future tree planting efforts.

Table 4 Tree Species to Plant in Specific Habitat Areas on Figure 5

Zones D, E, F, & G – Main Eucalyptus Groves & Roosting and Basking Areas		
Species	**Canopy Replacement**	**Notes**
Blue gum eucalyptus (*Eucalyptus globulus*)	Upper, highest canopy in habitat area	Compatible with existing BGE in groves. Important nectar source for Monarchs. Plant w/in 50' of roosting or basking areas and where canopy higher than 50' is needed
Red ironbark (*Eucalyptus sideroxylon*)	Mid to upper canopy, typically not as high as blue gum	Use to replace BGE where canopy up to 50' is needed. Plant away from public paths and structures.
Monterey Cypress *(Hesperocyparis macrocarpa)*	Mid-canopy, varies based on age and location	Plant along north and east edges of main grove as windbreak. Regional native. Good salinity, coastal, and wind tolerance.
Coast Redwood *(Sequoia sempervirens)*	Upper, highest canopy in habitat area	Plant only along east side of Creek. Regional native. Riparian adapted.
Zone H – Critical Windbreak (along Placer Way)		
Species	**Canopy Replacement**	**Notes**

Monterey Pine (*Pinus radiata*)	Mid to upper canopy	Plant to fill in mid to upper canopy gaps in the critical windbreak. California and regional native.
Canary Island Pine (Pinus canariensis)	Mid to upper canopy	Plant to fill in mid to upper canopy gaps in the critical windbreak
Blue gum eucalyptus (*Eucalyptus globulus*)	Upper, highest canopy in habitat area	Plant where highest canopy replacement is needed in the critical windbreak.
Zones A2, B & C – Southeast Grove and South and North Lakeside		
Species	**Canopy Replacement**	**Notes**
Red Alder *(Alnus rubra)*	Mid to upper canopy	Regional native. Good salinity tolerance, coastal and riparian adapted.
Monterey Cypress *(Hesperocyparis macrocarpa)*	Mid-canopy, varies based on age and location	Regional native. Good salinity, coastal, and wind tolerance.
Monterey Pine (*Pinus radiata*)	Mid to upper canopy	Plant to fill in mid to upper canopy gaps in the critical windbreak. California and regional native.
Torrey Pine *(Pinus torreyana)*	Lower to mid-canopy	California native. Good salinity and coastal tolerance, wind resistance.
Island Oak (*Quercus tomentella)*	Lower to mid-canopy	California native. Good salinity and coastal tolerance, wind resistance.
Coast Live Oak (*Quercus agrifolia*)	Lower to mid-canopy	Regional native. Good salinity and coastal tolerance, wind resistance.
Arroyo Willow *(Salix lasiolepis)*	Low canopy	Regional native. Good salinity and flooding tolerance. Riparian adapted. Winter nectar source.
Zone A1 - 40 Moran Way		
Species	**Canopy Replacement**	**Notes**
Monterey Cypress *(Hesperocyparis macrocarpa)*	Mid-canopy, varies based on age and location	Regional native. Good salinity, coastal, and wind tolerance.
Toyon *(Heteromeles arbutifolia)*	Lower canopy	Regional native. Good salinity, coastal, and wind tolerance. Good general habitat tree.
California buckeye *(Aesculus californica)*	Lower to mid-canopy	Regional native. Good salinity, coastal, and wind tolerance. Good general habitat tree.
Coast Live Oak (*Quercus agrifolia*)	Lower to mid-canopy	Regional native. Good salinity and coastal tolerance, wind resistance. Good habitat tree.
Arroyo Willow *(Salix lasiolepis)*	Low canopy	Regional native. Good salinity and flooding tolerance. Riparian adapted. Winter nectar source.
Blue Elderberry *(Sambucus mexicana)*	Low canopy	Regional native. Coastal tolerance. Good general habitat tree.

The following recommendations update the guidelines in the 2010 Plan on page 20 under New Tree Planting and Monitoring Guidelines.

Tree removals must be considered with the input of a certified arborist and the County's monarch specialist and if a replacement tree is recommended, it must be replaced by the next rainy season with a tree that will fulfill the functional needs of the overwintering habitat and the forest. The previous recommendation to replace every removed tree with a minimum of two trees is not viable

within the management area. The limiting factor is space; there is not enough space to double the number of trees on-site and maintain a healthy forest and functional overwintering habitat.

The **core habitat zone** (Figure 4) is where monarchs roost and bask during the overwintering season. This is the most sensitive part of the monarch habitat. The core habitat zone is expected to remain a mostly eucalyptus grove for the foreseeable future. Failures and removals of eucalyptus trees in the core habitat zone will be assessed by a certified arborist and the County's monarch specialist for replacement. If recommended, they will be replaced with Blue gum eucalyptus (*Eucalyptus globulus*) or Red ironbark eucalyptus *(Eucalyptus sideroxylon)* trees, or in limited cases, Monterey Cypress (*Hesperocyparis macrocarpa*) trees. The species selection will depend upon the canopy need. Blue gums will be used when the replacements are made in or within 50 feet of the roosting and basking areas and when canopy roughly 50-feet high or more is needed. Red ironbark will be used to replace blue gums when canopy roughly 25- to 50-feet high is needed. Blue gums provide consistency in canopy structure and red ironbark trees have been observed to be more drought resistant in the region. Planting red ironbark also serves to diversify the species of the grove. Red ironbark will be located away from public paths and structures due to their potential for limb failure. Monterey Cypress provides lower-level canopy and roosting locations within the larger eucalyptus grove. If, at some time in the future the trees become overcrowded, forest thinning may be considered to promote an increase in the health condition and vigor in the grove. Thinning will only be done with the input of the certified arborist and monarch butterfly specialist.

The **shelter habitat zone** surrounds the core habitat zone and serves to buffer the core habitat zone from adverse weather conditions. Failures and removals within the shelter habitat zone will be assessed by a certified arborist and the County's monarch specialist for replacement. If replacement(s) are recommended, potential species that will be considered for planting include Monterey Cypress (*Hesperocyparis macrocarpa*), Coast Live Oak (*Quercus agrifolia*), Island Oak (*Quercus tomentella*), Monterey Pine (*Pinus radiata*), Torrey Pine (*Pinus torreyana*), Canary Island Pine (*Pinus canariensis*), Toyon (*Heteromeles arbutifolia*), Red Alder *(Alnus rubra)*, and Red Ironback *(Eucalyptus sideroxylon)*. Blue Gum Eucalyptus (*Eucalyptus globulus*) will only be planted in specific situations where high canopy is required and other replacement species have failed. Native trees are preferred and will be planted where feasible. Shorter stature trees and trees that can withstand wind and coastal pressure, will be planted along the southwestern boundary of the management area nearest the coast. Additional native and eucalyptus tree species are being considered and these recommendations may need to be modified over time. Replacing and maintaining the tree wind shelter around the core habitat zone is essential to the site's longevity. In areas where blue gums have experienced consistent failures, the County will explore planting different species and/or a more diverse palette of tree species that are less prone to failure, thereby reducing the risk of negative impacts to the habitat and public safety. As noted above, native tree species are preferred. The County's long-term goal outside of the core habitat zone is to plant enough native trees to eventually replace the blue gum eucalyptus with trees that are better suited to the site conditions, do not grow as tall, and that support native biodiversity.

Eucalyptus trees are generally not available for purchase in the nursery trade; therefore, the County will make arrangements as needed to grow the trees with an entity such as Cal Poly or UC Santa Cruz, which have the expertise and ability to grow them on a regular basis.

Planted trees will generally be in either a 5-gallon or 15-gallon (or a comparable container size used for native plants), largely due to the expense and difficulty of planting a larger tree in the forest, and the fact that native trees perform better when planted at a smaller size. The trees will be inspected

by a certified arborist to ensure they are in good health. The contract with the tree grower will specify that root bound trees will not be accepted.

The exact location, species, and number of replacement trees to be planted will be determined in collaboration with County staff, a certified arborist, and a monarch specialist prior to or immediately following (within 15 working days) of a tree removal. Replacement tree plantings will be:

- Staked with two lodge pole stakes per tree and secured with flexible ties
- Mulched with a 3-inch-deep layer of wood chips at a minimum radius of 3 feet from the trunk, contingent on their locations and surrounding growing conditions. Mulch material must also be set back at least 4 inches from the trunk.
- Irrigated or hand watered as-needed in order to grow at optimal rates, with either a ring of Netafim Irrigation Tubing placed over the root ball or with two emitters per tree for irrigation, or the use of tree watering bags or donuts to facilitate efficient hand watering.

Maintenance of the replacement trees is also critical to ensure tree survival and to optimize tree growth. Either the County Parks staff or a landscape contractor will:

- Conduct twice-monthly inspections to ensure that the irrigation system is functioning and that weed competition is eradicated around the new trees
- Replenish the wood chip mulch around the trees periodically
- Remove the tree support stakes 3 years after installation and ties must be adjusted annually as not to girdle the tree where it's tied to the stakes
- The irrigation system will be adjusted over time to correctly be placed over tree root zones and to adjust the volume of water required to ensure optimal tree growth.

If tree replacement plantings fail (die), they must be replaced with a tree that fulfills the need of the overwintering habitat. Tree failures should be investigated to determine cause of death and records kept of successful and unsuccessful trees species to improve long-term management of the habitat.

Replacing and maintaining the trees that create the wind shelter around the perimeter of the management area is also essential to the site's longevity.

Specific Area Recommendations for Management Areas (Refer to Figure 5 for location of Management areas)

Northeast Corner Roost Area – Area F

- Plant Monterey cypress to fill the gaps between eucalyptus rows at the outer northeast and northwest edges of the area, north of the Sanitation Facility. There is some concern about maintaining sightlines into the grove to detect occupancy by unauthorized occupants so close coordination with public safety agencies is important.
- Plant Monterey cypress in the Sanitation District's 'Boneyard' area (northeast of the main eucalyptus grove) to block low and mid-level wind. Center the planting on the existing gap in the tree canopy created by the maintenance access road.
- Encourage blue gum saplings to grow and do not remove them within the roosting sites when they serve to provide canopies in the open row spaces.
- Maintain a partially open canopy along the boundary of the yard so that direct sunlight can penetrate from the yard edge for basking. This is one of the most important habitat

improvements and will allow the butterflies to remain in the interior when strong northerly winds occur.

- Keeping the future option of selective precise thinning of specific parts of the grove is important. Maintaining individual tree health in the face of aridification may require reduction of basal area. The remaining trees will fill in the canopy, as water and light availability allow. Pruning, if it occurs, will be directed by a certified arborist and the County's monarch specialist.

Critical Windbreak along Placer Street – Area H

- Maintaining wind shelter along the southwest boundary of the entire grove in the District's land is crucial for the monarchs clustering on the opposite side of the Sanitation Facility, particularly along Placer Street where the windbreak is narrow and there is limited space to plant trees. The eucalyptus in this area also abut residential properties along Placer Street, complicating management of the trees.
- Tree risks will be considered routinely and if trimming trees and removing hazard branches in this area is necessary, it will be done in collaboration with the County's monarch butterfly specialist and certified arborist to minimize impacts to the windbreak. Trees that have posed risks to the neighbors were topped in the past to reduce the risk while still maintaining the trees' ability to function as a windbreak. These topped trees will require more frequent maintenance and assessment by an arborist to remove weakly attached branches. Management of this windbreak should focus on preserving and enhancing a semi-permeable barrier of vegetation to allow for moderation of wind.
- The windbreak along Placer was one of the focus areas of the wind study conducted by Dr. Stu Weiss and Althouse & Meade that was completed in June 2025. The wind study simulated canopy height reductions along the Placer Street windbreak. The wind study model showed minimal changes in wind speed in the monarch habitat for canopy heights down to 80 feet. Canopy heights between 80 feet and 60 feet demonstrated slight increases in wind speed in the monarch habitat. Canopy heights below 60 feet resulted in rapid increases in wind speed throughout the monarch habitat. Therefore, the wind study analysis suggested that the critical height of tree canopy along Placer Street is approximately 80 feet. This height provides sufficient wind protection for the monarch habitat and provides a buffer of 10-20 feet of canopy height before monarch habitat is negatively impacted.
- Trees planted along the Placer Street windbreak must therefore have a mature height of roughly 80 feet in order to align with the results of the wind study and to provide sufficient long-term wind protection for monarch habitat.
- There are existing gaps in the Placer Street windbreak. Plant these gaps with the following tree species, with species selection to be based on specific canopy needs:
    - Canary Island Pine *(Pinus canariensis)*
    - Monterey Pine *(Pinus radiata)*
    - Other species if specifically recommended by a certified arborist and the County's monarch specialist
    - Blue gum eucalyptus *(Eucalyptus globulus)* will be planted if the other species above do not demonstrate good health and the potential to create a sufficient windbreak after a period of 5 years from planting, as determined by an arborist and monarch butterfly specialist. Factors that the arborist and monarch butterfly specialist may use to determine if the trees demonstrate potential to create a sufficient windbreak include: tolerance of soil, moisture,

and light conditions at the planting site, successful establishment adjacent to mature blue gum eucalyptus trees, demonstration of active growth, and the tree reaching an appropriate size for its age.

- Redwood trees were planted at this location in the past but did not successfully establish in part due to a lack of irrigation, and the fact that this location is ill-suited for Redwood's higher water needs.
- The wind study also analyzed the effects of partial removal of the existing blue gum eucalyptus trees. This was done to simulate the long-term plan to selectively remove some of the existing blue gum eucalyptus and replace them with a lower-growing tree species that still reaches roughly 80' to provide sufficient windbreak for the monarch habitat. The study showed that existing trees could be selectively removed from the Placer Street windbreak without negatively impacting the monarch habitat.
- Once existing gaps in the windbreak are planted, and the newly planted trees are in good health and demonstrate good structure after a period of at least 3 years, consider selectively removing 1-3 existing blue gum eucalyptus trees that were previously topped in consultation with a certified arborist and the County's monarch specialist as part of a pilot program to eventually replace the mature blue gum eucalyptus with lower-growing trees that still reach the 80' critical height. After removal, plant a replacement tree from the list above for each removed tree no later than the next rainy season. Evaluate the success of the pilot replacement program every 3 years by monitoring growth of the replacement tree and monitoring monarch behavior in the overwintering habitat. If the pilot replacements are successful, work with a certified arborist and the County's monarch specialist to continue selective replacement without negatively impacting monarch habitat.
- Plant a small stand of Monterey cypress at the southern corner of the Sanitation Facility, just south of the small, separate pump station, opposite the trail opening, to close the canopy gap and prevent southerly winds that penetrate into the grove along the trail and drive the monarchs away from the interior cluster site.

North and South Creekside Roost Area – Areas D and E

- In the Creekside Area, maintain and fill-in the row of trees southeast of the creek on the County-owned parcel that is east of the Creek and north of the Humphrey's parcel (APN 028-291-57). The public property is dominated by shrubs, including blackberries and other shrubs. Interplanting trees, such as Coast Redwood *(Sequoia sempervirens)* and Monterey Cypress *(Hesperocyparis macrocarpa)*, will reinforce existing wind shelter. However, care must be taken over the long run to not deeply shade the cluster sites along the creek.
- There are several eucalyptus trees that have previously been topped in the area west of the Humphrey's parcel. These trees should be monitored by an arborist for future management needs.
- There are several redwoods on the Sanitation Facility side of the drainage ditch at the southeast corner of the yard, that appear to be in poor to fair health. Monitor their progress, and if they do not maintain a healthy canopy or if they fail, replace them with blue gum or red iron bark eucalyptus for high-canopy wind shelter and Monterey cypress for mid-canopy wind shelter.

North and South Lakeside Roost Areas – Areas B and C

- Poor drainage along the margins of the lagoon contributed to past failures of blue gums between the trail and adjacent private properties in the North and South Lakeside areas. To

mitigate this, and to ensure the viability of the remaining trees, drainage features will be created and maintained so that standing water does not occur along the trail and at the base of the trees. Drainage improvements were installed in winter 2024/2025 and were recently improved in fall 2025. The drainage improvements will be routinely assessed and maintained. See section 5.3.5 below for more information regarding drainage.

- Approximately 47 Monterey cypress *(Hesperocyparis macrocarpa)* were planted between the lagoon and the trail in Area B in December 2024. Once mature, the trees will provide additional mid-level wind protection. This species has proven to do well in the immediate area. The recently planted trees will be maintained and additional trees will be planted in future years to enhance the windbreak, improve native habitat and biodiversity, and contribute to a long-term goal of eventually replacing the blue gum eucalyptus species in this part of the habitat with appropriate native species.
- Additional native trees such as Monterey Cypress, Monterey Pine *(Pinus radiata),* Coast Live Oak *(Quercus agrifolia)*, and Island Oak *(Quercus tomentella)* should be planted along the lagoon banks in Area C to fill in gaps in the windbreak where there is sufficient space.
- Salt-tolerant smaller trees and shrubs such as Arroyo Willow *(Salix lasiolepis),* Toyon *(Heteromeles arbutifolia),* Ceanothus species*,* and Coyote Brush *(Baccharis pilularis)* will be added along the lagoon banks to improve riparian habitat and native biodiversity. These plantings will include species that provide nectar to overwintering monarchs where possible.
- For Area C primarily, plant nectar plants of various species (see section 5.3.4 below) in areas that receive morning sun, or in spots with dappled light. The moist soil here allows for many species to thrive, as there are a variety of microhabitats available including marshy areas, creekbanks, and open grassy fields. Other narrow zones, between the trail and water on the west side of the lagoon, should also be planted with nectaring plants. Table 5 below provides recommended nectaring plants.
- For trees on the east side of the creek in Area C, where soil conditions are appropriate (not too wet), plant shorter stature trees and shrubs that can withstand wind and coastal pressure such as Arroyo Willow (*Salix lasiolepis)*, Shining Willow (*Salix lasiandra), Coyote Brush (Baccharis pilularis),* Mulefat *(Baccharis salicifolia),* or Saltmarsh Baccharis *(Baccharis glutinosa)*. These species are also nectaring sources for monarchs.

Southeast Grove – Area A2

- This area includes the southeast shore of the lagoon where there is a large, low-lying roughly triangular shaped piece of land that is available for tree planting. This area should be planted to enhance the existing windbreak and to facilitate the eventual replacement of blue gums with native trees. Drainage improvements were installed in this area in winter 2024/25 to reduce ponding of water. Eleven White Alder and six Monterey Cypress trees were planted in this area in December 2024. The White Alders did not survive, potentially due to lack of summer irrigation. Additional tree species should continue to be planted in this area to determine what will be successful. If the soil conditions allow tree roots to grow and succeed over time, evergreen trees such as Monterey Cypress and Monterey Pine (*Pinus radiata*) should be planted. If soil conditions are not appropriate for evergreen trees, California white alder (*Alnus rhombifolia*) and/or Red alder (*Alnus rubra*) were both recommended in the 2010 HMP and should be planted, but additional summer irrigation will likely be required for establishment. Arroyo Willow (*Salix lasiolepis*) should be planted along the east and southern portion of this area adjacent to the drainage swale.

Parcel at 40 Moran Way – Area A1

- The eucalyptus trees on the parcel at 40 Moran Way have experienced fungus and pest infestations and some have fallen or have been removed in the past. More recently, the February 2024 high-wind event caused 20 trees to fall and caused damage to adjacent private residences, property, and vehicles. Many of the remaining trees were weakened and four hazardous trees were immediately removed as a result of the storm; the remainder were topped in Summer 2024 to reduce their potential to fall. After the widespread failure of eucalyptus trees at this location, the County's certified arborist and monarch butterfly specialist determined that the property no longer functioned as a viable windbreak. Further, the County's certified arborist recommended removal of all eucalyptus trees on the property. All of the remaining trees were removed from the property and any stumps were ground in Summer 2025. The property was then completely re-graded in Fall 2025 to create positive drainage across the property and seeded annual grasses and legumes to provide erosion control.
- The parcel will be re-planted with at least 45 native trees and additional native shrubs in Fall 2026. The planting list for the parcel was developed by County Parks staff in conjunction with a certified arborist, biologists, and a monarch butterfly specialist, and consists of the following native trees: California Buckeye *(Aesculus californica),* Monterey Cypress *(Hesperocyparis macrocarpa),* Coast Live Oak *(Quercus agrifolia)*, Island Oak *(Quercus tomentella)*, Arroyo Willow *(Salix lasiolepis)*, Toyon *(Heteromeles arbutifolia),* and Blue Elderberry *(Sambucus mexicana)*. Native shrubs such as Baccharis species, Ceanothus species, Bush Monkeyflower *(Diplacus aurantiacus)*, California Coffeeberry *(Frangula californica)*, Coast Silktassel *(Garrya elliptica)*, Pacific Wax Myrtle *(Morella californica)*, and Pink Flowering Currant *(Ribes sanguineum var. glutinosum)* will also be planted. All plants are well-adapted to the specific conditions at this location, including wind and coastal conditions, and will provide improved habitat value for monarchs, pollinators, and other native species. None of the trees proposed for the property grow as tall as blue-gum eucalyptus, and large trees will be located away from private residences. Small trees and large shrubs will be planted along the western edge of the property bordering houses.

West of the Parking Lot

- In the area west of the parking lot and restrooms, shorter stature vegetation (small trees and large shrubs) that can withstand wind and coastal pressure, and that offer nectar or other habitat value should be planted such as Arroyo Willow *(Salix lasiolepis)*, Toyon *(Heteromeles arbutifolia),* Blue Elderberry *(Sambucus mexicana)*, Baccharis species, Ceanothus species, Bush Monkeyflower *(Diplacus aurantiacus)*, California Coffeeberry *(Frangula californica)*, Coast Silktassel *(Garrya elliptica)*, Pacific Wax Myrtle *(Morella californica)*, and Pink Flowering Currant *(Ribes sanguineum var. glutinosum).*

Tree planting described above will be conducted in the short term (1-3 years). Additional plantings in the future will be done in response to changes in the forest. A certified arborist and qualified entomologist will be consulted regarding future planting recommendations.

Action	Year 1	Ongoing	As-needed
Tree Planting		X	X

5.3.2 Hazard Trees

A certified arborist with a Tree isk Assessment Qualification (TRAQ) from the International Society for Aboriculture (ISA) will routinely and proactively assess trees on County owned property at least twice a year, once in the spring and once in the fall. A TRAQ-certified arborist will also assess trees on an as-needed basis following major storm events and if a new risk is identified. If hazards or other issues are identified, they will be addressed as noted below.

Hazard pruning and/or hazard removal recommendations to address identified hazards will be made by a certified arborist and will be based on the tree's health condition, structural integrity, and its hazard potential using standardized protocol and guidance from ISA. In general, if the tree is dead or declining or poses a hazardous condition but is located within a natural area with low to no human traffic, the tree is typically not recommended for removal or hazard pruning. However, removal or pruning is typically recommended for hazard trees that are located within a high-traffic area, in areas adjacent to residences, in areas with sensitive infrastructure, and for dead trees within the groves surrounding the Sanitation Facility. The County will prioritize public safety in tree management actions. As such, trees will be maintained routinely through trimming and/or removal when they pose a hazard to public safety.

Safety pruning, rather than removal, is preferred where it is feasible to address identified hazards. Topping of trees is not recommended due to the weakly attached nature of epicormic shoots; rather safety pruning should be conducted to preserve the health of the tree while addressing the hazard. Removals will also be done to reduce risk of tree failure when identified as necessary by a certified arborist as noted above. This may negate benefits of the tree for monarch habitat, but the County will prioritize public safety when addressing hazardous trees. If hazardous tree(s) are removed, a certified arborist and monarch specialist will assess the impact of the removal(s) on monarch habitat and recommend replacement tree(s), if appropriate. Replacement trees, if recommended per above, will be planted at the beginning of the next rainy season to ensure optimal growing conditions and survival.

If hazards are identified within the **core habitat zone**, special care will be taken in assessing urgency and targets of falling trees/branches. The potential for opening the cluster sites to wind if any of the trees or their branches are removed will be assessed by a monarch specialist prior to removal. Removal of trees or branches will be the minimum necessary to sufficiently reduce the hazard to minimize changes that could potentially degrade the monarch habitat.

No tree work will occur within the **core habitat zone** (Figure 4) between **October 1 through March 31** unless a true emergency arises. Outside of the core habitat zone and within the **shelter habitat zone** (Figure 4), no tree work will occur between **October 15 through March 15** unless a true emergency arises. If a hazardous tree must be removed during either of these times, then a certified arborist and qualified monarch butterfly specialist will be retained by the County to monitor and provide input regarding the tree maintenance activities prior to and during the removal. The protective measures outlined in Table 6 will be required for all tree work to avoid and minimize impacts to the maximum extent feasible.

Tree risk assessments will be conducted routinely and on an as-needed basis. Hazardous tree or branch removals will be done as needed to mitigate safety risk to the public, monarch habitat, and park resources.

Action	Year 1	On-Going	As-needed

Tree Risk Assessments	X	X
Safety Pruning and/or Hazardous Tree Removal		X

5.3.3 Fire Risk Abatement

Mid-story trees and shrubs can potentially create ladder fuels in the management area. However, the vertical continuity of fuels could be partially ameliorated by spatial separation of the shrub later from the mid-story tree layer, via offset plantings. Exact configurations of these wind shelterbelts will require detailed field examination and will need to consider light availability and potential crowding. If a vertical continuity of fuels (i.e., ladder fuels) is created through the addition of mid-story trees and shrubs, the risk of a ground fire spreading into a high intensity canopy fire rises.

Blue gum limbs and trees that have naturally fallen throughout the management area will be actively removed to decrease fuel loading and eliminate ladder fuel within the understory of the groves on-site. If the Sanitation Facility groves' understory is sealed with mid-story trees and shrubs, they will be spatially separated from each other and the blue gum canopy by offsetting the plantings to avoid the creation of ladder fuels to the maximum extent feasible.

The existing plants will be maintained during Year 1 and until the new nectaring plants are planted, have established, and are flowering.

Action	Year 1	Ongoing	As-needed
Fire Risk Abatement		X	

5.3.4 Nectaring Plants

Monarchs are less likely to use nectar plants in deep shade. Therefore, nectar plants of various species will be planted primarily in sunny areas, or in areas with dappled light outside the blue gum groves. Nectar plants of various species (listed in the 2010 draft plan and in the Xerces Society lists) will be planted primarily in areas that receive morning sun, or in spots with dappled light. Spring and summer nectar sources and milkweeds (*Asclepias* spp.) will not be planted in the management area. These plants disrupt the monarchs natural spring migration pattern. Disrupting the monarchs' natural migration pattern can lead to further conditions that may contribute to population decline. Although introduced plants also provide nectar for monarchs, native plants are recommended for planting due to the additional ecological value that they provide, as well as being adapted to their local environment (e.g., drought, coastal influence, soil).

Allowing Ivy to climb up trees without negatively impacting the health of the tree is an important management goal. Ivy that has climbed into tree canopies will be managed by cutting it back and removing it from the canopy. Starting at the tip of the ivy, it will be removed until it is no longer harming the health of the tree. Ivy will be retained on roughly 25 trees for nectar and will be trimmed regularly to prevent entry to the canopies. Ivy located on the east side of the grove where it receives morning insolation is likely to be preferred by monarchs.

North and South Lakeside – Areas B & C

The prime area for nectaring plants is on the east side of the creek in the sunny grassy area at the head of the lagoon. The moist soil here allows for many species to thrive, and on a microscale, the variety of habitats available including marshy areas, creekbanks, and open grassy fields. Other

narrow zones between the trail and water on the west side of the lagoon will be considered. Table 5 provides a list of recommended nectar plants, their bloom periods, and species-specific notes for the Moran Creek Bank.

Table 5 Recommended Nectaring Plants

Moran Creek Banks		
Shrubs/Small Trees		
Species	**Bloom period**	**Notes**
Douglas' Baccharis (*Baccharis glutinosa*)	July through October	Likely entire genus is attractive to monarchs. Important nectar source for many insects
Coyote Brush (*Baccharis pilularis*)	All year	
Mulefat (*Baccharis salicifolia*)	All year	
Arroyo Willow *(Salix lasiolepis)*	Winter & Spring	High quality riparian habitat plant and nectar source.
Perennial Herbaceous Plants		
Species	**Bloom period**	**Notes**
Coastal gumweed (*Grindelia stricta*)	May through October	-
Western goldenrod (*Euthamia occidentalis*)	July through November	Likely entire genus is attractive to monarchs
Canada goldenrod (*Solidago canadenis)*)	August through October	Likely the entire genus is attractive to monarchs. Great late season nectar source
Seaside daisy (*Erigeron glaucus*)	January through August	-

Nectaring plants will be planted in the short term (1-3 years) and monitored for survival. If plants do not survive they will be replaced in-kind immediately. Some plants are likely to die-off over time. Plantings will be monitored annually and replanted when/as plants die-off.

Additional Recommended Nectaring Plants

The Xerces Society recommends nectaring plants for coastal California that should also be considered. The list, in Appendix G, includes the blooming season of the plants. For the purposes of this plan, the County should plant those that bloom in the fall, winter and spring when monarchs are overwintering on site.

Action	Year 1	Ongoing	As-needed
Nectar Planting		X	

5.3.5 Drainage Improvements

Several areas of the habitat management area suffer from poor drainage. This had led to saturated soils and water-ponding around the base of existing trees. The saturated soils and ponding has in turn likely contributed to tree failure. Therefore, improving drainage is a critical goal to prevent additional tree failures and improve the health of existing trees. In addition, some areas will require improved drainage before replacement trees can be successfully grown.

South Lakeside and North Lakeside – Areas B & C

When the D.A. Porath Sanitation Facility was built in 1953, a sewer line was also installed along the western margins of the lake. The installation of the sewer line modified drainage patterns along the western side of the lake, creating artificial mounds and low-spots that restrict runoff flowing toward the lake. These problems persist today.

Ponding water and saturated soils are present at the base of the eucalyptus windrow along the western boundary of the management area between the residences and the trail along Moran Lake. The wet condition within the critical root zone of the eucalyptus trees negatively impacts roots, has likely led to past root and tree failure, and is likely to cause future tree failure if not addressed. Simple drainages will be created to allow the water to flow to the lake. The drainages will be placed at the lowest points where ponding occurs and as shown in Figure 6.

40 Moran Way – Area A1

A majority of this parcel is poorly drained and experiences saturated soil conditions during the rainy season. This parcel experienced 20 tree failures during the February 2024 high-wind event. There is an existing drain inlet along East Cliff Drive at the southeastern corner of the parcel. The County regraded the entire parcel in Fall 2025 to create positive drainage that directs runoff toward the existing drain inlet and reduces ponding and soil saturation. The drainage of this parcel should be monitored and maintained on an ongoing basis.

Action	Year 1	Ongoing	As-needed
Install Drainages	X		X
Maintain Drainages		X	

Table 6 Summary of Management Actions and associated Protective Measures

Action	Timeline	Protective Measures
Tree risk assessment	Ongoing	A certified arborist with a Tree risk Assessment Qualification (TRAQ) from ISA will assess trees on County owned property at least twice a year, once in the spring and once in the fall. A TRAQ-certified arborist will also assess trees as needed following major storm events and if a new risk is identified. If hazards or other issues are identified, they will be addressed as noted below.
Maintenance pruning and other routine tree work	As-needed	A certified arborist will recommend maintenance pruning and other routine tree work as part of the tree risk assessments to reduce risk to public safety and monarch habitat. Recommended tree work will occur outside of the monarch overwintering season (core habitat zone Oct 1 – Mar 31; shelter habitat zone Oct 15 – Mar 15), unless a true emergency arises (see emergency tree work below). Tree work will be conducted by a California-licensed tree contractor that has experience conducting work in sensitive habitat. Tree work will avoid damaging adjacent trees or limbs. A nesting bird survey will be required if tree work is conducted during nesting bird season. If necessary, preconstruction training will be required for contractors performing tree work to avoid and minimize impacts to sensitive resources.
Removal of hazardous tree or limbs	As-needed	Removals will be assessed by a certified arborist. Removals will occur outside of the monarch overwintering season (core habitat zone Oct 1 – Mar 31; shelter habitat zone Oct 15 – Mar 15), unless a true emergency arises (see emergency tree work below). Removals will be conducted by a California-licensed tree contractor that has experience conducting work in sensitive habitat. Removals will avoid damaging adjacent trees or limbs. A nesting bird survey will be required if removals are conducted during nesting bird season, and if nesting birds are found Certified arborist and monarch specialist will assess impact of removal on monarch habitat and recommend replacement tree, if appropriate. Plant replacement tree if recommended per above at the beginning of the next rainy season. If necessary, preconstruction training will be required for contractors performing tree work to avoid and minimize impacts to sensitive resources.
Failure of tree within monarch habitat	As-needed	Failures will be assessed by a certified arborist. Tree work associated with failures will occur outside of the monarch overwintering season (core habitat zone Oct 1 – Mar 31; shelter habitat zone Oct 15 – Mar 15), unless a true emergency arises (see emergency tree work below). A nesting bird survey will be required if tree work is conducted during nesting bird season. Certified arborist and monarch specialist assess impact of failure on monarch habitat and recommend replacement tree, if appropriate. Plant replacement tree if recommended per above at the beginning of the next rainy season.

Action	Timeline	Protective Measures
Emergency tree work (during monarch overwintering season)	As-needed	Tree work will be overseen by a certified arborist and monarch specialist who will recommend best management practices to avoid and minimize impacts to monarchs. Tree work will be conducted by a California-licensed tree contractor that has experience conducting work in sensitive habitat. Tree work will minimize damage to adjacent trees or limbs. Certified arborist and monarch specialist will assess impact of removal on monarch habitat and recommend replacement tree, if appropriate. Plant replacement tree if recommended per above at the beginning of the next rainy season. Preconstruction training will be required for contractors performing tree work to avoid and minimize impacts to sensitive resources.
Critical Windbreak Tree Replacement (Pilot Project)	As-needed	The critical windbreak will be enhanced by planting existing gaps in the windbreak with recommended tree species in Table 4. Selective removal of existing eucalyptus will be recommended by a certified arborist and monarch specialist and will not occur unless the existing gaps in the windbreak are planted. Removals will be overseen by a certified arborist and monarch specialist who will recommend best management practices to avoid and minimize impacts to monarchs. Removals will be conducted by a California-licensed tree contractor that has experience conducting work in sensitive habitat. Removals will minimize damage to adjacent trees or limbs. Certified arborist and monarch specialist will assess impact of removal on monarch habitat and recommend replacement trees. Follow guidelines for tree height established by the wind study to avoid negatively impacting monarch habitat.
Install and maintain positive drainage at base of trees to reduce ponding	Ongoing	Install and maintain drainages using best management practices to reduce erosion and prevent sediment deposition into Moran Lagoon. Prepare drainages prior to rainy season.
Maintenance of understory in eucalyptus groves	Ongoing	The understory within the eucalyptus groves will be managed to avoid the growth of ladder fuels and to keep sight-lines clear. Vegetation management will minimize impacts to monarch habitat by preserving nectar sources where feasible. If needed, a monarch specialist will advise vegetation management. Ivy that has climbed into trees will not be trimmed without input from a monarch specialist.
Removal of invasive species	Ongoing	Invasive species, other than blue gum eucalyptus that are necessary for monarch habitat, may be removed to restore native biodiversity and habitat. Where invasive species are removed, they will be replaced by wood chip mulch or native species that will achieve the habitat and restoration goals in this habitat management plan.
Tree and shrub planting	Ongoing	Tree planting will conform to the guidelines in this habitat management plan or be recommended by a certified arborist and monarch specialist. Native species will be planted where feasible, unless non-native species are necessary for monarch habitat enhancement or protection as outlined in this habitat management plan. Species selected for shrub planting will align with the public safety, habitat, and restoration goals in this habitat management plan.

Action	Timeline	Protective Measures
Removal of dead eucalyptus wood to reduce potential for eucalyptus pests	Ongoing	Not applicable

6 Monitoring Plan

This plan serves to manage and maintain the overwintering habitat at Moran Lake. Table 1 provides the historic data and counts of overwintering monarchs here. The two factors to be monitored are the number of monarchs that overwinter at Moran Lake and the quality of the habitat that the management area provides. Data in Table 1 helps to display regional and state-wide fluctuations, and to understand if the Moran Lake overwintering counts are consistent with the other sites in the county or possibly if the Moran Lake site is playing a more, or less, important role over time.

In order to analyze the effectiveness of the Moran Lake habitat, annual counts at Moran should be compared to other sites across the state and the immediate region as monarch counts will inevitably fluctuate between years. The goal should be to ensure that Moran Lake is hosting numbers that are proportionally similar to, or above, other regional sites. This will help determine whether habitat quality at Moran is the limiting factor in increasing the population of overwintering Monarchs at Moran.

6.1 Monarch Surveys

Monarch surveys will be conducted at least twice annually, and twice monthly as possible, during the overwintering season (October 15 to March 31). Surveys will be consistent with the Xerces Society's standards. Results will be recorded, uploaded to the Western Monarch Count database, and included in the annual report for this management plan.

6.2 Habitat Assessments

The long-term functionality of the management area habitat depends on the replacement trees survival and resulting wind protection needed by the overwintering monarchs. Replacement tree establishment must be prioritized by County Parks.

Depending upon the size of the trees planted and planting conditions (soil, water availability, etc.), trees could take up to 20 years or longer to reach full maturity and height, and shrubs could take 5 to 10 years. The goal of the plantings is to provide wind protection in the management area and particularly at the roosting and basking areas. Wind penetration will be measured using current wind modeling technology and applications every 3 to 5 years to understand the effectiveness of the plantings.

Tree health will continue to be assessed and monitored annually to identify hazardous trees and to identify trees with declining health. Health will be monitored by County's certified arborist and could be monitored by County's maintenance staff regularly. County staff can collaborate with the certified arborist to be aware of and notify them of situations like insect infestation or new potential tree hazards, so the arborist can monitor anything of significance.

6.3 Monarch Predator Assessments

During monarch surveys any change in the presence or evidence of predators will be recorded and discussed with the monarch butterfly specialist to determine if and what action may be needed.

6.4 Annual Report

Monitoring the tree plantings, habitat health, establishment of nectaring plants and other forest management actions will be done in Year 1 and annually. An annual monitoring report detailing the progress and findings will be prepared. Logs documenting implementation of the forest management actions will be completed and saved by the County. The report will include, as an appendix, other reports from the County arborist and monarch specialist.

The report will be used to determine if changes in management actions are necessary. Any corrective actions implemented to address threats to monarch habitat (i.e., pests, diseases, flood/erosion) and changes to monarch habitat use will be detailed in an annual monitoring report. The report will be saved by the County and be available to the public and resource agencies upon request.

6.5 USFWS Monitoring and Reporting Requirements 2022

County Parks was awarded a $20,000 grant to prepare this MBHMP update. To meet the grant requirements, monitoring data and analyses will be summarized in annual performance report that will be submitted to the USFWS. The Work Plan is included as Appendix C. The annual performance reports will include:

- Year 1: A detailed description of activities completed by County Parks, including the scope of activities, the date(s) and the specific location(s) within the management area
- Year 2 and annually thereafter: A description of the activities completed since the last reporting period, with the specific dates, such as X day of X month during X year. Description with a figure or sketch specifying where all activities occurred during the time period. The report will include:
  - Photos, before and after (whatever is appropriate);
  - Statements explaining any problems or delays in implementing project tasks;
  - Lessons learned (if appropriate); and
  - Other Reporting: If submitting reports to other federal, State, and local agencies and the above annual report content met then submitting these reports is acceptable.

Additionally, a final report will be submitted to the USFWS that will include all the above information/headings with a synthesis of all project activities completed. Annual and final reports must be submitted to the USFWS Project Officer, whose contact information is provided below.

Samantha Marcum
Coastal Program Regional Coordinator
U.S. Fish and Wildlife Service

6.6 California Coastal Commission

The Project Area is located within the County's Coastal Zone and the habitat management actions in this Plan, including vegetation removal and planting, constitute development pursuant to the

California Coastal Act[4], and thus coastal development permit (CDP) authorization is required. Portions of the recommended overall management actions (see Figure 7) fall within the original permitting jurisdiction of the California Coastal Commission, and therefore County Parks anticipates pursuing a consolidated CDP[5] from the Coastal Commission to comply with the requirements of the Coastal Act. For the purposes of that CDP, County Parks proposes the following reporting and adaptive management actions:

- County Parks will seek a five-year authorization through to April 30, 2031 to implement the overall management actions described in this Plan. Additionally, County Parks proposes that this authorization may be extended beyond the initial five-year period subject to review and approval by the Commission's Executive Director with a finding that there are no changed circumstances that may affect consistency with the policies of Chapter 3 of the Coastal Act and thus warrant re-review of the authorization. County Parks will submit a five-year extension request in writing to the Commission's Central Coast District Office by December 1, 2030, and the Executive Director's determination will be made in writing to County Parks.
- Annual reports as described above in Section 6.4 will be submitted by March 31 (or another date, subject to Executive Director approval) annually to the Commission's Central Coast District Office for Executive Director review and approval and will include:
    - A description of the actions completed during the previous year, including, but not limited to: (1) the number, species, and location of trees removed and planted; (2) location and nature of major limbing activities; (3) photos of the site before and after work; (4) any actions taken to address pests or predators; (5) a discussion of other project implementation actions not already included above and subsequent performance; and (6) adaptive management actions County Parks plans to implement over the subsequent year to ensure continued or more successful management, and progress towards long term management goals.

The annual report submitted to the Coastal Commission will be an enforceable component of the Commission's CDP authorization for the Plan and will require review and approval by the Commission's Executive Director prior to implementing any adaptive management actions.

[4] See Public Resources Code Section 30106.

[5] See Public Resources Code Section 30601.3.

7 Adaptive Management

The Moran Lake monarch butterfly overwintering habitat is regionally important, and care has been taken to preserve it. However, climate changes are impacting monarch habitat throughout coastal California that may require the County and other landowners and managers to respond and adjust to changes in real time. Monarch counts in the future are likely to fluctuate greatly, regionally, and at this site due to many factors, including climate change. At this time, preserving and managing the habitat so that it retains the key characteristics for overwintering is the objective of this management plan. Several recommendations for adaptive management are below. The County Park's arborist and entomologist will be consulted prior to initiating management actions.

- If the health of blue gums within the grove decreases and mass foliage losses occur at the cluster sites, the grove will be assessed for additional management actions.
- Soil amendments will be considered to encourage new vegetation growth, and a drip irrigation system could be installed to provide additional water, which is likely the greatest limiting resource.

This MBHMP update is an adaptive action taken to address the changing conditions and needs of the habitat. As discussed, tracking and adjusting replacement tree species and numbers is another adaption meant to more specifically address the changing needs of the site. Table 7 provides information about tree speices that did not thrive in the management area in the past. It will be important to track what species thrive and those that do not into the future and adjust accordingly.

Table 7 Tree Species Not Well-Suited to the Management Area

Tree Species	Location Planted in the Past	Observed issue
Pohutukawa	Between parking lot and lagoon	Poor growth, but the individual tree was planted in a very exposed location where no trees are currently thriving.
Coast redwood	Zones B and C – North and South Lakeside	Poor growth. This species is sensitive to salt spray and saline soils near the coast or tidal areas.
Coast Redwood	Zone H – Critical Windbreak along Placer Street	Trees died due to failed irrigation. May not be an appropriate area for coast redwoods due to lack of soil moisture.
Flooded-Gum Eucalyptus (*Eucalyptus rudis)*	North Lakeside	Infested by red-gum lerp psyllids.
Swamp gum	40 Moran Way	Insect infestation
California bay	Western margin of western grove, shaded area	Did not grow, potentially due to heavy shade, or competition from adjacent eucalyptus.

The 2010 Plan, Appendices 3.3 Recommended Plants for Overwintering Restoration, of included a list of species with their potential ecological role. Trees listed should be considered for planting in the appropriate locations and for the appropriate ecological role.

If plans or projects are developed in the future for Moran Lake, this plan will need to be incorporated into the plan with input from the County arborist and monarch specialist.

If the western monarch butterfly population is listed as a threatened or endangered by the USFWS, the agency will designate critical habitat for the species. It is likely the known or historic overwintering sites will be included as critical habitat. As a result, the regulatory setting for managing their habitat will become more complex and will include review and approval by USFWS. This management plan would very likely require an update or amendment to be consistent with the federal habitat protection requirements.

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