

Olympia Conservation Area
Habitat Management and Monitoring Plan
2022 Annual Report
(TE58263C-0)



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**Olympia Conservation Area HMMP
2022 Annual Report**

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Executive Summary

This report documents the work that was conducted in 2022 to implement the *Olympia Conservation Area Habitat Management and Monitoring Plan* (HMMP: McGraw 2020). The HMMP identifies the restoration, management and monitoring tasks, as well as adaptive management framework, for management of the Olympia Conservatio Area (OCA)—a 6.3-acre conservation area located within the San Lorenzo Valley Water District’s (District’s) 180-acre Olympia Watershed Property. The OCA supports endangered species and sensitive habitat found in the Santa Cruz Sandhills—a unique ecosystem found only on outcrops of Zayante soils, which features unique assemblages of plants and animals that include seven endemic plants and animals found nowhere else in the world (Table 1; McGraw 2004b). The OCA was set aside by the District to mitigate impacts of its capital improvements and operations and maintenance projects on rare species and sensitive habitat in the Sandhills. Work to implement the HMMP is covered under federal incidental take permit TE58263C-0.

2022 Activities

In 2022, Jodi McGraw Consulting (JMc) worked with District staff to implement initial habitat management and monitoring activities in the OCA.

Habitat Management, Restoration, and Enhancement

In the third year of implementing the HMMP, which was approved by the United States Fish and Wildlife Service in summer 2020, JMc implemented the following to manage, restore, and enhance habitat:

1. **Exotic plant management**, to control populations of exotic plant species that outcompete native plants, including the four endemic species, and degrade habitat for native animals, including the endangered insects;
2. **Enhancement of the Ben Lomond wallflower** (*Erysimum teretifolium*) population, by caging flowering individuals to prevent deer herbivory, which greatly reduces seed production and thus population growth;
3. **Access management**, to prevent impacts associated with unauthorized access to the area; and
4. **Restoration** of the 0.17-acre area (Figure 2) degraded by a prior stand of silver wattle (*Acacia dealbata*).

Exotic Plant Management

On March 25 and 29, 2022, JMc re-treated the following invasive plant species originally treated in 2020 within the OCA (Figure 2; Section 2.1):

1. French broom (*Genista monspessulana*);
2. Portuguese broom (*Cytisus striatus*);
3. Velvet grass (*Holcus lanatus*);
4. Prickly lettuce (*Lactuca serriola*);
5. Italian thistle (*Carduus pycnocephalus*);

6. Bull thistle (*Cirsium vulgare*); and,
7. Periwinkle (*Vinca major*).

In 2022, the exotic plant removal efforts required only one person-day, similar to the removal efforts in 2021, while the initial treatment in 2020 required four person days. This reflects the effectiveness of annual exotic plant control, which will be conducted again in spring 2023.

Ben Lomond Wallflower Enhancement

To increase the population of Ben Lomond wallflower, JMc caged 186 adult (flowering) plants to prevent herbivory by deer, which greatly reduce wallflower seed production (McGraw 2004b) and could contribute to declines in the already small population that could lead to its extirpation as a result of demographic or environmental stochasticity (McGraw 2020; Section 2.2). The plants were caged using 2" mesh that will avoid inhibiting access by pollinators, in order to promote seed production and increase the population. The cages will be moved in winter and early spring 2023 to cage the new cohort of adults and further promote the population.

Access Management

No trespass was detected in the OCA during monitoring and management activities at the site in 2022. Ongoing monitoring will be used to prevent unauthorized access that can degrade habitat in the OCA. In February 2021, JMc detected through quarterly monitoring that a motorcycle trespassing within the Olympia Watershed Property drove through the OCA (Section 2.3). The District immediately repaired the fence on the northern border where the ingress to the conservation area occurred and no future access was observed in 2021 or 2022.

Restoration

In 2022, JMc maintained the 0.17-acre silver wattle (*Acacia dealbata*, or 'acacia') area in the OCA (Figure 2; Section 2.4). The area featured acacia stumps, branches, and thick leaf litter (duff) on and in the soil following felling and partial removal of the trees between October 2011 and January 2012. This biomass was degrading habitat for the endangered plants and insects by physically inhibiting their use and promoting dense cover of exotic grasses and forbs.

In 2021, JMc initiated restoration by (Figure 3):

1. Removing the acacia stumps, branches, and surface leaf litter;
2. Removing of the partially decomposed acacia biomass/organic matter within the soil, to prevent ongoing establishment of exotic plants; and
3. Seeding the area with site-collected native herbaceous plants and subshrubs (characteristic of the sand parkland community (McGraw 2021b); and,
4. Planting 15 coast live oak (*Quercus agrifolia*) around the perimeter of the restoration area, to restore the structure to the native plant community and provide an additional food source.

In 2022, JMc maintained the Restoration Area through biweekly irrigation, exotic plant removal, and maintenance of the planted oaks (Section 2.4.2).

In addition, JMc conducted a combination of qualitative monitoring (Section 3.2.1), and plot-level monitoring (Section 3.2.2). Based on the results of the year 1 monitoring (Table 5), JMc conducted a second year of seeding in fall 2022 (Section 2.4.3) to increase native cover.

Monitoring and Adaptive Management

In 2022, JMc conducted Conservation Area Condition Monitoring, qualitative monitoring (Section 3.2.1), quantitative monitoring (Section 3.2.2), and photomonitoring (Section 3.3) to evaluate and document the conditions of the OCA to increase its effectiveness as outlined in Section 5.3 of the HMMP (McGraw 2020). Table 3 identifies the results of the quarterly Conservation Area Condition Monitoring conducted in 2022 to assess the general habitat conditions and determine the need for management to address stressors including exotic plants and issues related to access, as well as other factors such as erosion and disease. Figure 5 illustrates the locations of the 11 permanent photo monitoring stations reoccupied in 2022 to evaluate changes in habitat conditions over time, including progress of the acacia area restoration.

2023 Activities

In 2023, JMc will conduct habitat restoration, enhancement, management, and monitoring to follow up on the work in 2022 and as outlined in the implementation schedule in the HMMP (McGraw 2020).

In 2023, management will include three elements:

1. **Control exotic plants** including ornamental pine and exotic annual grasses and forbs, as well as re-treating the exotic plants managed in 2022 (Section 2.1), to prevent their reoccurrence.
2. **Enhance the Ben Lomond wallflower population**, by caging flowering individuals to prevent deer herbivory, which greatly reduces seed production and thus population growth; and
3. **Maintain the 0.17-acre acacia Restoration Area** through irrigation and related plant maintenance (e.g., spot weeding), and exotic plant control.

Additionally, Ben Lomond wallflower seed will be collected and dispersed into the restoration area in 2023 provided that a permit can be obtained from the California Department of Fish and Wildlife (Section 4.1.3).

In 2022, monitoring will consist of the following two elements:

1. **Conservation Area Condition Monitoring**, to examine conditions of the site on a quarterly basis to identify issues and determine the need for remedial actions (Section 4.2.1); and
2. **Restoration Area Monitoring**, to assess the need for remedial actions (i.e., follow-up treatments) and to begin to evaluate the effectiveness of the restoration project at achieving the quantitative objectives (Section 4.2.2).

1 Introduction

This report documents the work that was conducted in 2022 to implement the *Olympia Conservation Area Habitat Management and Monitoring Plan* (HMMP: McGraw 2020). The HMMP identifies the restoration, management, and monitoring tasks, as well as adaptive management framework, for management of the Olympia Conservation Area—a 6.3-acre conservation area located within the San Lorenzo Valley Water District's (District's) 180-acre Olympia Watershed Property. The conservation area was set aside by the District to mitigate impacts of its capital improvements and operations and maintenance projects on rare species and sensitive habitat in the Sandhills. The HMMP was approved by the United States Fish and Wildlife Service in summer 2020, when the District initiated work to implement the plan.

This document provides brief background information about the OCA, and then describes the work conducted in 2022 and the plan for implementation in 2023. Additional information about the OCA and its management is provided in the HMMP (Section 1.2; McGraw 2020).

1.1 Conservation Area Overview

The Olympia Conservation Area is a 6.3-acre area that supports endangered species and sensitive habitat found in the Santa Cruz Sandhills—a unique ecosystem found only on outcrops of Zayante soils, which supports unique assemblages of plants and animals that include seven endemic plants and animals found nowhere else in the world (Table 1; McGraw 2004b). The District established the Olympia Conservation Area in 2017 by granting to the Land Trust of Santa Cruz County (Land Trust) a conservation easement. The OCA was protected to compensate for impacts to sandhills species and habitat as part of the District's Probation Tank Replacement Project, which was permitted under federal incidental take permit TE58263C-0.

Table 1: Olympia Conservation Area Summary

Species and Communities	Status in Olympia Conservation Area
<u>Species</u>	
Santa Cruz kangaroo rat	Suitable Habitat
Zayante band-winged grasshopper	Species Present
Mount Hermon June beetle	Species Present
Ben Lomond spineflower	Species Present
Ben Lomond wallflower	Species Present
Ben Lomond buckwheat	Species Present
Silverleaf Manzanita	Species Present
<u>Communities</u>	
Sand Parkland	3.3 acres
Sand Chaparral	0.94 acres
Sandhills Woodlands and Forests	2.8 acres
Riparian	0.2 acres
Ornamental	0.01 acres
Total Area	7.3 acres

¹ The Olympia Conservation Area is a 6.3-acre area that is part of the SLVWD's 180-acre Olympia Wellfield. This plan assessed the contiguous 1.0-acre Mayer Conservation Easement area, which was previously protected but is not actively managed.

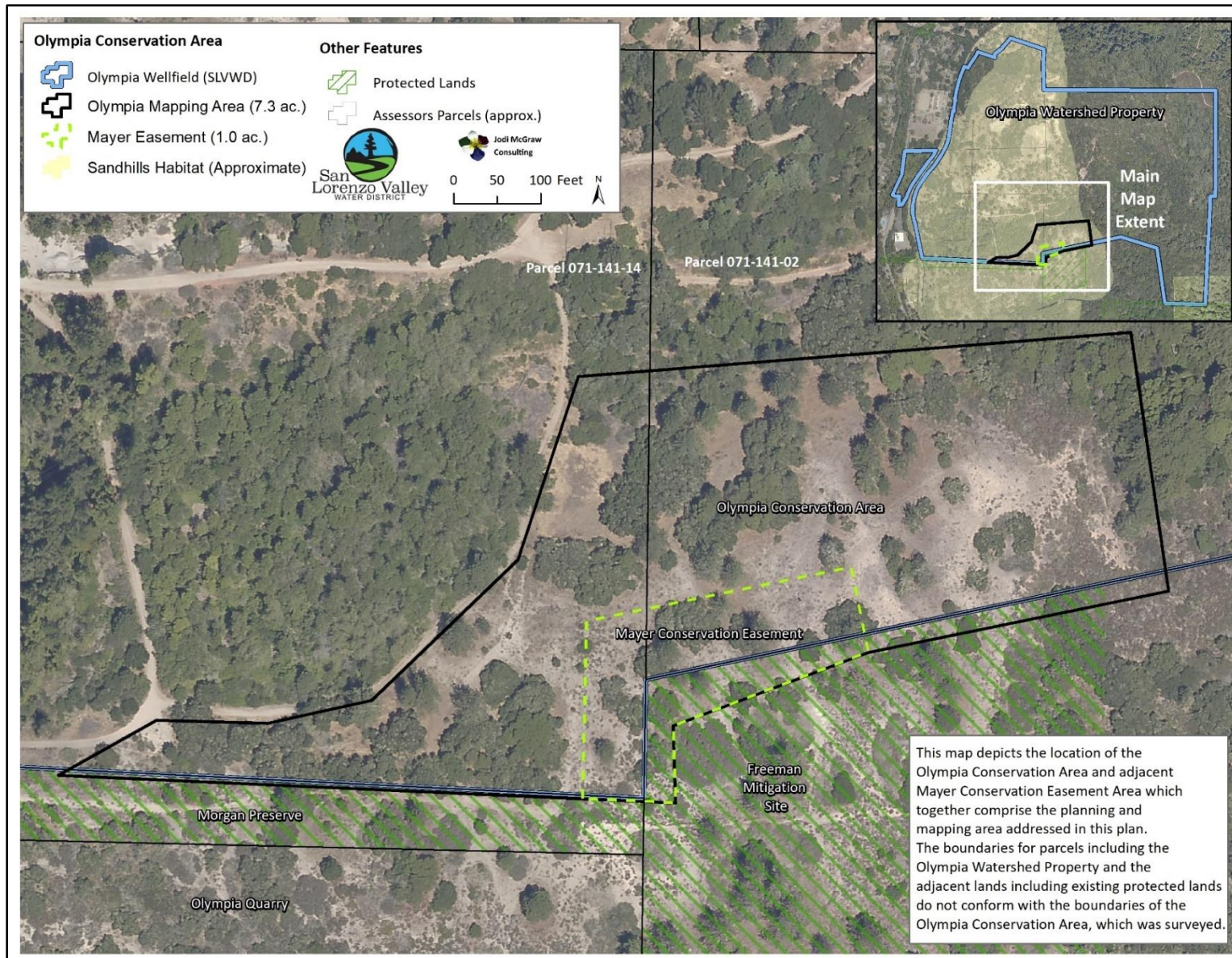


Figure 1: Olympia Conservation Area showing Mayer Conservation Easement Area and Olympia Mapping Area

Rather than setting aside just the habitat required to mitigate that project (0.995 acres; McGraw 2017), the District protected and committed to managing a larger area of Sandhills habitat to both provide for more meaningful conservation and provide a mechanism to mitigate its future capital improvement projects and operations and maintenance activities in the sandhills (McGraw 2017). With each project for which the District uses the OCA as compensatory mitigation, the District contributes funds to a non-wasting endowment used to fund implementation of the HMMP, as describe in Section 6 therein (McGraw 2020). Since its establishment, the OCA has been used to mitigate the impacts of three projects that have collectively used 2.082 acres of the habitat set aside. The remaining area is anticipated to be utilized to mitigate the impacts of future District infrastructure projects as well as operations and maintenance activities on the sandhills species, including those projects covered in a habitat conservation plan (HCP) that the District is preparing to cover activities in the sandhills over a 25-year period. The HCP is anticipated to identify additional conservation areas, as well as expand habitat restoration, management, and monitoring, as part of an update to the HMMP developed as part of the HCP planning process.

1.2 The HMMP

The HMMP describes the process by which it will be updated as part of the HCP planning process, including to fold in additional lands. In the meanwhile, it describes how the existing OCA will be restored, managed, and monitored, with greater detail provided for the initial 5-year phase of management. Specifically, the HMMP describes: the sandhills communities and species; the goals and objectives for management; the habitat management restoration, and enhancement strategies and techniques; the monitoring, reporting and adaptive management elements; a schedule, budget, and responsibilities for the initial phase of management; and guidelines for species protection during implementation of plan activities (McGraw 2020).

The HMMP addresses a 7.3-acre area that includes the OCA as well as the Mayer Conservation Easement Area—a 1.0-acre easement area established when the District granted a conservation easement in 2002 to the Center for Natural Lands Management (Figure 1). The OCA surrounds the Mayer easement on three sides; accordingly, the HMMP addressed the Mayer Conservation Easement area to enable seamless and thus more effective management. Implementation of the HMMP is covered under federal incidental take permit TE58263C-0.

1.3 The Report

This report was prepared to document the HMMP activities during 2022, the third year of implementation. Per the HMMP, the report documents the following:

1. **Section 2-Habitat Management, Restoration, and Enhancement:** The habitat management, restoration, and enhancement activities conducted, and the species protection measures implemented;
2. **Section 3- Monitoring and Adaptive Management:** Results of monitoring conducted, and any new information and changed conditions as well as modifications to management and monitoring approaches identified through the adaptive management framework; and
3. **Section 4-2023 Activities:** The planned management and monitoring for the following year based on the schedule in the HMMP (McGraw 2020).

2 Habitat Management, Restoration, and Enhancement

This section outlines the habitat restoration, enhancement, and management implemented in 2022, which entailed:

1. **Exotic plant management**, to control populations of exotic plant species that outcompete native plants, including the four endemic species, and degrade habitat for native animals, including the endangered insects;
2. **Enhancement of the Ben Lomond wallflower** (*Erysimum teretifolium*) population, by caging flowering individuals to prevent deer herbivory, which greatly reduces seed production and thus population growth;
3. **Access management**, to prevent impacts associated with unauthorized access to the area; and
4. **Restoration** of the 0.17-acre area (Figure 2) degraded by a prior stand of silver wattle (*Acacia dealbata*).

2.1 Exotic Plant Management

In 2022, JMc implemented high-priority invasive plant management in the OCA as outlined in Year 3 of the HMMP (McGraw 2020). Specifically, on March 25 and 29, 2022, JMc treated the following invasive plant species (Figure 3a) occurring within the OCA:

1. French broom (*Genista monspessulana*);
2. Portuguese broom (*Cytisus striatus*);
3. Velvet grass (*Holcus lanatus*);
4. Prickly lettuce (*Lactuca serriola*);
5. Italian thistle (*Carduus pycnocephalus*);
6. Bull thistle (*Cirsium vulgare*); and,
7. Periwinkle (*Vinca major*).

On May 20, 2022, JMc removed additional velvet grass while it was in flower and distinguishable from more widespread exotic annual grass species.

The treatment areas included 40 mapped patches totaling 4,780 square feet (Figures 2). Prior to the treatment, JMc examined the site to look for any additional occurrences of the target species. Spring vetch (*Vicia sativa*), while mapped in 2018, was not observed in 2022 and was not treated. The single ornamental pine (*Pinus cf. contorta*) died in 2022. The biomass will be removed if/wen it begins to impact the native plant community (e.g., if it falls; Section 3.4).

French broom (Figure 3a), Portuguese broom, and periwinkle were removed through hand pulling. Prickly lettuce, bull thistle, Italian thistle, and velvet grass were grubbed out using a Pulaski. The grass was bagged, as were the flower heads of the thistles. All exotic plant biomass was hauled to the SLVWD yard on site at the Olympia Wellfield (Olympia Watershed Property) and was stacked on pavement.

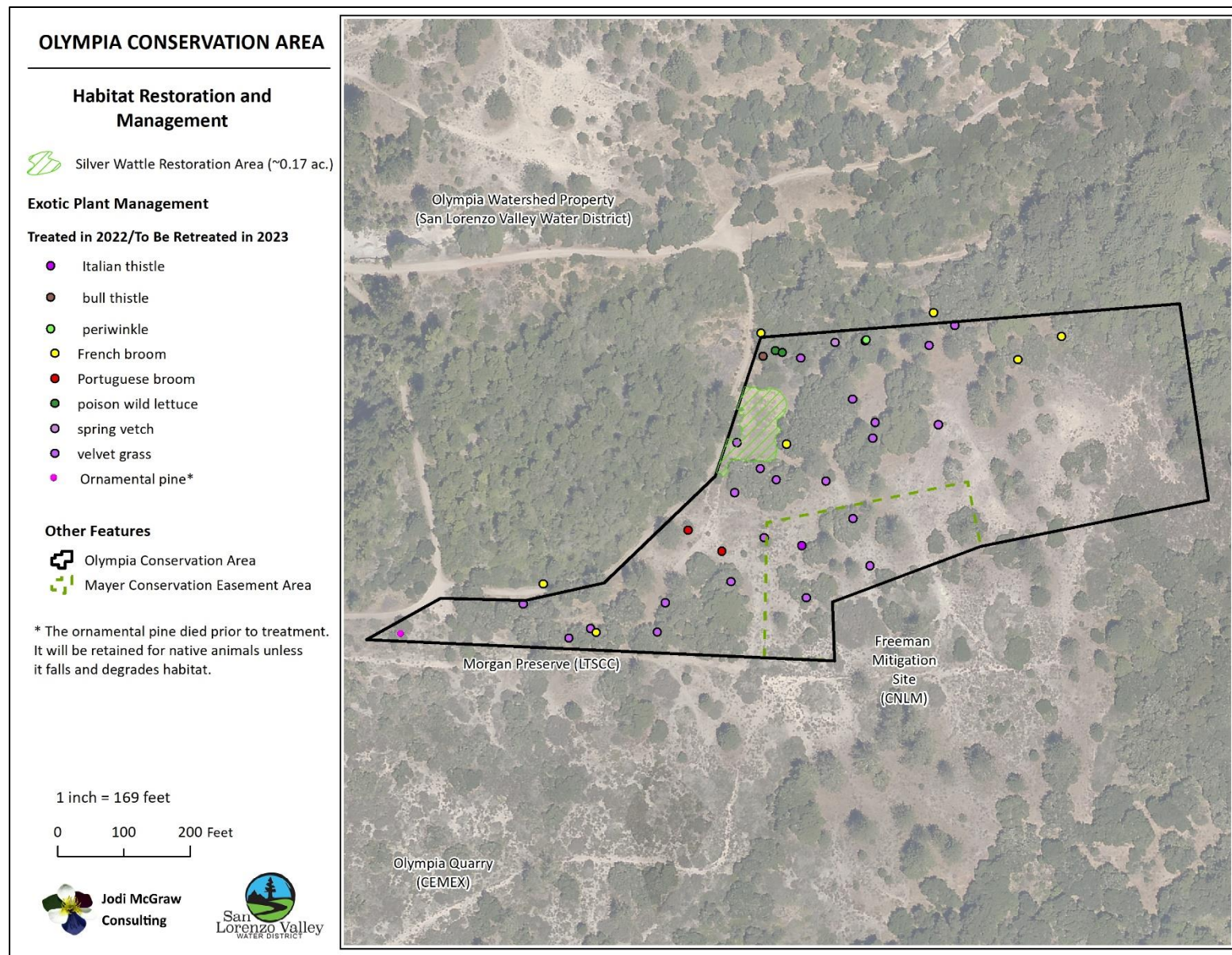


Figure 2: Habitat Management and Restoration Treatment Areas

The exotic plant removal efforts in 2022, as in 2021, required only one person day, while the initial 2020 efforts required a crew of four people to treat all of the mapped occurrences in the course of one day. This reflects the effectiveness of annual control, which will be conducted again in spring 2023.

2.2 Ben Lomond Wallflower Enhancement

On February 8, February 25, and April 20, 2022, JMc caged adult Ben Lomond wallflower within the OCA to prevent herbivory by black tailed deer (*Odocoileus hemionus columbianus*). Though deer are native, their populations may be unnaturally large due to reduced predation and/or increased availability of food in landscaped areas in the region. Their herbivory greatly reduces wallflower seed production (McGraw 2004b) and could contribute to declines in the already small population that could lead to its extirpation as a result of demographic or environmental stochasticity (McGraw 2020).

To protect the adult wallflowers from herbivory, JMc searched areas known to be occupied by Ben Lomond wallflower, as well as unoccupied but suitable habitat (McGraw 2020), to identify individuals that were likely to flower in spring based on their size and/or evidence of bolting (i.e., initiation of a flowering stalk). These individuals were caged using four-foot-tall wire cages made within 2" diameter avian wire, in order to avoid limiting access by pollinators such as the chalcedon checkerspot butterfly (*Euphydryas chalcedona*). A total of 186 cages were installed. Each cage contains at least one adult, though several cages were erected to protect multiple adults (Figure 3b).

2.3 Access Management

In 2022, District staff conducted tasks to manage access at the Olympia Watershed Property, of which the OCA is a part.

1. **Site Patrols:** in 2022, the District continued to with the Land Trust of Santa Cruz County to have the entire Olympia Watershed Property patrolled to assess public uses including detect any access into the Olympia Conservation Area.
2. **Fence and Sign Maintenance:** The District maintained the current fences and signs that are designed to promote compliance with the closure of OCA to unsupervised public access.

In February 2021, JMc detected through quarterly monitoring that a motorcycle trespassing within the Olympia Watershed Property drove through the OCA (Section 2.3). The District immediately repaired the fence on the northern border where the ingress to the conservation area occurred and no future access was observed in 2021 or 2022.

2.4 Restoration

2.4.1 Background

In 2022, JMc maintained the 0.17-acre former acacia (silver wattle; *Acacia dealbata*) area in the northwestern corner of the Olympia Conservation Area (Figure 2). The stand of acacia was removed by the District between October 2011 and January 2012 as part of a larger effort to control the invasive tree throughout the Olympia Watershed Property (SLVWD 2012). However, the acacia biomass was left to biodegrade in place. Despite the passage of approximately one decade, in fall 2021 the area featured recalcitrant woody debris including cut stumps and branches, and areas of dense litter from the only

partially decomposed leaves and fruits on the soil surface. Additionally, the soil featured relatively thick layer of organic matter from the partially decomposed biomass from the acacias.

The remaining woody debris, litter, and organic matter degraded the sand parkland habitat through a variety of mechanisms including (McGraw 2004a,b, 2020):

1. The nitrogen-fixing acacias increased the soil nitrogen, which promoted competitive exotic grasses including rip gut brome (*Bromus diandrus*), rattail fescue (*Festuca myuros*), and smooth cat's ears (*Hypochaeris glabra*), which dominated the plant cover and exerted strong competitive effects of the native herbaceous plants;
2. The branches and leaf litter on the soil surface, as well as the larger pieces of partially decomposed organic matter in the soil, inhibit establishment of smaller-seeded native plants and can promote larger seeded exotic plants, such as ripgut brome; and
3. The dense exotic plants (>50% cover) degraded habitat for the Zayante band-winged grasshopper, which preferentially occurs in areas of sparse (<20%) plant cover, and may have also impacted Mount Hermon June beetle, by reducing cover of native plants that can provide a food source for the fossorial larvae.

Thus, the acacia removal area was identified as a priority for restoration in the HMMP (McGraw 2020). Restoration of the area to feature open canopy sand parkland habitat suitable for the endangered plants and insects could increase their populations within the OCA. It also has the potential to connect occupied habitat in the OCA to that further north in the Olympia Watershed Property, thus creating an important corridor for dispersal of the endangered species between the habitat areas and promote the populations of Zayante band-winged grasshopper population and other endangered species within the property (McGraw 2020).

In fall 2021, JMc implemented the following initial treatments to restore the 0.17-acre acacia area (McGraw 2021b):

1. Removed the acacia biomass on the soil surface;
2. Removed of the acacia biomass/organic matter within the soil;
3. Seeded the area with a mix of site-collected native plants; and,
4. Planted 15 coast live oak (*Quercus agrifolia*) around the perimeter of the restoration area.

2.4.2 Restoration Area Maintenance

In 2022, JMc maintained the 2021 Restoration Area by conducting irrigation and plant maintenance of the 15 coast live oaks installed in 2021, and invasive plant removal.

Irrigation of the 15 coast live oaks occurred at biweekly intervals during the first year after planting. The oaks were weeded, as needed, and monitored for signs of herbivory, desiccation stress, and disease. A total of 14 oaks survived in the first-year post planting.

Silver wattle acacia seedlings observed germinating in the Restoration Area in spring and summer 2022. were pulled. No other invasive species were observed in the Restoration Area in 2022.

2.4.3 Seeding

Based on results of monitoring of the restoration area, which revealed lower native plant cover than desired to achieve the objective (Section 3.2.2), JMc conducted a second year of seeding within the Restoration Area. On November 2, 2022, JMc dispersed a total of 248 grams of site-collected seed from 17 native plant species (Table 2) within the treatment area. The seed was harvested from the site between May and September, cleaned to reduce excess chaff, and then weighed and mixed. Prior to seeding by hand, JMc mixed the seed with rice hulls, which acted as a carrier and visual aid to help with even dispersion of the seed.

Compact soil due, in part, to heavy equipment use to clear litter and organic matter from the restoration area, was implicated, along with low rainfall in January and February, with reducing native plant establishment. Prior to seeding, JMc conducted two treatments designed to increase soil to seed contact and loosen bare areas of compact soil:

1. **Raking Treatment:** The Restoration Area was raked to scarify the soil and increase soil to seed contact. This treatment was conducted in just approximately 30% of the area, which lacked native plants, to avoid impacting the established native plants such as Ben Lomond buckwheat and Ben Lomond spineflower (Figure 3d and 3e). Native plants established early in 2022 due to the rainfall that began in September and promoted germination of species including Ben Lomond spineflower, which were larger at the time of seeding in November (Figure 3e).
2. **Soil Loosening Treatment:** Portions of the Restoration Area featuring bare, compact soil were treated to loosen soil. These areas were loosened by using a shovel to dig down eight to ten inches and turn over the soil. A total of 45 holes were spread the eastern third of the Restoration Area (Figure 3f), where soil was most noticeably compact and featured bare soil and low native cover.

Follow the pre-treatments, the restoration area was broadcast seeded in two passes. First, all areas were seeded with the general seed mix which contained 15 species of subshrubs and herbs (Table 2). Second, the areas subject to soil loosening, or those featuring already loose soil, were additionally seeded with 24 grams of Ben Lomond buckwheat and 6 grams of silver bush lupine. These two species, which were not yet meeting the restoration objectives for cover in 2022 (Section 3.2.2.3), were seeded separately to ensure they were placed in loose sand soil that would maximally promote their establishment. Once seeding was complete, the seed was raked into the soil using rock rakes to promote soil to seed contact.

Table 2: Seed collected in 2022 from the OCA and seeded into the Acacia Restoration Area

Species	Common Name	Life Form	Weight (g)
<i>Achillea millefolium</i>	Yarrow	Perennial herb	4
<i>Acmispon glaber</i>	Deer weed	Subshrub	18
<i>Calyptridium monospermum</i>	One seeded pussypaws	Annual herb	8
<i>Castilleja exserta</i>	Owl's clover	Annual herb	34
<i>Chorizanthe pungens</i> var. <i>hartwegiana</i>	Ben Lomond spineflower	Annual herb	26
<i>Clarkia purpurea</i> ssp. <i>quadrivulnera</i>	Four spot	Annual herb	2
<i>Collinsia bartsiiifolia</i>	White blue-eyed Mary	Annual herb	0.5
<i>Corethrogyne filaginifolia</i>	California aster	Perennial herb	34
<i>Crocanthemum scoparium</i>	peak rush-rose	Subshrub	0.5
<i>Eriogonum nudum</i> var. <i>decurrens</i>	Ben Lomond buckwheat	Perennial herb	24
<i>Eriophyllum confertiflorum</i>	Golden yarrow	Subshrub	10
<i>Eschscholzia californica</i>	California poppy	Perennial herb	0.5
<i>Gilia tenuiflora</i>	Slender flowered gilia	Annual herb	1
<i>Heterotheca sessiliflora</i> ssp. <i>echiodes</i>	Bristly golden aster	Perennial herb	60
<i>Lasthenia gracilis</i>	Common goldfields	Annual herb	4
<i>Lupinus albifrons</i> var. <i>albifrons</i>	silver bush lupine	Woody shrub	6
<i>Monardella sinuata</i> ssp. <i>nigrescens</i>	Northern curly leaved monardella	Annual herb	4
Total			236.5¹

¹ The total weight of the 2022 seed was re-weighed prior to seeding and totaled 248 g, so this weight was reported when discussing seeding.



Figure 3: Restoration images, showing: a) French broom growing in the OCA prior to treatment in 2022, b) cages installed in 2022 to protect Ben Lomond wallflower from herbivory, c) signage and fencing to prevent access within the OCA, d) large Ben Lomond spineflower rosettes establishing within the Restoration Area, e) scattered native seedlings within the 0.17-acre Restoration Area, and f) holes manually created during the soil loosening treatment prior to 2022 re-seeding. Photographs by Jodi McGraw Consulting.

2.5 Species Protection Measures

During the course of management in 2022, JMc and District staff implemented the applicable species protection measures identified in Appendix C of the HMMP. These measures are collectively designed to reduce short-term, direct negative impacts to the listed species including the Mount Hermon June beetle, Zayante winged-grasshopper, Ben Lomond spineflower, and Ben Lomond wallflower during the course of management.

In 2022, ground-disturbing activities were confined to pre-seeding treatments, plant maintenance, and exotic plant removal. While impacts to the fossorial Mount Hermon June beetle and Zayante band-winged grasshopper were minimal, restoration personnel conducted the following measures to minimize ground disturbance:

1. staged project materials, equipment, and biomass (e.g. exotic plant biomass) on designated staging areas located in degraded habitat.
2. confined ground-disturbing activities to the designated restoration areas.
3. carried, rather than dragged, materials between the staging area(s) and the treatment areas.
4. monitored all soil-disturbing activities for Mount Hermon June beetle larvae.

No Mount Hermon June beetle or Zayante band-winged grasshoppers were observed during the treatments; therefore, no direct take in terms of impacts to individuals is anticipated to have occurred in 2022.

3 Monitoring and Adaptive Management

In 2022, JMc conducted Conservation Area Condition Monitoring (Section 3.1), restoration project monitoring (Section 3.2), and photomonitoring (3.3) to evaluate and document the conditions of the OCA to increase its effectiveness as outlined in Section 5.3 of the HMMP (McGraw 2020).

3.1 Conservation Area Condition Monitoring

In 2022, the Olympia Conservation Area was monitored at quarterly intervals (late February, June, September, and December) by JMc to identify exotic plants as well as evaluate access, erosion, disease, and other issues. The quarterly monitoring was used to assess general habitat conditions and determine the need for management as part of the Conservation Area Condition monitoring outlined in the HMMP and detailed in Table 3, which identifies the results of monitoring in 2022.

Table 3: Results of 2022 Conservation Area Condition Monitoring		
Condition	Methods	Observations
Access Management		
Fences	Visually inspect fence and document	The fences inhibiting access to the OCA from the public access trail was intact.
Signs	Visually inspect interpretive and 'sensitive habitat' signs	The interpretive sign and sensitive habitat signs were intact.
Access	Look for signs of access including footprints, dog and horse tracks and feces, debris, play equipment, etc.	No signs of trespass observed.
Exotic Plants		
Early Detection-Rapid Response	Visually inspect conservation area with an emphasis on invasion 'hot spots' (e.g. perimeter, trails, riparian area, etc.) to detect new invasive plant occurrences	No new invasive plant species were detected.
Examine Prior Invasive Plant Treatment Areas	Visually inspect prior invasive plant treatment areas to assess the need for follow-up treatments	Monitoring of the 2020-2021 treatment areas was conducted spring and summer 2022. In May 2022, follow-up treatment was conducted to remove velvet grass.
Other Factors		
Other Factors	Monitors should examine the site for other conditions that could influence management, including plant die-off or dieback due to disease or drought	No issues were identified.

3.2 Restoration Project Monitoring

In 2022, JMc conducted Restoration Project Monitoring to assess the effectiveness of restoration and management and to determine the need for remedial actions. The Restoration Project Monitoring included two components:

1. Qualitative assessments of conditions of the site; and,
2. Collection of quantitative data in plots and the use of descriptive and inferential statistical analyses to evaluate specific metrics that reflect the desired conditions (i.e., objectives) and track changes over time and/or compare conditions to reference sites (Section 3.3).

3.2.1 Qualitative Monitoring

In 2022, the first year following initial restoration, JMc conducted qualitative monitoring during biweekly site visits. During these reconnaissance-level site visits, the Restoration Area was inspected for native and exotic plant establishment, signs of erosion, and condition of the planted coast live oaks. The results of the monitoring were used to guide the need for exotic plant control, plant maintenance of the oaks, and other management activities.

3.2.2 Quantitative Monitoring

In 2022, JMc conducted the first year of quantitative monitoring to evaluate whether the treatment area is achieving the restoration objectives identified in the HMMP (McGraw 2020).

3.2.2.1 Sampling Design

In 2022, JMc established a total of 14, 4m² (2m x 2m) monitoring plots: 7 plots were randomly located throughout the Restoration Area, and the other 7 plots were randomly located within intact sand parkland habitat on the north-facing slope of the OCA, which served as the reference site (Figure 4). To facilitate future monitoring, JMc permanently monumented the plot corners using 12" metal nails, labeled the plots with an inverted pin flag in the northwestern corner, and georeferenced the plot using a Trimble Juno global positioning system (GPS).

3.2.2.2 Data Collection and Analysis

On June 2, 2022, JMc collected data on plant species cover as well as factors that influence plant performance (Table 4). Data from the sample plots were aggregated by treatment (restoration area vs. reference site) to calculate the following variables used to evaluate the restoration objectives:

- mean native and exotic plant cover;
- mean native and exotic alpha species richness: the number of native and exotic plant species in each plot; and,
- mean cover of each of the five target plants identified in the objectives: Ben Lomond spineflower, Ben Lomond buckwheat, Ben Lomond wallflower, silver bush lupine, and sessile golden aster.

Table 4: Variables measured during Quantitative Monitoring of the Restoration Area in 2022

Variables	Description
Soil Depth	The soil depth reading (cm) given by a 3-foot long (92-cm) soil probe.
Soil Moisture	The soil moisture, recorded as a percentage.
Disturbance	Cover of soil disturbance by type ²
Litter Cover	The percentage of the plot covered by litter, defined as herbaceous plants, tree and shrub leaves from the prior year(s), and the plant species that is/are the source of the litter.
Litter Depth	The litter depth recorded in cm to the nearest half cm.
Woody Debris	The percentage of the plot covered by woody debris (shrub or tree stems or branches), and the plant species that are the source of the woody debris. This does not include dead standing biomass; only woody debris lying on the ground.
Bare Ground	The percent cover of the plot featuring bare ground.
Plant Species Cover	Visual estimate of absolute cover by species using cover increments ¹ .

¹ Absolute cover was estimated using 0.1, 0.5, 0, and any whole integer between 1 and 100%.

² Soil Disturbances: animal diggings/burrows, trails, slides/erosion, and grading (or other mechanical)

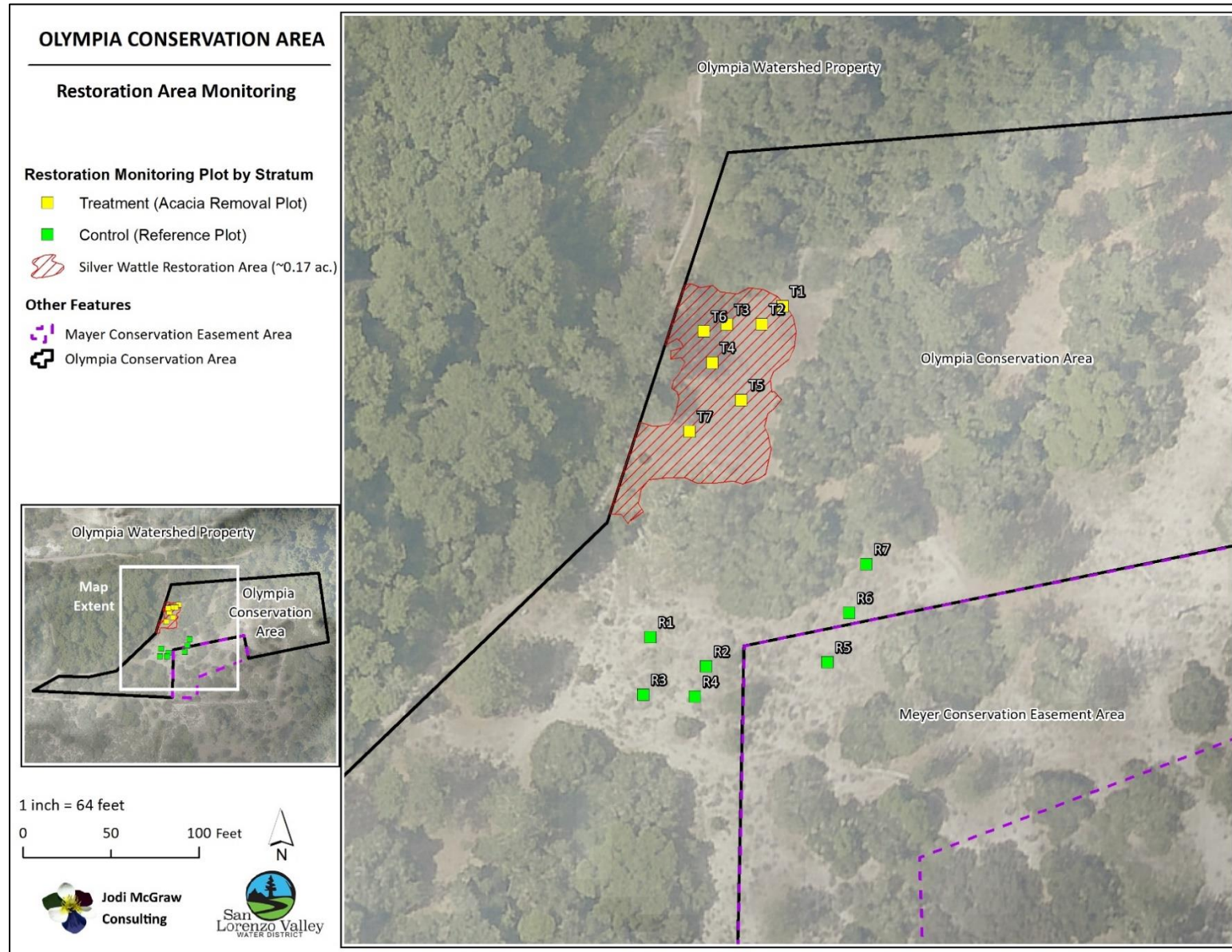


Figure 4: 2022 OCA Restoration Area Monitoring Plots

3.2.2.3 Results

Table 5 shows the current status of the Restoration Area towards achieving the objectives identified in the Restoration Plan McGraw 2020). In the first year post-treatment, the Restoration Area is meeting two out of the seven objectives: specifically, it is meeting the restoration objectives for native plant richness (the number of native plants), and for invasive and exotic plant cover. The restoration areas is not yet meeting the objectives for native plant cover, Ben Lomond wallflower, Ben Lomond buckwheat cover, and food sources and habitat for Mount Hermon June Beetle (MHJB) Zayante band-winged grasshopper (ZBWG; Table 5). The lack of achievement of these objectives is due to four factors:

1. The restoration area was only established in winter 2021, so there has not been sufficient time for native plants to establish and grow to achieve the desired cover of the reference site;
2. The restoration treatments were conducted in mid-winter (December 2021 and early January 2022), reducing the growing season for native plants, relative to if treatment was conducted in the fall as originally planned;
3. There was very low rainfall after the site was seeded in January 2022, limiting soil moisture availability for native plants; and
4. Use of heavy equipment compacted the soil in some places, and likely limited establishment of native plants.

During qualitative monitoring in 2022, high numbers of native plant seedlings (Figure 3e), including Ben Lomond buckwheat, were observed. It is likely that more time is needed for the first-year plants to continue to grow in size and meet the criteria for native plant cover.

Ben Lomond wallflower was not seeded in 2021 or 2022, but will be seeded in 2023 upon being granted a 2081a permit to collect seed from this species at the site (Section 4.1.3).

Table 5: OCA Restoration Area Monitoring Results

Objective			Restoration			
Name	Description	Reference Value	Target	Value	Objective Status	Next Restoration Steps
O1, O5: Native Cover ¹	90% of the native plant cover in the Reference Site plots.	32.49	29.24	27.00	Not Currently Meeting Objective	Seeded a mix of native plants in Fall 2022
O1, O5: Native Richness ¹	90% of the average native plant species richness in the Reference Site plots (alpha richness).	7.43	6.69	9.29	Currently Meets Objective	Maintain and monitor
O2: Establish Ben Lomond spineflower	Minimum 5% cover of Ben Lomond spineflower in the Restoration area.	N/A	5.00	23.14	Currently Meets Objective	Maintain and monitor
O3: Establish Ben Lomond wallflower	Minimum 1% cover of Ben Lomond wallflower in the Restoration area.	N/A	1.00	0.00	Not Currently Meeting Objective	Obtain permit for collection and seed in 2023
O4: Establish Ben Lomond buckwheat	Minimum 3% cover of Ben Lomond buckwheat in the Restoration area.	N/A	3.00	1.86	Not Currently Meeting Objective	Seeded Ben Lomond buckwheat in Fall 2022
O5L Establish native plants for Mount Hermon June beetle	Native plant cover at least 90% of that in in the Reference Site plots	32.49	29.24	27.00	Not Currently Meeting Objective	Seeded a mix of native plants in Fall 2022
	Native plant richness at least 90% of that in the Reference Site plots	7.43	6.69	9.29	Currently Meets Objective	Maintain and monitor
O6: Establish native plants for Zayante band-winged grasshopper	Minimum 3% cover of silver bush lupine and bristly golden aster in the Restoration Area.	N/A	3.00	0.36	Not Currently Meeting Objective	Seeded silver bush lupine and bristly golden aster in Fall 2022
O6: Provide suitable habitat for ZBWG	Exotic plant cover to remain under 20%.	N/A	20.00	0.49	Currently Meets Objective	Maintain and monitor
O7: Prevent invasive plants	Invasive plant cover to not exceed 5% absolute cover.	N/A	5.00	0.1	Currently Meets Objective	Maintain and monitor

3.3 Photomonitoring

In 2022, JMc reoccupied the 11 photostations established in 2021 (McGraw 2021b) to track changes in community structure and species composition over time and specifically evaluate the acacia restoration area.

Stations P1 - P9 (Figure 5) were established in spring 2021 to capture important baseline conditions as well as representative habitats and features including:

1. **Plant Associations:** Representative conditions of the 14 plant associations (McGraw 2020);
2. **Endemic Plant Occurrences:** Patches of the four rare plants;
3. **Endemic Insect Habitat:** Suitable habitat for the Zayante band-winged grasshopper and Mount Hermon June beetle; and,
4. **Management Issues:** Invasive plants, dense exotic plants, ingress/egress areas, and erosion features (i.e., trails on steep slopes).

Additionally, stations P15 and P16 were added in fall 2021 to evaluate recovery of the acacia restoration area.

3.4 Adaptive Management

In 2022, the ornamental pine that was slated to be removed from the OCA died. The biomass will be removed if/when it impacts the native plant community, such as by falling and creating dense leaf litter and woody debris that suppresses native plants and inhibits use of the habitat for the listed insects. Otherwise, it will be retained standing to provide habitat for other native animals including woodpeckers and insects that consume dead/decaying wood.

In addition, the collection and seeding Ben Lomond wallflower were delayed until 2023 when the requisite Scientific, Educational, or Management Permit will be obtained under Section 2081a of the California Endangered Species Act (Section 4.1.3).

Funds in the budget that were allocated toward these tasks were used to conduct the quantitative monitoring to inform adaptive management (e.g., reseeding and sit prep of the restoration area (Task 3.2.2)).

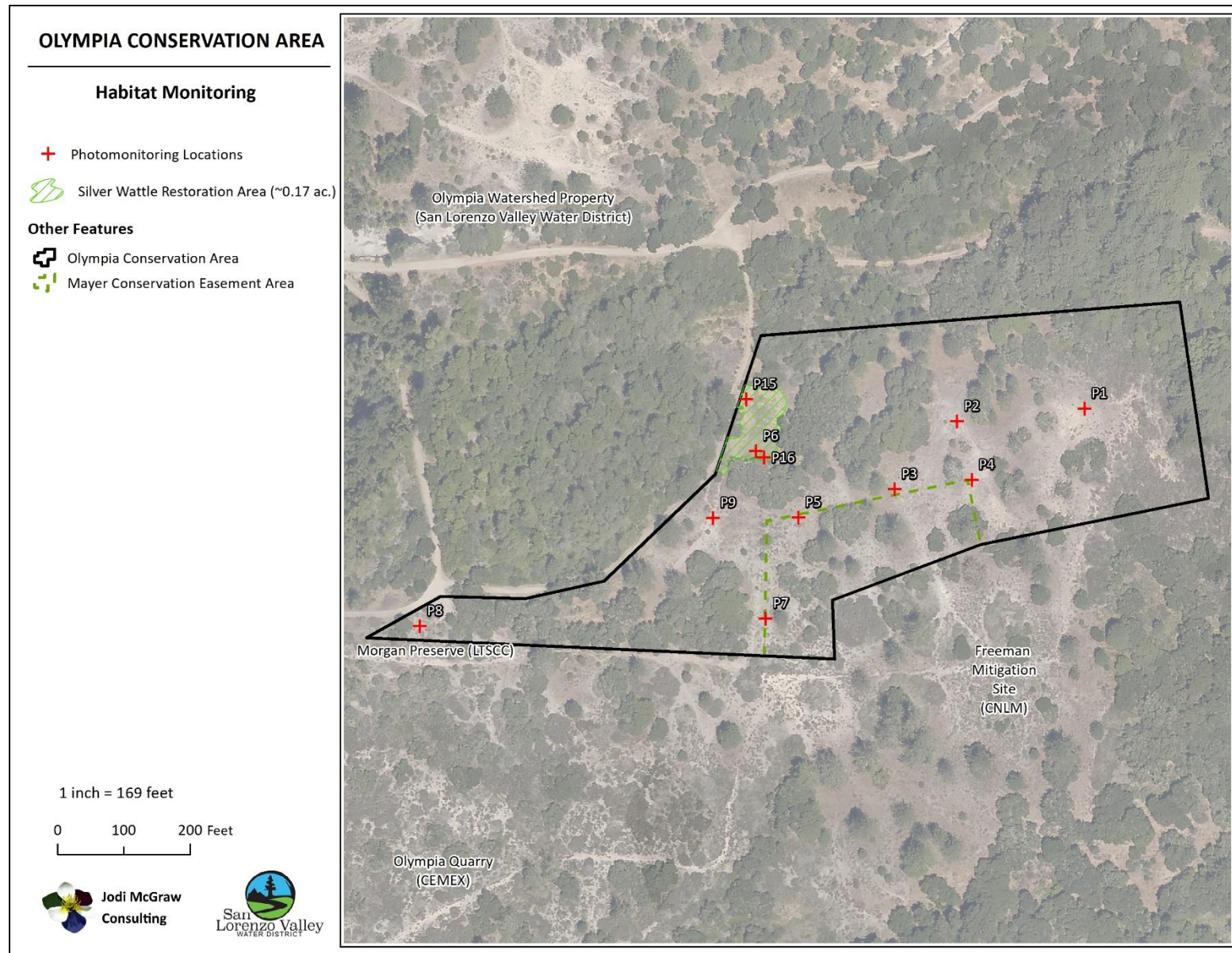


Figure 5: Photomonitoring Stations within the OCA

4 2023 Management and Monitoring

This section outlines the habitat restoration, management, and monitoring planned for 2023. It was developed based on the schedule for the first five years of management as outlined in the HMMP and the results of management and monitoring in 2022.

4.1 Habitat Restoration, Enhancement, and Management

In 2023, the District will implement three habitat restoration, enhancement, and management projects:

1. Control plants that were controlled in 2022 (Section 2.1), to prevent their re-establishment;
2. Enhance the Ben Lomond wallflower population, by caging flowering individuals to prevent deer herbivory, which greatly reduces seed production and thus population growth;
3. Maintain the 0.17-acre acacia Restoration Area through exotic plant control and seeding Ben Lomond wallflower if a 2081a permit can be secured.

4.1.1 Exotic Plant Management

In 2023, exotic plant management will be conducted to treat the following exotic plants conduct follow-up treatments for the invasive brooms, thistles, velvet grass, and periwinkle treated in 2022 (Section 2.1). In addition, the biomass of the dead ornamental pine will be removed if/when it impacts the native plant community, such as by falling and creating dense leaf litter and woody debris that suppresses native plants and inhibits use of the habitat for the listed insects; otherwise, it will be retained standing to provide habitat for other native animals including woodpeckers and insects that consume dead/decaying wood (Section 3.4).

All exotic plants will be managed through manual or mechanical means; no herbicides will be used. The treatments will be conducted in a manner to minimize negative impacts on the endangered species and sensitive habitat, as Section 4.1.2 of the HMMP (McGraw 2020).

4.1.2 Ben Lomond Wallflower Enhancement

In 2023, the District will conduct the third year of caging for adult Ben Lomond wallflower to prevent herbivory by deer, which greatly reduces seed production and could contribute to declines in the already small population that could lead to its extirpation as a result of demographic or environmental stochasticity (McGraw 2020).

During February of 2023, a biologist will revisit known areas occupied by Ben Lomond wallflower to identify individuals that are likely to flower that spring based on their size and/or evidence of bolting (i.e., initiation of a flowering stalk). These individuals will then be caged using 4' tall wire cages made of 2" avian wire or 2" x 4" welded wire, which is necessary to avoid limiting access by pollinators such as the chalcidon checkerspot butterfly (*Euphydryas chalcedona*). Cages installed in 2021 will be repurposed and new cages will be created, as needed, to protect all adult plants.

4.1.3 Restoration

In 2023, the restoration area will be maintained through the following:

1. Irrigation to maintain the coast live oaks; and
2. Exotic plant control to prevent establishment of invasive plants and dense occurrences of exotic plants.

Exotic plant control will be determined based on the results of monitoring (Section 4.2) and will include manual and mechanical treatments. For example, weed whacking will be used to control any dense occurrences of exotic grasses and forbs, where doing so will not significantly impact the native plants; hand pulling and hoeing will be used to remove isolated plants (e.g., brooms, thistles, invasive vines).

The cover of native plants will be qualitatively assessed in May 2023 and then quantitatively examined in May/June 2024 through the plot monitoring (Section 3.2.2) to evaluate whether establishment is sufficient or whether additional seeding will be needed to promote cover of native plants and if so, which species or life forms (e.g., native subshrubs).

Ben Lomond wallflower will also be seeded into the treatment area in 2023 by: 1) collecting seed from the population in the OCA, and 2) cleaning and dispersing the seed in the fall. As noted above, this treatment will require JMc or the District to obtain a 2081a permit for the state-listed plant from CDFW (McGraw 2020).

4.2 Monitoring

In 2023, monitoring will consist of the following elements:

1. **Conservation Area Condition Monitoring**, to examine conditions of the site on a quarterly basis to identify issues and determine the need for remedial actions; and,
2. **Photomonitoring**, to track changes in the condition of the vegetation and habitat area over time.

4.2.1 Conservation Area Condition Monitoring

In 2023, JMc will continue to conduct Conservation Area Condition Monitoring at quarterly intervals in order to identify exotic plants as well as evaluate access, erosion, disease, and other issues. The quarterly monitoring was used to assess general habitat conditions and determine the need for management as part of the Conservation Area Condition monitoring outlined in the HMMP and Table 3.

4.2.2 Photomonitoring

In 2023, the 9 permanent photomonitoring stations established in 2021 will be reoccupied. The photostations will be used to evaluate changes in habitat conditions, including plant community structure and general species composition, over time.

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