

**Plant Maintenance 2017-2019**  
**June 19, 2017, Pre-Bid Meeting**  
**Questions and Answers**

**Location: Bald Mountain Parking Lot**

**1. Question:**

Is there a plant establishment period that the implementation contractors maintain the plants for or starting maintenance as soon as they're planted?

**Response:**

The contractor is responsible for the plants in the existing sites (Site #3 Mt Um Trail Mitigation, Site #4 Bald Mountain Parking Lot, and Site #7 Mindego Gateway) at the expected start of contract on September 1, 2017. The contractor is responsible for the new sites as soon as plants are installed at them after September 1, 2017. The tentative schedule for installation of plants in Fall 2017 is:

- Site #1 Mt Umunhum Summit – September 9, 10, 30 and October 1
- Site #2 Mt Umunhum Road Mitigation – October 21, 22
- Site #5 Woods Trail Mitigation – October 28, 29
- Sites #6 Stevens Creek Nature Trail Mitigation – October or November, specific date to be determined
- Site #8 Sears Ranch Bioswale and Site 9 Harkins Bridge Mitigation in late September or early October.

**2. Question:**

Note: this question is added by District staff after an indirect question by contractors suggested clarification was needed. Is there cattle grazing in the vicinity of any of the revegetation sites?

**Response:**

Cattle grazing occurs on the La Honda Open Space Preserve in a pasture around Site #8 Sears Ranch Bioswale. As shown on the plans for Site #8 in Exhibit 3 of the Supplemental Conditions, a wire fence and two access gates will keep grazing livestock out of the parking lot and planting areas. Contractor should use caution and drive slowly if cattle are on or near the access road or gates.

**3. Question:**

Where is the water that can be used to irrigate the plants at the Mt. Um Summit?

**Response:**

There will be two 6,200-gallon water tanks 0.3 miles down Mt. Um. Road from the summit. PLEASE NOTE: the RFB states these tanks will be 5,000-gallons but the revised size of these tanks will now be 6,200 gallons each. This location was pointed out during the prebid tour. Contractors will be able to fill from a

hydrant that will be on Mt Um Road near the water tanks. District will supply the fittings, hoses and hydrant wrench to fill from the hydrant at this location. The only other use for the water in these tanks will be for occasional use by District maintenance staff for filling equestrian water troughs and similar maintenance tasks which are not expected to use more than 100 gallons per month, and for emergency response to fires. District will refill tanks if they are drawn down for fire response. In order to make sure that some water is available for emergency response at all times, Contractor must keep at least one water tank full at all times.

**4. Question:**  
Where is water available to fill up the tanks at the Mt. Umunhum Summit?

**Response:**  
The hydrant that may be used to fill the water tanks near the summit of Mt. Um is located approximately 12 miles away near the intersection of Hicks Road and Pheasant Road in the Rancho de Guadalupe area of Sierra Azul Open Space Preserve. Contractor will be responsible for fittings, hoses, and hydrant wrench to fill at this location.

**5. Question:**  
Do you define invasive plants in the RFB package?

**Response:**  
Yes, see the second bullet under Task 4 Weeding on page 10 of 25 in the Bid Package B. Bidding Documents and Exhibit 5 in the Supplemental Conditions.

**6. Question:**  
Does the District allow use of herbicides?

**Response:**  
Yes, the District allows contractors to use herbicides on certain revegetation sites. As stated on p. 10 of 25 of the Bid Package B. Bidding Documents, “All weeding techniques, especially the use of herbicides, shall be consistent with the District’s current IPM Program, including but not limited to Supplemental Conditions, Exhibit 6 - List of Approved Herbicides, Exhibit 7: IPM Best Management Practices, Exhibit 8: IPM Mitigation Measures, Exhibit 9: Posting of Herbicide Use.”

As specified on the Bid Sheet and under the description of the revegetation sites, certain sites under the RFB have the potential for rare plants or are near waterways so herbicides cannot be used at those sites or on portions of any site that is within 15 feet of water:

- Site 1. Mount Umunhum Summit Restoration

- Site 2. Mount Umunhum Road Mitigation
- Site 3. Mount Umunhum Trail Mitigation
- Site 4. Bald Mountain Parking Lot
- Site 6. Stevens Creek Nature Trail Mitigation
- Site 8. Sears Ranch Bioswale

**7. Question:**  
On the CalFlora reporting described in Task 9 Reporting, do we report all weeds that were treated or just the invasive species?

**Response:**  
Reporting under Task 9 should focus on the invasive weeds.

**8. Question:**  
Clarify the provisions for maintaining California nutmeg and buckeye and are they planted by seed?

**Response:**  
Some California nutmeg and California buckeye may be planted by seed and these seeded locations will be maintained according to the specifications under Task 6 Acorn Basins on page 12 of 25.

**9. Question:**  
When saplings that were started as seeds (acorns, California nutmeg and California buckeye) outgrow the plastic tube shelters, will Contractor be responsible for adding taller foliar cages?

**Response:**  
Task 6 Acorn Basins requires maintenance of plastic tube shelters in good condition and their removal as the plants grow and at the direction of the District, however, it does not require the Contractor replace them plant protection devices. If the District decides that installation of additional plant protection devices is required, it will be negotiated with the Contractor under the Unit Price bids for Item No. U-4 on the bid sheet and District will provide the materials.

**10. Question:**  
I've been on some sites where animals will chew plants and if that happens, will District provide the deterrent spray or protective material?

**Response:**

Spraying of browse deterrent, if determined to be necessary, will be negotiated with the Contractor under the Unit Price bids for Item No. U-3 on the bid sheet and District will provide the materials.

**11. Question:**

Will the nursery deliver replacement plants when needed under Task 7?

**Response:**

The District will be responsible for having replacement plants delivered under Task 7.

**12. Question:**

Will replacement plants under Task 7 be the same size as original plants installed?

**Response:**

Replacement plants will be the same or similar container size as those originally installed. Please note that most of the pot sizes of installed plants are tree bands at 2.25" x 3.75" x 4", and pot sizes are generally described in the plants lists in Exhibit 3 of the Supplemental Conditions.

**13. Question:**

Clarify monitoring requirements at Site #1 Mt. Umunhum Summit.

**Response:**

This sentence should be revised in Task 8 on page 13 of 25 to clarify that plant survival counts should be conducted at each site in summer 2018 and 2019 except for Site #1. "The only exception to summer plant counts is the Mount Umunhum Summit Site #1 where District will evaluate the survival rate and report to Contractor the replacement plants."

**14. Question:**

On the summer monitoring, is it a census count?

**Response:**

The summer monitoring is described under Task 8 and it consists of a count of the survival of installed plants and acorn basins by species and location, and observations of any causes and patterns. Representative photographs are also required.

**15. Question:**

Is this a low bid?

**Response:**  
Yes, refer to Section 15. Responsive Proposal on p. 20 of 25. The Total Base Bid is designated as “TOTAL FOR ALL NINE SITES” on the last page of the bid sheet.

**16. Question:**  
Will you provide the DIR number for prevailing wage reporting?

**Response:**  
Contractors must be registered with DIR and upon award the District will register the project and provide the contractor with the project number.

**17. Question:**  
Is the schedule for maintenance set by the contractor or by the District?

**Response:**  
The contractor is responsible for performing the tasks at the specified months and frequency provided in the Scope of Work in the Bid. The District will not require that certain tasks be conducted on certain days. Occasionally, the District may inform the Contractor of upcoming events such as special activities to avoid or special events prior to which monthly maintenance shall be completed. For example, the Grand Opening of Mt Umunhum Summit will be September 16 and 17 and Contractor should make sure the plants installed by that date are well-watered and in good condition.

**Location: Safety Talk at Contractor’s yard at Mt Um Summit**

**18. Question:**  
Are you using deer repellent in lieu of cages at the Summit?

**Response:**  
The designers of the Mt. Umunhum Summit revegetation concluded that there are not many deer at the top of the summit, and not many deer have showed up on our wildlife cameras there. Because of the scenic quality of this site, they recommended not to use cages and suggested deer repellent spray as an option if necessary. See Response to Question #10.

**19. Question:**  
Is deer repellent spray specific to the Umunhum planting sites?

**Response:**

The provisions for deer repellent spray are specific to Site #1 Mt. Umunhum Summit and Site #2 Mt. Umunhum Road, however, deer repellent spray or the installation of additional plant protection devices could be negotiated with the Contractor under Unit Price Items # U-2 and U-3.

**20. Question:**

Are there any sites where there will need be a cultural or biological monitor present for ground disturbance?

**Response:**

Task 4 Weeding on page 11 of 25 provides “Contractor should immediately notify the District of any unexpected conditions encountered during the work such as the discovery of special status species or cultural resources on site.” Best Management Practices #25 and #26 in Exhibit 7 of the Supplemental Conditions provide buffer areas around rare plants and additional conditions regarding the discovery of Cultural Resources. Mitigation Measure 4.3-3 in Exhibit 8 of the Supplemental Conditions provides measures to take in the event human remains are discovered. Remember that the Contractor is not installing the plants, so in general, we do not expect ground disturbance except to a minimal degree during weeding and plant replacement. At the planting areas at the Mt. Umunhum Summit, there has been much historical and recent ground disturbance and new findings of cultural resources are not expected. We have attached to this addendum the Mt. Umunhum Rare Plants Report and Mitigation that describes and has maps of rare plants at the Summit. District will provide a training to Contractor on the rare plants of Mt Umunhum and workers are expected to learn to identify these plants. If stands of rare plants germinate in the Umunhum planting areas, District will provide a biological monitor during weeding and plant replacement activities as needed to assist Contractor in avoidance. There are no known cultural resources or rare plants in the other revegetation sites included in the RFB.

**21. Question:**

Are we required to report rare plants to the CNDBB?

**Response:**

Task 4 Weeding on page 11 of 25 provides “Contractor should immediately notify the District of any unexpected conditions encountered during the work such as the discovery of special status species or cultural resources on site.” District will report any new rare plant locations to CNDBB.

**22. Question:**

Do you require a Qualified Applicator Certificate (QAC) worker to be onsite if there is any spraying, or do you need one in the company and people who have been trained?

**Response:**

See Best Management Practice #4 in Exhibit 7 of Supplemental Conditions of the RFB, "Pesticide applicators shall have or work under the direction of a person with a Qualified Applicator License or Qualified Applicator Certificate. Contractors and grazing and agricultural tenants may apply approved herbicides after review and approval by the District and under the direction of QAL/QAC field supervisors." Per the District's IPM Coordinator, a QAC-licensed supervisor provided by the Contractor needs to directly supervise staff working in the field by phone or by radio.

**23. Question:**

Do we decontaminate between sites?

**Response:**

Yes per Exhibit 4 in the Supplemental Conditions.

**Location: At top of the summit stairs/turn around circle**

**24. Question:**

What is the success criteria for the seeded areas at the Mt. Um Summit?

**Response:**

The contractor is only responsible for weeding in the seeded areas of the Mt Umunhum Summit and in any areas of all the revegetation sites not in the planting basins or acorn basins. The target is no more than 5% absolute cover of invasive plants in these areas per Task 4 on p. 10 of 25 in the Bid Package. The Contractor is not responsible for survival of seeded native plants in any seeded areas.

**25. Question:**

Is the Contractor responsible for irrigating the seeded areas?

**Response:**

No, only installed plant (from containers) and acorn basins shall be watered by the Contractor.

**26. Question:**

Are you solarizing the planting sites at Mt Umunhum Summit to treat soil Phythophthoras?

**Response:**  
No, per advice of Ted Swiecki from Phytosphere Associates, we are not solarizing the planting locations at the Mt. Umunhum Summit at this time. Because there was so much grading work done before the Phytophthora was discovered at a single location, and there are no remaining plants exhibiting symptoms at this time to guide detailed sampling and remediation, solarization does not appear to be warranted. We have been working closely with the nursery to produce clean plants that will be tested again before delivery to the site.

**27. Question:**  
When plant protection devices or plastic shelter tubes are removed, who determines when this occurs and what does Contractor do with removed material?

**Response:**  
Task 5 Plant Protection and Task 6 Acorn Basins provide descriptions of plant growth that the Contractor can use to indicate the need for removal of these items. In addition, District may request that they be removed, or not, at the end of the contract. Removed plant protection devices and plastic tube shelters shall be neatly stacked or contained on the site for pickup by the District.

**28. Question:**  
Will the plants be installed in some type of basin that will hold 2 to 3 gallons of water without running off and will mulch be placed around each installed plant?

**Response:**  
The description for each site specifies whether mulch has been included. To a large degree, we are not importing wood mulch at this time due to concerns about possible contamination with soil Phytophthoras.

At the Mt Umunhum Summit, each plant will be installed in a hole that will be approximately 2 times the diameter of the diameter of the pot. Approximately 6 inches of soil will be returned to the bottom of the hole, the hole will be watered with approximately 4 inches of water, the plant will be placed in hole, and remaining soil will be used to fill around edges of the plant. Soils will be compacted by hand to remove larger air pockets.

Each plant basin will have large rocks (2"- 6") placed around the plant collar, acting as mulch, downhill and far enough away that rocks will not slide and impact the plant collar. This will help increase soil retention and provide a cooler microsite for the plant to flourish. See page 29 of the Mt. Umunhum Vegetation Restoration Plan attached to this addendum.



Soils at the Mt Umunhum Summit planting sites had rock sorting prior to rebuilding the soil structure and incorporating compost at the planting areas. The planting basins will have soil to retain water. Refer to answer to Question #40.

**29. Question:**  
19,000 plants will be installed at the Mt Umunhum Summit?

**Response:**  
No. 1,959 plants and acorn basins will be installed at the Mt Um Summit, Lower Weather Shelter, and Flagpole planting areas in 2017 or were planted in the Experimental Planting Site in 2016. Approximately 500 plants and 10 acorn basins will additionally be planted at the Mt. Um Summit in 2018.

**30. Question:**  
At the Mt. Umunhum Experimental Planting Site, how long did it take for water to soak in?

**Response:**  
Approximately 1-2 minutes per plant.

**31. Question:**  
Do some of the sites have water tanks on-site that we can fill up ourselves?

**Response:**  
Yes, refer to Task 2 Revegetation Sites on pp. 5 through 9 of 25 for descriptions of sites that will have water tanks: Site #1 Mt Umunhum Summit that can be used to also water Sites #2-4; Site #5 Woods Trail Mitigation; and Site #6 Stevens Creek Nature Trail Mitigation.

**32. Question:**  
Do we need our own water meter? Are we paying for water? Will the District be providing the contractor a water meter to use on the hydrant for water outs?

**Response:**  
The District provides water for free to the contractor at its field offices and other preserve sites as described under Task 3 Watering. Contractor does not need to own a water meter. District will not be providing a water meter to the Contractor.

**33. Question:**  
Is there a spot on site where we can stage a water truck or a water buffalo?

**Response:**

The District can work with the contractor to provide a location to store a water tank or water buffalo near the water hydrant where the contractor will be filling with water near the South Area Outpost on Pheasant Road near Hicks Road and approximately 12 total miles from the Mt. Umunhum Summit (see Task 3 Watering on p. 10 of 25 and description of Site #1 on page 6 of 25).

**34. Question:**

Regarding the provision in Task 4 Weeding for no greater than 5% absolute cover of invasive plants in areas of the revegetation sites not in the planting basins or acorn basins, do you have a preferred survey protocol for determining absolute cover method?

**Response:**

Depending on site conditions, the District often uses point intercept, point-line intercept, or observational estimates to determine absolute cover of invasive plants. Contractor should propose which method they believe is most appropriate for these sites and use the same method on all sites.

**35. Question:**

Does the District have weed survey data that we can see before the bid for these sites?

**Response:**

Existing weed data is available for the following sites at these CalFlora link:

- Sites 1- 5:  
[www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.1672&x=-121.877&z=14](http://www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.1672&x=-121.877&z=14)
- Site 6:  
[www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.314&x=-122.1728&z=16](http://www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.314&x=-122.1728&z=16)
- Site 7:  
[www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.3084&x=-122.1993&z=18](http://www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.3084&x=-122.1993&z=18)
- Site 8:  
[www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.3275&x=-122.2798&z=16](http://www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.3275&x=-122.2798&z=16)
- Site 9:  
[www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.4373&x=-122.3673&z=17](http://www.calflora.org/entry/wgh.html#srch=t&crnx=px7&fmt=photo&inma=t&y=37.4373&x=-122.3673&z=17)

In addition, we are providing the following report for Mindego Gateway that contains some information on prior weed treatment:

- 2016 Mindego Gateway Planting and Landscape Maintenance, Annual Monitoring Report and Final Project Report, Confluence Restoration, December 2016.

**36. Question:**

Is there a prevailing wage determination sheet in the RFB?

**Response:**

See links provided under Section 12 Prevailing Wages on p. 19 of 25 of the Bid Package.

**Location: Mt Um Summit Ceremonial Circle**

**37. Question:**

In regions where there is no cell phone service, will the contractors be able to use radios?

**Response:**

Yes, we will have District issued radios for the contractors, and we will provide a training on how to use them.

**38. Question:**

Are we going to be able to drive up here with a water buffalo when the site is open to the public?

**Response:**

See response to Question # 41.

**39. Question:**

When the site is open, will we have guaranteed parking?

**Response:**

The District will work with the Contractor to identify parking areas in the general Mt Umunhum Summit area that will be available to the Contractor on weekdays for up to three vehicles. These locations are likely to occur in areas that are not otherwise available for parking by the general public such as by the water tanks.

**40. Question:**

At the planting areas on the Mt Umunhum Summit, describe any compaction?

**Response:**

During construction of the Summit facilities, planting areas were dug, decompacted, and organic material was mixed in to a depth of 18 inches at coarse 1-2 foot intervals with the top 18” having a compaction level of approximately 85%.

**Location: Mt Um Summit Experimental planting site**

**41. Question:**

Will we be allowed to drive an OHV utility vehicle, like a 4x4 with a water truck or water buffalo in this area between the Ceremonial Circle and the Experimental Planting Site?

**Response:**

The contractor will be allowed to drive vehicles up to the size of a 1-Ton pickup on the roads and trails of the Mt. Umunhum Summit. Any such vehicle must be able to navigate the curves of the new roads and trails. Hoses and other equipment should be operated in a way to not cause a tripping hazard to the visiting public.

**42. Question:**

Did the plants that were installed in the Experimental Planting Site in December 2016 receive any artificial irrigation?

**Response:**

Other than watering at the time of plant installation in December 2016, they did not receive any additional artificial irrigation.

**43. Question:**

Are there are more plants that will be installed in other areas of the Mt Umunhum Summit?

**Response:**

Yes, in the Fall of 2017 approximately 1,959 container plants will be installed throughout the summit of Mt Umunhum, the ceremonial circle area, the west summit, scarp area, radar tower area, east summit, lower weather shelter, and flagpole areas as shown for Site #1 in Exhibit 3 of the Supplemental Conditions.

**44. Question:**

Were all of the plants in the Experimental Planting Site marked with stake whiskers?

**Response:**

Most but not all of the plants installed in the Experimental Planting Site were marked with stake whiskers. We do not use wire stake flags for marking at the

Mt. Umunhum Summit because they fly away in high winds. We will not be installing stake whiskers or other markers at every single one of the approximately 2470 plants to be installed at the Mt Umunhum Summit in Fall 2017 and Fall 2018.

**45. Question:**

Are the plants to be installed at the Mt. Umunhum Summit grown in containers?

**Response:**

Yes, most plants have been growing at the nursery in containers (see plant tables in Exhibit 3 of the Supplemental Conditions for pot sizes), and native seed will be spread. The contractor is not responsible for installing any container plantings until replacement plantings occur. The District will provide replacement plants. See Task 7 Replacement of Dead Plants on p. 12 of 25 of the Bid Package.

**Location: Mt Um Summit parking lot**

**46. Question:**

Are there restrooms at the Mt Umunhum Summit?

**Response:**

Yes, there are restrooms at the Mt Umunhum Summit at the parking lot. There are also restrooms at the Bald Mountain Parking Lot and Mindego Gateway. There are bathrooms at the parking lot near the trailhead of Stevens Creek Nature Trail on Monte Bello, and at Gate PC05 near the preserve entrance to the Harkins Bridge Mitigation site.

**47. Question:**

For the steeper slopes, is the District installing any erosion control measures?

**Response:**

The slopes have been regraded to stable conditions. At some locations, retaining type walls or grid-like erosion control structures have been installed such as at the Lower Weather Shelter. No additional erosion control measures such as silt fences or erosion control blankets will be installed.

**48. Question:**

Are you broadcast seeding or hydro seeding?

**Response:**

The District will be broadcast seeding the planting areas at the Mt. Umunhum Summit with locally collected grass and forbs. There will be no hydroseeding at this site.

**49. Question:**  
Are there any limitations on operating a water truck, as far as the engine running during the day with visitors around?

**Response:**  
Refer to best management practice #30 in Exhibit 7 of the Supplemental Conditions: “All motorized equipment shall be shut down when not in use. Idling of equipment and off-highway vehicles will be limited to 5 minutes.”

**50. Question:**  
Does a safety plan need to be submitted with the bid?

**Response:**  
Safety plans regarding Task 1 on p. 5 of 25 of the Bid Package are required to be in place prior to work starting but are not required to be submitted with the bid.

**51. Question:**  
Are District preserves open sunrise to sunset?

**Response:**  
The standard operating hours for District preserves are from one-half hour before sunrise to one-half hour after sunset every day of the year.

**Location: Mt. Umunhum trail head**

**52. Question:**  
Do the plant basins installed along Site #3 Mt. Umunhum Trail have plant protection devices and where are they?

**Response:**  
Yes, There are 9 toyon and 2 canyon live oak plants installed approximately 100 feet from the Mt Um Trailhead at Bald Mt that have plant protection devices. The rest of the trail plantings are acorn plantings that are in plastic tube shelters. See the map for Site #3 Mt Umunhum Trail Map in Exhibit 3 of the Supplemental Conditions.

**53. Question:**  
Is there ATV access along the Mt Um Trail?

**Response:**  
4WD trucks can travel towards the planting locations on Site #3 Mt Umunhum Trail via an access road near Gate SA38 shown as a double-lined road on the map

for Site #3 in Exhibit 3 of the Supplemental Conditions. ATVs can proceed to the planting sites shown as single-line trails on the same map.

**54. Question:**

Are there any sites, besides the Mt. Umunhum Summit, that have limited access for vehicles?

**Response:**

At Site #6 Stevens Creek Nature Trail, 4WD trucks or ATVs can be driven to within 0.3 miles of the 3 planting sites, and then no vehicles can be driven across the bridges past these points. Lighter wheeled vehicles without engines can be pushed across the bridges and up the trails to the revegetation sites. Refer to the map for Site #6 in Exhibit 3 of the Supplemental Conditions - 4WD trucks and ATVs can be driven on the double-line trails but they cannot be driven on the single-line trails.

**Location: Bald Mountain parking lot**

**55. Question:**

Is the District testing its revegetation sites for Phytophthora soil diseases?

**Response:**

The District is in the process of hiring Dr. Jennifer Park with Oregon State University to test existing revegetation sites in the preserves in 2017 and 2018 and make recommendations on remedial actions where required.

**56. Question:**

Have the eucalyptus trees at Site #5 Woods Trail Mitigation been removed yet?

**Response:**

No. They cannot be removed until after September 15, the end of the raptor nesting season. A contractor and staff will fell or girdle the eucalyptus trees in October.

**57. Question:**

The Bid Proposal date has been extended. We revised schedule below.

**Response:**

June 8, 2017	Request for Bids issued
June 19, 2017	<b>Mandatory Pre-Bid Meeting, 11:00 a.m. RSVP is Mandatory and must be completed by 5:00 p.m. on June 15, 2017.</b>
<del>June 21, 2017</del> June 23, 2017	<b>3:00 p.m. - Deadline for Bidders to pose questions.</b>
<del>June 23, 2017</del> June 28, 2017	<b>3:00 p.m. - Final Addendum to Bid Package issued</b>
<del>June 28, 2017</del> June 30, 2017	Bid Opening, 3:00 p.m. 330 Distel Circle, Los Altos, CA, 94022
August 9, 2017	Award of Contract by District Board of Directors Regular Meeting, begins at 7:00 p.m.
August 10, 2017	Written Notice of Award of Contract
August 21, 2017	Pre-Construction Meeting and deadline to submit Labor and Materials Payment Bond, Performance Bond, Proof of Insurance, and signed Agreement
August 22, 2017	Written Notice to Proceed issued by District
December 31, 2019	Work on site complete
January 2020	Project Close Out & Completion



Attachments to Addendum 1, June 21, 2017, Request for Bids, Plant Maintenance of Multiple Revegetation Sites:

1. 2016 Woods Trail Revegetation Plan 2016\_12\_20
2. 2016.12.08\_Mindego Gateway\_Report\_FINAL
3. FINAL\_Mt Um Rare Plant Report 2017
4. Mt Umunhum Vegetation Restoration Plan FINAL 2016\_12\_01
5. Mt\_Umunhum\_Road\_Resurfacing\_Rare\_Plants\_Creekside\_Feb2017



Midpeninsula Regional  
Open Space District

## REVEGETATION PLAN

# SIERRA AZUL OPEN SPACE PRESERVE WOODS TRAIL OAK MITIGATION 2016



Document Prepared By  
Cleopatra Tудay  
For  
MROSD and CDFW

**REVEGETATION PLAN  
For  
Woods Trail Oak Mitigation  
Sierra Azul Open Space Preserve  
Santa Clara County, California  
Midpeninsula Regional Open Space District**

**December 19, 2016**

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## **PROJECT BACKGROUND**

Mount Umunhum is the fourth-highest peak in the Santa Cruz Mountains in Santa Clara County, California. The peak lies southeast of Los Gatos and south of San Jose. Formerly an Air Force station from 1958 to 1980, it was purchased by Midpeninsula Regional Open Space in 1981 and incorporated into the Sierra Azul Open Space Preserve. Woods Trail, also in the same preserve, is situated northeast of the Mount Umunhum summit. The trail starts at the junction of Hicks and Mt Umunhum Road, and runs perpendicular to Guadalupe Creek. There is a particular area of Woods Trail approximately one mile from the trailhead at Gate SA06 that appears to have been graded as a former building site. Now the site is a relatively bare area surrounded by non-native plantings. This part of Woods Trail is a degraded landscape that would greatly benefit from restoration to more natural conditions.

The Mount Umunhum Trail includes three bridges for which a California Department of Fish and Wildlife (CDFW) Streambed Alteration Agreement (Notification No. 1600-2016-0161-R3) is required. The Mount Umunhum Trail Bridge Construction Project (MUTBCP) Revegetation Plan is required by the CDFW permit in compensation for minor tree removal required by the bridge construction, and also to guide future maintenance, monitoring and reporting of the revegetation site. In Fall 2016, 34% of the mitigation requirements was completed with the installation of 15 nursery plants and 40 seeded basins along Mt. Umunhum Trail and trailhead (**Table 5, Figure 2**). The Mt. Umunhum Trail is a fairly undisturbed area and ubiquitously covered by California bay laurel and other evergreen trees. The abundance of shade made by the native evergreen tree cover makes additional revegetation difficult. Any plantable space consists of either valuable serpentine grassland or the rare woodland woollythreads (*Monolopia gracilens*). Therefore, mitigation on Woods Trail, with a close proximity to the Mt. Umunhum Trail and its history of land disturbance, would be the preferred site for completing CDFW mitigation requirements.

## **REVEGETATION PROJECT DESCRIPTION (CDFW permit condition 3.1)**

The open area adjacent to Woods Trail, just west of Guadalupe Creek, is mostly covered in eucalyptus duff (**Figure 1**). This disturbed area is surrounded by five tall eucalyptus trees and two large planted cypress trees (See **Sensitive Site Conditions**). We believe the cypress trees are non-native landscape varieties and we are currently checking on their identity, however, whether native or non-native, the cypress trees will be left to age since there are no signs of propagule spread. The rest of the surrounding tree cover consists of big-leaf maple, California bay laurel, canyon live oak, coast live oak, California nutmeg and buckeye. Understory growing from the eucalyptus duff includes toyon, coffeeberry, California blackberry and blue wild rye (**Table 6**). A previous eucalyptus removal effort by PG&E at this location left cut trunks along a decommissioned dirt road. San Francisco dusky footed woodrats have made nests in debris adjacent to one multi-trunked eucalyptus tree. The 12,000 square-foot Woods Trail site is situated on a northeast facing terraced slope. The planting basins will be installed on the flat portion of the terrace. Removal of large eucalyptus trees would provide ample open space for oak revegetation in this area. Removing the eucalyptus trees would also prevent the spread of eucalyptus seedlings, which are already present at this location.

This revegetation project will be two-part. First, as part of site preparation, the five eucalyptus trees will be girdled or stump-cut with herbicide application to improve site conditions. Secondly, 117 trees, understory plants, and seeded basins will be installed to complete the mitigation requirements set by CDFW shown in **Table 4**.

### ***Sensitive Site Conditions***

There is an artificial spring supporting leather root (*Hoita macrostachya*) at the site's boundary. This area is a potential wetland and will be avoided during all activity. A Golden Eagle nest has been reported in previous years along Woods Trail in a Douglas fir tree in this general vicinity. Care will be taken to avoid tree removal or potentially disturbing activity, including noise, during the nesting season (**CDFW permit condition 2.29**). Currently, the species of the two large planted cypress trees is unknown (*Hesperocyparis sp.*). The trees are most likely planted Monterey cypress (*H. macrocarpa*). Precaution is being taken to properly identify whether these trees are Monterey cypress, Santa Cruz cypress (Federally and State Endangered) or some non-native ornamental species. It is highly likely because of their size and placement on the disturbed flat with the eucalyptus trees that these are non-native ornamental cypress trees.

### ***Plant Orders and Collection of Propagules***

The target vegetation of this area is oak dominated mixed evergreen forest with native shrub understory. Species listed in **Table 3** will be used to revegetate the area. Acorns and plants will be from locally sourced seed and cuttings only (**CDFW permit condition 3.4**). Acorns will be planted whenever possible because of continuing *Phytophthora* contamination concerns in nurseries, as mentioned in the MUTBCP Revegetation Plan. Broadcast seeding in between installed plants will include a mix of native grasses and annual forbs. The seeded grass/forb mix will aid in reducing non-native plants.

Container plantings will be grown in *Phytophthora* free nurseries (**CDFW permit condition 3.5**). To prevent prolonged exposure to *Phytophthora*, plants will be in less than 1 gallon containers. Because of Sudden Oak Death (SOD) concerns, California bay laurel trees were not chosen among the species list and will instead be substituted with oaks and mixed evergreen understory species. Further justification of species selection is mentioned in the MUTBCP Revegetation Plan submitted to CDFW.

### ***Site Preparation***

Before felling and treatment of eucalyptus, woodrat nests will be flagged so that no disturbance occurs within 5 feet or, for nests that cannot be avoided, a qualified biologist will relocate woodrats and nests to a nearby location.

Native vegetation will be flagged prior to any work to be protected. Eucalyptus trees will be treated by either felling or girdling. The trunks of girdled trees and the stumps of felled trees will be treated with Roundup Pro-Max herbicide to prevent resprouting (**Table 1**). Girdling trees allows them to remain as snags for wildlife habitat. Girdling also reduces potential safety risks to tree crews when dealing with these extremely large trees and substantially reduces costs of converting this area to natural conditions. Following felling of smaller eucalyptus trees, branches will be chipped. Chips will be spread on site between installed plants and native recruitments to keep down weeds. Mulch layer will not exceed 3 inches in

depth. Excess material will be evenly distributed along the site edge. Larger trunks will be stacked within the old road to discourage off-trail use.

Prior to planting, staff will conduct general weeding by manually removing eucalyptus seedlings, yellow star thistle and bull thistle around the planting site.

The area will be broadcast seeded in order to prevent excess weed plants from growing and reduce erosion. No grading or other additional erosion prevention is needed.

## **PLANTING SPECIFICATIONS**

### ***Plant Installation***

Target vegetation is oak dominated mixed evergreen forest. This location's plant palette is based on an adjacent reference site which includes a mixture of mixed evergreen trees and understory plants (**Table 3 and 6**). In total, 26 nursery grown plants and 91 seeded basins of mostly oak species, will be installed at Woods Trail. **Figure 1** outlines the general revegetation area. Specific planting locations will be field fit based on existing plants, shade and topography.

Canyon live oak, coast live oak and California buckeye will be planted as seed. California nutmeg, as a continuing experiment, will also be planted as a seed. Note that California nutmeg has a germination dormancy of one year and thus will not germinate before the first monitoring year. Plant basins for tree species will be installed 8 feet on center. Understory basins will be installed 3 feet on center.

To collect and plant acorns, the following steps will be taken (**CDFW permit condition 3.4**):

- a) Oak trees should be in general vicinity of where acorns will be planted, same species as suitable for planting site and similar elevation, slope aspect and soils. It is easier to pick from trees that have low branches over slopes or branches under which a truck can be driven. Scope out potentially fertile oaks in August before acorns ripen.
- b) Pick ripe acorns from trees in late September or early October. When acorns start dropping to the ground, this is a good sign that acorns on the tree are ripe, however, acorns will not be collected off the ground. Ripe acorns on the tree are usually brown or starting to turn brown. If gently twisted, acorn body will come out of acorn cap without leaving any meat in the cap. Select plump acorns and avoid any with cracks or holes. Pick from many different trees rather than just one. On any one tree, try to pick no more than 25% of acorns so that plenty are left for wildlife. Keep a list and write on each bag the date, location and species of acorns collected. Do not mix different species or different locations in same bag. If acorns cannot be reached for hand picking, lay a clean tarp on ground and gently knock them down with a pole.
- c) Store acorns in one-gallon plastic bags. Fill each bag only one-half full with acorns. Add a handful of dry peat moss or perlite. Do not seal bags. Do not soak or moisten stored acorns. Lay open bags on side, preferably in vegetable drawer in refrigerator. Best refrigerator temperature is 33-41 degrees F; do not let acorns freeze. Do not plan on storing acorns in refrigerator longer than 3 to 4 months; 1 to 2 months is better. Keeping bags open, using peat moss or perlite, and not

wetting them are important steps to keeping acorns from getting moldy or germinating too early during storage in refrigerator.

- d) Before planting, remove debris within a 2-3 foot diameter of the planting basin especially any eucalyptus leaf litter or bark. Plant acorns by loosening soil one shovel deep and one shovel wide. Replace loose soil into hole. Hollow out planting hole fist deep and wide in loose soil. Place 3 acorns on their side in the hole, cover with soil to grade and firmly pat down. Center and sink plastic shelter (aka BlueX or Tubex), pound in and clip stake. Depending on the shelter design, the stake will either be slipped into the sleeve of the overlapped ends of the plastic sheet, or should be pounded on the inside of the tube (to prevent lizards and mice from climbing up from the outside and getting stuck on the inside) and attached to the shelter with ties through holes already punched near the top and the bottom of the shelter. The plastic tree shelter is installed in each acorn basin to reduce moisture loss from the soil and protect seedlings from wildlife browse. Within one to two years when the oak seedling is above the shelter, the shelter is replaced with a browse protector screen as described below.
- e) Earthen berms should be built around acorn basins as described under Installation of Plants from Pots below.

#### Installation of Plants from Pots

1. Soil in plant containers shall be watered and remain moist prior to installation of plants.
2. Clear an area measuring 1 square yard (3-foot by 3-foot) of weeds and mulch.
3. Auger or dig a planting hole at least 6-inch by 6-inch for small plants, 12-inch by 12-inch for gallon container plants and 12-inch by 16-inch for the tree pots. In all cases, the hole shall be large enough to accept the rootball and also provide a loosened area around and below the plant. Scarify sides and bottom of hole prior to inserting plant.
4. Remove the plant from the container with the rootball completely intact. Insert the rootball in the hole without bending or damaging the roots and maintain plumb. Position the plant so the root crown is at finished grade.
5. Backfill the planting hole with moist, pulverized native soil, making good soil contact with the rootball. Complete backfilling at finished grade, without covering the root crown.
6. Construct a 36-inch diameter, doughnut-shaped, hand-compacted, earth berm around single plants. For small container plants, berm can be as small as 24 inches or small groundcover plants (such as blackberry or grasses) in groups of three can be placed in one 36-inch diameter basin. Basin lip should be a minimum of 4 inches wide at the top, and 4 inches above basin grade. Plant basin interior should be level with the ground outside the berm.
7. Irrigate the newly installed plants with 2 to 3 gallons of water to settle the soil, and tamp soil to settle in. If the roots become exposed, add soil around the root crown and water a bit more.
8. Apply wood chip or weed-free straw, in this case we will use on-site native duff inside the basins. Duff will be collected from surrounding woodland and only the surface (1-2 in) of duff. Lay eucalyptus mulch outside basin to reduce weeds. Do not let mulch contact the foliage or main stem of installed plants. Mulch should be 2-3 inches deep.

### ***Plant Protection.***

Browse damage to the plantings from wildlife can be severe if protective measures are not taken. Plant species deemed palatable to deer, rabbits and rodents can be caged with a browse protection. Browse protection (cages) shall be a minimum of 30 inches in diameter, stand 48 inches in height, be constructed out of number 14-gauge or 16-gauge welded-wire fencing with 2-inch by 4-inch grid pattern and each cage shall be anchored into the ground using 2 medium duty steel T-posts, each 5 feet in length. Before installation, recycled cages will be cleaned to prevent transmission of plant pathogens. Cages shall be attached to the T-posts using a small amount of fence wire or zip ties or any other method that is easy to remove/replace during maintenance weeding.

## **MAINTENANCE AND MONITORING**

### **Maintenance**

Maintenance is expected to be necessary at regular intervals for the first three years after planting and will decrease over time. Maintenance includes the removal of invasive, non-native vegetation, such as eucalyptus seedlings; replacement of dead plants (only if survivorship drops below accepted thresholds); watering; checking of acorn seedlings; and removal of browse protectors. Monitoring data (see following section) will be used to evaluate the need for maintenance to ensure the success of the revegetation project.

**Watering.** The plantings will require watering for three years after planting. Water will be provided from a water tank stored on-site. In Year 1, the plantings will be irrigated approximately 2 times per month from May through October. Each watering will provide a significant amount of water to encourage the development of taproots (approximately 2 gallons per planting basin). The watering schedule in Year 2 will be similar to Year 1; in Year 3, watering is expected to be reduced to one deep watering per month. The watering schedule may be modified based on natural rainfall patterns to ensure plant survival. Watering will be performed by hand and basins will be filled slowly to allow the water to seep into the ground rather than spilling outside the basin. In exceptionally dry years, watering may be extended additional months and may occur more frequently.

**Weed Control.** All invasive plant control activities shall be consistent with the District's Integrated Pest Management Program. Note that the District's Integrated Pest Management Program is already consistent with all conditions required by ***CDFW permit condition 3.6.*** Weeds within the revegetation site will be controlled throughout the site as a whole, but particularly within each planting basin during the plant establishment period. Weed control methods during the plant establishment period shall be by mulching, pulling by hand, mowing or herbicide spraying (Roundup Pro-Max) depending on the site conditions.

The planting basins will be kept free of target invasive plants by maintaining the mulch layer and manually removing the weeds that become established in the mulch. The remainder of the revegetation site (between basins) will be maintained at less than 10% cover of target invasive plants. Weeds throughout the site (between planting basins) will be kept to a maximum height of 30-61cm (1-2 feet) year round by brush cutting. Weed control activities will occur before seed set, to the extent possible. Care will be taken to avoid impacting any native woody species that colonize the gaps between plantings. Maintenance staff shall work to avoid disturbing wildlife in the project area while mowing or brush-cutting including but not limited to equipment modifications, mowing patterns and buffer strips.



**Acorn Basins.** Acorn basins will be checked in the early spring and, as necessary, every few months thereafter to determine if more than one acorn germinated per basin. Only the most vigorous acorn seedling will be left in each basin and any extra oak seedlings in the same planting basin will be clipped below ground. Note that in dry years, some acorns may not germinate until the subsequent year, basins will be checked again for duplicate acorn germination. Plastic tree shelters will not be removed or replacement plants or acorns installed until germination conditions are evaluated at the beginning of the second summer. The same method will be used when checking California nutmeg seed basins.

**Plant Protection.** The revegetation site's browse protectors will be maintained in good working order during the first 3 years of the plant establishment period. Following Year 3, the conditions of the browse protectors and the plants will be evaluated and the protectors removed, if appropriate. At a minimum, the browse protectors will be removed and disposed of in Year 5. In general, once a plant reaches the top of the browse protector, and especially if it has additionally developed a canopy that spreads to the outside edge of the protector, that is a good time to remove the protector because deer tend to not browse too far inwards and rabbits and rodents cannot reach the top of the plant where the active growing points are located for shrubs and trees.

**Dead Plant Replacement.** Dead plants will be replaced if the plant survival for all installed species combined falls below 75% (*CDFW permit condition 4.1 with clarification by K. Garrison on 10/14/2016*). Plant species chosen for replacement will be based upon an evaluation of the vigor and growth of the plantings installed. Those species that are well adapted to the plantings sites and are rapidly establishing will generally be used to replace dead plants.

**Natural Recruitment.** Care will be taken to avoid damaging naturally recruiting native species during maintenance and weeding activities. Maintenance personnel will be trained to differentiate between native and non-native species. Fostering natural recruitment will aid in rapid habitat development.

## **MONITORING AND SUCCESS CRITERION**

Monitoring of the mitigation site by a qualified biologist will be conducted over five years. Monitoring will take place April, June and September and monitoring reports will be prepared annually. The success criterion is 75% survival (75% of the planting basins must have a healthy native plant) per CDFW permit requirement. A 75% survival after five years will result in 129 plants in replacement of the 24 bay trees (dbh 2-12") and 2 oaks (dbh 2 and 14") initially removed. These replacement plants will consist of those already installed November 2016 along Mt. Umunhum Trail and to be installed at the Woods Trail mitigation site (see Table 4). If 75% survival is not reached in the first five years, then plant replacement and monitoring should be extended to an additional three years (*CDFW permit conditions 3.1, 4.2 and email clarification provided by B. Blinn on 9/27/2016*). Replacement plants shall be monitored with the same parameters and success criteria as the original plantings. By the final year of monitoring, native habitat should be sufficiently well established to determine if the site will eventually achieve the long-term goals of increasing native plant cover and less than 10% cover of invasive species.

**Percent Survival and Health.** Each plant basin will be inspected to determine whether the plant therein is alive or dead and the overall plant health will be noted. Plant survival and health will be monitored in April, June and September. Survival will be assessed by a full plant count, in September recording survivorship by species.

A qualitative assessment of the health of each plant shall be made by considering such factors as leaf and stem color, bud development, new growth, herbivory, drought stress, fungal/insect

infestation and physical damage. Particular note should be made of any symptoms that appear to be consistent in most plants of the same species or in particular sections of the planting area.

## **REPORTING**

### **(CDFW permit conditions 4.1, 4.2, 4.3)**

The Revegetation Status Report on the Woods Trail site shall be submitted with the MUTBCP Revegetation Status Report by December 31, 2017. This report shall include information on when revegetation work was completed.

The Revegetation Annual Report shall include at minimum: a summary of the year's monitoring data, a summary of invasive plant control efforts and watering activities, an assessment of progress towards success survivorship requirements, and any recommendations, including a tally of any replacement plants required. The Revegetation Annual Report shall be submitted to CDFW by December 31 each subsequent year.

If any sensitive species are observed during Project surveys or at any time during Project implementation or mitigation and monitoring work, California Natural Diversity Database (CNDBB) forms will be submitted to the CNDDDB within five working days of the sightings, and copies of the CNDDDB forms and survey maps shall be provided to CDFW Region 3.

APPENDIX A

Figure 1. Overview of Woods Trail revegetation area and eucalyptus removal

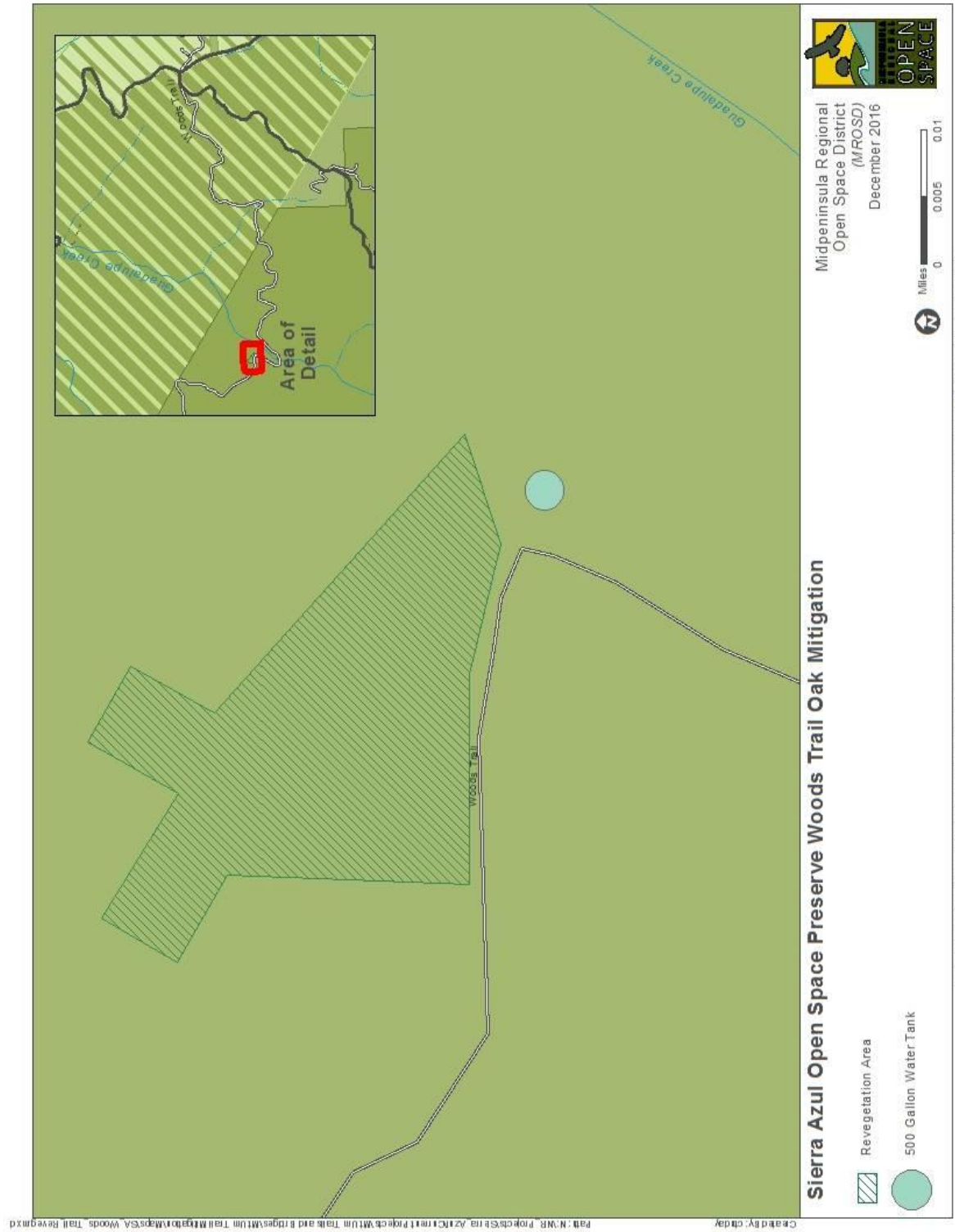
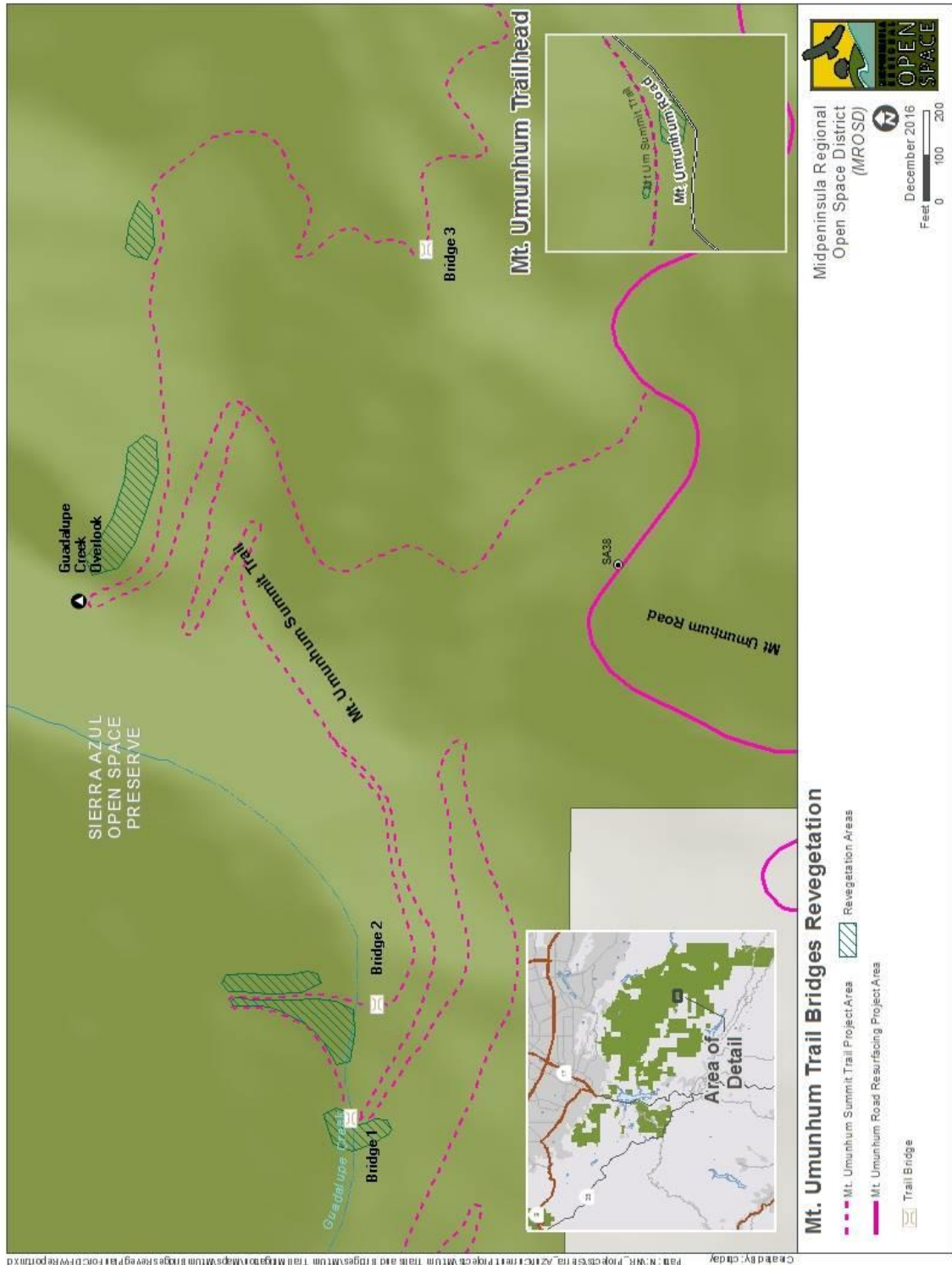


Figure 2. Mt. Umunhum Trail bridge construction project revegetation map



**TABLES**

**Table 1. Five Eucalyptus trees proposed for removal or girdling at Woods Trail site.**

<b>Tree ID#</b>	<b>DBH (inches)</b>	<b>Height (feet)</b>	<b>Treatment</b>
1	45	75	Cut and treat - contractor
2	66	70	Girdle and treat
3	67	80	Girdle and treat
4	½-24	40-60	Cut and treat -staff
5	10-12	50	Cut and treat –staff

**Table 2. Tentative schedule for Woods Trail Oak Mitigation**

<b>SCHEDULE</b>	<b>ITEM</b>
November 2016	First phase of mitigation plants installed at Mt Umunhum trail (CDFW permit condition 3.2).
Feb 15, 2017-Sep 15, 2017	Nesting season for raptors (CDFW permit condition 2.29) – avoid disturbance.
Oct 2017	Eucalyptus tree removal and eucalyptus tree girdling at Woods Trail site.
Oct 15-Dec 31, 2017	Planting at Woods Trail site (CDFW permit condition 3.2).
December 2017-2021	Annual monitoring and reporting to CDFW
December 2022-2024	Additional monitoring and reporting if success criteria not met.

**Table 3. Plant Palette for Woods Trail Oak Mitigation Site**

<b>Scientific Name</b>	<b>Common Name</b>	<b># Nursery Plant Basins</b>	<b># Seeded Basins</b>
<b>TREES</b>			
Acer macrophyllum	Big-leaf maple	2	
Aesculus californica	California buckeye		5
Corylus cornuta ssp. californica	Hazelnut	2	
Quercus agrifolia	Coast live oak		42
Quercus chrysolepis	Canyon live oak	3	40
Torreya californica	California nutmeg		4
<b>SHRUBS</b>			
Frangula californica	Coffeeberry	3	
Heteromeles arbutifolia	Toyon	4	
<b>HERBS</b>			
Iris fernaldii	Fernald's iris	2	
Mimulus aurantiacus	Sticky monkey flower	4	
Rubus ursinus	California blackberry	6	
<b>Total</b>		<b>26</b>	<b>91</b>

Nomenclature is consistent with the Jepson Manual 2012

**Table 4: Plant replacement ratios required by CDFW**

Type of tree removed	# Trees removed	Replacement Ratio	Type of replacement plants	# of required replacement basins	# replaced at Mt. Umunhum Summit Trail November 2016	# required additional replacement basins at Woods Trail site
CA Bay	6	6:1	CA bay or other tree or understory plants native to the region*	36	13	23
CA Bay	18	6:1	Oak acorns	108	40	68
Canyon live oak	0.5	10:1	Canyon live oak	5	2	3
Canyon live oak	1.5	15:1	Oak acorns	23	0	23
Total number of nursery plant basins				41	15	26
Total number of oak acorn planting basins				131	40	91
Total number of all planting basins				172	55	117

\*Leather oak, grey pine and toyon planted 2016. See Table 3 for tree and understory species for 2017.

**Table 5. Revegetation for bridge mitigation at Mt. Umunhum Trail and trailhead completed 08 November 2016.**

Scientific Name	Common Name	# Nursery Plant Basins	# Seeded Basins
<i>Pinus sabiniana</i>	Grey Pine	1	
<i>Quercus agrifolia</i>	Coast live oak		1
<i>Quercus durata</i>	Leather oak	3	30
<i>Quercus chrysolepis</i>	Canyon live oak	2	
<i>Quercus parvula</i> var. shrevei	Shreve oak		7
<i>Heteromeles arbutifolia</i>	Toyon	9	
<i>Torreya californica</i>	California nutmeg		2
<b>Total</b>		15	40

**Table 6. Species within reference site.**

<b>Woods Trail Site Species List</b>	
<b>Scientific Name</b>	<b>Common Name</b>
<b>TREES</b>	
<i>Acer macrophyllum</i>	Big-leaf maple
<i>Aesculus californica</i>	California buckeye
<i>Corylus cornuta</i> ssp. <i>californica</i>	Hazelnut
<i>Pseudotsuga menziesii</i>	Douglas fir
<i>Quercus agrifolia</i>	Coast live oak
<i>Quercus chrysolepis</i>	Canyon live oak
<i>Torreya californica</i>	California nutmeg
<i>Umbellularia californica</i>	California bay laurel
<b>SHRUBS</b>	
<i>Frangula californica</i>	Coffeeberry
<i>Heteromeles arbutifolia</i>	Toyon
<i>Toxicodendron diversilobum</i>	Poison oak
<b>HERBS</b>	
<i>Achillea millefolium</i>	Common yarrow
<i>Artemisia californica</i>	California sage
<i>Dryopteris arguta</i>	California wood fern
<i>Elymus glaucus</i>	Blue wild rye
<i>Iris fernaldii</i>	Fernald's iris
<i>Juncus</i> spp.	Rushes
<i>Lonicera hispidula</i>	Honey suckle
<i>Mimulus aurantiacus</i>	Sticky monkey flower
<i>Rubus ursinus</i>	California blackberry
<i>Sanicula crassicaulis</i>	Pacific blacksnakeroot

## PLANTING NOTES: BROADCASTING SEED BY HAND

1. Prepare the soil surface for planting using heavy equipment or hand tools to loosen the topsoil and smooth it. If using hand tools, use a rake to create a swath measuring 3 feet in width. Make sure the lines are drawn across (perpendicular to) the slope to ensure that seeds don't drain down the slope during the rainy season.
2. Spread handfuls of seed evenly in an organized pattern over the site. Note: the exact amount of seed will depend on the seeding rate (pounds per acre) and the size of the seeds. It is best to sow seed in 2 passes over the entire site, with the first pass only using 1/3 of the mix. This will help ensure a more even seed distribution.
3. Lightly rake over seed to cover (not necessary if covering seed with erosion control blanket or track-walking straw in next step). Soil depth covering the seed should be no more than 1/4-inch deep.
4. Cover with about 2 inches of weed-free straw. Crimp straw into soil by track-walking once over the straw with treaded heavy equipment or manually with the tip of a shovel to secure in place.



# 2016 MINDEGO GATEWAY PLANTING AND LANDSCAPE MAINTENANCE

## ANNUAL MONITORING REPORT AND FINAL PROJECT REPORT



### **Confluence Restoration**

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This report has been prepared by Confluence Restoration and shall serve as the 2016 Annual Monitoring Report and Final Project Report for the Mindego Gateway Project, part of the Russian Ridge Open Space Preserve managed by the Midpeninsula Regional Open Space District.

## **Introduction**

Site construction and plant installation occurred during October and November 2013. Project maintenance and monitoring began immediately after installation and has continued for nearly 3 years. This report serves as the third and final annual plant survivorship survey and site maintenance report. Maintenance and monitoring activities detailed in monthly maintenance reports submitted to the agency were summarized and divided into Winter 2015-2016, Spring 2016 and Summer 2016 categories.

Originally, 355 plants were installed by Confluence during Fall 2013 around the parking lot area. Additionally, there were 240 plants installed at the Commemorative Overlook area by a separate contractor. During the growing season the site was visited approximately every 14 days to assess soil moisture, water installed plants and perform invasive weed control. Invasive species removal efforts were prioritized by; hand removal of Yellow Star Thistle and other target invasive species throughout the site, hand removal of invasive species within and around planting basins and mechanical mowing of non-native annual grasses (weed whip).

## **Maintenance and Monitoring Activities**

### **Winter 2015-2016 (October-February)**

During this monitoring season Confluence performed seven site visits, including three watering events prior to natural rainfall events, which began late November. Once the soil was saturated the *Baccharis* recruits were removed from along edges of pavement and among caged basins to reduce competition with the installed shrubs. Weeds were minimal at this site for most of the maintenance period. Weeds and native annuals began to germinate and grow in early Spring.

### **Spring 2016 (March-May)**

During this monitoring period Confluence performed seven site visits to assess soil moisture and plant health as well as weed removal and site maintenance. No watering activities were needed during this period as natural rainfall kept soil moisture levels adequate for plant growth. During March some of the cages were removed from plants that were growing beyond the cages and becoming inhibited by the structures. Native wildflowers and grasses began blooming throughout the parking area and overlook in April, as did common weeds (thistle, burr clover and filaree). Weed removal efforts were performed using hand removal and periodic mowing.

### **Summer-Fall 2016 (June-November)**

During this monitoring period Confluence performed 10 site visits including 6 watering events. Watering events began in early June as soil moisture levels naturally declined and day length increased. Watering events continued until adequate natural rainfall events began. In contrast to previous years a native *Lotus* groundcover established along the overhang basins in the parking area and flourished during this time, but may have competed heavily with the installed plantings. The native grasses were allowed to set seed before mowing to encourage future native plant recruitment. Cages were removed from mature plantings to allow the area to naturalize.

## Annual Survivorship Summary

Plant survivorship and vigor surveys were split between the two areas of the site. The overhang basins and parking lot caged basins were combined into one area, ‘Parking lot’, for survivorship and vigor surveys. The Commemorative overlook plantings, referred to as ‘Overlook’, were surveyed only for survivorship. The scale of vigor ratings (1-9) was based on a lower score indicating better overall plant health (percent of healthy foliage) and those with higher vigor scores (i.e. 8-9) are not thriving.

### Parking lot

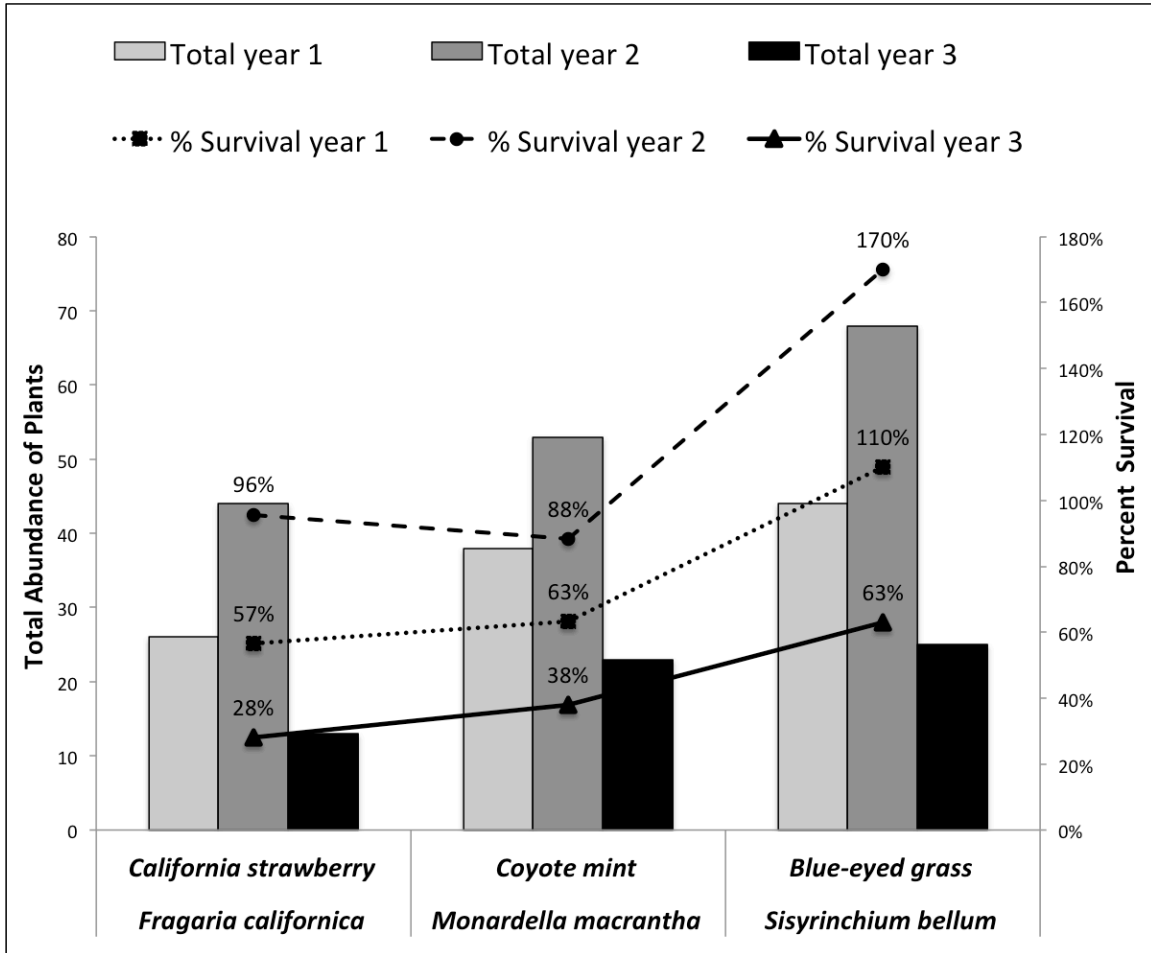
Originally, 355 plants were installed around the parking lot area during Fall 2013, 209 were planted in basins with deer cages (caged basins) and 146 were planted in clusters along the parking space overhang basins (overhang basins). All of the caged basin plants were surveyed at the beginning of September 2014 for survivorship and vigor and given a coded tag to track the individual plant over time (Appendix: Figure 1). A separate map was done for the overhang basins in order to track multiple plants per basin (Appendix: Figure 2).

An interesting pattern emerged over time with respect to the percent survival of plants in caged basins and the plants in the overhang parking basins (Table 1). In the second year of the plant establishment period the overhang basin plants did really well and total numbers increased to greater than the number of plants installed due to self-recruitment and natural processes. During the 2016 growing season there were more rainfall events than the previous year, which could have contributed to erosive forces along the bio-swale, degrading the natural seed bank left in 2015. There was also an increase of native *Lotus* groundcover not seen in 2015 that could have been competing with plants in the overhang basins.

	<b>Installation</b>	<b>Year 1-Fall 2014</b>	<b>Year 2-Fall 2015</b>	<b>Year 3- Fall 2016</b>	<b>Overall % Survival</b>
<b>Caged basins</b>	209	156	140	130	62%
<b>Overhang basins</b>	146	108	165	61	42%
<b>Total</b>	355	264	305	191	54%

The total number of plants and percent survival of the overhang basins were plotted by year to show changes in each species over the three-year monitoring period. Survival during the second year was best across all species, and declined markedly during the third year (Figure 1). Of the three species, Blue-eyed Grass was the most successful at establishing in the overhang basins, followed by Coyote Mint, and finally Strawberry was the least successful with only 28% survival at year 3 (Figure 1).

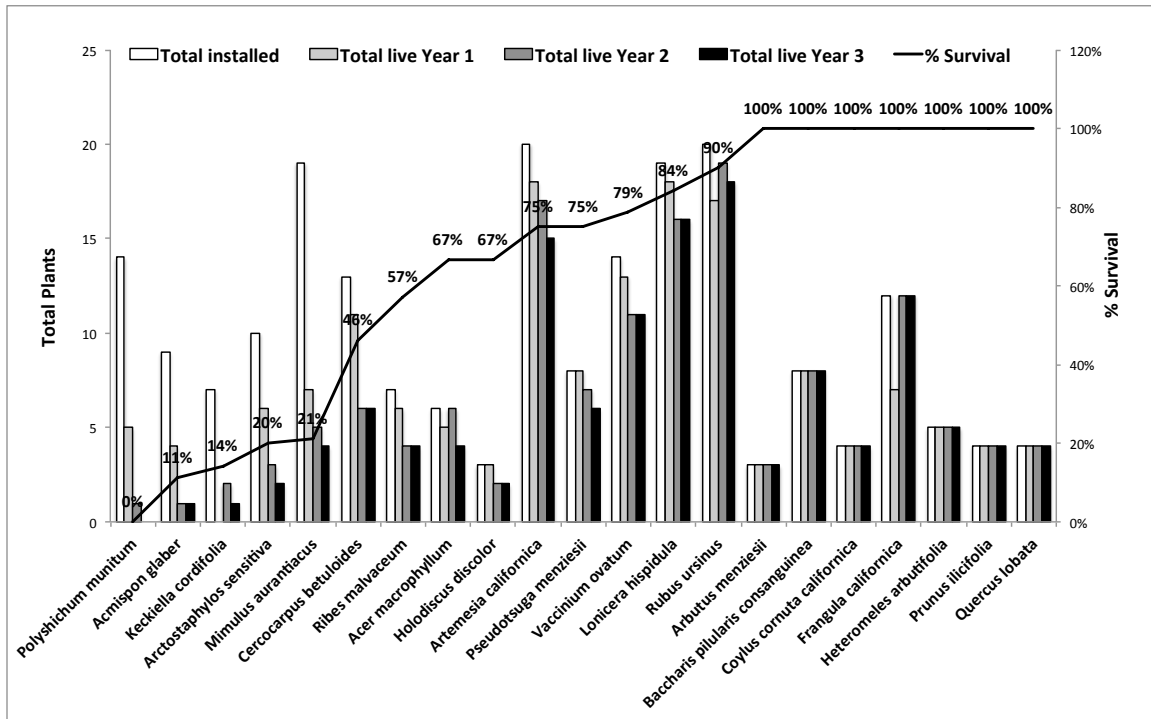
**Figure 1. Total Abundance of Individual Species in Overhang Basins and Percent Survival Over Time**



Plants in the caged basins had better overall success with establishment after three years, but not across all species (Table 2). Some species died off entirely (*Polystichum munitum*) while others were persistent and percent survival was maintained above 80% for the duration of the project. Of the 21 species planted in the caged basins, nine stayed above the 80% survival threshold and no replanting of any species was done during the establishment period. Total abundance of each species during each year was plotted to show success over time with percent survival of each species after three years plotted along the secondary Y-axis to show which species had the best survival over the three year period (Figure 2). Seven of the 21 species had 100% success with no individuals lost and at the time of the survey both *Rubus* and *Lonicera* populations were growing well beyond the cages surrounding them. Additionally, some of the *Heteromeles* and *Cercocarpus* shrubs had grown tall and robust enough to remove the cages without worry of herbivory damage.

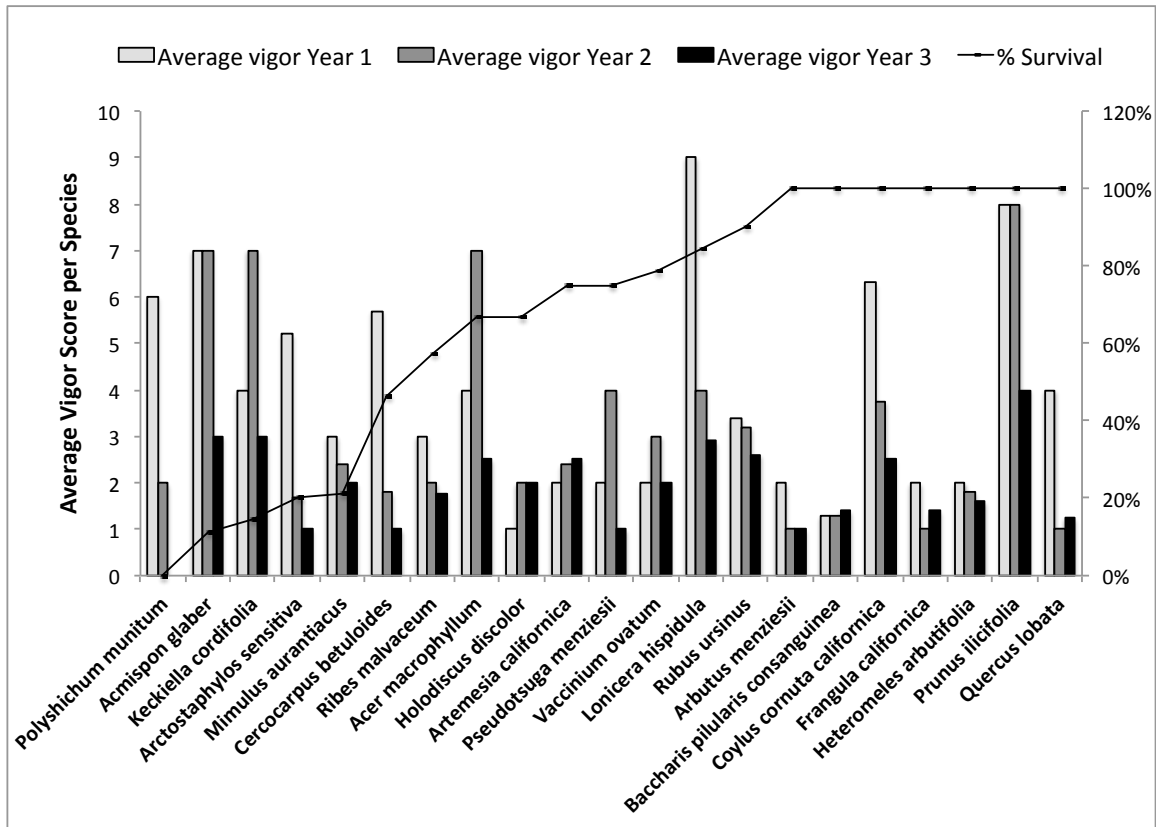
<b>Table 2. Total Abundance of Caged Basin Plants</b>					
<b>Latin name</b>	<b>Total installed</b>	<b>Total live Year 1</b>	<b>Total live Year 2</b>	<b>Total live Year 3</b>	<b>% Survival</b>
<i>Polyshichum munitum</i>	14	5	1	0	0%
<i>Acmispon glaber</i>	9	4	1	1	11%
<i>Keckiella cordifolia</i>	7	0	2	1	14%
<i>Arctostaphylos sensitiva</i>	10	6	3	2	20%
<i>Mimulus aurantiacus</i>	19	7	5	4	21%
<i>Cercocarpus betuloides</i>	13	11	6	6	46%
<i>Ribes malvaceum</i>	7	6	4	4	57%
<i>Acer macrophyllum</i>	6	5	6	4	67%
<i>Holodiscus discolor</i>	3	3	2	2	67%
<i>Artemesia californica</i>	20	18	17	15	75%
<i>Pseudotsuga menziesii</i>	8	8	7	6	75%
<i>Vaccinium ovatum</i>	14	13	11	11	79%
<i>Lonicera hispidula</i>	19	18	16	16	84%
<i>Rubus ursinus</i>	20	17	19	18	90%
<i>Arbutus menziesii</i>	3	3	3	3	100%
<i>Baccharis pilularis consanguinea</i>	8	8	8	8	100%
<i>Coylus cornuta californica</i>	4	4	4	4	100%
<i>Frangula californica</i>	12	7	12	12	100%
<i>Heteromeles arbutifolia</i>	5	5	5	5	100%
<i>Prunus ilicifolia</i>	4	4	4	4	100%
<i>Quercus lobata</i>	4	4	4	4	100%
<b>TOTAL</b>	<b>209</b>	<b>156</b>	<b>140</b>	<b>130</b>	
<b>% SURVIVAL</b>		<b>75%</b>	<b>67%</b>	<b>62%</b>	

**Figure 2. Total Abundance of Each Species per Year and % Survival After 3 Years**



Based on survivorship at the site we do not recommend direct replacement of original plant species but instead suggest replacement plants consist of species that have successfully established at the site. Figure 3 (below) shows average vigor scores for each species by year with the same overall percent survival curve as in Figure 2 which indicates that although some species declined in abundance over the three year period, the individuals that remained were doing relatively well, with most scores at year 3 in the healthy 1-3 range (Fig. 3).

**Figure 3. Average Vigor Score per Species Over Time and Overall Percent Survival**



**Overlook**

A mixture of 240 perennial plugs and shrubs were originally planted at this area of the site, and 136 individuals remained in September 2014, which indicated survivorship of 57%. Plant establishment and survival at this area of the site was a challenge due to small initial plant size and exposure to heat, wind and cold along the ridgeline. During 2015 some of the Overlook plants increased in abundance by self-recruitment while others declined, and total survivorship only fell by 10% (Table 3). During the 2015-2016 growing season many plants grew well at this area of the site, but then died back as the season progressed into hotter, drier, summertime conditions. Though the overall estimate of 35% survival since installation is not ideal, it may not be representative of each species particular life history strategy or phenology. During the time of the survey there were very few California Poppy and Blue-Eyed Grass present as plants may have gone seasonally dormant. This could skew the overall percent survival for the overlook area towards a lower number than we would have seen if the survey were performed earlier in the summer before those plants went dormant.

Although the total number of *Iris* has declined from the original planting numbers, the individual plants that remain are robust and growing well and number of individual plants has increased since 2015. The *Frangula* shrubs have grown so large they crate a hedge effect making it hard to distinguish individuals, which may have

skewed the total number lower for that species than physically exist. Additionally, growth of native grasses was strong in this area, namely *Stipa pulchra* and *Bromus carinatus*. These native grasses were allowed to flourish and set seed prior to mowing to encourage natural recruitment in following seasons.

Latin name	Common name	Original	2014	2015	2016
<i>Baccharis pilularis</i>	Coyote brush	18	18	22	24
<i>Frangula californica</i>	Coffeeberry	22	21	14	10
<i>Iris douglasiana</i>	Iris	50	35	23	29
<i>Epilobium canum</i>	Fuschia	50	24	25	18
<i>Sisyrinchium bellum</i>	Blue-Eyed Grass	50	34	18	0
<i>Eschscholzia califonica</i>	California Poppy	50	4	11	3
	<b>TOTAL</b>	<b>240</b>	<b>136</b>	<b>113</b>	<b>84</b>
	<b>% SURVIVAL</b>		<b>57%</b>	<b>47%</b>	<b>35%</b>

### Conclusion and Recommendations

Overall the plantings at this site have grown and established well during the past three years considering the exposure of the site and some questionable plant selections. The site will need continued weed control, especially of Yellow Star Thistle and Non-native Clover (*Trifolium dubium*). The *Trifolium* should be treated with an appropriate herbicide as its abundance is growing despite attempts at manual removal. Coyote Brush (*Baccharis*) actively recruits to the site and should be managed so that a few dense stands provide cover for wildlife but otherwise is not allowed to overtake native grassland habitat. In general, future maintenance efforts should shift toward passive restoration where native plant recruits are encouraged and invasive species controlled. Native grasses can be mowed to 3-6” after seed heads mature to reduce fire hazards along parking areas. Non-native annual grass seed heads can be mowed when 12-18” tall before seed heads mature to reduce the seed set while protecting smaller wildflowers and native grasses beneath. To provide shade, acorns of Valley Oaks could be planted near empty basins. Though they have been slow growers, the *Pseudotsuga menziesii* trees in the parking lot area are established now and would also be a good species to add if additional planting for shade trees takes place.



APPENDIX

Figure 1. Map of Plant Tags in Parking Lot Area

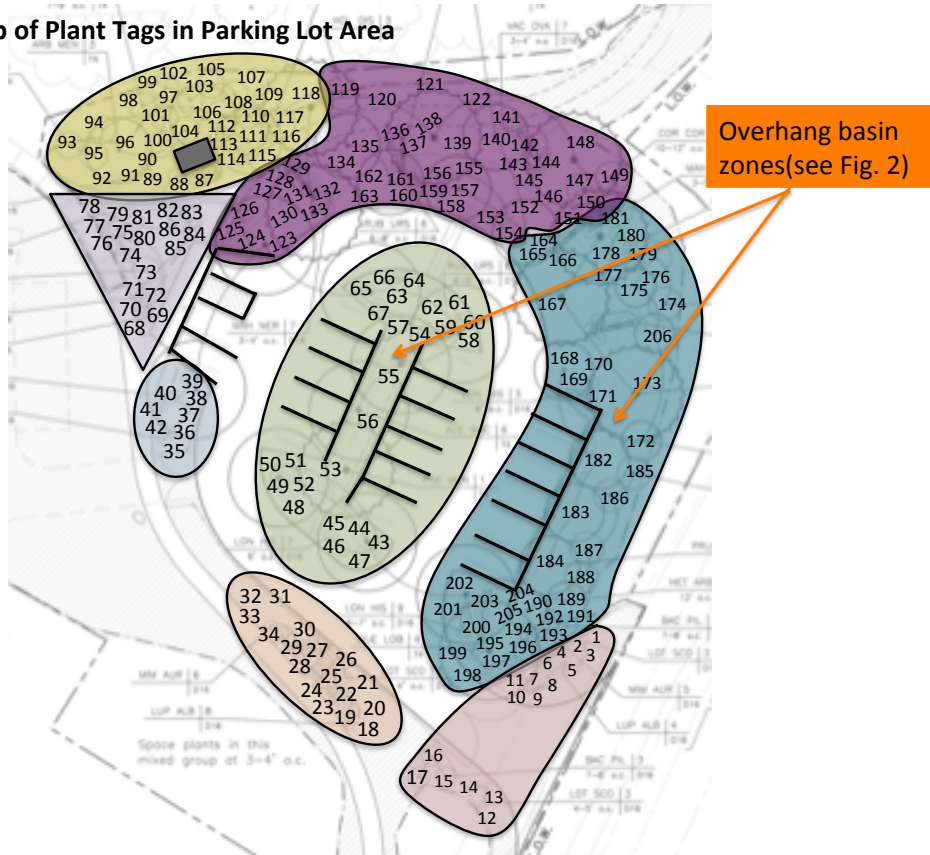


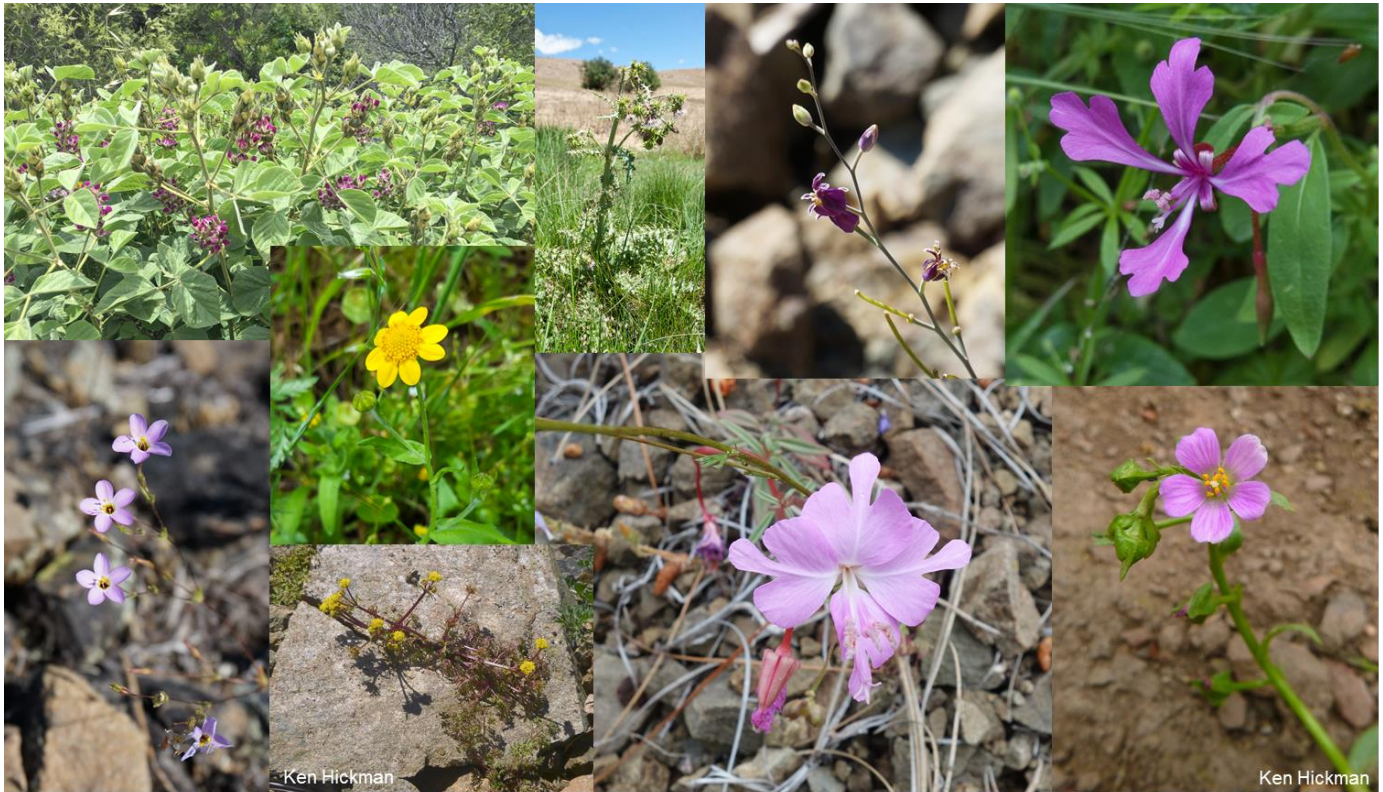
Figure 2. Overhang Basin Tag Map





Midpeninsula Regional  
Open Space District

## Mount Umunhum Rare Plant Report and Mitigation Plan Sierra Azul Open Space Preserve 2017



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## **Introduction**

The Mount Umunhum Summit Project, located within Sierra Azul Open Space Preserve (see Project Area maps; Attachment A) will construct visitor facilities including trails, parking lots, weather shelters, and restrooms within the former Almaden Air Force Station on the 3,486-foot peak of Mount Umunhum (Mt. Um.). In addition to facilities at the summit, the Project includes construction of a four-mile trail from the existing Bald Mountain Parking Area to the summit, and extensive resurfacing of Mt. Umunhum Road. The majority of the Project Area is heavily disturbed, developed land, and the Summit Project includes re-grading and soil reconstruction, installation of native container plants and direct seeding, including special-status species, to restore native habitat to the summit. However, the Project will disturb some natural habitat areas at the Summit, along the Summit Trail, and along Mt. Umunhum Road, and may have incidental construction, future maintenance, and/or visitor use impacts on native habitats adjacent to the construction area.

This report summarizes the results of surveys for special-status plants within the Project Area, and presents detailed steps for implementation of Mitigation Measure 4.3-2a, approved as part of the Mt Umunhum Environmental Restoration and Public Access Project Environmental Impact Report (Project EIR). This information will serve as a guideline for District staff to manage and maintain rare plant populations at Mt. Umunhum. Even though no state or federally-listed plants will be impacted, some species otherwise on the California Native Plant Society Inventory of Rare and Endangered Plants will be impacted (California Rare Plant Ranks 1B and 4). The District's Resource Management Policies adopted by the Board of Directors in 2014 includes policies to protect and enhance the habitats and populations of special status plant species and collaborate with resource agencies when doing so. The District policies define special status species as "Species that are state or federally listed as threatened, rare, endangered, species of special concern, candidate species or those plant species listed by the California Native Plant Society." This report will also be provided to the California Department of Fish and Wildlife (CDFW) for review. One of CDFW's roles is as a trustee agency under the California Environmental Quality Act (Section 15386) in which it provides expertise in reviewing and commenting on environmental documents and makes protocols regarding potential negative impacts to those resources held in the trust for the people of California.

## **Methodology**

Focused rare plant surveys were conducted in potential project impact areas during June 2013, May 2015, and May, June, July, and September of 2016 by qualified District biologists. Surveys took place during the peak bloom period of the target species, and the 2016 surveys were conducted during a year of unusually high late-season rainfall and associated heavy wildflower blooms. Concurrently with the focused rare plant surveys, ongoing floristic-level surveys of the entire Mt. Umunhum area are being conducted by California Native Plant Society botanist John Rawlings, and consulting biologist Ken Hickman. All species encountered during surveys were identified to the level necessary to determine their status.

## Floristic Inventory

Floristic-level surveys identified a total of 330 species of plants from 68 families in the Mt. Umunhum summit area (upper 1,000 feet), upper Guadalupe Canyon, and new Summit Trail (Hickman, Rawlings 2016). This includes 264 confirmed native species and 60 exotic species. Six species have not been fully identified to the appropriate species level. A table listing all observed species is provided in Attachment C. Of these plants observed, 252 species have been collected and vouchered as part of the Carl W. Sharsmith Herbarium at San José State University.

## Special-Status Plants

A total of eight special-status plant species were identified in the survey areas. One of these species, rock sanicle (*Sanicula saxatilis*), is state-listed as Rare. Four species are listed on List 1B of the CNPS *Inventory*: Mount Hamilton thistle (*Cirsium fontinale* var. *campylon*), Loma Prieta hoita (*Hoita strobilina*), woodland woollythreads (*Monolopia gracilens*), and rock sanicle (*Sanicula saxatilis*). Four species, Brewer's redmaids (*Calandrinia breweri*), serpentine leptosiphon (*Leptosiphon ambiguus*), Brewer's clarkia (*Clarkia breweri*), and Santa Clara red ribbons (*Clarkia concinna* ssp. *automixa*) are on List 4 of the CNPS *Inventory*. Bristly jewelflower (*Streptanthus glandulosus* ssp. *glandulosus*) was also identified in the survey area, and was recently reclassified during revision of the Jepson Manual from *Streptanthus albidus* ssp. *peramoenus*, however, the latter is still currently on the List 1B of the CNPS *Inventory*. For purposes of this project and report, the jewelflower at the top of Mt. Umunhum is being treated as a unique and unusual local plant and avoided or replaced to whatever degree possible. These special-status species are discussed below, and are mapped in Attachment B.

### Rock sanicle (*Sanicula saxatilis*)

Rock sanicle is a perennial herb from the Apiaceae (carrot) family. It is listed by the State of California as Rare and by CNPS as 1B.2 (rare, threatened, or endangered in California and elsewhere).

Rock sanicle is usually found on rocky ridges or talus slopes and associated with chaparral or woodland. It is known from Santa Clara and Contra Costa Counties, with seven presumed extant occurrences in the California Natural Diversity Database (CNDDB) (CNPS 2016). Plants are usually 10 to 25 centimeters tall growing from a spherical tuber. The leaves are compound, each divided into three leaflets which are deeply cut into serrated lobes. The herbage is green to purple and sometimes waxy in texture. The inflorescence is made up of one or more heads of bisexual and male-only flowers with tiny, curving, pale salmon pink, yellowish or straw-colored petals. The fruits are a few millimeters wide and covered in bumps and sometimes bristles. Associated species include scytheleaf onion (*Allium falcifolium*), naked buckwheat (*Eriogonum*

*nudum*), serpentine leptosiphon (*Leptosiphon ambiguus*), and Santa Clara red ribbons (*Clarkia concinna* ssp. *automixa*).

#### Occurrence in the Project Area

Scattered clusters of dozens to hundreds of plants were observed outside the project area, in rocky pockets and volatile scree slides on the east-face of Mt. Umunhum's northeast ridge, the southeast and east-facing slope below the summit into Guadalupe Canyon, and on the north-facing slope below Guadalupe Overlook.

#### Level of Impact

No plants were observed within the Project Area, and colonies are located in steep, difficult to access areas that are unlikely to receive significant visitor traffic. Therefore, the Mt. Umunhum Summit Project will not impact rock sanicle.

#### Mitigation Methods

The plants are well outside of the Project Area and will not be impacted by the project, therefore mitigation measures will not be taken.

### **Loma Prieta hoita (*Hoita strobilina*)**

Loma Prieta hoita is a perennial herb from the Fabaceae (pea) family. It is ranked CNPS 1B.1 (rare, threatened, or endangered in California and elsewhere, seriously endangered in California). It is not federal- or state-listed. Usually found on serpentine, not entirely an endemic, Loma Prieta hoita is known from chaparral, cismontane woodland, and riparian woodland. Sites are usually mesic (although many of the colonies on Mt. Umunhum Road appear quite dry). It is known from Santa Clara, Santa Cruz, and Contra Costa Counties, and presumed extirpated in Alameda County, with 28 presumed extant occurrences in the CNDDDB and 1 presumed extirpated (CNPS 2016). Plants are usually less than 1 m tall, with erect pubescent stems and white and blue/purple flowers 13-19 mm long (blooming May to October). It has tomentose pinnate leaves with three leaflets; the petioles are usually under 8 cm long. The calyx is distinctly irregular (Baldwin et al. 2012, Thomas 1961).

#### Occurrence in the Project Area

Five colonies of Loma Prieta hoita were observed along Mt. Umunhum Road. All were found in serpentine or mixed serpentine soils.

**HOISTR1.** The HOISTR1 occurrence is growing mostly in sun with toyon (*Heteromeles arbutifolia*), bigberry manzanita (*Arctostaphylos glauca*), coyote brush (*Baccharis pilularis*), ceanothus (*Ceanothus* spp.), and gray pine (*Pinus sabiniana*). The site appears dry, with convex topography. A portion of the colony is growing through the roadside gravel, as well as underneath the guardrail that is slated to be replaced. There is a total of 25 m<sup>2</sup> occupied, with about 8 meters linear along the roadside.

**HOISTR2.** This colony of Loma Prieta hoita is approximately 6 meters off the road on the downhill side with a total of 25 m<sup>2</sup> occupied that is far enough off of the road to be avoided during construction.

**HOISTR3.** This colony was found intermixed with the Mount Hamilton thistle (CIRFON1). At this location, there are dozens, possibly hundreds of individuals of both rare taxa growing right in the drainage area along the roadway. Vegetative associates include gray pine, toyon, coffeeberry (*Frangula californica*), ceanothus, coyote brush, arroyo willow (*Salix lasiolepis*), and blue wild rye (*Elymus glaucus*). There is a total of about 300-500 m<sup>2</sup> occupied, in partial shade.

**HOISTR4.** This colony exists on the south and downhill side of the road, growing in partial shade with gray pine, toyon, bigberry manzanita, ceanothus, foothill needlegrass (*Stipa lepidota*), and yerba santa (*Eriodictyon californicum*). The site appears dry. Plants are about 2.5 meters off the road, with about 10 meters along the roadside and a total of 30 m<sup>2</sup> occupied.

**HOISTR5.** This colony is found on the southeast side of the road growing in partial shade with gray pine, yerba santa, coffeeberry, and bigberry manzanita. The site is a depression, but appears dry on the surface. Some plants are growing into the roadside sign paddles that are marked for replacement as well as through the asphalt. Approximately 20 meters of roadside, a total of 100 m<sup>2</sup>, is occupied by the Loma Prieta hoita.

#### Level of Impact

**HOISTR1.** This colony extends from the hillside through a degraded guardrail adjacent to the road, with several plants growing in the roadside gravel. Impacts to this colony are unavoidable since removal of the existing guardrail post, road surface rehabilitation, and the application of a road surface seal will crush portions of plants or may cause direct mortality to a small number of individuals, while the majority of the colony is outside the construction impact area. An area of 2 m<sup>2</sup> of the total 25 m<sup>2</sup> occupied will be impacted by the replacement of the guardrail and resurfacing of the roadway. This colony has the potential to receive 5 m<sup>2</sup> of mitigation plantings.

**HOISTR2.** The HOISTR2 occurrence of Loma Prieta hoita is approximately 6 meters off the road on the downhill side and is far enough off the road to be avoided during construction. This colony has the potential to receive 5 m<sup>2</sup> of mitigation plantings.

**HOISTR3.** The largest hoita colony extends from the cut slope into the roadside drainage ditch. The original Project plans to install a 12-inch geocomposite drain below the existing inboard drainage ditch for this area have been eliminated since the improvements would result in removal of a significant number of plants. With this scope of work eliminated, Project work within the immediate vicinity of HOISTR3 is anticipated to not have an impact on the colony. Exclusionary fencing has been placed around colony 3, and will be kept in place throughout the duration of the Project. The exclusionary fencing acts as a boundary of work for the contractor within this location. This colony has the potential to receive 10 m<sup>2</sup> of mitigation plantings.

**HOISTR4.** The HOISTR4 occurrence of Loma Prieta hoita is approximately 2.5 meters off the road on the downhill side and is far enough off the road to be avoided during construction. This colony has the potential to receive 5 m<sup>2</sup> of mitigation plantings.

**HOISTR5.** Impacts to this colony are unavoidable since the removal of existing roadside sign paddles, road surface rehabilitation, and the application of a road surface seal will crush portions of plants or may cause direct mortality to a small number of individuals, while the majority of the colony is outside the construction impact area. Approximately 2 m<sup>2</sup> of the total 25 m<sup>2</sup> occupied will be impacted by the removal of roadside sign paddles, and resurfacing of the roadway. This colony has the potential to receive 5 m<sup>2</sup> of mitigation plantings.

**Table 1: Summary of impacts to Loma Prieta hoita:**

Colony	Area Occupied (m <sup>2</sup> )	Area of Impact (m <sup>2</sup> )	Mitigation for Impacts (m <sup>2</sup> )	Area Available for Mitigation Plantings (m <sup>2</sup> )
1	25	2	4	5
2	25	0	0	5
3	300-500	0	0	10
4	30	0	0	5
5	100	3	6	0
<b>Total</b>	<b>780 m<sup>2</sup> - 1,180 m<sup>2</sup></b>	<b>5 m<sup>2</sup></b>	<b>10 m<sup>2</sup></b>	<b>25 m<sup>2</sup></b>

### Mitigation Methods

**HOISTR1.** During construction activities in the Spring and Summer of 2017, plants will be impacted by the removal of the existing guardrail post, road surface rehabilitation, and the application of a road surface seal will be salvaged by a qualified biologist. Salvaged plants will be held and maintained at Grassroots Ecology Native Plant Nursery until outplanting at identified mitigation sites in the fall of 2017 or 2018. In addition to salvaged plants, seed will be collected according to standard protocols (including provisions to protect against soil *Phytophthora* diseases) and propagated at Grassroots Ecology Native Plant Nursery. Plants will be grown utilizing phytosanitary measures to prevent soil *Phytophthora* contamination.

Mitigation planting will take place within 5 m<sup>2</sup> of unoccupied area onsite; expanding HOISTR2; expanding HOISTR3; creating a new colony in the drainage of HOISTR3; or between HOISTR3 and HOISTR4. An area of 4 m<sup>2</sup> will be planted at one of the sites listed above to mitigate for 2 m<sup>2</sup> that will be impacted by construction activities. Exclusionary fencing will be placed around the remainder of the colony and will act as a boundary of work for the contractor within this location to prevent further impacts to this colony.

Maintenance of installed plants is expected to be at regular intervals for the first three years and will decrease by year four and five. Maintenance will include watering, removal of any non-native vegetation, plant protection, and replacement of dead plants. Watering will occur as necessary, approximately two times per month from May through October for the first two years.

Year three watering is expected to be reduced to one deep watering per month. The watering schedule may be modified based on natural rainfall patterns to ensure plant survival.

Monitoring of the mitigation site by a qualified biologist will be conducted throughout the five-year Plant Establishment Period, and monitoring reports will be prepared annually. Monitoring will take place quarterly, with the first monitoring to occur three months following site installation. The following elements will be monitored to evaluate the site's progression towards the goal of establishing 4 m<sup>2</sup> cover of Loma Prieta hoita.

Each plant basin will be inspected to determine whether the plant therein is alive or dead to determine percent survival. Vigor (overall plant health) shall be monitored several times per year. Vigor categories shall be assigned as follows: High vigor, 7-9 points, (67-100% healthy foliage), Medium vigor, 4-6 points, (34-66% healthy foliage), Low vigor, 1-3 points, (0-33% healthy foliage).

Cover will be used as the primary indicator of revegetation success. The goal is a steady increase over time to achieve 4 m<sup>2</sup> cover of Loma Prieta hoita. By year five of monitoring, native habitat should be sufficiently well established to determine if the site will eventually achieve the long-term goals to achieve no net loss of occupied habitat or individuals.

**HOISTR2.** This colony will not be impacted by construction activities and has the potential to receive up to 5 m<sup>2</sup> of mitigation plantings for impacts to HOISTR1 and HOISTR5. Exclusionary fencing will be placed around the remainder of the colony and will act as a boundary of work for the contractor within this location to prevent impacts to this colony.

**HOISTR3.** The scope of work has been changed to eliminate impacts to this colony. This colony has the potential to receive up to 10 m<sup>2</sup> of mitigation plantings for impacts to HOISTR1 and HOISTR5. Exclusionary fencing has been placed around colony 3, and will be kept in place throughout the duration of the Project. The exclusionary fencing acts as a boundary of work for the contractor within this location.

**HOISTR4.** This colony will not be impacted by construction activities and has the potential to receive up to 5 m<sup>2</sup> of mitigation plantings for impacts to HOISTR1 and HOISTR5. Exclusionary fencing will be placed around the remainder of the colony and will act as a boundary of work for the contractor within this location to prevent impacts to this colony.

**HOISTR5.** Approximately 3 m<sup>2</sup> of the total of 100 m<sup>2</sup> occupied will be impacted by the removal of the roadside sign paddles and resurfacing of the roadway. In order to avoid impacts to portions of colony 5, the existing roadside paddles will be cut at grade and removed. Installation of new roadside paddles will be moved to a location in the general vicinity where colony 5 will not be impacted. Avoidance of plants growing in the roadway asphalt is not possible. If possible, these plants/rootstock will be salvaged and planted in areas of suitable unoccupied habitat.

Salvaged plants will be held and maintained at Grassroots Ecology Native Plant Nursery until outplanting at identified mitigation sites in the fall of 2017 or 2018. In addition to salvaged plants, seed will be collected according to standard protocols (including provisions to protect



against soil *Phytophthora* diseases) and propagated at Grassroots Ecology Native Plant Nursery. Plants will be grown utilizing phytosanitary measures to prevent soil *Phytophthora* contamination.

Maintenance of installed plants is expected to be at regular intervals for the first three years and will be decreasing by year four and five. Maintenance will include watering, removal of any non-native vegetation, plant protection, and replacement of dead plants. Watering will occur as necessary, approximately two times per month from May through October for the first two years. Year three watering is expected to be reduced to one deep watering per month. The watering schedule may be modified based on natural rainfall patterns to ensure plant survival.

Monitoring of the mitigation site by a qualified biologist will be conducted throughout the five-year Plant Establishment Period, and monitoring reports will be prepared annually. Monitoring will take place quarterly, with the first monitoring to occur three months following site installation. The following elements will be monitored to evaluate the site's progression towards the goal of establishing 6 m<sup>2</sup> cover of Loma Prieta hoita.

Each plant basin will be inspected to determine whether the plant therein is alive or dead to determine percent survival. Vigor (overall plant health) shall be monitored several times per year. Vigor categories shall be assigned as follows: High vigor, 7-9 points, (67-100% healthy foliage), Medium vigor, 4-6 points, (34-66% healthy foliage), Low vigor, 1-3 points, (0-33% healthy foliage).

Cover will be used as the primary indicator of revegetation success. The goal for cover is a steady increase over time to achieve 6 m<sup>2</sup> cover of Loma Prieta hoita. By year five of monitoring, native habitat should be sufficiently well established to determine if the site will eventually achieve the long-term goals to achieve no net loss of occupied habitat or individuals.

#### Summary of Mitigation Measures

The following is a summary of avoidance and mitigation measures which will be followed to minimize impacts to Loma Prieta hoita populations and ensure the long-term viability of project-area populations.

MM-1. Trim colony to allow construction access. Under the direction of a qualified botanist, Loma Prieta hoita may be trimmed back to allow access to the work site. Trimming will be done by hand, after plants have seeded, and care will be taken to minimize removal of entire plants. Following trimming, the remaining colony will be protected during construction with fencing measures described below in MM-3.

MM-2. Collect and distribute seed. Seed will be collected from colonies according to standard protocols (including provisions to protect against soil *Phytophthora* diseases). Seed will be used to propagate plants at a native plant nursery for outplanting in areas of suitable unoccupied habitat within Mt. Umunhum Summit restoration areas to compensate for temporary construction impact (trimming) and any incidental removal of Loma Prieta hoita plants which cannot be avoided during construction or are subsequently affected by small changes in drainage. Plants impacted by construction activities will be salvaged and planted at identified mitigation sites.

MM-3. Fence and Avoid. All five populations of Loma Prieta hoita shall be protected during road improvements. As directed by a qualified biologist, the populations shall be fenced before construction with high-visibility fencing and an adequate buffer so that direct and indirect impacts will be minimized. Construction personnel shall be instructed to keep project activities out of the fenced areas. A qualified botanist shall periodically inspect the fencing to ensure that the fence is intact and the impacts to the populations are being avoided.

### **Mount Hamilton fountain thistle (*Cirsium fontinale* var. *campylon*)**

Mount Hamilton thistle is a serpentine endemic from the Asteraceae (sunflower) family. It is ranked CNPS 1B.2 (rare, threatened, or endangered in California and elsewhere, fairly endangered in California). It is not federal- or state-listed. A short-lived perennial herb, plants are found in serpentine seeps, streams and other mesic areas in valley and foothill grasslands, chaparral, and cismontane woodland. This species is known from Santa Clara, Alameda, and Stanislaus Counties, with 41 presumed extant occurrences in the CNDDDB (CNPS 2016).

Growing up to 2 m tall, Mount Hamilton thistle can be identified by its nodding white to pink-lavender flowering heads made of disk flowers only (blooming February to October); spiny involucre; hairless phyllaries that recurve for more than half their length; and velvety, fleshy, almost succulent leaves. It is distinguished from conspecifics by its phyllary spines that are generally 2-6 mm, and longer spines of cauline leaves 10-18 mm (Baldwin et al. 2012, Corelli and Chandik 1995, Beidleman and Kozloff). The plants are monocarpic (flower once and then die).

#### Occurrence in the Project Area

The CIRFON1 occurrence of Mount Hamilton thistle was found intermixed with the Loma Prieta hoita (HOISTR3). This is the only known location of the Mount Hamilton thistle in the project area. At this location, there are hundreds of seedlings growing in a two-inch layer of soil and duff that has accumulated on the existing road surface as well as hundreds of individuals growing right in the drainage area along the roadway. There is approximately 300 – 500 m<sup>2</sup> occupied in partial shade. Vegetative associates include gray pine, toyon, coffeeberry (*Frangula californica*), Ceanothus, coyote brush, arroyo willow (*Salix lasiolepis*), and blue wild rye (*Elymus glaucus*).

#### Level of Impact

**CIRFON1.** The original Project plans to install a 12-inch geocomposite drain below the existing inboard drainage ditch for this area have been eliminated since the improvements would result in removal of a significant number of plants. With this scope of work eliminated Project work within the immediate vicinity of CIRFON1 is anticipated to not have an impact on the colony. Exclusionary fencing has been placed around CIRFON1, and will be kept in place throughout the duration of the Project. The exclusionary fencing acts as a boundary of work for the contractor within this location.

Seedlings from plants growing in the roadside drainage ditch have been observed growing on top of a two-inch layer of soil and duff on the existing asphalt surface. Some of these seedlings were observed growing outside of the exclusionary fencing in January of 2017 and may be impacted by construction activities. However, a vegetation survey and photo documentation from May 2016 show that these seedlings do not survive prolonged dry periods and are therefore unlikely to reproduce. Since these seedlings are highly unlikely to reproduce any impacts to the small number of seedlings observed growing outside of the exclusionary fencing should not require mitigation.

### Mitigation Methods

The scope of work has been changed to eliminate impacts to this colony. Exclusionary fencing has been placed around CIRFON1, and will be kept in place throughout the duration of the Project. The exclusionary fencing acts as a boundary of work for the contractor within this location.

### Summary of Mitigation Measure

MM-3. Fence and Avoid. As directed by a qualified biologist, the populations shall be fenced before construction with high-visibility fencing and an adequate buffer so that direct and indirect impacts will be minimized. Construction personnel shall be instructed to keep project activities out of the fenced areas. A qualified botanist shall periodically inspect the fencing to ensure that the fence is intact and the impacts to the populations are being avoided.

## **Woodland woollythreads (*Monolopia gracilens*)**

Woodland woollythreads is an annual herb from the Asteraceae (sunflower) family. It is ranked CNPS 1B.2 (rare, threatened, or endangered in California and elsewhere). An annual herb endemic to California, woodland woollythreads is known from Santa Clara, San Mateo, Santa Cruz, Alameda, Monterey, San Luis Obispo, and Contra Costa Counties, with 51 presumed extant populations in the CNDDB (CNPS 2016). Plants colonize recently-disturbed areas within chaparral and woodland habitats, or within sparse serpentine grassland. Plants produce a slender, branching stem up to about 80 centimeters tall and are somewhat woolly in texture. The inflorescences at the ends of stem branches bear small hemispheric flower heads (blooming March to July). The golden ray florets are up to a centimeter long and surround a center of many disc florets.

### Occurrence in the Project Area

Woodland woollythreads is currently found at many sunny, exposed locations along the recently constructed Mt. Umunhum Trail, with vegetation clearing and soil disturbance presumably releasing the dormant seedbank. While pre-construction surveys conducted in 2013 failed to locate this species, plants are now observed to be colonizing bare soils on the new trail surface or cut banks in many previously unoccupied areas. Along the new trail between Bridge #2 and Bridge #3, and on two trail access roads, there are five occurrences of woodland woollythreads.

This species was not observed in the bridge construction areas, which are heavily shaded and do not provide suitable habitat. The occurrences along the trail exist in disturbed areas where the trail extends through chaparral. Occurrences MONGRA 1-3 are intermixed with tocalote (*Centaurea melitensis*, a non-native invasive plant), sweet phacelia (*Phacelia suaveolens*), whispering bells (*Emmenanthe penduliflora*), and California mustard (*Caulanthus lasiophyllus*). MONGRA 4 and 5 occur as a few scattered individuals on old roads that have been brushed to provide construction access to the Mt. Umunhum Trail. Other associated species include big berry manzanita (*Arctostaphylos glauca*), *Ceanothus* spp., and chamise (*Adenostoma fasciculatum*), and California mustard (*Caulanthus lasiophyllus*).

Suitable habitat for this species was created by the construction of the Mt. Umunhum Trail, with the banks and trail surface itself increasingly colonized as additional seedbank is released. The Project therefore has resulted in overall positive impacts to woodland woollythreads. However, direct impacts to individual plants will likely occur during final trail construction activities, as well as with trail use and annual maintenance activities (brushcutting).

#### Level of Impact

**MONGRA1.** This colony occupies an area of 70 m<sup>2</sup> and consist of approximately 2,000 individuals. Plants have been observed growing on both sides of the trail, and in some instances right in the middle of the trail. These plants are highly likely to incur impacts due to visitor use once the trail is open to the public. Direct impacts to individual plants will likely occur during final trail construction activities, as well as with trail use and annual maintenance activities (brushcutting).

**MONGRA2.** This colony occupies an area of 175 m<sup>2</sup> and consist of approximately 7,800 individuals. Plants have been observed growing on both sides of the trail, and in some instances right in the middle of the trail. These plants are highly likely to incur impacts due to visitor use once the trail is open to the public. Direct impacts to individual plants will likely occur during final trail construction activities, as well as with trail use and annual maintenance activities (brushcutting).

**MONGRA3.** This colony occupies an area of 65 m<sup>2</sup> and consist of approximately 4,500 individuals. Plants have been observed growing on both sides of the trail, and in some instances right in the middle of the trail. These plants are highly likely to incur impacts due to visitor use once the trail is open to the public. Direct impacts to individual plants will likely occur during final trail construction activities, as well as with trail use and annual maintenance activities (brushcutting).

**MONGRA4.** This colony occupies an area of 3 m<sup>2</sup> along a 6-foot-wide access road that leads to the Mt. Umunhum Trail and consist of approximately 100 individuals. Plants have been observed growing along the side of the road. Direct impacts to individual plants may occur during with road use and maintenance activities (brushcutting).

**MONGRA5.** This colony occupies an area of 3 m<sup>2</sup> along a 6-foot-wide access road that leads to the Mt. Umunhum Trail and consist of approximately 100 individuals. Plants have been

observed growing along the side of the road. Direct impacts to individual plants may occur during with road use and maintenance activities (brushcutting).

**Table 2: Summary of potential impacts to Woodland Woollythreads:**

Colony	Area Occupied (m <sup>2</sup> )	Number of Plants	Potential Area of Impact (m <sup>2</sup> )
1	70	2,000	22
2	175	7,800	20
3	65	4,500	28
4	3	100	1
5	3	100	1
<b>Total</b>	<b>316 m<sup>2</sup></b>	<b>14,500</b>	<b>72 m<sup>2</sup></b>

### Mitigation Methods

**MONGRA1 – MONGRA5.** To the maximum extent feasible, trail construction and maintenance in areas occupied by woodland woollythreads will occur during the dormancy period, which extends from seed set and plant senescence to germination (approximately August 1 to March 1). Spring vegetation surveys will occur in March or April of 2017 to identify areas that trail maintenance crews should avoid.

To mitigate for any impacts that occur with routine maintenance activities and visitor trail use, seed will be collected from extant colonies according to standard protocols (including provisions to protect against soil Phytophthora diseases). Approximately 75 meters of the Mount Umunhum trail was identified as suitable unoccupied habitat for woodland woollythreads. Seed will be sown 1-2 meters off of both sides of the trail in these unoccupied areas to increase woodland woollythreads cover by 135 m<sup>2</sup>.

In the summer of 2016, no more than 5% of the seed from colonies MONGRA 1-5 was collected, a total of 8 grams. Seed was collected according to standard protocols (including provisions to protect against soil Phytophthora diseases). This seed will be sown in areas of identified suitable unoccupied habitat along the Mt. Umunhum trail in the fall of 2017. Seed will be collected and sown for an additional two years.

Monitoring of the mitigation site by a qualified biologist will be conducted throughout the three-year monitoring period and monitoring reports will be prepared annually. The goal is a steady increase over time to achieve 135 m<sup>2</sup> cover of woodland woollythreads. By year three of monitoring, native habitat should be sufficiently well established to determine if the site will eventually achieve the long-term goals of increasing woodland woollythreads cover by 135 m<sup>2</sup>.

Areas colonized by woodland woollythreads will be hand-weeded to remove invasive tocalote and other invasive plants, annually as needed. Invasive plant removal will enhance habitat for this species by reducing competition and creating the disturbed/bare soils conducive to germination.

## Summary of Mitigation Measures

The following is a summary of avoidance and mitigation measures that will minimize impacts to woodland woollythreads and ensure the long-term viability of project-area populations.

MM-2. Collect and distribute seed. Seed will be collected from extant colonies according to standard protocols (including provisions to protect against soil Phytophthora diseases). Seed will be sown in areas of suitable unoccupied habitat along the Mt. Umunhum Trail.

MM-4. Avoid construction activities during flower and fruiting period. To the maximum extent feasible, trail construction and maintenance in areas occupied by woodland woollythreads will occur during the dormancy period, which extends from seed set and plant senescence to germination (approximately August 1 to March 1).

MM-5. Habitat enhancement (invasive plant removal). Areas colonized by woodland woollythreads will be hand-weeded to remove invasive tocalote and other invasive plants, annually as needed. Invasive plant removal will enhance habitat for this species by reducing competition and creating the disturbed/bare soils conducive to germination.

## **Brewer's redmaids (*Calandrinia breweri*)**

Brewer's redmaids is an annual herb from the Montiaceae (purslane) family. It is ranked CNPS 4.2 (uncommon in California). It is not federal- or state-listed. This species is native to the coastal mountains and canyons of California and Baja California, where it grows in several types of habitat, including recently burned and otherwise disturbed areas. An annual herb producing thick, hairless stems up to 45 centimeters long, Brewer's redmaids may grow upright or sprawl along the ground. The thick leaves are oval to spoon-shaped and up to 8 centimeters long. The inflorescence is a raceme of bright red to pink flowers, each on a long pedicel. Each flower has generally five petals which are under half a centimeter long (blooming March to June). The fruit is a capsule containing 10 to 15 seeds which are finely bumpy under magnification.

### Occurrence in the Project Area

Brewer's redmaids was identified in two locations along the Mt. Umunhum trail, and like woodland woollythreads, was not formerly identified at these locations and may be taking advantage of the disturbance caused by the trail construction to germinate similar to a response after a wildland fire. CALBRE1 is located between the Guadalupe Creek Overlook and Bridge #3. Occurrence CALBRE2 is closely adjacent to Bridge #3 construction area (Attachment B). Associated species include chamise (*Adenostoma fasciculatum*), red-stemmed spring beauty (*Claytonia rubra*) and California mustard (*Caulanthus lasiophyllus*).

**CALBRE1.** This occurrence is located well outside the bridge construction area but immediately adjacent and overhanging the new trail. This colony consists of only a few individual plants and occupies an area of 2 m<sup>2</sup>.

**CALBRE2.** This occurrence is located outside, but in close proximity to, the Bridge #3 construction area. This colony consists of only a few individual plants and occupies an area of 2 m<sup>2</sup>.

### Level of Impact

Bridge construction activities will not impact these two populations however, direct impacts to individual plants may occur during final trail construction activities, as well as with trail use and annual maintenance activities (brushcutting).

**Table 3: Summary of potential impacts to Brewer’s redmaids:**

Colony	Area Occupied (m <sup>2</sup> )	Number of Plants	Potential Area of Impact (m <sup>2</sup> )
<b>CALBRE1</b>	2	5	0.5
<b>CALBRE2</b>	2	5	0.5

### Mitigation Methods

To the maximum extent feasible, maintenance in areas occupied by Brewer’s redmaids will occur during the dormancy period, which extends from seed set and plant senescence to germination (approximately July 1 to March 1). Spring vegetation surveys will occur in March or April of 2017 to identify areas that trail maintenance crews should avoid.

To mitigate for any impacts that occur with routine maintenance activities and visitor trail use, seed will be collected from extant colonies according to standard protocols (including provisions to protect against soil Phytophthora diseases). This seed will be sown in areas of identified suitable unoccupied habitat along the Mt. Umunhum Trail in the fall of 2017.

Since the two colonies consist of only a few individuals, seed will be collected from 1 individual from each colony and sown into unoccupied areas in the vicinity of these two colonies. There is 30 linear meters of suitable unoccupied habitat along the Mt. Umunhum trail. Seed will be sown in approximately 27 m<sup>2</sup> of unoccupied habitat that will not be impacted by future maintenance activities or trail use. Seed will be collected and sown for a total of three years.

### Summary of Mitigation Measures

The following avoidance and mitigation measures will minimize impacts to Brewer’s redmaids and ensure the long-term viability of project-area populations.

**MM-2. Collect and distribute seed.** Seed will be collected from extant colonies according to standard protocols (including provisions to protect against soil Phytophthora diseases). Seed will be sown in areas of suitable unoccupied habitat along the Mt. Umunhum Trail.

**MM-4. Avoid construction activities during flower and fruiting period.** All construction activities associated with Bridge#3 will occur during the dormancy period of Brewer’s redmaids,

which extends from seed set and plant senescence to germination (approximately July 1 to March 1).

### **Serpentine leptosiphon (*Leptosiphon ambiguus*)**

Serpentine leptosiphon is an annual herb from the Polemoniaceae (phlox) family. It is ranked CNPS 4.2 (uncommon in California). It is not federal- or state-listed. A California endemic species, it is known from Alameda, Contra Costa, Merced, San Benito, Santa Clara, Santa Cruz, San Joaquin, San Mateo, and Stanislaus Counties. Usually found on serpentine soils, it is associated with cismontane woodland, coastal scrub, and valley and foothill grassland. It is a low annual plant with needle-like leaves and a vivid lavender flower (blooming March to June).

#### Occurrence in the Project Area

Plants were observed outside of the project area, in rocky pockets and volatile scree slides on the east-face of Mt. Umunhum's NE ridge, the southeast and east-facing slope below the summit into Guadalupe Canyon.

#### Level of Impact

No plants were observed within the Project Area, and colonies are located in steep, difficult to access areas that are unlikely to receive significant visitor traffic. Therefore, the Mt. Umunhum Summit Project is not expected to impact serpentine leptosiphon.

#### Mitigation Method

No plants were observed in the project area, however, if future vegetation surveys in April or May of 2017 identify serpentine leptosiphon in areas that may be impacted by trail use or routine maintenance work, seed will be collected from extant colonies according to standard protocols (including provisions to protect against soil Phytophthora diseases). Seed will be sown in areas of suitable unoccupied habitat along the Mt. Umunhum Summit Trail and within the Mt. Umunhum Summit restoration areas.

Tocolote was observed in areas of occupied habitat. These areas will be hand-weeded to remove the invasive tocalote and other invasive plants, annually as needed. Invasive plant removal will enhance habitat for this species by reducing competition.

#### Summary of Mitigation Measures

If impacts to serpentine leptosiphon, the following avoidance and mitigation measures will minimize these impacts and ensure the long-term viability of project-area populations.

**MM-2. Collect and distribute seed.** Seed will be collected from extant colonies according to standard protocols (including provisions to protect against soil Phytophthora diseases). Seed will be sown in areas of suitable unoccupied habitat within Mt. Umunhum Summit restoration areas.



MM-5. Habitat enhancement (invasive plant removal). Areas colonized by serpentine leptosiphon will be hand-weeded to remove invasive tocalote and other invasive plants, annually as needed. Invasive plant removal will enhance habitat for this species by reducing competition.

### **Brewer's clarkia (*Clarkia breweri*)**

Brewer's clarkia is an annual herb from the Onagraceae (evening primrose) family. It is ranked CNPS 4.2 (uncommon in California). It is not federal- or state-listed. A California endemic species, it is known from Alameda, Fresno, Merced, Monterey, San Benito, Santa Clara, and Stanislaus Counties. Usually found on serpentine soils, it is associated with chaparral, cismontane woodland, and coastal scrub. It produces short stems under 20 centimeters in height and sparse, narrow leaves. The distinctive flowers have four pink to lavender petals, each about 2 centimeters long and wide, with 3 odd lobes, the middle lobe being long and spoon-shaped.

#### Occurrence in the Project Area

No plants were observed within the Project Area, and colonies are located in steep, difficult to access areas that are unlikely to receive significant visitor traffic. Therefore, the Mt. Umunhum Summit Project is not expected to impact Brewer's clarkia. Associated species include scytheleaf onion (*Allium falcifolium*), naked buckwheat (*Eriogonum nudum*), serpentine leptosiphon (*Leptosiphon ambiguus*), and Santa Clara red ribbons (*Clarkia concinna* ssp. *automixa*).

#### Level of Impact

No impacts to Brewer's clarkia will occur as a result of the Project.

#### Mitigation Method

The plants are well outside of the Project Area and no plants will be impacted by the project, therefore mitigation measures will not be taken.

### **Santa Clara red ribbons (*Clarkia concinna* ssp. *automixa*)**

Santa Clara red ribbons is an annual herb from the Onagraceae (evening primrose) family. It is ranked CNPS 4.2 (uncommon in California). It is not federal- or state-listed. A California endemic species, it is known from Alameda, Santa Clara, and Santa Cruz Counties with 20 presumed extant occurrences. Usually found in chaparral and cismontane woodland, it has erect, herbaceous stems. The distinctive flowers have four looping sepals of red or dark pink (blooming April to July).

#### Occurrence in the Project Area

Santa Clara red ribbons clarkia occurs in small areas along the edges of the Mount Umunhum Summit construction area, primarily along the northern edge of the summit as well as the northeastern edge of the future parking lot and landing zone (colonies CLACON1 – CLACON7).

Associated species include gray pine (*Pinus sabiniana*), chamise (*Adenostoma fasciculatum*), mountain mahogany (*Cercocarpus betuloides*), red larkspur (*Delphinium nudicaule*), big berry manzanita (*Arctostaphylos glauca*), and blue dicks (*Dicholostemma capitatum*).

Level of Impact

Santa Clara red ribbons clarkia covers a total occupied area of 428 m<sup>2</sup> consisting of approximately 1,000 plants. A total of 65 m<sup>2</sup> consisting of approximately 150 plants is expected to be impacted by construction activities and additional impacts may occur with visitor use and routine maintenance activities since some of these colonies are located along the edges of future parking lots and trails.

**CLACON1-CLACON5.** These colonies occur immediately adjacent to the summit construction impact area. The majority of plants in these colonies are downslope and will not be impacted by construction activities. High visibility fencing has been installed along with straw waddles placed at the base of the fence to prevent any material from rolling downslope into the areas occupied by Santa Clara red ribbons clarkias. These colonies cover a total area of 363 m<sup>2</sup> and include approximately 750 plants. These colonies may be enhanced by up to 418 m<sup>2</sup> with additional seeding to mitigate for impacts to colony 6 and 7.

**CLACON6.** This colony will be significantly impacted by the construction of the Summit weather shelter. This colony occupies an area of 56 m<sup>2</sup> and consists of approximately 75 plants. The entire area occupied by clarkia will be impacted by the construction of the Summit weather shelter. Post construction surveys will be completed in August of 2017 to determine if any suitable unoccupied habitat remains for mitigation activities.

**CLACON7.** This colony will be impacted by the changes in grade near the Summit ceremonial circle. This colony occupies an area of 9 m<sup>2</sup> and consists of approximately 75 plants. The entire area occupied by clarkia will be impacted by grading activities. Post construction surveys will be completed in August of 2017 to determine if any suitable unoccupied habitat remains for mitigation activities.

**Table 4: Summary of impacts to Santa Clara red ribbons clarkia:**

Colony	Area Occupied (m <sup>2</sup> )	Total Number of Plants	Area of Impact (m <sup>2</sup> )	Number of Plants Impacted	Mitigation for Impacts (m <sup>2</sup> )	Area available for Mitigation (m <sup>2</sup> )
<b>1-5</b>	363	750	0	0	0	418
<b>6</b>	56	75	56	75	112	potential
<b>7</b>	9	75	9	75	18	potential
<b>Total</b>	<b>428 m<sup>2</sup></b>	<b>1,000</b>	<b>65 m<sup>2</sup></b>	<b>150</b>	<b>130 m<sup>2</sup></b>	<b>418 m<sup>2</sup></b>

Mitigation Methods

**CLACON1-CLACON5.** Although no impacts will occur as a result of construction activities, impacts may occur as a result of visitor use and routine maintenance activities since these

colonies are located along the edges of future parking lots and trails. All of these colonies may be enhanced with additional seed to mitigate for impacts to colonies 6 and 7. Approximately 418 m<sup>2</sup> of suitable unoccupied habitat is available in these colonies.

**CLACON6 – CLACON7.** To mitigate for any impacts that occur with construction activities seed will be collected from extant colonies according to standard protocols (including provisions to protect against soil Phytophthora diseases). Approximately 418 m<sup>2</sup> of the Mount Umunhum Summit construction project area was identified as suitable unoccupied habitat for Santa Clara red ribbons clarkia. Seed will be collected for a total of 3 years and sown in these unoccupied areas with a goal to increase red ribbons clarkia by 130 m<sup>2</sup> over 3 years.

In the fall of 2016, no more than 5% of the seed from colonies CLACON 1-7 was collected, a total of 2 grams. Seed was collected according to standard protocols (including provisions to protect against soil Phytophthora diseases). This seed will be sown in areas of suitable unoccupied habitat within Mt. Umunhum Summit restoration areas in the fall of 2017. Seed will be collected and sown for an additional 2 years and a total area of 130 m<sup>2</sup> will be seeded to mitigate for the 65 m<sup>2</sup> impacted by construction areas. Monitoring of the mitigation site by a qualified biologist will be conducted throughout the three-year monitoring period and monitoring reports will be prepared annually.

The goal is a steady increase over time to achieve 130 m<sup>2</sup> cover of Santa Clara red ribbons clarkia. By year three of monitoring, red ribbons clarkia habitat should be sufficiently well established to determine if the site will eventually achieve the long-term goals of increasing red ribbons clarkia cover by 130 m<sup>2</sup>.

Areas colonized by Santa Clara red ribbons clarkia will be hand-weeded to remove invasive plants, annually as needed. Invasive plant removal will enhance habitat for this species by reducing competition.

To the maximum extent feasible, maintenance in areas occupied by Santa Clara red ribbons clarkia will occur during the dormancy period, which extends from seed set and plant senescence to germination (approximately September 1 to April 1).

#### Summary of Mitigation Measures

The following avoidance and mitigation measures will be followed to minimize impacts to Santa Clara red ribbons clarkia and ensure the long-term viability of project-area populations.

**MM-2. Collect and distribute seed.** Seed will be collected from extant colonies according to standard protocols (including provisions to protect against soil Phytophthora diseases). Seed will be sown in areas of suitable unoccupied habitat within Mt. Umunhum Summit restoration areas.

**MM-3. Fence and Avoid.** As directed by a qualified biologist, the population shall be fenced before construction with high-visibility fencing and an adequate buffer so that direct and indirect impacts will be minimized. Construction personnel shall be instructed to keep project activities out of the fenced areas. A qualified botanist shall periodically inspect the fencing to ensure that the fence is intact and the impacts to the populations are being avoided.

MM-5. Habitat enhancement (invasive plant removal). Areas colonized by Santa Clara red ribbons clarkia will be hand-weeded to remove invasive tocalote, yellow star thistle, wild oats, and other invasive plants, annually as needed. Invasive plant removal will enhance habitat for this species by reducing competition.

### **Bristly jewelflower (*Streptanthus glandulosus* ssp. *glandulosus*)**

Bristly jewelflower (*Streptanthus glandulosus* ssp. *glandulosus*) was recently reclassified during revision of the Jepson Manual from *Streptanthus albidus* ssp. *peramoenus*. however, the latter is still currently on the List 1B of the CNPS *Inventory*. Bristly jewelflower is an annual herb from the Brassicaceae (mustard) family. It currently has no CNPS ranking, and is not federal- or state-listed. Prior to reclassification it was ranked CNPS 1B.2 (rare, threatened, or endangered in California and elsewhere). A California endemic species, it is known from 22 counties. It is associated with serpentine or metamorphic rocky, generally barren slopes, chaparral openings, and steep woodland. The flowers tend to be red-purple to dark maroon or lilac-lavender, sparsely hairy or glabrous (blooming March to May). For purposes of this project and report, the jewelflower at the top of Mt. Umunhum is being treated as a unique and unusual local plant and will be avoided or replaced to whatever degree possible.

#### Occurrence in the Project Area

The bristly jewelflower population within the Project Area was mapped as several small colonies (STRGLA1 – 13) along the uppermost, single-track segment of the new Mt. Umunhum Summit Trail, and between the main parking area and the summit. The colonies are closely associated with the open bands of exposed bedrock which extend in narrow fingers perpendicular to the trail alignment from an extensive rock outcrop downslope. Additional colonies of bristly jewelflower are located along edges of the construction area on the rocky slope below the western side of the radar tower. Within the Project Area, bristly jewelflower occurs in association with live-forever (*Dudleya* spp.), foothill penstemon (*Penstemon heterophyllus*), spikemoss (*Selaginella bigelovii*), and coyote mint (*Monardella villosa* ssp. *villosa*).

#### Level of Impact

**STRGLA1-13.** Some of the colonies located along the Mt. Umunhum Summit Trail alignment may be impacted by construction activities. Plants were observed growing on both sides of the trail and are likely to incur impacts due to visitor use once the trail is open to the public. Approximately 200 scattered plants along 243 linear meters of trail are likely to be impacted during annual maintenance activities and visitor use.

**Table 5: Summary of potential impacts to the bristly jewelflower:**

Colony	Area Occupied (m <sup>2</sup> )	Area of Impact (m <sup>2</sup> )	Number of Plants that may be Impacted
<b>STRGLA1 -13</b>	3,251	657	200

## Mitigation Methods

Impacts may occur to the bristly jewelflower with routine maintenance and trail use. These impacts will be minimized by avoiding maintenance activities during the flower and fruiting period (Approximately March 1 through July 1). Spring vegetation surveys will occur in April or May of 2017 to identify areas that trail maintenance crews should avoid. Seed will be collected according to standard protocols (including provisions to protect against soil Phytophthora diseases) from approximately 50 bristly jewelflowers and sown in suitable unoccupied areas along the Mt Umunhum Summit Trail for three years. This seed will also be used to propagate the bristly jewelflower at Grassroots Ecology Native Plant Nursery for seed augmentation. After the first 3 years of seeding along the Mt Umunhum Summit Trail, seed will be sown into the restoration areas at the Mt. Umunhum summit for 2 additional years. Removal of invasive plants including tocalote will also provide enhancement to occupied areas.

Monitoring of the mitigation site by a qualified biologist will be conducted throughout the five-year monitoring period and monitoring reports will be prepared annually. After year 5, seeding activities should meet the goals of expanding suitable, unoccupied areas of bristly jewelflower and mitigating for the 200 individuals that may have potential to be impacted by routine trail maintenance and trail use.

## Summary of Mitigation Measures

The following avoidance and mitigation measures will be followed to minimize impacts to the bristly jewelflower and ensure the long-term viability of project-area populations.

MM-2. Collect and distribute seed. Seed will be collected from extant colonies according to standard District protocols (including provisions to protect against soil Phytophthora diseases). Seed will be sown in areas of suitable unoccupied habitat along the Mt. Umunhum Summit Trail and within the Mt. Umunhum Summit restoration areas.

MM-4. Avoid construction activities during flower and fruiting period. To the maximum extent feasible, trail construction and maintenance in areas occupied by bristly jewelflower will occur during the dormancy period, which extends from seed set and plant senescence to germination (approximately July 1 to March 1).

MM-5. Habitat enhancement (invasive plant removal). Areas colonized by bristly jewelflower will be hand-weeded to remove invasive tocalote and other invasive plants, annually as needed. Invasive plant removal will enhance habitat for this species by reducing competition and creating the disturbed/bare soils conducive to germination.

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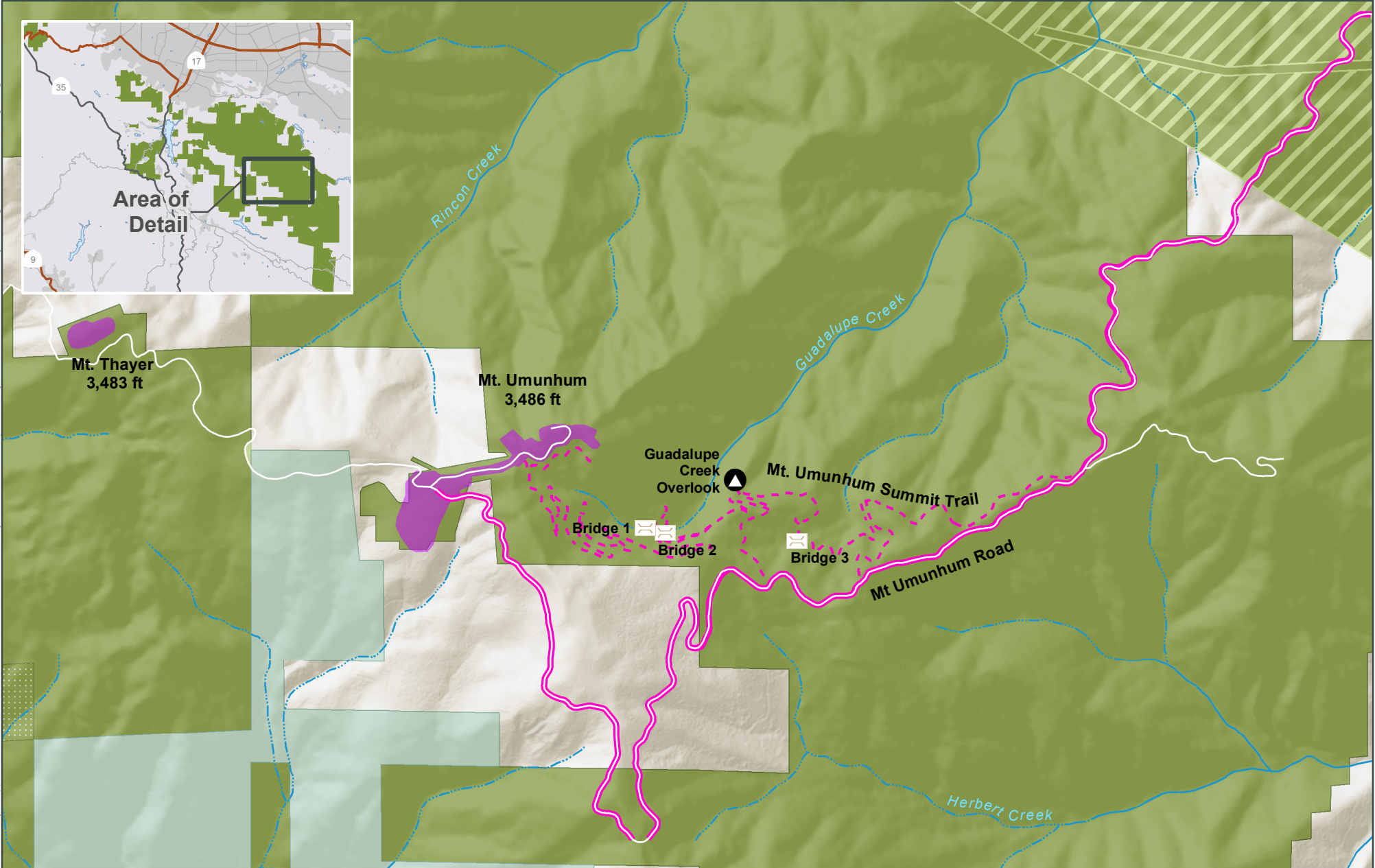
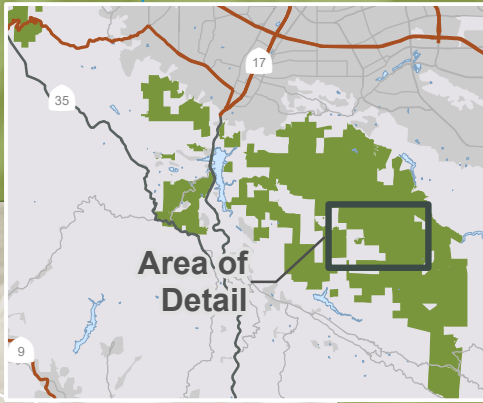
Thomas, John Hunter. 1961, Flora of Santa Cruz Mountains of California. Stanford University Press, Stanford, CA.

## **Attachments**

Attachment A: Project Area Maps

Attachment B: Mount Umunhum Special Status Species Map

Attachment C: Mount Umunhum Flora List



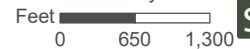
### Attachment A - Mt. Umunhum Environmental Restoration and Public Access Project Area

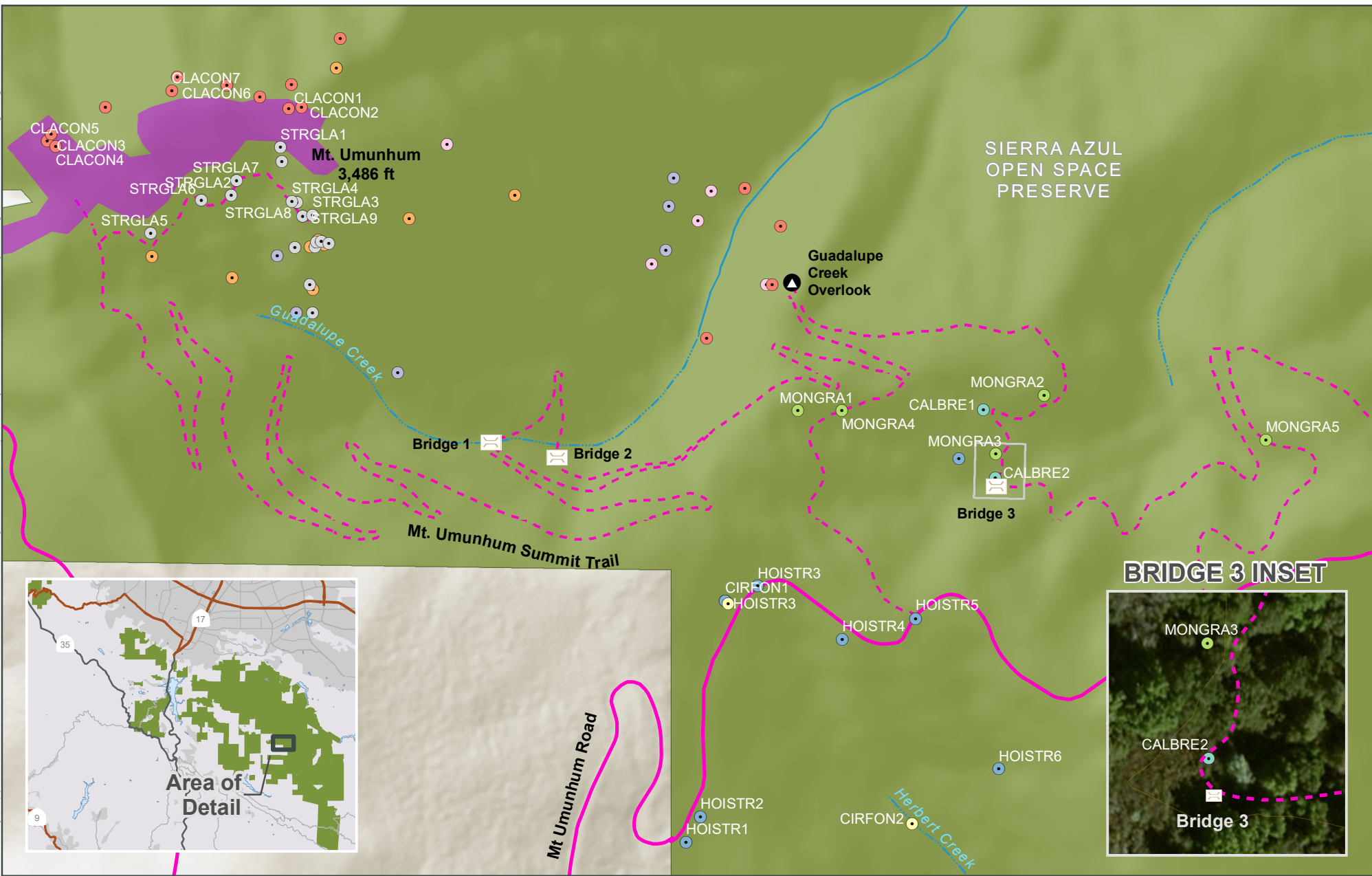
- Mt. Umunhum Summit Trail Project Area
- Mt. Umunhum Road Resurfacing Project Area
- Mt. Umunhum and Mt. Thayer Project Areas
- Trail Bridge

Midpeninsula Regional  
Open Space District  
(MROSD)



July 2016





### Attachment B - Mt. Umunhum Special Status Plant Species

- Rock Sanicle, *Sanicula saxatilis* – CA State Rare, CNPS Rank 1B.2
  - Loma Prieta Leather Root, *Hoita strobilina* – CNPS Rank 1B.1
  - Mount Hamilton Fountain Thistle, *Cirsium fontinale* var. *campylon* – CNPS Rank 1B.2
  - Woodland Woollythreads, *Monolopia gracilens* – CNPS Rank 1B.2
  - Brewer's Redmaids, *Calandrinia breweri* – CNPS Rank 4.2
  - Serpentine Leptosiphon, *Leptosiphon ambiguus* – CNPS Rank 4.2
  - Santa Clara Red Ribbons, *Clarkia concinna* subsp. *automixa* – CNPS Rank 4.3
  - Brewer's Clarkia, *Clarkia breweri* – CNPS Rank 4.2
  - Bristly jewelflower, *Streptanthus glandulosus* subsp. *glandulosus* – Recently Reclassified and Delisted from CNPS 1B.2
- Mt. Umunhum Summit Trail Project Area  
--- Mt. Umunhum Road Resurfacing Project Area  
--- Mt. Umunhum and Mt. Thayer Project Areas  
  Trail Bridge

Midpeninsula Regional  
 Open Space District  
 (MROSD)

March 2017

Feet  
 0 195 390

While the District strives to use the best available digital data, these data do not represent a legal survey and are merely a graphic illustration of geographic features.



## Mount Umunhum Flora

Flora observations for Mount Umunhum summit area (upper 1,000'), upper Guadalupe Canyon and new Summit Trail  
Ken Hickman, John Rawlings and botany-wise field companions: Sara Timby, Paul Heiple, Ken Himes, Stella Yang...

**Last updated June 2016**

333 Taxa, 68 Families, 8 CNPS Ranked, 1 State Rare

highlighting indicates taxa added in 2016

? Uncertain or incomplete IDs (still need flower, fruit, expert confirmation...)

# CNPS ranked and special status species

e Non-native species (exotics)

v Vouchered specimen in SJSU Sharsmith Herbarium

p Photo(s) in Flickr album

	Family	Scientific Name	Common Name
	Adoxaceae	<i>Sambucus nigra ssp. caerulea</i>	Blue Elderberry
	Agavaceae	<i>Chlorogalum pomeridianum</i>	Soap Plant
v p	Alliaceae	<i>Allium falcifolium</i>	Brewer's Onion, white-pink
v p	Alliaceae	<i>Allium unifolium</i>	Singleleaf Onion
	Anacardiaceae	<i>Toxicodendron diversilobum</i>	Poison Oak
v	Apiaceae	<i>Lomatium dasycarpum ssp. dasycarpum</i>	Woollyfruit Biscuitroot
v p	Apiaceae	<i>Lomatium macrocarpum</i>	Bigfruit Biscuitroot
v	Apiaceae	<i>Osmorhiza berteroi</i>	Wood Sweet Cicely
v p	Apiaceae	<i>Perideridia kelloggii</i>	Kellogg's Yampah
v	Apiaceae	<i>Sanicula crassicaulis</i>	Pacific Sanicle
v p SR 1B.2	Apiaceae	<i>Sanicula saxatilis</i>	Rock Sanicle / Diablo Snakeroot
v	e Apiaceae	<i>Scandix pecten-veneris</i>	Venus' Needle
	e Apiaceae	<i>Torilis arvensis</i>	Sock Destroyer
v	Apiaceae	<i>Yabea microcarpa</i>	California Parsley
v	Araliaceae	<i>Aralia californica</i>	Elk Clover
	Asteraceae	<i>Achillea millefolium</i>	Yarrow
v	Asteraceae	<i>Agoseris grandiflora var. grandiflora</i>	California Dandelion
	e Asteraceae	<i>Anthemis cotula</i>	Mayweed (pulled before seed)
v p	Asteraceae	<i>Arnica discoidea</i>	Rayless Arnica
	Asteraceae	<i>Artemisia californica</i>	California Sagebrush
	Asteraceae	<i>Artemisia douglasiana</i>	Mugwort
	Asteraceae	<i>Baccharis pilularis ssp. consanguinea</i>	Coyote Brush
	e Asteraceae	<i>Carduus pycnocephalus</i>	Italian Thistle
	e Asteraceae	<i>Centaurea melitensis</i>	Tocalote
	e Asteraceae	<i>Centaurea solstitialis</i>	Yellow Star-Thistle
v p	Asteraceae	<i>Chaenactis glabriuscula var. glabriuscula</i>	Yellow Pincushion
v p 1B.2	Asteraceae	<i>Cirsium fontinale var. campylon</i>	Mt. Hamilton Fountain Thistle
v p	Asteraceae	<i>Cirsium occidentale var. venustum</i>	Venus Thistle
	e Asteraceae	<i>Cirsium vulgare</i>	Bull Thistle
	e Asteraceae	<i>Crepis versicaria</i>	Beaked Hawksbeard
	e Asteraceae	<i>Dittrichia graveolens</i>	Stinkwort (pulled before seed)
v p	Asteraceae	<i>Ericameria arborescens</i>	Golden Fleece
v p	Asteraceae	<i>Ericameria nauseosa var. speciosa</i>	Whitestem Rabbitbrush

## Mount Umunhum Flora

v p	Asteraceae	<i>Erigeron petrophilus</i> var. <i>petrophilus</i>	Rock-loving Daisy
v	Asteraceae	<i>Eriophyllum confertiflorum</i> var. <i>confertiflorum</i>	Golden Yarrow
v	Asteraceae	<i>Gnaphalium palustre</i>	Marsh Everlasting
v	Asteraceae	<i>Hemizonia congesta</i> ssp. <i>luzulifolia</i>	Hayfield Tarweed
v p	Asteraceae	<i>Heterotheca sessiliflora</i> ssp. <i>echioides</i>	Bristly Goldenaster
v	e Asteraceae	<i>Hypochaeris glabra</i>	Smooth Cat's Ears
v	e Asteraceae	<i>Hypochaeris radicata</i>	Rough Cat's Ears
	Asteraceae	<i>Lagophylla ramosissima</i>	Hareleaf
v p	Asteraceae	<i>Logfia filaginoides</i>	California Cottonrose
v	e Asteraceae	<i>Logfia gallica</i>	Slender Cottonrose
v	Asteraceae	<i>Madia elegans</i>	Elegant Madia
v	Asteraceae	<i>Madia gracilis</i>	Slender Tarplant
v	Asteraceae	<i>Micropus californicus</i> var. <i>californicus</i>	Cottontops
v p	1B.2 Asteraceae	<i>Monolopia gracilens</i>	Woodland Monolopia
v p	Asteraceae	<i>Pseudognaphalium beneolens</i>	Fragrant Everlasting
v	Asteraceae	<i>Pseudognaphalium californicum</i>	California Everlasting
	e Asteraceae	<i>Pseudognaphalium luteoalbum</i>	Weedy Everlasting
v	Asteraceae	<i>Psilocarphus tenellus</i>	Woolly Marbles
v p	Asteraceae	<i>Rafinesquia californica</i>	California Chicory
v	e Asteraceae	<i>Senecio vulgaris</i>	Common Groundsel
p	Asteraceae	<i>Solidago velutina</i> ssp. <i>californica</i>	Goldenrod
	e Asteraceae	<i>Sonchus asper</i>	Prickly Sow Thistle
v p	Asteraceae	<i>Stephanomeria virgata</i> ssp. <i>pleurocarpa</i>	Rod Wire Lettuce
v	Asteraceae	<i>Uropappus lindleyi</i>	Silverpuffs
p	Asteraceae	<i>Wyethia glabra</i>	Coast Mule's Ears
v p	Berberidaceae	<i>Berberis pinnata</i> spp. <i>pinnata</i>	Mahonia / Barberry
	Betulaceae	<i>Corylus cornuta</i> ssp. <i>californica</i>	California Hazel
v	Boraginaceae	<i>Amsinckia menziesii</i>	Fiddlenecks
v p	Boraginaceae	<i>Cryptantha clevelandii</i> var. <i>florosa</i>	Cleveland's Cryptantha
v p	Boraginaceae	<i>Cryptantha flaccida</i>	Beaked Cryptantha
v	Boraginaceae	<i>Cynoglossum grande</i>	Pacific Houndstongue
v p	Boraginaceae	<i>Emmenanthe penduliflora</i> var. <i>penduliflora</i>	Whisper Bells
v	Boraginaceae	<i>Eriodictyon californicum</i>	Yerba Santa
v p	Boraginaceae	<i>Heliotropium curassavicum</i> var. <i>oculatum</i>	Heliotrope
v p	Boraginaceae	<i>Nemophila menziesii</i> var. <i>atomaria</i>	White Baby Blue Eyes
v p	Boraginaceae	<i>Nemophila parviflora</i> var. <i>parviflora</i>	Smallflower Nemophila
v p	Boraginaceae	<i>Nemophila pedunculata</i>	Meadow Nemophila
v p	Boraginaceae	<i>Phacelia distans</i>	Common Phacelia
v p	Boraginaceae	<i>Phacelia imbricata</i> ssp. <i>imbricata</i>	Foothill Phacelia
v p	Boraginaceae	<i>Phacelia nemoralis</i> var. <i>nemoralis</i>	Woodland Phacelia
v p	Boraginaceae	<i>Phacelia rattanii</i>	Rattan's Phacelia
v	? Boraginaceae	<i>Phacelia</i> sp. <i>breweri</i> ?	Phacelia - small annual
v p	Boraginaceae	<i>Phacelia suaveolens</i>	Sweet Scented Phacelia
v	Boraginaceae	<i>Plagiobothrys nothofulvus</i>	Popcornflower
v	Brassicaceae	<i>Athysanus pusillus</i>	Sandweed
v p	Brassicaceae	<i>Barbarea orthoceras</i>	Wintercress
v p	Brassicaceae	<i>Boechera breweri</i> ssp. <i>breweri</i>	Brewer's Rockcress

## Mount Umunhum Flora

	e	Brassicaceae	<i>Capsella bursa-pastoris</i>	Shepherd's Purse
p		Brassicaceae	<i>Cardamine californica</i>	Milkmaids
v	e	Brassicaceae	<i>Cardamine hirsuta</i>	Hairy Bittercress
v p		Brassicaceae	<i>Caulanthus lasiophyllus</i>	California Mustard
v p	e	Brassicaceae	<i>Draba verna</i>	Whitlow Grass / Spring Draba
v p		Brassicaceae	<i>Erysimum capitatum</i> var. <i>capitatum</i>	Western Wallflower
v p		Brassicaceae	<i>Lepidium strictum</i>	Wayside Peppergrass
v p		Brassicaceae	<i>Streptanthus glandulosus</i> ssp. <i>glandulosus</i>	Beautiful Jewelflower
v	e	Brassicaceae	<i>Sisymbrium altissimum</i>	Tumble Mustard
v		Brassicaceae	<i>Thysanocarpus curvipes</i> ssp. <i>curvipes</i>	Fringepod
v p		Campanulaceae	<i>Githopsis specularioides</i>	Blue Cup
v		Caprifoliaceae	<i>Lonicera hispidula</i>	Pink Honeysuckle
v		Caprifoliaceae	<i>Symphoricarpos mollis</i>	Creeping Snowberry
v	e	Caryophyllaceae	<i>Cerastium glomeratum</i>	Sticky Mouse Ear Chickweed
v p		Caryophyllaceae	<i>Minuartia douglasii</i>	Sandwort
v	e	Caryophyllaceae	<i>Silene gallica</i>	Windmill Pink
v p	e	Caryophyllaceae	<i>Spergularia rubra</i>	Purple Sand Spurry
	e	Caryophyllaceae	<i>Stellaria media</i>	Chickweed
v p		Caryophyllaceae	<i>Stellaria nitens</i>	Shining Chickweed
v p	e	Caryophyllaceae	<i>Velezia rigida</i>	Velezia
v p		Convolvulaceae	<i>Calystegia collina</i> ssp. <i>collina</i>	Hillside Morning Glory
v p		Convolvulaceae	<i>Calystegia purpurata</i> ssp. <i>purpurata</i>	Pacific Morning Glory
v p		Convolvulaceae	<i>Cuscuta californica</i>	Chaparral Dodder
v p		Cornaceae	<i>Cornus sericea</i>	Creek Dogwood
v		Crassulaceae	<i>Crassula connata</i>	Pygmy Weed
v p		Crassulaceae	<i>Dudleya cymosa</i> ssp. <i>cymosa</i>	Canyon Liveforever
v p		Crassulaceae	<i>Sedum radiatum</i>	Coast Range Stonecrop
v p		Crassulaceae	<i>Sedum spathulifolium</i>	Pacific Stonecrop
		Cucurbitaceae	<i>Marah fabacea</i>	California Wild Cucumber
	e	Cupressaceae	<i>Calocedrus decurrens</i>	Incense Cedar (planted)
v p		Cyperaceae	<i>Carex serratodens</i>	Serpentine Sedge
		Dryopteridaceae	<i>Dryopteris arguta</i>	Wood Fern
v p		Dryopteridaceae	<i>Polystichum imbricans</i> ssp. <i>imbricans</i>	Narrowleaf Swordfern
		Dryopteridaceae	<i>Polystichum munitum</i>	Western Swordfern
		Ericaceae	<i>Arbutus menziesii</i>	Madrone
v		Ericaceae	<i>Arctostaphylos crustacea</i> ssp. <i>crustacea</i>	Brittleleaf Manzanita
v p		Ericaceae	<i>Arctostaphylos glauca</i>	Bigberry Manzanita
v p		Fabaceae	<i>Acmispon brachycarpus</i>	Shortpod Lotus
v		Fabaceae	<i>Acmispon glaber</i> var. <i>glaber</i>	Deer Lotus
v		Fabaceae	<i>Acmispon parviflorus</i>	Hill Lotus
		Fabaceae	<i>Acmispon wrangelianus</i>	Calf Lotus
v		Fabaceae	<i>Astragalus gambelianus</i>	Gambel's Locoweed
	e	Fabaceae	<i>Cytisus scoparius</i>	Scotch Broom
v p	1B.1	Fabaceae	<i>Hoita strobilina</i>	Loma Prieta Leather Root
v p		Fabaceae	<i>Hosackia crassifolia</i> var. <i>crassifolia</i>	Broadleaf Lotus
v p		Fabaceae	<i>Lathyrus vestitus</i> var. <i>vestitus</i>	Pacific Pea
v p		Fabaceae	<i>Lupinus albifrons</i> var. <i>albifrons</i>	Silver Bush Lupine

## Mount Umunhum Flora

v p	Fabaceae	<i>Lupinus bicolor</i>	Annual Bicolor Lupine
v	Fabaceae	<i>Lupinus succulentus</i>	Arroyo Lupine
	e Fabaceae	<i>Lotus corniculatus</i>	Bird's Foot Trefoil
v p	Fabaceae	<i>Pickeringia montana</i> var. <i>montana</i>	Chaparral Pea
	? Fabaceae	<i>Trifolium albopurpureum/olivaceum</i>	Indian Clover
	Fabaceae	<i>Trifolium gracilentum</i>	Pinpoint Clover
	e Fabaceae	<i>Trifolium hirtum</i>	Rose Clover
	Fabaceae	<i>Trifolium microcephalum</i>	Smallheaded Clover
v	Fabaceae	<i>Trifolium willdenovii</i>	Tomcat Clover
v	Fagaceae	<i>Notholithocarpus densiflorus</i>	Tanoak - just a few
	Fagaceae	<i>Quercus agrifolia</i>	Coast Live Oak
	Fagaceae	<i>Quercus berberidifolia</i>	Scrub Oak
p	? Fagaceae	<i>Quercus berberidifolia x durata?</i>	Scrub-Leather Oak Hybrid
	Fagaceae	<i>Quercus chrysolepis</i>	Canyon Live Oak
v p	Fagaceae	<i>Quercus durata</i>	Leather Oak
p	Fagaceae	<i>Quercus kelloggii x wislizeni</i>	Oracle Oak / Black-Interior Hybrid
	Fagaceae	<i>Quercus wislizeni</i> var. <i>frutescens</i>	Interior Live Oak
v p	Garryaceae	<i>Garrya fremontii</i>	Fremont's Silk Tassel
	e Geraniaceae	<i>Erodium cicutarium</i>	Filaree
v	e Geraniaceae	<i>Geranium molle</i>	Cranesbill
	Grossulariaceae	<i>Ribes californicum</i>	Hillside Gooseberry
v	Grossulariaceae	<i>Ribes malvaceum</i> var. <i>malvaceum</i>	Chaparral Currant
p	Grossulariaceae	<i>Ribes menziesii</i>	Canyon Gooseberry
v p	Iridaceae	<i>Iris fernaldii</i>	Fernald's Iris
v p	Juncaceae	<i>Juncus patens</i>	Spreading Rush
v	Juncaceae	<i>Juncus xiphioides</i>	Irisleaf Rush
	Lamiaceae	<i>Clinopodium douglasii</i>	Yerba Buena
p	Lamiaceae	<i>Lepechinia calycina</i>	Pitcher Sage
v p	Lamiaceae	<i>Monardella villosa</i> ssp. <i>villosa</i>	Coyote Mint
v p	Lamiaceae	<i>Salvia columbariae</i>	Chia
	? Lamiaceae	<i>Salvia mellifera?</i>	Black Sage
v p	Lamiaceae	<i>Scutellaria tuberosa</i>	Skullcap
v	Lamiaceae	<i>Stachys rigida</i> var. <i>rigida</i>	Rough Hedge Nettle
p	Lamiaceae	<i>Trichostema lanceolatum</i>	Vinegar Weed
p	Lauraceae	<i>Umbellularia californica</i>	California Bay Laurel
v p	Liliaceae	<i>Calochortus albus</i>	Fairy Lanterns
v p	Liliaceae	<i>Calochortus argillosus</i>	Clay Mariposa Lily
v p	Liliaceae	<i>Fritillaria affinis</i>	Mission Bells
v p	Liliaceae	<i>Prosartes hookeri</i>	Drops of Gold
v p	Linaceae	<i>Hesperolinon micranthum</i>	Dwarf Flax
v p	Loasaceae	<i>Mentzelia lindleyi</i>	Lindley's Blazing Star
v p	Melanthiaceae	<i>Toxicoscordion fremontii</i>	Fremont's Star Lily
v	Melanthiaceae	<i>Trillium chloropetalum</i>	Giant Wake Robin
v p	4.2 Montiaceae	<i>Calandrinia breweri</i>	Brewer's Red Maids
v	Montiaceae	<i>Calandrinia menziesii</i>	Red Maids
v p	Montiaceae	<i>Claytonia exigua</i> ssp. <i>exigua</i>	Little Spring Beauty
v p	Montiaceae	<i>Claytonia rubra</i> ssp. <i>rubra</i>	Red Miner's Lettuce

## Mount Umunhum Flora

v		Montiaceae	<i>Claytonia parviflora ssp. parviflora</i>	Small-flower Miner's Lettuce
v		Montiaceae	<i>Claytonia perfoliata ssp. perfoliata</i>	Miner's Lettuce
v p		Montiaceae	<i>Lewisia rediviva var. rediviva</i>	Bitter Root - white
	e	Myrsinaceae	<i>Lysimachia arvensis</i>	Scarlet Pimpernel
v p		Myrsinaceae	<i>Lysimachia latifolia</i>	Pacific Starflower
v		Onagraceae	<i>Camissonia contorta</i>	Tiny Suncup
v p		Onagraceae	<i>Camissoniopsis hirtella</i>	Hairy Suncup
v p		Onagraceae	<i>Camissoniopsis micrantha</i>	Small Suncup
v p	4.2	Onagraceae	<i>Clarkia breweri</i>	Brewer's Clarkia
v p	4.3	Onagraceae	<i>Clarkia concinna ssp. automixa</i>	Santa Clara Red Ribbons
v		Onagraceae	<i>Clarkia purpurea ssp. quadrivulnera</i>	Winecup Clarkia
v p		Onagraceae	<i>Clarkia rhomboidea</i>	Diamond Clarkia
		Onagraceae	<i>Clarkia rubicunda</i>	Ruby Chalice Clarkia
v p		Onagraceae	<i>Clarkia unguiculata</i>	Elegant Clarkia
v p		Onagraceae	<i>Epilobium canum ssp. canum</i>	California Fuchsia
v p		Onagraceae	<i>Epilobium minutum</i>	Chaparral Willowherb
v p		Orchidaceae	<i>Corallorhiza striata</i>	Striped Coralroot Orchid
	e	Orchidaceae	<i>Epipactis helleborine</i>	Helleborine Orchid
v p		Orchidaceae	<i>Piperia elegans ssp. elegans</i>	Coast Rein Orchid
		Orchidaceae	<i>Piperia elongata</i>	Chaparral Rein Orchid
v p		Orchidaceae	<i>Piperia transversa</i>	Mountain Rein Orchid
v p		Orobanchaceae	<i>Castilleja affinis</i>	Indian Paintbrush
v p		Orobanchaceae	<i>Castilleja applegatei ssp. martinii</i>	Wavyleaf Paintbrush
v p		Orobanchaceae	<i>Castilleja attenuata</i>	Valley Tassels
v		Orobanchaceae	<i>Castilleja foliolosa</i>	Woolly Paintbrush
v		Orobanchaceae	<i>Cordylanthus rigidus ssp. rigidus</i>	Bird's Beak
v p		Orobanchaceae	<i>Orobanche fasciculata</i>	Clustered Broomrape
v p		Orobanchaceae	<i>Orobanche uniflora</i>	Broomrape - purple
v p	?	Orobanchaceae	<i>Orobanche vallicola?</i>	Hillside Broomrape
p		Orobanchaceae	<i>Pedicularis densiflora</i>	Indian Warrior
v p		Papaveraceae	<i>Dendromecon rigida</i>	Bush Poppy
v p		Papaveraceae	<i>Ehrendorferia chrysantha</i>	Golden Eardrops
		Papaveraceae	<i>Eschscholzia californica</i>	California Poppy
v		Phrymaceae	<i>Mimulus aurantiacus var. aurantiacus</i>	Bush Monkeyflower
		Phrymaceae	<i>Mimulus guttatus</i>	Seep Spring Monkeyflower
v p		Phrymaceae	<i>Mimulus rattanii</i>	Rattan's Monkeyflower
v		Pinaceae	<i>Pinus attenuata</i>	Knobcone Pine
p		Pinaceae	<i>Pinus sabiniana</i>	Foothill Pine
		Pinaceae	<i>Pseudotsuga menziesii</i>	Douglas Fir - just a few
v p		Plantaginaceae	<i>Antirrhinum vexillocalyculatum ssp. vexillocalyculatum</i>	Wiry Snapdragon
v p		Plantaginaceae	<i>Collinsia heterophylla var. heterophylla</i>	Chinese Houses
v p		Plantaginaceae	<i>Keckiella corymbosa</i>	Red Bush Beardtongue, incl. yellow
v p		Plantaginaceae	<i>Penstemon heterophyllus var. heterophyllus</i>	Foothill Penstemon
	e	Plantaginaceae	<i>Plantago lanceolata</i>	English Plantain
v p		Plantaginaceae	<i>Tonella tenella</i>	Innocence - both purple & white
p		Platanaceae	<i>Platanus racemosa</i>	Western Sycamore - just a few
v p	e	Poaceae	<i>Aira caryophyllea</i>	Hairgrass

## Mount Umunhum Flora

v	e	Poaceae	<i>Avena barbata</i>	Oat Grass
	e	Poaceae	<i>Brachypodium distachyon</i>	Purple False Brome
v	e	Poaceae	<i>Bromus arenarius</i>	Australian Brome
v	e	Poaceae	<i>Bromus diandrus</i>	Ripgut Brome
v	e	Poaceae	<i>Bromus hordeaceus ssp. hordeaceus</i>	Soft Brome, Soft Chess
v		Poaceae	<i>Bromus laevipes</i>	Woodland Brome
v	e	Poaceae	<i>Bromus madritensis ssp. madritensis</i>	Spanish Brome
v	e	Poaceae	<i>Bromus madritensis ssp. rubens</i>	Red Brome
v	e	Poaceae	<i>Bromus sterilis</i>	Poverty Brome Grass
v	e	Poaceae	<i>Cynosurus echinatus</i>	Hedgehog Dogtail Grass
v		Poaceae	<i>Elymus glaucus ssp. glaucus</i>	Blue Wild Rye
v		Poaceae	<i>Elymus xhanseni</i>	Squirreltail Rye
v		Poaceae	<i>Elymus multisetus</i>	Squirreltail Grass
v	e	Poaceae	<i>Festuca arundinacea</i>	Tall Fescue
v		Poaceae	<i>Festuca californica</i>	California Fescue
v		Poaceae	<i>Festuca microstachys</i>	Small Fescue
v	e	Poaceae	<i>Festuca myuros</i>	Rattail Grass
v	e	Poaceae	<i>Gastridium phleoides</i>	Nit Grass
v	e	Poaceae	<i>Hordeum marinum ssp. gussoneanum</i>	Mediterranean Barley
v	e	Poaceae	<i>Hordeum murinum ssp. leporinum</i>	Foxtail Barley
v p		Poaceae	<i>Koeleria macrantha</i>	June Grass
v p	e	Poaceae	<i>Lamarckia aurea</i>	Goldentops
v p		Poaceae	<i>Melica californica</i>	California Onion Grass
v		Poaceae	<i>Melica imperfecta</i>	Smallflower Onion Grass
v p		Poaceae	<i>Melica torreyana</i>	Torrey Grass
v	e	Poaceae	<i>Poa annua</i>	Annual Bluegrass
v	e	Poaceae	<i>Poa bulbosa ssp. vivipara</i>	Bulbous Bluegrass
v p		Poaceae	<i>Poa howellii</i>	Howell's Bluegrass
v	e	Poaceae	<i>Poa infirma</i>	Weak Bluegrass
v		Poaceae	<i>Poa secunda ssp. secunda</i>	Pine Bluegrass
v p	e	Poaceae	<i>Polypogon interruptus</i>	Beard Grass
v p	e	Poaceae	<i>Polypogon monspeliensis</i>	Rabbitfoot Grass
v		Poaceae	<i>Stipa lepida</i>	Foothill Needle Grass
v		Poaceae	<i>Stipa pulchra</i>	Purple Needle Grass
v	e	Poaceae	<i>Triticum aestivum</i>	Goat Grass
v p		Polemoniaceae	<i>Allophyllum divaricatum</i>	False Gilia
v p		Polemoniaceae	<i>Allophyllum gilioides ssp. gilioides</i>	Dense False Gilia
v		Polemoniaceae	<i>Allophyllum gilioides ssp. violaceum</i>	Violet False Gilia
v p		Polemoniaceae	<i>Collomia heterophylla</i>	Variableleaf Tiny Trumpet
	?	Polemoniaceae	<i>Eriastrum sp. abramsii?</i>	Woollystar
v p		Polemoniaceae	<i>Gilia achilleifolia ssp. multicaulis</i>	Manystem California Gilia
v		Polemoniaceae	<i>Gilia achilleifolia ssp. achilleifolia</i>	California Gilia
v p	4.2	Polemoniaceae	<i>Leptosiphon ambiguus</i>	Serpentine Linanthus
v p		Polemoniaceae	<i>Linanthus dichotomus ssp. meridianus</i>	Daytime Snow
v		Polemoniaceae	<i>Microsteris gracilis</i>	Slender Phlox
		Polemoniaceae	<i>Navarretia heterodoxa</i>	Calistoga Pincushion Plant
v		Polemoniaceae	<i>Navarretia mellita</i>	Honey-scented Pincushion Plant

## Mount Umunhum Flora

v p	Polygalaceae	<i>Polygala californica</i>	California Milkwort
v p	Polygonaceae	<i>Chorizanthe membranacea</i>	Pink Spineflower
v p	Polygonaceae	<i>Eriogonum luteolum</i> var. <i>luteolum</i>	Wicker Buckwheat
v p	Polygonaceae	<i>Eriogonum nudum</i> var. <i>auriculatum</i>	Nakedstem Buckwheat
v p	Polygonaceae	<i>Eriogonum saxatile</i>	Rock Buckwheat
v	e Polygonaceae	<i>Polygonum aviculare</i>	Knotweed
v	Polygonaceae	<i>Pterostegia drymarioides</i>	Fairy Mist
	e Polygonaceae	<i>Rumex acetosella</i>	Sheep Sorrel
v	Polypodiaceae	<i>Polypodium californicum</i>	California Polypody Fern
v	Primulaceae	<i>Primula hendersonii</i>	Henderson's Shooting Stars
	Pteridaceae	<i>Adiantum aleuticum</i>	Five-finger Fern
	Pteridaceae	<i>Adiantum jordanii</i>	Maidenhair Fern
v p	Pteridaceae	<i>Myriopteris intertexta</i>	Coast Lipfern
v	Pteridaceae	<i>Pellaea andromedifolia</i>	Coffee Fern
v	Pteridaceae	<i>Pellaea mucronata</i> var. <i>mucronata</i>	Birdfoot Fern
v	Pteridaceae	<i>Pentagramma triangularis</i> var. <i>triangularis</i>	Goldback Fern
v	Ranunculaceae	<i>Aquilegia formosa</i>	Columbine
v	Ranunculaceae	<i>Clematis lasiantha</i>	Chaparral Pipestem
v p	Ranunculaceae	<i>Delphinium nudicaule</i>	Red Larkspur
v p	Ranunculaceae	<i>Delphinium patens</i> ssp. <i>patens</i>	Woodland Larkspur
v	Ranunculaceae	<i>Ranunculus hebecarpus</i>	Slender Buttercup
v p	Ranunculaceae	<i>Ranunculus occidentalis</i> var. <i>occidentalis</i>	Western Buttercup
v	Rhamnaceae	<i>Ceanothus cuneatus</i> var. <i>cuneatus</i>	Buck Brush
v p	Rhamnaceae	<i>Ceanothus oliganthus</i> var. <i>sorediatus</i>	Jim Brush
v p	Rhamnaceae	<i>Ceanothus papillosus</i>	Wartleaf Ceanothus
v	Rhamnaceae	<i>Frangula californica</i> var. <i>tomentella</i>	California Coffeeberry
v p	Rhamnaceae	<i>Rhamnus ilicifolia</i>	Hollyleaf Redberry
v	Rosaceae	<i>Adenostoma fasciculatum</i>	Chamise
	Rosaceae	<i>Aphanes occidentalis</i>	Western Ladies Mantle
v p	Rosaceae	<i>Cercocarpus betuloides</i>	Mountain Mahogany
v p	Rosaceae	<i>Drymocallis glandulosa</i> var. <i>glandulosa</i>	Cinqfoil
	Rosaceae	<i>Heteromeles arbutifolia</i>	Christmasberry / Toyon
v p	Rosaceae	<i>Holodiscus discolor</i>	Cream Bush
	Rosaceae	<i>Oemleria cerasiformis</i>	Oso Berry
v p	Rosaceae	<i>Prunus ilicifolia</i>	Hollyleaf Cherry
v	Rosaceae	<i>Rosa californica</i>	California Rose
v p	Rosaceae	<i>Rosa spithamea</i>	Ground Rose
	Rosaceae	<i>Rubus ursinus</i>	California Blackberry
	Rubiaceae	<i>Galium aparine</i>	Goosegrass
v	Rubiaceae	<i>Galium californicum</i>	California Bedstraw
v	e Rubiaceae	<i>Galium parisiense</i>	Wall Bedstraw
v	Rubiaceae	<i>Galium porrigens</i>	Climbing Bedstraw
v p	Ruscaceae	<i>Maianthemum racemosum</i>	Feathery False Solomon's Seal
	Ruscaceae	<i>Maianthemum stellatum</i>	Starry False Solomon's Seal
	e Salicaceae	<i>Populus nigra</i>	Poplar (planted)
v	Salicaceae	<i>Salix lasiolepis</i>	Arroyo Willow
v	Sapindaceae	<i>Acer macrophyllum</i>	Bigleaf Maple

## Mount Umunhum Flora

	Sapindaceae	<i>Aesculus californica</i>	California Buckeye
v p	Saxifragaceae	<i>Heuchera micrantha var. micrantha</i>	Alum Root
v	Saxifragaceae	<i>Lithophragma affine</i>	Woodland Star
v	Saxifragaceae	<i>Lithophragma heterophyllum</i>	Hillside Star
v	Saxifragaceae	<i>Micranthes californica</i>	Saxifrage
v	Scrophulariaceae	<i>Scrophularia californica</i>	California Bee Plant
v p	Selaginellaceae	<i>Selaginella bigelovii</i>	Spikemoss
v p	Solanaceae	<i>Solanum umbelliferum</i>	Blue Witch
v p	Taxaceae	<i>Torreya californica</i>	California Nutmeg
	Themidaceae	<i>Brodiaea elegans</i>	Harvest Brodiaea
v	Themidaceae	<i>Dichelostemma capitatum ssp. capitatum</i>	Blue Dicks
v	Themidaceae	<i>Triteleia laxa</i>	Ithuriel's Spear
	Urticaceae	<i>Hesperocnide tenella</i>	Western Nettle
v p	Valerianaceae	<i>Plectritis macrocera</i>	White Sea Blush
v p	Violaceae	<i>Viola ocellata</i>	Western Heart's Ease
v p	Violaceae	<i>Viola purpurea ssp. quercetorum</i>	Oak Violet
v p	Viscaceae	<i>Arceuthobium campylopodum</i>	Golden Mistletoe
v p	Woodsiaceae	<i>Cystopteris fragilis</i>	Brittle Fern

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# Mt. Umunhum Vegetation Restoration Plan



LECH NAUMOVICH, VIC CLAASSEN & RESTORATION DESIGN GROUP  
December 1, 2016

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## Executive Summary

The Mt. Umunhum Restoration Vegetation Plan is intended to help guide the process of restoring ecologically appropriate vegetation to the summit of Mt. Umunhum. This plan provides site background, constraints analysis and recommendations for planting areas and densities that will meet a set of ecological restoration goals, while also aligning with aesthetic and recreation goals. Upon the completion of the two-phase planting recommendations, the document recommends qualitative and quantitative monitoring methods to ensure that the promulgated goals are met. This document also provides guidance with regard to plant pathogens.

# 1 INTRODUCTION

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## 1.1 BACKGROUND

Mount Umunhum is the fourth-highest peak in the Santa Cruz Mountains of California. The mountain is in Santa Clara County, southeast of Los Gatos and south of South San Jose. The summit of Mount Umunhum is the site of the former Almaden Air Force Station, an early-warning radar station built in 1957 that operated from 1958 to 1980. In constructing the Air Force Station, the U.S. Air Force leveled the summit and other nearby areas, built roads, and constructed nearly 80 structures.

In 1981, the Midpeninsula Regional Open Space District (MROSD) acquired the property and included it within the Sierra Azul Open Space Preserve. In 2009, MROSD received federal funding to clean up the site and subsequently removed all structures except the 80-foot tall support for the radar sail near the summit known as the Tower. In 2015, MROSD initiated regrading of the summit to return it to a more natural condition. In 2016, MROSD will continue the regrading while improving public access facilities (e.g., parking, trails, ADA access, and staircases) to accommodate visitors when the site opens to the public.

This revegetation plan for the summit of Mount Umunhum has been developed in conjunction with MROSD's summit grading and soil amendments that will be completed by Spring 2017. Plants and seeds for revegetation will be provided by Acterra Native Plant Nursery. This document provides a revegetation plan for the summit that directs the installation of Acterra's plants, establishes performance criteria, outlines a monitoring plan, and recommends adaptive management approaches in response to monitoring results.

## 1.2 REVEGETATION GOALS

The general goal of the summit revegetation is to install appropriate native plants, via direct seeding and container plant installation, onto the summit with the intent that they will eventually self-propagate and spread throughout the summit with minimal management. More specifically, the main goals of the revegetation are to:

- Re-establish appropriate native vegetation on the summit from locally appropriate and available materials so that the revegetated summit will start to be indistinguishable from surrounding vegetation after a period of approximately 10 years.
- Restore summit vegetation so that it becomes naturally recruiting and reproducing with minimal annual input from stewardship actions.
- Installed plants in Phase 1 and 2 should meet a 60% survival performance criterion within 3-years of the initial installation. In Year 5, survival shall not be lower than 80%. Installed plants should also be a minimum of 20% absolute cover in the restoration areas after 5 years.

Achieving these goals will require an initial investment of time associated with planning, propagate and plant material collection, growing the plants, and replanting following by regular maintenance and monitoring. To achieve these goals, MROSD intends to:

- Successfully install all the plants provided by the nursery in the defined planting areas and replace failed plants.

- Directly sow collected seed into the soil in delineated seeding sites. Determine which plants establish successfully from seed. In subsequent years, collect seed from a suite of established plants and continue direct seeding of bare areas with appropriate soils.
- Record and assess survivorship based on site, aspect and species planted. Use survivorship information to prioritize nursery recommendations for the following year.

### 1.3 SUCCESS CRITERIA

Establishing success criteria is essential for reviewing the success of a given project. This restoration plan recommends the use of both qualitative photopoints and quantitative measurements to ensure that vegetation is establishing as anticipated. Since few mountaintop restoration projects of this magnitude have occurred in the Bay Area, this plan attempts to provide reasonable success criteria based on professional opinion. Success criteria are presented and discussed in detail in Section 5.

### 1.4 IMPLEMENTATION PHASING

Revegetation for this project is divided into two initial stages: Phase 1, to be completed in Year 1 (Oct 2016-Sept 2017) and Phase 2, to be completed in Year 2 (Oct 2017-Sept 2018). Phase 1 is will install plants and directly sow seed into priority areas defined by the Restoration Design Group (project landscape architects) and MROSD staff. Phase 2 will ensure that Phase 1 areas are established and replanted as needed in those areas, and then expand into new Phase 2 areas. Implementation phasing is further discussed in Section 3.

### 1.5 PROJECT EXPECTATIONS AND LIMITATIONS

Re-establishing plants on a summit with highly altered soils will be difficult. This plan is attempting to use all known and reasonable methods to increase plant establishment on site. Successful plant establishment will require proper timing of installation (cooler, wet season), proper microsite selection, local soil amendment, proper watering and weeding. Even with successful installation and maintenance, we expect that mortality will occur. With this expectation, monitoring will be critical to determine what species are favored by various microsite variables, by tracking which plants successfully establish in what location. This monitoring information will then be used to instruct Phase 2. Phase 1 is expected to have a learning curve which should be applied to Phase 2.

## 2 EXISTING CONDITIONS

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### 2.1 CLIMATE

The Santa Cruz Mountains climate is considered to be a “cool summer Mediterranean climate, characterized by low average summer temperatures.” (Thomas, 1961) Yearly average temperatures are approximately 56F (Thomas, 1961) in the Ben Lomond area, which is most similar to Mt. Umunhum. Average annual precipitation can vary from 15 to 60 inches in this area, with Mt. Umunhum usually on the higher end of this spectrum. Summer months often bring coastal fog that extend over Mt. Umunhum which may be advantageous for plant establishment. Fog drip is also known to provide significant precipitation to plants if plants are within the drip line of larger trees.

## 2.2 EXISTING SOIL TYPES ON ADJACENT SLOPES AND RECONSTRUCTED SUMMIT SUBSTRATES

A soil scientist, Vic Claassen, PhD, based in Davis CA, who specializes in evaluation and regeneration of drastically disturbed substrates, was involved with project planning and development. He visited the site numerous times, evaluated soils and excavated substrates and worked to integrate soil regeneration with other project activities. His findings are presented here below. Soil amendments and treatment recommends are included later in this plan.

Santa Clara County soil surveys mapped the original Mt Umunhum summit and the surrounding slopes as 'complexes' of soils, meaning a repeated combination of several different soils that are grouped into a single unit. The general characteristics of these various reference soils that are located around and adjacent to the summit are summarized in Table 1. The following narrative describes the various characteristics that support vegetation cover under local climatic conditions.

In general, the current growth environment of the summit project is intermediate between the existing north-facing and south-facing slopes. Temperatures and evapotranspiration rates are also expected to be intermediate. Therefore, the substrate to be used for planting on the summit is designed to be intermediate between the described characteristics of the surrounding soils.



Table 1. Summary of basic soil conditions of mapped soil series from around the Mt Umunhum summit.

Soil	Elsman	Maymen	Sanikara	Mouser	Katykat
<b>geological parent material</b>	sandstone shale	shale schist greenstone sandstone	sandstone greenstone	sandstone mudstone greenstone	sandstone mudstone
<b>texture: surface subsurf</b>	sandy loam sand clay loam	sand clay loam sand clay loam	sandy loam sandy loam	loam	loam clay loam
<b>structure surf subsurf</b>	SBK to granular SBK	SBK massive	SBK to gran SBK	granular SBK	SBK to granular massive
<b>horizonation</b>	O /A /Bw /Bt	A /Bw / Cr	O / A / R	O /A /Bt / Cr	O /A /Bt / BCt
<b>coarse fragment</b>	very gravelly	gravelly	very gravelly	gravelly	paragravelly
<b>soil pH</b>	5.6 to 6.5	5.3 to 5.5	6.6 to 6.8	5.7 to 6.3	5.7 to 6.7
<b>rooting depth</b>	66 inches	10 inches	12 inches	51 inches	50 inches

Key to abbreviations: \*texture modifier: for 15-35% rocks add 'gravelly or stony' texture; 35 to 60% add 'very gravelly or stony' texture; > 60 % add 'extremely' gravelly or stony texture; SBK is sub angular blocky structure.

Geological parent materials of all soils are generally from the same source. These are seafloor sediments that are fractured and lofted to this summit position. The soils with the deepest rooting depths are those with shale or mudstone included in the geological strata. These rocks are weaker and weather more easily than the hard dense quartz-sourced rocks like sandstone or the heated and metamorphosed schists. The hardest stones and cobbles found in the summit substrates are dense sandstones. The fine soil fraction materials are a mix of all rocks, but probably contain more material weathered from the softer rock types. The sand and gravel sized materials are probably derived from the harder sandstones and metamorphosed minerals that persist.

The texture of the fine soil material (< 2 mm fraction) is similar for all soils and project substrates, ranging from sandy loam to loams to clay loams. The samples collected from the summit materials during construction during had clay contents ranging from 10 to 31 % with an average of 17 %. The average texture of all sampled materials is 68 % sand, 15 % silt and 17 % clay, which is classified as a sandy loam texture. This suggests that the fine soil fractions of the substrates are a viable growth media on the summit as they are on the existing slopes. The high rock content, however, is an issue for the summit substrates and appears to be higher than on many mapped slope soils.

The soil aggregate structure (subangular blocky (SBK) or granular or uniformly packed and non-structured (massive) are indicators of growth conditions on the slope soils but these characteristics would be destroyed during excavation and grading.

Soil horizonation is also mixed during excavation. Organic enriched A horizons, clay enriched B horizons and decomposed rock Cr horizon and the growth influences they generate are all disintegrated and blended, either by historic or current excavation activity.

Coarse fragment content in all soils is greater than 15 % gravels and some are greater than 35 %. These gravels displace fine soil materials that hold moisture, lowering the moisture retaining capacity of the profile as a whole. Materials exposed after initial landscape grading at the summit were about 50% rocks

greater than 3 inches (cobble and stone sized). This decreases the moisture retention by half. But during non-saturating rains it also delivers moisture more deeply and encourages plants to root more deeply as well. If the substrates are supported by rock-to-rock contact (i.e. clast-supported) rather than resting on compacted fine soil materials (i.e. matrix-supported), the potential for compaction may be reduced.

Soil acidity (pH) ranges from 5.6 to 6.8, which is typical for similar soils and is not growth limiting. Substrates sampled through the project had a similar range and averaged 6.3, which is ideal for plant growth.

Rooting depth appears to occur over a mixture of deep and shallow soils. Roots can spread many feet laterally to access moist substrates. Extensive fracturing of these geological materials suggests that rooting may be available beyond the mapped soil profiles.

In each of the soil mapping units on or around the summit area, about a third of the area is indicated to have a soil that has very deep rooting, ranging from 50 to 66 inches deep (Table 1). About two-thirds of each mapping unit has soils with shallow rooting from 10 to 12 inches deep. Since the summit is relatively flat compared to the steep north-facing or south-facing slopes, an adequate rooting depth for plant cover is also expected to be intermediate between the very deep and very shallow soil depths.

The reconstructed summit substrates have rocks mixed throughout the profile and in greater concentrations than indicated on the mapped soils. Therefore, several steps should be taken to ensure adequate rooting. One approach is to have wider plant to plant spacing to allow adequate rooting volume since rooting is less deep. Another strategy is to selectively remove rock from the local planting area or “planting pocket” to facilitate initial plant establishment.

Because of the heterogeneity of substrate conditions following land-forming work at the summit, rock content must be determined on the final grade surface and substrates for each planting area. Three potential rooting issues may occur that would make these substrates less able to support plant growth than the reference soils on the slopes:

1) Open void spaces between rocks in the near-surface substrates:

Some substrates are clast-supported (rock to rock contact) and may have pore space or voids between the rocks that are not filled. Roots perceive these voids as very dry and un-rootable compared to the adjacent soils. Larger void spaces must be filled with fine soil material.

2) Filled and compacted substrate materials in the spaces between rocks:

When the space between the rocks in clast-supported substrates is filled with soil material, the soil should not be compacted. This condition slows infiltration, retains moisture nearer to saturation and prevents aeration and root growth.

3) Compacted fine substrates in non-rocky substrates:

In areas with low rock content the soil matrix itself carries the weight of soil, water and surface traffic. These matrix-supported substrates may become compacted and should receive a final mechanical decompaction treatment but no rock removal is needed.

Because the high rock content and the variable status of the rooting substrates is potentially limiting for infiltration and revegetation, a modified planting method is recommended that combines cursory evaluation of local substrate conditions and decompaction or rock removal. It also integrates incorporation of organics and creation of a small planting hole at the same time, to fully prepare the site

for the planting crew. Most of these substrates are so rocky that they are practically unworkable by hand labor and tools. These recommendations are described below and also in Section 3.5.3. Plant Installation into Soil.



Figure 1: Detail photograph of soils on summit. Note the occurrence of small spaces between gravels and roots extending several feet into the soil (arrows)



Figure 2. As the vegetated edge of the summit is pulled back, the existing root channels and soil structure is mixed. Existing root channels and drainage pores are destroyed. Mixing of coarse wood materials and care to not re-compact the substrates are the primary treatments to regenerate pore space for root growth and drainage.



Figure 3. Existing or regraded areas of excavated soils have various dense subsoil layers or are compacted. A final re-excavation, mixing of coarse organics, and replacement without compaction are basic treatments to regenerate infiltration and allow root growth to re-enter these substrate volumes.

### 2.2.1 Soil Fertility Analysis for Plant Growth

A total of 20 soil samples were collected during the planning and pre-construction phases of the project (Appendix 7.5). These were evaluated for soil fertility and interpreted for wildlands planting conditions. Substrates varied greatly from sample to sample. But, in general, fertility levels in these substrates are not limiting to growth of wildlands plants. Because of their low organic content and because of disturbance from excavation, they are expected to be susceptible to compaction and are expected to be droughty in late summer. The general fertility from organic amendments is expected to provide basic, modest fertility for plant establishment. A critical emphasis is placed on treatments that regenerate rooting volume to allow plants to acquire moisture in the droughty late summer season, as discussed in the previous section.

## 2.3 VEGETATION TYPES

Undisturbed vegetation downslope of the active restoration site is being used as a reference for what we expect to establish on the summit. This section will provide a brief description of adjacent vegetation types that will serve as references for the restoration goals.

Due to differences in wind exposure, hydrology, and different soils, the downslope vegetation can differ from what is expected on an undisturbed summit. Since the scope of our surveys extends only 100-200 feet from the summit, we expect the reference systems to present a similar community of plants and vegetation stands as the summit prior to the development and grading of the site by the Air Force. A preliminary list of plants considered appropriate for restoration (from 9/10/2014) was compiled by Deanna Giuliano and can be used to present a more detailed snapshot of the vegetation present near the summit (Appendix 7.3).

The south facing slopes (Figure 4) are particularly applicable of our project goals. Vegetation on these slopes are characterized by patchiness, bare ground and rocky, exposed soils; this is the natural

vegetation of a mountain summit. The vegetation on these slopes is dominated by 4-8 foot tall shrubs primarily consisting of: mountain mahogany (*Cercocarpus betuloides*), chamise (*Adenostoma fasciculatum*), redberry (*Rhamnus crocea*), coyote brush (*Baccharis pilularis*), and black sage (*Salvia melifera*). There is a diverse mix of subshrubs present (1-4 foot tall) as well, including: golden fleece (*Ericameria arborescens*), yerba santa (*Eriodictyon californicum*), red rock penstemmon (*Keckiella cormybos*), and many others. A few larger foothill pines (*Pinus sabiniana*) occur in groves scattered across this exposure. Annuals (such as *Clarkia* spp., *Chaenactis glabriuscula*, *Madia* spp. and *Trifloium* spp.), bulbs (such as soap plant (*Chlorogalum pomeridanum*) and blue dicks (*Dichelostemma capitatum*)), and perennial grasses (blue wild rye (*Elymus glaucus*) and one-sided bluegrass (*Poa secunda*) are a notable portion of this vegetation.

Mosses and lichens are an important aspect of this system often occurring on rocks and bare soils. Two rapid assessments were completed on site in February 2015, in order to provide information on existing vegetation, planting density and composition. One assessment site was located near the West Summit and a second assessment was conducted on the southern slopes near the West Summit. Notable results from these two rapid assessments of reference areas is that bare ground, including rock, was visually estimated to be approximately 45% (West Summit) and 70% (East Summit Area) of the absolute cover. Planting recommendations were derived from what was observed at these two reference sites near the summit.



Figure 4: South facing slope just below the re-contoured East Summit Area. This vegetation community is serving as a reference and restoration target for much of the summit restoration. Note plant locations along cracks and fissures. These locations may lead roots to deeper, late-season soil moisture or may allow subsurface moisture during rains to seep from up-slope locations to the plant roots.

North facing slopes are characterized as a diverse bay-oak woodland vegetation dominated by mature trees such as coast live oak (*Quercus agrifolia*), bay trees (*Umbellularia californica*), canyon live oak (*Quercus chrysolepis*) and California buckeyes (*Aesculus californica*) which create large expanses of closed canopy forest. The shrub layer fills in the majority of the openings in the forest canopy. Dominant shrubs include leather oak (*Quercus durata*), holly-leaf cherry (*Prunus ilicifolia*), wavy leaf ceanothus (*Ceanothus papillosus*), coast silktassel (*Garrya elliptica*). There are a few bare, rocky areas which hold a

unique assemblage of plants including red rock penstemon, various *Clarkia* species, rock sanicle (*Sanicula saxatilis*), rock buckwheat (*Eriogonum confertiflorum*) and a diversity of other annuals, bulbs, and unique perennials. This vegetation occurs directly north of the restoration site and represents a later seral stage than is expected on the restoration site for some years. It is possible that in the long term (20-50 years) the existing woodland will extend up toward the restoration site.

## 2.4 SITE LANDFORM RESTORATION AND SOIL AMENDMENT

As described above, the site has been highly modified over the course of the past 80 years. The restoration of the summit was initiated in 2015, and at the date of this document, restoration of the site topography is well underway. MROSD staff began rough grading at the summit in the fall of 2015 summit (Figure 5) with available on-site material. Throughout the summit area, side cast materials on the sides of the existing flattened top were pulled up to establish a naturalized summit topography. Soils were over-excavated, mixed and filled to establish a soil profile that will support plant growth: a mixed soil depth of 5 feet was targeted to promote deep root penetration.

The following soil amendment prescription has been recommended by Vic Claassen, Ph.D. and is expected to be completed during the construction phase, before the planting described in this document.

In order to regenerate some portion of this growth potential on the final grade surface, the recommended treatment was to dig, decompact, and mix in coarse organic matter to 18 inches depth at coarse, 1 – 2 foot intervals across the planting area. It is assumed that the underlying substrates below 18 inches are not extensively compacted which can restrict downward root growth.

Because of the great variability of rock content, compaction, grade and landscape position across the site, more detailed specifications were not made for particular locations or plant types. Rather, a general treatment was recommended to remediate growth limitations resulting from construction activities. Going forward, more specific substrate treatments can be made on a case-by-case basis for specific plantings in specific substrate locations. Details of these compensatory treatments will need to be made based on the resulting as-built conditions and the vegetative plantings designed for each location.



Figure 5: Before and after photos of re-contoured east summit area after rough grading and structure removal. Grading will be refined in 2016-2017.

## 2.5 CONSTRAINTS TO REVEGETATION SUCCESS

The most difficult ecological component to restore on this project site is related to soil structure and soil microbiota. In particular, the soils of this site have been greatly altered by grading and mixing, which has completely destroyed the native soil and its physical properties. Soils are notably important in areas

with nutrient limitations, such as mountain summits. In addition, semi-angular crust was observed on site in 2015, which will increase runoff and decrease water infiltration. Soil amendments have been used to reduce crust formation.

Soil pathogens also pose a threat to restoration. *Phytophthora* species have been identified to be both in the vicinity of the project area and known to be in nursery stock. This pathogen is known to infect over 100 different host plants, ultimately causing a high degree of plant mortality in infected areas. Understanding about this genus of pathogens is rapidly developing. Seed collection, nursery growing conditions and outplanting all need to consider the risk of spreading this pathogen. For instance, plant cuttings that were collected in 2015 tested positive for *Phytophthora* in 2016. These plants were removed from the project stock. With added vigilance and sensitivity around this pathogen, historic plant propagation methods have been dramatically altered. We anticipate a greater effort will be required to grow fewer plants.

Environmental variability is likely the most important factor to weigh on restoration success. Given the stretch of drought, likely El Nino precipitation and hot summers, container plants and seedlings will likely have a more difficult time establishing.

## 3 REVEGETATION PLAN

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### 3.1 GENERAL CONSIDERATIONS

The revegetation plan for this site includes 3 distinct methods of revegetation:

- Container planting
- Direct seeding
- Natural recruitment

Each of these methods is anticipated to play a critical role in establishing the target vegetation onsite. In this portion of the document, the container plantings (out-planting) and direct seeding strategy are presented. Natural recruitment will naturally follow if the out-planted and seeded plants establish and reproduce successfully. After 5 years, it is anticipated that natural recruitment will start to be a visible mechanism by which the site continues to mature and restore as native mountain-top vegetation.

As stated in the Section 1.2, the main revegetation goals for this project are as follows:

- Re-establish appropriate native vegetation on the summit from locally appropriate and available materials so that the revegetated summit will start to be indistinguishable from surrounding vegetation after a period of approximately 10 years.
- Restore summit vegetation so that it becomes naturally recruiting and reproducing with minimal annual input from stewardship actions.
- Installed plants in Phase 1 and 2 should meet a 60% survival performance criterion within 3-years of the initial installation. In Year 5, survival shall not be lower than 80%. Installed plants should also be a minimum of 20% absolute cover in the restoration areas after 5 years.

### 3.2 SPECIES SELECTION AND PLANT PROPAGATION

To determine an appropriate species palette for direct seeding and container plant installation, a series of field surveys of nearby reference sites were conducted by the revegetation team in 2014 and 2015. Direct-seeded species selection focused on identifying early successional, often annual or short-lived

species which colonize disturbed, bare ground. Reference sites for this suite of species included recently-graded areas along Mt Umunhum Road and the new Summit Trail, as well as two recently-burned sites near Loma Prieta. The Loma Prieta sites were particularly informative due to the similar elevation, slope, and aspect, and close proximity to, the restoration site. The sites were heavily disturbed by the Loma Fire of 2009, and more recent disturbance was evident along power-line corridors.

Container plant species selection was based on numerous reconnaissance-level surveys of undisturbed habitat in the Mt Umunhum vicinity, and focused on identifying the dominant species of the mature mixed evergreen forest, oak woodland, and chaparral in the region. A comprehensive species list of the summit area (Hickman and Rawlings 2016) was also consulted.

Following compilation of an initial species list (Appendix 7.3), which was expanded to include traditional or medicinal use of each species, the revegetation team met with representatives from the Amah Mutsun Tribal Band, including the Tribal Ecologist, to gather input on specific ceremonial or management requests. Feedback received at this meeting confirmed the general goals to use local, native species that provide habitat for wildlife. Individual species were not identified beyond those already listed for revegetation.

The container plant species list was then refined to identify “core” plants, locally-dominant species known for ease of propagation and transplanting, as well as hardiness and aesthetic qualities. These core plants are targeted to be the dominant constituents of the Summit plant community and include deer weed (*Acmispon glaber* var. *glaber*), California fuchsia (*Epilobium canum*), golden yarrow (*Eriophyllum confertiflorum*), silver bush lupine (*Lupinus albifrons* var. *albifrons*), foothill penstemon (*Penstemon heterophyllus*), coyote mint (*Mondardella villosa*), and imbricate phacelia (*Phacelia imbricata*).

Plant propagation was completed by Deanna Giuliano and the staff and volunteers of Acterra Nursery. The nursery has adopted strict standards for limiting plant pathogen spread (Appendix 7.2) which include best management practices around seed collection, plant growing areas and various other propagation and cultural practices. In addition, annual plant seed was collected and will be used in order to attempt to grow annual seed in the nursery. The nursery has since been updated with a new, sterile growing area that follows best management practices for the control of plant pathogens such as *Phytophthora*.



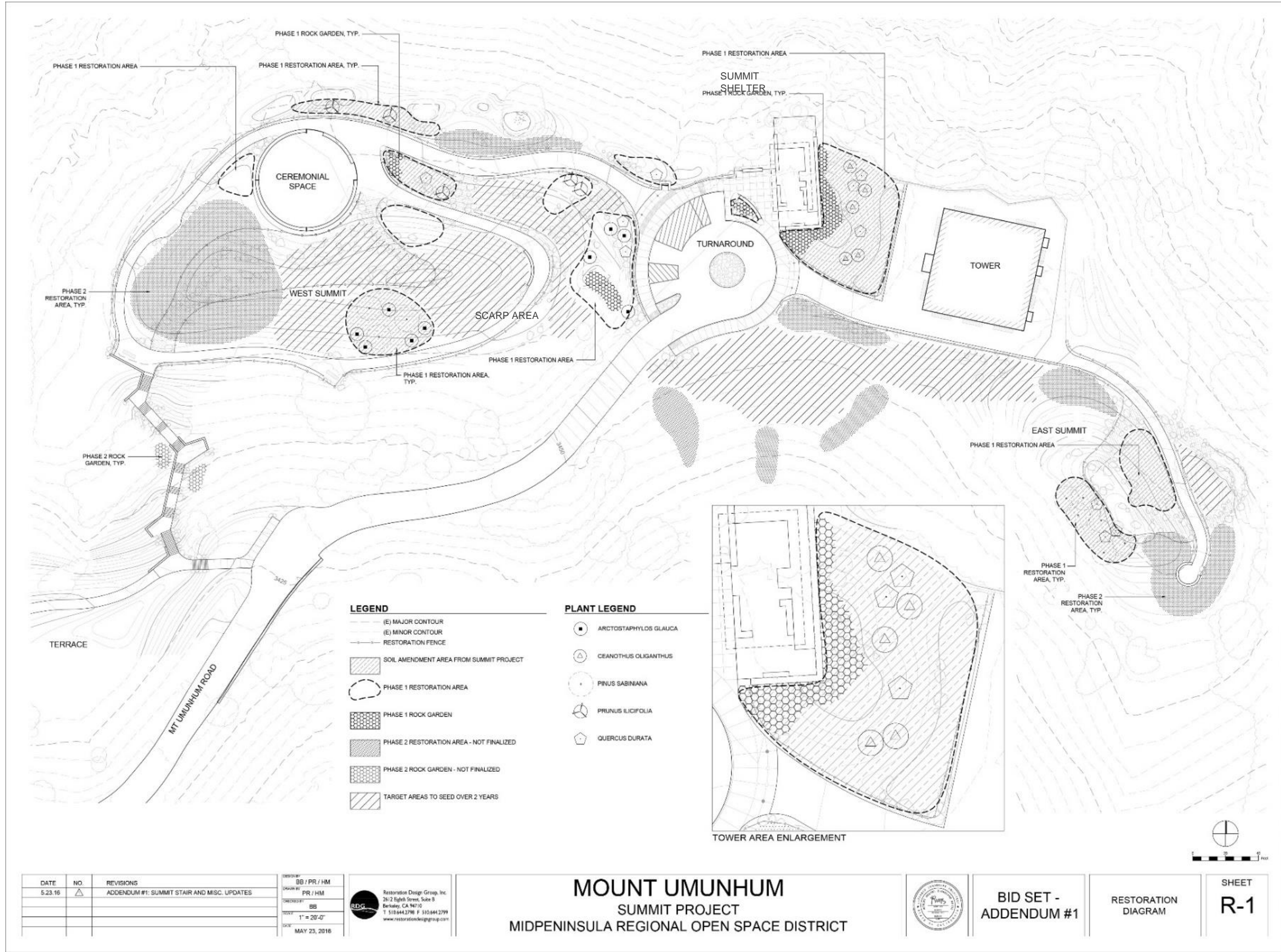
### 3.3 PLANTING PLAN

The planting plan presented includes several elements designed to increase the project's success. Additionally, the plan incorporates several redundancy measures to ensure vegetation establishes in important Phase 1 areas. Nutrient and microbial soils amendments, planting palette, a high density planting layout, direct seeding, phasing and monitoring will all help ensure goals for this project are met. The overall planting diagram is presented in Figure 6.

A total area of approximately 13,000 ft<sup>2</sup> will be planted with container plants in Phase 1. Phase 2 total planting area is highly dependent on the establishment of Phase 1 plants, but it is anticipated that another 5-10,000 ft<sup>2</sup> will likely be planted with container stock in Phase 2.

Total seeded area is anticipated to be on the order to 5,000 ft<sup>2</sup> per year. The actual area seeded will be subject to seed availability, notably the seed collected and propagated by the nursery. We anticipate this number will be highly variable dependent upon environmental factors such as climate and precipitation in any given year.

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DATE	NO.	REVISIONS
5-23-16	△	ADDENDUM #1: SUMMIT STAIR AND MISC. UPDATES

PREPARED BY: BB / PR / HM  
 DRAWN BY: PR / HM  
 CHECKED BY: BB  
 SCALE: 1" = 20'-0"  
 DATE: MAY 23, 2016



**MOUNT UMUNHUM**  
**SUMMIT PROJECT**  
 MIDPENINSULA REGIONAL OPEN SPACE DISTRICT



**BID SET -**  
**ADDENDUM #1**

RESTORATION  
 DIAGRAM

SHEET  
**R-1**

MIDPENINSULA REGIONAL OPEN SPACE DISTRICT: BID SET - ADDENDUM #1 - PROJECT/SUMMIT UMUNHUM FINAL DESIGN AUTOCADWORKING DRAWINGS REVISED DURING 5/11/2016  
 PLOTTED ON 5/19/2016

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Planting areas have been divided into two phases: Phase 1 planting to be completed in fall-winter of 2016-2017 and Phase 2 to be completed in fall-winter of 2017-2018. *This phasing is subject to change based on the Summit Project construction schedule and staffing availability.* The total area to be planted was planned based on anticipated plant availability from Acterra Nursery.

Phase 1 planting areas are typically considered to be higher priority and should receive attention before Phase 2 areas. Planting areas have been selected based on a number of factors including, but not limited to:

- Potential for restoration and plant establishment, which is derived from a combination of factors including:
  - a. north facing (cooler, wetter) slopes,
  - b. areas adjacent to standing native vegetation which may provide incidental propagules,
  - c. anticipated soil fertility for plant growth
- Ability to steward and maintain areas – areas with easy access for staff and volunteers where slopes not too steep, nor eroding
- User visibility and aesthetics – locations where park users will congregate and observe vegetation
- Areas where vegetation will interact with interpretative information – locations such as rock gardens in the Tower area may help with the interpretation of the site by users

Planting priorities were established after discussion with the project team. **The sites are presented in order of importance for Phase I planting.** If plants are missing, or haven't been grown for Phase I, they should first be removed from the lower priority areas. Those plants will then be inserted into the appropriate area in Phase II.

Tables include two calculations to allow for understanding the plant density in each planting area. The first figure states the overall density of plants, which tend to be from 9 to 10 ft<sup>2</sup> per plant. The second number “clustered spacing” assumes that plants will be in clusters, rather than regularly distributed on site. Therefore, if one assumes on average 30% of the site will be in a clustered planting area, plant density increases to an average of 2.7 to about 3.2 ft<sup>2</sup> per plant, or roughly the area of a medium sized cooler. If adjustments are needed on site, this calculation allows one to move plants from one denser planting area to another which may need more plants.

### 3.3.1 Tower Area

The Tower Area is a 4,000 square foot area located between the Tower and the Summit Shelter and Turnaround. This area will likely be the most visited revegetation area since the trail to the East Summit, the Tower, and interpretative displays all converge near this area. This area will receive the highest number of plants (326) and relatively high density of plants (average of one plant per 10.7 ft<sup>2</sup>). In addition, the Tower Area will be the site of a storm water swale which will have specific vegetation cover requirements outlined in the final engineering documents.

Table 2: Tower Area Planting Plan

Scientific Name	Common name	Quantity
<b>TREES</b>		
Ceanothus oliganthus	Hairy Ceanothus	5
Quercus durata (*may be planted by acorn)	Leather Oak	3
<b>TOTALS</b>		<b>8</b>
<b>SHRUBS</b>		
Artemisia californica	California Sagebrush	5
Keckiella corymbosa	Red Rock Penstemon	20
<b>TOTALS</b>		<b>25</b>
<b>PERENNIALS</b>		
Acmispon glaber var. glaber	Deerweed	3
Dudleya cymosa	Canyon Dudleya	20
Epilium canum	California Fuchsia	20
Eriogonum saxatile	Rock Eriogonum	20
Eriophyllum confertiflorum	Golden Yarrow	20
Lomatium dasycarpum	Biscuit root	40
Lupinus albifrons var. albifrons	Silver Bush Lupine	5
Penstemon heterophyllus	Foothill Penstemon	40
Monardella villosa	Coyote Mint	40
Phacelia imbricata	Imbricate Phacelia	30
<b>TOTALS</b>		<b>238</b>
<b>GRASSES</b>		
Koeleria macrantha	Junegrass	40
Melica californica	California Melic	15
<b>TOTALS</b>		<b>55</b>
<b>SITE TOTAL</b>		<b>326</b>
<b>Spacing (sf per plant)</b>		<b>10.7</b>
<b>Clustered Spacing at 30% (sf per plant)</b>		<b>3.2</b>

### 3.3.2 West Summit

The West Summit is a 1,665 square foot area that faces south between the Ceremonial Space, a loop trail, and the entry to the Summit Stair. This area will include the expansion of a grove of pine trees as well as other well-suited perennial vegetation that may break up the rocky, barren appearance of this summit while not obscuring views. This area will receive the second densest spacing (1 plant per 9.2 ft<sup>2</sup>) in order to allow for small, dense clusters of vegetation to establish on this exposed summit. We expect plants in this area may have a difficult time establishing due to the exposure and highly graded nature of the soils.

Table 3: West Summit Planting Plan

Scientific Name	Common name	Quantity
<b>TREES</b>		
Arctostaphylos glauca	Manzanita	5
Pinus sabiniana	Grey Pine	3
<b>TOTALS</b>		<b>8</b>
<b>SHRUBS</b>		
Keckiella corymbosa	Red Rock Penstemon	10
<b>TOTALS</b>		<b>10</b>
<b>PERENNIALS</b>		
Epilobium canum	California Fuchsia	20
Eriogonum saxatile	Rock Eriogonum	15
Eriophyllum confertiflorum	Golden Yarrow	20
Lupinus albifrons var. albifrons	Silver Bush Lupine	6
Penstemon heterophyllus	Foothill Penstemon	20
Monardella villosa	Coyote Mint	40
Phacelia imbricata	Imbricate Phacelia	10
<b>TOTALS</b>		<b>131</b>
<b>GRASSES</b>		
Melica californica	California Melic	30
<b>TOTALS</b>		<b>30</b>
<b>SITE TOTAL</b>		<b>179</b>
<b>Spacing (sf per plant)</b>		<b>9.2</b>
<b>Clustered Spacing at 30% (sf per plant)</b>		<b>2.7</b>



### 3.3.3 Ceremonial Space

This 2,540 square foot area will be near the site of Native American (Amah Mutsun) and other group ceremonies. This area will be vegetated with appropriate summit vegetation and include rock garden features. This area will highlight vegetation around trails and paths allowing for users to enjoy the summit and its views without tall vegetation being planted in view-sheds. Due to the inherently small plants used in rock gardens and around the ceremonial space, this location will have the highest density of plants (1 per 9 ft<sup>2</sup>).

Table 4: Ceremonial Space Planting Plan

Scientific Name	Common name	Quantity
<b>TREES</b>		
<i>Arctostaphylos glauca</i>	Manzanita	4
<i>Prunus ilicifolia</i>	Holly Leaf Cherry	4
<i>Quercus durata</i> (*may be planted by acorn)	Leather Oak	1
<b>TOTALS</b>		<b>9</b>
<b>SHRUBS</b>		
<i>Artemisia californica</i>	California Sagebrush	4
<b>TOTALS</b>		<b>4</b>
<b>PERENNIALS</b>		
<i>Dudleya cymosa</i>	Dudleya	5
<i>Epilium canum</i>	California Fuchsia	13
<i>Eriogonum saxatile</i>	Rock Eriogonum	15
<i>Eriophyllum confertiflorum</i>	Golden Yarrow	15
<i>Lomatium dasycarpum</i>	Biscuit root	20
<i>Penstemon heterophyllus</i>	Foothill Penstemon	15
<i>Monardella villosa</i>	Coyote Mint	30
<i>Phacelia imbricata</i>	Imbricate Phacelia	20
<b>TOTALS</b>		<b>133</b>
<b>GRASSES</b>		
<i>Poa secunda</i>	Junegrass	30
<b>TOTALS</b>		<b>30</b>
<b>SITE TOTAL</b>		
<b>Spacing (sf per plant)</b>		<b>9.0</b>
<b>Clustered Spacing at 30% (sf per plant)</b>		<b>2.7</b>

### 3.3.4 East Summit

The East Summit provides one of the best views from Mt. Umunhum. This 2,420 square foot site will be restored to vegetation that will blend with plants downslope. Much of this site is rocky and hot and will support a stand of pines near the summit to provide a shade opportunity. This area is listed as the fourth priority because it is physically separate from the other areas and can be easily signed with a “restoration coming soon sign” while minimally impacting the user experience and effort occurring near the tower and West Summit.

Table 5: East Summit Planting Plan

Scientific Name	Common name	Quantity
<b>TREES</b>		
<i>Pinus sabiniana</i>	Grey Pine	7
<i>Quercus durata</i> (*may be planted by acorn)	Leather Oak	3
<b>TOTALS</b>		<b>10</b>
<b>SHRUBS</b>		
<i>Artemisia californica</i>	California Sagebrush	10
<i>Keckiella corymbosa</i>	Red Rock Penstemon	10
<b>TOTALS</b>		<b>20</b>
<b>PERENNIALS</b>		
<i>Acmispon glaber</i> var. <i>glaber</i>	Deerweed	11
<i>Epilium canum</i>	California Fuchsia	20
<i>Eriogonum saxatile</i>	Rock Eriogonum	15
<i>Eriophyllum confertiflorum</i>	Golden Yarrow	20
<i>Monardella villosa</i>	Coyote Mint	40
<i>Phacelia imbricata</i>	Imbricate Phacelia	10
<b>TOTALS</b>		<b>116</b>
<b>GRASSES</b>		
<i>Poa secunda</i>	Junegrass	20
<i>Melica californica</i>	California Melic	30
<b>TOTALS</b>		<b>50</b>
<b>SITE TOTAL</b>		
<b>Spacing (sf per plant)</b>		<b>10.20</b>
<b>Clustered Spacing at 30% (sf per plant)</b>		<b>3.06</b>

### 3.3.5 Scarp Area

The 2,840 square foot Scarp Area is a previous road cut that has been regraded and now slowly ascends upwards towards the West Summit. This area is unique because as it was re-graded exposing two large boulders which can serve as native landscaping features. These boulders will serve as an anchor for the restoration plantings. This area is selected as the lowest priority because it is a steep slope which is exposed and not expected to be a location where visitors might expect to see plants establishing. Additionally, the exposed boulders alone provide a unique view of the bedrock geology.

Table 6: Scarp Area Planting Plan

Scientific Name	Common name	Quantity
<b>TREES</b>		
<i>Prunus ilicifolia</i>	Holly Leaf Cherry	2
<i>Quercus durata</i> (*may be planted by acorn)	Leather Oak	3
<b>TOTALS</b>		<b>5</b>
<b>SHRUBS</b>		
<i>Artemisia californica</i>	California Sagebrush	15
<i>Keckiella corymbosa</i>	Red Rock Penstemon	25
<b>TOTALS</b>		<b>40</b>
<b>PERENNIALS</b>		
<i>Acmispon glaber</i> var. <i>glaber</i>	Deerweed	10
<i>Dudleya cymosa</i>	Dudleya	5
<i>Epilium canum</i>	California Fuchsia	25
<i>Eriophyllum confertiflorum</i>	Golden Yarrow	25
<i>Lomatium dasycarpum</i>	Biscuit root	40
<i>Lupinus albifrons</i> var. <i>albifrons</i>	Silver Bush Lupine	5
<i>Penstemon heterophyllus</i>	Foothill Penstemon	25
<i>Monardella villosa</i>	Coyote Mint	50
<i>Phacelia imbricata</i>	Imbricate Phacelia	20
<b>TOTALS</b>		<b>205</b>
<b>GRASSES</b>		
<i>Poa secunda</i>	Junegrass	20
<i>Melica californica</i>	California Melic	25
<b>TOTALS</b>		<b>45</b>
<b>SITE TOTAL</b>		<b>295</b>
<b>Spacing (sf per plant)</b>		<b>10.17</b>
<b>Clustered Spacing at 30% (sf per plant)</b>		<b>3.05</b>

### 3.3.6 Rock Garden detail: sub-areas

For planning ease, all rock garden sub-areas are included as part of three of the above five mentioned areas: Tower Area, Scarp, and Ceremonial Space. These special “sub-areas” are included here to highlight their importance in the restoration of appropriate summit vegetation.



Figure 7: Rock Garden detail plants including geophytes and other wildflowers.

Rock Gardens are an essential part of vegetation typically found on summits in the Santa Cruz Mountains. These areas are typified by lots of bare ground, large rocks, and distinct microsites where plants grow and thrive. These often diminutive plants produce beautiful flowers and deserve more attention (Figure 7). Plant species closely associated with rocks found near the

Mt. Umunhum summit include: canyon dudleya (*Dudleya cymosa*), rock eriogonum, California fuchsia, flat-leaved onion (*Allium falcifolium*), most-beautiful jewelflower (*Streptanthus glandulosus*), rock sanicle (*Sanicula saxatilis*), Santa Clara red-ribbons (*Clarkia concinna* ssp. *automixa*), and biscuit root, to name a few.

## 3.4 SOIL PREPARATION

There are two aspects of soils that need to be considered prior to planting: how to speed up the soil rehabilitation process so that the substrate supports vigorous plant growth and how to ensure that bare soils will not erode during early plant establishment and revegetation. In order to improve soils, we recommended following soil amendment actions occur in Phase I Planting Areas (Pers. Comm. Claassen 2015). These treatments will be completed by the contractor pre-revegetation, thus preparing the site for planting the container stock.

1. Wood shreds should be incorporated into the fill substrate at low volumes, 5 to 10 %, to facilitate rooting. University of California Davis plant pathologists say the risk of root pathogens is not with dead woody material in the field but with contaminated nursery stock. This shredded material will be added to soils as outlined in the formal Construction Bid documents (RDG, 2016).
2. Final surface grading and drainage will be completed in order to mitigate surface runoff.

All other soil amendments will be limited to direct placement in the planting holes when plants are installed. These amendments will be added by persons planting the container stock. Amending each planting with a cup (8 oz dry, native soil) at the base of each hole can greatly help plant establishment.

This native soil will serve as an inoculum in order to help build bacterial and mycorrhizal associations with the plant. A topsoil donor sites near the summit will be approved with MROSD staff where impact to existing vegetation will be minimal and where there are no weed seeds or soil diseases. This site will be pretested for the presence of *Phytophthora* in 2016 by MROSD.

### 3.5 PHASE I AND II PLANT INSTALLATION METHODOLOGY

Plant layout, microsite selection and plant installation into soil are all presented in this section. Proper plant installation is vital for survival and this plan details step-by-step instructions for plant installation. As work proceeds on-site, some steps may be amended or altered as needed.

#### 3.5.1 Planting density and physical arrangement of plants

Because this is a harsh environment, higher density, clumped planting will be utilized. Instead of typical plant spacing of 24-36", smaller more condensed patches of vegetation are recommended where plants can grow together and form a distinct "vegetation island". Plants will be planted on approximately 18" centers, as a general rule (see spacing recommendations below).

Each of these island areas will include 20-40 plants of several species. One such typical island is diagramed (Figure 8) where plants are noted as polygons and inside each of those polygons, numbers denote the plant center (where it is to be installed). This diagram includes 4 plant taxa: CF = California fuchsia, CM = coyote mint, SBL = silver bush lupine, IP = imbricate phacelia.

Planting areas will be laid out with color-coded flags and/or other marking prior to installation.

One section should be completed at a time, from most important to less important. We recommend the following order of plant installation: Tower Area, West Summit, Ceremonial Site, East Summit, and finally the Scarp area.

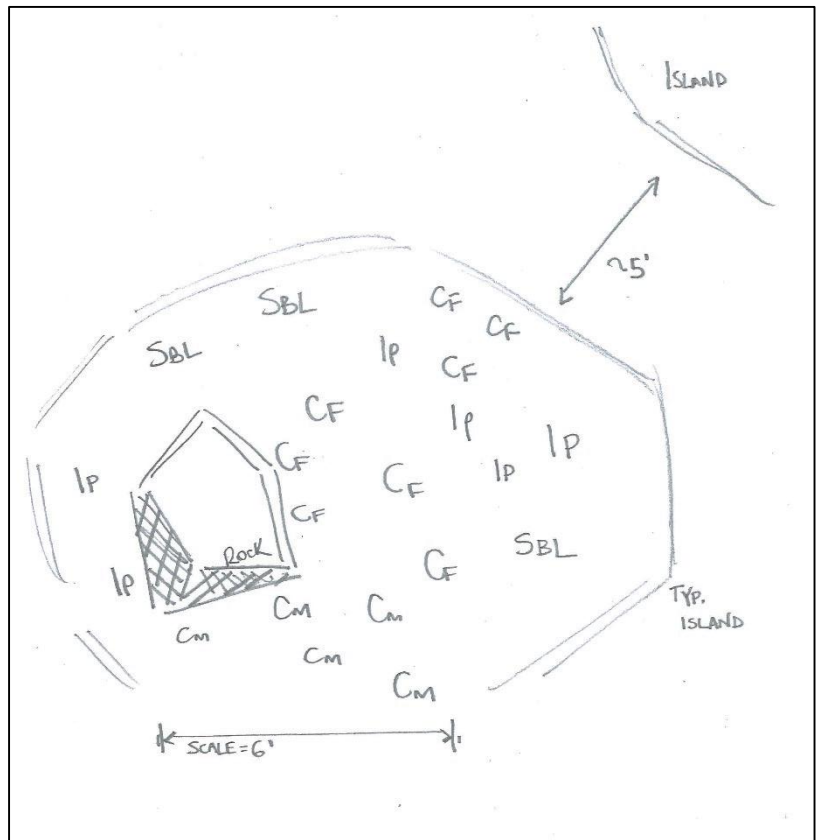


Figure 8: Planting island with 4 species of plants around a prominent rock feature.

#### 3.5.2 Microsite selection

Successful plant establishment will require plants to quickly adapt to rocky soils conditions and have adequate rooting opportunity. In addition, any form of shade from rocks may help retain moisture in the soil for the plant to use. Therefore, plants should be placed to the north and east of any large rock, with rock mulch to be installed from large rock fragments found in the planting hole (see more in following section on plant installation into soil).

### 3.5.3 Plant Installation into Soil

Proper installation of plants is critical to their survival and establishment. Although this task is seemingly simple in fertile, loamy soils, this task will be more difficult and include more steps in the rock substrate.

The procedure for installing plants is based on numerous training techniques. Figure 9 serves as a visual guide that will help explain the procedure.

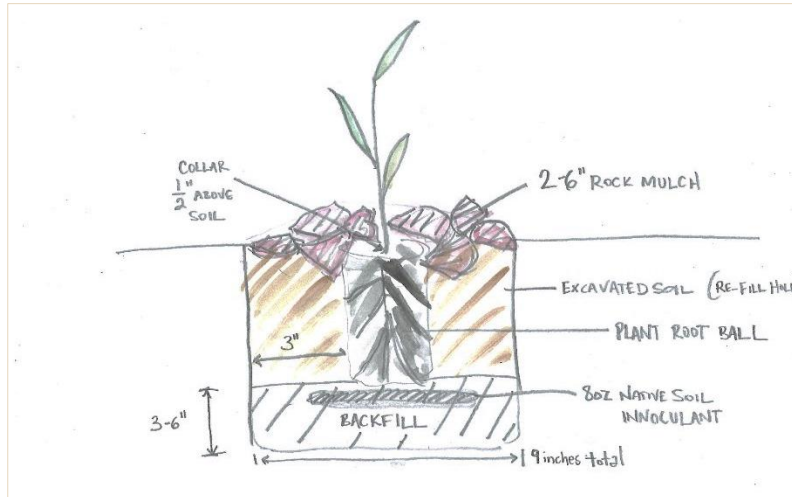


Figure 9: General planting diagram with approximate hole depth, width, inoculant placement, and rock mulch placement.

The standard planting sequence for substrates that are ready to plant are as follows:

1. Flag all planting sites with color coded flags to allow for a visual inspection prior to installation. Planting should commence from the upper portion of the planting island, moving downward on a slope so fewer plants are impacted as additional plants are installed.
2. Plant is selected and hole is dug to approximately two times the diameter of the pot (e.g. if a plant is in a 5 inch pot that is 5 inches tall, a hole that is 10 inches in diameter and 10 inches deep should be excavated. Large rocks should be removed and placed in a separate pile for rock mulching.
3. 6 inches of soil should be returned to the bottom of the hole. This soil will provide an easy rooting area for the new plant.
4. Soils at base of hole should be watered with approximately 4 inches of water.
5. Plant should be inspected and removed from pot. If plant is root-bound at bottom, roots should be separated "tickled" such that the plant "knows" it is out of the pot



Figure 10: Sample rock mulching technique.

and new roots can grow downward and sideways. Root-bound plants whose roots are not properly released often fail to establish.

6. Plant should be placed in hole and the plant collar should be placed 0.5 inches above the soil grade.
7. Remaining soil will be used to fill around edges. Soils should be compacted by hand to remove large air pockets.
8. Place large rocks (2-6" diameter) around the plant collar, acting as a mulch (Figure 8), downhill and far enough away that rocks will not slide and impact plant collar. Rock mulching will be critical for the establishment of plants on hot slopes. A small cover of rocks near the base of a plant can greatly increase soil-water retention and provide a cooler microsite for the plant to flourish.
9. Plant should be irrigated with water within 5 hours of installation, preferably over two courses with 3-5 minutes in between watering.

#### 3.5.4 Recommended treatments for treating subsurface conditions: Create a 'planting pocket'

Rocky soils or substrates may be very difficult to dig using hand tools. A special treatment step is recommended that utilizes small equipment (low ground pressure mini-excavator) to combine the final excavation activity with plant installation (Details in Section 2.2.1) and organic amendment (specification in Appendix 7.5). If the subsurface condition of the substrate is not known ahead of time (open void spaces, compacted fines), a recommended treatment involves using a 12-inch excavator bucket to pull back the material in a 18 – 24 inch deep planting pocket. The area may vary from a foot across to 10 ft or more for a planting bed. This step allows the crew to evaluate rock content and confirm that there is at least 50% finer soil content in the rooting volume (< gravel in size). Add the equivalent volume of a 3" layer of organic amendment across the area of the planting pocket. Areas may vary by planting location. At this point, rocks can be removed to increase the proportion of fine soil. The loose material can be roughly mixed by pushing with the back of the bucket into the pocket such that the organic material is roughly mixed throughout the pocket volume and so that about 25 % is left on the surface as a mulch. This creates an approximate 10 % mixture of organics to total planting volume. A small, 12-inch-deep divot may be left in the specific planting location for easy installation of container plants.

##### A. "Open void spaces" substrates:

These are clast-supported materials with rock to rock contact open void spaces between the rocks. The treatment is to pull bucket through the substrate to scoop out 18 – 24 inch depths in the planting area; remove rocks from the excavated material until the spaces between the rocks (approximately 50% of total volume) is filled with gravel size material or finer; apply a 3 inch surface layer of organics over the spoil pile (or an area equivalent to the area of the planting pocket), mix organics and finer soil with the back of the bucket while replacing spoil in the planting pocket. Approximately 25 % of the organic amendment should remain on the surface as a mulch.

##### B. "Filled and compacted" substrates:

These areas have the spaces between clast-supported rocks filled with non-compacted, gravel-sized material or finer. The treatment is to scoop out a plant rooting volume 18-24 inches deep; apply a 3 inch surface layer of organics equivalent to the area of the planting pocket, mix organics and finer soil with

the back of the bucket while replacing spoil in the planting pocket. Approximately 25 % of the organic amendment should remain on the surface as a mulch.

C. "Compacted fine" substrates:

These are matrix-supported areas with load-bearing substrates that are gravel-sized or finer that may be compacted during construction. The treatment is to scoop out a 18-24 inch depth to decompact fine substrates, apply a 3 inch surface layer of organics equivalent to the area of the planting pocket, mix organics and finer soil with the back of the bucket while replacing spoil in the planting pocket. Approximately 25 % of the organic amendment should remain on the surface as a mulch.

\*treatments are envisioned to be installed with a small 10,000 to 25,000 lb tracked excavator. The bucket width should be 12 inches for more small-scale mixing.

\*specifications for organic amendments, amounts and incorporation method are listed in Appendix 7.5.



### 3.6 SEEDING PLAN

Direct seeding can be a cost effective way to revegetate a disturbed site with little financial and labor input. Direct seeding, or broadcast seeding, can be completed in a variety of manners. Critical aspects for direct seeding are ensuring that seeds are fresh (1-2 years old optimally), seeds are pathogen-free and fungus-free, proper soil contact is possible so that germination will occur, and timing is coordinated with natural cycle of target plants. We recommend the use of seeds that do not require stratification.

Seeds should be collected on site using proper seed collection protocol so as not to impact the existing vegetation or future seed sets (Appendix 7-4). If seeding and planting efforts are successful, seeds should be collected from those plants for use in Phase 2 and beyond. Recommended taxa for collection include a mix of location specific annuals that may grow quickly along with perennials that may root more deeply. Based on what was observed on site in May 2016, we recommend the following preliminary list for seed collection (Table 7).

<b>SHRUBS</b>	
<i>Cercocarpus betuloides</i>	Mountain Mahogany
<i>Ericameria arborescens</i>	Golden Fleece
<i>Keckiella corymbosa</i>	Red Rock Penstemon
<b>ANNUALS AND SUBSHRUBS</b>	
<i>Acmispon glaber</i> var. <i>glaber</i>	Deerweed
<i>Clarkia</i> spp.	Annual clarkia around summit
<i>Chaenactis glabriscula</i>	Inner Coast Range Chaenactis
<i>Delphinium nudicale</i>	Red larkspur
<i>Dudleya cymosa</i>	Dudleya
<i>Epilium canum</i>	California Fuchsia
<i>Eriogonum nudum</i>	naked-stem buckwheat
<i>Eriogonum saxatile</i>	Rock eriogonum
<i>Eriophyllum confertiflorum</i>	Golden Yarrow
<i>Lomatium</i> spp.	Biscuit root
<i>Lupinus</i> annual spp.	Annual lupines
<i>Lupinus albifrons</i> var. <i>albifrons</i>	Silver Bush Lupine
<i>Penstemon heterophyllus</i>	Foothill Penstemon
<i>Monardella villosa</i>	Coyote Mint
<i>Phacelia imbricata</i>	Rock Phacelia
<i>Trifolium willdenovii</i>	tomcat clover
<b>GRASSES</b>	
<i>Koeleria macrantha</i>	Junegrass
<i>Melica torreyana</i>	Torrey's Melic
<i>Poa secunda</i>	One-sided bluegrass

Direct seeding (broadcast seeding) will be employed in specified areas in Phase 1 and 2 (Figure 4 from Section 3 of this document, also located in Appendix 7.3) if seeds are available.

The following general instructions are recommended (adapted from Bankosh, 2008).

1. When soils are lightly wet (but not muddy or dry), use a heavy-tined rake or McLeod, to create swath measuring 3' in width. Make sure the swathes are perpendicular to the slope to ensure that seeds don't drain down the slope during the rainy season. Swaths should be about 10' apart. Swathes should not be straight lines, but should be wavy and irregular so site does not look "row-cropped".
2. Spread 1-2 handfuls of seed mix over every 10 feet in length (seeding rate= 15 and 20 lbs/acre). Example: If you create a swath measuring 3' across and 20' long, you would spread 2 handfuls of shrub mix and 2 handfuls of annuals and grass mix over the area. If unequal amounts of seed is present, adjust seeding such that annuals and grass seed is evenly spread throughout the target area.
3. Lightly rake loose soil over seeds to cover to a depth of about ¼".
4. Soil should be lightly tamped with back of shovel or tamper to increase soil contact with seeds.

## 4 MAINTENANCE

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### 4.1 INSTALLATION MAINTENANCE

The revegetation of site will require persistence and regular maintenance. Anticipated activities include: plant protection from herbivory, weed control, and replacement of dead plants. Due to the difficult climate and soil conditions, plant establishment may be difficult. The following protocol is adapted from Bankosh, 2008 with some minor changes.

#### 4.1.1 Plant Protection

Browse damage to the plantings from wildlife could be severe if protective measures are not taken, but herbivory is not well documented in this restoration area. It is possible that herbivory will be negligible, and plant protection is not warranted. One method of plant protection is offered below. This method can be replaced by another method as appropriate.

As a first step, it is recommended that ecologically sensitive browsing deterrents be used at the time of plant installation. Perennial and annual plants can be sprayed with a deer deterrent such as rotten eggs (active ingredient in Liquid Fence) or capsicum (pepper) spray. Liquid fence, if used, should be applied immediately at installation and after any heavy rains. Instructions for each product should be followed. The specific product needs to be approved by MROSD staff and is subject to substitution as appropriate.

If herbivory continues to be a significant problem on the summit, temporary caging of plants may be necessary until those plants can get established. Cages should be used as a last resort.

#### 4.1.2 Post-installation Maintenance: Weed Control

Maintenance is expected to be necessary at regular intervals. During the active growing season as possible) for the first few years and will decrease over time. Maintenance includes the removal of invasive, non-native vegetation, such as yellow star-thistle; replacement of dead plants; and irrigation.

During the first growing season after plant installation, site monitors should maintain a record of invasive vegetation found on-site, distribution, population and how it was treated. These records will allow for land managers to prioritize weeds and fit maintenance tasks into a budget. We recommend the following target weeds receive treatment with the goal of eradication: yellow star-thistle (*Centaurea solstitialis*), tocolote (*Centaurea melitensis*), non-native thistles (*Carduus spp.*, *Cirsium vulgare*). A decision will need to be made by staff whether to treat other weeds such as non-native *Fabaceae* (for example, rose clover, *Trifolium hirtum*) and annual grasses. We recommend that if populations are

small, these plants should be treated. Information on best management practices for treatment of various invasives is found at the California Invasive Plant Council website ([www.cal-ipc.org](http://www.cal-ipc.org)).

In general, hand tools and hand pulling are the preferred management methods for invasive plants, with the goal of minimizing soils disturbance while not using herbicides.

Monitoring data (see following section) will be used to evaluate the continued need for maintenance to ensure the success of the restoration project.

#### 4.1.3 Dead Plant Replacement

During the first three years of the five-year Plant Establishment Period, dead plants will be replaced if the average plant survival for all installed species combined falls below the 80% plant survival criterion outlined in the next section. An adaptive management approach towards plant replacement will be instituted. Thus, the plant species chosen for replacement will be based upon a critical evaluation of the vigor and growth of the plantings installed. Those species that are well adapted to the plantings sites and are rapidly establishing will generally be used to replace dead plants. Phase 2 will include the replacement of plants lost from Phase 1 planting areas. These replacements will occur when weather is cooler and season is conducive (fall-winter 2017).

#### 4.1.4 Irrigation

Irrigation will not be installed in this project. If plants are properly installed at the correct time of year, hand watering with a water truck during extended periods of heat (7-10 days of extreme heat combined with lack of rainfall). Bridging the gap for first year plants during these extreme weather periods is important for plant establishment.

## 5 SUCCESS CRITERIA AND MONITORING

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### 5.1 SECTION OVERVIEW

The ultimate goal of this revegetation plan is to restore the summit of Mt. Umunhum with appropriate summit vegetation. The following 5-year success criteria are recommended:

1. After 5 years, 80% of the container plants have established
2. After 5 years, percent cover of container plants and natural propagules is 20% absolute cover
3. After 5 years, there are recognizable patches of seeded areas
4. After 5 years, invasive plant cover in restoration areas is less than 5% absolute cover

Each success criteria will be measured using a specific monitoring protocols mentioned below.

Monitoring of the mitigation site by a qualified biologist will be conducted throughout the five-year plant establishment period, and monitoring reports will be prepared annually. Monitoring once every 6 months should provide adequate information on how Phase 2 can be improved. By the final year of monitoring, native habitat should be sufficiently well established to determine if they would eventually achieve the long-term goals of establishing native vegetation on the summit and less than 5% cover of invasive species. The following elements will be monitored to evaluate the site's progression towards this goal:

## 5.2 PERCENT COVER MONITORING AND SUCCESS CRITERIA

Percent cover will be used as the primary indicator of restoration success. There are numerous ways of measuring percent cover, and we provide one such method that can be used efficiently, accurately and repeatedly.

The goal for percent cover is a steady increase in native cover over time. Percent cover will be determined using the line intercept method employed along 20 meter transects in 2-3 representative areas. Absolute percent cover of both the installed, seeded and naturally recruiting plants will be reported in years 2 and 5. Table 8 offers percent cover success criteria.

Restoration Site	Year 2	Year 5
Phase I	10%	20%
Phase II	N/A	20%

Installed plants in Phase 1 and 2 should meet a 60% survival performance criterion within 3-years of the initial installation. In Year 5, survival shall not be lower than 80%. If by Year 5, 80% survival has been achieved, plant survival monitoring can cease. Plant survival monitoring will take place in Years 1-3 and 5.

## 5.3 SEEDING SUCCESS

Direct seeding and seeding success will be measure by a simple 10-meter band transect through 3 seeded areas. This transect will measure presence/absence of seeded plants in 1 m<sup>2</sup> plots (typically using 1 meter PVC transect squares) lined up as follows along the transect: e.g. read cover at 1-2m plot, 4.5-5.5m and 8-9m plot along the 10 meter transect. Density will be reported in 4 absolute cover classes: not present (0% cover), low (< 1 % cover), medium (1-5% cover), high (> 6% cover) for annual and short-lived perennial plants. If recognizable patches of seeded areas are present after 5 years, the seeding was successful. If woody perennials establish from seed, they will be measured by ocular estimate in each plot.

## 5.4 INVASIVE PLANT COVER

A preliminary list of invasive plants that are recommended for control are listed in Section 4.1.2. Invasive cover of target plants should ultimately be determined by field staff one full year after site grading has been finalized. This timeframe allows likely invasives to germinate and then be identified. We recommend creating this target list of invasives to control with the goal of having their cover (total) be no greater than 5% in another restoration area. A visual estimate of percent cover can be conducted at the end of the growing year for each site.

## 5.5 PHOTO-DOCUMENTATION

Annual photo-documentation of the site will be conducted throughout the 5-year plant establishment period. Photographs will also be taken to record any events that may have a significant effect on the success of restoration such as flood, fire, or vandalism. The locations for photo-documentation will be selected during initial site monitoring and will be clearly marked on a figure as well as in the field with a

labeled metal t-post, or less obtrusive ground marker such as a round orange rebar cap buried to be just above soil surface. Caps can be engraved with a number to denote the photopoint ID and the direction the photo should be taken.

## 5.6 MANAGEMENT RECOMMENDATIONS

Management recommendations will be included in each monitoring report. Recommendations will identify potential impediments to restoration efforts and will propose solutions to site problems as appropriate.

## 5.7 PATHOGEN TESTING

Although best management practices are being used in order to minimize pathogen spread, it will be important to observe, record, and test areas where plant mortality is higher than expected. *Phytophthora* testing was considered prior to planting, but it seems as though this technique will likely not produce reliable results because typically plant material is tested, rather than soil without vegetation (Swiecki, pers. com.).

Instead, after Phase I, it is recommended that material from dead and dying plants (as per stated protocol by Phytosphere Research) is collected for analysis in their laboratory (or other equipped laboratory).

## 5.8 OTHER CONSIDERATIONS

Significant aspects of site performance and conditions not covered in the formal monitoring plan will also be discussed. These will include such items as vandalism, irrigation problems, maintenance requirements, and any aspects of the site that may be inhibiting restoration efforts.

# 6 REFERENCES

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- Bankosh, L. Skyline Ridge Tree Farm Restoration Project – Revegetation Plan. May, 2008.
- Ecosystems West Consulting Group. 2008. BOTANICAL SURVEY OF THE SIERRA AZUL OPEN SPACE PRESERVE, SANTA CLARA AND SANTA CRUZ COUNTIES, CALIFORNIA.
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- Hickman, K. and J. Rawlings. 2016. Comprehensive list of Plants found at the Summit of Mt. Umunhum. In preparation.
- Restoration Design Group (RDG). 2016. Mt. Umunhum Construction Bid Documents. Submitted to MROSD. May, 2016.
- Thomas, John Hunter. 1961. Flora of the Santa Cruz Mountains of California. Stanford Press, Stanford, CA.
- Tree of Life Nursery. 2016. Planting Guide. <http://www.californianativeplants.com/>

## 7 APPENDICES

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### 7.1 RAPID ASSESSMENT SURVEY FORMS PROVIDING INFORMATION ON REFERENCE VEGETATION (UNDISTURBED SITES NEAR THE SUMMIT) FROM FEBRUARY 2015

Please see adjoining pages.

**Lech Naumovich** Rapid Assessment DATE 2/25/15 UTM (NAD83) 597892 E 4113194 N  
 SITE ID: MT.VM REF2 Polygon/Survey Size: \_\_\_\_\_ Elevation 3435 ft / m

Photograph #'s: PHONE X2

Soil Texture code: \_\_\_\_\_ | SOIL SAMPLE IDS: \_\_\_\_\_

Topography: Macro: top upper mid lower bottom | Micro: convex flat concave undulating (circle one)

% Surface cover (sum to 100%) Lg rock: 30 Sm rock: 30 Bare/Fine: \_\_\_\_\_ Litter: \_\_\_\_\_ BA Stems: \_\_\_\_\_ Water: \_\_\_\_\_

Slope exposure, Actual °: \_\_\_\_\_ General: NE NW SE SW Flat Variable / All (circle one)

Slope steepness, Actual °: \_\_\_\_\_ General: 0° 1-5° 5-25° > 25° (circle one)

Size of stand: <1 acre 1-5 acres >5 acres Plot: Yes / No If yes, denote size: 100 m<sup>2</sup> / 400m<sup>2</sup> / 1000 m<sup>2</sup> / Other

DISTURBANCE TYPES:

Site history, stand age, and additional comments:  
BREAK IN SCRUB W/ CEANOBIUMS, CEROCARPUS

**PROVISIONAL VEGETATION ALLIANCE (MCV):**

Dominant SPECIES LIST	ABOVE % Cover PH	SPECIES	% Cover PH
<u>MONARDELLA</u>	<u>1</u>	<u>CIRSIA SCORDEMALE</u>	
<u>MOSS</u>	<u>2</u>	<u>GAULTH. PARVIFLORUS</u>	<u>1</u>
<u>PHACELIA</u>	<u>2</u>		
<u>ERODIUM</u>	<u>5</u>		
<u>ANEMONE</u>	<u>5</u>		
<u>ERIGONIA</u>	<u>2</u>		
<u>DICHELLOSTEMMA</u>	<u>1</u>		
<u>ERODIUM</u>	<u>1</u>		
<u>ERODIUM</u>	<u>1</u>		
<u>PENSSEMONA HETEROPHYLLUS</u>	<u>1</u>		
<u>CHRYSOTHAMNUS NAJIS</u>	<u>1</u>		
<u>ELYMUS MULTISEMIS</u>	<u>1</u>		

PHENOLOGY CODE: F - flowering, B - bud, V - vegetative growth only, S - fruit and seed developed, D - dying, senescing

UNUSUAL TAXA, GPS points taken:  
STEEP ALB. PERM. → 597916, 4115095  
DUDLEYA CF. CYMOSEA  
Downslope

NOTE: list species codes (i.e. BROMAD = *Bromus madritensis*) from 100 point wandering transect on reverse of this page, additional taxa listed on back also

**Lech Naumovich** Rapid Assessment DATE 2/25/15 UTM (NAD83) E Elevation 3476 ft/m N

SITE ID: Ref 1: WEST SUMMIT - MTUM Polygon/Survey Size: 10 x 2 M

Photograph #'s: PHINE - CONTACT

Soil Texture code: \_\_\_\_\_ | SOIL SAMPLE IDS: \_\_\_\_\_

Topography: Macro: top upper mid lower bottom | Micro: convex flat concave undulating (circle one)

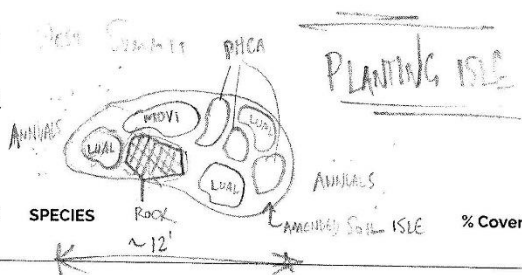
% Surface cover (sum to 100%) Lg rock: 5 Sm rock 10 Bare/Fine: \_\_\_\_\_ Litter: \_\_\_\_\_ BA Stems: \_\_\_\_\_ Water: \_\_\_\_\_

Slope exposure, Actual °: \_\_\_\_\_ General: NE NW SE SW Flat Variable / All (circle one)

Slope steepness, Actual °: \_\_\_\_\_ General: 0° 1-5° 5-25° > 25° (circle one) Bencht at ~90° slope

Size of stand: <1 acre 1-5 acres >5 acres Plot: Yes / No If yes, denote size: 100 m<sup>2</sup> / 400m<sup>2</sup> / 1000 m<sup>2</sup> / Other

DISTURBANCE TYPES: ✓

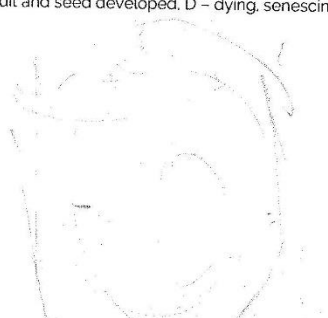
Site history, stand age, and additional comments:  
Next = FILL PILE WEST of WEST SUMMIT  
SAMPLE FOR WEST SUMMIT AREA:  


**PROVISIONAL VEGETATION ALLIANCE (MCV):**

Dominant SPECIES LIST	% Cover	PH	SPECIES	% Cover	PH
<u>MONARD YILL.</u>	<u>10</u>				
<u>EROMAD</u>	<u>2</u>				
<u>ACRISOPH GEARER</u>	<u>3</u>				
<u>CAROLINA DEC.</u>	<u>1</u>				
<u>PHACELIA</u>	<u>1</u>				
<u>LOMBARDIA MACRO</u>	<u>1</u>				
<u>ELIOPHYLLUM</u>	<u>2</u>				
<u>FRAGARIA RUBROV</u>	<u>2</u>				
<u>ANIMAL BRASSIC -</u>	<u>~30</u>				
<u>CHLOROPALLUM PUM.</u>	<u>1</u>				
<u>ALICANT</u>					
<u>BARE</u>	<u>~30</u>				

PHENOLOGY CODE: F - flowering, B - bud, V - vegetative growth only, S - fruit and seed developed, D - dying, senescing

UNUSUAL TAXA, GPS points taken:



NOTE: list species codes (i.e. BROMAD = *Bromus madritensis*) from 100 point wandering transect on reverse of this page, additional taxa listed on back also



## 7.2 BEST MANAGEMENT PRACTICES PROGRAM

These are the current best management practices (BMPs) for as of 12/1/2016. These guidelines will likely change and be updated. Please check the California Oak Mortality Task Force website for the most current standards. Information presented in this Appendix is linked to webpages with the appropriate information.

Main Webpage: [www.SuddenOakDeath.org](http://www.SuddenOakDeath.org)

### Nursery Management Resources

Guidelines to Minimize *Phytophthora* Pathogens in Restoration Nurseries – The Working Group for Phytophthoras in Native Habitats compiled these guidelines to help design and maintain a nursery system that excludes *Phytophthora* and other plant pathogens to the best extent possible. These are intended for professional nursery growers that supply plants to wildland restoration projects. (Latest draft updated September 22, 2016)

Understanding results from the CDFA lab – a handout for nurseries

A systems approach to producing healthy container-grown plants: webinar with Dr. Jennifer Parke, Oregon State University. April 28, 2015. See all online resources and view a recording at <http://uc-d.adobeconnect.com/r91g3to9726/>.

Presentations from the Do No Harm Restoration workshop, Palm Desert, November 2015

Exotic *Phytophthora* Species in Native Plant Nurseries, Restoration Plantings, and Wildlands, video recording. Courtesy of the Central California Native Plant Nursery Network, December 2, 2014

- Plant pathogen movement: around the world on planting stock – Susan Frankel, USDA-Forest Service, Pacific Southwest Research Station (<http://youtu.be/KZALeXWNGY>)
- *Phytophthora* species: life cycle, distribution, dispersal, impacts in California – Ted Swiecki, Phytosphere Research (<http://youtu.be/IMw4NpDgCTs>)
- *P. tentaculata*: History, Host Range, and Status in California Nurseries – Suzanne Rooney Latham, CDFA (<http://youtu.be/HK4-NMsDbm8>)
- Best Management Practices to minimize the risk of *Phytophthora* and other pests and pathogen introductions into nurseries – Kathy Kosta, CDFA (<http://youtu.be/oKEQqDBU3vw>)
- Systems approach to Phytophthoras in nurseries – Karen Suslow, NORS-DUC (<http://youtu.be/CuPYc9lcCcc>)
- *Phytophthora* Effects on Native Habitat Restoration – Greg Lyman, SF Public Utilities Commission (<http://youtu.be/ypRe4nX6fSo>)
- Case Study: Incorporating CDFA BMPs at a restoration nursery – Diana Benner, The Watershed Nursery (<http://youtu.be/7AEnZp2-14>)

Resources from the “Managing *Phytophthoras* in Native Plant Nurseries: A hands-on workshop on prevention and early detection,” June 16, 2015

- [Workshop agenda and speaker information](#)
- [The horticulture behind \*Phytophthora\* management](#)
- [Hands-on Irrigation Training](#)
- [Determining container physical properties worksheet](#)
- [Recognizing disease symptoms and sampling plants for the lab](#)
- [Examination & sampling for rotten roots and stems – root diagram](#)
- [CDFA Protocol for Baiting the Root Ball in a Pot for \*Phytophthora\* spp.](#)
- [CDFA Flow Through Protocol for Baiting of potted plants to detect presence of \*Phytophthora\* spp.](#)
- [Video overview of hand-on stations](#)

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## Guidelines for Restoration Activities

These draft guidelines were developed to prevent and manage Phytophthoras during various aspects of restoration. This guidance is targeted for use in rare plant and other high-value habitats.

- “[Restoration guidance](#)” covers General Construction; Guidelines for Planting at Field Sites; Procedures for sanitizing tools, surfaces, and footwear; and Clean water specifications.
- “[Contaminated site guidance](#)” is for restoration sites that has been confirmed to contain an *Phytophthora* infestation.
- “[Holding nursery guidance](#)” presents a set of practices to avoid contamination of nursery stock being held for planting at restoration sites.

## 7.3 ACTERRA NURSERY SPREADSHEET AND NOTES FROM DEANNA GIULIANO

9/10/2014 Plant Species Observed Mt Umunhum Near Summit / Summit

List compiled By Deanna  
Giuliano  
Nursery Manager/Botanical  
Consultant  
Acterra Native Plant Nursery

Trees	Species	Common	Part Used	Uses
	<i>Aesculus californica</i>	California Buckeye	Wood,Bark, Fruit	Tools, Medicine, Fish poison, Food when leached
	<i>Cercocarpus betuloides</i>	Mountain Mahogany	Wood	Tools
	<i>Pinus sabiniana</i>	Foothill Pine	Pitch, Nuts, Needles	Medicine, Food, Basketry
	<i>Prunus ilicifolius</i>	Hollyleaf Cherry	Bark, Fruit	Medicine, Food
	<i>Quercus chrysolepias</i>	Canyon Live Oak	Bark, Galls, Acorn	Medicine, Food
	<i>Quercus durata</i>	Leather Oak	Bark, Galls, Acorn	Medicine, Food
	<i>Sambucus nigra var caerulea</i>	Blue Elderberry	Wood,Bark, Fruit	Instruments, Medicine, Food
	<i>Umbellularia californica</i>	California Bay	Leaves, Fruit	Medicine, Food
<b>Shrubs</b>				
	<i>Adenostomma fasciculatum</i>	Chamise	Wood,Leaves	Tools, Medicine
	<i>Arctostaphylos crustacea</i>	Brille leaf Manzanita	Whole Plant	Medicine, Food
	<i>Arctostaphylos glauca</i>	Big Berry manzanita	Whole Plant	Medicine, Food
	<i>Artemisia californica</i>	Sagebrush	Whole Plant	Ritual, Medicine, Tools
	<i>Bachcharis pilularis</i>	Coyote Brush	Leaves	External Medicine
	<i>Ceanothus papillosus</i>	Wavy Leaf Ceanothus	Root, Bark,Branches, Seed	Medicine, Basketry, Food
	<i>Dendromecon rigida</i>	Bush Poppy	Leaves	Smoking
	<i>Ericameria arborescens</i>	Golden Fleece	Whole Plant	Medicine
	<i>Ericameria nauseosa var. speciosa</i>	Showy Rabbitbrush	Whole Plant	Medicine
	<i>Garrya elliptica</i>	Coast Silktassl	Leaves, Bark	Medicine
	<i>Keckiella corymbosa</i>	Red Rock Penstemon		
	<i>Lepichina calycinia</i>	Pitcher Sage	Whole Plant	Medicine
	<i>Salvia melifera</i>	Black sage	Leaves, Seeds	Medicine
	<i>Eriodictyon californicum</i>	Yerba santa	Leaves, Branches	Medicine
	<i>Pickeringia montana</i>	Chaparral Pea		
	<i>Rhamnus crocea</i>	Redberry		

<b>Perennials</b>				
	<i>Achillea millefolium</i>	Yarrow	Whole Plant	Medicine
	<i>Acmispon glaber</i> var. <i>glaber</i>	Deerweed	Leaves	Medicine
	<i>Epilobium canum</i>	California Fuchsia	Whole Plant	External Medicine
	<i>Erigeron petrophilus</i>	Rock Daisy		
	<i>Eriogonum nudum</i>	Naked stem Buckwheat	Whole Plant, Seeds	Medicine, Food
	<i>Eriogonum saxatile</i>	Rock Buckwheat	Seeds	Food
	<i>Eriophyllum confertiflorum</i>	Golden Yarrow		
	<i>Eschscholzia californica</i>	Poppy	Whole Plant	Medicine
	<i>Corethrogyne filaginifolia</i>	California Aster		
	<i>Lupinus albifrons</i> var. <i>albifrons</i>	Silver Bush Lupine	Whole Plant	Medicine
	<i>Penstemon heterophyllus</i>	Foothill Penstemon	Leaves, Roots	Medicine
	<i>Monardella villosa</i>	Coyote Mint	Whole Plant	Medicine
	<i>Phacelia imbricata</i>	Rock Phacelia	Leaves, Roots	Medicine
	<i>Pseudonaphalium californica</i>	Everlasting	Whole Plant	Medicine
	<i>Rubus ursinus</i>	Western Blackberry	Whole Plant	Medicine, Food
	<i>Toxicodendron diversilobum</i>	Poison Oak	Leaves, Roots	External Medicine
<b>Grasses</b>				
	<i>Elymus glaucus</i>	Blue Wild Rye		
	<i>Festuca idahoensis</i>	Idaho Fescue		
	<i>Koeleria macrantha</i>	June Grass		
	<i>Melica californica</i>	California Melic		
<b>Bulbs</b>				
	<i>Allium falcifolium</i>	Sickle Leaved Onion	Root	Food
	<i>Chlorogalum pomeridanum</i>	Soap Plant	Root	Fish Poison, Food, Soap
	<i>Dichelostemma capitatum</i>	Blue Dicks	Root	Food
<b>Annual</b>				
	<i>Acmispon brachycarpus</i>	Hillside Lotus		
	<i>Cirsium occidentale</i> var. <i>venustum</i>	Venus Thistle	Stems, Seeds	Medicine, Food
	<i>Clarkia brewerii</i>	Brewers Clarkia	Seeds	Food
	<i>Clarkia purpurea</i> var. <i>quadrivulnera</i>	Winecup Clarkia	Seeds	Food
	<i>Chorizanthe membranacea</i>	Pink Spineflower	Whole Plant	Medicine
	<i>Cryptantha flaccida</i>	Cryphantha		

	<i>Eriogonum luteolum</i>	Goldencarpet Buckwheat	Seeds	Food
	<i>Gilia achilleifolia</i> ssp. <i>multicaulis</i>	Few Flowered Gilia		
	<i>Madia gracilis</i>	Slender Tarweed	Seeds	Food
	<i>Mentzelia lindleyi</i>	Lindleys Blazing Star		
	<i>Plagiobotrys</i> spp.	Popcorn Flower		
	<i>Phacelia rattanii</i>	Phacelia		
	<i>Salvia columbariae</i>	Chia	Leaves, Seeds	Medicine, Food
	<i>Trifolium microdon</i>	Thimble Clover	Leaves, Seeds	Food
	<i>Trifolium willdenovii</i>	Tomcat Clover	Leaves, Seeds	Food
	<i>Uropappus lindleyi</i>	Silverpuffs		

## 7.4 SEED COLLECTION PROTOCOL AND RECOMMENDATIONS (FROM GOLDEN HOUR RESTORATION INSTITUTE)

# Steps to a Maximizing Seed Collection Effort

- **Identify locations** – Acquiring permission, permits, do no harm by ensuring that collection will not negatively impact population of native plants
- **Identify target taxa** – What species will you collect, can you accurately identify them later in the season? Plants tend to look very different in fruit!
- **Planning ahead for proper phenology** – When is plant in flower, in seed, allow for a 2-3 week collection buffer
- **Preparing information on collection area** – Find collection location on map, take a GPS point for future reference. Note your collection location with respect to the larger distribution of the taxon. Is it on an edge, or in the middle of the range? Is this a unique ecotype?
- **How much to collect** – Always start with a small percentage of the population – say 2-5%. Never collect more than 10-20% of the seed of an established population (source). Seed collection should allow for collection from at least 30-50 individuals to ensure genetic diversity. No more than 5% of rare plant seeds should ever be collected in one year (for an annual).

PAPAVERACEAE



*Eschscholzia californica* (CALIFORNIA POPPY)

- **Identify mature seeds** – Make sure the seeds have hardened and matured if planned for storage. *Some signs of maturity:* Characteristics to observe include the size and color of the fruit, whether the embryo is firm and swollen and whether the seed coat collapses when cut, is the seed easily collected, is the fruit/capsule/etc. dry and mature, are the berries/drupes wrinkled.
- **Inspect seed quality** - Look for infestations of insects, bugs, grubs in seeds and on plant. Avoid collections wherein pests are obvious. Earliest seeds for each individual tend have the highest fertility and energy stores. Later seeds are often less productive/fertile.
- **Collection vessels** – Envelops are an industry standard, although brown paper bags can work – use paper. Separate seeds by taxon as possible.
- **Storage** – Store seeds in a cool dry place – like a low humidity fridge. Check for stratification needs of seeds – freezing, desiccation, etc. Make sure your seeds are mature and dry before any long-term storage, otherwise you will have some unpleasant guests.
- **Distribution** – Please limit seed distribution to the watershed wherein the seed was collected. For gardening, this is less sensitive unless your property is on a wildland boundary. Help preserve unique ecotypes!
- **Germination** – High germination rates (>80%) are achievable for most well collected and stored seeds. Variation from species to species is normal

## 7.5 ORGANIC AMENDMENT AND SOIL INSTALLATION SPECIFICATIONS

(Reference: Mount Umunhum Summit Project 90% Set / 11 April 2016. SECTION 02300 – EARTHWORK and DRAINAGE )

### Subsection 2.1 K.

K. Soil Amendment for amending Restoration Areas shall be produced from a City of San Jose certified waste diversion facility or equal approved by O.R. The fine or coarse compost materials shall be derived from composted green / yard waste debris only and shall otherwise conform to Caltrans 2015 Standard Specification section 21-2.02K. Wood chip materials shall be derived from clean recycled construction wood debris only and shall otherwise conform to Caltrans 2015 Standard Specification 20-5.03E(2)(c)#3. All materials shall be free of phyophthora and canker pathogens. Caltrans 2015 Standard Specification source:

[http://www.dot.ca.gov/hq/esc/oe/construction\\_contract\\_standards/std\\_specs/2015\\_StdSpecs/2015\\_StdSpecs.pdf](http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2015_StdSpecs/2015_StdSpecs.pdf).

The soil amendment material may be composed of 100 % Coarse Compost as specified in Caltrans 2015 Standard Specification section 21-2.02K.

Alternatively the soil amendment material may be composed of a mixture of one quarter (volume basis) of Fine Compost as specified Caltrans 2015 Standard Specification section 21-2.02K mixed uniformly with three quarters Wood Chips as specified in Caltrans 2015 Standard Specification 20-5.03E(2)(c)#3.

### Subsection 3.5 A – E.

#### 3.5 RESTORATION AREA EXISTING SOIL AMENDMENT

- A. FLAG (VISUALLY DELINEATE) SOIL AMENDMENT RESTORATION AREA (SARA) ONSITE (SEE ATTACHED FIGURE FOR SARA)
- B. Install Soil Amendment to all restoration areas at the rate of either: 1) a 3 inch surface-applied layer of Wood Chips plus an additional 3/4 inch layer of Fine Compost or 2) a single 3 inch surface layer of Coarse Compost (a.k.a. compost overs).
- C. Mix Soil Amendment into the existing soil with excavators or backhoes to incorporate the specified Soil Amendment into the top 18 inches of existing soil by digging at intervals of one- to two-feet with a 12 inch bucket or such that, after incorporation, a quarter of the surface is remains covered with organic materials.
- D. Fine grade the surface of the SARA under the direction of O.R. to original grade to shed surface water and to not erode onto adjacent pavements, drainage inlets, or structures. Site should have smooth, non-furrowed, and de-compacted appearance at completion.
- E. Leave non-SARA sites untracked and uncompacted.

### 7.6 SOIL FERTILITY ANALYSES FOR MT UMONHUM SUMMIT SUBSTRATES

Mt Umunhum summit substrate samples																	
Set 1		OM	ENR	P1	HCO3_P	pH	pH	CEC	K	Ca	Mg	Na	K	Ca	Mg	Na	Ca:Mg
SAMPLE		%	lb/ac	ppm	ppm	water	buffer	cmol/kg	ppm	ppm	ppm	ppm	%	%	%	%	ratio
MUB		2.1	71	14.9	11.3	5.7	6.6	15.6	89.9	1632	471.5	24.8	1.5	52.1	24.8	0.7	2.1
MUV		3.7	104.8	23.4	12.6	5.8	6.7	11.0	119.1	1146	344.3	11.2	2.8	52.0	25.8	0.4	2.0
MUE	east	3.6	102.8	47.4	26.5	5.6	6.7	9.9	52.9	1041	267.8	16.4	1.4	52.3	22.2	0.7	2.4
MUS	saddle	1.4	58.8	9.5	9.2	6	6.7	16.4	57.7	1858	534.5	20.0	0.9	56.7	26.9	0.5	2.1
MUC	center	2.3	76	6.8	6.2	6.3	6.8	16.5	46.4	1807	670.9	28.8	0.7	54.6	33.4	0.8	1.6
MUW	west	2.2	74.8	7.5	6.5	6.2	6.7	16.9	39.7	1722	739.2	28.8	0.6	50.8	35.9	0.7	1.4
Set 2	location	OM	ENR	P1	HCO3_P	pH	pH	CEC	K	Ca	Mg	Na	K	Ca	Mg	Na	Ca:Mg
trailhead		%	lb/ac	ppm	ppm	water	buffer	cmol/kg	ppm	ppm	ppm	ppm	%	%	%	%	ratio
M9B	trail area 60-110cm,no fuel	3.0	90.6	7.5	3.8	6.7	--	16.7	36.4	1983.0	683.0	68.2	0.6	59.4	33.7	1.8	1.8
M9SUB	gray subsoil, fuel smell	2.3	76.6	12.1	1.2	8.2	--	16.2	14.7	1755.0	674.5	423.0	0.2	54.1	34.3	11.4	1.6
lower west parking																	
MP2	lower parking S end	2.0	70.6	17.3	7.5	7.2	--	11.9	47.0	1743.0	363.4	32.6	1.0	72.8	25.0	1.2	2.9
M14T	lower park N end, dist topsoil	2.9	87.6	12.5	6.1	6.8	--	11.6	56.1	1804.0	250.2	13.2	1.2	77.5	17.7	0.5	4.4
west summit area																	
M6A	C west sum, flat	1.9	68.4	11.3	7.9	6.8	--	13.6	58.1	2032.0	349.9	16.7	1.1	74.3	21.1	0.5	3.5
6BT	C west sum, side, buried topsoil	2.1	72.0	10.2	5.1	5.7	6.6	15.7	31.2	1792.0	396.4	18.9	0.5	57.1	20.8	0.5	2.7
M11	E west sum, flat, yellow gravel	2.9	87.0	14.8	8.7	6.2	6.8	13.6	43.6	1718.0	398.2	11.6	0.8	62.8	24.0	0.4	2.6
M13T	NW west sum, buried topsoil	8.8	206.6	22.2	15.0	5.4	6.5	15.9	45.8	1783.0	277.7	14.3	0.7	56.0	14.4	0.4	3.9
M7	SW west sum, typical push matl	2.6	82.2	10.7	5.8	6.3	6.8	15.3	53.7	1949.0	449.6	21.6	0.9	63.8	24.2	0.6	2.6
M12BT	W west sum, buried topsoil	3.1	91.8	34.8	17.8	5.8	6.7	10.5	29.0	1306.0	205.7	45.6	0.7	62.2	16.2	1.9	3.8
M12A	W west sum, yellow fill	2.7	83.4	12.1	4.9	5.7	6.7	12.1	39.2	1339.0	333.3	17.4	0.8	55.0	22.6	0.6	2.4
Set 3	SAMPLE DESCRIPTION	OM	ENR	P1	HCO3_P	pH	buf	CEC	K	Ca	Mg	Na	K	Ca	Mg	Na	Ca:Mg
	Mt Um rough grades	%	lb/ac	ppm	ppm		pH	cmol/kg	ppm	ppm	ppm	ppm	%	%	%	%	ratio
	'fine' substrate	2.1	72.0	29.0	13.0	6.7	--	11.5	44.4	1448.0	423.3	31.1	1.0	63.0	30.3	1.2	2.1
	'typical' substrate	4.0	109.6	14.0	10.9	6.9	--	14.2	69.3	2005.0	457.9	20.3	1.2	70.2	26.4	0.6	2.7
	organics-rich layer	6.6	162.8	15.0	10.7	5.9	6.7	12.0	64.1	1354.0	357.5	13.6	1.4	56.5	24.6	0.5	2.3
		OM	ENR	P1	HCO3_P	pH	buf	CEC	K	Ca	Mg	Na	K	Ca	Mg	Na	Ca:Mg
		%	lb/ac	ppm	ppm		pH	cmol/kg	ppm	ppm	ppm	ppm	%	%	%	%	ratio
AVERAGES		3.1	92.5	16.7	9.5	6.3	6.7	13.9	51.9	1660.9	432.4	43.9	1.0	63.2	25.2	0.8	2.5
Set 1		NO3	S	Zn	Mn	Fe	Cu	B	EC (salts)	SAND	SILT	CLAY	Textural				
SAMPLE		ppm	ppm	ppm	ppm	ppm	ppm	ppm	mmhos/cm	%	%	%	class				
MUB		1.7	3.7	0.9	2.7	14.4	0.9	0.3	0.2	81.6	8.0	10.4	LOAMY SAND				
MUV		4.4	3.2	4.9	5.2	20.6	1.1	0.3	0.2	77.6	12.0	10.4	SANDY LOAM				
MUE		1.8	2.7	17.7	3.2	29.4	1.2	0.3	0.1	67.6	20.0	12.4	SANDY LOAM				
MUS		1.2	2.2	2.5	2.5	17.8	0.8	0.3	0.1	75.6	12.0	12.4	SANDY LOAM				
MUC		0.8	3.4	2.1	4.3	12.7	0.8	0.3	0.1	63.6	14.0	22.4	SANDY CLAY LOAM				
MUW		1.7	3.0	1.5	4.5	13.0	0.9	0.3	0.1	63.6	20.0	16.4	SANDY LOAM				
Set 2	location	NO3	S	Zn	Mn	Fe	Cu	B	C (salts)	SAND	SILT	CLAY	Textural				
trailhead		ppm	ppm	ppm	ppm	ppm	ppm	ppm	mmhos/cm	%	%	%	class				
M9B	trail area 60-110cm,no fuel	2.9	6.4	0.4	2.3	26.2	2.5	0.7	0.1	62.8	18.0	19.2	SANDY LOAM				
M9SUB	gray subsoil, fuel smell	3.5	9.4	0.4	60.9	16.4	3.2	0.2	0.2	68.8	12.0	19.2	SANDY LOAM				
lower west parking																	
MP2	lower parking S end	3.6	12.7	2.0	1.5	14.9	1.0	0.2	0.3	66.8	14.0	19.2	SANDY LOAM				
M14T	lower park N end, dist topsoil	7.7	1.8	6.0	2.4	14.1	3.6	0.2	0.1	70.8	14.0	15.2	SANDY LOAM				
west summit area																	
M6A	C west sum, flat	21.1	3.1	56.9	1.1	13.7	0.6	0.2	0.1	70.8	12.0	17.2	SANDY LOAM				
M6BT	C west sum, side, buried topsoil	3.1	1.3	5.1	1.1	19.4	0.4	0.1	0.1	76.8	10.0	13.2	SANDY LOAM				
M11	E west sum, flat, yellow gravel	5.1	1.4	0.6	2.1	18.1	0.9	0.2	0.1	72.8	12.0	15.2	SANDY LOAM				
M13T	NW west sum, buried topsoil	4.0	2.6	1.2	4.6	61.3	0.6	0.1	0.1	76.8	12.0	11.2	SANDY LOAM				
M7	SW west sum, typical push matl	4.1	1.3	0.6	1.6	23.3	0.7	0.1	0.1	76.8	8.0	15.2	SANDY LOAM				
M12BT	W west sum, buried topsoil	13.6	6.2	0.9	1.4	17.2	0.9	0.1	0.2	70.8	16.0	13.2	SANDY LOAM				
M12A	W west sum, yellow fill	4.3	1.8	0.2	1.3	22.9	0.8	0.1	0.1	70.8	14.0	15.2	SANDY LOAM				
Set 3		NO3	S	Zn	Mn	Fe	Cu	B	EC	sand	silt	clay	texture				
	Mt Um rough grades	ppm	ppm	ppm	ppm	ppm	ppm	ppm	dS/m	%	%	%					
	'better' substrate	10.8	4.4	1.9	3.1	16.5	1.4	0.1	0.2	52.8	20.0	27.2	SANDY CLAY LOAM				
	'typical' substrate	8.4	3.4	0.2	1.3	26.8	0.8	0.1	0.2	52.8	16.0	31.2	SANDY CLAY LOAM				
	organics-rich layer	24.8	8.5	19.3	4.9	34.8	1.6	0.2	0.5	38.8	30.0	31.2	CLAY LOAM				
		NO3	S	Zn	Mn	Fe	Cu	B	EC	sand	silt	clay	Textural				
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	dS/m	%	%	%	class				
AVERAGES		6.4	4.1	6.3	5.6	21.7	1.2	0.2	0.1	71.6	14.3	14.1					



Overall nutrient status of Mt Um soils using averages for 20 samples gathered throughout the planning and construction process.

In general, these substrates are not limiting to growth of wildlands plants, but they are expected to be droughty in late summer.

#### Organic Matter (OM%)

Organic matter levels are moderately low but not atypical for wildlands soils. The surfaces will need mulch or accumulated organics to avoid surface crusting, as was observed. The low organic levels are expected to provide limited long term nitrogen or sulfur for extended plant growth. A few samples came from darker, well rooted horizons indicating concentrations of former topsoil materials.

#### Phosphorus (P1 or P<sub>HCO3</sub>)

Phosphorus levels vary widely at different among different substrates. Other than at start-up, these are not growth limiting levels for wildlands plants. A modest amount of slow-release nutrient should be provided in the planting hole. The higher levels of the east samples for the PHCO3 extract relates to the higher organic content.

#### pH

These soil acidity levels are not limiting to plants. The Buffer pH indicates that pH levels can be easily elevated with other potential amendments such as composts.

#### Cation Exchange Capacity (CEC)

Cation Exchange Capacity is the amount of ionic charge on the mineral surface that attracts and holds cations. Nearly all samples have adequate exchange capacity.

#### Potassium (K)

Potassium levels should approach 100 ppm and should exceed 1.5 % of the CEC. Various samples are low in this nutrient. Organic amendments (composts, woodchips) as specified can supply this nutrient.

#### Calcium (Ca)

Calcium levels are high in total availability (ppm) and as proportion of all available cation nutrients (Ca %exch). No amendment is needed.

#### Magnesium (Mg)

Magnesium levels are adequate for plant growth. Magnesium levels are not at high enough amounts relative to Ca to indicate a serpentinitic character. Serpentine growth conditions are indicated by Ca:Mg ratios of less than about 1.0. All of these samples are easily above this ratio and are interpreted as having no exclusionary serpentine edaphic quality.

#### Sodium (Na)

Sodium is low enough to have no negative effect on plant growth.

#### Nitrate (NO<sub>3</sub>)

Nitrate extraction levels are variable but not limiting to plant growth. A main source for nitrate in this location will be atmospheric N deposition. Organic amendments are designed to limit the effect of excess nitrate inputs from local airsheds.

#### Sulfur (S)

Sulfur is present in modest levels, but this indicator is a poor indicator for wildlands systems. This is not a growth limiting condition.

#### Zinc (Zn)

Zinc levels should be above 1 ppm so these levels are not limiting.

#### Manganese (Mn)

Manganese levels are not growth limiting for wildlands plants.

#### Iron (Fe)

Iron levels should be above 10 ppm. All samples have adequate iron levels for wildlands plants.

#### Copper (Cu)

Target levels for copper levels are around 1 ppm and nearly all samples are close to this level. Organic amendments will additionally supplement this micronutrient.

#### Boron (B)

Boron target levels are 1 ppm, so these samples are uniformly low in B. Organic amendment materials can safely add the small amounts of B needed.

#### Salts (EC)

Salts are uniformly low and are not limiting to plant growth.

#### Soil particle size distribution (texture).

Substrates generally have sandy loam textures. Samples from the non-vegetated bench had loamy sand textures while samples from the central part of the west summit had sandy clay loam textures. Clays ranged from 10 to 31 % clay with an average of 14.1%. These clay levels are adequate for moisture holding capacity within the fine soil fraction itself (< 2 mm). But a much larger issue is that the whole soil volume is excessively rocky. Even though these fine soil fractions are amenable for plant growth, large rooting volumes are needed to provide adequate levels of nutrients and moisture given the high rock content of the whole soil volume in its entirety. For these reasons, soil regeneration recommendations focus on maintaining infiltration, percolation to the subsurface horizons and adequate rooting volumes.

## 7.7 IMAGES OF MAPPED SOILS AND POTENTIAL EXAMPLE OF SOIL PARENT MATERIAL EFFECT ON NORTH-SLOPE VS SOUTH-SLOPE VEGETATIVE COVER

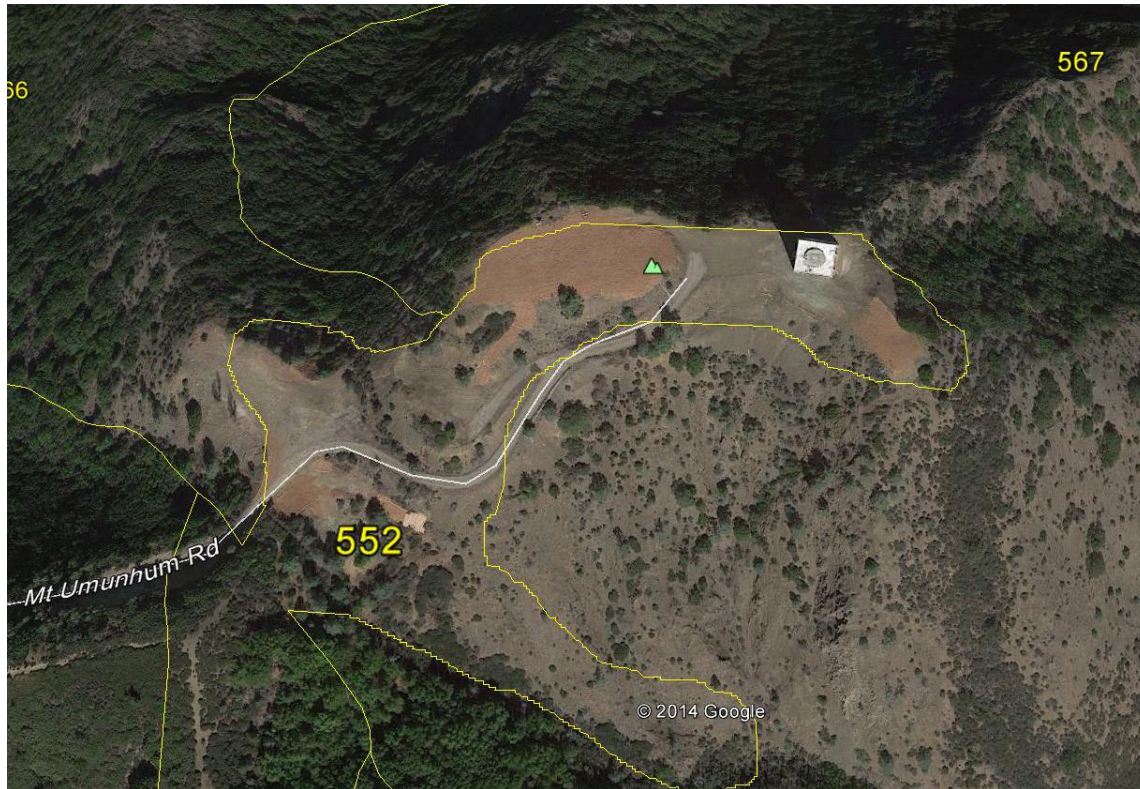


Figure 7.7.1. Each of the groups of intermixed soils surrounding Mt Umunhum are given a mapping unit number.

**Map Unit 552 contains Elsman (35%)-Maymen (25%)-Sanikara (20%), 30 to 50 percent slopes.**

It is mapped on the summit area and has the following soil series in a repeating pattern:

35 % of the area is Elsman; 25% Maymen; 20 % Sanikara; 10 % Mouser; 5 % Elsman; 3 % Santerhill.

**Map Unit 567 contains Sanikara (45%)-Mouser (30%)-Rock outcrop complex, 50 to 75 percent slopes**

This mapping unit is located on the N, S, and E slopes of the summit.

**Map Unit 566 contains Mouser (40%)-Katykat (30%)-Sanikara (25%) complex, 50 to 75 percent slopes.**

This mapping unit occurs on the NW slopes.

The fact that the soils are mapped as intermixed ‘complexes’ indicates that the group of soils occurs in a repeating pattern that is too small in scale to be delineated on a soils map. The soil series covering the majority of these areas were evaluated and the critical components for revegetation were listed in Table 1. These are compared in the narrative to describe the average growing condition surrounding the Mt Umunhum summit. From these reference site examples, the soil functions that are needed on the summit project itself can be estimated.



Figure 7.7.2. A potential example of the effect of aspect on vegetation growth. The curved band could be explained by an upturned layer of more easily weathered rock is tilted downward to the east and is exposed on the south and north sides of this ridge. These geological strata are visible elsewhere in the local area. The south slope half can be expected to be hotter and drier and less soil formation through centuries of time. The north-facing slope could be expected to be cooler and retain more moisture after rains. It would therefore develop more vegetation inputs and a deeper soil. Sampling of this band should show weaker sedimentary rocks such as shales and weakly cemented sandstones. This has not been confirmed in the field.



Each of the groups of intermixed soils surrounding Mt Umunhum are given a mapping unit number.

**Map Unit 552 contains Elsman (35%)-Maymen (25%)-Sanikara (20%), 30 to 50 percent slopes.**

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The fact that the soils are mapped as ‘complexes’ indicates that the group of soils occurs in a repeating pattern that is too small in scale to be delineated on a soils map. The soil series covering the majority of these areas were evaluated and the critical components for revegetation were listed in Table 1. These are compared in the narrative to describe the average growing condition surrounding the Mt Umunhum summit. From these reference site examples, the soil functions that are needed on the summit project itself can be estimated.

# Mount Hamilton thistle and Loma Prieta hoita surveys

Mt. Umunhum Environmental Restoration and Public Access Project



Results. February 7, 2017

Prepared for:

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## Project History

As part of the Mount Umunhum Environmental Restoration and Public Access Project, the Midpeninsula Regional Open Space District (MROSD) is planning to resurface Mount Umunhum Road from Hicks Road to Loma Almaden Road at its border with the McQueen property. Drainage improvements, erosion enhancements, and other infrastructure improvements (replacing guardrails, etc.) are planned.

MROSD had documented a colony of Mount Hamilton thistle (*Cirsium fontinale* var. *campylon*) and Loma Prieta hoita (*Hoita strobilina*) in a serpentine seep immediately adjacent to the road, and commissioned a survey for additional colonies, as well as recommendations for avoiding, reducing and mitigating impacts to these two taxa.

## Mount Hamilton thistle

Mount Hamilton thistle is a serpentine endemic from the Asteraceae (sunflower) family. It is ranked CNPS 1B.2 (rare, threatened, or endangered in California and elsewhere, fairly endangered in California). It is not federal- or state-listed.

A short-lived perennial herb, it is found in serpentine seeps, streams and other mesic areas in Valley and foothill grasslands, chaparral, and cismontane woodland. It is known from Santa Clara, Alameda, and Stanislaus Counties, with 41 presumed extant occurrences in the California Natural Diversity Database (CNDDB) (CNPS 2016).



Photo by David Tharp, CalPhotos

Growing up to 2 m tall, it can be identified by its nodding white to pink-lavender flowering heads made of disk flowers only (blooming February to October); spiny involucre; hairless phyllaries that recurve for more than half their length; and velvety, fleshy, almost succulent leaves. It is distinguished from conspecifics by its phyllary spines that are generally 2-6 mm, and longer spines of cauline leaves 10-18 mm (Baldwin et al. 2012, Corelli and Chandik 1995, Beidleman and Kozloff). The plants are monocarpic (flower once and then die).

Creekside Science has worked with the conspecific fountain thistle (*Cirsium fontinale* var. *fontinale*). Plants were aggressive, passively colonizing rapidly in areas where weeds were removed. Transplanting was successful, especially using larger stock and in moister areas. Although plants have been observed germinating throughout the year in the wild in moist conditions, and seeds germinate readily in the nursery without special treatment, seeding efforts in the wild at different times of the year were not very successful (Niederer and Weiss 2013, Niederer and Elliott 2012). It is expected that Mount Hamilton thistle would respond similarly.

## Loma Prieta hoita

Loma Prieta hoita is a perennial herb from the Fabaceae (pea) family. It is ranked CNPS 1B.1 (rare, threatened, or endangered in California and elsewhere, seriously endangered in California). It is not federal- or state-listed.

It is usually found on serpentine, but is not entirely an endemic. It is known from chaparral, cismontane woodland, and riparian woodland.

Sites are usually mesic (although many of the colonies on Mount Umunhum Road appear quite dry). It is known from Santa Clara, Santa Cruz, and Contra Costa Counties, and presumed extirpated in Alameda County, with 28 presumed extant occurrences in the CNDDDB and 1 presumed extirpated (CNPS 2016).

It is usually less than 1 m tall, with erect pubescent stems and white and blue/purple flowers 13-19 mm long (blooming May to October). It has tomentose pinnate leaves with three leaflets; the petioles are usually under 8 cm long. The calyx is distinctly irregular (Baldwin et al. 2012, Thomas 1961). Vegetatively, the three leaflets can make it look similar to poison oak (*Toxicodendron diversilobum*), which is oily, and various berries (*Rubus* spp.), which have spines or prickles.

Creekside Science contacted Janell Hillman, a biologist with the Santa Clara Valley Water District. She had no management experience with the taxon, and didn't know who had. Deanna Giuliano, nursery manager at Grassroots Ecology (formerly Acterra) has easily grown *Hoita macrostachys* from seed. We expect its congeneric to respond similarly.

Creekside Science also documented large rhizomes of Loma Prieta hoita in an eroding slope on Coyote Ridge. This implies sufficient reserves in the rootstock for successful salvaging (Photo 1).

**Photo 1. Large rootstocks of Loma Prieta hoita in eroded hill imply sufficient reserves for salvaging**



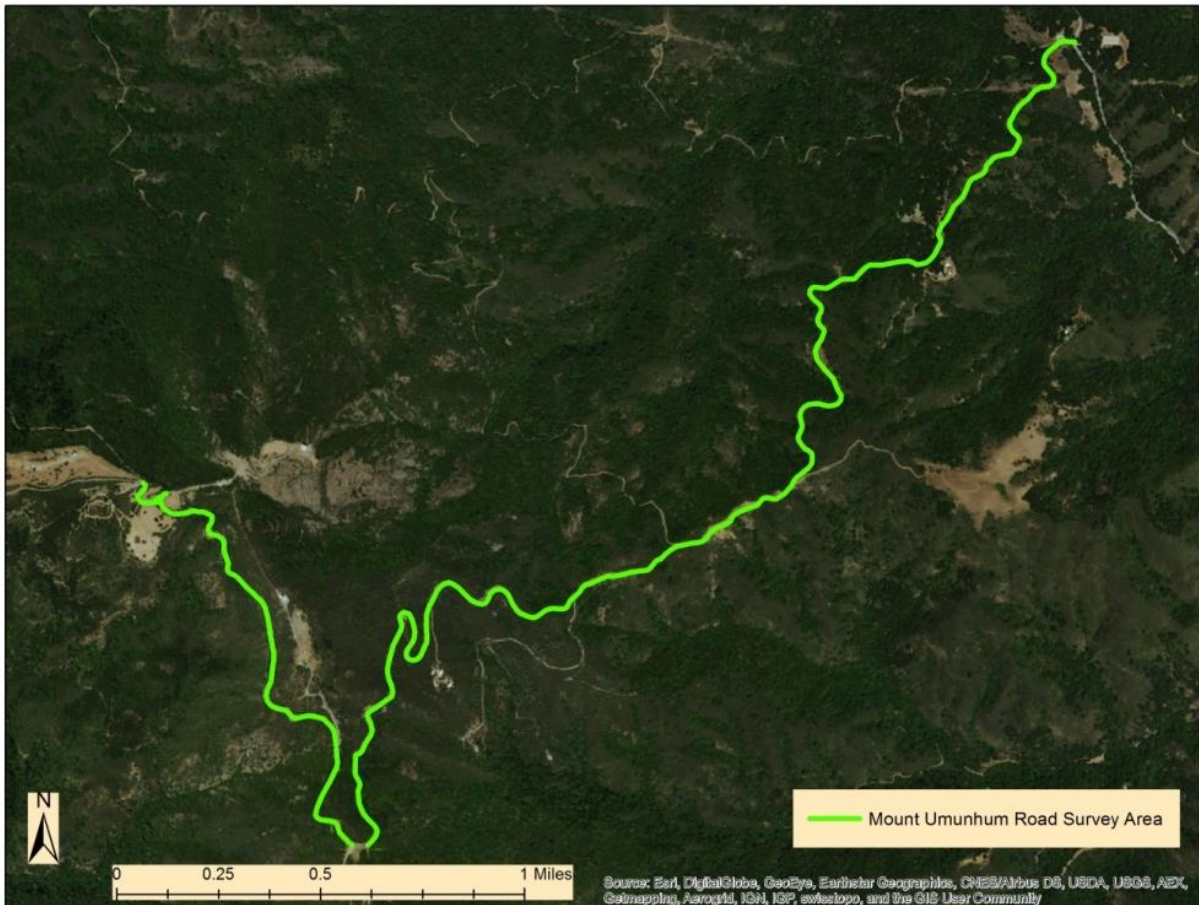
Photo by Janell Hillman, CalPhotos



## Methods

The known population on Mount Umunhum Road was visited as a reference. Both taxa were easily located and in bloom. In late May through early July 2017, each side of the 5.5 miles of road was walked (Map 1), with the surveyor walking the asphalt, berm, or ducking into vegetation as needed in order to survey 15 feet from the road edge, farther if the construction plans showed a wider impact. Special attention was paid to drainages and thickly vegetated areas. The areas within 100 m of observed colonies were given special attention, and the stretch of road from station 121+00 to 167+00 was surveyed twice as a buffer around the located colonies. Numbers of individuals were not counted for either taxa, but rather occupied area was estimated. Impact areas were measured January 17 and 18, 2017.

**Map 1. Project area**



## Results and Initial Recommendations

Five colonies of *Loma Prieta hoita* were observed. Colony 3 also had Mount Hamilton thistle (Map 2). All were found in serpentine or mixed serpentine soils. The colonies are also drawn in onto the work plans (sheets C-8 and C-9) in Figures 1 and 2. The perimeters of the colonies were not GPSed to avoid damaging sensitive habitat.

**Map 2. Five rare plant colonies on Mount Umunhum Road**

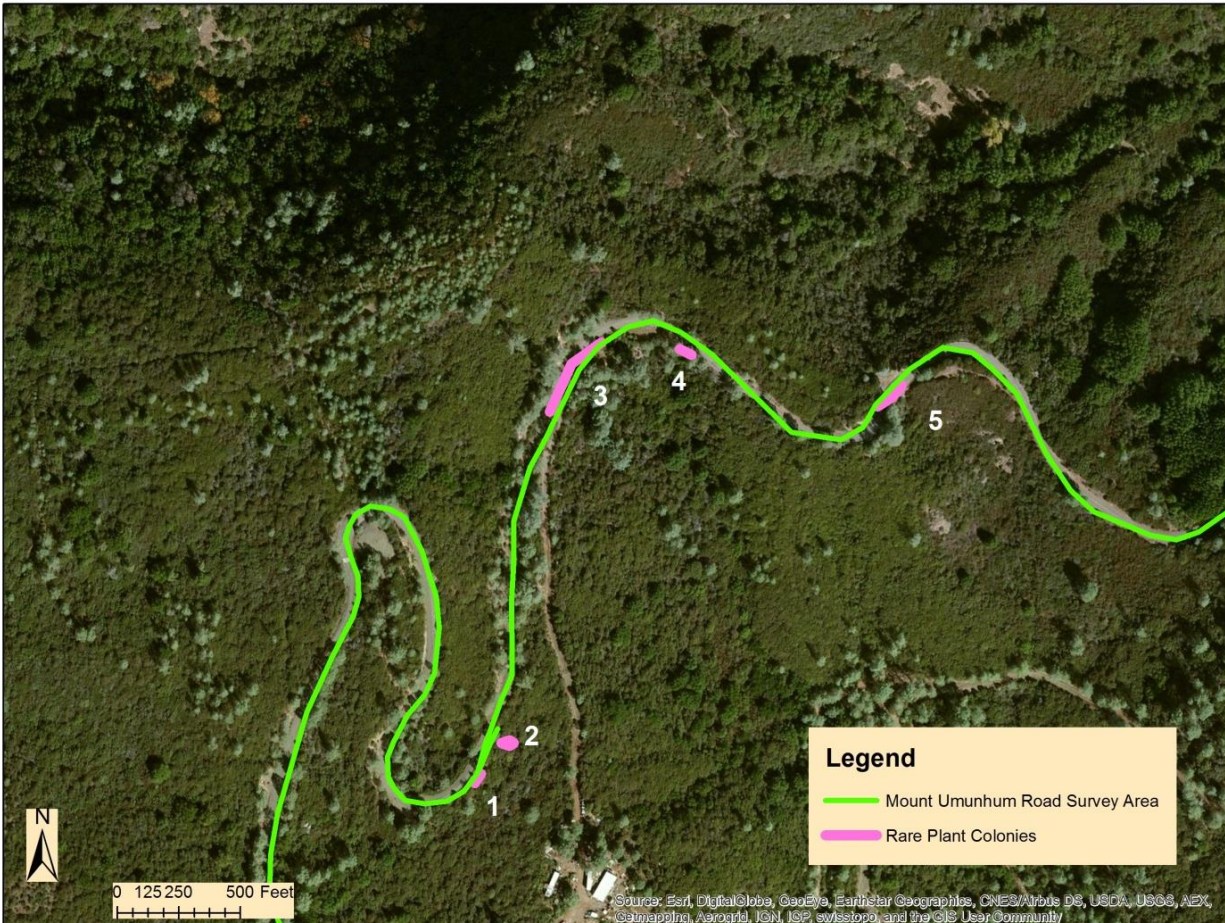


Figure 1. Colonies 1 and 2 in blue

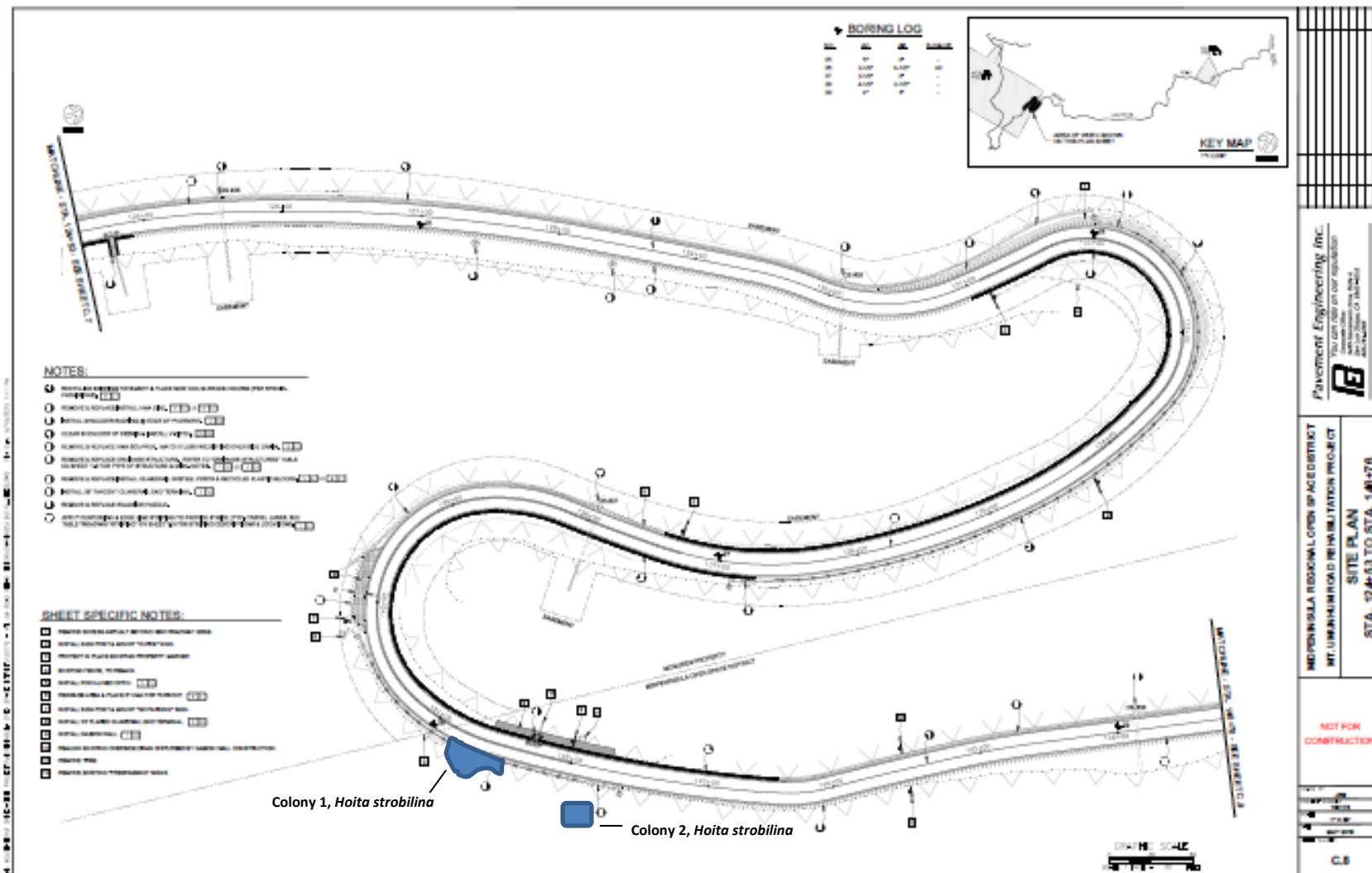
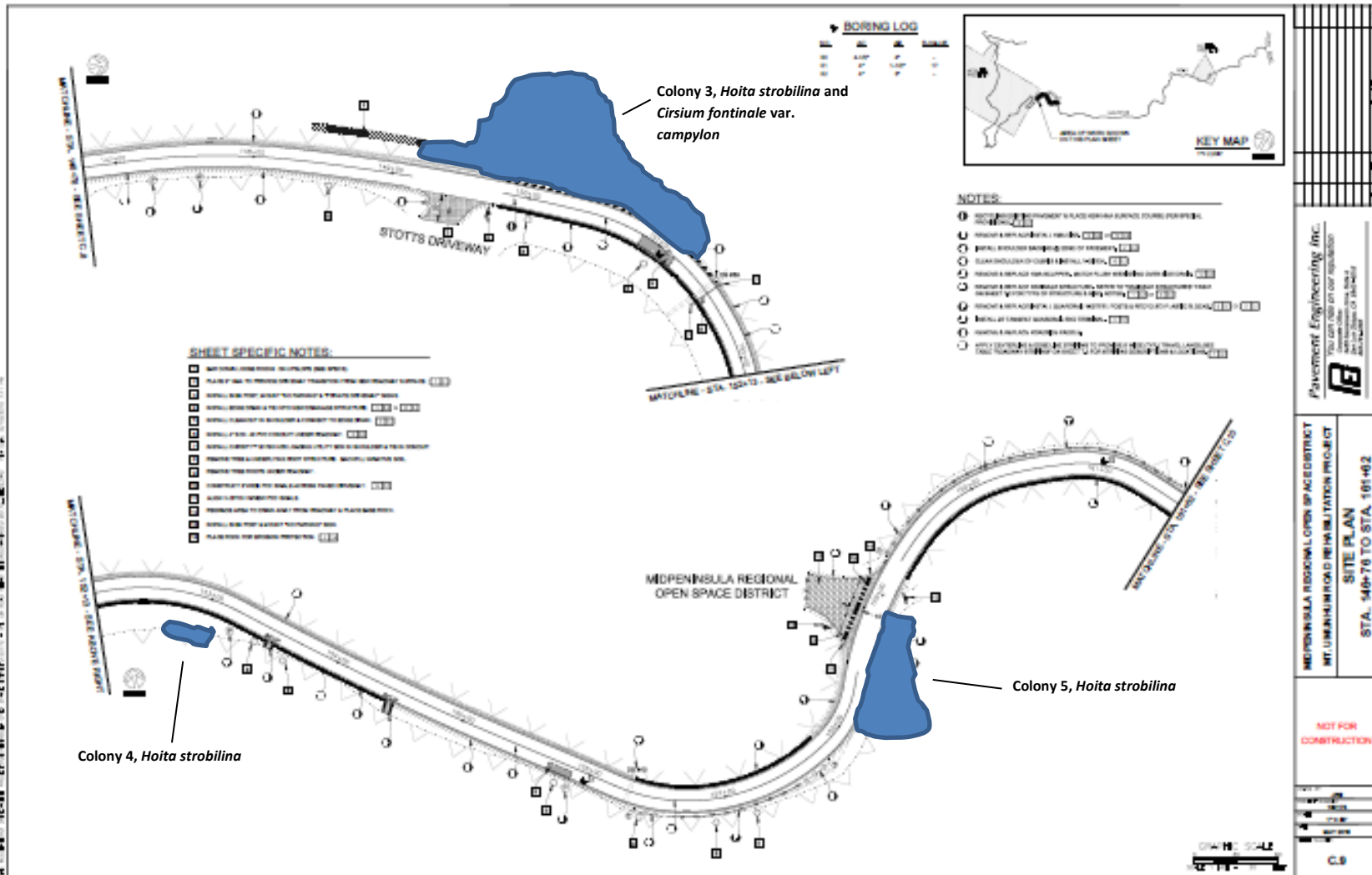


Figure 2. Colonies 3, 4, and 5 in blue



## Colony 1, Loma Prieta hoita

The first colony is on the downhill and southeast side of the road at station 141+00, growing mostly in sun with toyon (*Heteromeles arbutifolia*), bigberry manzanita (*Arctostaphylos glauca*), coyote brush (*Baccharis pilularis*), ceanothus (*Ceanothus* spp.), and gray pine (*Pinus sabiniana*). The site appears dry, with convex topography. The slope ranges from 5° to 30°, and aspect is east. A portion of the colony is growing through the roadside gravel, as well as underneath the guardrail that is slated to be replaced (Photos 2 and 3).

There is about 25 m<sup>2</sup> occupied, with about 8 meters linear along the roadside. Less than 2 m<sup>2</sup> is in the project impact zone.

**Photo 2. Colony 1**



**Photo 3. Colony 1 Hoita growing in guardrail and gravel**



### Mitigation Recommendation

The plants in the gravel by the guardrails are subject to take. If possible, they should be salvaged. Impacts to hydrology must be avoided.

- If possible, salvage plants/rootstock. Depending on site conditions (wetness), plant onsite or place in new 1-gallon container with moist potting mix same day, bring to nursery by next day
- Remove brush piles in occupied habitat
- Mitigation planting to take place (in order of priority, ratio as determined with CDFW) in any unoccupied area onsite, including the downhill perimeter shaded by manzanita; expanding colony 2; expanding colony 3; creating a new colony in the drainage of colony 3, between colonies 3 and 4; at an additional site on MROSD property; or at an additional site off MROSD property, such as Coyote Ridge Open Space Preserve.

### Colony 2, *Loma Prieta hoita*

The second colony is in a mostly shaded bigberry manzanita canopy just downhill of station 142+00, at the terminus of the guardrail marked 8 on the work plans (the same one discussed for Colony 1). It's approximately 6 meters off the road on the downhill side, at about a 25° slope. Aspect is east. There is about 25 m<sup>2</sup> occupied, and the site appears dry (Photo 4).

**Photo 4. Colony 2**



### Mitigation Recommendation

This colony is far enough off the road to be avoided. No mitigation is needed for impacts to this colony, although it may be suitable for receiving mitigation plantings.

### Colony 3, Loma Prieta hoita and Mount Hamilton thistle

The third colony is the original known location, and is by far the largest colony. It is the only known location of Mount Hamilton thistle in the project area. Both taxa are intermixed, with Mount Hamilton thistle generally occupying the wetter areas. The colony runs from station 149+00 to about 151+50 on the northwest and uphill side of the road, with 67 meters right on the road edge. Vegetative associates include gray pine, toyon, coffeeberry (*Frangula californica*), Ceanothus, coyote brush, arroyo willow (*Salix lasiolepis*), and blue wild rye (*Elymus glaucus*). There is about 300-500 m<sup>2</sup> occupied, in partial shade. The slope ranges from 5° to 30°, and aspect is southeast (Photo 5).

#### Photo 5. Colony 3



There are dozens, possibly hundreds of individuals of both rare taxa growing right in the drain area that was originally planned to be cleared. The moisture of the road drainage, plus loose material sloughing off the hill, is creating prime habitat for them. Altering the drainage per the original construction plans would eliminate a sizable portion of prime habitat. The plants appear to be occupying all or most of the appropriate habitat on site, meaning there is not an obvious and unoccupied onsite transplantation area.

#### Impact Options

The project as originally planned would constitute take of both taxa. It should also be noted that selected maintenance impacts will need to be completed at some unknown interval as material sloughs off the hill into the drainage ditch and onto the road. While plants are very likely to recolonize an area after maintenance actions, those plants will again be vulnerable to maintenance at a later date.

Four levels of impact are considered here.

**Level Zero.** Level zero is do nothing, and avoid resurfacing this area altogether. In the interest of time, MROSD could elect to avoid resurfacing this area altogether, especially since this section is not currently

known to have drainage problems. The road could be resurfaced, with a buffer around the plants to avoid any impact. Drainage issues could be left as is.

**Level Zero Impact.** Avoid area. No take.

**Level One.** Level one deals only with plants growing directly over asphalt (soil/duff layer < 2"). This level represents light maintenance that would only remove soil and duff from the asphalt. Any resurfacing would have a buffer that would not impact plants in deeper soil. It should be noted that plants in the level one impact zone are unlikely to reproduce. These impacts were measured in January 2017, in the middle of a very wet month. Multiple thistle seedlings are present in the shallow soil that are unlikely to live long in drier conditions, especially as their roots encounter asphalt. Reproductive individuals in deeper soil were observed falling onto the road, with seedlings readily germinating in this unlikely habitat (Photos 6 and 7). There are lots of recent thistle germinants that are extremely unlikely to survive in such thin soil above asphalt as the season progresses and the site dries. Resurveying for impacts in a drier season is recommended, as the majority of plants noted are likely to die off naturally.

**Level One Impact.** Plants over asphalt (soil/duff layer < 2")

0.5 m<sup>2</sup> Loma Prieta hoita

13.5 m<sup>2</sup> Mount Hamilton thistle (~99% are seedlings)

**Level Two.** Level two is the area where the ditch is, between the asphalt and the toe of the slope. This represents maintenance actions that would dig out the soil that has filled the ditch. The ditch could be cleared and recontoured as level two impact.

**Level 2.** Ditch (between asphalt and toe of slope)

6.0 m<sup>2</sup> Loma Prieta hoita

12.0 m<sup>2</sup> Mount Hamilton thistle

**Level Three.** Level three extends two meters beyond the toe of the slope. This represents potential soil disturbance and take that could occur if the ditch is cleared and possibly undermines the slope above it. Level three is additional impact caused by level two. It's unclear how much soil above the toe of slope would be impacted during level two maintenance. A 2m buffer is probably generous. If fewer plants are impacted, that should be recorded.

**Level 3.** Buffer 2m above toe of slope

47.0 m<sup>2</sup> Loma Prieta hoita

41.0 m<sup>2</sup> Mount Hamilton thistle



**Photo 6. A reproductive Mount Hamilton thistle rooted in deep soil has fallen onto the road.**



**Photo 7. Seedlings have germinated around the parent plant, in a thin layer of pine needles over the asphalt. They are incredibly unlikely to survive as the sites dries with the season.**



## Mitigation Recommendation

The project as originally planned would constitute take of both taxa.

- In the interest of time, MROSD has selected to avoid resurfacing the road in the area. This would constitute a level zero impact, or no take.
- If the ditch is reengineered in the future, Creekside Science recommends a dirt drainage ditch, rather than concrete or large pieces of hardscape, so that both taxa could recolonize. Contractor should recommend how to maintain drainage function while allowing plants to grow in the mesic drainage. It may be possible that the full amount of plants taken in levels 2 and 3 can passively recolonize the construction zone. Salvaging plants would speed up the process. If the mesic quality of the site can be maintained in the drainage, recolonization or transplanting is likely to succeed.
- Loma Prieta hoita should be salvaged as possible. Mount Hamilton thistle salvage should be possible, but it may not be feasible or promising to salvage seedlings (longest leaf <10 cm).
- Loma Prieta hoita mitigation planting to take place (in order of priority, ratio as determined with CDFW) in any unoccupied area onsite (especially disturbed slope of level 3 impact); creating a new colony in the drainage of colony 3, between colonies 3 and 4; expanding colony 2; expanding colony 1; at an additional site on MROSD property; or at an additional site off MROSD property, such as Coyote Ridge Open Space Preserve.
- Mount Hamilton thistle mitigation planting to take place (in order of priority, ratio as determined with CDFW) in any unoccupied area onsite (especially disturbed slope of level 3 impact); at an additional site on MROSD property; or at an additional site off MROSD property, such as Tulare Hill in San Jose.

### Colony 4, Loma Prieta hoita

The fourth colony is on the south and downhill side of station 153+00, growing in partial shade with gray pine, toyon, bigberry manzanita, Ceanothus, foothill needlegrass (*Stipa lepida*), and yerba santa (*Eriodictyon californicum*). The site appears dry. Plants are about 2.5 meters off the road, with about 10 meters along the roadside and a total of 30 m<sup>2</sup> occupied. The slope ranges from 5° to 20°, and aspect is south (Photo 8).

#### Photo 8. Colony 4



#### Mitigation Recommendation

This colony is far enough off the road to be avoided. No mitigation is needed for impacts to this colony, although it may be suitable for receiving plantings.

### Colony 5, Loma Prieta hoita

The fifth colony is on the southeast side of the road between 158+00 and 159+00, growing in partial shade with gray pine, yerba santa, coffeeberry, and bigberry manzanita. The site has concave topography, but appears dry on the surface. Some plants are growing into the paddles that are marked for replacement. They are also growing through the asphalt. About 20 meters of roadside is occupied, with about a total of ~100 m<sup>2</sup> occupied. The slope ranges from 5° to 30°, and aspect is southeast (Photos 9-11). Only 3 m<sup>2</sup> are in the impact zone.

**Photo 9. Colony 5**



**Photo 10. Colony 5 Loma Prieta hoita growing around paddles**



**Photo 11. Colony 5 Loma Prieta hoita growing in asphalt**



### **Mitigation Recommendation**

Only the plants in the asphalt and by the paddles are subject to take. If possible, they should be avoided. If this is not possible, salvage should be attempted. Impacts to hydrology must be avoided.

- It may be possible to avoid all impacts by shifting the road slightly. Even 6 to 12 inches could make a difference. If the contractor can avoid impacts, choose that route.
- Paddle removal should be done by sawing the paddles flush, rather than removing them and disturbing the soil.
- If possible, salvage plants/rootstock. Depending on site conditions (wetness), plant onsite or place in new 1-gallon container with moist potting mix same day, bring to nursery by next day
- Remove brush piles in occupied habitat
- Mitigation planting to take place (in order of priority, ratio as determined with CDFW) in any unoccupied area onsite; creating a new colony in the drainage of colony 3, between colonies 3 and 4; at an additional site on MROSD property; or at an additional site off MROSD property, such as Coyote Ridge Open Space Preserve.

### **Conclusion**

Five colonies of Loma Prieta hoita, one of which also contained Mount Hamilton thistle, were noted in this survey. Some of these colonies can probably be avoided with slight changes to the project, and others may need to be mitigated for. In the interest of time, some sections of the roadwork may need to be avoided, but mitigation options should be negotiated with CDFW should larger impacts need to be selected later.

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