Arana Gulch Habitat Management Plan
City of Santa Cruz

Year 3 (2016) Annual Report

CDFW Permit No. 2081 (a)-13-013-RP

Coastal Development Permit No. 3-11-074 (Arana Gulch)

February 10, 2017

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1. Executive Summary

This monitoring report evaluates the City's progress implementing the Arana Gulch Habitat Management Plan (HMP). The HMP guides the long-term restoration of the 67 acre Arana Gulch Open Space. The plan provides management goals and objectives to enhance three specific management areas: Hagemann Gulch Riparian Woodland Management Area, Arana Creek Wetland and Riparian Management Area and the Coastal Prairie/Tarplant Management Area.

The HMP was developed as part of the California Coastal Commission's (CCC) Coastal Development Permit process for the adoption of the Arana Gulch Master Plan (Master Plan). The Master Plan includes management guidelines for access, resource management, and education. Since Arana Gulch lies within the CCC's Coastal Zone, a permit was necessary to implement the Master Plan. The CCC conditionally approved the permit on December 8, 2011. Special permit conditions required, among other things, developing and implementing an HMP, establishing a technical advisory group to advise the City on habitat management actions, and submitting annual monitoring reports to document compliance with the HMP.

The City finalized and began implementing the HMP in 2013. A technical advisory group was formed, the Adaptive Management Working Group (AMWG). Actions outlined in the HMP were initiated in 2013 and 2014; these actions are described in the Year 1 (2014) Annual Report. Actions implemented in Year 2 (2015) are described in this report. The AMWG provided input to the City during the implementation of the Year 2 activities.

The purpose of this annual report is to describe the current condition of the Arana Gulch habitat areas, evaluate the performance of each area in relation to the interim performance standards outlined in the HMP and included in the CDP, and provide management recommendations for the following year to ensure progress toward and achievement of success criteria. In Year 3 (2016), the City continued to focus on improving the habitat of the Santa Cruz tarplant (SCT), a federally Threatened and a California State Endangered species. The City continued cattle grazing and continued to implement management to control invasive weeds from the prairie/tarplant management area. In addition, the City initiated management to remove and control invasive weeds and encroaching trees in the Arana Gulch Creek Management Area. All of these actions taken by the City are to continue progress to meet the HMP objectives. The habitat management activities undertaken in 2016 are summarized below.

Master Plan Improvements

Master plan improvements in 2016 were limited to the installation of signs and minor trail maintenance associated with the Arana Gulch Multi-Use Trail and the Agnes Street Connector Trail. These trails were completed in 2013 and 2014, respectively. The

AMWG provided the City with recommendations relating to the content of the park brochures and trail signs, particularly relating to the use of cattle as a tat management tool. Small areas within Area C were scraped to remove rocks left over from trail construction and to create bare areas for SCT.

Trail construction over Hagemann Gulch and Arana Creek affected riparian woodland and in 2014 the City prepared a revegetation plan pursuant to a CDFW Streambed Alteration Agreement. Revegetation at/around Arana Creek was installed in January and February 2015 by City staff and volunteers; additional plants were installed in February 2016. City staff maintained these plantings throughout 2016 and planted additional willows at Arana Creek to meet the conditions of approval. Mitigation plantings identified for the Hagemann Gulch area are scheduled for installation in 2017.

Summary of Coastal Prairie/Santa Cruz Tarplant Management Area Activities

Management actions in Year 3 included seasonal grazing and seasonal mowing. As per a grazing contract and Stocking and Work Program prepared in 2014, the City continued to contract with a local rancher for seasonal grazing. Cattle grazing commenced in January 2016 and extended to June 2016. Additional activities in this management area included monitoring plant composition, plant cover and residual dry matter (RDM) within grazed areas, implementing removal/control of invasive weed infestations, and documenting site conditions at previously established permanent photo stations. Cattle-rubbing posts were installed to encourage cattle congregation to create bare areas for SCT. The cattle trough was extended an additional 100 feet into Grazing Area A to both increase the opportunities for bare ground away from the fence-line in addition to separating park users from cattle which congregate around the grazing trough which had previously been located adjacent to the fence-line.

Prairie site conditions were documented in April 2016 with plant species composition and cover values recorded at permanent transects. Photo-documentation was also conducted in April 2016. Documentation of the Year 3 conditions, using permanent transects was done in compliance with the HMP. In coordination with the AMWG, five sub-management areas were identified to reflect the various plant species composition, as well as presence/absence of SCT, that may direct future management and monitoring. Grass heights were measured in February, April, and August per AMWG recommendations. Additionally, residual dry matter was assessed in October.

As per guidelines in the HMP, seasonal mowing was conducted for grassland/prairie areas located outside the grazing fences between January and December (Tarplant Area B) and between January and June (all other areas) to reduce the canopy height of the non-native grasses and forbs to benefit the coastal prairie species diversity and habitat function. Bird surveys were completed prior to mowing and no nests were observed. Buffer areas were created near the wooded areas and islands were left in the drainage

areas to ensure to create areas for hiding and hiding and nesting as per the recommendations from the Santa Cruz Bird Club.

A census of SCT was conducted in summer 2016; 35 SCT plants were found, an increase from 0 plants in 2015. Increasing the SCT population is an HMP goal. The population was recorded at 18 plants in 2013, 4 plants in 2014, 0 plants in 2015, and 35 plants in 2016. This is well below a population of approximately 348 plants in 2006.[1] In 2016, SCT plants were documented from Area A, in areas subject to cattle grazing. At appears that cattle grazing created suitable growing conditions for the SCT in 2016. To date, site management has increased the number of SCT meeting an HMP goal; however, the population is not up to the 2006 level.

In compliance with the HMP and an Invasive Weed Work Plan (IWWP) prepared for the management area, City staff implemented the plan. From January through June City staff removed occurrences of invasive, non-native plant species within the central prairie/grassland. The City continued to control remove cotoneaster, Himalaya blackberry, and English ivy from the prairie and removed basal rosettes and flowering stalks from thistles. In December, most of the trees around Grazing Area A, from Hagemann Bridge to the overlook above the harbor were removed, as the trees are not desired within areas designated for grassland in compliance with the IWWP and the HMP and recommended by the AMWG.

In November, wattles were placed along Hagemann Bridge to reduce sedimentation from run-off.

Summary of Hagemann Gulch Riparian Woodland and Arana Gulch Creek Riparian Woodland and Wetland Areas Activities

Pursuant to a survey that mapped of occurrences of invasive, non-native plant species within the Arana Gulch Creek Riparian Woodland and Wetland Management Area, City staff began removal and control of non-native, invasive weeds in a portion of the management area. English ivy was removed and controlled along the upslope portion of the Marsh Vista Trail.

In 2014 a revegetation plan was prepared for an area along Arana Creek and Hagemann Gulch pursuant to a Streambed Alteration Agreement (SAA) with CDFW to compensate for the removal of riparian vegetation as part of the construction of the Arana Gulch Multi-Use Trail. Revegetation at/around Arana Creek was installed in January and February 2015, with some replacement plantings installed in February 2016. City staff maintained these plantings throughout 2016. Additional willow plantings were installed near Arana Creek to replace previous planting that died.

[1] See Section 3.3, page 52 of Arana Gulch HMP.

Clean-ups from illegal camping activities were performed to remove trash and waste, primarily from the woodland areas.

Management Activities Proposed for 2017 (Year 4)

The following management actions are identified for 2017:

- Continue seasonal cattle grazing within the prairie/SCT management area, as per the approved grazing contract and Stocking and Work Program. Additional activities in this management area include monitoring plant composition, plant cover and residual dry matter (RDM) within grazed areas, implementing removal/control of invasive weed infestations, and documenting site conditions at the permanent photo stations.

- Within the boundaries of the prairie/SCT management area, designated woody plants growing outside of the grazing area, yet within the designated grassland, will continue to be removed and herbicide treatment may need to be applied, if needed to control stump sprouting. Continual treatments will need to be planned and implemented to keep woody plants from encroaching into the prairie. Three test scrape plots created in the northern portion of the greenbelt will be monitored in 2017 as to plant composition and cover to determine if these areas should be retained in the prairie management area. In addition, soil salvage areas created near Area C will be monitored for any expression of SCT.

- A census of SCT will be conducted in summer 2017. Seed collection of SCT may be done if more than 50 SCT are present, pending prior approval from CDFW.

- The City will implement management actions within the Arana Gulch Creek and Hagemann Gulch management areas. The City will complete the identification and mapping of invasive, non-native plant species within the Hagemann Gulch Riparian Woodland Management Area, pending funding and other resources. The City will solicit input from the AMWG on prioritizing invasive plant removal actions within the Arana Gulch Creek Riparian Woodland and Wetland Management Area and will use this input to develop an Invasive Weed Work Plan for these areas. The City will begin controlling ivy under the Hagemann bridge and continue removal and control actions along the Marsh Vista Trail.

- The City will close the ad-hoc path along Arana Creek to prevent public access to the natural area. Wattles and straw will be placed at the ad-hoc entrance to the creek area near the signage to prevent run-off from the Coastal Loop Trail from entering Arana Creek. The City will work with the AMWG to form recommendations for improving trail sections to improve walkability and deter new trails from forming.

- The City will continue to confer with the Resource Conservation District (RCD) on Arana Creek watershed management, including measures to reduce erosion and sediment entry into the watershed. The City provides funds to the RCD to apply for grant opportunities to implement erosion control projects.

- The City will continue to confer with the AMWG on adaptive habitat management activities in 2017 through periodic meetings and group email correspondence. The tentative schedule is to hold AMWG meetings in February, July, and November 2017.

- The City will seek membership from Lisa Sheridan to work on the group and provide expertise on birds.

- The City will coordinate with the Natural History Museum to conduct educational tours on restoration activities.

- The AMWG will finalize recommendations for aligning targets for the prairie, grassland, mixed, and SC tarplant areas.

2. Introduction

2.1 Background

Arana Gulch is 67 acres of open space owned by and located within the City of Santa Cruz. The eastern half of the property features the riparian corridor of Arana Gulch Creek and a tidal wetland where the creek drains into Monterey Bay at the Santa Cruz Harbor. The western half is remnant coastal prairie grassland that supports the Santa Cruz tarplant, a federally Threatened and a California State Endangered species. A steep and narrow intermittent drainage called Hagemann Gulch crosses the property on the western boundary. The features of the greenbelt property are depicted on **Figure 1**.

The City of Santa Cruz developed a master plan for the property to improve natural resource protection and restoration, public access and education. Implementation of the Arana Gulch Master Plan required the City to obtain a coastal development permit (CDP) from the California Coastal Commission because a portion of the planning area lies within the designated Coastal Zone. The CDP (3-11-074) included both standard and special conditions, requiring, among other things, developing the Arana Gulch Habitat Management Plan (HMP) to guide the long-term restoration of the open space. Specifically, Special Condition 3 of CDP 3-11-074 states:

> Arana Gulch Habitat Management Plan. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit for Executive Director review and approval three copies of a final Arana Gulch Habitat Management Plan (HMP). The HMP shall provide for the restoration, enhancement, and long-term management of all Arana Gulch habitat areas (including, as referenced by the Arana Gulch Master Plan, the Coastal Prairie/Tarplant Management Area, the Arana Gulch Riparian and Wetland Management Area, and the Hagemann Gulch Riparian Woodland Management Area) as self-sustaining and functioning habitats in perpetuity. The HMP shall be prepared by a qualified expert in restoration ecology for each of the habitat types, and shall take into account the specific conditions of the site as well as restoration, enhancement, and management goals. The HMP shall be substantially in conformance with the Master Plan documents submitted to the Coastal Commission, including the August 1, 2005 document entitled "A Management Program for Santa Cruz Tarplant (Holocarpha macradenia) at Arana Gulch"), including that it can be submitted in a package that includes relevant Master Plan documentation with an addendum that addresses this condition, provided all language is modified to be directive (e.g., "shall" rather than "should") and it complies with the following requirements and includes:
>
> (a) A baseline assessment, including photographs, of the current physical and ecological condition of the restoration and enhancement areas. All existing topography, wet features, and vegetation shall be depicted on a map.

(b) A description of the goals of the plan, including in terms of topography, hydrology, vegetation, sensitive species, and wildlife usage.

(c) A description of planned site area preparation and invasive plant removal.

(d) Any planting either of seeds or container plants shall be made up exclusively of native taxa that are appropriate to the habitat and Arana Gulch region. Seed and/or vegetative propagules shall be obtained from local natural habitats so as to protect the genetic makeup of natural populations. Horticultural varieties shall not be used.

(e) A plan for monitoring and maintenance of habitat areas in perpetuity, including:

- A schedule.
- A description of field activities, including monitoring studies.
- Monitoring study design for each habitat type, including, as appropriate: goals and objectives of the study; field sampling design; study sites, including experimental/revegetation sites and reference sites; field methods, including specific field sampling techniques to be employed (photo monitoring of experimental/re-vegetation sites and reference sites shall be included); data analysis methods; presentation of results; assessment of progress toward meeting success criteria; recommendations; and monitoring study report content and schedule.
- Adaptive management procedures, including provisions to allow for modifications designed to better restore, enhance, manage, and protect habitat areas.
- Provision for submission of reports of monitoring results to the Executive Director for review and approval in perpetuity, beginning the first year after initiation of implementation of the plan. Such Monitoring Reports shall be submitted annually until success criteria are met, and then shall be submitted on an every 3-year basis after that. Each Monitoring Report (annual and 3-year) shall be cumulative and shall summarize all previous results. Each report shall clearly document the condition of the habitat areas, including in narrative (and supporting monitoring data) and with photographs taken from the same fixed points in the same directions as the baseline assessment and prior Monitoring Reports. Each report shall include a performance evaluation section where information and results from the monitoring program are used to evaluate the status of the restoration, enhancement, and long-term management in relation to the interim performance standards and final success criteria. To allow for an adaptive approach, each report shall also include a recommendations section to address changes that may be necessary in light of monitoring results and/or other information, including with respect to current restoration information and data related to the habitat areas in question, and to ensure progress toward and achievement of success criteria. Actions necessary to implement the recommendations shall be implemented within 30 days of Executive Director approval of each Monitoring Report, unless the Executive Director identifies a different time frame for implementation.

(f) Interim success criteria to be achieved in the first year of implementation, tied directly to the annual reporting requirement. Also, measurable goals to achieve habitat improvement over time, subject to modification by the Adaptive Management Working Group.

(g) Implementation procedures, cost estimates, identification and allotment of funding for all HMP activities, and related reporting procedures.

(h) Provisions for minor adjustments to the HMP by the Executive Director if such adjustments: (1) are deemed reasonable and necessary; and (2) do not adversely impact coastal resources.

(i) Identification of the membership of the Adaptive Management Working Group, which initial composition and any future changes shall be subject to Executive Director approval. The Adaptive Management Working Group shall guide all HMP activities under the plan.

(j) All details associated with the grazing program, subject to Adaptive Management Working Group and Executive Director approval, in substantial conformance with the proposed cattle grazing program (see Exhibit P Tab 4).

PRIOR TO COMMENCEMENT OF CONSTRUCTION, the HMP shall be implemented by establishing the Adaptive Management Working Group (AMWG), receiving prioritized first-year management recommendations from the AMWG, and initiating implementation of the highest priority recommendations in the field.

The Permittee shall undertake development in accordance with the approved Arana Gulch Habitat Management Plan.

The HMP guides management of three habitat areas within Arana Gulch: the Hageman Gulch Riparian Woodland Management Area, the Arana Creek Wetland and Riparian Management Area and the Coastal Prairie/Tarplant Management Area. Within the Coastal Prairie/Tarplant Management Area, the HMP focuses on restoration of the coastal prairie and recovery of the Santa Cruz tarplant (SCT); this management area continued to receive the most attention in Year 3 (2017) due to the urgency to revitalize the SCT population. The population of SCT at Arana Gulch has varied greatly in response to previous management actions; in some years the population increased and in some years it dramatically decreased. Unfortunately, despite efforts from the City, the overall trend has been a decline in the population over the last two decades.

The HMP outlines various management tools for managing the three habitat areas on the site[2]. A key tool described in the HMP is an adaptive management framework for habitat restoration actions. Under this framework, and as required by the CDP, an Adaptive Management Working Group (AMWG) was formed to provide scientific expertise on

[2] See Section 3.1, page 33 of Arana Gulch HMP.

resource management activities to the City and the CCC[3]. In 2016, the AMWG provided input to the City during implementation of several components of the HMP.

Implementation of the HMP coincided with the construction of the Arana Gulch Multi-Use Trail project. Bike paths, hiking trails, cattle grazing infrastructure, and bridges were built within the greenbelt. Most of these features were completed in 2014 and the grazing infrastructure was completed in early 2015. The construction activities associated with the multi-use trail project that are relevant to the restoration effort are fully described in the Year 1 (2014) Annual Report (City of Santa Cruz, November 2015).

This is the 3rd annual report since adoption of the HMP and many objectives of the plan have not yet been realized as the long-term habitat management effort has just begun. The report is intended to report on the progress of the plan in the monitoring year, provide a comparison to previous year data and trends, and prepare for future management actions. The reader is directed to previous annual reports for specific details and data implemented in these years. The previous annual report (e.g., Year 1 [2014] Annual Report and Year 2 [2015] Annual Report) is available for review on the City's website (http://www.cityofsantacruz.com/departments/parks-recreation/parks-beaches-and-open-spaces/open-spaces/arana-gulch).

The HMP is grounded in an adaptive management framework. Implementation actions will constantly be reviewed and improved upon. Therefore, this annual report is not intended to lay out every action to be implemented for the upcoming year. It will highlight the actions that have been identified by the City and from AMWG meetings from the monitoring year; however, additional actions may be identified by the City and during AMWG meetings throughout the upcoming year.

[3] See Section 2.2, Page 22 of Arana Gulch HMP.

Figure 1. Location map

2.2 Project Purpose and Report Organization

The purpose of this annual report is to describe the current condition of the Arana Gulch habitat areas, evaluate the performance of each area in relation to the interim performance standards outlined in the HMP and included in the CDP, and provide management recommendations for the following year to ensure progress toward and achievement of success criteria. In addition to activities approved under the CDP, this report also reports on activities authorized by a Scientific, Educational, or Management Permit issued by the California Department of Fish and Wildlife (Permit No. 2081 (a)-13-013-RP). This report includes all activities conducted in the calendar year 2016 which is considered to be Year 3 pursuant to actions outlined in the HMP and the CDFW 2081(a) permit. Additionally, this report describes activities associated with the implementation of Arana Gulch Master Plan improvements where such activities intersect with the goals and objectives of the HMP. The City conferred with technical specialists, including AMWG members, regulatory agency personnel, the City of Santa Cruz Planning and Community Development Department, and members of the public while implementing adaptive habitat management activities on the greenbelt.

The adaptive management framework of the HMP is presented in Section 3. The habitat management actions associated with Master Plan improvements are described in Section 4. Actions implementing the HMP are presented in Sections 5 through 7 under their respective management area. Each management area section includes a summary of the implemented actions as they pertain to the goals and objectives in the HMP, and a performance evaluation. Recommendations for Year 4 (2017) are summarized in Section 8. Please refer to the HMP for technical background information on the Arana Gulch greenbelt and HMP goals and objectives. Please refer to previous annual reports (i.e., Year 1 [2014] Annual Report and year 2 [2015] Annual Report) for specific details on actions implemented in those years.

3. Adaptive Management Framework

3.1 Adaptive Working Group (AMWG)

The City adopted an adaptive management framework for implementation of the HMP. The City facilitated and coordinated habitat management activities with the AMWG in 2016. Two meetings were held with the AMWG in 2016; the minutes from the March 14 and July 19 meetings are presented in **Appendix A**. In addition, the City coordinated and facilitated group email correspondence between AMWG members to solicit input on management activities. The HMP outlines the formation of the AMWG, voting procedures, and other procedures.[4] The list of current members is presented in the meeting minutes **(Appendix A).** The group is currently inquiring resource professionals for additional membership.

The AMWG provided input to the City on habitat management activities within Arana Gulch throughout 2016. A detailed discussion of AMWG recommendations is included in the sections for each management area and in the meeting minutes. In short, the AMWG provided recommendations on the seasonal perimeter mowing, the location of grazing infrastructure (i.e., salt licks and relocation of water troughs), invasive weed control, drainage along the east-west trail, and measures to protect and manage wetlands along Arana Creek.

3.2 Public Outreach

In 2016 the City maintained a webpage on the City of Santa Cruz website to communicate restoration efforts to the public and to provide a place for documents related to the requirements of the CDP. The City periodically updated the webpage throughout 2015.

The AMWG meetings were open to the public and provided a forum for members of the public to express their ideas directly to the members and City. Public comments were also generated through the City's website and the AMWG was briefed of public comments and concerns during AMWG meetings.

In preparation of the beginning of grazing season in January 2016, City staff and park rangers spent time on site to discuss the grazing program and the importance of keeping dogs on-leash when they encountered violators of the rule. The City continued to provide a brochure at the entrances to the greenbelt informing the public of why grazing was being implemented and listing safety tips for human/dog and cattle interactions. The brochure was also posted onsite and on the City webpage. Signage was maintained onsite with a web address for notifying the City on any concerns regarding grazing or other public access issues within the greenbelt. When cattle were on site in 2016 (January through June), City staff and park rangers provided information to the public on the grazing program through park brochures and on-site conversations.

[4] See pages 22-24 of Arana Gulch HMP

3.3 Evaluation of Adaptive Management HMP Goals

A goal of the HMP is to maintain an adaptive management framework to allow stakeholders to conduct and evaluate actions. To meet this goal there are two objectives: conduct AMWG meetings and maintain funding levels. In 2016, two meetings were held with the AMWG as outlined in Objective 1A. The City dedicated funding to implement the habitat management actions identified in the HMP based on a prioritization recommended by the AMWG in 2014. The City and the AMWG began to re-visit prioritizing the HMP management actions in 2016, but this task was not completed. This task will be conducted in 2017 and the results of this prioritization will be included in the 2017 annual report.

To meet Objective 1B, the City dedicated Arana Gulch management as a line item in the City Parks and Recreation Departments operating budget. The City also hired a maintenance person that is partially dedicated to the Arana Gulch greenbelt. The position was filled in January 2016.

A second adaptive management goal is to conduct a two-tracked program of management and research with monitoring. The management actions implemented in 2016, such as seasonal grazing and perimeter seasonal mowing, were monitored to determine their effectiveness in meeting biological variables. The HMP identified a timescale for implementation of the management actions relative to the Santa Cruz tarplant with an objective of increasing the number of aboveground SCT to at least the 2006 level (348 plants) by 2016 (first year after grazing). Management actions are being implemented to meet this timescale. The timescale presented in the HMP for restoration of the coastal prairie or invasive plant control is a trend to a more functioning system by 2020.

The third adaptive management goal is to develop educational opportunities within Arana Gulch, with efforts to conserve and store its rare resources. The City maintained a web page on the City's website to post information about the HMP and received input from the AMWG and the public consistent with Objective 3A. Additional recommendations for public outreach were identified by the AMWG and the public (i.e., signs for cattle grazing and developing a brochure on cattle grazing) and the City implemented them in 2015. **Table 1** presents a summary of the objectives for adaptive management, actions implemented in 2016, and whether the actions were in compliance with the HMP.

Table 1. Monitoring of Adaptive Management Variables

Objective and Variable	Actions in Year 3 (2016)	Year 3 (2016) Results	Objective Met?
Goal 1. Maintain an adaptive management framework that allows stakeholders to scientifically conduct and evaluate actions			
Objective 1A. Conduct at least 3 AMWG meetings in 2013 with a quorum of members present each time. In subsequent years, the frequency of meetings beyond an annual November meeting can be determined by the needs of the AMWG.	Meetings held march 14 and July 19, 2016	Meeting minutes presented in Appendix D	Yes, two meetings held in 2016 and AMWG members agreed to postpone a November 2016 meeting to January 2016.
Objective 1B. Maintain funding levels to achieve a level of habitat management that is 1) indefinitely sustainable into the future, and 2) shows a stable or increasing trend in measured biological variables over a biologically appropriate timescale.	Funding allocated by City; line item established in operating budget	Funding allocated by City for fiscal year July 1, 2016 to June 30, 2016.	Yes, funding has allowed for a maintenance worker to implement management and there has been an increase in the measured biological variables.
Goal 2. Conduct a two-tracked program of management and research with built-in monitoring			
Objective 2A. Maintain a Management Track that leads to stable or increasing trend in measured biological variables over a biologically appropriate timescale.	The City incorporated AMWG recommendations into multiple management actions	Data from studies and monitoring were considered by City and AMWG during management decisions	Yes, monitoring of biological variables were conducted as outlined in the HMP. Trends in biological variables were also documented. Management actions were implemented to achieve desired variables for SCT by 2016 and coastal prairie by 2020 (timescale).
Objective 2B. Utilize a Key Management Question (KMQ) framework to guide the Research Track when research is needed to achieve the specific goals and objectives for SCT and the coastal prairie.	No research conducted in 2016	No research conducted in 2016	Yes, when additional research items are identified, the KMQ framework will continue to be used.
Goal 3. Develop public educational opportunities associated with Arana Gulch and efforts to conserve and restore its rare resources			
Objective 3A. Maintain a website to communicate restoration efforts to the public and provide a place for documents related to the requirements of the CDP, such as Monitoring Reports.	Webpage on City website developed in 2013	Webpage updated throughout 2016 with new information	Yes, City improved and updated website in 2016 and the webpage was periodically updated with reports and information as needed

4. Implementation of Master Plan Improvements

Construction of the Arana Gulch Multi-Use Trail was initiated in fall 2013 and was completed in December 2014. This east-west trail extends from Brommer Street (east of the greenbelt) westward to Broadway Street (west side of greenbelt, across Hagemann Gulch). The Agnes Street Trail extends southward from Agnes Street to join the east-west multi-use trail midway within the greenbelt. This trail was constructed in 2014. The Marsh Vista Trail, a pedestrian trail located along the east side of Arana Creek, was constructed in 2013. Activities associated with Master Plan improvements are described in this section. The schedule of when master plan improvements were implemented is provided in each section below.

4.1 Multi-Use Trail Construction Areas

A temporary construction access road was used in 2013 and 2014 during trail construction. The area was allowed to naturally revegetate from the existing soil seed bank. The access way is contained within Grazing Area C and was subject to periodic cattle grazing from January through June 2016. Coast tarweed (*Deinandra corymbosa)* colonized this area and surrounding areas, as depicted in **Figure 2**. The location of this road and other master plan improvements is presented in **Figure 3**.

Areas subject to hydromulch and hydroseeding for erosion control as part of trail construction were observed in 2016. No erosion was noted in these areas and no additional seeding was conducted in 2016. An area with construction-related gravel was scraped in December 2016 to remove the gravel; the topsoil was retained and re-scattered in place. The location of the scraped area is depicted in **Figure 3. Figure 4** depicts the site after removal of the gravel. No other actions were done along the central construction access way in 2016.

Figure 2. Condition of temporary construction access road, July 2016

Figure 3. Master Plan improvements, 2013 - 2016

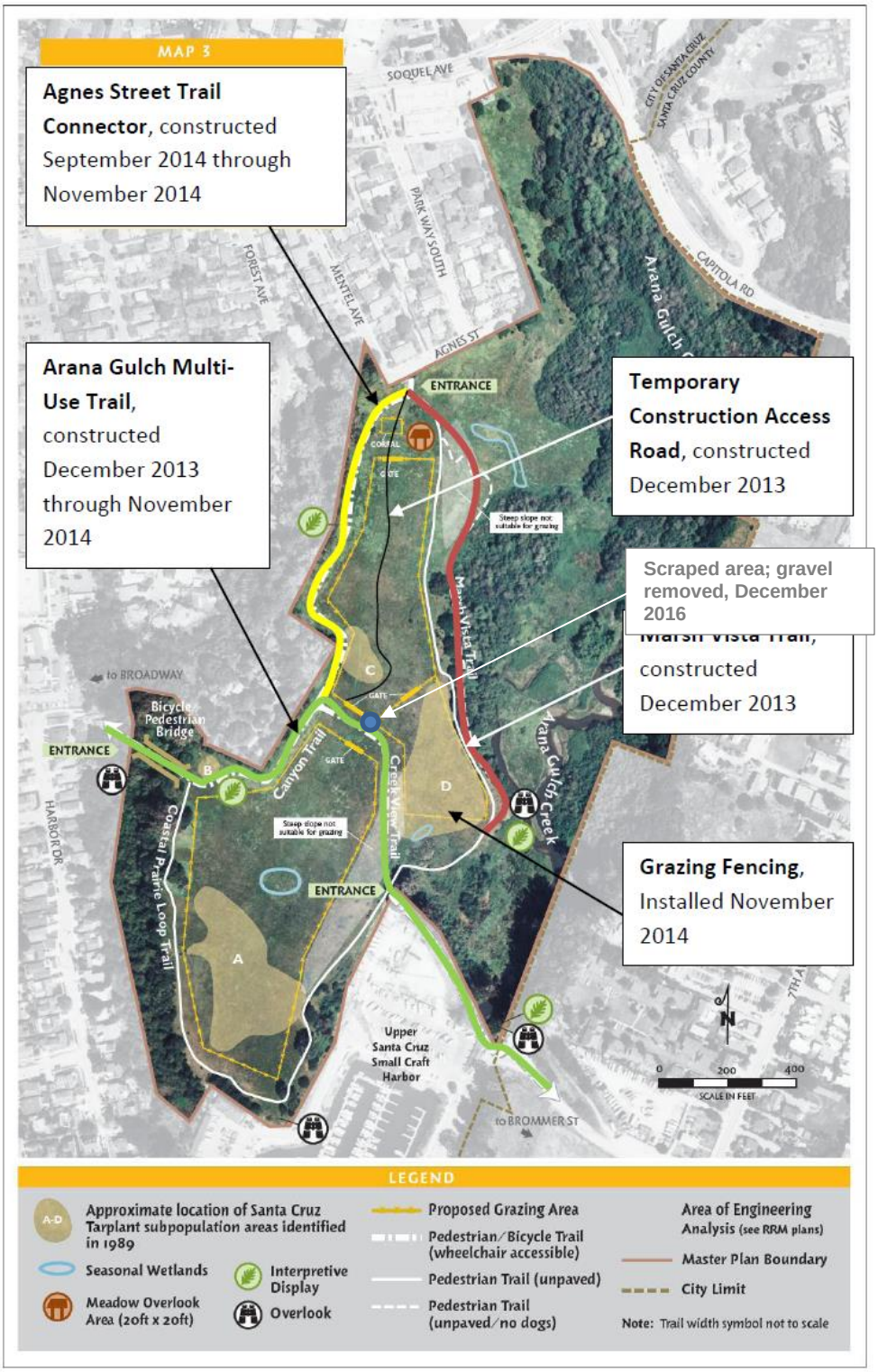


Figure 4. Scraped area along temporary construction access road, December 2016

4.2 Multi-Use Trail Soil Salvage Adjacent to Mapped Tarplant Areas

Project conditions of approval required the salvage of topsoil from areas within 20-feet of mapped tarplant if such areas are disturbed during trail construction. In December 2013, the upper 6 inches of topsoil from an area upslope of Tarplant Area D was salvaged and spread onto an approximately 3,750 square foot area south of Tarplant Area C. The location of the salvage and receiver sites is depicted on **Figures 5 and 6**, respectively.

In 2016, native and non-native plants continued to establish at the Tarplant Area D receiver site, similar to site observations in 2015. Native species observed included coast tarweed (*Deinandra corymbosa)* and California poppy (*Eschscholzia californica)* as well as non-native species include hare barley (*Hordeum murinum ssp. leporinum)*, oats (*Avena spp.)*, wild lettuce (*Lactuca sp.)*, cat's ear (*Hypochaeris sp.)*, filaree (*Erodium sp.)*, wild radish (*Raphanus sativus)*, ryegrass (*Festuca perennis)*, and ripgut brome (*Bromus diandrus)*. No SCT was documented from this receiver site in 2016.

The Agnes Street Trail Connector construction disturbed a section of soil within 20 feet of Tarplant Area C in September 2014. On September 15, 2014, the upper 6 inches of topsoil from this area was salvaged and spread onto areas southwest and northwest of Tarplant Area C. The two receiver areas encompass approximately 2,900 square feet (see **Figure 6).** Details on the soil salvage and soil depths within this placement area are presented in the Year 1 (2015) Annual Report. The location of the receiver sites, as well as data from the November 2014 soil sampling are shown in **Figure 6**.

Figure 5. Location of multi-use trail soil salvage sites, 2013 and 2014

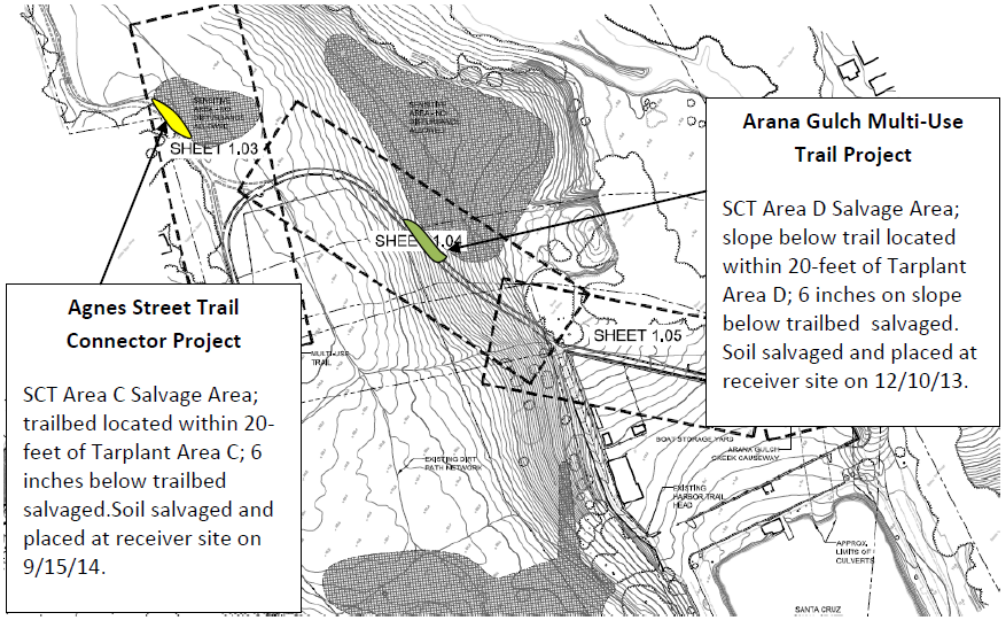
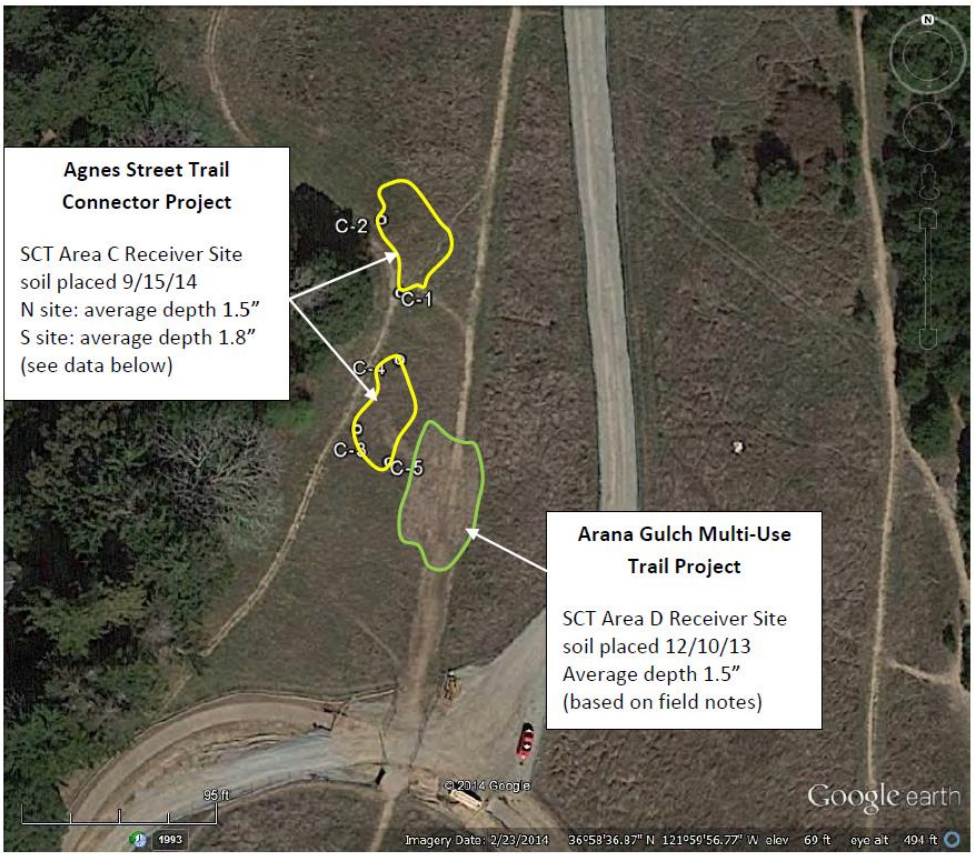


Figure 6. Multi-Use trail soil receiver sites on aerial photo, 2013 and 2014



In July 2016, native and non-native plants were growing at the Tarplant Area C receiver site. Native species observed included coast tarweed (*Deinandra corymbosa)* and California poppy (*Eschscholzia californica)*. Non-native species include hare barley (*Hordeum murinum ssp. leporinum)*, oats (*Avena spp.)*, cat's ear (*Hypochaeris sp.)*, filaree (*Erodium sp.)*, wild radish (*Raphanus sativus)*, and ryegrass (*Festuca perennis)*. No SCT was documented from the receiver site in 2016. The condition of this receiver site in 2016 is shown in **Figure 7**.

Figure 7. Condition of soil receiver site adjacent to Tarplant Area C, November 2016

4.3 Natural Recruitment of Native Plants along Multi-Use Trails

The construction of the multi-use trails included removal of soil under the trail's footprint in preparation for trail materials, base rock and pervious surface, to be installed. The excavated soil was taken off-site. Areas in close proximity to the paved trail (i.e., areas within the designated, fenced construction work area) were also disturbed. In spring and summer 2016, field observations of the Arana Gulch Multi-Use trail (east-west trail) construction area documented the presence of naturally establishing native and non-native plant species within the disturbed soil areas. Similar to observations in 2015, individuals of the native coast tarweed (*Deinandra corymbosa)* were observed within the trail construction zone, as depicted in **Figure 8**. Other plant species also naturally established in the construction area include several weedy, non-native species, such as wild oats (*Avena spp.)*, wild radish (*Raphanus sativa)*, milk thistle (*Silybum marianum)*, and bull thistle (*Cirsium vulgare)*. No SCT were observed in these areas in 2016.

Poor drainage along the edge of the east-west trail was observed in winter 2016. An AMWG member expressed concern that water was not passing under the trail, as designed, and water was prevented from reaching the downslope prairie (**Figure 9**). City staff installed a series of small gravel drains to enable water to penetrate the engineered drainage system under the pathway, as depicted in **Figure 10**. Staff believed that the clay content of the top soil was not allowing effective penetration to the drainage rocks beneath it. City staff monitored these areas during December and found that they were effective.

Figure 8. Coast tarweed growing along edge of east-west trail, July 2016

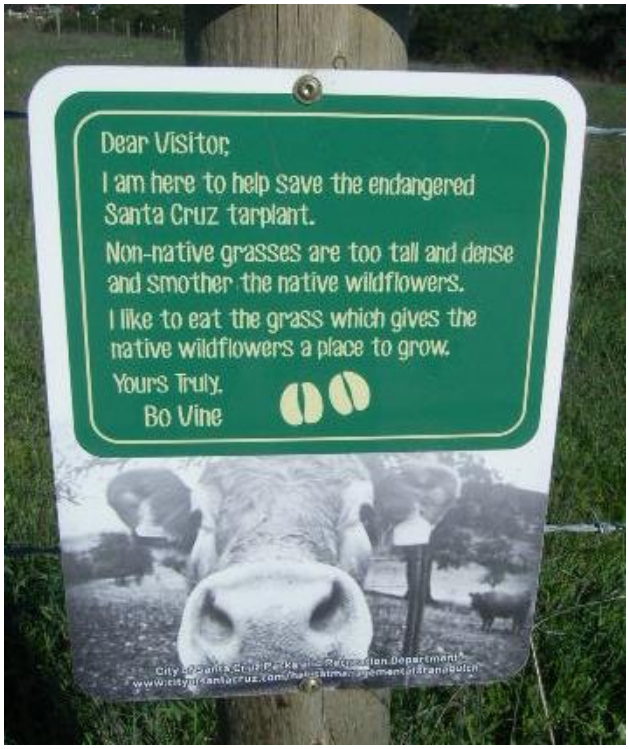
Figure 9. Water collecting on upslope edge of east-west trail, January 2016

Figure 10. Small gravel drain upslope edge of east-west trail, December 2016

4.4 Grazing Infrastructure and Stocking Program

Cattle infrastructure include fences, access gates, water line/water troughs and a temporary holding corral near Agnes Street. In January, per an agreement for cattle grazing with a local cattle rancher, cattle were brought onto the site as per the HMP Grazing Program and Stocking and Work Program. See Section 5.3 for more information on the 2015 cattle grazing program. Cattle grazing signs, installed at each entrance and along the fence, were maintained throughout the year. The signs continue to provide contact information to the City and rules of the site. Additional signs describing that the cattle are onsite to help the restoration of the SCT were installed in February 2016, these signs are shown in **Figure 11**. In November 2016, the water trough in Area A was moved southward approximately 100 feet so cattle do not congregate next the fence for better resource management.

Figure 11. Grazing signs installed on grazing fence, 2016



5. Habitat Management and Monitoring - Coastal Prairie/Santa Cruz Tarplant Management Area

Activities within this management area are summarized in the following section and include actions as outlined in Section 3.0 of the HMP as well as adaptive management actions recommended by the AMWG. Management actions in 2016 included grazing, perimeter mowing, monitoring of grazing actions, monitoring for SCT, and invasive weed control. City staff implemented most of these tasks. A log of maintenance actions is presented in **Appendix B.** The AMWG is in the process of collecting data on nearby coastal prairie reference sites that may be useful in developing performance criteria for percent cover of native and non-native plants, species richness, and percent cover that is bare ground that will be relevant to site conditions at Arana Gulch. These criteria will be applied to five sub-management areas that have been identified. It is anticipated that these criteria will be developed in 2017 and will be used to assess performance of the coastal prairie at Arana Gulch.

The coastal prairie occupies about 30 of the 67 acres at Arana Gulch and is essential because it has supported the third largest standing native SCT population and is one of only 13 populations found in Santa Cruz County (USFWS, 2015). However, the population of SCT has declined precipitously over the last two decades. This section describes management and monitoring actions for the SCT (Section 5.1), coastal prairie grassland (Section 5.2), grazing and stocking work program (Section 5.3), and the invasive weed work plan (Section 5.4). Each section concludes with a monitoring and performance evaluation of progress toward meeting the goals and objectives outlined in Section 3.0 of the HMP. Proposed actions for 2017 are discussed in Section 5.5.

5.1 Santa Cruz Tarplant

Several management actions for Santa Cruz Tarplant (SCT) were implemented in 2016, as described below.

5.1.1 Management Actions

Management actions for the Santa Cruz Tarplant (SCT) consisted of seasonal grazing of the Tarplant Areas A, C and D (and surrounding grassland) and seasonal mowing of Tarplant Area B. Tarplant Areas A, C, and D were grazed between January 2 and May 28, 2016. Further details on the grazing program can be found in Section 5.3. Tarplant Area B was mowed or weed-whipper approximately every 2-3 weeks from January through December, except for August and September when SCT could be flowering.

5.1.2 Monitoring and Results

A primary focus for this management area is the recovery of the SCT. The population of SCT at Arana Gulch has declined over the last two decades[5]. The HMP requires an annual census of the population (Goal 1) and a baseline assessment of SCT within the soil seed bank (Goal 4). Field surveys for SCT at Arana Gulch were first conducted in 1977 by Randy Morgan but plant counts are lacking in the current database. In 1986, he estimated there were over 100,000 plants on the property. In 1989, R. Doug Stone identified SCT in four locations he called Areas A-D (see Figure 1). These area designations have remained in use.

5.1.2.1 Census. A census for SCT was conducted by Kathleen Lyons and Brett Snider. The survey followed guidelines from *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFG, 2009), *CNPS Botanical Survey Guidelines* (CNPS, 2001), and *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Species* (UFWS (1996). Field surveys to determine the presence/absence of SCT were conducted in July, August, September, and October 2016. This survey period coincided with the blooming period of SCT. A reference population at the Santa Cruz Armory was field checked on July 1; plants at this location were in flower which suggests that the species would be flowering and easily detected within Arana Gulch. Surveys were conducted by walking the grassland (includes Tarplant Area A, B, C, and D over multiple days. Meandering walking surveys, which are parallel walking routes spaced 25-50 feet apart, were conducted to detect SCT. Survey days were July 1, July 12, August 22, August 23, September 30 and October 24, totally approximately 24 survey hours. If a SCT was observed a waypoint was taken with a handheld Global Positioning System (Garmin 60sce) that recorded the plant's patch location. The approximate patch size was also recorded. Field notes documented the height, branching, flowering status, and number of flowering heads per plant. A map showing the survey route is presented in **Appendix C (Item C-1).**

Thirty-five (35) SCT were documented onsite in 2016, as presented in **Table 2**. All plants were found in Tarplant Area A, as presented on **Figure 12**. This is an increase from 2015 (0 plants) and from four plants in 2014. The census documented an increase from 2013, wherein 18 plants were documented from Tarplant Area A. The survey was conducted in a slightly above-normal rainfall year. The census was conducted after approximately 2 years of seasonal grazing (grazing in spring/summer seasons of 2014 and 2015).

The portions of Tarplant Area B raked to remove thatch in 2015 were surveyed for presence of SCT in summer 2016; none were detected.

[5] See Section 3.1, page 63 of Arana Gulch HMP.

Table 2. Results of SCT Census, Arana Gulch, 2016

GPS # of Patch	Patch Size (feet)	Plant Number	Height (inches)	Height of Branching (in.) (0=none)	# Flower Heads
Tarplant Area A					
1	5x5	A-1	15	6	57
		A-2	11	6	24
2	1x1	A-3	15	6	36
3	5x5	A-4	8	1.5	21
		A-5	14	6.5	45
4	20x20	A-6	9.5	0.1	48
		A-7	5	1	7
		A-8	11	6.5	64
		A-9	6	1.5	3
		A-10	19	5.5	62
		A-11	4.5	0	3
		A-12	11	5	34
		A-13	9	3	46
		A-14	15	4	52
		A-15	8	3.5	18
		A-16	21	1.5	98
		A-17	12	3.5	42
		A-18	7	1	6
		A-19	22	4	47
		A-20	12	1	42
		A-21	16	.5	132
		A-22	6	4	4
		A-23	8	4	15
		A-24	8	3	19
		A-25	11	7	20
		A-26	7	4	8
		A-27	8	4.5	16
		A-28	9	2.5	22
		A-29	3.5	0	2
		A-30	6	3	9
		A-31	3.5	.5	32
		A-32	13	1	44
		A-33	17	1	142
5	3X3	A-34	5	.5	6
		A-35	10	6	24
			366	108.6	1250
Tarplant Area B					
			0	0	0
Tarplant Area C					
			0	0	0
Tarplant Area D					
			0	0	0
Total		**35 plants**			**1,250 heads**
Average			**10.5" height**	**3" branching**	**36/plant**

Figure 12. Location of patches (1-5) of SCT at Arana Gulch, 2016

5.1.3 HMP Performance Evaluation

The HMP has a goal to maintain a viable SCT population, with objectives to increase the number of aboveground SCT to at least the 2006 level in the first year after the return of grazing (i.e., summer 2016) (Objective 1A). Although 35 SCT were observed in 2016, the population is below the 2006 population level of 348 plants. The grassland management actions implemented in 2014 and 2015 (seasonal cattle grazing) appears to have resulted in an increase in the population of SCT as a means to meet Objective 1A. The cattle grazing that occurred in 2014/2015 appears to have improved growing conditions for SCT for 2016, as conditions were conducive to SCT germination after the first significant rainfall event in early 2016. The presence of SCT in 2016 represents the first effects of cattle grazing management on SCT germination and subsequent plant growth.

The HMP has an objective to expand the distribution of SCT beyond Tarplant Area A within three years (Objective 1B). As SCT were only found in tarplant Area A in 2016, Objective

1B was not met this year. The 2015 and 2016 cattle grazing occurred in Tarplant Areas A, C, and D; however, if the seedbank is depleted it could take several years for expansion to occur.

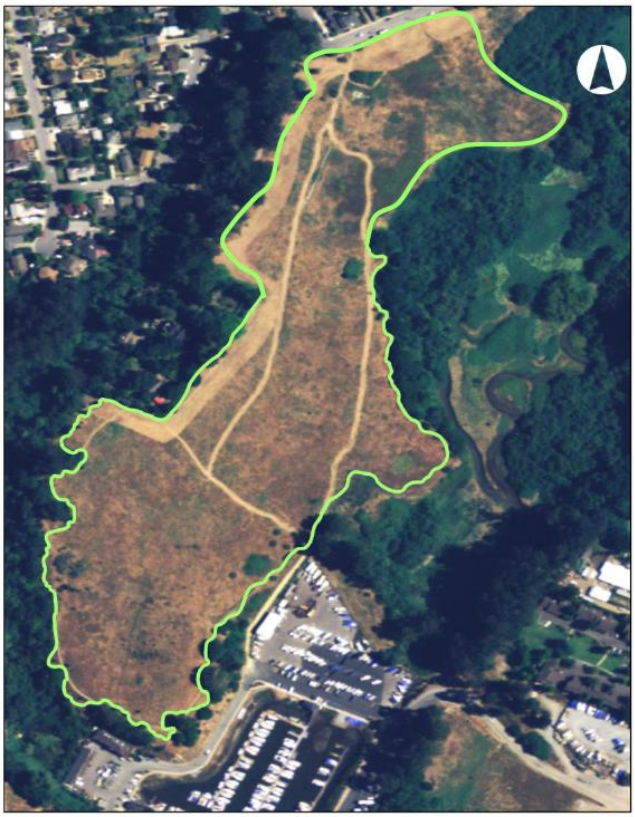
The HMP also has a goal to maintain a genetically and demographically viable soil seed bank in perpetuity (Goal 4), with an objective to increase the density of viable ray achenes in the soil seed bank from the baseline (first 3 years) to assessments done every 5 years (Objective 4A). As discussed in the Year 2 (2015) Annual Report, a baseline seed bank density study was conducted by Dr. Bainbridge in 2014 /2015. Future analyses of soil seed bank density will be compared to this baseline to determine compliance with this objective.

5.2 Grassland/Coastal Prairie

5.2.1 Management Actions

Grassland mowing occurred outside the grazing fences within areas delineated to remain as grassland. The grassland area to be maintained includes all areas within the grazing fences and areas extending to the drip line of the adjacent woodland, as depicted in **Figure 13**. Perimeter fuel break mowing was also identified along the trails.

Figure 13. Delineated grassland, April 2015



The City flail-mowed (to approximately 4" height) Tarplant Area B in March and May. The remaining areas were flail-mowed (to approximately 4" height) in May 2016. Areas subject to mowing are depicted on **Figure 14**. Mowing was conducted for grassland management purposes (i.e., reduce cover by non-native plants) and also for perimeter fuel break purposes. (Note: Please refer to Section 5.3 for the grazing management). Mowing was conducted after input from the AMWG at their March meeting and after the yearly grassland monitoring. The AMWG recommended that perimeter mowing occur once a year in late May or early June but only after a botanist inspects the site to assure that native plants, especially Mariposa lilies, would not be adversely affected. Prior to mowing, the City authorized a botanical review and a breeding bird survey of the mowing areas to ascertain if native plant species or nesting birds would be directly affected by the mowing. Kathleen Lyons, plant ecologist, conducted the botanical review and Garvin Hoefler, wildlife biologist, conducted the breeding bird survey. Representatives from the Santa Cruz Bird Club also conducted observations of the area and input to the City on habitat for bird breeding. No rare plants or breeding birds were detected in the areas subject to mowing; however, native plants of yellow Mariposa lily (*Calochortus luteus)*, Ithuriel' spear (*Tritelia laxa)*, and lupine (*Lupinus sp.)* were observed along the Coastal Prairie Loop Trail. A no-mow zone was demarcated in these areas to avoid impacting these plants. The pre-mowing survey results are presented in **Appendix C (Item C-2).** At the time of the May mowing, grass height was estimated to range 1-3 feet, based on pre-mowing visual observations. Flail mowing was conducted at approximately 4 inches. The areas mowed are depicted in **Figure 14**.

Figure 14. Areas Mowed in March and/or May 2016

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In 2014, the AMWG evaluated the northeast portion of the grassland (near Agnes Street) and whether this area should be retained in the delineated grassland. Three 50x50-foot scrape plots were created in 2014 to evaluate native plant recruitment. No native plant recruitment was noted in 2015. The AMWG will continue to monitor the scrape plots to see if any native plants grow before determining whether or not to keep this northeastern area as part of the coastal prairie. No additional vegetation sampling or scrape plots were recommended for this area. **Figure 15** shows the location of the scrape plots.

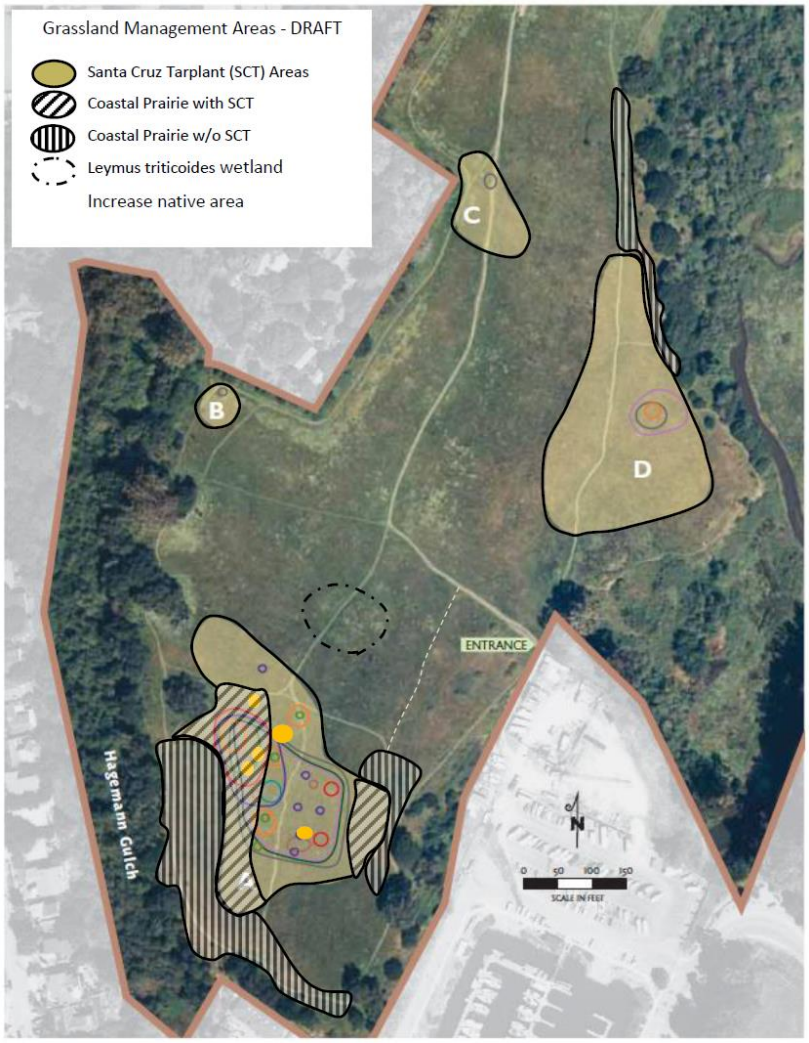
Figure 15. Location of scrape plots created in October 2014

Based on input from the AMWG, the City removed woody plant species from the delineated grassland area. Occurrences of cotoneaster *(Cotoneaster sp.)* and Himalaya blackberry *(Rubus ameniacus)* were removed from the grassland, yet removal of oaks was held off for one more year as the rate of encroachment by these trees is slow and some members of the public questioned the need to remove the oaks trees due to the habitat they provide to trail users, wildlife, and their aesthetic values. No tree removal was done in 2016.

At the July 2016 AMWG meeting, AMWG members suggested the grassland be identified by sub-management areas based on plant species composition and presence/absence of SCT. The sub-management areas would aid in the development of performance criteria for the grassland/coastal prairie. Five sub-management units were identified: coastal prairie with SCT, coastal prairie without SCT, annual grassland with SCT, annual grassland, seasonal

wetland with *Leymus*. A draft map was created to distinguish these areas; the distribution of these preliminary sub-management areas is presented as **Figure 16**. The AMWG will review and, if necessary, revise and update this map in 2017.

Figure 16. Sub-management areas in grassland (draft)



5.2.2 Vegetation Assessment

5.2.2.1 Monitoring Methods. Monitoring in 2016 consisted of an annual vegetation assessment (April), measurements of canopy height (February, April and August), and measurements of residual dry matter (RDM) (October). Photo-documentation was conducted in April 2016. Observations of grazing infrastructure occurred through the grazing period (January to June). Occurrences of invasive plant species were also monitored (year round).

The first baseline assessment of the vegetation conditions in the grassland was conducted in June, 2013. Subsequent monitoring of these transects has been conducted in April of 2014-2016. Monthly rainfall data is available from the University of California Cooperative Extension (UCIPM) Santa Cruz weather station, which is located at the DeLaveaga Golf Course, just north of Arana Gulch. Precipitation over the last four growing seasons has been below the long term average of 30 inches reported for the Santa Cruz area by the Western Regional Climate Center (**Table 3**).

Table 3. Monthly rainfall (inches) at the UCCE Santa Cruz (DeLaveaga) weather station for the 2013-2016 water years.

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
2015-2016	0.05	0.01	0	0.03	3.33	5.29	12.86	0.17	0.31	0.69	0.22	0	22.96
2014-2015	0.03	0	0.92	0.84	3.83	11.49	0	2.85	0.51	1.98	0.1	0.01	22.56
2013-2014	0.01	0.02	0.11	0.06	0.31	0.11	1.36	2.85	0.62	0.42	0.03	0.05	5.95
2012-2013	0	0	0	0.11	5.97	8.96	0.92	0.32	1.7	0.88	0.02	0.03	18.91

Vegetation Assessment. The CDP requires annual assessment of the vegetation in the grassland until the interim success criteria specified in the HMP are met and then monitoring every three years thereafter. The fourth vegetation assessment was conducted in April 2016 and this Year 3 report contains the full methods, results and discussion. The photo monitoring methods are described below. For the HMP performance evaluation (Section 5.2.3) the AMWG began the process in 2015 of collecting data on nearby coastal prairie reference sites in order to develop more specific performance criteria for evaluating changes in site conditions at Arana Gulch in response to management. This process is still underway so the HMP criteria remain in effect.

Vegetation transects 25 meters in length were first installed within each of the grazing enclosures on June 10-12, 2013. Satellite imagery from Google Earth was used to select a total of 8 starting points in Area A, 6 in Area C, and 4 in Area D using a stratified approach to get good coverage within each unit. In the field, GPS was used to locate the pre-selected starting point for each 25m transect and then used a random compass bearing to establish the line. The range of available compass bearings was limited as necessary to insure that there was at least a 5m buffer with infrastructure, existing dirt trails, or other features that needed to be avoided.

To determine if the number of transects for each enclosure was sufficient, the field sampling and power analysis used a statistical power calculator provided by DSS Research (http://www.dssresearch.com/toolkit/sscalc/size_a1.asp). This enabled a test of how much change could be detected by comparing the average cover and standard deviation values recorded for the transects to a fixed value that is 2.5 or 5% greater than that value. An 80%

power level ($\beta = 0.2$) and $\alpha = 0.1$ based on standard practice was accepted. In Area A, after sampling all 8 transects it was determined that an additional 3 transects would be required for a sample size of 11. For Area C, a sample size of 5 transects provided sufficient power, so no additional transect were installed. In Area D, the 4 transects were sufficient.

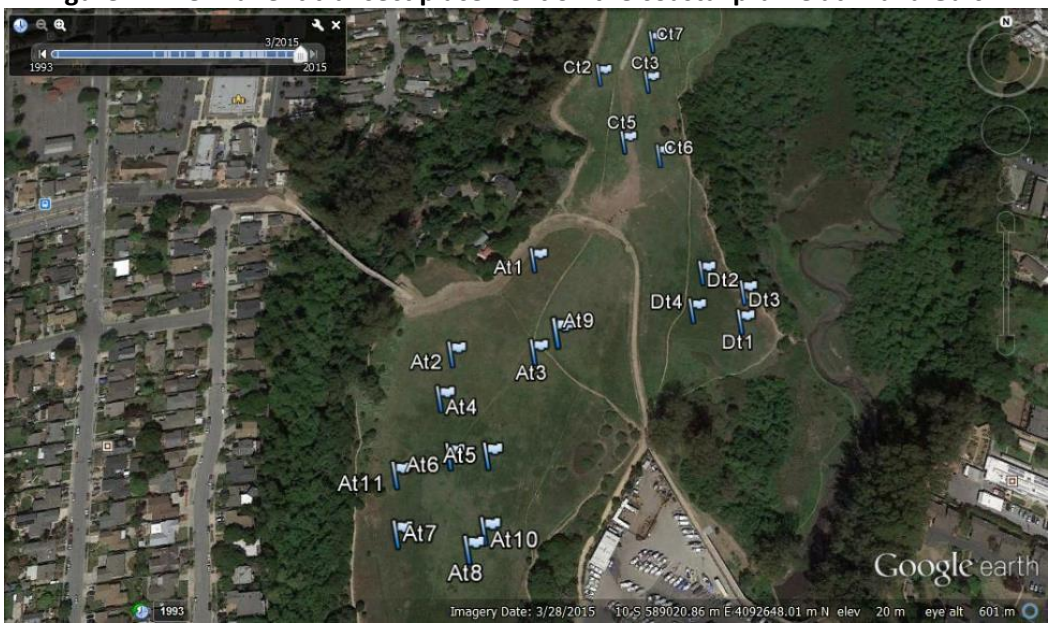
The point intercept method was used to assess changes in plant species cover and ground cover. This method uses a narrow diameter sampling pole that is slowly lowered to the ground at sample points spaced along a 25 meter transect. At each sample point, every plant species touched by the pin are recorded as "hits" along with the ground cover code (litter, bare, gopher disturbance, basal vegetation, rock) of the bottom "hit". It was not possible to accurately distinguish thatch (residue from the previous year's growth) from litter (senescent material from earlier in the growing season), so both were included in the ground cover code of litter. Percent cover is calculated by multiplying the number of hits for each plant species or ground cover class by a factor to equal 100 points. In 2016, sample 25 points per transect were recorded so the number of hits was multiplied by 4 to get percent cover.

The average height of the canopy layer was also measured at the 6, 12, 18, and 24 m points. In 2013 and 2014, the average low canopy height and high canopy height were recorded with a meter stick. In 2015 and 2016, the method was modified to utilize a plastic dinner plate threaded on a wire pin. The canopy height measurement was taken at the height where the plate comes to rest. Canopy height measurements were taken in February, April and August 2016 to capture winter, spring and late summer site conditions.

To permanently mark the transect, rebar posts one half inch in diameter were pounded into the ground at both ends and fitted with plastic rebar caps for safety. We then took a photo from 0m looking along the length of transect with a whiteboard held up at the 5m point labeled with the transect number and date. The transect photos are included in **Appendix C (Item C-3)**. On the data sheet, the following was recorded: GPS coordinates, compass bearing, elevation, slope, and aspect of the transect. In addition, a search was conducted within a 5m belt transect (using the transect as the centerline) to record the presence of any plant species that were not encountered on the transect. This additional method is often used to capture uncommon or rare species and more fully characterize species richness.

All of the rebar and caps were destroyed in a mowing on April 24, 2014. Therefore, it was necessary to re-install every vegetation transection in 2015 using the same GPS points and compass bearings. New rebar was required and the plastic caps were replaced with metal caps imprinted with "the City of Santa Cruz" on April 16-17, 2015. During the monitoring on April 26-27, 2016, some transects were missing rebar on one end and a few slight adjustments were made to alignments, but otherwise the transects were intact. **Figure 17** shows the locations of the 11 transects in Area A, 5 in Areas C, and 4 in Area D.

Figure 17. Permanent transect placement on the coastal prairie at Arana Gulch.



For analysis, the transect is the sample unit and for each the percent cover was calculated by species, the total number of species encountered, and the % ground cover of litter, bare, gopher, basal vegetation, and rock or cow flop. Cover values were also summed on each transect by guild: exotic annual forb (EAF), exotic annual grass (EAG), exotic perennial forb (EPF), exotic perennial grass (EPG), native annual forb (NAF), native annual grass (NAG), native perennial forb (NPF), and native perennial grass (NPG).

Statistical tests were performed using JMP version 10 software (SAS). Data were tested for normality and equality of variance required of ANOVA using multiple tests with a significance level at p=0.05. When data were normal, change in percent cover was examined using ANOVA with a Tukey's honest significant differences post-hoc test. For non-normal data, a Wilcoxon test was used. The variances of the 2015 and 2016 canopy heights were unequal in all areas and a Welch's test was used. The mean cover values for 2015 and 2016 are presented with error bars constructed using one standard deviation from the mean.

Photo Monitoring. Photo points for long-term monitoring were established during the monitoring in April 2015. A total of 15 points were distributed throughout the coastal prairie with two additional points on the Arana Creek Causeway and two on Hagemann Bridge (**Figure 18**). All points were located at either an interpretative sign or a fence corner for easy reference. Four photos were taken per point in a clockwise order facing into the enclosure; Photo 1 looks straight ahead, Photo 2 is to the right, Photo 3 looks straight behind, and Photo 4 to the left. Using a compass and taking photos of the cardinal directions would have entailed an extra step and instead using the infrastructure as a point of reference made intuitive sense and was efficient. All photos were captured in about one hour when the sun was overhead. The two points taken on the causeway looking into Arana Creek included the

revegetation area on the east bank above the culverts. The additional points located on Hagemann Gulch Bridge were taken from both sides of the bridge with a view straight out and looking down into the Gulch. One extra point was taken standing in front of the entry sign at Frederick street in order to observe the recovery from the construction. Photos are in **Appendix C (Item C-4)**.

Figure 18. Location of photo points for long-term monitoring established at Arana Gulch.

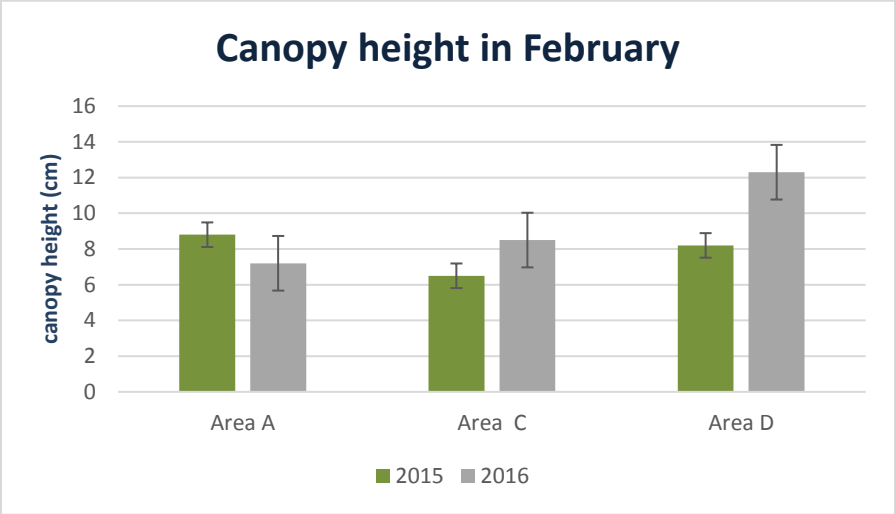
5.2.2.2 Monitoring Results

Vegetation Assessment. The 2013-2014 monitoring results are not presented because of the influence of timing in 2013 and drought in 2014. In 2013, the monitoring was not conducted until July, which is too late to capture peak production. In 2014, monitoring was conducted under the worst drought conditions ever recorded (see **Table 3**). In addition, every vegetation transect was re-installed in April, 2015, not always in the exact same location. The two years of additional baseline data were presented in previous reports to the City and are available on request. The results below compare the un-grazed conditions in April of 2015 to grazed conditions in April 2016. Although it is not ideal to use 2015 as a baseline because the vegetation had been subject to 6 weeks of grazing when it was sampled, it is the most representative dataset among the three years available. Life forms utilize the following codes: exotic annual forb (EAF), exotic annual grass (EAG), exotic perennial forb (EPF), exotic perennial grass (EPG), native annual grass (NAG), native perennial forb (NPF), and native perennial grass (NPG).

Canopy Height. In the HMP, Objective 3A is to reduce canopy height between the months of November thru April, to 2-3 inches (5-8 cm). In February, canopy height measurements in Area A were lower in February 2016 compared to February 2016, yet canopy heights in 2016

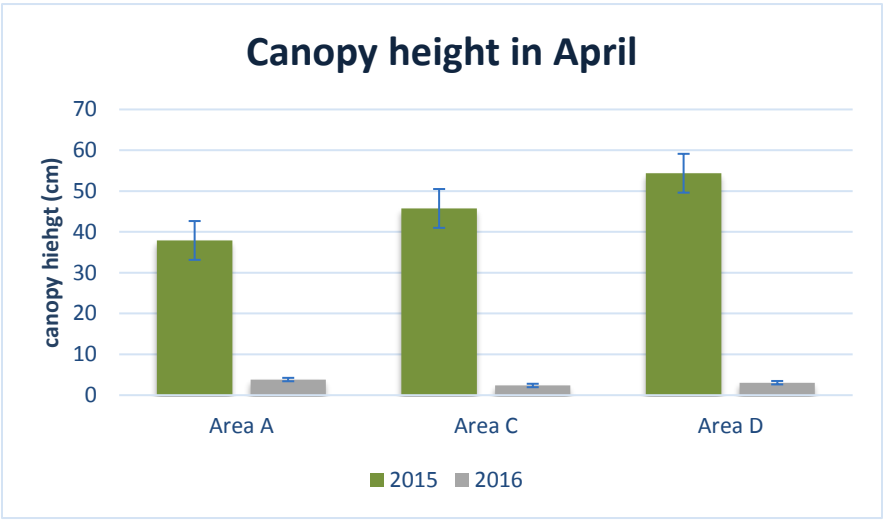
were higher in Areas C and D than in 2015. In 2016, Areas A and C were within the target of the objective; Area D was above target. Mean canopy height data from February is presented in **Figure 19**.

Figure 19. Mean canopy height (cm) in Area A, C, and D measured in February of 2015 and February 2016. Each error bar is constructed using 1 standard error from the mean



Average canopy heights measured in April were lower in 2016 compared to 2015 in all three areas (**Figure 20**, Welch's test at $p<.0001$) and were within the target of the objective.

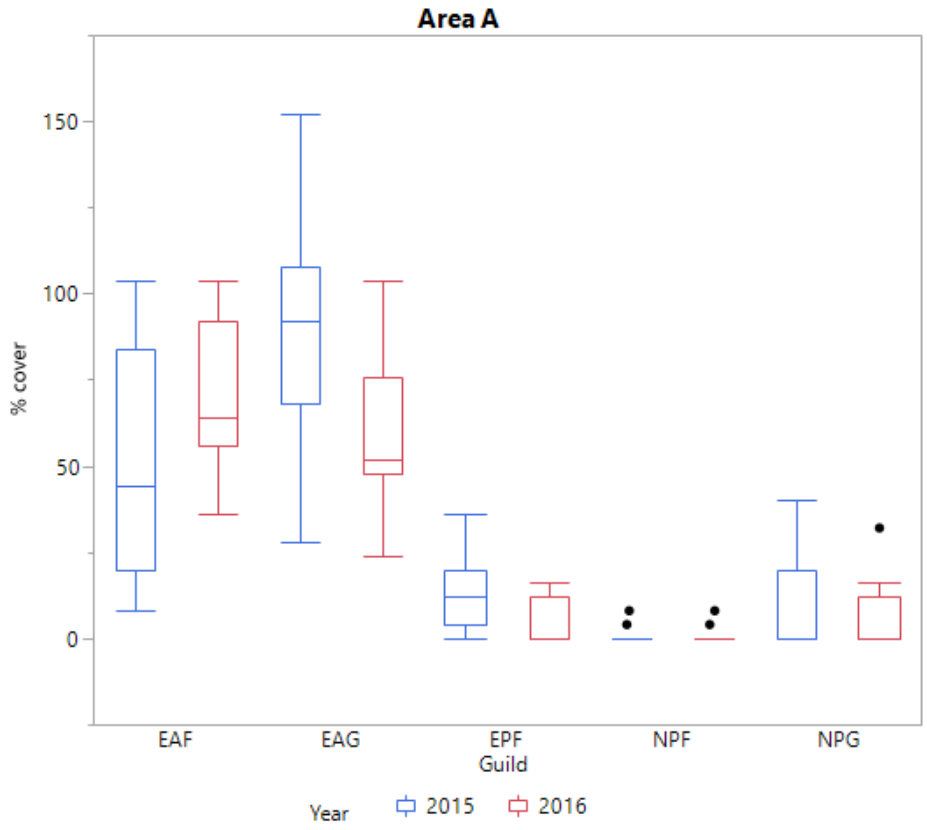
Figure 20. Mean canopy height (cm) in Area A, C, and D measured in April of 2015 and April 2016. Each error bar is constructed using 1 standard error from the mean



Native/Non-native Species Cover. Objective 3B is to reduce the cover of non-native species and Objective 3C is to increase the cover of native species. In 2016, the cover of several non-native plant guilds declined, while the cover of a single native guild increased in one area. In

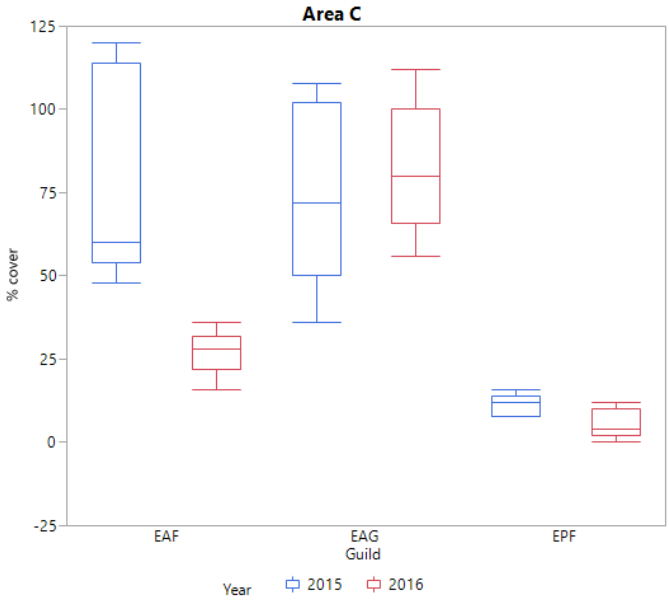
Area A, a significant decline in EAG cover in 2016 (**Figure 21**, ANOVA p=0.037) was likely due to a significant reduction in cover of wild oat (*Avena fatua)* from 43 to 12% (data not shown). A moderately significant decline in cover of EPF (Wilcoxon test, p=0.058) may have been due to loss of vetch (*Vicia sp.)* from the plot in 2016 (data not shown).

Figure 21. Mean percent cover of 5 plant guilds in Area A in April of 2015 and 2016. Each error bar is constructed using 1 standard error from the mean.



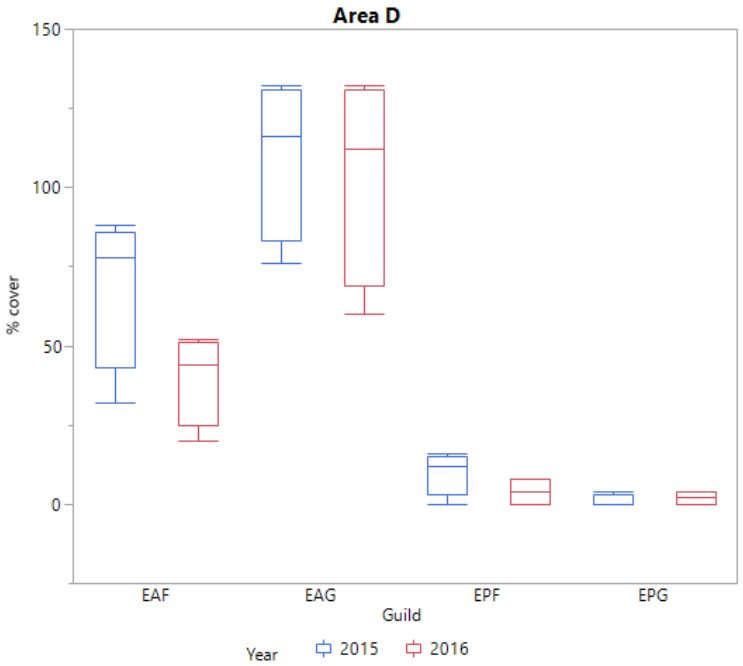
In Area C, native species were detected for the first time. A native wild rush (*Juncus bufonius*) was hit once on a transect (average cover 0.8% for the area, see **Table 4**) and two other native species were detected in the belt plot. EAF cover declined significantly in 2016 (**Figure 22**, ANOVA p=0.0081) and this may have been due to significant reductions in the cover of two non-native forbs; wild radish (*Raphanus sativa)* declined from 58% to 13% and filaree (*Erodium cicutarium)* declined from 20% to 12% (data not shown).

Figure 22. Mean percent cover of 3 plant guilds in Area C in April of 2015 and 2016. Each error bar is constructed using 1 standard error from the mean.



In Area D, although the decline in EAF cover was not significant (**Figure 23**, ANOVA p=0.09), there was a significant decline in filaree from 62% in 2015 to 35% in 2016 (data not shown).

Figure 23. Mean percent cover of 4 plant guilds in Area D in April of 2015 and 2016. Each error bar is constructed using 1 standard error from the mean.



Species Richness. Objective 3D is to increase native species richness. A total of 37 species were detected in the sampling across Areas A, C, and D, including 1 native tree, two native shrubs, one native forb and six native grasses (**Table 4**).

Table 4. Plant species detected in Areas A, C, and D in sampling conducted in 2013-2016.

Scientific Name, TJM 2	Area(s) found	Common Name	Life form	Family
Anagallis arvensis	A, C, D	Scarlet pimpernel	EAF	PRIMULACEAE
Avena fatua	A, C, D	Wild oat	EAG	POACEAE
Baccharis pilularis	A	Coyote brush	Shrub	ASTERACEAE
Briza maxima	A, D	Rattlesnake grass	EAG	POACEAE
Briza minor	A, D	Quaking grass	EAG	POACEAE
Bromus carinatus	A	California brome	NPG	POACEAE
Bromus diandrus	A, C	Ripgut brome	EAG	POACEAE
Bromus hordeaceus	A, D	Soft chess	EAG	POACEAE
Carduus pycnocephalus	C	Italian thistle	EPF	ASTERACEAE
Cerastium glomeratum	C	Mouse-ear chickweed	EAF	CARYOPHYLLACEAE
Cirsium vulgare	A	Bull thistle	EPF	ASTERACEAE
Convolvulus arvensis	A, C, D	Bindweed	EPF	CONVOLVULACEAE
Danthonia californica	A	California oatgrass	NPG	POACEAE
Elymus triticoides	D	wild rye	NPG	POACEAE
Erodium botyrs	A, C	long bill stork's beak	EAF	GERANIACEAE
Erodium cicutarium	A, D	red stem filaree	EAF	GERANIACEAE
Eschscholzia californica	A	California poppy	NPF	PAPAVERACEAE
Festuca (Vulpia)myuros	A, C, D	Rattail six weeks grass	EAG	POACEAE
Festuca perennis (Lolium multiflorum)	A, C, D	Italian ryegrass	EAG	POACEAE
Genista monspessulana	D	French Broom	Shrub	FABACEAE
Geranium dissectum	D	Cutleaf geranium	EAF	GERANIACEAE
Holcus lanatus	A, C, D	velvet grass	EPG	POACEAE
Hypochaeris glabra	A, C, D	Smooth cat's-ear	EAF	ASTERACEAE
Hypochaeris radicata	A, C, D	Hairy cat’s ear	EPF	ASTERACEAE
Juncus bufonius	C	Spreading rush	NAG	JUNCACEAE
Juncus patens	A, C, D	Spreading rush	NPG	JUNCACEAE
Lactuca serriola	C, D	Prickly lettuce	EPF	ASTERACEAE
Plantago lanceolata	A, C, D	English plantain	EPF	PLANTAGINACEAE
Quercus agrifolia	A	Coast live oak	Tree	FAGACEAE
Raphanus sativus	A, C, D	wild radish	EAF	BRASSICACEAE
Rosa californica	A	California rose	Shrub	ROSACEAE

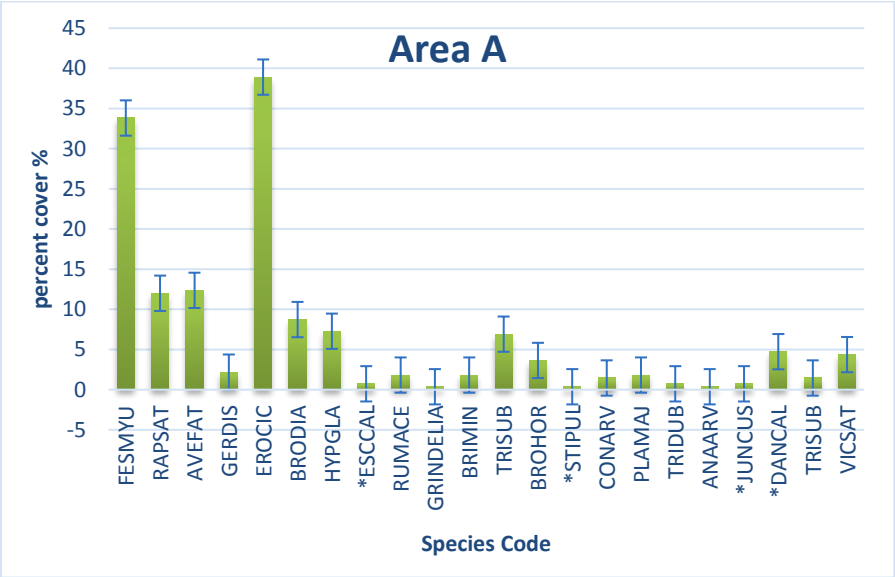
Scientific Name, TJM 2	Area(s) found	Common Name	Life form	Family
Rumex acetosella	A, D	Sheep sorrel	EPF	POLYGONACEAE
Rumex crispus	A, C	Curly dock	EPF	POLYGONACEAE
Stipa pulchra	A	Purple needlegrass	NPG	POACEAE
Tragopogon pratensis	A, C,D	Salsify	EPF	ASTERACEAE
Trifolium subterraneum	A	Subterranean clover	EAF	FABACEAE
Vicia sativa subsp. sativa/nigra	A, C,D	common/narrow leaved vetch	EPF	FABACEAE

In Area A, there has been less than one native species captured per sampling unit in all years 2013-2016 (**Table 5**). Native species detected in 2016 include California oatgrass *(Danthonia California)*, California poppy *(Eschscholzia californica)*, spreading rush (*Juncus patens)*, and purple needlegrass (*Stipa pulchra)*, all of which had less than 1% cover (**Figure 24**).

Table 5. Mean number of species recorded along 25 m transects and detected within a 5m belt in Area A (with one standard deviation in parentheses).

Species Richness	2013	2014	2015	2016
# Species per transect	9.5 (2.7)	7.3 (2.1)	7.6 (2.5)	8.0 (3.4)
# Additional species in plot	3.9 (2.5)	3 (2.7)	3.6 (2.3)	2.5 (1.8)
Total # species/125 m^2	13.4 (3.8)	10.3 (4.1)	11.2 (3.8)	10.5 (4.4)
# Native species per transect	0.4 (0.5)	0.5 (0.5)	0.7 (0.8)	0.6 (0.7)
# Additional native sp. in plot	0.3 (2.5)	0.5(0.8)	0.3 (0.5)	0.5 (0.5)

Figure 24. Mean percent cover of all plant species in Area A in April, 2016. Native species are marked with *. Each error bar is constructed using 1 standard error from the mean.

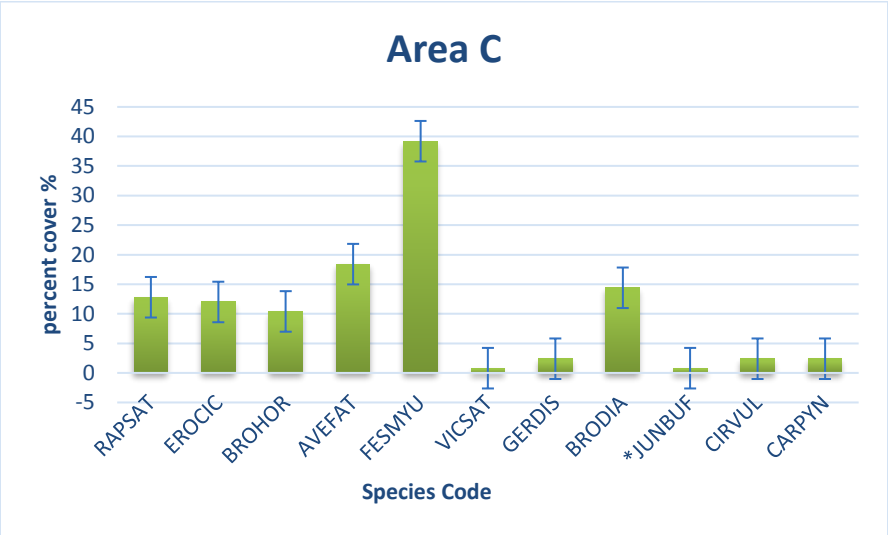


In Area C, no native species were captured in 2013 through 2015 **(Table 6**). In 2016, of the 11 species with recorded cover on the transects, native toad rush (JUNBUF) was the only native to be detected (**Figure 25**). Coast tarplant (*Deinandra corymbosa)* and spreading rush (*Juncus patens)* were detected in the belt plot of the same transect.

Table 6. Mean number of species recorded along 25 m transects and detected within a 5m belt in Area C (with one standard deviation in parentheses).

Species Richness	2013	2014	2015	2016
# Species per transect	8 (1.0)	8.3 (1.7)	6.0 (1.0)	7.0 (0.8)
# Additional species in plot	4.6	2 (1.4)	1.4 (0.9)	3.5 (2.6)
Total # species/125 m^2	12.6 (2.7)	10.3 (3.0)	7.4 (0.9)	10.5 (2.1)
# Native species per transect	0	0	0	0.3 (0.5)
# Native species per plot	0	0	0	0.5 (1.0)

Figure 25. Mean percent cover of all plant species in Area C in April, 2016. Native species are marked with *. Each error bar is constructed using 1 standard error from the mean.

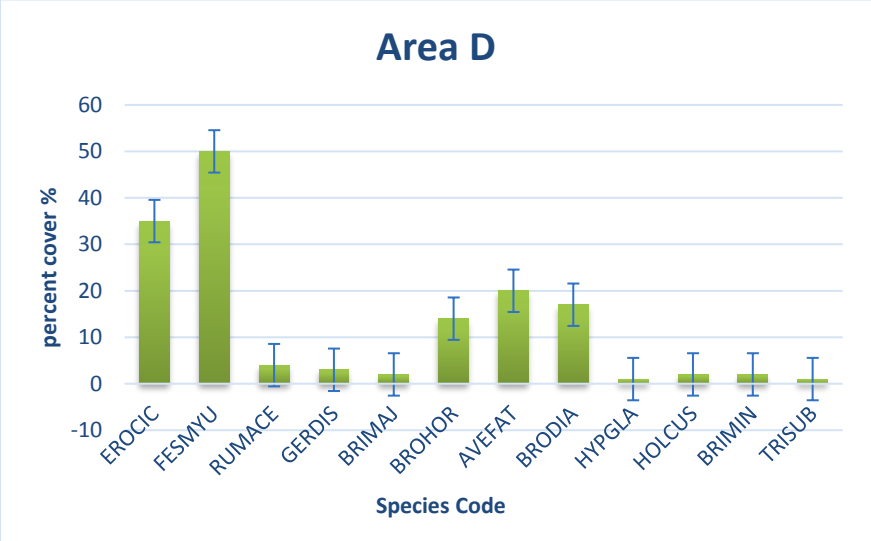


In Area D, spreading rush (JUNPAT) is the only native species that has been detected across the sampling years (**Table 7**). In 2016, cover of 12 species was recorded on the transect (**Figure 26**).

Table 7. Mean number of species recorded along 25 m transects and detected within a 5m belt in Area D (with one standard deviation in parentheses).

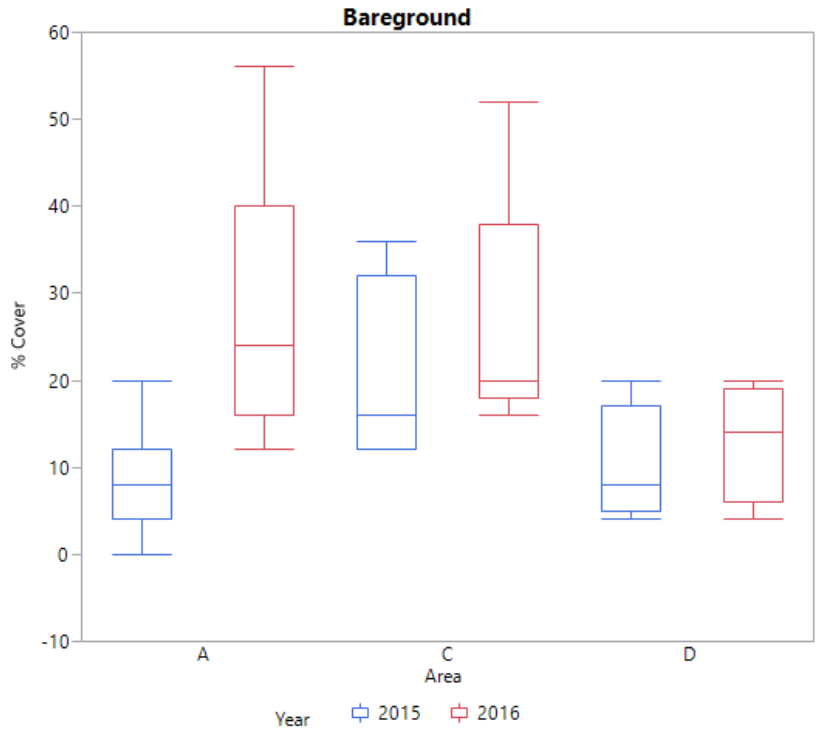
Species Richness	2013	2014	2015	2016
# Species per transect	10.3 (1.5)	8.8 (1.5)	8.5 (2.1)	7.8 (1.7)
# Additional species in plot	4.5 (2.6)	3.3 (3.3)	3.8 (1.0)	3.5 (0.6)
Total # species/125 m^2	14.8 (1.3)	12 (4.8)	12.3 (1.7)	11.3 (2.2)
# Native species per transect	0.5 (1.0)	0.5 (0.6)	0	0
# Additional native sp. in plot	0.3 (0.5)	0.5(0.6)	0	0.8 (0.5)

Figure 26. Mean percent cover of all plant species in Area D in April, 2016. Native species are marked with *. Each error bar is constructed using 1 standard error from the mean.



Bare Ground. Objective 3E is to increase the cover of bare ground. The cover of bare ground increased significantly in Area A from 8 to 26% (**Figure 27**, ANOVA p=0.0009).

Figure 27. Mean ground cover sampled in Areas A, C, and D in April, 2015 and 2016. Each error bar is constructed using 1 standard error from the mean.



5.2.3 HMP Performance Evaluation.

The HMP has three goals that apply to the coastal prairie and are not specific to the SCT (which is addressed in the previous section). Goal 2 seeks to maintain a functioning coastal prairie through the reintroduction of grazing and the resultant disturbance regime. Objective 2A identifies implementation of the grazing program by 2014 and Objective 2a requires that the grassland achieve residual dry matter (RDM) measurements within a range appropriate for SCT growth. Grazing was implemented in 2016, thus, the first two objectives have been met.

In previous years, the AMWG identified a need to establish more specific achievable objectives for the vegetation at Arana Gulch. During the development of the HMP there was not yet any baseline data to quantify existing conditions and so the interim restoration criterion was established as a return to an ideal of a functional reference coastal prairie. An AMWG task for 2016 was to better define what it means to be a functioning coastal prairie. However, limited data was available on vegetation conditions at reference coastal prairies because there are so few left. In addition, vegetation conditions depend on many factors including the position of the coastal terrace, soil type, hydrology, dominant species, and past land-use history and few or none of the remaining coastal prairie remnants match Arana Gulch in these important characteristics. Arana Gulch experienced intensive cultivation in the past and cultivation has been identified as a factor that most strongly negatively affects native cover and species richness. In the absence of acceptable data on reference coastal prairies, the AMWG may use these three years of baseline data and a first year of monitoring data under grazing in April, 2016 to begin refining the objectives under Goal 3.A trend of increasing native plant cover has yet to be detected, therefore, Objective 3A has not been met.

Objective 3E specifies an increase in bare ground to a level that enables SCT to complete their lifecycle by 2015. As 2016 represents the second growing season of grazing, canopy height has been significantly decreased since the pre-grazing baseline. In addition, the amount of thatch has been reduced and there are areas of bare ground. Patches of dense vegetation still persist, yet covering less acreage than in 2015. All SCT observations in 2016 were found in areas of least residual dry matter (RDM Red, <500 lbs./acre), thus, the site met Objective 3E this year.

5.3 Grazing and Stocking Program

5.3.1 Management Actions

The installation of cattle grazing infrastructure was completed in February 2015. The grazing enclosure includes about 18.75 acres (8.4 hectares), divided as follows: Area A = 15 acres (6 ha); Area C = 4.1 acres (1.6 ha); and Area D = 2.1 acres (0.9 ha).

Although fences were installed in 2014, a ramp from Agnes Street to the holding coral and water hook-ups for the troughs were completed in February 2015. Large “Cattle Grazing

Area" signs were installed at the three trail entrances; smaller signs were installed on the fence posts where trails are in close proximity to the grazing area. Additional signs indicating that the cattle graze to help restore the SCT were installed in February 2016. The City received input from the AMWG on the language for these signs. Fences, access gates, and other features to support cattle grazing were inspected and maintained throughout 2016. There were a few incidents of cut fence lines during 2016; however, less than 2015. City rangers and Police Officers patrolled the area after the incidents; however, no one responsible for the cutting was found. After each fencing-cutting episode, the City and/or the grazing contractor repaired the fences, as needed. No cattle escaped the grazing area.

The City's grazing contractor had cattle onsite from January 2 through May 28. The HMP's original estimate for cattle was 2 to 6 cow calf pairs. However, it became evident during the 2015 grazing season that this number of cattle was insufficient to keep up with the rate of grass growth. As an adaptive management action, the AMWG revised its recommendation to the City to provide the City and the rancher with more flexibility to increase the number of cattle at the site to keep pace with grass growth. The specific number of cattle present onsite throughout the 2016 grazing season are presented on **Table 8**.

As grazing occurred in 2016, the City conducted numerous observations of grazing operations, including the entry and exit of cattle from the site, conferring with the grazing operator, observations of feed and water troughs (regularly during the grazing season), recording residual dry matter (RDM) and adherence to BMPs (see Section 3.5.6 in HMP). Four wood rubbing posts (4x4's) were installed in the grazing area in December. Two posts were installed in Area A, one in Area C and one in Area D. The posts are intended to encourage cattle to congregate and create additional bare ground that may be suitable for SCT germination.

Table 8. Number of Cattle and Duration of Grazing Season per SCT Area in 2016

Duration	# of Cattle in Tarplant Area A	# of Cattle in Tarplant Area C	# of Cattle in Tarplant Area D	# of Cattle in Tarplant Areas C&D (open gate)	# of months grazed	The cattle were 600 lb. heifers. AU Conversion (0.6)	AUM	Comments
January 2 to February 19	7	-	-	0	0.63	0.6	4.2 AUM (Area A)	Seven animals[6] are introduced to site.
February 20-April 3	7	-	-	7	1.4	0.6	4.2 AUM (Area A) 4.2 AUM (Area C&D)	Seven additional animals brought on site
April 4 to April 16	14	-	-	6	0.43	0.6	8.4 AUM (Area A) 3.6 AUM (Area C&D)	An additional six animals are brought on site
April 17 to May 3	10	-	-	8	1.1	0.6	6.0 AUM (Area A) 4.8 AUM (Area C&D)	Animals moved from Area A to Areas C and D to reduce cover in these areas.
May 4 to May 15	15	-	-	-	0.40	0.6	9.0 AUM (Area A)	All animals moved to Area A to lower canopy in preparation for the end of the grazing season.
May 16 to May 20	-	-	-	15	0.16	0.6	9.0 AUM (Area C&D)	All animals moved to Area C and D to concentrate grazing and reduce canopy height
May 21 to May 28	-	15	-	-	0.23	.06	9.0 AUM (Area C)	All animals are moved to Area C to reduce canopy height
May 28	-	-	-	-	-	-	-	All animals removed from site.

[6] Class of cattle: I year old stockers and young heifers

Residual Dry Matter. Residual dry matter (RMD) is the amount of dry plant material left standing or on the ground from the previous year's growing season (Bartolome *et al*. 2006). RDM includes three components: 1) the current year's crop of palatable forage, 2) non-palatable plants, weeds, and the stubble of dry matter that is left behind when clipping and 3) thatch, which is dead plant material greater than one year old. *A Mulch Manager's Guide for Monitoring Success* (Wildland Solutions 2008) provides practical information on how to assess RDM in a manner that is objective and directly related to management objectives for rangeland health.

The RDM monitoring was conducted on November 24 by Kathleen Lyons and Brett Snider. Pursuant to the methodology outlined in *Guidelines for Residual Dry matter on Coastal and Foothill Rangelands in California* (UC Publication 8092 by J. Bartolome) the grazing areas were walked along random transects. Equipment consisted of a clip and weigh RDM kit from Wildland Solutions that included a 13.25" diameter circular hoop plot, a Pesola gram scale, The RDM plot was tossed down and sampled to record an RDM level of blue, green or red. The condition at each level was noted such that the observers eye was calibrated to recognize the three levels. The grazing areas were mapped as blue, green and red. Where needed, samples were taken within each area to confirm the designation. The edge of each mapping areas was recorded with GPS waypoints. Sampling consisted of clip plots within each mapped level. A photo was obtained of each plot before and after clipping; note plot number, RDM level and date on dry erase board. The measuring bag was weighed empty, summer annual plants and any tree leaves were removed from the clip plot; old thatch was not evident and not included. Plants rooted in the plot were clipped as close to ground as possible, clippings were placed in the bag, weighed and recorded (subtracting weight of bag). The weight of clippings was converted to pounds per acre (grams clipped x 100 = lbs./acre RDM).

The results were plotted onto an aerial photo to create an RDM zone map, based on GPS points mapped onto most recent Google Earth imagery available, and polygons created. The RDM zone map, portraying the following RDM levels, provides a sufficient level of detail for aiding management and cattle grazing decisions:

BLUE:	Highest RDM (exceeds objective (>650 lbs./acre)
GREEN:	Middle RDM (meets objective (500-650 lbs. per acre)
RED:	Lowest RDM, below objective (<500 lbs./acre)

5.3.2 Monitoring Results

Residual Dry Matter. In Area A, most of the southern portion of the grazing area had the lowest RDM (red, <500 lbs./acre) which reflects the effects of seasonal grazing that occurred between January and June. The northern portions of the grazing area had higher RDM values. At most locations, thatch was not evident as cattle ingested the current and previous year's growth. **Figure 28** exhibits the RDM map for Area A. **Figure 29** displays the RDM map for

Areas C and D. **Figures 20, 31,** and **321** show clip plots with highest RDM (>650 lbs./acre), middle RDM (500-650 lb./acre) and lowest RDM (<500 lbs./acre), respectively.

Figure 28. RDM map for Grazing Area A, October 2016

BLUE: Highest RDM (exceeds objective (>650 lbs./acre)
GREEN: Middle RDM (meets objective (500-650 lbs. per acre)
RED: Lowest RDM, below objective (<500 lbs./acre)

Figure 29. RDM map for Grazing Areas C and D, October 2016

BLUE: Highest RDM (exceeds objective (>650 lbs./acre)
GREEN: Middle RDM (meets objective (500-650 lbs. per acre)
RED: Lowest RDM, below objective (<500 lbs./acre)

Figure 30. Clip plot of highest RDM (Blue), October 2016

Figure 31. Clip plot of middle RDM (Green), October 2016

Figure 32. Clip plot of lowest RDM (Red), October 2016

5.3.3 Discussion

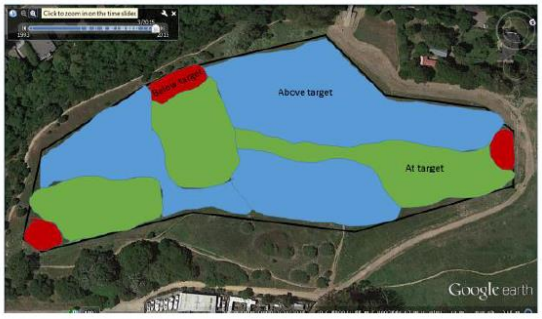
In 2016, cattle grazing significantly reduced canopy height during the germination and emergence period for SCT (April to November) in all Areas to meet the target objective of 2-3 inches (5-8 cm). Grazing reduced biomass across the prairie and in the process also increased bare ground in Area A. Non-native species remained dominant with very high

cover, but a few reductions were observed. Several species with high forage value declined or were lost in the sampling. In Area A, wild oat (*Avena fatua)* cover declined by 21% and wild vetch (*Vicia sp.)*, a nitrogen fixing legume and a superior food source, was not detected in the sampling in 2016. In Area C, cover of the high value forage filaree (*Erodium sp.)* declined and wild radish (*Raphanus sativa)* cover declined by over 50%. This large reduction may be due to the fact that wild radish (*Raphanus sativa)* retains a higher forage value late in the season, unlike many other species which lose nutritional value as they mature.

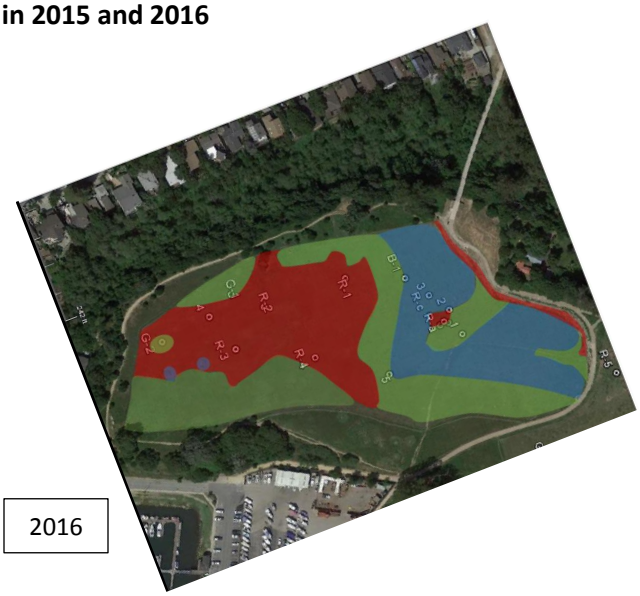
Native species cover did not increase, but three natives were detected in the sampling in Area C for the first time. Spreading rush (*Juncus patens)* is one of the primary native species that is found throughout the prairie in all Areas. It has been observed in Area C in the past, but was not captured by the sampling until this year. The appearance of the other species may be more directly related to the construction and/or grazing. A big bloom of coastal tarweed (*Dienandra corymbosa)* along the margin of the east-west multi use central in the spring of 2015 was in apparent response to the grading for the trail. In 2016, several rosettes were detected within the belt of CT5, located on the periphery of the large area of cattle disturbance near the gate that is closest to the multi-use trail (see **Figure 1**). The detection of toad rush (*Juncus bufonius)* in Area C is less clear and could be due to multiple factors including greater light penetration from the reduced canopy, increased moisture from higher precipitation, or grazing disturbance (i.e. introduced in the supplemental forage or on cattle hide).

RDM levels decreased in most of the grazed areas between 2015 and 2016. A comparison of RDM levels between 2015 and 2016 is presented in **Figures 33** (Area A) and **Figure 34** (Areas C and D).

Figure 33. Comparison of RDM for Area A in 2015 and 2016

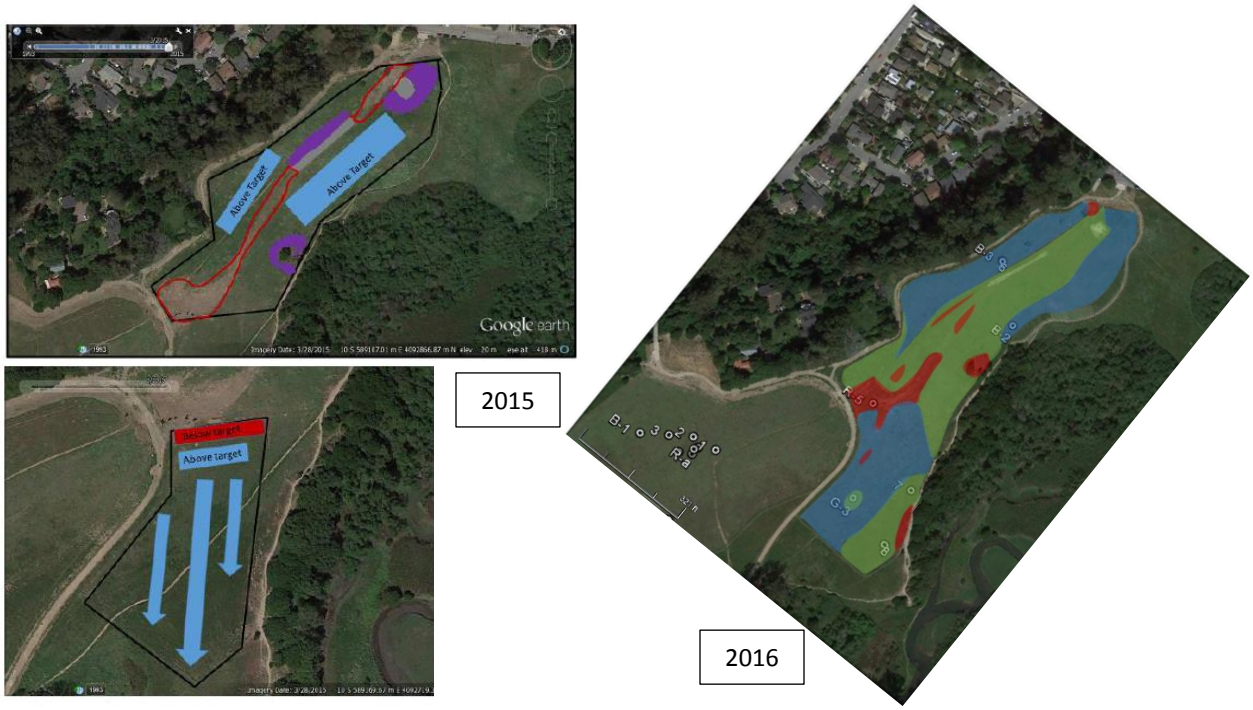


2015



2016

Figure 34. Comparison of RDM for Areas C and D in 2015 and 2016



Areas of lowest RDM increased in Area A from 2015 to 2016. Red RDM levels were recorded in the central portion of the grazing area where cattle were encouraged to graze to benefit the SCT. More green RDM levels were recorded in Areas C and D in 2016 than in 2015, as a result of additional grazing in these Areas in 2016. Observations of SCT in 2016 were all found within areas mapped with the lowest RDM levels, as depicted in **Figure 35**.

Figure 35. SCT patches (in yellow) depicted on RDM Map, Area A 2016

The large reduction in biomass, canopy height, and RDM across the prairie represents positive progress in improving vegetation conditions. However, Arana Gulch has been highly disturbed for well over one hundred years and returning the prairie to reference conditions, if possible, will take many more years.

5.2.2.3 Evaluation of HMP Goals. The HMP has three goals that apply to the coastal prairie and are not specific to the SCT (which is addressed in the previous section). Goal 2 seeks to maintain a functioning coastal prairie through the reintroduction of grazing and the resultant disturbance regime. Objective 2A identifies implementation of the grazing program by 2014 and Objective 2a requires that the grassland achieve residual dry matter (RDM) measurements within a range appropriate for SCT growth. Grazing was implemented in 2015, thus, the first two objectives have been met.

Observations and BMP implementation monitoring of the grazing program were implemented concurrent with grazing. The protocol for monitoring of the grazing program in 2015 are outlined in the HMP and include observations of feed and water troughs (3 times during grazing), adherence to BMPs (see Section 3.5.6 in HMP), and documenting residual dry matter (once a year in September or October). The following BMPs, as identified in the HMP[7] , were implemented and monitored:

- Due to a below-normal rainfall year, the AMWG recommended that temporary fencing was not needed around the seasonal wetland within the southern grazing area or its 50-foot buffer. Grazing was allowed in the seasonal wetland area between February 26 and June 17, as recommended by the AMWG.
- Water troughs were placed adjacent to grazing area gates and away from the top of steep slopes; the troughs were located outside of sensitive areas (occupied SCT areas/seasonal wetland). No supplemental feed was used in 2016.

[7] See page 68 (Section 3.5.6) of Arana Gulch HMP.

- Due to slightly below-normal rainfall year, the number of animals on site did not result in any erosion. There was no significant volume of cattle waste due to the relatively low number of animals on site during the grazing season.
- The City and the grazing contractor conducted regular visual inspections of fence lines to ensure cattle remained within the designated grazing area in 2016. There were two incidents of cut fence lines before the grazing season began but none during the grazing season. The City and the grazing contractor repaired the fences before the grazing season began. At no time did any cattle escape the grazing area.
- During rainfall events, the City conducted visual inspections (by foot) to document whether there was any rilling or other erosion within and from the grazing area. No erosion issues were detected; however, 2016 was a slightly below normal rainfall year. There was no need to install erosion control measures, such as straw wattles, to prevent any accelerated or channelized runoff toward steep slopes.
- The grazing contractor avoided motorized vehicle use during rainy season/soil saturation.

5.4 Invasive Weed Work Plan

5.4.1 Management Actions

In 2015 the City mapped the invasive plants within this management area and prepared an Invasive Weed Work Plan (IWWP). The IWWP outlined methods for the removal and control of invasive, non-native plant species in the management area. Species addressed in the plan include: Italian thistle (*Carduus pycnocephalus)*, bull thistle (*Cirsium vulgare)*, poison hemlock (*Conium maculatum)*, cotoneaster (*Cotoneaster sp.)*, Bermuda grass (*Cynodon dactylon)*, French broom (*Genista monspessulana)*, English ivy (*Hedera helix)*, velvet grass (*Holcus lanatus)*, Harding grass (*Phalaris aquatica)*, *Prunus sp.*, pyracantha (*Pyracantha sp.)*, wild radish (*Raphanus sativa)*, Himalaya blackberry (*Rubus ameniacus)*, and milk thistle (*Silybum marianum).* The IWWP is presented in the Year 2 Annual Report, Appendix B.

In 2016 the City filled a park maintenance position with dedicated hours for Arana Gulch. Park maintenance in 2016 was used to continue to remove re-sprouts of cotoneaster (*Cotoneaster sp.)*, Himalaya blackberry (*Rubus ameniacus)*, and English ivy (*Hedera helix)* from the coastal prairie on the hillside near the Harbor entrance. **Figure 36** shows this area in December 2017.

Figure 36. Hillside after removal of cotoneaster, Himalaya blackberry, and English ivy, December 2016

In addition, significant maintenance was provided to remove and control thistles from the grassland, including the grazing areas. In spring 2016, thistle rosettes were routinely shovel cut from the grassland. As per the IWWP, the City implemented control actions and if seed heads of thistles were observed, they were cut and disposed of off-site. As thistles (*Cirsium, Silybum,* and *Carduus spp.)* were widespread on site, control of these species was a significant effort and the control efforts reduced cover by these species. Large thickets of Himalaya berry (*Rubus armeniacus)* in the northern portion of the grassland were also routinely mowed and/or weed-whipped. Occurrences of ivy (*Hedera helix)* and non-native vines were removed/controlled along the western property line. Trees encroaching into the designated grassland were cut in December. Most of the trees around Grazing Area A, from Hagemann Bridge to the harbor overlook were cut as trees are not desired in the designated grassland. None of the trees were heritage trees as defined by the City's municipal code. Additional trees will be cut in 2017. A log of the City's maintenance actions is presented in **Appendix B**.

5.4.2. Evaluation of HMP Goals. The HMP has three goals that apply to the coastal prairie and are not specific to the SCT (which is addressed in the previous section). Goal 2 seeks to maintain a functioning coastal prairie through the reintroduction of grazing and the resultant disturbance regime. Objective 2A identifies implementation of the grazing program by 2014 and Objective 2a requires that the grassland achieve residual dry matter (RDM) measurements within a range appropriate for SCT growth. All three of these objectives have been met in 2016.

5.5 Proposed Actions for 2017

The following actions and expected timing are proposed for 2017:

- Continue the cattle grazing program, beginning in January 2017, with grazing extending to July 2017.
- Monitor grazing operation and implement the HMP-designated BMPs (see Section 3.5.6 in HMP and bullet list above) (January– July 2017).

- Evaluate scrape plots in NE portion of grassland; mow or graze all delineated areas (May/June 2017).
- Close the ad-hoc path along Arana Creek to public access.
- Evaluate and update, as needed, the draft sub-management area map.
- Continue to implement invasive plant species control as per the IWWP, focusing on removal/control of the following species:
    - Himalaya blackberry (*Rubus armeniacus)*
    - Cotoneaster *(Cotoneaster sp.)*
    - French broom (*Genista monspessulana)*
    - Velvet grass (*Holcus lanatus)*
    - Thistles (*Cirsium sp., Carduus sp., Silybum marianum)*
    - Medusa head (*Elymus caput-medusae)*
- Conduct census for SCT (August/September 2017).
- Monitor plant cover, canopy height, species richness, bare ground at permanent transects and compare data to previous years and HMP desired direction of change (April 2017).
- Document canopy height three times a year: February, April, and August/September 2017
- Document RDM in September/October 2017.
- Evaluate and update, as needed, the draft sub-management area map and develop/finalize specific performance targets for percent cover of native species, nonnative species and bare ground, and species richness for coastal prairie that will be used to determine whether HMP objectives have been met. In the absence of acceptable data on reference coastal prairies, the AMWG may use these three years of baseline data and a first year of monitoring data under grazing in April 2016 to begin refining the objectives under Goal 3.
- Document site conditions from the permanent photo-points.
- Maintain the restoration plantings near Arana Creek. Plant additional willows at Arana Creek.

Table 9. Biological Variables Monitored in Coastal Prairie/Tarplant Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Interim Target Date	Year 3 (2016) Results	Objective Met?
Goal 1. Maintain a viable SCT population at Arana Gulch						
Objective 1A. Increase number of aboveground SCT to at least the 2006 level by 2015 (Note: 2006=348 plants in Area A)	# of above ground SCT plants	Yearly in Aug./Sept.	Increase	2014	35 SCT	No, but increase from 0 plants in 2015, 4 plants in 2014, 18 plants in 2013[8]
Objective 1B. Expand the distribution of SCT beyond Area A within 3 years (Note: Year 3 = 2017)	Distribution of SCT plants	Yearly in Aug./Sept.	Expansion	2017	SCT limited to Area A	No
Goal 2. Reintroduce grazing to restore a disturbance regime that maintains functioning coastal prairie						
Objective 2A. Implement the Grazing Program by 2014	2A.1 Observation of feed and water troughs	3x during grazing	Stable	2015	City monitored water troughs in 2016	Yes, one trough relocated in 2016
	2.A.2 BMP implementation monitoring	3x during grazing	Stable	2015	City monitoring plant height and other BMPS through grazing season	Yes, BMPs were implemented
Objective 2B. Maintain RDM within a range that allows SCT to complete its lifecycle and protects coastal prairie grassland from erosion (700-1,500 lbs./acre)	Residual dry matter (RDM)	Yearly in Sept./Oct.	Maintain within range	2017	RDM measured in October; areas were At Target, yet several areas Above Target; SCT observed in below target areas.	Yes, although some areas were above target; the SCT were observed in below target areas

[8] HMP acknowledges that number of aboveground SCT is not likely to increase until after grazing program is implemented; SCT increase from grazing may not be fully detected until 2016.

Table 9. Biological Variables Monitored in Coastal Prairie/Tarplant Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Interim Target Date	Year 3 (2016) Results	Objective Met?
Goal 3. Minimize detrimental effects of high non-native plant cover and restore coastal prairie species diversity and habitat function						
Objective 3A. Reduce canopy height during the basal rosette stage for SCT (Nov. – April) from the baseline level to 2-3 inches[9] by 2015	Average canopy height	3x during growing season	Reduction	2015	Canopy height in April, 2016 was significantly lower than it was in 2015. Canopy height in September, 2016 was slightly above target.	Yes, cattle grazing reduced canopy height in April to less than 2 inches in Areas A, C, and D. However, the grass grew after cattle were removed and the height in September (5 inches) was slightly above target.
Objective 3B. Reduce cover of non-native species in the coastal prairie from the baseline to one more representative of a reference functioning coastal prairie system by 2020	Percent cover of non-native plants	Yearly at peak growth in April	Reduction	2020	There was a significant decline in the cover of EAG in Area A and in EAF cover in Area C and of one non-native species in Area D. Total non-native cover was well above 100% in all 3 areas.	No, cattle grazing reduced cover of some non-native plant guilds and a few select species but total cover remains very high and non-native species dominate the plant communities.
Objective 3C. Increase cover of native species from baseline levels to one more representative of a reference functioning coastal prairie system by 2020.	Percent cover of native plants	Yearly at peak growth in April	Increase	2020	Cover of native species remains at <1%. Natives were detected in Area C sample plots for the first time. Reference systems have range of 20-40% cover as per Holl and Reed (2010), Hayes and Holl (2003).	No, cover of native species has not increased and native plants are encountered very infrequently.

[9] AMWG reduced threshold from 0.5 m (1.6 feet) to 2-3 inches in January 2015

Table 9. Biological Variables Monitored in Coastal Prairie/Tarplant Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Interim Target Date	Year 3 (2016) Results	Objective Met?
Objective 3D. Increase native species richness from baseline levels to one more representative of a reference functioning coastal prairie system by 2020.	Native species richness	Yearly at peak growth in April	Increase	2020	11 native species including one tree, two shrubs, two forbs and six grasses have been detected in the sampling across Areas A, C, and D. Reference systems have a range of 4 to 21 species as per Holl and Reed (2010), Hayes and Holl (2003).	Yes, meeting trend of increased native species richness; coast tarplant and toad rush were detected for the first time in 2016.
Objective 3E. Increase cover of bare ground in the coastal prairie from baseline level to a level that enables SCT plants to complete their lifecycle by 2015.	Percent bare ground	3x during growing season	Increase	2015	Average cover of bare ground increased significantly from 8 to 26% in Area A, but did not change in Area C (20;26%) or Area D (10;13%).	Yes, meeting trend of increased bare ground in Area A, but not in other two areas.
	Permanent photo points with GPS location and compass direction	Before, during and post construction and then yearly at peak growth	Improving	2015	Photo points established in April 2015, approximately 8 weeks after initiation of cattle grazing.	Yes, photo points were re-sampled in 2016
Goal 4. Maintain a genetically and demographically viable soil seed bank in perpetuity.						
Objective 4A. Increase the density of viable ray achenes in the soil seed bank from baseline in the first 3 years and then assessed every 5 years.	Seed bank density (#of viable ray achenes)	Yearly	Increase	2015	No viable seed in Areas B and C; viable seed found in Areas A and D	N/A, baseline determined in 2015 and will be reassessed every 5 years

6. Habitat Management and Monitoring - Hagemann Gulch Riparian Woodland Management Area

Activities within this management area were limited in 2016. The bridge and trail construction was completed in 2014 and erosion control and wildlife protection measures were implemented, consistent with Goal 3 of the HMP. Historic "Rose of Castille" bushes were relocated to City Hall, consistent with Goal 5 of the HMP and a riparian revegetation plan was prepared and approved by CDFW to compensate for impacts of the bridge project. Mapping and identification of invasive, non-native plant species was initiated in 2016 and is expected to be completed in 2017.

6.1 Management Actions

6.1.1 Bridge Construction Project

Management actions associated with the bridge construction project were in place until the completion of bridge construction, which was December 2014.

The City prepared a riparian revegetation plan which was reviewed by the AMWG and approved by CDFW to compensate for impacts to native trees and shrubs by the bridge project. This plan was contained in the Year 1 Monitoring Report. The plantings, six native California roses (*Rosa californica)* will be planted near the eastern bridge abutment in early 2017.

6.1.2 Integrated Pest Management (IPM)

The eucalyptus trees that were trimmed to accommodate the bridge were field checked for re-sprouts. Minor re-sprouting of eucalyptus branches from some of the trees were noted. These sprouts will be included in the in the IPM plan for the gulch when this plan is developed.

6.1.3 Fire Hazard

No management actions were implemented in 2016.

6.1.4 Wildlife Protection

Prior to construction of the bridge over Hagemann Gulch, measures were implemented to avoid impacts to wildlife. These measures were completed in 2014. No additional management actions were implemented in 2016.

6.1.5 Appropriate Uses in Hagemann Gulch

No management actions were implemented in 2016. Rangers periodically patrolled open space activities in and around the bridge for transient encampments and other illegal activities. Encampments were removed as needed. Branches were placed to block areas that appeared to be used for unauthorized access to the riparian areas.

6.1.6 Rose of Castille Bushes

The "Rose of Castille" bushes located near the Hagemann Gulch bridge construction area were relocated to City Hall in 2013, in consultation with the City Arborist. The roses receive regular maintenance and care and are thriving in their new location. Staff has decided that adding interpretive signage is too risky and may lead to vandalism or theft. The potential risks to the plants outweigh the educational benefits from the signage.

6.2 Monitoring and Performance Evaluation

6.2.1 Monitoring Methods

No surveys or monitoring was conducted in 2016.

6.2.2 Monitoring Results

No monitoring results are available for 2016.

6.2.3 Evaluation of HMP Goals

Table 10 presents a summary of the biological variables monitored, the Year 3 (2016) values, and the desired direction of change.

The HMP has a goal to seek funding to develop an integrated pest management (IPM) plan to reduce the understory of invasive non-native species in Hagemann Gulch (Goal 1, Objectives 1A, 1B, and 1C). The City has not begun this task; and thus, these objectives have not been met; however; the AMWG has suggested that the City initiate this task by identifying the invasive, non-native plant species growing within the gulch. The City began this work in 2016 and will proceed with this task in 2017. Ivy growing below the bridge has been identified as a priority and removal will begin in 2017, as funding allows.

Goal 2 (Objective 2A) of the HMP for this management area identifies the need to reduce the fire hazard within the gulch. The objectives include reducing the cover of woody thickets (comprised of invasive, non-native species) and prioritize the removal of eucalyptus trees, as feasible. Construction of the multi-use bridge resulted in the removal of a several eucalyptus trees near the western abutment and from the central gulch; however, several large stands of eucalyptus trees remain. As noted above, the City has not implemented the IPM plan for the removal of the woody invasive plant species that would address the fire hazard. The City will initiate this work as funding allows; however, this may not be feasible until 2017. This objective has not yet been met.

Protection of wildlife habitat features is a goal of the HMP (Goal 3). This goal and it associated objectives were met concurrent with construction of the trail and the bridge over Hagemann Gulch in 2014. Objective 3A requires the identification and protection of San Francisco dusky-footed woodrats with the bridge construction zone (within 25m of the bridge). No woodrat nests/houses were documented within the construction zone. No further action is required; however, the City will continue to search for nests when work is

performed in the area. Objective 3B requires monitoring for sensitive bird and bat roots and/or nests occurring within 25m of the Hagemann Gulch bridge, with monitoring and protection of such resources for 3-5 years post-construction. The 2013 bat survey found that the trees in the area provide only foliage roosting habitat. No cavities or crevices were found to support sensitive bat roosts. As the baseline is zero, no additional monitoring is required; however, the City could elect to monitor bat roosts to document if there is an increase in bat roosting after the trail and bridge project. Similarly, the 2014 nesting bird survey was negative for sensitive bird nesting. As the baseline is zero, no additional monitoring is required; however, the City could elect to monitor the area for sensitive bird nesting to document if there is an increase in such nesting after the trail and bridge project. These objectives are no longer applicable as part of the plan.

Goal 4 for this management area requires observing uses in Hagemann Gulch after trail and bridge construction and to determine if there are changes in use from site improvements. In 2016 City park rangers routinely patrolled the greenbelt to detect appropriate and inappropriate uses; off-leash dog use and periodic illegal encampments were noted in/around the bridge. Objective 4A has been met.

Goal 5 of the HMP is to preserve the "Rose of Castille" bushes located near the Hagemann Gulch bridge construction area. To preserve these shrubs, the City elected to relocate them to City Hall in 2013, in consultation with the City Arborist. The shrubs are in excellent condition and Objectives 5A and B have been met.

6.3 Proposed Actions for 2017

The following actions and expected timing are proposed for 2017:

- Monitor appropriate uses within Hagemann Gulch through periodic City ranger patrols (January– December 2017).
- Install six California rose (*Rosa californica)* as part of riparian revegetation plan; maintain plantings throughout year with weeding and supplemental irrigation; monitor plant survival (spring- summer 2017).
- Continue to map invasive, non-native plant species in the area and initiate weed eradication prioritization.

Table 10. Biological Variables Monitored in Hagemann Gulch Riparian Woodland Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 3 (2016) Results	Objective Met?
Goal 1. Seek funding to develop an integrated pest management (IPM) plan to reduce the understory of invasive non-native species in Hagemann Gulch					
Objective 1A. Use a combination of methods to reduce the cover of non-native invasive woody plant thickets from baseline levels in the first year.	Non-native invasive woody plant cover	Before and after every removal effort	Decrease	Eucalyptus trees removed near western bridge abutment and along bridge sightline	Partial compliance; some eucalyptus trees removed but large stands remain
Objective 1B. Monitor re-sprouting of removed vegetation and recruitment of new seedling on a regular basis, for at least 5 years after initial removal efforts.	Re-sprout and seedling emergence of target weeds	After every removal effort	Decrease	Minor re-sprouting of eucalyptus branches from trees limbed for the bridge placement	Yes, re-sprouts were monitored; re-sprouts to be considered in IPM plan when plan is developed
Objective 1C. If passive restoration is not adequately controlling erosion, use revegetation with appropriate native species or other cultural methods to limit the amount of exposed soil and the potential for re-infestation and erosion.	Area of exposed soil (bare ground)	After every removal effort	Decrease	No action; no erosion detected	Yes, no erosion has been detected; no actions needed at this time
Goal 2. Reduce the fire hazard within Hagemann Gulch					
Objective 2A. Reduce the cover of woody thickets as per Objective 1A to reduce overall fire risk.	Non-native invasive woody plant cover	Before and after every removal effort	Decrease	Eucalyptus trees removed near western bridge	Partial compliance; some eucalyptus trees removed but large stands remain

Table 10. Biological Variables Monitored in Hagemann Gulch Riparian Woodland Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 3 (2016) Results	Objective Met?
				abutment and along bridge sightline	
Objective 2B. Prioritize the removal of eucalyptus trees where feasible.	Area occupied by eucalyptus	After every removal effort	Decrease	Eucalyptus trees removed near western bridge abutment and along bridge sightline	Partial compliance; some eucalyptus trees removed but large stands remain
Goal 3. Protect wildlife habitat features in Hagemann Gulch					
Objective 3A. The number of SF dusky-footed woodrat nests occurring within Hagemann Gulch bridge construction zone will be identified and the nests protected.	Number of SF dusky-footed woodrat nests within 25m of Hagemann Bridge construction zone	Yearly, if observed prior to construction.	Stable	None detected within construction area Hagemann Gulch bridge; unknown number within 25m of bridge	N/A. No nests were identified prior to construction
Objective 3B. Monitoring for sensitive bird and bat roosts and/or nests occurring within 25 m of the Hagemann Gulch bridge construction zone will be identified and protected and continued for 3-5 years post-construction.	Sensitive bird or bat detections within 25m of Hagemann Bridge construction zone	Yearly, if observed prior to construction.	Stable	None detected within 25m Hagemann Gulch bridge	N/A. No nests were identified prior to construction
Goal 4. Increase appropriate uses in Hagemann Gulch					

Table 10. Biological Variables Monitored in Hagemann Gulch Riparian Woodland Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 3 (2016) Results	Objective Met?
Objective 4A. Observe the condition of all improvements at least 4 times per year in the first 3 years and at least twice a year thereafter.	Observation of infrastructure conditions	4x per year	Stable	Stable	Park rangers and maintenance staff periodically inspected the area in 2016; issues of illegal encampments were documented in close proximity to the bridge
Goal 5. Preserve the "Rose of Castille" historic roses					
Objective 5A. Relocation of the roses will occur only if no other alternative is feasible for development of the Hagemann Gulch Bridge. Any relocation will be done in the vicinity of the existing trees, in consultation with the City Arborist.	Presence of Rose of Castile	Yearly in June/July	Stable	Shrubs relocated to City Hall	Yes, roses were located to City Hall to ensure regular maintenance and care
Objective 5B. Address the public education benefits of identifying the Rose of Castille and providing interpretative panels.	Presence of Rose of Castile	Yearly in June/July	Stable	Decision was made.	Staff determined that identifying them would expose them to potential theft and vandalism. No additional action is necessary.

7. Habitat Management and Monitoring - Arana Gulch Creek Riparian Woodland and Wetland Management Area

The Arana Gulch Multi-Use Trail including the causeway over Arana Gulch Creek was completed in 2014. This construction project required the implementation of erosion control, wildlife protection measures prior to construction, and revegetation of areas near the causeway consistent with construction permit conditions. Riparian revegetation was implemented in 2015. Consistent with Goal 3 of the HMP, the City continued to work with the Resource Conservation District of Santa Cruz County (RDCSCC) on measures to implement habitat enhancement actions within the Arana Gulch watershed. In addition, the City continued on the development of a plan to reduce the non-native understory in the management area by completing maps showing the distribution of invasive weeds, consistent with Goal 4 of the HMP.

7.1 Management Actions

7.1.1 Trail and Causeway Construction Project

In 2014, the City prepared a riparian revegetation plan which was reviewed by the AMWG and approved by CDFW to compensate for impacts to native trees and shrubs by the causeway construction. Three areas were designated for revegetation. In 2014, Area A, the slope by the causeway, was hydroseeded with sterile seed as per the CDFW-approved revegetation plan. Twenty dormant willow cuttings were installed at the toe of the slope in December 2014. In Area B, located near the northwestern causeway abutment, 40 creeping wild rye (*Elymus triticoides)* were planted (March 2015). In Area C, a flat area north of the causeway, was planted with 40 creeping wild rye (*Elymus triticoides)*, 16 California rose (*Rosa californica)*, 16 mugwort (*Artemisia douglasiana)*, and 3 coast live oak (*Quercus agrifolia)* were planted (March 2015). The plantings were installed by City staff and volunteers recruited by the RDCSCC. The City maintained these plantings within 2015, implementing periodic weeding and hand-watering; however, plant survival of the willows in Area A was low and the area was replanted in winter 2016. Plant survival of the creeping wild rye was low in Area B; therefore, the City elected to install additional native shrubs in Area C, where growing conditions were considered to be better. Additional willow pole cuttings (25) were installed along the slope above Arana Creek to replace previous plantings that died.

7.1.2 Wildlife Protection

Prior to construction of the Arana Gulch Multi-Use Trail, measures were implemented to avoid impacts to wildlife. These measures were completed in 2014. No additional management actions were implemented in 2015.

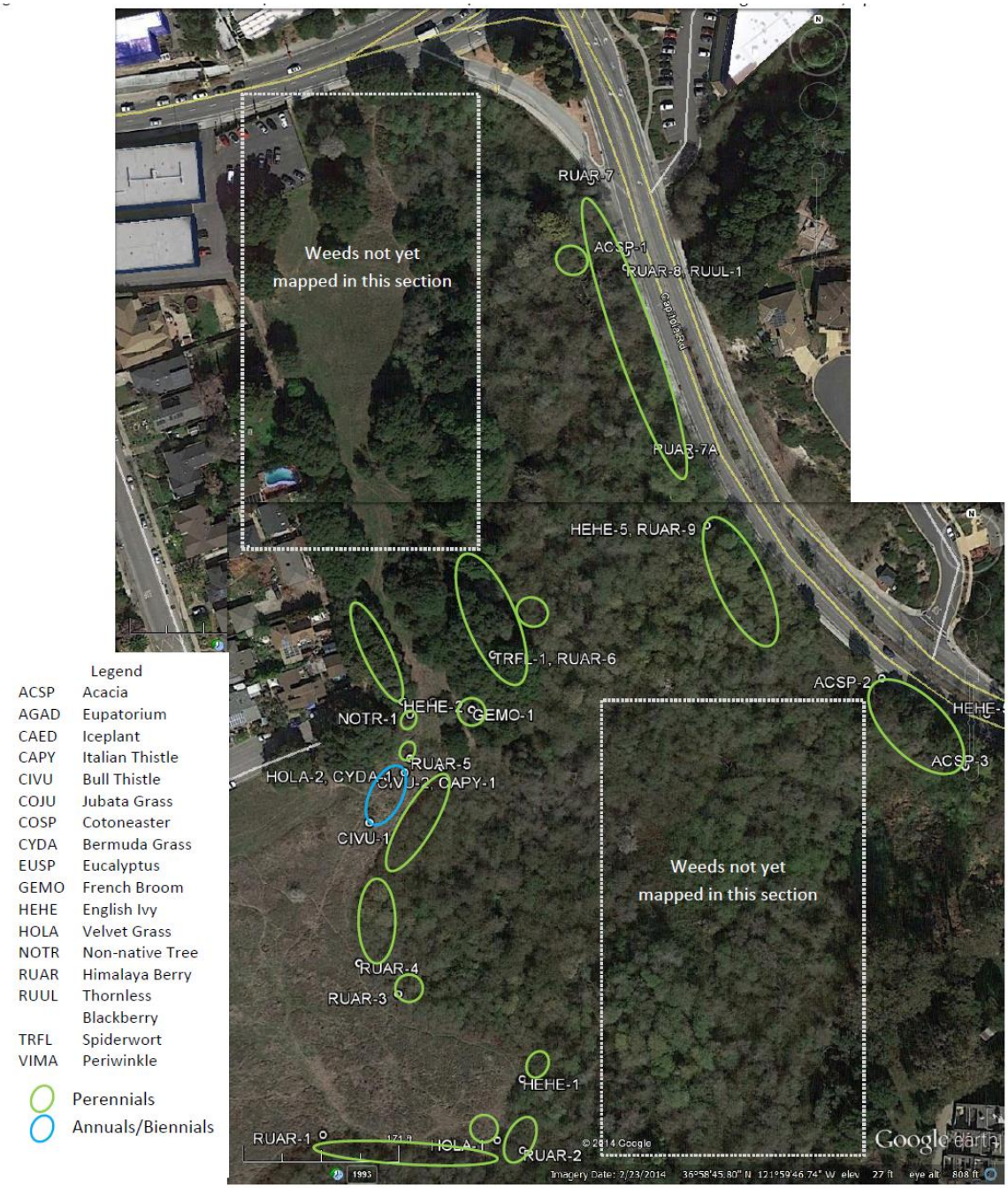
7.1.3 Integrated Pest Management (IPM)

In October 2014, mapping of invasive weeds within this management area was initiated. Additional invasive weed mapping was conducted in 2015. Access is limited in several areas of the management area and future field surveys are needed to map occurrences in these areas, pending access. The mapping will be used to guide future management activities for species removal/ control.

The mapping in 2015 used visual searches from accessible locations within the management area to detect invasive, non-native plant species. Species documented were those identified as priority weeds by (Cal-IPC and/or the Bay Area Early Detection Network). The approximate size, density of plants (dense, moderate, and sparse) and the location of each non-native invasive species patch was documented using GPS and mapped on aerial photos. A map of data collected, as of April 2015, is presented in **Figure 37A-D**.

Invasive non-native plant species documented to date in the management area include: (*Acacia spp.)*, perennial pepperweed (*Lepidium latifolium*), eupatorium (*Ageratina adenophora)*, iceplant (*Carpobrotus edulis)*, Italian thistle (*Carduus pycnocephalus)*, bull thistle (*Cirsium vulgare)*, jubata grass (*Cortederia jubata)*, cotoneaster (*Cotoneaster sp.*), Bermuda grass (*Cynodon dactylon*), eucalyptus (*Eucalyptus sp.)*, French broom(*Genista monspessulana*), English ivy (*Hedera helix*), velvet grass (*Holcus lanatus*), Himalayan blackberry (*Rubus armeniacus*), thornless blackberry (*Rubus ulmifolius)*, spiderwort (*Tradescantia fluminensis)*, and periwinkle (*Vinca major)*.

Figure 37A. Location of Invasive Plant Species within Arana Gulch Creek Riparian Woodland and Wetland Management Area, April 2015



Arana Gulch Greenbelt – Location of Invasive Plant Species in Arana Creek Management Area
April, 2015 - Sheet 1 of 4

Figure 37B. Location of Invasive Plant Species within Arana Gulch Creek Riparian Woodland and Wetland Management Area, April 2015

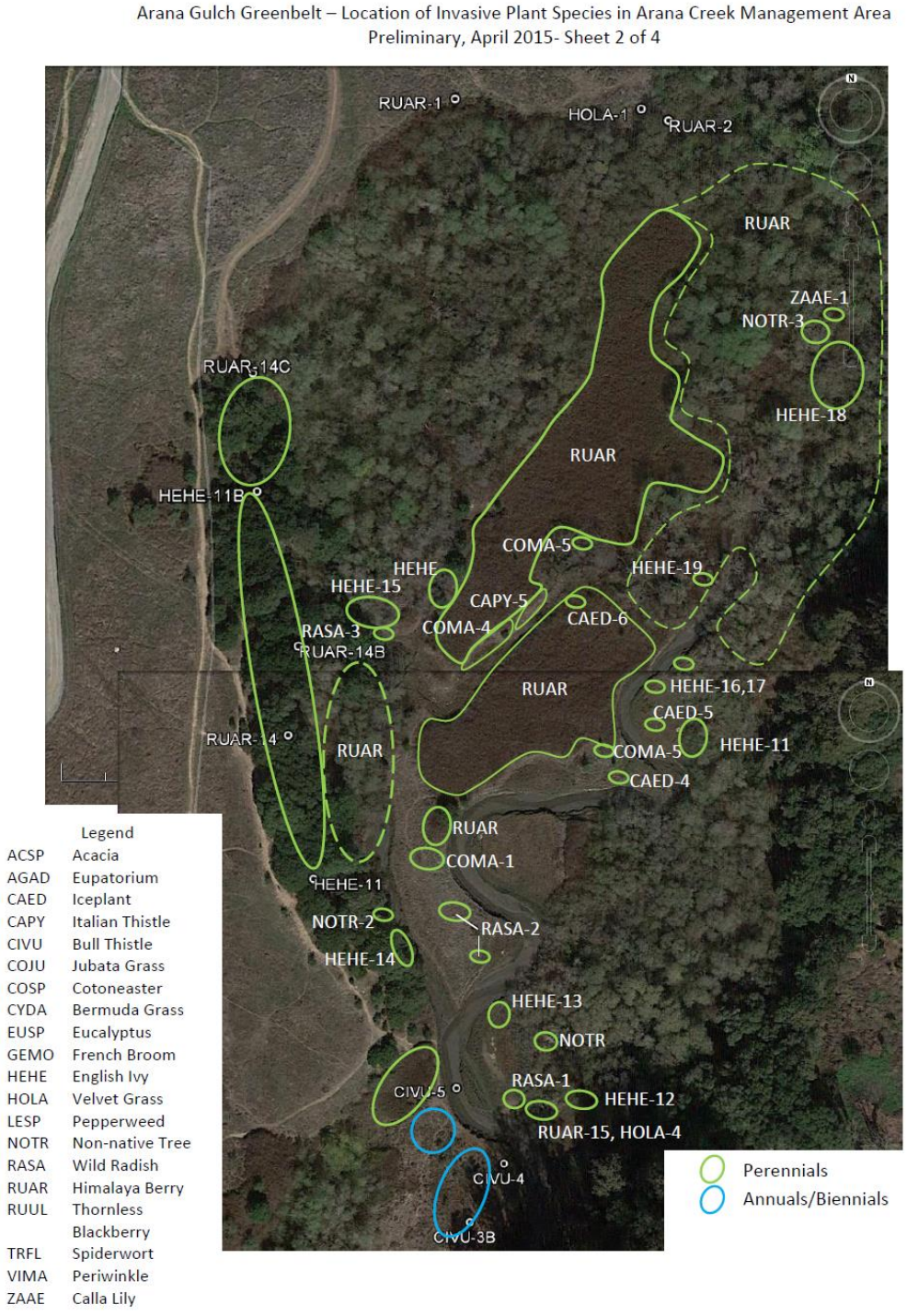
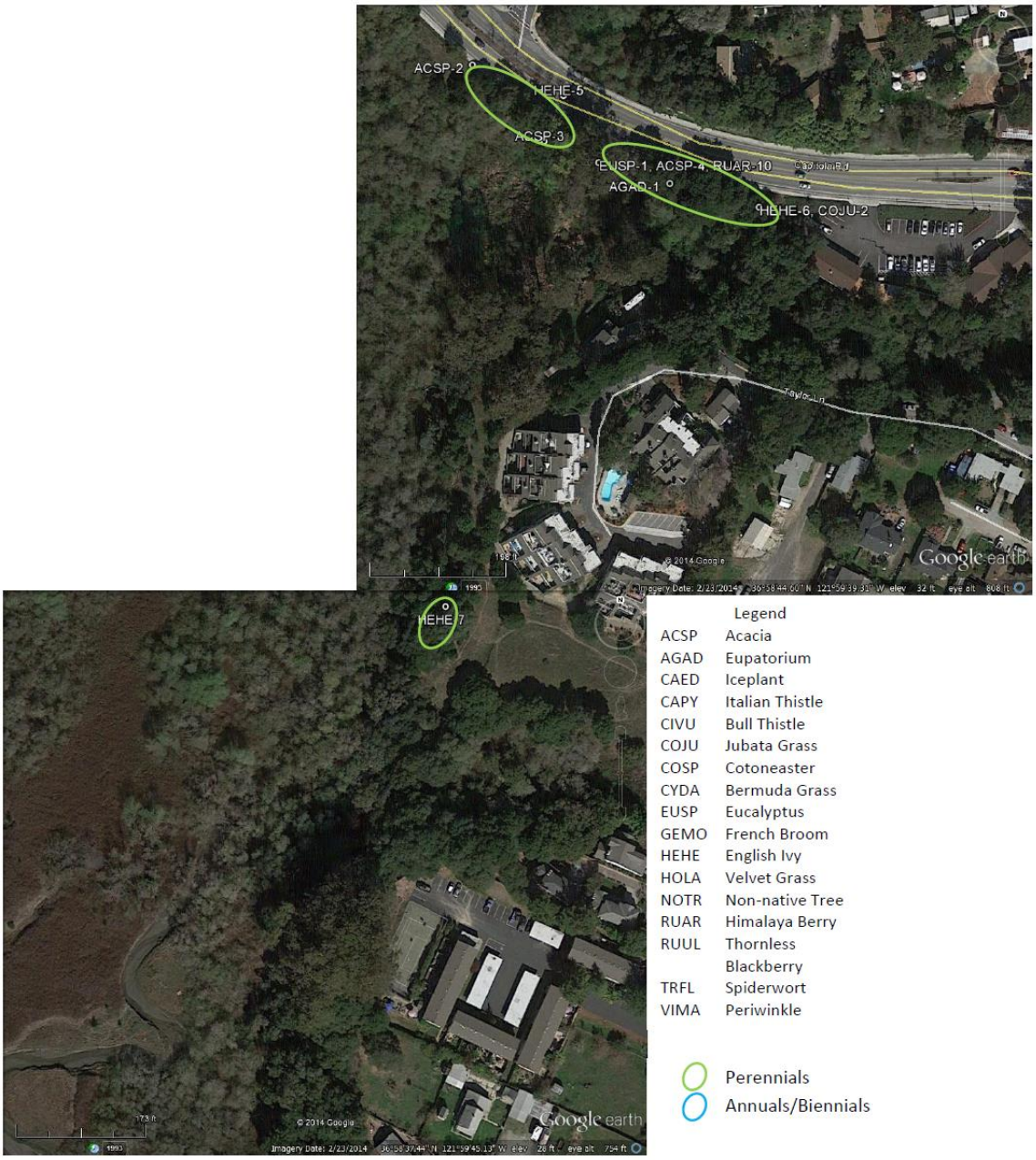


Figure 37C. Location of Invasive Plant Species within Arana Gulch Creek Riparian Woodland and Wetland Management Area, April 2015

Arana Gulch Greenbelt – Location of Invasive Plant Species in Arana Creek Management Area
Preliminary, April 2015- Sheet 3 of 4

Figure 37D. Location of Invasive Plant Species within Arana Gulch Creek Riparian Woodland and Wetland Management Area, April 2015



7.1.4 Coordination with the RCDSCC

The City coordinated with the RCDSCC in 2016 on measures to improve habitat conditions in the watershed. In 2016, the RCDSCC attended an AMWG field meeting and had their consultants (Balance Hydrology) present their findings on a watershed sediment study. The A field meeting included a discussion of erosion problems in the management area. The watershed study evaluated watershed issues that have the potential to deliver significant amounts of new sediment to the harbor (two gullies in upper watershed) and compared existing conditions to the 2002 Arana Gulch Enhancement Plan. The results of that study were not available at the time of this report and will be summarized in the 2017 annual report.

7.2 Monitoring and Performance Evaluation

7.2.1 Monitoring Methods

The riparian revegetation areas were monitored in 2016. A plant survival count was conducted on December 2. The revegetated areas are required to meet 80% absolute cover of native species (including planted and naturally regenerating species) and less than 5% of invasive weeds; therefore, plant cover within the revegetation area was documented by a visual assessment using the CDFW Combined Vegetation Rapid Assessment and Releve Field Form. A copy of these forms is presented in **Appendix D**.

7.2.2 Monitoring Results

Within Area A, the November 2015 monitoring found a dense cover of hydroseeded barley on the slope; plant cover was dominated by the seeding barley and naturally-establishing blackberry was also present. At the toe of the slope the willow cuttings exhibited a 10% survival rate; only two of the 20 willow cuttings were found to be alive. Plant cover within the revegetation area was recorded at is 95%, provided by Himalaya berry (*Rubus ameniacus)* (60%), grasses and forbs (25%) and willow (*Salix lasiolepis)* (15%), (see **Table 11**). This area does not meet the required 80% native woody cover required by CDFW; therefore, an additional 25 willow pole cuttings were installed on the slope in December 2016.

Within Area B, 40 creeping wild rye (*Elymus triticoides)* were planted in 2015. Due to poor survival and poor growing conditions; these plantings were abandoned and additional shrubs were installed in Area C; however, pre-existing creeping ryegrass plants are still present in the area, which is reflected in the plant cover measurements (see **Table 11**). Within Area C. plant cover was recorded at 80%, with cover provided by California rose (*Rosa californica)* (20%), mugwort (*Artemisia douglasiana)* (15%), creeping wild rye (*Elymus triticoides)* (20%), coastal live oak (7%) and grasses and forbs (40%). These data are depicted on **Table 11**. This area does not yet meet the required 80% native cover required by CDFW. Additional growth is needed for the plantings to provide additional cover; the plantings will be maintained throughout 2017.

Table 11. Monitoring Results from Riparian Revegetation Area, Arana Creek, 2016

Species	# Installed Plants Alive, 2016	Plant Cover
Area A		
Willow	2	15%[1]
Himalaya Blackberry	-	60
Grasses and Forbs	-	25
Area B		
Willow	-	10%
Himalaya Blackberry	-	5%
Creeping Wild Rye	10 +	70%
Ryegrass	-	15%
Area C		
Creeping Wild Rye	-	20%
California Rose	76	20%
Mugwort	27	15%
Coast Live oak	3	7%
Grasses and Forbs		60%

[1] 25 additional willow pole cuttings installed in December 2016

7.2.3 Evaluation of HMP Goals

Table 12 presents a summary of the biological variables monitored, the Year 3 (2016) values, and the desired direction of change.

The HMP has a goal to seek funding to reduce sediment and improve steelhead conditions within the Arana Gulch watershed (Goal 1 of HMP), a goal to stabilize the tidal reach of Arana Gulch Creek (Goal 2), and to restore the eroded gully on the greenbelt (Goal 3). To meet this goal, the City conferred with the RCDSCC in 2016 to discuss management activities within the watershed and within the greenbelt property. The City coordination with the RCDSCC is in compliance with goals of the HMP, yet the goal has not yet been met.

Goal 4 is to develop an integrated pest management (IPM) plan to reduce the understory of invasive non-native species in the management area (Goal 4). The City continued to make progress on this task by mapping occurrences of invasive, non-native plant species growing within the management area in compliance with goals of the HMP.

7.3 Proposed Actions for 2017

The following actions and expected timing are proposed for 2017:

- Continue to engage with the RCDSCC on watershed and greenbelt projects through annual meeting with the RCDSCC. (January– December 2017).
- Maintain all plantings throughout year with weeding and supplemental irrigation; monitor plant survival in fall 2017.
- Confer with the AMWG of prioritizing removal and control of invasive, non-native plant species within the management area.

Table 12. Biological Variables Monitored in Arana Gulch Creek Riparian Woodland and Wetland Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 3 (2016) Results	Objective Met?
Goal 1. Reduce sedimentation and improve steelhead habitat conditions within the Arana Creek watershed					
Objective 1A. High priority sediment-related projects identified in the Arana Creek watershed enhancement plan area implemented.	# of completed sediment-related projects with the RCDSCC	Yearly	Increase	Funding provided to RCD to seek grant opportunities and help prioritize projects.	No
Objective 1B. High priority steelhead habitat improvements identified in the Arana Creek watershed enhancement plan area implemented.	# of completed steelhead habitat improvement projects with the RCDSCC	Yearly	Increase	Funding provided to RCD to seek grant funding and help prioritize projects.	No
Goal 2. Stabilize the tidal reach of Arana Gulch Creek					
Objective 2A. Engage the RCDSCC Arana Gulch Working Group staff to attend targeted AMWG meetings to identify possible solutions for the tidal reach of Arana Gulch Creek.	RCDSCC attendance at AMWG meetings	Yearly	Increase	City has engaged with RCDSCC	Yes. City will continue to coordinate with RCDSCC in 2017 to meet goals
Objective 2B. Work with the RCDSCC staff to obtain funding to design and implement a bank restoration project that reduced head cutting and bank erosion along the tidal reach of Arana Gulch Creek.	Funding level for the tidal reach restoration	Yearly	Obtain/increase	Funding provided to RCD to seek grant funding and help prioritize projects.	No

Table 12. Biological Variables Monitored in Arana Gulch Creek Riparian Woodland and Wetland Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 3 (2016) Results	Objective Met?
Goal 3. Restore the eroded Greenbelt Gully					
Objective 3A. Work with the RCDSCC staff to pursue funding for the Greenbelt Gully restoration project.	Funding level for the Greenbelt Gully project	Yearly	Obtain/increase	Funding provided to RCD to seek grant funding and help prioritize projects.	No
Goal 4. Seek funding to develop an integrated pest management (IPM) plan to reduce the understory of non-native species in the Arana Gulch Creek Management Area					
Objective 4A. Remove and reduce the cover of non-native invasive species in the riparian woodland relative to baseline conditions including: black acacia found near the culverts, dense thickets of Himalayan berry, scattered French broom, tall white top, and periwinkle.	Non-native invasive woody plant cover	Yearly	Decrease	Initiated mapping of invasive plants in October 2014	No, but initiated mapping of invasive, non-native plant species
Goal 5. Provide education opportunities and increase appropriate uses					
Objective 5A. Observe the condition of all improvements at least 4 times per year in the first 3 years and at least twice a year thereafter.	Observation of infrastructure conditions	4x per year	Stable	Conditions were monitored.	First year of monitoring was 2015

8. Conclusions from Year 3 and Recommendations for Year 4 (2017)

8.1 Conclusions from 2015

The City continued its initiation of the HMP in 2016 (Year 3). Many of the management actions in this year were associated with the management actions within the coastal prairie and SCT management as cattle grazing was initiated. Invasive weed control was also started in this management area. There was effective and efficient coordination between the City, the AMWG, and the RCDSCC in 2016 as management actions and monitoring protocols were discussed. The City communicated with users of the greenbelt on the cattle-grazing and provided a ranger patrols to encourage/enforce regulations and deter vandalism and illegal camping.

8.1.1. Coastal Prairie/Santa Cruz Tarplant Management Area

Within the Coastal Prairie/SCT Management Area cattle grazing occurred on site from January through May. Implementing cattle grazing is in compliance with the HMP. Monitoring of plant cover and residual dry matter was implemented and some objectives were met in some areas for these variables. Objectives of the HMP relating to improving the coastal prairie to a more functioning system have not yet been met.

Grassland management actions were implemented in areas not subject to seasonal grazing. Flail mowing of the perimeter was conducted once May. Management of the grassland is required under the HMP; therefore, the City is in compliance with the HMP.

A census of SCT was conducted in 2016; 35 above-ground plants were documented from Area A. The HMP objective of reaching 348 plants was not met in 2016.

8.1.2. Hagemann Gulch Riparian Woodland and Arana Gulch Creek Riparian Woodland and Wetland Management Areas

Management actions were conducted in the Arana Creek Riparian Woodland and Wetland Management Area and the Hagemann Gulch Riparian Woodland Management Area in 2016. An IPM Plan was prepared in 2015, in compliance with the HMP, yet objectives for removal and control have not yet been met. Management actions in the Hagemann Gulch Riparian Woodland Management Area have not yet been implemented. These objectives of the HMP have not yet been met. The City coordinated with the RCDSCC on management issues within the Arana Gulch watershed in compliance with the HMP.

8.1.3. Adaptive Management and Public Outreach

The City engaged with the AMWG in 2016 through two meetings as well as email correspondence. The City received input from the AMWG on management actions and implemented the requested management actions. Consultation with the AMWG in 2016 was

done in compliance with the HMP. The City maintained a web page on the City's website for public outreach and responded to comments from the public and the AMWG on ways the site could be improved. These actions were in compliance with the HMP.

8.1.4 Schedule and Budgeting

The City established a line item in their operating budget for Arana Gulch and allocated funds for fiscal year July 1, 2016 to June 30, 2017. The City established a maintenance position for the greenbelt, which became effective in January 2016. Establishing funding for management actions is in compliance with the HMP.

8.2 Recommendations for 2017

The City will discuss with the AMWG recommendations for management actions for 2017 at the January 2017 meeting. The AMWG will provide input to the City on actions based on management priorities. The following summary of actions is preliminary and may be revised based on input from the AMWG and available funding.

8.2.1 Coastal Prairie/Santa Cruz Tarplant Management Area

HMP activities for 2017 (Year 4) is the continuation of seasonal cattle grazing within the prairie/grassland. The City will continue to implement the Stocking and Work Program. Management activities will include monitoring plant composition, plant cover and residual dry matter (RDM) within the grazed areas, grassland conditions along the permanent transects, documenting conditions from the permanent photo-stations, and continuing to remove and control high-priority invasive, non-native plant species.

The City will also continue to implement seasonal mowing within the non-grazed areas that are to be retained as grassland. A census of the SCT will be conducted in summer 2017. Seed collection of SCT may occur depending on the SCT population and prior approval from CDFW.

8.2.2 Hagemann Gulch Riparian Woodland Management Area

HMP activities identified for 2017 (Year 4) will be to monitor appropriate uses within the gulch concurrent with public use of the trail and bridge. City park rangers will monitor use as per their regular patrol duties within the greenbelt. Riparian revegetation as per an approved CDFW Streambed Alteration Agreement (SAA) will be planted and maintained in 2017. Plantings will be maintained and monitored throughout 2017 as per the SAA. Invasive plant mapping will be completed in 2017.

8.2.3 Arana Gulch Creek Riparian Woodland and Wetland Management Area

HMP activities identified for 2017 (Year 4) will be consultation with the AMWG on prioritizing removal/control of invasive, non-native plant species and then initiating removal/control of high-priority infestations. Riparian revegetation plantings will be maintained and monitored throughout 2017 as per the SAA.

8.2.4 AMWG and Public Outreach

In 2017 the City will continue to confer with the AMWG on adaptive habitat management activities throughout the year through scheduled meetings and group email correspondence. The AMWG will provide recommendations to the City on management priorities, grazing monitoring and public outreach. The City will solicit input from the public on HMP actions through the City webpage and through public input at the scheduled AMWG meetings.

8.2.5 Schedule and Budgeting

Table 13 presents a schedule for the HMP actions scheduled for 2017. The City has allocated funds for fiscal year July 1, 2016 to June 30, 2017; funding for fiscal year July 1, 2017 to June 30, 2018 has yet to be determined.

Table 13. Timeline for Habitat Management Actions Proposed for Year 4 (2017)

	2017												2018
Task	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
Coastal Prairie/Santa Cruz Tarplant Management													
Objective1. Santa Cruz tarplant census													
Objective 2. Monitor grazing program and variables													
Objective 3. Monitor baseline condition and photo points													
Hagemann Gulch Riparian Woodland Management													
Objectives 1 and 2. Implement IPM Plan and reduce fire hazard													
Objectives 3 and 4. Document wildlife habitat features and implement infrastructure monitoring[10]													
Objective 5A and 5B. Monitor survival of Rose of Castille shrubs													
Arana Gulch Creek Riparian Woodland and Wetland Management													
Objectives 1, 2, and 3. Collaborate with RCDSCC													
Objective 4. Implement removal/control of invasive													

[10] Includes completion of riparian revegetation at bridge and implementing year-long maintenance and monitoring.

Table 13. Timeline for Habitat Management Actions Proposed for Year 4 (2017)

	2017												2018
Task	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
non-native woody plant species and target weeds													
Objective 5. Infrastructure monitoring[11]													
Adaptive Management													
Objective 1. Conduct AMWG meetings													
Prepare Yearly Monitoring Report													

[11] Includes riparian revegetation and implementing year-long maintenance and monitoring.

9. References

Bainbridge, Susan. 2015. Status of the Soil Seed bank of Santa Cruz tarplant (*Holocarpha macradenia* Greene), Arana Gulch Open Space, CA. Submitted to City of Santa Cruz Dept. of Parks and Recreation, December 2015

Baldwin (ed.), 2013. The Jepson Manual Vascular Plants of California. University of California Press.

California Native Plant Society. 2001. CNPS Botanical Survey Guidelines. CNPS, Sacramento CA. June 2001.

California, State of, Department of Fish & Game. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural. November 2009.

Stanton, Alison. 2013. Arana Gulch Habitat Management Plan. Prepared for the City of Santa Cruz Planning Department and Department of Parks and Recreation. Revised September 2013.

Stanton, Alison. 2014a. Arana Gulch Coastal Prairie Baseline Assessment Study: Summer 2013. Prepared for the City of Santa Cruz Planning Department, Department of Parks and Recreation, and the Arana Gulch Adaptive Management Working Group. January 2014.

Stanton, Alison. 2014b. Arana Gulch Coastal Prairie Baseline Assessment Study: Spring 2014. Prepared for the City of Santa Cruz Planning Department, Department of Parks and Recreation, and the Arana Gulch Adaptive Management Working Group. November 2014.

Stanton, Alison. 2015. Arana Gulch Habitat Management Plan, 2015 Coastal Prairie Assessment. Prepared for the City of Santa Cruz Planning Department, Department of Parks and Recreation, and the Arana Gulch Adaptive Management Working Group. December 2015.

USFWS, 1996. Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed, and Candidate Species. September 23, 1996.

Appendix A AMWG Meeting Minutes, 2017

A-1: AMWG Meeting Minutes for:

March 2017
July 2017

Appendix B Restoration Maintenance Activity Log

B-1. Arana Gulch Restoration Maintenance and Activity Log

Appendix C Coastal Prairie/Santa Cruz Tarplant Management Area

C-1. SCT Survey Route Map

C-2. Pre-mow Plant and Breeding Bird Surveys, Santa Cruz Bird Club EBird Records

C-3. Transect Photos

C-4. Photo Monitoring

Appendix D Arana Gulch Creek Riparian Woodland and Wetland Management Area and Hagemann Gulch Riparian Woodland Management Area

D-1: Arana Creek Revegetation Areas: Revegetation Monitoring Results, Year 2: CNPS and CDFG Combined Vegetation Rapid Assessment and Releve Field Forms

Arana Gulch Habitat Management Plan
City of Santa Cruz

Year 3 (2016) Annual Report - Appendices

CDFW Permit No. 2081 (a)-13-013-RP
Coastal Development Permit No. 3-11-074 (Arana Gulch)

February 10, 2017

Appendix A AMWG Meeting Minutes, 2017

A-1: AMWG Meeting Minutes for:

March 2017
July 2017

Minutes
Arana Gulch Adaptive Management Working Group Meeting
Arana Gulch
9:00 a.m. – 12:30 p.m. on March 14, 2016

PARTICIPANTS:
Kate Huckelbridge, Ecologist, CA Coastal Commission
Kathy Lyons, Biotic Resources Group
Noah Downing, Planner, City of Santa Cruz Dept of Parks and Recreation
Mike Ferry, Planner, City of Santa Cruz Dept of Planning and Community Development
Grey Hayes, CNPS
Suzanne Schettler (CNPS alternate)
Devii Rao, Livestock and Natural Resources Advisor, University of California Extension

ABSENT:
Susan Bainbridge, Researcher, University and Jepson Herbarium
Lena Chang, USFWS
Melissa Farinha, Biologist, CDFW

AGENDA ITEMS AND DISCUSSION TOPICS:

1. **Cape and English ivy removal**
   Cape ivy removal is most effective when a ten foot buffer area is created around the entire ivy location to limit future spread and removal is focused inward from the buffer zone. A fly is being tested that feeds on the ivy and may effectively kill ivy if the practice is approved. However, the study has been ongoing for 10 years and it is not clear if or when the practice can be used. Given the extensive scope of the cape ivy removal project, it may be better to control outlying patches first which are more manageable. The English ivy can be clipped near the ground to prevent future seeding. Removal of broom and other invasive brush is important for fire management.

2. **Mowing Area B**
   The mowing regiment follows the Watsonville Airport protocol of 3 times per year. The group decided to mow at more regular intervals to keep the grass height down until Santa Cruz tarplant growing season begins in mid-June.

3. **Creating a barrier between the pathway and Area B**
   Public comments were received regarding bicyclists and pedestrians walking off the path onto Area B. At the November 2015 meeting, the group had discussed a possible

solution to place limbs or install split rail fencing to keep people outside of the area. The group inspected the area and plants were identified that grow under similar conditions of the Santa Cruz tarplant. Group members discussed that it would be better to monitor the location for Santa Cruz tarplant instead of placing structures or limbs on top of the soil which may prevent Santa Cruz tarplant from growing. The disturbance may be helping the SC tarplant. If Santa Cruz tarplant grows in the area, a temporary fence and interpretive signage will be installed to educate visitors and protect the plants.

4. Waterbars on Coastal Loop Trail near Area A

A community member raised concerns that some water bars had been dug in to the trail to shed water off the trail onto the adjacent hillside. The group members discussed that it was a common practice along trails and helps prevent rutting of the pathway and loss of sedimentation and more should be installed. A potential volunteer project was identified to remove the bunch grasses growing in the middle of the trail and replant them on the side of the trail. The timing for the volunteer effort would need to be in [Please add].

5. Thistle Abatement

Noah described that the areas with thistles were being weed wacked frequently. The group discussed allowing the grasses to grow taller than the thistles before cutting them because it will prevent many thistles from growing, and the weed wacking can occur after the thistles bolt, thereby reducing the amount of staff time necessary to control the population.

6. **Perimeter Mowing Timing**

The bird nesting season conficts with the perimeter mowing season. Last year, a biologist performed a survey of the area before mowing began. However, the height of the grass may make it difficult to identify all the nests. The Parks Maintenance Worker is scheduled to be trained in identifying bird nests. Additionally, a list of birds found onsite by birders can be found on ebird and can at least give us an indication of which ground nesting birds are currently nesting, when, and what to look for. In addition to a biologist, the City can look into contacting the local birding clubs to see if there are any volunteers that can be enlisted to help search for bird nests. The nests would be identified and a buffer zone could be flagged before mowing begins. An alternative option could be to mow early in the season before nesting begins and to keep grass low to deter nesting in the area. However, the large expanses of grassland would be difficult to staff and fund mowing on a regular basis. The northeast stretch of grassland that is adjacent to the dirt

road at the end of Agnes Street can be mowed at the same time as the perimeter mowing.

7. Molasses or Salt and Mineral Block timing and locations.

Placing molasses and salt and mineral block locations is not as effective during the rainy season when the wet grass has more sugar and the grass has more salt from its coastal location. The rancher typically uses molasses and salt and mineral blocks later in the season. The group discussed placing rubbing posts in the field. They could be dug deeper in the ground so as not to require concrete support. The cows rub on the posts and would help create bare ground in the area. An existing post was observed performing this similar function in grazing Area A.

8. Trail section on slope by cotoneaster removal area.

The path is in poor shape and a new ad-hoc trail has been created to bypass the area. Water seeps out of the hillside onto the trail and creates a muddy surface that is not a preferable choice to walk on. The trail can be improved by creating water bars to shed the water off the trail and by placing layers of crushed rock to create a walking surface that is free from mud and still allows water to flow off the trail. The water bars will be located near the hillside water seepage to capture the water and redirect it off the trail. The trees have recently been pruned but some additional pruning can be undertaken to provide for a more comfortable space to walk.

9. Sedimentation and Erosion Issues in Arana Creek

Barry Hecht and Jason Parke, Balanced Hydrologics, led a tour of lower reach of Arana Creek. They described the work they had done throughout the years and the fascinating history of the creek. Much of the bank destabilization is occurring because the bends of the river do not accommodate the increase in water flow and the widening of the creek which has resulted from land-use patterns upstream. Given that the creek is not currently formed to support the flow pattern, erosion will occur until the curves straighten out over the next four decades. The group identified a few areas that can be corrected more immediately. First, water, most likely from the wetland area immediately above, is flowing down to the creek and is causing a channel to form on the banks edge. A large berm can be placed along the edge of the wetland to slow the flow of the water. Additionally, the ad-hoc trail that connects Area D to the creek is causing erosion as water flows down from the coastal loop trail to the creek. A berm can be placed in this area to disperse the water flow into the surrounding vegetation. Signage can be placed in this location indicating the need to obtain restoration goals of revegetating the area. The Himalaya blackberry should remain on the creek edge as it

helps prevent further expansion of the ad-hoc trail. Graffiti was observed on the opposite side of the creek and on the tree. The City has a graffiti hotline that can be called to remove graffiti.

They described that the drought had weakened root systems for the plants and trees which had held up the banks. Arana Creek is one of the only sandy watersheds in Santa Cruz and it is difficult to derive a conclusive sediment budget because every 5 to 15 year timeframe there is a huge deposit of sand that comes from (xyz). They described that the 2002 Arana Creek Watershed Enhancement Plan is a comprehensive document on Arana Creek and the City will post it on the AMWG's website. They also mentioned a memo on the effects of the tsunami and another study from 1982 that can also be posted on the website.

10. Wetland Near Area D

The trail near the wetland area is muddy and wet and is in a poor location. An additional berm is needed to prevent water from eroding Arana Creek. Potential improvements to this area could be to add a raised platform so people do not expand the trail footprint to try to avoid the mud.

11. Hydrological Concerns

The multi-use path along the hillside had been raised as a potential hydrological concerns as water was observed running along-side the trail and not over the trail as originally intended. The trail was designed with drainage rock 24 inches on both side of the trail and drainage rock underneath the trail. The intention of the design was to allow for water to flow down through the drainage rock on the upslope side of the trail, then under the trail, and out the downslope side. Check dams were installed at intervals underneath the trail to make sure water did not flow directly under the trail and was instead redirected downslope. The Parks and Rec Department removed soil from the top of the drain rock and installed drain rock capture basins. Fabric was installed beneath the rock and on the sides. Larger drain rock was placed at the bottom with smaller rocks on top. The purpose was to filter the sediment so it doesn't clog. They appeared to be working and more will be added next year at the start of the rainy season.

12. Public Comments:

Public comments were discussed during the field trip and no additional public comments were received during the public comment period.

13. Additional Amenities

The City has received feedback from a recent educational tour of the site that there is a need for restroom facilities. The group discussed the possible location of porta-potty near the Agnes Street entrance. Additionally, the Parks and Recreation Department has a memorial bench program where people can purchase memorial benches to place at the park. Noah described that one idea would be to create a semi-circle amphitheater such as exists near the entrance to Neary Lagoon to help with educational tours such as will be pursued with the Natural History Museum and hopefully others in the future. The Agnes Street entrance area has been discussed as non-critical habitat and may be a good site to locate the amphitheater. The City will work with the Coastal Commission to determine if these additional amenities require additional permitting.

14. AMWG Membership

The group had discussed reexamining the format to determine how the process can be most effective to members in the future. Given the amount of time members dedicate, it is important that the annual report communicate the achievements made throughout the year so as to clearly illustrate the progress made. Given that the program is up and running, it may be good to discuss if any changes are needed in the time commitment or format to ensure the meetings are productive and do not become perfunctory. Additionally, the City and CCC will search for an additional land manager and wildlife biologist to become a group member.

NEXT STEPS:

- The City will continue to implement the weed management plan.
- The City will check-in with the Coastal Commission about the permitting process for adding a berm and raised walkway to the wetland area and for the potential use of a porta-potty of additional of benches to create a learning area near Agnes Street.
- The City will add a berm to the ad-hoc path that connects the coastal loop trail to Arana Creek.
- The City will identify cape ivy locations within Hagemann Gulch and begin English ivy removal efforts along the Marsh Vista Trail and Hagemann Gulch.
- The City will continue to keep down grass height in Area B until mid-June.
- The City will work with the bird clubs to help identify nests before the perimeter mowing in Early June.
- The City will install posts for the cattle to rub on after the tarplant growing season ends.
- The City will post hydrological reports to website.
- The City will fix trail section on slope near cotoneaster removal area.
- The City will install catch basins along multi-use trail to improve drainage.
- The City will work with the Coastal Commission on finding new members.

Minutes
Arana Gulch Adaptive Management Working Group Meeting
Arana Gulch
9:00 a.m. – 12:00 p.m. on Tuesday, July 19, 2016

PARTICIPANTS:
Kate Huckelbridge, Ecologist, CA Coastal Commission
Kathy Lyons, Biotic Resources Group
Noah Downing, Planner, City of Santa Cruz Dept of Parks and Recreation
Grey Hayes, CNPS
Suzanne Schettler (CNPS alternate)
Devii Rao, Livestock and Natural Resources Advisor, University of California Extension

ABSENT:
USFWS
CDFW

AGENDA ITEMS AND DISCUSSION TOPICS:

1. **Public Comments**
    a. **Via Email**
        i. **Boulders/Unauthorized path along Arana Creek**
        Staff had access to free granite rocks that will be used for a trail maintenance project at Arana Gulch. The rocks were placed along the revegetation area. A member of the public was concerned that their placement made it appear like the ad-hoc path to Arana Creek was more prominent. The path needs to be closed to conform to permit approvals. The AMWG was supportive of installing signs restricting access with information regarding habitat and wildlife protection.
        ii. **Owl/bat nesting boxes**
        After the Santa Cruz Bird Club helped perform a bird nesting survey in preparation for the mowing, they inquired as to whether or not nesting boxes could be installed. The AMWG is supportive of their idea and the City will check-in with the Santa Cruz Bird Club to see if they have any recommendations for the type of bird boxes and locations.
        iii. **Noise issues related to using gas operated equipment**
        Staff received a comment about a gas blower being used and how it created noise and is inappropriate for Arana Gulch. Staff let the group know that most of the restoration work that is performed at Arana Gulch

requires the use of power equipment. Gas blowers are seldom used in Arana Gulch and for short durations of time.

iv. **Unauthorized trails**

A comment was received about the creation of new trails at Arana Gulch from people not staying on the trail. A trail improvement project is scheduled for the Fall/Winter and will help create a better trail surface so people don't feel the need to walk around the slippery, muddy areas during the rainy season.

b. **In Person at Meeting**

A member of the public asked the group about whether or not soil carbon sequestration practices could be applied to Arana Gulch. She explained that the use of electric fencing is used to concentrate large numbers of cattle in small areas for the purposes of overgrazing sections and fertilizing sections of land. She described that the practices is being used in Marin and studies have found improvements to the fertility, microbial communities, and aggregate formation in the soil. She also inquired as to whether or not introducing compost would help. AMWG members voiced concerns that the soil sequestration practices do not really align with the primary goals of improving the coastal prairie and SC tarplant habitat. The cattle are only present at Arana Gulch for a short period of time and are removed after the grasses have begun to turn brown. The tarplant needs light and it would not be helpful to the tarplant to allow any grass growth to return after each section had been grazed. The study in Marin did not study how soil carbon sequestration grazing impacted native plant species. Fertilizer would inadvertently cause the non-native grasses to grow taller and would worsen the situation. Native grasses grow in low fertility areas.

2. Department Update

a. **Revegetation planting (Cub Scout Planting)**

Cub Scout Den 608 helped plant 60 additional native plants in the revegetation area.

b. **Invasive weed removal**

Much work has been focused on eliminating thistle populations and blackberry from the prairie areas. The cotoneaster and blackberry removal may need herbicide treatments. An AMWG member recommended removing the remaining cotoneaster tree on the harbor side of the trail so that seeds do not continue to disperse onto the hillside from birds, wind, and other factors. Staff confirmed that it could be removed. An AMWG member recommended a method could be applied consisting of laying special fabric to cover the area to block-out sunlight. Straw would be applied over it. If this method was utilized in

the grazing area, it may be necessary to fence-off sections so that the cattle do not dismantle the fabric.

c. **Bird surveys and mowing**
The Bird Club helped survey for birds in Arana Gulch and recommended leaving islands of tall grass strip adjacent to the woodland areas as an area to hide from predators and build nests. Another survey was conducted by Garv Hoefler, Wildlife Biologist. An AMWG member mentioned that if the Santa Cruz Bird Club performs the survey that it may be sufficient so the City can save some money on the consultant in the future.

d. **Grass height, non-native cover, and species richness surveys and photopoints**
The numbers do not demonstrably show the progress happening at Arana Gulch. Canopy height was reduced but there is not yet a real change in species composition, native species richness, and bare ground has only slightly increased.

e. **Recent SC tarplant numbers for this year**
   i. July 12th Survey
   ii. 33 plants
   iii. 7.75 inch avg. height
   iv. 440 total flower heads
   v. 16 open flower heads

f. **Illegal camping issues**
Staff described the areas where camps have been found and the clean-ups that occurred. Questions were asked about whether or not camps have increased or decreased since the trail project had been completed. Staff has not observed major camping issues within Arana Gulch near the trail. Two camps were removed since the last meeting and Arana Gulch does not have the same issues as other open spaces. However, the northeast corner has been a constant camping destination throughout the years.

g. **Cattle grazing season overview**
Staff described that there were a total of 20 cows. The cows were removed from Area A in mid-May and from the site at the end of May. The call to remove the cattle earlier than suggested in the Cattle Grazing program was pursued because the cattle had grazed the grassland so low that it would not have been possible to tell where the SC tarplant were popping up. SC tarplant were observed at 8 inches in height at DeLaveaga in May. Given that there are some concerns that SC tarplant could be impacted by cattle eating them and given that the numbers of SC tarplant are so low, the City took the conservative approach to pull the cattle from Cattle Grazing Area A early. AMWG members felt that the email sent

by City Staff indicating the concerns and inviting AMWG members to review the grassland conditions was a good way to involve the group in the decision-making process.

h. **AMWG membership changes**
    i. Former members:
        1. Lena Chang, USFW
        2. Melissa Farinha, CDFW
        3. Tim Hyland, CA State Parks
    ii. New members include:
        1. Mark Ogonowski, USFW Fish and Wildlife Biologist
        2. Terris Kasteen, CDFW Biologist
        3. Randi Adair, CDFW Senior Environmental Scientist Supervisor
    iii. AMWG members suggested asking Lisa Sheridan, President, Santa Cruz Bird Club, if she would be interested.

3. Setting Target Areas for SC Tarplant and Coastal Prairie Goals

a. Grey Hayes briefly described the Elkhorn Slough Coastal Training Program's December 3rd Workshop. Some of the comments that arose during the workshop were exploring a regional target for SC tarplant populations and the potential for seedbank monitoring, potentially through a partnership with the USFWS.
b. The group worked on a mapping exercise to identify which areas should be managed for SC tarplant populations compared to coastal prairie or other management areas. Staff will work with the biologist to map out the recommendations. Staff will superimpose tarplant areas on RDM map for the following designations: SC tarplant, SC tarplant plus coastal prairie, coastal prairie, and grassland.

4. Ongoing projects (2016)

a. Monitoring
    i. Monitor grass height (August)
    ii. RDM study (September)
    iii. SC Tarplant Survey (August/September)
b. Seed collection (If # > 50 plants)
c. Invasive weed removal (ongoing)
d. Map Invasive species in Hagemann Gulch. Identify cape ivy locations within Hagemann Gulch and begin English ivy removal efforts along the Marsh Vista Trail and Hagemann Gulch.
e. Remove trees from Coastal Prairie (September)
f. Add a berm and raised walkway to the wetland area

g. Install posts for cattle rub on after the tarplant growing season ends.
h. Fix trail section on slope near cotoneaster removal area.
i. Install catch basins along multi-use trail to improve drainage.
j. Work with the Coastal Commission on finding new members.
k. Natural History Museum tours.

5. Explore Future Projects and Priorities

a. Potential additional activities
    i. Provision of a porta-potty or joint-use agreement for use of the harbor's restroom.
    ii. Scraping – Would it be beneficial to scrape an experimental test plot in the grazing area? When?
    iii. Develop IPM for the creek areas.
    iv. Seedbank analysis 2020.
    v. Refined targets (2020).
    vi. Volunteer projects. Staff will continue to seek opportunities to involve volunteers in the restoration process.
    vii. Close ad-hoc path along Arana Creek. The group recommended adding signage describing the restoration and purpose behind closing the ad-hoc paths. Staff will work on the signage and send it AMWG members for review.

Optional Site Visit: Staff walked with group members who partipated in the optional site visit to observe the conditions of the grazing area. There were many indications of success for grazing. Many species were observed that are native and indicators of SC tarplant habitat. There was substantial bare ground. Populations of Coastal tarplant were spreading as well.

Appendix B Restoration Maintenance Activity Log

B-1. Arana Gulch Restoration Maintenance and Activity Log

Arana Gulch

Restoration Maintenance and Activity Log

2016

Annual / Routine Restoration Maintenance

- Mow, weed whip, and maintain grazing area B (December – May).
- Clean up homeless encampments (year round).
- Weed whip/ mow invasive weed patches along fence line in area C, along fence line in area A near Live Oak tree cluster, and other miscellaneous patches commonly found throughout the grazing areas (November – June).
- Plant, water, and maintain restoration site along Bromer St bridge (year round).
- Weed whip / reciprocate Cotoneaster, Himalayan Blackberry, and Poison Oak, on Cotoneaster hillside (November – June).
- Maintain hiking trails (year round).
- Mow with “Billy Goat” non-native grasses, and weeds along perimeter fence lines of grazing areas C, and A where needed (December – June).
- Weed whip / reciprocate Himalayan Blackberry patch under Live Oak tree in grazing area C (year round).
- Weed whip / reciprocate miscellaneous Himalayan Blackberry patches throughout the park (year round).
- Complete and assist Cathy with various Biological studies of Arana Gulch (year round).
- Walk fence line perimeters of all grazing areas and check for vandalism, homeless encampments, trash, fencing problems, cattle trough issues, erosion issues, invasive weeds, and cattle issues (year round).
- Weed whip and maintain all park entrances (year round).

Restoration Projects

- Hand pull, remove, and hall out English Ivy from NW side of the Marsh Vista Trail (July – August).
- Flail mow with tractor non-native grasses in meadows and open spaces, behind the furniture store, below area C nearest to Arana Gulch, and on Cotoneaster hillside nearest to the harbor(June).
- Work with Cub Scouts to help plant Mugwart, California Rose, and Live Oak at restoration site along Bromer St bridge (April).
- Install 4 cattle rubs, 2 in grazing area C, one in grazing area D, and two in grazing area A (January).
- Install new irrigation for cattle trough in grazing area A (December).
- Chainsaw and remove Live Oak trees between hiking trail and fence perimeter of Area A, from Hagamenn Bridge hiking trail around the back side of grazing area A to bench's that lookout over the harbor (November-January).
- Install wattles below Cotoneaster hillside, Broadway St entrance (October).
- Install 2 drainage boxes along multi use trail between grazing area A and grazing area D (March).
- Install willow plugs along Arana Gulch river bank nearest to Bromer St entrance (January).
- Install 3 wattles and two signs to close down use of river walk trail because of erosion (January).
- Remove gravel from tarplant area C using sifter and dingo (December)

Appendix C Coastal Prairie/Santa Cruz Tarplant Management Area

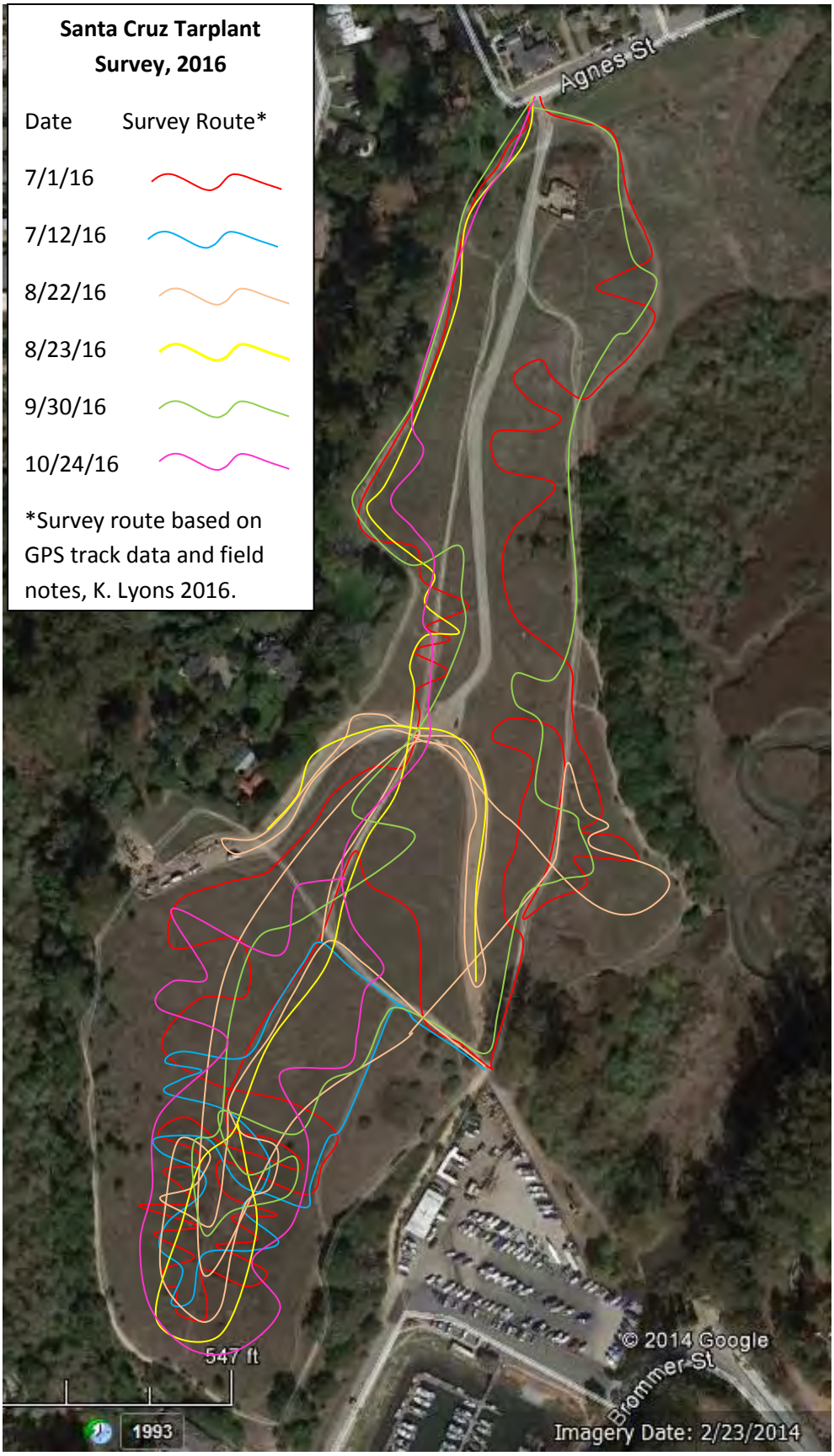
C-1. SCT Survey Route Map

C-2. Pre-mow Plant and Breeding Bird Surveys, Santa Cruz Bird Club EBird Records

C-3. Transect Photos

C-4. Photo Monitoring

SCT Census Survey Routes and Dates, 2016



Pre-Mowing Nesting Bird Survey

Arana Gulch

SANTA CRUZ, CA 95062

19 May 2016

Garv Hoefler – wildlife biologist

Introduction: The purpose of this survey was to investigate the proposed mowing area of trees and grasslands to determine the presence of any nests – active/inactive, assess activities such as nest building or the carrying of nest materials or food by birds to nest sites that might be in the proposed area. Brett Snider of Santa Cruz Parks and Recreation assisted in the survey.

Methodology: Starting ~7:10 The dominant trees in the area are mostly California Live Oak *(Quercus agrifolia)* with an occasional California Bay *(Umbellularia californica)*. Most of these trees form a border along the west side adjacent a narrow roadway outside the Gulch boundaries and in separated stands along the east side. All of these trees were searched thoroughly both with the unaided eyes and with binoculars looking for constructed nests, woodpecker holes or other natural crevices, which might serve as nests, and any species of birds engaging in courtship rituals, carrying nest materials or food. Along parts of the east edge there are dense shrubs – possibly species of Willow – and these were searched as best as possible for nests. The expanses of varying species of grasses, thistles and other plants were walked carefully back and forth and across in a stochastic manner so as to flush any nesting bird, and to very carefully look for the nest of such a bird.

Observations: There was one older constructed nest in an oak tree on the east side; however, this tree was situated way over 50 feet away from the proposed mowing area. There were no woodpecker holes seen, and no appropriate breaks in or on any branches. There was one natural cavity in what appeared to have been formed from the scar of a removed branch. This was searched and no nesting materials were found. No birds flushed from the walks through expansive grasslands. There were no obvious courtship flights, nor any bird seen carrying nest materials or food. In amongst a group of 8-10 or more of Chestnut-backed Chickadees that were chattering and hopping around on the northeast inner edge of trees, Brett heard young Chickadees among the adults. Several poorly constructed nest-like accumulations of leaves and small sticks were seen and determined to be those of Fox Squirrels *(Sciurus niger)*. Several dead Norway Rats *(Rattus norvegicus)* were seen in various places within the grassy areas toward the southeastern areas. Most had not been even nibbled at, but a few were just half carcasses.

Conclusion: It is our opinion that the proposed mowing of the can go ahead without impacting any species of birds.

Weather Conditions:

Time:	Temperature in F	Sky Conditions:	Wind:
7:25 AM	60	5-10% clouds	calm
8:50 AM	62	sunny but hazy	slight breeze
10:30 AM	67	partly cloudy	slight breeze

Species seen or heard around the site:

Birds: Brandt's Cormorant, Cooper's Hawk, Red-tailed Hawk, Western Gull, Heermann's Gull, California Gull, Band-tailed Pigeon, Mourning Dove, Anna's Hummingbird, Acorn Woodpecker, Black Phoebe, Olive-sided Flycatcher, Cliff Swallow, Violet Green Swallow, Western Scrub Jay, American Crow, Chestnut-backed Chickadee, Northern Mockingbird, American Robin, Black-headed Grosbeak, Lesser Goldfinch, Spotted Towhee, California Towhee, and Song Sparrow.

Mammals: Fox Squirrel *(Sciurus niger)*

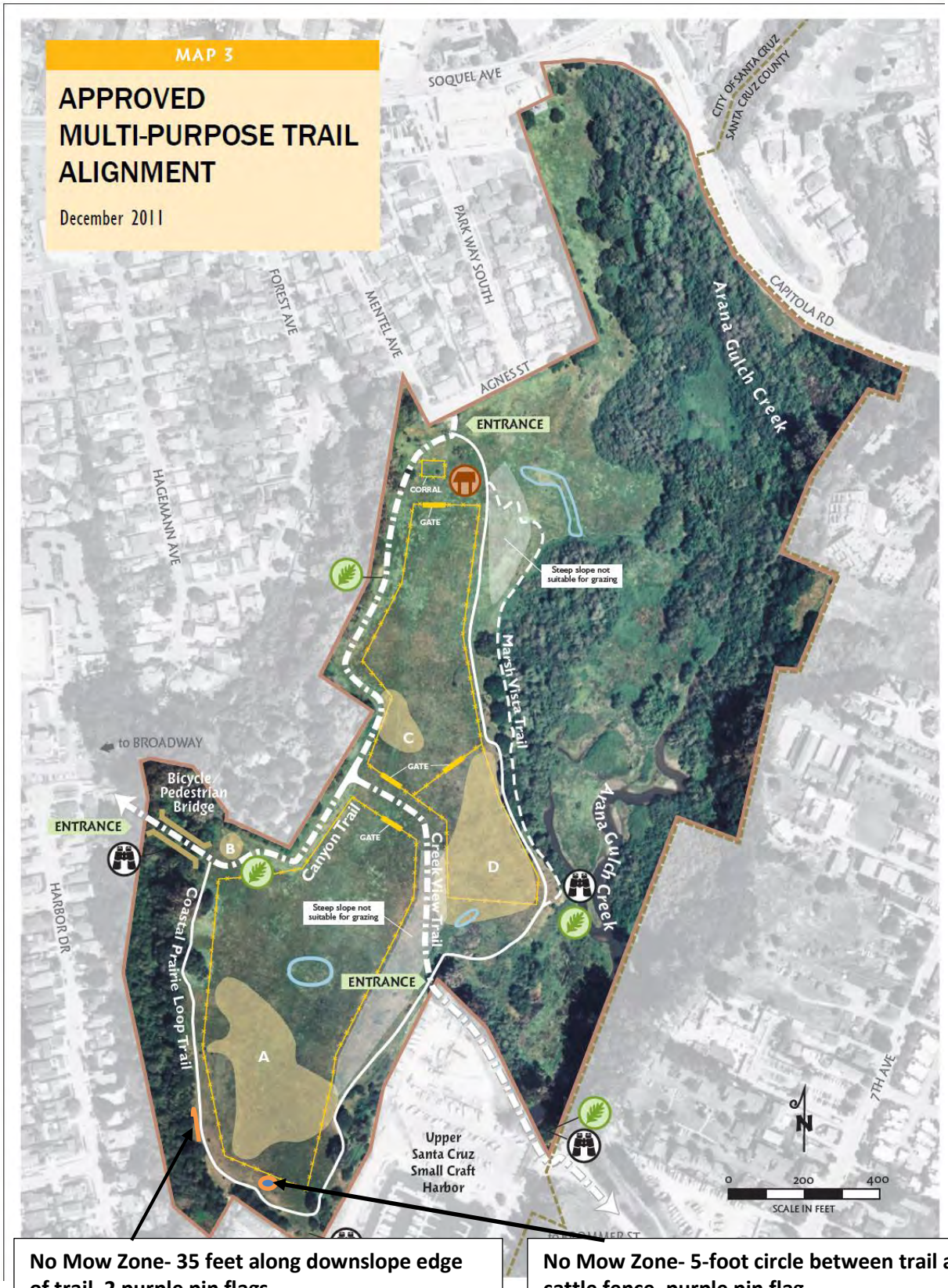
Picture #1: The inactive old nest listed in the observations.

Picture #2: The grassy area of the southeast corner

Picture #3: Brett examining a newly planted tree

Picture #4: Looking to the north just south of the areas with many trees.

Picture #5 Part of a Norway Rat; one of many, but the only one eaten.



No Mow Zone- 35 feet along downslope edge of trail, 2 purple pin flags
Yellow Mariposa Lily and Ithuriel's Spear

No Mow Zone- 5-foot circle between trail and cattle fence, purple pin flag
Lupine

Original Message-----
From: ebird-checklist <ebird-checklist@cornell.edu>
To: Trotrider <Trotrider@aol.com>
Sent: Sat, May 21, 2016 4:53 pm
Subject: eBird Report - Arana Gulch Open Space, May 16, 2016

Arana Gulch Open Space, Santa Cruz, California, US
May 16, 2016 9:00 AM - 11:30 AM
Protocol: Traveling
1.0 mile(s)
Comments: Jane Mio and I met with City Park Staff- Brent to observe park property for potential nesting birds in grass area.
32 species

Mallard (Anas platyrhynchos) 6 fly over
Red-tailed Hawk (Buteo jamaicensis) 2
Band-tailed Pigeon (Patagioenas fasciata) 5
Mourning Dove (Zenaida macroura) 4
Anna's Hummingbird (Calypte anna) 3
Allen's Hummingbird (Selasphorus sasin) 3
Pacific-slope Flycatcher (Empidonax difficilis) 2
Black Phoebe (Sayornis nigricans) 7 pair feeding three juvenile on fence
Western Scrub-Jay (Aphelocoma californica) 6
American Crow (Corvus brachyrhynchos) 7
Common Raven (Corvus corax) 2
Violet-green Swallow (Tachycineta thalassina) 20
Barn Swallow (Hirundo rustica) 1
Cliff Swallow (Petrochelidon pyrrhonota) 1
Chestnut-backed Chickadee (Poecile rufescens) 7
Oak Titmouse (Baeolophus inornatus) 4 begging fledged
Bushtit (Psaltriparus minimus) 6 hanging nest, was torn up and without form. Possible predation.
Bewick's Wren (Thryomanes bewickii) 1
American Robin (Turdus migratorius) 4
Northern Mockingbird (Mimus polyglottos) 3
European Starling (Sturnus vulgaris) 5
Orange-crowned Warbler (Oreothlypis celata) 2
Wilson's Warbler (Cardellina pusilla) 1
Dark-eyed Junco (Junco hyemalis) 1
Song Sparrow (Melospiza melodia) 8
California Towhee (Melozone crissalis) 6
Spotted Towhee (Pipilo maculatus) 2
Black-headed Grosbeak (Pheucticus melanocephalus) 1
Hooded Oriole (Icterus cucullatus) 3 2 males were chatting at each other and acting territorial
House Finch (Haemorhous mexicanus) 12
Lesser Goldfinch (Spinus psaltria) 2
American Goldfinch (Spinus tristis) 1

View this checklist online at http://ebird.org/ebird/view/checklist?subID=S29725040

This report was generated automatically by eBird v3 (http://ebird.org)

-----Original Message-----
From: ebird-checklist <ebird-checklist@cornell.edu>
To: Trotrider <Trotrider@aol.com>
Sent: Sat, May 21, 2016 4:53 pm
Subject: eBird Report - Arana Gulch Open Space, May 20, 2016

Arana Gulch Open Space, Santa Cruz, California, US
May 20, 2016 9:00 AM - 9:45 AM
Protocol: Traveling
0.25 mile(s)
Comments: Observed the meadow area East of the path for possible nesting birds.
28 species (+1 other taxa)

Red-tailed Hawk (Buteo jamaicensis) 1
gull sp. (Larinae sp.) 2
Rock Pigeon (Feral Pigeon) (Columba livia (Feral Pigeon)) 6
Band-tailed Pigeon (Patagioenas fasciata) 3
Mourning Dove (Zenaida macroura) 5
Anna's Hummingbird (Calypte anna) 2
Allen's Hummingbird (Selasphorus sasin) 1
Acorn Woodpecker (Melanerpes formicivorus) 1
Pacific-slope Flycatcher (Empidonax difficilis) 1
Black Phoebe (Sayornis nigricans) 6 Phoebe's on cattle fence wire feeding young, two others on Eastern meadow
Western Scrub-Jay (Aphelocoma californica) 3
American Crow (Corvus brachyrhynchos) 2
Violet-green Swallow (Tachycineta thalassina) 15
Oak Titmouse (Baeolophus inornatus) 2
Bushtit (Psaltriparus minimus) 1
Bewick's Wren (Thryomanes bewickii) 2
Wrentit (Chamaea fasciata) 1
American Robin (Turdus migratorius) 1
Northern Mockingbird (Mimus polyglottos) 2 below oak tree near entrance to park.
European Starling (Sturnus vulgaris) 2
Orange-crowned Warbler (Oreothlypis celata) 1
Wilson's Warbler (Cardellina pusilla) 1
Dark-eyed Junco (Junco hyemalis) 2
Song Sparrow (Melospiza melodia) 3
California Towhee (Melozone crissalis) 4
Spotted Towhee (Pipilo maculatus) 1 Along edge of meadow where meadow will be mowed.
Black-headed Grosbeak (Pheucticus melanocephalus) 2 two males calling and singing from on top of willows at the eastern edge of the meadow.
House Finch (Haemorhous mexicanus) 7
Lesser Goldfinch (Spinus psaltria) 2

View this checklist online at http://ebird.org/ebird/view/checklist?subID=S29823422

This report was generated automatically by eBird v3 (http://ebird.org)

Dear Noah,

Jane Mio and I enjoyed a two and a half hour walk with Brett at Arana Gulch. We looked for possible ground nesting birds in the East Meadow as a precaution for the upcoming scheduled mowing. During this time we noticed juvenile birds being fed by parents, nest building activity in progress and territorial behavior by courting birds.

We did not see any ground nesting birds in the meadows planned for mowing. This can be difficult to spot unless one notices nest building or feeding activity by the parent birds. However, Arana Gulch is currently showing a high level of nesting/breeding behavior throughout the park and especially along the eastern perimeter of the big meadow.

Jane and I both encourage the city to leave as much border as possible ten feet would be nice, between the meadow and the border of oaks, willows and mixed vegetation, as the grass offers continual protection and a source of food for many of the young birds. Any possible islands of meadow grass also offers sanctuary, feeding stops and perching for fly catching and ground birds. We did discuss these recommendations with Brett.

We want to compliment the Park and Rec. Dept on their choice of hiring Brett, who seems engaged, informed and committed to doing a through job on behalf of the City and the environment. We appreciate that you approached the bird club in working with you as added sets of eyes in protecting the birds during the nesting season.

I will send you my ebird notes from two different occasions documenting the birds and activity that were noticed.

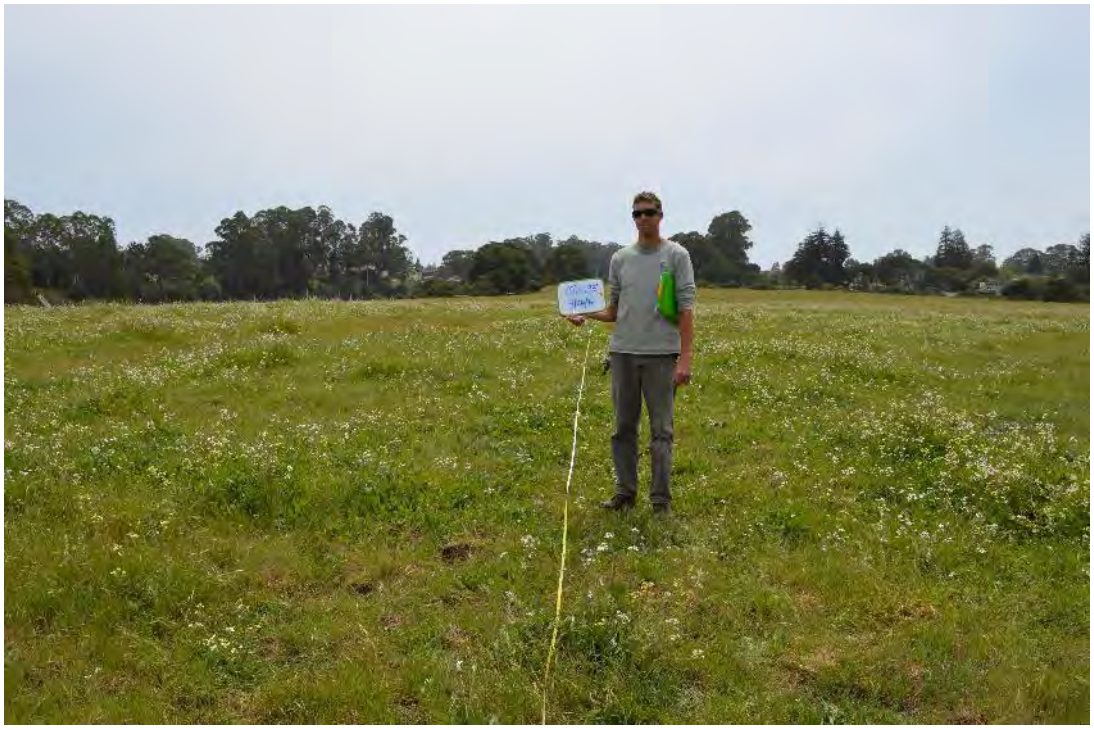
Best Regards,

Lisa Sheridan (2015 Santa Cruz Bird Club Conservation Officer)
Jane Mio (2016 Santa Cruz Bird Club Conservation Officer)

Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT1 2015

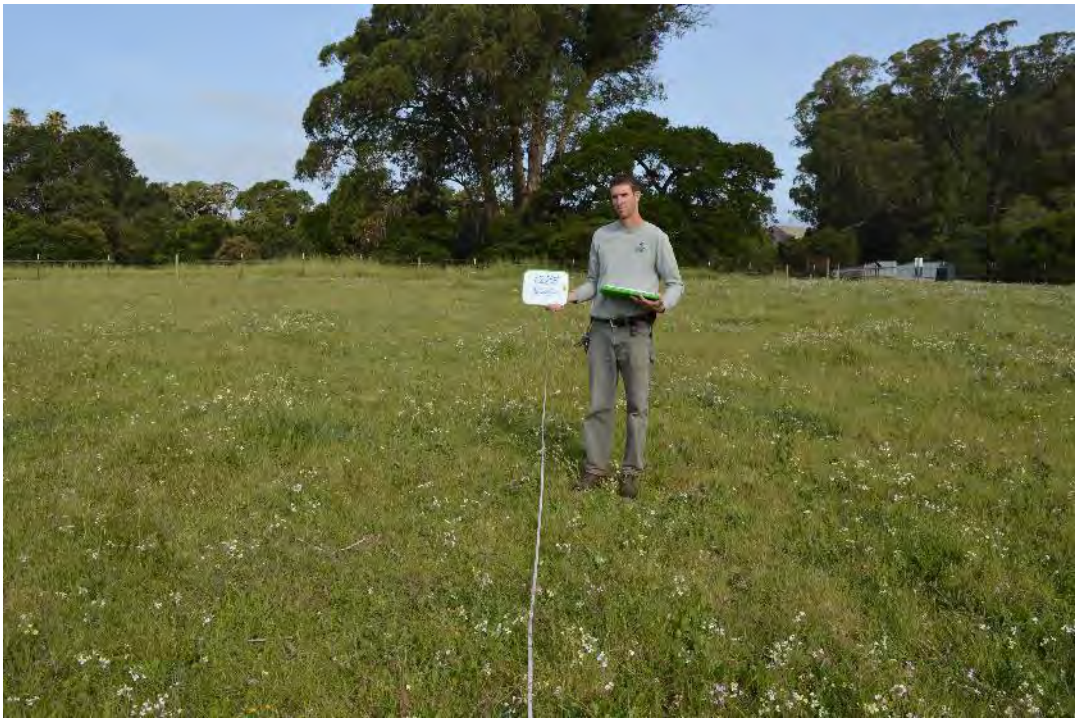
AT1 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT2 2015

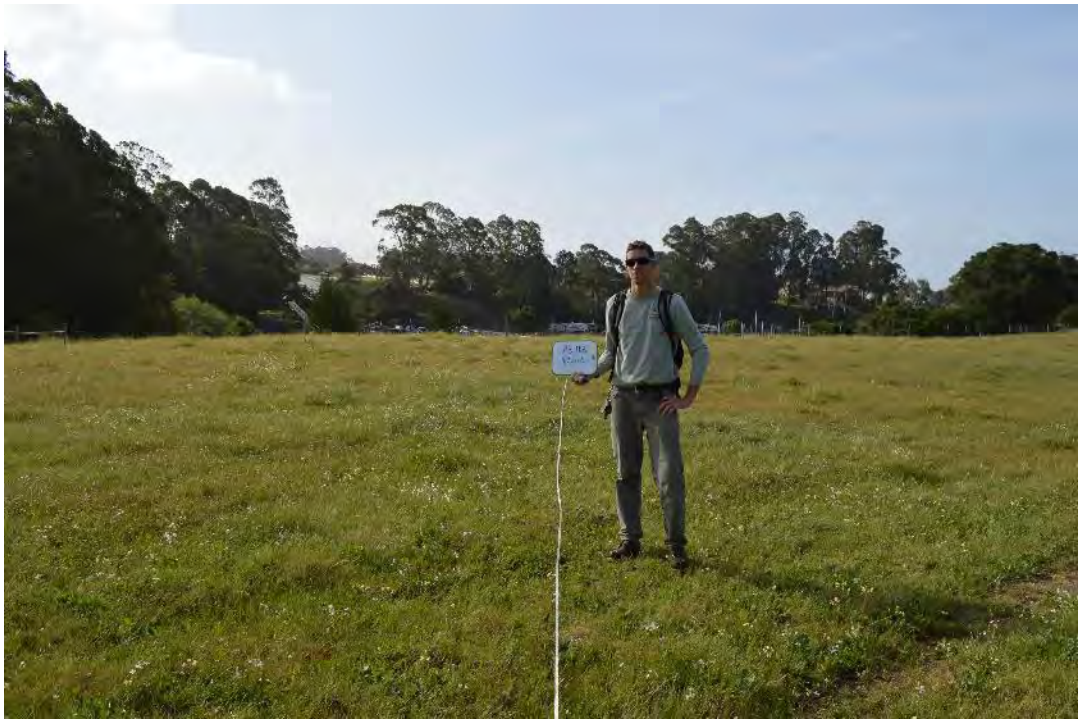
AT2 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT3 2015

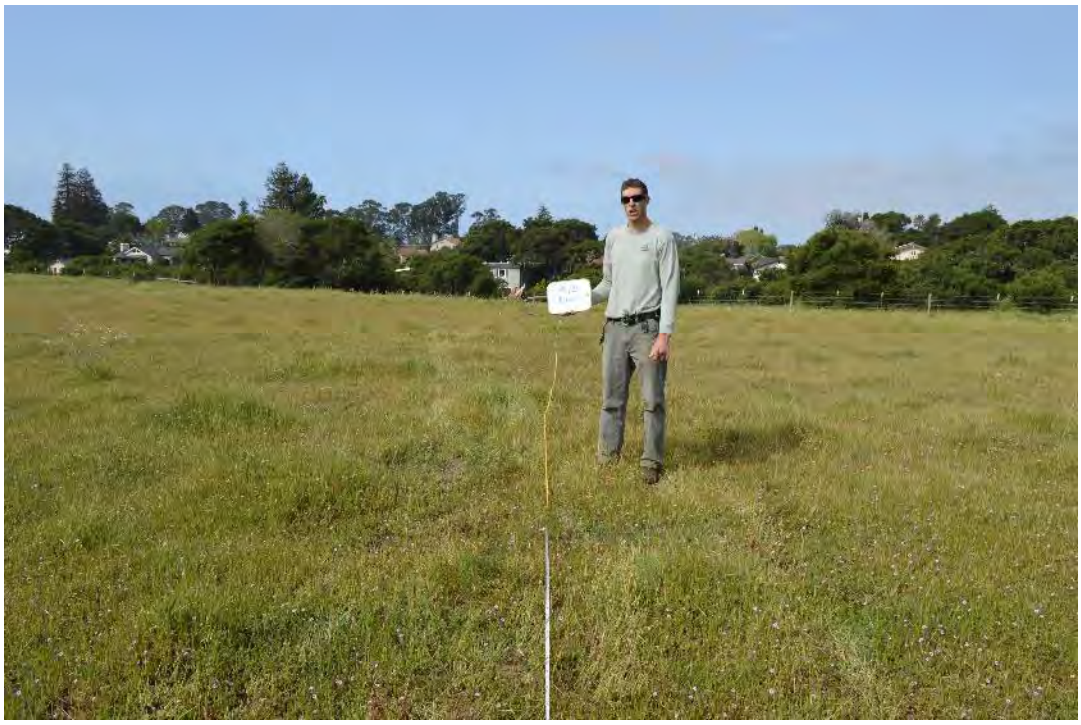
AT3 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT4 2015

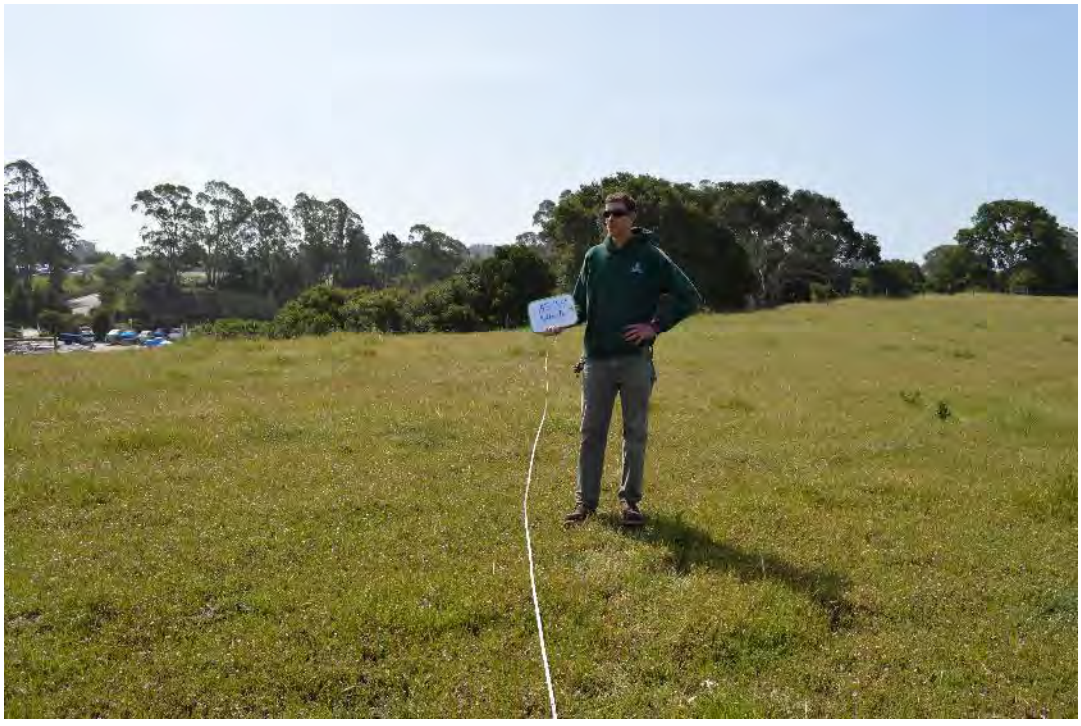
AT4 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT5 2015

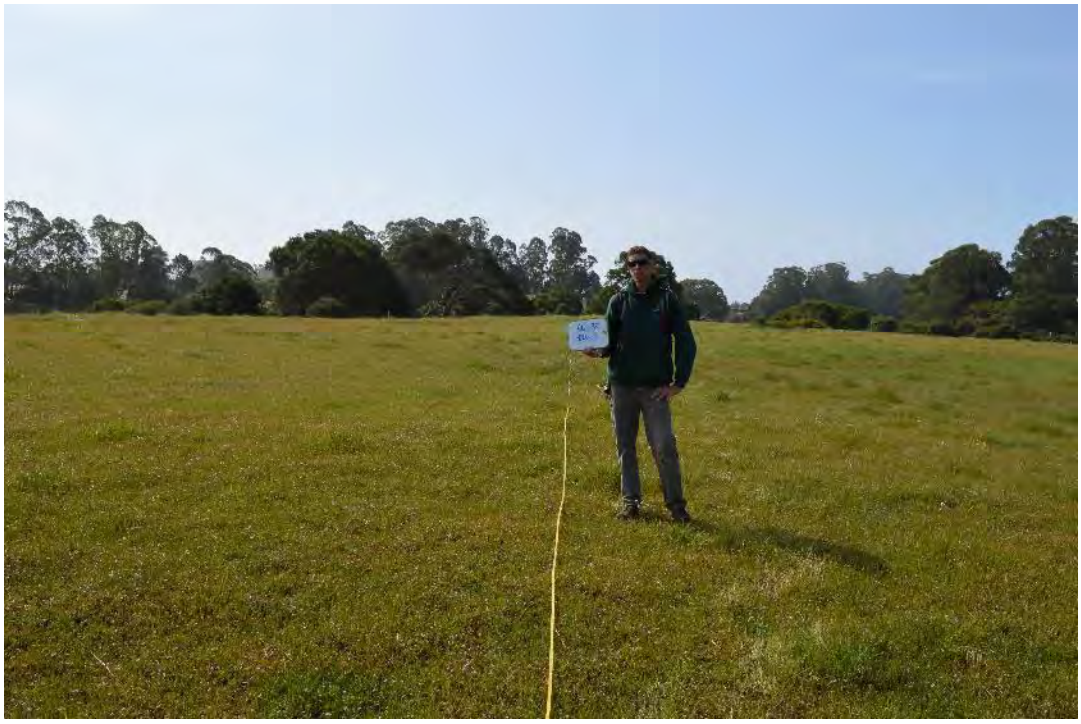
AT5 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT6 2015

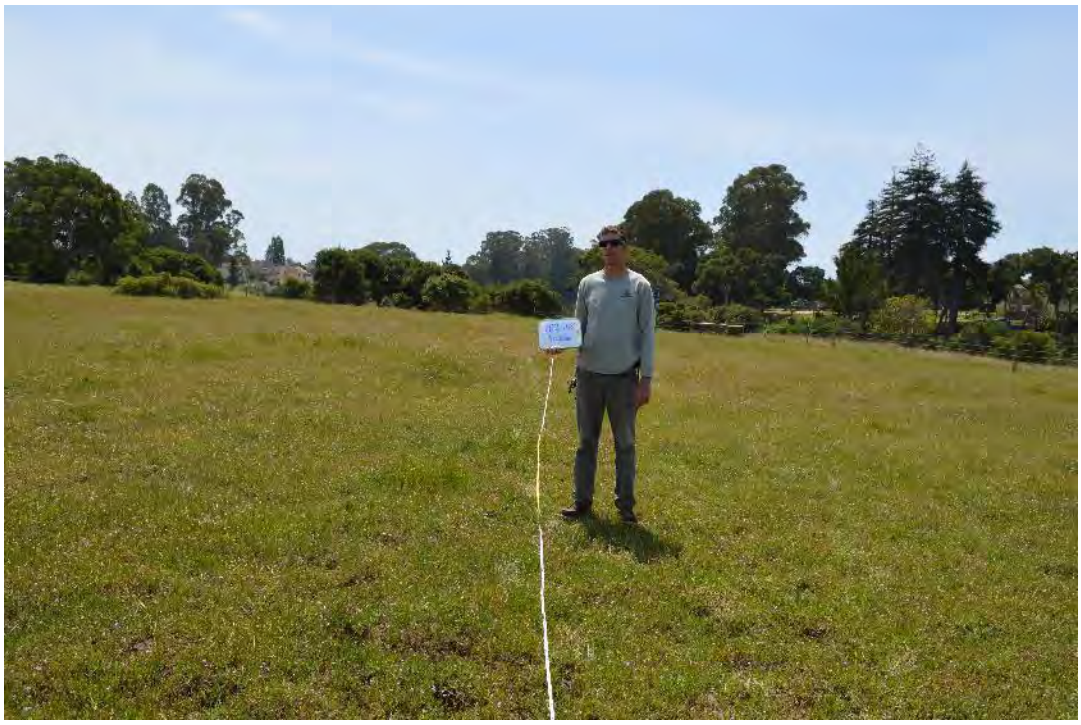
AT6 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT7 2015

AT7 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT8 2015

AT8 2016

Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

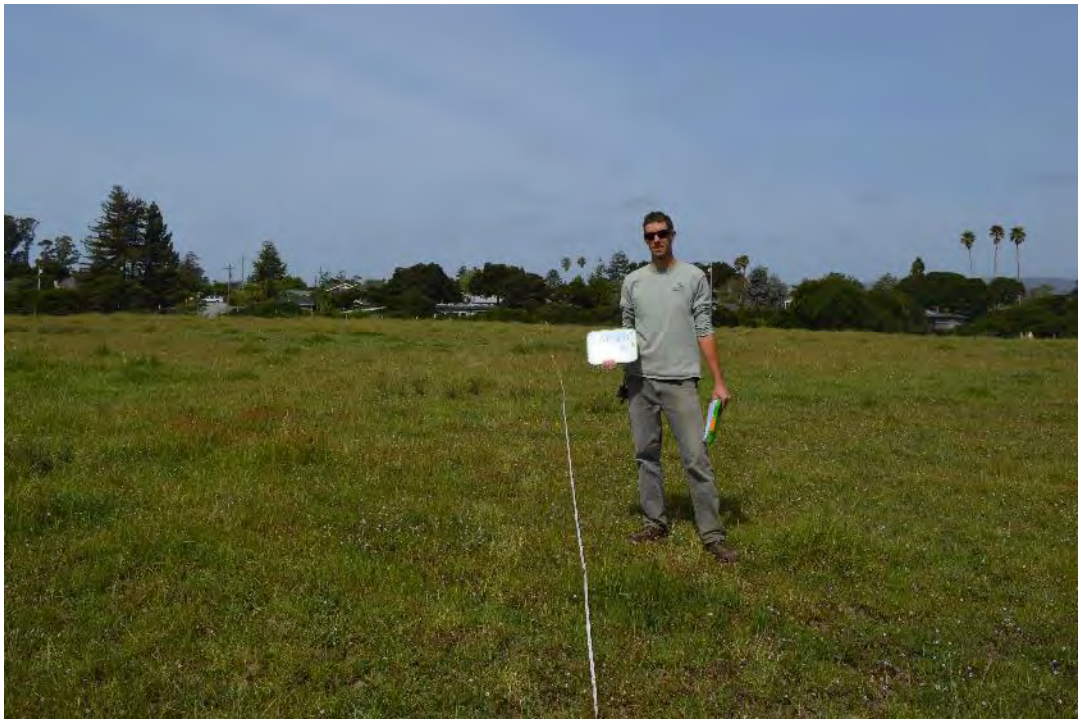
AT9 2015

AT9 2016

Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT10 2015

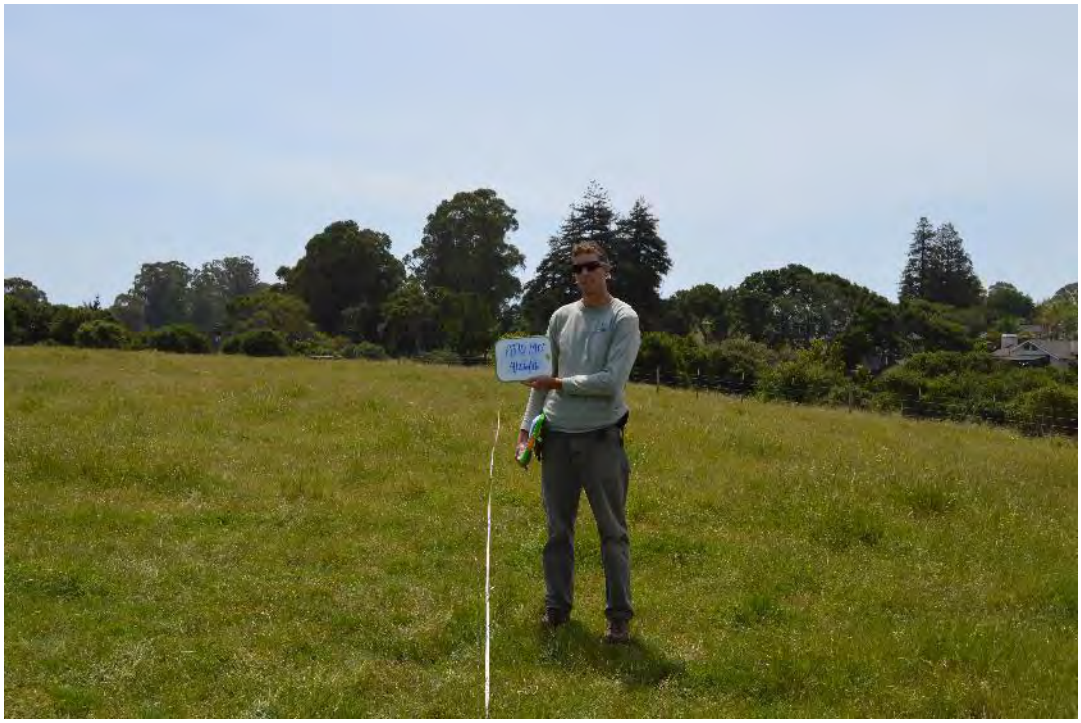
AT10 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

AT11 2015

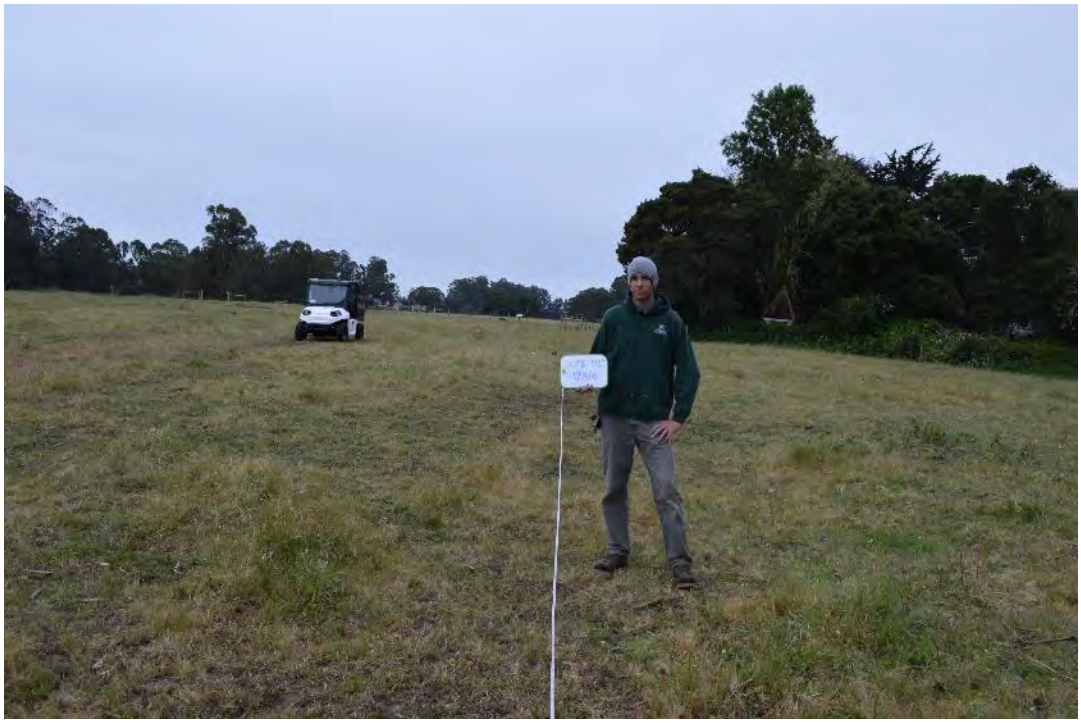
AT11 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

CT2 2015

CT2 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

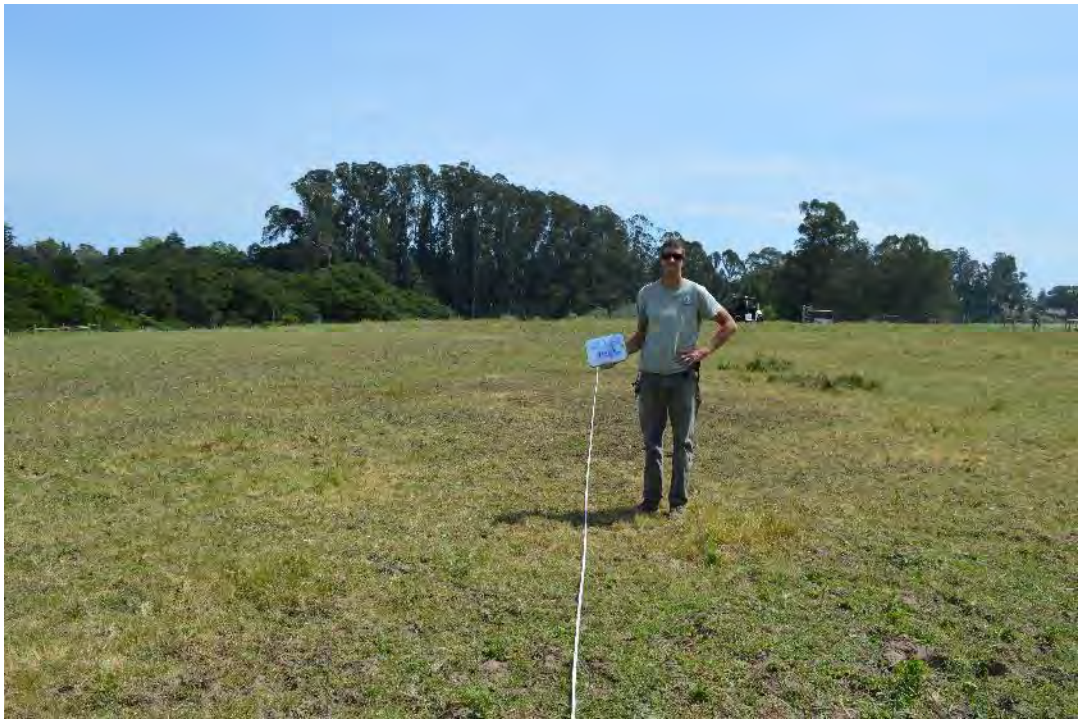
CT3 2015

CT3 2016

Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

CT5 2015

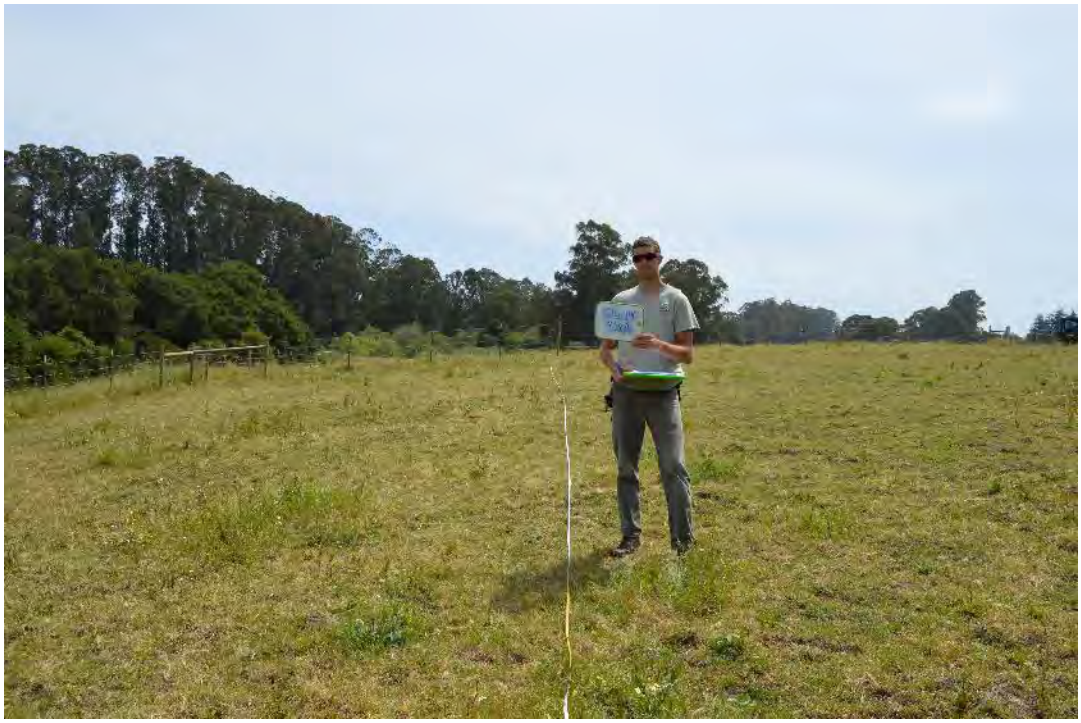
CT52016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

CT6 2015

CT6 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

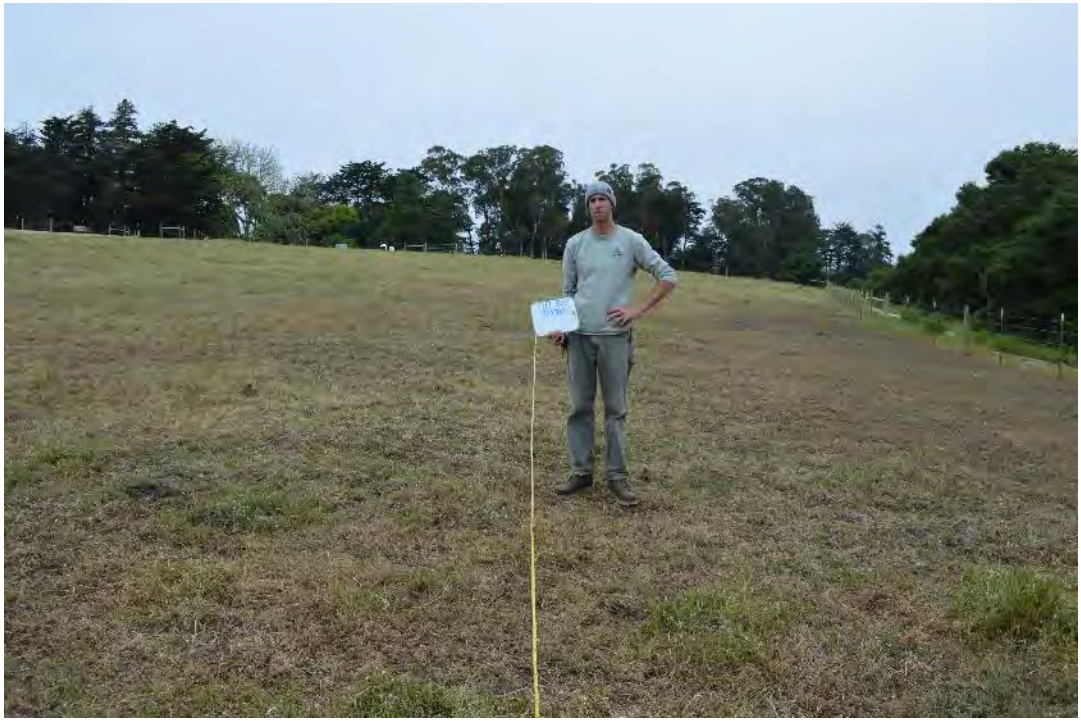
CT7 2015

CT7 2016

Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

DT1 2015

DT1 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

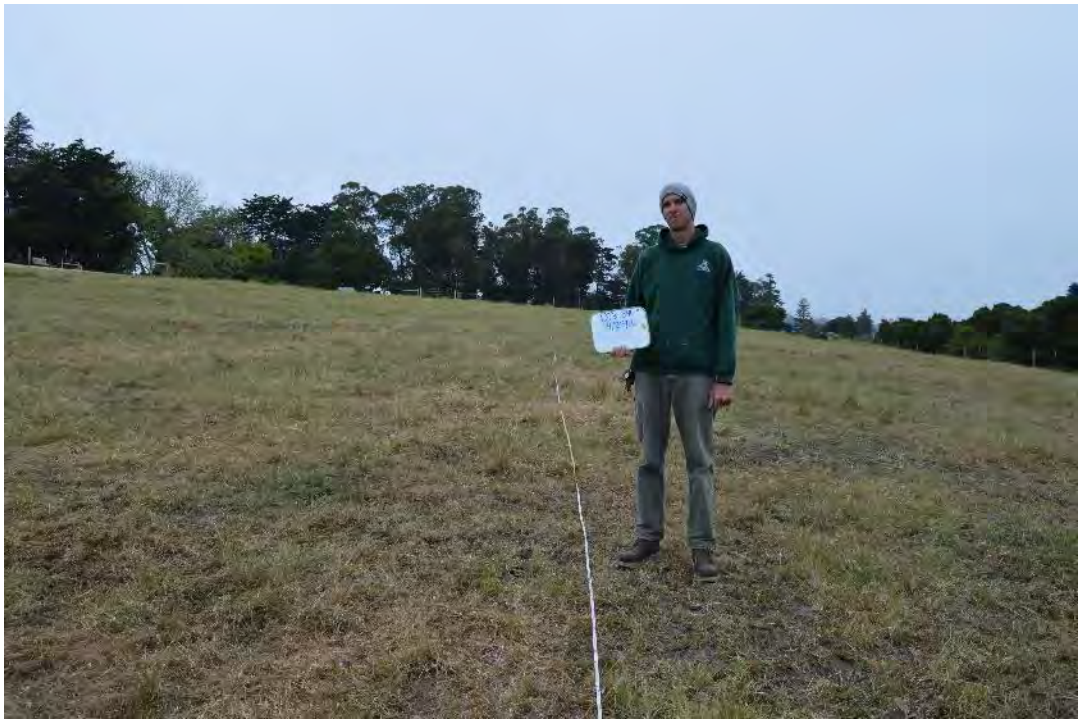
DT2 2015

DT2 2016

Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

DT3 2015

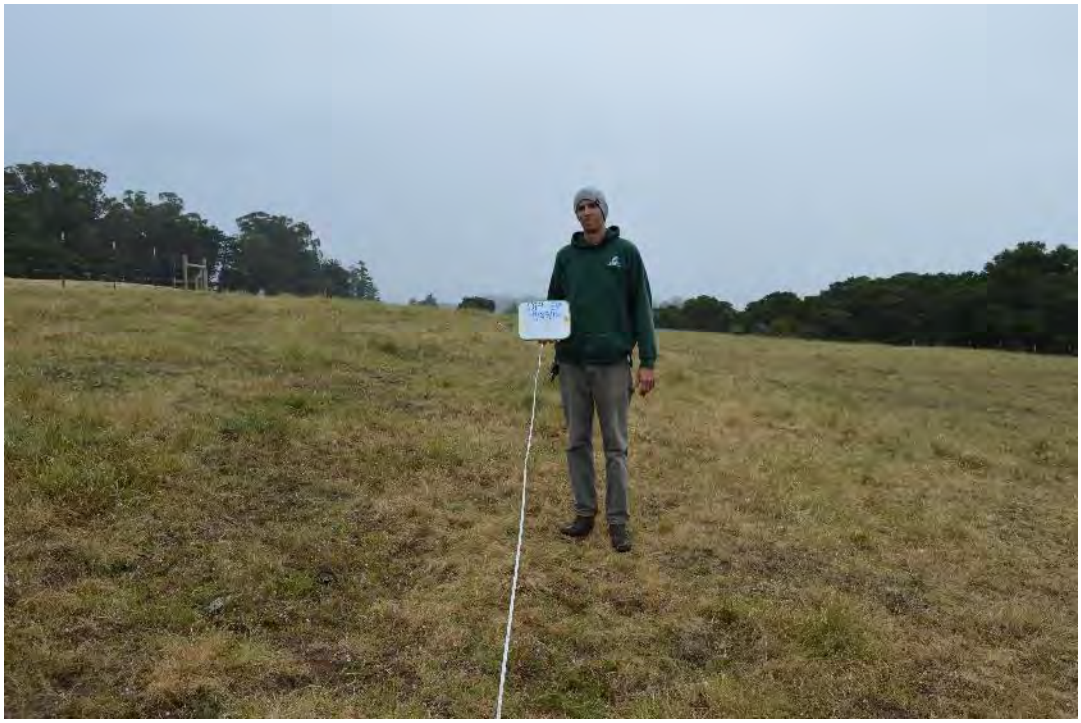
DT3 2016



Appendix A Arana Gulch Vegetation Assessment – Permanent Transect Photos

DT4 2015

DT4 2016



Arana Gulch Photo Point Monitoring

PP1 1 2015 2016

PP1 2

PP1 3

PP1 4 2015 2016

PP2 1

PP2 2

PP2 3 2015 2016

PP2 4

PP3 1

PP3 2 2015 2016

PP3 3

PP3 4

PP4 1 2015 2016

PP4 2

PP4 3

PP4 4 2015 2016

PP5 1

PP5 2

PP5 3 2015 2016

PP5 4

PP6 1

PP6 2 2015 2016

PP6 3

PP6 4

PP7 1 2015 2016

PP7 2

PP7 3

PP7 4 2015 2016

PP8 1

PP8 2

PP8 3 2015 2016

PP8 4

PP9 1

PP9 2 2015 2016

PP9 3

PP9 4

PP10 1 2015 2016

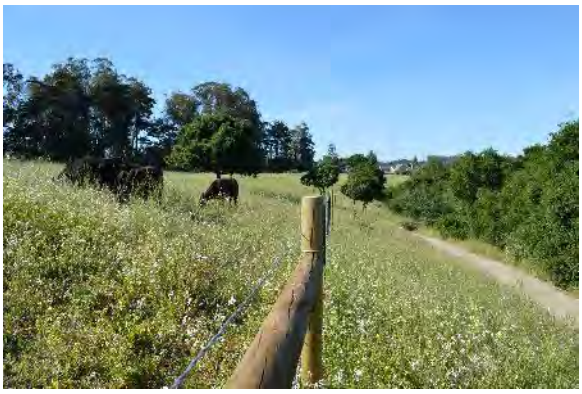
PP10 2

PP10 3

PP10 4 2015 2016

PP11 1

PP11 2



PP11 3

PP12 1 2015 2016

PP12 2

PP12 3

PP12 4 2015 2016

PP13 1

PP13 2

PP13 3 2015 2016

PP13 4

PP14 1

PP14 2 2015 2016

PP14 3

PP14 4

PP15 1 2015 2016

PP15 2

PP15 3

PP15 4 2015 2016

PP16 1

PP16 2

PP16 3 2015 2016

PP16 4

PP17 1

PP17 2 2015 2016

PP17 3

PP17 4

P23 2015 2016

HG 1

HG2

HG3 2015 2016

HG4

Appendix D Arana Gulch Creek Riparian Woodland and Wetland Management Area and Hagemann Gulch Riparian Woodland Management Area

D-1: Arana Creek Revegetation Areas: Revegetation Monitoring Results, Year 2: CNPS and CDFG Combined Vegetation Rapid Assessment and Releve Field Forms

CNPS and CDFG Combined Vegetation Rapid Assessment and Relevé Field Form

Relevé or Rapid Assessment (Circle One) (Revised Sept 10, 2009)

For Office Use:	Final database #:	Final vegetation type name:	Alliance / Association: Year 2 Monitoring

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Polygon/Stand #:	Air photo:	Date:	Name(s) of surveyors (circle recorder):
Arana A	—	12/2/16	K. Lyons

GPS wypt #: ____ GPS name: ____ Datum: ____ or NAD83. Bearing, left axis at SW pt____ (degrees) of Long / Short side

UTME ___ ___ ___ ___ ___ ___ UTMN ___ ___ ___ ___ ___ ___ ___ Zone: 10 / 11 (circle one) Error: ±____ ft / m / pdop

GPS within stand? Yes / No If No, cite from waypoint to stand, distance ____(meters) & bearing ____(degrees)

Elevation: ft / m Camera Name/Photograph #'s:

Stand Size (acres): (<1,) 1-5, >5 | Plot Size (m^2): 10 / 100 / 400 / 1000 | Plot Shape ___ x___ ft / m or Circle Radius ___ ft / m

Exposure, Actual °: W NE NW SE SW Flat Variable /All | Steepness, Actual °: ____ 0° 1-5° (5-25°) > 25°

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

Geology code: _____ Soil Texture code: _____ | Upland or (Wetland/Riparian) (circle one)

% Surface cover

H20:___ BA Stems:___ Litter: ___ Bedrock:___ (Incl. outcrops) Boulder:___ (>60cm diam) Stone:___ (25-60cm) Cobble: ____ (7.5-25cm) Gravel:___ (2mm-7.5cm) Fines:____ (Incl sand, mud) =100%

% Current year bioturbation _____ Past bioturbation present? Y / N | % Hoof punch _____

Site history, stand age, comments:

Slope adjacent to trail and toe of slope along Arana Creek, seeded slope and willow plantings at toe (planted December 2014)

Type/ Level of disturbance codes: ___/___ ___/___ ___/___ ___/___ ___/___ "Other"

II. HABITAT AND VEGETATION DESCRIPTION

Tree DBH: (T1 (<)" dbh), T2 (1-6" dbh), T3 (6-11" dbh), T4 (11-24" dbh), T5 (>24" dbh), T6 multi-layered (T3 or T4 layer under T5, >60% cover)

Shrub: S1 seedling (<3 yr. old), S2 young (<1% dead), (S3 mature (1-25% dead), S4 decadent (>25% dead)

Herbaceous: H1 (<12" plant ht.), (H2 (>12" ht.) % Non-Vasc cover: 0 Total % Vasc Veg cover: 95

% Cover -Overstory Tree Conifer/Hardwood: 15 Low-Medium Tree: 5 Shrub: 55 Herbaceous: 40

Height Class - Overstory Conifer/Hardwood: 05 Low-Medium Tree: 04 Shrub: 02 Herbaceous: 01

Height classes: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

Species, Stratum, and % cover. Stratum categories: T= Overstory tree, U= Understory Tree, S = Shrub, H= Herb, N= Non-vascular.
% cover intervals for reference: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, 75%.

Strata	Species	% cover	C	Strata	Species	% cover	C
T	Salix lasiolepis	4					
VT	Salix lasiolepis	1					
S	Rubus ameniacus	40					
H	Hordeum sp.	20					
H	Frankenia salina	10					
H	Salicornia sp.	2					

Unusual species: _____

III. INTERPRETATION OF STAND

Field-assessed vegetation alliance name: Willow-blackberry scrub

Field-assessed association name (optional): _____

Adjacent alliances: _____

Confidence in alliance identification: L M H Explain: _____

Phenology (E,P,L): Herb ___ Shrub ___ Tree ___ Other identification or mapping information:

CNPS and CDFG Combined Vegetation Rapid Assessment and Relevé Field Form

Relevé or Rapid Assessment (Circle One) (Revised Sept 10, 2009)

For Office Use:	Final database #:	Final vegetation type name:	Alliance / Association Year 2 Monitoring

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Polygon/Stand #:	Air photo:	Date:	Name(s) of surveyors (circle recorder):
Arana B		12/2/16	C. Lyons

GPS wypt #: ____ GPS name: ____ Datum: ____ or NAD83. Bearing, left axis at SW pt____ (degrees) of Long / Short side

UTME ____ UTMN ____ Zone: 10 / 11 (circle one) Error: ±____ ft / m / pdop

GPS within stand? Yes / No If No, cite from waypoint to stand, distance ____(meters) & bearing ____(degrees)

Elevation: ft / m Camera Name/Photograph #'s:

Stand Size (acres): (<1) 1-5, >5 | Plot Size (m^2): 10 / 100 / 400 / 1000 | Plot Shape ___ x___ ft / m or Circle Radius____ft / m

Exposure, Actual °: ____ NE (NW) SE SW Flat Variable /All | Steepness, Actual °: ____ (0°) 1-5° 5-25° > 25°

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

Geology code: ____ Soil Texture code: ____ (Upland) or Wetland/Riparian (circle one)

% Surface cover

H20:____ BA Stems:____ Litter: ____ Bedrock:____ Boulder:____ Stone:____ Cobble: ____ Gravel:____ Fines:____ =100%
(Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)

% Current year bioturbation ____ Past bioturbation present? Y / N | % Hoof punch ____

Site history, stand age, comments:

Revegetation area northwest of Arana Creek causeway abutment

Type/ Level of disturbance codes: ___/___ ___/___ ___/___ ___/___ ___/___ "Other"

II. HABITAT AND VEGETATION DESCRIPTION

Tree DBH : T1 (<1" dbh), (T2) (1-6" dbh), T3 (6-11" dbh), T4 (11-24" dbh), T5 (>24" dbh), T6 multi-layered (T3 or T4 layer under T5, >60% cover)

Shrub: S1 seedling (<3 yr. old), (S2) young (<1% dead), S3 mature (1-25% dead), S4 decadent (>25% dead)

Herbaceous: (H1) (<12" plant ht.), H2 (>12" ht.) % Non-Vasc cover: 0 Total % Vasc Veg cover: 90

% Cover -Overstory Tree Conifer/Hardwood: ___/___ Low-Medium Tree: 5 Shrub: 30 Herbaceous: 65

Height Class - Overstory Conifer/Hardwood: ___/___ Low-Medium Tree: 01 Shrub: 02 Herbaceous: 01

Height classes: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

Species, Stratum, and % cover. Stratum categories: T= Overstory tree, U= Understory Tree, S = Shrub, H= Herb, N= Non-vascular.
% cover intervals for reference: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, 75%.

Strata	Species	% cover	C	Strata	Species	% cover	C
T	Quercus agrifolia	5		H	Trifolium angustifolium	1	
S	Artemesia douglasiana	15					
S	Rosa californica	15					
H	Leymus triticoides	20					
H	Festuca perennis	20					
H	Rumex crispus	10					
H	Raphanus sativa	10					
H	Vicia sativa	2					
H	Plantago lanceolata	2					

Unusual species: ____

III. INTERPRETATION OF STAND

Field-assessed vegetation alliance name: ____

Field-assessed association name (optional): ____

Adjacent alliances: ____

Confidence in alliance identification: L M H Explain: ____

Phenology (E,P,L): Herb ____ Shrub ____ Tree ____ Other identification or mapping information: