Point Blue Report

Annual Report

Pacheco Creek Reserve Riparian Restoration Project

Report to the Santa Clara Valley Habitat Agency

December 2022

Conservation science for a healthy planet

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Point Blue Conservation Science

STRAW Project

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Point Blue Conservation Science – Point Blue's 160 scientists work to reduce the impacts of climate change, habitat loss, and other environmental threats while developing nature-based solutions to benefit both wildlife and people. We partner with land and water managers, fishermen, ranchers, farmers, cities, counties, and others to improve the health of our planet. Visit Point Blue on the web www.pointblue.org.

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PROJECT SUMMARY

The Pacheco Creek Preserve is a 55-acre property located in the southeastern portion of the Santa Clara County on the southeast side of Highway 152 (SR 152), approximately 13.6 miles east of Gilroy. There is a federally owned property to the east-southeast of the site which provides a buffer between the site and private land.

The acquisition of the Pacheco Creek property by the Santa Clara Valley Habitat Agency (Agency) provides key contributions to the Santa Clara Valley Habitat Plan (Summary, Pacheco Creek Mitigation Area, January 2016) in terms of management considerations. The Pacheco Creek property is located in conservation analysis zone Pacheco-6 (moderate conservation effort) and could contribute to conservation analysis zone requirements identified for Pacheco 1-6 and Plan-wide requirements. At the species-level, the site protects potential habitat for 9 of the 18 covered species. At the natural-community level, the site protects a healthy riparian woodland natural community (willow riparian forest and scrub and mixed riparian forest and woodland and Central California sycamore alluvial riparian) and provides opportunities for enhancement and restoration of these same land cover types. At the landscape level, the site protects land on either side of SR 152 at one of two key crossing points targeted under the Habitat Plan to protect and provide opportunities to enhance wildlife movement across the road. It protects 0.65 miles of Pacheco Creek and contributes to the protection of 2 linkages (#15 Henry W. Coe State Park southeast to San Benito County line and #17 Main stem of Pacheco Creek).

In October 2017, the Agency requested the assistance of Point Blue Conservation Science's (Point Blue) Students and Teachers Restoring A Watershed Program (STRAW) for contract in revegetation and habitat enhancement, local classroom involvement in restoration implementation, as well as maintenance and monitoring of plantings. STRAW sub-contracted Prunuske Chatham, Inc. (PCI) to assist with the revegetation planning and implementation.

The goal of the project is to enhance wildlife habitat with the establishment of a diverse palette of native tree and shrub species utilizing a climate-smart restoration approach to prepare the system for the consequences of climate change. Key considerations in the design plan include: 1) enhancement of Sycamore Alluvial Woodland Habitat (SAW); 2) inclusion of native heat/drought-tolerant woody species; 3) incorporating plant species that benefit special-status wildlife species such as the Least Bell's Vireo; California Red-legged Frog, California Tiger Salamander, and the San Joaquin Kit Fox; and 4) involving local schools and community members in hands-on restoration and stewardship.

Figure 1 illustrates the Pacheco Reserve Enhancement/Restoration planting area which is a total of 2 acres. The planting zone and design plan was developed by PCI and adapted by STRAW and was chosen given the mix of Cortina very gravelly loam and Garretson gravelly loam soil types which support both upland oak woodland and riparian forest natural communities.

Figure 1. Pacheco Reserve Enhancement/Restoration planting area. Additional replanting occurred in March to June 2020 within the boundaries of this planting area.

PLANTING IMPLEMENTATION

K-12 students, community volunteers, and STRAW staff were involved in plant installation for the Pacheco Reserve Enhancement/Restoration planting area. Table 1 describes the planting dates as well as schools and community volunteers involved.

Volunteers installed acorns and container plants with browse protection from deer and hare by using deer cages above ground. Seed baskets were used for oak plantings as direct acorn seed was utilized in planting. Seed baskets extended below-ground by 10 inches to protect roots from ground squirrel and gopher activity. Coir weed mats were also installed by volunteers to deter invasive plant growth directly around plants. Tree wrap was later used on trees and woodier shrubs to deter rodent girdling. STRAW staff installed dripline irrigation for each plant after installation.

Table 1. Volunteer participation in Pacheco Creek Reserve Riparian Restoration Project in 2017-2020.

Date Installed	Community Volunteers	# of Volunteers
12/14/17	Rucker Elementary	76
1/10/18	R.O. Hardin Elementary	80
1/12/18	R.O. Hardin Elementary, Pinnacles NP Intern Volunteer	85

2/15/18	Bradley Elementary	62
2/16/18	Bradley Elementary, Pinnacles NP Intern Volunteers	56
3/11/20	R.O. Hardin Elementary	94
	Total Volunteers	**453**

Figure 2. Replanting efforts in March 2020.

PCI developed an initial plant list (Table 2) for STRAW restoration activities, and from that list Point Blue conducted a climate-smart restoration assessment. In general, climate models predict more extreme weather events along with warmer temperatures. Climate projections (Table 3) were collected from Cal-Adapt (cal-adapt.org) to give a sense for future climate conditions at Pacheco Reserve. Other climate models, such as Climate-Smart Watershed Analyst (climate.calcommons.org/tbc3/sf-bay-watershed-analyst), can provide even more insight for projecting seasonal water balances and seasonal precipitation patterns. The planting palette included drought tolerant species (e.g. live oak, buckeye,

sagebrush) and species diversity to provide insurance against unknowns. Diverse food sources as well as structure and flowering/fruiting timing help support wildlife facing climate stresses. To meet these needs, 18 species of trees, shrubs, and forbs were selected for the planting palette. Figures 3 and 4 below describe the planting palette's climate-smart performance. As we began to source plants, we made adaptations to the original planting list and design plan based on limited plant stock availability onsite and at nurseries. These adaptations are described below. In some cases, we bumped up numbers planted to fill in for species we were unable to locate. Further, Point Blue began replanting in winter/spring 2020 to account for previous year's mortality.

For another climate-smart analysis perspective, we ran the plant species list in the Climate Smart Habitat Riparian Model Planner (cSHRMP), which is a (beta-phase) tool created for restoration designers in the Bay Area of California. This tool evaluates species planting lists for potential vulnerabilities by projecting habitat suitability models through two climate scenarios, CNRM (representing a Warm + Wet future scenario) and MIROC (representing a Hot + Dry future scenario). The intended use of cSHRMP is to identify species within a planting list which have low suitability based on the specific project location, which factors in precipitation, temperature, and climatic water deficit at the Watershed Planning Level. Therefore, restoration designers should first create a planting list, and then use cSHRMP for refinement. Figure 5 details the results based on our plant species list for this project. In evaluating our plant species list, all species show high suitability based on the historic model which makes sense because these are the species we already see occurring and thriving on site. Alternatively, species such as *Aesculus californica*, *Frangula californica*, *Mimulus aurantiacus*, and *Quercus agrifolia* show low suitability under the MIROC model which indicates that these species may do poorly in a hotter and drier future. Species like *Juglans hindsii* shows low suitability under the CNRM model, or a warm and wet climate scenario.

Table 2. Planting palette for the Pacheco Creek Reserve Riparian Restoration. The actual number planted reflects adjusted planting number totals due to available plant stock.

Scientific Name	Common Name	Original number to plant per design	Actual number planted	Replanting numbers 2020	Plant Material
Aesculus californica	CA Buckeye	0	0	12	Container pot and direct seed
Artemisia californica	Coastal Sagebrush	20	21	0	Container pot
Baccharis pilularis	Coyote Brush	40	38	0	Container pot
Frangula californica	CA Coffeeberry	40	19	22	Container pot
Heteromeles arbutifolia	Toyon	40	30	18	Container pot
Juglans hindsii	CA Black Walnut	15	10	0	Container pot
Mimulus aurantiacus	Sticky Monkeyflower	20	7	0	Container pot

Prunus ilicifolia	Holly Leaf Cherry	10	0	0	Container pot
Quercus agrifolia	Coast Live Oak	15	13	0	Direct seed
Quercus douglasii	Blue Oak	5	0	0	Direct seed
Quercus lobata	Valley Oak	20	19	21	Direct seed and container pot
Platanus racemosa	CA Sycamore	20	0	0	Container cuttings
Populus fremontii	Fremont Cottonwood	15	11	0	Container pot
Rosa californica	CA Rose	40	26	0	Container pot
Sambucus nigra ssp. caerulea	Blue Elderberry	40	44	24	Container pot
	Totals	**340**	**238**	**97**	

Table 3. Modeled climate projections for annual averages from Cal-Adapt, grid cell 37.03125, -121.34375. Historic values observed from 1950-1990, modeled projected values are for 2070-2099. Modeled projections feature two scenarios: RCP 4.5 – Emissions peak around 2040, then decline. RCP 8.5 – Emissions continue to rise strongly through 2050 and plateau around 2100.

Climate Variable	Historic Annual Mean	Modeled Projection RCP 4.5	Modeled Projection RCP 8.5
Maximum temperature	70.9 degrees F	76.0 degrees F	78.7 degrees F
Minimum temperature	44.1 degrees F	49.4 degrees F	52.5 degrees F
Precipitation	20.2 inches	22.1 inches	25.1 inches
Extreme heat days*	4 days	19 days	31 days

**Extreme heat days are defined as a day in a year when the daily maximum temperature exceeds the 98th historical percentile of daily maximum temperatures based on observed historical data from 1961-1990 between April and October. The threshold temperature for this grid cell is 96.7 degrees F.*

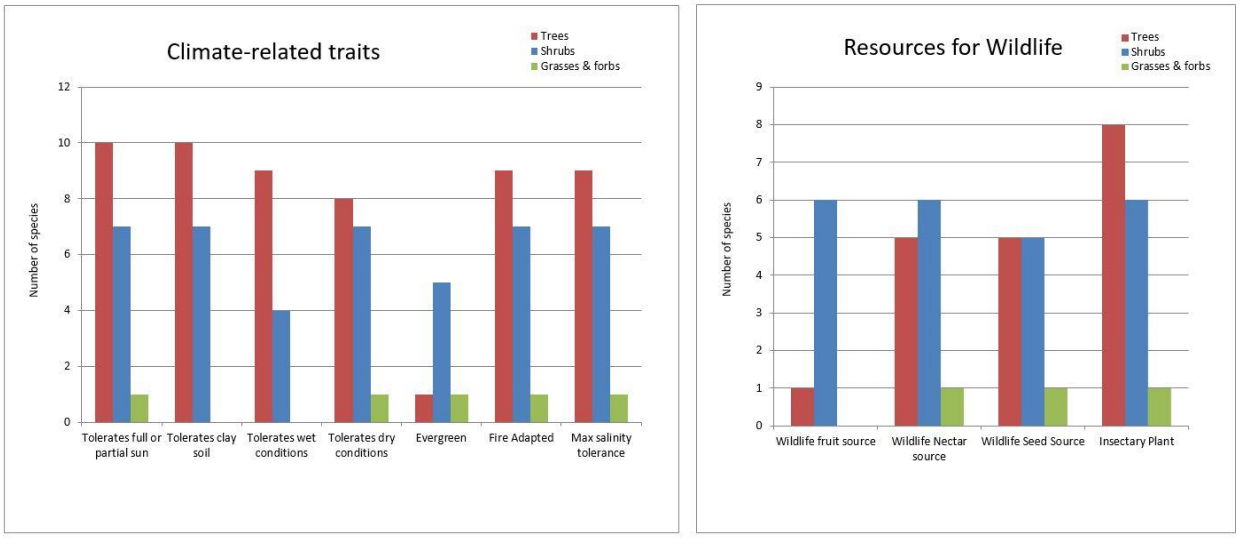

Figure 3. Evaluating the plant list with Point Blue's Climate-Smart Restoration Toolkit, each chart shows the number of species that meet specific climate-related traits and number of species provide wildlife resources. Some species exhibit several traits.

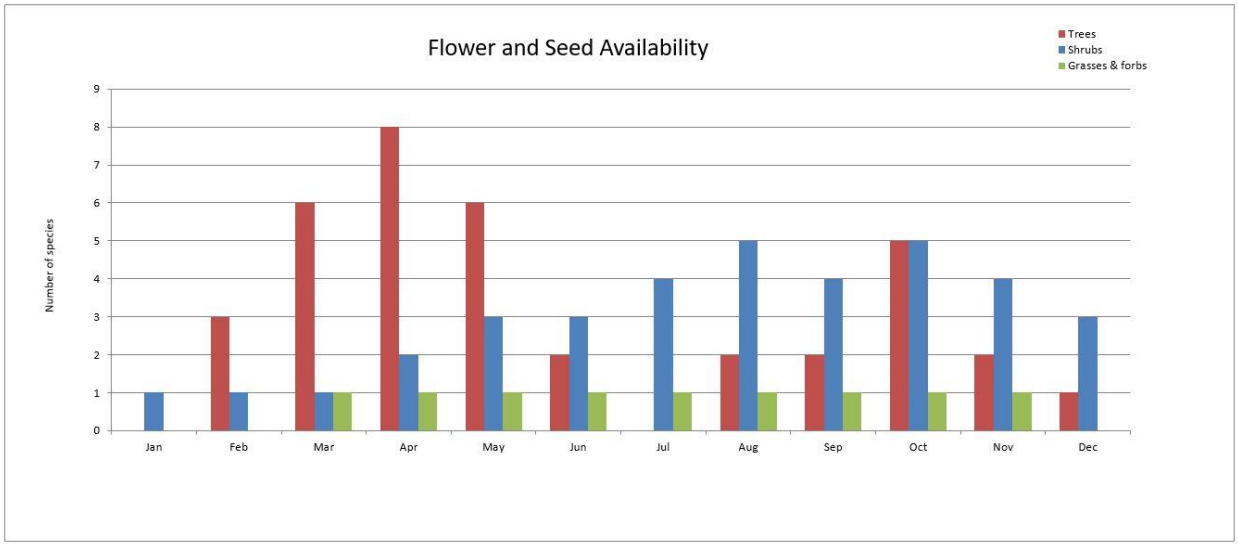

Figure 4. Evaluating the plant list with Point Blue's Climate-Smart Restoration Toolkit, this chart depicts how many plant species in our palette provide wildlife resources throughout each month of the year. An optimal spread would be to have several species of varying vegetative structure (trees, shrubs, grasses & forbs) providing wildlife resources for each month of the year. A year-round supply of wildlife resources buffers wildlife against changing climate conditions.

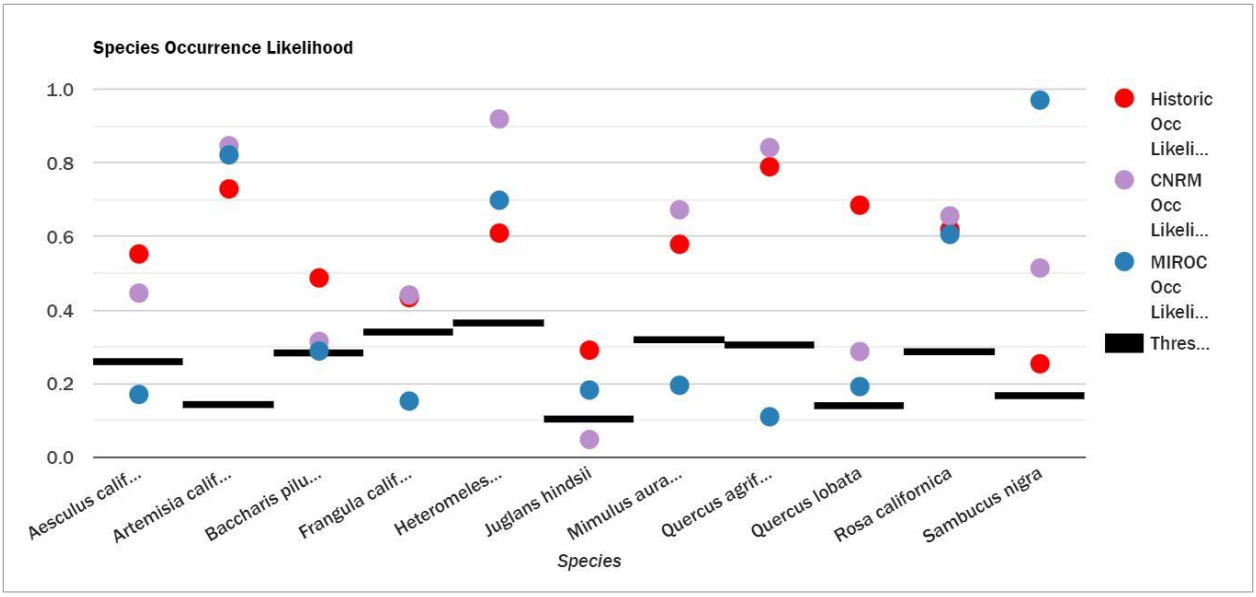

Figure 5. Each dot represents the site suitability for each species for three different climate scenarios: Historic (red), CNRM (purple) and MIROC (blue). CNRM and MIROC are modeled future scenarios for 2050-2079, where CNRM represents a Warm+Wet scenario and MIROC represents a Hot+Dry scenario. The black bars represent 95% site suitability thresholds for each species. Therefore, if a dot is above a bar for a particular species, it can be inferred that the plant and their associated traits fall within the site characteristics at 95% of observed locations for that species.

As for adaptations to our planting design, we collectively decided to omit from our design plan willow and cottonwood planting along the banks. The planting along the northern bank was intended for 3-foot sprigs of 20 cottonwood (*Populus fremontii*) and 3-foot sprigs of 77 willow (*Salix lasiandra* and *Salix lasiolepis*); however, the plant stock on site was not adequate. Further discussion with the Agency later in planning determined anticipated stream restructuring and the need to obtain a Lake & Streambed Alteration 1600 permit from CDFW, therefore sprigging was omitted from the plan at this time.

An additional change to our planting design was the omission of planting 80 sycamores (*Platanus racemosa*) in the Pacheco Reserve Enhancement/Restoration planting area, for two reasons. First, STRAW staff was unable to locate confirmed non-hybridized sycamore plant stock at local native plant nurseries. Second, given a previous study conducted by San Francisco Estuary Institute (SFEI) and H.T. Harvey & Associates (HTH), in partnership with the Agency, we collectively determined that we didn't have enough information yet to appropriately assess non-hybridized sycamore stands to select planting material from nor an informed methodology for successful propagation techniques. According to the 2017 Sycamore Alluvial Woodlands study, groundwater levels are a crucial factor in sycamore survivability as well as periodic flooding to create conditions that support regeneration. Consultation with the Agency, California Department of Fish and Wildlife, and H.T. Harvey are needed prior to any restoration implementation involving sycamores. However, one approach to encourage sycamore

regeneration could involve planting woody plant nurseries with species that are closely associated with sycamores as well as monitoring primary channels for invasive species that may outcompete sycamores.

STRAW staff procured all planting materials for restoration implementation. Acorns for Coast Live Oak (*Quercus agrifolia*) and Valley Oak (*Quercus lobata*) were sourced from several trees on site. Blue Oak (*Quercus douglasii*) was removed from the design plan as we determined that our planting zones were just below the elevation for optimal Blue Oak success. The remainder of plants were sourced from local nurseries who are utilizing phytosanitary best management practices for reduced risk of introducing plant pathogens to restoration sites via plant stock. Those nurseries are Central Coast Wilds, The Watershed Nursery, Capitol Wholesale Nursery, and California Flora Nursery. Further, Point Blue has consulted with Phytosphere Research principal, Ted Swiecki Ph.D., and now perform almost all phytopthora testing in-house using pear-bait and leachate testing methods.

For future plantings, we highly recommend sourcing local seed sources and conducting a contract grow. Currently, Point Blue is doing extensive research into site-specific seed collection, propagation, and planting and monitoring for any trends in survival and climate change resilience. Seed collection methods and timing protocols have been developed so seeds can be stored and grown at our own Casa Grande Nursery in Petaluma, California. In late summer 2020, we conducted small-scale seed collection efforts of Narrowleaf Milkweed (*Asclepias fascicularis*) and sent seeds into Hedgerow Farms for storage and future propagation. For future projects, we encourage discussions for future plantings so that we may be able to collect and store seeds now.

CURRENT SURVIVAL AND SITE CONDITIONS FOR PACHECO RESERVE ENHANCEMENT/RESTORATION PLANTING

The table below (Table 4) shows the species and number of plants installed as well as plant survival numbers, height class, and health rating, either as high vigor (HV) showing healthy new growth or buds or as low vigor (LV) showing systemic stress. Plant establishment monitoring was performed on October 19th, 2022. The survival percentage in the Pacheco Reserve Enhancement/Restoration planting area monitored for five summers after installation has an overall survival percentage of 36%, down from 41% last year. Of the surviving plants, most plants are of high vigor, exhibiting new height and foliage growth as well as flowering and fruiting.

Table 4. Pacheco Reserve Enhancement/Restoration planting area survival data after summer 2022 (Year 5 of 5 for maintenance and monitoring).

Latin Name	Common Name	Total Planted	Alive 2018	Alive 2019	Alive 2020	Alive 2021	Alive 2022	Survive 2022	<3ft-LV	<3ft-HV	>3ft-LV	>3ft-HV
Quercus lobata	Valley Oak	19	17	17	43	33	33	174%		12		21
Quercus agrifolia	Coast Live Oak	13	12	17	13	13	10	77%		4		6
Aesculus californica	CA Buckeye	12	0	0	7	4	1	8%	1			
Rosa californica	California rose	26	4	3	3	1	1	4%		1		
Artemisia californica	Coastal Sagebrush	21	2	0	0	1	1	5%		1		
Heteromeles arbutifolia	Toyon	30	5	5	21	14	13	43%		6		7
Sambucus nigra	Blue Elderberry	44	8	4	10	3	2	5%			1	1
Juglans hindsii	CA Black Walnut	10	1	2	2	1	1	10%		1		
Baccharis pilularis	Coyote Brush	38	13	9	5	8	4	11%				4
Mimulus aurantiacus	Sticky Monkeyflower	7	1	0	0	0	0	0%				
Frangula californica	CA Coffeeberry	19	19	15	23	24	23	53%		15		8
Populus fremontii	Fremont Cottonwood	11	2	1	0	0	0	0%				
	Total	**250**	**84**	**73**	**127**	**102**	**89**	**36%**	**1**	**40**	**1**	**47**
								Percent	*1%*	*45%*	*1%*	*53%*

The next section provides details on each maintenance visit over the summer (Table 5). This past maintenance season focused on keeping surviving plants weeded and watered. After an initial weeding in late spring, plants required little weeding maintenance over the summer. Of note, Yellow-star Thistle infestations around planting area seemed subdued this year and only required some hand-pulling in some areas. We removed cages from dead plants and reconfigured drip lines to reduce the length of tubing onsite. To ensure watering capacity, Point Blue continued to work closely with the Habitat Agency to notify when we needed a battery swap to power the pump and operate the irrigation. Overall, the batteries stayed adequately charged all season, and only periodic pump filter cleanings were needed. We continued irrigation maintenance visits until October and have received consistent rain into the winter season.

Overall rodent pressure was relatively minimal this past summer and fall. Despite minimal rodent pressure and consistent watering, we did notice some die-off that could not be attributable to anything observable. Other observations throughout maintenance season include the presence of cows and wild pigs (Figure 6), although neither had a major impact on plant health.

Figure 6. Evidence of periodic wild pig activity within the planting area. Overall, no impacts to plantings.

MAINTENANCE WORK PERFORMED FOR PACHECO RESERVE ENHANCEMENT/RESTORATION PLANTING

Table 5. Maintenance work performed during summer of 2022 at the Pacheco Reserve Enhancement/ Restoration planting area. Maintenance visits typically entailed running irrigation, walking drip line and repairing leaks, and weeding. Irrigation was not run on an automated system and only ran during maintenance visits.

Date	Water Duration Hours	Voltage reading (start / end)	Work Conducted	Observations	Notes for next visit
5/26/22	3.5 (S1, S2)	28.8 / 28.8	Watered S1 and S2 for 3.5 hrs each. Weeded around and inside of plant cages in zones S1, S2, and S3. Removed cages from dead plants.	Many plants didn't get watered the entire 3.5 hrs as emitters/lines plugged. Did not notice any leaks.	Continue weeding in zones S3, S4, and S5. Run irrigation in those zones as well.
6/3/22	1.5 hrs (S3, S4, S5)	27.5 / 28.1	Watered S3, S4, and S5 for 1.5 hrs each. Finished weeding all plants!	Plants look good. Saw small flock of Band-tailed Pigeons on the elderberry. Saw a small deer later in the afternoon browsing nearby the coffeeberry (not eating our plants).	Yellow star-thistle is flowering. Would be good to continue pulling/hoeing isolated patches.
6/10/22	0.5 hr (S1, S2)	28.8 / 25.5	Watered S1 and S2 for 0.5 hours. Continued hoeing YST patch by the oaks.	Plants looking lusher as we've begun recent watering. Hot weather today (upper 90's)!	Continue pulling YST.
6/16/22	3 hrs for all zones	30.4 / 30.4	Watered all zones simultaneously. Because of this, it took a bit of time for water to move to the end of zone S5.	Great! New growth on some plants. Elderberry is flowering. Our planted toyons are also starting to flower.	Continue pulling YST as it pops up.
6/30/22	1 hr per zone	28.8 / 27.4	Watered all zones.		
7/15/22	2 hrs per zone	28.8 / 28.7	Watered all zones. No leaks found. Plants look good!	Wasn't initially receiving optimal volume of water to	Notify Gerry that we're due for a filter cleaning.

				run irrigation. Pulled up filter (out of muck?) and received much better volume. Cleaned filter, tube, and power cord with water and wiped dry.	
7/22/22	3.5 hrs per zone	28.8 / 27.6	Watered all zones. No leaks found. Plants look good! New growth.	Virtually no signs of rodent herbivory impact to plants. Observed area of torn up grass, likely by pigs. No damage to plantings.	
7/29/22	3.5 hrs per zone	28.8 / 28.7	Watered all zones. Fixed minor leaks near emitters in zone S1, likely from rodents.	Little to no herbivory seems to be the theme.	
8/4/22	3.5 hrs per zone	28.8 / 28.8	Ran irrigation. Water not reaching the ends of lines in zones S3, S4, and S5. Maybe filter needs to be cleaned again? Fixed two minor leaks in ¼" line, otherwise no other leaks.	Plants are looking really good. Saw 6 deer upon arrival (4 adults and 2 bambis).	Notify Gerry that we need the filter cleaned.
8/18/22	1.5 hrs per zone	27.5 / 28.8	Ran irrigation, fixed minor leaks.	Ran into Anhiga!	
8/25/22	2 hrs per zone	28.8 / 28.8	Ran irrigation for all zones and fixed minor leaks.	Herons and egrets on the move.	
9/2/22	3 hrs per zone	27.1 / 28.8	Ran irrigation for all zones. Fixed leak in usual spot at valve at S4.	Observed cow poop in S1 near the pump. Hoof marks on dirt road. More cow poop in S4. Pacheco Creek is completely dry.	
9/9/22	3 hrs per zone	27.7 / 28.8	Ran irrigation. Leak in chewed mainline just past S4 valve. Pressure is really low, no other leaks found.	Two cows in planting area, exited OVER fence on upstream end.	

9/16/22	2 hrs per zone	28.2 / 28.2	Ran irrigation. No leaks.	Plants look good!	
9/30/22	2 hrs per zone	28.8 / 28.8	Ran irrigation and fixed minor leaks.	Plants continue to look good!	
10/7/22	1.5 hrs per zone	27.1 / 28.8	Ran irrigation and fixed minor leaks.	Plants continue to look good!	
10/12/22	1.5 hours per zone	27.8 / 28.5	Ran irrigation. very last plants didn't get water at first - cut off first zones (S1,S2) then water was flowing to last ones.	Plants looking great.	
10/19/22	0 hrs	27.5 / 27.5	Tried running irrigation, but pump making a loud noise. No water in well?	Conducted annual monitoring for survival numbers and photo monitoring.	Notify Gerry about pump complications.

SITE MONITORING PHOTOS

Figure 7. Each year, Point Blue conducts photo-monitoring surveys (year 5 of 5). Photo point locations below. Zone A = Oak Contingency Planting area photo points, and Zone B = Pacheco Reserve Enhancement/ Restoration planting area photo points.

Photomonitoring point Pacheco Reserve Enhncmnt/Rest_1 – Nov. 2018 (left) and Oct. 2022 (right)

Photomonitoring point Pacheco Reserve Enhncmnt/Rest_2 – Nov. 2018 (left) and Oct. 2022 (right)

Photomonitoring point Pacheco Reserve Enhncmnt/Rest_3 – Nov. 2018 (left) and Oct. 2022 (right)