Cooperative Agreement between U.S. Fish and Wildlife Service
AND
National Audubon Society, Inc.

Project Title: ARAMBURU ISLAND SHORELINE PROTECTION AND ECOLOGIGAL ENHANCEMENT PROJECT
Recipient: National Audubon Society, Inc. (Richardson Bay Audubon Center & Sanctuary)
Agreement Number: FVHC982205200Y4
Date of Report: 10/31/2012
Period covered: 4/1/2012 through 10/1/2012

SUMMARY OF ACTIVITIES:

Since April 1, 2012 Audubon has accomplished several tasks directly related to the Aramburu Island Enhancement project. Those tasks include (1) continued post-enhancement shorebird monitoring; (2) collected plants for propagation, planted seeds in the nursery, and cared for propagation beds and nursery plants; (3) removed non-native plants by hand from the new shoreline and continued experimenting with saltwater irrigation; (4) Continued to experiment with goose management strategies, (5) completed monitoring for native oysters; and (6) processed invertebrate samples, and (6) begun Phase II of construction activities on the island, which involves all upland work, the seal channel, and the new sandy foreshore.

(1) Monitoring shorebird response to island enhancement

For the period of July 1 through September 30, 2012 shorebird monitoring continued as in previous quarters, although construction on the island began in early September leading to a break in the surveys that will continue until the construction work on the island is completed. This period also corresponds to a seasonal low in shorebirds using the San Francisco Bay as they slowly trickle back from their northern breeding grounds. The returning species, such as Black-bellied Plovers and Marbled Godwits, continued to use the new shoreline of Aramburu Island for feeding and resting, and during the last survey (prior to construction) on August 22, we counted nearly 100 shorebirds.

Even with the typically low numbers of birds in general during the summer season, we noted that two local shorebird species appeared to have bred on the island. During this period, we continued to observe pairs of Black-necked Stilts and Killdeer with their chicks on Aramburu Island. This is especially encouraging because the enhancement project will likely increase the habitat available to both these species when it is complete.

Figure 1. Cormorants resting on newly-enhanced shoreline of Aramburu Island

(2) *<u>Plant Propagation in Native Plant Nursery</u>*

The Richardson Bay Audubon Center & Sanctuary (Center) is preparing for island revegetation. Since 2011, we have propagated 850 individual plants in our nursery facility and 525 square feet of rhizomatous plants in propagation beds (an increase of 25% from last year). These plants include both marsh and upland species such as *Ambrosia psilotachya*, *Eleocharis macrostachya, Frankenia salina*, *Distichlis spicata*, and *Grindelia stricta*. We have also started seed amplification of *Elymus glaucus*, collecting seeds from plants propagated last season. We have experimented with vegetative propagation of *Grindelia*, which appears to be successful and could provide an additional and relatively quick way to grow out this species. We have collected seeds of *Madia gracillis*, *Madia sativa and Limonium californicum* and have begun propagating these species. This fall, we have also discovered local populations, collected and started propagation of two new species: *Cressa truxillensis* and *Iva axillaris*. Discovering small populations of these species on our property ultimately saves us resources because we are able to propagate them ourselves. Existing plants are thriving and we expect them to transfer successfully to the island once planting begins during the winter of 2012-13.

Figure 2. Native plant nursery on Center grounds

(3) *<u>Goose Management Experiments</u>*

To ensure that island re-vegetation is successful, we continued to experiment with ways to keep Canada Geese from eating the newly planted vegetation. We placed a grid of string across a small section of the island to prevent the geese from accessing the area and then removed all droppings. We measured our success by the amount of goose droppings in the grid. Our first experimental grid was unsuccessful, thus we experimented with a new grid with more lines, including ones that cross the interior of the grid (Figure 4). We also put two coyote decoys on the island to act as deterrents (Figure 3). While the coyote decoys appear to be doing little to scare the geese, the grids with additional lines (less room for the geese to land, take off and maneuver) do seem to be deterring the geese from these areas. We expect that once native plants

are in the ground, this method will help to significantly control grazing by the geese. We kept these grid structures in place for the remainder of the summer, and will utilize our analysis to inform our goose management activities in the winter/spring when new vegetation is planted.

Figure 3. Coyote decoy acting as goose deterrent

Figure 4. Coyote decoy paired with experimental grid acting as goose deterrent

(4) *<u>Non-native Plant Removal & Saltwater Irrigation</u>*

With staff and volunteers, we have continued removing non-native plants along the new shoreline this quarter, including a number of thistle species such as the highly invasive star-thistle (*Centaurea solstitialis*), pepperweed (*Lepidium latifolium*). We will closely monitor this area for new growth after the completion of construction activities. In addition, we are salt-water irrigating areas of the upland terrace that are dominated by non-native species such as Italian thistle (*Carduus pycnocephalus*) and broom (*Genista spp.)* using a portable water pump.

Figure 5. Saline irrigation for non-native species

Figure 6. Volunteers removing invasive control Carpobrotus edulis (iceplant)

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(5) *Native oyster monitoring*

In conjunction with the San Francisco Bay National Estuarine Research Reserve, we placed five sets of ceramic tiles at the southern shore of Aramburu at 0m MLLW to allow us to monitor for oyster spat. Every three months, two sets of tiles will be replaced and monitored and the others will be photographed and returned to the water. In addition, a Hobo data logger was deployed to monitor temperature. We will complete an oyster survey along the south end of the island in July, 2012. These data will inform the oyster restoration on Aramburu.

We have continued our native oyster monitoring at the southeastern shore of Aramburu in conjunction with the San Francisco Bay National Estuarine Research Reserve. In addition to the five sets of settling tiles we monitor quarterly, we will regularly survey oysters along the shoreline and collect temperature data. We will complete the next round of tile replacement and population surveys in November, 2013.

On July 6, 2012, the Center, along with volunteers completed an oyster survey at a +1.5 foot tide height on the Aramburu shoreline. We monitored and photographed nine sites with a 0.25m quadrat along a 30m transect parallel to the shoreline. We photographed the sample areas to assess the amount of hard substrate available for oyster settlement and the other fouling species that may compete for space. The plots contain plenty of hard substrate that oysters could use, although most of it was covered with barnacles. Only 3-13% of the rock was not fouled. In total, we found 70 oysters ranging in size from 9-50mm. The average size was approximately 27mm. On July 27, 2012, we replaced six and photographed three of the ceramic monitoring tiles. In total, the six tiles had six oysters ranging in size from 1-5mm. These tiles were also very fouled, primarily with barnacles and bryozoans (Bugula stolonifera).

(6) *Invertebrate sample processing*

We continue to make progress on the pre-restoration invertebrate samples. Sorting invertebrates from the mud core samples advances at a slower pace. We have redirected staff time to more pressing issues including removing non-natives and improving the nursery in preparation for the second half of construction this summer. We have found it difficult to recruit regular volunteers for this task, and are completing the work using staff time. We are still waiting for the use of a microscope camera in order to photograph the specimens.

CONTRACTOR ACTIVITIES:

(1) Project Consultant (Wetlands and Water Resources):

- Task 1: Pre-construction contractor meeting/staking (WWR/Hanford A.R.C.)
- Task 2: Construction oversight: Shoreline (WWR)
- Task 3: Construction oversight: Sandy foreshore (WWR)
- Task 4: Construction oversight: Island Terrace (WWR)

Pre-construction contractor activities included shoreline geomorphology surveys conducted Wetlands and Water Resources (the project consultant) and Audubon staff in late August. The results of these surveys are still being analyzed, but so far indicate the following:

- The beach profile of central and northern cells was extensively reworked by storms, but the mixed gravel-sand-shell berm profile persisted throughout their length except at the south-facing headlands at the southern end of the cells where the designed cobble-gravel berm dominated the profile.

- There was no reactivation of wave-cut scarps by storm wave action in the island backshore fill - cobble and gravel berms inhibited erosion of the island during all storm events.

- In the southern cell and south-facing headlands, the sand fraction was eroded from the beach by winter storms, leaving a coarse gravel and cobble beachface.

- Longshore drift of beach sediment occurred during the first winter. The updrift sides of microgroins in the central cell prograded with oyster shell and gravel, forming local concave-bayward beaches reoriented to face the dominant southerly wave approach direction. The downdrift sides of micro-groins retreated, but maintained a narrow gravel berm profile.

- Though the micro-groin field does restrict the extent of longshore drift within the littoral cells, longshore drift of sand, gravel and shell extended beyond the placement zone of the central and northern cells, depositing as fringing spit recurves dominated by shell and sand along the central cove spit shoreline and along the former salt marsh scarp on the north shore of the island.

- Berm crest elevations and beach grain size in summer 2012 varied alongshore within and among littoral cells, consistent with the estimated wave energy gradient. Mean berm crest elevations of all littoral cells ranged between 7.35 ft-7.76 ft NAVD, consistently greater than the high tide line elevation (7 ft) and still-water MHHW, but below the highest observed tide elevation of 8.48 ft.

(2) Project Contractor Activities for Physical Restoration Groundwork (Hanford A.R.C.)**:**

- Task 1: Pre-construction contractor meeting/staking
- Task 2: Mobilization of Equipment
- Task 3: Clearing/Grubbing/Debris removal
- Task 4: Bury invasive vegetation
- Task 5: Grading of upland areas: Seasonal ponds, Oak tree protection berm, saline flats, tidal marsh transition zone, grass-sedge meadow, high tidal marsh
- Irrigation for dust control, soil salinity

Following shoreline, nesting, and shorebird surveys, we commenced Phase II of Aramburu Island construction activities. We are nearing completion of Phase II construction activities on Aramburu Island, which includes all of the aforementioned upland grading work, and will include digging the seal channel to allow harbor seals to have deep water access to the island.

Aramburu Island Construction Photos

Figure 7. Grading of freshwater vernal marsh/pool feature

Figure 8. New high tidal marsh habitat at finish

Figure 9. Contractors dig deep pits and bury large quantities of invasive vegetation including *Carpobrotus edulis (Iceplant), Carduus spp., Genista monspessulana and Phalaris aquatica*

Figure 10. Grading of terrace and saline wetland in central cell of Aramburu Island

WORK PLANNED FOR 2012-2014:

(1) *Construction*

- The final steps of placing the new sand (beneficial reuse material form San Francisco Marina Dredging project) along the shoreline and digging the seal channel will begin the week of October 29th. The seal channel will take approximately 1 week to excavate. The excavated material will then be spread and used to cap newly created seasonal wetland areas in the upland zones of the island. The spreading and compacting of this thick, clay-like material throughout created wetland areas will allow for these areas to temporarily hold overwash from extreme high tides as well as winter rains.

- After application of a final layer of bay mud in the upland zones of the island, all graded and enhanced areas will undergo a saline "wash down" designed to raise soil salinity levels to the degree that viability of non-native seeds will be dramatically reduced if not eliminated. Raising soil salinity prior to initial re-vegetation efforts also allows for halophytic and halotolerant species to thrive and establish before invasive species have a chance to colonize and dominate the vegetation community.

(2) *Re-vegetation & Vegetation Management*

- After post-construction saline irrigation and once winter rains have started (November-December), aggressive re-vegetation efforts will begin and continue throughout the spring. The Watershed Nursery and Richardson Bay Audubon Center & Sanctuary restoration team have continued propagating native plants (see above nursery section) for this effort.

- Following the first year (season) of planting and moving into the summer (May-October), Audubon staff will monitor vegetation establishment closely. Audubon Ecologist and staff will measure in particular vegetation density, composition, and percent die off, with special attention to any invasive species that have established on the island. Invasive vegetation (depending on the species) will be treated through a variety of mechanisms including saline irrigation, hand-pulling, and tarping.

- Consecutive phases of re-vegetation will begin next winter (November 2013 - April 2014) with later successional (and less salt tolerant) species being planted on the island. In total, re-vegetation efforts will be implemented for three years, with on-site propagation, adaptive management of the vegetation communities and invasive species continuing indefinitely.

(3) Monitoring

Monitoring protocols will be implemented to assess the effects of enhancement activities on biological communities and geomorphic processes (sediment transport and erosion). Audubon California and Wetlands and Water Resources (WWR) will monitor biological and geomorphic processes following enhancement activities within an adaptive management framework aimed at assessing the initial biological and geomorphic response and making necessary adjustments early to ensure that conservation targets are met (Table 1). The monitoring schedule herein is contingent on receipt of funding. Additional monitoring will occur in years five and ten to assess long-term changes as well as project success pending receipt of funding (Table 1).

Table 1. Schedule of geomorphic and biological monitoring post-enhancement on Aramburu Island. Monitoring activities are dependent on receipt of sufficient funding.

Monitoring activity	Year										
	2011*	2012**	2013	2014	2015	2016	2017	2018	2019	2020	2021
Time-series photographs	X	X	X	X		X		X			X
Shoreline geomorphology		X	X				X				X
Shorebirds	X	X	X		X		X				X
Landbirds				X		X		X			X
Infaunal community			X		X		X				X
Fish			X		X		X				X
Oysters			X	X[1]	X	X[1]					X
Vegetation – Community sampling			X	X	X[2]			X			X
Vegetation – Non-native control		X	X	X	X	X					X
Vegetation - Mapping							X				X

*Construction Phase I began July 2011
**Construction Phase II began September 2012
[1]Monitor oyster sampling bags
[2]Monitoring in 2015 is contingent on successful establishment of target plant species.

(3a) Time-series photographs

We will use time-series photographs taken from fixed observation points to visually document changes in shoreline and terrace habitats post-enhancement. We will establish a minimum of 10 fixed observation photo points around Aramburu Island (along the shoreline and within island terrace habitats). We will establish photo points within each terrace habitat type (oak grove, saline flat/pan, vernal pool, vernal marsh, saltgrass meadow, grass-sedge meadow, and high tidal marsh) and within each of the three eastern shoreline cells. We will take photos every third month at 1.0-1.5 ft tide height immediately following enhancement in years 2012, 2014, 2016, and 2021 (4 photo events per year; Table 1). Pre-enhancement photos will be taken in February 2011 and May 2011. Additional photos will be taken at the shoreline observation points following major storm events to document changes in the shoreline features following storms to assess sediment transport.

(3b) Shoreline geomorphology

We will monitor the evolution of the shoreline geomorphology following project implementation using a combination of shoreline topographic transects, grain size analyses, and general beach inspections. We will conduct a total of five discrete monitoring events, which we have scheduled based on expected beach evolution timelines, thus allowing us to make any necessary corrections to site constructed features at appropriate points along the project evolutionary timeline. We will conduct the first three monitoring events within the first two years following project construction. We conducted the first event in the spring of 2012 to assess beach conditions following the first post-construction winter storm season (see Contractor Activities). We will conduct the second monitoring event in the fall of 2012 to assess beach conditions following the first summer season. The third monitoring event will occur in the fall of 2013 to assess conditions at the end of the second post-enhancement year. We will conduct the final two monitoring events in years 5 and 10 (2016 and 2021). All monitoring events will be conducted at low tide when the shoreline elements are exposed.

We will survey one shore-normal topographic cross section in each of the shoreline cells (north, central, south), extending from the island terrace to the intertidal environs of Richardson Bay, capturing the entire extent of enhanced beach forms. In addition, we will survey a topographic transect at the extreme north end of the island, to monitor any movement of placed beach materials beyond the terminal groin on the eastern shoreline. Topographic data will be collected using either total station or Real Time Kinematic (RTK) differential GPS methods. We will perform surveys along existing shoreline topographic transect alignments and will survey the same transects each year to compare pre- and post-enhancement conditions and to monitor changes over time. We will survey and monument (i.e., stake) the landward cross section endpoints and record the cross section heading so that the same alignments can be reoccupied in each monitoring effort. All topographic data will be referenced to local benchmarks in the NAVD88 vertical datum.

Along each of the four shoreline topographic cross sections described above, we will take beach material samples and analyze them for grain size distribution to determine how sediment distribution along the beach forms change over time. Along each cross section alignment, we

will divide the beach profile into discrete, shore-parallel "zones" based on homogeneity of sediment distribution and we will take a representative sample from each zone for analysis. We will sieve the samples following standard USDA protocols and determine the grain size distribution and D50 (median grain size) of each individual sample. We will conduct the grain size analyses in the same years as the shoreline topographic surveys.

In addition to the topographic and grain size data collection, we will also perform a general, qualitative assessment of shoreline condition. In this assessment we will walk the length of the shoreline and inspect and describe the nature of the beach features. Items of particular interest in this survey will include:

- Formation of beach berms and spits
- Distribution of beach materials
- Micro-groin stability
- Large woody debris stability/distribution
- Areas where beach material has been scoured (i.e., exposed beach scarp)
- Transport of material around the northern terminal groin

(3c) Shorebirds

Audubon California will survey shorebirds along the eastern shores of Aramburu Island, Pickleweed Island, and the Un-named Island that is located southwest of the Richardson Bay Audubon Center following a Before-After-Control-Impact (BACI) design to document the effects of island enhancement on migratory shorebirds (Figure 1). We will conduct shorebird surveys following standard protocols (Point Reyes Bird Observatory, pers. comm.). We will conduct paired surveys at high tide (> 5') and low tide (1.5 to 2.5'). Surveys conducted at high tide will provide information related to roosting, while low tide surveys will provide information on foraging. We will conduct shorebird surveys three times a month, pairing a low tide survey with a high tide survey post-enhancement in years 2012, 2023, 2015, 2017, and 2022 post-enhancement (Table 1). Pre-enhancement shorebird surveys were conducted three times a month from 2009-2011. Shorebird surveys are scheduled to occur soon after enhancement because (1) shorebirds are highly mobile, (2) shorebirds are most likely to respond to enhancements made to the shoreline (i.e., do not need to wait for vegetation to respond), and (3) initial assessments of shorebirds will allow us to determine if changes in the shoreline need to be made to reach conservation goals. Post-enhancement surveys will begin in March in the years indicated and will continue through March the following year. Observers will slowly scan the shorelines of each island from one vantage point located on the shores of Richardson Bay (Figure 11). Observers will record the number of species and individuals detected during each scan. Observers will also record behaviors of all birds detected (roosting, foraging, other).

(3d) Landbirds

The goal of landbird monitoring is to determine the effect of enhancement activities on birds using the upland (i.e., terrace) of Aramburu Island. We will monitor landbirds following a BACI design. We will monitor landbirds at Aramburu Island as well as at two control sites

(Pickleweed Island and Un-named Island; Figure 2). At each site we will conduct standard area searches (Ralph et al. 1993, Bibby et al. 2000). Area searches will consist of a series of three 20-minute counts conducted within 5 hours of sunrise during the breeding season (March-August). We conducted area searches every three weeks pre-enhancement in 2009-2011. We will conduct post-enhancement area searches every three weeks in years 2014, 2016, 2018, and 2022 post-enhancement (Table 1). Landbird surveys are scheduled to begin two years post-construction as vegetation will likely not mature substantially in the first two years of the project, which will affect use of the area by landbirds. Landbird surveys are scheduled to coincide with vegetation surveys (Table 1). Observers will search two separate areas on Aramburu Island for 20 minutes each and will search both control sites for 20 minutes (Figure 12). Observers will record the number of birds of each species seen or heard during the 20-minute interval. Observers will also record the location of nesting birds, pairs, and juvenile birds detected during the 20-minute area searches.

(3e) Infaunal community

We will sample the infaunal community pre- and post-enhancement following a BACI design to determine if construction increased both relative abundance and richness of the infaunal community. We conducted pre-enhancement surveys in September and December 2010. We will conduct post-enhancement surveys in years 2013, 2015, 2017, and 2022 in the same location following standardized protocols (Lowe 2002). Surveys will occur in the fall (September) and winter (December) in each year to coincide with shorebird migration (Table 1). Infaunal sampling will coincide with shorebird surveys and is scheduled to assess the initial response of the infaunal community to allow us to make adjustments to site constructed features if warranted. Infaunal sampling will take place on days when shorebird surveys are not scheduled to reduce any potential disturbance. The infaunal community may respond in as little as two years or as long as ten, thus we planned our monitoring accordingly (Table 1).

We will establish perpendicular transects stratified by habitat type within each of the cells (south, central, and north) on Aramburu Island. Three infaunal community transects will be placed randomly within each of the cells on Aramburu Island (n = 9 transects total). Four infaunal transects will be placed randomly along the shoreline at Pickleweed Island. The number of infaunal transects differ on Aramburu and Pickleweed due to the size of each island. Along each transect we will sample surface dwelling organisms or subsurface benthic invertebrates at five tidal height locations (+0.5, +1.0, +1.5, +2.5, and +3.0' tide heights) depending on substrate. For soft substrates we will sample the subsurface benthic invertebrates with a 4 inch clam gun coring to a depth of 10 cm (Lowe 2002). We will identify all organisms found in the core to order or family and calculate biomass. If the substrate is too hard to penetrate with the clam gun, we will count the number of surface organisms present within a 0.50 m^2 quadrat. To capture the surface epifaunal invertebrates we will place a Tuffy kitchen scrubber fixed to a re-bar at five locations along each transect ((+0.5, +1.0, +1.5, +2.5, and +3.0' tide heights). We will leave the Tuffy in place for two days. At the end of the two day period, we will collect the Tuffy and will identify all organisms to family or order and calculate biomass.

(3f) Oysters

The goal of oyster monitoring is to determine if enhancement has increased oyster density on Aramburu Island. We will count and measure all oysters occurring along created oyster reefs in November 2013 (peak of oyster spawn). Oysters will again be counted and measured in 2015 and 2022 (Table 1). In the intervening years (2014 and 2016), we will assess oyster establishment and recruitment by placing oyster shell sampling bags in the intertidal zone. We will place sampling bags in August/September and will collect sampling bags in November/December and count the number of oysters that settled on the sampling bags.

(3g) Fish

The goal of fish monitoring along the eastern shoreline is to determine species presence/absence post-enhancement. We will conduct beach seine hauls in the fall (September/October) post-enhancement. Seine surveys will occur at outgoing high-tide. Given the highly mobile nature of fish and the expectation that fish will not respond immediately to enhancement activities, beach seines will occur in 2013, 2015, and 2017.

(3h) Vegetation

Community sampling. The goal of vegetation community sampling is to document successful establishment of target plant species as well as monitor changes in vegetation cover and species richness over time. We will sample the plant community on Aramburu Island pre- and post-enhancement using a point intercept method to determine the change in percent cover and relative abundance of individual species (Elzinga et al. 1998). Fifteen points will be randomly placed, no less than 30 meters apart, along the centerline of the island. From each point a transect will be extended from east to west the entire extent of the island. Along each transect, vegetation sampling points will be placed at 5 meter intervals starting with point 1 at the western most end of the transect. At each sampling point, observers will place a ¼ inch sampling rod vertically at each point and recording the plant species in contact with the sampling rod. The length of each transect will vary depending on width of the Island.

We will conduct vegetation surveys at the peak of the growing season (April-May) pre- and post-enhancement. Post-enhancement surveys will take place in years 2013 and 2014 to ensure that newly planted vegetation is taking hold. If vegetation does not appear to be establishing, we will plant additional plants and continue monitoring in 2015 (Table 1). Monitoring conducted within the first two or three years following enhancement is designed to assess establishment and to allow us to make changes to site constructed features if necessary. The first years following planting are critical for plants, thus monitoring must occur during these sensitive times. Long-term monitoring to assess changes in the vegetation community will occur in 2022, allowing time for vegetation to mature.

Non-native control. We will monitor and remove non-native plants detected in the first five years post-enhancement (Table 1). Non-native plants are most likely to establish early on which can negatively impact establishment of native vegetation; therefore we will monitor and remove

non-native plants during the first five years. Monitoring and removal (if required) will also occur in 2022.

Mapping. We will map vegetation on Aramburu Island to examine the change in the vegetation community pre and post-enhancement in 2017 and 2022. Mapping is scheduled to occur after vegetation has had time to mature. Mapping will be conducted with high-precision handheld GPS units, walking perimeters of distinct vegetation units identified during vegetation community sampling described above. Data will then be transferred into GIS and overlaid onto available aerial photography.

Monitoring reports

- Audubon California and WWR will submit monitoring reports in October of each year that monitoring occurs. Reports will include a comprehensive analysis of the effects of enhancement on biological communities and geomorphic processes.

- Recommendations for modifications to site constructed features, if any, will be made in each report within an adaptive management framework.

- In the interim years, if monitoring indicates that modifications to site constructed features are required to keep biological and geomorphic process on track to achieve the stated goals, we will issue a memo indicating the need for such changes.

- Monitoring reports will also include recommendations, if any, for modifying the monitoring approach if conditions warrant.

Figure 11. Location of shorebird surveys. Observers will scan the shores of Aramburu, Un-named Island, and Pickleweed Island from the shores of Richardson Bay.

Figure 12. Location of landbird area searches. Observers will search areas 1-3 for 20 minutes each recording all birds seen or heard.

Volunteer Participation

This quarter, 44 volunteers contributed 221 hours of work related to the Aramburu Island project. These volunteers conducted shorebird surveys, worked on the propagation beds, and maintained the native plant nursery. The volunteers for the Aramburu project have learned local shorebird identification as well as the importance of shorebird habitat, the dangers of invasive species, plant propagation and habitat restoration skills.

Milestones Achieved:

- Vegetation management (pre-construction)- Audubon
- Oyster and Shoreline Geomorphology surveys- Audubon/Wetlands and Water Resources
- Clapper rail, Nesting bird, and Shorebird surveys- Audubon
- Phase II of Construction- Hanford A.R.C.
    - Clearing, grubbing and debris removal
    - Burial of invasive vegetation
    - Uplands grading

Problems encountered in performance of work: N/A

Recommendations for modifications to site enhanced features:
At this time, we have no recommendations for modifications to enhanced site features. As we are still in the construction phase of the project, any potential modifications to enhanced features as part of our adaptive management strategy will be implemented after we have evaluated the performance of those enhanced features post-construction.
Expenditures: See attached financial documents that correspond with tasks performed by contractors.

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