



December 28, 2007

Mr. George Johnson
City of Santa Barbara
Parks and Recreation Department
620 Laguna St.
P.O. Box 1990
Santa Barbara, CA 93102

**Re: Year 1 Status Report
Arroyo Burro Estuary Restoration Project**

Dear Mr. Johnson,

This letter contains the Year 1 monitoring and maintenance report for the Arroyo Burro Estuary Restoration Project. The restoration began with an initial planting effort in December of 2006, followed by several smaller planting phases in April, October, and December of 2007. This report covers the restoration maintenance assessment and monitoring conducted throughout 2007.

1.0 BACKGROUND INFORMATION

In 2006, the City of Santa Barbara (City) undertook major habitat restoration actions on Mesa Creek and Arroyo Burro Estuary to enhance water quality and expand habitat function. The restoration project included: 1) replacement of the culvert along Mesa Creek with an open revegetated channel; 2) expansion of the estuary 3) revegetation of the site with native plants; 4) modification of the concrete apron under the Cliff Drive bridge to facilitate fish passage; and 5) creation of trails and a footbridge across Mesa Creek to allow pedestrian access to the adjacent Douglas Family Preserve. Permits and approvals were issued for the creek restoration by the U.S. Army Corps of Engineers (ACOE), Regional Water Quality Control Board (RWQCB), and California Department of Fish and Game (CDFG), which require the City to monitor the progress of the restoration and ensure that certain performance criteria for plant growth and weed cover are met throughout the 5-year maintenance period (ending in December 2011). The City must provide annual reports to these agencies on the status of the restoration efforts.

The primary objectives of the habitat restoration are to: 1) improve water quality at the estuary; 2) improve tidewater goby (*Eucyclogobius newberri*) and steelhead trout (*Oncorhynchus mykiss iridius*) habitat; 3) improve potential steelhead trout passage from the

lower estuary to upstream areas; 4) restore Mesa Creek to a functioning riparian system by removing an existing culvert and restoring the streambed vegetation; 5) reduce bank erosion; and 6) transform habitat dominated by exotic plants to an area dominated by appropriate native riparian and scrub vegetation types. The restoration site was planted with several habitat types including riparian woodland, riparian scrub, emergent wetlands, streambed wetlands, native grassland, coastal sage scrub, and a bioswale that captures runoff from the gutter along Cliff Drive. Additionally, brush mattresses made with arroyo willow (*Salix lasiolepis*) cuttings were installed along the most undercut and erosive creek banks on the north and south sides of Mesa Creek at the confluence with the estuary (see Attachment 1: Restoration Landscape Plan).

The initial planting in December 2006 included installation of 3,169 plants (See Attachment 2). Emergent wetland plants were not installed at this time so that they would not get washed out during high flow events. Instead 892 emergent wetland plants were installed along the Mesa Creek channel and Arroyo Burro Estuary in April 2007 (See Attachment 3). The City has involved local community members in the restoration project by offering community planting days such as that held in October 2007 where 315 plants were installed in the area south of Mesa Creek (See Attachment 4). In December 2007, a total of 843 plants were installed as part of a phased approach to install several of the understory species a year after the trees were installed (Attachment 5). Therefore, from the initial planting effort to the end of Year 1, a total of 5,219 native plants have been installed at the restoration site.

2.0 SITE MAINTENANCE

The restoration project includes a 5-year maintenance and monitoring program. Maintenance consists of routine watering and weeding of the site, repairs to the irrigation system, and replacement planting to meet performance criteria. The City's restoration planner inspects the site on a regular basis and provides guidance to the maintenance staff. A description of the routine maintenance activities for Year 1 is summarized below.

2.1 Weed Control

Routine maintenance was conducted at the restoration site by Plowboy Landscapes, Inc., including weed removal and irrigation of the planted areas. City Creek Supervisor, George Johnson inspected the site on a regular basis to determine maintenance needs and direct the maintenance crew. Hand weed removal was performed by a two to three person crew once a week. During the spring, hand weeding efforts were increased to address aggressive weed growth. The entire site was mulched after weeds were hand removed, except for steep slopes.

Non-native plants were collected and disposed of appropriately to prevent re-establishment. Herbicides were not used per compliance with the City's Integrated Pest Management Program. At the conclusion of Year 1, URS biologists, Johanna Kisner and Julie Love conducted a site inspection with the City Creeks Planner, George Thomson, to assess restoration progress and provide guidance to Plowboy Landscapes, Inc. on weeding priorities.

2.2 Irrigation

Drip irrigation was used in Year 1 to reduce transplant shock and compensate for inadequate soil moisture. The irrigation was installed beneath a layer of mulch and will stay in place permanently; however, it will only be used if rainfall amounts are inadequate for healthy plant growth and survival. Drip irrigation is preferred for water conservation and weed abatement because less water will be lost to evaporation and only the installed plants will receive irrigation. Overhead irrigation can increase weed issues because it provides supplemental water to the entire site, promoting weed germination. The irrigation was initially used three times a week for a duration of two to ten minutes. As of December 2007, irrigation was scheduled once a week for twenty to thirty minutes. The irrigation schedule will be adjusted in response to seasonal precipitation changes and plant needs.

2.3 Replacement Planting

No replacement plants were installed during Year 1.

3.0 RESTORATION MONITORING

URS Corporation (URS) has provided guidance and support to the City throughout the planning, implementation, and monitoring phases of this restoration project. In March 2007, URS biologists assisted the City with designing monitoring methods to assess the success of the restoration project. URS will document the progress of the restoration in annual monitoring reports, and provide recommendations to the City in order to meet the performance criteria throughout the 5-year maintenance and monitoring program.

3.1 Methods

Fixed linear point intercept vegetation monitoring transects were established in November 2007 to examine the progress of native plant establishment and weed cover over the 5-year monitoring and maintenance period. The first vegetation transect monitoring event occurred on November 13, 2007. Transects were used to estimate average native plant cover and non-

native plant cover across the restoration site. In addition, categories identifying bare ground, dead plants, wood, rocks, and water were also used to assess percent cover. Twelve transects were established within the project area, crossing three major vegetation types, coastal sage scrub, riparian scrub and riparian woodland (see Attachment 6). Two transects were established in coastal sage scrub areas (Transects A, B). Five transects were established in riparian scrub (Transects D, E, F, K, L), with Transect E being in the bioswale. Four transects were established in riparian woodland (Transects C and G through J), with Transects G through J traversing Mesa Creek and the streambed wetlands in the channel bottom. Transects varied in length between 13 and 39 meters, depending on the width of the planting area. Each transect end point was established using fixed objects such as rocks or trees. Transects were not marked in the field; however, detailed map sketches were made for each transect location.

Once the transect meter tape was fixed in place, URS biologists identified plants at half-meter intervals. Plants observed within five centimeters of the point were recorded. Only the plants native or non-native status was recorded, plants were not identified to species; however, all species and dead plants observed along the transect were recorded. Additionally, bare ground, rocks, water, and dead wood were recorded. For Transects G through J, the start and end of the water line was recorded to the nearest tenth of a meter.

All transect data was entered into an excel spreadsheet to calculate percent cover of native plants, non-native plants, tree canopy cover, and bare ground for each of the twelve vegetation transects. Using excel pivot tables, the average percent cover across all transects was calculated for each category. In order to calculate the percent survival of plants for Year 1, a count of dead plants was conducted on November 13, 2007. URS biologists examined the restoration site and counted dead plants in each habitat type. If the species could be determined, then it was recorded. The total number of dead plants was divided by the total number of installed plants to calculate an approximate percent survival.

Twenty photopoints were established on December 18, 2007, to be used over the 5-year monitoring period to document vegetation growth at various representative areas throughout the restoration site (Attachment 6). Photographs will be taken at photopoints twice a year, once in the spring and once during the fall to capture seasonal variations in plant growth. Year 1 photopoint photographs were taken on December 18, 2006, March 8, 2007, and November 21, 2007 to document vegetation growth at established photopoints (Attachment 7). In addition, photographs were taken on November 13, 2007 at each end of the vegetation transects to document vegetation along the transects compared to other areas of the restoration site (Attachment 8).

3.2 Results

Percent Cover

The percent cover of natives, non-natives, bare ground, dead plants, wood, and water was calculated using the November 13, 2007 transect data. Average percent cover across all transects for each category is shown in Table 1, and percent cover for each transect is shown in Table 2.

**TABLE 1
 AVERAGE PERCENT COVER ACROSS TRANSECTS**

Cover Category	Average Percent Cover
Bare Ground	36
Dead Plants	0
Native Plants	57
Non-native Plants	4
Rocks	1
Water	1
Wood	1
Total	100

**TABLE 2
 YEAR 1 PERCENT COVER PER TRANSECT**

	Bare Ground	Dead Plants	Non-native Plants	Native Plants	Rocks	Water	Wood	Total
Transect A	38	0	0	63	0	0	0	100
Transect B	41	0	3	56	0	0	0	100
Transect C	48	0	5	47	0	0	0	100
Transect D	23	7	0	60	10	0	0	100
Transect E	54	0	0	46	0	0	0	100
Transect F	30	0	0	70	0	0	0	100
Transect G	29	0	8	59	0	3	2	100
Transect H	26	0	2	64	0	4	4	100

	Bare Ground	Dead Plants	Non-native Plants	Native Plants	Rocks	Water	Wood	Total
Transect I	12	0	11	72	4	0	0	100
Transect J	15	0	4	77	0	4	0	100
Transect K	62	0	5	33	0	0	0	100
Transect L	55	0	4	40	0	0	0	100

Native plant cover is the dominate cover with an average of 57 percent for the restoration site. Bare ground constitutes the second largest amount of cover with an average of 36 percent, which for a newly planted restoration site can be expected. Non-native plant cover is minimal with an average of four percent. Rocks, wood, and water each have a cover of one percent, and no dead plants were recorded on the transects.

Evaluated on an individual basis, each transect displayed a similar pattern to the overall restoration site. Native cover had the highest average percent cover per transect, ranging from 33 percent to 77 percent. Bare ground had the second highest averages, ranging from 12 percent to 62 percent. A minimal percentage of non-native plant cover was observed, ranging from zero percent to 11 percent. Water cover is recorded on only three transects, two within riparian woodland, and one within riparian scrub.

Native Cover

Table 2 shows Transects F, I, and J had the highest average percent native cover with over 70 percent cover each, and Transects C, E, L, and K had the lowest average percent native cover with under 50 percent cover each. Table 3 below shows the native species that were observed along each transect. Transects G and H had the highest number of native species with 11 species on each transect. Attachment 9 is a list of all plant species observed at the site in Year 1. Attachments 9 does not provide a complete list of species known to occur at the project site, only species observed during transect monitoring. Several species are only visible in the winter or spring that may not have been observed.

TABLE 3
NATIVE PLANTS OBSERVED ALONG EACH TRANSECT

Scientific Name	Common Name	A	B	C	D	E	F	G	H	I	J	K	L
<i>Acer negundo</i> var. <i>californicum</i>	California boxelder									x			
<i>Alnus rhombifolia</i>	White alder							x	x		x		
<i>Anemopsis californica</i>	Yerba mansa							x	x	x			
<i>Artemisia douglasiana</i>	Mugwort				x	x	x	x					
<i>Baccharis douglasii</i>	Marsh baccharis							x	x		x		
<i>Baccharis pilularis</i>	Coyote bush								x		x		
<i>Baccharis plummerae</i>	Plummer's Baccharis						x						
<i>Baccharis salicifolia</i>	Mule fat							x	x	x	x		
<i>Cornus sericea</i>	Creek Dogwood								x				
<i>Distichlis spicata</i>	Saltgrass			x									
<i>Eleocharis macrostachya</i>	Common spikerush							x	x		x		
<i>Eriogonum parviflorum</i>	Seacliff buckwheat	x											
<i>Euthamia occidentalis</i>	Western goldenrod							x	x	x	x		
<i>Gnaphalium canescens</i>	Everlasting							x					
<i>Heteromeles arbutifolia</i>	Toyon		x									x	
<i>Isocoma menziesii</i>	Coast goldenbush	x	x	x	x								x
<i>Juncus patens</i>	Common rush					x				x	x		
<i>Juncus texilis</i>	Basket rush								x	x	x		
<i>Leymus condensatus</i>	Giant rye grass	x											x
<i>Leymus triticoides</i>	Creeping wild rye									x			
<i>Malacothrix saxatilis</i> var. <i>saxatilis</i>	Coastal cliff aster											x	
<i>Platanus racemosa</i>	Western sycamore	x	x		x								x
<i>Populus balsamifera</i> subsp. <i>trichocarpa</i>	Black Cottonwood							x					
<i>Prunus ilicifolia</i>	Hollyleaf cherry											x	x
<i>Quercus agrifolia</i>	Coast live oak		x		x						x	x	x
<i>Rhus integrifolia</i>	Lemonade sumac		x	x		x		x	x				x
<i>Ribes speciosum</i>	Fuchsia flowered gooseberry					x	x					x	x
<i>Rubus ursinus</i>	California blackberry								x	x	x	x	x
<i>Salix lasiolepis</i>	Arroyo willow		x							x			
<i>Salvia leucophylla</i>	Purple sage	x		x									
<i>Salvia mellifera</i>	Black sage	x	x	x									
<i>Scirpus maritimus</i>	Alkali bulrush							x					
	Total	6	7	5	4	4	3	11	11	9	10	6	8

Non-native Cover

The current weed cover is likely due to germination of the remaining non-native seed bank, and introduction of seed through wind, water, and animal transport. Transects G and I have the highest weed cover at eight and 11 percent cover. More frequent and intensive weed eradication methods should be used in these areas. Transects A, D, E and F have zero percent weed cover, likely due to the weed fabric and mulch used for weed control in these areas. (See Table 2)

Table 4 below shows all the non-native species observed along each of the monitoring transects. Transect H had the highest number of weeds species with eight species. A list of all plant species observed at the restoration site is provided Attachment 9. The most common weeds observed throughout the site include bristly ox-tongue (*Picris echioides*), English plantain (*Plantago lanceolata*), burclover (*Medicago polymorpha*), cheeseweed (*Malva parviflora*), rabbitsfoot grass (*Polypogon monspeliensis*), and bindweed (*Convolvulus arvensis*).

**TABLE 4
 NON-NATIVE PLANTS OBSERVED ALONG EACH TRANSECT**

Scientific Name	Common Name	A	B	C	D	E	F	G	H	I	J	K	L
<i>Agrostis viridis</i>	Water bent grass								X				
<i>Anagallis arvensis</i>	Scarlet pimpernel							X					
<i>Brassica nigra</i>	Black mustard			X									
<i>Chamaesyce maculata</i>	Spotted Spurge			X				X					
<i>Chenopodium spp.</i>	Goosefoot							X	X	X	X		
<i>Conium maculatum</i>	Poison hemlock												X
<i>Convolvulus arvensis</i>	Bind weed							X	X				
<i>Cyperus involucratus</i>	Umbrella plant			X									
<i>Foeniculum vulgare</i>	Sweet fennel							X					
<i>Juglans regia</i>	English walnut				X								
<i>Malva parviflora</i>	Cheeseweed			X					X				
<i>Medicago polymorpha</i>	Bur clover			X									
<i>Nicotiana glauca</i>	Tree tobacco								X				
<i>Oxalis pes-caprae</i>	Bermuda buttercup								X		X	X	X
<i>Plantago lanceolata</i>	English plantain		X	X									
<i>Plantago major</i>	Broadleaf plantain							X					
<i>Polypogon monspeliensis</i>	Rabbitsfoot grass								X	X			
<i>Raphanus sativa</i>	Radish								X				
<i>Rumex spp.</i>	Dock												X

Scientific Name	Common Name	A	B	C	D	E	F	G	H	I	J	K	L
<i>Vicia sativa</i>	Vetch												x
	Total	0	1	6	1	0	0	6	8	2	2	1	4

Plant Health, Growth, and Mortality

The installed plants are healthy and thriving. Many rhizomatous species are spreading and many species have produced seed. Attachment 7 contains the collection of photopoints taken after construction in Year 1. As time progresses, the site is showing a clear and abundant growth of installed plants.

Fifty-eight dead plants were counted during the November monitoring event, not including willow cuttings. The total number of plants installed prior to November 2007 equal 4,376 plants (3,169 plants in December 2006, 892 plants in April 2007, and 315 plants in October 2007). Therefore, the restoration site had a 99 percent survival rate. Mugwort (*Artemisia douglasiana*) had the highest amount of mortality. No replacement plants have been installed and none are required due to a high plant survival rate and good vegetative cover after the first year.

4.0 PERFORMANCE CRITERIA

Performance criteria were established by the CDFG in several conditions attached to the Streambed Alteration Agreement (1600-2004-0229-R5) to determine the success of the restoration project. The specific performance criteria for the CDFG permit condition #52 reads as follows:

“All planting shall have a minimum of 80% survival, by species, the first year and 100% survival thereafter and/or shall retain 75% cover after 3 years and 90% cover after 5 years for the life of the project. Prior to the mitigation site(s) being determined successful, they shall be entirely without supplemental irrigation for a minimum of 2 years. No single species shall constitute more than 50% of the vegetative cover, no woody invasive species shall be present, and herbaceous invasive species, except for grasses, shall not exceed 5% cover. If the survival and cover requirements have not been met, the operator is responsible for replacement planting to achieve these requirements. Replacement plants shall be monitored with the same survival and growth requirements for 5 years after planting.”

CDFG permit condition #50 further specifies minimum height requirements after three and five years for several of the woody species planted at the site. These requirements are listed in Table 5.

**TABLE 5
 HEIGHT REQUIREMENTS BY SPECIES**

Scientific Name	Common Name	Height (feet)	
		3 years	5 years
<i>Juglans californica</i>	Black walnut	7	12
<i>Platanus racemosa</i>	Western sycamore	5	9
<i>Populus fremontii</i>	Fremont's cottonwood	7	12
<i>Quercus agrifolia</i>	Coastal live oak	3	6
<i>Salix lasiolepis</i>	Arroyo willow	10	15
	Scrub	2	4

The CDFG permit condition #53 only requires biennial reports; however, annual reports will be produced for the RWQCB and the City, and thus reports will also be submitted to CDFG annually. Irrigation guidelines included in CDFG permit condition #53 require that irrigation is provided for at least two years after planting, and to be used when natural moisture conditions are inadequate to ensure plant survival. In addition, all plants must survive and grow for at least three years without supplemental water.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The following describes the results of the vegetation monitoring for Year 1 in comparison to the performance criteria, and maintenance recommendations for Year 2.

- The installed plants are healthy and thriving, and have exceeded the performance criteria of 80 percent survival by the end of Year 1 at 99 percent survival. Therefore, no replacement plants are necessary.
- Percent native cover has increased over time and many plants have seeded and/or began vegetative reproduction. The average native plant cover for the restoration site is 57 percent. Riparian woodland areas along Mesa Creek have the highest native cover. By the completion of Year 3, it is anticipated that native plant cover will increase to 75 percent to meet the performance criteria. An addition of 843 plants installed in December 2007

will also increase the vegetation growth to help meet the performance criteria for native cover.

- Average non-native cover was four percent in Year 1, meeting the City's goal and the CDFG performance criteria to maintain weed cover, except for non-native grasses, at less than 5 percent. No woody invasive species were observed at the restoration site.

Weeds are more abundant along Mesa Creek, possibly due to steep slopes covered with coconut netting, which makes hand removal difficult. Therefore, it is recommended that these areas become a priority for weed removal. Weeds that are highly invasive are also a high priority for removal. *Arundo* (*Arundo donax*) was one of the most prevalent and persistent weeds prior to restoration. Although arundo was not observed during monitoring, rhizomes may persist in the soil and/or enter the site from upstream. Special attention should be focused on routine arundo removal to keep it under control. Cape ivy (*Delairea odorata*) is another highly invasive weed found in small numbers on site and in adjacent areas and will likely need to be removed routinely to keep it under control.

Weed removal should be prioritized to maximize survival of native plants and minimize further spread of weeds. A 3-foot radius around each container plant should be cleared by hand to eliminate competition for resources. Weeds should be removed completely and/or flowering stalks cut prior to seeding to prevent increased non-native cover throughout the restoration site. Any weeds containing seeds should be removed, bagged, and disposed of in trash containers to reduce contamination of the seed bed.

It is recommended that weeds be controlled using manual methods including hand removal, weed whacking, mulching, and, if possible, limited herbicide treatment. Several weeds at the project site can only be removed effectively through the use of herbicides including Bermuda grass, arundo, and Bermuda buttercup. If herbicide is not allowed, these species should be hand removed with shovels and immediately covered with at least four inches of mulch. Cape ivy should be carefully hand removed from its host vegetation. If possible, continue to seek permission to use limited herbicides on weeds that cannot be effectively removed through mechanical methods.

- Established native plants along with newly installed plants will be irrigated with the drip irrigation system as needed depending on rainfall in Year 2. All native plants will be monitored to ensure they receive adequate water.
- Erosion did not appear to be an issue along the creek banks, beds or the estuary.

Mr. George Johnson
City of Santa Barbara Parks and Recreation Department
December 28, 2007
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The performance criteria for plant survival, native cover, and weed cover were achieved in Year 1. By following the weeding recommendations mentioned above, it is anticipated that weed cover can be maintained below five percent cover throughout Year 2.

Please call me if you need additional information or have any questions.

Sincerely,



Johanna Kisner
Project Manager/Senior Biologist

cc: George Thomson, City Creeks Planner

List of Attachments

- Attachment 1 Restoration Landscape Plan
- Attachment 2 December 2006 Planting List
- Attachment 3 April 2007 Planting List
- Attachment 4 October 2007 Planting List
- Attachment 5 December 2007 Planting List
- Attachment 6 Vegetation Transects and Photopoint Location Map
- Attachment 7a Photopoint Photographs – December 18, 2006
- Attachment 7b Photopoint Photographs – March 8, 2007
- Attachment 7c Photopoint Photographs – November 21, 2007
- Attachment 8 Transect Photographs – November 13, 2007
- Attachment 9 Project Site Plant Species List