



CITY OF SANTA BARBARA IRRIGATION OF NATIVE PLANTS WITH RECYCLED WATER AT THE ARROYO BURRO ESTUARY RESTORATION PROJECT

Background

In an attempt to limit the use of potable water for irrigation purposes, the Creeks Division entered into an agreement with the Water Resources Division to test the effectiveness of irrigating native riparian plants with recycled water. The location for the test was the Arroyo Burro Estuary Restoration project site. The agreement allowed the Creeks Division to install two water meters at the restoration site, one for potable water and one for recycled water. This provided flexibility in testing the effectiveness of using recycled water for irrigation by allowing staff to switch between water sources dependent on plant health /growth. Staff agreed that if the recycled water was clearly impacting the health of the plants, the entire site would be switched to potable water and that if the recycled water did not impact the health of the plants, the entire site would be switched to recycled water. A time frame for when to switch between water sources was not part of the agreement.

In order to easily identify the two different irrigation areas, the project site was split into two parts of roughly equal size (.75 acres) along a north south axis. The potable water was used on the north side of the creek and the recycled water was used on the south side of the creek. The site characteristics were fairly uniform except that the south side of the creek is against a steep hill, which created more shade than on the north side of the creek (especially during the winter months when the sun is low on the horizon.)

Additional water saving measures were designed into the project, which included limiting irrigation to a five year plant establishment period and utilizing a drip irrigation system rather than an overhead irrigation system.

Results

The site was monitored on a regular basis (approximately once every two weeks). Monitoring consisted of visually inspecting the site for plant health, weed infestations, and irrigation coverage. A landscaping contractor performed maintenance of the site once a week which consisted mostly of weed removal and irrigation repair. In addition, an intensive plant survey (using transects and photographs) was performed on an annual basis, which evaluated the native and nonnative plant coverage, tree heights and plant health. During the first year of monitoring (2007), no significant differences between the potable and recycled water were apparent. However, it did appear that the plants irrigated with recycled water were growing slower and had less coverage than the plants being irrigated with potable water. The differences were not significant but were noticeable. The apparent slower growth rates could have been related to the additional shading; therefore, it is inconclusive whether the recycled water had any impact on

growth rates during the first year. If it did impact growth, it was minimal and should not discourage the use of recycled water.

During the first year, there was significant die-off of two species of plants: lemonade berry and toyon. This occurred within both areas but seemed more severe in the recycled water area. Staff thinks the die-off could have been related to a severe frost, which occurred about a month after planting. Again, the shaded area would be more impacted by this event and so it is difficult to determine what, if any, impact the recycled water had on the plants.

The second year of monitoring (2008) did not reveal any noticeable differences between the plants being irrigated with recycled water and the plants being recycled with potable water.

Because recycled water did not appear to be impacting plant health, we switched the entire site to recycled water in February 2009. The plants previously irrigated with potable water have remained healthy since switching water sources.

Rainfall at the project site has been low for the last three years when compared to historical averages. It has been reported that recycled water can sometimes result in build-up of salts in the soil. The soil around the plants was not tested for salinity but there appears to be no excessive salt build-up in the soil because plants are healthy and growing vigorously.

Conclusions/Next Steps

It should be noted that this report is not based on scientific evidence and all conclusions/results were based on personal observations. A long-term scientific study would need to be performed to verify the impact of recycled water on native plants.

Overall, the use of recycled water did not appear to impact the growth or health of any of the plants. Plant growth at the site for both potable and recycled water was very vigorous and so far all planting goals for the restoration area have been met. In the future, staff supports using recycled water to irrigate native plants for restoration with the following two conditions: 1) Use of recycled water with drip irrigation systems only (since overhead irrigation on native plants has not been tested). 2) Use of recycled water for irrigating native plants as long as future evidence/studies indicate no problems/issues with plant health or surface water quality.

Staff will be conducting a third year of plant monitoring in November 2009. Results of the plant survey will be available in January 2010. If any health issues are identified during the plant survey that could be attributed to recycled water use, this report will be updated. Staff will stop irrigating the site in December 2009. Staff will update this report if any new information/observations are made over the next two years, which would change the results of this report.

Scientific Name	Common Name
_*	Weedy violet
<i>Acer negundo</i> var. <i>californicum</i>	California boxelder
<i>Agrostis viridis</i> *	Water bent grass
<i>Alnus rhombifolia</i>	White alder
<i>Anagallis arvensis</i> *	Scarlet pimpernel
<i>Anemopsis californica</i>	Yerba mansa
<i>Artemisia californica</i>	California sagebrush
<i>Artemisia douglasiana</i>	Mugwort
<i>Aster subulatus</i> var. <i>ligulatus</i>	Aster
<i>Atriplex triangularis</i>	Spearscale
<i>Baccharis douglasii</i>	Marsh baccharis
<i>Baccharis pilularis</i>	Coyote bush
<i>Baccharis plummerae</i>	Plummer's baccharis
<i>Baccharis salicifolia</i>	Mule fat
<i>Bolboschoenus maritimus</i>	Alkali bulrush
<i>Bolboschoenus robustus</i>	Big bulrush
<i>Brassica nigra</i> *	Black mustard
<i>Calystegia macrostegia</i>	Coastal morning glory
<i>Chamaesyce maculata</i> *	Spotted spurge
<i>Conium maculatum</i> *	Poison hemlock
<i>Conyza bonariensis</i> *	South American horseweed
<i>Cornus sericea</i>	Creek dogwood
<i>Cortaderia selloana</i> *	Pampas grass
<i>Cynodon dactylon</i> *	Bermuda grass
<i>Cyperus eragrostis</i>	Tall flatsedge
<i>Cyperus involucratus</i> *	Umbrella plant
<i>Distichlis spicata</i>	Saltgrass
<i>Eleocharis macrostachya</i>	Common spikerush
<i>Encelia californica</i>	California sunflower
<i>Epilobium canum</i>	California fuchsia
<i>Eriogonum parvifolium</i>	Seacliff buckwheat
<i>Eschscholzia californica</i>	California poppy
<i>Euthamia occidentalis</i>	Western goldenrod
<i>Foeniculum vulgare</i> *	Sweet fennel
<i>Gnaphalium canescens</i>	Everlasting
<i>Gnaphalium luteo-album</i> *	Everlasting

Scientific Name	Common Name
<i>Heteromeles arbutifolia</i>	Toyon
<i>Isocoma menziesii</i>	Coast goldenbush
<i>Juglans californica</i> var. <i>californica</i>	Black walnut
<i>Juglans regia</i> *	English walnut
<i>Juncus patens</i>	Common rush
<i>Juncus textilis</i>	Basket rush
<i>Leymus condensatus</i>	Giant rye grass
<i>Leymus triticoides</i>	Creeping wild rye
<i>Lobularia maritime</i> *	Sweet alyssum
<i>Lonicera subspicata</i> var. <i>subspicata</i>	Santa Barbara honeysuckle
<i>Lotus corniculatus</i> *	Birdfoot trefoil
<i>Malacothrix saxatilis</i> var. <i>saxatilis</i>	Coastal cliff aster
<i>Malacothrix saxatilis</i> var. <i>tenuifolia</i>	Coastal cliff aster
<i>Melica imperfecta</i>	Melic grass
<i>Mimulus aurantiacus</i>	Sticky monkey flower
<i>Nassella pulchra</i>	Purple needle grass
<i>Nasturtium officinale</i> *	Watercress
<i>Nicotiana glauca</i> *	Tree tobacco
<i>Oxalis pes-caprae</i> *	Bermuda buttercup
<i>Piptatherum miliaceum</i> *	Smilo grass
<i>Plantago major</i> *	Broadleaf plantain
<i>Platanus racemosa</i> var. <i>racemosa</i>	Western sycamore
<i>Poa annua</i> var. <i>annua</i> *	Annual bluegrass
<i>Polygonum arenastrum</i> *	Common knotweed
<i>Polypogon monspeliensis</i> *	Rabbitsfoot grass
<i>Populus trichocarpa</i>	Black cottonwood
<i>Prunus ilicifolia</i>	Hollyleaf cherry
<i>Quercus agrifolia</i>	Coast live oak
<i>Rhamnus californica</i>	Coffeeberry
<i>Rhus integrifolia</i>	Lemonade berry
<i>Ribes speciosum</i>	Fuschia flowered gooseberr
<i>Rosa californica</i>	California rose
<i>Rubus ursinus</i>	California blackberry
<i>Rumex crispus</i> *	Curly dock
<i>Rumex</i> spp.*	Dock
<i>Salicornia virginica</i>	Pickleweed
<i>Salix laevigata</i>	Red willow

Scientific Name	Common Name
<i>Salix lasiolepis</i>	Arroyo willow
<i>Salvia leucophylla</i>	Purple sage
<i>Salvia mellifera</i>	Black sage
<i>Salvia spathacea</i>	Hummingbird sage
<i>Sambucus mexicana</i>	Mexican elderberry
<i>Schoenoplectus californicus</i>	California bulrush
<i>Sisyrinchium bellum</i>	Blue-eyed grass
<i>Solanum douglasii</i>	Douglas nightshade
<i>Solidago californica</i>	California goldenrod
<i>Sonchus</i> spp.*	Sowthistle
<i>Stachys bullata</i>	Wood mint
<i>Symphoricarpos mollis</i>	Snowberry
<i>Toxicodendron diversilobum</i>	Poison oak
<i>Urtica dioica</i>	Stinging nettle
<i>Verbena lasiostachys</i>	Common verbena
<i>Vicia sativa</i> *	Vetch

*non-native plant species