

Bull Creek

Section 1135 Preliminary Restoration Plan

1. Project.

Environmental restoration for the Bull Creek channel within the City of Los Angeles, Los Angeles County, California.

- a. **Name of Modification:** Bull Creek Channel Ecosystem Restoration.
- b. **Project Being Modified:** Sepulveda Flood Control Basin, Los Angeles County, California.
- c. **Date Constructed:** Construction of the Sepulveda Dam and Flood Control Basin was completed in December 1941 by the U.S. Army Corps of Engineers, Los Angeles District. Recreation uses of the Basin began in 1974.
- d. **Authorized Purpose:** Sepulveda Dam was authorized by the Flood Control Act of 1936. The primary purpose of the project as set forth in the Flood Control Act of 1936 is flood control. The Flood Control Act of 1941 incorporated the Sepulveda Flood Control Dam into the comprehensive plan for control of floods in the Los Angeles County drainage area. Subsequent Acts of Congress (1944, 1946, 1954, 1960, 1962, 1965) authorized recreational uses of the Sepulveda basin as a secondary project purpose. Sepulveda recreation lake and other components of Bull Creek Park were authorized by a special Act of Congress know as the Supplemental Appropriations Bill, 1985.

2. Location.

Sepulveda Detention Basin is the 2,097 acre site of a flood control dam/reservoir completed in 1941 on the Upper Los Angeles River. It is located in the San Fernando Valley area of the City of Los Angeles, two miles southwest of the community of Van Nuys and about 10 miles west of the City of Burbank.

The project area contains the last 3000 feet of the Bull Creek channel, which flows north to south from Victory Boulevard to the Los Angeles River (See Figure 1). The project area is bounded by Lake Balboa Park to the east and Balboa Boulevard to the west. Residential development adjoins the project area to the north.

The project area is readily accessible by two major freeways - the Ventura Freeway (U.S. Highway 101) and the San Diego Freeway (Interstate 405) - and several major arterials including Sepulveda, Ventura, Van Nuys, Burbank, Victory Boulevards, and White Oak Avenue.

3. Description of Proposed Ecosystem Restoration

a. Summary of Proposed Modification.

The proposed project would develop approximately 26.1 acres of aquatic, riparian, and native upland habitat to enhance and restore wildlife resources along the Bull Creek channel within the Sepulveda Detention Basin. Currently the site contains a mixture of native and exotic species. *Arundo* (*Arundo donax*), an extremely invasive exotic plant, has become established in the channel and is rapidly displacing native vegetation.

The proposed project would restore scarce, high-value wildlife habitat to an area that has been heavily impacted by urbanization. Over the years the channel has been straightened and flood flows have scoured the channel to a depth of approximately 20 feet with steep, unstable side slopes (2:1 – 1:1). As a result, the artificial channel cross-section provides little support to sustain a healthy riparian system needed to attract and sustain area wildlife. Debris from upstream pollutes the channel. It has been estimated that as much as 97% of the riparian community has been eliminated from Southern California floodplains (Faber et al., 1989). As such, restoration of aquatic ecosystems is considered a high priority in a national restoration agenda (National Research Council, 1992).

The existing site supports limited aquatic habitat fed by urban run-off upstream and reclaimed water discharged into the lower part of the channel. The remaining area supports disturbed riparian vegetation and turf areas. The proposed project would restore and expand aquatic and riparian habitats, and restore associated habitats. The proposed habitats and approximate acreage are as follows:

- Aquatic 2.6 acres.
- Riparian woodland 10.0 acres.
- Woodland 5.5 acres.
- Grassland 7.5 acres.
- Ruderal/disturbed 0.5 acres.

The ruderal/disturbed habitat includes areas needed for maintenance access, miscellaneous structures, and areas that are unable to be restored.

In addition to restoring native flora and fauna to the area, the proposed project would have potential positive impacts on the following resources:

- Water quality, due to the removal of trash and unwanted debris.
- Socio-economics, due to the potential increase in real estate values that riparian aesthetics typically have on neighboring communities.
- Education, due to the creation of areas for bird/animal observation, interpretation, and potential uses for school field trips, etc.

b. Existing Corps Project; Federal Causes of Degradation and Consequential Results.

Bull Creek drains an area of approximately 25 square miles. As the drainage area became more urbanized, the storm flow velocities increased and the sediment loads decreased. When these flows reached the unprotected channel segment within the Sepulveda Basin, they scoured the existing 20 feet deep channel. The addition of rip-rap and other flood control structures to protect the unstable banks further disturbed existing habitat. The use of the Sepulveda Basin for recreation degraded habitat with the planting of a turf monoculture above the banks. These actions weakened the native habitat, allowing exotic species to prosper.

c. Proposed Project Features.

The proposed project would restore approximately 26.1 acres of native habitat by regrading the banks and enhancing the existing stream flow. The restored area would support the following habitat types (relative acreage shown is preliminary and would be reanalyzed during the next phase of the study):

- Aquatic 2.6 acres.
- Riparian woodland 10.0 acres.
- Woodland 5.5 acres.
- Grassland 7.5 acres.
- Ruderal/disturbed 0.5 acres.

A naturalistic progression would be created for the habitats listed above. The banks would be regraded to be less steep and an oxbow-like area would be created to the west of the channel. Reclaimed water from Lake Balboa would be released into the channel near the 'oxbow' to enhance the existing flow, resulting in an island that may be closed to people during nesting periods (Refer to Figure 1, Conceptual Restoration Plan). A debris collector would be installed at the upstream extents of the project area to prevent unwanted debris from entering the restored habitat area. Interpretive nodes would be placed to allow educational use of the site. These would be connected by paths that double as maintenance access. Bridges would span the channel to allow pedestrian/maintenance access. These bridges would also serve as overlooks, allowing people to see along the channel into the core of the habitat areas. An unobtrusive fence would be installed along the paths and interpretive nodes. The fence would provide a psychological barrier, suggesting people should remain on the path and away from habitat areas. Signs could reinforce this.

To increase the chances of success, the restoration of native habitat would be phased over 3 years. The majority of plants would be installed in the initial construction phase (first year). The second and third year, exotic plants would be removed and additional native plants installed to provide the appropriate habitat density. A temporary irrigation system using reclaimed water will be needed to establish the plantings.

There would be no adverse impact to the flood control capacity of the channel. The 'oxbow' area would actually increase capacity.

d. Project Purpose

The purpose of this project is to restore high quality riparian and upland habitat suitable for wildlife native to the area.

1) Degradation History

Before the construction of the Sepulveda Detention Basin, the area around Bull Creek was used for residential housing. It is assumed that the channel was straightened at this time. After the construction of the Basin, the site was leased for agricultural purposes. In recent years, the agricultural applications have been replaced by recreational uses by the City of Los Angeles Department of Recreation and Parks. As the drainage area served by Bull Creek became more developed, the storm flow velocities increased and the sediment loads decreased. When these flows reached the unprotected channel segment within the Sepulveda Basin, they scoured the existing 20' deep channel. The addition of rip-rap and other flood control structures to protect the unstable banks further degraded existing habitat.

2) Existing Condition

Channel erosion and deposition appear to be in equilibrium at normal flows. *Arundo (Arundo donax)*, an extremely invasive exotic plant, has become established in the channel and is rapidly taking over, to the detriment of native plant and animal species. Castor Bean (*Ricinus communis*), and Fountain Grass (*Pennisetum setaceum*) are also found in the channel. Above the channel banks a turf monoculture has been planted to support recreational uses. Turf provides low-value wildlife habitat.

Over 200 species of birds have been seen in the Sepulveda Basin.

3) Future Condition

Wildlife in the area has been greatly altered from natural conditions due mostly to heavy urbanization and channelization. These deleterious conditions are expected to continue. Because of the rarity of riparian areas in an arid, urban environment, any open water that is available becomes important habitat for migratory or over-wintering shorebirds, waterfowl, and raptors. Recent observations indicate the presence of waterfowl, shorebirds, and migratory birds in the area. Continued urbanization and invasion by exotic species is expected to diminish useful habitat in the future.

By increasing multi-layered, diverse native vegetation cover, and increasing the amount of habitat and habitat 'edge', existing habitat is expected to be significantly improved. Aquatic habitat is expected to greatly benefit birds and migratory waterfowl. Section 3e, 'Project Outputs,' conceptually quantifies the increased habitat outputs associated with the proposed project.

e. Project Outputs

This section provides a preliminary assessment of existing and future biological outputs for an ecosystem restoration project. The goal of the project is to restore a variety of habitat types that have been degraded within the project area. A similar methodology would be used in the Ecosystem Restoration Report (ERR) as discussed in Section 3j, "Study Methodologies," below. This preliminary assessment is based on a modified Habitat Evaluation Procedure (HEP) approach. The intent is to quantitatively value without- and with-project biological outputs in terms of habitat units. Habitat units are derived from assigning an area of a certain community type a 'habitat suitability index', or habitat value. This value multiplied by the area of the particular community type provides the habitat units for that specific area. Values are given as a range of 0.0 to 1.0, with 1.0 being the highest habitat suitability rating. In this assessment, the following rating criteria were used to assess habitat value of different community types: presence of wildlife, diversity of wildlife, diversity of vegetation, structure of vegetation, and amount of habitat edge. The different community types are habitat indicators, and consist of aquatic, riparian woodland, woodland, grassland, and ruderal/degraded communities.

Table 1 below, identifies habitat values based on without- and with-project conditions of the area using the rating criteria explained above. The analysis incorporates the following assumptions:

- Under a no-Federal-action condition, the aquatic habitat that exists within the project area will provide roughly the same quality habitat.
- Under a no-Federal-action condition the existing ruderal/degraded habitat has low productivity, lacks diversity, has few native plants, and has little layering in its vegetative structure. This is expected to worsen due to continued degradation and the expansion of exotic species .
- Increases in habitat values associated with the proposed habitat types assume that the project will be designed and maintained to maximize potential values. Therefore:
 - Multi-layered structure will be designed into the riparian woodland, woodland, and grassland communities.
 - Habitats, including aquatic habitat, will be expanded to increase the habitat 'edge.'
 - Some system for trash removal from the stream will be required at the upstream extent of the project area.

The modified HEP analysis indicates that the habitat output associated with the project site in the future without-project and with-project conditions total 1.0 and 16.7 habitat units, respectively. Therefore, implementation of the proposed project would result in an increase of 15.7 habitat units. It should be noted that the acreage and habitat units shown for the respective habitat types are approximate and would be revisited during the next phase of study to help maximize overall habitat value.

Table 1. Modified HEP Analysis

Habitat Type and Rating Factor		Without-Project Habitat Values		With-Project Habitat Values
		Existing	Future	Future
Existing ruderal habitat				
	Wildlife Present	.3	.2	.6
	Diversity of wildlife	.1	.1	.7
	Diversity of native vegetation	.2	.1	.5
	Multi-layering vegetation structures	.3	.1	.6
	Amount of habitat "edge"	.2	.2	.7
	Average Habitat Value	.2	.1	.6
	Acreage	6	6	0.5
	Habitat Units (avg. hab. val. x acres)	1.3	0.8	.3
Aquatic habitat				
	Wildlife Present	.2	.2	.5
	Diversity of wildlife	.2	.2	.4
	Diversity of native vegetation	.2	.2	.6
	Multi-layering vegetation structures	.2	.2	.5
	Amount of habitat "edge"	.2	.2	.6
	Average Habitat Value	.2	.2	.5
	Acreage	.7	.7	2.6
	Habitat Units (avg. hab. val. x acres)	.1	.1	1.4
Riparian woodland habitat				
	Wildlife Present	0	0	.7
	Diversity of wildlife	0	0	.7
	Diversity of native vegetation	0	0	.6
	Multi-layering vegetation structures	0	0	.7
	Amount of habitat "edge"	0	0	.7
	Average Habitat Value	0.0	0.0	.7

	Acreage	0.0	0.0	10.0
	Habitat Units (avg. hab. val. x acres)	0.0	0.0	6.8
Woodland habitat				
	Wildlife Present	0	0	.6
	Diversity of wildlife	0	0	.7
	Diversity of native vegetation	0	0	.6
	Multi-layering vegetation structures	0	0	.7
	Amount of habitat "edge"	0	0	.7
	Average Habitat Value	0.0	0.0	.7
	Acreage	0.0	0.0	5.5
	Habitat Units (avg. hab. val. x acres)	0.0	0.0	3.6
Grassland habitat				
	Wildlife Present	0	0	.6
	Diversity of wildlife	0	0	.6
	Diversity of native vegetation	0	0	.7
	Multi-layering vegetation structures	0	0	.5
	Amount of habitat "edge"	0	0	.7
	Average Habitat Value	0.0	0.0	.6
	Acreage	0.0	0.0	7.5
	Habitat Units (avg. hab. val. x acres)	0.0	0.0	4.7
TOTAL ACREAGE		6.7	6.7	26.1
OVERALL AVG. HABITAT VALUE		.4	.3	3.1
TOTAL HABITAT UNITS		1.5	1.0	16.7

f. Importance of Project Benefits

Restoration of riparian habitat in this arid environment is invaluable. Restoration and reintroduction of riparian habitat plus aquatic habitat will allow for increased use by native and migratory wildlife. More importantly, reestablishment of these habitats will aid in providing habitat values into the future within an area that is becoming increasingly degraded by succession of non-native habitat species and the effects of urbanization. Because of this increasing degradation, riparian areas are becoming a rarity within the region with an associated devastating impact on wildlife. Reintroduction of native vegetative species along with open water areas will support and provide protection for native wildlife. These areas may be used by endangered and threatened species in the future. Aquatic habitat is expected to benefit migratory waterfowl such as ducks, geese, and herons. Birds expected to use the restored woodland habitat could include egrets, mourning doves,

hummingbirds, wrens, shrikes, and sparrows. Historical records indicate Bull Creek was a significant 'migrant trap', attracting a rare warbler species in particular. By restoring high value habitat, the 'migrant trap' effect of Bull Creek could be restored.

The introduction of reclaimed water further upstream than the existing discharge point will support vegetative growth needed for habitat. The habitat restoration could provide the following benefits:

- Water quality, due to the removal of trash and unwanted debris.
- Socio-economics, due to the potential increase in real estate values that riparian aesthetics typically have on neighboring communities.
- Education, due to the creation of areas for bird/animal observation, interpretation, and potential uses for school field trips, etc.

Historically, riparian areas have been ignored and devalued as productive habitat. Research has shown that riparian areas perform valuable functions, such as:

- Providing foraging habitat, resting stopovers and wintering grounds for migratory waterfowl.
- Supporting high species diversity.
- Providing protection for endangered and threatened species.
- Providing opportunities for education.
- Constituting a reservoir of biodiversity.

In an expansive urban setting such as Los Angeles, these benefits are multiplied because of the rarity of or distance to quality riparian habitat.

g. Status of LERRDs

This section relates to requirements for project land, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas (LERRDs). The lands at the Sepulveda Basin are owned by the U.S. Army Corps of Engineers. The majority of these are leased to the City of Los Angeles, Department of Recreation and Parks, for recreational development. The Bull Creek Channel is on land leased to the City of Los Angeles Department of Recreation and Parks by the U.S. Army Corps of Engineers.

h. Other Ongoing or Proposed Actions

The Basin will continue to be developed for recreation uses. Currently a plan is being formulated for passive recreation in the area between Bull Creek and Balboa Boulevard. This plan would work cooperatively with the restoration of Bull Creek. The City of Los Angeles is looking at restoring habitat in the River. If the Los Angeles River restoration efforts coincide with Bull Creek restoration efforts, a shortage of plants or other materials may occur.

Coordination between the Corps and the City of Los Angeles should occur to prevent any conflicts

i. Study Methodologies

A Modified Habitat Evaluation Procedure (HEP) will be prepared in the Ecosystem Restoration Report (ERR) and used to assess conditions in the study area. The Modified-HEP is used to document quality and quantity of available habitat for selected wildlife species and/or habitat elements. The Modified-HEP provides information for two general types of wildlife comparisons: 1) the relative value of different areas at the same point in time; and 2) the relative value of the same area at future points in time. By combining the two types of comparisons, the impact of proposed or anticipated land and water use changes on wildlife habitat can be quantified.

The Modified-HEP analysis will assess and quantify existing biological conditions within the study area and to project future environmental conditions under the proposed project

The Modified-HEP is based on the assumption that a Habitat Quality Index (HQI) can be used to describe habitat for selected wildlife species or habitat elements. HQI values are assigned to individual cover types based on the vegetation type, structure and corresponding potential of that cover type to support multi-species and/or sensitive species indicative of a healthy, viable wetlands system. The habitat values calculated for future with-project conditions are compared to estimated habitat values for future without-project conditions to identify and quantify net environmental benefits and/or detriments.

4. Consistency Statement

The proposed project modification is consistent with the flood control purposes of Bull Creek and the Sepulveda Detention Basin, and would not affect the degree of protection provided by the channels. The proposed project modification will provide habitat types similar to those that existed prior to straightening of the channels and urbanization of the area. This will provide restoration of ecosystem habitat.

5. Views of Sponsor

The City of Los Angeles has provided a letter of intent for this project (attached).

6. Views of Federal, State, and Regional Agencies

Prior to finalization of this Preliminary Restoration Plan, Coordination would need to take place with affected and interested agencies. A meeting should be conducted to determine overall project support and to seek input. Participation would include representatives of the City of Los Angeles, California Department of Fish and Game (CDFG), United States Fish and Wildlife Service (USFWS), United States Environmental Protection Agency (USEPA), and local legislative representatives.

7. Status of Environmental Compliance

An Environmental Assessment (EA) will be prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended and in conjunction with the development of the ERR. The Draft EA will be released for a 30-day public review and comment period. Upon completion of the public review period, comments provided on the adequacy of the document will be addressed by the Corps; comments will be incorporated into the EA; the EA will be finalized; and the Finding of No Significant Impacts (FONSI) will be prepared. As required by NEPA, all appropriate Federal and State statutes will be complied with, including but not limited to, Endangered Species Act (ESA), Fish and Wildlife Coordination Act (FWCA), the Clean Water Act (CWA), Clean Air Act (CAA), and National Historic Preservation Act (NHPA). The U.S. Fish and Wildlife Service will be coordinated with pursuant with the FWCA, to ensure project implementation results in either no or beneficial effects on Federally-listed species (potentially) occurring in the project area, pursuant with the ESA.

8. Costs and Benefits

a. Cost Benefit Analysis

The implementation cost for the proposed project is estimated at \$4,062,721. This includes preparation of the Ecosystem Restoration Report (ERR), planning, design, and construction. The cost to complete the ERR is estimated at \$280,000 (see Table 2). The cost for the design and construction of the restoration project is estimated at \$3,782,721 (see Table 3). Future Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) requirements would include several years of maintenance of the restoration area at an estimated average annual cost of \$100,000.

Primary environmental benefits include the restoration of riparian habitat areas that are disappearing from the study area. Approximately 16.7 habitat units would be generated by the proposed plan, representing 15.7 habitat units over the no-action plan. This results in a per-habitat unit cost of approximately \$244,000.

The introduction of riparian and wetland habitat to the study area will allow for a return of native and migratory wildlife to the area. More importantly, re-establishment of riparian habitat in the area will aid in protection of sensitive native wildlife species and support high species diversity. Due to increased urbanization and 'hard channel' flood control measures in the study area, riparian habitat is rare. Reintroduction of native riparian vegetation and wetlands will support diverse flora and fauna. The riparian habitat will also have an indirect but very positive impact on real estate, socio-economics, and air quality of the area. Restoration of riparian habitat in an urban, semi-arid environment, such as the study area, is invaluable.

b. Institutional and Public Recognition

The inherent value of wetland ecosystems and biological functions they provide are acknowledged in the following Federal Statutes and Executive Orders:

- Clean Water Act of 1977 (33 U.S.C 1251 et seq., Public Law 92-500)
- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901-3932)
- Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.)
- Executive Order 11988 Floodplain Management
- Executive Order 11990 Protection of Wetlands
- Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2911)
- National Environmental Policy Act of 1969 (42 U.S.C 432- 4347)
- North American Wetlands Conservation Act (16 U.S.C. 4401 et seq.)
- Water Resources Development Act (various Public Laws)
- Wild and Scenic River Act (16 U.S.C. 1271 et seq.)

c. Operation, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R)

OMRR&R costs would include periodic maintenance and upkeep of the trash control structure(s), and weed removal at an estimated annual cost of \$100,000.

d. Funding Source Statement

The local funding source for the non-Federal funds is the City of Los Angeles. Contributing funds are not Federal.

9. Schedule

The proposed project is scheduled for completion in FY ???. Based on an ERR start date of ?. A preliminary schedule is provided below:

<i>Task</i>	<i>Date</i>
LAD and Sponsor Review	?
SDP Review	?
HQUSACE Review and Approval.....	?
Initiate ERR	?
Circulate Draft EA	?
Complete ERR, FONSI, and Draft PCA.....	?
SPD ERR/PCA Approval	?
Initiate Plans & Specs	?
Complete Plans & Specs.....	?
Execute PCA.....	?
Award Contract.....	?
Complete Construction	?

10. Supplemental Information

Not applicable.

11. Financial Data

Project Modification Costs are as follows. [Note: Costs in this PRP are preliminary and subject to additional District and City of Los Angeles review.]

	Total	Non-Federal	Federal	Fed. Funding Needs	
				FY 99	FY+1
Reports	\$ 280,000		\$ 280,000	\$ 280,000	
Plans & Specs	\$ 324,697		\$ 324,697		\$ 324,697
Construction	\$ 3,458,024	\$ 864,506	\$2,593,518		\$2,593,518

Total	\$ 4,062,721	\$ 864,506	\$ 3,198,215	\$ 280,000	\$ 2,918,215
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b.) Non-Federal Requirements (Estimate)

LERRD	\$ 0
Cash	\$864,506
Work in Kind	\$ 0
Annual OMRR&R	\$ 0,000

12. Federal Allocations to Date

Preliminary Restoration Plan	\$0
Ecosystem Restoration Plan	\$0
Plans and Specifications	\$0
Construction	\$0

June 1999

?
?

**Environmental Planning Section
South Pacific Division
Los Angeles District**

[Note: Costs in this PRP are preliminary and subject to additional District and City of Los Angeles review.]

Table 2. Cost Estimate for Environmental Restoration Report

Work Element				Estimated Cost
Planning Management				
Program Management				\$ 30,000
Study Management				\$ 25,000
Plan Formulation				\$ 15,000
Report Preparation & Review				\$ 25,000
PCA Development				\$ 5,000
Technical Review (QA/QC)				\$ 10,000
			Subtotal	\$ 110,000
Environmental Resources				
NEPA Documentation/Analysis				\$ 25,000
Biological Inventory/Habitat Analysis				\$ 30,000
Coordination & Documentation				\$ 10,000
Cultural Resources Assessment				\$ 5,000
			Subtotal	\$ 70,000
Engineering Management				
Hydrology & Hydraulics				\$ 25,000
Engineering & Design				\$ 35,000
Surveys & Mapping				\$ 25,000
HTRW Studies				\$ 5,000
Cost Estimates				\$ 10,000
			Subtotal	\$ 100,000
			Total	\$ 280,000

[Note: Costs in this PRP are preliminary and subject to additional District and City of Los Angeles review.]

Table 3. Environmental Restoration Preliminary Construction Cost Estimate

Preliminary Construction Cost Estimate				
Item Description	Quantity	Unit	Unit Cost	Total
Water Distribution System	1	ls	\$225,000	\$ 225,000
Excavation / Grading	250,000	cy	\$5	\$ 1,250,000
Interpretive Site Amenities	1	ls	\$70,350	\$70,350
Concrete Fencing	1,000.0	lf	\$19	\$ 19,000
Debris Basin	1.0	ls	\$82,500	\$ 82,500
Bridge w/ Abutments	4 Bridge 1.0	ls	\$161,150	\$ 161,150
Oxbow Crossing	1.0	ls	\$50,000	\$50,000
Stabilized DG Paths	37,100.0	lf	\$9	\$326,480
Aquatic / Riparian Habitat Development	12.6	ac	\$35,000	\$441,000
Woodland / Grassland Habitat Development	13.0	ac	\$20,000	\$ 260,000
Irrigation System	1,136,916	sf	0.23	\$261,491
Operation, Maint., and Replacement (per yr.)	1	ls	\$100,000	\$100,000 300,000
			Subtotal	\$ 3,246,971
Supervision & Administration				\$ 211,053
Engineering & Design				\$ 324,697
			Total	\$ 3,782,721

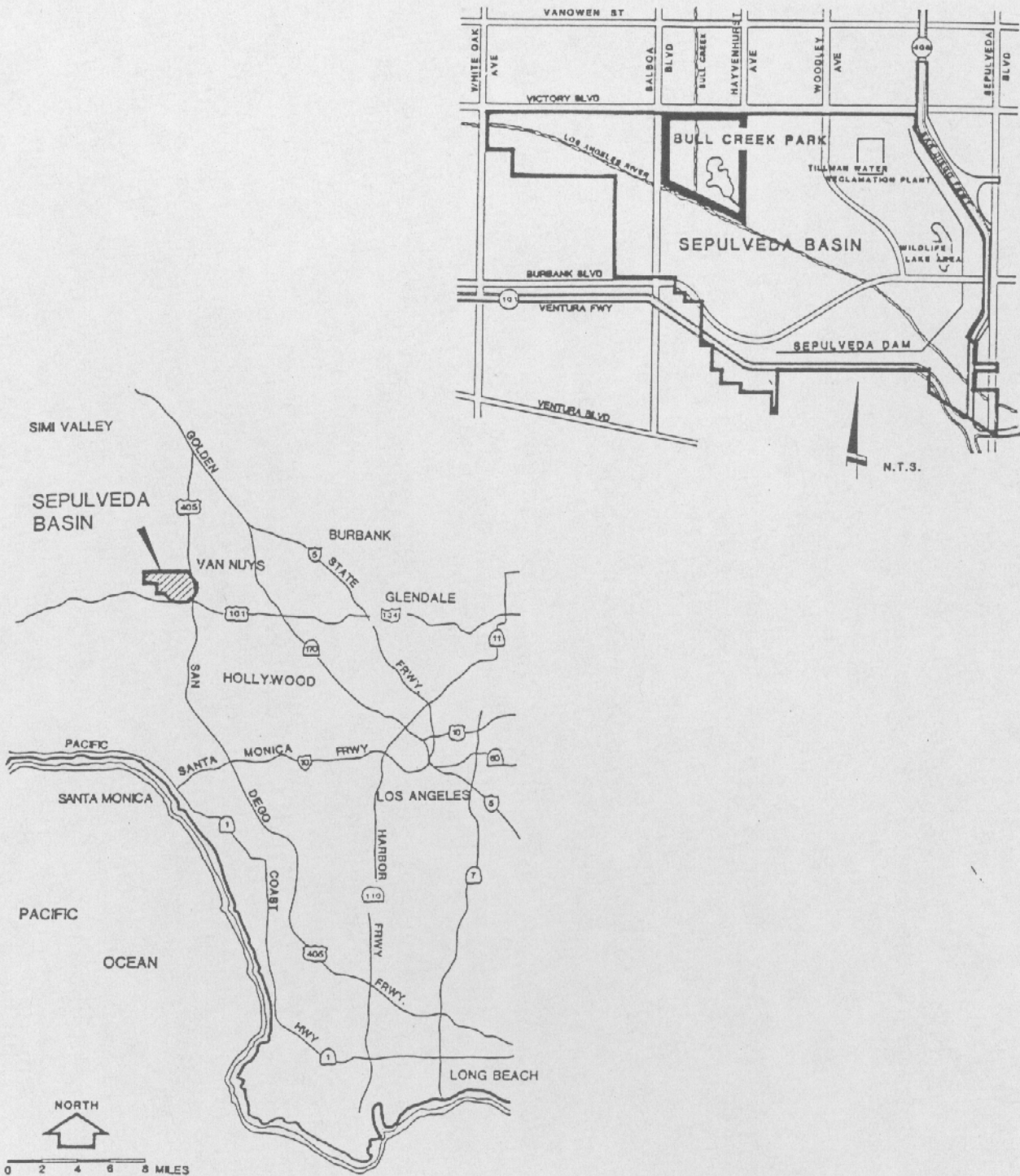
getting reclaimed water to oxbow

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REFERENCES

- Faber, P.A., E. Keller, A. Sands, and B.M. Massey, 1989. *The Ecology of Riparian Habitats of the Southern California Coastal Region: A Community Profile*. U.S. Fish and Wildlife Service Biology Report 85(7.27). 152909
- National Research Council, 1992. *Aquatic Ecosystems: Science, Technology, and Public Policy*. National Research Council on Geosciences, Environment, and Resources. National Academy Press, Washington D.C.
- U.S. Army Corps of Engineers, 1987. *Sepulveda Basin Recreation Lake: Feature Design Memorandum*. Los Angeles District, March 1987.



VICINITY MAP

Figure 1
 Vicinity & Location Maps
 Bull Creek Environmental Restoration

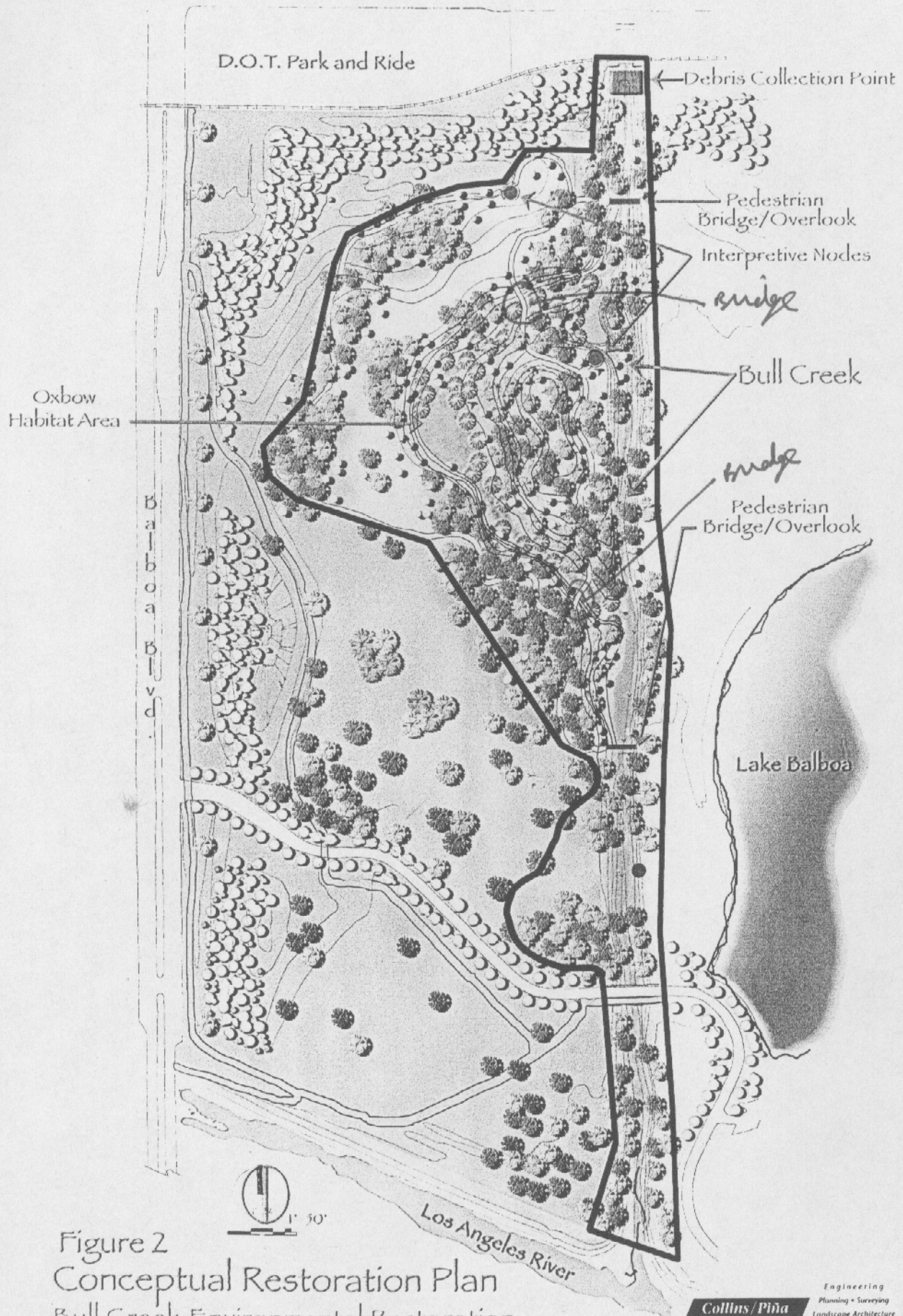


Figure 2
 Conceptual Restoration Plan
 Bull Creek Environmental Restoration



Photo #1: This photo shows the beginning of the restoration project area. Banks are steep (2:1 – 1:1) and unstable. Rip-rap has been used to stabilize areas.

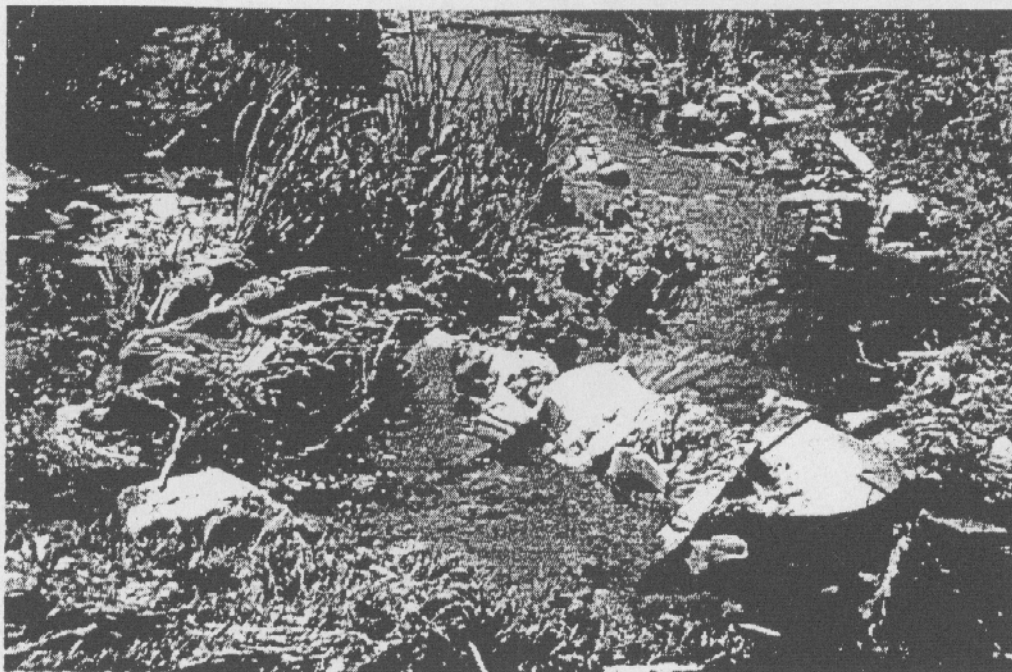


Photo #2: This photo shows some of the debris that washes out of the urbanized area upstream. A debris collector would be required to prevent this from degrading restored habitat.



Photo #3: This photo shows some of the invasive vegetation in Bull Creek. Arundo (right) is a highly invasive exotic species that is rapidly displacing native vegetation in the project area.

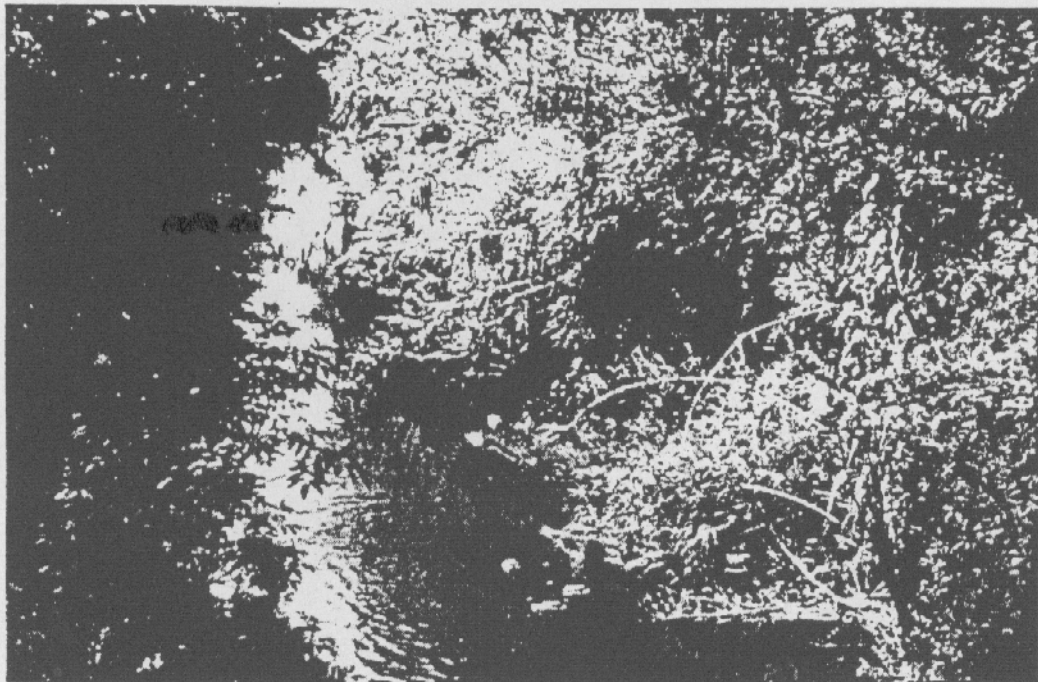


Photo #4: This photo shows Bull Creek channel. Arundo is visible on the left bank. Ducks and other waterfowl use the area for foraging and resting. This use is expected to increase with habitat restoration efforts.