COUNTY OF SAN BERNARDINO

CALIFORNIA

SAN SEVAINE CREEK WATER PROJECT

FINAL

LOAN APPLICATION REPORT AND FEASIBILITY STUDY

AUGUST 1995

REGISTERED PROFESSIONAL ENGINEER
ROGER A. SHINTAKU
No. 32183
Exp. 12/31/96
CIVIL
STATE OF CALIFORNIA

SUBMITTED
UNDER THE GUIDELINES OF THE
SMALL RECLAMATION PROJECTS ACT OF 1956 - P.L. 84-984
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

REGISTERED PROFESSIONAL ENGINEER
TIM E. CLARK
NO. AG 000493
Exp. 9/30/97
AGRICULTURE
STATE OF CALIFORNIA

ROGER A. SHINTAKU
Planning & Engineering Consultant

CLARK ASSOCIATES

Board of Supervisors
County of San Bernardino

MARSHA TUROCI
CHAIRMAN
SUPERVISOR, FIRST DISTRICT

September 12, 1995

Mr. Robert W. Johnson, Acting Regional Director
U.S. Department of the Interior
Bureau of Reclamation, Lower Colorado Regional Office
Post Office Box 61470
Boulder City, Nevada 89006-1470

Attention: Ms. Jean Shepherd, Regional Loan Program Manager

Subject: SAN SEVAINE CREEK WATER PROJECT
FINAL LOAN APPLICATION REPORT AND FEASIBILITY STUDY
WITH FINAL ENVIRONMENTAL ASSESSMENT DATED AUGUST, 1995

Dear Mr. Johnson:

The County of San Bernardino (County) herewith submits twenty (20) copies of the San Sevaine Creek Water Project *Final Loan Application Report and Feasibility Study (LAR)* with the supporting *Final Environmental Assessment.* Federal financing under this loan will be used to construct facilities to recharge approximately 25,000 acre-feet of surface runoff to the Chino Groundwater Basin annually. Natural resources conservation, infrastructure improvement, and environmental enhancement will result from project construction and operations. The proposed project will also provide flood protection and recreational opportunities to one of the highest growth regions in Southern California. A 137 acre sensitive vegetative community and wildlife habitat will be preserved under the reformulation of project objectives first considered in 1985.

Construction features of the $51.9 million project include: 2 miles of levees; 10 recharge basins with a combined storage capacity of 4,290 acre-feet; the rehabilitation of 7 miles of drainageways to convey runoff to the basins; 6 miles of linear parkways; and the preservation of 137 acres of sensitive wildlife habitat. The County will contribute $31.2 million or 60% of the total project cost and repay the estimated $19.2 million loan and $1.5 million reimbursable interest during construction over 15 years with $14 million in interest. The loan application includes $37.9 million in grant requests.

The County of San Bernardino and its engineering consultants are available to provide any additional information that may be helpful in processing the final *LAR*. We wish to acknowledge the cooperation and assistance of the Bureau of Reclamation staff in preparing this report and to express our appreciation for their valued efforts.

Sincerely,

Marsha Turoci

MARSHA TUROCI,
Chairman

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MINUTES OF THE BOARD OF SUPERVISORS
OF SAN BERNARDINO COUNTY, CALIFORNIA

RE: APPROVING SAN SEVAINE CREEK WATER PROJECT LOAN APPLICATION REPORT AND AUTHORIZING THE FILING OF APPLICATION FOR LOAN UNDER PUBLIC LAW 84-984, AS AMENDED

On motion of Supervisor Riordan duly seconded by Supervisor Eaves, and carried, the following resolution of the Board of Supervisors of the County of San Bernardino, State of California, is hereby adopted:

RESOLUTION NO 95– 213

WHEREAS, the County of San Bernardino desires to secure a Federal loan under the Small Reclamation Projects Act, P.L. 84-984, as amended, and has, through its consulting engineer, Roger Shintaku, prepared a feasibility report in support of an application for said loan to finance construction of a water conservation system consisting of a debris basin and reservoir, lined channel system, percolation basins, water spreading grounds, and a 137 acre sensitive wildlife habitat preserve; and

WHEREAS, said consulting engineer, as required under the Small Reclamation Projects Act, has prepared a supporting Loan Application Report and a Final Environmental Assessment, entitled "San Sevaine Creek Water Project", dated August, 1995; and

WHEREAS, the Board of Supervisors of the County of San Bernardino concur in and approve said Loan Application Report which proposes a project having a total estimated cost of $51,916,101, comprised of a $19,179,026 loan and $1,559,934 for reimbursable interest during construction which would be obtained from the Federal Government under provisions of P.L. 84-984 as amended, to be repaid within a 15-year period and $31,177,141 would be a contribution the County of San Bernardino or a Joint Powers Authority representing the County and other affected agencies. Additional funding by Grant from the Government is requested in the application and is estimated to be $37,880,874.

NOW, THEREFORE, BE IT RESOLVED that the Chairman of the Board of Supervisors is authorized and directed to make application to the U.S. Department of the Interior, Bureau of Reclamation, for said loan and grant, and that the Chairman of the Board and the Flood Control Engineer are further authorized and directed to perform any other acts necessary in connection with the filing of such application.

BE IT FURTHER RESOLVED THAT a copy of this resolution be transmitted to the U.S. Department of the Interior, Bureau of Reclamation, with the loan application report and final environmental assessment..

PASSED ADOPTED AND APPROVED by the Board of Supervisors of the County of San Bernardino at a regular meeting of said Board held on September 12, 1995 by the following roll call vote:

AYES: SUPERVISORS: Mikels, Riordan, Walker, Eaves, Turoci

NOES: SUPERVISORS None

ABSENT: SUPERVISORS None

STATE OF CALIFORNIA)
COUNTY OF SAN BERNARDINO)

I, Earlene Sproat, Clerk of the Board of Supervisors of the County of San Bernardino, State of California, hereby certify the foregoing to be a full, true and correct copy of the record of the action taken by said Board of Supervisors, by vote of the member present, as the same appears in the Official Minutes of said Board at its meeting of September 12, 1995.

Earlene Sproat, Clerk of the Board

By [signature]

000137

SAN SEVAINE CREEK WATER PROJECT
LOAN APPLICATION REPORT AND FEASIBILITY STUDY

AUGUST 1995

FINAL

Submitted by

SAN BERNARDINO COUNTY
PUBLIC WORKS GROUP
DEPARTMENT OF TRANSPORTATION/FLOOD CONTROL
825 East Third Street
San Bernardino, CA 92415-0835

UNDER THE GUIDELINES OF THE
SMALL RECLAMATION PROJECTS ACT OF 1956
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Prepared by

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EXECUTIVE SUMMARY

PROJECT DESCRIPTION

The proposed project is needed to provide flood protection and up to 25,000 acre-feet annual groundwater recharge to the Chino Groundwater Basin. Project features include levees, a debris basin, minor to extensive improvements to nine existing recharge basins, improvements to Etiwanda and Etiwanda/San Sevaine flood channels, a wildlife habitat preserve, and a linear parkway.

1. **Etiwanda Levees and Debris Basin**
   The Etiwanda Levees will extend downstream from the mouth of East Etiwanda Canyon to stabilize the natural drainageways and direct debris-laden runoff into the proposed Etiwanda Basin. The basin will be located on Etiwanda Creek north of 24th Street, replacing a portion of the existing spreading grounds, but not resulting in a net loss of recharge from the project. The levees and basin will form the boundaries of the wildlife habitat preserve. Levee and basin designs are not final and could be altered to include additional land in the preserve if the land can be acquired outside the proposed project.

2. **San Sevaine Retention Basins**
   Runoff emanating from San Sevaine Canyon enters five existing retention basins located along San Sevaine Creek; each combines flood control and percolation functions. The lower San Sevaine Retention Basin (Basin 5) is of significant area and volume. This component of the project will include a new outlet conduit, a new chute spillway, and the basin will be excavated for additional storage capacity.

3. **Victoria Basin**

Victoria Basin is an existing basin, but has no inlet from the Etiwanda Channel to receive storm flows. Inlet and outlet structures with some embankment modifications would be completed under the proposed project.

4. **Rich Basin**

Rich Basin is an existing retention basin connected to the San Sevaine Basins by an existing concrete-lined channel. The basin will be excavated to provide additional storage.

5. **Hickory Basin**

Hickory Basin is an undeveloped flow-through basin with very little existing storage capacity. The basin would be modified to provide a true recharge capability by additional excavation and embankment work and by appropriately sized and configured inlet and outlet works.

6. **Jurupa Basin**

Jurupa Basin is undeveloped and is presently used to spread flows turned out from San Sevaine/Etiwanda Channel during very low storm flows. The proposed project calls for excavation and embankment modifications, as well as outlet and inlet features.

7. **Conveyance Channels**

No new conveyance channels will be constructed, but under the proposal, existing channels will be modified as necessary to accommodate specified flow volumes and some will be concrete-lined. The Etiwanda Creek Channel will be lined from the proposed Etiwanda Basin to the existing trapezoidal Etiwanda Channel contiguous with the San Sevaine Channel at Basin 5. A dirt and rip-rap channel for the combined San Sevaine-Etiwanda Creek extending from Foothill Boulevard to Jurupa Basin will also be concrete-lined.

8. **Wildlife Enhancement**

A wildlife corridor will be established through land south of the San Bernardino National Forest. The corridor will provide habitat for birds and small animals while connecting the forest land with conservation basins located north of Interstate 15. The major portion of the corridor is comprised of the 137 acre habitat preserve.

9. **Linear Parkways**

The existing flood control and recharge facilities are largely inaccessible to the public and wildlife. The proposed project calls for extensive revegetation, landscaping, and recreational facility construction to incorporate enhancement features into the project. Native plant species and bicycle/jogging paths, horse trails, exercise facilities, and picnic areas will be included in the project along all major floodways and some infiltration basins (except in the preserve area).

BENEFICIAL EFFECTS

The project is expected to result in groundwater recharge of 25,000 acre-feet per year which is expected to offset the adverse effects of regional development which is reducing the amount of natural recharge. The water conserved by the project would benefit safe yield as defined under the Chino Basin adjudication and will not be credited as an additional supply. The conserved water would, therefore, not be responsible for any growth-inducing effects.

Current flood control facilities are undersized or incomplete to adequately protect existing land improvements--both private and public. There is also the demand for additional protection of private-undeveloped property. Maintenance of the existing system is significant and generates more dust and pollution than would be the case if the project is completed. Debris entering the drainage system from the National Forest is the primary cause of many problems. Construction of the debris basin is critical to the integrity of downstream channels and culverts, reducing maintenance, and the effective operation of conservation facilities.

In addition to providing groundwater recharge and flood control benefits, environmental enhancement is also part of the proposed project. A total of 137 acres of high-quality coastal sage scrub will be permanently preserved between the Etiwanda Levees. The levees will be revegetated with native sage scrub species. The Etiwanda Debris Basin will be revegetated to establish native mule fat scrub and native trees. All project features below the basin will be incorporated into a major regional linear parkway with equestrian trails, footpaths, exercise facilities, and landscaping for wildlife and recreational use. Project facilities, including the preserve area, will be routinely patrolled and inspected to minimize unauthorized use.

ORGANIZATION

The proposed project is sponsored by the County of San Bernardino, California. The County Department of Transportation/Flood Control is responsible for planning, design, construction, and operations and maintenance. The County's assets and liabilities as of June 30, 1991 are listed as follows:

Assets (in thousands):	
Cash	$ 779,433
Investments	1,460,025
Restricted Cash and Investments	164,804
Fixed Assets	634,471
Other	710,758
TOTAL	$ 3,749,491
Liabilities:	
Liabilities	$ 1,897,226
Equity and other credits	1,852,265
TOTAL	$ 3,749,491

LAND CLASSIFICATION

A study of the irrigation suitability of land resources in the Chino Basin was conducted by the Bureau of Reclamation in 1991/92 as an extension of studies conducted in 1987/88. The study found nitrate to be the only toxic constituent of concern. Levels of selenium and arsenic were found to be acceptable. Results of the study also indicated that 23,315 acres of the total 23,614 acres irrigated are arable under land suitability specifications developed by the Bureau of Reclamation for the Chino Basin. Results of the land classification are summarized as follows:

Designation	Acres	% of Total
Class 1	6,106	26
Class 2	3,390	15
Class 3	13,819	59
Sub Total - Gross Arable	23,315	100
Irrigated 6I	299	
Total Irrigated Acres	23,614	79
Farmsteads and Improvements	5,886	21
Total	29,500	100

AGRICULTURAL LAND USE

Pasture and alfalfa comprise the largest portion of agricultural land use. The majority of operating farms are established in the agricultural preserve located in the lower Basin. Vineyards that once dominated the lower valley are rapidly converting to municipal and industrial (M&I) use. The benefit area is limited to the lower Basin area that will realize improved water quality as result of project operations. Agricultural land use in the benefit area is summarized on the next page.

Description	Acreage	% of Total
Dairies & Farmsteads	6,086	21
Pasture Land	7,034	24
Alfalfa	4,729	16
Vegetables	1,700	5
Corn (silage)	756	3
Fallow	6,195	21
Grapes	3,000	10
Total	29,500	100

WATER USE

Water supplied from the Chino Groundwater Basin under safe yield is allocated between three operating pools. Pool 1 represents agriculture, the others are categorized as M&I. Safe yield is 140,000 acre-feet per year with 5,000 acre-feet of controlled over-production benefiting the appropriative pool (Pool 3).

Pool	Allocation
1. Overlying agricultural	82,800
2. Overlying nonagricultural	7,366
3. Appropriative	54,834
TOTAL	145,000

Water use in the benefit area is monitored by the Chino Basin Watermaster. Projections are that agriculture will produce approximately 36,000 acre-feet and M&I 104,000 acre-feet from the benefit area in 2000 (year one of the proposed repayment period). Agricultural production is expected to decrease to 23,000 acre-feet and M&I production increase to 117,000 acre-feet by 2014 (the last year of the repayment period). Irrigation deliveries to excess lands are expected to account for approximately 0.05% of the total use (about 70 acre-feet annually).

PROJECT FEATURES

The San Sevaine Creek Water Project features include:

- 1.9 miles of levees
- 137 acres of habitat preserve
- 1 new debris basin (Etiwanda)
- Major improvements to Basin 5, and Rich and Jurupa Basins
- Minor improvements to 5 conservation basins
- 7.2 miles of lined channel
- 6.2 miles of linear parkway.

CONSTRUCTION COSTS

Etiwanda Levees	$ 5,746,231
Etiwanda Basin	7,542,606
San Sevaine Conservation Basins	9,207,292
Additional Conservation Facilities	7,691,135
Channel and Structures	19,765,662
Subtotal	$ 49,952,926
Unlisted Items @ 10%	4,995,293
Total	$ 54,948,219

Additional amounts comprising the total project cost of $89,796,975 are identified in Table S-1. Grant and reimbursable interest during construction amounts are not included in the total project cost as defined under SRPA for the purpose of identifying the maximum allowable cost ceiling. The total project cost without grant or RIDC is $50,356,166.

TABLE S-1
SUMMARY OF ESTIMATED PROJECT COSTS

Total Direct Costs:		$54,948,219
Contingencies @ 15%		8,242,233
Subtotal		63,190,451
Projected Cost Increase @ 5% (from Table E.9)		9,925,685
Subtotal		73,116,136
Engineering and Administration @ 18%		13,160,904
BASE CONSTRUCTION COST		$86,277,040
Other Costs:		
Loan Application †		500,000
San Bernardino County Staff and Facilities †		1,000,000
USBR Plan Review and Inspection †		180,000
RIDC (form SCRB Table 6)		1,559,934
USBR Participation		280,000
Processing of application	30,000	
Administration of loan	250,000	
TOTAL PROJECT COST *		$89,796,975
Less APPLICANTS CONTRIBUTION		($31,177,141)
† Other Costs	(1,680,000)	
Reach 2 Design and Construction	(8,308,672)	
Etiwanda Basin and Levee Design	(900,000)	
Basin 5 Outlet Design and Construction	(2,900,000)	
Land & Rights-of-Way	(14,888,469)	
Cash	(2,500,000)	
TOTAL FEDERAL SHARE		$58,619,834
Loan	19,179,026	
Grant	37,880,874	
RIDC	1,559,934	
Less Grant		(37,880,874)
Less RIDC		(1,559,934)
TOTAL LOAN OBLIGATION		$19,179,026
Less USBR expenditures prior to loan		(30,000)
TOTAL FEDERAL APPROPRIATION REQUIREMENT		$57,029,900
Less USBR administration of loan		(250,000)
TOTAL FEDERAL FUNDS TO BE ADVANCED		$56,779,900

* For SRPA ceiling purposes the "Total Project Cost" is less grant and RIDC or $50,356,166

Project costs are allocated under separable cost remaining benefit methodology with results as follows:

Water Supply	34.4%
Flood Control	43.0%
F&W Enhancement	6.9%
Recreation	15.7%

The repayment obligation for water supply is further divided between regular agriculture, excess lands, and M&I in the preliminary repayment schedule. The percentages change annually based on projected water use as discussed previously. Actual percentages will be determined based on production records maintained by the Chino Basin Watermaster.

OPERATIONS, MAINTENANCE, REPLACEMENT and POWER (OMR&P) COSTS

Annual OMR&P costs are representative water resource projects involving flood control, water storage, and percolation functions. The addition of the linear parkway and wildlife preserve significantly increase annual costs and liability. The annual budget of $1.705 million provides for personnel, equipment, insurance, and replacement costs. An emergency reserve fund of almost $400,000 will be established in the 8th year of repayment through annual payments of $40,000 to an interest bearing account.

FINANCIAL PROGRAM

Total project cost	$ 89,796,975	
Total project cost (SRPA)	50,356,116	
Total loan obligation	19,179,026	
Grant	37,880,874	
Contribution	31,177,141	(34.7%)

IDC payments	$ 2,690,312
Interest	11,429,872
Principle	19,179,026
TOTAL	$ 33,299,210

Repayment rate	7.625%
Discount rate	7.750%
Present worth of payments	$ 18,941,538
Loan factor	17.1%

Loan repayment period 15 years (2000-2014)

CHAPTER 1
GENERAL INFORMATION

The San Sevaine Creek Water Project is a resources management initiative aimed at providing a diversity of benefits including flood control, water conservation, habitat preservation for wildlife, and recreation. The proposed project will control runoff originating in the San Gabriel Mountains to recharge the Chino Groundwater Basin, maintain sensitive wildlife habitat, and create recreational areas along existing floodways.

1.1 LOCATION

The project area is located in Southern California approximately 50 miles east of Los Angeles. The location map presented as Figure 1.1 describes the project site in relation to the greater Los Angeles area and the Chino Groundwater Basin. The proposed project is located in San Bernardino County, northeast of the Ontario Airport and about 15 miles west of the City of San Bernardino. Ontario, Rancho Cucamonga, and Fontana are smaller cities located near the project as delineated in Figure 1.2. Unincorporated areas of San Bernardino and Riverside Counties are also affected by the project. Major agricultural areas are located along Interstate 15 and in the southern portion of the Chino Basin, including the Chino Agricultural Preserve which incorporates an area of about 27,000 acres between the City of Ontario and the Santa Ana River.

The San Gabriel Mountains located north of the project are part of the San Bernardino National Forest; the Angeles National Forest is located approximately 8 miles to the west and the Cleveland National Forest approximately 20 miles south. The Santa Ana River is an effluent dominate stream that drains the inland valleys to the Pacific Ocean. The river supports extensive wetland habitat as well as recharging basins in both the upper and lower Santa Ana Watersheds.

The project extends in elevation from approximately 2,000 feet above mean sea level (MSL) in the San Gabriel foothills to 825 feet where the project joins existing facilities south of Jurupa Basin (approximately 1 mile south of Interstate 10). Runoff originating in the mountains recharges the Chino Basin and flows into the Santa Ana River under flood conditions. Subsurface flows follow the direction of surface runoff from north to south.

The Chino Groundwater Basin (Basin) covers a surface area of approximately 220 square miles, extending from the San Gabriel Mountains to the Santa Ana River. The Basin is the source of water for a diverse area of agricultural and municipal and industrial (M&I) users. Chapters 3 and 4 present detailed information regarding land and water resources.

1.2 PROJECT MAP

The project map presented as Figure 1.3 locates construction features and the preserve area. Interstate 15 bisects the project into upper and lower areas; the upper area receives runoff directly from the Etiwanda Creek and San Sevaine Creek watersheds in close proximity to the National Forest. Grades are relatively steep at 8 to 1.5%, and the soils are porus with high infiltration capacities, although the depth to basement is shallow. Existing facilities are described by Figure 1.4.

Upper area conservation features serve mainly to collect runoff and debris, provide recharge and retention capacity, and direct flows into Reach 1 of the main flood channel. However, being in close proximity to the National Forest and situated in the foothills, the area also has significant wildlife habitat and recreational value. The areas located along Etiwanda and San Sevaine Creeks contain the sensitive Riversidian alluvial coastal sage scrub plant community that will be preserved as result of the proposed project. Wildlife will be able to utilize the preserved areas and freely access water ponded in the recharge basins. Controlled access along linear parkways will also provide the public with open-space recreational opportunities including jogging, hiking, and horseback riding. The area is easily accessible off

Interstate 15 from Highland and Summit Avenues. The Los Angeles Department of Water and Power (LADWP) and Southern California Edison (SCE) utility corridors provide additional access.

The lower conservation features consist of Reaches 2 and 3 of the flood channel, Victoria Basin, Hickory Basin, and Jurupa Basin at the southern end. Grades are less steep and the soils retain relatively high infiltration capacities. In contrast with the upper area, the lower area is inaccessible by wildlife other than birds and small animals, and there are no areas of significant biota. However, linear parkways constructed adjacent to the floodway will provide the backbone for a regional park system. Developing communities in Rancho Cucamonga and Fontana will be able to expand on the County facility to achieve additional benefits. The area is easily accessible from Interstates 10 and 15 off Etiwanda Avenue.

1.3 CLIMATE

Climate within the project area is typically Mediterranean, characterized by warm, dry summers and mild winters. High pressure dominates the Southern California coastal ranges during summer blocking moist air from the south; the result being that approximately 90% of the area rainfall occurs in the winter months when frontal storms push down from the northwest. These Pacific winter storms are typically of low intensity. Relative humidity averages 10 to 20% in the summer and 40 to 70% in winter. Infrequent summer thunder storms are typically high intensity and may reach 3 to 4 inches of rain per hour over small areas.

Winds are typically light breezes inland from the Los Angeles-Orange County area ranging from 5 to 15 miles per hour. On occasion, "Santa Ana" winds develop from high pressure conditions in the eastern deserts that reverse the predominant coastal air flow. These winds can gust up to 80 miles per hour and reduce the relative humidity to less than 10 percent.

Temperature and precipitation data is used in this report to estimate irrigation requirements for cropped acreage. Precipitation data for the watershed is also used to calculate storm runoff. The diversity in climate between the farms in the lower valley and high runoff producing areas in the mountains requires that two sets of data be presented. Additional evapotranspiration and hydrologic data are presented in Chapters 4 and 5.

Temperatures in the agricultural area range from highs above 100°F to lows below freezing, although these extremes are uncommon. Table 1.1 presents average climatological data collected by the Cooperative Extension, University of California, at the Riverside Experimental Station from 1956 through 1980. The record high temperature in Upland (located approximately 10 miles west of the project area) was 111°F in July of 1960; the record low was 23°F in December of 1968.

Annual precipitation varies from the central valley (13 inches at Prado Dam) to the base of the San Gabriel Mountains (25 inches). The average annual precipitation used in this report to estimate irrigation requirements is 15.2 inches as described in Table 1.1. Figure 1.5 graphically relates average temperature and rainfall data for the agricultural area.

Air quality in the project area is poor with excessive levels of ozone, carbon monoxide, and suspended particulates. Table 1.2 compares air quality data as compiled by the South Coast Air Quality Management District for cities in Southern California.

CHAPTER 5
DRAINAGE CONDITIONS

On-farm surface and subsurface drainage problems are not of significant concern. Irrigated agriculture has existed in the area for over 60 years without significant drainage problems and no new land will be brought into production as a result of this project. Additional information regarding land suitability for irrigation is presented in Section 3.3 and in Appendix B of this report.

The focus of this project is to improve groundwater supplies through the direct recharge of storm runoff occurring in the Etiwanda and San Sevaine Creek watersheds. Drainage patterns for these creeks to the Santa Ana River are through the agricultural areas along Interstate 15 and in the lower Chino Basin. The proposed project will provide flood protection benefits to agriculture as well as developing areas along the drainageways in addition to water supply benefits.

This chapter presents information regarding the surface hydrology and recharge aspects of the project.

5.1 SURFACE DRAINAGE

5.1.1 Conservable Runoff

Often the terms "salvageable runoff", "conservable runoff", or "recoverable yield" are used interchangeably referring to the amount of runoff recoverable from the groundwater basin. The computation of "recoverable yield" or "conservable runoff" from annual precipitation is at best an approximation. The recoverable yield or conservable runoff may be defined as the difference between the average annual water supply (from precipitation) and the average annual water loss from evaporation and transpiration. Theoretically, the remainder of the precipitation should be recoverable if not otherwise transported away from the basin.

Conservable runoff is expressed as follows:

Conservable runoff =

Average Annual Precipitation x drainage area - losses
= acres x inches/12 - losses
= acre-feet/year - losses

The runoff average has a wide range and can vary from approximately 15 percent to more than 50 percent of precipitation. Highly developed and mountainous areas will produce more runoff than the non-developed and valley areas.

Percolation of precipitation is considered to include both percolation of precipitation on the general land surface and in the stream channel and basins. Because of the proposed lining of certain natural streams in the watershed area below the foothills, streambed percolation is a minor factor in future percolation. Spreading areas and water conservation basins will be developed to provide additional percolation areas that will compensate for streambed losses.

Percolation of precipitation is equal to the sum of precipitation less the sum of losses or consumptive use, which in this analysis is considered to be all losses due to evaporation, transpiration and water possibly held in the soil. The "recoverable water" or "conservable runoff" is comprised of precipitation that percolates below the vadose zone and eventually reaches the zone of saturation.

Due to the lack of historical artificial recharge data and difficulty in assessing percolation of precipitation in the watershed area, the conservable runoff was estimated using hydrologic methods based on acceptable runoff criteria. The runoff criteria was based on estimated runoff coefficient ("C" factor) presently in use for the area and the average annual rainfall.

The runoff factors assumed for the various conditions within the project area are summarized in Table 5.1. The C factors were adjusted to compensate for the basins, freeways, open areas (such as the SCE corridor), and other similar areas within the overall drainage area.

TABLE 5.1

STORM RUNOFF COEFFICIENT

SAN SEVAINE/ETIWANDA WATERSHED

Reach	"C" Factor Range	Adjusted "C" Factor
Above LADWP Corridor	.50	.50
LADWP Corridor to Interstate 15	.24 to .58	.50
Interstate 15 to AT&SF Railroad	.24 to .84	.59
AT&SF Railroad to Jurupa Basin	.24 to .84	.64

Notes:

1. The storm runoff coefficients ("C" factor) were derived from the "San Bernardino County Hydrology Manual".
2. The C factors were weighted to account for open space in the drainage area, such as the SCE Corridor, basins, freeways, etc.
3. The runoff factors are based on existing or planned developments in the watershed area.

To arrive at a conservable runoff factor (percent) with which to compute the estimated amount of conservable runoff, the C factors were further adjusted to compensate for the following losses:

A. Evaporation from the conservation basins and spreading grounds.

B. Losses in the vadose zone due to transpiration and/or evaporation.

C. Losses in the "Capillary Fringe" zone.

D. Losses in drainage pipes and/or channel systems, if any.

The losses were estimated to be 5 percent and effectively reduced the percentage of conservable runoff from the adjusted C factor. The "conservable runoff factors" that were applied to the estimated precipitation are listed in Table 5.2.

Based on the tributary drainage areas, the average annual precipitation in acre-feet per year was computed and is shown in Table 5.2. The estimated precipitation in acre-feet per year and the amount of precipitation that can be reclaimed by pumping from the basin ("Conservable runoff") is given in Table 5.2.

The annual precipitation for the San Sevaine Creek Watershed is estimated to be 53,950 acre-feet/year. Approximately 27,350 acre-feet/year, or 51 percent of the total estimated annual precipitation, can be conserved. For the loan repayment analysis in Chapter 8, the conservable runoff is rounded to 25,000 acre-feet/year.

The runoff figures may appear to be high; however, approximately 75 percent of the watershed area is below the canyon mouths and within the urbanizing area, and the runoff from urban areas is usually very high, ranging from 45 percent in low density areas to as high as 85 to 90 percent in commercial, high density and industrial areas. These areas have to be weighted to account for power-line corridors, large open spaces, parks, etc.

Some specific examples were evaluated to review the approximate "conservable runoff" figures used in this report. A 1,500-acre development is presently under construction within the watershed area. A tabulation of the increased runoff (peak flow and volume) is shown in Table 5.3. The site hydrology is based on San Bernardino County methodology and indicates an increased runoff volume from 110 percent, based on a 2-year storm, to 55 percent, based on a 100-year storm. The development is being required to provide detention basin storage to handle the increased runoff from the site. The site is not unique, being a combination of residential, commercial and light industrial uses. It is referenced because it is in the San Sevaine Creek Watershed area and is presently being planned and designed. The development has substantial area dedicated to open space and landscaping.

TABLE 5.2
CONSERVABLE RUNOFF
SAN SEVAINE/ETIWANDA CREEK SYSTEM WATERSHED

System Reach	Average Annual Precipitation[2]	Tributary Drainage Area (acres)	Precipitation (ac-ft/yr)	Conservable Runoff Factor[3] (%)	Conservable Runoff[4] (ac-ft/yr)
Above Line of Etiwanda Debris Dam	28.0"	7,225	16,858	45	7,586
Etiwanda Debris Dam to Summit Ave.	23.5"	6,340	12,416	45	5,587
Summit Ave. to Baseline Rd.	18.0"	5,003	7,504	54	4,052
Baseline Rd. to SFRR	16.0"	6,096	8,128	59	4,796
SFRR to Jurupa Basin	14.5"	7,483	9,042	59	5,335
TOTALS		32,147	53,948		27,356
				CCWD Supply[5] =	1,000
				Remainder for Percolation =	26,356
				For loan repayment analysis: use	25,000

Notes:

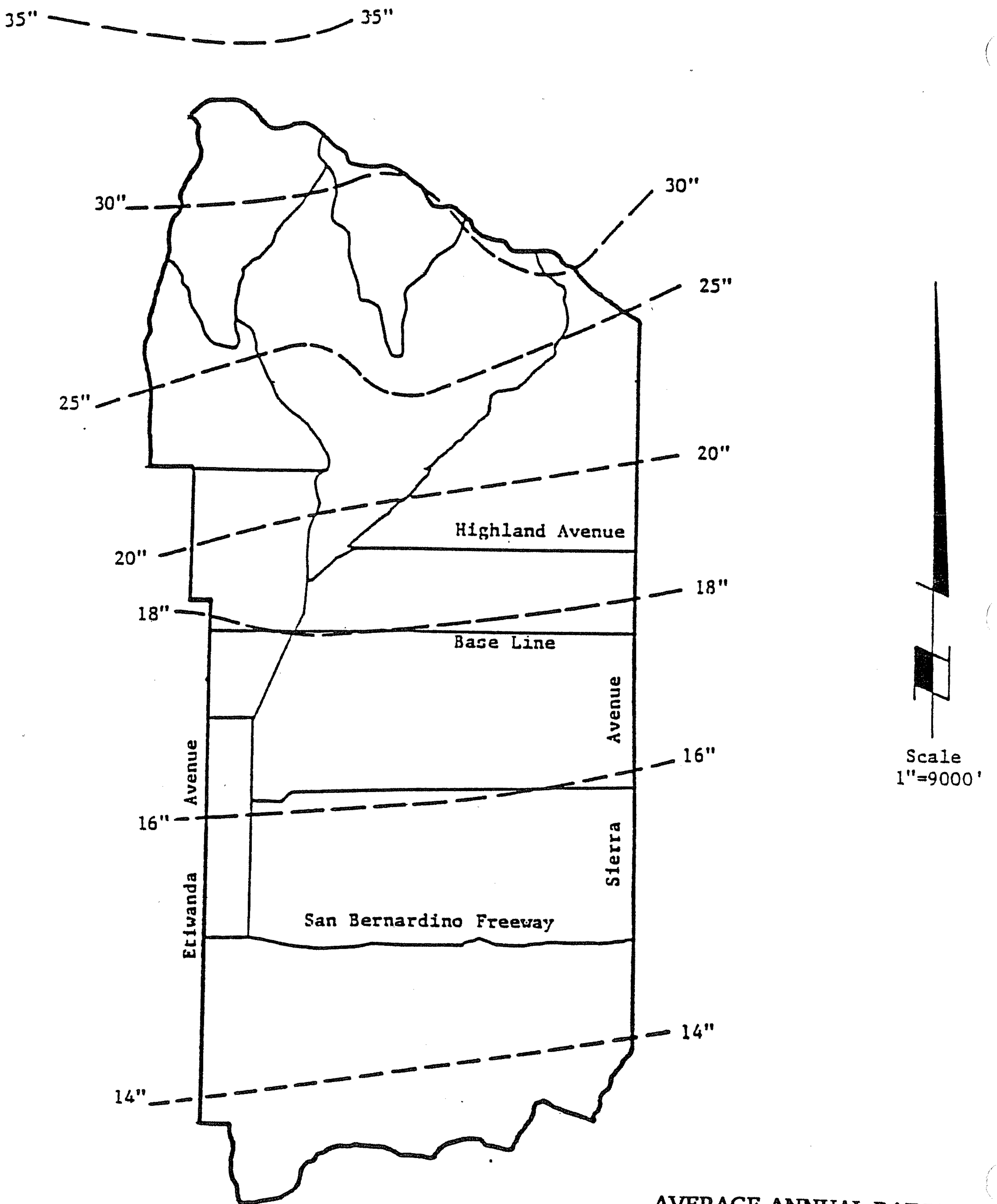
1 "Conservable Runoff" = average annual precipitation x drainage area - losses.

2 Average Annual Precipitation isohytels are shown on Figure 5.1

3 The conservable runoff factors were reduced from the adjusted "C" factors shown in Table 5.1 to account for additional losses.

4 The conservable runoff is based on the ultimate development of the watershed except for mountainous and foothill areas.

5 The Cucamonga County Water District has a master plan calling for the diversion and use of 1,000 acre-feet/year from Etiwanda Creek runoff.



AVERAGE ANNUAL RAINFALL

FIGURE 5.1

TABLE 5.3

INCREASED RUNOFF FROM HERITAGE VILLAGE DEVELOPMENT

Storm Frequency	Pre-Development		Post-Development		Increase	
	Q(CFS)	V(AF)	Q(CFS)	V(AF)	CFS (%)	AF (%)
2-year	632	125	1,038	263	506 (64)	138 (110)
10-year	1,118	290	1,977	521	859 (77)	231 (80)
25-year	1,416	383	2,570	647	1,154 (81)	264 (69)
100-year	1,923	574	3,406	892	1,483 (77)	318 (55)

Due to the lack of recorded data, a more exact determination of conservable runoff is not practical. It is recognized that the project water production estimate could be off by as much as 10 percent. However, based on the present policy of the County in the urbanizing areas and the degree of storm drain construction required in the developing areas, the conservable runoff estimates should be reasonably close. If the estimated conservable runoff is slightly on the high side, the differential will more than be made up by projected increases in the volume of water.

5.1.2 Conservable Runoff in San Sevaine Creek Watershed

The estimated conservable runoff for the San Sevaine/Etiwanda Creek System is 26,350 acre-feet/year as developed in Table 5.2. For the purposes of this loan application, the estimated runoff volume is conservatively rounded to 25,000 acre-feet/year. The estimated numbers do not include the potential water supply of 1,000 acre-feet to be diverted by the Cucamonga County Water District from Etiwanda Creek. The total proposed storage capacity for runoff flows is approximately 4,290 acre-feet.

Table 5.2 shows the approximate sub-area itemization of the runoff from the mountains to Jurupa Basin. The conservable runoff figures are recognized to be estimates only and based on best judgement, historical data, previous studies, and a reasonable knowledge of what the watershed will look like in the future. The conservable runoff totals are based on the ultimate development of the watershed. This is a reasonable analysis due to the long-range need for water supply and the long life of the lined channels and water percolation facilities, once they are constructed.

Due to the higher percolation rates in the Lower San Sevaine Basin, Victoria Basin, and Rich Basin (3 feet/day or more vs. 1 to 2 feet/day in the lower area), a maximum effort will be made to develop those areas for water spreading. However, Jurupa Basin must be utilized to the fullest extent because of its existence and the proposed development of areas tributary to this basin, although the percolation rates are lower. Other than Hickory and Jurupa Basins, there are no other percolation areas available below the Devore Freeway to capture and percolate runoff from the approximate 18,000-acre area.

The estimated proposed recharge capacity within the San Sevaine Creek Water Project is 508 acre-feet/day. If the basins and spreading grounds are assumed to contain water 30 days out of a year, then the recharge volume would be in the range of 15,750 acre-feet for the 30-day period. Although Jurupa Basin does not have a high recharge rate, the recharge capability of this basin is significant to regional groundwater recharge due to its location.

Jurupa Basin will have 1,200 acre-feet of storage for water percolation and a 56 acre-feet/day recharge capability when developed. Hickory Basin will have 220 acre-feet of storage and a 40 acre-feet/day recharge capability. Victoria Basin will have 235 acre-feet of storage and 56 acre-feet/day recharge capability. The Lower San Sevaine Basin is the major facility for water conservation with 2,350 acre-feet of storage for water percolation and 234 acre-feet/day recharge capacity.

The San Sevaine Creek Water Project will provide a total of 4,290 acre-feet of storage capacity. Based on the previous data, 26,350 acre-feet/year annual runoff can be percolated into the Chino Basin in approximately 44 days.

The proposed project will develop a minimum of 19,000 acre-feet of water per year for percolation into the Chino Groundwater Basin immediately after the construction of the project. As indicated, the water development will increase to approximately 25,000 acre-feet/year in later years.

5.1.3 Recharge Capacity

The proposed project plan involves seven percolation facilities including the retention basin (six facilities will actually be constructed or modified). The preliminary plans for these facilities are included in Appendix C. Water spreading grounds, known as the Etiwanda Spreading Grounds, the San Sevaine Basins (1 through 4), and the Lower San Sevaine Retention Basin (Basin 5) are located near the upper end of the proposed project. The other four proposed basins are located in the middle and lower end of the project. Groundwater recharge will be accomplished by the capture, storage and percolation of runoff originating in the mountains to the north of the service area and the valley area within the San Sevaine Creek Watershed area. The major water conservation facilities are located at the upper end (north) of the project where runoff from the mountain areas occurs and the percolation rates are the highest.

Urban runoff will be conducted to the basins by a system of existing or proposed storm drain systems which are not part of this project. The facilities are shown in general on Figure 1.3 and on Plate 1, Plot Plan, included in Appendix C. Several of the percolation basins exist as flow-through areas with very limited water storage areas. The proposed project will greatly increase the storage volume and subsequently the groundwater recharge capability of the existing facilities. Storage capacity of the proposed water conservation facilities is shown in Table 5.4. The recharge capability of the facilities is shown in Table 5.5.

TABLE 5.4

PROJECT RECHARGE FACILITIES

Facility	Existing Flow-Thru Area (acres)	Proposed Storage Area[a] (acres)	Proposed Storage Capacity (ac/ft)
Etiwanda Spreading Grounds	42	8	59
Etiwanda Basin	0	19	235
San Sevaine Basins (1 thru 4, existing)	22	22	200[b]
Lower San Sevaine Retention Basin 5	19	110	2,350
Victoria Basin	19	19	235
Rich Basin	14	5	26
Hickory Basin	16	12	220
Jurupa Basin	19	56	1,200
Totals	151	251	4,290[c]

[a] The "proposed areas" are areas usable for water percolation and/or storage. The existing areas are mainly flow-through areas only.

[b] Existing storage capacity

[c] Although the Etiwanda Debris Basin could provide 235 ac/ft of storage, the basin is not currently planned to be operated for storage purposes.

No Storage = No Conservation

TABLE 5.5

PROJECT RECHARGE CAPABILITY

Facility	Proposed Recharge Capacity (cfs)	Proposed Recharge Capacity (ac-ft/day)	Estimated Recharge Rate (ft/day)
Etiwanda Spreading Basin	21	42	3
Etiwanda Basin[a]	--	--	2.5
San Sevaine Basins (1 thru 4, existing)	33	66	3
Lower San Sevaine Retention Basin 5	117	234	2.5
Victoria Basin	28	56	3
Rich Basin	7	14	3
Hickory Basin	20	40	3
Jurupa Basin	28	56	1
Totals	254	508	

[a] The proposed Etiwanda Basin is not planned to be operated as a recharge facility.

5.1.3.1 Percolation Rates Of Proposed Recharge Facilities

Etiwanda Basin, the San Sevaine Basins, Basin 5, and Victoria Basin have a higher potential for percolation because they overlie coarser ground material that permits higher rates of percolation. Conversely, the percolation basins located lower on the alluvial fan (Hickory and Jurupa Basins) have reduced rate of percolation due to finer grained materials.

The United States Geological Survey, in its report "Artificial Recharge in the Upper Santa Ana Balley" dated 1972, analyzed and estimated recharge rates on all of the recharge facilities in the Chino Basin area. These rates were based on review of well driller logs, ring infiltrometer tests, and field inspections. The recharge rates are listed in Table 5.6.

The State of California Department of Water Resources (DWR) and the Metropolitan Water District of Southern California (MWD) completed a conjunctive use study of the Chino Basin for the storage of imported water from the State Water Project. The study included the potential use of the Etiwanda Spreading Grounds, San Sevaine Spreading Grounds, and Victoria Basins for water spreading purposes. The DWR/MWD analysis of the three facilities indicated a potential recharge capacity of 22,800 - 34,200 acre-feet/year based on a filtration rate of 2 to 3 feet/day and 100 days of spreading. Percolation tests by the Chino Basin Municipal Water District (CBMWD) in the San Sevaine Spreading Grounds and San Sevaine Basins indicate a sustained percolation rate of 2.5 feet/day. More recent studies being completed by MWD could significantly benefit final designs and maintenance procedures. Final designs will be completed in collaboration with MWD and the Chino Basin Watermaster.

The recharge rates used in the DWR/MWD report are compatible with recharge rates determined by USGS and those used in this report. There is no data available for Rich, Hickory, and Jurupa Basins. However, based on other information in the general area, a filtration rate of 2 to 3 feet/day for Rich and Hickory Basins, and 1 to 1.5 feet/day for Jurupa Basin, appear to be reasonable.

TABLE 5.6

ESTIMATED RECHARGE RATES

Facility	Continuous Long Term	Initial Short Term
Etiwanda Spreading Grounds	3.0 ft/day	3-6 ft/day
Etiwanda Basin	2.5 ft/day	3-6 ft/day
San Sevaine Basins (1 - 4)	3.0 ft/day	3-6 ft/day
San Sevaine Basin 5	2.5 ft/day	3-6 ft/day
Victoria Basin	2.0 ft/day	2-4 ft/day
Rich Basin	2.0 ft/day	2-3 ft/day
Hickory Basin	2.0 ft/day	2-3 ft/day
Jurupa Basin	1.5 ft/day	1-2 ft/day

5.1.3.2 Historic Water Recharge In Existing Basins

There is limited historical water recharge data available on the existing basins. Although the existing facilities have been used for a combination of debris and water conservation basins for many years, there are no gauges on the facilities to measure inflow and/or storage.

The San Sevaine Spreading Grounds has no storage capacity and is a flow-through facility. Although some recharge takes place in the spreading grounds, storm flows pass through the area very rapidly. The existing San Sevaine Basins (1 through 5) are water conservation facilities with very limited storage capacity.

Etiwanda Spreading Grounds (north of 24th Street) receives turnout flows from Etiwanda Creek. The inlet, comprised of a small diversion dike, turns the creek flow into the spreading grounds. The dike erodes under intense flow allowing debris laden storm water to bypass the spreading grounds. Therefore, the spreading grounds operates as a water conservation facility during low flows, and does not become plugged during moderate and high-runoff events.

Both the San Sevaine and Etiwanda Spreading Grounds are being used to some degree for spreading and percolating State Project Water by the CBMWD to replace water being mined from Chino Basin in excess of safe yield.

Victoria Basin is an existing basin but has no inlet from the Etiwanda Channel to receive storm flows. Hickory Basin is basically an undeveloped flow-through basin with very little existing storage capacity.

Jurupa Basin is undeveloped and is presently used to spread low flows turned out from San Sevaine Channel. Larger debris-laden flows are largely kept in the channel to keep the basin from becoming inoperable due to deposition.

Etiwanda, Lower San Sevaine, Victoria, Hickory, and Jurupa Basins will have significant storage capacity when the basins are developed (see Tables 5.4 and 5.5). The Etiwanda Spreading Grounds will serve as a water conservation facility once the erodibility and debris movement of existing Etiwanda Channel are controlled and an adequate turnout from the channel is provided.

The recharge rate of Jurupa Basin will be enhanced due to the amount of material to be removed from the basin. Jurupa Basin is an important water conservation facility due to its location at the end of the proposed project.

5.1.3.3 Estimated Recharge Capacity In Unlined Etiwanda And San Sevaine Channels

Recharge capacity is more difficult to evaluate for unlined stream channels than for recharge basins. The U.S. Geological Survey (USGS) estimated recharge capacities for several unlined channels for the general area in 1972, including Etiwanda and San Sevaine Creeks. The estimated recharge capacity for the existing channels is summarized:

A. Etiwanda Creek (canyon mouth to Foothill Boulevard)

Based on the USGS report, a recharge rate of 3 feet per day was used. The estimated recharge capacity for the unlined Etiwanda Creek channel is approximately 85 acre-feet/day. This number is probably excessive due to the fact the 85 acre-feet/day is based on the entire channel bottom being wet, which is not the case for small flows.

Any loss in recharge capacity will be made up by directing channel flows into the Etiwanda Spreading Grounds, Lower San Sevaine Basins, and Victoria Basin.

B. San Sevaine Creek (Devore Freeway to Jurupa Basin)

The estimated recharge capacity for the unlined San Sevaine Creek Channel is approximately 90 acre-feet/day based on a recharge rate of 3 feet/day. Any loss in recharge capacity will be made up by directing channel flows into Hickory and Jurupa Basin.

The loss in recharge capacity by lining the channel will be more than made up by the recharge capacity of the proposed recharge facilities. Refer to Tables 5.4 and 5.5 for a description of the proposed recharge facilities, including basin area, storage capacity and recharge capacity.

Due to the steepness of the channel slope, channel flows generally run off very quickly, particularly flows from the urbanizing valley areas. Therefore, it is more beneficial to direct flows to offsite recharge facilities from a recharge capability standpoint than to utilize unlined streams for percolation. In recharge basins and spreading grounds, the flows can be retained to allow percolation; whereas, in streams on steep alluvial fans, the storm flows runoff rapidly before they can percolate. Also, as indicated on Table 5.5, the proposed recharge basins will have a storage capacity of 508 acre-feet per day. The storage capacity will allow the retention of flows until percolation can occur.

The erosiveness of the channel bottom and banks and the high velocity of flows in the unlined channel requires the channel to be lined. Even small storm flows are damaging to the channel and have broken out in the past, causing severe damage to property. However, as shown above and by referring to Table 5.4, the recharge capacity of the proposed system will be greatly increased and will be adequate to capture and percolate storm flows.

5.2 SUBSURFACE DRAINAGE

The Chino Basin is divided into three subbasins as delineated in Figure 5.2. The Pomona, Claremont Heights, and Cucamonga Basins are hydrologically isolated from the larger Basin. Chino II and III are referred to as the "lower Basin". Groundwater elevations are fairly consistent due to the facts that the Basin is extremely large (40 million acre-feet) and continuously recharged to maintain safe yield. Depth to groundwater contours are presented in Figure 5.3. The Santa Ana River, located at the Basin's southern extreme, is hydrologically connected through rising groundwater. Depths to groundwater range from less than 100 feet in the lower Basin to over 400 feet in Chino I.

The water-bearing sediments range in depth from 200 to 1,000 feet. The bearing capacity is generally good in Holocene and Pleistocene alluvium (MWD, 1988). Fractures in the Older Continental deposits and metamorphic-basement

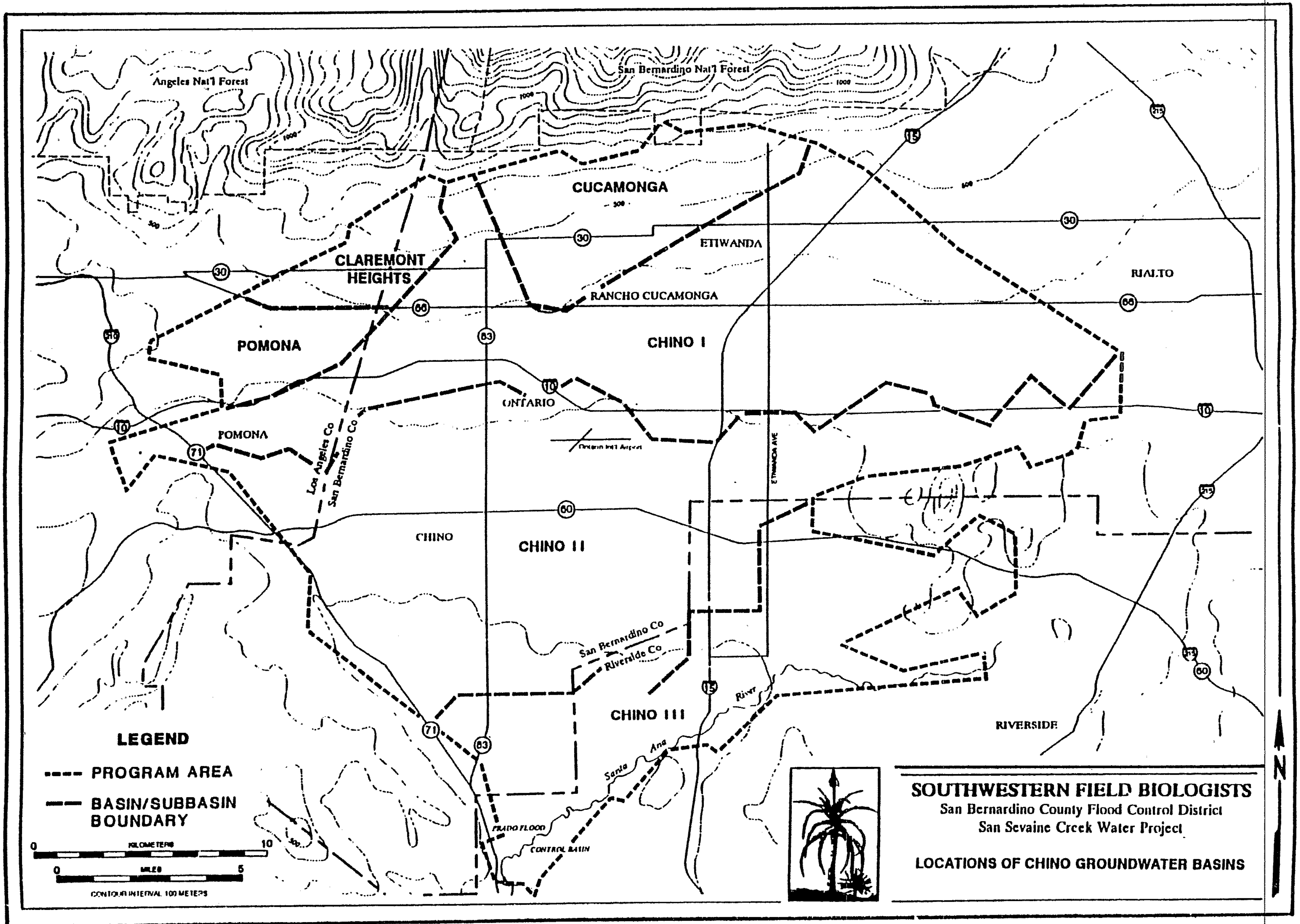
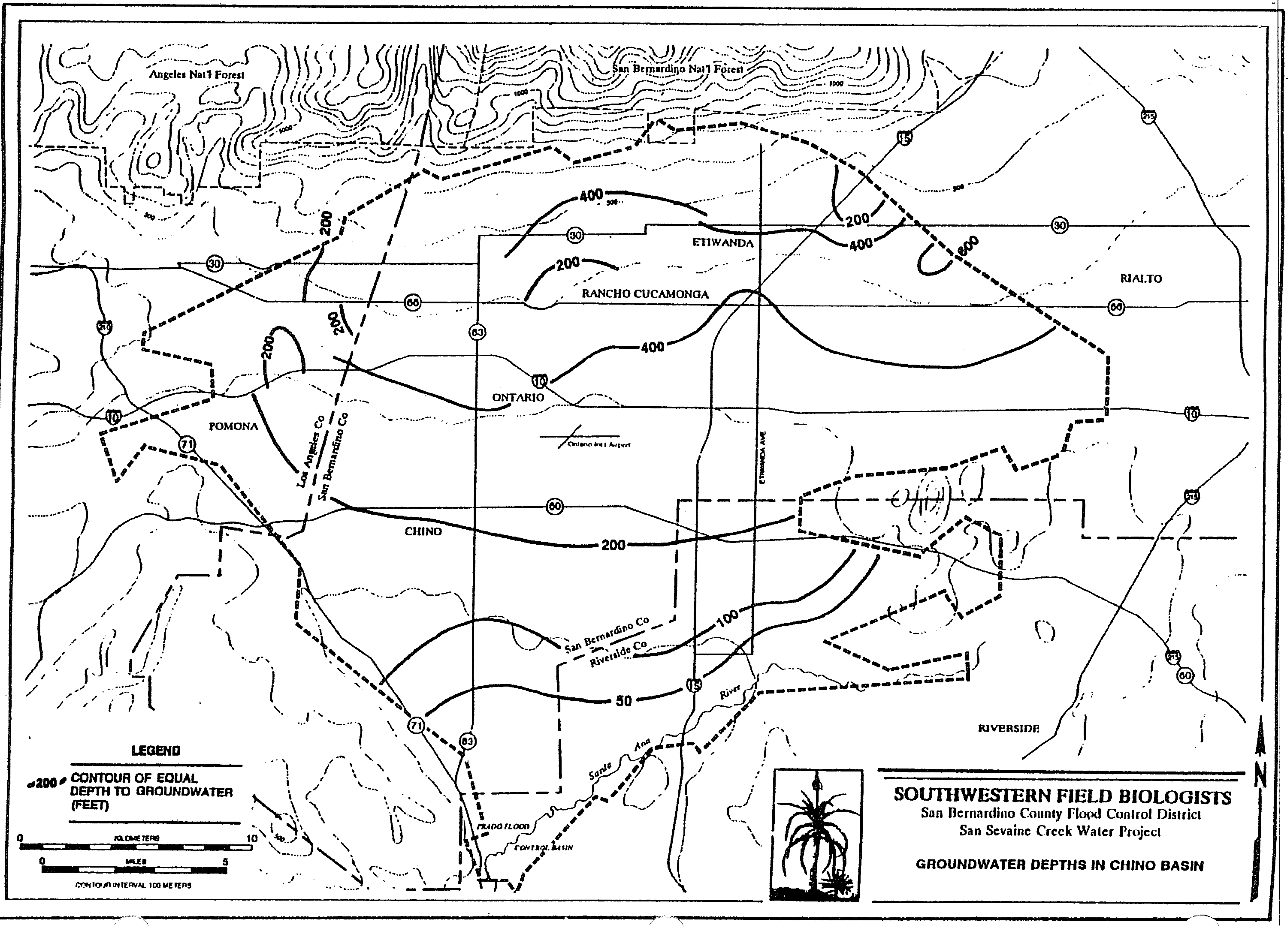

Angeles Nat'l Forest
San Bernardino Nat'l Forest
CUCAMONGA
CLAREMONT HEIGHTS
ETIWANDA
RANCHO CUCAMONGA
RIALTO
POMONA
CHINO I
ONTARIO
POMONA
Los Angeles Co
San Bernardino Co
Ontario Int'l Airport
ETIWANDA AVE
CHINO
CHINO II
San Bernardino Co
Riverside Co
CHINO III
Santa Ana River
PRADO FLOOD CONTROL BASIN
RIVERSIDE
LEGEND
PROGRAM AREA
BASIN/SUBBASIN BOUNDARY
KILOMETERS
MILES
CONTOUR INTERVAL 100 METERS
N
SOUTHWESTERN FIELD BIOLOGISTS
San Bernardino County Flood Control District
San Sevaine Creek Water Project
LOCATIONS OF CHINO GROUNDWATER BASINS

FIGURE 5.2



Angeles Nat'l Forest
San Bernardino Nat'l Forest
ETIWANDA
RANCHO CUCAMONGA
RIALTO
ONTARIO
POMONA
Ontario Int'l Airport
Los Angeles Co
San Bernardino Co
CHINO
San Bernardino Co
Riverside Co
Santa Ana River
PRADO FLOOD CONTROL BASIN
RIVERSIDE
ETIWANDA AVE
400
200
400
600
200
400
200
200
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100
50
LEGEND
200 CONTOUR OF EQUAL DEPTH TO GROUNDWATER (FEET)
KILOMETERS 0 10
MILES 0 5
CONTOUR INTERVAL 100 METERS
N
SOUTHWESTERN FIELD BIOLOGISTS
San Bernardino County Flood Control District
San Sevaine Creek Water Project
GROUNDWATER DEPTHS IN CHINO BASIN

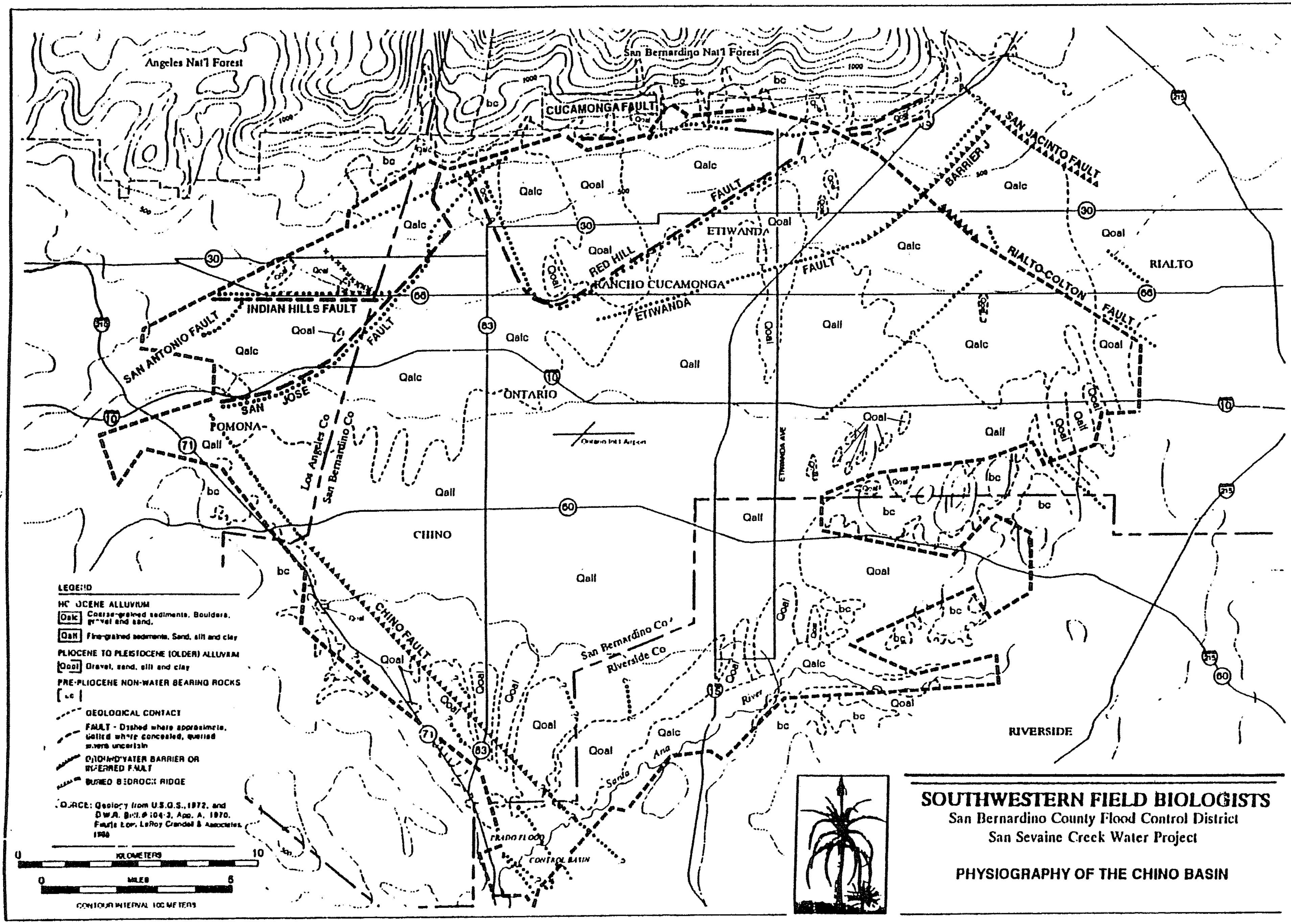
F[illegible]RE 5.3

complex provide additional capability. Permeabilities in the upper Basin, closer to the San Gabriel Mountains, are generally higher except in localized areas of mud-flow deposits. Faults, clay lenses, and cemented materials restrict water movement in limited areas. Figure 5.4 locates area faults.

Transmissivity values in the Basin range from 50,000 gpd/ft to 400,000 gpd/ft (CDM, May 1991). Higher values in the Chino I are associated with coarser gravel deposits near the San Gabriel Mountains although ancient mud flows are responsible for impermeable layers in isolated areas.

Water quality varies substantially between subbasins. Groundwater movement generally follows the direction of surface flows, from the mountains in the north to the river. Water quality degrades in the direction of flow. High to good quality water recharges the Basin along the foothills by natural and artificial means. Nitrate concentrations in almost all of Chino III currently exceed the maximum contaminant level under state and federal law (45 mg/L). A large nitrate plume located southeast of the City of Chino in Chino II contains concentrations between 100 and 250 mg/L. The maximum recommended contaminant level for TDS (500 mg/L) is exceeded in over half of the lower Basin and in some areas exceeds 1,000 mg/L. An isolated plume of contaminated drainage associated with the abandoned Kaiser Steel plant is located in the project area (southern edge of Chino I).

Computer models used to predict changes in the groundwater quantity and quality have been updated by the Santa Ana Watershed Project Authority, MWD, and other agencies over the last 10 years to assist in managing the upper Santa Ana Basin. These models have been used to determine the effects of the proposed project on groundwater elevations and movement. Results of the model runs indicate that the recharge amounts are nominal in comparison to the Basin storage capacity and changes in groundwater elevations and quality will be insignificant, although the proposed project--together with other recharge efforts--will help to stabilize current overdraft conditions.



SOUTHWESTERN FIELD BIOLOGISTS

San Bernardino County Flood Control District
San Sevaine Creek Water Project

PHYSIOGRAPHY OF THE CHINO BASIN

FI E 5.4

The upper Santa Ana Basin contains about 25.3 million acre-feet of water in the unsaturated zone (JMM, 1991). Undisturbed areas in the upper Basin suggest that natural TDS and nitrate levels in the vadose zone were approximately 180 mg/L and 2 mg/L respectively. The volume-weighted average TDS concentration for the upper Santa Ana Basin is about 486 mg/L, which is about 36% higher than the average TDS concentration in pumped water. The volume-weighted average nitrate concentration is about 70 mg/L, 119% higher than average concentration in pumped groundwater.

CHAPTER 6
PLAN OF DEVELOPMENT

The San Sevaine Creek Water Project results from a diversity of needs placed on limited natural resources by a growing population. Flood control, water supply, recreation, and the preservation of the environment are all components of the proposed project which fall under jurisdiction of the San Bernardino County Government in addition to other local, state, and federal agencies. The plan of development responds to regional planning efforts of the various agencies and provides the basic infrastructure to expand for the greater public benefit.

The information presented in this chapter is based on the October 1989 loan application report prepared by Engineering Science in association with Bill Mann & Associates. Basic designs for the flood control features have not changed with the exception of added features for recreation, modifications to accommodate added environmental enhancement, exclusion of the proposed debris basin on San Sevaine Creek, and relocation of the Etiwanda Debris Basin from Etiwanda Canyon south to 24th Street.

6.1 PROJECT PURPOSE AND OBJECTIVES

The main purpose is to conserve high-volume runoff while providing flood control through a system of dikes, channels, and basins to retain storm flows and recharge the Chino Groundwater Basin. Flood protection, soil conservation, and improved groundwater quality will result from project operations. The proposed project is also designed to serve as the backbone of a regional linear-park system extending from Highland Avenue six miles south to Jurupa Basin. The preservation of a sensitive plant community, open space for wildlife use, and habitat enhancement are also objectives adopted by project planners.

Project alternatives investigated by the County include:

1- No Action

2- Direct conveyance to Riverside County for discharge to the Santa Ana River (no retention)

3- A two-dam system including debris basins at the mouths of San Sevaine and Etiwanda Canyons (the 1989 proposal)

4- A single-basin conservation/flood control project without environmental or recreational enhancements (similar to alt. 5).

5- A single-basin system incorporating the use of existing facilities to minimize impacts to the Riversidian alluvial coastal sage scrub, and the use of additional right-of-way and infrastructure construction to create added recreational and environmental benefits.

These alternatives were developed over the many years of project planning and are further discussed in the "San Sevaine Creek Water Project Environmental Assessment" dated August 1995 and prepared in support of this federal loan application report. Alternative 5 was selected as the preferred plan based on the need for flood protection and the public demand for resource conservation in this quickly developing area of western San Bernardino County.

6.2 PHYSICAL PLAN

This project proposes the integration of existing flood-control facilities with new or rehabilitated facilities to meet extend public needs. Table 6.1 summarizes the main project features. The project map presented in Chapter 1 as Figure 1.3 delineates the project and related features. Existing features are described by Figure 1.4. Additional information on hydrologic aspects of the project is contained in Chapter 5. Preliminary design drawings for each of the features are contained in Appendix C.

TABLE 6.1

PROPOSED PROJECT FACILITIES

Facility	Length (miles)	Area (acres)	Storage Capacity (ac/ft)
New:			
Etiwanda West Levee	0.8	13	
Etiwanda East Levee	1.1	13	
Habitat Preservation	1.1	137	
Etiwanda Debris Basin	0.2	55	235
Improved Conservation Basins:			
San Sevaine Basins	1.2	140	2,550
Victoria Basin	0.2	19	235
Rich Basin	0.3	14	26
Hickory Basin	0.4	16	220
Jurupa Basin	0.4	54	1,200
Improved Flood Channel:			
Reach 1 -			
Etiwanda Basin to Highland Avenue	1.0		
Reach 2 -			
Highland Avenue to Foothill Boulevard	2.1		
Reach 3 -			
Foothill Boulevard to Jurupa Avenue	4.1		
Linear Parkway	6.2	25.8	

6.2.1 Etiwanda Levees

The proposed levees would extend from near the mouth of Etiwanda Canyon to the proposed debris basin at 24th Street (see Figure C.1). The primary purpose of the levees is to prevent lateral movement of the stream bed outside the existing floodway in order to maintain the effectiveness of the planned debris basin. The levees would extend for approximately 1.1 miles along the existing drainage channel and protect the natural habitat occurring in the floodplain. The levees would be located between 800 and 1,800 feet apart to accommodate meandering stream flows necessary to sustain high-value coastal sage scrub. The upper 1,500 feet of the existing Etiwanda Spreading Grounds (representing about 27 acres) would also be preserved between the levees. The west levee would be constructed along an existing dirt road--having nominal effects on existing habitat values. Both levees would be constructed using fill material excavated from the proposed debris basin.

Compacted fill would range in height from 0 to 20 feet with facing side slopes of 3:1. Back slopes may be flattened to 5:1 if adequate material is available or through a levee maintenance program (see Figure C.2). Facing slopes would be rip-rap armored. All areas impacted by construction (except roadways) would be restored and revegetated with naturally occurring plant species after consultation with appropriate state and federal agencies. The east levee will be completely revegetated and accessed only for repairs. The levees would not be open to public access as part of an agreement with the U.S. Fish and Wildlife Service and California Department of Fish and Game to preserve the natural habitat and limit access to the National Forest. The County property would be fenced to prevent all access, although construction may be phased as required to accommodate wildlife movement.

The preserve will function mainly to benefit high-quality sage scrub that exists in the flood plain. Natural flow between the levees will not be impeded but allowed to meander--providing the hydrologic regime necessary to sustain the plant community. Water will not flow bank-to-bank between the levees or be restricted to cause high levels of sedimentation.

6.2.2 Etiwanda Debris Basin

A debris basin along Etiwanda Creek is required for effective operation of downstream flood control and conservation facilities. The basin would extend from the proposed levees and be constructed using a balanced cut/fill design with an earthen embankment located north and adjacent to 24th Street in the location of the existing Etiwanda Spreading Grounds. The height of the proposed embankment would be approximately 50 feet (on-slope) with a facing side slope of 5:1 (see Figure C.3). Outlet works would convey 100 cubic feet per second (cfs) through the dam and the emergency spillway would be designed to accommodate flows greater than the maximum probable flood (150,000 cfs).

The total area of construction would require approximately 54 acres. The basin would also provide infiltration capacity in excess of that lost by the partial displacement of the spreading grounds, although the basin would not be operated as a conservation pool to store runoff. Specific details regarding expansion of the existing spreading grounds into the excavated basin area are being discussed with the Chino Basin Watermaster and the Metropolitan Water District of Southern California. This expansion could significantly increase the habitat value as a riparian area, although this is not currently a planned project feature.

The basin would be designed to accommodate debris from the tributary drainage area of approximately 3 square miles. The debris storage volume would be approximately 1 million cubic yards--which should be adequate to accommodate a 100-year storm following a catastrophic fire in the upper watershed. (Detailed hydrologic studies are currently underway to develop final design data). The large storage capacity is necessary to ensure adequate operational capability under worst-case conditions. The debris material is marketable and would be removed from the project site or used to maintain the levees.

Criteria for debris basin design are usually based on providing storage capacity for debris generated by a single major flood event as a minimum. Considerable information has been gathered by the Los Angeles County Flood Control District on its large network of dams and debris basins. Maximum single-storm debris production rates as high as 120,000 cubic yards from a one square-mile watershed, and single season rates as high as 150 percent of the maximum single-storm rate have been recorded. Debris volumes carried by flowing streams which equal the clear water volume of the stream (100 percent bulking) have also been recorded.

Wildland fire history is an important factor in debris studies. Debris discharges from totally burned watersheds can be many times the rate of an unburned watershed. Valuable information on historical fires is available from the U. S. Forest Service or California Division of Forestry for use in making debris studies. Because of the experience the Los Angeles County Flood Control District has had with debris movement in the San Gabriel Mountains, its criteria was used in the preliminary design of the debris basin as shown on the plans. Final designs would be based on the most recent information available.

The designer is aware that certain basins and dams as defined in the "Statues and Regulations Pertaining to Supervision of Dams and Reservoirs" published by the State Department of Water Resources, Division of Safety of Dams, would fall under State jurisdiction (see Section 6.7.2). The designer would review regulation and design criteria established by the state and federal government.

6.2.3 Lower San Sevaine Conservation Basin (Basin 5)

A series of five percolation basins exist along the San Sevaine Creek Channel between Summit Avenue and Interstate 15. These are flow-through basins providing debris catchment and water conservation. Basin 5 would be expanded to approximately 2,350 acre-feet of storage capacity. The existing basin would be redesigned with an improved inlet, outlet, and spillway works (see Figures C.4 - C.8). The outlet is sized to accommodate 1,200 cfs, while the emergency spillway would handle up to 35,300 cfs. The depth of the improved basin would range from 0 to 12 feet with side slopes of 2.25:1 and extend for 7,560 feet. The area would be revegetated after construction and safety features provided to allow public use of the area as an extension of the proposed regional parkway system.

The linear parkway would be extended to include basins 1-4. Upstream features including the spreading grounds and debris basins previously proposed have been excluded from the proposed project to avoid impacts to biological and cultural resources.

6.2.4 Victoria Basin

Victoria Basin is located north of Interstate 15 on the western edge of the Etiwanda Channel. The inlet and outlet structures of this existing basin would be modified for improved operation (see Figure C.9). Some earthwork would be required to complete the improvements, however there would be no excavation to increase the existing 235 acre-feet of storage capacity.

6.2.5 Rich Basin

Rich Basin is located northeast of the San Sevaine Basins along the existing Hawker-Crawford Channel. This flow-through basin would be deepened by approximately 3 feet to provide 26 acre-feet of storage capacity (see Figure C.10).

6.2.6 Hickory Basin

Hickory Basin is a partially developed flow-through basin located east of the San Sevaine Channel and south of the Santa Fe Railroad. The basin serves as the terminus of the West Fontana Channel and covers an area of about 16 acres although its existing storage capacity is minor. The basin would be deepened and inlet/outlet works would be added to provide for approximately 220 acre-feet of storage (see Figures C.11 through C.13).

6.2.7 Jurupa Basin

Jurupa Basin is located on about 60 acres east of the existing unlined channel at Jurupa Avenue, the southern project boundary. This basin would be excavated and designed as a bypass basin to receive peak flows from the channel for up to 1,200 acre-feet of storage (see Figures C.14 and C.15). A spillway would direct excess flows back into the channel. Low channel flows would also be directed into the basin for improved conservation.

6.2.8 Etiwanda/San Sevaine Floodway Channel

The velocity of flow in the existing Etiwanda Creek earth ditch varies from 15 to 20 feet per second (fps). Steep slopes and high velocities cause major damage to the existing channel, even in small storms. Flows have seriously eroded the channel banks in many storms and have broken out of the channel in several past events. Portions of the existing channel have rail and wire revetted levees. It would not be feasible to line the channel walls and leave the channel bottom unlined due to the erosive nature of the soil and the high velocity of the channel flow. Therefore, in order to intercept and conduct storm flows into the recharge facilities and prevent loss of life and property, the lining of the channels is necessary. Although the initial (dry) infiltration capacity of a natural channel is typically higher than that of an excavated basin of equal area, high flow velocities and sediment transport are not conducive to recharge. Assuming an average velocity of 15 fps, flows emanating from the San Gabriel Mountains would enter downstream facilities in Riverside County in less than one hour. Under saturated conditions with high flows, it is doubtful that infiltration volumes would even be measurable. Infiltration losses due to channel lining would be more than recovered through improved operation of the conservation basins for any size flow.

The existing floodway would be improved for effective operation of the conservation basins as well as recreational use. The floodway is referenced in three sections for the purposes of this report:

Reach 1, from the proposed Etiwanda Basin to Highland Avenue
Reach 2, from Highland Avenue to Foothill Boulevard
Reach 3, from Foothill Boulevard to Jurupa Avenue

Most of the floodway would be constructed as a trapezoidal channel with 1.5:1 side slopes (see Figures C.16 through C.19). Rectangular sections are required at some locations due to construction conditions. All sections would be designed to convey 100-year flows. Chain link fencing would isolate the channel from the adjacent linear parkways.

Reach 1 (Etiwanda Channel): Reach 1 would extend approximately 5,000 feet from the Etiwanda Basin outlet to the existing lined channel north of Highland Avenue and Interstate 15 with a design capacity of 6,300 cfs. The channel freeboard and adjacent linear parkways could contain flows in excess of 10,000 cfs although extensive damage would result to improvements. A concrete box structure would replace the present 24th Street dip section. The existing earthen Etiwanda channel is maintained with heavy equipment.

Reach 2 (San Sevaine Etiwanda Double Channel): Reach 2 begins near the outlet of Basin 5, upstream from Interstate 15, and extends approximately 12,000 feet to Foothill Boulevard. The existing channel is actually two separate but parallel concrete-lined channels to maintain separate flows in Etiwanda and San Sevaine Creek. Channel lining is complete, however modifications are needed to provide public access as part of the linear parkway. The channel capacity at the end of Reach 2 is 12,200 cfs.

Reach 3 (San Sevaine Channel): This existing earthen channel extends approximately 21,000 feet from Foothill Boulevard to Jurupa Avenue and accommodates flows from 12,200 to 18,850 cfs. Hickory and Jurupa Basins are located along this reach. Three reinforced concrete box structures have been constructed to conduct flows under Arrow Highway, Whittram Avenue, and the Santa Fe Railway.

A concrete-lined channel would be constructed from the Santa Fe Railway south to Interstate 10. The Metropolitan Water District Upper Feeder crosses beneath the channel approximately 1,000 feet south of the railroad. A concrete pad would be constructed over the pipeline for added protection. A transition (drop structure) would be constructed immediately downstream of the pipeline because of the grade change, and a rectangular channel would be required for a short distance downstream.

Triple box structures are proposed at channel crossings at San Bernardino Avenue, Valley Boulevard, and possibly at the railroad spur south of San Bernardino Avenue. Mulberry Channel, located immediately south of Valley Boulevard, is proposed for connection to San Sevaine Creek. At Interstate 10, two converging rectangular concrete-lined channels would be constructed under the freeway. The eastern channel would intercept Mulberry Channel flows, and the two channels would join immediately south of the freeway. Freeway traffic should not be affected by the proposed construction.

Because of the proposed rectangular channel under Interstate 10 and the proximity of the Southern Pacific Railroad, a rectangular concrete-lined channel would be built between these two crossings. A triple box structure would be located at the rail-line crossing. A bypass track would be necessary to keep the line in operation during construction. A trapezoidal concrete-lined channel is proposed downstream of the railroad crossing to Slover Avenue. A triple box structure is planned for the Slover Avenue crossing.

6.2.9 Wildlife Preserve

Approximately 137 acres of natural habitat would be preserved along the Etiwanda Creek, between the San Bernardino National Forest and the proposed site of the Etiwanda Debris Basin. The preserve would extend for approximately 1.1 miles and vary in width between 800 and 1,800 feet depending on the natural contour of the floodplain. Approximately two-thirds of the area is comprised of Riversidian alluvial fan sage scrub supporting a variety of plant and animal life. A wildlife corridor would extend from the preserve area to the San Sevaine recharge basins providing a connection between Etiwanda and San Sevaine Creeks back to the National Forest. The preserve area would not be open to public access.

Habitat and water supply for wildlife would be enhanced through surface retention in the recharge basins. Imported water supplied through the Metropolitan Water District of Southern California for recharge in the Etiwanda Spreading Grounds would also complement wildlife use of the preserve. The area would be fenced and

Not Good for percolation & water conservation patrolled regularly to reduce damage from unauthorized use. The need for fencing would be evaluated annually to determine optimum wildlife use while restricting public access. Annual inspections will be performed by federal biologists and an evaluation workshop conducted every five-years with the County.

6.2.10 Linear Parkways

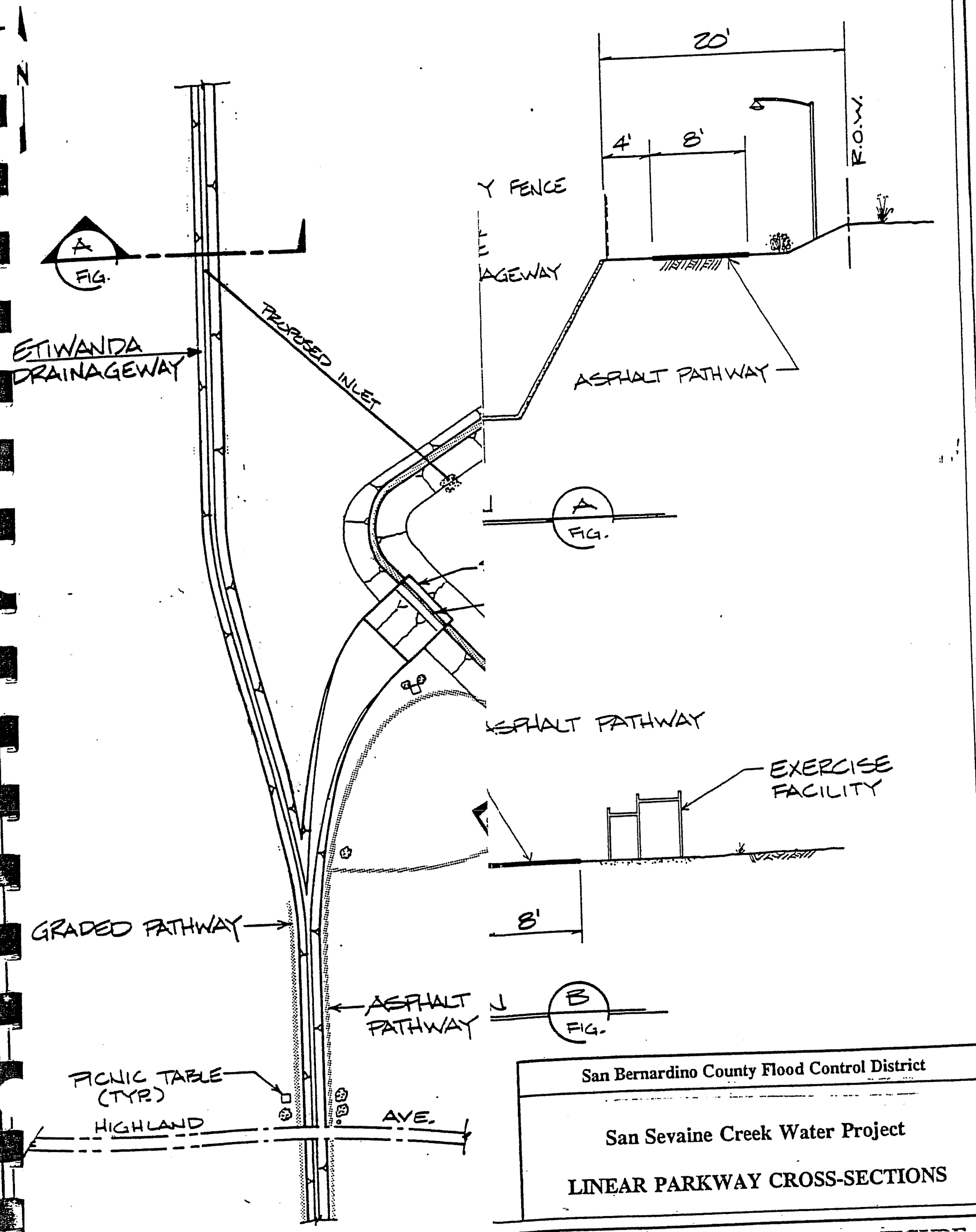
Approximately 6 miles of linear parkways would be constructed adjacent to flood control features. The parkways would double as maintenance access for the channels and basins, but would be open to public use. The east-side parkway would contain an asphalt paved jogging path, the west-side path would remain unpaved. Both sides would be landscaped--some areas in grass. Open areas adjacent to basins would be furnished with picnic tables and exercise facilities. Lighting would not be provided and the park would be closed between dusk and dawn. Figures 6.1 and 6.2 describe the parkway as conceptualized. Actual facilities and landscaping would be determined during final design and limited to the budget provided in the project loan.

The project will provide an increased water supply to the Chino Basin by providing water storage and percolation areas. The percolated runoff will assist in recharging the Basin, the basic water supply of the western part of San Bernardino Valley. Chino Basin provides water to agriculture, as well as industry and municipalities.

As indicated in Chapter 4 (Water Requirements), approximately 60 percent of the water used in the area overlying Chino Basin is pumped from the underground basin. All water used by agriculture is groundwater.

6.3 GEOLOGIC INVESTIGATIONS

The Cucamonga Fault System is located in the northern project area at the base of the San Gabriel Mountains. Because of the fault zone, a "Reconnaissance Geotechnical Investigation" report (a preliminary study) was provided by the



San Bernardino County Flood Control District

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LINEAR PARKWAY CROSS-SECTIONS

consulting engineering and geotechnical firm of Moore & Taber. The "Reconnaissance Geotechnical Investigation" report is included as Appendix D. Final sitings and designs will be based upon a detailed geotechnical and soils investigation to be performed during the final design.

The preliminary design concepts are predicated on an earth-fill embankment to be located no closer than a 75-foot setback line north of the Cucamonga Fault System. Both undisturbed and native alluvium should provide excellent bearing support for proposed embankments.

Preliminary assumptions indicate the unweathered native alluvial soils and/or bedrock will provide excellent bearing for the embankment and structural facilities. The dams will be keyed into the foundation soils. This will provide basal integrity with the foundation soils and stability of the embankment. The necessary depth of the keys will depend primarily on the strength parameters of the downstream surficial sediments, but is assumed to be 5 feet.

Preliminary calculations, using assumed strength parameters for the onsite alluvial sediments, indicate that the low to moderate height rock embankments would be stable with 2:1 slopes although flatter slopes are proposed. The dams have preliminary design heights of about 45 to 60 feet which meets criteria for the moderate height category. Excavation within the recent and older sediments should no be a problem using standard heavy equipment.

Subsequent to selections of alternative dam sites (if necessary) and design concepts, detailed site-specific geotechnical studies will be necessary. These studies should include geophysical surveys, trenching and detailed geologic mapping. More specific calculations and foundation recommendations will be provided by the detailed geotechnical studies.

The preliminary siting and design of the Etiwanda Basin and Basin 5, based on the aforementioned "Reconnaissance Geotechnical Investigation", will provide sufficient information for cost estimating purposes.

6.4 ENGINEERING DESIGNS

The five San Sevaine percolation basins are designed to provide an outlet for several storm-drain systems in the San Sevaine Creek drainage area. The storm drains are not part of the project; however, they will capture additional runoff from urbanizing areas for percolation and recharging the underground basin. The basins and Etiwanda Spreading Grounds will also capture runoff from the mountainous area for water storage and percolation. See Chapter 5 for a more detailed description of the percolation basins and recharge data.

The preliminary plans for the lined channels are based on a 100-year frequency design flow with freeboard. Preliminary plans for Etiwanda Basin are based on approximately 135,000 cubic yards of debris storage for each square mile of drainage area.

Specific preliminary design criteria is included for the Etiwanda Basin and appurtenant facilities, the Lower San Sevaine Dam and Retention Basin and appurtenance facilities, the percolation basins, and the lined channels. Preliminary designs for the proposed levee system is pending possible changes to augment the wildlife preserve area. Hydrologic analysis of runoff and sediment transport in Etiwanda Creek is currently underway. Final designs will be prepared after geotechnical and soil investigations, hydraulic analysis, and materials testing are performed.

6.4.1 Etiwanda Basin Preliminary Design

Due to the project's reconfiguration, preliminary designs needed to be redone and are currently underway.

6.4.1.1 General

The Etiwanda Basin component of the project includes hydrology, sediment transport, right-of-way, the cut/fill embankment, outlet works, and spillway.

6.4.1.2 Basin Capacity

Etiwanda Basin, sized by the Tatum Method, will store 400,000 cubic yards of debris, or approximately 135,000 cubic yards of debris per square miles of tributary watershed. The area-capacity curves indicate that the required storage is provided by a reservoir with a bottom elevation of 1600 MSL and a spillway weir elevation of 1650. The design anticipates that the reservoir will be filled with debris every few years and will have to be re-excavated.

6.4.1.3 Embankment

The levee and basin site is part of a boulder-strewn gravel alluvial fan (wash). The design philosophy will be to make no attempt at creating a water barrier. The embankment, shown in Plan and Section in Appendix C, will be designed as a rock fill flow-through section.

Minimum safety factors proposed:

Loading Conditions for Upstream Slope	S.F.
Reservoir empty	1.5
Reservoir full	1.5
Full drawdown*	1.3
Reservoir empty + seismic	1.1

Loading Conditions for Downstream Slope	S.F.
Reservoir empty	1.5
Full flow through*	1.3
Reservoir empty + seismic**	1.1

* Assumed free draining, but with a seepage force parallel to the slope.

** Pseudo-static, at S - 0.2W.

6.4.1.4 Spillway

The Etiwanda Creek conveyance system will be designed for a 100-year frequency storm and the water conservation facilities will be designed primarily to capture and conserve "annualized" storm runoff and/or small storm flows.

However, because of the potential catastrophe of topping a dam or basin levee in the event of a major flood in excess of a 100-year storm, spillways are designed to convey much higher design flows. State Division of Safety of Dams requires the design of "dam" spillways to pass the "maximum probable flood". The hydrology for the conveyance system is based on a 100-year storm.

The spillway consists of an 80-foot long broad crested (trapezoidal) weir, an 80-foot wide reinforced concrete chute that is constructed over the embankment, and a terminal Type IV stilling basin. It is sized to pass 15,000 cfs without overtopping the dam. This corresponds to 5,000 cfs/square mile, whereas 3,700 cfs corresponds to the Creager formula at C-100. For C-100, the net freeboard is 2.8 feet.

The chute is reinforced concrete and has a 12-inch thick slab and 12-inch thick walls. The slab and walls of the stilling basin are 18 inches thick. The chute is not articulated but has heavy longitudinal steel (one percent of the area of concrete). The floor slab is perforated a 4 feet on centers, each way, with vitrified clay drain pipes that will relieve uplift pressures under the flow-through condition. Additionally, the slab is anchored back into the dam at 5 feet on centers, as is the reinforcement on the downstream slope of the dam.

6.4.1.5 Outlet Works

The outlet works conform to the Los Angeles Flood Control District Standard and are totally uncontrolled. They consist of a multi-ported 5-foot diameter intake tower which rises to the spillway weir elevation, and a 36-inch diameter reinforced concrete pipe conduit that passes under the dam. *

Reference is made to the Los Angeles County Flood Control District Design Manual "Debris Dams and Basins" for general guidelines. Detail design of the outlet works shall be based on criteria approved by the California Division of Safety of Dams and the Bureau of Reclamation.

6.4.1.6 References and Additional Debris Analysis

An analysis and recommendation on debris potential and design shall be made, and approval by the California Division of Safety of Dams shall be obtained prior to determination of final design methodology and criteria, and prior to initiation of the final design of the debris basin. A detailed geotechnical and soils investigation analysis and report will be necessary for final design. The debris basin will also come under the jurisdiction of the State of California Division of Safety of Dams criteria and will have to be designed accordingly.

Debris production rates and analysis by the Los Angeles County Flood Control District and the U.S. Corps of Engineers are referenced in Appendix I. "Safety of Dams" considerations are discussed in paragraph 6.7.2. The normal criteria used for spillway design for any dam under the jurisdiction of the State of California "Safety of Dams" is based on discharge from the Probable Maximum Flood (PMF).

The spillway design flow and other design criteria will be reviewed at the time final design plans are prepared.

6.4.2 Lower San Sevaine Retention Basin (Basin 5) Preliminary Design

6.4.2.1 General

Basin 5 is a combination flood control basin and percolation pond used for reducing the peak discharge of San Sevaine Creek and recharging the groundwater. This component of the project includes an embankment and weir spillway, an uncontrolled outlet conduit, and an uncontrolled chute spillway.

Due to the embankment height and storage volume, the facility will come under the jurisdiction of the State Division of Safety of Dams. The spillway and embankment will be designed using the same criteria as that used for the Etiwanda Basin. Refer to Section 6.7.2 for the preliminary design criteria. A detailed geotechnical and soils study will be made prior to design of the facility.

6.4.2.2 Reservoir Capacity

The reservoir has been sized for 2,350 acre-feet capacity, with a spillway weir elevation of 1430. A preliminary plan and sections are provided in Appendix C. Inflow to the reservoir will be the discharge from upstream Basins 1-4. Accordingly, with most of the deposition taking place upstream, it is anticipated that the Basin 5 will require little to no maintenance excavation in the reservoir due to the silt build-up, and only occasional scarification.

6.4.2.3 Embankment

The embankment design for Basin 5 is similar to Etiwanda Basin with some differences. The existing retention basin site at its lower end is at about elevation 1400, compared to about 1600 at the Etiwanda site. The embankments will be constructed exclusively from reservoir excavation at both sites. At the lower site the borrow is cohesionless sand, gravel, cobbles, and boulders, but nominally finer than at Etiwanda because the site is farther out in the alluvial fan.

Of the 2,350 acre-feet of storage, the existing basins and an additional 1,200 acre-feet will be below grade (and below the elevation of the outlet conduit) and will serve as percolation pond which overlies an estimated 800-foot depth of pervious alluvium.

The basin site is part of a boulder-strewn, and grovel alluvial fan (wash). The design philosophy will be to make no attempt at creating a water barrier. The embankment, shown in plan and section in Appendix C, will be designed as a rock fill flow-thru section, consisting of the following:

1. Wing sections, from Station 0+00 to Station 46+00 and Station 500+00 to Station 75+60. These are represented by Section A and feature: Crest Elevation 1445.1; crest width 24 feet; 2:25:1 slopes, both up and downstream; Zone 1 coarse rock on the upstream dam face and a pit-run interior Zone 2.

2. The spillway section, from Station 47+00 to Station 49+00, is represented in Section C. This has a broad crested weir at Elevation 1430, and will pass a Probable Maximum Flood (PMF) of 35,300 cfs (Creager C-100), with zero freeboard at Elevation 1447.

3. An overflow section, from Station 46+00 to Station 47+00 shown on Section B, which features: crest Elevation 1445.1; crest width 50 feet; 2.25:1 slopes both up and downstream; Zone 1 coarse rock on both faces; and pit-run interior Zone 2.

The construction site will first be cleaned or stripped of brush. The embankment site will then be excavated over the full footprint for an estimated constant depth of 5 feet. No unsuitable material is anticipated at this depth, but if so encountered it will be removed and wasted. The foundations will then be moistened and prepared to receive embankment by compaction with a heavy vibrating roller. Then the zoned embankment shall be placed.

Zone 1 material will be a 2-foot thick upstream and downstream rock facing on the upstream dam face. It will be processed by passing over a double bar screen.

Zone 2, the interior zone will be made up of material taken from dam excavation, pit-run borrow excavated from the reservoir, and grizzly tailings. Maximum size in Zone 2 will be 18 inches. The zone will be placed, moistened and compacted to 75 percent relative density, in 18-inch lifts.

The slopes will be designed on the basis of precedence, and analysis by the technique of infinite slope, sliding wedge and/or the ordinary method of slices. Minimum safety factors proposed:

Loading Conditions For Upstream Slope	S.F.
Reservoir empty	1.5
Reservoir full	1.5
Full drawdown*	1.3
Reservoir empty + seismic	1.1
Reservoir empty	1.5
Full Flow through*	1.3
Reservoir empty + seismic**	1.1

* Assumed free draining, but with a seepage force parallel to the slope.
** Pseudo-static, at S - 0.2W.

The tentative slopes are 2.25:1 on both the upstream and downstream faces.

6.4.2.4 Spillway

The spillway consists of a 200-foot long broad crested (rectangular) weir, a 150-foot wide reinforced concrete chute that is constructed over the embankment, and a terminal Type IV stilling basin. It is sized to pass 35,300 cfs without overtopping the dam. This corresponds to the Creager formula at C=100.

The chute is reinforced concrete and has a 12-inch thick slab and 12-inch thick walls. The slab and walls of the stilling basin are 18 inches thick. The chute is not articulated but has heavy longitudinal steel (one percent of the area of concrete). The floor slab is perforated at 4 feet on centers, each way, with vitrified clay drain pipes that will relieve uplift pressures under the flow-thru condition.

6.4.2.5 Outlet Works

The outlet works are similar to the Los Angeles Flood Control District Standard and are totally uncontrolled. They consist of a multi-ported 10-foot diameter intake tower which rises to the spillway weir elevation, and a 10-foot by 8-foot reinforced concrete box channel that passes under the dam and discharges into the existing paved flood control channel.

6.4.3 Preliminary Designs of Jurupa, Hickory, Victoria and Rich Basins

Jurupa and Hickory Basins will have approximately 1,200 acre-feet and 220 acre-feet of storage volume respectively. A turnout from San Sevaine Channel into Jurupa Basin will direct drainage flows into the basin for percolation. A spillway from the basin back into the channel will be provided to direct flows in excess of basin capacity back to the channel. A basin drain will be provided. Refer to Appendix C for a preliminary plan of the basin.

Drainage flows from San Sevaine Channel will also be directed to Hickory Basin for percolation. In addition, Hickory Basin will also store and percolate drainage flows from the existing West Fontana Channel extending easterly from the basin. A spillway form the basin to San Sevaine Channel will be provided to direct flows in excess of the basin capacity to the channel.

The remaining basins and/or spreading grounds will have turnouts from the channels and minor spillways to direct excess flows back to the channels.

The Jurupa, Lower San Sevaine, and Hickory Basins will be excavated to an interim basin floor level as a part of this project. Sufficient excavation will be accomplished to construct the required levees and spillways. The remaining excavation to meet the ultimate basin floor level will be accomplished by permit activity in support of development projects, freeway construction, etc. The County has had a borrow permit operation for many years and has constructed several water percolation basins by this method.

Geotechnical and soils reports have been prepared for Jurupa and Hickory Basins. Preliminary plans for the facilities are on file with the County.

Victoria Basin exists, but has no inlet. A turnout form Etiwanda Channel to direct drainage flows to the basin for percolation will be provided.

Rich Basin exists as a partial basin with some existing capacity. The basin will be deepened to increase the storage volume and its recharge capability.

6.4.4 Hydrology and Hydraulic Design

6.4.4.1 Hydrology

The design storm frequency normally used for main line channels is the 100-year frequency event. The 100-year frequency design flow was used for the preliminary design of the San Sevaine Creek and Etiwanda Creek Channel.

The unit hydrograph method was used for determining peak flow rates using a 24-hour storm pattern. The peak flow rates used in the channel conveyance design are tabulated in Table 6.2.

The design criteria for major channels comes under the jurisdiction of the local agency (San Bernardino County Flood Control District) and is not governed by the California Division of Safety of Dams. However, because of safety and inundation considerations, Etiwanda Basin and San Sevaine Basin 5 fall within the jurisdiction criteria of the California Division of Safety of Dams.

TABLE 6.2

SAN SEVAINE CREEK CHANNEL SYSTEM

Watershed Location Point Number	Watershed Location	Design Flow 24-Hour Storm Q 100 (cfs)
1	San Sevaine Creek Canyon Mouth	2,921*
2	Etiwanda Creek Canyon Mouth	3,700*
3	Lower San Sevaine Basin Spillway	4,743*
4	Etiwanda Channel at Devore Freeway	8,091
5	San Sevaine Channel at Devore Freeway	4,743
6	San Sevaine Channel at Foothill Blvd. (combined)	15,107
7	San Sevaine Channel at Hickory Basin	18,266
8	San Sevaine Channel at Jurupa Basin inlet	23,722

* Spillways will be designed for a flow in excess of a 100-year flood.

The preliminary plans for the project and the hydrology report are on file with the County and will be made available for review.

The side drain laterals connecting to the channel or outletting directly into the water percolation facilities are generally based on a 25-year design flow and in some cases, a 100-year design. The 25-year frequency design is consistent with the City and County Comprehensive Storm Drain Plans within the San Sevaine Creek Channel System watershed boundary.

Although storm drains are not a part of this project, urban runoff will be conducted to the percolation basins by the existing and future storm drains. The storm drains will increase the runoff available for percolation into the groundwater in the future.

6.4.4.2 Channel Hydraulic Design

In general, the lined conveyance channel general design criteria listed below was used in the development of the preliminary plans.

1. Concrete lined channel with a Manning's n = 0.015.
2. Side slopes for trapezoidal channels = 1-1/2:1.
3. Freeboard of 2.0 feet for channel velocities 35 fps or less. Freeboard of 3.0 feet for channel velocities greater than 35 fps.
4. Streamlined extension of dividing walls upstream and downstream of culverts and bridges for wall thickness exceeding 1 foot.
5. Pipe inlet structure confluence with channel at 45 degrees for sizes 36 to 57 inches, and 30 degrees for sizes 60 to 72 inches. Special junction structures will be used for pipe 78 inches and larger.

6.5 PRELIMINARY PLANS

Preliminary plan and profile sheets have been prepared for Etiwanda Basin, San Sevaine Basin 5, and the water percolation basins, spreading grounds, and linear parkway. Preliminary drawings are included in Appendix C.

The preliminary plans for the lined channel proposed as a part of the project have been completed and are on file with the County. Because of the number of plan and profile sheets (25), they are not included in this report.

Preliminary plans for the lined channels and the percolation basins have been approved by the Counties of San Bernardino and Riverside.

Final plans for the entire project will be based on the preliminary plans, criteria established by the san Bernardino County Flood Control District, the State of California, Division of Safety of Dams, review by the Bureau of Reclamation, other involved agencies, and appropriate engineering design standards.

6.6 CONSTRUCTION CONSIDERATIONS

6.6.1 Construction Methods

The construction method will be by contract with advertised, competitive bidding. All required state and federal guidelines will be followed. The percolation basins will be constructed within existing right-of-way. The existing earth channel and existing basins are located within existing right-of-way and no additional right-of-way will be required. The Etiwanda Basin, Basin 5, and water spreading facilities will be constructed primarily within existing rights-of-way. Some additional rights-of-way may be necessary.

Any canyon flows occurring during the construction period will have to be passed through the site. This will necessitate starting construction in late spring with raising of the embankments prior to winter storms.

Excavation within the recent and older alluvial deposits will be by standard heavy grading equipment and should not be a problem.

The U.S. Corps of Engineers has constructed three debris dams similar to and in close proximity to the proposed Etiwanda Basin within the last ten years. The dams were similar in height, construction and material to the proposed basins. The same methodology and similar materials as used in the construction of the Corps of Engineers facilities will be used in constructing the Etiwanda Basin.

Lined channels will be constructed within the existing unimproved channel and/or wash areas. Normal heavy-duty, earthmoving equipment will be used for channel excavation and placement of embankment. The earthwork necessary for the construction of the percolation basins will be accomplished with similar equipment used in the excavation of the channels.

6.6.2 Construction Materials

The embankment design for the dams excludes the use of fine-grained material for the core. All the materials for embankment will be obtained from the gravel on site. Refer to the preliminary geotechnical investigation in Appendix D. Screening and blending of materials will be necessary.

Etiwanda Levees and Basin, Basin 5, Hickory Basin, and Jurupa Basin levees will be constructed from material excavated within the basins. Soils investigations and reports have already been prepared for the basins.

6.6.3 Construction Conditions

The material in the percolation basin areas and channels can be excavated and placed with heavy equipment under normal conditions. Weather conditions are excellent year-round and no unusual conditions are anticipated in construction of these facilities.

6.6.4 Labor Conditions

The Southern California area has a large number of construction companies, various trade companies and supervising personnel. There is also a large labor pool within the general area. No labor problems are anticipated.

6.6.5 Inspection Requirements

The San Bernardino County Flood Control District, a special district of the County, will handle the administration and inspection of the construction contract. The District has had experience in constructing many projects similar to the proposed San Sevaine Creek Water Project.

6.6.6 Construction Schedule

Design of the proposed project will take 3 years to complete, non-continuous. This time will include the necessary detailed geotechnical and soils investigation for the design of the debris basin and retention reservoir, and for processing the design plans through the State Division of Safety of Dams, Reclamation, and the Army Corps of Engineers. The design of the lined channels and percolation basins will be more straight forward due to the fact the channel alignment and preliminary grade has been set and there are limited utility problems to overcome. Preliminary plan ad profile design plans have been completed for the dams, lined channels, and percolation basins. Final design plans on parts of the project are being prepared at this time including Basin 5.

Completion of the entire San Sevaine Creek Water Project is estimated to take 5 years, with the project separated into six phases. Letting the construction contracts in six phases will divide the remaining estimated construction cost of $62.8 million for the total project into annual expenses of $5 million for Fiscal-Year 1996, $17 million for Fiscal-Year 1997, $19 million for Fiscal-Year 1998, and $21.8 million for Fiscal-Year 1999. Additional information on funding requirements is presented in Section 7.3. A preliminary construction schedule is presented as Figure 6.3.

6.7 MISCELLANEOUS DESIGN AND COST CONSIDERATIONS

6.7.1 Compliance with Executive Orders

6.7.1.1 Executive Order 11988 - Flood Plain Management

Executive Order 11988 was signed May 24, 1977, and revoked and replaced Executive Order 11296. It establishes a new general policy and cites specific requirements for compliance by federal executive agencies.

The order requires agencies to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid the direct or indirect support of floodplain development wherever there is a practicable alternative.

The proposed project will result in an economic use and development of the floodplain in question and will lessen the risk of flood losses. The proposed project is a necessary use of the floodplain in achieving the goals of the project. Flood hazards have been evaluated and the project has been designed to withstand these hazards. Additional expenditures by the federal government after construction will not be required for additional flood protection. Therefore, the proposed project is in compliance with Executive Order 11988.

6.7.1.2 Executive Order 11990 - Protection of Wetlands

Executive Order 11990 stresses the need to avoid adverse impacts of construction activities in wetlands. Existing wetlands will not be affected by this project. Therefore, the proposed project is in compliance with Executive Order 11990.

6.7.2 Safety of Dams Consideration

Etiwanda Basin and Basin 5 will be non-federally owned structures. Therefore, in addition to design approval by Reclamation, the facilities will have to be designed, constructed, maintained and operated in accordance with State of California Standards.

Reference is made to the State of California "Statutes and Regulations Pertaining to Supervision of Dams and Reservoirs", dated 1970. The latest edition of the statutes will be used.

The State of California has regional safety considerations for supervision of dams that fall within the state requirements. Etiwanda Basin and Basin 5 shall be constructed, maintained, operated, and inspected under state statute regulations.

The County has several dams that have been constructed under state statutes.

The general guidelines of the State's Dam Safety Program are provided below:

1. <u>Application for New Dam</u> - "Construction of any new dam shall not be commenced until the owner has applied for and obtained from the Department (State Department of Water Resources, Division of Safety of Dams) written approval of plans and specifications".

   The Department will require a geotechnical and soils investigation, design plans, and hydrology and hydraulic analysis at the time the application is filed.

2. <u>Inspection and Approval</u> - "Immediately upon completion of a new dam or reservoir, the owner shall give a notice of completion to the Department and as soon thereafter as possible, shall file with the Department supplementary drawings describing the dam as actually constructed".

   "As soon as practical, the completed dam or reservoir shall be inspected by the Department".

   "A certificate of approval shall be issued upon finding that the dam or reservoir is safe to impound water within the limitations prescribed in the certificate".

3. <u>Certificate of Approval</u> - "Each certificate of approval issued by the Department may contain such terms and conditions as the Department may prescribe".

"The Department may revoke any certificate of approval when ever it determines that the dam or reservoir constitutes a danger to life and property".

Jurisdictional facilities are inspected once a year by the Department of Water Resources and the certificate is renewed yearly.

4. Inspection During Progress of Work - "During the construction, enlargement, repair, alteration or removal of any dam, the Department shall make continuous or periodic inspections for the purpose of securing conformity with the approved plans and specifications".

6.7.3 Fish and Wildlife

The requirements of the Fish and Wildlife Coordination Act as required in Section 8 of the Small Reclamation Projects Act of 1956 (P.L. 84-984), as amended, will be complied with (see "San Sevaine Creek Water Project Environmental Assessment", Clark Associates, August 1995). A Coordination Act Report prepared by the Fish and Wildlife Service dated February 1995 is on file with the County and Bureau of Reclamation.

6.7.4 Rights-of-Way and Relocation Assistance

Most rights-of-way necessary for the construction of the project are held by the County. There will be no relocation assistance necessary to construct the project. Except for utility relocations and bridge construction, there are no obstructions to be removed for project construction.

6.7.5 Sedimentation

The only major sedimentation expected will occur in the proposed Etiwanda Basin and San Sevaine Basins 1-4. Maintenance plans include budgeting to remove sediments after significant levels of accumulation.

The Etiwanda and Lower San Sevaine Basins preliminary design estimates for debris production are discussed in Section 6.4.

Aside from the Etiwanda Basin, no significant sedimentation below the debris basins is expected. The precipitation runoff that will be turned into the proposed basins below Interstate 15 will be relatively free of major sedimentation. However, some silts and other small grained materials may pass over the basin and dam spillways and subsequently may be deposited into the percolation basins. Additionally, some sedimentation and minor debris from the urban area south of the mountains may be conducted to the percolation basins by the existing and proposed storm drain systems.

This type of sedimentation is an expected condition of percolation basin maintenance and will be removed as part of the regular maintenance program. The San Bernardino County Flood Control District has had a long-standing operation of maintaining water conservation and debris basin facilities.

The removal of sedimentation and debris from the proposed project facilities is included in the operation, maintenance and replacement costs provided in Chapter 7. Annual operation, maintenance and replacement costs are estimated to be $1.7 million (see Table 7.4). An emergency reserve fund of approximately $398,000 will also be established. The fund is provided to finance extraordinary costs beyond the normal OM&R costs as required by SRPA.

6.7.6 Urban Runoff Contaminants

A significant amount of urban runoff will be recharged to the groundwater basin. This runoff will carry some pollutants associated with urban runoff. Automobile use within the study area will be responsible for major deposition of such pollutants as lead from exhaust emissions, asbestos from brake linings, and oil and grease that accumulate on streets and parking surfaces. Chlorinated hydrocarbons, nitrogen, and phosphorous could possibly accumulate in this runoff from pesticide and fertilizer use on landscaped areas.

The contaminants which might be contained in urban runoff are primarily directed toward drainage channels, surface water bodies, or recharge facilities in the first rain of the season, or in the case of a major first rain, in the first day of the first rain. The quality of urban runoff will not normally contain significant amounts of contaminants after the first rain.

According to personnel of the Santa Ana Regional Water Quality Control Board and SCAG's 208 Water Quality Planning Program, there is insufficient data to establish whether urban runoff could significantly impact groundwater quality. SCAG's planning efforts related to pollutants in urban runoff were primarily directed toward possible concentration of pollutants in surface water bodies such as lakes and coastal areas. The potential for degrading groundwater quality through the percolation of urban runoff was not considered significant. Efforts to mitigate impacts from urban runoff are primarily related to minimizing the deposition of contaminants in areas where they could be washed into water bodies.

The California Regional Water Quality Control Board, Santa Ana Region, has indicated they see no problems in the proposed project from a water quality standpoint. They also indicate urban area contaminants have been discussed as a potential problem, but there is not sufficient data available to establish whether urban runoff would significantly impact groundwater quality. It should be noted that most contaminants from urban runoff are likely to enter the groundwater due to the frequency of low intensity precipitation that washes contaminants into the unlined channels. At the present time, most contaminants in the urban runoff will enter the groundwater through the unlined channel systems, existing basins and spreading grounds, and through natural percolation of the soil. Any contaminants that do not enter the soil in the upper part of the Chino Basin are conveyed to the Santa Ana River and/or Prado Basin.

Construction of the proposed recharge facilities will mean that a significant amount of the urban runoff that would otherwise flow to the Santa Ana River will now be recharged into the upper Chino Basin. Urban runoff from streets, parking lots, etc., will not, however, comprise more than 50 percent of the water entering the proposed recharge facilities. The balance of the water to be recharged is high quality mountain runoff and runoff from open valley areas. The infusion of significant amounts of high-quality mountain runoff is expected to balance the contaminants normally contained in urban runoff, with the net result of an incremental improvement of groundwater quality.

The monitoring of urban runoff, and the control of hazardous spills will be handled as follows:

6.7.6.1 Urban Runoff Monitoring Program

The County, and the San Bernardino County Flood Control District in particular, have had a long standing program of monitoring spills, discharges from plants or other disposing of deleterious materials.

A program can be established in conjunction with the involved cities to monitor the urban runoff entering the channels and basins to reduce water quality problems and eliminate any water quality problems that might occur.

6.7.6.2 Accidental Spills of Hazardous Material

Accidental spills of hazardous material into channels and storm drains has not been a major problem in the past in this area. However, as the area urbanizes and as more storm drains are constructed, the possibility of hazardous spills and possible entry into water conservation basins will increase.

At the present time, any spill that affects or can enter any County facility or natural stream is sealed off and isolated. The material is removed by various means and disposed. If the material should get to the basins before it can be isolated, the material would be removed from the basin before it can percolate into the groundwater.

The County Flood Control District, the County Environmental Health Services Department, as well as other health agencies, work very closely with the

State Water Quality Control Board to monitor and control hazardous material spills.

6.7.7 Debris Disposal

The County owns approximately 200 acres in the area of the proposed Etiwanda Basin--along the natural drainageway. A portion of the property will be set aside for a debris storage area. The area set aside will be based on a storage volume of two times the debris volume generated by a major flood.

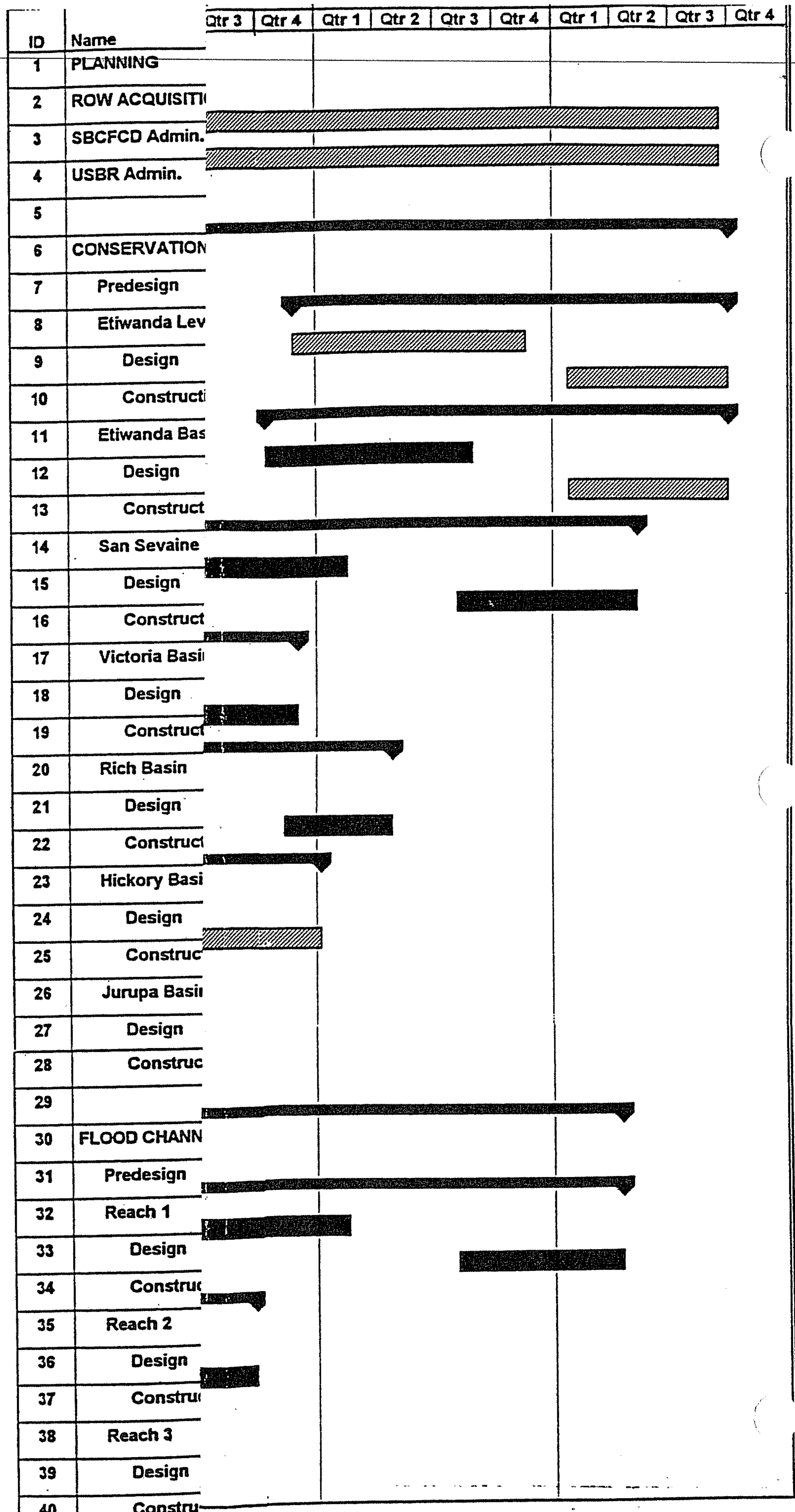
The County also has rights-of-way in excess of 80 acres along the San Sevaine natural drainageway above 24th Street. A portion of the rights-of-way can be set aside as debris storage area. Additional area is available for debris storage if necessary.

6.7.8 Requirements of Public Law 84-984

The County meets the requirements of Subsection 2 (c) of the Small Reclamation Projects Act regarding the term "organization" in that it is a political subdivision of the State of California.

The proposal qualifies as a "project" under the provisions of Subsection 2 (d) of the Act by being a "multiple-purpose water resource project that is authorized or is eligible for authorization under Federal Reclamation Laws". The proposal meets the requirements of Subsection 2 (f) of the Act in that the estimated loan amount does not exceed the allowable amounts of the Act. The County has complied with the requirements of Section 4 (b) of the Act. The proposal meets the requirements for a Category I criteria, as defined by the Act.

The powers of the County, including its special districts, include the right of eminent domain; to issue bonds and cause taxes and assessments to be levied; to enter into binding contracts with the federal government, public agencies, and others; to collect and conserve runoff waters for beneficial purposes; and to construct, operate, and maintain facilities to supply water to agriculture, municipal and industrial uses.



Project: ETIWANDA S

CONSTRUCTION SCHEDULE
FIGURE 6.3

8.4 COST ALLOCATION AND REPAYMENT EVALUATION

8.4.1 Cost Allocation

The San Sevaine Creek Water Project is a multi-purpose project benefiting commercial irrigation and M&I water supply (including excess land), flood control, fish and wildlife enhancement, and outdoor recreation. The cost allocation is determined using Reclamation guidelines for the "separable cost-remaining benefit" (SCRB) method. The detailed SCRB analysis is contained in Appendix G and summarized below.

Costs are allocated based on alternative projects and "project without" conditions. Recreational facilities are the only facilities identified as single purpose. Benefits to water supply are developed in Chapter 5 as 25,000 acre-feet (on average) for production from the Chino Groundwater Basin under safe yield. All other benefits were identified through analysis conducted with the U.S. Army Corps of Engineers, the F&W Service, the County Department of Parks and Recreation, and the Bureau of Reclamation as documented in Appendix G.

The SCRB procedure results in the following cost allocation:

Water Supply	34.4%
Flood Control	43.0%
F&W Enhancement	6.9%
Recreation	15.7%

The proposed project will improve groundwater supplies through direct recharge to the Chino Basin on a constant-average basis. The Basin is recognized as a water supply facility supporting agriculture and M&I demands. Regular agricultural costs (not including excess lands or small plot M&I) are repaid without interest. Costs allocated to M&I and excess lands are repaid with interest. Therefore, the cost allocation for water supply must be further divided. This division is a function of annual water use best described relative to the repayment schedule. For continued discussion see Section 9.2.1.

8.4.2 Repayment Provisions

The repayment contract will contain provisions for identifying actual water use by agriculture and M&I to determine the interest due on each annual payment. This will be accomplished through a review of the Chino Basin Watermaster's annual report.

Excess land is defined as a single holding wherein the total irrigated acreage is greater than 320 acres. There are two land holdings containing irrigated or arable acreage in excess of 320 acres associated with commercial irrigation in the Chino Basin, one of 420 acres and the other at 353 acres. The total excess land associated with these two holdings is currently 133 acres. Interest payments are required for excess lands, and therefore the cost allocation is adjusted as described in Section 9.2.1.

CHAPTER 9

FINANCIAL PROGRAM

The San Sevaine Creek Water Project is a multi-use project benefiting water supply, flood control, fish and wildlife enhancement, and outdoor recreation. Benefits from the construction and operations of the proposed facilities extend to commercial irrigation (including excess lands), M&I water supply, wildlife, and local communities through flood control, open space and recreation. This chapter identifies the cost allocation between the repayment entities and demonstrates how the federal loan will be retired.

9.1 LOCAL COST SHARING PROVISIONS

Local cost sharing provisions under SRPA require a minimum 25% contribution which increases with respect to federal subsidy requirements as the loan amount reaches the maximum ceiling of $34,200,000 (1995). Current policy changes recommended by Reclamation staff would increase the minimum contribution to 33%. The County will contribute $31,177,141 of the total $89,796,975 project cost, representing a 34.7% local share. The local contribution is identified in Table 9.1. The contribution is also identified in the schedule of expenditures contained in Appendix E as Table E.10.

Planning costs include $500,000 for preparation of the loan application reports and environmental documents and $180,000 for Reclamation coordination and technical review (paid to date). County administrative and planning costs are estimated at $1,000,000 for the 10-year period from 1985 through 1995. The filing fee is also included as a planning cost item.

TABLE 9.1

LOCAL CONTRIBUTION

Item	Cost
Planning	$1,680,000
Land Acquisition & ROW	14,888,469
Facilities Design & Cnst.	12,108,672
Cash	2,500,000
Total Contribution	$ 31,177,141

Land acquisition will be required for portions of the levees, habitat preservation areas, and linear parkways. Approximately 16 acres will be required to construct these facilities at a maximum estimated cost of $30,000 per acre. The entire project, including 137 acres of habitat preserve and 36 acres of linear parkways, covers an area of approximately 521 acres. The value of the land as a local contribution is estimated using an average cost of $27,577 per acre for a total of $14,888,469.

Predesign and design of project related facilities was initiated in 1985-after the federal notice-of-intent was submitted to Reclamation (January 14, 1985). Some facilities have been constructed and are essential to the operational success of the project. Rescoping of project objectives to include the habitat preservation and recreational opportunities required some design modifications.

9.2 FEDERAL LOAN REPAYMENT PROVISIONS

9.2.1 Cost Allocation Summary

The project cost allocation is developed in Appendix G using the separable cost remaining benefit (SCRB) methodology. The resulting allocation for the four main project functions is:

Water Supply	34.4%
Flood Control	43.0%
F&W Enhancement	6.9%
Recreation	15.7%

The water supply function is subdivided according to water use (i.e. regular irrigation, excess lands, small tract M&I, and regular M&I). This refinement is accomplished in the preliminary repayment schedule based on estimated future demands. The "rolling-cost allocation" is developed from Table 9.2 which projects use based on historical trend. Historical and projected production by the agricultural pool is delineated in Figure 9.1. The estimate assumes that water produced by the planned Chino Desalters will be allocated as M&I water by the Chino Basin Watermaster.

Table 9.3 relates the production percentages developed in Table 9.2 to the 25,000 acre-feet of water conserved annually by the project. In the year 2000, regular irrigation is expected to utilize 25.7% of the water produced under safe yield. Irrigation deliveries to excess lands will account for 0.067% of the total and M&I deliveries 74.2%. By the end of the repayment period (2014), M&I deliveries are expected to represent over 80% of production under safe yield. Actual interest payments will be based on actual withdrawals as recorded by the Chino Basin Watermaster. If agricultural use declines at a rate slower than projected, then the interest bearing portion will be less, and visa versa. As discussed in Chapter 4, all unused agricultural water is distributed among the appropriative pool members. Therefore, the equation for determining the cost allocation is doubly sensitive to agricultural reductions--a one acre-foot decline in agricultural pool withdrawals is also a one acre-foot increase in M&I use. It should also be restated that the allocation is limited to the safe yield of 140,000 acre-feet annually and does not include imported supplies.

The loan amount allocated to regular-commercial irrigation of single ownerships less than 320 acres is non-interest bearing. Interest during construction for this amount is also non-reimbursable. The remaining loan amount (including the excess land and M&I water supply functions) will be repaid with interest calculated at 7.625% annually. The rolling cost allocation built into the preliminary repayment schedule attempts to account for annual changes between interest and non-interest bearing functions.

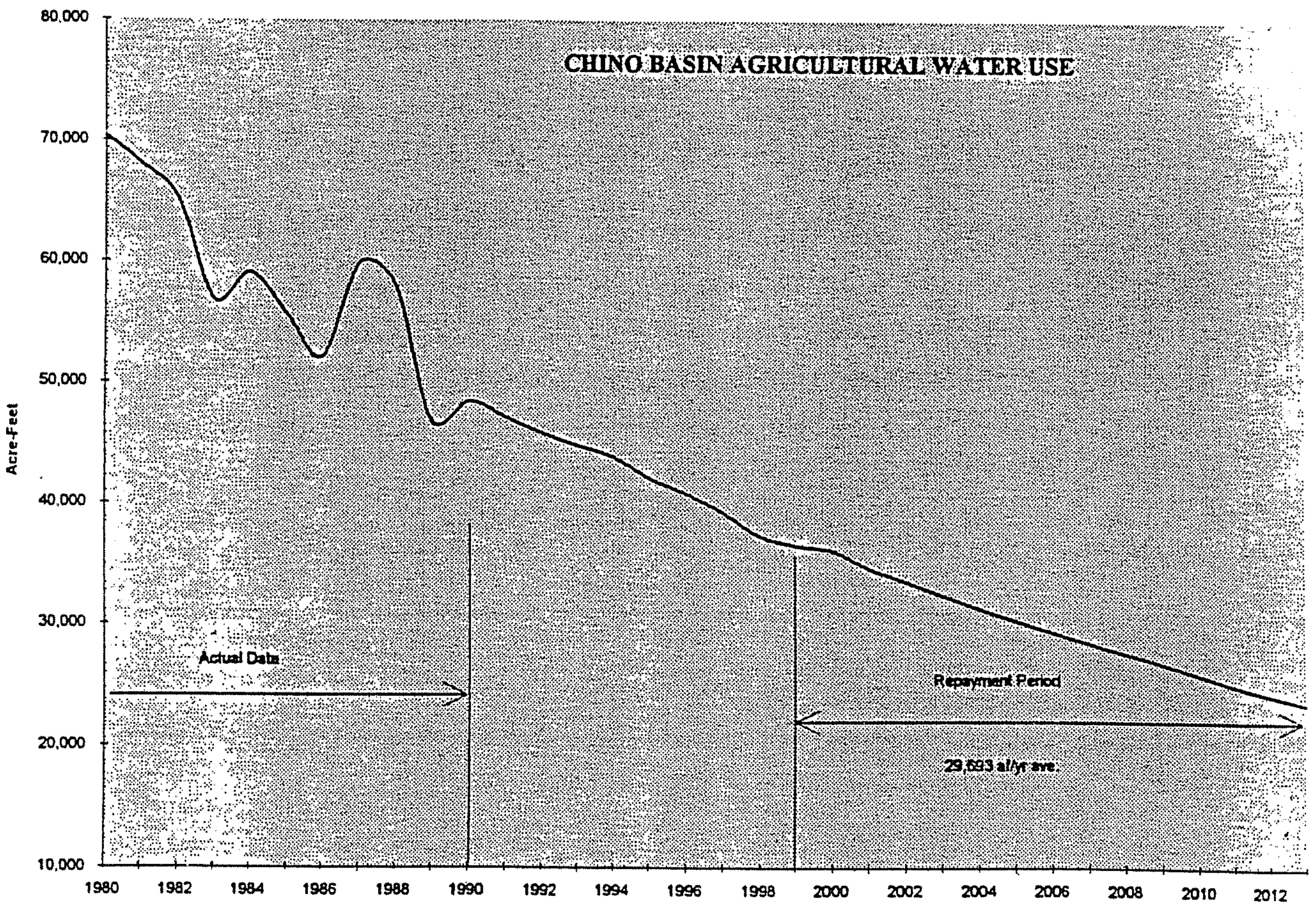


FIGURE 9.1

TABLE 9.2

BASIN WATER USE PROJECTIONS

Year of Repayment		Chino Basin Deliveries Under Safe Yield								
			Irrigation							
			Total		Regular		Excess		M&I	
		Total (ac-ft)	(ac-ft)	(%)	(ac-ft)	(%)	(ac-ft)	(%)	(ac-ft)	(%)
1	2000	140,000	36,072	25.77	35,978	99.74	94	0.2615	103,928	74.23
2		140,000	34,628	24.73	34,538	99.74	90	0.2599	105,372	75.27
3		140,000	33,494	23.92	33,408	99.74	86	0.2568	106,506	76.08
4		140,000	32,378	23.13	32,296	99.75	82	0.2533	107,622	76.87
5		140,000	31,291	22.35	31,213	99.75	78	0.2499	108,709	77.65
6	"05	140,000	30,270	21.62	30,195	99.75	75	0.2465	109,730	78.38
7		140,000	29,356	20.97	29,285	99.76	71	0.2425	110,644	79.03
8		140,000	28,458	20.33	28,390	99.76	68	0.2387	111,542	79.67
9		140,000	27,612	19.72	27,547	99.77	65	0.2347	112,388	80.28
10		140,000	26,779	19.13	26,717	99.77	62	0.2309	113,221	80.87
11	"10	140,000	25,865	18.48	25,806	99.77	59	0.2281	114,135	81.52
12		140,000	24,991	17.85	24,935	99.77	56	0.2253	115,009	82.15
13		140,000	24,232	17.31	24,179	99.78	54	0.2217	115,768	82.69
14		140,000	23,477	16.77	23,426	99.78	51	0.2183	116,523	83.23
15	"14	140,000	22,747	16.25	22,698	99.79	49	0.2150	117,253	83.75
Total		**2,100,000**	**431,649**		**430,609**		**1,040**		**1,668,351**	
Percent of total		**100**	**20.55**		**20.51**		**0.0495**		**79.45**	

TABLE 9.3
PROJECT WATER ALLOCATION

Year of Repayment		Total (ac-ft)	Project Water Allocation to Chino Basin: Irrigation: Total (ac-ft)	Irrigation: Total (%)	Irrigation: Regular (ac-ft)	Irrigation: Regular (% Ag)	Irrigation: Regular (% Total)	Irrigation: Excess (ac-ft)	Irrigation: Excess (% Ag)	Irrigation: Excess (% Total)	M&I (ac-ft)	M&I (%)
1	2000	25,000	6,441	25.77	6,425	99.74	25.70	17	0.2615	0.0674	18,559	74.23
2		25,000	6,184	24.73	6,168	99.74	24.67	16	0.2599	0.0643	18,816	75.27
3		25,000	5,981	23.92	5,966	99.74	23.86	15	0.2568	0.0614	19,019	76.08
4		25,000	5,782	23.13	5,767	99.75	23.07	15	0.2533	0.0586	19,218	76.87
5		25,000	5,588	22.35	5,574	99.75	22.29	14	0.2499	0.0558	19,412	77.65
6	"05	25,000	5,405	21.62	5,392	99.75	21.57	13	0.2465	0.0533	19,595	78.38
7		25,000	5,242	20.97	5,230	99.76	20.92	13	0.2425	0.0508	19,758	79.03
8		25,000	5,082	20.33	5,070	99.76	20.28	12	0.2387	0.0485	19,918	79.67
9		25,000	4,931	19.72	4,919	99.77	19.68	12	0.2347	0.0463	20,069	80.28
10		25,000	4,782	19.13	4,771	99.77	19.08	11	0.2309	0.0442	20,218	80.87
11	"10	25,000	4,619	18.48	4,608	99.77	18.43	11	0.2281	0.0421	20,381	81.52
12		25,000	4,463	17.85	4,453	99.77	17.81	10	0.2253	0.0402	20,537	82.15
13		25,000	4,327	17.31	4,318	99.78	17.27	10	0.2217	0.0384	20,673	82.69
14		25,000	4,192	16.77	4,183	99.78	16.73	9	0.2183	0.0366	20,808	83.23
15	"14	25,000	4,062	16.25	4,053	99.79	16.21	9	0.2150	0.0349	20,938	83.75
Total		375,000	77,080		76,894			186			297,920	
Percent of total		100	20.55		20.51			0.0495			79.45	

9.2.2 Sources of Funding

The local contribution is funded through general taxes, development fees, and a special fund generated by the Mello-Roos Community Facilities District for rural infrastructure improvements.

The County will contract with the United States Department of Interior, Bureau of Reclamation under the Small Reclamation Projects Act to complete funding requirements. Federal funding is scheduled to commence in Fiscal-Year 1996. The County will finance federal design and construction activities (as capable) if the SRPA project is approved and funding is unavailable as scheduled. County financing of costs identified in this application as loan or grant is reimbursable when federal funds become available with the provision that such costs are not incurred until after federal approval.

9.2.3 Sources of Revenue

As the regional agency responsible for loan repayment, the County will collect fees and otherwise obtain the funds necessary to retire the federal loan obligation within the 15-year repayment period. The County will also commit a portion of its zone tax rate to the project for operations, maintenance, and replacement costs including establishment of the emergency reserve fund.

The County is empowered to collect assessments, fees, and taxes. Fees and assessments will vary to meet operations and repayment obligations depending on fluctuations in water use. The theoretical increases in water rates necessary to achieve the 15-year repayment schedule are $66.15 per acre-foot for agriculture and $80.00 per acre-foot M&I. Additional revenues will be collected from excess land users as permitted under state law.

9.2.4 Interest Charges

Interest charges result from irrigation of excess lands, M&I service, and project costs allocated to flood control, fish and wildlife enhancement, and recreation (excluding grant funds). The computation for interest during construction (IDC) is contained in Appendix E (Table E.8). Cost allocation factors associated with interest bearing aspects of the loan are summarized in Section 9.2.1 and derived in Appendix G (Table 6). There are no other aspects of the loan requiring interest payments.

Construction is scheduled for completion in the fourth quarter of Fiscal-Year 1999. The computation for IDC thus ends on September 30, 2000, and repayment interest is calculated from October 1, 2000. An interest repayment rate of 7.625% and a discount rate of 7.75% are used in the calculations. These rates are expected to decrease for a repayment contract executed after January 1996.

9.3 PAYOUT SCHEDULE

The loan repayment period is limited by law to 40 years and governed by irrigation payment capacity and federal subsidy criteria. The County desires to limit the repayment period to 15 years based on the amount of grant involved and its ability to generate repayment revenue from sources other than agriculture.

The preliminary repayment schedule is identified in Table 9.4. The repayment period of 15 years describes total utilization of project generated agricultural payment capacity ($66.15 per acre-foot) and an increase of $80.00 per acre-foot for M&I deliveries. Additional revenues generated by the County through taxes and fees are required to repay the loan in 15 years.

The total loan repayment is identified as $33,299,210 including $11,429,872 for interest, $2,690,312 for RIDC, and $19,179,026 as the principle. The loan repayment schedule is tentative for the purposes of this application and will be specified as variable in the repayment contract based on a fixed interest rate (in effect at the time of contract execution) and actual quantities of water pumped from the Chino Groundwater Basin as recorded annually by the Chino Basin Watermaster.

Federal funding is limited to the amount specified in this application and cannot be increased without the approval of an escalation report or supplemental loan application. Funding for specific project features may vary from the cost estimates contained herein. Federal funds authorized under this application will be utilized to reimburse County expenses if actual construction costs are less than projected to the extent that program guidelines regarding the minimum contribution and maximum loan factor are observed. RIDC will be recalculated at the end of construction based on the actual appropriation schedule.

9.4 SUBSIDY CRITERIA FOR APPROVAL AND FUNDING

The loan factor is calculated to be 17.1%, qualifying the San Sevaine Creek Water Project for Category I consideration (see Table G.1).

4

San Sevaine Creek Water Project

County of San Bernardino, California

SCRB Analysis and Repayment Schedule
Small Reclamation Projects Act Loan Program

August 12, 1995

prepared by

CLARK ASSOCIATES

SECTION 1: NARRATIVE REVIEW

SECTION 2: BENEFIT DETERMINATIONS

SECTION 3: SCRB

SECTION 4: PROPOSED PROJECT COST DETAILS

SECTION 5: SINGLE -PURPOSE ALTERNATIVES

SECTION 6: MULTI-PURPOSE WITHOUT PROJECTS

SECTION 7: REPAYMENT SCHEDULE

SECTION 8: O&M CALCULATIONS

August 12, 1995
Final

SAN BERNARDINO COUNTY
SAN SEVAINE CREEK WATER PROJECT

MULTIPURPOSE COST ALLOCATION AND REPAYMENT SEPARABLE COSTS REMAINING BENEFITS (SCRB) ANALYSIS

1.0 PROJECT DESCRIPTION

The San Sevaine Creek Water Project is a multipurpose water resources and land use project that augments existing groundwater supplies while providing flood protection and benefiting wildlife and outdoor recreation. The proposed project will collect runoff from Etiwanda and San Sevaine Canyons in the San Gabriel Mountains for recharge to the Chino Groundwater Basin (Basin). Facilities will be constructed to remove debris from the flood water, direct flow into spreading grounds and recharge basins, protect private and public land, accommodate wildlife movement, create and conserve habitat, and provide for outdoor recreational opportunities.

Flood protection benefits valued at $87.6 million will be extended to 3,650 acres of undeveloped land. Additional public and private land with over $600 million of existing improvements will also benefit from the proposed project, although these benefits are not included in the economic analysis. Planned development in the area will add additional value to the protected land. The combined facilities will prevent the transport of over 2 million cubic yards of soil and other debris to the Santa Ana River--which would eventually impact the storage capacity and wetlands of Prado Reservoir. All flood-control features will be designed to benefit soil and water conservation, fish and wildlife (F&W) enhancement, and outdoor recreation.

The Chino Basin covers about 200 square miles and has supported intensive irrigated agriculture for the past 50 years. The adjudicated Basin is also the source of local M&I supplies. Imported water from the Metropolitan Water District of Southern California (MWD) is used to augment the M&I supply. The project will recharge an additional 25,000 acre-feet annually (on average) for shared use under the existing adjudication.

Recharge and flood control will be accommodated by approximately 1.5 miles of natural floodway, two debris basins, 6.5 miles of concrete lined floodway, and 10 recharge basins with a combined capacity of 4,290 acre-feet. The debris basins will intercept trees, boulders, rocks, and other large debris capable of causing serious damage to downstream channels and facilities. Silt, fines and small organics will be allowed to pass through the initial control structures. Continuous maintenance will be necessary to remove these materials from the recharge facilities.

Recreational use of the proposed maintenance roads atop the 2.4 miles of levees for jogging and equestrian riding will not be allowed per agreement with the U.S. Fish and Wildlife Service (Service). Recreational opportunities will be afforded by the construction of linear parks along the concrete reaches of the floodway below Etiwanda Basin. The parks will feature jogging paths and open areas for picnicking and playgrounds. The parks will be vegetated and irrigated to promote use and reduce dust erosion.

The complete project will encompass approximately 521 acres, including a 137-acre habitat preserve area specifically acquired for wildlife enhancement purposes.

Planning, construction, and operations and maintenance of the proposed project requires the combined efforts of San Bernardino County, the U.S. Bureau of Reclamation, the Chino Basin Watermaster, California F&G, U.S. F&W Service, U.S. Forest Service, California Department of Parks and Recreation, the cities of Rancho Cucamonga and Fontana, local developers, and MWD. San Bernardino County is the lead agency responsible for repayment of SRPA financing.

2.0 PROJECT PURPOSES

There are four main project purposes considered in this analysis:

1. Water Supply
2. Flood Control
3. Fish and Wildlife Enhancement
4. Outdoor Recreation

San Bernardino County is responsible for regional planning of flood control and recreational projects. The County's recent experience with Reclamation and the SRPA Program on the Day Creek Project prompted planners to develop the San Sevaine Project as an SRPA Project. Environmental and recreational benefits were added in light of federal objectives for the program and developing local needs to offset the adverse effects of urbanization. The resultant multipurpose project provides a diversity of benefits--each complementing the other to conserve resources, protect the environment, and provide recreational opportunities in an area with one of the Nation's highest growth rates.

3.0 COST ALLOCATION

The proposed project features are identified as follows:

Feature	Cost
1. Etiwanda Levees (Natural Floodway)	$ 5,746,231
2. Etiwanda Dam and Conservation Basin	7,542,606
3. San Sevaine Conservation Basins	9,207,292
4. Additional Conservation Facilities	7,691,135
5. Channels and Structures	19,765,662
Total	$49,952,926

NOTE: The habitat enhanced fish and wildlife area is included in the natural floodway and the linear parkway is included in all project features except the Etiwanda Levees and debris basin. Unlisted items, contingencies, IDC, administration, and other added costs are not included. These costs are detailed in the SCRB analysis and LAR.

3.1 Single-Purpose Alternatives - Tables 1 and 2 (in the SCRB section) provide cost summaries of the single-purpose alternatives as later described. Comparative cost details for each of the alternatives are provided in the table sets contained after the SCRB analysis. Interest during construction is calculated at 7.625% as described in tables *S.10 for each alternative. Cost escalation is calculated in tables *S.11 using an annual rate of 5.00%. The computation of IDC and escalation assumes that the amount for total direct costs and contingencies (from tables *S.1) is appropriated over a 5-year construction period. The "Total Project Cost" (bottom of Table 1) includes engineering and administration, loan application costs, IDC, OMR&P (OM&R), and USBR processing and administration. Land values contained in the facility line items are noted below the totals. A summary of the single-purpose alternative costs is presented in Table 2.

Proposed Multi-Use Project - The proposed project as described in Section 1 is delineated in Figure 1. The total project cost of $119,074,008 as described in Table 1 includes IDC, OMR&P

capitalized at 7.625% for 100 years, and $14,888,469 in land values estimated at a maximum of $30,000 per acre (see also the detailed cost estimates as contained in the LAR, i.e. Table 7.1, etc.).

Water Supply - Most of the single-purpose features are similar to those proposed in the multi-use project except for flood control features above Etiwanda Basin, the habitat preserve area, and the linear parkway which are excluded. Runoff is captured, treated, conveyed and recharged through reduced channel capacity.

Etiwanda debris basin would be constructed for the sole purpose of intercepting large debris that could damage downstream facilities. There would be no conservation pool or capability to regulate outflows. Concrete lining is used in all areas to maximize flow velocities thereby avoiding sedimentation and reducing land requirements. The omission of wildlife and recreational use also serves to reduce land requirements. All facilities are designed to withstand 100-year flows under the worst-case scenario in order to protect human life (as required by California State Law). The recharge basins are designed to maximize recharge capability given local soil conditions (for maximum side slopes). Wildlife use of the basins will be limited to birds since the only land approach will be on the O&M access road and the basins will be security fenced. The area around the basins is limited to that needed for O&M.

The levees would not be built. It is assumed that the County would achieve flood control above Etiwanda Basin by some other means thereby saving the project $5.7 million in direct construction costs (Table 1, item 1, not including escalation, administration, etc.). Exclusion of the linear park system reduces the cost by another $4.8 million. The channels are also downsized by 33% to avoid transport of peak flood flows in excess of recharge capacity through the project area. Operations, maintenance and replacement costs are minimized by the hard-lining and the exclusion of F&W and recreation responsibilities. Debris removal from the basins is also less costly since operations would not be concerned with avoiding habitat areas. The resulting single-purpose project cost is $78,892,312 as summarized in Table 1. This alternative is approximately $40.2 million less than the comparable cost of the proposed multi-use project ($119,074,008 including IDC and OM&R).

Flood Control - The single-purpose flood control project is identical to the proposed project except that the habitat preserve and recreational areas are excluded, and excavation from the conservation basins is reduced. Debris control and public safety are driving factors in sizing the dams and channels. Sizing of the recharge facilities would however be reduced to serve only as retention facilities used to reduce peak flows. The cost estimate assumes that these facilities would be located at the existing recharge sites. The exclusion of F&W and recreational benefits (including vegetation and irrigation) would be identical to the water-supply alternative. Mitigation is required as result of impacts to the alluvial fan sage scrub (Etiwanda levees and resulting channel). The Service is currently seeking a 3:1 acquisition ratio for the plant community in Southern California. (This mitigation requirement is similar to that identified for the 1989 San Sevaine Project). The resulting single-purpose project cost is $105,706,260. This alternative is approximately $13.4 million less than the comparable cost of the proposed multi-use project.

Fish and Wildlife Enhancement - The F&W alternative is similar to the proposed multi-use project with the exclusion of those facilities located below Foothills Boulevard. The debris basins are necessary to pond water and extend the canyon habitat into the foothills area. Upper Etiwanda Creek is maintained in its natural state with additional width to accommodate meandering flows, wildlife movement, and critical habitat. The levees are required to protect the preserve from unlimited public access and prevent flows from channeling onto private property where they could be diverted. The basins would also be included to provide riparian habitat accessible from the ground by gradually sloped banks with vegetative cover. The basins and levees would not be sized for 100-year flood protection and the cost is significantly reduced. Although the infiltration basins and linear parkways south of Foothills Boulevard will result in benefits to fish and wildlife, these benefits are comparatively insignificant and not included in the project justification or cost allocation. The single-purpose F&W project cost is $22,803,606. This alternative is approximately $96.3 million less than the comparable cost for the proposed multi-use project.

Recreation - The single-purpose recreation alternative is the same as the recreation features contained in the proposed multi-use project. The F&W enhancement features were important elements of recreational use in the area above Foothills Boulevard, however they have been excluded from the proposed project due to an agreement with the FWS to curtail public access above Etiwanda Basin. Hiking and equestrian trails are limited to the area south of San Sevaine Basin 5. Bird watching and native plant collection are not considered in the analysis as a recreational benefit although they were important factors in formulating the project plan with the FWS, California F&G, and activist organizations.

The lower project area can support recreational benefits associated with the linear park and the uninterrupted nature of the floodway. Construction of a linear park is accommodated by its proximity to the floodway and its shared ROW with the O&M easement. OMR&P costs for the park are significant, in excess of the original capital investment. For this reason the total single-purpose cost of $23,901,953 is more than triple the total direct construction cost of $6,843,262. The single-purpose recreation project is approximately $95.2 million less than the proposed multi-use project.

3.2 Separable Costs - Separable costs are determined through the analysis of the proposed multi-purpose project condition without each of the independent project functions (water supply, flood control, etc.). Table 3 lists the alternative costs under "project-without" conditions. Cost details are developed in the table packages labeled *M.*--similar to those reviewed previously for the single purpose alternatives. Additional explanation of the cost details is presented later in this section.

Table 4 provides the derivation of separable costs by comparing the proposed project with project without conditions. The results indicate that $40,628,514 or 34% of the proposed costs are separable. The separable amounts are carried forth for use in Table 5 (Item 5) in determining the percent distribution and cost allocation.

Without Water Supply - The multipurpose project without water supply is essentially the same as the proposed multipurpose project except that the conservation basins are not excavated for additional conservation storage. Inlet structures, outlet controls and rights of way remain identical to the proposed project. O&M costs would be reduced significantly since the basins would not need to be maintained for optimum percolation. The total alternative cost is identified as $112,690,045 in Tables 3 and 4. The separable cost identified in Table 4 is $6,383,963.

Without Flood Control - Flood control is the most beneficial project function, however shared costs with the water supply function are significant and therefore the separable costs are estimated at only

$17,866,506 (see Table 4). The major difference between the two project functions is that flood control upstream from Etiwanda Basin is not needed to operate the recharge basins. This is also the area of highest environmental concern which contributes significantly to the total project cost. However, for this alternative, the inclusion of F&W enhancement negates the need for mitigation. For the purposes of this analysis, the channel and structures cost (Table 3, Item 5) is reduced to remove peak flow handling capability. The total alternative cost is the lowest at $101,207,502.

Without Fish and Wildlife Enhancement - This alternative simply assumes the habitat preserve is omitted and a smaller area is diked to direct flood flows into Etiwanda Basin. Since the preserve is omitted, mitigation is required. The $2.2 million mitigation line item reflects the difference between the cost of the alternative flood channel and the proposed preserve area cost. Because of the need for mitigation, the total project cost is reduced only by the O&M cost to patrol and maintain the preserve. The total without cost is the highest at $118,037,635. The separable cost is $1,036,372 (Table 4).

Without Recreation - The linear park system contains the second highest amount of separable cost ($15,341,674). Approximately 68 acres will be required to develop the recreational facilities including the bike paths, children's playground, and safety fencing--a portion of which is cost shared with the channels for O&M right-of-way. All remaining costs are allocated solely to recreation including pavement, vegetation, the irrigation system, lighting, and park furnishings.

3.3 Joint Costs - From a practical standpoint, most project facilities are considered joint use as each serves more than one function. Alternative projects are distinctly similar reflecting the value in combining facilities to meet multiple objectives. As described in Tables 3 and 4, the exclusion of any single project purpose has a nominal impact on the total cost for the remaining three purposes (project "without" conditions). This is specially true when considering cost associated with operations, maintenance and replacement (OM&R).

From an economics standpoint, joint costs are the amounts remaining after separable costs have been deducted ($119,074,008 - $40,628,514 = $78,445,494 joint cost, see Table 5 total column). The joint cost is allocated to each of the project functions based on the percent distribution (a function of the justifiable expenditure). Total allocated costs are the sum of the separable and joint costs (Table 5, item 9).

3.4 Project Benefits -

Water Supply - Recharge resulting from the proposed project will increase the volume of high-quality water available for use from the Chino Groundwater Basin. On average, the project will augment existing natural recharge by 25,000 acre feet per year. The value of this benefit is measured by the alternative cost of importing MWD water for recharge. The Chino Basin Watermaster currently recharges MWD water at the Etiwanda Spreading Grounds for the off-season rate $250 per acre foot. The average annual benefit of $6,250,000 equates to a capitalized benefit of $81,914,451 at 7.625% over the 100-year life of the project as identified in Table 5 (Item 2).

The allocation of water supply benefits between agriculture and M&I is based on projected use of the Chino Basin as a supply source independent of project costs or other benefits as later described (see Table 7 and Figure 3).

Flood Control - Flood control benefits are as determined by the San Bernardino County Department of Transportation/Flood Control in its letter to the Army Corps of Engineers (CoE) dated May 26, 1994. The County analysis describes a benefit of $24,000 per acre for protecting land on the undeveloped alluvial fan--an area of approximately 3,650 acres. The incremental benefit of $87.6 million does not include improved protection to downstream facilities currently valued at $610 million. The CoE response to the benefit determination dated June 9, 1994 concurs with the County's methodology for determining flood control benefits for federal financing (letters attached).

Fish and Wildlife Enhancement - Fish and Wildlife benefits are as determined by the Fish and Wildlife Service in its letter to the County of San Bernardino dated April 4, 1995 (copy attached). Project benefits are identified as three times the cost of land and facilities needed to support wildlife habitat in the project area north of Interstate 15. There are no benefits to wildlife south of the Interstate as determined by FWS. Annual costs for O&M are also identified as benefits in the letter.

Recreation - Recreation benefits are as determined by the San Bernardino County Regional Parks Department and the Bureau of Reclamation. Annual benefits are identified as accruing to biker/hiking usership (1,399,767 annual uses) and equestrian riding (313,040 annual uses). Annual usership was based on studies conducted for the Santa Ana River Corridor Trail System Master Plan (1990) and work conducted by the Army Corps of Engineers. There is currently no recreational use of, or in proximity to the project area. Incremental benefits are valued at $1,707,098 annually which equates to a capitalized benefit of $22,373,759 as determined by the Bureau of Reclamation. The recreational benefits were estimated using the unit-day value method for general recreation provided in *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (Principles and Guidelines) dated March 10, 1983. Reclamation assumed that users of the linear parkway would spend a maximum of 2 hours (0.17 user day) recreating on the linear parkway. Accordingly, the recreational benefit estimates based on the Principles and Guidelines were adjusted by 0.17.

3.5 SCRB Allocation - The SCRB allocation is derived in Table 4.

The following narrative describes the cost analysis presented in the derivation. All costs are capitalized at 7.625% over the 100-year project life. Interest during construction is calculated for each project alternative (not to be confused with reimbursable IDC (RIDC) or federal IDC (FIDC)).

1. Total Costs Allocated - are the costs described in Section 3.0 and listed in Table 1. These costs include construction estimates, environmental mitigation, rights of way, land acquisition, unlisted items, contingencies, escalation, engineering and administration, loan application costs, USBR processing and administration, IDC, and OM&R.

2. Benefits - are the amounts identified in Section 3.4.

3. Single-Purpose Alternatives - are the amounts identified in Section 3.1.

4. Justifiable Expenditures - the lesser of the single-purpose alternative or the calculated benefit.

5. Separable Costs - the amounts developed in Table 4 and Section 3.2.

6. Remaining Justifiable Expenditures - the amounts obtained by subtracting the separable costs from the justifiable expenditure.

7. Percent Distribution - is obtained by dividing the remaining justifiable expenditure for each purpose by the total remaining justifiable expenditure.

8. Remaining Joint Costs - Joint costs are costs of project works which serve more than one function and often several purposes or objectives. Remaining joint costs are the costs that remain after all separable costs have been deducted from total project costs.

9. Total Allocated Costs - the sums of the separable costs and the remaining joint costs.

4.0 CALCULATION OF GRANT, DISTRIBUTED CONTRIBUTION, RIDC, AND LOAN AMOUNTS -

The SCRB Cost Allocation (Table 5) results in the following allocation percentages:

Purpose	Allocation
1. Water Supply	34.4%
2. Flood Control	43.0%
3. F&W Enhancement	6.9%
4. Recreation	15.7%

The recreation percentage is relatively high due to significant OM&R costs and the fact that most recreation facilities are considered separable.

Table 6 presents the derivation of the grant, loan, and RIDC amounts illustrating how the local contribution is credited between project purposes. Line 1 carries forward the total allocated construction costs (percentages listed above). Grant for flood control is limited to 75% of the total allocated cost, F&W and recreation are limited to 50%. The percentage distribution relates to row 3. Distributed contribution is a function of the percentage distribution, but also takes into account provisions regarding land values and the fact that the 25% cost not included in the flood-control grant must come from contributed funds. Loan application costs are included in the construction costs and therefore are not credited separately in row 6. IDC is calculated by methodology similar to total construction costs and the remainder of the table simply adds the two cost components.

4.1 Water Supply Allocation between Agriculture and M&I - Approximately 34% of the project is allocated to the water supply function. Under the Chino Basin Judgment of 1977, the Basin was divided into three operating pools with first entitlement to produce up to 145,000 acre-feet of groundwater annually. The agricultural pool is entitled to 82,800 acre-feet annually while the two M&I pools account for the remaining 62,200 acre-feet. Actual agricultural use has diminished from approximately 70,000 acre-feet in 1980 to 48,000 in 1990 (record low production in 1989 and 1990 is partially attributable to drought conditions impacting planting).

Table 7 and Figure 3 describe the projected agricultural diversion from the Chino Basin. A statistical analysis of agricultural pumping from 1980 through 1990 was used to project water use through the year 2013. The annual average agricultural delivery over the 15-year project repayment period is estimated to be 29,693 acre-feet or 21.2% of the total safe yield. The average M&I equivalent then is 79.8% representing the interest bearing and reimbursable IDC portion of the water supply cost allocation. Row 13 in Table 6 therefore identifies nonreimbursable IDC for water supply as allocated IDC times 21.2%. Actual RIDC for water supply will computed annually based on actual diversions from the basin as recorded by the Chino Basin Watermaster (see preliminary repayment schedule for water supply portion). Apart from the grant credit, all other IDC is reimbursable.

5.0 PRELIMINARY DRAFT REPAYMENT SCHEDULE

A preliminary repayment schedule is included after the detailed cost estimates for alternative projects as Table 3. The schedule reflects a 15-year repayment period assumed to begin in the year 2000 and ending in 2014 (a 1-year delay from previous analysis).

Table 1 presents an estimate of future water use in the Chino Basin and associates this use by category pertinent to the development of the repayment schedule. Table 2 applies the percentages calculated in Table 1 to the project-generated water supply to estimate acre-foot volumes. These volumes and percentages are used in the determination of revenue and costs associated with the tentative rolling cost allocation. The volumes and percentages used in determining actual repayment will be based on actual amounts recorded by the Chino Basin Watermaster.

9.4.3 Regional

Closer to home, the San Bernardino County recently completed a survey relating to park, recreation and cultural activities. In it two of the three highest expressions of need were bicycle trails and natural areas, with senior citizen centers equally high on the list of fourteen facility types.

Table 9-3, as previously shown, overviews recent population statistics for the three county region of the Santa Ana River corridor. This region has grown by over 34% in the last ten years, exceeding the statewide growth rate of 23% for the same period. Riverside County is the fastest growing county in the state. Orange, San Bernardino, and Riverside Counties are the states' third, fifth, and seventh most populous counties respectively.

Table 9-4, as previously shown, shows population projections for the three counties for the next ten and twenty year periods. Though the current rapid expansion is expected to slow, the pace of growth will still be, by all standards, frenzied.

TABLE 1
ALTERNATIVE COST ESTIMATES for SINGLE-PURPOSE PROJECTS

Feature	Proposed Multi-use	Single-Purpose Alternatives: Water Supply	Flood Control	F&W	Recreation
1. Etiwanda Levees:	$ 5,746,231	$0	$9,027,140	$ 4,107,521	$ -
West Levee - 4,500 ft	412,384	0	412,384	247,934	0
East Levee - 8,300 ft	2,273,847	0	2,273,847	799,587	0
Habitat Preserve Area - 137 acres	3,060,000	0	0	3,060,000	0
Linear Parkway - 12,800 ft	0	0	0	0	0
Conveyance Channel	0	0	799,587	0	0
Mitigation	0	0	5,541,322	0	0
2. Etiwanda Dam and Conservation Basin:	7,542,606	7,542,606	7,542,606	210,384	0
Dam and Basin - 840 ac-ft	5,063,981	5,063,981	5,063,981	205,134	0
Outlet Works - 100 cfs	1,448,750	1,448,750	1,448,750	1,500	0
Spillway - 15,000 cfs	1,029,875	1,029,875	1,029,875	3,750	0
Linear Parkway - 3,300 ft	0	0	0	0	0
3. San Sevaine Conservation Basins:	9,207,292	8,338,600	6,884,850	4,366,100	977,783
Dam and Basins - 2,550 ac-ft	7,266,100	7,266,100	5,812,350	4,358,600	109,091
Outlet Works - 1,200 cfs	376,500	376,500	376,500	1,500	0
Spillway - 35,300 cfs	696,000	696,000	696,000	6,000	0
Linear Parkway - 13,200 ft	868,692	0	0	0	868,692
4. Additional Conservation Facilities:	7,691,135	7,691,135	7,468,535	0	0
Etiwanda Spreading Grounds	0	0	0	0	0
Victoria Basin - 235 ac-ft	655,820	655,820	650,920	0	0
Rich Basin - 26 ac-ft	549,200	549,200	450,000	0	0
Hickory Basin - 220 ac-ft	703,250	703,250	584,750	0	0
Jurupa Basin - 1,200 ac-ft	5,782,865	5,782,865	5,782,865	0	0
5. Channel and Structures:	19,765,662	11,779,881	16,496,725	200,999	3,842,160
Reach 1 - 4,000 ft (Etiwanda Dam to Basin 5):					
Drainageway	1,708,755	1,227,818	1,708,755	200,999	66,116
Linear Parkway	377,040	0	0	0	377,040
Reach 2 - 9,800 ft (Basin 5 to Foothill Blvd.):					
Drainageway	7,418,457	5,087,457	7,418,457	0	161,983
Linear Parkway	923,748	0	0	0	923,748
Reach 3 - 20,880 ft (Foothill to Jurupa Basin):					
Drainageway	7,369,513	5,464,606	7,369,513	0	345,124
Linear Parkway	1,968,149	0	0	0	1,968,149
Subtotal	49,952,926	35,352,222	47,419,856	8,885,004	4,819,943
Unlisted Items @ 10%	4,995,293	3,535,222	4,741,986	888,500	481,994
Contingencies @ 15%	8,242,233	5,833,117	7,824,276	1,466,026	795,291
Cost Increases @ 5% annually	9,925,685	7,136,216	9,712,320	425,051	746,034
TOTAL DIRECT CONSTRUCTION	$ 73,116,136	$ 51,856,777	$ 69,698,438	$ 11,664,581	$ 6,843,262
Engineering and Administration @ 18%	13,160,904	9,334,220	12,545,719	2,099,625	1,231,787
Loan Application Phase	1,680,000	1,680,000	1,680,000	1,680,000	1,680,000
IDC	8,491,950	7,560,055	10,902,641	970,885	1,194,696
OMR&P (capitalized)	22,345,017	8,181,260	10,599,463	6,108,515	12,672,207
(annual, not included in total)	1,704,905	624,223	808,730	466,074	966,878
USBR Processing and Administration	280,000	280,000	280,000	280,000	280,000
TOTAL PROJECT COST	$ 119,074,008	$ 78,892,312	$ 105,706,260	$ 22,803,606	$ 23,901,953
Land & Rights-of-Way	14,888,469	9,071,956	10,119,477	8,652,320	1,708,992

OMR&P computed at 7.625% for 100 years.

TABLE 4
Project Costs, "Multipurpose Without" Costs, and Derivation of Separable Costs

Item	Proposed Multipurpose Project	Multipurpose Without[1] Water Supply	Flood Control	F&W	Recreation
Construction Cost	$88,237,040	$85,735,051	$77,211,571	$88,237,041	$81,100,399
IDC	8,491,950	7,719,094	7,178,234	8,491,950	7,886,983
OM&R capitalized	22,345,017	19,235,900	16,817,697	21,308,645	14,744,952
OM&R annual	1,704,905	1,467,682	1,283,175	1,625,831	1,125,027
Total Project Cost[2]	**$119,074,008**	**$112,690,045**	**$101,207,502**	**$118,037,635**	**$103,732,334**

Item	Total Project	Water Supply	Flood Control	F&W	Rec
Separable Costs:					
Const. Costs	20,664,101	2,501,989	11,025,470	(0)	7,136,642
IDC	2,691,539	772,856	1,313,716	0	604,967
OM&R capitalized	17,272,874	3,109,117	5,527,320	1,036,372	7,600,065
OM&R annual	1,317,905	237,223	421,730	79,074	579,878
Total Separable Cost	**$40,628,514**	**$6,383,963**	**$17,866,506**	**$1,036,372**	**$15,341,674**

[1] All "Multipurpose Without" projects use the proposed project as a basis.
[2] Includes IDC and Capitalized OM&R (not annual).

Project Life 100
Interest Rate 7.625%

TABLE 7.2
SAN SEVAINE CREEK PROJECT
SUMMARY OF ESTIMATED CONSTRUCTION COSTS

Feature	Item Cost	Total Cost
1. Etiwanda Levees:		$5,746,231
West Levee - 4,500 ft	$412,384	
East Levee - 8,300 ft	2,273,847	
Habitat Preserve	3,060,000	
Linear Parkway - 12,800 ft	0	
2. Etiwanda Dam and Conservation Basin:		7,542,606
Dam and Basin - 840 ac-ft	5,063,981	
Outlet Works - 100 cfs	1,448,750	
Spillway - 15,000 cfs	1,029,875	
Linear Parkway - 3,300 ft	0	
3. San Sevaine Conservation Basins:		9,207,292
Dam and Basins - 2,550 ac-ft	7,266,100	
Outlet Works - 1,200 cfs	376,500	
Spillway - 35,300 cfs	696,000	
Linear Parkway - 13,200 ft	868,692	
4. Additional Conservation Facilities:		7,691,135
Etiwanda Spreading Grounds (existing)	0	
Victoria Basin - 235 ac-ft	655,820	
Rich Basin - 26 ac-ft	549,200	
Hickory Basin - 220 ac-ft	703,250	
Jurupa Basin - 1,200 ac-ft	5,782,865	
5. Channel and Structures:		19,765,662
Reach 1 - 4,000 ft (Etiwanda Dam to Basin 5):		
Drainageway	1,708,755	
Linear Parkway	377,040	
Reach 2 - 9,800 ft (Basin 5 to Foothill Blvd.):		
Drainageway	7,418,457	
Linear Parkway	923,748	
Reach 3 - 20,880 ft (Foothill Blvd. to Jurupa Basin):		
Drainageway	7,369,513	
Linear Parkway	1,968,149	
Subtotal	$49,952,926	$49,952,926
Unlisted Items @ 10%		4,995,293
TOTAL DIRECT CONSTRUCTION:		**$54,948,219**

TABLE E-2
ETIWANDA DAM AND CONSERVATION BASIN

No.	Item	Quantity	Unit	Unit Cost	Total
	DAM :				
1.	Clear & Grub	9,741	S.Y.	0.34	$3,312
2.	Excavation				
	a. Basin	785,000	C.Y.	1.50	1,177,500
	b. Dam Foundation	258,600	C.Y.	1.50	387,900
3.	Embankment	1,043,600	C.Y.	2.45	2,556,820
4.	Soil Cement	75,600	C.Y.	9.70	733,320
5.	Revegitation	12	Ac.	2,000	24,000
6.	Land and Right-of-Way	6	Ac.	30,000	181,129
7.	Linear Parkway (Type 2)	0	L.F.	66	0
	Subtotal				$5,063,981
	SPILLWAY :				
8.	Concrete	3,400	C.Y.	300	1,020,000
9.	24" Ø Drain	175	L.F.	35	6,125
10.	Chain Link Fence	500	L.F.	7.50	3,750
	Subtotal				$1,029,875
	OUTLET WORKS :				
11.	5' Ø Inlet Structure	5,000	Lb.	1.00	5,000
12.	36" Ø Steel Pipe	730	L.F.	75	54,750
13.	Concrete	4,625	C.Y.	300	1,387,500
14.	Chain Link Fence	200	L.F.	7.50	1,500
	Subtotal				$1,448,750
	TOTAL				**$7,542,606**

TABLE E-3
LOWER SAN SEVAINE CONSERVATION BASINS

No.	Item	Quantity	Unit	Unit Cost	Total
	BASINS:				
1.	Excavation				
	a. Basins	350,000	C.Y.	1.50	$525,000
	b. Dam	200,000	C.Y.	1.50	300,000
2.	Dam Embankment				
	a. Cobble Facing	35,000	C.Y.	10.00	350,000
	b. Zone 2	550,000	C.Y.	3.15	1,732,500
3.	Revegetation	2.8	Acre	2,000	5,600
4.	Transplanting stipa cernuua (native grass)	1	L.S.	3,000	3,000
5.	Land and Right-of-Way	145	Acre	30,000	4,350,000
6.	Linear Parkway (Type 2)	13,200	L.F.	66	868,692
	Subtotal				$8,134,792
	SPILLWAY :				
7.	Concrete	2,300	C.Y.	300	690,000
8.	Chain Link Fence	800	L.F.	7.50	6,000
	Subtotal				$696,000
	OUTLET WORKS :				
9.	Liner	105,000	Lb.	1.00	105,000
10.	Concrete	900	C.Y.	300	270,000
11.	Chain Link Fence	200	L.F.	7.50	1,500
	Subtotal				$376,500
	TOTAL				**$9,207,292**

TABLE E-4.1
WATER CONSERVATION FACILITIES
Victoria Basin

No.	Item	Quantity	Unit	Unit Cost	Total
1.	Channel Turnouts (2) (48" RCP)	180	L.F.	144	$25,920
2.	Gate Structure & Catch Basin	1	L.S.	25,000	25,000
3.	Rock Splash Pad	1	L.S.	10,000	10,000
4.	Modify Basin Outlet	1	L.S.	10,000	10,000
5.	Embankment	2,000	C.Y.	2.45	4,900
6.	Land and Right-of Way	19	Acre	30,000	570,000
7.	Miscellaneous	1	L.S.	10,000	10,000
	TOTAL				**$655,820**

TABLE E-4.2
WATER CONSERVATION FACILITIES
Rich Basin

No.	Item	Quantity	Unit	Unit Cost	Total
1.	Excavation	66,000	C.Y.	1.50	$99,000
2.	Land and Right-of Way	15	Acre	30,000	450,000
3.	Revegetation*	0.10	Acre	2,000	200
	TOTAL				$549,200

* Revegitation of temporary construction staging areas and roadways.

TABLE E-4.4
WATER CONSERVATION FACILITIES
Jurupa Basin

No.	Item	Quantity	Unit	Unit Cost	Total
1.	Excavation	150,000	C.Y.	1.5	$225,000
2.	Embankment	150,000	C.Y.	2.45	367,500
3.	Inlet Channel & Wier	11,733	C.Y.	245	2,874,585
4.	Concrete Flip Bucket	360	C.Y.	250	90,000
5.	Concrete Outlet Spillway	1	L.S.	129,360	129,360
6.	Rock Splash Pad	1	Ea.	10,000	10,000
7.	48" RCP Basin Drain	840	L.F.	100	84,000
8.	Land and Right-of Way	56	Acre	30,000	1,680,000
9.	Outlet Channel and Transi	1,316	C.Y.	245	322,420
	TOTAL				**$5,782,865**

DISTRIBUTION LIST

The *San Sevaine Creek Water Project Loan Application Report And Feasibility Study,* together with the supporting Environmental Assessment were submitted to the following agencies:

California Department of
Water Resources
1416 Ninth Street Rm. #449
Sacramento, CA 95814
Attn: Nadell Gayou

California Fish and Game Department
330 Golden Shore, Suite 50
Long Beach, CA 90802

California State Office of
Planning & Research
California State Clearing House
1400 Tenth Street
Sacramento, CA 95814
Attn: Loreen McMahon

Chino Basin Municipal Water District
8555 Archibald
P.O. Box 697
Rancho Cucamonga, CA 91730
Thomas J. Homan, General Manager

Chino Basin Watermaster
8555 Archibald
P.O Box 6917
Rancho Cucamonga, CA 91730
Attn: Ed James

City of Chino
13220 Central Avenue
Chino, CA 91710

County of Riverside
Parks Department
4600 Crestmore Road
P.O. Box 3507
Riverside, CA 92519
Attn: Paul D. Romero
Director

Kaiser Steel
8300 Utica Avenue, Suite 301
Rancho Cucamonga, CA 91730
Attn: Rob Hortman

Metropolitan Water District of
Southern California
P.O. Box 54153
Los Angeles, CA 90054
Attn: Andy Slenkiewich

Regional Water Quality Control Board
Santa Ana Region
2010 Iowa Avenue, Suite 100
Riverside, CA 92507-2809
Attn: Gerard J. Thibeault
Executive Officer

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April 12, 2007

I, Paula S. Molter, am an employee of the Chino Basin Watermaster ("Watermaster"). As part of its normal course of business, Watermaster maintains a library of documents relevant to the Chino Groundwater Basin and Watermaster's role as the arm of the Court administering the Chino Basin Judgment. It is part of my regular duties to retrieve such documents from the library in response to requests from various parties.

I hereby certify that the attached document, titled ***San Sevaine Creek Water Project Final Loan Application Report & Feasibility Study Aug. 1995***, is a full, true and accurate copy of that document, on file and of record in the Watermaster library.

Paula S. Molter