

**Santa Clara Valley Water District
And
U.S. Army Corps of Engineers, San Francisco District**

UPPER GUADALUPE RIVER

**FINAL FEASIBILITY REPORT
and
ENVIRONMENTAL IMPACT
STATEMENT/REPORT**

JANUARY 1998

**UPPER GUADALUPE RIVER FLOOD CONTROL FEASIBILITY STUDY
SANTA CLARA COUNTY, CALIFORNIA
FINAL REPORT
JANUARY 1998**

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Special thanks also to Mr. Robin Mooney for his invaluable guidance.

**UPPER GUADALUPE RIVER
FEASIBILITY STUDY FOR FLOOD CONTROL**

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**UPPER GUADALUPE RIVER FLOOD CONTROL FEASIBILITY STUDY
SAN JOSE, CALIFORNIA
EXECUTIVE SUMMARY**

INTRODUCTION

This report summarizes the study process and results of the Upper Guadalupe River Flood Control Feasibility Study. The purpose of the study is to evaluate potential Federal interest in providing flood protection along five miles of the Guadalupe River between the Southern Pacific Railroad (SPRR) and Blossom Hill Road in Santa Clara County, California. Over 7,500 residential and commercial structures lie within the 100-year floodplain within the study area. Average annual flood damages in this area exceed \$19,000,000. The non-Federal sponsor is the Santa Clara Valley Water District (SCVWD).

MEASURES AND ALTERNATIVES CONSIDERED

Flood protection measures which were considered included storage on upstream reservoirs, channel widening, bypass channels, levees, floodwalls, and nonstructural measures. These measures were combined to create several alternatives. The major considerations in plan development were high real estate costs and preservation of the existing riparian habitat. Those alternatives which survived the screening process are summarized below.

No Action: Under the No Action Plan, it is assumed that a Federal project would not be constructed to reduce the flood hazard in the study area boundaries.

Willow Glen Plan: This plan would increase the minimum main stem capacity downstream of Canoas Creek to 9,000 cubic feet per second (cfs). Improvements on the main stem would be limited to the lower one-mile reach of the Guadalupe River immediately upstream of the SPRR bridge. Improvements would include the replacement of two bridges and a combination of low floodwalls and bank widening. The downstream reach of Ross Creek would be channelized, and new culverts and floodwalls would be placed along Canoas Creek to address backwater effects from the mainstem Guadalupe. No recreation features are included with this plan. The net benefits for this alternative average \$10,910,000 per year over the life of the project.

Valley View Plan: This plan would increase the minimum main stem capacity downstream of Canoas Creek to 12,000 cfs. Improvements on the main stem would include the replacement of four bridges and a combination of low floodwalls and bank widening. The downstream reach of Ross Creek would be channelized, and new culverts and floodwalls would be placed along Canoas Creek to address backwater effects from the mainstem Guadalupe. No recreation features are included with this plan. The net benefits for this alternative average \$12,640,000 per year over the life of the project.

Bypass Channel Plan: This plan would increase the minimum main stem capacity downstream of Canoas Creek to 14,600 cfs. Unlike the other plans considered, this plan would utilize bypass channels to convey flood flows. Additional improvements on the main stem would include the replacement of five bridges and a combination of low floodwalls and bank widening. The downstream reach of Ross Creek would be channelized, and new culverts and floodwalls would be placed along Canoas Creek to address backwater effects from the mainstem Guadalupe. A multi-purpose recreational trail would be incorporated on access roads and other flood control structures of this plan. The net benefits for this alternative average \$12,122,000 per year over the life of the project. This figure does not include any costs or benefits associated with the recreation features of this plan.

Each of the action alternatives would include features to mitigate adverse environmental impacts.

RECOMMENDED PLAN

The Valley View Plan has been identified as the National Economic Development (NED) plan since it maximizes the net benefits. However, the Santa Clara Valley Water District has identified the Bypass Channel Plan as the Locally Preferred Plan (LPP) since it efficiently maximizes protection with a benefit-to-cost ratio of 2.1. Providing maximum protection is particularly important given that the study area is highly urbanized and already fully developed. In addition to being very effective, the Bypass Channel Plan fully meets the Federal flood protection objectives. Therefore, the San Francisco District recommends that the Bypass Channel Plan be constructed as the Recommended Plan. However, the Federal share of the cost of the Recommended Plan will be limited to the Federal share of the cost of the NED Plan.

The first project cost of the NED Plan is \$83,520,000, which is equivalent to \$6,148,000 on an average annual basis at October 1997 price level. The first project cost of the Recommended Plan is \$132,835,000, which is equivalent to \$9,778,000 on an average annual basis at October 1997 price levels. The benefit-to-cost ratio for the Recommended Plan is 2.1 to 1. The Federal share of the first cost would be \$54,288,000, and the non-Federal share would be \$78,547,000. The non-Federal sponsor would be responsible for an additional payment of \$2,685,000 for betterments associated with project construction.

The Recommended Plan would remove over 6,600 structures from the 100-year floodplain. Mitigation would include the replacement of approximately 30 acres of riparian forest, urban forest, wetland, and shaded riverine habitat within the study area. The mitigation plan has been coordinated with the U.S. Fish and Wildlife Service during the course of this study.

**UPPER GUADALUPE RIVER FLOOD CONTROL FEASIBILITY STUDY
SANTA CLARA COUNTY, CALIFORNIA
FINAL REPORT
JANUARY 1998**

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ACRONYMS AND ABBREVIATIONS

Main Report

APN	assessor's parcel number
BAAQMD	Bay Area Air Quality Management District
BCR	benefit-to-cost ratio
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
DFG	California Department of Fish and Game
EIS/R	environmental impact statement/report
EQ	environmental quality (account)
FEMA	Federal Emergency Management Agency
FWS	U.S. Fish and Wildlife Service
HTRW	hazardous, toxic, and radiological waste
IDC	interest during construction
LERRD	lands, easements, relocations, rights-of-way, and disposal
MCACES	micro-computer aided cost estimating system
NAP	normal annual precipitation
NED	national economic development
NFIP	National Flood Insurance Program
O&M	operation and maintenance
OMRR&R	operation, maintenance, repair, replacement, and rehabilitation
OSE	other social effects (account)
PCA	project cost-sharing agreement
PED	preconstruction engineering and design
PSA	preliminary site assessment
RBA	risk-based analysis
RED	regional economic development (account)
SCVWD	Santa Clara Valley Water District
SPRR	Southern Pacific Railroad
SRA	shaded riverine aquatic (habitat)
UPRR	Union Pacific Railroad
USEPA	U.S. Environmental Agency

**UPPER GUADALUPE RIVER FLOOD CONTROL FEASIBILITY STUDY
SAN JOSE, CALIFORNIA
FINAL REPORT**

1.0 INTRODUCTION

1.1 Purpose and Scope

This report summarizes the study process and results of the Upper Guadalupe River Flood Control Feasibility Study. The purpose of the study is to evaluate potential Federal interest in providing flood protection along the Guadalupe River upstream of the Southern Pacific Railroad (SPRR) in Santa Clara County, California (see Figure 1), and to identify a feasible project which fulfills the Federal interest requirements and meets the needs of the non-Federal sponsor. Project feasibility is assessed in terms of physical, environmental, economic, and political considerations. The study area extends over five miles between the SPRR at the downstream end to Blossom Hill Road at the upstream end. Federal interest requires that a proposed project be in accordance with Federal principles and guidance, comply with applicable environmental laws and statutes, and have the support of a non-Federal sponsor who is willing and able to participate in the cost-sharing requirements for project implementation.

1.2 Study Authority

Section 4 of the Flood Control Act of 18 August 1941 authorized a preliminary examination of the Guadalupe River, its tributaries and adjacent streams. The authorization reads as follows:

"The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys for flood control, to be made under the direction of the Chief of Engineers, in drainage areas, the United States and its territorial possessions, which include the following named localities: Coyote River and tributaries, California; San Francisquito Creek, San Mateo and Santa Clara Counties, California; Matadero Creek, Santa Clara County, California; and Guadalupe River and tributaries."

Note that the authorization refers to Coyote Creek as "Coyote River".

On 6 June 1945, the Chief of Engineers endorsed the Preliminary Examination Report of Guadalupe River and Tributaries (dated 28 February 1945). This endorsement authorized a flood control investigation of Guadalupe River, Coyote Creek, San Francisquito Creek and numerous other creeks which continued to be studied under the 1941 Guadalupe River and Adjacent Streams authorization.

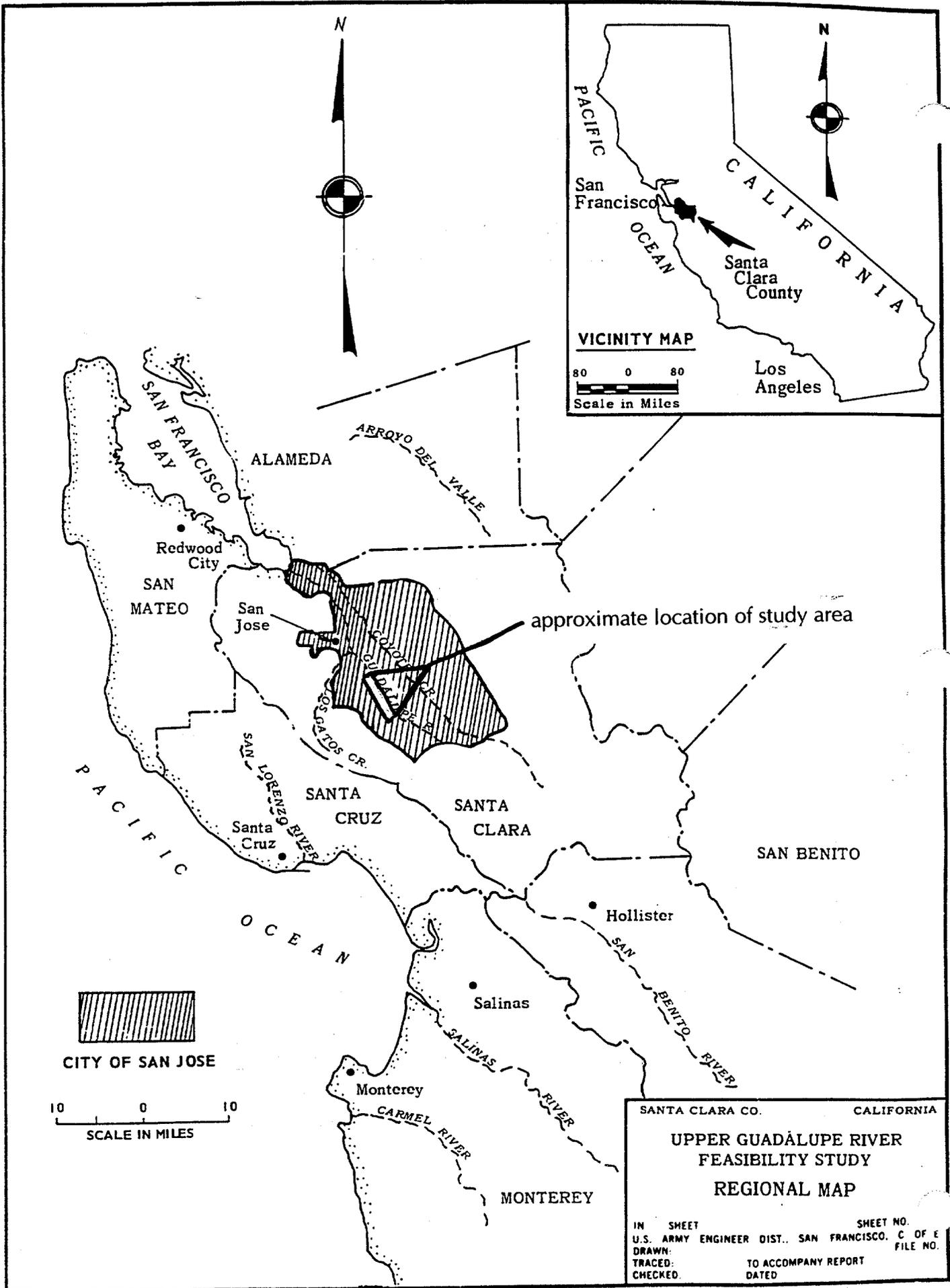


Figure 1

1.3 Study Participation and Coordination

The reconnaissance phase of this study was initiated in 1987 in response to a request from the non-Federal sponsor, the Santa Clara Valley Water District (SCVWD). Upon completion of the reconnaissance phase, the feasibility phase was initiated in 1989. The Santa Clara Valley Water District has provided continuous financial and technical support while serving as an active member of the study team. Because Federal funding is not guaranteed, or may not be timely, the SCVWD has moved forward with their own studies and design of a project. Thus, there are two studies being conducted for the same purpose - the Federal study (Corps/SCVWD), and the local study (SCVWD).

The Corps is required to investigate several different alternatives for providing flood protection. In order to optimize the size of a project (from an economical point of view) the Corps investigates several different levels of flood protection. The Corps has included a modified version of the SCVWD design as one of several alternatives under investigation. This plan is called the Bypass Channel Plan. It differs from the SCVWD plan in that it does not include any features between Highway 280 and the Southern Pacific Railroad near Willow Street. Nor does it include any features south of Blossom Hill Road. These areas were excluded from the Federal studies because they were unlikely to be economically justified.

The SCVWD studies include an Environmental Impact Report (EIR), while the Corps study includes a combined Environmental Impact Statement (EIS) and EIR. Note that an EIR is required to comply with state law, while an EIS is required to comply with Federal law. To reduce the amount of paper required to publish the Corps EIS/EIR, studies and data presented in the SCVWD EIR have been incorporated into the EIS/EIR by reference. Any reader wishing to obtain a copy of the SCVWD EIR executive summary may contact Dennis Cheong (SCVWD) to receive a copy.

The remainder of this report deals with the Corps/SCVWD study. Coordination of this study was established with the U.S. Fish and Wildlife Service (FWS), the California Department of Fish and Game (DFG), the City of San Jose, and other appropriate regional and local agencies. The FWS provided assistance in plan formulation, impact evaluation, and the development of mitigation measures.

Public Workshops and Meetings

The Santa Clara Valley Water District sponsored three public meetings in March 1989. The meetings were part of the sponsor's own planning process and were designed to solicit public comments on flood problems in the study area and possible solutions. Two of the meetings included a presentation of the Corps of Engineers planning process. Public comment forms were provided at the meetings. Over 260 people attended and 80 public comment forms were submitted. In December 1991, the local sponsor also provided the public an opportunity to review their

preliminary flood control plans, and they sponsored a public hearing in April 1997, subsequent to the release of their draft Environmental Impact Report.

In January and February 1989, the Corps of Engineers chaired two meetings to announce the future study activities, and to allow other local and state agencies to aid in scoping the needs of the Environmental Impact Statement. In March and April 1991, the Corps held two public workshops to describe the ongoing flood control studies and to receive additional input from the community. A total of 70 people attended the workshops. Public concerns were raised regarding the length of the study process, the removal of homes as proposed by one of the alternatives, potential losses in environmental resources, and the potential decrease in property values due to the loss of the natural appearance of the channel. The Corps sponsored a final public meeting in October 1997.

1.4 Prior Study Reports

The Guadalupe River has a long, documented history of floods as evidenced by the number of studies and projects that have been conducted along the river. A summary of the studies pertaining to the upper Guadalupe River is provided below.

U.S. Army Corps of Engineers, San Francisco District

The following reports were prepared by the San Francisco District Office under the Guadalupe River and Adjacent Streams study authority.

1. *Phase I Report and Environmental Evaluation of Flood Control Alternatives, Guadalupe River and Adjacent Streams.* The Corps of Engineers completed this report in 1975, and circulated the document as an environmental working paper to other federal, state and local agencies; environmental organizations; and the general public. The report recommended that the hydrologic information be reviewed and corrected in subsequent efforts to reflect physical changes in the drainage basins of the study area.
2. *Progress Report on the Guadalupe River and Adjacent Streams.* This document served as an interim report and presented the findings of the investigation up to 1976. Channelization alternatives were developed for the Guadalupe River. Flood control alternatives were also identified for the "Baylands Area", where the Guadalupe River and Coyote Creek floodplains merge near San Francisco Bay.
3. *Information Brochure on Guadalupe River and Adjacent Streams Survey Investigation.* This public information brochure was released in 1976, with cooperation from the Santa Clara Valley Water District. The brochure solicited public comments on six water resource management measures developed for the river channel between Interstate 880 (formerly Highway 17) and Curtner Avenue. A questionnaire was included to help identify public preferences for proposed flood control alternatives.

4. *Hydrologic Engineering Office Report, Guadalupe River and Coyote Creek, Santa Clara County, California.* This report was completed in 1977 and serves as the basis for all subsequent hydrologic studies.

5. *Stage 2 Report on Guadalupe River and Adjacent Streams Survey Investigation.* This report (completed in 1980) presented study findings since 1972. The report found that Federal participation in a flood control project was economically justified for Guadalupe River between Interstate 880 and Park Avenue.

6. *Final Guadalupe River Interim Feasibility Report and Environmental Impact Statement.* This report (completed in 1985) presented the preliminary studies of two structural plans and the No Action plan. Two flood control alternatives for a project between Interstates 880 and 280 were determined to be economically justified for Federal participation. One alternative was identified as the National Economic Development plan and recommended for implementation. Proposed channel modifications upstream of Interstate 280 were not economically justified, due to the shallow depth of potential flooding and predominance of residential development in the floodplain.

7. *Reconnaissance Report, Upper Guadalupe River, California.* This office report (completed in November 1989) presented the findings of the reconnaissance phase of this feasibility study for providing flood protection along the upper Guadalupe River from Interstate 280 to Blossom Hill Road. The reconnaissance study focused on reevaluating two preliminary channel modification plans that had previously been considered in the 1985 Guadalupe River Interim Feasibility Report. The study resulted in carrying forward both structural alternatives, the Widened Channel Plan and the Bypass and Widened Channel Plan, for further consideration during this feasibility phase of the study. The Widened Channel plan was determined to be the most efficient alternative for providing flood control protection. The No Action plan was also carried forward as a baseline condition against which to measure the impacts of the two structural plans.

Santa Clara Valley Water District

The Santa Clara Valley Water District (SCVWD) also provided reports which were used during the various Corps of Engineers' studies.

1. *"Environmental Setting of the Watershed and Floodplains of Guadalupe River, Coyote Creek, and Their Tributaries" and "Potential Flood Damages on Guadalupe River and Coyote Creek and Adjacent Streams".* These two reports (published in 1974) constitute the SCVWD's first direct input to the Corps of Engineers investigations.

2. *Study Report for the Guadalupe River from State Route 17 to Curtner Avenue.* The report (issued in 1976) presented the SCVWD's portion of a cooperative study conducted with the San Francisco District Corps of Engineers. The report examined channelization alternatives that were previously screened in the Corps of Engineers Phase I study. The document presents design

guidelines and describes both flood control features and recreational elements. No preference for a specific plan was indicated.

3. *Guadalupe River Flood Control Planning Study.* The SCVWD's flood control planning program issued several reports in the late 1970s and early 1980s that addressed separate areas of the river. The study investigated flood control alternatives for the areas of Hillsdale Avenue to Blossom Hill Road in 1977, Coleman Avenue and Old West Julian Street in 1981, and Alviso to U.S. Highway 101 in 1982.

4. *SCVWD Draft EIR/EIS for the Upper Guadalupe River, Interstate 280 to Blossom Hill Road, February 1997.* This document analyzes impacts associated with two local flood control projects proposed to be built by SCVWD near the study area.

U.S. Army Corps of Engineers, Sacramento District

The Corps' Sacramento District Office is currently constructing portions of the downtown Guadalupe River Flood Control Project located in the vicinity of downtown San Jose, downstream of the area studied in this report. The alternatives studied in this Upper Guadalupe River Feasibility Study would pass flows through the downtown Guadalupe River Flood Control Project. The following report was prepared by the Sacramento District.

Guadalupe River General Design Memorandum. The Sacramento District Office completed this report in December 1991. Final developmental studies are presented for the Recommended Plan along Guadalupe River, between Interstates 880 and 280. The document serves as the basis for final construction plans and specifications. The project is authorized under Section 401(b) of the Water Resources Development Act of 1986 (Public Law 99-662), as amended by the Energy and Water Development Appropriations Act for Fiscal Year 1990 (Public Law 101-101).

2.0 STUDY AREA DESCRIPTION

2.1 Setting

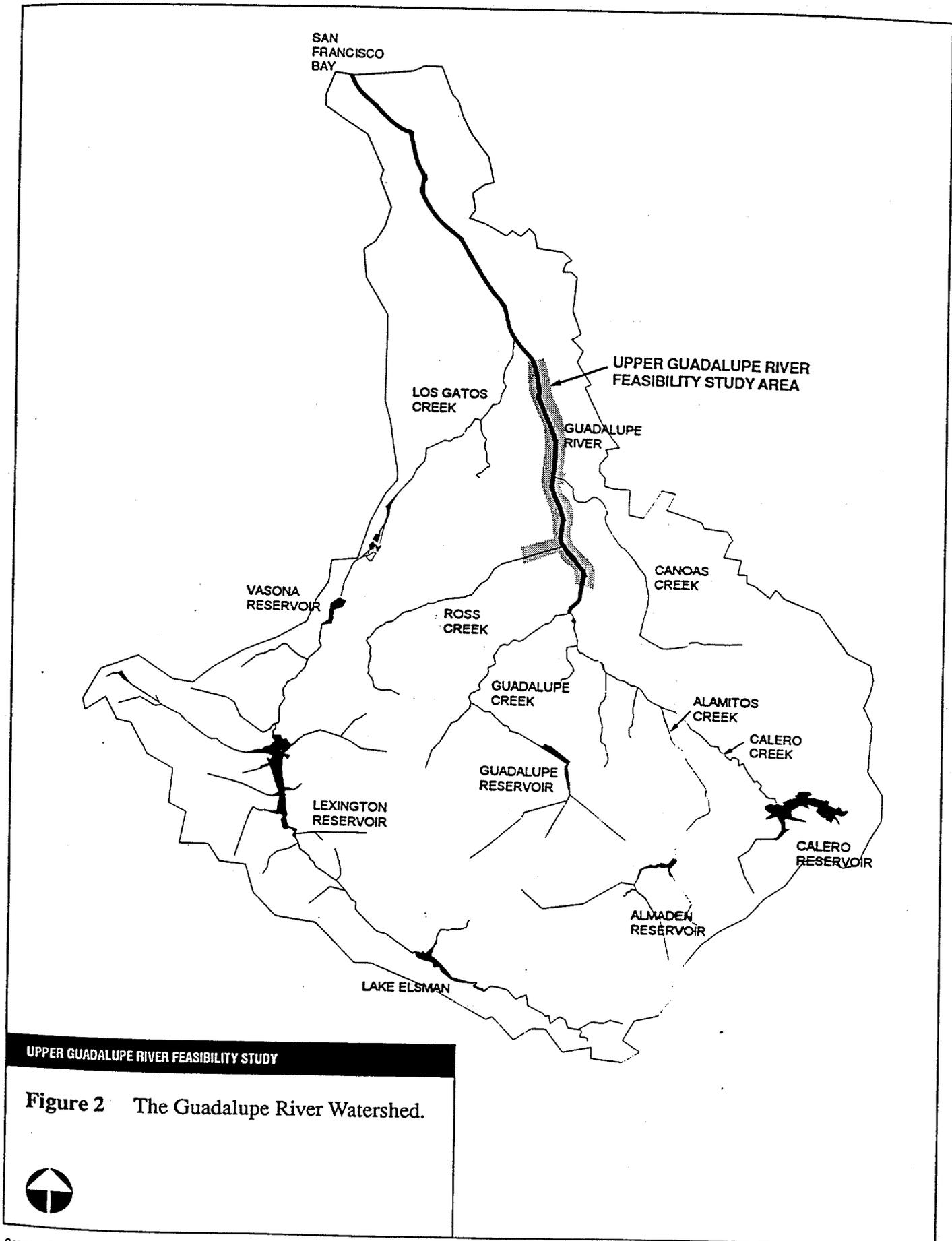
The local study area is situated in an urban area of southwestern San Jose, in the extreme southern area of the highly urbanized Santa Clara Valley. Santa Clara Valley lies in the center of Santa Clara County in west central California, immediately south of San Francisco Bay. The county is bounded on the northeast by Alameda County, on the northwest by San Mateo County and the southwest by Santa Cruz County (See Figure 1, Regional Map).

The Guadalupe River watershed (See Figure 2) is bounded on the south and southwest by the east side of the Santa Cruz Mountains, on the west by the San Tomas and Saratoga Creeks basin, on the north by the San Francisco Bay, and on the east by the Coyote Creek basin. The Guadalupe River is the second largest stream in Santa Clara County discharging into the South San Francisco Bay, draining an area of approximately 170 square miles. The river corridor passes through a region of the valley that is predominantly residential and commercial. The river flows from south to north for approximately 20 miles before emptying into San Francisco Bay. Its upstream terminus is located one-quarter mile south of Blossom Hill Road, at the confluence of Guadalupe Creek and Alamos Creek. The upstream 5-1/2 miles of the river comprise the study area which is bounded by the Southern Pacific Railroad bridge crossing and the Blossom Hill Road Bridge (see Figure 3). The study reach has two tributaries, Ross Creek and Canoas Creek. The Guadalupe, Almaden and Calero Reservoirs are located upstream of Blossom Hill Road.

For descriptive purposes, the study area has been divided into "river reaches" and "economic areas" corresponding to the major bridge crossings and floodplain areas, respectively. River reaches are defined in Table 1 and Figure 3, and economic areas are shown in Plate 1.

Table 1: Upper Guadalupe Study River Reaches

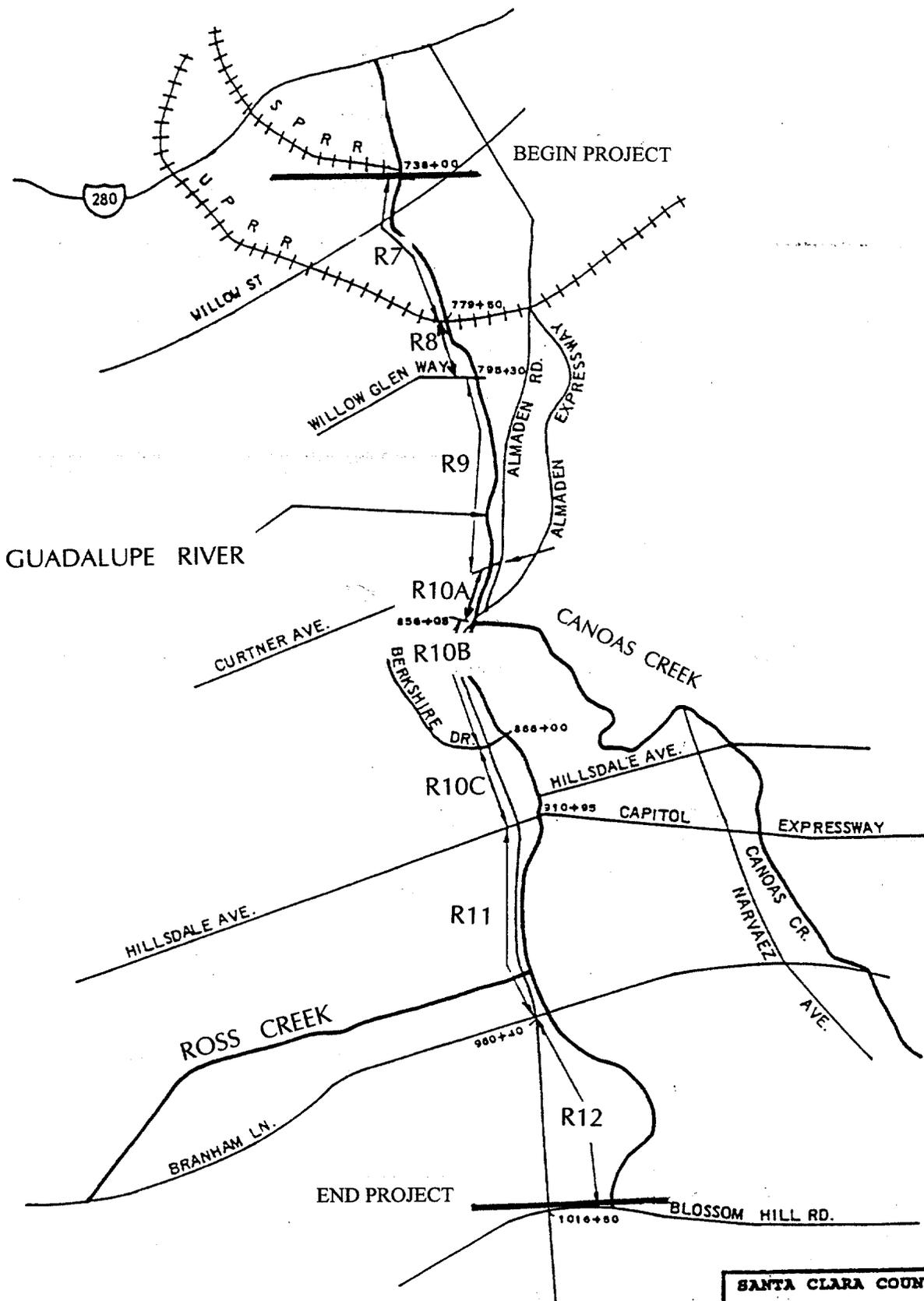
River Reach Number	Approximate Project Station	From	To
7	740 - 781	SPRR river crossing	Union Pacific Railroad (UPRR) river crossing
8	781 - 797	UPRR river crossing	Willow Glen Way
9	797 - 843	Willow Glen Way	Curtner Avenue
10	843 - 909	Curtner Avenue	Capitol Expressway
11	909 - 940	Capitol Expressway	Branham Lane
12	940 - 1016	Branham Lane	Blossom Hill Road



UPPER GUADALUPE RIVER FEASIBILITY STUDY

Figure 2 The Guadalupe River Watershed.





SANTA CLARA COUNTY CALIFORNIA
 UPPER GUADALUPE RIVER
 FEASIBILITY STUDY
 STUDY AREA
 REACHES
FIGURE 3

IN SHEET
 U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
 DRAWN: FILE NO.
 TRACED:
 CHECKED: TO ACCOMPANY REPORT
 DATED

2.2 Existing Conditions

Land Use

The study area is highly urbanized. The Guadalupe River and its tributaries are flanked by widespread residential subdivisions, which are interspersed with commercial shopping centers, light industrial development, and scattered open spaces. Property improvements adjacent to the river typically encroach onto the channel banks. Figure 4 shows the approximate locations of major commercial developments and open spaces. Areas which are not identified with a specific land use are generally residential.

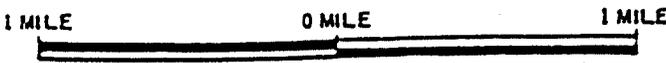
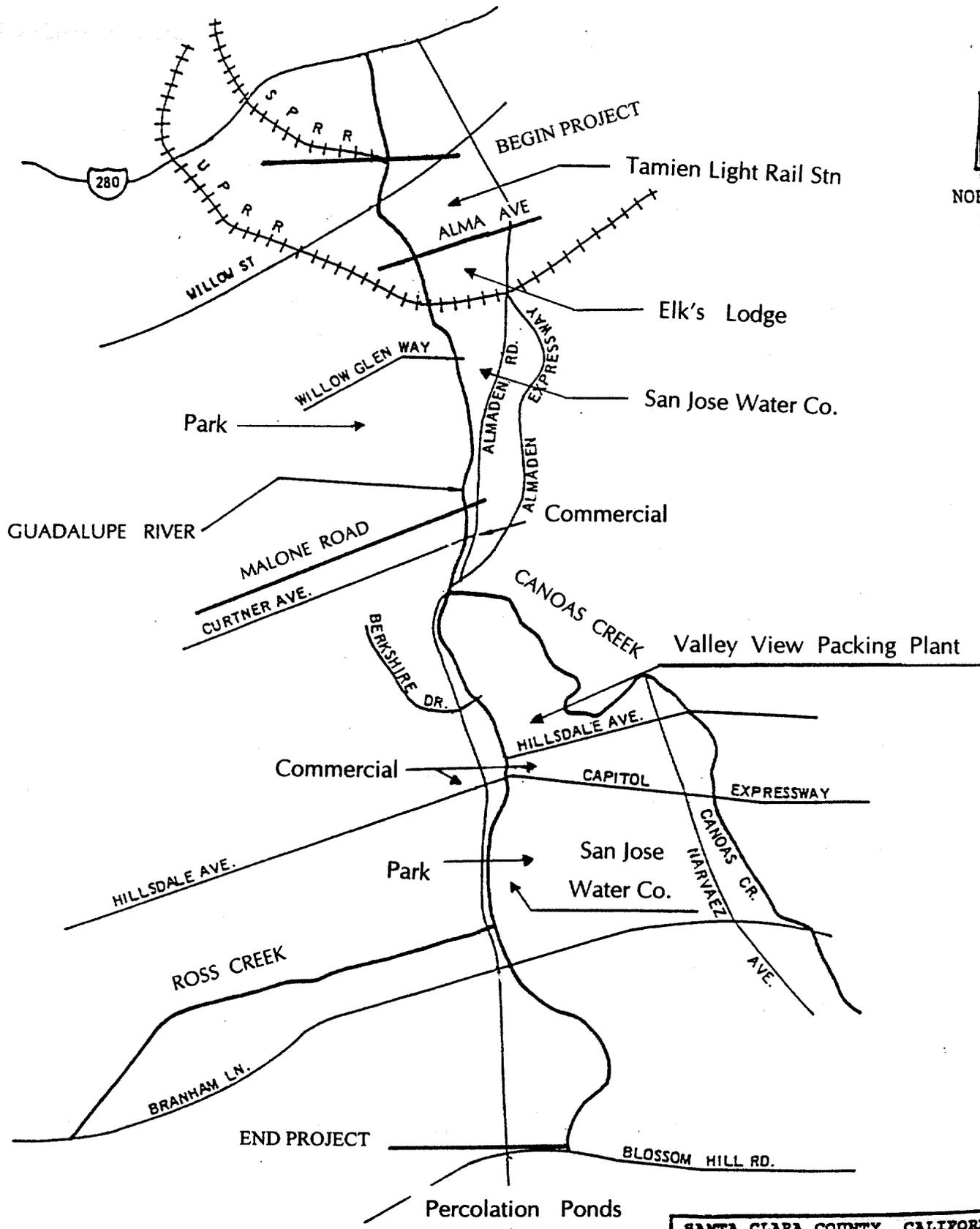
Open spaces in the study area include three city-operated neighborhood parks adjacent to the project corridor. Additional open space exists on both river banks near Blossom Hill Road where the Santa Clara Valley Water District maintains percolation ponds. These ponds are operated for groundwater recharge purposes. The Santa Clara Valley Water District also owns a half-acre parcel of property near Alma Street which is actively used as a community garden. The San Jose Water Company owns water well fields adjacent to the river in Reaches 9 and 11; both well fields are surrounded by residential development. Santa Clara County, the State of California and the Santa Clara Valley Water District all own maintenance easements along the river's banks.

Socioeconomic Conditions

Employment and Income

Prior to World War II the Santa Clara Valley supported chiefly agricultural activities and related industries. The primary produce was fruit, primarily prunes and apricots, which supported a canning industry. After the war, expansion of existing industrial facilities and an increase in new manufacturing plants began to replace agricultural activities, and many agricultural lands were lost to residential developments. Currently, only one agricultural parcel remains within the study area. In the early 1970s the invention of the silicon microchip spurred a boom in light industry, and the computer software and hardware industry has since become the dominant employment industry. This dominance has earned the region the nickname "Silicon Valley".

The industrial transformation in Santa Clara County has made the city of San Jose the center of economic activity in the San Francisco Bay Area's South Bay region. Approximately 45 percent of San Jose's total population is employed. The high technology and manufacturing industries lead the city's employment sector, accounting for 34 percent of total employment. The next largest employers are the service and the retail trade sectors which provide 26 percent and 14 percent of available jobs, respectively. Other employment sectors include government, wholesale trade, mining, construction, finance, insurance, real estate, transportation and public utilities.



SANTA CLARA COUNTY CALIFORNIA
 UPPER GUADALUPE RIVER
 FEASIBILITY STUDY
 LAND USE
 FIGURE 4

IN SHEET SHEET NO.
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The high paying jobs in the "Silicon Valley" area contribute to the relatively high median incomes of Santa Clara County and San Jose, both of which are greater than the state median income. In 1990, the median household income in San Jose was \$46,200, which is 14% higher than the state median of \$40,500 and only 4% below the Santa Clara County median of \$48,100.

Population

The city of San Jose is the largest community in Santa Clara County, accounting for more than half of the County's population. The post-war population boom increased urbanization and led to the widespread residential and commercial development of a large portion of the Santa Clara Valley. Table 2 summarizes historical population growth in Santa Clara County and San Jose. The 1993 population estimate for the city of San Jose is 822,000. Due to existing build-out, future population growth within the study area is expected to be minimal.

Table 2: Population Growth in Santa Clara County

YEAR	SANTA CLARA COUNTY POPULATION	AVERAGE ANNUAL % INCREASE OVER PRECEDING DECADE	CITY OF SAN JOSE POPULATION	AVERAGE ANNUAL % INCREASE OVER PRECEDING DECADE	PORTION OF COUNTY POPULATION IN SAN JOSE
1950	290,600	N/A	95,300	N/A	33%
1960	658,700	8.5%	204,200	7.9%	31%
1970	1,064,700	4.9%	445,800	8.1%	42%
1980	1,295,100	2.0%	628,300	3.5%	49%
1990	1,497,600	1.4%	782,200	2.2%	52%
1993	1,563,800	1.5%	822,000	1.7%	52%

Property Values

The majority of dwellings in the study area were constructed during the 20-year period following World War II. In 1990, San Jose had nearly 259,400 housing units. Recent conversion of single family units to multi-family units and increasing encroachment of businesses into the project area borders indicate that changes in usage are occurring.

The median value of homes in Santa Clara County and San Jose reflect the relatively high incomes in the area. In 1990, the median value of an owner occupied household in Santa Clara County was \$289,400, and the median value in San Jose was \$259,000. The average value of the homes in the study area are typical of the county average.

Recreation

There are a number of small community parks near the upper Guadalupe River. Sixteen parks are located within one mile of the study reaches. Eight of these parks are under two acres in size or are undeveloped. At present, the major recreational resources in and near the study area are the Almaden Lake Park along the Guadalupe River south of Blossom Hill Road, the Guadalupe River Park downstream of Interstate 280 (downstream of the study area), and the upstream part of reach 12 and the adjacent percolation ponds. The latter is property owned by the SCVWD which is available for undeveloped recreation.

Recreational trails are currently limited in the vicinity of the study area. There are several segments of bicycle path along the State Route 87 freeway. The Alamitos/Calero Creek Trail runs along Los Alamitos Creek upstream of the Almaden Lake Park. The Coyote Creek park chain, located several miles east of the Guadalupe River, has recreational trails. The Los Gatos Creek Trail runs from Leigh Avenue to Lexington Reservoir. The City of San Jose has planned an extensive trail network in and around the study area. Most of these planned trails are either: (1) dependent upon acquisition of a flood control right of way along the upper Guadalupe River, or (2) proposed bicycle lanes on city streets.

Public Infrastructure

Public Utilities. Water mains which serve residences and commercial establishments are located along the project route. Storm and sewer drain lines, underground telephone and television cables, and gas and electric lines also exist along the project route. Utility services are provided and operated by the San Jose Water Company, the City of San Jose Municipal Water System, the City of San Jose, Pacific Bell Company, American Telephone and Telegraph Company, Pacific Gas and Electric Company and cable television companies.

Transportation. Santa Clara County Transit provides seven bus lines in the study area and operates the southern portion of the Guadalupe Corridor Light Rail line, which is located in the median of State Highway 87. The existing use and relative location of the major streets, bridge crossings, and transportation systems within the upper Guadalupe River study area corridor are summarized in Table 3.

Table 3: Major Streets, Bridge Crossings, and Transportation Systems

Street/Railroad Name	General Orientation	River Reach	Description & Existing Use
Willow St	E-W	R7	Bridge crossing 200' D/S of local bypass terminus
Alma St	E-W	R7	Extends east of Guadalupe River. A light rail station is nearby.
UPRR	E-W	R7/R8	Railroad Bridge crossing
Willow Glen Way	E-W	R8/R9	Bridge crossing
Malone Rd	E-W	R9	New bridge crossing, designed & constructed for 100-year flood event
Curtner Ave	E-W	R9/ R10	Bridge crossing near a light rail station
Almaden Expwy	N-S	R10	Main N-S thoroughfare in study area, providing ramp access to both Interstate 280 and U/S segment of Highway 87
Hillsdale Ave	E-W	R10/ R11	Bridge crossing
Capitol Expwy	E-W	R10/ R11	Bridge crossing, near a light rail station
Branham Ln	E-W	R11/ R12	Bridge crossing, near a light rail station
Blossom Hill Rd	E-W	R12	U/S terminus of proposed project on Guadalupe River

NOTE: Many of the above streets are used by the County Transit bus system.

Water Supply

The Santa Clara Valley Water District operates three reservoirs which are located on tributaries to the Guadalupe River upstream of the study area. These reservoirs are operated for water supply and groundwater recharge purposes. Although they do not serve a flood control purpose, they provide incidental flood control storage. Groundwater is also a major water supply source within the study area. To reduce the threat of land subsidence that would be caused by excessive net withdrawal from groundwater pumping, the SCVWD operates groundwater recharge systems within the Guadalupe River watershed. These systems are based on instream and offstream percolation facilities which are operated in conjunction with the reservoirs and imported water.

2.3 Environmental Conditions

Precipitation

Precipitation data is collected from numerous stations within the study area. Data from the Los Gatos, San Jose and Santa Clara University stations were used to develop the distribution of monthly average precipitation in the basin. The periods of record for the three stations are 92, 103, and 95 years, respectively.

Normal annual precipitation (NAP) in Santa Clara County varies from 14 inches near the San Francisco Bay to 50 inches near the crest of the Santa Cruz Mountains. Virtually all of this precipitation falls as rain, and snowfalls are infrequent events. The normal annual precipitation in the Guadalupe River basin is 26 inches. Ninety percent of the rainfall occurs during the winter, in the six-month period between November and April, with January having the highest average rainfall. Refer to the Hydrology and Hydraulics Appendix for the distribution of monthly average precipitation.

Runoff

Floods on the upper Guadalupe River are primarily due to winter rain flows. Gaging station records on the Guadalupe River in San Jose for the period of 1931 to 1960 indicate that the natural average annual runoff is approximately 35,500 acre-feet. The record shows runoff ranging from zero in 1931 to over 123,000 acre-feet in 1938, which is believed to be the wettest year of record. Nearly 99% of all natural runoff occurs during the five-month period of December through April. Refer to the Hydrology and Hydraulics Appendix for the distribution of monthly average runoff.

Air Quality

The study area is located within the Bay Area Air Quality Management District (BAAQMD), which has been designated by the United State Environmental Protection Agency (USEPA) as a non-attainment area for ozone and carbon monoxide. The study area has also been designated as a non-attainment area on the State level for ozone, carbon monoxide, and inhalable particulates (PM₁₀).

Water Quality

Nonpoint source pollution is a threat to water quality in the Guadalupe River. Urban stormwater runoff typically introduces contaminants such as oil, grease, pesticides, and herbicides to the receiving river. There is sufficient mercury contamination in the river sediments for fishing to be banned by health authorities.

Increases in water temperature are attributable to the lack of shade along the riverbank due to the degradation of the riparian forest. Salmon may be less impacted than trout since salmon may

migrate out of the river in the spring before water temperatures reach their summer peaks. In general, the upper reaches of the river (Reaches 10-12) provide less shade cover than the lower reaches, thus providing poor habitat for anadromous fish.

Sedimentation

A sediment study for the Guadalupe River basin was completed by a consultant, Philip Williams and Associates, in February 1996. The study found that under existing conditions, the upper Guadalupe River appears to have a fairly stable sediment transport regime. A scouring trend observed in the lower reaches of the river may be indicative of the generally sediment-starved state of the river. Upstream dams and the increased urbanization in the watershed have reduced the instream sediment transport and natural runoff sediment load of the upper Guadalupe River.

Natural Environment

Terrestrial Habitats and Wetlands. The most important wildlife habitat in the study area is riparian (streamside) forest. This habitat type is found along much of the river's length, and is the most visually distinctive feature of the river corridor in most locations. However, the portions of Canoas Creek and Ross Creek within the study area have been channelized and relocated, and do not support riparian forest.

The riparian forests in the study area have generally been degraded and fragmented. However, these riparian forests are still characterized as unusually extensive when compared to those in most other urban stream environments in the San Francisco Bay area and are still very important to wildlife. Riparian areas lacking forest provide an opportunity for mitigation of project impacts by creating new riparian forest in these areas.

Riparian forests normally support a high diversity and abundance of wildlife, due to its typically high levels of biological productivity and structural diversity. Field studies confirm a high diversity and abundance of bird life in this habitat type within the study area, but also show a low diversity and abundance of terrestrial vertebrates (Engineering-Science, Inc., 1994, Appendices WA and WB). Other terrestrial habitats in the study area, such as scrub, ruderal, and urban forest, are of lesser value to wildlife.

The local sponsor has completed a delineation of jurisdictional wetlands and other waters of the U.S. (Engineering-Science, 1995 Update, Appendix V-B). Within the study area, these categories are generally limited to the bottom parts of river and creek channels and percolation ponds. Small areas of freshwater marsh habitat found at some locations in the river channel bottom provide comparatively high habitat values for fish and wildlife.

Plates showing the existing vegetation types within the study area by river reach are contained in the accompanying Environmental Impact Statement/Report (EIS/R) and are summarized in Table 4. This table clearly illustrates that Ross and Canoas Creeks have minimal

terrestrial habitat value, while Reach 9 has the greatest riparian forest acreages. Freshwater marsh habitat is limited within the study area. Reach 12, with 2.75 acres, has the only significant amount of such habitat.

Wildlife Resources. Terrestrial vertebrates have relatively low population and limited diversity in the study area. Field studies revealed sixteen mammal species, including nine native species. Six species of reptiles and amphibians have been noted, of which five are native.

Although terrestrial vertebrates are not abundant, a diverse variety of birds exist, and many species are abundant. Ninety species have been observed along the study reaches (Engineering-Science, Inc., 1994, Appendices WA and WB). Birds are most abundant in the river corridor areas that have multi-layered canopies of tall trees. The presence of old cottonwood trees, commonly having heart rot and trunk cavities, increases the availability of habitat for cavity-nesting birds.

Aquatic Habitat. Within the aquatic ecosystem of the Guadalupe River, the primary area of concern is shaded riverine aquatic (SRA) cover, which is associated with riparian forest along the river banks. In the Santa Clara Valley, SRA cover is essential for the maintenance of self-sustaining populations of cold-water fish species such as salmonids.

The SRA cover in the Guadalupe River has been considerably degraded and reduced in extent. This situation primarily affects salmonids, which are a sensitive resource of significant public and regulatory concern. There is considerable potential for improvement of SRA cover along the river. This potential represents an opportunity for mitigating the impacts of structural alternatives.

Fishery Resources. The non-estuarine portions of the Guadalupe River system are currently inhabited by a total of 28 fish species, 10 of which are native. Table 5 lists the native and non-native fish within the study area. The only salmonids present are Chinook (or king) salmon and rainbow/steelhead trout. Steelhead trout are the same species as rainbow trout, but are anadromous (they spawn in fresh water but spend their adult lives in the ocean).

Chinook salmon and their redds (nests) have been observed at various locations along the Guadalupe River, especially in the downtown reach of the river. Overall aquatic habitat conditions in the Guadalupe River are generally marginal for salmon; it is not known to what extent the salmon observed in the river are the result of *successful* local reproduction, as opposed to being strays from other streams.

Unconfirmed observations of steelhead trout redds have been made in the study area, but summer water temperatures within this portion of the river system are generally too high for rainbow trout and for steelhead trout, whose young spend their summers in fresh water. As a result, rainbow trout are not normally found in the study area, and it is doubtful that the steelhead trout observed here represent a self-sustaining population.

TABLE 4: Acreage of existing vegetated habitats within the Upper Guadalupe River Feasibility Study Area.

Habitat Type	Acres Per Reach						Total Acres	Percent of Total
	7	8	9	10	11	12		
Riparian Forest	4.43	1.66	8.97	7.34	7.41	2.28	34.96	36%
Freshwater Marsh	0.00	0.00	0.00	0.68	0.04	2.75	3.72	4%
Ruderal Herbaceous	0.21	0.02	0.08	4.29	2.64	15.36	26.36	27%
Ruderal Scrub	1.29	0.00	0.48	3.90	3.59	4.17	14.00	14%
Upland Landscaping	0.35	0.05	0.00	4.55	1.01	1.51	8.50	9%
Urban Forest	<u>0.00</u>	<u>1.97</u>	<u>0.80</u>	<u>0.00</u>	<u>0.00</u>	<u>0.00</u>	<u>9.23</u>	<u>10%</u>
Total	6.28	3.70	10.33	20.76	14.69	26.07	96.77	100%

Source: SCVWD and CE 1994.

Notes: The three other habitat types in the study area (unvegetated, reverment, and river) are not included in this table. The accuracy of measurements is within approximately 5% of the stated values. The percentage values have been rounded.

Table 5: Fish Species of the Guadalupe River

<u>Type</u>	<u>Common Name</u>	<u>Scientific Name</u>
Anadromous	Chinook (king) salmon	<i>Oncorhynchus tshawytscha</i>
Anadromous	Steelhead trout	<i>Oncorhynchus mykiss</i>
Anadromous	Pacific lamprey	<i>Lampetera tridentata</i>
Resident	Resident Rainbow trout	<i>Oncorhynchus mykiss</i>
Resident	Sacramento sucker	<i>Catostomus occidentalis</i>
Resident	Three-spined stickleback	<i>Gasterosteus aculeatus</i>
Resident	Hitch	<i>Lavinia exilicauda</i>
Resident	California roach	<i>Lavinia symmetricus</i>
Resident	Prickly sculpin	<i>Cottus asper</i>
Resident	Riffle sculpin	<i>Cottus gulosus</i>
Resident	Brown bullhead*	<i>Ameiurus nebulosus</i>
Resident	Smallmouth bass*	<i>Micropterus dolomieu</i>
Resident	Largemouth bass*	<i>Micropterus salmoides</i>
Resident	Black bullhead*	<i>Ameiurus melas</i>
Resident	Black crappie*	<i>Pomoxis nigromaculatus</i>
Resident	White crappie*	<i>Pomoxis annularis</i>
Resident	Green sunfish*	<i>Lepomis cyanellus</i>
Resident	Pumpkinseed*	<i>Lepomis gibbosus</i>
Resident	Bluegill*	<i>Lepomis macrochirus</i>
Resident	Redear sunfish*	<i>Lepomis microlophus</i>
Resident	Mosquitofish*	<i>Gambusia affinis</i>
Resident	Goldfish*	<i>Carassius auratus</i>
Resident	Carp*	<i>Cyprinus carpio</i>
Resident	Threadfin shad*	<i>Dorosoma petenense</i>
Resident	Channel catfish*	<i>Ictalurus punctatus</i>
Resident	Rainwater killfish*	<i>Lucania parva</i>
Resident	Inland silverside*	<i>Menidia beryllina</i>
Resident	Golden shiner*	<i>Notemigonus crysoleucas</i>

* Non-native species.

The highest quality salmonid habitat in the Guadalupe River watershed is found upstream of the study area (above Blossom Hill Road) in several tributaries. However, there are several obstacles to fish passage that limit (to varying degrees) the ability of fish to move up the river. The most significant of these is a 13.5-foot-high drop-structure located above Blossom Hill Road, which prevents anadromous fish from reaching habitat farther upstream. The SCVWD plans to provide a ladder at the drop structure prior to the year 2000. Other obstacles are located in Reach 10/11 at Hillsdale Avenue, upstream of the confluence of Canoas Creek and the Guadalupe River in Reach 10, and downstream of the confluence of Ross Creek and the Guadalupe River in Reach 11 (see Figure 5). These lesser obstacles hinder the upstream movement of fish primarily at low flows.

Endangered and Threatened Species. No federally listed endangered species are known to exist in the study area. However, one sighting of an endangered peregrine falcon was recorded in 1987. One recently listed threatened species, the California red-legged frog, could exist in the study area, although SCVWD surveys have failed to find any. A second species, the steelhead trout, has recently been listed as a threatened species. This species is known to exist in the area. Six candidate species, listed in Table 6 may exist in the study area.

Cultural Resources. The Santa Clara Valley is abundant in cultural resources from the prehistoric and historic periods. The current project area of potential effect has been investigated through archaeological survey, and an inventory of surface sites has been completed. One of the identified sites within the area of potential effect has been determined to be eligible for the National Register of Historic Places as a result of consultation with the California State Historic Preservation Officer. However, it is not expected that this site will be disturbed during construction. A second site, where early tools have been found within forty feet of the river along the east bank of Reach 11, may be eligible for the National Register. It is expected that proposed widening in this area will expose further resources. A site survey must be performed in order to determine whether this recently identified site may be eligible for the National Register. Known cultural resources within the study area are summarized in Table 7.

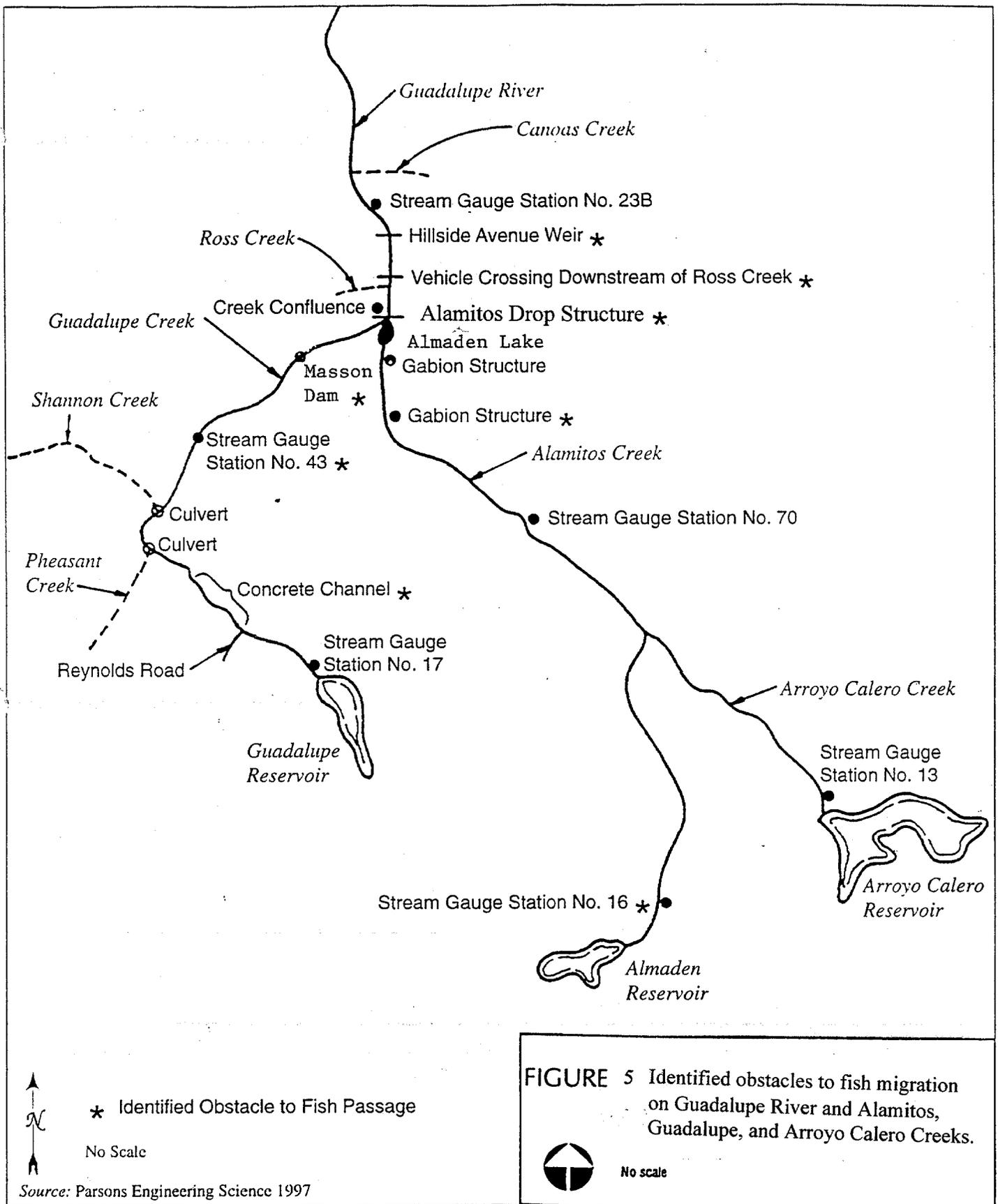


TABLE 6 Special-status wildlife species observed or potentially occurring within the Upper Guadalupe River Feasibility Study Area.

Common Name	Scientific Name	Status	O/P
Mammals			
Pacific western big-eared bat	<i>Plecotus townsendii townsendii</i>	FC2, SSC	P
Greater western mastiff bat	<i>Eumops perotis californicus</i>	FC2, SSC	P
Birds			
Double-crested cormorant	<i>Phalacrocorax auritus</i>	SSC	O
Osprey	<i>Pandion haliaetus</i>	SSC	O
Black-shouldered kite	<i>Elanus caeruleus</i>	SFP	O
Sharp-shinned hawk	<i>Accipiter striatus</i>	SSC	O
Cooper's hawk	<i>Accipiter cooperii</i>	SSC	O
Merlin	<i>Falco columbarius</i>	SSC	O
Peregrine falcon	<i>Falco peregrinus</i>	FE, SE	P
Prairie falcon	<i>Falco mexicanus</i>	SSC	P
California gull	<i>Larus californicus</i>	SSC	O
Burrowing owl	<i>Athene cunicularia</i>	SSC	O
Black swift	<i>Cypseloides niger</i>	SSC	P
Willow flycatcher	<i>Empidonax traillii</i>	ST	P
Yellow warbler	<i>Dendroica petechia</i>	SSC	O
Yellow-breasted chat	<i>Incteria virens</i>	SSC	P
Reptiles			
Southwestern pond turtle	<i>Clemmys marmorata pallida</i>	FT, ST	P
Alameda striped racer (whipsnake)	<i>Masticophis lateralis euryxanthus</i>	FC, ST	P
Amphibians			
California red-legged frog	<i>Rana aurora draytoni</i>	FC1, SSC	P
Foothill yellow-legged frog	<i>Rana boylei</i>	FC2, SSC	P
California tiger salamander	<i>Ambystoma tigrinum californiense</i>	FC2, CSC	P
Invertebrates			
San Francisco fork-tail damselfly	<i>Ichnura gemina</i>	FC2	P
Edgewood blind harvestman	<i>Calicina minor</i>	FC2	P
Ricksecker's water scavenger beetle	<i>Hydrochara rickseckeri</i>	FC2	P
Fish			
Steelhead trout	<i>Oncorhynchus mykiss</i>		

Sources: SCVWD and CE 1994; USFWS 1993; SCVWD and CE 1993.

Notes:

Federal Status

FE Federally Endangered: taxa in danger of extinction throughout all or a significant portion of its range.

FT Federally Threatened: taxa likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

FPE/T Federal Proposed Endangered/Threatened: taxa proposed for listing as endangered or threatened.

FC1 Federal Candidate Species, Category 1: taxa under review. Sufficient biological information exists to support a proposal listing as an endangered or threatened species.

FC2 Federal Candidate Species, Category 2: taxa which may warrant listing, but for which substantial biological information to support a proposal is not currently available.

FC3c Federal Candidate Species, Category 3: taxa that are too widespread and/or are not seriously threatened enough to support listing.

1R Recommended for Federal Candidate Species, Category 1 status.

2R Recommended for Federal Candidate Species, Category 2 status.

State Status

SE California Endangered: a native species or subspecies of animal in serious danger of extinction throughout all or a significant portion of its range.

ST California Threatened: a native species or subspecies likely to become an endangered species in the foreseeable future, although not presently threatened with extinction.

SSC California Species of Special Concern: species not officially state listed, but vulnerable to extirpation given population declines or restricted geographic ranges.

SFP California Fully Protected.

O/P = Observed/Potential occurrence within the Upper Guadalupe River project study area.

Table 7 Significant Cultural Resources

Resource	Description	River Reach	Eligible for National Register
Lewis Canal excavated between 1866 and 1871	May be situated in existing channel	R7	No
Valley View Cannery constructed in 1930s	Still in operation	R10, east side	No
A mid-twentieth century prune-drying plant and farmstead site	Located on Valley View Cannery property. All but the foundation has been demolished.	R10, east side	No
Prehistoric archaeological sites CA-SCL-674, * CA-SCL-690	lithic scatter (midden), village/cemetery	west of Canoas Creek R7, east bank	No Yes
Historic archaeological site CA-SCL-635H	Redwood retaining wall circa 1860-1870	R10	No
Archaeological site CA-SCL-636	exposed fire-cracked rocks and lithics	R11, east bank	Unknown

*NOTE: This site was excavated during a previous construction project. Data recovery was performed, and the potential for further disturbance is anticipated to be minimal.

Hazardous, Toxic and Radiological Waste. A project area review and preliminary site assessment (PSA) of the study area was conducted in two phases by Kleinfelder, Inc., as described in their January and August 1992 reports. The purpose of the studies was to (1) identify potential sources of surface and subsurface contamination, (2) evaluate potential impacts of existing contamination sources, (3) identify potential impacts of contamination, and (4) provide recommendations for additional investigation, as necessary to evaluate the extent and impacts of contamination to the project design and construction.

The PSA identified twenty-four properties, located between Interstate 280 and Blossom Hill Road, as having a high potential for contamination impact. A high potential means that the properties are known or suspected to be contaminated, based on the following criteria:

1. Existing or former presence of underground or aboveground storage tanks;
2. Storage and use of hazardous materials, including agricultural pesticides; and
3. Site located adjacent to a property with known contamination.

Subsequent to the PSA, the Santa Clara Valley Water District conducted a Level II HTRW investigation, which was documented in April 1995. The results of the Level II investigation indicate that there are several areas of concern along the project alignment. These areas are described below, summarized in Table 8 and located in Figure 6.

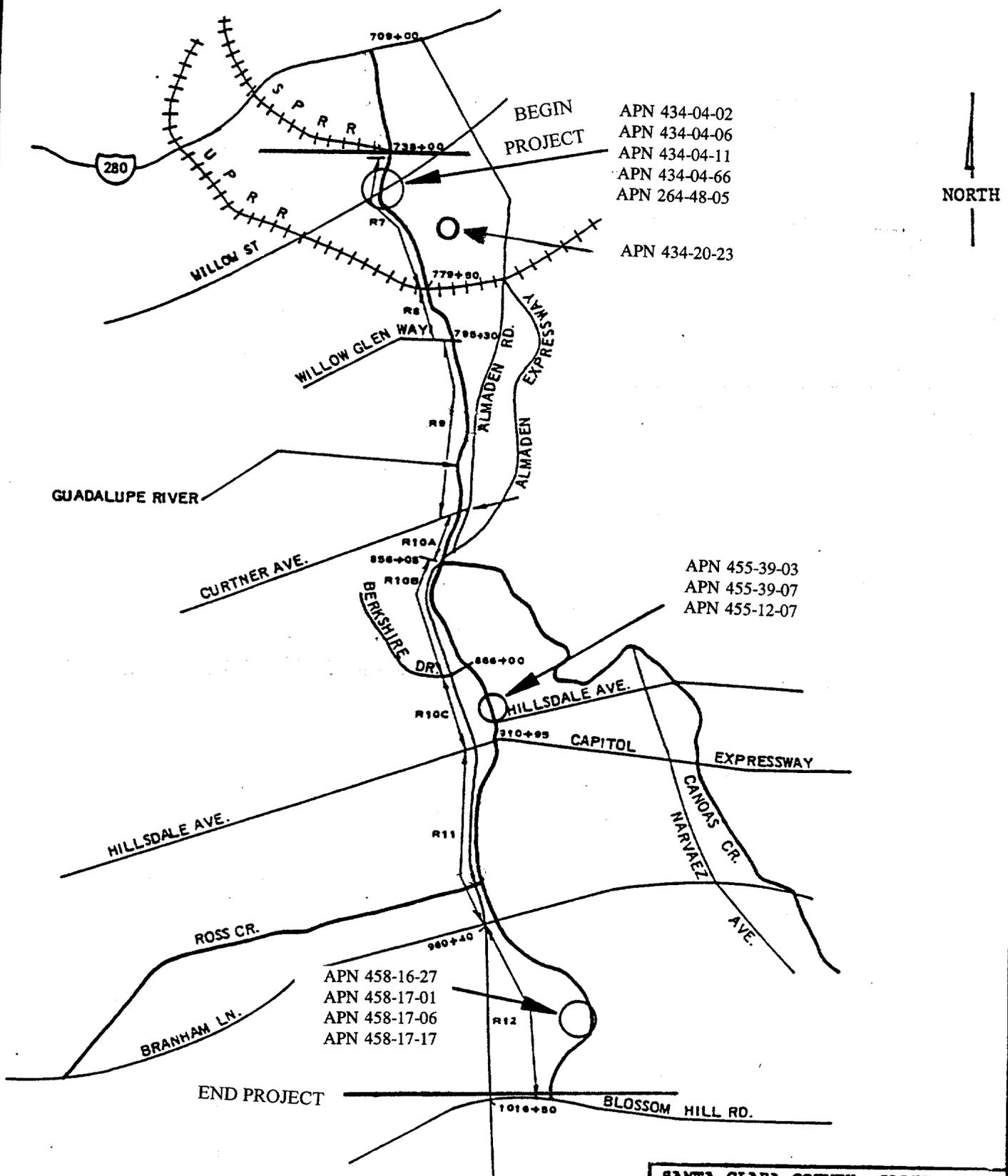
- (1) Two small areas of stained soil on parcel APN-264-48-005, Bennett's Automotive, are impacted with elevated concentrations of mercury. A total of 20 cubic yards of impacted soil should be excavated and removed prior to property acquisition.
- (2) Approximately 89 cubic yards of soil below a storm drain outflow pipe and near the west gate on parcel APN 434-04-002. This soil may contain elevated concentrations of chlordane and DDT and dinoseb. In addition, this soil also contains petroleum hydrocarbon concentrations. Removal of this soil from the property is recommended prior to property acquisition. If the soil removal is not completed prior to construction, the soil will have to be excavated and properly disposed of during construction activities.
- (3) Petroleum hydrocarbons have impacted soil and groundwater at a site at the corner of Willow Street and Lelong Avenue. The hydrocarbon plume appears to have impacted at least three parcels (APN 434-04-006, -011 and -066). The estimated volume of impacted soil is 16,400 cubic yards.
- (4) Parcel 434-20-023 (Elks Lodge) was investigated as part of the bypass channel/island bank assessment. The upper 5 feet of soil at the Elks Lodge site appears to contain mercury concentrations at elevated levels. Either additional characterization should be performed to show that the soil is not hazardous with respect to mercury, or the upper 5 feet of soil should be excavated and properly disposed.

- (5) The Valley View Packing Facility (APN 455-12-007, 39-003, 39-007) is the site of a documented fuel release and some pesticide impact in shallow soil. The volume of pesticide impacted soil is estimated to be 4,720 cubic yards. The volume of petroleum hydrocarbon impacted soil is estimated to be 5,000 cubic yards.
- (6) Soil on parcels 458-17-001, -006, -017 and 458-16-027 were proposed for use as wetland construction material. Nickel and silver exceeded the guidelines for cover and non-cover soil. Mercury and pesticides exceed the guidelines for cover soils but not non-cover soils.

Table 8 Potential HTRW Sites

Assessors Number	Address	Contaminants of Concern
264-48-005	384 McLellan Ave	Mercury
434-04-002	Undeveloped	Chlordane, DDT, Dinoseb
434-04-006	450 Willow St	Petroleum Hydrocarbons
434-04-011	1127 Lelong St	Petroleum Hydrocarbons
434-04-066	456-458 Willow St	Petroleum Hydrocarbons
434-20-023	Elks Lodge	Mercury in top 5' of soil
455-12-007, 455-39-003, & 455-39-007	Valley View Packing Plant	Petroleum Hydrocarbons
458-16-027, 458-17-001, 458-17-006, & 458-17-017	Vacant	Nickel and Silver

NOTE: All of the contaminants of concern listed above are regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). However, none of the above sites are designated as Superfund sites.



SANTA CLARA COUNTY CALIFORNIA
 UPPER GUADALUPE RIVER
 FEASIBILITY STUDY
 FIGURE 6
 HTRW SITE LOCATIONS

ON SHEET	SHEET NO.
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E	FILE NO.
DRAWN:	
TRACED:	TO ACCOMPANY REPORT
CHECKED:	DATED

2.4 Existing Water Resources Projects

Santa Clara County currently has several water resource development projects in and around the study area, including small and large reservoirs for recreation, irrigation, water supply, and conservation. In addition, numerous flood control structures have been or are being constructed on the Guadalupe River. By widening the river corridor and constructing levees, the channel capacity between San Francisco Bay and U.S. Highway 101 was increased to convey a 100-year flood event. Although, the reach between U.S. Highway 101 and Interstate 880 can convey 100-year flood flows, it does not meet the standards of the Federal Emergency Management Agency's (FEMA) flood insurance program. The Santa Clara Valley Water District is developing plans to meet FEMA standards.

Downtown Guadalupe River Project

On March 30, 1992, the Santa Clara Valley Water District and the Corps of Engineers, Sacramento District Office, signed a Local Cooperation Agreement to implement the downtown Guadalupe River Flood Control Project located in downtown San Jose. The project consists of channel modifications between Interstate 880 and Interstate 280 (downstream of the current study area) and includes recreation features. The project is expected to be constructed at a total cost of \$138 million. As co-sponsors of the project, the Santa Clara Valley Water District, the San Jose Redevelopment Agency, and the State of California will share approximately \$78 million of the total cost. Construction began in late September 1992 and is currently ongoing.

SCVWD Flood Control Projects

The Santa Clara Valley Water District is undertaking two local flood control projects near the study area, independently and without Federal contribution. The first local project is a 4,800-foot long bypass channel which is designed to join the downtown Guadalupe River Project and the proposed upper Guadalupe River Project. The bypass will be aligned adjacent to the east bank of the Guadalupe River and will tie into the downtown Guadalupe River Project at Interstate 280 and extend to the Southern Pacific Railroad bridge (which separates the independent SCVWD project from the joint Corps/SCVWD project) where it would tie into the upper Guadalupe River Project. These plans are currently being developed. Also, during 1997 flood control planning studies will begin for a second local project along the Canoas Creek tributary. Project construction is expected to begin after 2000.

Existing Reservoirs

The Santa Clara Valley Water District has constructed dams and reservoirs since 1933 and now operates ten facilities. Table 9 lists the storage capacities of the three reservoirs located upstream of the study area on tributaries to the Guadalupe River. These reservoirs are operated for water supply and groundwater recharge purposes. Although they were not constructed for flood control purposes, they provide incidental flood control. Lake Elzman and Vasona and Lexington

Reservoirs are also within the Guadalupe River watershed, but the discharges from these reservoirs enter Guadalupe River downstream of the study area.

TABLE 9: Santa Clara Valley Reservoir Capacities

Reservoir	Storage Capacity (acre-ft)
Almaden	1,780
Calero	10,160
Guadalupe	3,740

Groundwater Recharge System

In order to reduce the threat of land subsidence that would be caused by excessive net withdrawal from groundwater pumping, the SCVWD operates groundwater recharge systems within the Guadalupe River watershed. Several measures are employed to impound water for eventual gradual percolation into the groundwater basin during the dry season. One method used is to divert water from the river and impound it in percolation ponds adjacent to the river. Percolation ponds are located on either side of Reach 12 of the upper Guadalupe River. A second method is the construction of temporary dams which impound water in the stream channel. Water is stored in the three permanent reservoirs listed in Table 9. During the dry season, water is released from the various reservoirs in the watershed, and the percolation ponds facilitate the recharge of water into the groundwater basin.

3.0 PROBLEMS, NEEDS AND OPPORTUNITIES

3.1 Flooding

Historical Flooding

The history of flooding along the Guadalupe River dates back to the founding of Mission Santa Clara and pueblo San Jose de Guadalupe by Mexican settlers in 1777. Soon after their establishment both settlements were forced to move from their original location on the bank of the river to higher ground. Very little factual data is available from the floods prior to 1930 when the first stream gauges were installed. The table below presents a summary of the major historical flood events on the Guadalupe River system along with the estimated area of inundation and basin-wide or county-wide damages in terms of historical dollars. One of the highest discharges on record was produced by the flood of 1958 when floodwaters overbanked in downtown San Jose and covered a two square block area to depths of up to four feet. During the February 1980 event, the river overtopped its east bank upstream of Alma Street and flooded the Elks Lodge and surrounding area. In March 1982, the River's east bank was again overtopped inundating about 15 acres between the Union Pacific Railroad crossing and W. Virginia Street. The under crossing of the Southern Pacific Railroad at Willow Street and Alma Street filled with flood waters to a depth of ten feet. This approximately 15-acre area was again flooded in January 1983. More recently, during 1995 Santa Clara County was twice declared a national disaster area by President Clinton due to flooding along the Guadalupe River. The areas inundated during the storms in the study area are shown in the Hydrology and Hydraulics Appendix, (also see photograph next page).

TABLE 10 - Historical Flooding On The Guadalupe River In Santa Clara County

HISTORICAL FLOOD (1)	MAGNITUDE OF EVENT		DAMAGE ESTIMATE (Historical \$)
	Flow (cfs)	Freq. (yrs)	
December 1955	-	-	\$753,500 (2)
April 1958	9,150 @ St. John Street	5	\$1,348,000 (2)
March 1982	5,642 @ Almaden Exp	8	\$14,740,000 (3)
January 1983*	8,400 @ Almaden Exp	18	Not Available
January 1995*	8,470 @ Almaden Exp.	14	\$3,000,000 (3)
March 1995*	5,590 @ Almaden Exp	6	\$6,000,000 (3)

(1) Anecdotal evidence also suggests flooding in 1862, 1867, 1895, 1911, 1917, 1950 and 1963

(2) Damages along entire mainstem, including areas beyond study area boundaries

(3) County-wide damages which may include areas beyond Guadalupe basin.

*Santa Clara County declared a National Disaster Area

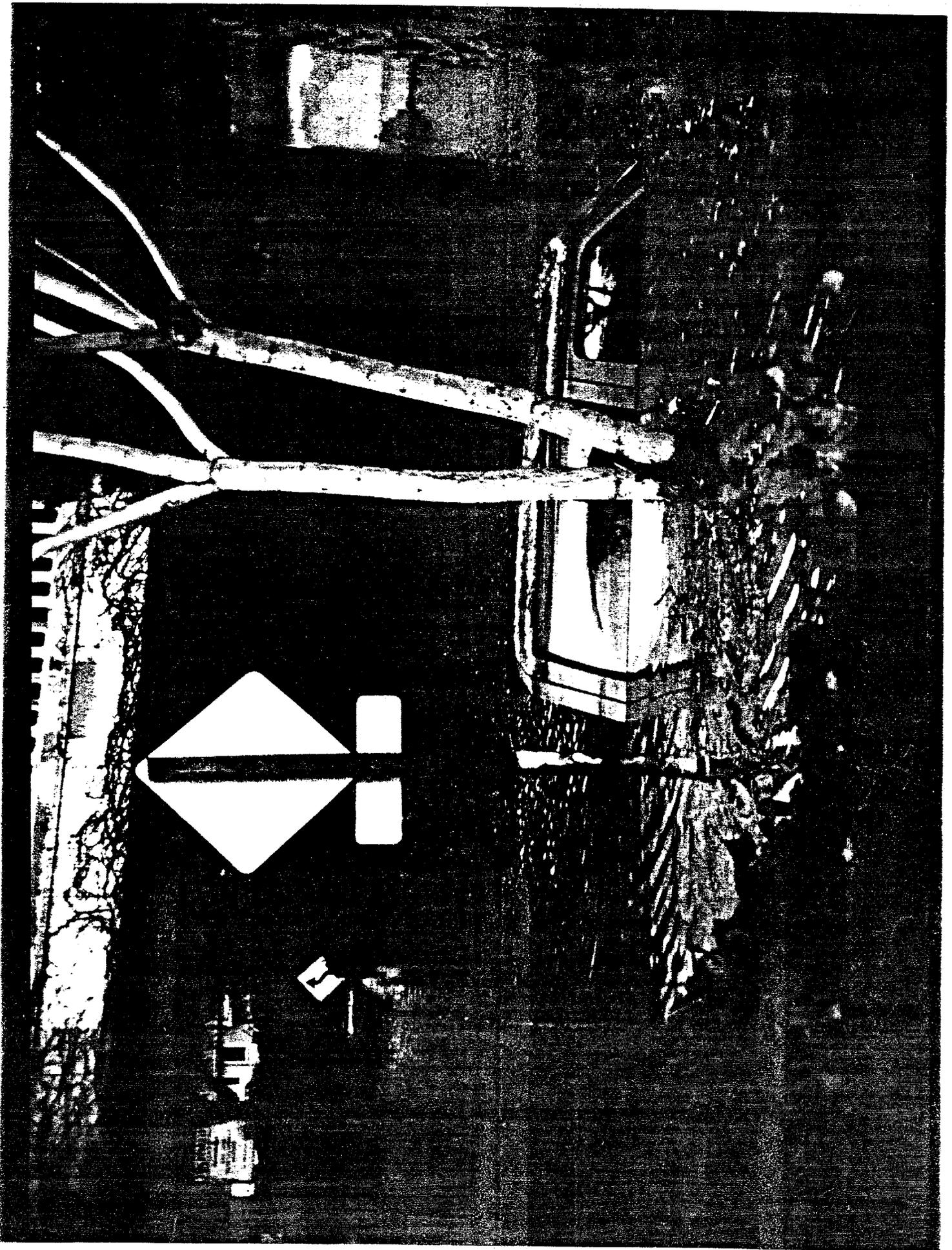


FIGURE 7: FLOODING FROM G DALUPE RIVER AT WILLOW ST 3/10/95

Existing Floodplains

Under current conditions, the Guadalupe River's channel capacity within the study area varies from as little as 6,000 cubic feet per second (cfs) (a 6-year mean event) to more than 12,000cfs (a 60-year mean event). The table below lists the approximate existing channel and bridge flow capacities. The flows shown for the bridge sections represent channel capacities which would be safely passed unobstructed by the low bridge chord.

Table 11: Existing Capacities of Channels and Bridges

River Reach and Bridges	Capacity (cfs)	Mean Exceedence Interval (Years)
Main Channel Reach 7	6,000	6.5
Willow Street Bridge	6,420	7-8
Alma Street Bridge	6,300	7-8
Main Channel Reach 8	8,000	15
UPRR Bridge	11,300	50
Main Channel Reach 9	12,000	60
Willow Glen Way Bridge	11,630	55
Malone Road Bridge	12,000	70
Main Channel Reach 10	11,000	50
Curtner Ave Bridge	11,340	50
S. Almaden Exprwy- Canoas Bridge	10,000	33
N. Almaden Exprwy Bridge	24,000	500+
Hillsdale Ave Bridge	9,680	50
Main Channel Reach 11	10,000	60
Capitol Exprwy Bridge	8,200	33
Branham Lane Bridge	7,200	25
Main Channel Reach 12	8,000	37
Ross Creek Channel Capacity	930	5.5
Canoas Creek Capacity	2,100	9

Note from the table that river reaches 7 and 8, and the Willow Street and Alma Street bridges have the least capacity. Although Ross and Canoas Creeks have greater capacity in their upstream reaches, they have minimal capacity near their confluences with the Guadalupe River due to backwater effects and low capacity culverts and cross sections. The 20-, 50-, 100- and 500-year floodplain maps were developed for the study area and are shown as Plates 2, 3, and 4.

Within the study area, the Guadalupe River channel resembles a perched channel on an alluvial fan. When breakouts of the existing channel occur, the flow leaves the channel and enters a floodplain that flows parallel with the existing channel. Once the flows leave the channel there is no transfer of flows back into the channel until the floodwaters pond at the downstream end of the study area. During a mean 20-year event floodwaters break out from the west bank between the Union Pacific Railroad and Willow Glen Way, then flow downstream towards Interstate 280. Floodwaters also break out from the east bank downstream of the Union Pacific Railroad, and flow downstream between Highway 87 and the Guadalupe River channel, and then reenter the channel at Virginia Avenue.

Likewise, for the mean 50-year event, floodwaters break out from the east bank downstream of Alma Street and flow towards Interstate 280. Floodwaters also break out from the west bank at Willow Street and between the Union Pacific Railroad and Willow Glen Way, then flow downstream to Interstate 280.

Finally, flows from the mean 100-year flood event break out from the Guadalupe River's east bank downstream of Alma Street, and from 1000 feet on either side of Branham Lane. Floodwaters flow downstream through the floodplain towards Interstate 280. Canoas Creek and Ross Creek also overtop their downstream banks and contribute to the flooding within the Guadalupe River floodplain. Flooding along the west bank is similar to that which occurs in the 50-year floodplain. The 500-yr floodplain is similar to the 100-year floodplain, but with a greater volume of floodwater. The 100-year floodplain and the 500-year floodplain inundate approximately 2,310 and 2,960 acres, respectively.

For events greater than the mean 5-year event on Ross Creek, backwater effects from Guadalupe River cause Ross Creek to overflow, resulting in breakouts from both banks that either flow downstream through the Guadalupe River floodplain towards Interstate 280 or pond to the south of the creek. Similarly, for events greater than the mean 9-year event on Canoas Creek, backwater effects cause Canoas Creek to overflow its downstream levees. The overflow floods subdivisions from Blue Jay Road to the intersection of Almaden Expressway and Highway 87.

3.2 Existing Flood Damages

Economic areas were developed from the floodplain maps and are shown in Plate 1. The economic areas are generally formed from specific breakout points. For example, Economic Area 2 is formed by the breakout from the low flow channel section of Ross Creek, and Economic Area 3 is formed by the breakout on the east side of the main channel near the Willow Street Bridge.

Table 12 presents the approximate without-project flood damages by Economic Area and event. An examination of this table reveals that most of the damages from a 20-year event occur in Economic Areas 1 and 2. These damages occur at the low channel capacities on Ross Creek and the east bank breakout on Reach 7 below the UPRR bridge adjacent to the Elks Lodge parking lot. The total damages from a 50-year event are more than double those of a 20-year event and about half of the total damages for a 100-year event. The major 100-year flood damages occur in economic areas 2 and 4.

Table 12 - Approximate Expected Without-Project Flood Damages By Economic Area (Future Conditions)

Economic Area	20-Year Event	50-Year Event	100-Year Event	500-Year Event
1	\$9,741,000	\$13,232,000	\$20,189,000	\$27,334,000
2	\$45,147,000	\$66,526,000	\$83,732,000	\$134,515,000
3	\$895,000	\$9,529,000	\$13,104,000	\$30,949,000
4	\$3,318,000	\$63,013,000	\$132,440,000	\$263,303,000
5	negligible	negligible	\$30,986,000	\$55,805,000
Total	\$59,101,000	\$152,300,000	\$280,451,000	\$511,906,000

NOTE: These damages correspond to the without-project future conditions.

3.3 Fish and Wildlife Habitat Needs

Over the years, degradation and loss of fish and wildlife habitats has occurred within the study area. Both Canoas and Ross Creeks currently have minimal habitat value. Due to the heavily-urbanized nature of the Santa Clara Valley and the ecological value of riparian forest and shaded riverine aquatic (SRA) cover, these habitats are considered to be significant resources and are of concern to both resource agencies and the public. Human actions have caused severe cumulative losses of riparian forest and SRA cover in the San Francisco Bay Area and the state of California in the past century. These losses have negative impacts on wildlife and fisheries; thus, further net losses of these habitats would be strongly contested by regulatory agencies and the public.

Current habitat conditions are marginal for anadromous fish, and the implementation of a flood protection project may offer opportunities to enhance aquatic habitat. Opportunities exist to remove obstacles to fish migration beyond Blossom Hill Road, where the highest quality salmonid habitat in the Guadalupe River watershed is found. Removal of obstacles may result in increased spawning success for the sensitive steelhead trout and king salmon. Furthermore, opportunities exist to increase the total number of acres of SRA habitat. Shade provided by SRA cools the water within the creek. By preserving existing SRA and increasing the total number of SRA acreage, it is

believed that the water temperature can be reduced sufficiently to provide improved habitat for steelhead trout and king salmon.

3.4 Recreation Opportunities

Due to rapid urbanization, there is a definite need in the study area for open space recreation opportunities. The Santa Clara Valley Water District and the City of San Jose recognize the need to coordinate park master planning with flood control planning. The objective of coordinating the two planning activities is to balance the need to reduce flood damage from the Guadalupe River with the need to optimize public access and use of the river corridor. The Santa Clara Valley Water District prefers that flood control projects be designed to accommodate any identified future recreation use. For example, to comply with the American Disabilities Act of 1990, flatter slopes on access ramps would allow planned maintenance roads, when developed as a recreation trail, to be more accessible to the disabled.

The study area corridor receives limited recreation use by the public due to lack of public access. The City of San Jose is interested in developing recreational opportunities and is coordinating their efforts with the Corps of Engineers' and Santa Clara Valley Water District's flood control planning process. The City of San Jose Department of Parks and Recreation has developed an Interim Report of the Park Master Plan for the Guadalupe River South Corridor. The city's goals include: preserving and restoring a natural creek environment; providing bicycle, pedestrian and equestrian access for neighborhood recreational use; integrating existing and proposed trails and parks within the city's planning area; and providing a continuous park and trails network. The city's interim report for the south corridor includes conceptual plans for trails and park development which give consideration to the flood control alternatives already being developed for the study area. A continuous trail along the Guadalupe River is part of Santa Clara County's trail and pathways Master Plan.

Corps policy directives and physical constraints severely limit the type and extent of recreational facilities that could be provided on a cost-shared basis. The recreational facility with the greatest potential recreational benefits and which the local sponsors are most interested in cost-sharing is a multi-use recreation trail linking the study area with the existing trails along the Guadalupe River in downtown San Jose and upstream of Blossom Hill Road. This trail would be built upon project features such as maintenance access roads and mitigation benches. The trail would provide a critical link in a planned regional trail network, which would enhance its economic value. The economic benefits of such a trail are highly dependent on its degree of continuity, which in turn is dependent upon the continuity of flood control improvements from I-280 to Blossom Hill Road.

4.0 PLAN FORMULATION

4.1 Planning Process

Plan formulation is an iterative process that establishes planning objectives, develops potential alternatives that meet the objectives, screens out plans based on comparison criteria, and identifies plans for implementation. This process is consistent with the planning requirements of the Water Resources Council Principles and Guidelines, the National Environmental Policy Act of 1969, and the U.S. Army Corps of Engineers Planning Guidance Notebook. The process requires systematic development and evaluation of alternatives for alleviating water resources problems and realizing potential opportunities.

During the planning process, study efforts involved the non-Federal sponsor, the public, and other agencies to properly identify and address the water resource problems and opportunities. This coordination also helped to identify all possible potential plans for achieving the planning objectives.

4.2 Planning Objectives and Constraints

Planning Objectives

The national objective of water resources planning is to contribute to the national economic development (NED) consistent with protecting the nations' environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to NED are considered to be increases in the net value of the national output of goods and services, expressed in monetary units and are defined as the direct net benefits that accrue in the planning area and the rest of the nation. In the case of this study, net benefits are related to the reduction of flood damages and other costs associated with flood protection and response.

The national objective to contribute to the NED is not specific enough for direct use in plan formulation. The specific objectives of this study reflect the problems and opportunities which were identified within the study area. The primary objective of this feasibility study is to present a plan to reduce damages to surrounding communities due to flooding from the upper Guadalupe River and its tributaries, Canoas Creek and Ross Creek. After formulating each alternative on the basis of providing flood protection, opportunities to include recreation features were considered as a secondary study objective. Federal policy allows full consideration of recreation as a project purpose, as legislated by Section 4 of the Flood Control Act of 1944, as amended; the Federal Water Project Act of 1965, Public Law 89-72, as amended; and the Water Resources Act of 1986.

Planning Constraints

Constraints are overriding concerns that must be considered in the formulation of a plan. These concerns may be of such importance that to violate them would compromise the validity of the planning effort. Avoidance of negative impacts to habitat was a major constraint for all plans considered. One method of achieving this was to limit channel widening to only one side of the river in order to preserve existing riparian and fishery habitats on the unaltered bank. In order to meet this constraint, complete channelization of the river was excluded from consideration in order to preserve the existing riparian corridor on at least one bank of the river. Additional planning constraints for this study are discussed below.

Riparian Vegetation. The existing riparian forest habitat in the study area is generally degraded relative to an undisturbed riparian forest, but still offers valuable habitat for a very diverse bird population as well as important shade for anadromous fish. While a variety of past occurrences such as agricultural development, urbanization, gravel mining, and freeway development appear to have reduced the extent, continuity, and habitat quality of the forest, this forest is still the second best riparian forest corridor in the northern Santa Clara Valley. Because of its regional scarcity, the remaining riparian corridor is considered to be a significant resource and important for providing habitat for fish and wildlife. Attempts to avoid removal of additional riparian forest were stressed in the development of each alternative.

Endangered Species. Alternatives were developed to avoid, to the maximum extent practicable, negative impacts on federally listed endangered or threatened species. The recently listed threatened species, the California red-legged frog, may exist in the study area, although surveys have failed to find it. The recently listed threatened steelhead trout is known to exist in the study area. expected to become a listed species in the near future.

Fishery Resources. To protect the remaining king salmon and steelhead trout, attempts to preserve riparian vegetation were made to reduce any further loss of shade. Increased sediment loads associated with construction activities should be minimized to avoid negative impacts on water quality and spawning areas. Finally, whenever practicable, obstacles which prevent upstream migration to potential spawning areas should be removed or modified to allow easier fish passage, and the introduction of barriers associated with any proposed project were avoided.

Aesthetics. The existing riparian corridor provides visual relief from the surrounding urban development. Attempts to preserve this urban buffer should be made, particularly in residential areas that border the upper Guadalupe River.

Hazardous and Toxic Wastes. Numerous HTRW sites exist along the channel in the study area, and every effort was made to avoid incorporating these lands in the project.

Real Estate. The highly urbanized nature of the study area and the vigorous economy makes the acquisition of real estate for project lands very expensive. The alternative designs were

aligned to avoid as many buildings as possible. An effort was made to align the alternatives within the rights-of-way and properties owned by the sponsor.

4.3 Description of Preliminary Flood Protection Measures

A number of flood reduction measures were considered during the early phases of study on the upper Guadalupe River. These measures are summarized in the Table 13, and the preliminary flood protection alternatives which were first formulated during the 1989 Corps of Engineers Upper Guadalupe River Reconnaissance Study are described in Attachment A. Each measure in Table 13 is a stand alone feature which can be combined with other measures to constitute a comprehensive flood reduction alternative. Some of these measures are "nonstructural", and others are "structural".

"Structural" measures are designed to prevent flood damages by altering the flow patterns (the water surface profile) of the river itself. Structural measures include dams, levees and floodwalls, and channel modifications which increase the capacity of the existing channel in order to contain flows in the channel.

"Nonstructural" measures are designed to prevent flood damages by modifying the buildings and structures within the floodplain. Nonstructural measures include evacuation, relocation, and may involve modifications to existing structures within the floodplain.

Only those measures in Table 13 which are labeled "Retained for Alternatives" were included in the plan formulation process described below. In areas where channelization was appropriate, the choice between channel widening and bypass channel measures was evaluated based on trade-offs between habitat and real estate impacts. Similar trade-offs were evaluated for aesthetics and interior drainage when determining whether to use floodwalls or levees.

4.4 Plan Formulation Rationale

The proposed plans in this study were formulated by combining the preliminary measures discussed above. An array of plans was developed based upon significant break points in the cost curve. These break points correspond to physical barriers such as bridges, homes, valuable habitat, or expensive property which would significantly increase the cost of implementing the measure being considered. All of the alternatives have been formulated to reduce losses of riparian forest. Benches have been included in the design to provide opportunities to revegetate disturbed areas with native species.

The plan formulation process begins by identifying where flows break out of the existing channel for various magnitudes of flood events. These "breakout areas" are often located in channel reaches where the capacity is lower than that for upstream reaches. Capacity may be restricted by the existing channel configuration or by an obstacle such as a bridge. Once restricted reaches are identified, flood control measures are developed to increase the capacity of

Table 13: Summary of Flood Damage Prevention Measures Considered

INITIAL FLOOD CONTROL MEASURES	RETAINED FOR ALTERNATIVES	REMARKS
Upstream Reservoirs	No	No effective sites for flood control reservoirs. 3 existing water supply reservoirs provide incidental flood control benefits.
Modify Existing Reservoirs	No	Existing reservoirs do not have sufficient capacity for both water supply and flood control purposes.
Channel Widening	Yes	Increasing flow capacity of existing channels may be cost effective, but requires mitigation for lost riparian habitat.
Bypass Channel	Yes	A bypass channel may be effective and may preserve existing riparian habitat, but real estate costs may be expensive.
Levees	Yes	High real estate values may preclude the construction of new levees. However, existing levees may be raised in an economical manner. New levees may impact local drainage systems.
Floodwalls	Yes	Low floodwalls of less than five feet were retained; high floodwalls would have excessive safety, local drainage and aesthetic impacts.
Channel Clearing	No	Removal of existing channel vegetation has high negative impacts. Requires very expensive offsite mitigation. Does not provide adequate capacity.
Floodplain Regulation	Yes	The floodplain is currently regulated and flood insurance is required.
Relocation of existing structures in the floodplain	No	Relocation is not cost effective as numerous residences and business are located in the floodplains.
Flood Warning System	No	Floodplains are large and dispersed and lead time is very short due to the relatively small watershed.
Floodplain Management (non-structural)	Yes	Continue to publicize floodplain information and coordinate with zoning and other regulatory agencies to prevent unwise future development in the floodplain.

each restricted reach. The least costly measure which is environmentally and socially acceptable is sought for each reach. Greater flood protection can be achieved by providing successively larger flood protection structures for a single reach or by providing flood reduction measures on multiple reaches.

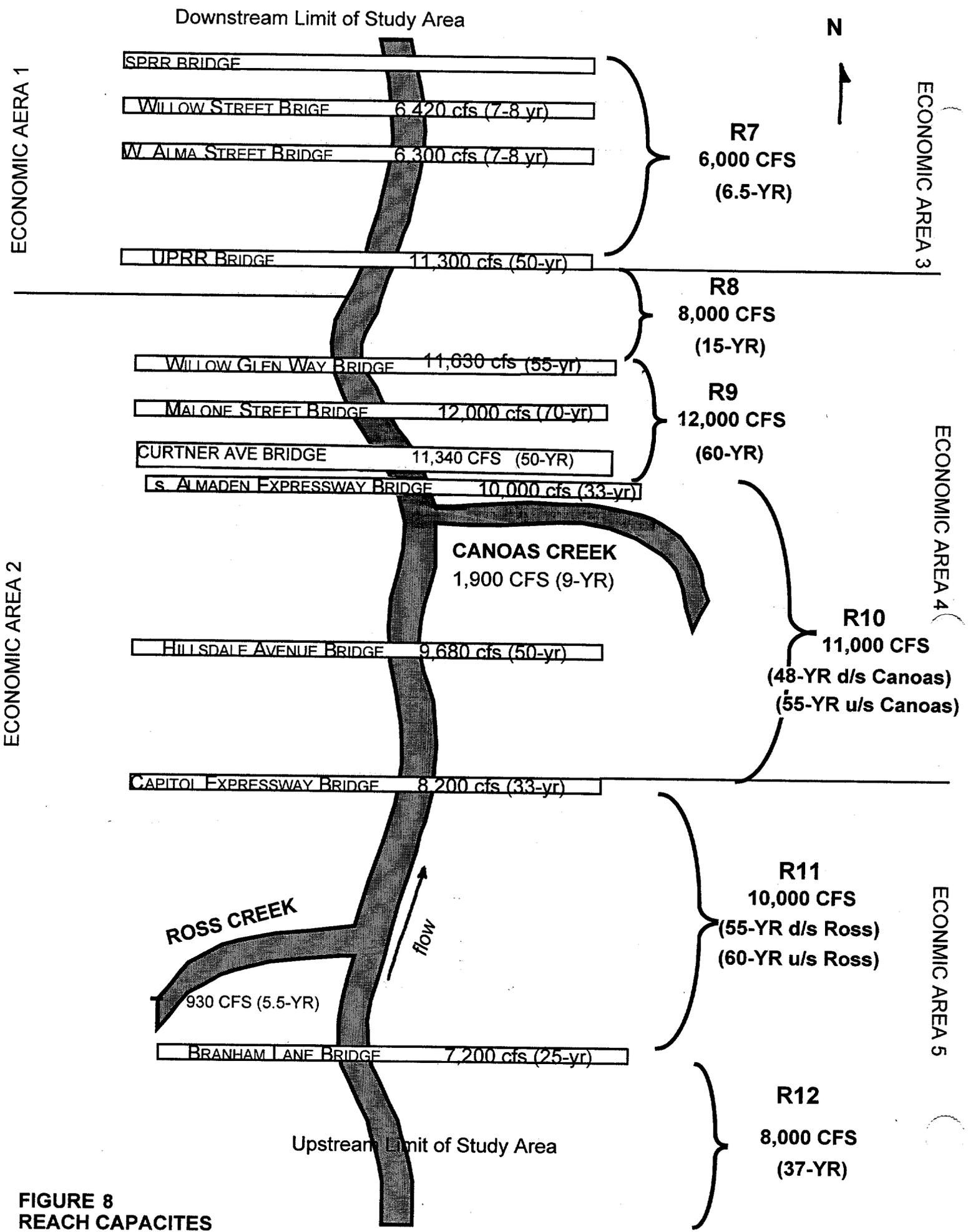
A basic strategy used for the plan formulation rationale is to examine the low flow constraint locations. From these, a low cost structural measure is developed which increases the flow at that constraint point, going from the lower channel capacities upward to the higher level channel capacities. The extent of the measure is bounded by physical limitations, such as bridges, roads, or buildings, which correspond to breaks in the cost curve.

Flows generally increase as you move downstream (toward the lower reaches, in this case). In cases where the capacity of the channel does not also increase as you move downstream, breakouts occur. The locations of diminished channel capacity are flow constraint points. Figure 8 can be used to illustrate the locations and relationships of the flow constraint points in the study area. This figure displays the existing capacities and corresponding mean exceedence intervals for each river reach. The major bridge crossings, along with their associated capacities and mean exceedence intervals, are also shown. The economic areas, which are used to define damages due to flooding, are also shown in Figure 8. Note that the minimum capacities are in river reaches 7 and 8 and in Ross and Canoas Creeks.

For the upper Guadalupe River, there are three major points to consider during the formulation of flood reduction alternatives. First, Figure 8 indicates that the upper Guadalupe River capacity increases as you move from Reach 12 down through Reach 9. However, the capacity is greatly reduced as you move from Reach 9 to Reach 8. The capacity is reduced again as you move from Reach 8 to Reach 7. Thus, Reaches 7 and 8 are clearly constraint locations.

Second, a significant portion of benefits which accrue to any alternative plan are realized by reducing flooding from Ross Creek. Ross Creek has the minimum capacity both in volume and mean exceedence interval, and an examination of the Economic Areas (see Table 12, Without-Project Damages By Economic Area, page 33) also reveals that much of the flood damages occur in Economic Area 2. Therefore, increasing the capacity of Ross Creek results in significant benefits.

And finally, the flow in Ross Creek is mostly constrained by the backwater effects related to the water surface level in the main channel and by a culvert underneath the Almaden Expressway. Thus, beyond a minimal level, improvements made to Ross Creek will be ineffective unless the capacity in the main channel and the culverts underneath the expressway are modified.



**FIGURE 8
REACH CAPACITIES**

Alternative plans were formulated by combining least cost measures in order to increase the capacities of Ross and Canoas Creeks, while also reducing the water surface level of the main stem Guadalupe River. Two plans were formulated, the Willow Glen and Valley View Alternatives, which widen the existing channel to accommodate 9,000 cfs and 12,000 cfs, respectively. Jumps in the cost curve were associated with channel widening in Reach 8 for the Willow Glen Plan and channel widening in Reach 9 for the Valley View Plan. For flows greater than 12,000 cfs, it was determined that widening the existing main channel was not a cost effective means to increase the channel capacity. Therefore, a third alternative which uses bypass channels, the Bypass Channel Plan, was formulated combining the least cost measures to provide approximately 14,600 cfs of channel capacity throughout the study area. The factors which were considered during the formulation of the two major tributaries are described below. The structural plans are described in more detail in the following paragraphs.

Canoas Creek

Flooding on Canoas Creek results from two different mechanisms; the runoff contribution from Canoas Creek's watershed and backwater flows from the Guadalupe River. The SCVWD has indicated that they intend to manage the peak runoff flows from the Canoas Creek watershed through local measures. Thus, for plan formulation purposes, improvements to Canoas Creek were limited to backwater effects, which occur in the lower reach of Canoas Creek. Each of the plans described below include identical improvements to Canoas Creek. These include the replacement of culverts beneath Almaden Expressway and Nightingale Drive and low floodwalls along both banks of the creek. The SCVWD has indicated that any additional improvements undertaken to manage peak flows on Canoas Creek would be undertaken as a local project.

For the purposes of sizing improvements on the main stem Guadalupe River, it was assumed that the main stem channel directly downstream of the confluence with Canoas Creek would accommodate flows associated with any event from Canoas Creek. This assumption was made to be consistent with the SCVWD's intention to manage peak runoff on Canoas Creek through local measures. Note that because peak flows on Canoas and the main stem are not coincident, the additional peak flows from Canoas are incidental when compared with flows in the main channel.

Ross Creek

Backwater effects from Guadalupe River cause Ross Creek to overflow, resulting in breakouts from both banks that either flow downstream through the Guadalupe River floodplain towards Interstate 280 or pond to the south of the creek. A significant portion of the total study area damages are associated with the overtopping of the north bank of Ross Creek. Improvements on Ross Creek were formulated to correspond to the same level of protection that was proposed for the mainstem Guadalupe River.

No Action Plan

The No Action plan is the "without-project" condition that serves as the basis for developing and comparing the impacts of other plans. Under the No Action Plan, it is assumed that a Federal project would not be constructed to reduce the flood hazard in the study area boundaries. The flood damages outlined in Table 12, page 33, would occur unabated in the future. The "without-project" condition assumes that flood control projects which are proposed downstream (north) of the study area would be completed. Specifically, it is assumed that the flood control project currently under construction in downtown San Jose and the SCVWD flood control bypass channel between the Southern Pacific Railroad and Interstate 280 would both be completed prior to completion of a project upstream (south) of the Southern Pacific Railroad.

Willow Glen Plan (9,000 cfs)

As noted earlier in Table 12, most of the flood damages occur in economic areas 2 and 4, which are the floodplains represented by breakouts from Ross and Canoas Creeks, respectively. The Willow Glen Alternative was formulated to increase capacity on Ross and Canoas Creeks and to increase the Guadalupe River channel capacity as much as possible without widening the main channel in Reach 8. Figure 8, page 40, shows that Reach 8 has a channel capacity that is capable of conveying the mean 15-year event, and Reach 7 has a channel capacity that is capable of conveying the mean 6-year event. The minimum Guadalupe River channel capacity downstream of Canoas Creek can be increased to 9,000 cfs by increasing the capacity of Reaches 7 and 8 and improving the downstream reaches of Ross and Canoas Creeks. The increased channel capacity would be capable of passing flows associated with the mean 20-year event. The extent of the improvements were limited to the point where the backwater effects from the main channel had a noted effect on the tributary capacity.

All of the channel sections and bridge openings which constrained flow below 9,000 cfs, as well as improvements to Canoas and Ross Creeks, were included in the alternative and are summarized in Table 14. Low floodwalls were included in Reach 8 to increase the flow capacity at the low bank locations. Low floodwalls also provide a cost effective means of adding additional capacity to Reach 8 without increasing the costs of the other measures. These low floodwalls will not increase the water surface level in other channel reaches. The major components of the Willow Glen Plan are illustrated in Plate 7.

Several measures for increasing the capacity of the channel in Reach 7 were initially considered. The major considerations were the high real estate costs and preservation of the existing riparian habitat. The least costly and most hydraulically efficient measure, a rectangular concrete channel, was not possible due to the impacts to the existing riparian habitat and the resulting excessively high mitigation costs. West bank widening was investigated, but due to the residential development, real estate costs would be prohibitive in most areas. Additionally, consequential environmental impacts would occur to riparian vegetation on the west bank. Although commercial/industrial property would be impacted on the east bank, east bank widening

was chosen as the least cost measure in this reach. The top width of the half trapezoidal shaped channel will vary from 80 to 110 feet wide with a side slope of 1V to 1.5H. The channel excavation will begin at a point three feet above the existing channel invert in order to preserve the existing channel bottom and provide for fish passage during low flows. A low floodwall will be needed on the east bank upstream of the West Alma Street Bridge adjacent to the Elks Lodge parking lot since the riverbank is particularly low and the channel is perched. Improvements to Ross Creek would include increasing the bottom width of the channel to 25 feet; construction of floodwalls from Almaden Expressway to a point 300 feet upstream of Cherry Avenue; and adding culverts at Almaden Expressway and Jarvis Avenue. Habitat impacts associated with this plan would require that approximately 3.6 acres of riparian forest habitat be replaced. Impacts to shaded riverine aquatic habitat and wetlands can be fully mitigated as a by-product of this riparian forest habitat mitigation.

Table 14 - Willow Glen Alternative Summary of Measures

River Reach	Approximate Project Station	Description of Measures
7	740 - 781 744 750 773 773 - 781	East bank widening Improvements to Hwy 87 Bridge Replace Willow Street Bridge Replace W. Alma Street Bridge 2 - 4 foot high floodwall on the east bank
8	781-793	1 - 3 foot high floodwalls on the east and west banks
Canoas Creek	856	Add culverts under Nightingale Drive and Almaden Expressway. Floodwalls both banks.
Ross Creek	950	Trapezoidal channelization increasing channel bottom width to 25 feet from the confluence with the main channel to Jarvis Avenue. Additional culverts under the Almaden Expressway and Jarvis Avenue and 2,800 feet of floodwall (1 to 3 feet high) on both banks.

Note: Interior drainage features will be included in Reaches 7 and 8 and on Canoas and Ross Creeks to prevent locally induced flooding due to the floodwalls.

Valley View Plan (12,000 cfs)

The Valley View Plan increases the minimum main stem capacity downstream of Canoas Creek to 12,000 cfs (providing sufficient channel capacity to convey the mean 50-year event.) As discussed above, improvements along Canoas Creek are limited to correspond to a mean 20-year storm event. In the absence of additional improvements along Canoas Creek, approximately 2,800 of nearly 4,900 structures within the 50-year floodplain would remain within the 50-year floodplain. Figure 8 indicates that Reach 9 has a capacity of 12,000 cfs. However, many flow constraints exist upstream of Reach 9. Many of these flow constraints are located at bridge crossings. The Capitol Expressway and South Almaden Expressway bridges

support major thoroughways which would be prohibitively expensive to replace. However, the flow capacity of these bridges may be increased sufficiently to pass the required flow without replacing either bridge. The Valley View alternative was formulated by combining the least cost measures to increase the channel capacities at these flow constraints. The measures included in this alternative are summarized in Table 15 and illustrated in Plate 8.

Table 15 - Valley View Alternative Summary of Measures

River Reach	Approx. Station	Description of Measures
7	740 - 781 744 750 773 773 - 781 781	East bank widening Improvements to Hwy 87 Bridge Replace Willow Street Bridge Replace W. Alma Street Bridge 2 - 4 foot high floodwall on the east bank Improvements to SPRR Bridge
8	781-793 795	1 - 3 foot high floodwalls on the east and west banks (same as Willow Glen Plan) Replace the Willow Glen Way Bridge
9	None	None
10a	843 - 855	East Bank widening
10c	895 - 897.5 897.5 - 906 906 - 912 906	East Bank widening West Bank widening East and West Bank widening Replace Hillsdale Bridge
11	935 - 938 938 - 942 942 - 960	East Bank widening West Bank widening East Bank widening
Canoas Creek	856	Add culverts under Nightingale Drive and Almaden Expressway. Floodwalls both banks.
Ross Creek	950	27-ft wide trapezoidal channel from main channel to 750 feet upstream of Jarvis Ave. New culverts under Almaden Expwy and Jarvis Ave. 2,800 feet of floodwall (1 to 3 ft high) on both banks.

Note: Interior drainage features will be included in Reaches 7 and 8 and on Canoas and Ross Creeks to prevent locally induced flooding due to the floodwalls.

The improvements to Reach 7 are very similar to the Willow Glen Alternative but are slightly larger. An additional feature is the replacement of the UPRR bridge. Low floodwalls from 1 - 3 feet in height would be provided on the east and west banks of Reach 8. In Reach 10, the east bank would be widened near the Curtner Avenue Bridge. The Hillsdale bridge would be replaced. All of the channel widening in this reach and upstream would be contained between the top of banks of the existing channel. Farther upstream, in Reaches 10 and 11, the channel would be widened on the appropriate banks given the specific flow constraints at that location.

Improvements to Ross Creek would include increasing the bottom width of the channel to 27 feet; construction of a 600-foot long section of floodwall which would begin at Jarvis Avenue; and adding culverts at Almaden Expressway and Jarvis Avenue. Impacts to shaded riverine aquatic habitat and wetlands can be fully mitigated as a by-product of riparian forest habitat mitigation. Approximately 12.1 acres of riparian forest habitat must be replaced to achieve full habitat mitigation.

Bypass Channel Plan (14,600 cfs)

Finally, the Bypass Channel plan was formulated to provide approximately 100-year channel capacity to all the reaches. However, as discussed above, improvements along Canoas Creek are limited to provide protection for a 20-year storm event. In the absence of additional improvements along Canoas Creek, approximately 880 of roughly 7,500 structures within the 100-year floodplain would remain within the 100-year floodplain. The use of bypass channels was found to be the most cost effective means of providing protection against the mean 100-year event, particularly in areas of channel constraints, due in large part to the high cost of real estate and impacts to riparian habitat. The bypass channel provides a means of conveying the excess flows above the existing channel capacity with the least amount of disruption to the existing river channel. The least cost measures for each river reach were formulated and are summarized in Table 16 and illustrated in Plate 9.

Each bypass channel is located immediately east of the existing channel. The largest bypass channel is located in Reaches 7 and 8 between Willow Street and Willow Glen Way. The portion of the bypass between Willow Street and Alma Street is located in the existing floodway. This alignment preserves the existing banks of the river and allows for the transfer of high flows between the existing channel and the bypass. Upstream of Alma Street in Reach 7, and downstream of Willow Glen Way, the bypass is offset from the existing channel. A low floodwall on the east side of the bypass is required for the channel upstream of Alma Street and downstream of the UPRR bridge. A total of 13 residential and 16 commercial structures will be impacted by the bypass channel alignment in Reaches 8 and 9. Impact to these residential structures in Reach 8 is unavoidable for any plan which provides more capacity than the Valley View alternative. Channel widening and a bypass channel are the least cost alternative measures in Reach 9 depending on the existing channel topography. Where possible, a bypass channel in this reach is preferred over the channel widening to lessen the impacts to the existing riparian habitat. The least cost measures in Reach 10 consist of east bank widening where necessary and replacement of the Curtner and Hillsdale Avenue bridges. Low floodwalls and a levee are also provided on the west bank from the Almaden Expressway southbound bridge to the Almaden Expressway northbound bridge. Finally, the least cost measures in Reach 11 consist of channel widening and a bypass channel, where the preferred measure is a bypass channel. Improvements to Ross Creek would include increasing the bottom width of the channel to 35 feet and adding culverts at Almaden Expressway and Jarvis Avenue. Approximately 22.4 acres of riparian forest, 3.6 acres of urban forest, and 1.5 acres of wetland habitat (27.5 acres in total) will be replanted to mitigate for impacts to these habitat types.

Table 16 - Bypass Channel Alternative Summary of Measures

River Reach	Approx Station	Description of Measures
7	740 740 - 773 750 770 - 773 773 773 - 781 773 - 781 781	Four 20 x 17-foot RCB culverts under SPRR bridge Bypass channel with 1:1 slopes and a variable width 30-85 feet Replace Willow Street Bridge East bank floodwall Replace Alma Street Bridge Bypass channel with 1:1 slopes and a 60 foot wide bottom 2 - 4 foot high floodwall on the east bank Three 20 x 17-foot RCB culverts under the UPRR bridge
8	781 - 795 795 795 795 - 797	Bypass channel with 1:1 slopes and a 85 foot wide bottom Bypass inlet weir 190 feet long Replace Willow Glen Way Bridge East bank widening
9	797 - 817 817 - 825 822 825 - 830 830 - 843	Bypass channel with variable slopes and width East bank widening Malone Road Bridge Modification Bypass channel 1:1 slopes and 40 foot bottom width East bank widening
10a	843 843 - 855	Replace Curtner Avenue Bridge east bank widening
10b	856 - 860 860 - 868 868 - 871	4 foot high floodwall on west bank 4 foot high levee on the west bank 4 foot high floodwall on west bank
10c	887-911 906	Widen east bank Replace Hillsdale Avenue Bridge
11a	909 - 915 915 - 922 922 - 940	East bank widening Bypass channel with 2:1 slopes and 50 foot bottom width East bank widening
11b	940 - 950	West bank widening
11c	950 - 960	West bank widening
12	960 - 969	2 - 4 foot high floodwall on east bank.
mitigation		1.29 acres riparian forest mitigation immediately upstream of Blossom Hill Rd
Canoas Creek	856	Add culverts under Nightingale Drive, Almaden Expressway. Floodwalls both banks.
Ross Creek	950	35-ft wide trapezoidal channel from Guad River to 750 ft upstream of Jarvis Ave. New culverts under Almaden Expwy & Jarvis Ave.

Note: Interior drainage features will be included in Reaches 7, 10B, and 12 and on Canoas and Ross Creeks to prevent locally induced flooding due to the floodwalls and levees.

5.0 EVALUATION OF CANDIDATE PLANS

5.1 Introduction

Three alternative plans were formulated in addition to the no-action alternative for analysis in the final array of plans. These plans are compared against the base case (no-action plan) as well as against each other (see Table 17 below). As noted in the preceding chapter, the plans represent a cost effective means of increasing the flow capacity in the main channel up to a point where a major "break in the cost curve" occurs. The Willow Glen Plan provides the least amount of additional flow capacity and likewise removes the least amount of land, approximately 400 acres, from the 100-year floodplain. It also has the least amount of negative impacts associated with the construction and land acquisition activities. Only one residential structure needs to be relocated and 2 acres of riparian habitat are impacted. The Bypass Channel Plan, on the other hand, provides the most additional channel capacity and removes 2,000 acres from the 100-year floodplain, five times as much as the Willow Glen Plan. But it also impacts the most riparian habitat and requires that 13 residences and 16 commercial businesses be relocated.

These results are not surprising in that providing much needed flood control protection in a heavily urbanized area will be costly and have some negative impacts. Furthermore, negative impacts generally tend to increase with the level of flood protection. It should be noted that the Bypass Channel Plan was formulated to minimize the impacts to the riparian habitat. Thus, when the incremental negative impacts are weighed against the incremental additional protection, the Bypass Channel Plan has the least amount of negative impacts on riparian habitat per acre of land removed from the floodplain.

5.2 NED Analysis

Federal policy directs the Corps of Engineers to evaluate a range of plans and to determine which plan maximizes the economic benefits of public investment in a project. The cost-effectiveness of public investment is measured by comparing average annual economic benefits and costs. The plan with the greatest net benefits (difference between annual costs and benefits) is defined as the plan which maximizes national economic development (NED). This plan is defined as the NED plan, and is the plan which is normally recommended for construction in the absence of overriding considerations. The following sections present the NED analysis for the three alternatives.

NED Economic Benefits. The economic areas shown in Plate 1 are consistent with the floodplain maps and represent where the flood damages occur. Table 18 indicates the flood damages which are prevented by each alternative plan. Note that much of the flood damages prevented occur in economic area 2, which is the breakout from Ross Creek. Additional benefits include reduction in flood insurance administration costs, emergency costs during floods, advance replacement of bridges, current maintenance cost savings, and benefits accrued during project construction which result from the completion of a significant portion of the project.

Table 17 - Summary of Major Impacts

Impact	No-Action Plan	Willow Glen Plan (9,000 cfs)	Valley View Plan (12,000 cfs)	Bypass Channel Plan (14,600 cfs)
Real Estate Impacts	None	50 acres	65 acres	170 acres
Total Lands Impacted				
Relocations of Residences	None	13	13	13
Relocations of Businesses	None	16	16	16
Riparian Habitat	None	2 acres	7 acres	9 acres
Cultural Resources	None	None known	None known	One potential site in Reach 11
Land Removed from 100-year Floodplain	0 acres	400 acres	1,300 acres	2,000 acres
Number of Structures Protected from Flooding (100-year Floodplain)	0	1,150	2,060	6,620

Average annual benefits were computed based on a discount rate of 7-1/8% over a 50-year project life. Annual benefits are summarized in Table 19 and are explained in more detail in the Economics Appendix. Note that the vast majority of the benefits are due to flood damage reduction.

Table 18 - Average Annual Flood Damages Prevented by Economic Area (\$1,000) - Based on Future Hydraulic Conditions at Oct 1995 Price Levels

Economic Area	Willow Glen Plan (9,000 cfs)	Valley View Plan (12,000 cfs)	Bypass Channel (14,600 cfs)
1	1,676	1,946	2,202
2	8,947	10,146	11,201
3	1,742	1,870	1,928
4	1,313	2,213	3,113
5	0	230	863
Total	13,678	16,405	19,307
Total at 1997 Price Level	14,460	17,343	20,411

Table 19 - Summary of Total Annual NED Benefits Based on Expected Damages (\$1,000) at 1997 Price Levels

Benefit Category	Willow Glen Plan (9,000 cfs)	Valley View Plan (12,000 cfs)	Bypass Channel (14,600 cfs)
Flood Damage Reduction	14,460	17,343	20,411
Emergency Flood Costs	282	293	328
Flood Insurance Savings	36	65	208
Traffic Impact Reduction	74	136	179
Current Maintenance	126	126	210
Bridge Replacement	156	350	570
Benefits During Project Construction	0	1,671	1,671
Total NED Benefits	15,134	19,984	23,577

NED Cost Estimates. Cost estimates for the three candidate plans were prepared. Construction costs (including utility relocations) for the three plans are \$23.7, \$48.8 and \$77.8 million, respectively and are summarized in Table 20. Major cost features for each of the plans include channel widening, bridge replacements and real estate acquisition (see Table 21) costs. Mitigation costs have been estimated based on anticipated habitat replacement requirements.

MCACES cost estimates were prepared for all three plans in March 1995. An additional MCACES estimate was prepared for the Bypass Channel Plan in December 1996 and updated in December 1997 at the October 1997 price level. The figures for the Bypass Channel Plan in Table 20 are based on the December 1997 estimate. The March 1995 estimates for the two smaller plans were adjusted to be consistent with the December 1997 estimate.

Table 20 - Major Construction Costs (October 1997 Price Level, \$1,000)

Project Feature	Willow Glen Plan (9,000 cfs)	Valley View Plan (12,000 cfs)	Bypass Channel Plan (14,600 cfs)
Channel Work and Grade Control	8,662	24,672	37,318
Flood Walls	250	308	136
Bridge Modifications and Culverts	1,211	1,950	4,147
Misc. (local drainage, gates, fencing, etc)	184	297	300
RR Culverts @ Elks Lodge	112	0	0
Utility Relocations			
Public utilities	26	137	2,328
Bridge replacements	4,045	6,868	9,178
Roadway replacements	60	154	890
Subtotal	4,131	7,159	12,396
Recreation Features	0	0	1,676
Canoas Creek	1,356	1,356	1,356
Ross Creek	3,803	3,887	4,866
Mob and Demob	106	106	778
Mitigation	197	1,449	2,594
Subtotal	20,012	41,184	65,567
Contingency @ avg of 18.6%	3,729	7,673	12,203
Total Construction Costs*	23,741	48,857	77,770

*Subtotal costs include contract O/H @ 15%, contract profit @ 8%, and contract bond @ 1%.

Traffic Re-routing and Delay Costs: Each of the final alternatives includes bridge relocations and modifications. Bridge modifications may be accomplished without disruption to traffic. However, bridge replacements will result in temporary traffic detours. Each alternative has been designed to minimize disturbance of major traffic arteries and bridges. To reduce traffic disruption during construction, adjacent bridges will not be replaced simultaneously. Costs associated with traffic detours are summarized in the Economics Appendix.

Lands, Easements, Rights of Way, Relocations, and Disposal (LERRD) Costs: LERRD costs for the three plans include land costs, relocations assistance for residential and commercial relocations, and utility relocation costs. Costs for utility relocations were included in the major construction cost estimates as shown in Table 20. The Willow Glen Plan will require about 50 acres, 38 of which are required for flowage easements in unimproved reaches or sections of the river bank. The Valley View Plan will require about 65 acres, 30 of which are required for flowage easements in unimproved areas, and the Bypass Channel Plan will require approximately 170 acres, none of which are required for flowage easements in unimproved reaches. LERRD costs are approximately \$29.9 million (\$25.0 million for lands and relocations assistance for residential and commercial buildings, and \$4.9 million for utility relocations) for the Willow Glen Plan, \$39.2 million (\$30.6 million for lands and relocations assistance for residential and commercial buildings, and \$8.5 million for utility relocations) for the Valley View Plan and \$64.7 million (\$50.0 million for lands and relocations assistance for 13 residential buildings and 16 businesses, and \$14.7 million for utility relocations) for the Bypass Channel Plan. Therefore, LERRD costs are equivalent to approximately 53 percent, 40 percent and 42 percent, of the estimated total NED project costs for each of the respective plans.

Interest During Construction Costs: Interest during construction (IDC) is an opportunity cost of the money used for project construction prior to completion of the project. IDC includes costs for construction, land, relocations, mitigation, and other elements. IDC was computed over the construction period for each alternative. Because the Willow Glen Plan is the smallest plan, its construction period is the shortest at less than two years. The Valley View and Bypass Channel Plans are more complicated and would both require approximately three years for construction. The major NED cost features, including IDC, are summarized in Table 21 and are described below.

Operation and Maintenance Costs: Operation and Maintenance (O&M) is an expense which is incurred on an annual basis. The O&M requirements for each plan include annual inspections and routine maintenance of bridges, maintenance roads, floodwalls, channel slopes, and rock weirs. Vegetation, sediment, trash and debris removal are also included in the annual maintenance costs. The Bypass Channel Plan O&M requirements also include routine repairs associated with recreation features, including daily maintenance of restrooms.

Average annual O&M costs are estimated to be \$100,000 for the Willow Glen Plan, \$221,000 for the Valley View Plan, and \$482,000 for the Bypass Channel Plan. Because there is no first cost associated with O&M, these costs are not reflected in Table 21. They are, however, included in the average annual costs which appear in Table 22.

Table 21 - Summary of the Major NED Cost Features - First Costs (October 1997 Price Level, \$1,000)

Project Feature	Account	Willow Glen Plan (9,000 cfs)	Valley View Plan (12,000 cfs)	Bypass Channel Plan (14,600 cfs)
Lands & Damages	1	25,031	30,666	50,033
Utility Relocations <u>1/</u>	2	4,899	8,491	14,685
Subtotal LERRD		29,930	39,157	64,718
Fish & Wildlife Facilities <u>1/</u>	6	234	1,719	3,076
Recreation Facilities <u>1/</u>	14	0	0	2,000
Floodway Control & Diversion Structures <u>2/</u>	15	18,608	38,648	58,008
E&D	30	2,000	2,800	3,500
S&I	31	399	1,196	1,533
Traffic Re-routing/delay		793	2,613	2,699
Interest During Construction		4,957	11,533	18,359
TOTAL COSTS		56,921	97,666	153,893

1/ These figures reflect those individual items shown in Table 20 with an 18.5% contingency.

2/ These figures reflect the total shown in Table 20 less the utility relocations.

Net NED Benefits and Benefit-to-Cost Ratios. Net benefits and Benefit-to-Cost Ratios (BCRs) are presented in Table 22. Average annual costs and benefits were computed based on a discount rate of 7-1/8% over a 50-year project life. Average annual benefits are based on an analysis of a reduction of flood damages and other associated costs. The Economics Appendix summarizes the benefits analysis. The difference between average annual benefits and costs yields annual net benefits. Table 22 indicates that the Valley View Plan maximizes net benefits. The benefit to cost ratios are shown in Table 22 below.

Table 22: NED Benefit-to-Cost Ratios Based on Expected Damages (\$1,000)

	Willow Glen Plan (9,000 cfs)	Valley View Plan (12,000 cfs)	Bypass Channel (14,600 cfs)
Avg Annual Benefits	15,134	19,984	23,577
Avg Annual Costs <u>1/</u>	4,224	7,344	11,455
Net Benefits	10,910	12,640	12,122
Benefit-to-Cost Ratio <u>2/</u>	3.6	2.7	2.1

1/ Average annual costs include annual O&M estimates and exclude the costs associated with relocations assistance.

2/ In order to quantify the sensitivity of the benefits to the upstream build-out assumptions, average annual benefits and BCRs associated with current hydraulic flows (present damages) were computed, as discussed in the Economics Appendix. Using present damages, the BCR for the Bypass Channel Plan drops from 2.1 to 2.0, and is therefore not sensitive to the upstream build-out assumption.

5.3 Recreation Cost Analysis.

The City of San Jose is interested in developing recreational opportunities within the highly urbanized study area. The city is coordinating their efforts with the Corps of Engineers' and the Santa Clara Valley Water District's flood control planning process. Recreation opportunities were not considered during the formulation of flood protection alternatives, but once formulated, the addition of recreation features was considered for each alternative.

The City of San Jose has planned a comprehensive recreation network in and around the study area; see Figure 9. Most of the planned trails are either: (1) dependent upon acquisition of a flood control right of way along the upper Guadalupe River, or (2) proposed bicycle lanes on city streets. Neither the Willow Glen Plan nor the Valley View Plan would provide sufficient property acquisition for an uninterrupted recreation trail. However, implementation of the Bypass Channel Plan would enable San Jose to develop a continuous recreation trail within the study reaches.

Recreation costs and benefits were not included in the NED analysis above. However, Federal policy allows full consideration of recreation as a project purpose, as legislated by Section 4 of the Flood Control Act of 1944, as amended; the Federal Water Project Act of 1965, Public Law 89-72, as amended; and the Water Resources Act of 1986. Therefore, recreation was included in the planning process, and the costs and benefits associated with recreation are presented below. A description of the recreation features is provided in Section 7.2.

Recreation Economic Benefits. In addition to benefits associated with flood damage reduction, reduction in flood insurance costs, reduction in emergency costs during floods, advance replacement of bridges and reduction in current maintenance costs, recreation benefits were developed for the Bypass Channel Plan. For modest added costs, the Bypass Channel Plan

can provide substantial recreational benefits of approximately \$3.0 million per year. These benefits are based on anticipated use of the proposed recreational facilities. The Economics Appendix presents the recreation benefits analysis. Average annual benefits were computed based on a discount rate of 7-1/8% over a 50-year project life. Annual benefits including recreation are summarized in Table 23.

Recreation Cost Estimates. In addition to the major cost features including channel widening, bridge replacements and real estate acquisition costs, the cost increment associated with recreation for the Bypass Channel Plan was computed to be \$2.0 million (including contingencies), or \$147,200 per year. No additional real estate or mitigation is required for the implementation of the recreation features; therefore, the only increase in costs is realized in the construction cost subtotal. Inclusion of recreation features increases the construction cost of the Bypass Channel Plan from \$75.8 million to \$77.8 million.

Table 23 - Summary of Total Annual Benefits *Including Recreation* (\$1,000)

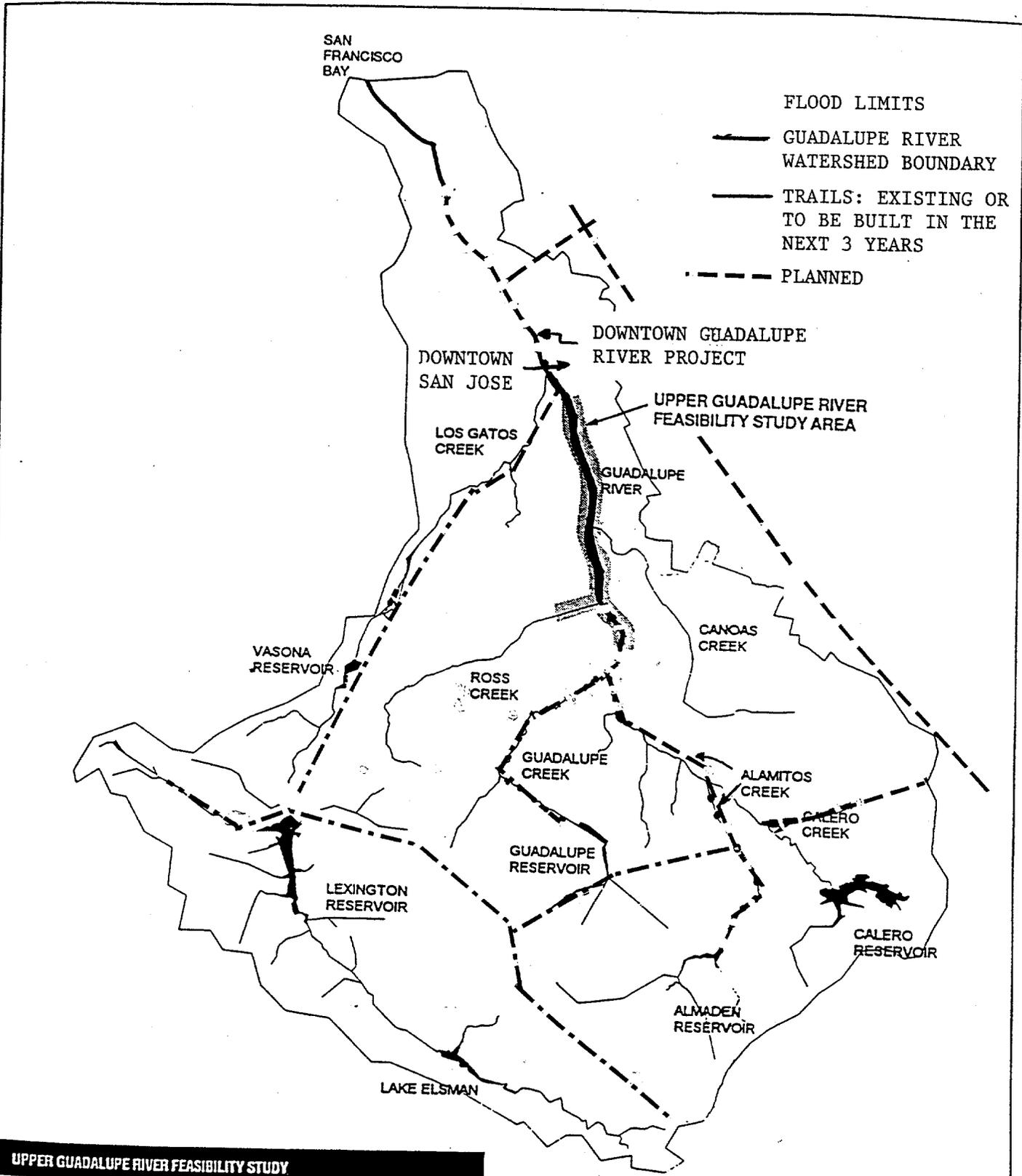
Benefit Category	Willow Glen Plan (9,000 cfs)	Valley View Plan (12,000 cfs)	Bypass Channel (14,600 cfs)
Flood Damage Reduction	14,460	17,343	20,411
Recreation	0	0	3,018
Emergency Flood Costs	282	293	328
Flood Insurance Savings	36	65	208
Traffic Impact Reduction	74	136	179
Current Maintenance	126	126	210
Bridge Replacement	156	350	570
Benefits During Project Construction	0	1,671	1,671
Total NED Benefits	15,134	19,984	26,595

Net Recreation Benefits and Benefit-to-Cost Ratio. Net benefits and Benefit-to-Cost Ratios (BCRs) associated with the recreation features of the Bypass Channel Plan are presented in Table 24. Average annual costs and benefits were computed based on a discount rate of 7-1/8% over a 50-year project life. The benefit to cost ratios are shown in Table 24 below.

Table 24: Benefit-to-Cost Ratios *Including Recreation* (\$1,000)

	Willow Glen Plan (9,000 cfs)	Valley View Plan (12,000 cfs)	Bypass Channel (14,600 cfs)
Avg Annual Benefits	15,134	19,984	26,595
Avg Annual Costs <u>1/</u>	4,224	7,344	11,602
Net Benefits	10,910	12,640	14,993
Benefit-to-Cost Ratio <u>2/</u>	3.6	2.7	2.3

1/ Note that average annual costs include O&M, but exclude the costs associated with relocations assistance.



UPPER GUADALUPE RIVER FEASIBILITY STUDY

Figure 9 The Guadalupe River Watershed. Recreation Trail Network



6.0 TRADE-OFF ANALYSIS

6.1 Introduction

This section compares the candidate plans described above. The major elements of the plans are summarized and compared in terms of their contributions to the four accounts of National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). The alternative plans are then tested against four specific evaluation criteria described below. The plan(s) that establishes Federal interest is also identified.

System of Accounts

Four accounts are established to facilitate evaluation and display the effects of the alternative plans. These accounts are described below.

National Economic Development (NED): The NED account shows the effects on the national economy. Project cost comparisons and benefit-to-cost comparisons are included under this account.

Environmental Quality (EQ): The EQ account shows the effects on ecological, cultural, and aesthetic attributes of significant natural and cultural resources that cannot be measured in monetary terms.

Regional Economic Development (RED): The RED account shows the effects the proposed plans could have on regional economic activity.

Other Social Effects (OSE): The OSE account shows the project's urban and community impacts and effects on life, health, and safety.

Associated Evaluation Criteria

During plan evaluation, the alternative plans are tested against four specific criteria. These criteria are defined in the following paragraphs.

Acceptability. The acceptability of a plan is determined by evaluating its acceptance by the concerned public. A plan is acceptable if it is, or would likely be, supported by a significant segment of the public.

Completeness. Plan completeness is determined by analyzing whether all necessary investments or other actions necessary to attain the full plan have been included.

Effectiveness. Plan effectiveness is determined by analyzing how well it satisfies the planning objective(s) and contributes to the System of Accounts.

Efficiency. The efficiency of a plan is its ability to achieve the planning objective(s) and the NED outputs in the least costly manner.

6.2 Trade-offs Among Final Alternatives

The trade-off analysis compares how the implementation of each alternative is distinguished from all other alternatives. The trade-offs considered include the achievement of the study planning objective(s), the economic benefits versus the costs associated with implementation, and the environmental and other social effects associated with each alternative. Table 25 summarizes the trade-offs considered using the System of Accounts.

The No-Action Alternative would not meet the planning objectives to reduce flood damages or provide recreation opportunities along the upper Guadalupe River. No construction costs, economic benefits, or environmental impacts would result from this alternative.

While all three action alternatives would meet the objective to reduce flood damages, only the Bypass Channel Plan meets the second objective of providing recreation opportunities in the study area.

As one might expect, the impacts, benefits, and costs increase with the size of the project. The short-term disruptions to individuals due to construction noise, inconvenience, and relocations are greatest for the Bypass Channel Plan. Conversely, the extent of flood protection associated with this plan provides significantly greater long-term protection of life, health and safety than either of the other two plans.

Because the Bypass Channel Plan is the largest plan considered, it would impact more total acres of riparian habitat than either of the other two plans. However, the use of bypass channels throughout the study area successfully preserves the existing riparian habitat by avoiding any disturbance to it wherever possible. Through careful mitigation planning, the Bypass Channel Plan provides an opportunity to restore the riparian habitat to a continuous condition. Neither the Willow Glen nor the Valley View Plan provide that opportunity. Over the short-term, the construction activities and removal of vegetation associated with the Bypass Channel Plan will have the greatest negative aesthetic impacts within the study area. However, the restored riparian habitat associated with the Bypass Channel Plan will provide long-term aesthetic improvements which neither of the other plans could provide.

The local community is very sensitive to the environment and has provided comments on the Bypass Channel Plan through numerous public meetings/workshops. Public comments have indicated that bypass channels are preferred to channel widening measures. Such public comments were responsible, in part, for the incorporation of the bypass feature in the design. By

using bypass structures rather than widening the existing channel, impacts to the riparian habitat are avoided altogether in portions of Reaches 7-9 and 11. Therefore, the public prefers the Bypass Channel Plan as the plan that would least impact the existing riparian habitat. Also, given the two significant floods in 1995, the local community is very supportive of a flood protection project.

In addition to environmental considerations, the local sponsor finds the Bypass Channel Plan to be more acceptable than either the Willow Glen or Valley View plans. Neither of the smaller plans provide satisfactory levels of flood protection, recreation opportunities, or continuous maintenance access to the channel.

6.3 NED Plan

By definition, the plan which maximizes the net benefits is identified as the National Economic Development (NED) Plan. The plans were formulated to minimize the costs of providing additional channel capacity below a major flow constraint. Table 25 presents the net benefits for all plans, which range from a low of \$10,910,000 to a high of \$12,640,000. Total NED costs are approximately \$56.9 million, \$97.7 million and \$153.9 million, for the Willow Glen, Valley View and Bypass Channel Plans, respectively.

Guidance provided during review of this report indicates that recreation outputs associated with this project are a low priority and are not to be considered in the determination of the NED Plan. If the NED plan is to be determined based solely on the purpose of flood control, the Valley View Plan maximizes net NED benefits. Thus, the Valley View Plan is the NED Plan.

6.4 Locally Preferred Plan (LPP)

The NED Plan would be very efficient with a benefit-to-cost ratio estimated at 2.7 to 1.0. However, the NED Plan would not be very effective, removing only 1,300 acres and 27 percent of existing structures from the 100-year floodplain, when compared with the Bypass Channel Plan which would remove 2,000 acres and 88 percent of the existing structures from the floodplain (see Table 17). Although the NED Plan is efficient, it is not very effective in removing the flood threat from larger storm events. This is particularly important given that the study area is highly urbanized and already fully developed. The local sponsor wishes to implement a plan which would maximize protection. The Bypass Channel Plan is an efficient plan, with a benefit-to-cost ratio estimated at 2.1 to 1.0. Because it maximizes protection while also being efficient, the Santa Clara Valley Water District has identified the Bypass Channel Plan as the Locally Preferred Plan (LPP).

TABLE 25
SYSTEM OF ACCOUNTS COMPARISON

	Willow Glen Plan	Valley View Plan	Bypass Channel Plan	No Action
NATIONAL ECONOMIC DEVELOPMENT				
Total Avg Annual Benefits	\$15,134,000	\$19,984,000	\$23,577,000	N/A
Total Avg Annual Costs	\$4,224,000	\$7,344,000	\$11,455,000	N/A
Total Net Benefits	\$10,910,000	\$12,640,000	\$12,122,000	N/A
Benefit-To-Cost Ratio	3.6	2.7	2.1	N/A
ENVIRONMENTAL QUALITY				
PHYSICAL ENVIRONMENT	Temporary noise/air pollution during construction. Moderate traffic disruption. Limited use of floodwalls.	Temporary noise/air pollution during construction. Moderate traffic disruption. Limited use of floodwalls.	Temporary noise/air pollution during construction. Greatest traffic disruption. Moderate use of floodwalls.	No change from existing conditions.
BIOLOGICAL ENVIRONMENT	Minor short-term negative impacts. Minor long-term positive impacts. Loss of 1.8 acres riparian forest. Replace 2.7 acres. Minimal improvement to degraded riparian habitat.	Moderate short-term negative impacts. Moderate long-term positive impacts. Loss of 8 acres riparian forest. Replace 12.1 acres. Moderate improvement to degraded riparian habitat.	Greatest short-term negative impacts & long-term positive impacts. Loss of 11.3 acres riparian forest. Replace 22. Greatest improvement to degraded habitat and removal of fish barriers.	No change from existing degraded conditions.
CULTURAL RESOURCES	Some potential disturbance to cultural resources expected.	Moderate potential disturbance to cultural resources expected.	Highest potential for disturbance to cultural resources expected.	No change from existing conditions.

TABLE 25 (Continued)
SYSTEM OF ACCOUNTS COMPARISON

	Willow Glen Plan	Valley View Plan	Bypass Channel Plan	No Action
REGIONAL ECONOMIC DEVELOPMENT				
Local Government Finance	SCVWD to provide non-Federal share of funds.	SCVWD to provide non-Federal share of funds.	SCVWD to provide non-Federal share of funds.	N/A
Economic Development	Some additional employment during construction.	Some additional employment during construction.	More additional employment during construction.	No change from existing conditions.
Industrial Growth	No significant impact.	No significant impact.	No significant impact.	No change from existing conditions.
Population Growth	No significant impact.	No significant impact.	No significant impact.	No significant impact.
OTHER SOCIAL IMPACTS				
Public Health and Safety	Least reduction to risk of injury or loss of life related to floods.	Moderate reduction to risk of injury or loss of life related to floods.	Greatest reduction to risk of injury or loss of life related to floods.	No change from existing conditions.
Aesthetics	Permanent floodwalls in Reaches 7 & 8 and Ross Creek. Riprap along parts of channel. Removal of least vegetation.	Permanent floodwalls in Reaches 7 & 8 and Ross Creek. Riprap along parts of channel. Removal of more vegetation.	Permanent floodwalls in Reaches 7 & 10b and Ross Creek. Riprap minimized due to bypasses. Removal of more vegetation.	No change from existing conditions.
Recreation	No significant opportunities for recreation.	No significant opportunities for recreation.	Greatest opportunities for recreation w/ continuous riverside recreation trail.	No change from existing conditions.
EVALUATION CRITERIA				
Acceptability	No issues.	No issues.	No issues.	N/A
Completeness	No issues.	No issues.	No issues.	N/A
Effectiveness	Meets flood protection objective. Does not meet recreation objective. Satisfies NED Account.	Meets flood protection objective. Does not meet recreation objective. Satisfies NED Account.	Meets flood protection objective. Meets recreation objective. Satisfies NED Account.	N/A
Efficiency	Least efficient plan.	Most efficient plan.	Moderately efficient plan.	N/A

6.5 Selection of the Recommended Plan

The Santa Clara Valley Water District supports the arguments that there is a substantial justification for the construction of the Bypass Channel Plan and has selected the Bypass Channel Plan as the Locally Preferred Plan. In addition to being very effective, the Bypass Channel Plan fully meets the Federal flood protection objectives. Therefore, the San Francisco District recommends that the Locally Preferred Plan, the Bypass Channel Plan, be constructed. However, the Federal share of the cost of the Recommended Plan would be limited to the Federal share of the cost of the NED Plan. Table 26 summarizes the performance of the NED and the LPP plans.

Table 26 - Comparison of the NED (Valley View) and LPP (Bypass Channel) Plans (\$1,000)

Condition	Valley View (NED)	Bypass Channel (LPP)	Increment Provided By Bypass Channel Plan
Land removed from 100-yr floodplain (2,300 acres)	1,300 acres removed	2,000 acres removed	700 additional acres removed
Structures removed from 100-yr floodplain (7,500 total)	2,060 removed	6,620 removed	4,560 additional removed
Total Cost-Shared Costs	\$83,520	\$132,835	\$49,315
Federal	\$54,288	\$66,418	\$12,130
Non-Federal	\$29,232	\$66,418	\$37,186
Average Annual Cost	\$7,344	\$11,455	\$4,111
Flood Control	\$7,344	\$11,308	\$3,964
Recreation	\$0	\$ 147	\$ 147
Average Annual Benefits	\$19,984	\$26,595	\$6,611
Flood Control	\$19,984	\$23,577	\$3,593
Recreation	-	\$3,018	\$3,018
Net Benefit w/rec.	\$12,640	\$14,933	\$2,293
Total Residual Damages (\$1995)	\$8,319	\$5,417	\$2,902
Economic Area 1	\$364	\$108	\$ 256
Economic Area 2	\$1,617	\$562	\$1,055
Economic Area 3	\$181	\$123	\$ 58
Economic Area 4	\$5,100	\$4,200	\$ 900
Economic Area 5	\$1,057	\$424	\$ 633

A review of Table 26 indicates that implementation of the NED plan would leave significant portions of an urban area within the post-project floodplain, while the LPP would minimize the acreage and number of structures left within the floodplain. As compared with the NED plan, the LPP would have a more significant impact on the local planning environment and would result in a greater reduction of the overall risk from flooding to the urban area. The details of these comparisons are discussed below.

Limit of Protection Provided by NED Plan: The 100-year floodplain within the study area encompasses approximately 2,300 acres of fully developed land. Approximately 7,500 structures are located within this floodplain. Over 90% of these structures (6,900) are residential. Residual floodplains for the Valley View and the Bypass Channel Plans are shown as Plates 5 and 6. These plates indicate that if the Valley View Plan were implemented, a significant portion of the 100-year floodplain would be left unprotected. The Valley View Plan would remove 1,300 acres of land and 2,060 structures from the floodplain, leaving approximately 1,000 acres and over 5,400 structures within the post-project floodplain. Implementation of the Bypass Channel Plan would remove 2,000 acres and 6,620 structures from the post-project floodplain, leaving about 880 structures in the floodplain. Thus, the Bypass Channel Plan would remove three times as many buildings from the floodplain as the Valley View Plan.

Changes to Local Planning Environment: Implementation of the Bypass Channel Plan would reduce total expected damages by 78%, which is a 12% increase over the protection offered by the Valley View Plan. The Bypass Channel Plan significantly reduces the residual flooding in all of the study reaches. Implementation of the Bypass Channel Plan would reduce the extent of the 100-year floodplain and may encourage proper redevelopment in sections of the eastern floodplain. Furthermore, implementation of the Bypass Channel Plan improves critical habitat for the threatened steelhead trout; protects government facilities and transportation structures which are critical to the local, regional, and national economy; and provides a link in the overall flood control system for the Guadalupe River which is compatible with other Federal projects in the watershed. Implementation of the NED plan would not result in these same benefits.

Finally, implementation of the NED Plan would be incongruous with the Corps' Downtown San Jose project, which is located approximately one mile downstream of the proposed Upper Guadalupe project. The downtown project, which is currently under construction, will provide "100-year" protection, while the NED Plan would provide only "50-year" protection. Implementation of the Bypass Channel Plan would eliminate the appearance of inequitable protection for residents of a single municipality.

Risk Reduction: Both the LPP and the NED Plans are essentially incised channel projects with limited use of floodwalls. Although incised channels may be overtopped if design flows are exceeded, the risk of catastrophic failure, such as a levee breach, is negligible. The LPP design meets the FEMA requirements for certification since the floodwalls have at least a 90 percent chance of containing flows associated with a 100-year event. However, because the NED Plan's capacity is less than that of the LPP, the NED Plan would not meet the FEMA requirements for certification.

Residual flooding associated with both the LPP and the NED Plan occurs due to flows in the upstream portion of Canoas Creek. In order to minimize the risk associated with the residual flooding, the sponsor must continue to comply with the National Flood Insurance Program. To

further minimize this risk, it is recommended that the sponsor implement floodplain management and zoning measures where feasible, and prepare a flood warning and evacuation plan.

7.0 THE RECOMMENDED PLAN

7.1 General

The recommended plan (Bypass Channel Plan) is designed to carry 11,400 cfs between Blossom Hill Road and Ross Creek; 12,400 cfs between Ross Creek and Canoas Creek; and 14,600 cfs below Canoas Creek. This plan emphasizes preservation of existing riparian vegetation. Plate 9 illustrates all of the proposed features, which are described below.

7.2 Plan Description

The Bypass Channel Plan is the plan recommended to alleviate the damages associated with flooding along upper Guadalupe River. The features of this plan are described below.

Bypass Channel Plan (14,600 cfs)

The Bypass Channel Plan features a bypass channel, channel widening, levee and floodwalls designed to contain the 100-year discharge on the upper Guadalupe River and Ross Creek. Channel widening will be limited to one bank in most cases to preserve as much as possible of the existing riparian habitat. A schematic of the Bypass Channel Plan is shown in Plate 9. The plan is described below.

SPRR Bridge to 500' upstream of Willow Street: Improvements to this project section will include an 18'-deep bypass channel with an 85'-wide floodway and 1:1 side slopes.

500' upstream of Willow Street to Alma Street: Improvements to this project section will consist of a combined natural and bypass channel. An 18'-deep bypass will be combined with a 30'-wide floodway, each with 1:1 side slopes. The surface elevation of the embankment between the bypass and natural channel would allow transfer of floodwaters between the two alignments during high flows.

Alma Street to UPRR Bridge: A gabion-lined bypass channel will be built through the existing Elks Lodge parking lot.

UPRR Bridge to Willow Glen Way: An 18'-deep bypass with 85'-wide channel floodway with 1:1 side slopes will be built between the railroad bridge and Willow Glen Way.

Willow Glen Way to Blossom Hill Road: Improvements to this project section will include channel widening, a bypass channel, limited levees/floodwalls, and bridge replacements. The bank to bank width of the project will range from 75 feet to 200 feet, 4-10 feet above the invert.

Canoas Creek: Canoas Creek will be improved to alleviate flooding associated with backwater effects from the mainstem Guadalupe River. Culverts will be added to the Nightingale Drive and Almaden Expressway bridges, and floodwalls will be added between those two streets.

Ross Creek: Improvements to Ross Creek will include new culverts and channel widening. The channel bottom width will be excavated to 35 feet from Almaden Expressway to a point 750 feet upstream of Jarvis Avenue. The existing 12'W x 10'H x 210'-long box culvert at Almaden Expressway will be replaced with a 20'W x 10'H x 210'-long culvert. At Jarvis Avenue two 12'W x 9.5'H culverts will be installed in addition to the existing 12'W x 9.5'H culvert.

Betterments: The project requires that the Hillsdale Avenue bridge be replaced by a bridge with a larger opening. The SCVWD desires to eliminate the Hillsdale bridge altogether and replace it with a bridge with a larger traffic capacity at a location several hundred feet downstream from the existing Hillsdale Avenue bridge location. The new bridge would be located at the planned extension of Pearl Avenue. The new Pearl Avenue bridge will be an improvement over the existing Hillsdale Avenue bridge, and is therefore considered to be a betterment.

The replacement of the Hillsdale Avenue bridge is a utility relocation which is a local LERRD responsibility for which the SCVWD will receive credit toward their contribution. However, since the Pearl Avenue bridge is a betterment, the local sponsor will not receive credit for the cost increment over the cost of an in-kind replacement of the Hillsdale Avenue bridge. All costs reflected in the NED analysis correspond to an in-kind replacement of the Hillsdale Avenue bridge. A separate cost estimate was developed for the construction of the larger Pearl Avenue bridge. This cost was used to determine the cost apportionment for the proposed project.

Recreation: A recreation trail will be paved on the surface of gravel based maintenance access roads which are required for the proposed project. The trail will follow the maintenance road and portions of the bypass channels and levees within the project area. In order to provide a continuous pathway, portions of the trail will leave the project lands and will be provided off-site on city streets by the City of San Jose. Additional recreation features, such as picnic areas and bathrooms, will be included in the overall recreation plan. These additional features are to be provided on lands which are required for channel access, mitigation, and flowage areas between proposed bypass channels and the existing channel.

The major features of the recreation plan include 4.3 miles of paved trail, 1620 feet of railing, and 3800 feet of chain-link fencing. Two picnic areas with a total of 6 picnic tables and two restrooms with drinking fountains will be provided on project lands. Two pedestrian / bicycle bridges will be constructed to cross the river. Additional features will include exercise stations; safety lighting; call boxes; vehicle barriers; trash cans; various directional, rule and interpretive signs; additional picnic tables; and benches.

7.3 Risk and Uncertainty

The uncertainty and variability associated with the upper Guadalupe River project is similar to that associated with many flood control projects. Due to the complexity of factors associated with a storm, the flow for a particular storm cannot be known with certainty. Likewise, the stage for a given flow can vary. For these reasons, no project can ever provide guaranteed full protection against all events. While the project will reduce the risk of flooding, it will not eliminate it. Technology now available allows us to identify the probability of experiencing flood damages with the project in place. For example, with the Bypass Channel Plan design in place, it is still possible to experience some flooding associated with a "100-year event". The Hydrology and Hydraulics Analysis appendix tabulates the probability of overtopping the project at various locations for a variety of storm magnitudes.

Without this project in place, a "100-year" event is expected to cause approximately \$280 million in damages, which translates to \$24.7 million on an average annual basis. With the project in place, the expected damages for a "100-year" event will be reduced from \$24.7 million to approximately \$5.4 million per event. The Economic Analysis Appendix describes the risk-based analysis (RBA) used to evaluate project benefits.

7.4 Project Impacts and Mitigation

The impacts of the recommended plan are discussed in the Environmental Impact Statement/Report (EIS/R). These impacts and appropriate mitigations are summarized below.

a. Erosion. Short-term impacts are expected to be less than significant as long as major earthwork is performed between May and October and exposed soils are stabilized during construction. Gabions or cribwalls will be used in areas with steep slopes in order to ensure that the long-term impacts are less than significant.

b. Habitat. In response to the draft Coordination Act Report submitted by the USFWS, approximately 27.5 acres (22.4 acres of riparian forest, 3.6 acres of urban forest, and 1.5 acres of wetland habitat) will be replanted in order to mitigate for impacts to these habitat types. An additional 0.95 acres of wetland will be restored by the SCVWD at local expense. Refer to the EIS for a full description of habitat impacts.

c. Cultural Resources. One site within the area of potential effect has been identified as eligible for the National Register of Historic Places. This site was disturbed during a previous construction activity, therefore, disturbance is expected to be minimal. Early tools have been recently discovered in Reach 11, but it is not yet known whether it is eligible for the National Register. This site is located beneath a building which is going to be removed from the project area during construction. A site survey will be performed at the time the building is removed in order to determine whether or not the site is eligible for the National Register.

Construction sites near the study area such as the joint Corps Sacramento District/SCVWD downtown Guadalupe River Project, the CalTrans Tamien Light Rail Station, and some State Highways projects, have encountered buried cultural resources. It is reasonable to expect that cultural resources will be encountered during construction, therefore, a cultural resources plan is being developed and will be implemented during the preconstruction engineering and design project (PED) and construction phases, as appropriate. This plan includes a site survey of a site in Reach 11 where early tools have been discovered.

d. Utility Replacements. Water and sewer lines will be disturbed during the construction of the bypass culvert. All utility lines that are affected will be replaced by lines of the same size as those existing prior to construction. Residents living in the vicinity of the construction will be provided with temporary utility hook-ups during construction in order to avoid any long-term disruptions to utility service. Table 27 lists the relocation and replacement requirements by reach for roads, bridges, and utilities.

e. Relocations of Residents. The Bypass Channel Plan will permanently displace 13 residential buildings and 16 commercial buildings. Costs associated with relocation assistance are included in the real estate costs associated with this plan.

f. Traffic Disruptions. The Bypass Channel Plan was formulated to avoid impacts to major thoroughfares and bridges. However, implementation of the plan will require that five neighborhood bridges be removed and replaced. No bridge is more than a fraction of a mile from an alternate bridge, and adjacent bridges will not be out of service simultaneously. Traffic re-routing will be conducted with the assistance of a traffic controller.

g. HTRW. HTRW sites are expected to be encountered in Reaches 7, 10, and 12. A project-specific remediation plan will be developed to reduce the contaminant concentrations to acceptable levels. The local sponsor will be responsible for implementing the plan prior to initiation of construction.

7.5 Real Estate Requirements

Approximately 170 acres of land are required for implementation of the Recommended Plan. About 160 acre have been appraised as tantamount to fee, while temporary work area easements are required for the remaining 10 acres. Relocations of utilities and residents are discussed above under Project Impacts. An attorney's opinion of compensability has been prepared which states that there is a compensable interest in utilities to be relocated.

No new lands are required for the recreation features of the Bypass Channel Plan. The design of the recreation trail has been coordinated with the City of San Jose, and brief stretches of the trail will be located off-site, but will be the sole responsibility of the City of San Jose. These stretches are limited to striping of existing city streets and the placement of signs along the trail. All of the recreation features proposed for the Bypass Channel Plan will be constructed on

project lands which are required for flood control purposes. Similarly, all mitigation features are located on project lands which are required for flood control purposes. Therefore, real estate costs associated with recreation and mitigation features are nominal.

Table 27: Utility Replacements & Modifications

Reach	Type	Approx. Location
7A	Willow Street Bridge removal & replacement	Willow Street
	Utility relocation - sanitary sewer, water lines, stormwater outfalls	Willow Street
	Temporary railroad relocation for culvert	SPRR Bridge
7B	Utility relocation - water lines, stormwater outfalls	Alma Ave. bridge
	Alma Avenue Bridge removal and replacement	Alma Ave. & Elks Lodge
8	Utility relocation - stormwater outfalls	Bypass channel
	Willow Glen Way Bridge removal and replacement	Willow Glen Way
	Temporary railroad relocation for culvert	UPRR Bridge
9	Utility relocation - SJWC booster pumps, 2 SJWC wells, stormwater outfalls	Willow Glen Way
10A	Curtner Avenue Bridge removal & replacement	Curtner Avenue
	Utility relocation - stormwater outfalls	Curtner Avenue
10C & D	Hillsdale Avenue Bridge removal & replacement	Hillsdale Avenue
	Utility relocation - sanitary sewer, stormwater outfalls	Sta. 889+20
11	Utility relocation/mod. - stormwater outfalls, SJWC pumping station improvements	Bryan Ave. Station
Canoas Creek	Roadway replacement for culvert addition/enlargement at two locations	Almaden Expwy. and Nightingale Drive
Ross Creek	Utility relocation - stormwater outfalls	N. bank only
	Roadway replacement for culvert addition/enlargement at two locations	Almaden Expwy. and Jarvis Avenue

7.6 Design and Construction Considerations

Following report approval, it is anticipated that the Preconstruction Engineering and Design, including preparation of plans and specifications, could be accomplished within two years. Upon subsequent negotiation of a Project Cooperation Agreement, acquisition of real estate, and receipt of construction funds, it is estimated that construction could be completed within 3 years. Major construction items would include rock-lined bypass channels, channel excavation, concrete floodwalls, the removal and replacement of five neighborhood bridges, the removal and replacement of underground utilities (water and sewer lines), and mitigation planting.

During the construction period, measures cited in Engineering Pamphlet 1165-2-501, "Environmental Policies, Objectives, and Guidelines for the Civil Works Program of the Corps of Engineers", would be followed to maintain public dialogue, minimize disturbance to environmental and cultural resources, ensure proper debris disposal methods, and restore the site. Safety measures would be taken to protect individuals present at the site or living in the vicinity of the construction area.

7.7 Operation, Maintenance, Repair, Replacement and Rehabilitation Requirements

Operation, maintenance, repair, replacement and rehabilitation (OMRR&R) of the flood control project is the non-Federal sponsor's responsibility, in accordance with provisions contained in the Water Resources Development Act of 1986 (PL 99-662). The OMRR&R requirements will be described in the Operations and Maintenance (O&M) Manual to be prepared by the Corps during the Preconstruction Engineering Design phase of study. SCVWD has prepared a preliminary maintenance plan which was used as the basis for estimating the total annual OMRR&R cost, currently estimated to be \$482,000. The OMRR&R requirements for the selected plan include annual inspections and routine maintenance of bridges, maintenance roads, floodwalls, channel slopes, and rock weirs. Surveillance of project performance, to be accomplished by measures such as the periodic production of stage and discharge records, will also be required. Routine repairs for gabions, cribwalls, fencing, and recreation features (including daily maintenance of restrooms) are also included. Vegetation, sediment, trash and debris removal are also included in the annual maintenance costs.

7.8 Economic Considerations

Economic benefits and costs for the Bypass Channel Plan are summarized below.

A. Summary of Benefits. The flood control benefits associated with the selected plan are based on the following categories: 1) flood damage reduction to structures and their contents; 2) emergency flood response savings; 3) flood insurance administrative cost savings; 4) savings

associated with current channel maintenance activities; 5) advanced bridge replacement benefits; 6) reduction of transportation delays; and 7) benefits accruing during construction upon completion of significant portions of the project. The benefits for the Bypass Channel Plan are based on a 7-1/8 percent discount rate, and a 50-year period of economic evaluation. The methodology for the development of the benefits is presented in the Economics Appendix.

B. Summary of Costs: Construction costs for the selected plan were developed using the Corps of Engineers Micro-Computer Aided Cost Estimating System (MCACES). The MCACES summary report is presented in the Cost Estimates Appendix. Real estate costs were based on an appraisal of the current cost of acquisition. Details of the real estate cost estimate are included in the Real Estate Appendix. The price level of the MCACES cost estimate is October 1997.

A Fully Funded Estimate was developed based on the construction costs. The Fully Funded Estimate adjusts the construction costs for budget purposes to better anticipate the actual future costs recognizing the impact of future price levels. The Fully Funded Estimate is escalated to the mid-point of construction using OMB designated inflation rates.

Interest During Construction (IDC) is calculated using an 7-1/8% discount rate over an estimated construction period of three years. Costs included in the calculation of IDC include construction costs, the development of plans and specifications, engineering during construction, supervision and administration of construction, and economic real estate costs. The total IDC is \$18.4 million at the October 1997 price level, or \$1.4 million on an average annual basis using a capital recovery factor equal to 0.07361, which is based on a 7-1/8% discount rate and a 50-year period of economic evaluation.

C. Cost Allocation and Apportionment: All costs associated with the Valley View Plan are allocated to the flood control purpose. The Bypass Channel Plan allocates costs to flood control, recreation, and local betterments. All project features, except the features associated with recreation and betterments, are subject to a five-percent up-front cash contribution by the local sponsor. The sponsor is then responsible for all Lands, Easements, Rights of Way, Relocations, and Disposal (LERRD) and any cash contributions that may be required to bring the local share up to 35% of the total project cost. If the cash contribution plus the costs of LERRD are less than 35% of the project first costs, the local sponsor will pay the difference in cash. If the cash contribution plus the LERRD is greater than 50% of the project first costs, the project will be cost-shared at a rate of 50% Federal and 50% non-Federal. Recreation features associated with the Bypass Channel Plan will be cost-shared at a rate of 50% Federal and 50% non-Federal, and betterments are 100% non-Federally funded.

Normally, the Federal government participates in cost-sharing based on the cost of the NED Plan. However, since the Recommended Plan is different from the NED Plan, both are included in the cost allocation and apportionment summary. Table 28 itemizes the cost for the Valley View and the Bypass Channel Plans. Federal and non-Federal cost apportionment

summaries are presented for both plans in Table 29. The Federal share of the cost of the Recommended Plan will be limited to the Federal share of the cost of the NED Plan.

TABLE 28
PROJECT COST SUMMARY
VALLEY VIEW AND BYPASS CHANNEL PLANS
(\$1,000)

Account	Item	Valley View Plan (NED)		Bypass Channel Plan (LPP)	
		Oct 97 Price Level	Fully Funded Estimate	Oct 97 Price Level	Fully Funded Estimate
1	Lands & Damages	30,666	36,616	50,033	59,741
2	Relocations	8,491	10,139	14,685	17,534
6	Fish & Wildlife Facilities	1,719	2,053	3,076	3,673
15	Floodway Control & Diversion Structures	38,648	46,147	58,008	69,264
14	Recreation Facilities	0	0	2,000	2,388
	Subtotal	79,524	94,955	127,802	152,600
30	E&D	2,800	3,343	3,500	4,179
31	S&A	1,196	1,428	1,533	1,830
	Total	83,520	99,726	132,835	158,609

- * Valley View figures pro-rated from Mar 95 estimates as described in Sect. 5.2, NED Analysis.
- * Lands and Damages associated with recreation and mitigation are nominal since all recreation and mitigation features will be implemented on project lands needed for flood control purposes.
- * IDC and traffic delays not included.
- * Fully funded to mid-point of construction (Nov 2003).

TABLE 29
 COST APPORTIONMENT FOR THE
 BYPASS CHANNEL AND VALLEY VIEW PLANS
 (\$1000)

BYPASS CHANNEL PLAN
 (LPP)

FIRST COST	FLOOD CONTROL		RECREATION		TOTAL COST SHARED		BETTERMENTS		TOTAL COSTS	
	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal
Lands & Damages	-	50,033	-	-	-	50,033	-	-	-	50,033
Relocations	-	14,685	-	-	-	14,685	-	-	-	14,685
Construction	61,084	-	1,000	2,000	62,084	-	2,585	2,585	62,084	3,585
E&D	2,573	488	35	76	2,608	893	30	30	2,608	923
S&I	901	485	74	147	974	559	70	70	974	629
Subtotal	64,557	66,061	1,109	2,217	65,666	67,168	2,655	2,655	65,666	69,824
Cash Contributions	(6,531)	-	1,109	-	(5,422)	7,639	2,685	-	(5,422)	10,324
Total	58,027	72,592	1,109	2,217	59,135	73,700	2,685	2,685	59,135	79,365
Percent of First Cost	-	56%	50%	50%	45%	55%	0%	100%	44%	56%
Final Adjustments	7,283	(7,283)	0	0	7,283	(7,283)	0	0	7,283	(7,283)
Adjusted Total	65,309	65,309	1,109	2,217	66,418	66,418	2,685	2,685	66,418	66,418
Adjusted % of First Cost	50%	50%	50%	50%	50%	50%	0%	100%	49%	51%

VALLEY VIEW PLAN
 (NEED PLAN)

FIRST COST	FLOOD CONTROL		RECREATION		TOTAL COST SHARED		BETTERMENTS		TOTAL COSTS	
	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal	Federal	Non-Federal
Lands & Damages	-	30,666	-	-	-	30,666	-	-	-	30,666
Relocations	-	8,491	-	-	-	8,491	-	-	-	8,491
Construction	40,367	-	-	-	40,367	-	-	-	40,367	-
E&D	2,100	700	-	-	2,100	700	-	-	2,100	700
S&I	777	419	-	-	777	419	-	-	777	419
Subtotal	43,244	40,276	-	-	43,244	40,276	-	-	43,244	40,276
Cash Contributions	(4,176)	-	-	-	(4,176)	4,176	-	-	(4,176)	4,176
Total	39,068	44,452	-	-	39,068	44,452	-	-	39,068	44,452
Adj'd Cash Contrib	15,220	(15,220)	-	-	15,220	(15,220)	-	-	15,220	(15,220)
Total	54,288	29,232	-	-	54,288	29,232	-	-	54,288	29,232
Percent of First Cost	65%	35%	0%	0%	65%	35%	0%	0%	65%	35%

8.0 PLAN IMPLEMENTATION

8.1 General

In accordance with the Water Resources Development Acts of 1986 and 1996, project implementation requirements for the plans recommended for further study are summarized as follows:

Upon approval of the final report, funds will be provided (subject to availability) to initiate Preconstruction Engineering and Design, including the preparation of plans and specifications and necessary surveys and materials investigations. This would be followed by the preparation of a final project cost estimate by the District Engineer. At that time, a signed Project Cooperation Agreement (PCA) between the Corps of Engineers and the Santa Clara Valley Water District (SCVWD), the non-Federal sponsor, would be required. Upon execution of the agreement and acquisition of real estate, bids could be invited, and a contract could be awarded for construction. Following completion of construction, as-built drawings and an operation and maintenance manual will be furnished to the Santa Clara Valley Water District, which would be responsible for operation and maintenance of the project.

8.2 Division of Plan Responsibilities:

Section 211 of the Water Resources Development Act of 1996 (WRDA '96) provides specific non-Federal interests the opportunity to receive reimbursement for the construction of authorized flood control projects. Subparagraph (4) of Section 211 names the Upper Guadalupe River, California, project as a project which would be eligible for construction reimbursement. Corps policy states that Section 211 construction reimbursement is contingent upon approval by the Secretary of the Army of the plans for construction and the Secretary's determination that the project is economically justified and environmentally acceptable. This approval must be obtained prior to the initiation of construction of the work for which the reimbursement request will be made. Prior to negotiating a reimbursement agreement, the Secretary must notify the Committees on Appropriations of the House and the Senate. This notification must include the total commitment and the reimbursement requirements that the Administration intends to support in future budget submissions. As of the completion of this document, January 1998, the Santa Clara Valley Water District has not requested that Section 211 construction reimbursement be pursued for the construction of the Selected Plan. Therefore, Congressional authorization will be sought for Corps construction of the proposed project. The following Federal and non-Federal responsibilities must be met upon authorization.

A. Federal Responsibilities: The Corps of Engineers would be responsible for the following tasks:

- (1) Conduct advance planning, engineering, and design studies.
- (2) Prepare a Feature Design Memorandum.
- (3) Prepare plans and specifications.
- (4) Negotiate and execute a Project Cooperation Agreement.
- (5) Contract and supervise construction.
- (6) Prepare as-built drawings and O&M manual
- (7) Conduct periodic inspection of the completed work with non-Federal interests to ensure proper operation and maintenance.

B. Non-Federal Responsibilities: As the sponsor for all project purposes, including flood control and recreation, the SCVWD would be responsible for the following tasks:

a. Provide a minimum of 35 percent, but not to exceed 50 percent, of total project costs as further specified below:

- (1) Provide, during construction, a cash contribution equal to 5 percent of total project costs;
- (2) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, and maintenance of the project;
- (3) Provide or pay to the Federal Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and
- (4) Provide during construction any additional costs as necessary to make its total contribution equal to 35 percent of total project costs.

b. For so long as the project remains authorized, pay 100 percent of costs to operate, maintain, repair, replace, and rehabilitate the completed project or functional portion of the

project prescribed by the Federal Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor now or hereafter owns or controls for access to the project for the purpose of inspection, and, if necessary after failure to perform by the non-Federal sponsor, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall operate to relieve the non-Federal sponsor of responsibility to meet the non-Federal sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

d. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;

e. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

f. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the operation, maintenance, repair, replacement, and rehabilitation of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the Non-Federal sponsor with prior specific written direction, in which case the Non-Federal sponsor shall perform such investigations in accordance with such written direction;

g. Assume complete financial responsibility, as between the Federal Government and the Non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the operation, maintenance, repair, replacement, or rehabilitation;

h. As between the Federal Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA;

- i. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for the operation, maintenance, repair, replacement, and rehabilitation of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;
- j. Comply with all applicable Federal and State laws and regulations including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;"
- k. Provide 35 percent of that portion of total cultural resource preservation, mitigation and data recovery costs attributable to flood control that are in excess of 1 percent of the total amount authorized to be appropriated for flood control;
 - l. Provide 50 percent of that portion of project costs attributable to recreation;
- m. Participate in and comply with applicable Federal floodplain management and flood insurance programs in accordance with Section 402 of Public Law 99-662, as amended;
- n. Within 1 year after the date of signing a project cooperation agreement, prepare a floodplain management plan designed to reduce the impact of future flood events in the project area. The plan shall be prepared in accordance with guidelines developed by the Federal Government and must be implemented not later than 1 year after completion of construction of the project;
- o. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder operation and maintenance of the project;
- p. Not less than once each year, inform affected interests of the extent of the protection afforded by the project; and
- q. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project.

8.3 Views and Financial Capability of the Sponsor

The local sponsor (SCVWD) supports the Bypass Channel Plan as it would provide "100-year level of protection" while enhancing the natural habitat values as much as possible. The SCVWD is aware of local cost-sharing requirements associated with flood control projects, and has furnished a letter of intent.

The SCVWD supports the construction of the Bypass Channel Plan as it would have significant impacts on the local planning environment. The Bypass Channel Plan would remove approximately 2,000 acres and 6,600 buildings from the 100-year floodplain. Furthermore, implementation of the Bypass Channel Plan would be consistent with two major projects which impact the study area, while implementation of the Valley View Plan would be inconsistent with both of these projects. These projects are summarized below.

First, the Corps of Engineers, Sacramento District, is currently constructing a flood control project, also sponsored by the SCVWD, between Interstate 880 and Interstate 280 (immediately downstream of the current study area). This project, which was designed prior to the implementation of risk-based analysis techniques, is designed to pass flows associated with the one-percent chance event. The SCVWD is undertaking a local flood control project, independently and without Federal contribution, which is a 4,800-foot long bypass channel which is designed to join the downtown Guadalupe River Project and the proposed upper Guadalupe River Project. Implementation of the Valley View Plan would be incongruous with both the Federal and the local projects, while construction of the Bypass Channel Plan is consistent with both projects.

Second, the City of San Jose has planned a comprehensive recreation network in and around the study area. Most of the planned trails are either: (1) dependent upon acquisition of a flood control right of way along the upper Guadalupe River, or (2) proposed bicycle lanes on city streets. Implementation of the Valley View Plan would require cyclists and pedestrians to use busy thoroughfares within Reaches 7, 8, 10, and 11. However, implementation of the Bypass Channel Plan would enable San Jose to develop a continuous recreation trail within these reaches. The bike trail will connect an existing heavily used regional park, the Guadalupe River Park, with suburban open areas some five miles away, forming the backbone of a regional trail network. The bike trail will not be provided through the study area in the absence of a flood control project. Therefore, construction of the Bypass Channel Plan is necessary for realizing the potential recreation benefits.

The SCVWD has a policy of providing "100-year" level of flood protection and they strongly support the Bypass Channel Plan. Given the highly urbanized study area and historically increasing real estate costs it has proven to be cost effective in the long run to provide "100-year" protection. The local sponsor's "100-year" policy also reflects an equity issue, since, it may be perceived as unfair if one locality receives less than "100-year" protection.

Finally, the Bypass Channel Plan provides more protection against possible loss of life during major flood events than would the Valley View or Willow Glen Plans.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

Major conclusions of this Feasibility study include:

- Significant flooding has historically occurred along the upper reaches of the Guadalupe River in the southern area of the City of San Jose.
- Economic analyses indicate that over 7,500 buildings lie within the 100-year floodplain as compared to 4,870 in the 50-year floodplain.
- Hydrologic and hydraulic analyses indicate that the existing channel provides protection for a 7 to 8-year flood event below the UPRR bridge; for a 5-year event on Ross Creek; and for a 9-year event on Canoas Creek. Therefore, the risk of flooding within the study area is substantial.
- The NED plan has been identified as the Valley View Plan which would provide "50-year level of protection" for the upper Guadalupe River.
- The Recommended Plan has been identified as the Bypass Channel Plan which would provide "100-year level of protection" for the upper Guadalupe River.
- The local sponsor is willing to cost-share in the construction of the Recommended Plan.
- The Recommended Plan fully meets the non-Federal sponsor's flood control objectives.

9.2 Recommendations

Reduction of flooding by means of structural improvements is economically justified at this time. The Valley View Plan has been identified as the NED Plan. However, the San Francisco District is recommending that the Bypass Channel Plan be constructed because it provides protection to three times as many structures as the Valley View Plan; it provides significant recreation opportunities; it is consistent with other Federal flood control projects within 1.5 miles of the study area; and it is consistent with local policies. The Federal share of the cost of the Recommended Plan will be limited to the Federal share of the cost of the NED Plan.

Accordingly, I recommend that improvements for flood damage reduction and recreation opportunities in the upper Guadalupe River area be authorized subject to cost sharing as required by Public Law 99-662, the Water Resources Development Act of 1986, as amended by Section 202 of Public Law 104-303, the Water Resources Development Act of 1996. This recommendation is also subject to the non-Federal sponsor agreeing to comply with applicable

Federal laws and policies, including the requirements as stated in Section 8.2 of this report. The first cost of the project is currently estimated at \$132,835,000, of which the Federal government would contribute \$54,288,000, and the non-Federal sponsor would contribute \$78,547,000. The non-Federal sponsor would be responsible for an additional payment of \$2,685,000 for betterments associated with project construction.

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Date



RICHARD G. THOMPSON

LTC, EN

Commanding

PLATES

1. Economic Areas
2. 20-year Floodplain
3. 50-year Floodplain
4. 100-year Floodplain
5. Residual Floodplain (50-year)
6. Residual Floodplain (100-year)
7. Major Features of Willow Glen Plan
8. Major Features of Valley View Plan
9. Major Features of Bypass Channel Plan