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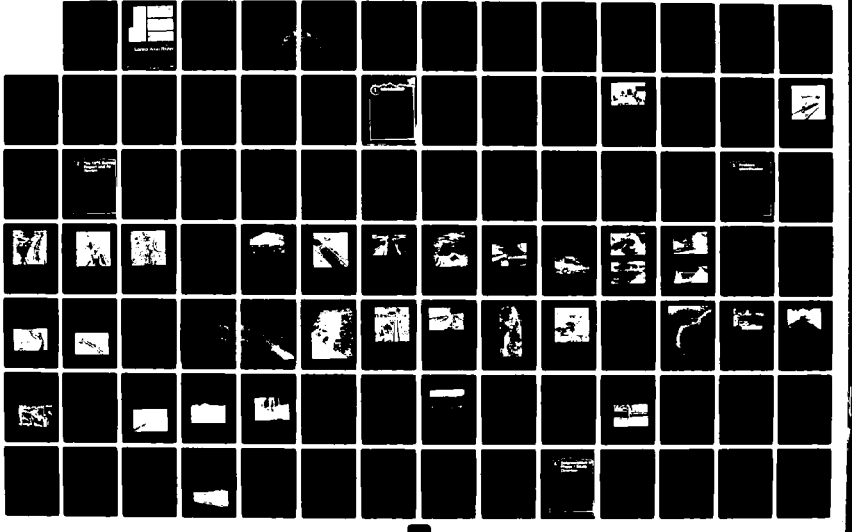

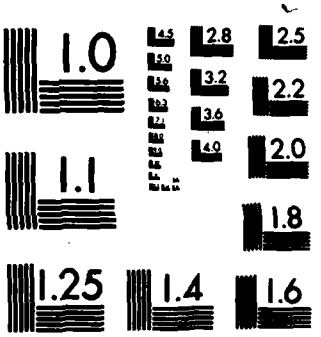

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Santa Ana River

PHASE I GDM ON THE SANTA ANA RIVER MAIN STEM including Santiago Creek

MAIN REPORT & SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

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SEPTEMBER 1980

U.S. ARMY CORPS OF ENGINEERS, LOS ANGELES DISTRICT

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An analysis of major proposals for flood control along the Santa Ana River Main Stem and Santiago Creek. Studies for this type of memorandum can be as simple as a review, update, and reaffirmation of plans recommended in previous survey reports, or may involve extensive reanalysis and reformulating of original plans. The original plan recommended by the District Engineer was submitted in 1975, following an exhaustive 9-year study of the flood control and related problems in the Santa Ana River Basin.

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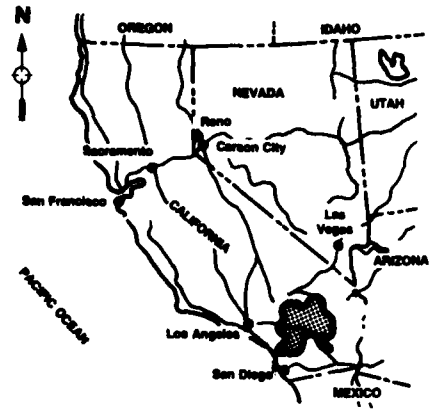

LEGEND

RECOMMENDED PLAN

- CHANNEL IMPROVEMENT
- DAM AND RESERVOIR

EXISTING

- FLOOD CONTROL DAM
- CHANNEL
- LEVEE
- BOUNDARY OF SANTA ANA RIVER DRAINAGE AREA

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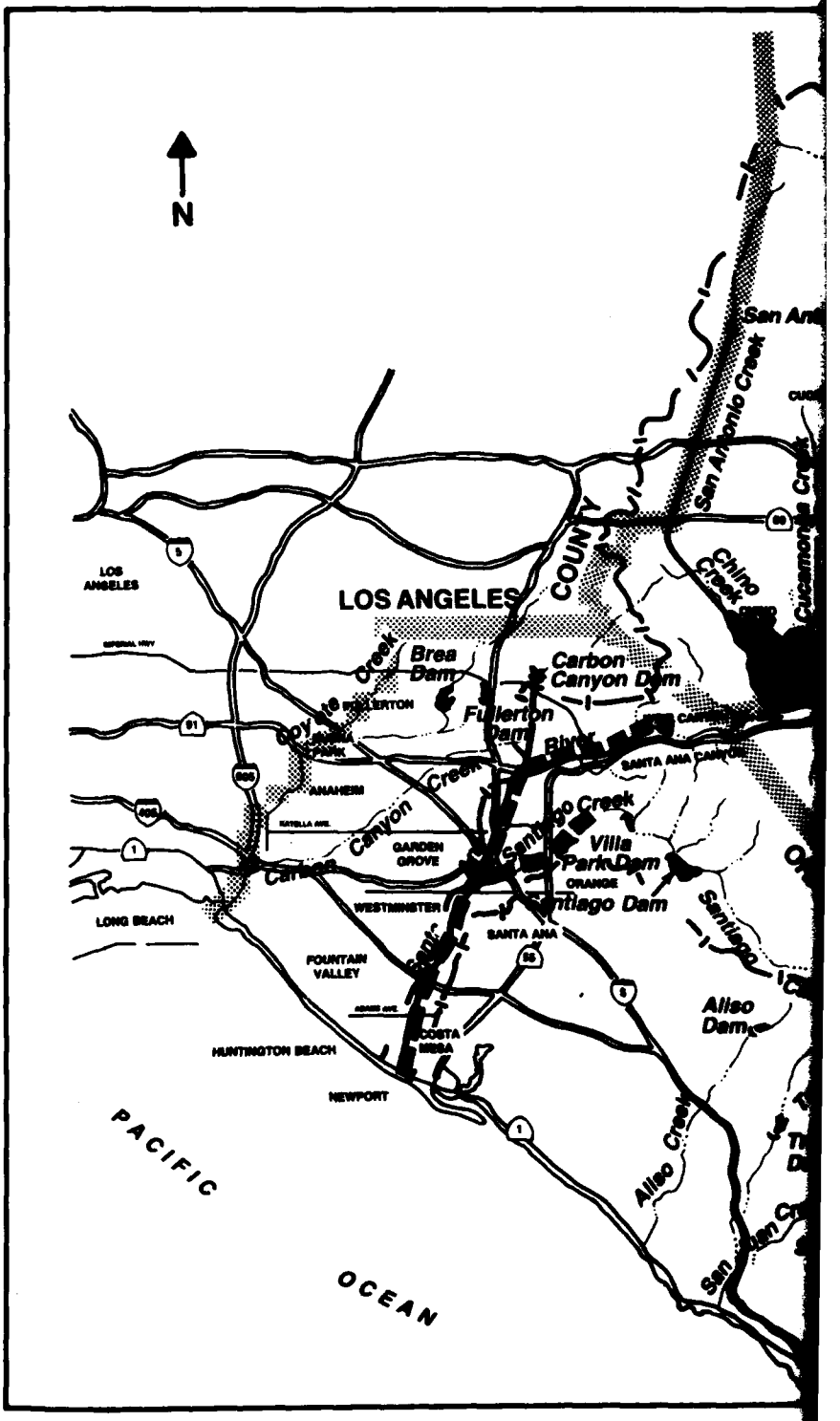
SCALE IN MILES

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
LOS ANGELES, CALIFORNIA

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
SANTA ANA RIVER BASIN
LOCATION MAP



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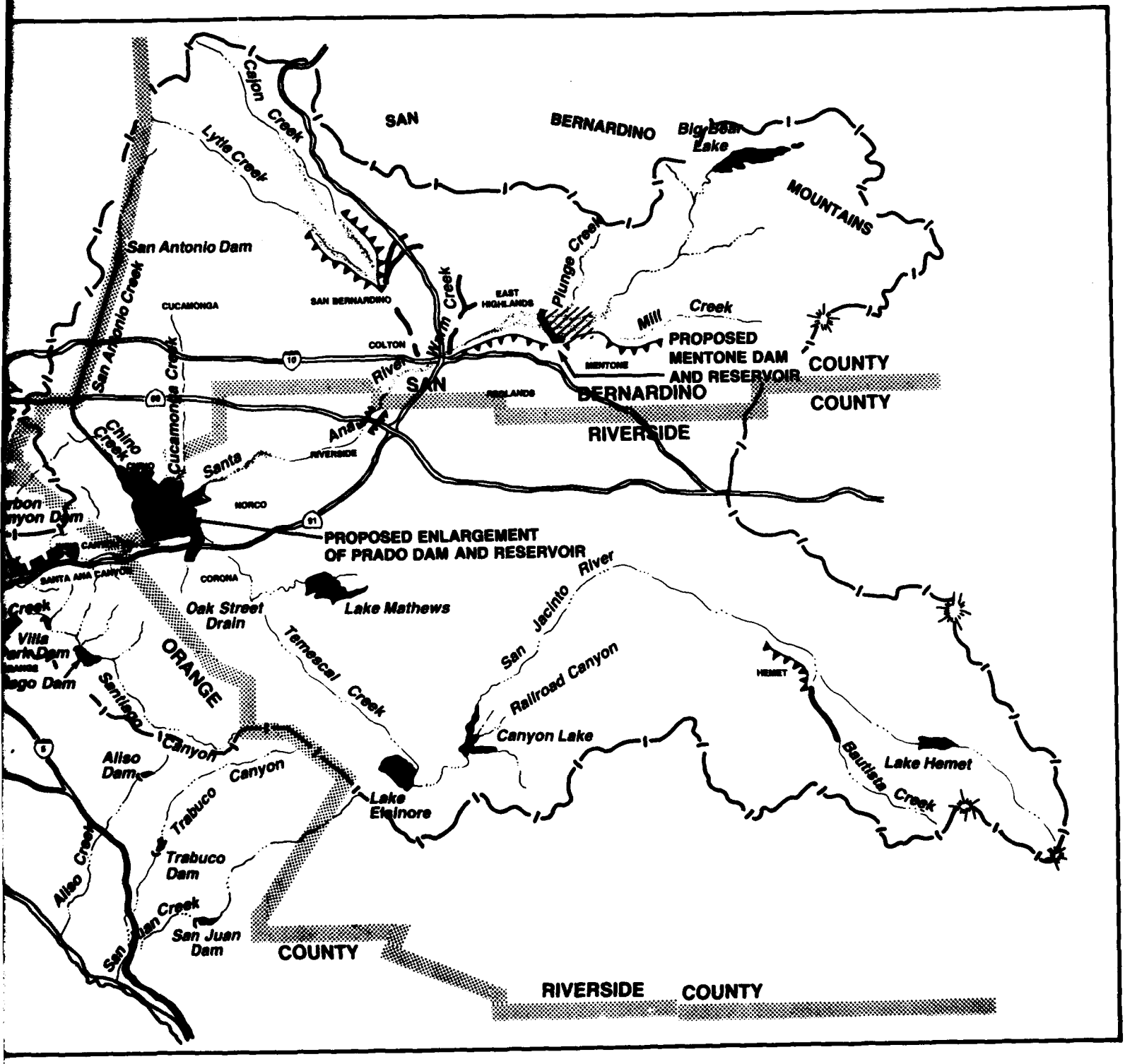
Cajon Creek
Lytle Creek
SAN
BERNARDINO
Big Bear Lake
MOUNTAINS
San Antonio Dam
San Antonio Creek
CUCAMONGA
SAN BERNARDINO
EAST HIGHLANDS
Plunge Creek
Mill Creek
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Aliso Dam
Trabuco Canyon
Lake Elsinore
Trabuco Dam
Aliso Creek
San Juan Creek
San Juan Dam
COUNTY
RIVERSIDE COUNTY

PHASE I GENERAL DESIGN MEMORANDUM

MAIN REPORT AND SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

SANTA ANA RIVER MAIN STEM

INCLUDING SANTIAGO CREEK

Counties of
Orange, Riverside, and San Bernardino,
California

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES, CALIFORNIA
SEPTEMBER 1980

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SYLLABUS

This Phase I General Design Memorandum on the Santa Ana River was authorized by Section 109 of The Water Resources Development Act of 1976 (PL 94-587). It is an analysis of major proposals for flood control along the Santa Ana River Main Stem and Santiago Creek. Studies for this type of memorandum can be as simple as a review, update, and reaffirmation of plans recommended in previous survey reports, or may involve extensive reanalysis and reformulating of original plans. The original plan recommended by the District Engineer was submitted in 1975, following an exhaustive 9-year study of the flood control and related problems in the Santa Ana River Basin.

Since that original 1975 Survey Report, there have been economic, social, and hydrological changes within the basin; the District has received numerous review comments from citizens and from local, State, and Federal agencies; and those who would be directly interested in the proposal for flood control facilities have had an opportunity to express their feelings about the 1975 plan. The findings in the 1975 Survey Report have been examined in the light of these changes, review comments, and desires of local interests.

THE 1975 SURVEY REPORT

The 1975 Survey Report was thoroughly reviewed to assess the accuracy and adequacy of problem-analysis studies and the completeness of the alternative analysis. This was done to determine if significant new scientific and technical studies would be necessary, or if the technical findings of the original study could be reaffirmed.

REVIEW COMMENTS ON THE 1975 SURVEY REPORT

The 1975 Survey Report was intensively reviewed, largely because the flood problem in the basin is immense and the solution recommended is extremely complex. In addition, the 1975 Survey Report recommendations departed substantially from the objective of National Economic Development, that is, to solve the problem in the most economically efficient manner. During this review, groups within and outside of the Corps of Engineers raised a number of important questions and issues, all of which were important to project formulation. These review comments were analyzed, first, to determine if additional study or alternative analysis would be necessary during the Phase I study and, second, as a basis for further analysis of plans for the basin.

CHANGED CONDITIONS IN THE STUDY AREA SINCE 1975

Nearly 5 years have elapsed since the Survey Report study conclusions were made. A number of changes in the study area could affect the current validity of these conclusions. Changes in local flood control measures could affect flood plain limits, perhaps significantly. New urban development within the area, particularly in the basin above Prado Dam, could affect the plan formulation. New

development below the dam would intensify the need for additional flood control measures, while new development above the dam might alter the type of measures to be taken. Changes in environmental conditions, such as changes in land use, could affect inflow estimates. Changes in environmental law or policy, identification of new environmentally sensitive regions, or discovery of endangered species habitat could alter previous conclusions and therefore, set new directions for Phase I studies.

DESIRES OF LOCAL INTERESTS

In the 5-year period since local interests first expressed support for the Survey Report recommendations, there have been numerous economic and social changes which could have altered local preferences for various plan components. Local interests were consulted to determine if this was true, and if, therefore, new analysis of plan components was necessary.

SUMMARY OF INITIAL PHASE I STUDY

The review of the Survey Report, analysis of reviewers' comments, analysis of study area changes, and analysis of current preferences of local interests indicated that, in general, the 1975 Survey Report had adequately covered the range of planning alternatives. Study area conditions were not found to have changed significantly since 1975, and local interests were still strongly in favor of the 1975 plan. The review did indicate that three of the alternatives considered in 1975 should be reexamined.

The project formulation studies for Phase I were therefore, defined narrowly and specifically to allow for efficient use of study resources. Because the Survey Report studies were generally adequate and complete, Phase I studies built on this foundation. Thus, the studies should be considered as review, update, and reaffirmation of the 1975 Survey Report, with a focus on updating previous information, redesigning elements of alternatives to be reconsidered, and working with those affected by the plan to address issues raised during the review of the 1975 plan. Because the 1975 Survey Report was found to be substantially valid for 1980, the primary emphasis of the Phase I study was on evaluating five alternatives, three of which were refinements of alternatives from the 1975 Survey Report and two of which were added to the nine alternatives considered in 1975:

1) Alternative 6 from the 1975 Survey Report, the 1975 Recommended Plan

2) Alternative 7 from the 1975 Survey Report, the National Economic Development Plan

3) Alternative 5 from the 1975 Survey Report, similar to Alternative 7 and considered because of changes in Prado Dam area property costs

4) Alternative 10, an Environmental Quality Plan developed by review of 1975 data and newly acquired data

5) Alternative 11, an All-Channel Plan for limiting improvements to Orange County.

The distinction between Alternatives 5 and 7 is technically minor, 5 calling for a 580-foot (msl) taking line and 7 calling for 582 feet. The impact of this 2-foot difference on project benefits-to-cost ratio was, however, considered worthy of investigation. The exception to this emphasis was the Santiago Creek study. For a number of reasons, the Santiago Creek study involved complete reformulation, and a new plan was developed and studied in detail.

PHASE I STUDY CONCLUSIONS: SUMMARY

The conclusion of the Phase I study is that the 1975 Survey Report Recommended Plan, with technical modifications and with reformulation of the plan for Santiago Creek alone, is the best plan for meeting the needs of the people of the Santa Ana River Basin. This plan, with modifications described later in this document, meets the critical need for flood control in the area, is supported by all three local sponsors, and provides the best balance of social, environmental, and economic benefits to the area.

Modifications to the 1975 Recommended Plan have been made in response to issues raised by local, state, and Federal interests, but the basic viability of the 1975 Recommended Plan was reaffirmed during this Phase I study. The "All-River" approach of this plan was found to provide the best combination of benefits for the area. Construction of Oak Street Drain improvements was reaffirmed to protect residents along the channel and to compensate Corona and Riverside County for social and economic impacts of the project in the Prado Reservoir area. The reformulated plan for Santiago Creek was found to be consistent with the overall plan for flood control.

The current plan for the main stem of the river includes construction of the Mentone Dam; flood plain management between Mentone Dam and Prado Reservoir; raising Prado Dam 30 feet and the acquisition line 10 feet; acquisition of the Santa Ana Canyon flood plain; channelization of the lower Santa Ana River; and acquisition, and preservation, of 92 acres of marshland at the mouth of the Santa Ana River. An integral part of the plan for Prado Dam, the Oak Street Drain plan involves construction of the channel recommended in the 1975 Survey Report from an existing debris basin to Prado Reservoir. The Santiago Creek plan involves detention storage of 100-year floodflows at existing gravel pits, with minimum downstream channelization. Facilities for recreation are included in the plans for the Santa Ana River and for Santiago Creek.

Total project cost would be $938,937,000--$918,568,000 for flood control features and $20,369,000 for recreation features. Under President Carter's water policy, the Federal cost share would be $698,862,000. The State of California share would be $46,947,000. The local share would be $193,128,000.

The Federal Government would maintain and operate both dams at an estimated annual cost of $1,230,000. Locals would maintain and operate all other flood control features and all recreation features of the project at an estimated total annual cost of $2,724,000.

RECOMMENDED PROJECT IMPACT

The project would greatly reduce the potential for flood damage along the Santa Ana River. Although most of the flood-damage reduction would occur in Orange County, constructing the Mentone Dam and applying flood-plain management techniques between Mentone Dam and Prado Reservoir would provide significant flood damage reduction in Riverside and San Bernardino Counties. Average annual flood damage reduction benefits for the entire project would be $147,626,000. The project would also provide significant recreational features throughout its length. Annual recreation benefits would be $4,735,000. The project would have a benefit to cost ratio of 2.1 to 1.

The recommended plan would also have potential for increased water conservation. The proposed enlargement of Prado Dam and Reservoir, and the construction of Mentone Dam would increase ground water recharge from detained floodflows, primarily during large floods when water would be detained for an extended period of time at Prado Dam. Quantitative studies indicate that the flood control operation of the proposed Mentone Dam would increase ground water recharge in the Santa Ana River between the new dam and Prado Reservoir, and there would continue to be incidental water conservation benefits from Prado Dam operations.

The recommended plan also provides for minimum detrimental impact on the river channel below Prado Dam, on the delicate marshlands at the mouth of the river, and on the essentially rural environment surrounding Prado Dam itself.

There would be certain unavoidable adverse environmental effects. Construction of the Mentone Dam and raising Prado Dam by 30 feet would cause relocation of up to 176 homes, 2 ranches, 27 dairies, and 13 businesses. Channel construction at the river's mouth would cause 8 acres of tidal salt marsh to be lost, but this would be mitigated by the purchase of another 8 acres of the salt marsh. Acting to comply with provisions of the Endangered Species Act of 1973 (sections 2c and 7a(1)), the Corps will acquire the remaining 84 acres of salt marsh and adjacent open land to provide habitat for two Federal endangered species and one species protected by the State of California. The Corps will restore the salt marsh in this area and preserve it to ensure viability

for these three species. This action is consistent with ER 1105-2-129, "Preservation and Enhancement of Fish and Wildlife Resources." A new tide gate would be provided to improve the condition of the marsh.

Mentone Dam construction would significantly alter the appearance of the river in the East Highlands and Mentone area, and about 1,600 acres of alluvial shrub and regionally unique juniper woodlands habitat. The dam would greatly reduce downstream flooding, though. During the 11-year construction period, large amounts of concrete, gravel, and fuel would be consumed, and there will be some noise and inconvenience. Many jobs will be created for those in the area, however. All elements of the plan are in compliance with Executive Order 11988, Flood Plain Management, and 11990, Protection of Wetlands. Plan elements are consistent with applicable State and Federal environmental laws and policies and Corps' efforts to ensure compliance with such laws and policies are described in appropriate sections of this report.

In compliance with ER 1105-3-105, 'Guidelines for Assessment of Economic, Social, and Environmental Effects,' the Recommended Plan compensates the communities surrounding Prado Reservoir and the Riverside County and the City of Corona for some of the social and economic disruption the plan may cause by providing flood protection along the Oak Street Drain. This action will help stabilize the communities in the Corona of Riverside County area, where the primary social impacts of the project will occur.

The Recommended Plan for the Santa Ana Basin meets the critical immediate need for flood protection in Orange County. It also provides protection in Riverside and San Bernardino counties. Because it involves improvements along the entire length of the Santa Ana River, no single area of the river bears the entire brunt of the project. Impacts of the project are distributed along the river, not concentrated in any one area. Those making comparisons of individual plan elements of the Recommended Plan and other alternatives may find some elements of other alternatives appealing on an individual basis, but the Recommended Plan provides the best balance of economic, environmental, social, cultural, and engineering features. Unlike the other alternatives considered, it does not favor one interest over another. The realistic compromises it involves make it the best overall plan for the entire region. The interests of upper and lower basin residents are served and flood control benefits are shared by all communities along the river.

SANTA ANA RIVER
PHASE I GENERAL DESIGN MEMORANDUM

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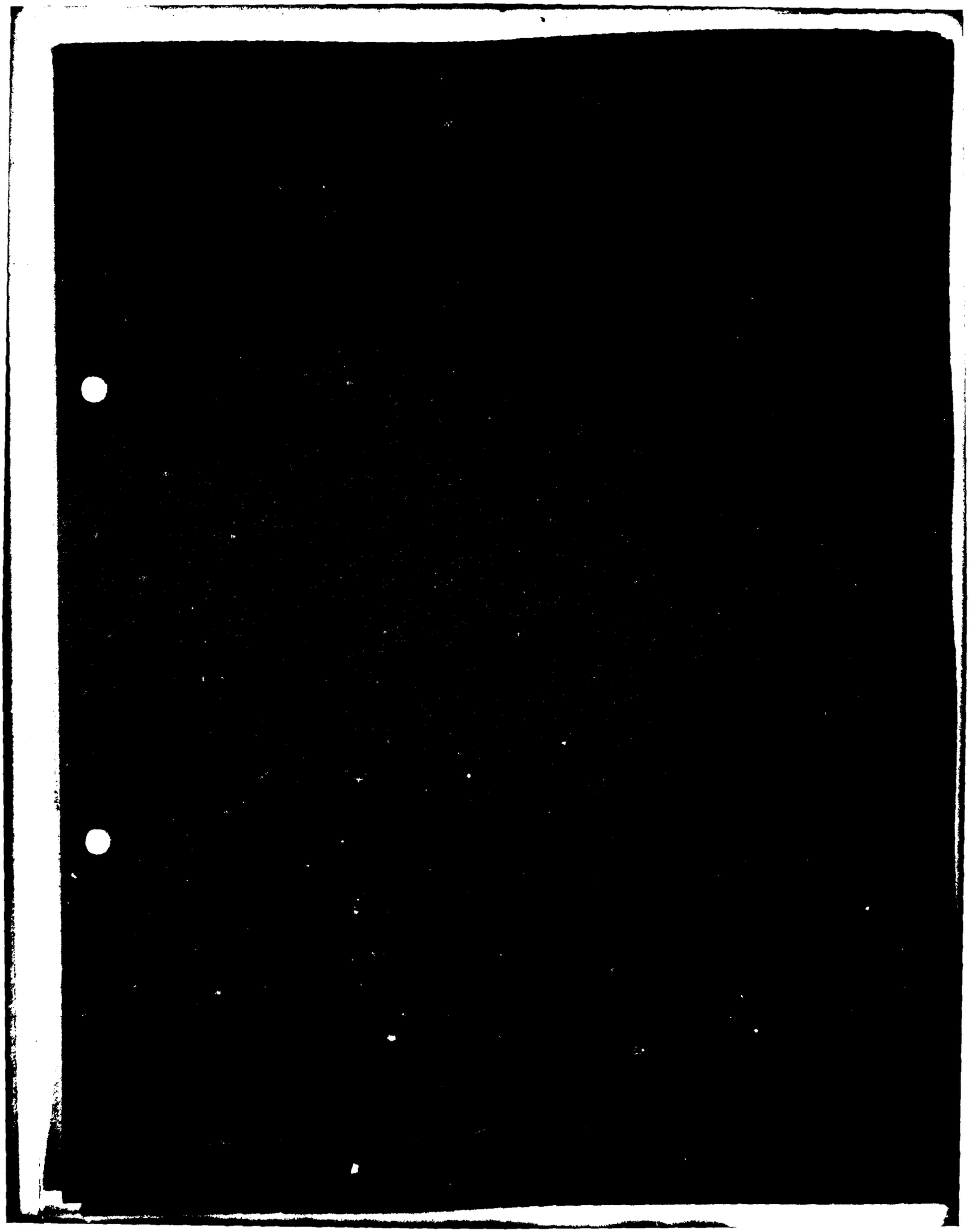


SANTA ANA RIVER PHASE I GENERAL DESIGN MEMORANDUM (GDM)

1. INTRODUCTION

BACKGROUND TO THE PHASE I GDM

A serious flood hazard exists within the rapidly developing urban area of Orange, Riverside, and San Bernardino Counties. Without further flood control improvements along the Santa Ana River, future floods could cause an estimated $9,150,000,000 in damages and would jeopardize the lives of over 1,800,000 people who live or work in the flood plain, primarily in Orange County. As urbanization of the area increases, this hazard grows.

In May of 1964, the original study of the problem along the main stem of the Santa Ana River (including study of Santiago Creek and the Oak Street Drain in the City of Corona) was authorized under a resolution by the Committee on Public Works, House of Representatives. The purpose of this study was to develop the best plan for alleviating the potentially catastrophic flood problem, as well as to investigate water conservation, recreation, and environmental quality needs. In December of 1975, this study effort culminated in the "Review Report on the Santa Ana River Main Stem" (hereafter the 1975 Survey Report). This report contains a thorough analysis of the flood control problem along the river, an analysis of nine alternative solutions to the problem, a recommended plan for the river main stem and several tributaries, and extensive analysis of all factors affecting the development of flood control facilities in the area.

The study for the 1975 Survey Report included a 5-year public involvement program. Citizens contributed to the plan at over 25 public workshops and meetings, there was extensive coordination with local, State, and Federal agencies, as well as public interest groups. The State of California Department of Water Resources formed an advisory committee of representatives from local organizations and the public in the three affected counties to assess environmental impact of alternative plans and assist in plan development. Over 60 plans, offering various degrees of protection and various control measures, were analyzed before nine plans were selected for detailed study.

The Recommended Plan, the sixth of the nine alternatives studied in detail, had full support from all counties and affected cities in the Santa Ana River Basin. It provided for Standard Project Flood (SPF)* protection, and consisted of nine basic elements: (1) constructing Mentone Dam on the Santa Ana River about 35 miles upstream from Prado

* Standard Project Flood (SPF) is defined as an estimated or hypothetical flood that might result from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical region involved, excluding extraordinarily rare combinations.

Dam, near East Highland and Mentone, and enlargement of the Mill Creek Levee; (2) managing the standard project flood (SPF) overflow on the Santa Ana River between Mentone damsite and Prado Reservoir; (3) raising Prado Dam 30 feet, enlarging the reservoir by acquiring properties to elevation 566 feet, 10 feet above the existing taking line, and modifying the spillway and outlet works; (4) providing, as a part of the plan for Prado, 2.4 miles of channel improvements along Oak Street Drain extending from the Santa Fe Railroad bridge upstream to Ontario Avenue in the City of Corona; (5) acquiring 1,500 acres within the Santa Ana Canyon flood plain for safe conveyance of flood control releases from Prado Dam and for open space; (6) providing channel improvements to about 23 miles of the Santa Ana River downstream of the existing Prado Dam to the Pacific Ocean; (7) acquiring and restoring 92 acres of salt-marsh for mitigation and preservation of wildlife habitat for an endangered wildlife species; (8) providing 2.1 miles of concrete rectangular channel on Santiago Creek from its confluence with the Santa Ana River to the Garden Grove Freeway and bank protection at selected locations from this point upstream to Prospect Avenue; and, (9) developing a system of recreational facilities extending from Mentone damsite to the Pacific Ocean.

PHASE I GDM AUTHORITY AND STUDY SCOPE

The 1975 Survey Report was reviewed extensively by interested parties. Following this review, it was submitted through channels to Congress in September 1978. In the meantime, in 1976, Congress passed a Water Resource Development Act, Section 109 of which authorized the Secretary of the Army, acting through the Chief of Engineers, to conduct Phase I General Design Memorandum studies of the Santa Ana River Project. Results of these studies were to be submitted to Congress as a basis for construction appropriations.

The area of the river basin to be studied was the main stem of the Santa Ana River from the base of the San Bernardino Mountains to its mouth about 66 miles away at the Pacific Ocean and two tributaries to the river, the lower portion of Santiago Creek and the Oak Street Drain. Larger areas were addressed when required for making population projections, for evaluating economic data, and for analyzing water resource needs.

The Phase I study had two stages, the first to determine if the 1975 Survey Report should be reaffirmed or if it should be reevaluated and plans reformulated due to changing conditions or new knowledge of the area. In this first stage, four factors were studied:

1. The adequacy of the 1975 Survey Report

2. The issues raised by those who had reviewed the 1975 Survey Report

3. Changes in social, economic, and environmental conditions since 1975 and their potential impact on the 1975 Recommended Plan

4. The desires of local interests.

On the basis of this initial study, the 1975 Survey Report was found to be sufficient in detail to serve as a foundation for evaluating the functionality, economic justification, and social and environmental acceptability of an array of detailed flood control plans for the defined area. Analysis of the other three factors supported this conclusion. As a result, it was determined that the Phase I study would be more comprehensive than a simple reaffirmation study, but less comprehensive than a study involving complete reformulation of the 1975 plan. Specificially, the second stage study of the main stem of the river would be focused on a review and refinement of a selected number of alternatives for main stem flood control. The studies of the Oak Street Drain would also be limited to review and refinement and this project element would continue to be linked closely to other work proposed for Prado Reservoir. For Santiago Creek, however, complete reformulation studies would be required, as conditions had changed significantly since the 1975 Survey Report.

The Phase I study did not duplicate work performed for the 1975 Survey Report. Rather, it was built on the foundation provided by this report. Its focus was on resolving those issues raised by reviewers of the 1975 report, and on determining whether the 1975 Recommended Plan was, and still is, the best approach to flood control in the study area. This Phase I GDM contains the reevaluation of the 1975 Recommended Plan in the light of changed conditions and changed evaluative criteria.

PUBLIC PARTICIPATION IN THE PHASE I STUDY PROCESS

Because the Phase I study focused on review and refinement of selected alternatives for the main stem of the river, public involvement and coordination efforts were tailored to address specific issues which required resolution in order to evaluate alternatives. For the main stem of the Santa Ana River, the emphasis was on issues raised during review of the 1975 Survey Report. A series of informal workshops was held, focusing on questions about development of the Santa Ana River mouth and on alternative plans for Prado Reservoir.

Throughout the study period, concerned local, State and Federal agencies provided input, and members of the study group were available for workshops on other issues, if public interest seemed to demand them. For Santiago Creek, which required formulation of an entirely new plan, a citizens' advisory group was established to help develop and review plans. The public involvement in all phases of the project is described in Appendix A.

Photo 1: Discussion group at a Santiago Creek public workshop.

SCOPE OF THE STUDY REPORT

Following the main report, there are 10 appendixes. The main report covers the two project areas, each handled differently because study scope varied from area to area. All areas are then covered in a Final Supplemental Environmental Impact Assessment Statement (FSEIS), which follows the District Engineer's Recommendations and forms part of the main report.

In the main report, two study areas are handled differently, because each required a different kind of study. The emphasis of the main stem Santa Ana River portion is on review of issues raised during the years after the 1975 Survey Report and on evaluation of alternative plans for meeting the needs established in the 1975 report. The portion dealing with the Santiago Creek study describes reformulation efforts.

To make them easily referenceable, the appendixes are briefly described here:

Appendix A Public Views and Responses: The first part describes public involvement in the study and how public concerns were incorporated into the plan. The second part contains copies of pertinent correspondence from the public and from other agencies, and responses to this correspondence.

Appendix B (Hydrology): Flood history and hydrologic characteristics of the Santa Ana River Basin are covered here.

Appendix C (Hydraulics): Overflow analysis and design work involving channel capacity, dam spillways, drop structures, and other structures is included in this section.

Appendix D (Geology and Soils): Results of geologic and soils studies are covered here.

Appendix E (Real Estate): Right-of-way and acquisition costs for all detailed plans are included in this section.

Appendix F (Design and Cost Estimates): Engineering details for design and cost estimates are presented here.

Appendix G (Recreation): Recreational opportunities inherent in all detailed plans are identified in this section.

Appendix H (Social Impact Analysis): The existing social environment in the Santa Ana River Basin is described and the beneficial and adverse impacts of detailed plans are analyzed.

Appendix I (Environmental): Technical reports and other background material used in preparing the Final Supplemental Environmental Impact Statement, an inventory and assessment of project impacts on significant environmental issues, are included.

Appendix J (Economics): Economic data is presented here, along with a description of procedures used in economic evaluation of alternative plans.

SUMMARY OF THE STUDY PROCESS

Study steps are summarized so that the different emphasis of each portion of the study will be clear.

The Santa Ana River Main Stem Project, Including the Oak Street Drain

This portion of the study began with a review of the 1975 Survey Report recommendations. Physical conditions of the study area were then reevaluated. Issues raised during review of the 1975 Survey Report were

addressed, along with the desires of local interests. On the basis of this, five primary alternatives for this project area were assessed and evaluated, including the Recommended Plan from the 1975 Survey Report. When it was determined that the 1975 Recommended Plan was, with refinements, still the best plan for the area, the detailed design features and cost estimates were reevaluated, along with detailed impacts and division of plan responsibility of the recommended plan. The plan implementation sequence was then developed and described.

Work on the Oak Street Drain portion of the study began with a reevaluation of the engineering and economic feasibility of the recommended plan in the light of changed conditions. Initial study revealed that conditions in the study area had changed somewhat since 1975. Specifically, Riverside County had constructed a debris basin somewhat smaller and in a different location than in the 1975 Recommended Plan. From an engineering standpoint, the remaining elements of the 1975 plan were feasible and the project's relationship to the plan for the main stem project was found to make it justifiable. The plan for the Oak Street Drain was then refined in the light of the changes that had occurred in the project area since 1975.

Strong local support for including the Oak Street Drain improvements in the project was re-studied. The basis for this support was examined in terms of the economic and social impact of the Prado Reservoir portion of the plan on the communities surrounding Prado. This analysis identified the scope of the social and economic impact of the project on these communities and played a significant part in the decision involving the Oak Street Drain.

The Santiago Creek Project

The plan for this area was completely reformulated. Following the 1975 Survey Report, Orange County conducted an extensive study of Santiago Creek and, after evaluation of a number of alternatives, determined that local needs could best be met with a plan other than that recommended in the 1975 Survey Report. Elements of the County plan, however, were opposed by some interested parties. The Phase I study of Santiago Creek began with a review of this and the 1975 Survey Report recommendations. An intensive public involvement effort helped to identify strengths and weaknesses in both plans and resulted in a single plan which best serves the needs of the area.

RELATED STUDIES

At all times, the Phase I study was coordinated closely with other work done in the Santa Ana River Basin. The authority to review the Santa Ana River Basin and all of Orange County stems from two separate projects in accordance with the Congressional authorizations. The first of these projects is referred to as "the Santa Ana River Basin and Orange County Project" comprising five completed dams (Brea, Carbon Canyon and related channel improvements, Fullerton, Prado, and San Antonio), two completed channel improvements (Lytle and Cajon Creeks and

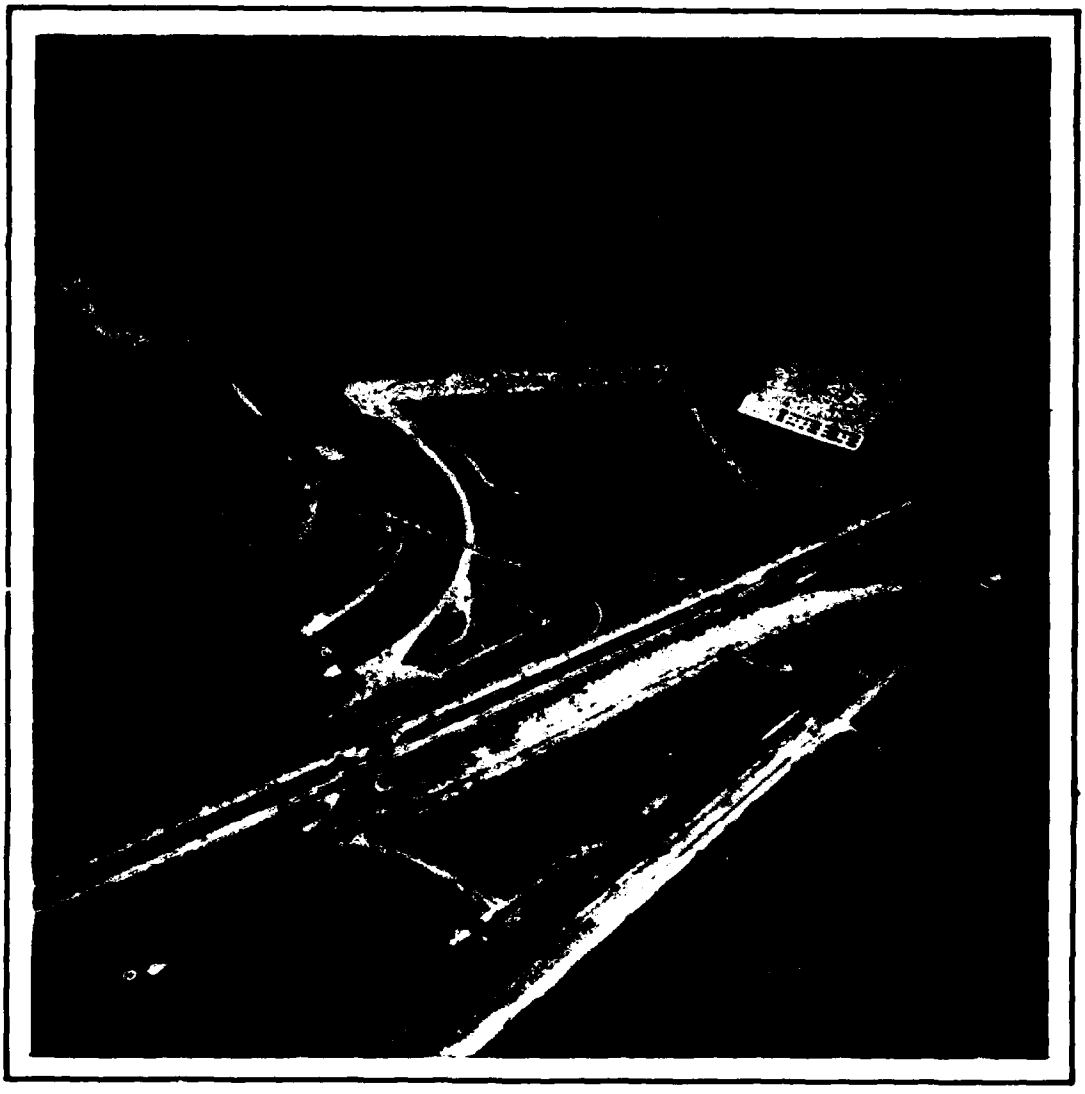


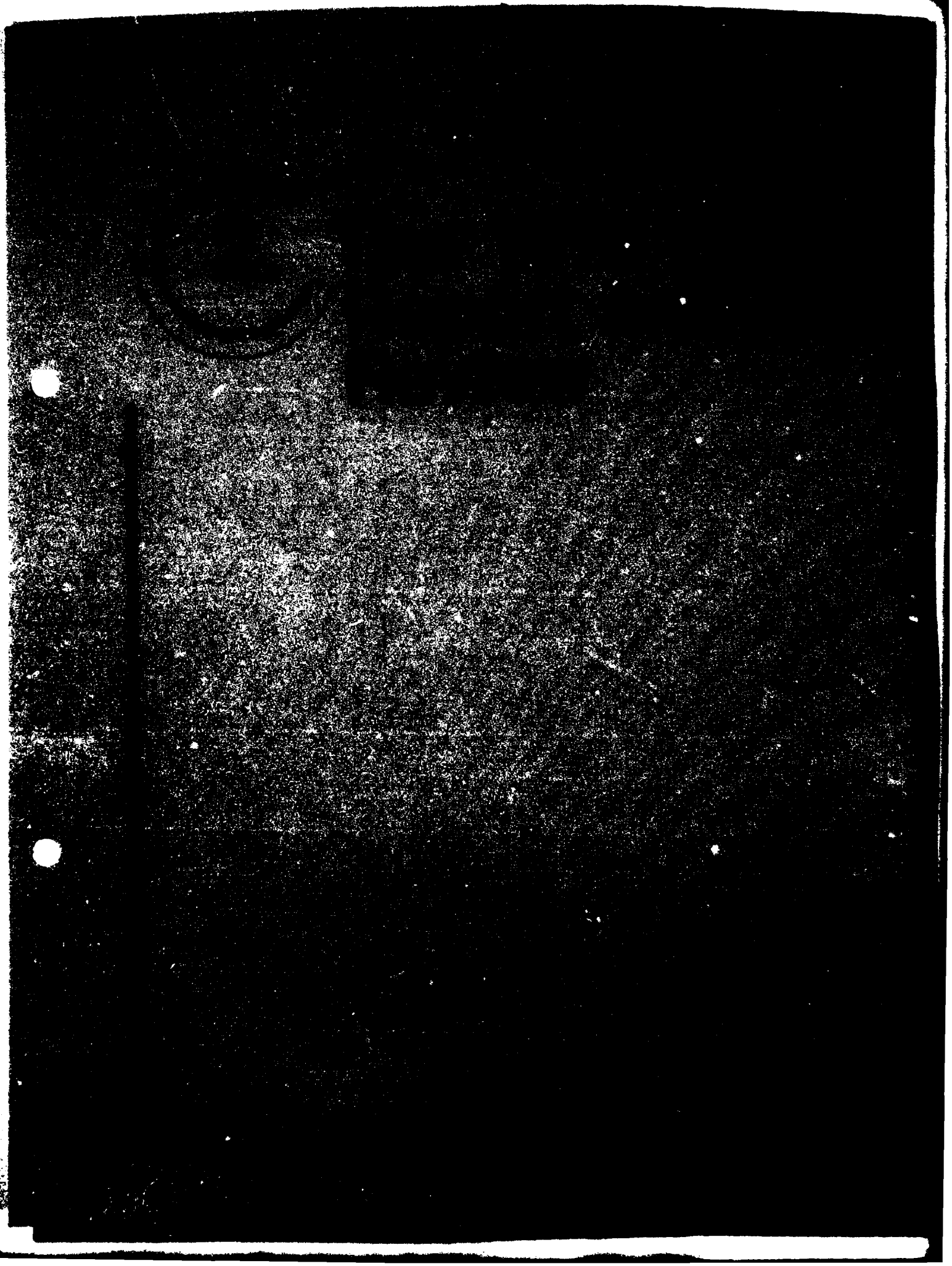
Photo 2: Prado Dam and spillway

San Antonio and Chino Creeks), and four dams in an inactive status (Aliso Creek, San Juan, Trabuco, and Villa Park). The second project is referred to as "the Santa Ana River Basin Project" comprising the following completed units: Devil, East Twin, and Warm Creeks channel

improvements and Lytle Creek levee, Mill Creek levees in San Bernardino County; Riverside levees on the Santa Ana River; and San Jacinto River levee and Bautista Creek channel in Riverside County. Since the 1975 Survey Report, construction of the Lytle and Warm Creeks levees in San Bernardino County has been completed. These projects were authorized by the Flood Control Acts of 1936, 1938, 1941, 1944, 1950, 1958, and 1965. The Cucamonga Creek Flood Control Project, authorized in 1968, is currently under construction with completion scheduled for 1983.

Included in the Santa Ana River Basin authority is a review investigation for the Santa Ana River and its tributaries in Orange, Riverside, and San Bernardino Counties, California. This review investigation is being accomplished through three interim reports and a final report. The 1975 Survey Report and this Phase I report are the first interim covering the main stem of the Santa Ana River, Oak Street Drain, and Santiago Creek. The second interim study is also underway and covers San Timoteo, Temescal, Mission, Zanja, and Wilson Creeks. Studies reveal that standard project flood level of protection for these creeks is not justified. Current studies are investigating lesser levels of protection and nonstructural measures. The third interim report covers Brea, Fullerton, Carbon Creek, San Diego Creek, and tributaries. The final report will cover all remaining areas within the Santa Ana River Basin as well as other coastal streams in Orange County.

Under the Dam Safety Assurance Program, a study is being conducted to modify Prado Dam so that it can safely pass a maximum probable flood without overtopping the dam. Construction is scheduled for 1984 and will require 2 years. This proposed modification will not provide any additional flood protection. For planning purposes, this report will consider this modification completed.



2. THE 1975 SURVEY REPORT AND ITS REVIEW

Due to the size and scope of the Santa Ana River project, the 1975 Survey Report was exhaustively reviewed. Some elements of the report were controversial, and a thorough review of the issues raised by those commenting on the report was necessary before detailed analysis of the project area was appropriate.

The report and comments on it are both summarized briefly in this section to provide a reference point for the detailed analysis of the geographic, climatologic, hydrologic, sociologic, historical, and economic aspects of the three-county area affected by the flood problem.

THE 1975 SURVEY REPORT

This report culminated a 9-year study effort to develop the best plan to alleviate the flood problem along the Santa Ana River, generally regarded as one of the greatest potential flood threats in the United States. The Recommended Plan, Alternative 6 in the report, was an "All-River Plan" which called for improvements along the entire length of the main stem of the river, including construction of a dam above the present flood control reservoir at Prado Dam. The proposed improvements would prevent a standard project flood and in doing so would prevent an estimated $9,150,000,000 in damages. Selected as the most feasible and most acceptable to a broad spectrum of those living in the locality, the plan was supported by resolutions passed by Orange, Riverside, and San Bernardino counties. Primarily intended for flood control, the proposed improvements also included recreation, water conservation, and protection and enhancement of the environment as secondary purposes. Key elements of the plan are summarized below. All costs below are in 1975 dollars. All other data in these descriptions is also 1975 data. Some conditions, such as the number of homes in an improvement area, have changed between 1975 and 1980. The figures here are not necessarily consistent with figures used in reevaluating alternatives for the current phase of the project.

Mentone Dam

The design of this new upstream reservoir called for a horseshoe-shaped earthfill dam across the Santa Ana River below its confluences with Mill Creek and Plunge Creek near the towns of Mentone and East Highlands. The top of the dam would be 1,560 feet above mean sea level. At its middle portion, the 3.6 mile-long crest would be 230 feet above the riverbed. At this point, the dam would have a top thickness of 70 feet and a base width of 2,700 feet. The existing Mill Creek levee would be improved and extended further upstream along Mill Creek. This levee improvement would have a height ranging up to 25 feet and a total length of 4 miles. A spillway at the south end of the dam would have a crest elevation of 1,535 feet above sea level. The reservoir created by the dam, spillway and levee would encompass 1,820 acres and have a net storage capacity of 181,000 acre feet.

The total area required for the dam outlet works and reservoir would be 3,400 acres. The reservoir pool level would rise to a maximum elevation of 1,552 feet in the event of an extremely large, spillway-design flood. Impounded floodwaters would be retained for only short periods of time to prevent saturation of the dam's foundation.

Construction of the dam would displace 29 homes and require relocation of one railroad line and one local road. The large volume of earthfill construction material and spillway concrete would account for most of the 1975 estimated $337 million cost of the dam, reservoir and contiguous levee improvements. This upstream reservoir would allow a 14-foot reduction in the maximum water level at Prado Reservoir during standard project flood conditions.

Approximately 300 acres of the 3,400-acre Mentone Reservoir would be developed as a regional park offering water-oriented and dry-land recreation. This park would include a series of three interconnecting lakes, with a total water surface of 50 acres, for swimming, fishing, and non-power boating. Support facilities would include a nature study center, picnic, camping and playfield areas, and a scenic drive atop the dam. Remaining acreage in the reservoir (including the citrus groves in the northern portion) would be retained as natural areas and a buffer zone. Several small pools or guzzlers would be permanent sources of water for wildlife. Mentone Dam and Reservoir would provide incidental water conservation by the short-term retention of floodflows.

Mentone-to-Prado Reach

Since the existing floodways, levees, and natural channelization along this 35-mile reach were capable of handling the maximum release of 6,000 cubic feet per second (cfs) from Mentone Dam plus the downstream tributary inflow, no construction improvements were considered necessary along this reach of the project. A recreational corridor (17 miles of bicycle and hiking trail, between Mentone Dam and Riverside County line) and flood-plain management were recommended for this reach.

Prado Reservoir

The plan included enlarging the existing reservoir by raising Prado Dam from elevation of 566 feet to 596 feet above sea level. From the elevation of 543 feet, the spillway would be modified and raised to 563 feet above mean sea level. The reservoir's real estate limit would be raised from 556 feet to 566 feet. The reservoir would thus be expanded by 1,670 acres to 11,411 acres, with an increase in gross flood storage capacity to 363,000 acre-feet at spillway crest elevation 563 feet. The reservoir was designed for maximum controlled release of 30,000 cubic feet per second. Retention time of floodwaters impounded above the debris pool elevation would be 3 weeks or less. When flood forecasts are favorable, water would be stored below the debris pool elevation for slow release to downstream spreading grounds for ground water recharge.

Expanding the reservoir would have displaced 23 homes, 6 dairies, and 2 businesses. In addition, property owners of another 102 homes, 19 dairies, and 5 businesses would have the option of relocating, flood proofing, flowage easements, or "life estates" instead of outright acquisition and removal. The cost for structural features, reservoir properties, and relocations was estimated at $148 million (1975 prices). With recreation, the total cost reached $159 million (1975 prices).

The recreational plan tied existing and proposed recreational facilities together, through interconnecting recreation trails, two lakes and riparian areas. Additional facilities included campgrounds (for tents, trailers, groups, and primitive use), day-use area, picnic areas, various trails and lakes for fishing and non-power boating. Approximately 1,000 acres of the additional 1,670 acres necessary for expansion of Prado Reservoir would be required for this park unification. Remaining acreage would be leased for agriculture or used as open-space buffer zones.

Within Prado Reservoir, the riparian habitats of the Santa Ana River, Cucamonga Creek, and Chino Creek would be retained as wildlife preserves and as buffer zones between different areas of recreational development. Duck ponds, ranging in size from 1 to 5 acres, would be provided adjacent to Cucamonga Creek. These ponds and other lakes would stimulate wildfowl populations and would serve as a stopover for migratory birds. Prado Dam and Reservoir would also maintain a throughflow of surface water and ground water and would provide incidental water conservation.

Santa Ana Canyon

Because of the natural and recreational amenities that exist in Santa Ana Canyon, the Recommended Plan called for a "natural" channel. The 9-mile reach in the canyon was to be kept essentially as it is, except that revetment would be provided where necessary to protect the Riverside Freeway, railroad, bridges, and major utilities. The riverbed itself thus would continue to function as a natural channel for waters released from Prado Reservoir. The 1,760-acre floodway through this canyon would be acquired in public ownership. The existing Featherly Regional Park and Green River Golf Course would be subject to inundation when controlled releases were made from Prado Reservoir. Recreational trails would be provided, but they would be situated out of environmentally sensitive areas. Acquisition of this area in the Santa Ana Canyon was considered of major importance to the Recommended Plan for several reasons. First, all of the land to be acquiried would be flooded by release from Prado Dam during a Standard Project Flood even after all other improvements had been made. Acquisition of the area would ensure that no changes would take place in the flood plain that might affect other, downstream, elements of the riverbed. Second, and perhaps more importantly, the Santa Ana Canyon is one of the few remaining open space habitats in the area. The canyon has considerable

value as a wildlife corridor, and maintaining it is considered an important part of efforts to achieve an overall environmental balance in the Santa Ana River project.

Oak Street Drain

Planned flood control improvements for Oak Street Drain consisted of two major elements: the main channel and the collection channel. The main channel was to be a rectangular concrete channel about 2.4 miles long extending from north of the AT&SF railroad upstream to a debris basin to be constructed south of Ontario Avenue, downstream. The main channel, about 24 feet wide and 13 feet deep, was to be designed for standard project flood capacity.

The collection system included several improvements. A rectangular concrete channel approximately 10 feet deep and 20 feet wide was planned from Lincoln Avenue to the Oak Street Drain to collect and divert water coming down Lincoln Avenue and the small channel next to it. The lower portion of the existing Mangular channel just above its confluence with the Oak Street Drain was to be rebuilt to provide a smooth transition into the main channel. A debris retention basin about 25 feet deep and with a capacity of 320 acre-feet was to be constructed south of Ontario Avenue. The Oak Street Drain plan did not include recreation.

LOWER RIVER. From Weir Canyon Road (at the lower end of Santa Ana Canyon) to Katella Avenue, the recommended plan called for 10 miles of earth-bottom channel with drop structures and revetted side slopes, very similar to the present channel. From Katella Avenue to 17th Street, the plan would consist of 3 miles of earth-bottom channel with retaining walls around the perimeter of Riverview Golf Course. From 17th Street to 1/4 mile below the Hamilton Avenue-Victoria Street bridge, the plan called for 8-1/2 miles of concrete rectangular channel between 250 and 365 feet wide, ranging from 17 to 23 feet deep, with a right-of-way width of about 400 feet. From the Hamilton Avenue-Victoria Street bridge to the ocean, 1-1/2 miles of earth-bottom channel with vertical concrete walls and with bottom width ranging from 365 to 450 feet and total depth of 21 to 23 feet were planned.

The features described above would not displace any homes, but many utility crossings and 19 bridges would have to be rebuilt to accommodate the enlarged channel. The total cost for this portion of the proposed project was estimated at $222 million, including recreation costs.

The recreational plan for the lower Santa Ana River would provide a recreational corridor with various facilities, extending from Prado Dam to the ocean. A major feature of the lower Santa Ana River plan was the joining of existing and proposed county and city parks with various trails and greenbelts. Trail entrances would serve as focal points of the trail system and also be points of information, providing directional signs for various recreational areas and maps of the complete trail system.

Marsh Acquisition

At the river's mouth (east of the river and north of Pacific Coast Highway) about 8 of the remaining approximately 100 acres of a once-vast salt marsh area would have to be taken for an enlarged flood control channel. The 8 acres required for flood control were fish and wildlife habitats including wetlands, filled wetlands, and tidal channel. The remaining 92 acres had remnant tidal channels and expanses of salt marsh vegetation. The salt marsh provided habitat for three endangered species of birds. As the indirect effects of the recommended plan would accelerate loss of habitat in the salt marsh, it was deemed essential to acquire the remaining salt marsh in public ownership, and to provide an adequate tidal opening in the Greenville-Banning channel levee to improve tidal flushing of the wetland area. The Recommended Plan provided for acquisition of 8 of the remaining 92 acres as mitigation for 8 acres of channel rights-of-way acquisition and acquisition of the remaining 84 acres for preservation of endangered species in response to the mandate of the Endangered Species Act.

Santiago Creek

Flood control measures for the area would involve intermittent channel revetment upstream and a concrete rectangular section from about 200 feet above the Garden Grove Freeway downstream to the confluence of Santiago Creek and the Santa Ana River (about 2.1 miles). Approximately 1.5 miles of the concrete channel was to be located in a highly urbanized area with extremely limited rights-of-way available for flood control and recreation.

The recommended recreational development consisted of a bicycle-hiking trail within the channel invert from the confluence of the Santa Ana River to Santiago Park. The bicycle-hiking trail was then to be continued along to Grand Avenue and Hart City Park. Environmental treatment consisted of landscaping with native trees and vegetation.

The total project first cost for all elements of the plan was estimated at $741 million ($656 million Federal and $85 million non-Federal). Amortized over the life of the project, cost was estimated to be $54.0 million annually, including operation-maintenance costs. The average annual flood damage prevented was estimated at $71.9 million. Other benefits included $3.6 million for recreation, $ 1.1 million for elimination of future flood-proofing costs and land enhancement, and $ 2.0 million for incidental quantifiable benefits. Additional but non-quantified benefits included water conservation, preservation of natural vegetation and wildlife, advance replacement (modernization) of bridges, and elimination of maintenance costs for existing flood control facilities. Total project operation and maintenance were estimated at $2.0 million per year. Using these figures, the benefits-to-costs ratio was estimated at 1.5 to 1 ($78.6 million to $54 million).

SURVEY REPORT REVIEW COMMENTS

The 1975 Survey Report was exhaustively reviewed. The Board of Engineers for Rivers and Harbors, a review organization within the Corps of Engineers (hereafter BERH), conducted a thorough review and raised a number of questions. The plan was also extensively reviewed by other local, State, and Federal agencies, and by the general public. Analysis of these issues was an important part of the Phase I study, and contributed to decisions about the scope and direction of the subsequent work. Roughly speaking, there were four categories of review comments: (1) comments about limiting cost sharing to the NED Plan, (2) comments about the need to reconsider several alternative plans to the Recommended Plan, (3) comments about considering the President's Water Policy, and (4) suggestions for changes in specific plan elements or addition of specific plan elements. These review comments are summarized briefly here, to provide a backdrop for the more detailed Problem Identification Chapter which follows.

Limiting Cost Sharing to the NED

The 1975 Survey Report recommended the Federal Government assume a cost share $206.4 million more than that it would assume if the National Economic Development Plan were recommended. In their 1976 report, BERH questioned the advisability of taking this action, even while recognizing that the Recommended Plan provided for fewer adverse social impacts. The Recommended Plan differed from the NED Plan in that it involved construction of the Mentone Dam and Reservoir and raising Prado Dam only 30 feet; under the NED, Prado Dam would have been raised 45 feet. The BERH commented that the Recommended Plan provided somewhat less flood protection to the principle damage reach, fewer national benefits, and that Mentone Dam committed more natural and scenic resources and was not incrementally justified. The Board did recognize the lessened social impact of the Recommended Plan and the expressed preference of local sponsors for this plan. Nevertheless, the Board concluded that these factors did not justify the additional Federal cost, and recommended that the NED Plan be implemented instead. Optionally, if locals continued to prefer the All-River Plan, the Board suggested it would be more appropriate for local interests to assume the additional costs of that plan and that the Federal cost share be limited to the Federal share under the NED Plan.

The Need to Reconsider Alternative Plans

In their 1976 report, the Board recognized that obtaining agreement between upstream and downstream interests over payment of the greater costs for the 1975 Survey Report Recommended Plan may be an unresolvable issue. If the Federal Government did not agree to assume the additional expenses, the Board believed strong institutional concerns would delay implementation of the plan. The Board suggested that additional alternatives should be developed and reviewed, particularly those plans which would negate the institutional concerns. A plan which would

confine all improvements to Orange County was specifically mentioned as well as plans which would provide local protection to the upstream reaches.

Considering the President's Water Policy

The Office of Management and Budget, in a letter dated 27 July 1978, requested modification to the project during Phase I planning to reflect the President's recent water policy. This policy requires a redistribution of cost between Federal and non-Federal agencies. Under this policy, local sponsors would pay 20 percent of the project costs allocated to flood control. States would pay 5 percent of the total project cost. Since previous policy required local sponsors of the Santa Ana River project to pay only about 12 percent of the total cost and the State was not required to share in project costs, this change will put a greater burden on the project's non-Federal sponsors.

The President's water policy also includes Executive Order 11988, Flood Plain Management. This order requires that all projects avoid, to the extent possible, adverse impacts associated with flood plain occupancy and modification and support of prudent flood plain management wherever there is a practical alternative. The Office of Management and Budget, therefore, requested that Phase I planning modify the project to include any changes necessary to insure that it is in conformity with Executive Order 11988. The Department of the Interior in a letter dated 7 July 1977 also urged that maximum emphasis be placed on nonstructural measures and that development of adequate flood plain management plans by included counties should, if possible, be required prior to the completion of final project design.

These suggestions that new guidelines be applied to analysis of alternatives, played a major role in Phase I study design. A number of comments about specific plan elements were also considered.

Comments on Specific Plan Elements

The BERH contributed several important comments about specific plan elements, and a number of other agencies made specific suggestions or requests.

MARSH ACQUISITION. The Board did not believe that acquiring 84 acres of salt marsh near the Santa Ana River mouth for critical habitat under the Endangered Species Act of 1973 would be justified on the basis of project impacts. The project would affect only 8 acres, which included only one-half acre of significant wetland. The Board also indicated that if the area was really "critical" habitat, then its protection was the responsibility of other agencies, especially the Department of the Interior, State of California, and local jurisdictions. The Board, however, did not object to the acquisition of the 8-acre area for mitigation for loss of habitat area due to channel construction.

Contrary to the Board's recommendation, the U.S. Fish and Wildlife Service, the Environmental Protection Agency, the State of California, and local citizen and conservation groups commented in support of the acquisition of marshland. The Board recognized this support for marsh acquisition, but felt Corps acquisition required a more compelling justification than had been presented.

PRESERVATION OF THE LEAST TERN COLONY. The proposed widening of the Santa Ana River would require realinement of the Huntington Beach-Talbert channel, a local storm drain channel. This in turn would displace a portion of a least tern nesting colony at the river mouth. The California least tern is a Federally protected endangered species. The Board, therefore, requested that Phase I studies investigate adequate means and measures for preserving this existing nesting colony.

POTENTIAL SOURCE OF BEACH REPLENISHMENT. In a letter dated 11 May 1977, the State of California recommended that since the present source of beach nourishment between Newport and Anaheim Bay is nearly exhausted, a major portion of the 13 million cubic yards of sediment to be excavated for channel improvements should be designated for beach replenishment in this area. They also requested that flood control plans include a schedule and means for placing the material on the beaches.

DEFINITION AND ACQUISITION OF AN ADEQUATE FLOODWAY BETWEEN MENTONE DAMSITE AND PRADO RESERVOIR. The Board requested that through hydrologic and hydraulic analyses the Phase I study more precisely define the extent of real estate interest necessary to accommodate local inflow and expected releases from Mentone Dam. They also questioned why the Recommended Plan did not include acquiring the real estate interest between the two reservoirs, since operating Mentone Dam would depend upon sufficient channel capacity to accommodate releases and local inflow.

RECREATION PLAN CONCERNS. Concern over the recommended recreation plan was expressed by several agencies. The Board had several reservations abut the recommended recreation plan. Since the proposed recreational lakes at Prado and Mentone and the court games at Mentone were not incrementally justified, the Board recommended deleting these features. In light of new recreation cost-sharing policies implemented subsequent to the 1975 Survey Report, the Board also recommended deletion of recreation facilities outside of flood control rights-of-way. Recreation features outside of project right-of-way included recreational trails between Mentone and Prado and some trail rest stops and esthetic treatment features along the channels. In accordance with the cost-sharing policy presented in the 1975 Survey Report, the Board recommended that the replacement cost for the existing lower Santa Ana River trail be a non-Federal cost like "any other utility." The Department of the Interior, in their letter dated 11 May 1977, however, noted that Land and Water Conservation Fund monies were used for construction and that adequate measures should be included in the project for replacement or protection of this recreation, as required by Public Law 88-579.

In a letter dated 27 July 1978, the State of California expressed concern that the proposed recreational facilities at Mentone might have a minor negative impact on the ground water quality in the extreme upper end of the Upper Santa Ana River Basin. They also commented that the 1975 Survey Report did not address the loss of recreational opportunities at Huntington State Beach which would result from the proposed Santa Ana River mouth's widening.

The Department of Transportation requested that the study cover traffic impact from recreation usage of the various highways leading to the planned recreation facilities.

PRADO RESERVOIR: APPLICATION OF STANDARD ACQUISITION POLICIES. The Board disagreed with the 1975 Survey Report recommendation to grant several real estate options to current owners of developed properties in Prado Reservoir fringe areas below the proposed taking line (elevation 566 feet). These options consisted of life estates, flowage easements, flood proofing, fee acquisition, or combinations of two or more of the above. The Board suggested that the Phase I GDM should recommend the Corps' standard acquisition policy. This policy requires acquisition of all structures used for human habitation in the reservoir area. It does, however, permit other productive property uses that allow occasional flooding without interference with the reservoir's operation and maintenance.

WATER CONSERVATION POTENTIAL. In a letter to the Chief of Engineers (11 May 1977), the State of California requested that the Phase I planning more firmly establish the potential water conservation benefits likely to result from construction of the Mentone Dam and the modification of Prado Dam. Other local interests, including Orange County Water District, have also expressed a similar concern. The 1975 Survey Report found water conservation through control of floodflow to be incidental to flood control operations. The State, however, suggested that once the dam's operation schedules are established, the Corps reevaluate whether the dilution of the ground water supply with floodflows can improve the river basin's ground water quality, and can furnish more water conservation benefits than the 1975 Survey Report revealed.

PROTECTION OF CULTURAL RESOURCES. Two agencies were concerned that the 1975 Survey Report did not adequately address the preservation of archeological, paleontological, and other historical items within project areas.

The Board requested that the Phase I study more clearly define the need for protection of archeological, paleontological and historical remains in Prado Reservoir. In the Survey Report's Environmental Impact Statement (EIS), protection measures and cost estimates for only two of the 10 sites within the Recommended Plan's taking line in Prado Reservoir are described. It was the Board's view that the Phase I study should include protective or mitigation measures for all significant sites within Prado.

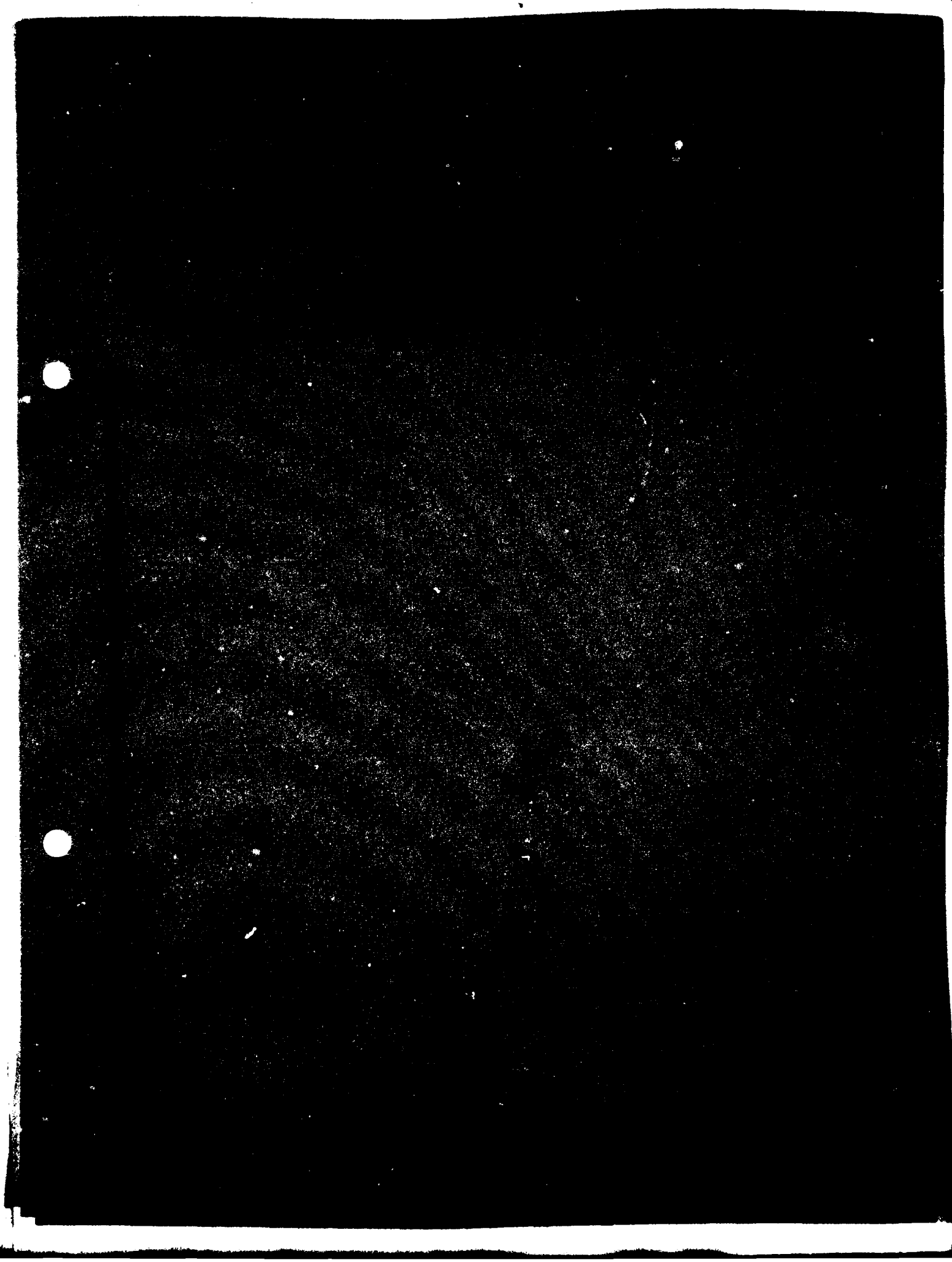
In the July 1977 letter to the Chief of Engineers, the Department of the Interior requested more detailed identification and description of cultural resources within project areas. The Department was concerned that the 1975 Survey Report failed to consider impacts to cultural resources that may occur as a result of recreational development. According to the Department, the results of the 1975 Survey Report concerning the effect of inundation upon cultural resources within Prado were inconclusive and measures to protect the two adobes in Prado Reservoir were questionable.

ORDER OF CONSTRUCTION OF PROJECT ELEMENTS. Since the proposed enlargement of Prado Dam and Reservoir would produce the most benefits and provide the greatest degree of the flood reduction, the State of California requested that Prado be modified first. Riverside and San Bernardino Counties, however, favored building Mentone Dam and Reservoir first. These counties feared that if Prado and the other elements were built first, funding limitation might result in Mentone never being built.

RECONSIDERATION OF OAK STREET DRAIN IMPROVEMENTS. The BERH felt that the proposed location of the basin for the Oak Street Drain (south of Ontario Avenue) could allow debris to clog the channel upstream of the basin, thereby causing floodwaters to spread and reach the damage area. Spur channels on Border Avenue and Lincoln Avenue might not function as designed. The Board concluded that the project might not produce the benefits estimated in the 1975 Survey Report.

PUBLIC CONCERN OVER THE 1975 SURVEY REPORT'S SANTIAGO CREEK PLAN. Subsequent to the 1975 Survey Report, Orange County rejected the Corps' plan for Santiago Creek and developed a plan that differed both conceptually and physically. Orange County believed that their "Lower Santiago Creek Specific Plan," dated April 1977, provided a more comprehensive solution to a full range of problems than did the Corps' plan. Public opposition, however, has developed over several elements of the County plan. Orange County requested that the Corps reformulate the 1975 Survey Report Santiago Creek plan. They also suggested that the Corps use the Santiago Creek Specific Plan and the public's input as guides for developing a plan which has public support while providing a comprehensive solution to a full range of problems.

MICROCLIMATE AT MENTONE SITE. Agricultural interests in the Mentone area were concerned that impounding large amounts of water behind Mentone Dam, even for brief periods, could induce changes in the weather of the immediate area. In particular, they were concerned about the water lowering temperatures around the reservoir and creating local frosts severe enough to damage crops. There was also some concern that microclimate changes might affect some operations at the nearby Norton Air Force Base.



3. PROBLEM IDENTIFICATION

With the issues raised by review of the 1975 Survey Report in mind, problems which the 1975 Recommended Plan was designed to solve were reviewed. Existing conditions within the basin were reviewed, including the physical setting for the project, the flood history, existing flood control improvements (some of which had changed since 1975), flood insurance, and the resources of the study area. Special attention was directed to evaluating changes in the basin since the 1975 Survey Report was completed. On the basis of this analysis, and using new knowledge gained since the 1975 Survey Report, the consequences of taking no Federal action were reprojected and reestimated.

This thorough analysis of the current situation in the project area led to refinement of problem statements and, in a more positive vein, to a renewed sense of the opportunities for meeting flood control, economic, environmental, and other area needs in a balanced plan. Finally, considering National Objectives (for National Economic Development and for Environmental Quality) and a number of constraints on any viable plan, a firm set of planning objectives was developed.

This process of careful, step-by-step analysis leading to a refined set of planning objectives is described in depth in the following pages. Particular emphasis is given to changes in conditions, in problem analysis, and in planning policy since the 1975 Survey Report was completed.

EXISTING CONDITIONS

The Santa Ana River Basin: Geography, Geology, and Climate

The 3,200 square mile Santa Ana River Basin contains the largest river system in southern California. Bounding the basin on the north is Mojave River Basin; on the east, the Whitewater River Basin; and on the south, the Santa Margarita River Basin. The Santa Ana Mountains and Chino Hills bisect the drainage area separating the upper and lower basin. In the upper basin, in San Bernardino and Riverside counties, mountains and hills occupy about 1,100 square miles, with elevations ranging from 11,485 feet at San Gorgonio Mountain and 10,804 feet at San Jacinto Peak to 4,680 feet at Santiago Peak. In the lower basin, in Orange County, the high Santa Ana Mountains (over 5,000 feet) stand in sharp contrast to the lower rolling Chino Hills (1,780 feet). The valley in the lower basin occupies about 1,300 square miles and the coastal plain about 70 square miles. The relatively flat coastal plain areas are mainly committed to urban use, and any remaining open spaces are few in number and small in size. Despite the relatively low agricultural productivity of native soils, the optimal climatic conditions and extensive irrigation and fertilization practices encourage high agricultural production in the region.

According to the "Nationwide Rivers Inventory", Phase 1 by the Department of of Interior, no segments of the Santa Ana River are Wild or Scenic Rivers.

Photo 3: The Santa Ana River Channel in Anaheim (looking upstream).

Oak Street Drain, an upstream tributary of the Santa Ana River, rises on the northern slopes of the Santa Ana Mountains and includes the ephemeral flows of several smaller canyons. From its source, Oak Street Drain courses northward through the western part of the City of Corona and joins Prado Reservoir at its southeastern corner. The total drainage area of the Oak Street Drain is 11.5 square miles. Above Ontario Street, the flood plain remains largely in agricultural use, but below that point the area becomes progressively more developed.

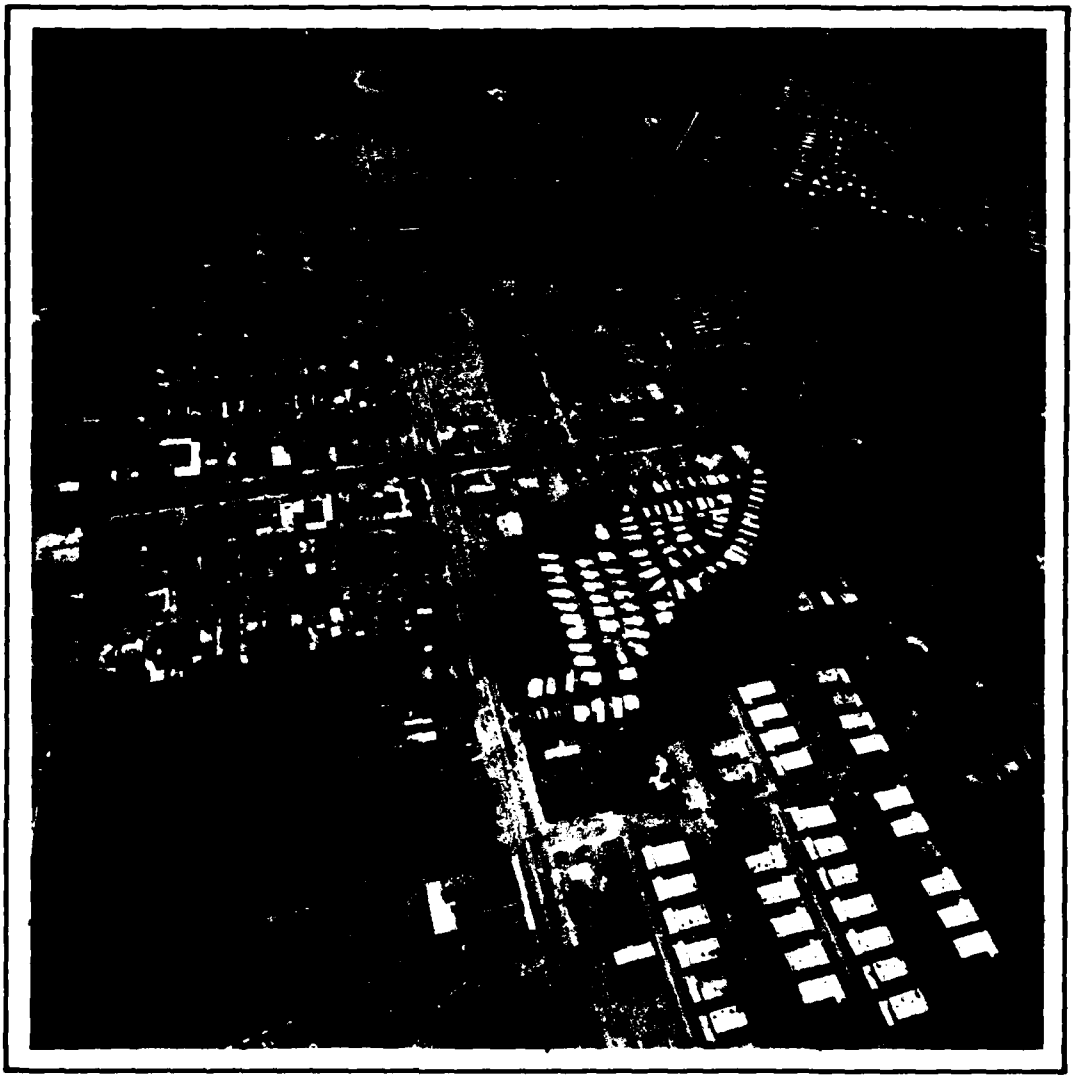


Photo 4: Oak Street Drain in Corona

Santiago Creek, a principal tributary of the Santa Ana River, rises on the western slopes of the Santa Ana Mountains and contains the ephemeral flow of several smaller canyons, including Black Star, Baker, Silverado, Modjeska, and Harding. Irvine Lake, also known as Santiago Reservoir, is formed by Santiago Dam, constructed on Santiago Creek by the Irvine Ranch Company and the Carpenter-Serrano Irrigation District. From Santiago Dam, Santiago Creek courses northwestward through Irvine Park, a County regional recreational facility, to Villa

Photo 5: Santiago Creek in the vicinity of the Santa Ana Freeway. Note the high density of residential and commercial buildings adjacent to the Creek.

Park Reservoir; it then courses southwestward through the Cities of Villa Park, Orange, and Santa Ana to just below the Garden Grove Freeway crossing where it joins the Santa Ana River. The creek drains a total of 102 square miles. Below Villa Park, the creek flood plain is heavily urbanized; above this point, it remains largely in its natural state except for the two dams.

The Santa Ana River basin geology is diversified and complex. Generally, the hills and mountains surrounding the upper basin are composed of various granites and metamorphic rocks including schists and gneisses. The Puente Hills and Santa Ana Mountains separating the upper and lower basins are composed primarily of sedimentary sandstones and shales with some volcanic flows. The valley floors, coastal plain and other lowlands are composed primarily of sands and silts eroded from the mountain rocks with the exception of accumulations of peat and organic soils over several square miles just inland from the mouth of the river. All the mountain blocks in the basin are bordered by major active faults, such as the San Jacinto, San Andreas, and Cucamonga. As evidenced by the folded and fractured formations exposed in the mountains, earthquakes have been occurring for millions of years and are expected to continue. Seismic activity in the area is monitored closely, and all plans have been evaluated to ensure the integrity of improvements in the event of earthquakes. These efforts are described in detail in Appendix D.

Other local features, such as landslides, subsidence, ground water, and seawater intrusion, are also part of the geologic environment. Landslides, which are common in the hills throughout southern California, exist locally on both sides of the river in Santa Ana Canyon. Although subsidence in the Santa Ana River Basin has been slight, some has been reported in the San Bernardino Area, and a minor amount may be occurring in Orange County. Ground water levels vary throughout the basin, primarily in response to the underlying geologic structures and the amount of pumping and recharge. Generally, the ground water levels occur at depths over 100 feet and rise to near ground surface through Santa Ana Canyon and along the coast. Overpumping in Orange County, however, has caused the ground water slope to reverse so that the lower basin is subject to seawater intrusion.

Elevation, topography, and distance from the ocean influence the climate of the Santa Ana River Basin. The lower elevations of the basin have a semiarid, subtropical climate. Summers are long, hot, and dry, and temperatures often exceed 90° F; winters are short, cool, and mild, with only infrequent frost in urbanized areas of the basin.

Annual precipitation averages 12 to 16 inches per year in the upper valley and coastal plain. About 90 percent of this rainfall occurs between November and April; there is practically no rainfall in summer months. Summer thundershowers occur in the mountains, but do not contribute significantly to runoff. The average annual precipitation in the mountainous areas of the watershed exceeds 45 inches in some places; above the elevation of 6,000 feet, precipitation usually occurs as snow in winter months.

Three types of storms produce precipitation in the study area: general winter storms, local thunderstorms, and general summer storms. General winter storms, which cause most of the major floods in the basin usually occur during the period November through April. These storms

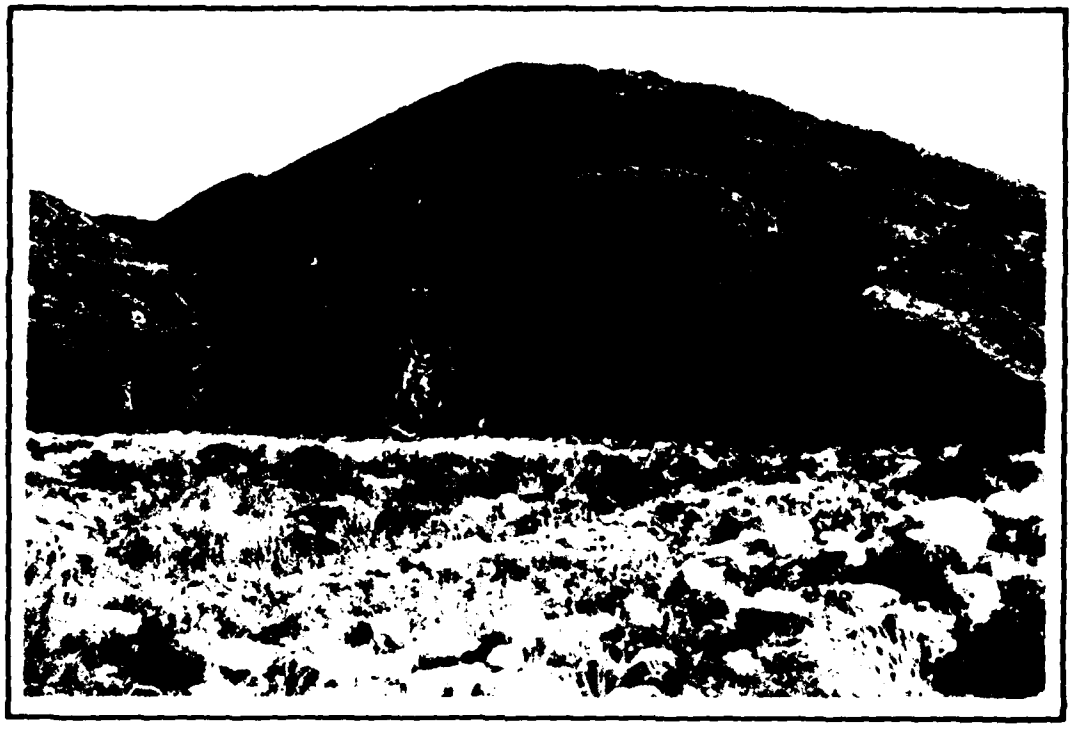


Photo 6: The Santa Ana River as it emerges from the San Bernardino Mountains.

usually originate over the Pacific Ocean and move eastward across southern California, sometimes lasting for several days. They reflect orographic influences and are usually accompanied by widespread intensive convective-type storms usually accompanied by heavy precipitation over small areas for short durations. Since general summer storms usually occur at the end of the dry season in the summer and early fall months and are quite rare, the flood potential from these storms is normally somewhat reduced.

The Santa Ana River originates in the San Bernardino and San Gabriel Mountains about 75 miles inland from the Pacific Ocean and 9 miles above the proposed Mentone damsite. Of the numerous tributary ephemeral streams that lead from surrounding mountains and hills, the principal ones, in downstream order, are: Bear, Mill, Plunge, City, Mission-Zanja, San Timoteo, Warm, Lytle, Reche, Rialto, University Wash, San Sevaine, Day, Cucamonga, Temescal, and San Antonio-Chino; below Prado Dam are Carbon Canyon and Santiago Creeks.

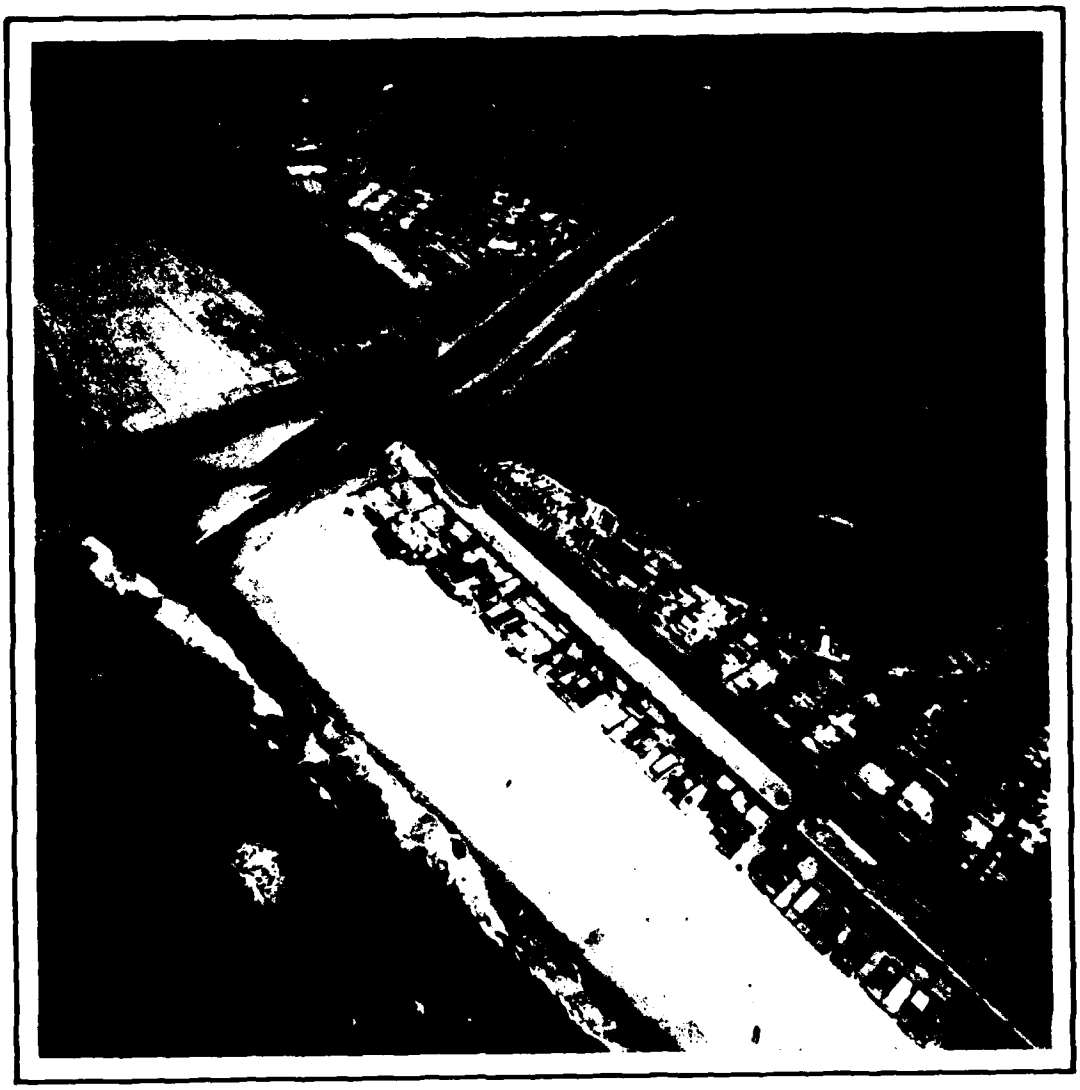


Photo 7 : The Santa Ana River mouth.

From its origin to Prado Dam and Reservoir, the Santa Ana River mostly follows a natural course--progressively wide and rocky, sandy and narrow, and wide and shallow. Between San Bernardino and Riverside, the river course is partly controlled by levees to protect suburban, industrial, and other land uses. From the La Loma Hills to Mount Rubidoux, the river is contained by levees to protect the urban development in the Riverside area. Below Mount Rubidoux, the river meanders past the flat agricultural lands of the middle Santa Ana Valley

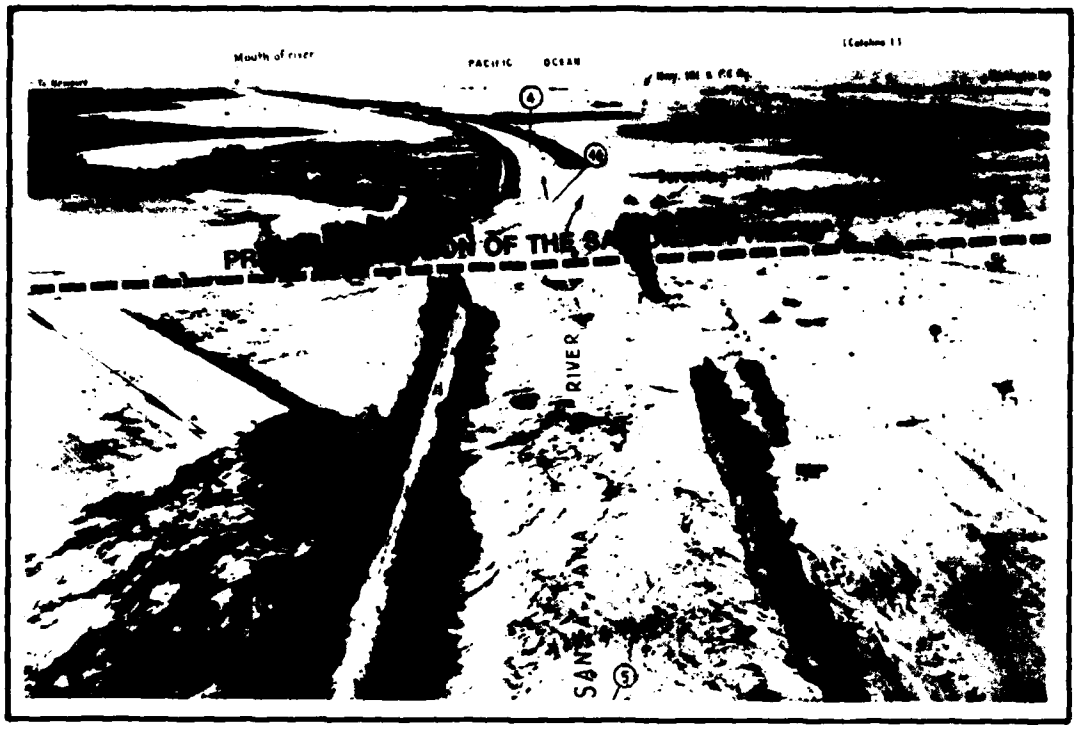


Photo 8: March 1938 overflow across Huntington Beach; circled numbers refer to distance (in miles) from the ocean.

development in the Riverside area. Below Mount Rubidoux, the river meanders naturally--except for about 3 miles of revetment in a 9-mile course--through Santa Ana Canyon. From 3 miles above Imperial Highway to the Pacific Ocean about 23 miles downstream, the river is completely contained by channels to protect the densely populated, broad, gently shaped coastal plain of Orange County. There are several spreading basins in this 23-mile reach.

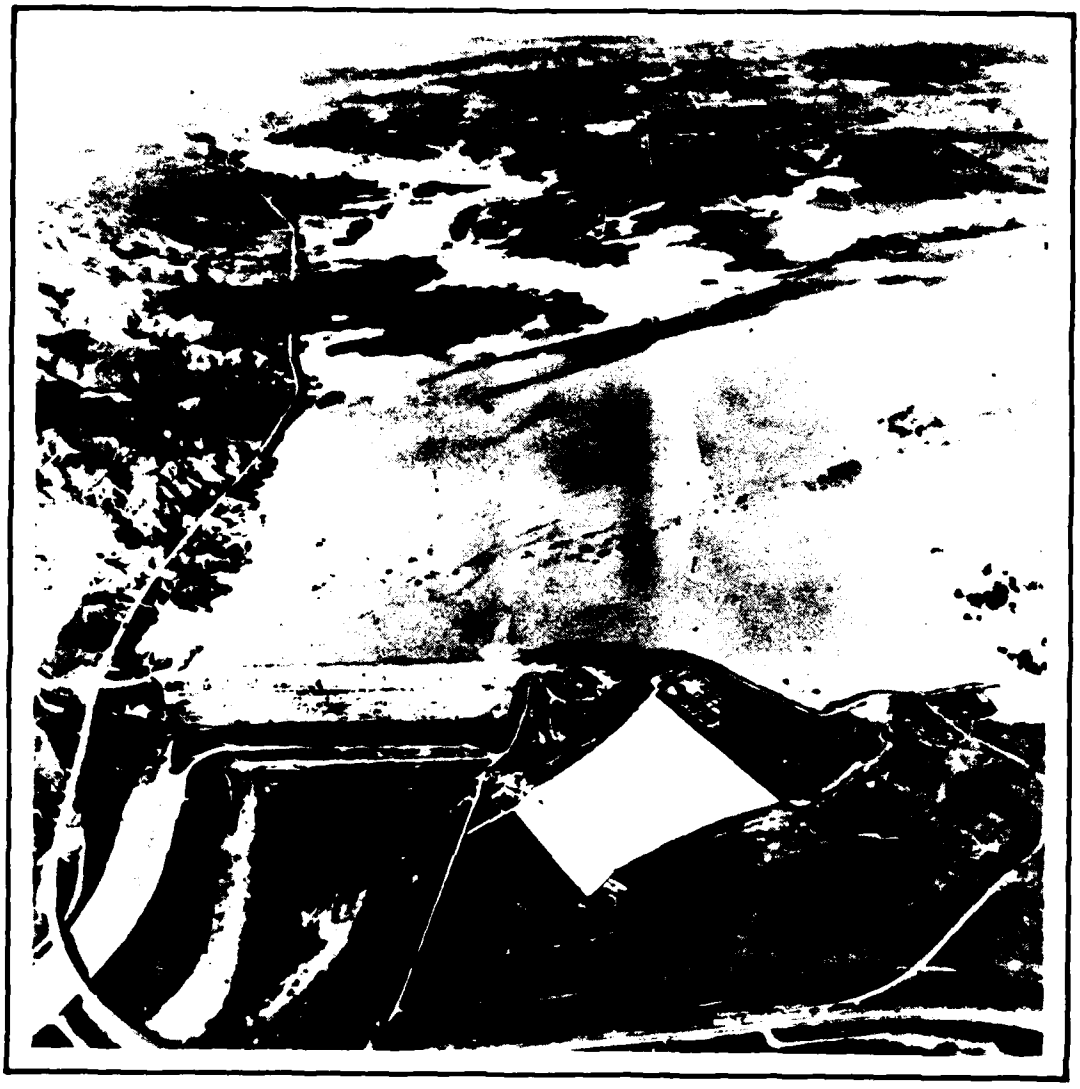


Photo 9: A large lake was created behind Prado Dam during the 1969 Flood.

Flood History

Large floods in the Santa Ana River Basin occur in magnitude incomprehensible to those who have not witnessed their destruction. Little information exists regarding the magnitude of floods prior to 1850. Recorded data from 1897 to the present show that medium to large winter floods occurred in 1903, 1910, 1914, 1916, 1921, 1922, 1927, 1938, 1943, 1965, 1966, 1969, 1976, and 1980. Although not much information is available on the flood of 1862, evidence suggests that after 15 days of continuous rain this flood broke loose from the Santa Ana River on 22 January and brought destruction and desolation to everything in its path. This flood's peak discharge was estimated in recent decades, on the basis of historical notations on highest wat• levels, at 327,000 cubic feet per second at Riverside Narrows.

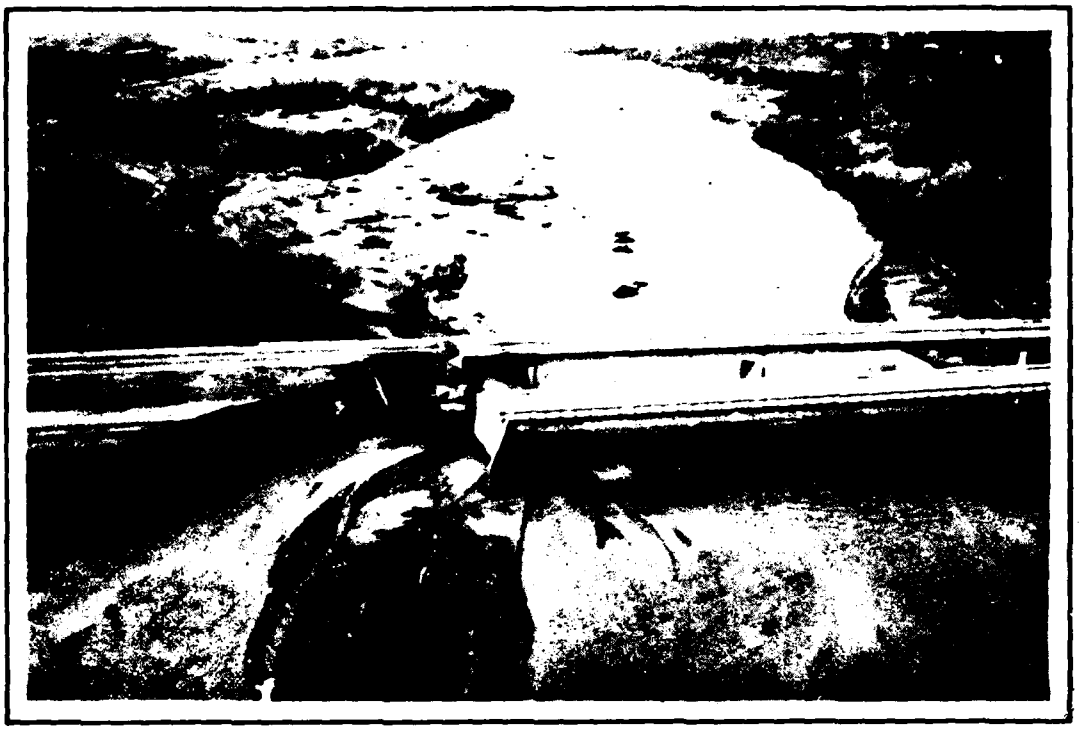


Photo 10: Washout of Van Buren Boulevard Bridge over the Santa Ana River during the 1969 Flood.

The largest recorded flood in this century in the Santa Ana River occurred in March 1938. The peak flow reached about 100,000 cubic feet per second at Riverside Narrows. It was about a 40-year frequency flood, and caused damages of about $4 million (1938 price level) in Orange County. Although this flood was the cumulation of 7 days of non-continuous rain, the greatest part of the rain fell in a 19-hour period. Several mountain stations reported 30 inches or more of precipitation for the storm period.

The next major flood on the Santa Ana River occurred in January and February 1969. This flood transpired after the last of a series of storms, which climaxed more than a month of extremely heavy, recurring rainfall. The rains were heaviest in the mountains where one station reported more than 10 inches of rain. The peak discharge of runoff reached 36,000 cubic feet per second at Riverside Narrows. The flood caused about $22 million in damages in Orange County alone and $43 million in San Bernardino, and $20 million in Riverside counties (1969 price level). This was a 40-year frequency flood that would have caused an additional $440 million damage if Prado Dam had not been constructed in 1941. Over 1 million dollars in damage occurred in the Oak Street Drain overflow area. Damages from this flood were greater than the 1938 flood, mainly due to increased development.

Photo 11: Floodwaters undermined houses next to Santiago Creek during the 1969 Flood.

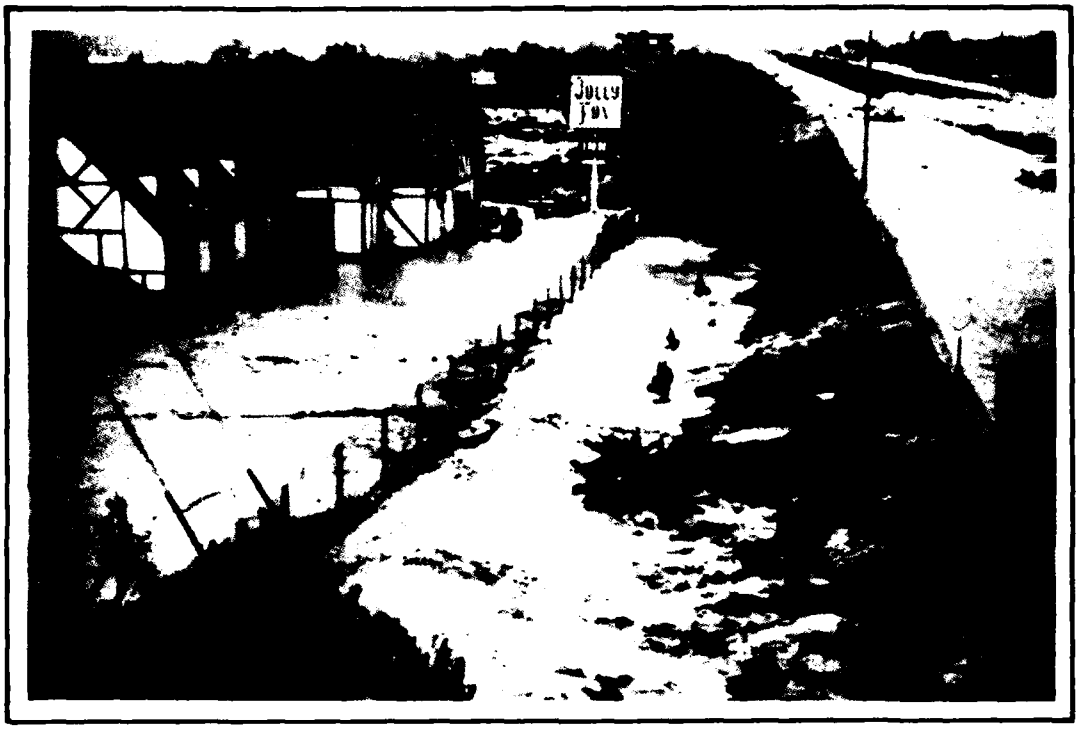


Photo 12: The Riverside Freeway (91) was closed due to the floodwaters from Oak Street Drain during the 1969 Flood.

Photo 13: Overflows from Oak Street Drain during the 1969 Flood damaged much of the commercial district in Corona.

Photo 14: The arrow shows the water level reached on this house from Oak Street Drain overflows from the 1978 Flood.

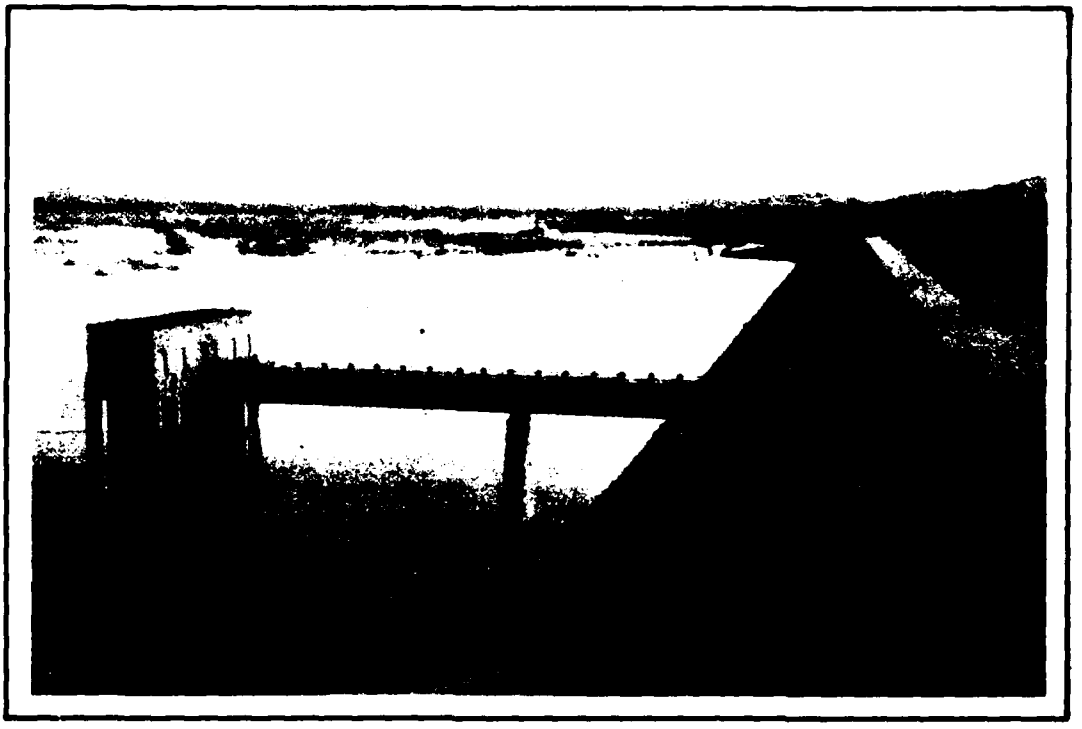


Photo 15: Water level of Prado Dam after 1980 storms. The water level rose to a record high elevation of 528 feet.

Since the 1975 Survey Report, two more floods have occurred in the Santa Ana River basin. The March 1978 flood, a 12-year frequency flood, resulted in $13 million dollars in damages. This flood caused over million dollars damage on Oak Street Drain alone. The February 1980 flood was close to a disaster. The constant rain over only a 10-day period required releasing floodwaters from Prado Dam at a faster rate than ever before. During this flood, the water level at Prado Dam reached 528 feet, the highest elevation in the dam's history. Another four or five inches of rain, one large storm, would have resulted in uncontrolled spillway discharge causing immense damages downstream in Orange County. In this flood additional flows entered Prado from Lake Elsinore, 25 miles away, down Temescal Wash. The water surface level at Lake Elsinore during this flood exceeded the water level during the 1916 flood, the last time Lake Elsinore spilled. Any higher water would have resulted in spills into Temescal Creek eventually reaching Prado Dam. Lake Elsinore, following the 1980 flood, will remain at an abnormally high water level (27 feet above normal). The lake's water level is not expected to recede to a normal level for at least 15 years. Consequently, the flood threat of Lake Elsinore outflows will continue to contribute to the potential of flooding downstream of Prado Dam. The 1980 flood also uncovered a severe weakness in the Santa Ana River Channel below 17th Street. Even through floodflows were only 20 percent of the rated channel capacity, severe erosion occurred in the invert of 4 miles of the channel. Concrete side slopes were undermined, collapsed and failed. Emergency flood fighting efforts were undertaken around the clock to prevent levee breaks. Prado Dam, already dangerously full, had to cut back on releases to allow the repair work to go on and to prevent even worse damage. A disaster was prevented only by the fact that a series of new storms threatening to advance along the path of the previous 6 storms that had brought great flooding did not advance as had been predicted. The 1980 flood caused $10 to $15 million in damages on the lower Santa Ana River alone.

During these two recent floods in 1969 and 1978, damage to areas around the Oak Street Drain totaled approximately $2,400,000. The trailer parks on the east edge of the existing channel were flooded in both floods. The parks are primarily for senior citizens, who are seriously threatened by any flood in the area and are less able to cope with emergencies than those in more permanent housing. During the February 10, 1978 flood, one woman suffered a heart attack during the flood evacuation and died. Her death cannot be casually linked to the flood, but flooding in this area would seriously hamper the ability to those in the trailer park to get timely emergency care.

These recent floods, in particular the flooding of Lake Elsinore, dramatized the need for work on this project to begin with all reasonable speed. They were also analyzed in determining the feasibility and desirability of plan alternatives.

Existing Flood Control Improvements

SANTA ANA RIVER. Existing flood control improvements built by local interests and the Corps of Engineers along the 75-mile length of the Santa Ana River reduce damages from small floods but provide an insufficient level of protection for the highly urbanized lower Santa Ana River flood plain. The following paragraphs describe these improvements in detail.

Farthest upstream, the 2.4-mile long Mill Creek levee, constructed by the Corps in 1960, lies on the south side of Mill Creek, just above its confluence with the Santa Ana River. It was nearly overtopped in 1965, 1966, and 1969 when waves of debris piled up along sections of the levee. For several miles downstream from the Mill Creek confluence, San Bernardino County efforts to prevent bank erosion have provided protection so that the natural river banks are adequate to contain moderate floodflows. Downstream from the confluence with City Creek, bank protection measures have been constructed for about 5 miles. These levees provide limited protection to Norton Air Force Base at San Bernardino and adjacent areas near Redlands. Further downstream the Corps of Engineers, since the 1975 Survey Report, has completed improvements to the lower portion of Lytle and Warm Creeks and a short reach of the Santa Ana River near the confluence. From just above the Interstate 10 and Interstate 15 interchange, bank protection measures continue into Riverside County. The Riverside levees, which extend along a 3-mile-reach of the river, were constructed by the Corps of Engineers in 1958. The levees provide nearly standard project flood protection to the City of Riverside and nearby areas. West of Riverside, the river channel is well entrenched and no improvements have been made from that area down to the upper end of Prado Reservoir.

The lower basin is currently provided limited protection by Prado Dam and Reservoir which was completed in 1941. At the time, it was thought that the dam and resevoir would be capable of controlling a 200-year flood. But, since Prado Dam was built, changes which have occurred in the drainage area, and additional historical data on rainfall and runoff coupled with advances in predicting future flood potential have shown Prado Dam to presently offer only 70-year protection. A large flood could fill the reservoir and flow uncontrolled over the spillway, racing down Santa Ana Canyon, overtopping the existing levees, and spreading into a wide flood plain to the south and west of Imperial Highway. About two million people live and work within this flood plain. Another serious concern is that the existing Prado Dam and spillway could not accommodate a probable maximum flood, resulting in overtopping of the dam. (A probable maximum flood, estimated to be 2 to 2-1/2 times as great as a standard project flood, is commonly used in determining the design of a spillway.)

The Corps of Engineers is currently working on a 2-year study under the Dam Safety Assurance Program to modify Prado Dam so that it can pass a probable maximum flood without overtopping the dam. Several alternatives are being studied. The most likely changes to be made are addition of a parapet wall to the top of the dam and widening of the dam spillway. Construction is scheduled for 1984 and will require 2 years. Although the proposed modification will alleviate the threat of the dam overtopping during a maximum probable flood, it will not provide any additional flood protection. As previously mentioned, this modification is considered completed for the purpose of the plan and will be completed before any additional construction begins.

Downstream from Prado Dam, long stretches of the channel are inadequate to convey large floodflow safely to the ocean. Just below Prado Dam, the river flows through a natural channel capable of containing only about an 8-year flood (about 2,000 cubic feet per second). A mobile home park, the Green River Golf Course, Featherly County Park, and several orange groves are located adjacent to the waterway. A railroad crossing and the Corona Freeway in the area impede large floodflows (see figure 16).

Photo 16: The Santa Ana Canyon (looking east). Prado Dam is at the top of the photo.

The channel improvements made by Orange County begin below the Santa Ana Canyon at Weir Canyon Road at which point rocks have been placed to protect the sides of the channel. From Weir Canyon Road to Garden Grove Freeway, near Anaheim Stadium, the existing earth-bottom channel has revetted side slopes and drop structures. Channel capacity is probably greatest in this reach, up to 36,000 cubic feet per second. Within this stretch, from about 1/2 mile west of Imperial Highway to just upstream from Katella, the river passes a water-spreading area which consists of several ponding areas that allow percolation into the ground water table (see figure 17). The channel is tightly confined in the area.

Downstream of Katella Avenue to the confluence of Santiago Creek the channel capacity decreases because of narrow width and numerous bridges, to about 25,000 cubic feet per second. Since the 1975 Survey Report, local interests have constructed three drop structures and rebuilt one existing drop structure to reduce the velocities of the floodflows. From the Garden Grove Freeway south to about 17th Street in the City of Santa Ana, the river retains the same capacity but has more of a greenbelt appearance, sporting a golf course within the river channel itself. Since the 1975 Survey Report, from upstream of 17th Street to the Pacific Coast Highway the existing earth-bottom trapezoidal channel's side slopes have been paved with concrete. The improved channel was designed for the rated capacity 40,000 cubic feet per second. Recent flood experience, however, raises some doubt of the channel's ability to carry a large flood approaching this capacity.

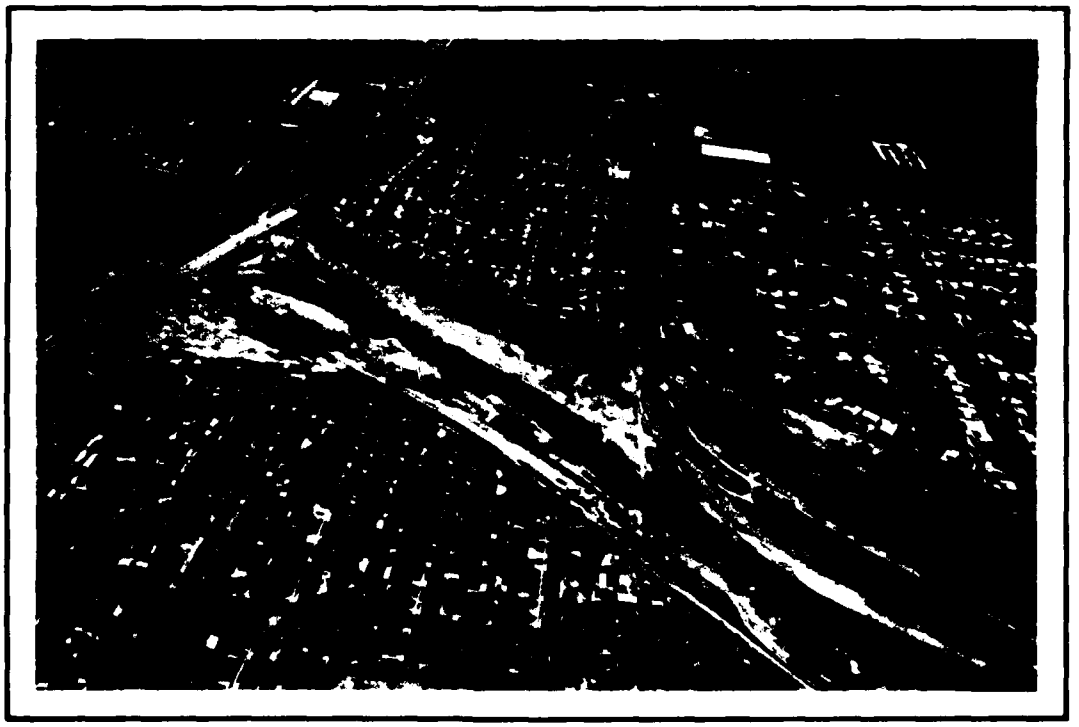
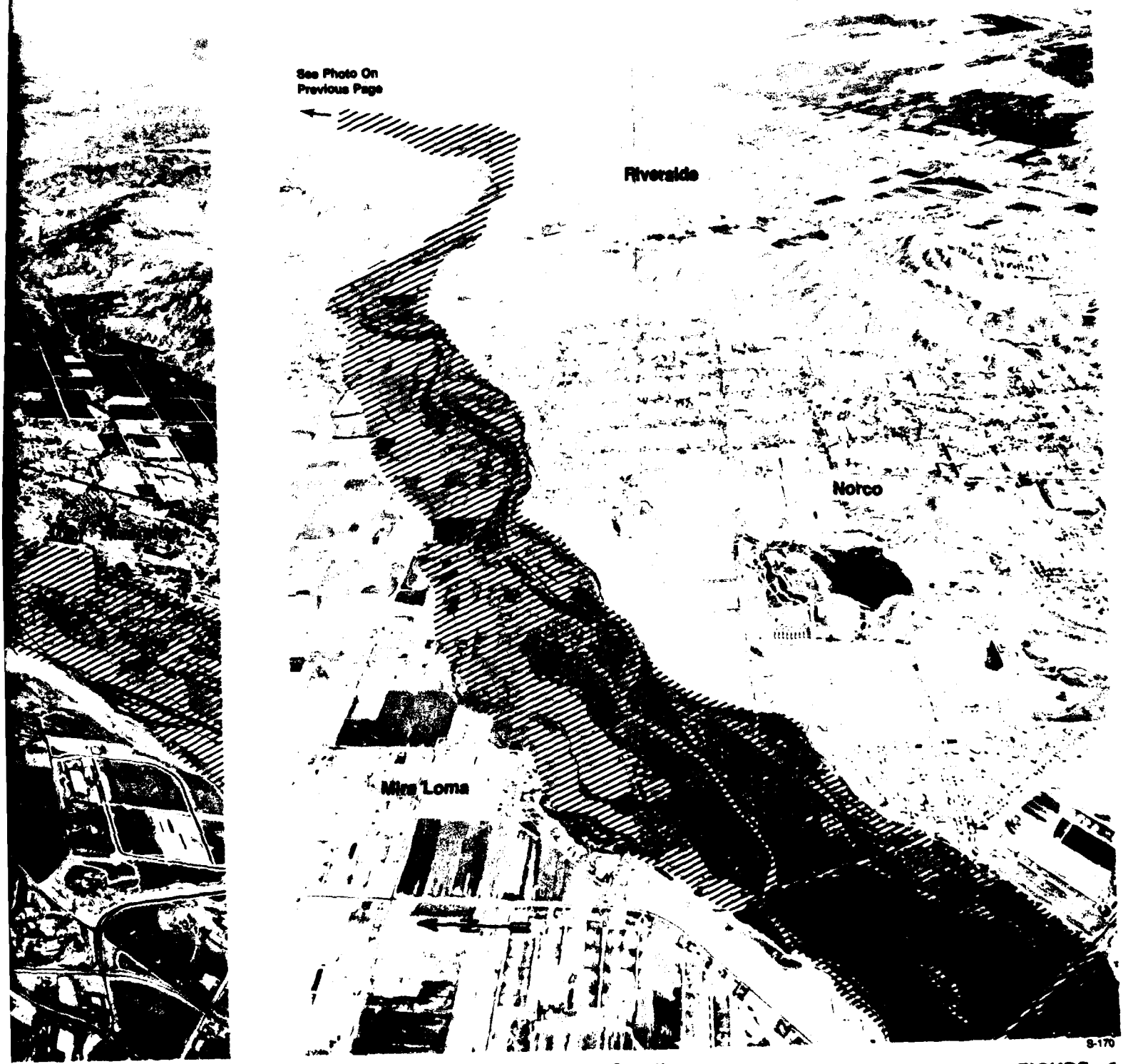


Photo 17: Confluence of Santiago Creek with the Santa Ana River.

Below Edinger Avenue, the streambed flattens to a slope of only 5 feet per mile and the levees rise to about 12 feet above the ground. Along much of this section, homes and industries crowd the rights-of-way.

South of the San Diego Freeway, the levees are about 14 feet above the ground. About 1/4 mile south of the San Diego Freeway, the Greenville-Banning storm drain channel approaches from the east and runs parallel to the Santa Ana River channel. The Fairview channel joins the Greenville-Banning channel just downstream of Adams Avenue. These storm drains must maintain a bottom elevation lower than that of the Santa Ana River in order to provide drainage to nearby homes.

Upper Santa Ana River Standard Project Flood Overflow In



liver Standard Project Flood Overflow in San Bernardino and Riverside Counties.

FIGURE 1

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FIGURE 2

SANTA ANA RIVER OVERFLOW AREA IN ORANGE COUNTY

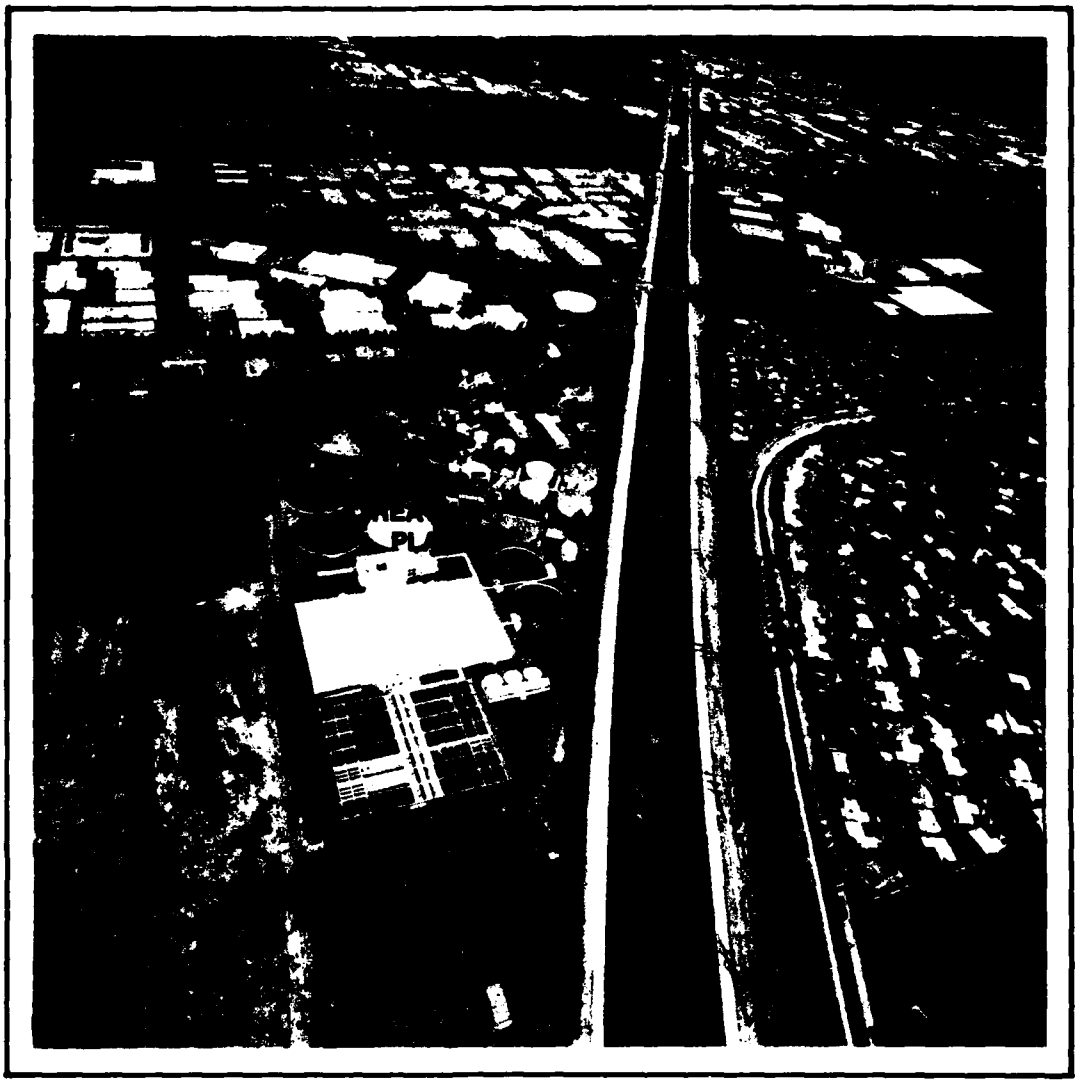
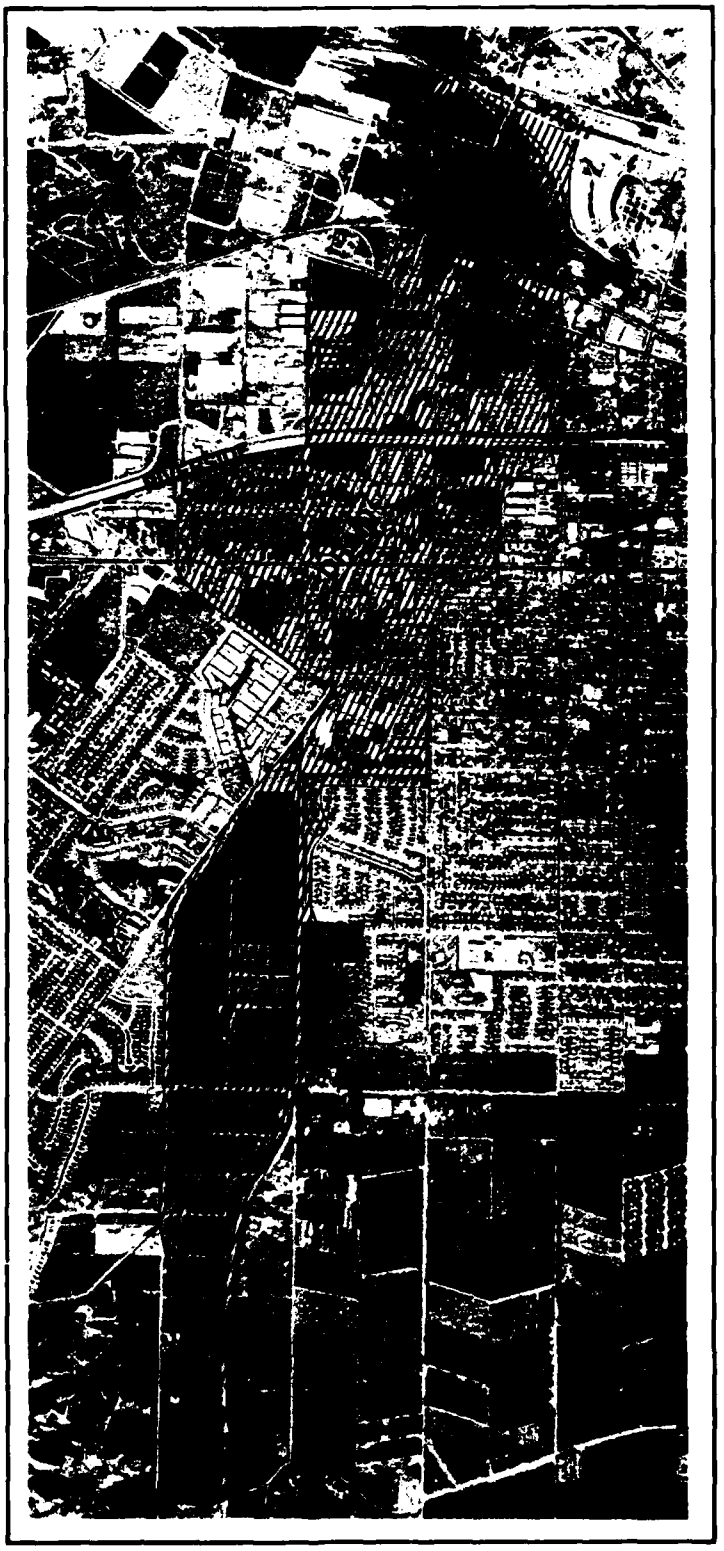


Photo 18: View looking upstream of the lower Santa Ana River channel. Commercial buildings, residences, sewage plant and powerlines crowd the rights-of-way in this area.

The stretch near the San Diego Freeway is constrained. Industrial buildings hug the rights-of-way at the freeway, and new homes, apartments, and electric powerlines adjacent to the channel crowd the east side of the river. On the west side, several pipelines, including trunk sewerlines of 7 and 10 foot diameters, are buried in the levee. Downstream from Garfield Avenue, electric transmission towers follow the river on the west side. In addition, two wastewater treatment plants are located about 4 miles apart and near the west levee of the river. Just upstream from the Pacific Coast Highway bridge, the Huntington Beach channel approaches the Santa Ana River; and the Greenville-Banning channel, the Huntington Beach channel, and the Santa Ana River then flow parallel into the Pacific Ocean.

Photo 19: Oak Street Drain (looking downstream) between Chase Street and Ontario Avenue.

OAK STREET DRAIN. Existing flood control improvements for Oak Street Drain consist of a channel and debris basin (see figure 15). Riverside County Flood Control District constructed the debris basin after the 1975 Survey Report was released. This debris basin was a feature of the 1975 Survey Report's Oak Street Drain Recommended Plan, but the county constructed the debris basin 3,500 feet farther upstream (south) and with a smaller capacity than provided for in the Corps' Recommended Plan. Since the severity of past floods was in part due to the large amounts of debris produced by the steep slopes in the upper reaches of the Oak Street Drain drainage basin, the debris basin has alleviated some of the threat posed by the drain. The channel begins at the debris basin and extends to the Santa Fe Railroad crossing, 3.1 miles downstream (north). From the debris basin to the channel's confluence with Mangular Channel the drain is an earth-bottom channel with pipe-and-wire side slopes. At that point, the channel becomes concrete trapezoidal channel with steep walls until its reaches Lincoln Avenue. The channel then is a concrete covered section until just upstream (north) of Riverside Freeway. Finally, between Riverside Freeway and the Santa Fe Railroad crossing, the channel becomes an earth-bottom channel with stabilizers and concrete walls.



OAK STREET DRAIN STANDARD
PROJECT FLOOD OVERFLOW AREA

S-151
FIGURE 3

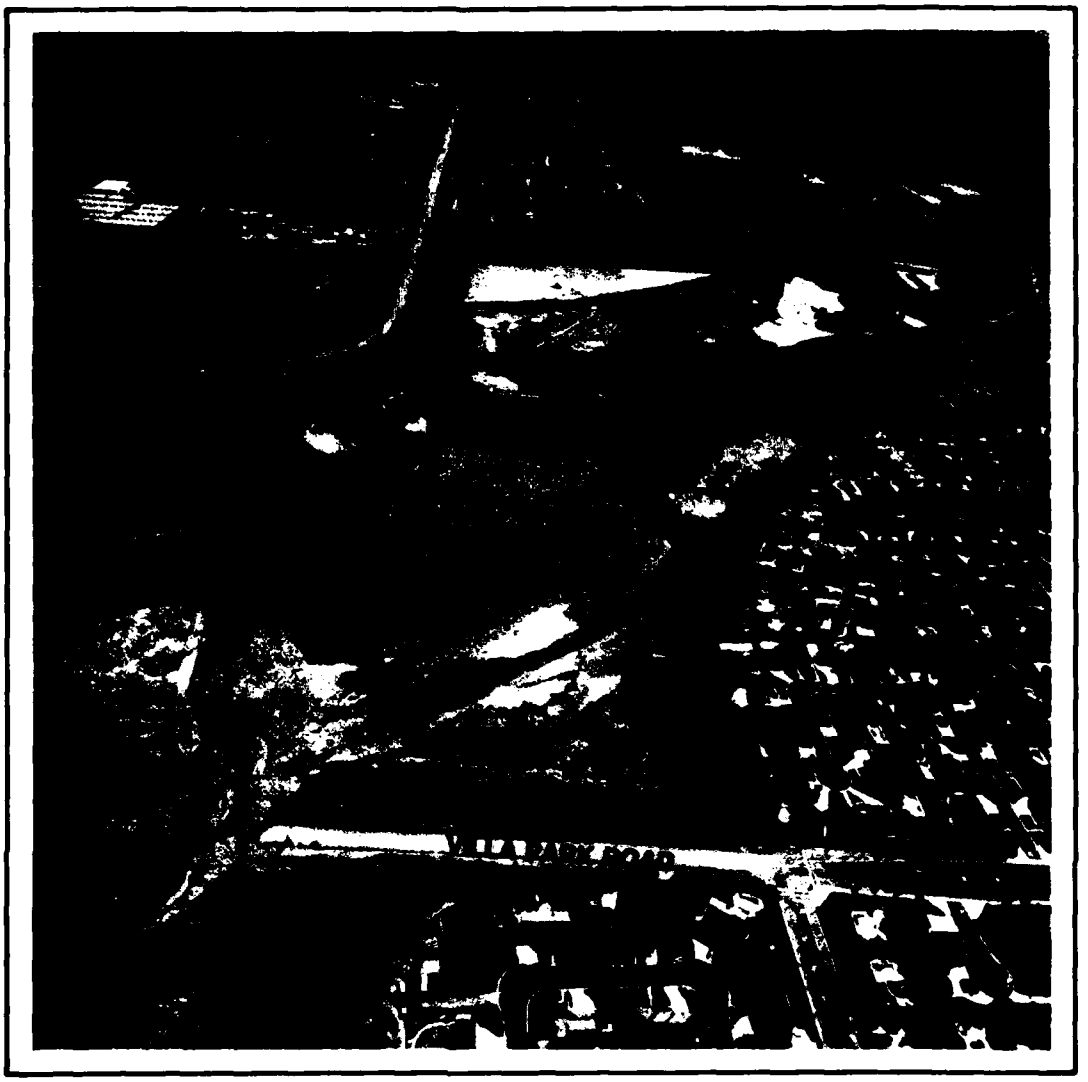


Photo 20: Santiago Creek gravel pits between Villa Park Road and Prospect Street.

SANTIAGO CREEK. Between the Santa Ana River and Villa Park Dam, Santiago Creek varies widely. Protective works have been implemented in a piecemeal approach which provides no consistent watercourse identity. From Villa Park Dam to Loma Street the creek remains relatively natural. Just upstream of Loma Street the creek is confined by somewhat deteriorated eastern embankments. A few adjacent homeowners also have constructed minor encroachments into the flood plain which have little restriction on the flow of floodwaters other than to route them around the structural improvements.

The configuration of Santiago Creek from Loma Street to Prospect Street has been drastically modified from its natural condition by the local sand and gravel operations near the creek. Some of the gravel pits reach depths as great as 200 feet below the adjacent terrain. A few exhausted pits have been used for desilting basins for wash water and are now full or nearly full of silty fines. Some of the pits are

along the watercourse and in a storm would fill before any flow could continue downstream in the existing poorly-defined channel. The current channel steers the flow to the northwest of most of the pits.

In the reach from Prospect Street to the Southern Pacific Railroad (SPRR) bridge, the creek is a semi-natural, earth-bottom channel. The south bank is an irregular earth embankment constructed by the sand and gravel companies to protect their plant operations from inundation. Some earth levees exist along portions of this low-lying area but they are relatively ineffective due to the lack of continuity. On the north bank, concrete slope paving protects adjacent residential development.

Between the abandoned SPRR bridge and Chapman Avenue the creek remains a natural earth-bottom channel. On the south bank, the earth embankment gradually gives way to the natural stream bank which has ten to fifteen foot high bluffs bolstered in places with concrete rubble. Development has not encroached on this bank. Consequently the natural irregularity of an uncontrolled watercourse exists. Riprap protection has been installed on the north bank to protect adjacent residential development extending approximately 1,200 feet upstream from Chapman Avenue.

The short reach from Chapman Avenue to the Newport Freeway is semi-natural with some disruption to the original watercourse. The south bank in this reach is a bluff, with concrete rubble responsible for the steepness of the embankment. The north bank is dotted with remains of old concrete channel pilasters.

Downstream of Chapman Avenue, the banks are protected with riprap. This form of channelization extends approximately half way to the Newport Freeway bridge. Upstream of this location, portions of the creek have been improved with uniformly graded earth channel slopes. The channel invert remains natural throughout the reach.

The creek flows through a semi-natural flood plain from Tustin Avenue to Cambridge Street. At approximately the midpoint of this reach the flood plain is reduced by encroaching development. The north bank is lined with riprap to protect houses located at the top of the slope. The natural appearance beyond this restriction is modified by the turf slopes of Santiago Golf Course through which the creek flows.

Natural flood plain is characteristic of the creek from Cambridge Street to Shaffer Street. A poorly defined levee has been constructed between the creek and an abandoned gravel pit near Shaffer Street pit to protect the pit from inundation, however, the levee is only 2 to 4 feet high in some locations and does not effectively serve this purpose. A steel culvert through a private road embankment constructed across the creek at one point creates adverse backwater conditions upstream. Extensive vegetation constricts the flow through portions of the reach.

Through Hart Park (Shaffer Street to Glassell Street), the creek is channelized into a vertical wall rubble masonry channel. The invert of the channel is paved with concrete and used as a parking lot.

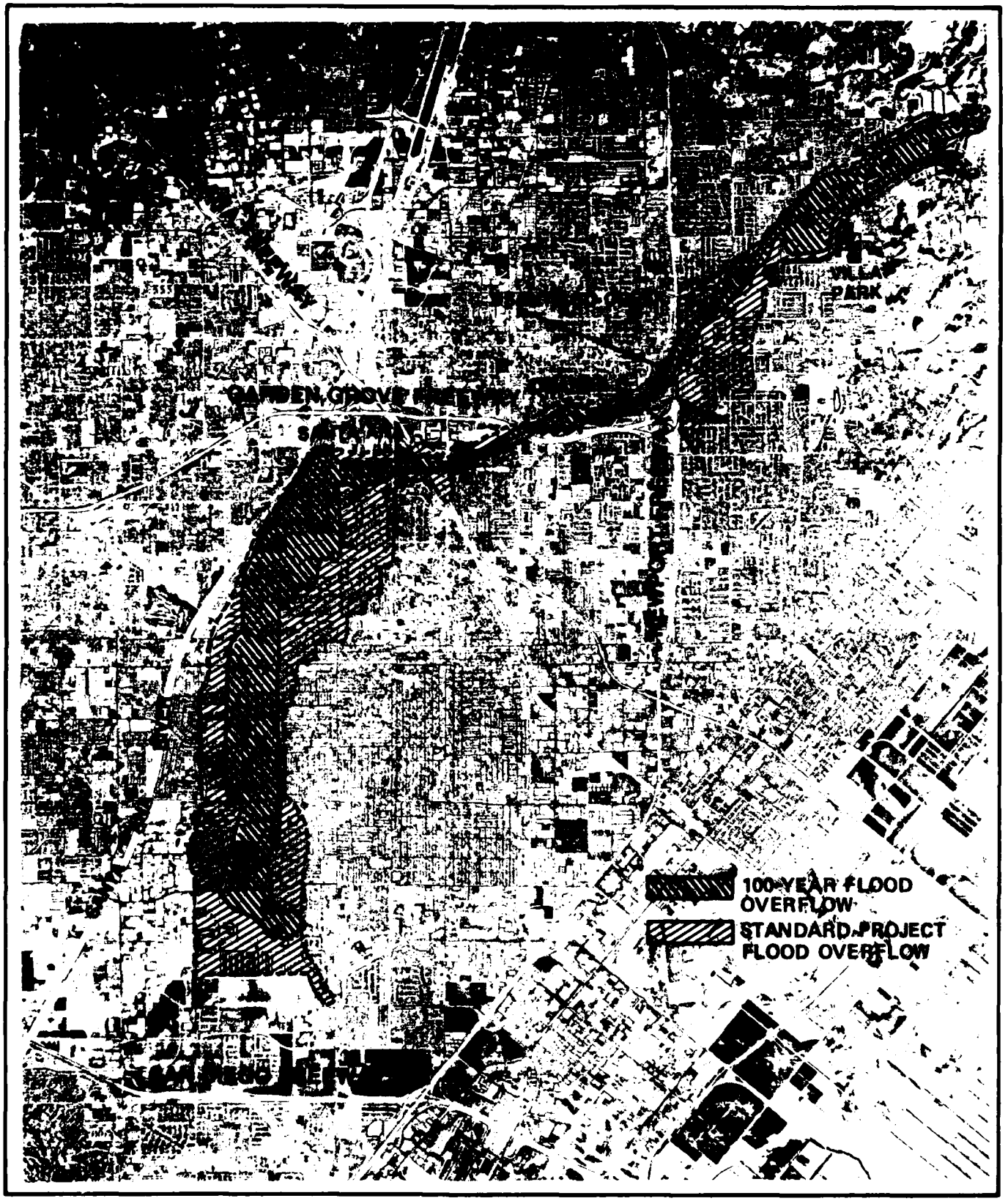


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FIGURE 4

SANTIAGO CREEK OVERFLOW AREA

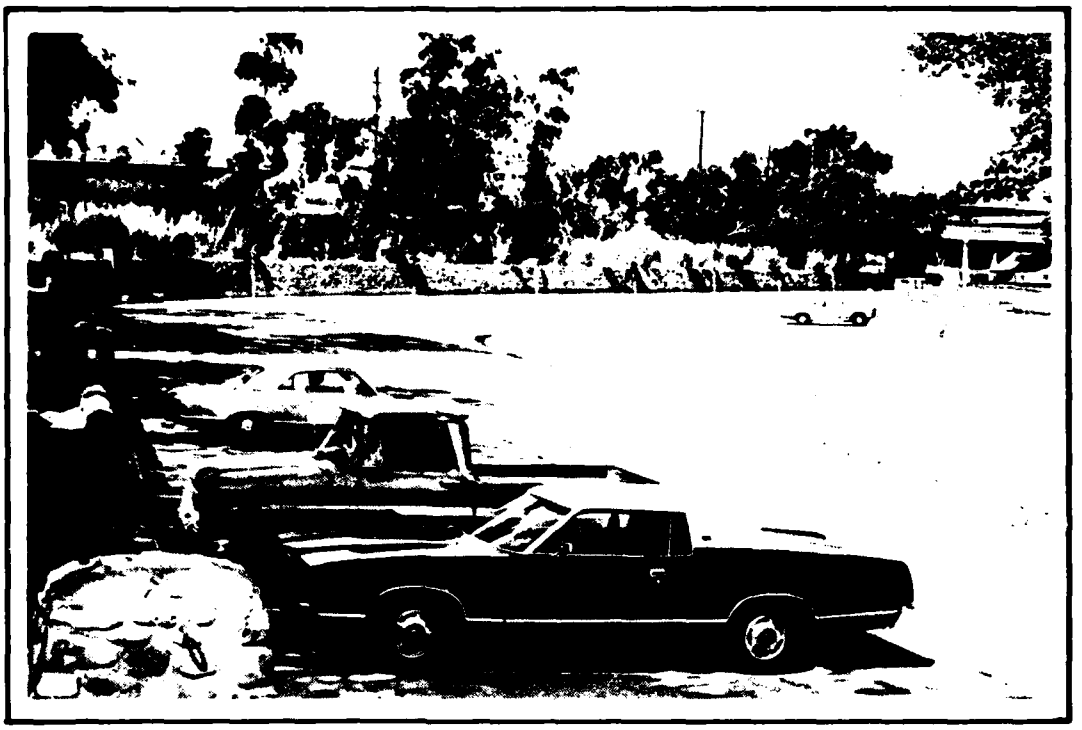


Photo 21: Santiago Creek in Hart Park doubles as a parking lot.

Extending from Glassell Street (through Santiago Park) to upstream of the Santa Ana Freeway there are channel walls with a terraced cross-section.

From Santa Ana Freeway to Flower Street the creek is semi-natural with numerous local encroachments in the form of backyard gardens, retaining walls, fences and trees. The watercourse remains earth-bottomed.

In the reach from Flower Street to the Santa Ana River the creek is a trapezoidal cross-section with compacted earth material and an earth-bottom. The overall effect of this rather jumbled mixture of natural channel, variable-height levees, channel encroachments, and narrow culverts is difficult to summarize. Flooding could occur at many points along the channel, though predicting what would cause flooding at any particular point would be difficult.

Photo 22: Encroachments along Santiago Creek limit right-of-way.

Flood Insurance

All of the cities affected by the Santa Ana River are currently enrolled in the National Flood Insurance Program administered by the Flood Insurance Administration of the Federal Emergency Management Agency. This program provides relief to subscribers who sustain property damage from floods. Since participation in the program requires local interests to adopt and enforce land use controls within the flood-prone area, local interests have demonstrated their concern with the flood hazard to future development in the flood plain.

Only recently has a flood plain insurance study of the 100-year flood plain been developed recognizing the channel improvements within the Santa Ana River since 1975. As a result of this study, in order to qualify for the National Flood Insurance Program local cities must develop more stringent flood plain management practices. Cities, therefore, are requiring flood plain management practices such as elevating all new construction within the flood plain. These controls will have little impact, since most of the land within the flood plain is already developed.

Resources of the Study Area

SOCIO-ECONOMIC RESOURCES. The physical setting of Santa Ana River's Standard Project Flood (SPF) overflow area varies tremendously between the upper and lower basin. On one hand, the lower basin, the area subjected to the greatest flood threat, is highly urbanized, mostly residential. While comparably few lands are devoted to agriculture, the Santa Ana Canyon area, located downstream of Prado Dam to Weir Canyon Road, provides the only major area of undeveloped land in the lower basin. Portions of twelve Orange County cities lie within the lower basin's overflow area: Anaheim, Fullerton, Buena Park, Garden Grove, Santa Ana, Orange, Stanton, Westminster, Fountain Valley, Huntington Beach, Seal Beach and Costa Mesa. Over 1,800,000 people reside or work within the potential flood area.

On the other hand, the upper basin area subject to a standard project flood has a relatively rural atmosphere. The majority of the land is devoted to agricultural use. Fewer people reside within the upper basin flood overflow area (550,000). The residents around Prado Reservoir are particularly concerned that their area remain as one of the few open, agricultural areas in close proximity to the greater Los Angeles Area. Maintaining the rural atmosphere of the Prado area has high priority for these residents.

Photo 23· Rural setting in the town of Norco.

As predicted in the 1975 Survey Report, population growth in the lower basin (Orange County) has slowed considerably because developable land within the basin has largely been used up. The population in the relatively rural upper basin has grown more rapidly than that of the lower basin, indicating a trend to urbanization in the upper basin.

This population growth has greatly increased demand for developable land, particularly for land in the areas closest to the lower basin--the Santa Ana Canyon and the area around Prado Dam. Land values in the area have increased significantly since the 1975 Survey Report, and three developers have plans for the flood plain in Santa Ana Canyon. Under the 1975 Recommended Plan, this flood plain was to be acquired and preserved as open space for a number of reasons, not the least of which was the magnitude of potential floodflows in the canyon and severe erosive capabilities of these flows. Pressure to develop the canyon has increased since 1975, and in 1980 Orange County adopted a resolution calling on the Corps to modify its flood control plan to allow some urban development in the canyon. At the same time, concern for maintaining the canyon as open space has also increased. Since the 1975 Survey Report, the U.S. Fish and Wildlife Service has strongly supported the original recommendation that this canyon be preserved as open space. These changes in interests have led to recent efforts on the part of the developers to coordinate with Orange County and the Fish and Wildlife Service to develop a plan that is more compatible with the Corps' plan for acquiring all land within the area which will be subjected to flooding from releases from Prado Dam.

Because the Santa Ana River Basin is thriving economically and is a highly desired place to live, employment growth in the basin has continued strong since the 1975 Survey Report. Upper-basin employment has surged and incomes are high. Employment growth in the lower basin has not increased at as high a rate, but income levels in the lower basin remain higher than those in the upper basin. Manufacturing, trade, and service continue to dominate basin employment.

In general, most residents in all basin areas are satisfied with their surroundings, and county government expenditure data indicate that residents' needs are being met. Rapid population growth, however, has posed some problems for public schools, health care facilities, recreation facilities, and has resulted in increased crime rates.

The socio-economic picture for the basin, then, is generally what it was when the 1975 Survey Report was issued. Those living in the basin enjoy a high level of social and economic well-being, and the area continues to be a highly desirable place to live. Population continues to grow, as predicted, with some urban "spill over" from the lower into the upper basin. Pressure to develop remaining open areas in the lower basin remains high, as does the possibly conflicting desire to retain open spaces wherever possible, particularly in the Prado basin and Santa Ana Canyon areas. State Propositions 13 in 1978 and 4 in 1979 may place restrictions on local spending for recreation, as well as for flood control project maintenance. This could not be anticipated in 1975.

RECREATION RESOURCES. Outdoor recreation opportunities in the basin are numerous. The facilities attract many participants. Major recreational facilities within the upper basin include regional and local parks, nature preserves, and golf courses. Since the 1975 Survey Report, construction of Yucaipa Regional Park, 5 miles to the southeast of the Mentone damsite, has begun. This 253-acre park will feature day use areas. Two regional trails could link this park to the Mentone damsite. Equestrian and hiking trails along the Santa Ana River within Riverside County link several regional parks and will eventually connect to Prado Reservoir. Prado Reservoir contains two regional parks, and a community park. Facilities around the reservoir include a pistol range and Corona National Golf Course. Since the 1975 Survey Report the Corps, with San Bernardino County, has shared in development of a 50-acre lake within Prado Regional Park. The major recreational facilities within the lower Basin include regional parks, beaches, harbors, preserves, golf courses and local parks. In Santa Ana Canyon, a regional bicycle trail extends from Green River Golf Course adjacent to Riverside Freeway, 2.5 miles to Featherly Park. Beginning at Imperial Highway, heavily used regional trails run along the river for 20 miles to the Pacific Ocean. The regional trails between Imperial Highway and the ocean include six rest stops, extensive landscaping, underpasses at all bridges, and access points at all street crossings. Santiago Creek has four local parks adjacent to it, three bicycle trails which tie into it, and equestrian trails near and in the area (from the gravel pits to Villa Park Dam).

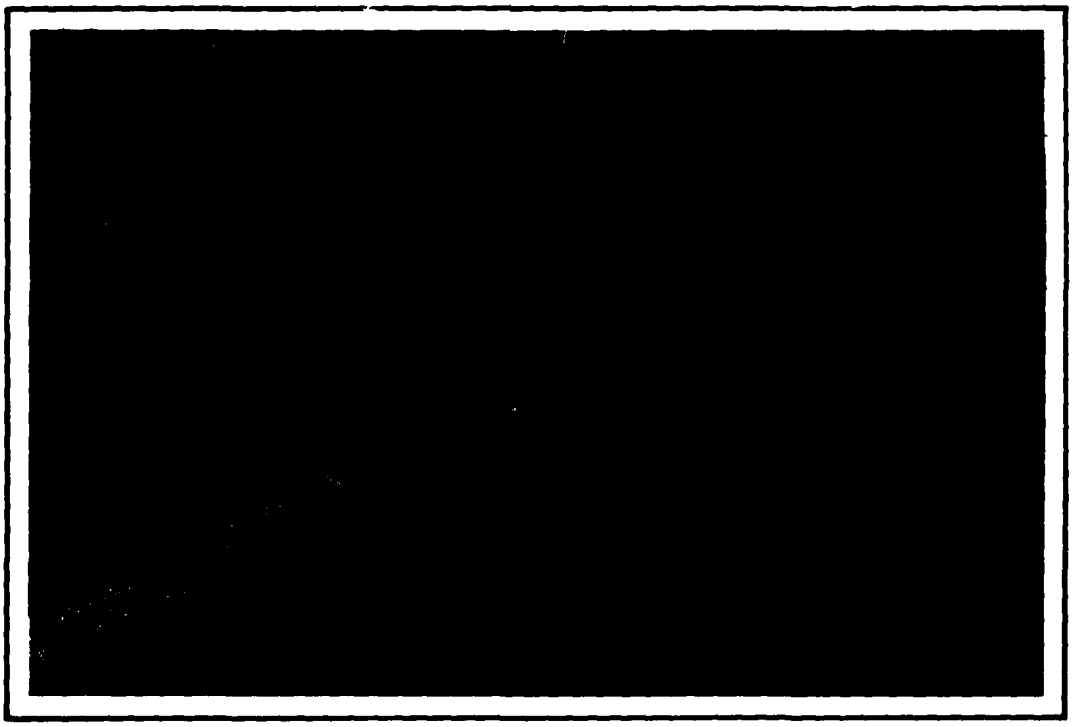


Photo 24: Bicycle underpasses are at all bridge crossings along the lower Santa Ana River trail.

BIOLOGICAL RESOURCES. The flora and fauna within the Santa Ana River basin vary considerably. Vegetation in the basin is highly diversified. Conifer forests interspersed with mixed woodlands dominate the upper elevations of the mountains; dense, shrubby chaparral dominates the lower mountainous areas and higher foothills; and less dense, shorter, shrubby coastal sage-scrub vegetation covers much of the lower hillside areas. Along the undisturbed valley floor, grasses and lower herbaceous plants usually dominate. In and the along the river, plant communities also vary. Contrary to the Survey Report statement that a characteristic of the upper Santa Ana River basin above San Bernardino is an almost total lack of vegetation, the proposed Mentone damsite contains one of the few areas of mature Juniper Woodlands found on the coastal side of the San Bernardino mountains. This area is extensive and intermixed with coastal sage scrub, providing habitat for varied mammals and birds. A minor vegetation type in the area is riparian woodland, which provides important perching and nesting habitat for birds, especially raptors.

Photo 25: Juniper woodlands within the proposed Mentone Reservoir.

Limited, scattered vegetation and habitat exist along the Santa Ana River from the proposed Mentone Damsite to about the City of Riverside. From this point to Prado Reservoir the area along the river contains high quality, diverse riparian vegetation, and habitat for the

least Bell's vireo and the yellow-billed cuckoo. The Prado Reservoir area contains the largest stand of mature forested woodland remaining in Southern California, 3,000 to 5,000 acres of willows with some cottonwoods and sycamores and wetland-type habitat. In addition, many of the 9,741 acres within the reservoir are open dairy farm areas. These dairy farms, many of which replaced farms in rapidly growing Orange County, are an important community resource and preserve rural esthetic values in the greater Los Angeles Metropolitan Area. Their loss would be economically and esthetically important to local and regional residents. Of the total agricultural area, 3,366 acres have been designated as Prime and Unique Farmlands.

Photo 26: Prado County Park (Prado Reservoir) abutts the Santa Ana River.

In the Oak Street Drain drainage area, coastal sage scrub dominates in the intermediate mountain elevations while chaparral dominates in the upper elevations. Below the mountains, the area around the drain flattens into an alluvial plain covered primarily with citrus groves above 10th Street. Below 10th Street the area is urbanized with no vegetation of consequence.

Although man's encroachment on the Santa Ana Canyon has degraded the natural environment, a majority of the canyon remains in a relatively natural state. This area contains extremely high quality and diversified riparian vegetation. The U.S. Fish and Wildlife Service has based much of its support of the 1975 Recommended Plan on the preservation of this last remaining relatively natural portion of the coastal Santa Ana River ecosystem.

In the Santiago Creek drainage area above Villa Park Dam, vegetation consists of a mixed understory of grassland and coastal sage scrub, chaparral communities, scattered oak, willow, and sycamore trees. Below this reach, Santiago Creek is essentially an earth-sided and earth-bottom channel. The creek's course between Villa Park Dam and Villa Park Road provides valuable riparian habitat. Below this reach, Santiago Creek's course is of ecological significance primarily because birds are attracted to ponded water following rains. The area adjacent to the creek between the Hart Park and the Santa Ana River is heavily landscaped with exotic trees and shrubs with esthetic importance.

Near the coast, salt marsh, freshwater pond, and limited riparian habitat exist. These habitat types are in short supply along the coast of southern California. The size and quality of the marsh to the east of the river mouth has been reduced due to poor tidal flushing and localized placement of fill, but the marsh remains an important ecosystem.

The current studies reveal more abundant wildlife than the initial 1975 Survey Report studies revealed. Significant wildlife exists along the Santa Ana River corridor except for the upper river corridor between the confluence of Warm Creek and the Santa Ana River and Mount Rubidoux and the lower river corridor between Yorba Linda Park and Hamilton Avenue-Victoria Street. Contrary to the Survey Report findings, the area of the Mentone damsite was found to contain diverse habitats, supporting approximately 50-60 species. Six or seven different types of habitat exist in this area alone. The juniper woodland provides food and cover for large numbers of rodents, doves, and other non-game species, which in turn are prey to foxes, coyotes, hawks, and eagles living in and around the site.

Birds are especially abundant along the river corridor. The Santa Ana River between the City of Riverside and Prado Reservoir, in the Prado basin, and in the Santa Ana Canyon provide a breeding site for two rare and endangered birds: least Bell's vireo (Federal Candidate Species and State Protected Endangered Species) and yellow-billed cuckoo (Federal Candidate Species and State Protected Rare Species). Prado

Reservoir serves as a valuable habitat for wintering ducks and geese. Peregrine falcons and bald eagles, listed endangered species, are also known to forage in the reservoir.

Wildlife is abundant in the national forest above Oak Street Drain. Along the remaining reaches, however, wildlife is impoverished. This is due in part to the natural sparsity of habitat, but in greater degree to man's encroachment.

Wildlife is abundant in the higher elevations of Santiago Creek above Villa Park Dam and less abundant but still signifcant along the river course between Villa Park Road and Villa Park Dam. Along most of the remaining reaches, however, wildlife is limited because of urban encroachment adjacent to the narrow stream channel.

A wide variety of birds reside along the coastal corridor. At the remnant salt marsh on the east side of channel north of Pacific Coast Highway, 74 species of birds have been observed over the past 8 years. Three endangered species have been documented: the California least tern (Federal), the light-footed clapper rail (Federal), and the Belding's savannah sparrow (State). The beach at Huntington Beach just west of the Santa Ana River hosts a major California least tern colony.

In an otherwise heavily suburban environment, the Victoria Pond, located along the east side of the river channel just below Victoria Street, provides a freshwater wetland environment unique in this area. It is used by numerous waterfowl. The U.S. Fish and Wildlife Service considers it a valuable habitat and favors post-project restoration of the pond and connection of the pond with the marsh wetland at the mouth of the Santa Ana River.

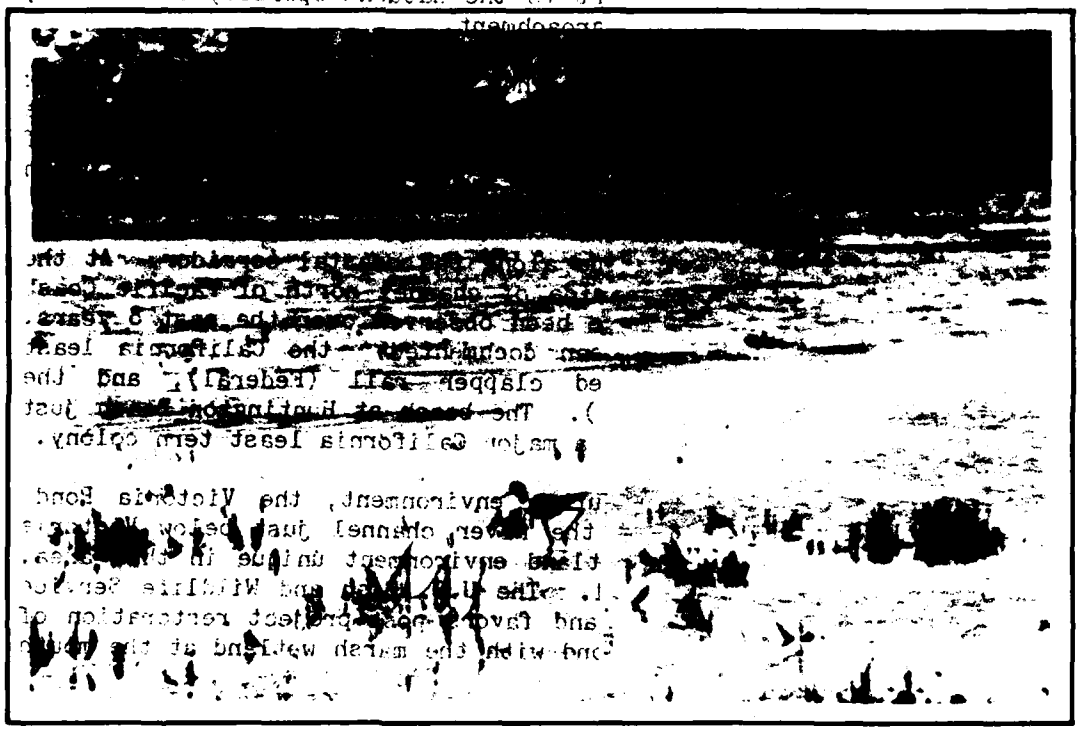


Photo 27: Victona Pond, a freshwater pond near the Santa Ana River mouth, hosts a wide variety of birds.

CULTURAL RESOURCES. No cultural resources have been identified within project borders in the Mentone Dam area, though the base of bluffs near Mill Creek and the Santa Ana River may contain prehistoric sites. Some 16 sites exist between the Mentone damsite and Prado Reservoir. These sites have not been test excavated. Within the 582-foot (msl) taking line proposed as a part of the NED Plan for Prado Reservoir, 24 cultural properties have been identified, including two historical and four prehistoric sites which appear to meet National Register of Historic Places criteria. Other sites are severely disturbed or otherwise appear not meet National Register criteria. South of Prado Dam there are a number of cultural resources along the river, all but one having been designated as county historical monuments. Several State and county historical landmarks along the river mark locations of early settlements and of former or preserved ranchos and adobes.

There were few cultural resources discovered in the Phase I study which had not already been inventoried in the 1975 Survey Report, and there were no significant changes in the overall view of the cultural value of the area.

WATER QUALITY AND SUPPLY. The quality of both surface and ground water varies tremendously within the Santa Ana River Basin. The water quality is excellent at the headwaters; however, the quality deteriorates progressively downstream to a generally poor quality at the lower end of the upper basin. This degradation of water quality is largely due to storm flow of poor bacteriological quality and partially treated municipal wastewater effluents. The water quality in the lower basin suffers from upstream degradations as well as in-basin degradations, overdrafting, seawater intrusion, or oilfield brines and relatively high total dissolved solids (TDS) concentrations of imported waters.

Seven ground-water reservoirs underlie the Santa Ana River watercourse from the Mentone area to the Prado Basin. Orange County Water District owns about 2,000 acres in the Prado Reservoir area which is used in the District's water conservation program. The District also maintains 1,017 acres between Imperial Highway and Katella Avenue to percolate local runoff, and the ground water basin here is an important source of average quality water. Currently more imported water than local water is applied. There are presently two functional water conservation structures on Santiago Creek. One is the reservoir formed by Villa Park Dam. Here stormwaters are held for recharge into the ground water system. The other structure, a small ground water dam, is located several hundred feet downstream of the dam.

The water supply in the Santa Ana River Basin is not sufficient to meet basin needs and surface water in the lower basin is consistently low quality. Recycled water and water imported both from the Feather River (under the California State Water Project) and the Colorado River are used to meet the deficits in the supply. However, local ground water is by far the basin's major source for local water supply.

Ground water levels over the past 20 years have changed significantly. In 1950, the upper basin was relatively full; ground water levels were near the surface in several areas. The lower basin during this same time, however, was dangerously low, with some seawater intrusion being caused by the ground water level being below sea level. Both basins have had continual overdrafting over the past few decades. In the upper basin, ground water levels have dropped considerably, whereas in the lower basin, they have risen because of an extensive replenishment program.

AIR QUALITY. The Santa Ana River Basin lies in the middle of the South Coast Air Basin, which has the poorest air quality in the State. The most prevalent form of pollution in the area is photochemical smog (nitrogen oxides and organic hydrocarbons interacting in sunlight to form ozone). From June to October, the increased hours of sunlight, the

speed of light morning winds, and the more frequent temperature inversions cause more frequent and severe air pollution. In addition, prevailing sea breezes often blow air pollutants generated in Los Angeles and Orange Counties eastward into the San Bernardino and Riverside areas, causing severe air pollution in the upper Santa Ana Valley. Accumulated air pollution has had noticeable effects in recent years on pollution-sensitive pine trees in the San Bernardino National Forest and on agricultural crops throughout the basin. Adverse influence of such pollution on human health is also a basinwide problem.

Significant odors along the river stem from equestrian stables and from the tidal lagoon east of the river mouth. In addition at the lower end of the upper basin, a large dairy industry located north of Prado Dam and Reservoir produces odors that create a problem for residents of new developments in the area. In addition, the still water that stagnates in warm weather behind Prado Dam creates a second locally significant source of odor in this area.

MINERAL RESOURCES. The principal mineral resources in the Santa Ana River Basin are sand, gravel, limestone and other stone, and petroleum.

Sand and gravel are extracted along the Santa Ana-Mill Creek wash between the cities of Mentone and Colton, along the lower Santa Ana River between the cities of Yorba Linda and Orange, and along Santiago Creek between Villa Park Road and Prospect Street. Gravel excavation in the Santiago Creek operations is expected to continue through 1980 before reserves are depleted. A proposed gravel operation just downstream of the existing operations, is expected to continue through 1984.

Limestone quarries in the upper basin have been in production since the turn of the century and still have ample reserves. Other quarries in the Riverside and Corona areas furnish broken stone and some dimension stone. Among the major fireclay producers in the state with good reserves are quarries near El Toro and Corona.

Petroleum, the most valuable resource in the study area, is extracted near the river around Yorba Linda, Huntington Beach, and Newport Beach. Three oil wells are currently operating in the Prado Basin.

COASTAL RESOURCES. Although the river was once a source of significant amounts of beach sand, its importance as a source of beach replenishment material is greatly diminished at present because of the construction of Prado Dam and other flood control measures along the river. Additional structural measures such as the Anaheim Bay jetties and entrance channel have precluded the transfer of materials downcoast which may have entered the coastal zone from the Los Angeles and San Gabriel Rivers. The predominant source of littoral materials which nourish the beaches in the vicinity of the river mouth at the present time is the feeder-beach upcoast at Surfside-Sunset Beach. The basic shore configuration of the littoral cell is a northwest-to-southeast

alinement, with a crescent-shaped delta existing at the mouth of the Santa Ana River. This beach orientation is conducive to a net southerly transport of littoral material during the winter and spring months (January through April), and to a net northerly transport of material during the summer and fall months (July through October). Since the Santa Ana River mouth region experiences a significant amount of gross transport during the summer months and fall months when there is low (or no) flow of water down the Santa Ana River, the river mouth is unable to flush littoral material out and it clogs up. This condition prevents the tidal exchange between the Santa Ana River and the tidal channel in the salt marsh on the east side of the channel. Orange County alleviates this condition by mechanically clearing out the Greenville-Banning channel on an as needed basis.

Photo 28: Sand often plugs the Santa Ana River mouth during summer months.

SUMMARY OF CONDITIONS CHANGES SINCE THE 1975 SURVEY REPORT. The rapid urbanization of the remaining open spaces in the lower river basin, and the increased urban pressure on open areas such as the Santa Ana Canyon, were predicted in the 1975 Survey Report, and have occurred. As run-off is likely to be increased when such open-space to urban-use transitions occur, the possibility of above capacity floodflows along the entire river has increased. The urbanization has also increased the at-risk population in the flood plain.

Several changes have been made in flood control facilities along the main stem, and a debris basin has been built in the Oak Street Drain, but these may have been offset by unanticipated damage to the river channel during the 1980 floods. There have been few physical changes in the Santiago Creek area, but local needs have changed significantly as the area has become of greater importance recreationally.

The combination of decreases in open space and increasing national policy emphasis on environmental concerns has made environmental issues of somewhat higher priority since the 1975 Survey Report. And new knowledge of the importance of the plant and animal communities along the river has added to this effect.

Considering these, and a number of other changes, a new prediction of the status of the area if no Federal action were to be taken, is possible.

CONDITIONS IF NO FEDERAL ACTION IS TAKEN (IF PROPOSED PROJECT IS NOT IMPLEMENTED)

Socio-Economic Conditions

The economy of the basin will remain strong and employment will remain high. Urban development will continue with or without flood protection, and it will be concentrated in the upper basin, where most of the developable area remains. Population will probably reach 3.5 million by 2000, an increase of 35 percent over 1970 population. This is slightly higher than predicted in 1975.

Future Flooding

Urbanization since 1975 has intensified the potential damage which could result from a major Santa Ana River flood. In the upper basin above Prado Dam, a standard project flood would cause an estimated $331 million in damages, $205 million more than was predicted in the 1975 Survey Report. Added development along the river, and increased property values, account for most of this increase. Flood protection for this area would also prevent potential loss of life, preserve an increasingly complex network of transportation and communications facilities, and prevent potentially crippling damage to a major Air Force supply center. In a significant flood, people in the area would suffer loss of business and wages, as well as direct property damage to residential, commercial, and industrial areas. Dairy feedlot operations would be hampered, reducing milk supply for the entire southland.

A standard project flood on the Oak Street Drain would cause an estimated $11 million in damages under existing conditions, about 760 homes would sustain damage, some of it substantial, and the Riverside Freeway would flood as well as numerous local streets. Secondary economic effects of this would include future flood fighting, flood proofing, and flood insurance costs, a decrease in available low-income housing which tends to cluster around the river, increase in the cost of existing housing (from reduction in supply and flood insurance premiums), and increased new housing costs, caused by the need to flood proof them.

Along the Oak Street Drain, flooding would again endanger the lives of senior citizens in the trailer parks on the east side of the channel. Ill-equipped to respond quickly to flood emergencies, these citizens are likely to be seriously threatened by floods along the channel.

A standard project flood on Santiago Creek could be expected to cause $104 million in damages if it were to occur under today's conditions (1980). Annual damages of $801,000 could be expected. Future flood fighting, flood proofing, and flood insurance costs would also be incurred. In the event of a large flood, many local streets would be closed. About 12,200 homes would sustain damage, some of it quite substantial. The flooding would adversely affect the supply of homes. Housing rents could again be expected to increase. New homes in the flood plain would cost more, for previously mentioned reasons.

Because of the terrain and drainage pattern, the Santa Ana River flooding impacts in the lower basin area would be far more disastrous than in other study areas. Flood control facilities along the Santa Ana River now provide approximately 70-year flood protection below Prado dam. A standard project flood would inundate over 110,000 acres and directly involve some 500,000 homes and 1,800,000 people who now live within the SPF flood plain. The limits of the standard project flood overflow area extends from Imperial Highway to the west of the river to Orange Thorpe Boulevard in Yorba Linda to Fullerton Creek. At this point the boundary of the potential flood area proceeds to the southwest along Coyote Creek. The potential flood area boundary then straddles the Orange County/Los Angeles County Boundary and continues along the San Gabriel River to the Santa Ana River mouth. Within this overflow area there are two high areas within Seal Beach and Huntington Beach that will not be inundated. The boundary of the standard project flood overflow area spreads out to the east at the river's confluence with Santiago Creek and then returns to the river. It also spreads out again downstream of the San Diego Freeway and then returns fairly close to the river until it reaches the river mouth. The area inundated would include hundreds of thousands of homes, thousands of businesses and factories, and hundred of schools. With only about 8 hours warning time, complete evacuation before the peak flow would be impossible. People would be unaware of how to escape. Traffic jams would virtually halt egress. Untold numbers of people could be killed in the

floodwaters. In addition, many lives could be lost from failure of bridges, the fall of electrical transmission lines, and from a possible mass panic.

Even though each community has its own emergency plan, a catastrophic flood could make these plans extremely difficult to effectively implement. Hospital and clinic capacities would quickly become strained and overloaded. Ambulance, rescue and emergency care services would be hampered by flooded roads and washed-out bridges. The operation of police, fire and National Guard units would be complicated by the number of crises that could occur, such as explosions, toxic chemical spillages, mudslides, and traffic jams.

Evacuation plans could be crippled by the sheer volume of demand. Evacuating several hundred thousand people who need food and shelter would strain transportation and shelter capacities. The logistics of effectively accomplishing such a potentially huge evacuation in a relatively short period of time are extremely complex.

A rapid increase in the incidence of crime, particularly in looting, burglary and motor vehicle theft, would occur in the wake of a catastrophic flood. Violent crime would be likely to increase until adequate numbers of police protection personnel were available for assignment to seriously flooded communities and neighborhoods.

In the aftermath of the catastrophic flood, there would also be serious health hazards. Drinking water probably would be contaminated, resulting in various kinds of diseases and the possibility of epidemics. Sewerlines might be broken creating various types of sanitation problems.

Thousands of families would have to be evacuated for anywhere from one week to several months. In the meantime, children would need to be taken to other schools, creating crowded conditions. The employees of flooded businesses and industries would simply be out of work until these places reopened or until workers found new jobs. Homeowners, suffering flood damages to the structure of their houses, to the interior spaces (carpets, floors), to their furniture, to their landscaping investments, etc., would be forced (upon return from evacuation centers) to spend considerable time in repair work. Natural gas, electrical and telephone services would be interrupted and repairs delayed by virtue of the intensity of need for attention to many different breaks. With several hundred thousand potentially affected homeowners, the demands on assistance would be staggering and delays and frustrations inevitable.

The direct damages from a standard project flood would total $9 billion. This is $6 billion more than if this flood were to have occurred under existing conditions at the time the 1975 Survey Report was prepared. This significant increase in the dollar damage resulting from a standard project flood can be attributed to two factors--rapidly rising construction cost and reanalysis of projected damages. The

hydrologic analysis conducted in this study indicated higher depths of floodwater in the event of a major flood, which in turn would result in greater damages.

Recreation

As stated in the 1975 Survey Report, the demand for recreation in Southern California will continue to increase. This increase in demand can be attributed to four factors: (1) an increase in population; (2) the region's higher standard of living; (3) more leisure time for recreational pursuits; and (4) the residents' high mobility.

To help meet this demand, several regional parks are proposed within the Santa Ana River Basin. Existing and proposed local funding constraints inacted since the 1975 Survey Report, however, may result in local agencies not constructing these proposed developments. Although capital expenditures are still available for recreational development, capital available for operation and maintainance is scarce.

Water Supply and Quality

Increasing population and resulting urban runoff will probably continue to stress the future quality of water in the basin. The Santa Ana Watershed Planning Authority (SAWPA), however, has formulated a set of objectives to check the long-time increase in contaminants and eventually reverse the trend of continually dropping water quality. The objectives have been adopted by the State Water Resource Control Board (SWRCB) and the Regional Water Control Board (RWCB).

Measures for control of contamination which have been planned and are being implemented are:

(1) Closer containment of dairy wastes and other agricultural wastes.

(2) Additions to existing wastewater treatment plants, and consolidation into a smaller number of systems. By 1985, the plans call for advanced, Type III treatment in all regional plants.

(3) Completion of the Santa Ana Regional Interceptor (SARI) for removing highly saline groundwater, as well as highly contaminated industrial wastewaters and dairy wastes from the basin. Because water supply and quality are affected by a variety of factors, specific predictions about them are difficult to make. If no project action is taken, water quality is likely to decline in the future, but how serious this decline will be cannot be predicted.

Summary of Conditions If No Federal Action Is Taken

Continued urbanization will exacerbate these conditions, increasing runoff, increasing encroachment on the flood plain, increasing the potential for catastrophe. While the major damage area from the

standard project flood will still be the lower basin, increased growth in the upper basin will mean steadily increasing damage levels for this area as the years pass. The demand for open space will continue to be in conflict with the demand for housing and business construction sites.

In Orange County, heavy pressure to develop available lands will continue. The ecologically valuable lands of the Santa Ana Canyon and the salt marsh at the river mouth could be expected to be fully developed as population grows and the demand for housing development increases. In the coastal zone, the marsh has not been developed, at least in part because of its value to petroleum producers. It has not been protected as a functioning ecosystem, however. In the last two years, for example, fill has been illegally dumped in the area twice. In 1979 Orange County dumped 6 acres of dredged channel material on the marsh. The Corps required the county to remove this material, but it was, instead, spread out over the marsh. If marsh preservation is not an integral part of the Santa Ana Project the marsh may not be preserved as a stable habitat and will most probably continue to deteriorate.

PROBLEMS AND OPPORTUNITIES

On the basis of these general expectations of conditions within the basin should no Federal action be taken, a detailed analysis of problems to be solved and opportunities to be seized was undertaken.

The Flooding Problem

The 1975 Survey Report finding that the main problem is in the lower Santa Ana River from Weir Canyon Road to the Pacific Ocean is reaffirmed by Phase I analysis. There is a serious threat to San Bernardino and Riverside counties, but the major catastrophe would be in the lower basin. The relatively rural flood plain from Prado Dam to Weir Canyon Road can be inundated with relatively minor damage.

Major existing flood control improvements include Prado Dam and channel improvements along the reach below the dam. The dam-channel combination will not adequately control more than a 70-year flood, and its capacity is severely limited by constrictions from numerous bridges. Tributary channel improvements by the Orange County Environmental Management Agency (OCEMA) have capacity to convey local runoff, but will not alleviate conditions caused by large overflows from the Santa Ana River. Excess flows in the river will breach the channel at any of several locations and cause widespread flooding in Anaheim, Fullerton, Buena Park, Garden Grove, Santa Ana, Costa Mesa, Fountain Valley, Orange, Stanton, Westiminster, Huntington Beach, and in adjacent unincorporated areas.

Because of the magnitude of the flood problem in Orange County and the difficulty of determining the area affected due to the maze of flood patterns created by the extreme urbanization of the affected area, a major part of Phase I study was an hydraulic reanalysis, taking into account channel improvements constructed since 1975. This study

validated the 1975 Survey Report's hydraulic analysis. The analysis included sediment transport, channel capacity, breakout, and overflow studies.

The sediment transport analysis confirmed that sedimentation is a major problem on the downstream end of the lower Santa Ana River. In a standard project flood up to 4 feet of sediment will be deposited in the reach from Edinger to the Pacific Ocean and between drop structures in the vicinity of Imperial Highway. The analysis also reconfirmed that several feet of scour will occur between Garden Grove Boulevard and McFadden Avenue. These conditions will tremendously reduce the capacity of the channel during a major flood, and any subsequent flood occurring before the channel is restored.

The channel capacity analysis reconfirmed that since most of the upper portion of the channel levees are unprotected, these levees, when exposed to long duration flows from a flood, will erode. Consequently, floodflows will break out of the channel and flood the surrounding areas.

The final analysis conducted was an overflow analysis. Because of the extremely large area involved and the complex flow patterns resulting from major obstructions, large developed areas, and numerous streets, it was necessary to conduct a moderately simplified overflow analysis. The general approach used in the overflow analysis included the following steps: (1) identification of major obstructions and principal flow paths from the results of the breakout analysis, (2) compilation of flood depths upstream of major obstructions, (3) determination of average inundation depth by assuming normal depth and making allowances for obstructions, (4) allocation of some floodwaters being intercepted by major local drainage channels and losses due to storage effects in the affected flood plain, and (5) consideration of block walls in the flood plain which were not designed to resist floodwater.

The results of the overflow analysis confirmed the 1975 Survey Report findings that a large area from Katella Avenue to the Pacific Ocean will experience damages from a standard project flood. The area subject to flood overflows in Orange County covers over 110,000 acres.

On the basis of the analysis, however, floodwater depths in the area would be greater than those predicted in the 1975 Survey Report. The average depth of floodwaters will be 3 feet for a standard project flood. Floodwater depths in ponded areas and next to major obstructions will be much higher. Huntington Beach's low areas will have a much higher average flood depth (6 feet). The overflow area would be slightly greater than that predicted by the 1975 Survey Report.

Although the hydraulic analysis revealed a slightly larger standard project flood overflow area and greater flood depths, the analysis results are very similar to the 1975 Survey Report's.

Recreation Problems and Opportunities

Recreational development is a high priority in the Santa Ana River Basin. Any flood control right-of-way might offer desirable recreation facilities or open space. Local groups are particularly interested in developing regional recreational trails to tie in with their system of local trails. Since the 1975 Survey Report, local interests in San Bernardino and Riverside Counties have conducted planning studies for a regional bicycle, hiking, and equestrian trail throughout Prado Reservoir. Due to the high cost associated with this trail's development, local interests have indefinitely postponed the trail's construction.

Since the 1975 Survey Report, a new property tax measure has limited local ability to develop and, especially, to operate and maintain recreational facilities. Therefore, the 1975 Survey Report's recommended recreation plan has been revised so that it is low maintenance and, when possible, self-supporting. The recreation plan includes native plants and, wherever possible, situates recreation facilities so that local interests can charge user fees. There may also be difficultly in obtaining local assurances due to uncertainty about future funding abilities. Coordinated action to develop recreation facilities as a part of the overall project to protect the area from floods is one way of providing for preservation of open space and for improving the quality of life for those in the project area. The project provides local interests with an opportunity to develop needed recreation areas and flood control facilities in one effort, thus decreasing the cost of achieving each goal.

Photo 29: The lower Santa Ana River bicycle trail and a rest stop at the San Diego Freeway.

Water Quality and Supply

A secondary water resource problem in the Santa Ana River Basin is sinking ground water tables of the river basin. (Much of the ground water quality is superior to that of imported water). Prado Reservoir, the existing spreading ponds from Imperial Highway to Katella Avenue along the lower Santa Ana River, the river course from about a mile upstream to about two or three miles downstream of Mentone damsite, and the gravel pits along Santiago Creek between Villa Park Road and Prospect Avenue could help replenish the ground water basin. Santa Ana River and Santiago Creek storm water could improve the chemical quality of water in the basin if a capacity for storage and controlled release of storm water was added. The lower TDS levels of storm water make it a valuable resource for water recharge. The 1975 Survey Report's Recommended Plan had only incidental water supply benefits from the operation of the reservoirs for flood control.

As discussed in the chapter "The Survey Report and Its Reviews," several agencies, including the Board of Engineers for Rivers and Harbors, had serious concerns that the provision of water conservation was not included as a project purpose.

Cultural Resources

Cultural resource studies conducted during this Phase I study along with the cultural studies done for the 1975 Survey Report have provided sufficient information to make the determination that cultural resources within Prado Reservoir appear to meet the criteria for eligibility for the National Register of Historic Places as an Archeological District. Phase II will include additional surveys and studies of mitigation and preservation measures. Depending on the nature and location of the cultural resource sites, action may be taken to protect the sites (by diking) or to mitigate the effect of inundation by a data recovery operation.

Coastal Resources

Santa Ana River sediment still replenishes the shoreline between the Anaheim Bay and Newport Jetties. The U.S. Geological Survey estimates that it contributes 150,000 cubic yards per year to the beaches under present conditions. It is the only natural source of material for this stretch of coast.

Improvement of the lower Santa Ana River channel would allow more frequent and larger releases from Prado Dam which would result in slightly more sand reaching the beach.

Although the feeder-beach at Surfside-Sunset Beach provides 300,000 cubic yards of imported sand per year to the shoreline between Anaheim Bay and Newport Jetties, the surf zone between Huntington Beach and the Newport Submarine loses about 112,000 cubic yards of sand per year. Since sources of artificial supply are scarce, any sand suitable for beach replenishment excavated from the Santa Ana River could be used to maintain this area's beaches at the highest level practicable to sustain the intensely used public beaches.

Operations to improve channel capacity in the lower Santa Ana River could contribute to efforts to maintain the beaches in this heavily-used stretch of the coastline.

Another problem uncovered concerning the Santa Ana River mouth is the complete closure of the exit of the Santa Ana River. This condition occurs as littoral material is trapped between the jetties, particularly during the summer months when river flow is minimal. Three major factors contribute to the formation of the closure of the mouth of the Santa Ana River: (a) small tidal prism, (b) large wave power, and (c) little or no (intermittent) streamflow. This blockage prevents the free interchange of tidal water in the salt marsh and could impede the restoration of the proposed 92-acre marshland. In order to restore the marsh, tidal exchange between the marsh and the ocean must be improved. Solutions to the problem may be achieved by preventing the formation of the sand plug by the use of jetties or other structures, or by successive breachings of the blockage during its formation.

Biological Resources

At the turn of the century nine major estuaries or saltwater wetland areas existed along the coast of the Los Angeles and Orange Counties. Development, dredging, reclamation, pollution and siltation have reduced their physical size and natural productivity 90 percent in this past century. The salt marsh at the mouth of the river is one of the few major riverine ecosystems remaining which has retained significant habitat values. In addition, as previously mentioned, two Federal and one State endangered species use this site for feeding. There is, at present, an opportunity to preserve this now-rare ecosystem as a part of the proposed project. The opportunity to preserve this wetlands habitat may be lost if the marsh is not included in the plan for the river at this time. Any development of the marsh area may be subject to Corps review under Section 404 of the Clean Water Act of 1977, and the area is subject to California Coastal Act until a Local Coastal Plan is approved. The deadline for these plans to be prepared was originally January 1981, but local authorities will not meet this deadline. Protection under this plan is thus at least several years away. In the meantime, the protection provided by the California Coastal Commission has not been sufficient. In 1979, the wetland area west of the river mouth was significantly affected by Orange County's removal of a culvert which facilitated tidal flow into the area, and the wetland area has not to this date been restored. In the marsh area at the mouth of the

channel, there have been two cases of illegal fill dumping during the last two years. The approach taken to seizing this opportunity depends on how the marsh fits into the overall plan selected for flood control.

NATIONAL OBJECTIVES

In evaluating alternatives to solve these problems and take advantage of these opportunities, two national objectives for all plans need to take precidence over other considerations. All plans are required to be evaluated on the basis of the National Economic Development Objective and the Environmental Quality Objective.

Contributions to National Economic Development (NED) are identified by net increases in the value of the national output of goods and services. Plans are thus evaluated in terms of their net effect on the nation's output in relation to their net cost.

Contributions to Environmental Quality are those which contribute to protection or improvement in the quality of natural and cultural resources. Such contributions are measured in common physical units (such as numbers of acres protected or improved) or in terms of specific Environmental Quality values (such as protection of rare or endangered species).

PLANNING CONSTRAINTS

Planning constraints specify limitations on the planning study that are of such importance that to violate them would compromise the validity of the entire planning process.

The 1975 Survey Report's planning constraints were not explicitly stated. One of these implicit planning constraints limited plan formulation. This implicit constraint was minimizing the relocation of homes and businesses in Orange County. An initial study of a plan which confined construction to Orange County, the main problem area, revealed that such a plan would require the relocation of about 2,000 homes and businesses; therefore, all detailed plans included construction in the upstream counties--Riverside and San Bernardino--to minimize relocations in Orange County. This Phase I study did not include minimizing social impacts as a constraint. The only impact this decision had on the conduct of the Phase I study was to include one additional plan which would confine improvements to Orange County.

The other planning constraints, however, did not prohibit the identification of a full range of alternative plans in the 1975 Survey Report.

The planning constraints for this stage of study, with the exception of minimizing relocation of homes and businesses in Orange County, are unchanged from the implicit 1975 Survey Report planning constraints. These planning constraints are presented below.

(1) Due to a seismic problem, water should not be held for an extended period in any reservoir site upstream from Prado Dam.

(2) Any significant losses in the water spreading capacity in Orange County along the Santa Ana River between Imperial Highway and Katella Avenue would lower the water supply of the lower basin and would, therefore, be unacceptable.

(3) Since the cost of relocating the sewage treatment plant near the river mouth would be prohibitive, any widening of the existing channel in the area must avoid this plant.

(4) Bottom organisms which are vital to the food chain of the least tern, an endangered species, live on the earth-bottom channel between Hamilton Street-Victoria Avenue. Channel improvements in this area must have an earth-bottom to be acceptable.

PLANNING OBJECTIVES

Planning objectives are based on a consideration of all of the preceeding elements: on the issues raised during review of the 1975 Survey Report, on analysis of the current conditions in the Santa Ana River Basin, on analysis of the flood control problem and the various opportunities for improving conditions in the affected area while solving the flood control problem, on consideration of National Objectives and project constraints. All of these are summed into a positive statement of what should be achieved by alternative plans.

These positive statements of objectives serve two purposes. First, they act as guides in the formulation of alternative plans to match various management measures and different combinations of solutions to the problems being solved. Later, they provide a basis for evaluating the degree to which each combination of measures is appropriate to the area, to the times, and to the people affected.

The general objectives of the 1975 Survey Report are shown in table 2. These general objectives took the form of plan alternatives, and were based on a set of implicit objectives which provided a sound basis for identification of a broad array of alternatives and for evaluation of these alternatives in an objective and reasonable manner.

The planning objectives for this Phase I study, virtually the same as those implicitly behind the 1975 Survey Report, are presented in table 1. All of these objectives are for the period 1980-2080.

TABLE 1

Alternatives were initially formulated, and later evaluated, on the basis of these objectives. The alternative chosen was that which achieved the best balance of all of these objectives.

1. Plans should contribute to the control of overflow from the main stem of the Santa Ana River.

2. For Santiago Creek, plans should contribute to control of overflow.

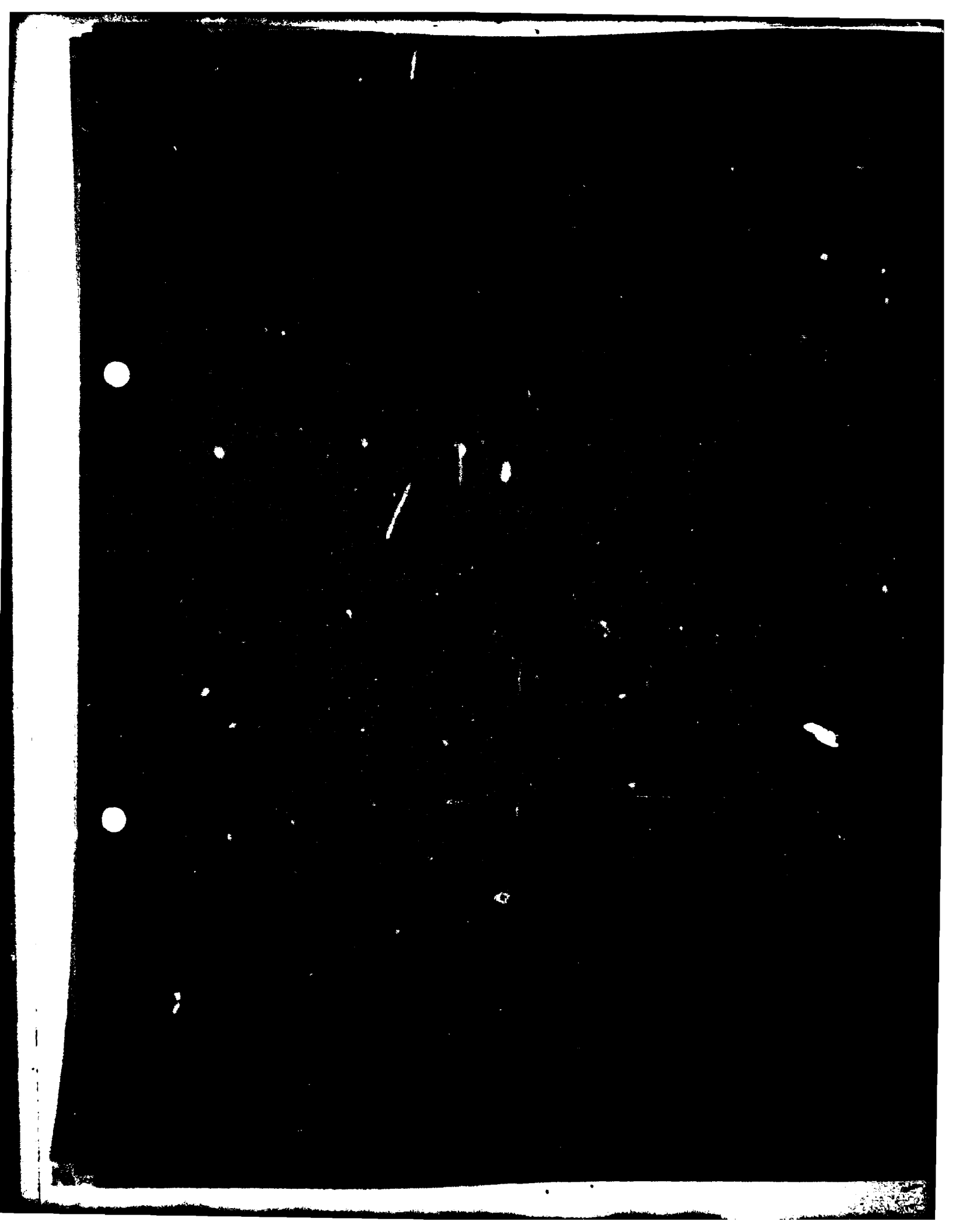
3. Plans for the main stem and for the Oak Street Drain should contribute to preserving the rural communities surrounding the Prado Reservoir.

4. Plans should contribute to preserving the open space and ecological values of the Santa Ana Canyon.

5. Plans should enhance and preserve the degraded salt marsh near the mouth of the Santa Ana River for preservation of endangered species and for general ecologic diversity.

6. Plans should contribute to increasing recreational opportunities within the project area.

7. Plans should contribute to the use of Santa Ana River and Santiago Creek flows for water conservation.



4. DETERMINATION OF PHASE I STUDY DIRECTION

INTRODUCTION

The initial objective of this Phase I GDM study was to either affirm the validity of the previously recommended plan in light of current conditions and criteria, or to reformulate the plan as required by such conditions and criteria. A number of important study components were identified as influences on the type and level of detailed studies, on the alternatives that needed to be reviewed or developed, and on the effort to gain and emphasis of public involvement. It was believed that analysis of the selected components would sufficiently clarify the reaffirmation/reformulation nature of the study and identify the most pertinent concerns that the Phase I study must address, allowing efficient execution of the study process.

Concern for the integrity of the study process, and for those reviewing this Phase I GDM who may wish to understand the thinking process underlying the direction of the study, requires that this thinking be recapitulated here. The elements to be considered in determining Phase I study direction have already been summarized. They were:

1. The 1975 Survey Report
2. Review Comments on the 1975 Survey Report
3. Changes in Conditions in the Study Area Since 1975
4. The Desires of Local Interests

In previous sections of this Phase I GDM, these elements have been described. Our analysis of them, and our conclusions about them, are now presented. From this the logical basis for the study direction may be seen. The rationale for decisions regarding scope and depth of the study is, thus, the subject of this section.

The 1975 Survey Report

The 1975 Survey Report was the culmination of an exhaustive 9-year study on identification of the problems within the river basin, development of alternative solutions to those problems, and selection of a single plan for implementation. A thorough review of that document, with emphasis on assessing the adequacy and accuracy of the development of the problem and determination of the completeness of the array of alternative solutions, would determine how comprehensive the initial studies were. If the initial studies were still viewed as complete and accurate, this would certainly limit the need for significant further plan formulation studies as part of the Phase I GDM.

Review Comments on 1975 Report

Review comments on the 1975 Survey Report were major determinants of Phase I study direction and effort. The Survey Report was subjected to an intense review process, largely due to the sheer enormity of the flood problem and the immensity and complex nature of the recommended solution. In addition, the 1975 Recommended Plan departed significantly from the objective of National Economic Development--or solving the problem in an economically efficient manner. The thoroughness of the review process raised many important issues and concerns, all of which could be most important to project formulation. An analysis of those review comments would be helpful in defining the need for additional studies during the Phase I study.

Changed Conditions in the Study Area Since 1975

The Survey Report was completed in late 1975 and 5 years have elapsed since the study conclusions were formalized. During that period, changes have or could have occurred in a number of areas which could affect the study conclusions. Changes in provision of flood control measures by local interests could physically affect flood plain limits perhaps changing the previous study's conclusions. New urban development anywhere in the basin, but particularly in the upper basin above Prado Dam, could effect the relative justification among the array of alternatives and could effect plan formulation. New development in the lower basin was seen to merely intensify the need for a flood control measure, but new development in the upper basin could very much alter the form of that measure.

Changes in environmental features subsequent to 1975 could alter the previous report's conclusions. New environmental protection laws or policies, identification of new environmentally sensitive regions, or discovery of endangered species habitat could alter previous conclusions and therefore set direction for Phase I studies.

Changes in the perception of lands scheduled for acquisition and use as a part of the 1975 Recommended Plan could affect local support for project features. Increasing consciousness of the ecological value of the marsh at river mouth or the riparian habitat in the Santa Ana Canyon, for example, could affect local desires that these areas be preserved. The urbanization which has occurred during the 5 years since the 1975 Survey Report has taken numerous previously open spaces, and the value of the remaining few would increase accordingly.

Desires of Local Interests

The final component for review was the desires of local interests. In the five-year period since local interests had provided expressions of support, many things could have happened which could alter their preference for a particular plan. Renewal of the expression of local desires would be extremely beneficial in helping to define the course of the Phase I study.

ANALYSIS OF THESE ELEMENTS

The 1975 Survey Report

Determining the adequacy of the 1975 Survey Report was essential to establishing Phase I study direction. Reanalysis of the flood problem was a basic step in this evaluation process, as changes in conclusions about the extent, frequency, and depth of potential floods could invalidate previous plan formulation studies. The hydrologic review described in Chapter 3 was entirely supportive of the 1975 Survey Report analysis, verifying the conclusions of the 1975 report in regard to the nature and extent of the flood problem.

With the verification of the potential flood problem, the next logical portion of the Survey Report to be analyzed was the plan formulation studies. In general, the survey report development and analysis of structural alternatives were thorough and complete. During the initial screening stages of plan development, extensive studies were executed on channelization of the Santa Ana River below Prado Dam, increasing storage at Prado Dam and upstream, and combinations of channelization and increased storage.

Eight channel designs were developed for the Santa Ana River below Prado Dam with capacities varying from future 50-year protection to standard project flood protection. Design varied from concrete channels, to an earth-bottom greenbelt channel design. This array of channel designs provided a very complete representation of channelization impacts on the lower Santa Ana River. Impacts of each of these alternatives were evaluated in this initial screening process to a level of detail sufficient for comparison and identification of plans for detailed evaluation. The environmental impact to marshlands and open space at the mouth of the river was identified for each plan as well as identification of the number of homes and businesses that would require relocation for each plan. Findings of this channelization study showed that channel sizes calling for more land outside the existing rights-of-way would involve significant financial and social costs due to relocation of homes, businesses, utilities, and bridges. Running parallel to the existing channel is an extensive network of sewerline and other utility services. From Prado Dam to the ocean thirty-six bridges cross the river and most would have to be enlarged to accommodate larger channel designs.

At Prado Dam, four basic methods were identified for increasing storage. Additional storage could be provided at Prado by acquiring additional land, by diking the perimeter of the reservoir, by construction of long benches around the perimeter (somewhat similar to the diking alternative except that this would eliminate any overtopping hazard that could be associated with dikes), and by excavation of material from the existing reservoir area. Although many different configurations were studied for each of these four basic methods for gaining additional storage at Prado, the 1975 Survey Report concluded that additional land acquisition and raising the dam

embankment would be the most efficient method. A comparison of the costs and effects for each method of gaining storage was presented in the Survey Report.

Prado Dam was not the only site for additional storage investigated in the early phase of the Survey Report studies. Other upstream and downstream damsites on the Santa Ana River and tributaries were also investigated. Downstream of Prado Dam, provision of additional storage was investigated for Carbon Creek, Santiago Creek, and Handy Creek. Dams already exist on Carbon Creek and on Santiago Creek and studies looked at raising these existing dams. All downstream storage sites proved to be either inefficient or unfeasible in offering additional storage possibilities.

Upstream of Prado Dam, possible storage sites were investigated on the Santa Ana River, Lytle and Cajon Creeks, Mill Creek, San Timoteo Creek and tributaries, Temescal Wash, and Lake Elsinore. In all, 12 potential plans for upstream reservoirs were investigated. These preliminary studies determined that the most practical site for an upstream reservoir would be near Mentone, on the Santa Ana River.

With these broad findings on downstream channelization and provision of additional storage the job of identification of alternative structural plans for detailed evaluation became clearer. Further refinements in these studies screened different combinations of downstream channel capacity and upstream storage. These studies determined that the more acceptable plans from an economic and social viewpoint would restrict downstream channel capacity to that which could be provided efficiently within the existing rights-of-way. Additional upstream storage was far more preferable than expansion of the downstream channel beyond the existing rights-of-way. The survey report found that channel expansion, up to the existing rights-of-way, is far cheaper than additional upstream storage. But channel expansion beyond the existing rights-of-way is far more expensive than additional upstream storage. Thus, the optimal channel capacity would be reached by restricting releases from Prado Dam to 30,000 cubic feet per second.

These preliminary studies proved to be extremely valuable during the Survey Report studies in that they allowed the study to focus on those plans which would optimally meet the study objectives. This approach was entirely necessary to ensure that detailed studies would concentrate on matters of central importance to the study objectives and not waste valuable study resources on plans which were inherently flawed.

The Survey Report identified nine alternatives which should be carried forward from the initial screening process. These nine alternatives were studied in detail. They are listed and identified in table 2.

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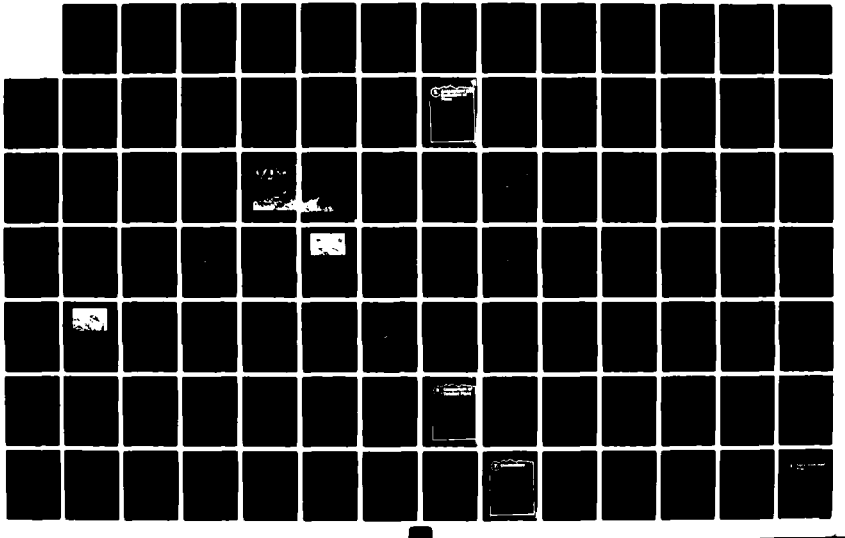


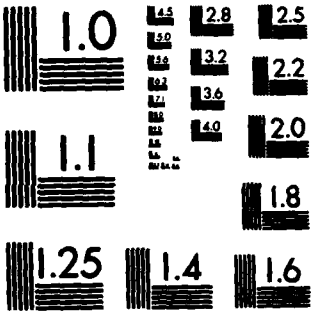


TABLE 2
1975 SURVEY REPORT ALTERNATIVES STUDIED IN DETAIL

Alternative	Description
1	No action plan
2	Correcting Prado Dam Safety Considerations
3	Present 100-year flood protection below Prado Dam
4	Future 100-year flood protection below Prado Dam
5	Standard Project Flood Protection below Prado Dam
6	Highest degree of flood protection throughout the entire basin without causing major social dislocation (the All-River Plan)
7	Maximization of National Economic Development (the NED Plan)
8	Maximization of Environmental Quality
9	Provision of flood protection throughout the basin with a minimum of social disruption

These nine alternatives were developed to meet nine general objectives established during the early stage of the survey report study. This Phase I study reviewed these general objectives and determined that they were not planning objectives as they were too specific in defining geographic coverage and actual levels of flood protection. Had these general objectives been utilized for the study's planning objectives, the Survey Report study may not have developed an adequate array of alternative plans. However, the plan formulation process was actually based on broader implicit planning objectives which provided for development of an adequate array of alternative measures for a full range of problem solutions. The conclusion to be made from the Phase I study review of the planning objectives is that deficiencies in stating the objectives did not lead to deficienicies in developing an adequate array and range of problem solutions. On the whole, the survey report studies considered a variety of flood protection levels and numerous structural and nonstructural methods for achieving flood protection or reduction.

Although the conclusion of the Phase I study review of the survey report plan formulation process was that an adequate job had been accomplished, this review did point out a certain weakness in identification of plans for detailed evaluation. This weakness did not effect plan selection. Ninety-five percent of the flood damage potential from the Santa Ana River is centered solely within Orange County. The primary objective of the Survey Report study was to alleviate this flood damage potential within Orange County. However, none of the plans identified for detailed evaluation and providing high levels of flood protection would confine construction activities and project impacts to Orange County. The survey report had considered such a plan--an All-Channel Plan--earlier in the preliminary screening process but indicated adverse impacts were too significant to allow serious consideration of the plan. This plan was not considered beyond the initial screening because minimizing relocation of homes in Orange County was a major, implicit, constraint on plan formulation. In view of the potential conflicts between upper basin and lower basin interests over adverse impacts on upper basin areas in plans primarily benefiting lower basin communities, such an all-channel plan was reintroduced for detailed consideration in Phase I study. As an all-channel plan would confine improvements to Orange County, the county standing to benefit most from improvements, the support of only one county would be necessary for this approach. Institutional conflicts involved in other plans would thus be eliminated from consideration should an all-channel plan be chosen as the recommended plan.

Except for the need to include an all-channel plan in the detailed evaluation studies, the alternatives developed in the Survey Report represented an adequate array of problem solutions and were based upon an adequate plan formulation study. Phase I studies determined there was no need to reconduct extensive plan formulation studies. Instead, Phase I studies could build from the foundation prepared in the Survey Report studies and concentrate efforts on updating and refining previously considered plans. This tentative conclusion would depend

upon the findings of the Phase I study review of the three remaining components which could alter study direction--review comments in the 1975 Survey Report, changed conditions in the study area since 1975, and desires of local interests. These components are discussed below.

Review Comments on the 1975 Survey Report

The Santa Ana River Survey Report was subjected to an exhaustive review process, particularly within the Corps of Engineers review chain. A number of significant issues and concerns were identified which created uncertainty over the project recommendations. A thorough review and analysis of these comments were seen as extremely important in defining the direction of the Phase I study efforts.

The Board of Engineers for Rivers and Harbors (BERH) subjected the survey report to an extensive review and developed serious reservations over the report recommendations. BERH's main reservations were not over the quality of the survey report studies, but generally involved policy matters. The BERH's 7 December 1976 report stated:

* * *

"13. The Board concurs in general in the findings of the reporting officers. There is a need for flood protection for many areas within the Santa Ana Basin. The need is most urgent in Orange County, where high-density development within the flood plain is vulnerable to potential catastrophic flood losses. It is the Board's view that the appropriate studies have been made in sufficient detail for a survey scope investigation. Several alternative means of solving the flood problems have been identified, which are generally sound from engineering, economic, and environmental standpoints. The Board does not concur, however, with the specific recommendations of the reporting officer..."

* * *

The Board's detailed comments on the survey report study together with comments from other agencies and groups, provide insight into the direction this Phase I study should take in building on or modifying material from the survey report.

Earlier in the report, in the section entitled "1975 Survey Report and its Review", the review comments were described. From this list of comments, 15 principal issues were identified which were deemed pertinent to project formulation studies which this Phase I report would undertake. Those 15 principal issues are identified together with the commenting agency or agencies in table 3 (page), and analyzed in the pages which follow.

TABLE 3
PRINCIPAL ISSUES RAISED DURING REVIEW OF THE 1975 SURVEY REPORT

Principal Issue	Raised by (X)				
	Board of Engineers for Rivers and Harbors	Office of Management and Budget	State of California	Department of Interior	Others
1. Federal cost share should be limited to the NED plan Federal share	X	X			
2. Readdress certain alternatives including an all-channel plan in Orange County and local protection upstream of Prado	X				
3. Adopt Present's Cost Sharing Policy		X			
4. Conform to E.O. 11988		X			
5. Marsh acquisition not justified	X				
6. Preservation of least tern nesting habitat not adequately considered	X		X	X	
7. Acquire interest in floodway between Mentone and Prado	X		X		

TABLE 3 (Continued)

8. Recreation element deletion, conformance with guidelines, and cost sharing	X	X	X	X
9. Prado Reservoir: application of standard acquisition policies	X			
10. Include conservation of water			X	X
11. Define need for protection of archeological/cultural/ historical sites in Prado	X		X	
12. Order of construction of project elements			X	X
13. Reconsider Oak Street Drain	X			
14. Reformulate Santiago Creek				X
15. Microclimate at Mentone might change as a result of the reservoir				X

Principal Issue 1: Federal Cost Share

Principal Issue 1 was raised by the Board of Engineers for Rivers and Harbors. The Survey Report recommended a plan which was about $200 million more costly than another alternative, the National Economic Development Plan, which provided slightly more flood protection to the principal damage reach. The Board pointed out that the bulk of the $200 million additional cost would be a Federal responsibility. The Board was not convinced that the Survey Report recommendation to incur these additional costs could be justified. The Board agreed that the Recommended Plan presented fewer social impacts than the NED Plan; however, the Board believed amelioration of the social impacts was very costly and was not in the national interest. Resolving differences between upstream and downstream interests was a local responsibility, and the Board suggested that the State of California could be the appropriate party. If such controversies cannot be resolved, the Board believed the Federal Government should recommend a plan which could be entirely implemented in the principal damage reach--Orange County. Such a plan would be an all-channel plan.

Principal Issue 1 is a question of policy. The Board identified three alternative plans--the Recommended Plan, the NED Plan, and the All-Channel Plan--and suggested that the real choice, as far as the Federal Government should be concerned, lay between the NED Plan and the All-Channel Plan. The Board did not disagree that the Recommended Plan could be implemented, but only on the condition that local interests accept the more than $200 million in additional costs. In order to address the policy question, detailed information on costs and benefits needed to be developed for all three plans to allow identification of the tradeoffs between these plans. For the Recommended Plan and for the NED Plan this amounted to review and update of existing information as these plans were two of the nine Survey Report plans studied in detail. For the All-Channel Plan, substantial new work needed to be undertaken as this plan was not carried through the preliminary screening process in the Survey Report.

Principal Issue 2: Readdress Several Alternatives

The Board, primarily because of its concerns over the Federal cost share for the Recommended Plan as mentioned above, suggested that certain alternatives to this plan be readdressed, particularly those that would negate strong institutional controversy. The Board made specific mention of an all-channel plan and plans that would provide local flood protection in the upper Santa Ana River. The Board implied that there may be other alternatives which could overcome the institutional concerns.

The Survey Report could not identify any plan which did not have strong institutional concern. Considerable energies and efforts were expended during the Survey Report study in the pursuit of a plan which could overcome institutional concerns and it is extremely unlikely that any new alternative exists and could be identified during the Phase I

study. Therefore, to resolve Principal Issue 2, the Phase I studies updated and reevaluated previously studied plans. Resolution of Principal Issue 2 could be accomplished by studying the two plans the Board suggested be reevaluated, together with the previously Recommended Plan.

The Board also suggested that plans which provide local flood protection in the upper Santa Ana River should be readdressed. These plans, which were investigated during preliminary Survey Report studies, could not be economically justified. Additionally, these plans provide absolutely no benefits in reducing storage requirements at Prado or in reducing channelization requirements in Orange County. Taking additional lands at Prado for flood storage to protect lands in Orange County is clearly the issue which became the paramount institutional concern of the Santa Ana River study. Planning for local flood protection in the upper Santa Ana River would not address this concern. This fact, coupled with the lack of economic justification, argues against restudy of local flood protection in the upper Santa Ana River.

Principal Issue 2 therefore, affected project formulation studies during the Phase I investigation by calling for reanalysis of the Survey Report Recommended Plan, review of the NED Plan, and the All-Channel Plan.

Principal Issue 3: Adopt President's Cost Sharing Policy

Principal Issue 3 was viewed as not affecting plan formulation studies. Corps of Engineers regulations which implement the President's cost sharing policy are entirely clear. The policy will be applied to all potential plans. The development and presentation of Corps' plans would not change under this new policy.

The Corps' criteria for recommending a specific plan remain that a recommended plan must have combined beneficial NED and EQ effects that would outweigh combined adverse NED and EQ effects (Federal Register, Vol 45, No. 190, part 11, # 711.92). Application of the President's Cost Sharing Policy will not affect the basic plan formulation of Corps' plans during Phase I study.

Principal Issue 4: Conformance with E.O. 11988

Resolution of Principal Issue 4, conformance with Executive Order 11988, did not require significant efforts during the Phase I study. Executive Order 11988, issued 24 May 1977, has as an objective avoiding, to the extent possible, long and short term adverse impacts associated with flood plain occupancy and modification, and avoiding direct and indirect support of flood plain development wherever there is a practical alternative. Survey report studies, although performed prior to issuance of this EO, were sensitive to this same objective. In addition, restoration and preservation of wetlands, particularly the least tern nesting colony and the salt marsh at the mouth of the river

channel, were adequately considered during Survey Report studies. Phase I studies did not require any intensive reformulation efforts to accomodate the EO.

Principal Issue 5: Marsh Acquisition Justification

The Board was not convinced that the Corps should be responsible for purchasing 84 acres of marshlands at the river mouth as the Board believed the project would not have significant direct or indirect adverse impacts to this area. Further studies of the value of this habitat and better identification of the project impacts were valuable in defining project responsibilities to this area. Project formulation efforts for the Phase I study's resolution of this issue were in the development and analysis of sufficient data to enable a supportable decision to include or exclude these 84 acres from the Recommended Plan.

During Phase I, studies were conducted to determine whether it was in the Federal interest to acquire and preserve the marsh and adjacent upland habitat for preservation of endangered species, and for enhancement of other wildlife and fish resources. These studies were conducted with reference to the Endangered Species Act of 1973 and ER 1105-2-129 "Preservation and Enhancement of Fish and Wildlife Resources." During these studies, the Corps co-ordinated closely with the U.S. Fish and Wildlife Service and the California Department of Fish and Game.

Principal Issue 6: Preservation of Least Tern Habitat

The Board, the agency raising this issue, believed Phase I studies should consider the possibility of the least tern colony abandoning the entire nesting site due to project impacts. The Board suggested special studies to be undertaken during the Phase I study process. Project formulation efforts for the Phase I study were directed toward development and analysis of additional data pertinent to project impacts on the least tern colony.

Biologists from the U.S. Fish and Wildlife Service and California Department of Fish and Game were consulted to determine if the nesting site could be moved, and under what conditions this could best be accomplished.

Principal Issue 7: Floodway Acquisition Between Mentone and Prado Dams

The Board suggested that the Phase I study should more precisely define the extent of real estate interests necessary to accommodate local inflow and expected releases from Mentone Dam. These studies would concentrate on development and analysis of hydrologic and hydraulic data. These studies would not result in significant reformulation of the recommended project.

Principal Issue 8: Reformulate Recreation Plans

Resolution of this issue would result in a reformulation of the recreation plan for the recommended project. Since the 1975 Survey Report was published, new recreation policies have been promulgated and the 1975 Survey Report plan would now clearly be in violation of these new policies. Although this issue called for extensive reformulation of recreation features, resolution of this issue did not affect formulation of the flood control features of any plan. Recreation, although an important feature, has been viewed throughout this study as a secondary purpose.

Principal Issue 9: Prado Land Acquisition

Principal Issue 9 is a question of policy. Settlement of this issue is incidental to formulation of the flood control elements of the project. Because the Survey Report recommendation to offer flexibility in property acquisition policy behind Prado is clearly an exception to existing Corps policy, a thorough review of the Survey Report recommendation must be accomplished during the Phase I study. The results of this review would not impact project formulation in any areas other than the policy for real property acquisition at Prado Dam.

Principal Issue 10: Water Conservation

The 1975 Survey Report studies found water conservation through control of floodflow releases and increase in ground water recharge to be incidental to flood control operations. Even today, there is no reason to believe water conservation can be other than incidental to the Santa Ana River Project. However, additional studies were called for in the Phase I study to reevaluate this conclusion. It was unlikely that these studies would result in extensive reformulation of the Survey Report plan.

Principal Issue 11: Cultural Resource Protection

Better definition of the need for protection of archeological, cultural, or historical sites at Prado Reservoir could best be accomplished through further studies during Phase I. Recommendations from these studies were not foreseen to affect overall project formulation.

Principal Issue 12: Construction Sequence

The order of construction of project elements is important to the specific project plan but would not affect formulation of the plan. Construction sequence would be established in Phase I study.

Principal Issue 13: Changes in Oak Street Drain

The Board recognized that the City of Corona had, subsequent to finalization of the Survey Report, objected to the location of the debris basin proposed under the Recommended Plan. The Board believed

consideration of this objection together with restudy of certain plan elements called for by the Board may make the plan not economically justified. Restudy of Oak Street Drain would therefore be required during the Phase I study.

Since the original justification for the Oak Street Drain was that it would at least partially mitigate for social and economic disruption caused by construction and operation at Prado Reservoir and for the community dislocations which would occur as a result, study of the Oak Street Drain was focused on quantifying the economic and social impacts of the project on Riverside County, particularly Corona. These studies were done in accordance with Section 122 of the Rivers and Harbors Act of 1970. Restudy of a modified plan for Oak Street Drain was also undertaken.

Principal Issue 14: Santiago Creek Plan Reformulation

In April 1977, Orange County released a report entitled "Lower Santiago Creek Specific Plan." This report included the Corps' study reach and presented a plan different in concept and specifics from the Corps' Survey Report plan. The County believed their plan to be a more comprehensive solution to the full range of problems. Subsequent to the County report, public opposition developed over elements of the County plan. This Phase I study continued the process started by the County's Specific Plan to reformulate the plan for Santiago Creek.

Principal Issue 15: Mentone Microclimate

Potential for Mentone Dam to affect the microclimate of the upper river basin was considered worthy of careful investigation. Any potential adverse effect of this nature would exert a relatively minor influence on evaluation of alternatives for this area, as such effects were likely to be minor.

CONCLUSIONS

Analysis of the 15 principal issues which could affect plan formulation studies led to the conclusion that addressing the issues did not require extensive reformulation studies for the main stem of the Santa Ana River. For the main stem of the river, addressing all 15 issues did not require formulation of an alternative not previously considered during the Survey Report studies, and in fact, addressing all 15 issues could be accomplished by restudy of just three alternative plans--the Recommended Plan, the NED Plan, and the All-Channel Plan. Reviewing and updating these plans provided for resolution of the issues raised during the Survey Report review process.

Addressing the issues for the Oak Street Drain portion of the Prado area plan did not require significant reformulation study. Addressing the issues for Santiago Creek did require reformulation studies. Although Oak Street Drain would probably be reaffirmed with only slight modifications to the Survey Report plan, the plan for Santiago Creek had to be completely reformulated.

Changed Conditions in the Study Area Since 1975

Since completion of the Survey Report late in 1975, there have not been significant changes in the study area. As predicted in the 1975 Survey Report, lack of developable land in the lower basin has slowed down its growth. Although urban growth in the upper basin has accelerated at a more rapid rate than in the lower basin, the upper basin has not grown significantly more than predicted in the 1975 Survey Report. A reanalysis of the 1975 Survey Report's hydraulic analysis of the area subject to flooding from the Santa Ana River in Orange County confirmed the severity of the flood problem and the adequacy and accuracy of the 1975 Survey Report's hydraulic analysis. Local interests have built additional flood control improvements since the 1975 Survey Report; however, these improvements have not significantly reduced the flood threat.

Changes have taken place in the Oak Street Drain study area since the 1975 Survey Report was written. In 1979 Riverside County constructed a debris basin located 3,500 feet upstream (south) and with a smaller capacity than that proposed in the 1975 Survey Report and new development has taken place in the overflow area. A reanalysis of hydrologic, hydraulic, and economic data was undertaken to address changes in the study area as well as the Board's comments. As a result of this reanalysis, the plan was modified, enlarging the study area and incorporating the Riverside County debris basin.

Changes in local social needs and in environmental concerns were not found to have altered the demand for recreation nor the critical need for preservation of open space in the area.

Knowledge of the area's environmental problems and resources had increased somewhat since the 1975 Survey Report. The ecological value of the Mentone Dam area was better understood during Phase I study. Understanding of the value of the Santa Ana Canyon as a wildlife corridor also increased. At the same time, general public awareness and concern for preservation of Prime and Unique Farmlands increased. These changes were incremental, not fundamental, in nature and did not mean that plans required significant reformulation.

Desires of Local Interests

The Santa Ana River study is perhaps a classic case study in the conflicts of upstream versus downstream interests. Over ninety-five percent of the damage potential from floods on the Santa Ana River exists downstream of Prado Dam. As such, the area downstream of Prado Dam stands to realize the majority of the benefits from construction of a flood control project. Yet most alternatives for providing flood control would have the majority of the adverse construction impacts at/or upstream of Prado Dam. The conflict is exacerbated by the fact that the political boundaries for the downstream county (Orange County) and the upstream counties (San Bernardino and Riverside) come together immediately downstream of Prado Dam. These political divisions, which

nearly coincide with the division between upstream and downstream project impacts, institutionalize the conflicts over upstream versus downstream interests. These political boundaries make it possible for project economic and social impacts to be readily identified, both in degree and in geographic location, and championed through well-established and well-equipped organizations of government.

The upstream versus downstream conflicts are founded in historical events preceeding the Santa Ana River study. They are rooted in the geographic, physical, and cultural differences which characterize upstream from downstream. Physically, the upstream counties are separated from Orange County by the Chino Hills and the Santa Ana Mountains. Santa Ana Canyon, through which the Riverside Freeway threads, is the main link between the two areas. Orange County, within the Santa Ana River flood plain, is heavily urbanized. It is a vast, relatively flat, sprawl of suburban subdivisions and urban centers. The upstream counties, on the other hand, are relatively rural and rurally oriented. Agriculture is an important activity in the upstream counties. Many of the large dairies in Riverside and San Bernardino Counties have relocated from Los Angeles or Orange County because of the intense urban pressures. The upstream counties view with alarm the rapid advancement of urbanization in Orange County. Many see a real threat to their valued rural lifestyle. Some have fled urban pressures before and do not want to be forced out again.

The 1975 Survey Report studies necessarily had to deal with upstream versus downstream conflicts, as determining an acceptable plan hinged upon satisfying the needs of local interests as much as possible. Therefore, the 1975 Survey Report studies involved major efforts to identify the viewpoints of all local interests. Given the long history of differences between the upstream and downstream counties, developing an acceptable plan for flood control without consultation and guidance from all local interests would be impossible. This was an entirely realistic impression, as the 1975 Survey Report could identify only one plan which met the tests of acceptability.

Nothing has changed since the Survey Report was published in 1975 which would lessen the importance of local interests' desires in determining an acceptable plan. Local interests still hold that there is one and only one acceptable plan and that is the plan recommended in 1975. In early 1979, subsequent to a series of meetings held in the three county area to initiate the Phase I studies, each county provided a resolution from its respective Board of Supervisors which reiterated support for the 1975 plan. Only Orange County asked for a modification to that plan and that was to consider another alternative for Santiago Creek to be included with the 1975 plan. Recently, Orange County has also asked the Corps to modify plans for the Santa Ana Canyon, but general support for the 1975 Recommended Plan remains firm.

Summary of the Review of Study Components

The review of the four components provided clear direction for project formulation studies which would be required during the Phase I studies. The review disclosed that, in general, the Survey Report had adequately identified a full range of planning alternatives; the review process suggested a relook at two of those alternatives as well as the Recommended Plan; since 1975, conditions in the study area have not changed significantly; and local interests still desire only the 1975 plan, albeit with minor modifications.

In analyzing all of these elements, it became clear that the Phase I study could be focused fairly narrowly on reevaluation and refinement of previously considered plans. The substantial technical validity of the 1975 Survey Report, the lack of substantial unpredicted change in the study area, and the strength of local support for the 1975 Recommended Plan all pointed to reaffirmation study rather than reformulation study. The focus of Phase I study was, then, on updating previous information, refining alternatives to be considered, and working with the public and with local, state, and Federal agencies to resolve the issues which were raised in review of the 1975 Survey Report. The only significant changes since 1975 which would affect evaluation were changes in policy regarding cost sharing and environmental quality considerations and changes in the extent of urbanization of the study area, which would change economic data (property values primarily) for areas affected by the alternative plans.

REFORMULATION OF SANTIAGO CREEK PLAN

Background

The need to reformulate the plan for Santiago Creek has already been discussed. The first step in reformulation study was to analyze the plan prepared (April 1977) by OCEMA and to determine if it was an adequate basis for reformulation of the Corps' plan. This would ensure that there was no duplication of effort during Phase I study.

Examination of this study revealed that the County plan was a more comprehensive solution to a full range of problems than the 1975 Survey Report Recommended Plan for Santiago Creek. The study incorporated water conservation, environmental enhancement, and more extensive recreation than proposed in the Corps' plan. From a broad array of alternative plans, a plan physically and conceptually different from the plan developed in the 1975 Survey Report was developed that apparently best met local needs. Study efforts included all the studies normally conducted in a Corps feasibility study as well as a through public involvement effort. The public involvement program included a citizen task force and numerous public workshops and town meetings.

The Lower Santiago Creek Specific Plan Recommendations

The plan that was selected in the Orange County study included improvements from Villa Park Dam to the creek's confluence with the Santa Ana River. The selected plan included regulation of Villa Park Dam to increase controlled releases and decrease uncontrolled spills, and minor spot protection between Villa Park Dam and Villa Park Road. The existing gravel pit area between Villa Park Road and Prospect Street was designated for joint use as a flood-retarding basin and a water conservation basin. Recreation uses of the basin included a regional park with both water-oriented and dry-land activities. The flood-retarding basin would be contained within the top 22 feet of the basin. The purpose of the basin would be to reduce the peak flow in Santiago Creek downstream of the basin. To accomplish this, a vertical-wall reinforced-concrete bypass channel was proposed along the northwesterly boundary of the project site from Villa Park Road to Prospect Street. At the downstream end of the basin (approximately 400 feet upstream of Prospect Street), a channel side weir would be installed on the south side of the concrete channel section over which peak floodflows would be diverted into the basin area.

In addition to the flood-retarding measures described above, channel protective works were proposed at various locations along the creek where the existing improvements or natural watercourse are not of sufficient capacity to convey the design flow. The proposed retarding facilities and protective works would provide standard project flood protection.

To preserve the flood plain necessary for implementing the suggested channelization and greenbelt, the adjacent cities would be encouraged to adopt flood plain zoning along Santiago Creek. This would restrict development upon flood-prone land which was an integral part of the suggested plan.

The channel protective works were to begin downstream of the retarding basins at Prospect Street where a turf-lined greenbelt channel extended to Chapman Avenue. This channel would be trapezoidal, with rock protection on the side slopes. The turf channel would be approximately 9 feet deep and have a base width of about 52 feet. The mild side slopes would permit use of the channel for park activities. During major floods, the soil cover might wash away; however, the underlying rock banks would limit the extent of lateral erosion. Several longitudinal gradient control structures would be necessary to lower the profile of the greenbelt channel as it drops out of the foothills. The structures would range in height from four to seven feet and would be approximately 1,500 to 2,600 feet apart.

Downstream of Chapman Avenue there would be no structural improvements until the Newport Freeway. Between the Newport Freeeway and Tustin Avenue a trapezoidal channel with rock slope protection was proposed. The channel would be approximately 13 feet deep and would have a seventy-foot base width. The riprap slopes would be inclined

at 2 to 1. There would again be no structural improvements downstream of Tustin Avenue until Santiago Golf Course where a trapezoidal turf-lined channel would be extended to Cambridge Street. This type of channelization would provide moderate side slopes (5 to 1) suitable for park use in conjunction with the city's proposed expansion of the park in this area. The slopes would be underlaid with riprap at 2 to 1 slope which would prohibit lateral erosion should the turf and underlying soil be washed out during storm flows.

Downstream of Cambridge Street, there would be no structural improvements until Glassell Street where the plan called for lining the invert of the existing channel until Santiago Avenue. No structural improvements were proposed from Santiago Avenue until 400 feet upstream of Main Street. From that point to the creek's confluence with the Santa Ana River, the channel was to be a vertical wall concrete channel. The channel would be approximately 75 feet wide and 12 feet deep.

Bicycle, hiking, and equestrian trails were proposed along with numerous trail rest stops throughout the entire project length.

Following the Orange County study, however, public opposition developed over elements of the recommended plan. The Corps' approach to Phase I study of Santiago Creek was to use the basically sound OCEMA plan as a starting point for developing a single plan to meet the area's needs. Public concerns about the OCEMA plan were dealt with through an intensive public involvement effort.

The Corps' public involvement program revealed that the Orange County plan reasonably satisfied the public. The three strongest objections to the plan were: (1) the concrete channelization of Santiago Creek between Main Street and the creek's confluence with the Santa Ana River, and (2) the recreation trails along the channel within the City of Santa Ana, and (3) a level of protection that was greater than desired.

Based on the Orange County plan and modification to that plan from public involvement input and Corps engineering studies, this Phase I study developed a plan called the Detention Storage and Minimal Channel Upgrading Plan. This plan is very similar to the Orange County Plan; however, it contains less structural improvement, maintains more of the natural streambed, and provides less flood protection (100 year). Rather than a concrete channel between upstream of Main Street and the creek's confluence with the Santa Ana River, the Detention Storage and Minimal Channel Upgrading Plan proposes a trapezoidal channel with rock-revetted side slopes and an earth-bottom from downstream of Santa Ana Freeway to the creek's confluence with the Santa Ana River. The only other structural improvements the Corps' plan includes are the detention basin between Villa Park Road and Prospect Street and a trapezoidal channel with rock-revetted side slopes and an earth bottom leading out of the detention basin to Walnut Avenue.

BRIEF DESCRIPTION OF MAIN STEM PLANS CARRIED FORWARD FOR DETAILED STUDY

The All-River Plan, Alternative 6

This plan is the Recommended Plan from the 1975 Survey Report studies. It calls for construction of Mentone Dam on the upper Santa Ana River; raising Prado Dam 30 feet and the acquisition line 10 feet, including construction of Oak Street Drain; acquisition of flood plain lands in Santa Ana River; construction of Santiago Creek improvements; and acquisition of 8 acres of marshland for mitigation and 84 acres of marshland for preservation. The plan also includes comprehensive recreation development for most main facilities.

The National Economic Development Plan, Alternative 7

The process of determining the National Economic Development Plan in the 1975 Survey Report studies involved evaluating successively larger scales of projects in terms of benefits and costs until the scale was reached where increments of costs no longer were offset by benefits. In the Survey Report studies, the optimum design release from Prado Dam was found to be 30,000 cubic feet per second. Greater discharges would have resulted in a larger downstream channel and in sharply greater costs due to severe relocations costs. It was found that maximization of benefits would result from a system of improvements designed to control a flood of magnitude slightly greater than standard project flood. This corresponded to raising the acquisition limit of Prado Reservoir to elevation 582 feet when coupled with a 30,000 cubic feet per second release in the downstream channel. The project costs and benefits were determined and this plan was designated as Alternative 7 or the National Economic Development (NED) Plan.

Alternative 5

In the time elapsed since preparation of the Survey Report in 1975 and the onset of the Phase I General Design Memorandum studies it was observed that the costs of raising Prado Reservoir to a high elevation would be greatly increased. Many homes were being built in the fringe areas, especially near elecation 580 feet. Also, the prices of homes had risen rapidly since 1975. In the early stages of the Phase I studies, it appeared that the rapid development in the Prado Reservoir fringe areas coupled with the high property values would tend to change the point of optimization to a project which would raise Prado Dam to a lower elevation than Alternative 7. With these factors in mind, the Los Angeles District staff proceeded with reanalysis of costs for the NED Plan in terms of a taking line at Prado Dam at elevation at 580 identified as Alternative 5 in the Survey Report, as well as the reanalysis of costs for Alternative 7. A comparison of these two plans would determine the true NED Plan.

Neither Alternative 5 nor Alternative 7 would call for any construction works upstream from Prado Dam. Prado Dam would be raised 43 or 45 feet and the acquisition line raised to elevation 580 or

582 feet. All other elements of the plan (Oak Street Drain, Santiago Creek, Santa Ana Canyon, and the lower Santa Ana River) would be identical to those of Alternative 6. Alternatives 5 and 7 would not call for marshland acquisition for preservation of endangered species, but would call for 8 acres of acquisition for mitigation.

The Environmental Quality Plan, Alternative 10

During the conduct of the Phase I study, information developed during the study of detailed plans resulted in the formulation of a different Environmental Quality Plan than was considered during the Survey Report study.

The Survey Report plan considered provision of future 100-year flood protection by channelization of the lower Santa Ana River flood plain, and raising Prado Dam 23 feet and the spillway 13 feet. It was believed the lower protection level would minimize structural measures and result in less adverse impact to the environment. However, early in the Phase I study it became apparent that the Survey Report plan did not completely address the objective of reducing flooding, and raising Prado Dam to higher elevations actually would provide environmental benefit rather than create adverse impacts as the Survey Report had assumed. More environmental benefit can be gained by raising Prado Dam because greater acreage could be reclaimed from urban usage and allowed to revert to natural habitat. Adverse impacts associated with construction of a dam have largely been absorbed by the construction of the existing dam in 1941.

Restudy of Alternative 7, the NED Plan from the 1975 Survey Report, indicated that this plan, with a few modificiations, would better serve the environmental quality objective and would better meet the objective of controlling floods. Therefore, the decision was made to formulate a new Environmental Quality Plan.

This plan would be identical to Alternative 7, except that most homes, businesses, and farms behind Prado Dam would be removed from the acquisition area, an existing mobile home park in Santa Ana Canyon would be relocated, and 200 acres of marshland at the mouth would be acquired and restored.

The All-Channel Plan, Alternative 11

The objective of the All-Channel Plan was to provide a high level of protection to Orange County without increasing the present Prado Reservoir area or otherwise adversely impacting the upstream counties. The most efficient design developed through these Phase I studies would involve some work at Prado Dam to increase the size of the outlets, acquisition of flood plain lands in Santa Ana Canyon, and construction of a large channel (from 330 to over 800 feet wide) in the lower river. Santiago Creek would be a part of this plan. The channel would be sized to control a standard project flood spillway discharge from Prado Dam of 200,000 cubic feet per second.

RECREATION PLAN VARIATIONS

All alternative plans include recreational development. The proposed recreation plan for Alternative 6, the All-River Plan, includes the most extensive recreational development plan. This plan calls for (1) 235 acres of park development at Mentone Reservoir including a 50 acre recreational lake; (2) 350 acres of wildlife management area and 280 acres of park development including four recreational lakes at Prado Reservoir; (3) trail development along the Santa Ana River through Santa Ana Canyon and along Santiago Creek between Villa Park Road and Walnut Avenue; (4) and replacement of the existing 20 miles of trails between Imperial Highway and the ocean along the lower Santa Ana River.

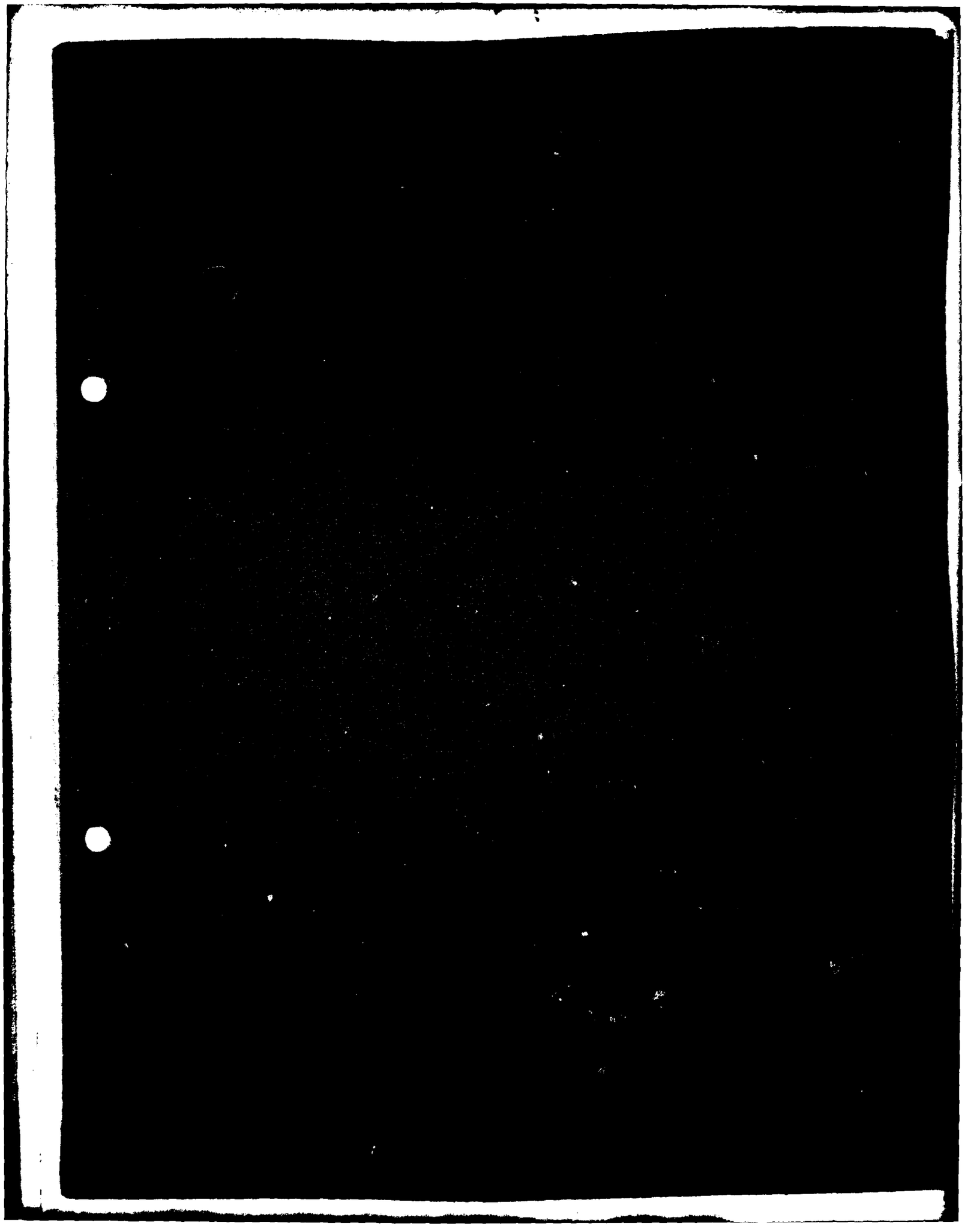
Recreation plans of Alternatives 5, 7, and 10 are virtually the same as the All-River recreation plan except that they do not include recreation at Mentone Reservoir.

Alternative 11, the All-Channel Plan, provides few recreational opportunities. This alternative's recreation plan only includes trail development along the lower Santa Ana River through Santa Ana Canyon and along Santiago Creek between Villa Park Road and Walnut Avenue, and replacement of the existing lower Santa Ana River trails.

TABLE 4. RECREATIONAL DEVELOPMENT AREAS PROVIDED BY ALTERNATIVE PLANS

Project	The All-River Plan Alternative 6	The NED Plan Alternative 7*	The EQ Plan Alternative 10	The All-Channel Plan Alternative 11
Mentone Dam and Reservoir	Yes	No	No	No
Prado Dam and Reservoir	Yes	Yes	Yes	No
Santa Ana Canyon	Yes	Yes	Yes	Yes
Santa Ana River Main Stem	Yes	Yes	Yes	Yes
Santiago Creek	Yes	Yes	Yes	Yes

*Recreation features provided for under Alternative 5 are the same as Alternative 7's.



5. ASSESSMENT AND EVALUATION OF DETAILED PLANS

INTRODUCTION

Impact assessment is an objective analysis conducted to identify and measure the likely economic, social, and environmental changes expected to result from implementation of alternative plans. These changes form the basis for determining the beneficial and adverse contribution of the plans during the evaluation task. Economic, social, and environmental conditions expected under each alternative plan are compared to conditions expected if no plan were to be implemented.

In conducting this impact analysis, the Corps is guided by:

1. The Rivers and Harbors Act of 1970, Section 122. ER 1105-2-105 describes the nature and extent of the impact analysis expected.

2. The National Environmental Policy Act of 1969 which sets forth the basic environmental goals for Federal projects (Section 101), and procedures for environmental analysis and reporting (Section 102).

3. The Clean Water Act of 1977, which requires submission of a water quality evaluation to Congress for projects requiring exemption from requirements of Sections 301, 402, and 404.

4. The Endangered Species Act of 1973, as amended, which describes the affirmative steps required to preserve habitat critical to the survival of Federal endangered species.

5. The Fish and Wildlife Coordination Act, as amended, and The Coastal Zone Management Act of 1972, as amended, which set guidelines for coordination of Federal, state, and local agencies in projects affecting wildlife and coastal areas.

6. The ER1105-2-200 series which establishes a process under which alternative plans are formulated and the resulting economic, social, and environmental impacts assessed and evaluated.

7. Executive Order 11988, Flood Plain Management.

8. Executive Order 11990, Protection of Wetlands.

The evaluation task involves determining the beneficial and adverse contributions of each alternative plan. Plan impacts are analyzed to determine the beneficial or adverse value of the contributions each plan would make when compared with what would happen in the absence of carrying out any of the plans. Then the relative contributions of the alternative plans are ranked and traded off, based on professional analysis and the perceptions of the public.

Evaluation activities are: (1) establishing the extent to which alternatives satisfy the planning objectives; (2) evaluating each plan's contributions to National Economic Development, Environmental Quality, Regional Development, and Social Well-Being; and (3) evaluating each alternative plan against nine specified criteria.

The nine specified criteria are: acceptability, completeness, effectiveness, efficiency, certainty, geographic scope, NED benefit-cost ratio, reversibility, and stability. Acceptability of a plan is determined by analyzing the public response to it. Completeness is determined by analyzing whether all necessary investments or other actions necessary to assure full attainment of the plan outputs have been incorporated. Effectiveness is determined by analyzing the technical performance of a plan and its contributions. Efficiency is determined by analyzing a plan's ability to achieve the planning objectives and NED and EQ outputs in the most economic way. Certainty is determined by assessing the likelihood that the planning objectives and contributions to NED and EQ accounts will be realized. Geographic Scope is determined by analyzing the area encompassed by the plan. The NED benefit-cost ratio is determined by comparing the economic costs and benefits. Reversibility refers to the capability, if public needs and values change or should unusual future circumstances so warrant, of restoring the partially or fully implemented plan to an approximation of the "without condition." Stability is determined by analyzing the range of alternative futures, data and/or assumptions which can be meaningfully accommodated with the plan. Each plan was analyzed and compared on the basis of this evaluation process. When this had been accomplished, relative benefits and cost of the alternative were clearly set forth.

This chapter describes all alternatives studied in detail: the No Action Plan; Alternative 6, All-River Plan; Alternative 7, NED Plan; Alternative 5; Alternative 10, All-Channel Plan; Alternative 11, EQ Plan. Figures 6 through 10 display the general features of each alternative.

All alternatives comply with Executive Order 11988, Flood Plain Management. This Executive Order calls for the preservation of flood plain in their natural state. Preservation of the natural flood plain was a major study consideration. All structural plans were formulated to minimize impacts upon the natural flood plain while providing flood protection to existing development.

Executive Order 11990, Protection of Wetlands, is also incorporated into all alternatives. All structural alternatives include measures to preserve wetlands and to mitigate for wetlands lost, where possible, and are thus in compliance with the order. As the gravel pits along Santiago Creek were determined not to be significant wetlands, no provision has been taken to apply EO 11988 to them in any of the alternatives developed.

Alternatives 5, 6, 7, and 10 affect the cultural resources within Prado Reservoir. Since Alternative 11 and the No-Action Plan would not require raising flood levels or taking excavation material from Prado Reservoir, these plans would not affect the cultural resources within Prado Reservoir. Under these alternatives cultural resources within Prado Reservoir's existing 556 feet elevation will receive protection under Executive Order 11593.

All plans that would affect cultural resources within Prado Reservoir would include a program of protection, preservation and data recovery for these sites. The Corps has coordinated this program with the State Historic Preservation Officer (SHPO). Specific steps to be taken would be determined in Phase II study and coordinated with the SHPO.

Surveys of the other project reaches reveal that no other major cultural resources would be affected by any of the project alternatives.

The cultural information developed in this Phase I GDM is based on literature searches and surface examinations. Test excavations will be conducted during Phase II investigations to verify the site evaluations and impact assessments, and to provide information needed to formulate an effective program of preservation and data recovery.

NO ACTION PLAN

Plan Description

This no action alternative proposes no major structural project on the Santa Ana River. Flood protection would be limited to that afforded by existing facilities, including the existing Prado Reservoir, and what channel improvements the respective counties have been able to afford. Adjustments to the flood hazard in various areas would be limited with little significant change over what exists today. Flood insurance, which would not prevent damages, would provide some compensation to property owners and residents for the major part of damages incurred. New developments in the areas subject to flooding would be elevated or otherwise constructed so as to reduce or minimize damages from major floods. Further flood prevention action would be taken when certain areas were renewed or redeveloped in cases where old buildings were torn down and new buildings and property layouts constructed. Very few existing properties would be significantly flood-proofed and such properties would remain subject to periodic flood damage. Local agencies would continue to employ flood plain management means, including zoning restrictions, as they consider appropriate.

The existing Prado Dam is deficient from a safety standpoint in that the dam may be overtopped during a probable maximum flood. The probable maximum flood (PMF) is the flood that can be expected from the most severe combination of meteorologic and hydrologic conditions reasonably possible in the region. Probable maximum flood, as the name implies, is an estimate of the upper boundary of flood potential for a drainage

area. At the present time, the Corps of Engineers is studying methods to correct this deficiency. Under the Dam Safety Assurances Program, several alternatives are being studied which will eliminate the overtopping threat. This no action plan assumes one of these alternative plans will be implemented, probably involving a parapet on the top of the dam and a widened spillway. Correcting the overtopping deficiency will have insignificant effect on reducing the flood problem downstream.

Impact Assessment

Implementation of this No Action Plan would pose no impact on the stream habitat resulting from construction of flood control structures. In Orange County it is predicted that virtually all remaining undeveloped land would be filled in with urban residences, industries, and business establishments within the next two decades.

Environmental impact of taking no action would be adverse. The ecologically valuable areas of the river mouth and the Santa Ana Canyon would very likely be lost to development and, at the river mouth, critical habitat for two Federal endangered species would be lost.

The impact of flooding under this No Action alternative would be devastating. These impacts have been extensively discussed in Chapter 3. In the case of a standard project flood under existing conditions of development and current price levels, damages and economic losses would amount to the following estimates:

Santa Ana River from Prado Dam to the ocean	$9,150,000,000
Santiago Creek apart from the Santa Ana River	104,000,000
Santa Ana River from East Highlands and Mentone down to Prado Dam	330,000,000
Oak Street Drain in Corona	11,000,000

Respectively the damages from a 100-year flood in each of these areas would be about $3,750,000,000; $44,000,000; $152,000,000, $5,400,000.

Nonstructural management of the flood plains along the main stem of the Santa Ana River is not a viable "no-action" alternative. The SPF flood plain below Prado Dam is currently heavily developed and has only 70-year flood protection. This level of protection will diminish as sediment depletes reservoir storage capacity and urbanization produces greater runoff during heavy storms.

Life, health, and safety would remain threatened under the No Action alternative. Cultural resources in the Prado Reservoir would not be affected by taking the No Action alternative. Those currently subject to inundation would continue to be damaged by floodflows.

Table 5 displays Regional, Environmental, and Social Well-Being impacts for the No Action Plan.

TABLE 5

REGIONAL, ENVIRONMENTAL, AND SOCIAL WELL-BEING IMPACTS FOR THE NO ACTION PLAN.

Regional Development

Beneficial effects	Adverse effects
1. No local cost.	1. Flood insurance would be required.
2. Permits development of Santa Ana Canyon	2. Flooding will impact businesses, industries, and employment.
3. No loss of tax base.	
4. Agricultural lands maintained.	

Environmental

Beneficial effects	Adverse effect
1. No adverse impact from construction.	1. Possible development of marina or urban facilities in degraded marshland at river mouth.
	2. Probable development of Santa Ana Canyon.
	3. Possible continued deterioration of cultural resources within Prado Reservoir.

Social Well-being

Beneficial effects	Adverse effects
1. No social disruption from project.	1. Flooding will threaten lives, health, and community cohesion.

Mitigation Requirements

No mitigation is required for this plan as there are no direct plan-related impacts.

Evaluation and Trade Off Analysis

This plan does not provide for any positive actions toward meeting the study's planning objectives. Positive contributions will not be made toward flood damage reduction, toward environmental preservation, and toward increasing recreational opportunities.

Costs and Benefits of Plan

This No Action Plan has some Federal costs associated with it. These costs are the Federal share of correcting the Prado Dam deficiency and the Federal cost of administering the Flood Insurance Program and subsidies paid for insurance premiums. Local interests and developers would pay other costs such as administering zoning ordinances and reviewing development plans and providing flood proofing of new developments.

Implementation Responsibilities

COST ALLOCATION AND APPORTIONMENT. This No Action Plan would require Federal cost sharing in construction to correct the Prado Dam deficiency and in the administration and premium subsidies of the Flood Insurance Program.

Local interests would pay all other costs.

FEDERAL RESPONSIBILITIES. The Corps of Engineers is responsible for construction to correct Prado Dam deficiencies under the Dam Safety Assurance Program.

The Federal Emergency Management Agency is responsible for administering all requirements of the Flood Insurance Program.

NON-FEDERAL RESPONSIBILITIES. Local interests are responsible for implementation of requirements of the Flood Insurance Program.

Public Views

FEDERAL AGENCIES, NON-FEDERAL AGENCIES, AND THE PUBLIC. The basis for the entire Santa Ana Project is concern that taking no action will result in catastrophe, particularly in the lower basin. While comments on the No Action alternative were not solicited during this Phase I review, Riverside, San Bernardino, and Orange Counties have previously expressed serious concern that some action to control potential flooding be taken. Orange, Riverside, and San Bernardino Counties have expressed preference for a plan which proposes structural measures. Some residents in the vicinity of Prado Dam have expressed a desire for this No Action Plan or some other plan which does not adversely impact their homes, farms, and businesses.

THE ALL-RIVER PLAN, ALTERNATIVE 6

Plan Description

This plan is similar to the 1975 Survey Report Recommended Plan. It includes 8 major elements: Mentone Dam; flood plain management for the reach between Mentone and Prado Dam; raising Prado Dam 30 feet and channelizing of Oak Street Drain; acquiring 1,500 acres in Santa Ana Canyon for post-project releases from Prado Dam; channelizing of the lower 23 miles of the Santa Ana River; providing flood detention and channel facilities on Santiago Creek; acquiring 92 acres at the mouth of the Santa Ana River--8 acres of degraded marshland would be acquired for mitigation of project impacts and 84 acres would be acquired for preservation of endangered species; and providing recreation features.

MENTONE DAM. Mentone Dam (see figure 11) would be located approximately two miles downstream of the confluence of Mill Creek and the Santa Ana River, north of the City of Redlands in the southwestern part of San Bernardino County. It would control runoff from a 260 square mile drainage area. The horseshoe shaped embankment would extent 17,200 feet in length and stand 223 feet above the existing ground at its highest point. The spillway for Mentone Dam would be a detached, rectangular concrete structure 6,900 feet long and 1,000 feet wide at the crest. Controlled outflow would be shunted through three gates into a 14-foot diameter outlet conduit. To divert major floods into the reservoir, Mill Creek levee, an existing Corps-built structure would be extended 6,720 feet and 13,100 feet of the existing levee would be raised 2 to 12 feet. An alternative of a non-gated outlet structure for the dam could be considered during Phase II because such structures have fiscal and safety benefits.

Construction of the dam would require relocation of 3.8 miles of existing AT&SF railway. Greenspot Road would be rerouted. Fifty-five residences and three businesses would be relocated as well as 275 acres of orchard and farmland. The dam and reservoir area would require 3,110 acres of land.

MENTONE TO PRADO DAM REACH. No structural measures are included for this reach (see figure 13). Instead, the post-project flood plain would be delineated and local interests would be required to manage the identified flood plain.

Acquisition of lands in this reach is not required for the operation of Mentone Dam under this alternative. Mentone will reduce SPF flood flows by approximately 95,000 cubic feet per second at Riverside Narrows, from 225,000 to 130,000 cubic feet per second, most of the remaining flows coming from tributaries. These large secondary flows mean that development of the post-project flood plain must be restricted, but since Mentone's operation does not require acquisition, there is no compelling Federal interest in removing these lands from private ownership and use.

PRADO DAM. Prado Dam (see figure 14) would be raised 30 feet and the spillway raised 20 feet. Additional land (1,461 acres) would be acquired below the acquisition line at 566 feet. New outlets would be constructed to increase the outflow capacity to 30,000 cubic feet per second. Raising the dam would affect 121 homes, 2 ranches, 27 dairies, and 8 businesses. These properties would be considered for alternative methods of acquisition including flood proofing, flowage easements, life estates, as well as full purchase. A standard project flood capacity rectangular concrete channel would be constructed along Oak Street Drain (see figure 15) from an existing debris basin 3.1 miles to below the Riverside Freeway. An underground box section would carry the flow under the freeway.

SANTA ANA CANYON. To allow safe passage of post-project releases from Prado Dam, 1,500 acres of flood plain lands in the canyon would be acquired and maintained free from urban development (see figure 16).

Post-project operation of a raised Prado Dam will increase significantly the flood flows through the Santa Ana Canyon. As these increased flows could seriously affect current, non-development oriented uses of the flood plain (such as agricultural uses) the Federal government has an obligation to acquire the property in question. Any less direct method of flood plain management would mean the proper operation of the raised Prado Dam would be hindered by concerns for property in the unprotected canyon downstream.

LOWER SANTA ANA RIVER. Along the 23 miles of lower river (see figures 17, 18, 19, and 20), the existing channel would be improved. The upper 13 miles would generally involve strengthening the existing channel, raising the levees, and adding channel stablizers. The lower 7-1/2 miles would involve construction of a rectangular concrete channel 250 feet to 365 feet in width. The final 2-1/2 miles would have a natural earth invert and reach a maximum width of 480 feet. The Greenville-Banning channel would be realined to join the Santa Ana River channel just below Hamilton Avenue-Victoria Street. The Huntington Beach-Talbert Channel would be realined to the northwest.

SANTIAGO CREEK. Santiago Creek (see figure 21) would be improved by using existing gravel pits for detention storage and construction of a channel from the gravel pits to Walnut Avenue, flood plain management to downstream of the Santa Ana Freeway, and improving the existing channel from this point to the Santa Ana River. This plan would offer 100-year flood protection.

MITIGATION AND PRESERVATION. Ninety-two acres of degraded marshland at the river mouth would be acquired--8 acres for mitigation of project effects and 84 for preservation of endangered species. In addition 1-1/2 acres of the least tern nesting preserve at the beach and 5 acres of Victoria Pond, which would be displaced by the project would be restored.

RECREATION. The All-River Plan calls for recreation facilities to be expanded at Prado Reservoir (see figure 14), along the lower Santa Ana River (see figures 17, 18, 19, and 20), and along the Santiago Creek (see figure 21). In addition, there would be recreation facilities at Mentone Dam (see figure 12) where none exist at present.

Impact Assessment

On the main stem of the Santa Ana River, this plan would provide substantial social and economic benefits by providing standard project flood protection to both the upper and lower river basin. Mentone dam would provide about $3,306,000 in annual flood damage reduction benefits to the reach between the dam and Prado Reservoir. The project as a whole would provide $144,320,000 in annual flood damage reduction benefits to the area below Prado Dam (including Santiago Creek).

The Santiago Creek element of the plan would provide $801,000 in annual flood damage reduction. Santiago Creek construction would offer protection from the 100-year flood while all other elements would offer 200-year flood protection.

The most significant adverse impacts to human populations from this plan would involve the relocation of homes, businesses, and farms in order to construct Mentone Dam and enlarge Prado Reservoir. At the Mentone Dam, 55 residences would be removed completely and relocated. Three businesses would also have to be relocated and 275 acres of orchard and farmland would be turned over to reservoir uses. A total 3,110 acres would be dedicated to the dam and levee structures and impoundment of water. The dam would be visually prominent to the East Highlands community area.

Construction of the reservoir would require an 8-year period. Tremendous amounts of earthmoving work would be required, creating severe dust and noise impacts. Sixteen hundred acres of sage scrub habitat would be lost to construction activities. Five hundred acres of this habitat is juniper woodland, unique to the area.

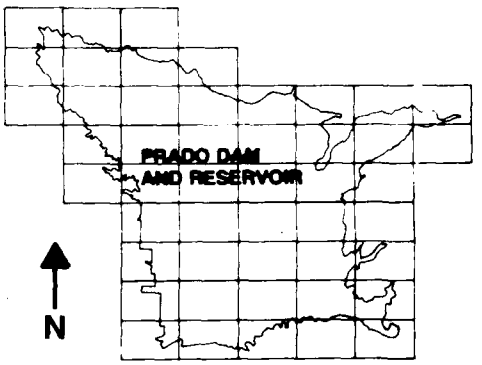
Significant adverse impacts would occur to 5,146 acres of Prime and Unique Farmlands at Prado Reservoir, 3,366 of these acres within the existing taking line and 1,780 acres to be newly affected by raising the taking line to 566 feet (msl). Another 275 acres of such farmlands would be affected at the Mentone Damsite. Most existing agricultural uses at Prado Dam would continue, though some Prime and Unique Farmlands would be eliminated at proposed Prado borrow sites and recreation development sites.

At Prado reservoir, the most significant adverse impact would be experienced in relocation of homes, businesses, and farms required to enlarge the reservoir. The additional acreage required for the project would effect 121 residences, 8 businesses and industries, 29 dairies and ranches and one public facility. The adverse impact will be reduced somewhat by allowing (life estates, flowage easements, and flood

proofing) options in the method of acquisition. After authorization of the project, negotiation with these landowners would identify whether the property would be taken in fee; whether it would be flood proofed and allowed to remain; whether the owner wished to sell the property but remain in a life estate; or whether a flowage easement could be offered to obtain the right to inundate these properties on an infrequent basis. These options were identified as feasible at Prado Reservoir because the properties in question are all at the extreme fringe of the reservoir limits. Survey Report studies determined the unlikely probability of flooding for these properties presents less severe of an impact than the immediate relocation.

Within the City of Corona, the enlargement of Prado would have a significant adverse economic and social impact. It would require the relocation of 29 homes. Prado enlargement would also remove from the city's tax roll 127 acres of undeveloped land. In the city's general plan, these lands are slated for residential and industrial uses. Prado's enlargement would prevent these lands from being put to economical uses for the community's benefit and would reduce the city's future tax base. The lands that the city proposes for residential use could provide 462 high density housing units, 41.5 million dollars of new development, and could provide 30 single family housing units, 3.6 million dollars of new development. These lands are located in a floodway fringe. The lands the city proposes for industrial use could provide about 3,200 jobs. Acquisition of these lands for the Prado Reservoir (see Figure 5) will affect the city's ability to develop these lands as planned. Plans for a flood control project along Temescal Creek, of which the Oak Street Drain is a tributary, would have made some of this development feasible by stabilizing flows down this creek. The loss of an existing residential community and of potentially developable lands is thus a real loss, not merely a paper loss of unquantifiable "potential." The relocation of the established residential community, a community which has a number of ties to other established neighboring residential areas, would particularly have severe negative ramifications. Improvements to Oak Street Drain would partially mitigate these negative impacts to the City of Corona's economy and social well-being. Loss of currently developable areas in the Prado Reservoir area would be compensated for by improving the stability and safety of the Oak Street Drain channel, thereby permitting some additional residential and commercial development. This would in some ways replace that which would otherwise take place in the Prado Reservoir.

Within Prado Reservoir six cultural sites which appear to be eligible for the National Register of Historic Places and one site on the Register (the Yorba-Slaughter Adobe) would be adversely impacted by construction activities and recreational development. Impacts to these sites are described in paragraph 5.38 in the FSEIS. All of these sites, except for the Yorba-Slaughter Adobe, are within the existing reservoir taking line (elevation 556 feet) and are already subject to flooding from rare events. Under this alternative, these sites would be inundated for longer periods during rare flood events.



EXISTING RESERVOIR

EXISTING RESIDENTIAL AREA

PROPOSED RESIDENTIAL AREA

PROPOSED INDUSTRIAL AREA

SCALE

500' 0 500'

SANTA ANA RIVER, CALIFORNIA
PHASE 1
GENERAL DESIGN MEMORANDUM

LANDS RECOMMENDED PLAN WILL REMOVE FROM CORONA'S JURISDICTION

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

S-154

FIGURE 5

2

In Santa Ana Canyon, acquisition of 1,500 acres would allow for releases from Prado Dam while preserving an important open space and wildlife habitat. Several proposals for development already threaten the remaining natural features of the canyon.

Channelization of the lower Santa Ana River would have relatively insignificant adverse impacts (except at the mouth) as the river is already channelized. No homes or businesses would be relocated as a result of this alternative. At the mouth of the river 8 acres of salt marsh would be destroyed as would 1-1/2 acres of the California least tern nesting habitat at the beach. These impacts would be compensated for through acquisition of 92 acres of former marsh and restoration of the marsh habitat and through replacement of the nesting area adjacent to the existing site.

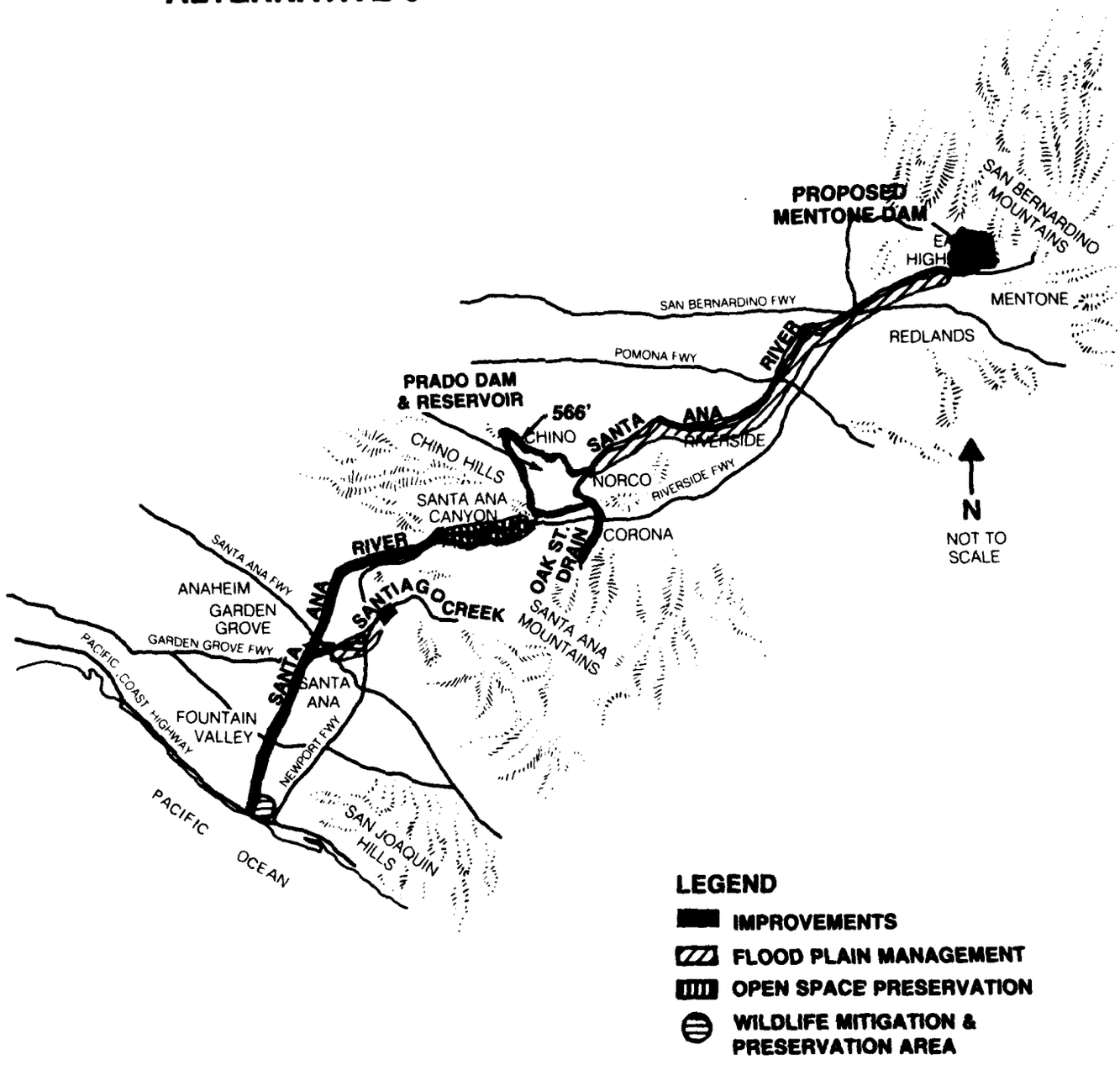
One-third of the existing pond to the east of the channel and downstream from Victoria Avenue would be eliminated by the channel expansion under this plan. It would be replaced to the southeast as a part of mitigation efforts.

Widening of the lower Santa Ana River channel would have adverse impacts on the existing recreation trails along the river between upstream of Imperial Highway and the ocean. These trails would be replaced. Portions of these trails were partially funded by funds from the Land and Water Conservation Fund Act of 1965, as amended (LWCFA). As required by this Act, facilities funded by LWCFA that are affected by the project would be replaced by local authorities with ones of equal value and utility.

Seven and one-half million cubic yards of material excavated from channel construction would require disposal. From 1,000,000 to 3,700,000 cubic yards the material may meet the Environmental Protection Agency (EPA) standards for beach replenishment. During channel excavation, up to 3.7 million cubic yards of excavated soil would be placed at selected beach sites and allowed to drain. Later, this material would be tested to determine if it should be used for permanent beach restoration. Soil determined to be unsuitable for beach areas would then be removed to other disposal sites, probably to gravel pits along Santiago Creek between Villa Park Road and Prospect Street or the pit along the east bank of the Santa Ana River at Lincoln Avenue. While soils are being drained on the beach, efforts would be taken to minimize any temporary environmental impacts. Placement of this material may adversely affect some marine life and visibility of scuba divers during project construction, but it may not have long-term adverse impacts. It would also help alleviate the current shortage of beach nourishment. Since the pits along Santiago Creek are used for water recharge, soils disposed of in these pits would be distributed to minimize their impact on water recharge capability. One method for minimizing impact would be for impermeable soils to be placed in the center of the pits, with more permeable soils used to stabilize the pit slopes. Construction and operation of the Santiago Creek project can be accomplished with little or no impact on ground water recharge. Utilization of the Santiago

Creek gravel pits for disposal of excess material from construction of the Santa Ana River flood control channel would result in a loss of an average of 500 acre-feet per year of recharge at the gravel pits. This represents 18 percent of the annual ground water recharge which would take place without this action. This loss would be offset by increasing ground water recharge downstream of Prado Dam by 3,500 acre-feet per year as a result of raising Prado Dam and implementing a new operation policy. Nevertheless, placing excavated soil in the pits might lead to increased eutrophication and allied water quality problems. A positive impact of depositing soils in the pits will be that the sides of the pits will be stabilized by the added soil. Evaluation of the environmental value of the pits has led to the conclusion that they do not have significant value as wetlands and do not have to be treated as such in this plan. A more detailed impact analysis of the disposal of material on water conservation would be conducted in the Phase II GDM. Since the disposal material would be covered by landscaping, the visual quality of the pits would be improved. These impacts are summarized in table 6.

THE ALL RIVER PLAN
ALTERNATIVE 6



LEGEND

- **IMPROVEMENTS**
- **FLOOD PLAIN MANAGEMENT**
- **OPEN SPACE PRESERVATION**
- **WILDLIFE MITIGATION & PRESERVATION AREA**

FIGURE 6

TABLE 6

REGIONAL, ENVIRONMENTAL, AND SOCIAL WELL-BEING IMPACTS
FOR ALTERNATIVE 6--THE ALL-RIVER PLAN

Regional Development

Beneficial effects	Adverse effects
1. Flood Insurance would not be required.	1. Loss of tax base from relocation of 55 homes, and 3 businesses within Mentone Reservoir.
2. Would provide 1.0 to 3.7 million cubic yards of excavated material for beach replenishment.	2. Eliminates 275 acres of orchards and farmland within Mentone Reservoir.
3. Would create temporary increase in personal and business income during construction.	3. Loss of tax base from relocation of up to 121 homes, 8 businesses, 27 dairies, and 2 ranches within Prado Reservoir.
4. Provides incidental water conservation benefits.	4. Eliminates potentially developable lands in Santa Ana Canyon.

Environmental

Beneficial effects	Adverse effects
1. Restores net 84 acres of salt marsh.	1. Temporarily eliminates 1,600 acres of sage scrub habitat including 500 acres of unique juniper woodland.
2. Improves surface and ground-water quality from increased water conservation at Prado Dam.	2. Loss of 1,000 acres of riparian growth in Prado Reservoir for potential Mentone Dam borrow site.
3. Preserves 1,500 acres in Santa Ana Canyon as open space and wildlife habitat.	3. Adverse effect on noise and air quality during project construction.

TABLE 6 (Continued)

4. After initial construction impacts, preserves 3,110 acres at Mentone damsite as open space.	4. Loss and replacement of 1-1/2 acres of least tern nesting area at the beach.
	5. Loss and replacement of 8 acres of degraded marshland. Loss and replacement of 1/3 of Victoria Pond.
	6. May affect cultural resources within Prado Reservoir.

Social Well-Being

Beneficial effects	Adverse effects
1. Provides physical and mental security from flooding to the upper and lower basin.	1. Loss of some community cohesiveness to the communities surrounding Prado Reservoir.
2. Provides an increase in recreational opportunities.	2. Significant community disruption to Corona and Riverside County in Prado Basin area, to be mitigated for by improving Oak Street Drain
	3. Some community disruption in Mentone Damsite area.

Mitigation Requirements

Mitigation measures for adverse impact to cultural resources within the Prado Reservoir are discussed in paragraphs 5.33-5.40 of the FSEIS.

Because channelization of the lower Santa Ana River would destroy 8 acres of former marshland, mitigation would require purchase of an adjacent 8 acres. This 8 acres, along with the 84 acres for preservation, would reestablish viable marsh habitat.

Other mitigation would include replacement of a portion of the least tern nesting preserve at the beach and replacement of a portion of the pond near Victoria Street.

Cost and Benefits of Plan

Costs and benefits of this alternative are shown in table 11 (page 133).

COSTS OF PLAN. The costs shown in table 11 are displayed as first costs and as annual costs. First costs include estimates for construction, relocations, rights-of-way, esthetic treatment, recreation, and mitigation; annual costs include interest in the total investment, interest during construction, amortization of the total investment over a 100-year period, and average annual costs of maintenance and operation. Annual charges were computed using a 7-1/8 percent interest rate.

BENEFITS OF PLAN. The primary benefit of this plan would be flood damage reduction. A second category of benefit would be removal of flood-proofing requirements imposed by the flood insurance program. Without this plan, new developments in the entire 100-year flood plain must be elevated to be protected from 100-year flooding. With this plan, flood proofing would not be required, and savings in these costs represent a benefit of the plan. Recreational benefits would be provided with this plan.

Incidental benefits would also accrue to this plan. Upgrading and preserving 92 acres of marshland would provide benefit to two Federal endangered species and one California endangered species. Construction activities would provide employment opportunities. Some water conservation will result from various plan elements.

Evaluation and Trade Off Analysis

This plan would provide standard project flood protection for all elements except Santiago Creek. This plan would reduce the total flood damage potential on the upper and lower Santa Ana River by 86 percent. The flood damage potential on the upper Santa Ana River would be reduced by 72 percent while the flood damage potential on the lower Santa Ana River would be reduced by 86 percent. The Mentone Dam feature of this plan offers the opportunity of protecting the river above Prado Dam.

Thus, while the additional storage at Mentone Dam minimizes the need to relocate property behind Prado Dam, it also provides benefits to the upper Santa Ana River. Without the Mentone Dam element, to gain an equivalent level of protection downstream of Prado Dam, Prado Dam would have to be raised 43 feet, 13 feet higher than under this plan. The guide taking line would be raised 14 feet to elevation 580 feet affecting an additional 527 homes, 12 businesses, and 55 dairies and ranches at Prado. Mentone Dam requires 55 homes and 3 businesses to be relocated. Therefore, construction of Mentone will save relocation of 472 homes, 9 businesses, and 52 dairies and ranches plus provide $3,307,000 in annual benefits to the upper Santa Ana River.

To assist in identifying the benefits provided by the Mentone Dam element, a special analysis was performed and appears in Appendix J. This analysis considered the benefit to be provided by Mentone Dam if it alone were constructed, and the benefit that it would add if all other elements of this plan were already in place. This analysis, called a "first added-last added" analysis showed that under either case, Mentone Dam would provide more in benefits than it would cost.

At Prado Dam, some relocations of residences, dairies and businesses would be necessary, but this plan provides a high level of protection and minimizes the number of relocations. Oak Street Drain compensates for some of the social impacts these relocations create and other adverse impacts to the City of Corona associated with raising Prado Dam.

No relocation of homes or businesses would be required downstream of Prado Dam as the combined flood storage of Mentone and Prado would allow construction of a downstream channel almost entirely within the existing right-of-way.

This plan meets the study objective of preservation of ecological and open space values of Santa Ana Canyon. One-thousand-five-hundred acres of land within the Canyon would be acquired for control of post-project releases from Prado Dam and maintained free from urban encroachment. Marshland preservation would be provided through acquisition and restoration of 92 acres of marsh habitat at the river mouth.

The ability of this plan to meet the nine selected evaluation criteria is displayed in table 16 (page 148). Of note here is that this plan is the only plan which both upstream and downstream interests will accept and support.

Planning Objectives Accomplished

The All-River Plan would produce positive contributions to all but one of the planning objectives. Although this plan attempts to alleviate impacts that raising Prado Dam would have on the surrounding community, the plan would have an overall negative impact on the communities surrounding Prado Reservoir. This plan attempts to alleviate impacts to the communities surrounding Prado Dam by offering

property owners within the proposed Prado taking line flexible real estate acquisition options and by including improvements to Oak Street Drain to compensate the City of Corona.

This plan would provide positive contributions to the planning objectives of controlling overflows from the Santa Ana River, and Santiago Creek. It reduces by 86 percent the flood damage potential from the Santa Ana River, by 44 percent the flood damage potential from Oak Street Drain, and by 95 percent the flood damage potential from Santiago Creek. This plan contributes to reducing overflows from the Santa Ana River in both the upper and lower basin.

The All-River Plan preserves and enhances the salt marsh near the river's mouth by acquiring 92 acres of this degraded marsh and restoring it to the thriving productive marsh it once was.

The All-River Plan's positive contribution to the planning objective of preserving the ecological and open space values of the Santa Ana Canyon stems from the proposal to acquire 1,500 acres of the canyon floodway for releases from Prado Dam as well as for ecological and open space value.

The All-River Plan contributes to the planning objective of increasing recreational opportunities by providing additional recreational facilities within Mentone Reservoir, Prado Reservoir, Santiago Creek, and the Santa Ana River below Prado Dam.

Positive contributions to the final planning objective, contributing to the use of floodwaters from the Santa Ana River and Santiago Creek for water conservation, stem from a new operating policy for Prado Dam which would allow for increased water supply storage, incidental to flood control operations. Greater releases from the dam would allow greater percolation into the spreading basins between Katella Avenue and Imperial Highway.

Implementation Responsibilities

COST ALLOCATION AND APPORTIONMENT. Allocation of project costs among the project purposes of flood control, preservation of endangered species, and recreation is shown in table 12 (page 136).

Apportionment of these costs among responsible parties is shown in table 12. Apportionment of the costs of the flood control measures is based on the President's June 1978 Water Policy. Apportionment of the costs of measures for endangered species preservation and for recreation measures is based on the President's Water Policy Message and on existing legislation.

FEDERAL RESPONSIBILITIES. The Federal Government would be responsible for constructing all elements of the plan. Operation and maintenance of Prado Dam and Mentone Dam for flood control would be a Federal responsibility. The U.S. Fish and Wildlife Service would be responsible for operating and maintaining wildlife lands at Mentone

Reservoir, Prado Reservoir, and the 92-acre marsh preserve at the river mouth, but would most likely turnover actual operation to the California Department of Fish and Game.

NON-FEDERAL RESPONSIBILITIES. Local interests would operate and maintain all flood control facilities except Mentone Dam and Prado Dam. All recreation facilities would be maintained and operated by local interests.

Public Views

FEDERAL AGENCIES. In the Supplemental Fish and Wildlife Coordination Act Report, the U.S. Fish and Wildlife Service commented on the All-River Plan, indicating continued overall support for the plan. Their support would be contingent upon full implementation of the mitigation/compensation/enhancement program provided for in the All-River Plan. In this report the U. S. Fish and Wildlife Service did not specifically address the Estuarine Protection Act (16 USC 1224). This act calls for projects affecting estuaries and their natural resources to include a discussion by the Secretary of the Interior of such estuaries and such resources and the effects of the project on them. The U. S. Fish and Wildlife Service concurs that the project's effects on the estuary area will be to preserve and restore the salt marsh at the Santa Ana River mouth, enchance endangered species habitat and benefit marine fishery resources. This report may be found in Appendix I; the Fish and Wildlife Services Position Statement is included in Attachment B to the FSEIS.

NON-FEDERAL AGENCIES. Local interests have consistently stated that this alternative is the only plan which can achieve overall unanimous support. The 1975 Survey Report studies clearly pointed this out. These Phase I studies have reaffirmed that conclusion. Local interests do not agree, however, with the cost apportionment displayed with this plan. They note the new policy now makes the local share of costs 20 percent of the total costs. Under existing legislation, the local cost share would be 6 percent (see chapter 8).

PUBLIC. Public views are generally supportive of this plan. At the four public meetings held in August 1980 most of the people speaking favored the All-River Plan. A public workshop held in January 1980 to consider proposals for the mouth of the Santa Ana River revealed little opposition to the flood control element of this plan. There was a concern at the meetings over the possibility that the 92-acre marsh preservation proposal would preclude construction of a marina at the site.

Upstream interests, at several meetings held in February 1980 to discuss raising Prado Dam, expressed a desire to confine all construction to Orange County. Nearly six hundred residents attended a series of meetings and forcefully expressed their concern over any plan to raise Prado Dam. However, if Prado Dam must be raised, then the proposal under this plan is the only one they would support.

NATIONAL ECONOMIC DEVELOPMENT PLAN, ALTERNATIVE 7

Plan Description

This plan, identified as Alternative 7, the National Economic Development (NED) Plan in the Survey Report, would provide protection principally to the heavily populated urban area below Prado Dam, about 99 percent of which is in Orange County.

The size of reservoir and channel were calculated to provide maximum contributions to economic efficiency and would provide slightly greater than standard project flood protection (about 230-year recurrence interval) should the flood occur at the end of the assumed 100-year economic life.

Under this optimum combination, the reservoir taking line would be raised from its 556 foot elevation level to 582 feet. The spillway would be set at elevation 579, which is the calculated maximum water surface level occurring at the 100th year of project life, assuming a controlled release up to 30,000 cubic feet per second from Prado Dam. The storage capacity at elevation 579 (according to recent topographic surveys) is about 557,000 acre-feet. In 100 years, sedimentation would reduce that capacity to an estimated 497,000 acre-feet. For comparison, the storage capacity at the present spillway crest elevation is about 196,000 acre-feet (as of August 1979). This plan would necessitate raising the crest elevation of the dam from 566 to 611 feet elevation in order to contain a probable maximum flood without overtopping the dam. A long dike would have to be built from the east end of the spillway to assure containment of the flood within the reservoir.

The existing spillway would have large amounts of concrete added to raise the crest elevation from 543 to 579 feet. The crest length would be increased from about 1,000 feet to 1,300 feet necessitating reconstruction of the spillway walls. New outlet works would be constructed, located between the existing dam and spillway, capable of discharging a 30,000 cubic foot per second design release.

In the Santa Ana Canyon, below Prado Dam, sufficient property would be acquired for the releases from the dam with protection from erosion of banks provided by revetment placed along certain portions of the Riverside Freeway and the Santa Fe Railroad. This proposal would be identical to that under Alternative 6, the All-River Plan.

In the urban 23 mile reach of river from about Weir Canyon Road to the ocean, the channel capacity would be increased to about 43,000 cubic feet per second to take care of contemporaneous side inflows. Below Santiago Creek, the channel capacity would be 46,000 cubic feet per second. The channel would be earth bottom, generally with revetted side slopes down to the Santiago Creek confluence and then a concrete rectangular channel to the mouth (with a soft bottom substituted for the concrete invert the last 2.6 miles). This would be identical to the channel work called for in Alternative 6, the All-River Plan.

Provisions for Oak Street Drain and for Santiago Creek would be identical to those under the All-River Plan.

Alternative 7's recreational features would be the same as those under the All-River Plan except that as Mentone Dam would not be constructed no recreation features would be provided upstream of Prado Dam.

Impact Assessment

Downstream from Prado Dam and at Oak Street Drain, the elements of this plan are identical to those of Plan 6, the All-River Plan. Plan impacts would be nearly identical for these locations. At Prado Reservoir, the plan impacts would be dissimilar.

At Prado Reservoir, the enlargement to elevation 582 would require 5,545 acres on which 718 homes, 82 dairies and ranches, and 25 businesses are presently located. Homeowners or residents displaced would have to find other affordable housing in the area. Dairy owners might have difficulty finding alternative profitable locations for their business enterprises. The California Institute for Women in the Chino area would have to be relocated as protective diking would not be possible. The prison is a unique facility and relocation would be an arduous and expensive proposition. This alternative would affect substantially more Prime and Unique Farmlands in Prado Reservoir than would be affected by Alternative 6. The Soil Conservation Service has computed the acreage which would be affected. Most of the existing Prime and Unique Farmlands would be allowed to continue but some might be eliminated by borrow site and recreational development elements of the project.

In expanding the Prado Reservoir area, most homes and dairies would have the option of relocation, flood proofing, flowage easements, or "life estate." The Corona Airport would have to evacuate about 150 aircraft in the event of a major flood and would incur damages to remaining facilities. The Corona Water Reclamation Plant and Alcoa Aluminum Plant would be flood proofed. The abandoned sewage treatment plant on Temescal Creek and three local parks would incur flooding damages. Highway Route 71 would have to be rebuilt in the vicinity of the dam. Increasing the height of Prado Dam by 45 feet would significantly increase the existing adverse visual impact in the greater Corona-Norco-Chino area.

Archeologic and historic resources in the Prado Basin presently susceptible to damage by flooding would be subject to infrequent inundation to greater depths. Several additional sites, not currently within the Prado Reservoir 556 taking line would be subjected to infrequent flooding under this plan. The Prado Park Museum would be evacuated in the event of flooding and would incur flood damages. Plans for recreation facilities in the area would also affect cultural and historic resources. Impacts are summarized on table 8 (page 114).

THE N.E.D. PLAN
ALTERNATIVE 7

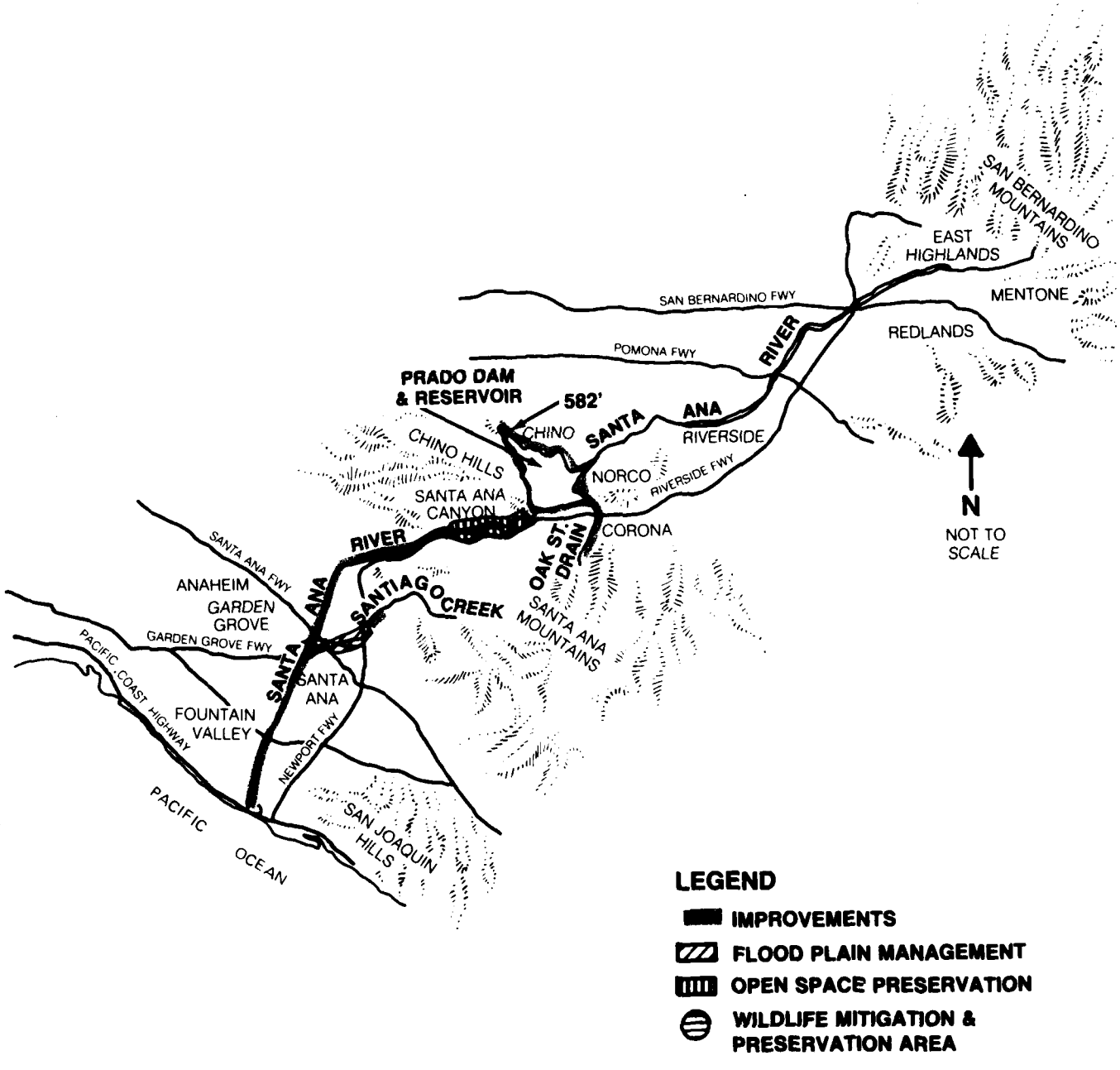


FIGURE 7

TABLE 7

REGIONAL, ENVIRONMENTAL, AND SOCIAL WELL-BEING IMPACTS
FOR ALTERNATIVE 7--THE NED PLAN

Regional Development

Beneficial effects	Adverse effects
1. Flood insurance would not be required in lower basin.	1. Loss of tax base from relocation of up to 718 homes, 82 dairies, 6 ranches, and 25 businesses at Prado Reservoir.
2. Would create temporary increase in personal and business income during construction.	2. Potential loss of 651 job opportunities from relocation of businesses, ranches, and dairies.
3. Provides 1 to 3.7 million cubic yards of excavated material for beach replenishment.	3. Relocation of California Institute for Women at Prado Reservoir.
4. Provides incidental water conservation benefits.	4. Eliminates potentially developable lands in Santa Ana Canyon.
	5. Highway 71 will have to be relocated and rebuilt in the vicinity of the dam, causing temporary disruption of the transportation corridor.

Environmental Impact

Beneficial effects	Adverse effects
1. Adds 5,545 acres to Prado Reservoir with potential vegetation and wildlife benefit.	1. Short term construction and noise impact.
2. Improves surface and ground water quality from increased water conservation at Prado Dam.	2. Loss and replacement of 1/3 of least tern nesting area on the beach.

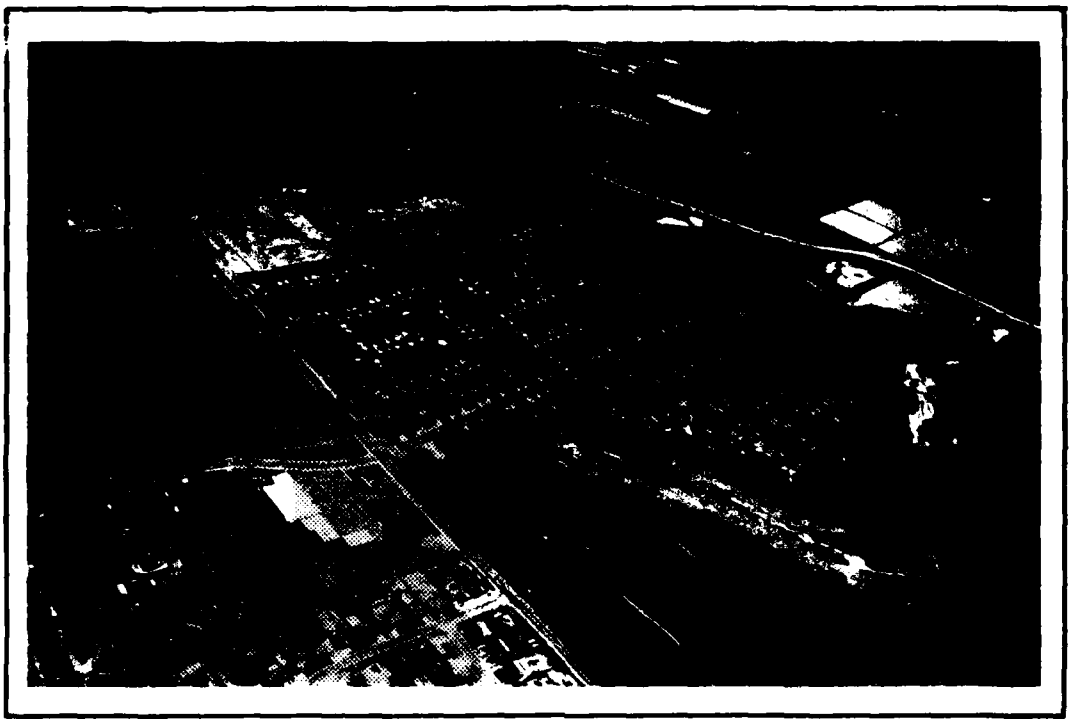


Photo 30: Houses in Corona that would be removed under the NED Plan.

TABLE 7 (Continued)

3. Preserves 1,500 acres of vegetation and wildlife habitat in Santa Ana Canyon.	3. Loss and replacement of 8 acres of degraded marshland.
	4. Loss and replacement of 1/3 of freshwater pond near Victoria Street.
	5. Additional cultural resource sites in Prado Reservoir will be inundated.

Social Well-Being

Beneficial effects	Adverse effects
1. Provides physical and mental security from flooding to the flood plain residents.	1. Loss of community cohesiveness to the communities surrounding Prado Reservoir.
2. Provides an increase in recreational opportunities.	2. Major community disruption to the area surrounding Prado Reservoir from relocation of homes, dairies, ranches, and businesses.

Mitigation Requirements

Mitigation requirements are also identical to those under the All-River Plan, Alternative 6, except that greater mitigation would be required for the additional cultural resources which would be affected by Alternative 7. In addition, 8 acres of marshland will be acquired and restored for mitigation of project impacts, but 84 acres of marshland would not be purchased for endangered species preservation. A portion of the least tern nesting habitat at the beach would be replaced, and a portion of the pond near Victoria Street would be replaced.

Costs and Benefits of Plan

Costs and benefits of this alternative are shown in table 11 (page 133).

COSTS OF PLAN. The costs shown in table 11 are displayed as first costs and as annual costs. First costs include estimates for construction, relocations, rights-of-way, esthetic treatment, recreation and mitigation. Annual costs include interest on the total investment, interest during construction, amortization of total investment over a 100-year period, and average annual costs of maintenance and operation. Annual costs were computed using a 7-1/8 percent interest rate.

BENEFITS OF PLAN. The primary category of benefit that would accrue to this plan is flood damage reduction. A second category of benefit would be removal of flood proofing requirements imposed by the flood insurance program. Without this plan, new developments in the 100-year flood plain, which is already heavily developed, must be elevated to be protected from 100-year flooding. With this plan, flood proofing would not be required, and savings in these costs represent a benefit to the plan. Recreational facilities provided under this plan would produce benefits from increased recreational opportunities based on proposed use of the facilities. Incidental benefits would include construction activities which would provide employment opportunities, and water conservation.

Evaluation and Trade Off Analysis

Because this plan calls for no improvements above Prado Reservoir, this plan does not fully meet the study objective of controlling floods throughout the Santa Ana River's length. This plan would provide for slightly greater than standard project flood protection to the lower Santa Ana flood plain, but no protection to the upper Santa Ana flood plain. The total reduction in flood damage potential for the entire river would be 89 percent. The total reduction in flood damage potential for the lower river alone would be 91 percent.

At Prado Dam, a significant number of homes, businesses, dairies and ranches, would require relocation. Oak Street Drain improvement is included in this plan to compensate for adverse impacts to the City of Corona associated with raising Prado Dam.

The ability of this plan to meet the 9 selected evaluation criteria is displayed in table 16 (page 148). Upstream interests in Riverside and San Bernardino Counties oppose this plan primarily because its impact on the area around Prado Reservoir is much greater than that of the All-River Plan (because of the increased height of the dam) and compensation for this impact is not possible (the land taken cannot be replaced with like land in the same general area).

Planning Objectives Accomplished

The National Economic Development Plan would make positive contributions to all but two of the planning objectives. This plan would have a negative contribution to the planning objective to enhance and preserve the salt marsh at the river's mouth. Although the plan would mitigate for the loss of 8 acres of salt marsh from widening the channel by proposing acquisition of an additional 8 acres, it would not enhance the salt marsh. This plan also would have a negative contribution to the planning objective of contributing to preserving the unique rural character of the communities surrounding Prado. Like the All-River Plan, this plan would attempt to alleviate impacts to the communities surrounding Prado by offering flexible acquisition policies and flood control improvements to Oak Street Drain to compensate the City of Corona.

This plan's contributions to the planning objectives only varies from the All-River Plan's contributions in one other way. The plan would reduce 91 percent of the flood damage potential from the Santa Ana River. However, this would all be accomplished on the lower river and no contributions to reducing flood damage would be made on the upper river above Prado Dam.

Implementation Responsibilities

COST ALLOCATION AND APPORTIONMENT. Table 12 (page 136) presents allocation of project costs among the project purposes of flood control, preservation of endangered species, recreation, and apportionment of cost to responsible parties.

Apportionment of the costs of the flood control measures is based on the President's June 1978 Water Policy Message to Congress. Apportionment of the costs of measures for endangered species preservation and for recreation measures is based on the President's Water Policy Message and on existing legislation.

FEDERAL RESPONSIBILITIES. The Federal Government would be responsible for constructing all elements of the plan. Operation and maintenance of Prado Dam for flood control would be a Federal responsibility. Although the U.S. Fish and Wildlife Service would be responsible for operating and maintaining wildlife lakes within Prado Reservoir and the 8-acre marsh preserve, they will probably transfer this responsibility to the California Department of Fish and Game.

ALTERNATIVE 5

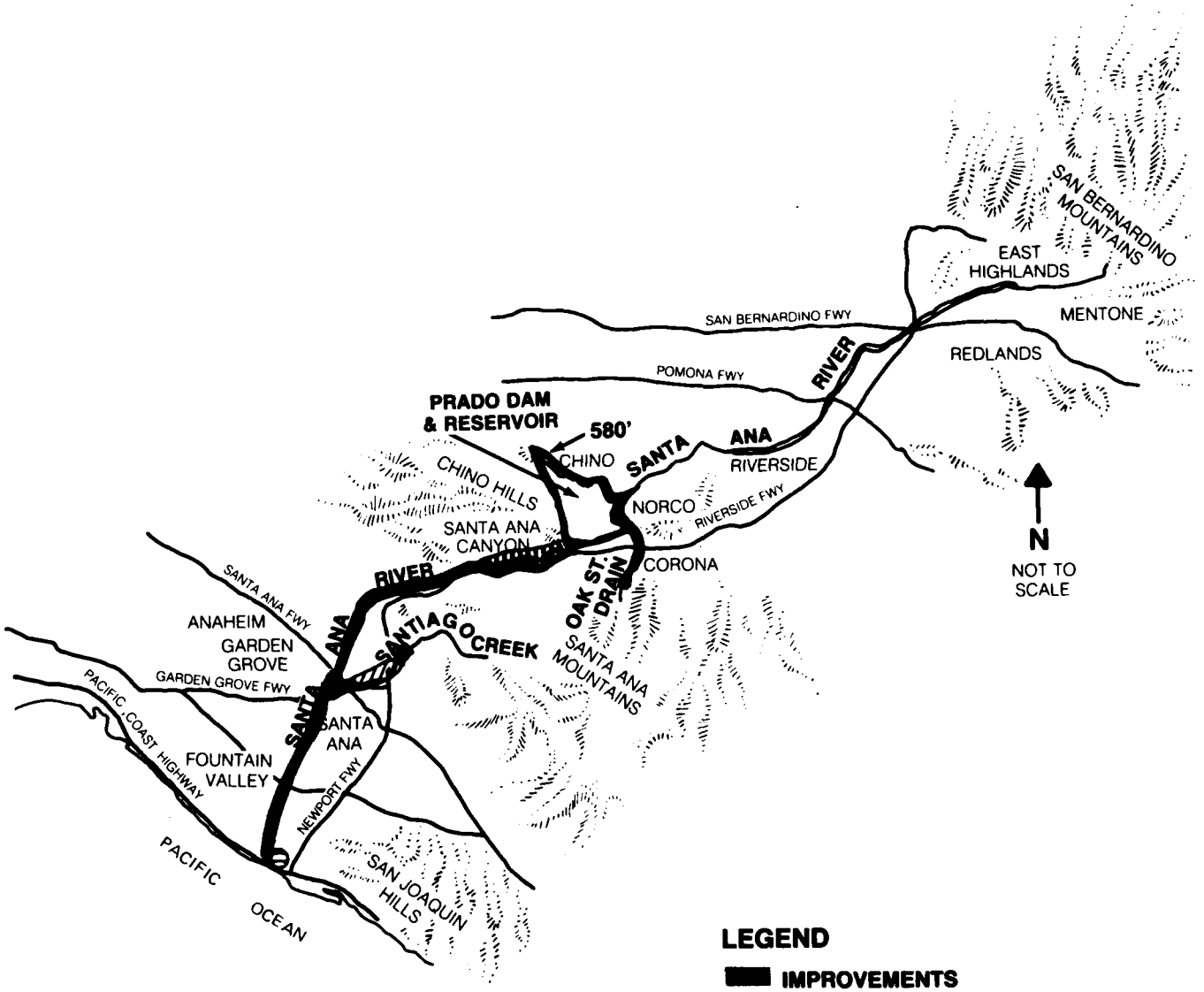


FIGURE 8

NON-FEDERAL RESPONSIBILITIES. Local interests would operate and maintain all flood-control facilities except for Prado Dam. All recreation facilities would be maintained and operated by local interests.

Public Views

FEDERAL AGENCIES. In a June 1980 letter, the U.S. Fish and Wildlife Service stated that this plan would not be acceptable unless additional mitigation measures were included.

NON-FEDERAL AGENCIES. No non-Federal agency supports this alternative plan. Upstream Counties are adamantly opposed to this alternative. The primary reason for opposition to this plan is the relocation impacts from raising Prado Dam and the lack of adequate compensation for these impacts.

PUBLIC. There is little public opposition to elements of the plan below Prado Dam. A public meeting held in January 1980 to consider issues near the mouth of the Santa Ana River found little opposition to the flood control element for the lower Santa Ana River.

At several meetings held in February and March 1979 and February 1980 in the vicinity of Prado Dam, strong opposition was expressed over any plan to raise Prado Dam. Nearly six hundred residents attended meetings in February 1980 and forcefully expressed a desire not to raise Prado Dam. This alternative for raising Prado Dam was completely unacceptable.

ALTERNATIVE 5

Plan Description

This alternative remains substantially unchanged from the 1975 Survey Report Alternative 5, and is quite similar to Alternative 7 in this report. It would provide standard project flood protection to Orange County. The only difference between this plan and the National Economic Development Plan is that Prado Dam would be raised to 609 feet, the spillway to 577 feet, and the taking line to 580 feet (msl). The taking line under this plan would thus be 2 feet lower than that under the NED Plan. This plan is included in the analysis of alternative plans to enable a proper determination of the National Economic Development Plan. As stated earlier in this report, at the beginning of this Phase I study it was uncertain whether Alternative 7 from the Survey Report studies would continue to be the NED Plan. Rapid increases in land values behind Prado Dam since the 1975 Survey Report indicated that the optimal economic plan might be realized through raising Prado Dam 43 feet rather than 45 feet as under Alternative 7. Detailed studies failed to confirm this indication and the NED Plan remains as Alternative 7--raising Prado Dam 45 feet. Alternative 5 is reported here to demonstrate that Alternative 7 is still the NED Plan but it is also displayed because it would provide an equivalent level of

flood protection as the All-River Plan, Alternative 6. Alternative 5 would provide standard project flood protection and is therefore directly comparable to Alternative 6.

Impact Assessment

Impacts expected for areas downstream of Prado Dam and for the Oak Street Drain would be identical to those expected under the NED Plan, but impacts at the Prado Reservoir would be slightly less severe. Enlargement of the reservoir would be less extensive under this plan (5025 acres vs. 5545 acres under the NED Plan), and 70 fewer houses, 5 fewer businesses, and 6 fewer dairies would be affected. All other impacts would be identical to those already outlined under the NED Plan. Impacts are summarized on table 8.

Mitigation Requirements

Although impacts would not be quite as severe under this plan as they would be under the NED Plan, required mitigation would be substantially similar.

TABLE 8

REGIONAL, ENVIRONMENTAL AND SOCIAL WELL-BEING IMPACTS
FOR ALTERNATIVE 5

Regional Development

Beneficial effects	Adverse effects
1. Flood insurance would not be required in lower basin.	1. Loss of tax base from relocation of up to 648 homes, 76 dairies, 6 ranches, and 20 businesses at Prado Reservoir.
2. Would create temporary increase in personal and business income during construction.	2. Potential loss of 608 job opportunities from relocation of businesses, ranches and dairies.
3. Provides 1 to 3.7 million cubic yards of excavated material for beach replenishment.	3. Relocation of California Institute for Women at Prado Reservoir.
4. Provides incidental water conservation benefits.	4. Eliminates potentially developable lands in Santa Ana Canyon.

TABLE 8 (Continued)

Environmental Impact

Beneficial effects	Adverse effects
1. Adds 5,025 acres to Prado Reservoir with potential wildlife benefit.	1. Short-term construction and noise impact.
2. Improves surface and ground water quality from increased water conservation at Prado Dam.	2. Loss and replacement of 1/3 of least tern nesting area on the beach.
3. Preserves 1,500 acres of vegetation and wildlife habitat in Santa Ana Canyon.	3. Loss and replacement of 8 acres of degraded marshland.
	4. Loss and replacement of 1/3 of freshwater pond near Victoria Avenue.
	5. Additional cultural resource sites in Prado Reservoir will be inundated.

Social Well-Being

Beneficial effects	Adverse effects
1. Provides physical and mental security from flooding to the lower basin.	1. Loss of community cohesiveness to the communities surrounding Prado Reservoir.
2. Provides additional recreational opportunities.	2. Major community disruption to the area surrounding Prado Reservoir from relocation of homes, dairies, ranches, and businesses.

Costs and Benefits

The costs and benefits of this plan are shown in table 11 (page 133)

COSTS OF PLAN. The costs shown in table 11 are displayed as first costs and as annual costs. First costs include estimates for construction, relocations, rights-of-way, esthetic treatment, recreation and mitigation. Annual costs include interest on the total investment, interest during construction, amortization of total investment over a 100-year period, and average annual costs of maintenance and operation. Annual costs were computed using a 7-1/8 percent interest rate.

BENEFITS OF PLAN. The primary category of benefit that would accrue to this plan is flood damage reduction. A second category of benefit would be removal of flood proofing requirements imposed by the flood insurance program. Without this plan, new developments in the entire 100-year floodway must be elevated to be protected from 100-year flooding. With this plan, flood proofing would not be required, and savings in these costs represent a benefit to the plan. Recreational facilities provided under this plan would accrue benefits from increased recreational opportunities based on proposed use of the facilities. Incidental benefits would also accrue to this plan, including water conservation. Construction activities would provide employment opportunities.

Evaluation and Trade Off Analysis

Since this plan would provide for no improvements above Prado Reservoir, it does not fully meet the objective of controlling floods throughout the Santa Ana River's length. The plan only provides standard project flood protection for the lower flood plain (Orange County) of the Santa Ana River. The total reduction in flood damage potential for the entire river would be 86 percent and the total reduction for the lower river would be 91 percent.

As in Alternative 7, the Oak Street Drain is included in this alternative, but this plan impacts fewer homes, dairies, and businesses around Prado since the reservoir taking line is lower. The ability of this plan to meet the nine selected evaluation criteria is displayed in table 16 (page 148).

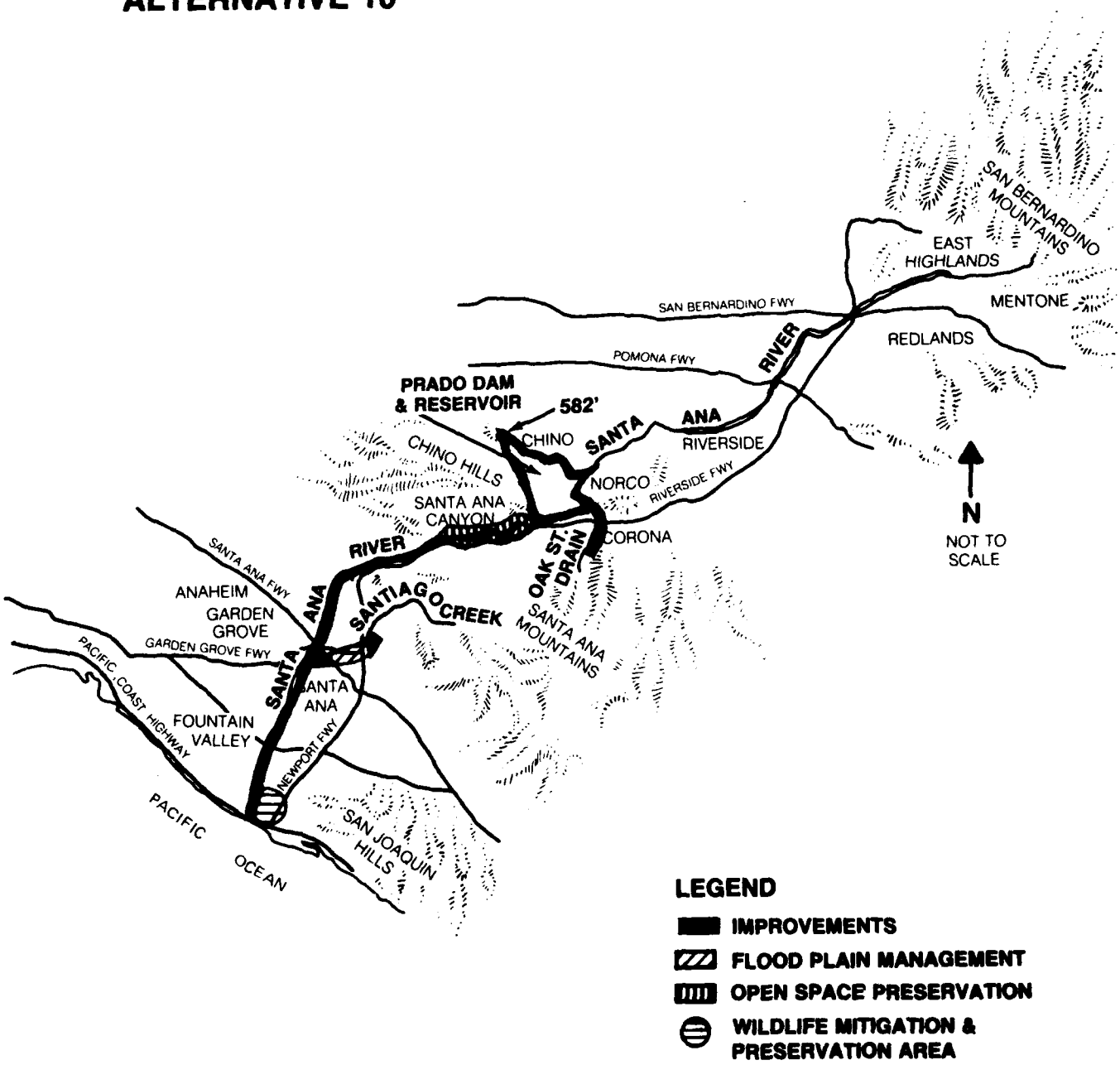
Planning Objectives Accomplished

The planning objectives met by this plan are identical to those met under Alternative 7.

Implementation Responsibilities

COST ALLOCATION AND APPORTIONMENT. Table 12 (page 136) presents allocation of project costs among the project purposes of flood control, preservation of endangered species, recreation, and apportionment of

THE E.Q. PLAN
ALTERNATIVE 10



LEGEND

- **IMPROVEMENTS**
- **FLOOD PLAIN MANAGEMENT**
- **OPEN SPACE PRESERVATION**
- **WILDLIFE MITIGATION & PRESERVATION AREA**

FIGURE 9

these costs among responsible parties. Apportionment of the costs of the flood control measures is based on the President's June 1978 Water Policy Message to Congress. Apportionment of the costs of measures for endangered species preservation and for recreation measures is based on the President's Water Policy Message and on existing legislation.

FEDERAL RESPONSIBILITES. The Federal Government would be responsible for constructing all elements of the plan. Operation and maintenance of Prado Dam for flood control would be a Federal responsibility. Operation and maintenance of the 8-acre marsh preserve would be the responsibility of the U.S. Fish and Wildlife Service but would probably be transferred to the California Department of Fish and Game.

NON-FEDERAL RESPONSIBILITIES. Local interests would operate and maintain all flood-control facilities except for Prado Dam. All recreation facilities would be maintained and operated by local interests.

Public Views

FEDERAL AGENCIES. U.S. Fish and Wildlife Service comments on the NED Plan would also apply to this plan (see page 113).

NON-FEDERAL AGENCIES. No non-Federal agency supports this alternative plan. Upstream counties are adamantly opposed to this alternative. The primary reason for opposition to this plan is the relocation impact from raising Prado Dam and the inability of the plan to provide adequate compensation for this impact.

PUBLIC. There is little public opposition to elements of the plan below Prado Dam. A public meeting held in January 1980 to consider issues concerning the mouth of the Santa Ana River found little opposition to the flood control element for the lower Santa Ana River. At several meetings, held in February and March 1979 and February 1980 in the vicinity of Prado Dam, strong opposition was expressed over any plan to raise Prado Dam. Nearly six hundred residents attended meetings in February 1980 and forcefully expressed a desire not to raise Prado Dam. This alternative for raising Prado Dam was completely unacceptable.

ENVIRONMENTAL QUALITY PLAN, ALTERNATIVE 10

Plan Description

For the main stem of the Santa Ana River, this plan is nearly identical to the NED Plan, Alternative 7. No upstream reservoir at Mentone would be constructed. Prado Dam would be raised 45 feet and the guide taking line raised 26 feet to elevation 582 feet; Oak Street Drain will be improved as mitigation for impact from raising the dam. Santiago Creek would also be improved. However, a difference between this plan and the NED Plan is that most residences, businesses, dairies

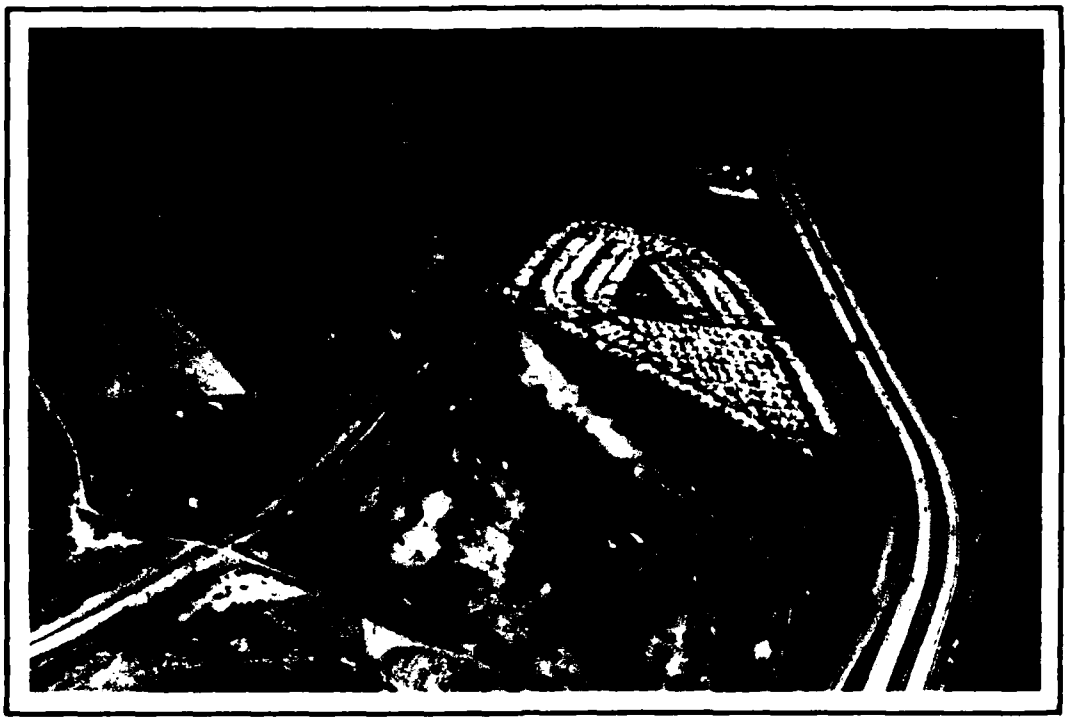


Photo 31: View of mobile home park in Santa Ana Canyon which would be relocated under the EQ Plan.

and ranches below the guide taking line would be removed completely from the reservoir to maximize open space and wildlife habitat values. Prime and Unique Farmlands which would be allowed to remain in agricultural uses under the NED Plan would be removed from such uses under this plan. Santa Ana Canyon flood-plain lands would be acquired but an existing mobile home park would be relocated from the flood plain rather than protected. The plan for the Santa Ana River channel downstream of Santa Ana Canyon would be identical to that of Alternative 6 or 7. At the river mouth, 200 acres of former marshland would be acquired and added to the marsh preservation proposal 180 of which will enhance and preserve habitat. As with the NED Plan, the EQ Plan's recreational plan is similar to the All-River Plan's but, again, would have no features upstream of Prado Dam.

Impact Assessment

With the Environmental Quality Plan, many of the impacts are equivalent to those under the NED Plan (Alternative 7), as the physical flood control improvements are similar. The downstream channel impacts are also common to those of the All-River Plan, which uses the same channel design below Prado Dam. In Prado Reservoir, at the time of construction, most of the 718 homes, 82 dairies, 6 ranches, and 25 businesses would be vacated and cleared away. In the Santa Ana Canyon the residents in the mobile home park would be subject to a similar one-time inconvenience in moving. Social and economic costs of relocation would be high, and those relocated would be forced to find replacement housing and business structures in an expensive and limited market place.

Effects along the urban reach of the channel would be about the same as the effects under Alternative 6 or 7, as the channel improvement would be similar.

Enlargement of the habitat area near the river mouth would preclude other uses such as a marina or public accessed recreation. Impacts are summarized on table 9.

TABLE 9

REGIONAL, ENVIRONMENTAL, and SOCIAL WELL-BEING IMPACTS
FOR ALTERNATIVE 10--THE ENVIRONMENTAL QUALITY PLAN

Regional Development

Beneficial effects	Adverse effects
1. Flood insurance would not be required in lower basin.	1. Loss of tax base from definite relocation of 718 homes, 82 dairies, 6 ranches, and 25 businesses at Prado Reservoir.
2. Creates temporary increase in personal net income during construction.	2. Loss of 651 job opportunities from relocation of businesses, and dairies at Prado Reservoir.
3. Provides 1 to 3.7 million cubic yards of excavated material for beach replenishment.	3. Loss of tax base from relocation of 333 mobile homes, 10 homes, and 1 business in Santa Ana Canyon.
4. Provides incidental water conservation benefits.	4. Eliminates about 1,530 acres potentially developable land in Santa Ana Canyon.

Environmental Impacts

Beneficial effects	Adverse effects
1. Adds 5,545 acres to Prado Reservoir, the majority of which will be restored to vegetation and wildlife habitat.	1. Short-term construction and noise impact.

TABLE 9 (Continued)

2. Improves surface and ground water quality from increased water conservation at Prado Dam.	2. Loss and replacement of 1/3 of least tern nesting area on the beach.
3. Preserves 1,530 acres of vegetation and wildlife habitat in Santa Ana Canyon.	3. Loss and replacement of 8 acres of degraded marshland.
4. Restores and preserves 200 acres degraded marshland at river mouth.	4. Loss and replacement of 1/3 of freshwater pond near Victoria Avenue.
5. Preserves and replaces waterfowl habitat along the Greenville-Banning channel in the lower river reach.	5. Additonal cultural resource sites in Prado Reservoir will be affected.
	6. Probable eventual urbanization of up to 40% of area of Mentone Damsite, with accompanying loss of wildlife habitat and unique juniper woodland.

Social Well-Being

Beneficial effects	Adverse effects
1. Provides physical and mental security from flooding to the lower basin.	1. Major community disruption to the area surrounding Prado from relocation of homes, dairies, ranches, and businesses.
2. Provides an increase in recreational opportunities.	

Mitigation Requirements

As for Alternatives 6 and 7, eight acres of former marshland at the mouth would be destroyed through channel construction. An adjacent 8 acres would be purchased and restored to natural marsh habitat. A portion of the least tern nesting preserve at the beach and a portion of the pond near Victoria Street would be replaced in a manner similar to that provided for in Alternatives 6 and 7. Adverse impacts on cultural resources within the Prado Reservoir would require mitigation efforts, to include flood proofing and data recovery programs where appropriate.

Cost and Benefits of Plan

Costs and benefits of this alternative are shown in table 11 (page 133).

COSTS OF PLAN. The costs shown in table 11 are displayed as first costs and as annual costs. First costs include estimates for construction, relocations, rights-of-way, esthetic treatment, recreation and mitigation. Annual costs include interest on the total investment, interest during construction, amortization of the total investment over a 100-year period, and average annual costs of maintenance and operation. Annual costs were computed using a 7-1/8 percent interest rate.

BENEFITS OF PLAN. The primary category of benefit that would accrue to this plan is flood damage reduction. A second category of benefit would be removal of flood-proofing requirements imposed by the flood insurance program. Without this plan, new developments in the 100-year flood plain must be elevated to be protected from 100-year flooding. With this plan, flood proofing would not be required, and savings in these costs represent a benefit to the plan. A third category of benefits is recreational benefits.

The plan would provide significant but unquantifiable environmental benefits. Five-thousand-five-hundred and forty-five acres of open space and wildlife habitat would be restored through raising Prado Dam. Removal of the mobile home park in Santa Ana Canyon would reduce urban pressure on canyon features. Provision of 200 acres of restored marshland at the mouth would provide habitat for endangered species and other wildlife. There would be recreational benefits, particularly to those interested in open space recreation.

Evaluation and Trade Off Analysis

This plan is entirely similar to Alternative 7, the NED Plan, in the ability to meet the study objective of controlling floods throughout the Santa Ana River's length. No improvements are called for above Prado Dam and all contributions toward meeting the flood control objective would be confined to the area below Prado Dam as in Alternative 7. This plan would reduce total flood damages by 89 percent for the entire river and by 91 percent for the lower Santa Ana River.

At Prado Dam, as in Alternative 7, 718 homes, 82 dairies, and 31 businesses and ranches would be impacted by raising the dam. However, unlike Alternative 7, no flexible acquisition policies would be offered and all development would be removed from the reservoir area. As in Alternative 7, Oak Street Drain improvement would be included in this plan as partial compensation for adverse social impacts resulting from raising Prado Dam.

This plan offers more positive contributions toward preservation of open space and ecological values of Santa Ana Canyon than any other alternative. A total of 1,530 acres of land would be maintained as open space within the canyon. Thirty acres of this open space would be reclaimed by relocating an existing mobile home park.

At the mouth of the river, this plan also provides the greatest contribuion to preserving and restoring marshland habitat. The ability of this plan to meet the nine selected evaluation criteria is displayed in table 16 (page 148). Because the Prado Dam element is similar to that of Alternative 7, this plan is also unacceptable to upstream interests.

Planning Objectives Accomplished

The Environmental Quality Plan would make positive contributions to all but one of the planning objectives. The plan has a severe negative contribution to the planning objective of preserving the unique rural character of the communities surrounding Prado since more land would be acquired than under the All-River Plan and as much as under the NED Plan, and flexible acquisition policies are not offered to the property owners.

Since this plan would involve acquiring 200 acres of the salt marsh at the river's mouth, more land than in all but the All-Channel Plan, it contributes more to the planning objectives of enhancing and preserving the marshland at the river's mouth.

The Environmental Quality Plan's contributions to the other planning objectives are the same as those of the National Economic Development Plan.

Implementation Responsibilities

COST ALLOCATION AND APPORTIONMENT. Table 12 (page 136) presents allocation of project costs among the project purposes of flood control, preservation of endangered species, and recreation, and apportionment of these costs among responsible parties. Apportionment of the costs of the flood control measures is based on the President's June 1978 Water Policy Message to Congress. Apportionment of the costs of measures for endangered species preservation and for recreation measures is based on the President's Water Policy Message and on existing legislation.

THE ALL CHANNEL PLAN
ALTERNATIVE 11

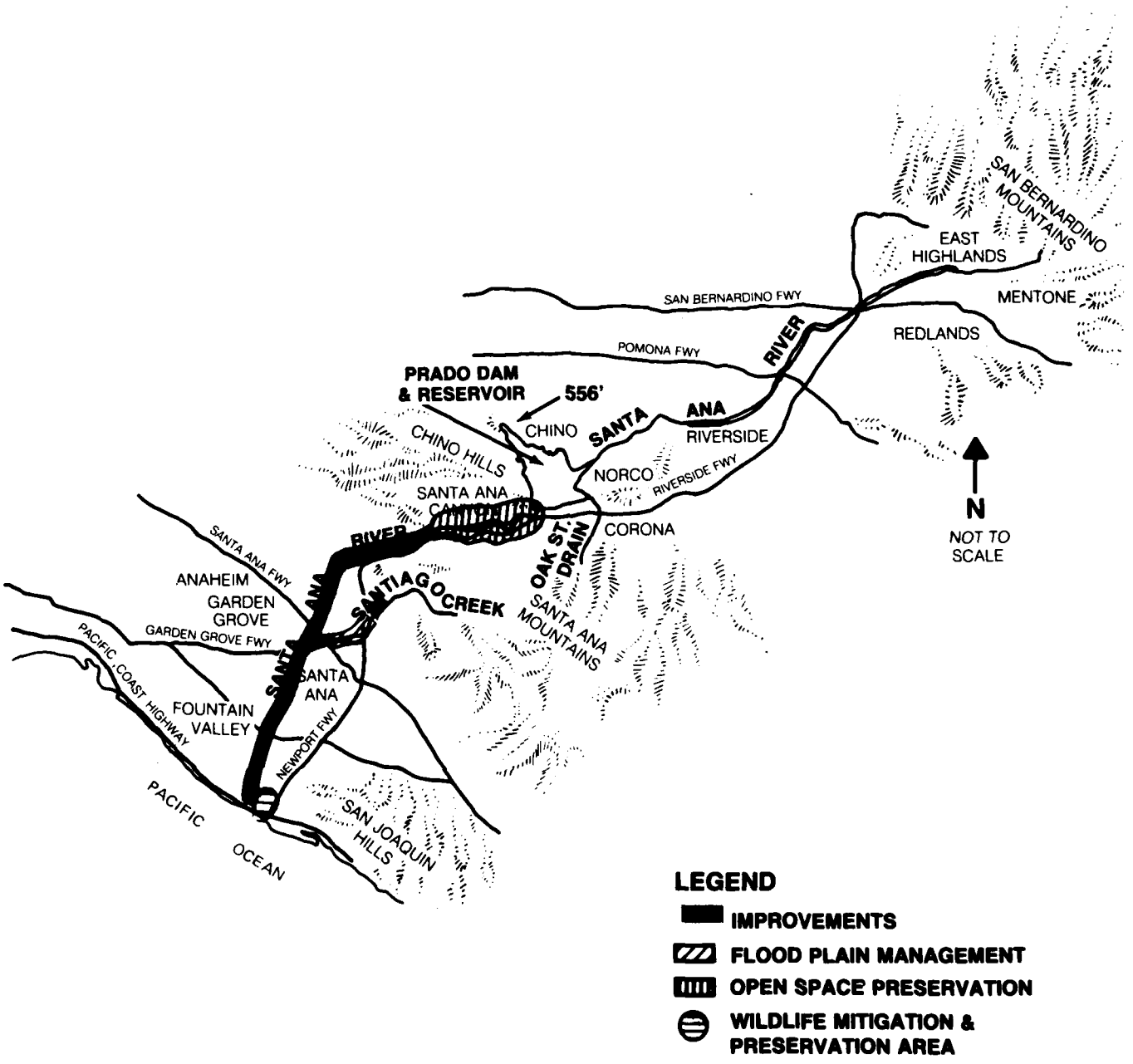


FIGURE 10

FEDERAL RESPONSIBILITIES. The Federal Government would be responsible for constructing all elements of the plan. Operation and maintenance of Prado Dam for flood control would be a Federal responsiblity. The U.S. Fish and Wildlife Service would probably transfer its responsibility for operating and maintaining the marsh preserve and wildlife lakes at Prado Reservoir to the California Department of Fish and Game (CDFG).

NON-FEDERAL RESPONSIBILITIES AND THE PUBLIC. Local interests would operate and maintain all flood control facilities except for Prado Dam, and all recreation facilities.

Public Views

FEDERAL AGENCIES. In their June 1980 letter, the U.S. Fish and Wildlife Service concluded that the Environmental Quality Plan provided "long-term biological benefits which are superior to those of the recommended All-River Plan."

NON-FEDERAL AGENCIES AND THE PUBLIC. The EQ alternative was presented formally to the public in August of 1980, and elements have been reviewed as a part of review of other plans. Raising Prado Dam to the elevation called for under this EQ Plan has met with strong continued opposition, and would engender more opposition if there were no flexible real estate acquisition policies for those living below elevation 582 feet. However, at the four public meetings held in August 1980 most environmental groups supported the EQ alternative.

In the river-mouth area, there was much public sentiment toward having large amounts of land set aside for open space and endangered species habitat. In contrast, other people were interested in developing a boat marina in that area.

ALL-CHANNEL PLAN, ALTERNATIVE 11

Plan Description

This plan was originally considered during initial alternative screening for the 1975 Survey Report, but it was not carried forward for detailed analysis at that time because it was felt to involve unacceptable impacts on residential and commercial developments along the lower river channel. It was reintroduced for analysis during Phase I study because it would reduce the extent of impact from improvements to one county, the county receiving the primary flood control benefits from all alternative plans.

Basically, the All-Channel Plan involves enlarging the channel downstream of Prado Reservoir to provide standard project flood protection without making substantial improvements at Prado Reservoir. Prado Dam would be modified to provide additional outlet capacity. Downstream would be characterized by a concrete channel, with vertical walls to great depths, large bridge rebuilding costs, and some relocations of homes, industries and utilities.

At Prado Dam and Reservoir, the reservoir taking line or reservoir limit would remain at 556 feet elevation--the existing taking line. The spillway crest elevation would remain at elevation 543 feet. The outlets would be completely reconstructed to the same capacity called for in both the NED and the All-River Plan. Under these conditions, the channel capacity needed from Prado Dam down to the river mouth to contain a standard project flood occurring at the 100th year of project life is about 200,000 cubic feet per second. A large portion of this outflow would be uncontrolled, passing over the spillway. It would not be practical to provide outlet capacity for controlled releases approaching 200,000 cubic feet per second.

In the Santa Ana Canyon area, from Prado Dam to Weir Canyon Road, it would be necessary to acquire about 1,630 acres for the floodway and provide for much heavier levees and revetment than for the 1975 Recommended Plan. A high levee would be built to protect the mobile home park near the Green River Golf Course, about 2 miles downstream from Prado Dam. Levees or revetment would be placed along portions of the freeway and railroad which are subject to flooding.

At Weir Canyon Road, a very deep vertical-walled concrete channel would begin. The channel would have a bottom and top width of 400 feet, and an average wall height of 20 feet from Weir Canyon Road to Katella Avenue, a distance of about 10 miles. Bridges at Imperial Highway, Lakeview Avenue, Riverside Freeway, Tustin Avenue, Glassell Avenue, Lincoln Avenue, Ball Road, and Katella Avenue would all have to be rebuilt in order to minimize interference to high velocity flows (32 to 38 feet per second during the design flood). These bridges would generally have longer spans with only one set of piers in the middle of the channel. Railroad bridges would also have to be rebuilt for longer spans.

The concrete channel through the principal reach of the river devoted to water spreading, from Imperial Highway to Katella Avenue, would result in the loss of about 350 acres of water spreading area. Partial mitigation would be accomplished by building turnouts from the bottom of the channel, capable of diverting up to about 400 cubic feet per second into off-channel spreading areas. At Katella Avenue the channel would narrow to about 330 feet top width and continue at that width to about the San Diego Freeway with wall heights ranging from 23 to 26 feet. The invert would range from 11 to 14 feet below the existing invert. Below the San Diego Freeway, the channel would widen to about 390 feet and then 450 feet near Adams Avenue because of flattening of the grade. All bridges downstream of the Santa Ana Freeway would have to be rebuilt for longer spans between piers.

From the 17th Street bridge southward, some properties, homes, and industries would be displaced because available right-of-way is only 400 feet wide from 17th Street to Edinger Avenue and narrows to 350 feet downstream. From Harbor Boulevard downstream, there are high voltage electric transmission lines. Where these have to be moved, their relocation would in turn displace adjacent industrial and residential

properties. The Greenville-Banning channel would be brought directly into the Santa Ana River in order to minimize right-of-way requirements downstream.

Near Adams Avenue, the greatly deepened invert would reach sea level and would continue below sea level to the river mouth where the bottom elevation would be about 17 feet below mean sea level. South of Adams Avenue, near the entrance of the Fairview storm-drain channel, the channel walls would rise to about 30 feet and the channel would widen to 650 feet. Most of the widening would be on the east side. The channel would be soft-bottom from Hamilton Avenue-Victoria Street downstream, beyond which the channel would become trapezoidal in order to reduce the problems associated with excessive wall heights. At the mouth, jetties would extend several hundred feet into the ocean to prevent a sand plug from blocking the mouth of the channel which could cause excessively high water in the channel during a standard project flood.

Pertinent quantitative data on the All-Channel Plan is:

Prado Reservoir		
Reservoir guide taking elevation	556	feet (same as present)
Reservoir area	9,741	acres
Prado Dam		
Dam crest elevation	583	feet
Spillway crest elevation	543	feet (same as present)
Spillway crest length	1,000	feet (same as present)
Outlet works--capacity	50,000	cubic feet per second at full head
Downstream channel		
Capacity	200,000	cubic feet per second
Additional right-of-way needed		
Canyon area to Weir Canyon	1,630	acres
Urban area	230	acres
Total	1,860	

Channel dimensions	Depth	R/W Width Reqd	R/W Width Available
Imperial Highway	20	400	470
Lincoln Avenue	20	400	560
Katella Avenue	23	330	600
Santa Ana Freeway	23	330	590
17th Street	24	330	420
Harbor Blvd.	24	330	400
San Diego Freeway	25	350	480
Adams Avenue	29	450	550
Pacific Coast Highway	30	650	960

Recreation under the All-Channel Plan is limited to the project areas of the Santa Ana River through the Santa Ana Canyon (new trail development); the Santa Ana River from Imperial Highway to the ocean (a replacement of existing trails); and Santiago Creek from Villa Park Road to Walnut Avenue (new trail development). To make direct comparison alternative plans' costs possible, the marsh acreage to be acquired under the All-Channel Plan was reduced in this analysis from 200 acres to 92 acres. In the FSEIS, the original figure of 200 acres is used for purposes of environmental impact assessment. The FSEIS analysis is thus a "best case" approach to this alternative.

Impact Assessment

With the All-Channel Plan, properties at Prado Reservoir would not be adversely affected because the reservoir would not be enlarged. Downstream of Prado Dam, flows would be much larger and more frequent than under present conditions. Upstream of Prado Dam, there would be no change over "without project" conditions.

In the Santa Ana Canyon, releases of water would be much larger than present and on numerous occasions would rise to large amounts in a very few hours. Recreation facilities, such as the golf course and county parks, might be flooded too often to be practical in their present configuration. A high levee between the river and the mobile home park 2 miles downstream of the dam would preclude the necessity of displacing the mobile homes. The Santa Fe Railroad bridge would have to be rebuilt and lengthened to pass a flood of 200,000 cubic feet per second. About 4 homes in the canyon flood plain would be displaced.

The 23 miles of channel from Weir Canyon Road to the ocean would have a bottom elevation ranging from 8 to 18 feet lower than the existing invert. Excess channel bottom material to be disposed of would amount to about 28,000,000 cubic yards. All highway and railroad bridges would have to be rebuilt for longer spans. The 4 freeway bridges could possibly be rebuilt under full-traffic conditions although this type of construction would be expensive. Other bridges would probably be rebuilt with one-half open at one time.

In the water spreading area, between Imperial Highway and Katella, about 350 acres of percolable bottom would be lost to water conservation. Partial mitigation would be accomplished by construction of turnouts into remaining spreading areas.

The Riverview Golf Course would be severed by the 340-foot wide channel. Although it is conceivable that the golf course could continue to operate, the course would have to be severely modified and would be degraded.

From 17th Street downstream, some properties would have to be displaced because the existing right-of-way is of insufficient width to accommodate the channel. More properties would be displaced from Edinger downstream because, with the narrower right-of-way, more properties are crowded in close to the river. A total of 128 residences would be relocated as part of the channel construction. Fifty-five of these residences are mobile homes. Nine horse stables would be

relocated and 25 commercial or industrial establishments would be displaced or severed. Many hundreds of linear feet of retaining wall would be installed to minimize further relocations. Below Talbert Avenue, an electric powerline would have to be relocated about 50 feet to the east to allow for more channel width. This in turn would displace some industries and a row of homes on the east side of the channel south of the San Diego Freeway. The greatly deepened channel would necessitate relocation of several deeply buried pipelines crossing the river. Relocation of parts of the sewer outfall lines buried in the west levee would be necessary. The channel bottom would be at sea level just upstream of Adams Avenue. Tide waters would periodically flow up about 3 miles from the ocean. The deep excavation required for the 200,000 cubic feet per second channel will possibly cut through ground water aquifer lenses, and allow more salt water intrusion into some of the ground water pumping areas within 3 miles of the ocean.

At the Hamilton Avenue-Victoria Street crossing, there is a bluff on the east side of the river. A nominal portion of the bluff would have to be carved out to make enough room for the channel. Near the Pacific Coast Highway, the outfall sewerlines would have to be realined to the west, in violation of a study constraint. The Pacific Coast Highway bridge would have to be rebuilt and lengthened to about 800 feet. Most of the least tern nesting preserve to the oceanward side of the highway would be displaced by the widened channel. The jetties built out into the ocean to keep the channel open would probably cause starvation of sand from the nearby beaches without remedial action.

The high flows of the All-Channel Plan would carry two to three times as much silt and sand to the river mouth than under any of the other plans, probably causing the mouth to close more frequently and thus blocking the tidal flow into the channel area.

In summary, the All-Channel Plan would have the most impacts in the general area being protected from flood rather than upstream in the reservoir areas. Impacts are summarized on table 10.

TABLE 10

REGIONAL, ENVIRONMENTAL, AND SOCIAL WELL-BEING IMPACTS
FOR ALTERNATIVE 11--THE ALL-CHANNEL PLAN

Regional Development

Beneficial effects	Adverse effects
1. Flood insurance would not be required.	1. Loss of ground water recharge to the spreading grounds between Imperial Highway and Katella Avenue.
2. Would create temporary increase in personal and business income.	2. Eliminates potentially developable lands in Santa Ana Canyon.

TABLE 10 (Continued)

Regional Development

Beneficial effects	Adverse effects
3. Provides material for beach replenishment.	3. Displaces 25 businesses wholly or partially.

Environmental

Beneficial effects	Adverse effects
1. Preserves 1,630 acres of vegetation and wildlife habitat in Santa Ana Canyon.	1. Eliminates more or all of the valuable riparian habitat within the Santa Ana Canyon floodway.
2. Preserves a net 72 acres of marshland at mouth of Santa Ana River.	2. Loss and replacement of least tern nesting area on the beach.
	3. Loss and replacement of 20 acres of degraded marshland.
	4. Loss and replacement of the freshwater pond near Victoria Avenue.
	5. Loss of ground water recharge.
	6. Possible seawater intrusion.

Social Well-being

Beneficial effects	Adverse effects
1. Provides physical and mental security from flooding to the lower basin.	1. Require relocation of 128 residences.
2. Provides additional recreational opportunities.	

Mitigation Requirements

At the mouth, the 750 foot right-of-way requirement would destroy 20 acres of marshland and completely displace the least tern nesting reserve at the beach. The plan provides for 20 acres of marshland to be acquired in mitigation for these impacts and 72 acres for enhancement and preservation of habitat.

Between Imperial Highway and Katella Avenue, the project would displace 350 acres of existing percolable channel bottom. Losses in water recharge could partially be mitigated by constructing larger turn outs into the existing spreading basins. However, additional mitigation would probably be required for the losses to ground water recharge. As the plan would not affect cultural resources, no cultural mitigation measures would be required.

Cost and Benefits of Plan

Costs and benefits of this alternative are shown in table 11 (page 133).

COSTS OF PLAN. The costs shown in table 11 are displayed as first costs and as annual costs. First costs include estimates for construction, relocation, rights-of-way, esthetic treatment, recreation and mitigation. Annual costs include interest on the total investment, interest during construction, amortization of the total investment over a 100-year period, and average annual costs of maintenance and operation. Annual costs were computed using a 7-1/8 percent interest rate.

BENEFITS OF PLAN. The primary category of benefit that would accrue to this plan is flood damage reduction. A second category of benefit would be removal of flood-proofing requirements imposed by the flood insurance program. Without this plan, new developments in the entire 100-year flood plain must be elevated to be protected from 100-year flooding. With this plan, flood proofing would not be required, and savings in these costs represent a benefit to the plan.

Incidental benefits would include upgrading and preserving 200 acres of marshland to provide benefit to three endangered species. Construction activities would provide employment opportunities. Some recreation benefits would also be realized under this plan.

Evaluation and Trade Off Analysis

As under Alternative 7, this plan also calls for no construction upstream of Prado Dam. As such, this plan cannot fully meet the study objective of controlling floods throughout the Santa Ana River's length. It provides standard project flood protection to the lower Santa Ana River flood plain, but no protection to the upper Santa Ana River flood plain. The total reduction flood damage potential for the entire river would be 76 percent. The total reduction in flood damage potential for the lower river alone would be 77 percent. No relocations would be required at Prado Dam. This plan would necessarily utilize

Prado Dam spillway for operation during large floods. In a standard project flood the spillway flow would be 150,000 cubic feet per second, in addition to 50,000 cubic feet per second from the outlet conduits.

The outlets would only be able to provide positive control for 100-year or smaller floods. Although the downstream channel would be sized to control the standard project flood, the lack of positive control at Prado Dam for this flood is believed to be a weakness of this plan.

Acquisition of up to 1,630 acres of flood plain in Santa Ana Canyon would contribute to the study objective of preserving open space and habitat values. However, this alternative plan will result in greater and more frequent discharges through the canyon which would be extremely destructive. Most vegetation in the canyon could be destroyed by these larger and more frequent discharges.

This plan, although it involves acquiring and restoring 92 acres of marshland at the river mouth, would nonetheless destroy more marshland habitat than any other alternative and would, therefore, have an overall neutral effect. This fact combined with the need to completely displace the least tern nesting preserve, prevents this plan from fulfilling the objective of preservation of endangered species.

The ability of this plan to meet the nine selected evaluation criteria is displayed in table 16 (page 148). Again as with every other alternative except Alternative 6, this plan is not acceptable to some or all local interests.

Planning Objectives Accomplished

The All-Channel Plan would make positive contributions to three planning objectives, table 15 (page 146). It would contribute to control of overflows from the main stem of the Santa Ana River and Santiago Creek. The plan would reduce 77 percent of the flood damage potential from the Santa Ana River and 44 percent of the flood damage potential for Santiago Creek. This plan also would contribute to the planning objective of increasing recreational opportunities along the Santa Ana River. Recreation facilities included in this plan are trails and support facilities along the lower Santa Ana River and Santiago Creek.

This plan would contribute to preserving the unique rural character of the communities surrounding Prado Reservoir. Even though the All-Channel Plan would include the acquisition and preservation of 1,630 acres within Santa Ana Canyon, this plan's impacts on the unique riparian vegetation would be so severe that this plan has a overall negative impact on the planning objective to preserve the ecological and open space values of the Santa Ana Canyon. The plan would eliminate 20 acres of degraded salt marsh and virtually the entire least tern nesting area at the river mouth. Acquisition of 92 acres of salt marsh and adjacent lands would mitigate for loss of the 20 acres of salt marsh, but might not be adequate mitigation for loss of the nesting site, as efforts to establish a completely different nesting location

(rather than merely shifting boundaries as in the All-River Plan) may prove difficult. Experience in the lower Newport Bay has shown that this may be a serious problem. This plan would have a negative contribution to the planning objective of utilizing the floodwaters from the Santa Ana River and Santiago Creek for water conservation. Between Katella Avenue and Imperial Highway, this plan would displace 350 acres of percolable river bottom.

Implementation Responsibilities

COST ALLOCATION AND APPORTIONMENT. Table 12 presents allocation of project costs among the project purposes of flood control, preservation of endangered species, and recreation, and apportionment of these costs among responsible parties. Apportionment of the costs of the flood control measures is based on the President's June 1978 Water Policy Message. Apportionment of the costs of measures for endangered species preservation and for recreation measures is based on the President's Water Policy Message and on existing legislation.

FEDERAL RESPONSIBILITIES. The Federal Government would be responsible for constructing all elements of the plan. Operation and maintenance of Prado Dam for flood control would be a Federal responsibility. The U.S. Fish and Wildlife Service would be responsible for operating and maintaining the completed marsh preserve, but would probably transfer this responsibility to the California Department of Fish and Game.

NON-FEDERAL RESPONSIBILITIES. Local interests would operate and maintain all flood control facilities except for Prado Dam. All recreation facilities would be maintained and operated by local interests.

Public Views

FEDERAL AGENCIES. In their June 1980 letter, the U.S. Fish and Wildlife Service has commented that the All-Channel Plan is "totally unacceptable because of the significant adverse ecological consequences."

NON-FEDERAL AGENCIES AND PUBLIC. At advisory committee meetings and meetings of Orange County city and county officials, the All-Channel Plan was presented at various times from 1973 through 1975. The response ranged from indifference to opposition, principally because of the great displacement of homes, businesses, rebuilding of bridges, utilities relocation, and amount of land taken. The cost to Orange County would have been several hundred million dollars, and resources of that magnitude were not at all apparent.

Various interests in the Prado Reservoir area, from 1971 through 1975 and again in February 1980, expressed the view that if the people downstream from Prado Dam wanted flood protection, they should have a large channel despite the inconveniences rather than the upstream people having the adverse impacts of enlarging Prado Reservoir.

Various interests in the Prado Reservoir area, from 1971 through 1975 and again in February 1980, expressed the view that if the people downstream from Prado Dam wanted flood protection, they should have a large channel despite the inconveniences rather than the upstream people having the adverse impacts of enlarging Prado Reservoir.

TABLE 11

COSTS AND BENEFITS OF ALTERNATIVE PLANS
(VALUE IN $(1000), 7-1/8%, 100-YEAR LIFE)

	Alternative 5 SPF Protection Below Prado Dam	Alternative 6 All-River Plan	Alternative 7 NED Plan	Alternative 10 EQ Plan	Alternative 11 All-Channel Plan
First Costs of Flood Control					
Mentone Reservoir					
Construction	--	360,325	--	--	--
Rights-of-way	--	21,500	--	--	--
Relocations	--	4,496	--	--	--
Subtotal		386,321			
Prado Reservoir					
Construction	156,387	116,177	160,079	160,079	93.200
Rights-of-way	334,930	92,230	368,430	368,430	31,500
Relocations	10,222	10,222	11,382	11,382	6,300
Subtotal	501,539	218,629	539,891	539,891	131,000
Santa Ana River below Prado Dam					
Construction	254,052	254,052	254,052	254,052	678,300
Rights-of-way	19,040	19,040	19,040	29,340	86,000
Relocations	26,303	26,303	26,303	26,303	153,000
Subtotal	299,395	299,395	299,395	309,695	917,300
Mitigation	367	367	367	367	917
Preservation	--	3,853	--	11,633	3,303
Santiago Creek					
Construction	6,198	6,198	6,198	6,198	6,198
Rights-of-way	3,500	3,500	3,500	3,500	3,500
Relocations	305	305	305	305	305
Subtotal	10,003	10,003	10,003	10,003	10,003
Total	$811,304	$918,568	$849,656	$871,589	$1,062,523

TABLE 11 (Continued)

	Alternative 5 SPF Protection Below Prado Dam	Alternative 6 All-River Plan	Alternative 7 NED Plan	Alternative 10 EQ Plan	Alternative 11 All-Channel Plan
First Costs of Recreation					
Mentone Reservoir	--	6,070	--	--	--
Prado Reservoir	13,149	13,149	13,149	13,149	--
Santa Ana River below Prado Dam	740	740	740	740	740
Santiago Creek	410	410	410	410	410
Total	14,299	20,369	14,299	14,299	1,150
Total First Cost of Project	825,603	938,937	863,955	885,888	1,063,673
Annual Flood Control Costs of Alternative Plans					
Mentone Reservoir					
Interest & Amortization	--	28,616	--	--	--
Operation and Maintenance	--	950	--	--	--
Subtotal	--	29,566	--	--	--
Prado Reservoir					
Interest & Amortization	36,241	15,963	38,987	38,987	9,580
Operation and Maintenance	360	330	370	370	260
Subtotal	36,601	16,293	39,357	39,357	9,840
Santa Ana River below Prado Dam					
Interest & Amortization	21,354	21,354	21,354	22,088	65,425
Operation and Maintenance	1,330	1,330	1,330	1,330	2,200
Subtotal	22,684	22,684	22,684	23,418	67,625
Mitigation	26	26	26	26	65
Preservation	--	285*	--	850**	246*
Santiago Creek					
Interest & Amortization	713	713	713	713	713
Operation and Maintenance	30	30	30	30	30
Subtotal	743	743	743	743	743
Total	60,054	69,597	62,810	63,394	78,519
Annual Costs of Recreation for Alternative Plans					
Mentone Reservoir					
Construction	--	433	--	--	--
Operation and Maintenance	--	408	--	--	--
Subtotal	--	841	--	--	--

* Includes $10,000 annual maintenance cost
** Includes $20,000 annual maintenance cost

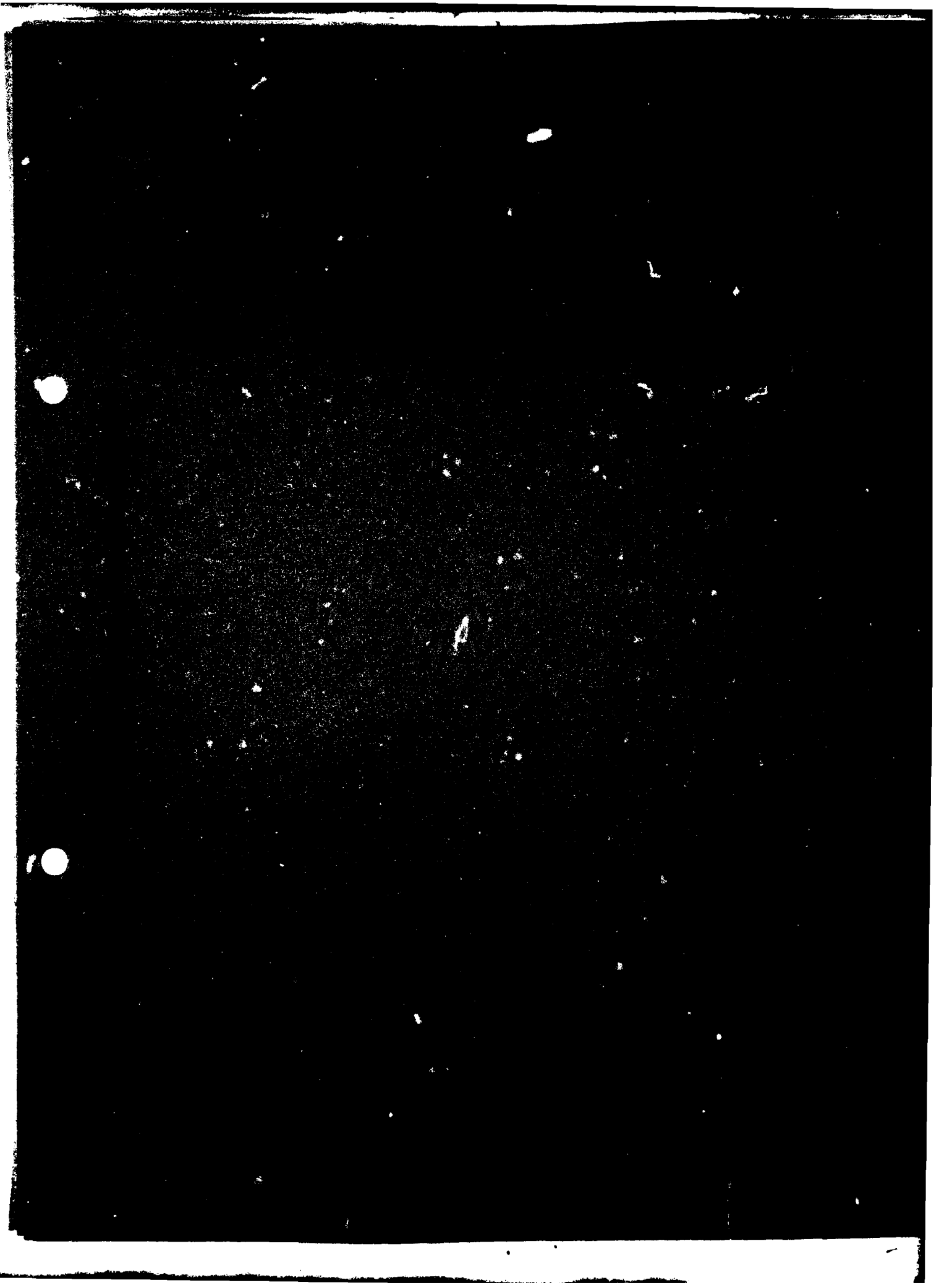
TABLE 11 (Continued)

	Alternative 5 SPF Protection Below Prado Dam	Alternative 6 All-River Plan	Alternative 7 NED Plan	Alternative 10 EQ Plan	Alternative 11 All-Channel Plan
Prado Reservoir					
Construction	938	938	938	938	--
Operation and Maintenance	822	822	822	822	--
Subtotal	1,760	1,760	1,760	1,760	--
Santa Ana River below Prado Dam					
Construction	53	53	53	53	53
Operation and Maintenance	50	50	50	50	50
Subtotal	103	103	103	103	103
Santiago Creek					
Construction	29	29	29	29	29
Operation and Maintenance	24	24	24	24	24
Subtotal	53	53	53	53	53
Total	1,916	2,757	1,916	1,916	156
Annual Flood Control Benefits of Alternative Plans					
Santa Ana River					
Flood Damage Reduction	149,047	147,083	153,002	153,002	129,127
Savings in Flood Proofing	543	543	543	543	543
Subtotal	149,590	147,626	153,545	153,545	129,670
Annual Flood Control Costs of Alternative Plans	60,054	69,597	62,810	64,394	78,519
Net Benefits	89,536	78,029	90,735	89,151	51,151
Benefit-to-Cost Ratio	2.5	2.1	2.4	2.4	1.7
Annual Recreation Benefits of Alternative Plans					
Recreation Benefits	3,133	4,735	3,133	3,133	264
Annual Recreation Costs of Alternative Plans	1,916	2,757	1,916	1,196	156
Net Benefits	1,217	1,978	1,217	1,217	108
Benefit-to-Cost Ratio	1.6	1.7	1.6	1.6	1.7
Total Project Benefits	152,723	152,361	156,678	156,678	129,934
Total Project Costs	61,970	72,354	64,726	66,310	78,675
Total Project Net Benefits	90,753	80,007	91,952	90,368	51,259
Total Project Benefit-to-Cost Ratio	2.5	2.1	2.4	2.4	1.7

TABLE 12
COST ALLOCATION AND APPORTIONMENT FOR ALTERNATIVE PLANS

Construction Costs	Alternative 5 Standard Project Flood Protection Below Prado Dam	Alternative 6 The All-River Plan	Alternative 7 The National Economic Development Plan	Alternative 10 The Environmental Quality Plan	Alternative 11 The All-Channel Plan
Flood Control					
Federal Share	608,478	689,696	637,242	656,018	801,553
State Share	40,565	45,929	42,483	43,580	53,126
Local Share	162,261	182,943	169,931	171,991	211,844
Total	811,304	918,568	849,656	871,589	1,066,523
Recreation					
Federal Share	6,435	9,166	6,435	6,435	517
State Share	715	1,018	715	715	58
Local Share	7,149	10,185	7,149	7,149	575
Total	14,299	20,369	14,299	14,299	1,150
Grand Total Federal	614,913	698,862	643,677	662,453	802,070
Grand Total State	41,280	46,947	43,198	44,295	53,184
Grand Total Local	169,410	193,128	177,080	179,140	212,419
Grand Total Project	825,603	938,937	863,955	885,888	1,067,673
Operation and Maintenance*					
Flood Control					
Federal Share	310	1,230	320	320	260
Local Share	1,410	1,410	1,410	1,410	2,230
Total	1,720	2,640	1,730	1,730	2,490
Recreation					
Federal Share	--	--	--	--	--
Local Share	896	1,304	896	896	80
Total	896	1,304	896	896	80
Grand Total Federal	310	1,230	320	320	260
Grand Total Local	2,306	2,714	2,306	2,306	2,310
Grand Total Project	2,616	3,944	2,626	2,626	2,570

*Maintenance of the marshland preserve would be the responsibility of the U.S. Fish and Wildlife Service. Maintenance activities will ultimately be turned over to the California Department of Fish and Game. Maintenance costs are not displayed in this table but would annually be $10,000 for Alternatives 6 and 11 and $20,000 for Alternative 10.



6. COMPARISON OF DETAILED PLANS

INTRODUCTION

Each of the 5 alternative plans carried forward for detailed analysis has its own unique blend of benefits, costs, and effects on various elements of the Santa Ana River Basin. The decision to recommend one over another cannot be made on the basis of analysis of them on an alternative-by-alternative basis, as they are presented in the previous report section. Direct comparison of the effects of each alternative plan--beneficial and adverse--is essential to such a decision. This comparison of effects is summarized in this section of the report for all 5 named plans and for the "No Action" Plan.

Tables within this section show the differences in the effects of alternatives on economic, environmental, regional development, and social features of the basin. The alternatives are also compared on the basis of how well they contribute to meeting the planning objectives for the project. Important features of each table are explained in text.

EFFECTS COMPARISONS

Economic Effects

Compared to the No Action Plan, all five structural alternative plans are easily justified economically. They provide from $129 million to $153 million in annual flood damage reduction benefits. The net benefits after all costs have been accounted for, range from $51 million annually to $91 million annually.

The NED Plan, Alternative 7, produces the highest net annual economic benefit, $91 million, $13 million annually more than the All-River Plan, Alternative 6. Because the level of protection it provides is slightly lower than that in the NED Plan, the All-River Plan also provides slightly less gross benefits, but it does provide benefits to the river above Prado Dam totaling $3.8 million annually.

The All-Channel Plan, Alternative 11, provides the least net benefits, $51 million, because it would cost substantially more to implement than any other alternative and provides substantially fewer annual benefits. It also does not provide any benefits to the upper reaches of the river.

There have been economic changes in the basin which have significantly changed the conclusions regarding the economic justification of the Mentone Dam since the 1975 Survey Report. In 1975, the dam was not incrementally justified; today, benefits to be gained from Mentone Dam's construction give it an incremental benefit-to-cost ratio of 1.2 to 1. The dam is thus justified as a "last added" element of the All-River Plan.

The plan for Santiago Creek, which offers detention storage of floodwaters and 100-year flood protection, provides economic flood control benefits of $801,000 annually for a benefit-to-cost ratio of 1.1 to 1.

Other plans provide net economic benefits, as shown in table 13.

TABLE 13. COMPARISON OF ECONOMIC BENEFITS OF ALL ALTERNATIVE PLANS (VALUE IN $(1000), 7-1/8%, 100-YEAR LIFE)

Plan	Annual Gross Benefits**	Annual Costs	Annual Net Benefits	Benefit-to-Cost ratio
Alternative 5	152,723	60,028	90,753	2.5*
All-River Plan, Alternative 6	152,361	69,286	80,007	2.1
NED Plan, Alternative 7	156,618	62,784	91,952	2.4
Environmental Quality Plan, Alternative 10	156,678	63,518	90,368	2.4
All-Channel Plan, Alternative 11	129,934	78,208	51,259	1.7
No Action Plan	0	0	0	0

*NOTE: Although the Benefit-to-Cost Ratio of Alternative 5 is greater than Alternative 7, the NED Plan is Alternative 7 because the annual net benefits are greater.

** Including recreation.

Environmental Effects

In the Mentone area, the All-River Plan is the only plan with project-related environmental impact. Under this plan about 1,600 acres of sage scrub and juniper woodland would be removed along with 227 acres of citrus groves. There would thus be an immediate adverse impact on the varied wildlife in this area. Some revegetation is planned for the area to mitigate for this impact. In contrast, no other plans would have direct, project-related impact on the Mentone area. In the absence of Mentone Dam, up to 40 percent of the damsite would probably be developed residentially, causing some loss of habitat. Although building the dam would have direct, project-related impact on the area,

this impact would be somewhat offset by the fact that some of the land behind the dam, land which would probably otherwise be developed, would be preserved.

The All-River Plan has the highest direct impact on the proposed borrow sites (in Redlands or behind Prado Dam). If Mentone Dam is built, there will be at least short-term removal of habitat and considerable loss of agricultural lands. The State has acquired part of the Redlands borrow site as a wildlife sanctuary and may purchase more of this site. The effect of the All-River Plan would be to remove this sanctuary from the area, at least for the duration of construction.

In the reach of the Santa Ana River from the proposed Mentone site to the Prado Reservoir boundary, the All-River Plan would have minimal impact allowing some encroachment on the floodway. Provisions which require flood plain management would limit development in the post-project SPF flood plain.

All plans except the All-Channel Plan involve some impact on the Prado Reservoir area. The All-River Plan would require removal of 340 acres of willow and upland vegetation for soil material to raise Prado Dam and 1,000 acres vegetation if Prado Reservoir is selected as the borrow site for the Mentone Dam. Short-term construction impacts will affect some wildlife in the area. Under the All-River Plan, 1,670 acres would be available for habitat, but most could be expected to remain in generally residential or agricultural use.

Both the NED Plan (Alternative 7), Alternative 5, and the Environmental Quality Plan (Alternative 10) significantly increase the amount of land protected from urban encroachment in the Prado Reservoir. All involve taking less soil from borrow sites than would be removed under the All-River Plan. The EQ Plan ensures that wildlife habitat in the reservoir area would be increased by up to 5,000 acres. Under the EQ Plan much Prime and Unique Farmland would be removed from agricultural uses.

All plans except for the All-Channel Plan allow for preservation of the Santa Ana Canyon flood plain riparian vegetation. The All-River, NED, Alternative 5 and EQ Plans would result in preservation of approximately 1,500 acres along the approximately 9-mile reach from Prado Dam to Weir Canyon Road. The All-Channel Plan calls for 1,630 acres to be acquired, but high releases from Prado Dam under this plan would frequently inundate and destroy the riparian habitat of the Canyon. In the lower reaches from Imperial Highway to the last 2.5 miles of the channel, only the All-Channel Plan involves significant changes in the river channel, several of which would have adverse environmental impacts. This portion of the channel is already heavily developed, however, and these impacts are not critical to wildlife or habitat values in the area.

Heavy siltation of the river mouth would also occur under the All-Channel Plan, with adverse impacts resulting from decreased tidal flows through the river mouth.

The plans differ considerably in their impact on the river mouth and the marsh adjacent to it. The All-Channel Plan would destroy 20 acres of this marsh, though it does provide for 92 acres of marshland to be acquired to partially mitigate for this and to enhance and preserve wetland habitat. Neither the NED Plan nor Alternative 5 provide for more than 8 acres of marsh to be destroyed, and both provide for only 8 acres to be acquired in mitigation.

Impact of the All-River, EQ and the two High Prado Plans on the marsh would be identical, but the EQ Plan provides for greater enhancement and preservation. All plans involve some impact on the least tern nesting area at the mouth, and all provide for some replacement of this area. The All-Channel Plan would more adversely affect the marshland, the least tern nesting area, the Victoria Pond, and tidal areas at the river mouth.

Impacts of all plans on the Oak Street Drain and Santiago Creek are quite similar, though the EQ Plan calls for more esthetic treatment and preservation of habitat in both areas, which would enhance the value of the areas as wildlife habitat.

All of the plans have environmental benefits and costs. On the balance, the EQ Plan provides the broadest range of benefits to wildlife and habitat values. The All-River Plan would adversely affect the Mentone site plant and animal communities, especially during dam construction, but would preserve some open space that might otherwise be urbanized. As a package, the All-River Plan is considered acceptable environmentally because it allows the Santa Ana Canyon to be preserved, provides significant mitigation for adverse impacts at the mouth of the river and may in the long run preserve some open space in the Mentone area.

The NED Plan and Alternative 5 do not provide for enhancing the river mouth marshland. The All-Channel Plan has negative impacts on the environmentally important Santa Ana Canyon and the mouth of the Santa Ana River. A more detailed discussion of the environmental impacts of these alternatives is found in the FSEIS.

Regional Effects

Compared to the No Action Plan, all alternative plans will make significant contributions to regional development. Reduction of flood damage potential will allow the region to grow and prosper without restriction due to periodic catastrophic flooding.

Alternative 6, which reduces the flood damage threat throughout the basin by 86 percent would provide a better geographic distribution of this regional effect than any other plan. In the upper basin, Alternative 6 will reduce the flood damage potential from the Santa Ana River by 72 percent while in the lower basin it will reduce potential damages by 86 percent.

Alternative 10, the Environmental Quality Plan, because of relocations required, would have the greatest adverse effect on regional development. It would involve the greatest loss of homes, businesses, dairies and ranches, together with associated employment opportunities. Alternatives 5 and 7 would have a slightly less adverse effect on these factors. Alternative 6, which minimizes relocations from raising Prado Dam, would have the least adverse effect of these three plans. Of all alternatives, Alternative 11, the All-Channel Plan, which has the fewest relocations, would have the least adverse effect on the region due to relocations of homes, businesses, and dairies.

A summary of the regional effects of all of the alternatives is presented in table 14 (page 144).

Socio-Economic Effects

Alternative 6, the All-River Plan, would have a number of significant beneficial effects for the residents of the lower river area in Orange County, while there would be certain adverse impacts, mainly associated with the relocations of homes and businesses, on the residents of the upper river area.

From a social effects perspective, the All-Channel Plan, Alternative 11, would negatively impact some communities in the lower basin but would be associated with a number of generally beneficial impacts throughout the region.

Alternatives 5 and 7 and to a greater extent, Alternative 10 would have a relatively large number of adverse impacts on the social conditions of area residents. These impacts would result mainly from the large number of relocations of families and businesses associated with either plan and would be of a long-term character because of the community disruption that would occur from either plan.

Table 14 summarizes the social and economic effects of all the alternatives.

Socio-Economic Effects on Corona and Riverside

Under all but the All-Channel Plan, Alternative 11, the impact of the project on the City of Corona and Riverside County will be significant in social and eonomic terms. Employment losses to the two entities range from 100 jobs under the All-River Plan to 134 jobs under the NED Plan. Although some of these employment opportunities may be replaced as businesses relocate, most are permanent.

The numbers of people, businesses, and farms to be relocated varies as well, but is significant under all of the plans. The All-River Plan will require 47 residential relocations, 2 business relocations, and 16 dairy and ranch relocations. This compares to a high of 285, 3, and 19 (respectively) for the NED Plan, Alternative 7.

The numerical impacts of raising Prado Dam can also be expressed in human terms. Under all but the All-Channel Plan, the communities of Corona and Riverside County will be seriously disrupted. Under the All-River Plan, the fewest acres will be taken, 973, but this is a significant percentage of the developable land available to the city. Under the NED Plan, 3,081 acres would be taken.

The impacts of various plans on community cohesion and development would also be varied, with the All-River Plan having the lowest impact but still significantly disrupting community life. Relocation of the Corona National area development will affect school attendance patterns, community services, transportation plans, and place considerable pressure on the local housing market.

These impacts are complicated by the uniqueness of the Prado Reservoir area. There are, for example, no comparable lands for dairy farms left in the local region (the Greater Los Angeles Metropolitan Area), and the rural atmosphere of the area is not duplicated in other residential areas. Plans calling for raising Prado Dam by 45 feet would have the most serious impact of this nature, but the All-River Plan's will be significant nonetheless.

All plans except the All-Channel Plan, Alternative 11, would cause serious economic hardship for Corona area residents forced to relocated. The All-River Plan minimizes this impact, but will still involve 47 relocations of residences.

With the exception of the All-Channel Plan, then, all of the alternatives considered have a significant adverse social and economic impact serious enough to require appropriate mitigation. Stabilization of the Oak Street Drain channel is included, thus, in all of the plans which involve raising Prado Dam.

Planning Objectives Accomplished

The All-River Plan produces more positive contributions to achieving the planning objectives than any of the other alternatives. Although this plan renders negative contributions to the planning objective of preserving the rural character of the communities surrounding Prado Reservoir, it does include measures to compensate for losses. This plan provides more positive contributions to the planning objective of controlling overflows for the main stem of the Santa Ana River than any other plan. It is the only plan that reduces the flood damage potential of the entire river, both the lower and upper basin.

The National Economic Development Plan, Alternative 7 (and Alternative 5), furnishes positive contributions to all but two of the planning objectives. Next to the All-River Plan, they make more positive contributions to the planning objectives than any other plans. Since these plans do not include acquisition and preservation of the salt marsh at the river's mouth for preservation of an endangered species and for general ecological diversity, they do not contribute

to this planning objective. These plans have a significant negative contribution to the planning objective of preserving the unique rural character of the communities surrounding Prado Reservoir. The only other difference between these plans' contributions to the planning objectives and the All-River Plan is that these plans control flood overflows only in the lower basin.

The Environmental Quality Plan, Alternative 10, provides positive contributions to all but one planning objective. This plan, however, produces the most negative effect regarding preservation of the unique rural character of the communities surrounding Prado Reservoir because it requires the relocation of all residents within the proposed taking line for Prado Reservoir. Since this plan proposes to restore more salt marsh than any other plan it makes more positive contributions to the planning objective of enhancing and preserving the salt marsh at the river's mouth. Like the National Economic Development Plan, this plan contributes to controlling Santa Ana River overflows only in the lower basin.

The All-Channel Plan, Alternative 11, makes fewer positive contributions to achieving planning objectives than any of the other alternatives. It has a negative effect on efforts to achieve two planning objectives: (1) contributing to preserving the ecological and open space values of the Santa Ana Canyon, (2) and contributing to the use of floodwater for water conservation. This plan makes no contribution to the planning objective of controlling overflow from Oak Street Drain. Because this plan does not call for raising Prado Dam it would allow the communities around the reservoir to maintain their cohesiveness and unique character. It therefore would make a positive contribution to the objective of preserving the unique rural character of the communities surrounding Prado Reservoir. Since this plan reduces only 76 percent of the flood damage potential from the Santa Ana River, less than any other structural plan, and controls flood overflows only in the lower basin, it provides fewer positive contributions to the planning objective of controlling overflows from the Santa Ana River than any other plan.

TABLE 14. COMPARISON SUMMARY OF ALTERNATIVE PLANS

	The All-River Plan Alternative 6	The NED Plan Alternative 7 (and Alternative 5)	The EQ Plan Alternative 10	The All-Channel Plan Alternative 11	Santiago Creek
Environmental Impacts					
Vegetation	-	+	++	-	0
Wildlife & Endangered Species	-	0	++	-	0
Water Quality, Water Supply	+	+	+	-	0
Cultural Resources	--	--	--	0	0
Esthetics	-	0	0	-	0
Urban Development	minor decrease	minor decrease	minor decrease	no change	no change
Regional Effects					
Reduction in need for flood insurance	++	+	+	+	+
Reduction of flood impact on regional development	++	+	+	+	+
Regional effect of relocations	-	--	--	-	0
Social and Economic Impacts					
Income	0	0	0	+	0
Employment	0	--	--	+	0
Social Well-Being	0	--	--	0	0
Quality of Life	0	--	--	0	+

++ more positive predicted contribution
+ positive predicted contribution
0 No net change predicted
- adverse change predicted
-- more adverse change predicted

TABLE 14a

SOCIO-ECONOMIC IMPACTS OF ALTERNATIVES ON THE CITY OF CORONA AND RIVERSIDE COUNTY

	Regional Economic Impacts Employment	Total Acreage Affected	# of Residences	# of Farms	# of Commercial	Social Impacts
Alternative 5	**127 Jobs**	2,601	285	15	3	1. Loss of community cohesiveness to commun ies surrounding Prado.
Alternative 6	**100 Jobs**	973	47	14	2	2. Loss of tax base from relocation of homes, dairies, ranches, and businesses.
Alternative 7	**134 Jobs**	3,081	285	15	3	3. Major community disruption due to relocation of homes, dairies, ranches and businesses.
Alternative 10	**134 Jobs**	3,081	285	15	3	
Alternative 11	**0**	0	0	0	0	1. Disruption to use of golf course while configuration changes are underway.

TABLE 15
EVALUATION OF ALTERNATIVE PLANS' ABILITY TO MEET PLANNING OBJECTIVES

Planning Objective	Alternative 6 All-River Plan	Alternative Plan Alternative 7* NED Plan	Alternative 10 Environmental Quality Plan	Alternative 11 All-Channel Plan
1. Plans should contribute to control of overflow from the main stem of the Santa Ana River.	++(86%)	+(89%)	+(89%)	+(76%)
2. Plans should contribute to control of overflow from Santiago Creek.	+	+	+	+
3. Plans for the Main Stem should contribute to preserving the unique rural character of the communities surrounding Prado Reservoir.	-	-	--	+
4. Plans should contribute to preserving the ecological and open space values of the Santa Ana Canyon.	+(1,500ac)	+(1,500ac)	++(1,530ac)	--(1,630ac)
5. Plans should enhance and preserve the degraded salt marsh on the east site of the Santa Ana River between Hamilton Street and the Pacific Coast Highway for preservation of an endangered species and for general ecological diversity.	+(92ac)	0(8ac)	++(200ac)	+(92)
6. Plans should contribute to increasing recreational opportunities along the Santa Ana River.	++	+	+	+
7. Contribute to the use of the floodwaters from the Santa Ana River and Santiago Creek for water conservation.	+	+	+	--

++ Highly positive contribution.
+ Positive contribution.
0 Neutral contribution.
- Negative.
-- Severely negative.

*Alternative 5's impacts are identical to Alternative 7, except that Alternative 5 contributes to controlling 86 percent of the overflows from the Santa Ana River.

Acceptability

Only one alternative is acceptable to a broad base of local interests. That alternative is Alternative 6, the All-River Plan, the same plan recommended in the 1975 Survey Report.

Alternative 6 was formulated during the early 1970's as a compromise for all local interests in order to gain unanimous support for a plan. The plan was developed through the combined efforts of upstream and downstream interests and is the only plan both upstream and downstream interests will support. At the beginning of the Phase I study in early 1979, local interests again unanimously expressed support for this plan. Throughout the Phase I study, local interests have expressed support for this plan and only this plan.

Although there have been expressions of concern over elements of the All-River Plan, support for this alternative remains firm. Recent actions by Orange County, requesting the Corps modify plans for Santa Ana Canyon, do not indicate any change in basic support for the All-River approach.

TABLE 16. ABILITY OF PLANS TO MEET EVALUATION CRITERIA

CRITERIA	Alternative 6 The All-River Plan	Alternative 7* The NED Plan	Alternative 10 The EQ Plan	Alternative 11 The All-Channel Plan
1. Acceptability	The only plan which upstream and downstream interests will support. Favored by State. Acceptable to USF&WS.	Plan is not acceptable to upstream interests.	Plan is not acceptable upstream interests. Favored by USF&WS	Plan is not acceptable to downstream interests.
2. Completeness	Yes. Does not require further action.	Complete for lower Santa Ana River. Does not meet planning objective in upper Santa Ana River.	Complete for lower Santa Ana River. Does not meet planning objective in upper Santa River.	Complete for lower Santa Ana River. Does not meet planning objectives in upper Santa River.
3. Effectiveness	Technically sound. Contributes to the four accounts, except for environmental which requires mitigation.	Technically sound. Contributes partially to objectives.	Technically sound. Contributes partially to objectives.	Technically sound. Contributes partially to objectives.
4. Efficiency	In general, meets all objectives in efficient manner.	Most efficient for some objectives; does not meet planning objective for upper basin.	Efficient for some objectives; does not meet planning objective for upper basin.	Inefficient for meeting all objectives.
5. Certainty	It is likely this plan would achieve the planning objectives and provide the output anticipated.	It is likely this plan would achieve the planning objectives and provide the output anticipated.	It is likely this plan would achieve the planning objectives and provide the output anticipated.	It is likely this plan would would achieve the planning objectives and provide the output anticipated.
6. Geographic Scope	Plan encompasses full geographic scope of upper and lower river.	Plan limited in geographic scope.	Plan limited in geographic scope.	Plan limited in geographic scope.
7. NED Benefit-Cost Ratio	2.1	2.4	2.4	1.7
8. Reversibility	Irreversible	Irreversible	Irreversible	Irreversible
9. Stability	Accommodate broad range of alternative futures.	Accommodate range of alternative futures in lower basin only.	Accommodate range of alternative futures in lower basin only.	Accommodate range of alternative futures in lower basin only.

*NOTE: The ability of Alternative 5 to meet the nine evaluation criteria is nearly identical to Alternative 7 except that Alternative 5's NED Benefit-Cost Ratio is 2.6.

RATIONALE FOR SELECTED PLAN

In choosing an effective and acceptable plan for flood control along the Santa Ana River, Corps project planners were guided by a number of laws, regulations, and policies and influenced by the legitimate interests of a number of agencies and public groups. There were frequent cases of conflicts in point of view. Environmental groups, for example, generally favored the features presented in the EQ Plan, Alternative 10, but this plan involved significant adverse social impact on residents of the Prado Reservoir area. There were even conflicts in the application of several laws or regulations to project elements. For example, the Rivers and Harbors Act of 1970 directs the Corps to consider, minimize, and mitigate for adverse social and economic impact where possible, but application of Executive Order 11988, Flood Plain Management, may itself cause some of these adverse social cnsequences by reducing communities' planning options for land use in the project area, by prohibiting certain levels of development within the flood plain. Community plans to develop must be changed, then, and existing zoning and land use policies are affected. Finally, a number of state, local and Federal agencies have jurisdiction over the project area, and there is not always agreement among these regarding the advantages and disadvantages of project features.

In dealing with issues raised by those interested in the project, Corps planners have been guided by the desire to give all interests equal consideration. Concern for minimizing cost has been balanced by an equal concern for minimizing socio-economic impact of the project and for preservation of environmental resources in the project area where possible. Ideal engineering solutions to problems have been adjusted to achieve environmental, social, and esthetic goals--without sacrificing essential flood protection.

This sense of a balanced approach to varying interests is the primary basis for selecting the All-River Plan over the other alternatives considered. There were many appealing individual features to the other alternatives, but the advantages they provided were outweighed by considerable costs to important interests. For example, the All-Channel Plan limited construction to Prado outlet improvements and the lower reaches of the Santa Ana River. It did not provide any flood protection for the upper river. The All-Channel Plan's cost was also higher than the All-River Plan.

The All-River Plan, then, was considered a reasonable response to all of the laws, policies, interests, and desires which guided the planning effort. It involved significant compromises and trade-offs in almost all of its features. Some of the more important of these are described below:

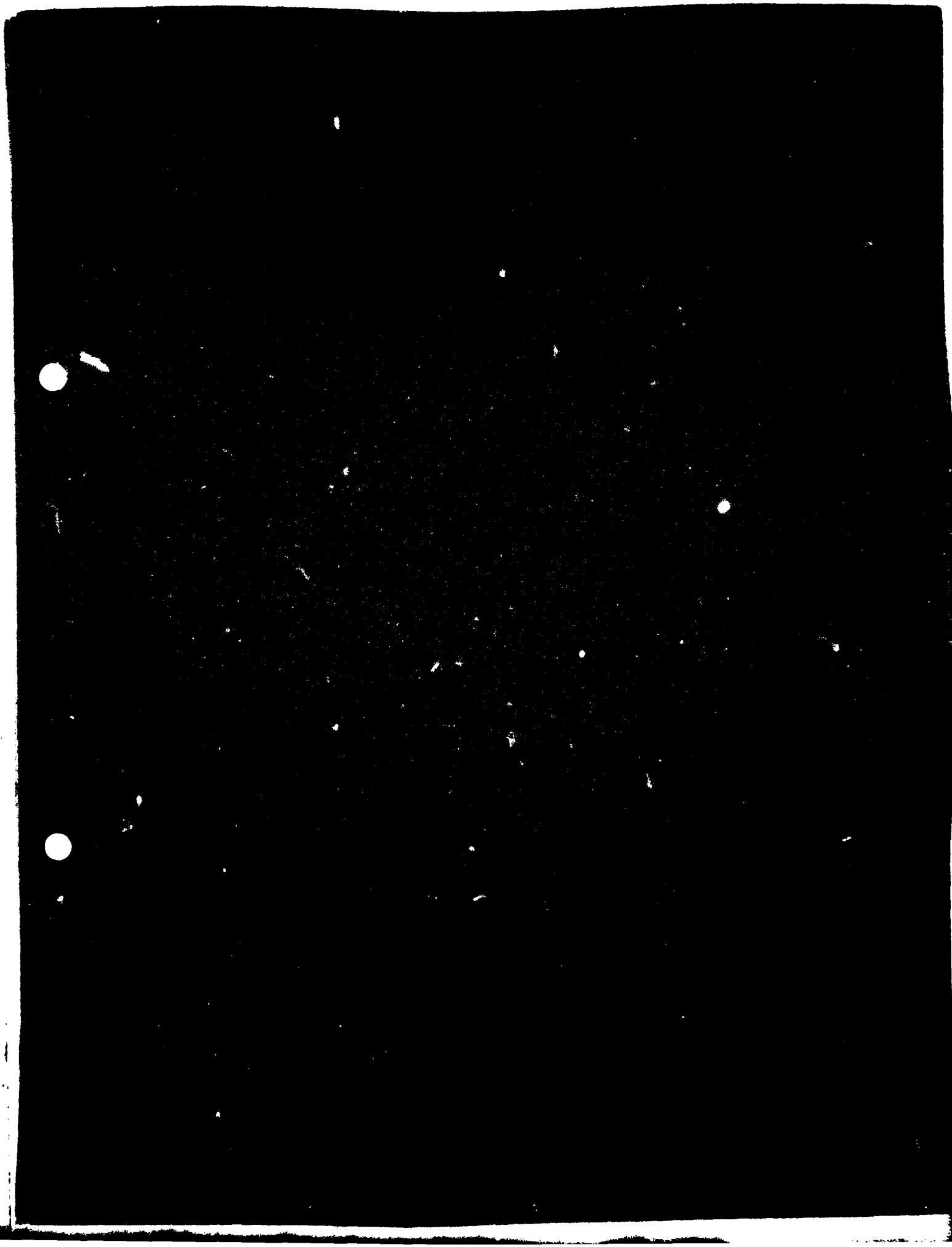
1. The Trade-off Between Cost and Social Impact.
The All-River Plan will cost approximately $75 million more than the NED Plan, Alternative 7, but will involve significantly lower impact on the sensitive communities surrounding Prado Reservoir. It is less costly, though, than the All-Channel Plan.

2. The Trade-off Between Environmental and Social Impact.
The Environmental Quality Plan, Alternative 10, called for most lands within the taking line of a raised Prado Dam to be restored as open space and habitat for wildlife. The social cost of moving the residences and farms in the area was, however, seen as too great to justify the environmental benefits. The All-River Plan permits agricultural use of the lands in the basin which will only infrequently be subjected to flooding (flooded with only about 200-year frequency). The dairy farms in the area will preserve open space and provide some habitat for wildlife, and the social cost of relocating these operations from the area will not be incurred.

3. The Trade-off Between Cost and Environmental Quality.
Corps purchase of 92 acres of salt marsh and adjacent lands at the mouth of the Santa Ana River will be costly, but will be consistent with the spirit and letter of the Endangered Species Act of 1973 which directs Federal agencies to utilize their authorities in furtherance of conservation of endangered species.

4. The Trade-off Between Corps Standard Acquisition Policy and Social Impact.
The standard Corps policy is to acquire lands within the taking line of the reservoir. Application of this policy at Prado Dam, however, would have severe adverse social impacts without significant benefits to outweight these. The lands in question would be subject to flooding infrequently and their use would be restricted so that no significant development would be allowed. Alternative methods of securing the lands, such as life estates and easements, were thus considered to provide the necessary control of the lands without requiring actions which would have severe social impact on the area.

There were numerous other trade-offs made during the decision-making process, and many other interests were considered. The Recommended Plan involves more of these than the other plans and thus gives a better balanced approach--on the whole--than the others.



7. CONCLUSIONS

Review of the viable solutions to the flood control problem along the Santa Ana River and Santiago Creek has included 5 alternatives, and the "No Action" Plan. The alternatives considered were:

1. The All-River Plan, Alternative 6 from the 1975 Survey Report and the 1975 Recommended Plan

2. The NED Plan, Alternative 7 from the 1975 Survey Report

3. The All-Channel Plan, Alternative 11

4. An updated Environmental Quality Plan, Alternative 10

5. A High-Prado Plan Similar to the NED Plan, Alternative 5

These alternatives were identified on the basis of review of the 1975 Survey Report, comments received during review of the Survey Report, changed conditions in the study area, and the desires of local interests. On the basis of this review, the focus of the Phase I study was narrowed, making it possible to conduct only those engineering, design, economic, social and environmental studies pertinent to these alternatives and to concerns and issues raised during Survey Report review. The Phase I study has been conducted with full public involvement and coordination.

The conclusion of Phase I study is that the 1975 Survey Report Recommended Plan, as modified herein, remains the best plan for the Santa Ana River Basin. This conclusion has been made in light of the comments raised during 1975 Survey Report review, especially those of the Board of Engineers for Rivers and Harbors. The positive and adverse impacts of all alternatives on economic, environmental, social well-being, and regional development have been weighed in making this conclusion that the Recommended Plan better meets the needs of t.. basin.

In evaluating the selected plan and other viable alternatives, the following points were considered pertinent:

1. There is potential for serious flooding along the main stem of the Santa Ana River and along Santiago Creek

2. There is a need to preserve the unique rural character of the communities around the Prado Reservoir.

3. Any flood control project along the main stem of the river should be formulated to meet the need for preserving the ecologically valuable areas of the Santa Ana Canyon and the salt marsh at the mouth of the Santa Ana River.

4. There is a need to provide recreational facilities wherever possible as a part of any flood control project.

5. There is a need to develop the water conservation potential within the Santa Ana River basin.

The action proposed is based on thorough analysis and evaluation of various practicable alternative courses for achieving the stated objectives. Whatever adverse effects are found to be involved, they cannot be avoided by following reasonable alternative courses of action which would achieve the specified purposes. Where the proposed action has an adverse effect, this effect is either ameliorated or substantially outweighed by other considerations of national policy.

Insofar as has been practical, the recommended action has been designed to comply with national statutes, policies, and administrative standards. Those of prime importance are noted below:

1. The Coastal Zone Management Act of 1972. In this phased decision-making project, general consistency with this act to the maximum extent practicable has been established. The issues which have been raised by the Coastal Commission during this Phase I study will be addressed in detail during Phase II design studies. In particular the least tern nesting colony relocation feasibility, the definition of wetlands areas, and the design of the Talbert Channel will be the subject of extensive studies. The Corps will make a final determination of consistency prior to bid opening for construction. If, by then, a Local Coastal Program has been prepared, the Corps will prepare a final consistency determination with regard to this local plan.

   At present, to the extent practicable at this stage of design, the Recommended Plan is consistent with the Coastal Zone Management Act of 1972.

2. The Endangered Species Act of 1973. The proposed action makes provision for preserving habitat essential for a Federal endangered species and for protecting endangered species during construction.

3. The Wild and Scenic Rivers Act. The Santa Ana River has been evaluated to determine if it should be designated a wild and scenic river. Its position in a heavily developed urban area and the flood control facilities already in place, make it ineligible for inclusion under this act.

4. The Rivers and Harbors Act of 1970. In particular, the proposed action responds to this act's directive to analyze the social and economic impact of projects and to mitigate for these impacts to the extent practical.

5. The Clean Water Act of 1977, especially Sections 301, 402, and 404. The impact of this project on water quality in the region has been analyzed and, where practicable, the project designed to improve water quality or to minimize adverse impact. Wetlands covered by this act (Section 404) have been evaluated to the extent possible, and within the constraints imposed by the flood control purpose of the project, are preserved and protected. (See Attachment A to the FSEIS for complete discussion of Secton 404 determinations and findings.)

6. The Fish and Wildlife Coordination Act. Close coordination with the California Department of Fish and Game and the U.S. Fish and Wildlife Service has been maintained throughout the project design and will be maintained hereafter. Both of these agencies have responded extensively to the Recommended Plan and have made suggestions for maintaining environmental quality during and following construction. They have expressed support for the project contingent on these recommendations being implemented.

7. The National Environmental Policy Act of 1969. The goals and procedures outlined in this act have been thoroughly considered during all stages of design.

8. The Net Benefits Rule (Federal Register, Vol. 45, No. 190, 711.92). The net benefits to the overall project far outweigh the net costs, both economic and environmental quality.

9. Executive Order 11990, Protection of Wetlands. Efforts have been made to integrate protection of wetlands into the recommended design, and to mitigate for any actions which will adversely affect such wetlands.

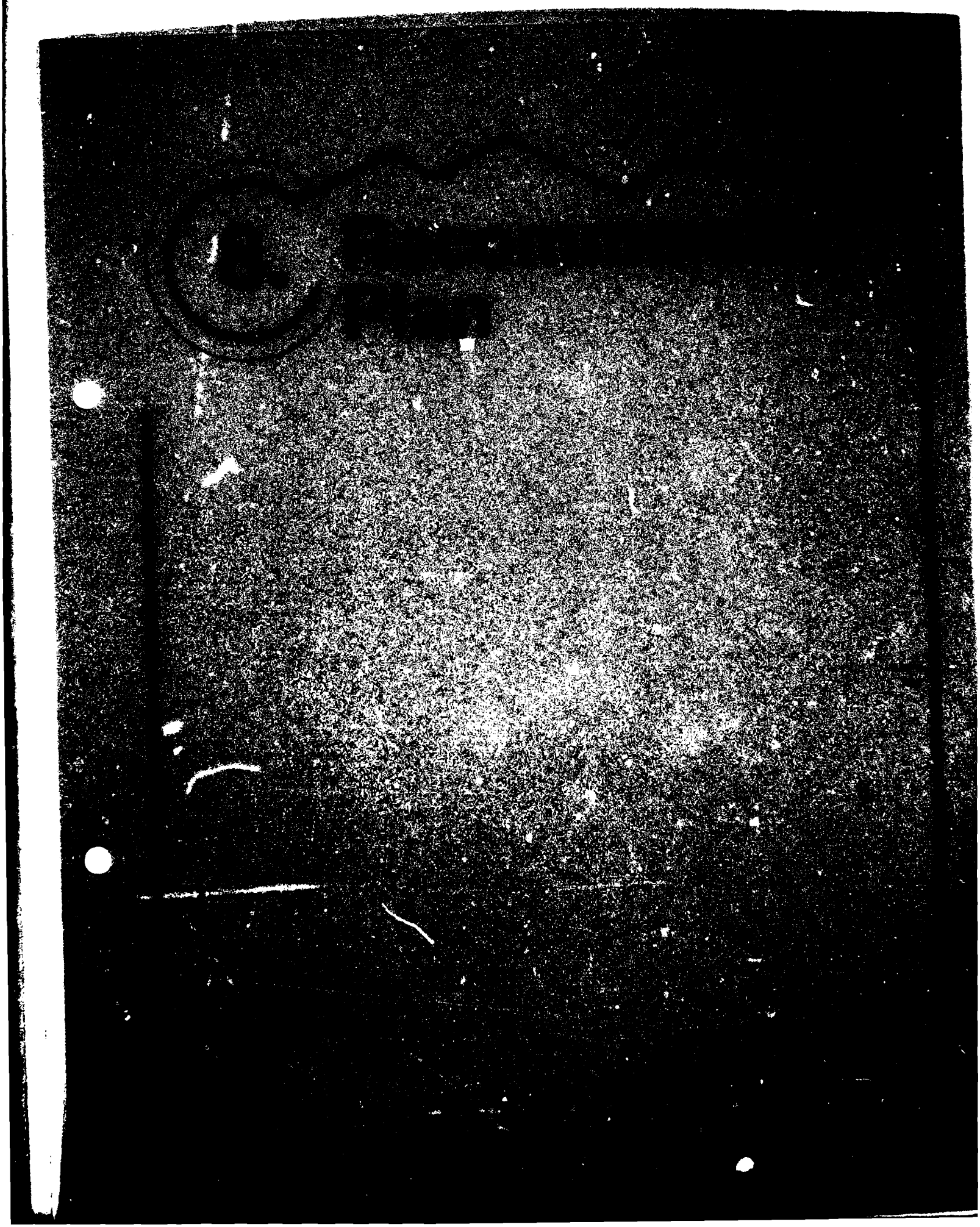
10. Executive Order 11988, Floodplain Management. As flood control necessarily affects flood plains, the Corps has held extensive public meetings to inform the public of the proposed project and to involve the public in the planning process. Efforts have been made to ensure wise use and conservation on flood plain resources in the project area. The structural measures recommended are the minimum necessary to meet the need for flood protection for existing development.

11. ER 1165-2-28. Preservation and Enhancement of Fish and Wildlife Resources Acquisition of the marsh and adjacent lands complies with ER 1165-2-28 in several ways. First, it was a part of the Recommended Plan in the 1975 Survey Report, approved by the Office of the Chief of Engineers during review at that time. Second, it is likely to the "more cost effective to implement or manage when directly integrated" with the other elements of the plan for the mouth of the river (Section 4.b.(1)(c)).

This partial list of efforts to comply with applicable laws and regulations summarizes the Corps efforts to ensure that, on the balance, the total public interest is best served by implementation of the recommendation.

The Recommended Plan must be implemented to reduce existing flood losses, preclude future flood losses, and satisfy a portion of the recreational needs of the area. The Recommended Plan will primarily serve to reduce damages to existing development. Development induced by the project will be limited to a few gaps and vacant property mixed in with existing development in the flood plain.

Taking no action is not considered acceptable. Hundreds of thousands of homes and 1,800,000 people presently reside or work in the flood plain. Flooding would be catastrophic and overwhelming, with a great potential for loss of life. No program of flood-plain management, except a structural solution, could be implemented.



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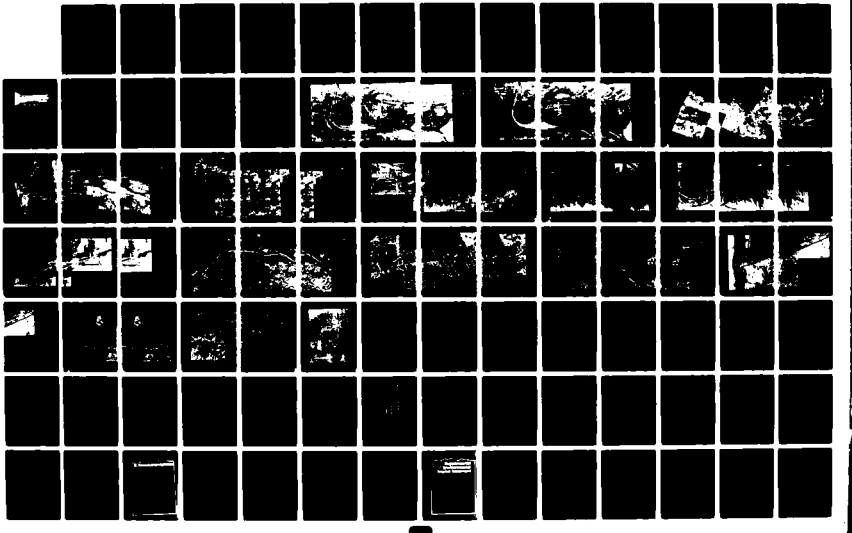
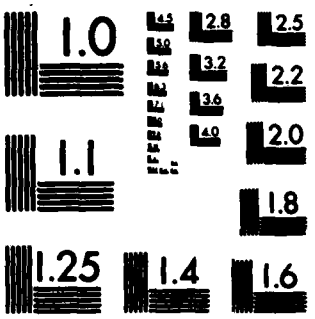




8. THE RECOMMENDED PLAN

DESCRIPTION OF PLAN

Although the recommended plan of flood control channels and recreational development would present a continuous solution, it can best be described in 8 elements: (1) construction of a rock and earth-filled dam located in San Bernardino County near the communities of Mentone and East Highlands; (2) management of the flood plain between Mentone Dam and Prado Reservoir; (3) enlargement of Prado Reservoir including improvements to Oak Street Drain; (4) acquisition of the Santa Ana Canyon Flood Plain; (5) improvement of the lower Santa Ana River channel from Prado Dam to the Pacific Ocean; (6) improvements of the Santiago Creek channel in Orange County; (7) preservation of 92 acres of wildlife habitat at the Santa Ana River Mouth; and (8) recreation development. Phase I study efforts to coordinate with the California Coastal Commission and comply with the Coastal Zone Management Act are discussed in paragraphs 1.23ff of the FSEIS. It is District policy to establish cooperative relationships with the local and State agencies having jurisdiction over the coastal zone and to take all practicable steps to comply with the Coastal Zone Management Act. The 404 water quality requirements for the Recommended Plan, if implemented will be accomplished through Option B, exemption from the requirements of Sections 301, 402, and 404 of the Clean Water Act of 1977, as part of the authorization process. Option B calls for the required 404 determinations and findings to be included in the GDM and FSEIS prior to Congressional submittal. The 404 water quality evaluation, Attachment A to the FSEIS, concludes that appropriate measures have been identified and incorporated into the plan recommended to minimize adverse effects on the environment resulting from fill activities. Plans for recreational facilities are being recommended for many of the flood control elements. A summary of the recreational plans follows the discussion of the flood control features.

Upstream Reservoir Near Mentone

The upstream reservoir's primary purpose would be collection of floodwaters from Big Bear Lake area, the upper Santa Ana River, Mill Creek, and Plunge Creek (see figure 11). Floodflows of up to 126,000 cubic feet per second will be reduced to 6,000 cubic feet per second as they pass through the outlet gates. Such a reservoir would be best located in the area around Mentone. The proposed Mentone Dam is an essential part of the All-River Plan; without it, the taking line at Prado would have to be raised to unacceptable levels. The Mentone Dam is also essential to flood control in the upper basin.

The construction of Mentone Dam will alter the peak discharges and durations of floods in the Santa Ana River between Mentone Dam and Prado Reservoir. Mentone Dam will reduce the peak discharges fo floods passing through the reservoir and increase the duration of flows. The impact of these changes on the downstream channel will be minimal. The dam will reduce the standard project flood peak discharge from 126,000 cfs to a maximum release of 6,000 cfs. This release will be confined within the existing streambanks. The maximum effect on the duration of

flow will occur during the standard project flood, where the duration of the hydrograph will be increased from 4 days to 21 days. The effect of the increased duration on bank erosion will be small. Bank erosion is occurring without Mentone Dam and will continue if Mentone Dam is constructed. The effect of the longer duration on bank erosion will be offset by the reduction in peaks.

As to the geology of the damsite, in 1974 several holes were drilled in the riverbed along the proposed alinement of the dam. Under the guidance of seismic consultants, the riverbed materials were analyzed and parameters for a suitable, safe construction of the dam were developed. Since we are still in the preliminary stages of design, which involves mostly gross quantities of soils, gravels, concrete, and other construction materials, and their unit prices, the designers did not find it necessary to do any borings along the north portion of the dam axis. The Phase I studies reaffirmed the basic structural and economic feasbility of the dam prior to authorization by Congress for more specific detailed design studies.

The dam and reservoir will require approximately 3,110 acres of land, much of which is already used for flood control and water conservation. There are currently numerous water conservation structures in place along the river above the site of the proposed Mentone Dam. Most of these are dikes located to the north of the juncture of the Santa Ana River and Mill Creek and to the north of the main stem of the river some 2,000 feet to the east of Church Street. Several hundred acres are devoted to water conservation. Much of the rest of the area is a broad, flat wash. The dam will be a 3-1/2 mile long, horseshoe-shaped earthfill structure composed of 66 million cubic yards of fill, some of which will be gathered at one of two borrow sites (either at Prado or in the upper basin). The dam crest will be 1573.5 feet above mean sea level, with spillway height at 1548.5 feet above msl. The rock zone of the downstream face of the dam is at spillway crest elevation. A levee will be built along Mill Creek to ensure floodflows in this area are directed into the impoundment reservoir and 8 groins will be added to divert water and debris from Mill Creek into the central area of the Mentone Reservoir. Spillway and outlet works will be concrete structure. The reservoir will have a gross storage capacity of 181,500 acre-feet, including 37,000 acre-feet for debris storage. Water levels within the reservoir will rise rapidly during flooding to a maximum of 200 feet, and for this reason some development already within the basin will have to be removed, including 55 homes. Because removal of homes is essential, the land included within the basin will be acquired by fee purchase.

In Phase II design studies of the dam structure, the Corps will establish a Board of Consultants similar to that established during the 1975 Survey Report studies. The Corps will call on the services of the members of the Board to review all structural designs. At that time, extensive testing and design work will establish the exact configuration of the embankment. The dam section presented in this report represents the best design possible recognizing that, as is true in any planning

investigation, only those studies have been done which would be sufficient to demonstrate feasibility. To ensure that, during Phase II design studies, detailed foundation explorations and tests will not identify any serious foundation problems which would challenge the feasibility of the dam, an analysis has also been made demonstrating the effect of a "worst case" foundation condition. This analysis appears in Appendix D, Soils and Geology, and demonstrates that a dam at the Mentone site designed for the worst possible foundation conditions and would still be feasible, would cost $50,000,000 more than the structure presented in this report, and would also be economically justified as a last added plan element.

The dam will have a number of benefits. After the initial construction phase, the land behind the dam will revert to open space, providing wildlife habitat and recreation land. The dam will control the floodflows from the upper river and prevent flood damages to the reach between the dam and Prado Reservoir.

The Mentone Dam will cost an estimated $392 million, most of this for actual dam construction. Construction will take 8 years. Differences between the current proposal and the 1975 Survey Report proposal are: (1) the current proposal calls for less fill material (66 million cubic yards vs. 100 million cubic yards), (2) crest and spillway elevations have been raised, (3) reservoir area has been decreased, but the area involved along Mill Creek has been increased, and (4) a cutoff wall has been added to the zone upstream of the dam to prevent saturation of the foundation during flooding.

Mentone Dam to Prado Reservoir Reach of the Santa Ana River

For this reach (see figure 13), flood plain management is being recommended. Local interests will be required to manage the post project standard project flood floodway and fringe flood plain. These areas will be delineated by the Corps of Engineers. As mentioned previously, acquisition is not being recommended for this reach because it is not required for operation of Mentone Dam. Restricted development of the flood plain is all the project requires, and this end can be accomplished through flood plain management.

Prado Reservoir

The plan for modifying Prado Reservoir is essentially what it was in the 1975 Survey Report, and improvements are designed to serve the same purposes (see figure 14). The enlargement will provide SPF flood protection (in conjunction with the Mentone Dam) for the lower Santa Ana Basin, will do much to preserve the open space values of the Prado area, and will increase present wildlife and recreation area.

Enlarging Prado to the full height needed for present and future storage requirements would involve the following main features of the plan.

1. Raise Prado Dam 30 feet. (Embankment material would be obtained from borrow areas within the basin.)

2. Construct a new outlet works to more than double the existing outlet capacity.

3. Raise the concrete spillway from a crest elevation of 543 to 563 feet and increase the crest length from 1,000 to 1,300 feet.

4. Construct levees to protect the Santa Fe Railroad, the Corona wastewater treatment plant, the Alcoa Aluminum Plant on Rincon Street in Corona, and the California Institute For Women at Chino.

5. Modify the interchange between Riverside Freeways and State Highway 71.

6. Develop recreational facilities. These would include overlook, camping, picnic, and park day-use areas; an information center; three fishing lakes; a trailer camp; and recreational trails. Included also in the plans are agricultural buffer zones and a wildlife area.

With the recommended project, water surface elevations for various floods are given in the following tabulation:

	Maximum water surface elevation (feet)	
Flood size	Present	100-years hence
Standard project flood	551	563
100-year flood	539	546
50-year flood	527	533

Enlarging Prado Dam and Reservoir will require the acquisition of approximately 1,461 acres of additional land. All land and structures within the current reservoir limit (elevation 556) would be acquired in fee. All undeveloped land between this level and the proposed reservoir taking line (elevation 566) would also be purchased. The reservoir guide taking line was selected as the future standard project floodwater surface elevation plus a 3-foot freeboard. Developed property in the zone between the present reservoir limit and the proposed taking line would be considered for the alternative methods of acquisition including life estates and selected flood proofing.

Operation of Prado Reservoir under the proposed release schedule and with the proposed water supply pool may influence water quality on Federal lands near the Corona Airport during successive years of above-average rainfall. If this is determined to be significant during Phase II studies, results and recommendations will be reported.

Since all land and structures would be purchased up to elevation 556, no development would be subject to flooding from the standard project flood under current conditions. Even at the end of the project

life, no development would be damaged by a 100-year flood. Only for very rare floods would there be damage. Since the water rises relatively slowly and there are numerous roads out of the fringe area, there would be little danger to people even from large floods at the end of the project life.

Improvements to the Oak Street Drain (see figure 15) would provide flood protection for the entire reach from the newly constructed debris basin to Prado Reservoir. Because Riverside County built a debris basin 0.7 miles further upstream than was recommended in the 1975 Survey Report for this area, the new proposal for the Oak Street Drain contains a number of refinements from the previous proposal.

The flood control improvement for Oak Street Drain consists of a rectangular concrete channel from north of the Santa Fe Railroad upstream to an existing debris basin. The main channel will be 0.7 mile longer than was recommended in 1975 and will have a standard project flood capacity. A reanalysis of the hydrology indicated that standard project flood peak flows would be moderately reduced because of construction of the existing debris basin and the recommended channel was slightly downsized as a result.

The result of an analysis regarding a cross-channel to carry flows from Lincoln Avenue over to Oak Street Drain Channel revealed difficulties in effectively collecting those flows from the boulevard for diversion into the channel. Furthermore, the magnitude of the flows indicates that the connector channel should be a storm drain facility to be built by local interests. A 10-year flow along Lincoln Avenue would be much less than 800 cubic feet per second which is the established criteria for separation of local storm drain responsibilities from major flood control works. This connector channel was part of the 1975 plan but is not recommended in this Phase I report.

A stub to intercept Mangular Storm drain flows would be provided, as was assumed in 1975. Farther downstream near D Street and Lincoln Avenue, a new commercial establishment has been built along what was to be part of the channel alinement. The culvert section proposed in the 1975 plan would be extended about 200 feet upstream to be compatible with the business establishment. The culvert was downsized slightly and will be a single, box section.

At the downstream end, a longer transition is designed to lead the flows into the upper end of the Prado Reservoir. There will be no formal tie-in with Temescal Creek, which also enters Prado Reservoir in the same area.

The Oak Street channel as now designed will begin downstream of the existing debris basin north of Chase Drive. At Ontario Avenue a new bridge will be built. The channel will have a width of 20 feet at the upper end, and, as more tributary flows enter the channel, the width will increase in stages to 24 feet near the intersection of D Street

and Lincoln Avenue, where the channel will go into an enlarged box culvert. Channel depths, 8.5 feet at the upper end, will increase progressively to 11 feet.

As the Oak Street Drain channel approaches D Street, the rectangular channel changes into a concrete box section to pass under Lincoln Avenue and the Riverside Freeway. The box will be about 24 feet wide and 11 feet high. A three-stage construction process was developed to keep the freeway open at all times and to minimize congestion.

Below the freeway, the Oak Street Drain channel will become a vertical-walled concrete section 26 feet wide and 13 feet high and continue downstream to a point just north of the Santa Fe railroad. Some utility lines in this area will have to be lowered to permit a more efficient channel gradient and allow adequate clearance beneath the railroad bridge. Just below the railroad, the channel will end and energy dissipation will be accomplished by transition into wing levees, dumped stone, riprap, and then the earth bottom natural channel to Temescal Wash.

Water Conservation Potential at Prado Reservoir

EXISTING FACILITIES. The existing water conservation facilities for the lower basin consist of Prado Reservoir and approximately 1,017 acres of spreading basins located along the Santa Ana River downstream from Prado Reservoir. The reservoir is currently being operated in a manner that provides water conservation benefits to the extent that flood control operations are not jeopardized. For example, if a storm should occur late in the flood season--where a following storm would be unlikely--as much as 30,000 acre-feet may be held behind the dam for later releases to the percolation basins. If the same storm were to occur early in the flood season, all of the impounded water would be quickly wasted to the ocean to make storage available for possible following storms.

Water released from Prado Reservoir enters the percolation basins about 2,000 feet west of Imperial Highway through a series of pipes and gates. The basins extend downstream almost 7 miles to just upstream of Katella Avenue. The percolating capacity of the basins is about 300 cubic feet per second. When the percolating capacity of the basins is exceeded, the excess water is wasted back into the river at the downstream end of the basins.

Using flow data collected between 1920 and 1979 and the current operation schedule for Prado Reservoir, the average annual amount of water available for percolation to the spreading basins was calculated to be 82,800 acre-feet per year.

ALTERNATIVE PLANS. Alternative plans for increasing the water conservation capabilities in the Prado area were developed and analyzed. A description of these plans and a tabulation of the analysis results follows.

Dedicated Storage. Three levels of storage dedicated for water conservation were studied. Each level was added to the flood control capacity of Prado Reservoir as recommended in the 1975 Survey Report. The first level added 10,000 acre-feet of capacity to the flood control reservoir. The cost of raising the dam an incremental amount to gain the required water and buying the increased reservoir area behind the dam was calculated at $13 million. It is estimated that the increased storage capacity would yield an average annual increase of 4,800 acre-feet over the without-project condition. The second level of dedicated storage added 20,000 acre-feet to the flood control plan. The cost of this increment would be about $26 million. The increased storage capacity would yield an average annual increase of approximately 5,800 acre-feet. The third level added 30,000 acre-feet of storage to the recommended plan. This increment would cost approximately $39 million. This increase in storage capacity would yield an average annual increase of approximately 6,700 acre-feet to the percolation basins.

Additional Spreading Basins. Three amounts of additional spreading basin acreage were studied for their possible contribution to water conservation--50, 100, and 150 acres. These increments were analyzed using the average annual flows, and expected yields were calculated. The expected average annual yield from the addition of 50 acres to the spreading basins comes to 5,000 acre-feet. The cost of this alternative would be $8 million. The average yield from the addition of 100 acres to the spreading basins comes to 5,800 acre-feet. The cost of this alternative would be $16 million. The average annual yield from the addition of 150 acres comes to 6,700 acre-feet. The cost of this alternative would be $24 million.

Results. The costs of each alternative were amortized over the project life at an interest rate of 7-1/8 percent to arrive at average annual costs. Average annual benefits were calculated using $53 per acre-foot as a value for water. This is the current cost to Orange County for imported water under long-term contracts negotiated several decades ago. These contracts will expire soon and the cost of water will increase significantly. Benefits have been calculated using this current figure and are thus, in the long run, extremely conservative. The benefit over cost ratios are shown in table 17 (page).

The results of this analysis confirm the 1975 Survey Report conclusion that water conservation at Prado Reservoir is incidental to flood control operations. Nevertheless, operations at Prado Dam should contribute an additional 3,500 acre-feet of water annually to the ground water supply.

Table 17. COMPARATIVE RESULTS OF ALTERNATE CONSERVATION PLANS AT PRADO DAM

Alternative	Inflow (AF/YR)*	Conserved (AF/YR)*	Waste (AF/YR)*	First Costs $(1000's)	Average Annual Benefits $(1000's)	Average Annual Costs $(1000's)	B/C Ratio
Present Reservoir Operation Schedule 1978-79	97,900	82,800	14,000	--	--	--	--
Alternative 6--Proposed Operation Expanded Debris Pool with--							
1. Additional 10,000 AF of storage	97,900	87,600	9,200	13,000	68	927	0.1
2. Additional 20,000 AF of storage	97,900	88,600	8,200	26,000	123	1,850	0.1
3. Additional 30,000 AF of storage	97,900	89,500	7,300	39,000	171	2,780	0.1
Alternative 6--Proposed Operation Expanded Debris Pool with--							
1. Increase spreading capacity by 50 acres	97,900	87,800	9,000	8,000	71	570	0.1
2. Increase spreading capacity by 100 acres	97,900	88,600	8,200	16,000	123	1,140	0.1
3. Increase spreading capacity by 150 acres	97,900	89,500	7,300	24,000	171	1,710	0.1

* AF/YR--Acre-Feet/Year

Santa Ana Canyon

From Prado Dam to Weir Canyon Road intermittent guide levees and rock side slopes will protect freeway, railroad, bridges, the mobile home park, and other improvements along this approximately 8-mile reach (see figure 16). Releases from the modified Prado Dam will be considerably higher than those from the dam as it is currently designed and operated. Since these releases will be potentially damaging to lands within the post-project SPF flood plain, this flood plain will be acquired (see figure 16). Lands acquired will be maintained as open space and wildlife habitat with minor recreaton facilities in the form of trails.

The Lower Santa Ana River Channel

WEIR CANYON ROAD TO IMPERIAL HIGHWAY. Along this 3-mile reach (see figure 17) the Orange County Environmental Management Agency has improved the river channel in the last decade to provide a better interim level of flood control. These improvements are not adequate to handle the planned 30,000 cubic feet per second releases from Prado Dam, plus tributary inflows, for periods of several days.

The Recommended Plan calls for inlet wing levees just upstream from Orange County's proposed Weir Canyon Road bridge crossing. Downstream the existing cross-section of channel will be utilized to the extent practical. New drop structures will be constructed to supplement the existing ones, with some stabilizers added in between. The result will be that the invert level will be about the same or slightly lower and the berm level will be about the same or up to 4 feet higher depending on location.

On the south side of the river the berm will be built upward and outward into the existing river channel with new revetment placed along the slope. Freeway lanes nearby make it impractical to encroach into the freeway right-of-way. In order to obtain a usable channel bottom width of between 290 and 300 feet it will be necessary to tear out and rebuild about 2-1/2 miles of the existing north levee. It is necessary to increase the usable cross-section to a dependable 43,000 cubic feet per second capacity. Thus, the channel centerline would be shifted about 20 feet northward. There will be a small encroachment into Yorba County Park. A transition will bring the channel back to the existing centerline just upstream of the Imperial Highway bridge.

IMPERIAL HIGHWAY TO KATELLA AVENUE. Improvements in this 7-mile reach (see figure 18) will consist of upgrading the existing trapezoidal earth-bottom channel. To provide greater channel capacity, levee heights will generally be raised up to 3 feet, depending on location with respect to drop structures. The size of the rock protecting the channel side slopes will be increased, and the rock toe revetment will be extended to a lower elevation. Rock protection will comply with Corps of Engineers standards. Because the 5 existing drop structures require additional protection, rock placement downstream from each

structure will be lengthened and deepened to resist channel degradation at periods of high flow. New drop structures will be added. The spreading basins adjacent to the flood control channel will remain. At bridge crossings, a minor amount of work will be necessary; for example, access ramps above and below the bridges will be provided or restored as necessary.

KATELLA AVENUE TO 17TH STREET. In the 3-mile reach (see figure 19) of river from south of Katella Avenue downstream to the Garden Grove Freeway, the river bottom is less suitable for percolation of water into the groundwater basin; thus, the spreading basins discontinue at Katella Avenue. A drop structure located about 1,800 feet downstream from Katella Avenue was damaged in the flood of early 1978 and was rebuilt afterward. Only minor modification is needed for incorporation into the Recommended Plan. The new structures slow the flow of water to reduce erosion of the earth-bottom channel.

In the existing channel the bottom width narrows from about 320 feet upstream of Katella Avenue to 270 feet downstream. Downstream of Katella Avenune, Orange County has, in addition to the 4 recent stabilization structures, placed more rock revetment and raised the berm level about 2 to 3 feet to just below the Garden Grove Freeway. Rather than widen the channel as assumed in the 1975 Survey Report it is now considered more practical to raise the berm levels slightly and strengthen the revetment to avoid unnecessary relocations or modifications of several bridges.

The Katella Avenue bridge will be rebuilt; the Orangewood bridge will receive longer pier spans. The other bridges in the reach, the Orange Freeway, Chapman Avenue, Santa Ana Freeway, Garden Grove Freeway, and Garden Grove Boulevard, can remain essentially as is with minor pier footing work.

Private interests, under a lease arrangement with the Orange County Flood Control District, have developed the sandy river bottom into a golf course greenbelt. This public golf course is located in the channel from below the Garden Grove Freeway to above 17th Street. Three other structures were added in late 1978--a drop structure near Chapman Avenue, a drop structure just below Garden Grove Freeway, and a stabilizer below Garden Grove Boulevard.

The current design calls for continuing of the channel with two rock-revetted side slopes, about 270 feet bottom width and an average 16 foot depth, to the confluence of Santiago Creek.

At the Santiago Creek confluence, the east revetment will bend around to the north bank of the creek and stop about 200 feet upstream. Below the creek, the riverflows will be contained by a parapet wall running along the east edge of the golf course. On the west side of the river a rock-revetted slope will continue to a transition into a concrete channel about 700 feet upstream of 17th Street.

The channel in the golf course reach will be designed so that probably only 3 holes or tees will need to be moved, 50 feet or less. To the degree compatible with safe flood control design, grass and plants will be allowed to partially obscure the channel bottom and sides to create a more pleasing visual effect.

17TH STREET TO HAMILTON AVENUE-VICTORIA STREET. From 1973 through 1979, Orange County upgraded the last 10 miles (See figure 19) of the channel, from upstream of 17th Street down to near Pacific Coast Highway. The channel has concrete side slopes, normally extending about 7 feet below the soft-bottom invert. The scour and damages occurring in the 1978 and early 1980 floods suggest some inability to carry floods up to the normal design level. To gain more capacity and more assurance that the channel will be able to contain large flows for long durations, the Recommended Plan calls for conversion to a rectangular, hard-bottom channel. In the critical flow reach--from 17th Street down to 0.4 miles north of Adams Avenue, the top (and bottom) width of channel would be about the same as the existing top width, in the range of 242 to 250 feet. The channel is designed to fit generally within the existing right-of-way to avoid the need to displace homes and businesses.

The recommended channel will be between 17 and 23 feet deep. The vertical-walled concrete channel will require at least 60 feet less right-of-way than a channel with side slopes, thus avoiding displacement of homes. The capacity of the proposed channel will be 47,000 cubic feet per second near the river mouth.

Bicycle and equestrian trails along the river, which are generally separated, will be improved, improvements to be made in compliance with the Land and Water Conservation Fund Act of 1965. Ramps constructed at appropriate locations along the reach will provide access into the concrete channel. The entrances will give access for maintenance and to recreational areas. At several bridges, tunnel underpasses will be constructed to retain grade-separated trail crossings. Several bridges need to be completely rebuilt: Fairview Avenue, 5th Street, Bolsa Avenue, Edinger Avenue, Harbor Boulevard, Warner Avenue and Talbert Avenue. The others can remain with some footing modifications.

South of Edinger Avenue, the river is no longer deeply entrenched. The levees rise to about 12 feet above the natural ground line, with the river bottom only about 3 feet below the ground line. Lowering the riverbed will increase channel capacity, but three large sanitation district pipelines crossing the channel will have to be lowered. Below the San Diego Freeway, a tributary (Greenville-Banning) channel approaches the Santa Ana River from the east. The channel, which drains the low-lying properties on the east, directs the drainage to the ocean.

About 1-1/2 miles south of the San Diego Freeway crossing (near Adams Avenue), the channel gradient flattens from 9 feet per mile to about 3 feet per mile. At this point the Santa Ana River concrete channel will widen from 250 to 365 feet, and the wall heights will increase from about 18 to 21 feet to accommodate the slower flow. To

avoid taking homes located along the east side of the Greenville-Banning channel near Adams Avenue, the channels will be located very close to one another. Thirty feet of clearance will be maintained between the two channels to provide for an elevated multiuse access road.

The Fairview channel and the Greenville-Banning channel join below Adams Avenue. These channels form a local drainage system that carries the runoff from the City of Costa Mesa to the sea. The Santa Ana River channel will transition upstream of Adams Avenue into subcritical flow and widen from 250 to 365 feet. Both the Santa Ana River and Greenville-Banning channels will be close together and of rectangular-shaped concrete construction to just opposite the Fairview channel entrance.

Downstream, the Santa Ana River will transition and widen further to 450 feet. The invert will change from concrete to soft bottom below the Greenville-Banning channel confluence with the Fairview channel. Tee wall construction with heavy supports below grade will be used. The soft bottom will allow continued growth of benthic organisms in the tidal zone of the river.

HAMILTON AVENUE-VICTORIA STREET TO THE PACIFIC OCEAN. The Santa Ana River and Greenville-Banning channels (see figure 20) will be merged into the one common channel just below the Hamilton Avenue-Victoria Street Bridge. The access road between the channels will bridge across the Greenville-Banning channel just above the confluence and continue on the east side of the single channel to Pacific Coast Highway. The Santa Ana River and Greenville-Banning combined channel will be 22 feet deep and 480 feet wide. The vertical concrete channel walls will continue to within 500 feet of the ocean; at that point, the channel walls will transition to rock stone jetties that extend to the low tide line. The widened channel will eliminate about 5 acres on the east side of the Victoria Pond, a freshwater lagoon to the east of the current channel. This will be replaced by expanding the pond to the southeast, and the pond will be maintained at its current 13-acre size.

To make more room for the Santa Ana River channel, the last 2,100 feet of the Huntington Beach (Talbert) channel will be realined to the ocean. This channel drains the low-lying areas to the west of the Santa Ana River. Realinement of the lower portion of the channel is necessary to widen the main Santa Ana channel. One third of the least tern sanctuary, about 1-1/2 acres, located in the Huntington Beach State Park, will have to be moved. This will be accomplished before channel changes are made to ensure that the least tern population is established in a new nesting site before being displaced from the old sanctuary.

The current nesting site is adjacent to the current Talbert Channel outlet to the sea. The new channel will cut the eastern-most 1-1/2 acres from this site. To ensure the terns are not seriously affected by this, their current site will be expanded in phases to the west prior to construction activities along the east side of the channel. The fenced protection will be extended to the west. Work

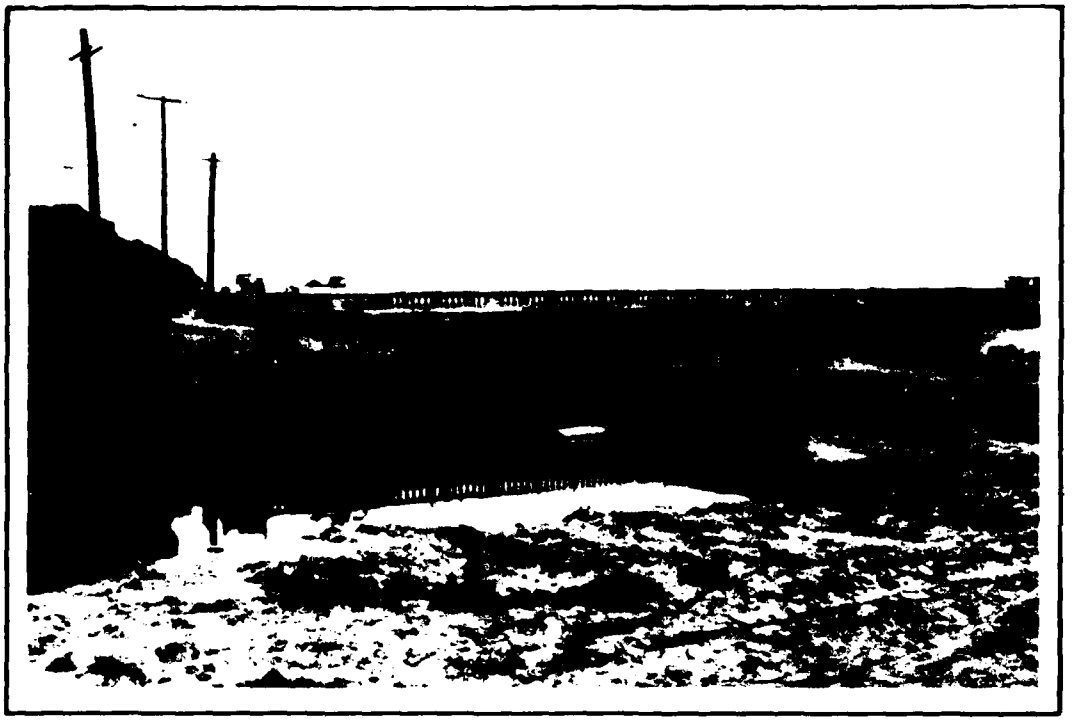


Photo 32: Tidal gate between the tidal channel adjacent to salt marsh and Greenville-Banning channel. Proposed enlarged tidal gate will improve tidal flushing between these water bodies.

will be carried out following the nesting season to avoid disturbing the colony at a critical time. During all work, the colony will be monitored to ensure that the terns are not being adversely affected by construction. U.S. Fish and Wildlife Service biologists believe that this plan can be implemented successfully.

Flood control plans for the salt marsh on the east side reach of the Santa Ana River will create additional possibilities for preserving two endangered species dependent on the area and for encouraging a proliferation of river wildlife. Flood control improvements between Victoria Street and Pacific Coast Highway in the City of Newport Beach will destroy approximately 8 of the 100 acres of salt marsh and adjacent upland, which is a remnant of the river's once-extensive tidal system. As mitigation, 8 acres of the salt marsh will be purchased. An additional 84 acres of salt marsh, adjacent waterway, and upland area will be purchased to preserve the endangered species. Studies made during project design stages will indicate appropriate measures for rejuvenating this marsh (revegetation or deepening tidal creeks to increase intertidal area). A more effective tide gate will be installed in the Greenville-Banning channel levee in an effort to improve tidal circulation in the wetland area.

The oil drilling and extraction facilities currently located in this marsh area will be allowed to remain in place and operation. Their direct impact on the marsh habitat has been evaluated and thier impact is not deemed serious enough to justify their removal at this time.

Floodflows in the lower Santa Ana channel can be expected to leave about 150,000 cubic yards of silt in the channel bed annually. This will accumulate as high-volume high-velocity flows are necessary to carry it to the ocean and these occur infrequently. Sediment will thus be excavated on an as-needed basis and used to replenish nearby beaches when appropriate.

During construction of the river channel, about 7.5 million cubic yards of sediment will be removed from the channel bed. This sediment, which without existing or future flood control measures would be deposited on the beach by floodflows, will be placed on neighboring beaches in Newport Beach if it is deemed suitable for such use. It is probable that up to 3.7 million cubic yards will meet beach replenishment standards. The rest will be disposed of in the gravel pits along Santiago Creek and along the Santa Ana River by Lincoln Avenue. More precise estimates of the amount of sediment to be moved will be made during Phase II study, and the exact method of disposal will be determined then also.

Santiago Creek

Santiago Creek (see figure 21), the largest tributary of the Santa Ana River in Orange County, cuts a course 28 miles long from the headwaters near mile-high Santiago Peak to its mouth at the Santa Ana River. The improvements along Santiago Creek will be directed toward

increasing the flood control capacity through the highly urbanized areas that would suffer the greatest flood damage. The plan of improvement consists of a detention reservoir formed in a gravel pit between Villa Park Road crossing and the Collins-Prospect Avenue crossing. Downstream, limited channel work will be done principally in two reaches, the first from Collins-Prospect to Walnut Avenue, and the other from downstream of the Santa Ana Freeway to the confluence with the Santa Ana River. The remainder of the existing channel is considered adequate to contain flows up to about 5,000 cubic feet per second without loss of structural integrity.

The gravel pits along Santiago Creek will serve as disposal pits for up to 4.5 million cubic yards of sediment excavated during construction of the project with up to 1.75 deposited in a pit near Lincoln Avenue along the Santa Ana River. Disposal methods will be further studied during Phase II.

The channel improvement will consist of rock-revetted side slopes. Native plant coverings will enhance the appearance.

Recreation and Esthetic Treatment: Mentone

Recreational facilities will be developed at Mentone Reservoir in a proposed 235-acre regional park site (see figure 12). The recreation plan will feature a 50-acre multipurpose recreation lake with a depth of 12 to 15 feet. Water-oriented opportunities will include shoreline fishing, non-power boating, and swimming. Approximately 30 percent of the lake's shoreline will be established as a fish and wildlife preserve. Much of this preserve will be developed as islands within the lake to minimize human encroachment. Access to the wildlife area will be limited. Other recreational facilities proposed include a swimming beach (5 acres), picnic area (80 acres), a recreation vehicle and primitive camping area (80 acres), and a multipurpose game area (10 acres). Equestrian, bicycle, and hiking trails will run throughout the site, connecting the parks. A 10-acre equestrian staging area and interpretive area will provide a base for riding and hiking trails into the surrounding areas. Much land will be retained as buffer for wildlife habitat protection and screening between recreational uses. The dam's west slope will be planted with drought-tolerant trees arranged between native rocks.

Recreation and Esthetic Treatment: Prado Dam

The recreation plan for Prado (see figure 14) calls for three separate park areas based on the potential boundaries of the three local jurisdictions within the Prado Reservoir: Riverside County, San Bernardino County, and the City of Corona. Under this plan there will be four lakes (from 15 to 40 acres, and approximately 12 feet deep) for shoreline fishing, non-power boating, and protected fish and wildlife habitat. Portions of each lake's shoreline would be reserved for wildlife use. There will also be 80 acres of picnic grounds, an 80-acre recreational vehicle and tent camping area, and a 20-acre multi-purpose

game area. Hiking, bicycle, and equestrian trails will link the recreational developments together. There will be a 350-acre wildlife management area. Finally, the Santa Ana River Project Visitor Center will be built near the dam, will be accessible from all trails and from the Corona Freeway, and will contain information about the project.

An alternative plan to provide maximum recreational use of the basin would be based on development of a 400-acre lake instead of the 4 small lakes. This plan was studied but is not presently recommended because of high costs and adverse environmental impacts. All other features would be similar to the recommended plan.

For esthetic treatment in Prado Reservoir, buffer zones will be established in some areas and the remaining reservoir lands will be retained as natural buffer.

Recreation and Esthetic Treatment: Lower Santa Ana River

A bicycle, hiking and equestrian trail will be developed from Prado Dam through the Santa Ana Canyon to Imperial Highway. A 2.5-mile existing section of bicycle trail along Green River Golf Course will be retained as a part of this 9-mile trail. Since most of the lower Santa Ana River trails and bridge underpasses will be destroyed from the proposed channel rebuilding and widening, the tunnels under the bridge approaches will be replaced and the proposed project service roads and tunnels will double as the new bicycle paths. Equestrian trails will be located adjacent to the paved service road. Two bicycle bridges will be included for crossing the channel. In addition, the trail system will include twenty bicycle accessways and three bicycle staging areas to serve approximately 33 miles of new or reconstructed bike paths. Two equestrian staging areas and three trail rest areas will support 32 miles of new or rebuilt equestrian trails. See figures 16, 17, 18, 19, and 20 for the general route of these trails and for the location of the staging and the rest areas. Existing recreation trails in this area were at least partially funded under the Land and Water Conservation Fund Act of 1965 which requires that projects thus funded cannot be converted to other uses without approval of the Secretary of the Interior. In building flood control improvements along the lower river reach the trails are not being converted to other uses but are, rather, being moved a few dozen feet. Nevertheless, the local sponsors must coordinate closely with the Department of the Interior on plans for recreation in this area.

Esthetic treatment in the form of landscaping for shade and screening will be developed along the trail and in staging and rest areas along the trail system.

Recreation and Esthetic Treatment: Santiago Creek

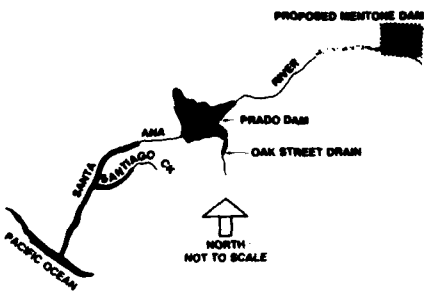
The recreation plan calls for a 1.7 mile bicycle, hiking, and equestrian trail from Villa Park Road to Walnut Avenue. The plan also includes a bicycle staging area. The area along the trail will be

landscaped. However, in the Phase II planning process, further study will investigate whether, in light of the reformulated plan, the recommended recreation plan could be expanded to the recreation plan developed in the Orange County 1977 "Specific Plan for Lower Santiago Creek." This plan calls for a recreational lake for fishing, non-power boating and such park activities as day camping, game courts and sports fields as well as the recreation trails and support facilities discussed above in the current recommended recreation plan within the gravel pits between Villa Park Road and Walnut Avenue.

TABLE 18. SANTA ANA RIVER TRAILS SUPPORT FACILITIES

Project Area	Quantity
Santa Ana Canyon	
Rest Stop	2
Equestrian Staging Area	1
Bicycle Staging Area	0
Santa Ana River Main Stem	
Rest Stop	1
Equestrian Staging Area	2
Bicycle Staging Area	0
Santiago Creek	
Rest Stop	0
Equestrian Staging Area	1
Bicycle Staging Area	1

KEY



LEGEND

— — — —	PROJECT RIGHT OF WAY
—1335— TO —1540—	FINISH CONTOUR LINES

SCALE

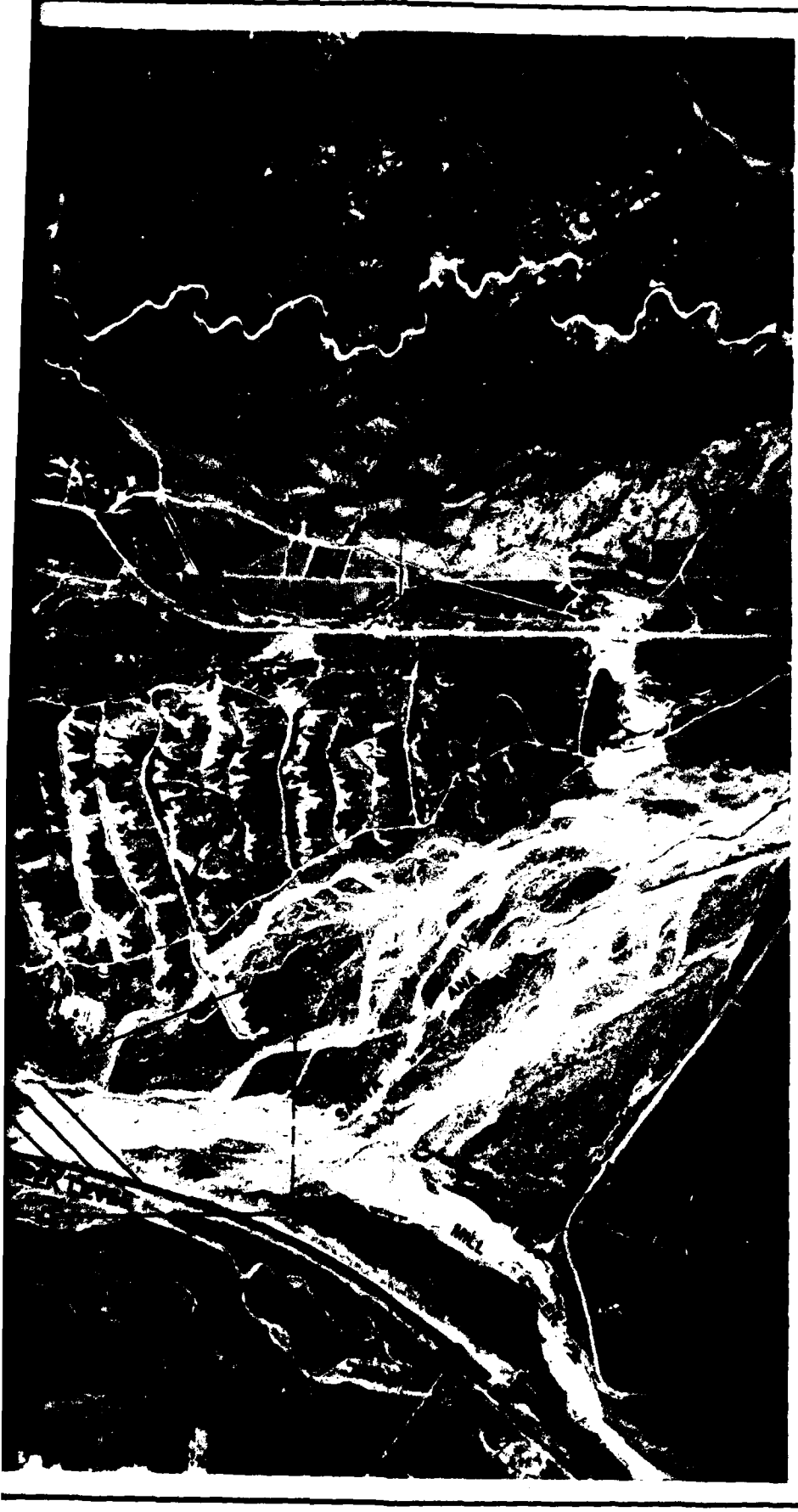
1000′ 0 1000′

SANTA ANA RIVER AND RESERVOIR
PHASE I
GENERAL DESIGN MEMORANDUM
MENTONE DAM AND RESERVOIR
RECOMMENDED PLAN
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

S-165

FIGURE 11


PROPOSED MILL CREEK LEVEE



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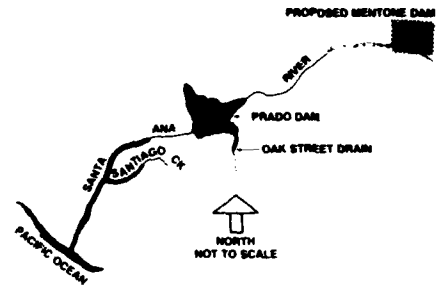


LEGEND

HIKING AND RIDING TRAIL

RECREATION ROAD

SCALE

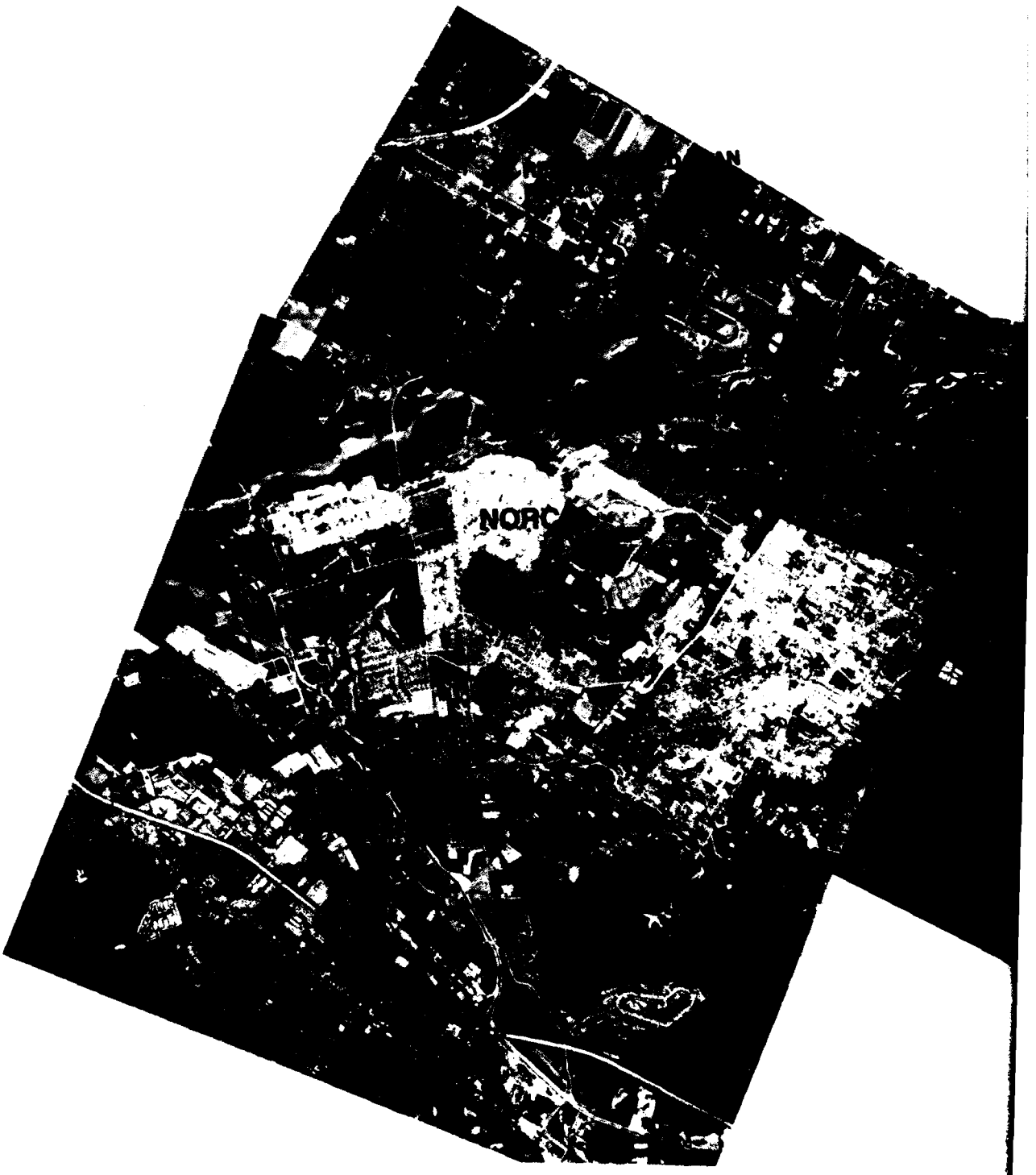
1000' 0 1000'

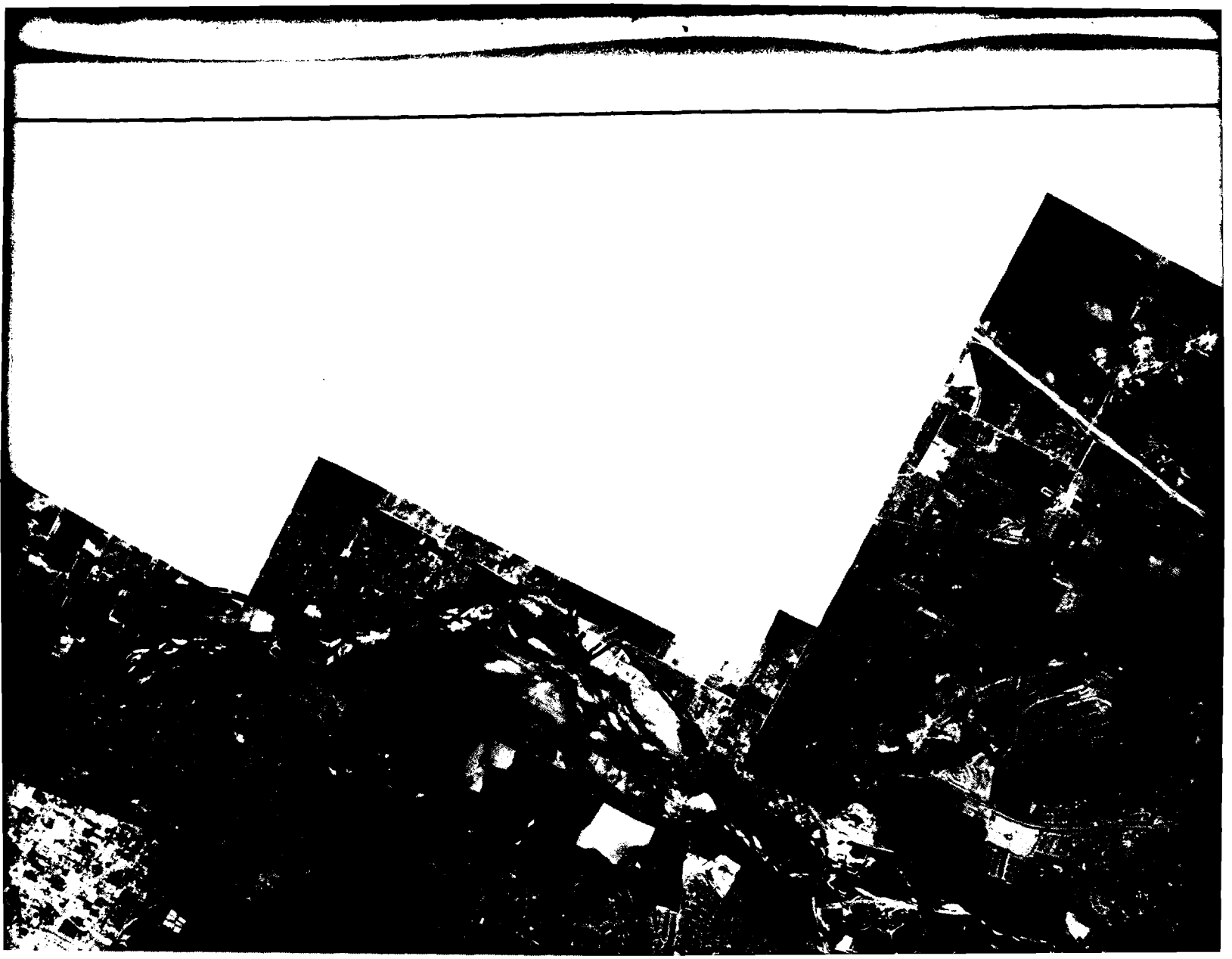
SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
MENTONE DAM AND RESERVOIR
RECOMMENDED RECREATION PLAN
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

S-184

FIGURE 12

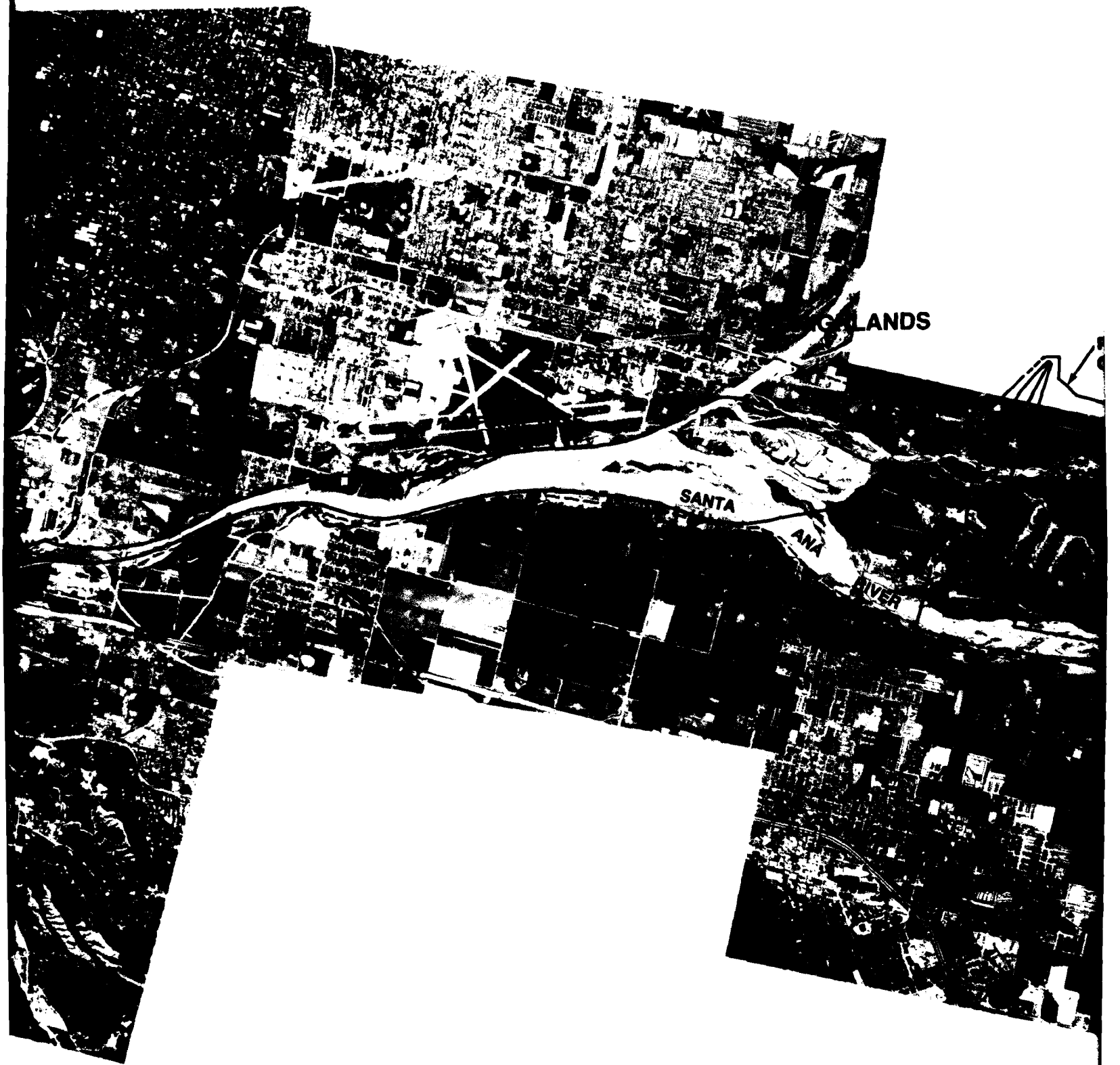
L 1 3

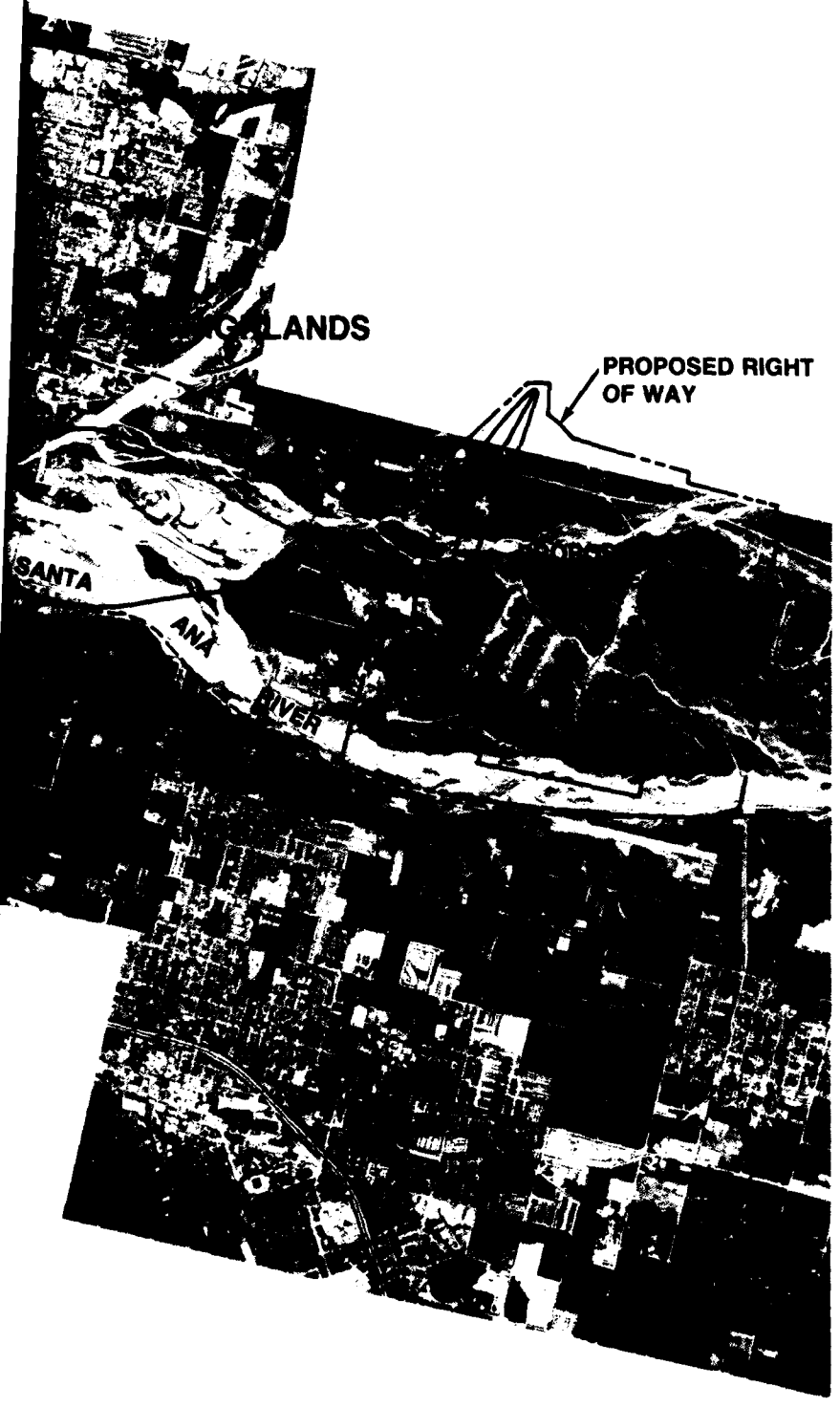

NORC



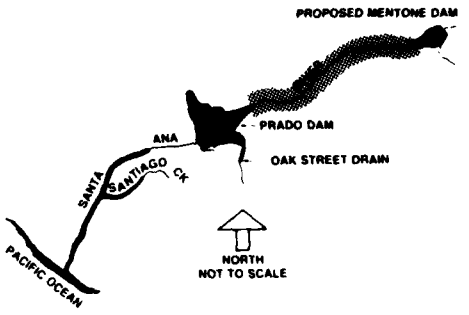
S-162

COLTON
RIVER
RR


LANDS
SANTA
ANA
RIVER



KEY



LEGEND

—— STANDARD PROJECT FLOOD WITH PROJECT

- - - STANDARD PROJECT FLOOD WITHOUT PROJECT

SCALE

1 ½ 0 1

MILES

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
MENTONE-PRADO

RECOMMENDED PLAN

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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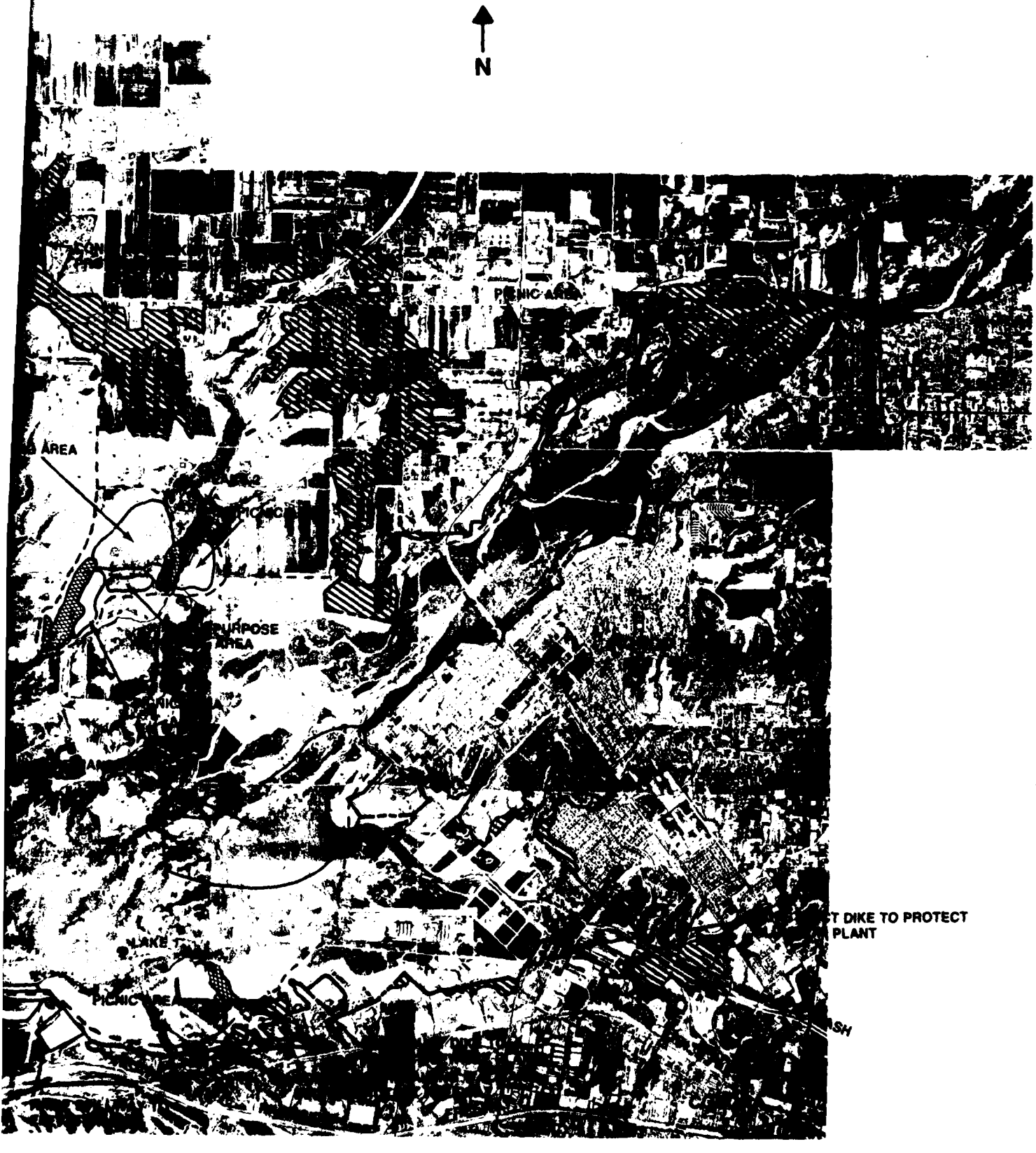
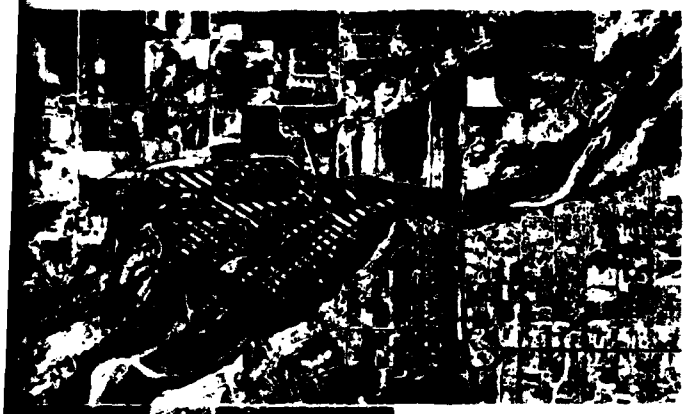
FIGURE


CAMPING AREA
PICNIC AREA

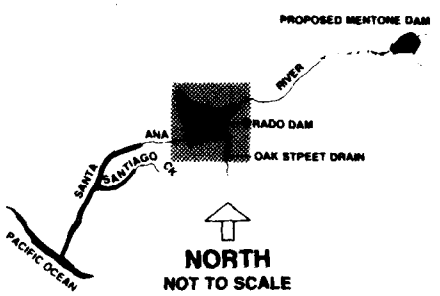

N
PICNIC AREA
AREA
PURPOSE
AREA
LAKE
PICNIC AREA
T DIKE TO PROTECT
PLANT
SH



T DIKE TO PROTECT
PLANT

SH

KEY



LEGEND

EXISTING RESERVOIR TAKING LINE

RESERVOIR EXPANSION AREA

RECREATIONAL LAKE

RECREATIONAL TRAIL

SCALE

0 5000'

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDIUM
PRADO DAM AND RESERVOIR
RECOMMENDED PLAN
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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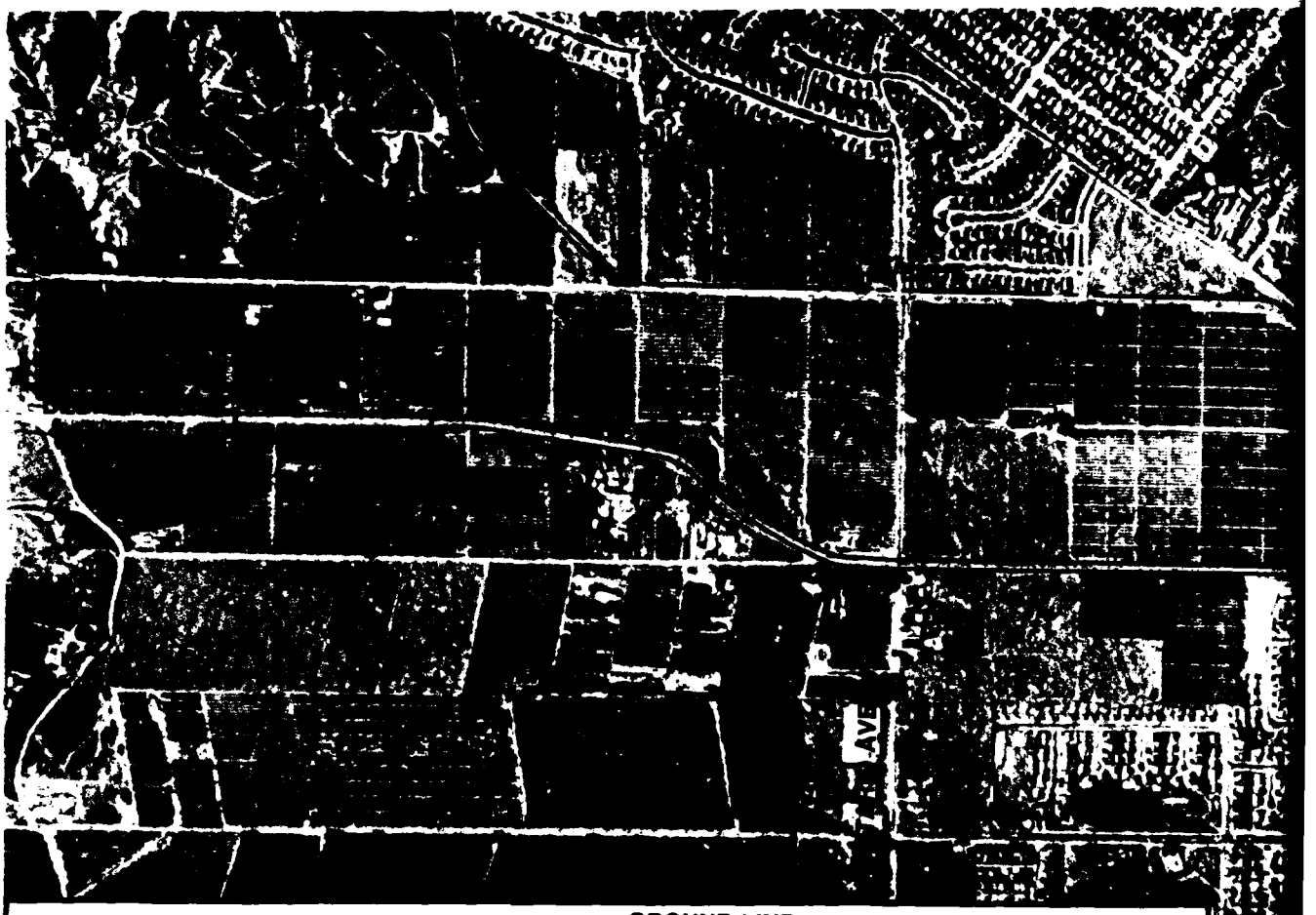
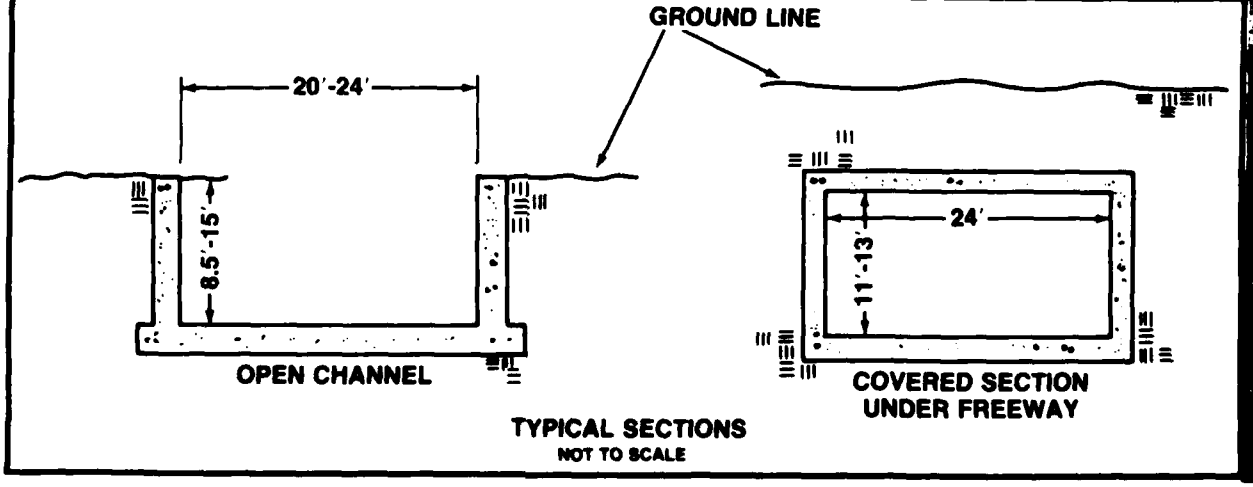
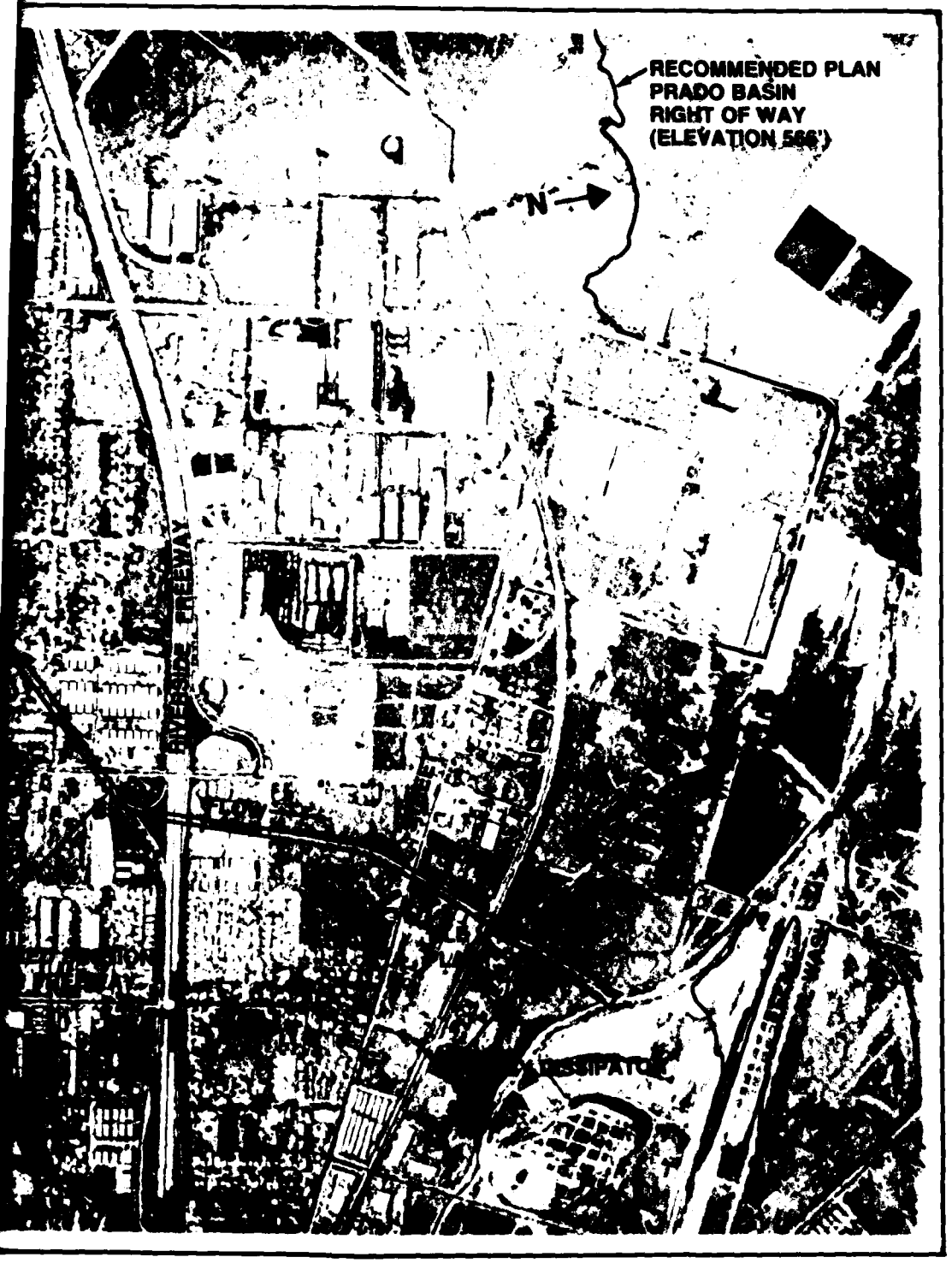
FIGURE 14





TYPICAL SECTIONS
NOT TO SCALE


AVENUE
DRAIN
HIGH
CHANNEL
RIVERSIDE FREEWAY
FLOW
N



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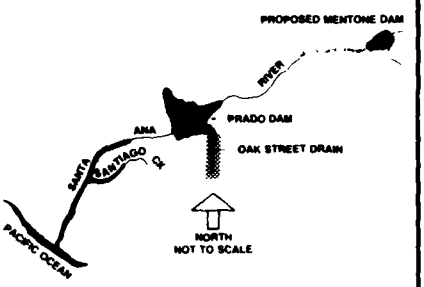

LEGEND

PROJECT RIGHT OF WAY

1000 0 1000

FEET

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
OAK STREET DRAIN
RECOMMENDED PLAN
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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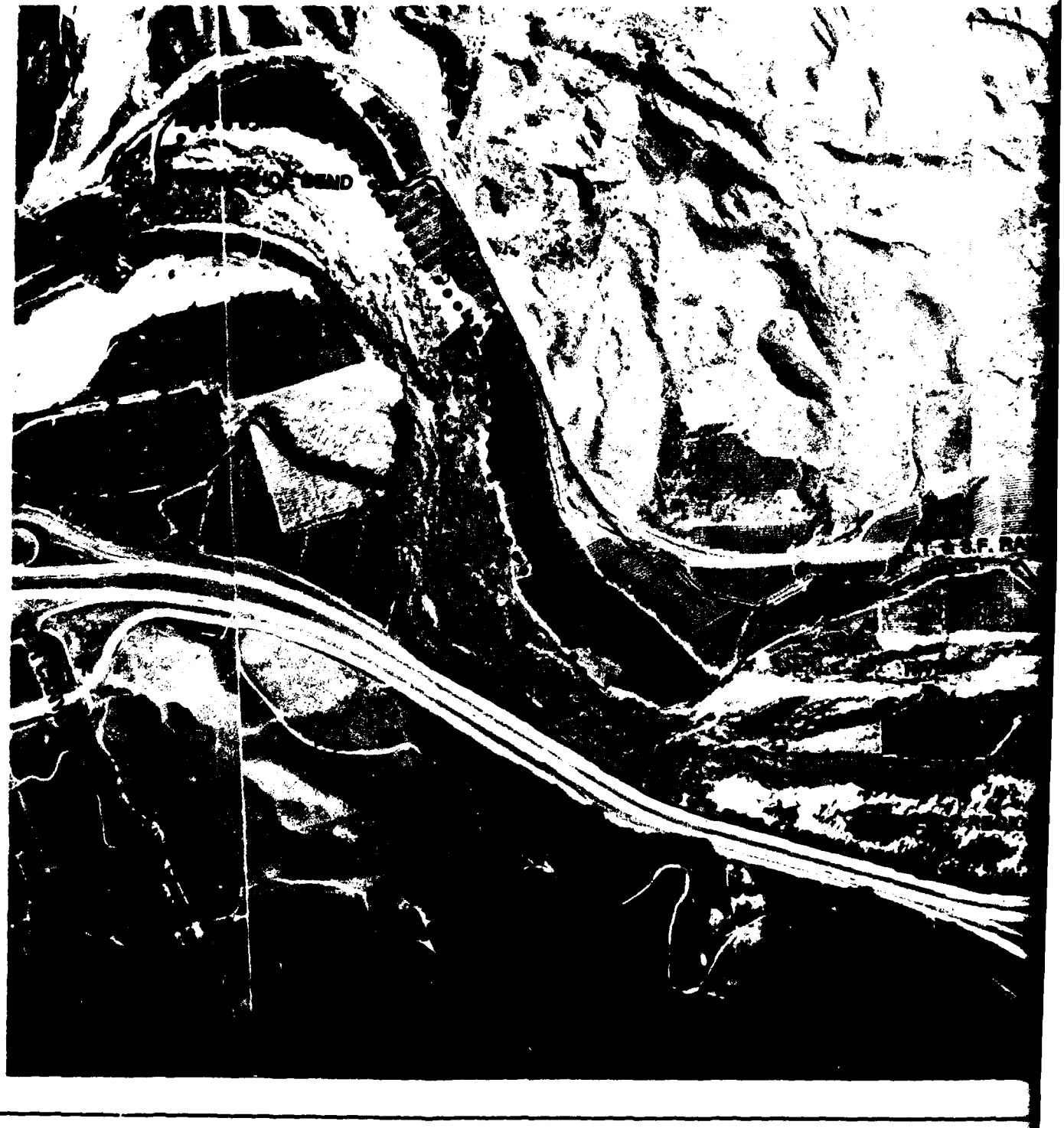
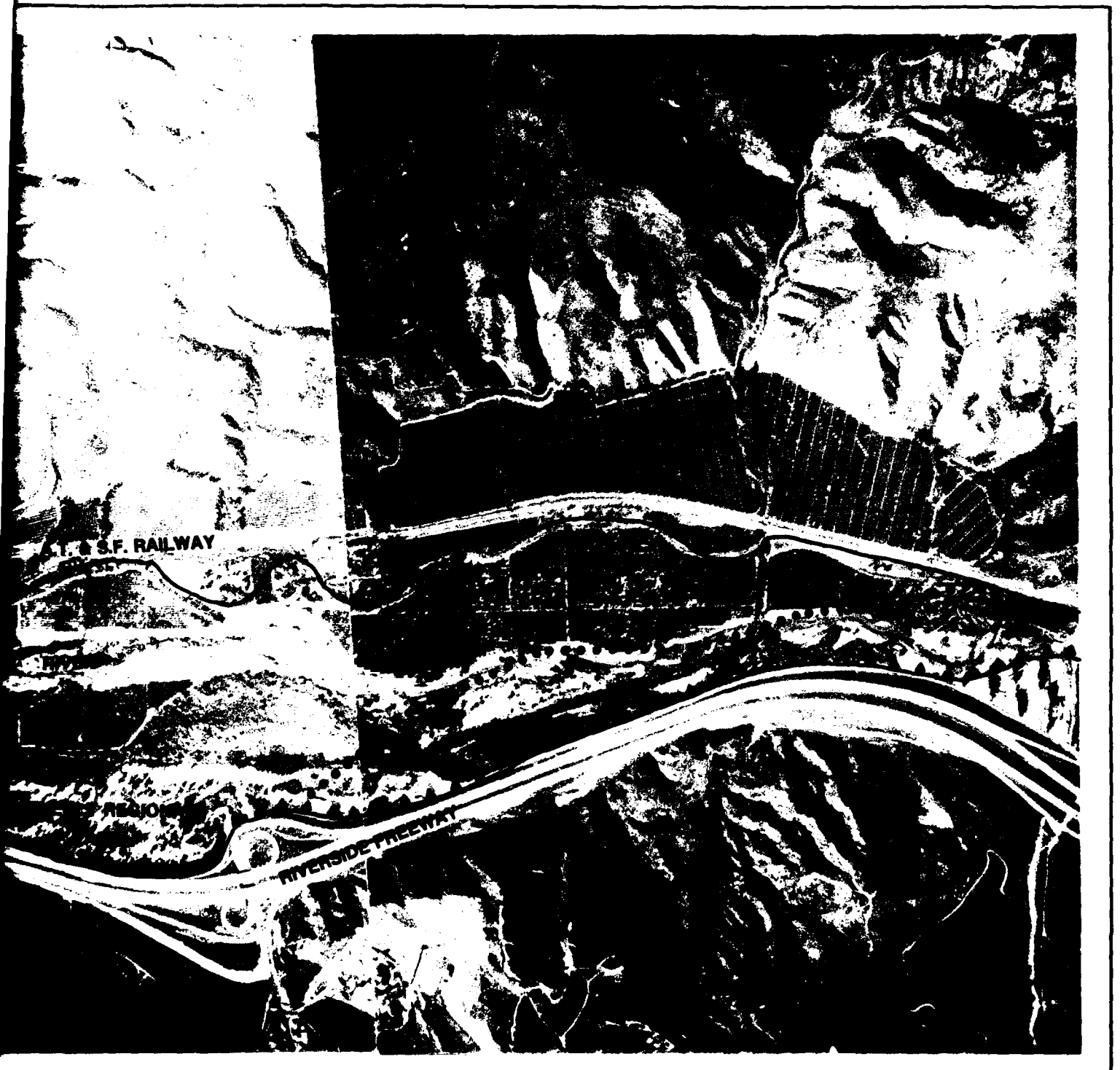
FIGURE 15

2 1 3





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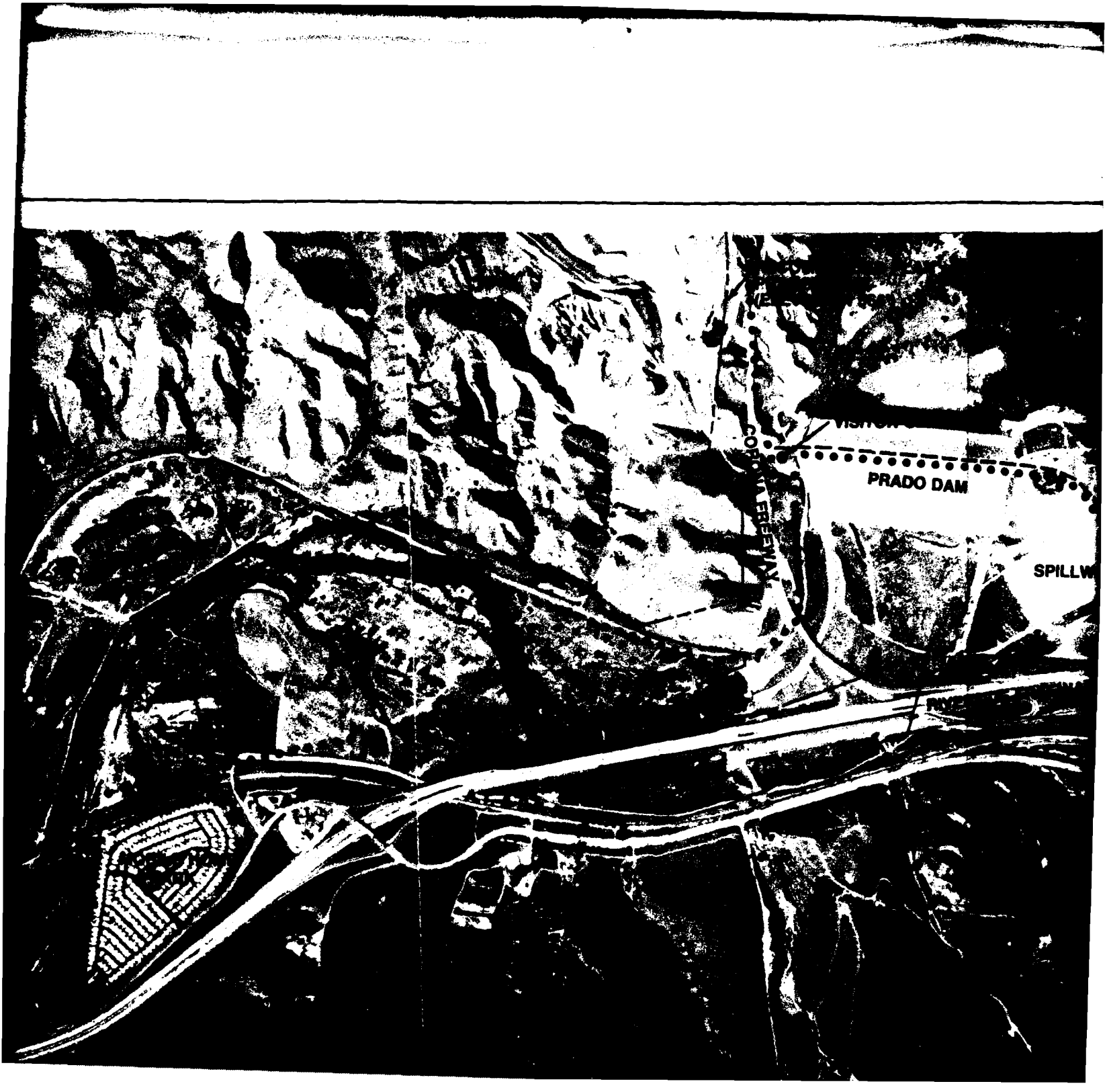
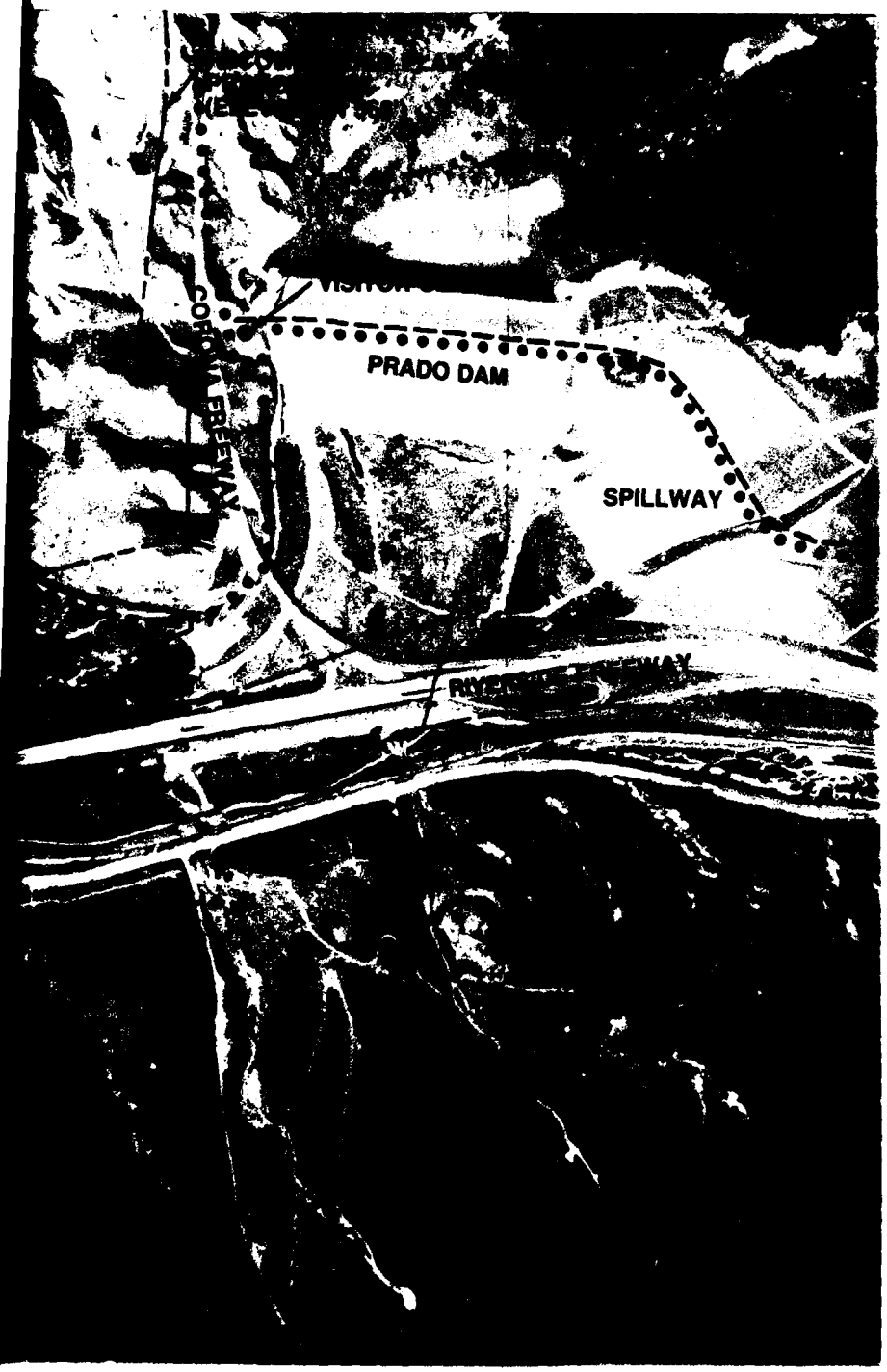
2


PRADO DAM
SPILLW



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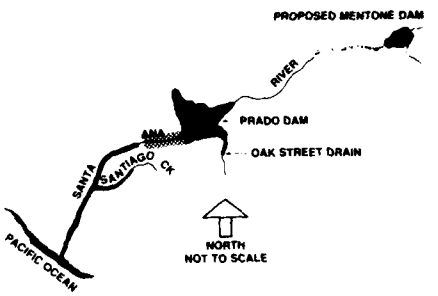

LEGEND

- PROJECT RIGHT OF WAY
- PROPOSED PROJECT TRAIL
- EXISTING TRAIL
- PROPOSED STAGING AREA
- PROPOSED REST STOP

1000 0 1000
FEET

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
SANTA ANA CANYON
(PRADO DAM TO WEIR CANYON ROAD)
RECOMMENDED PLAN
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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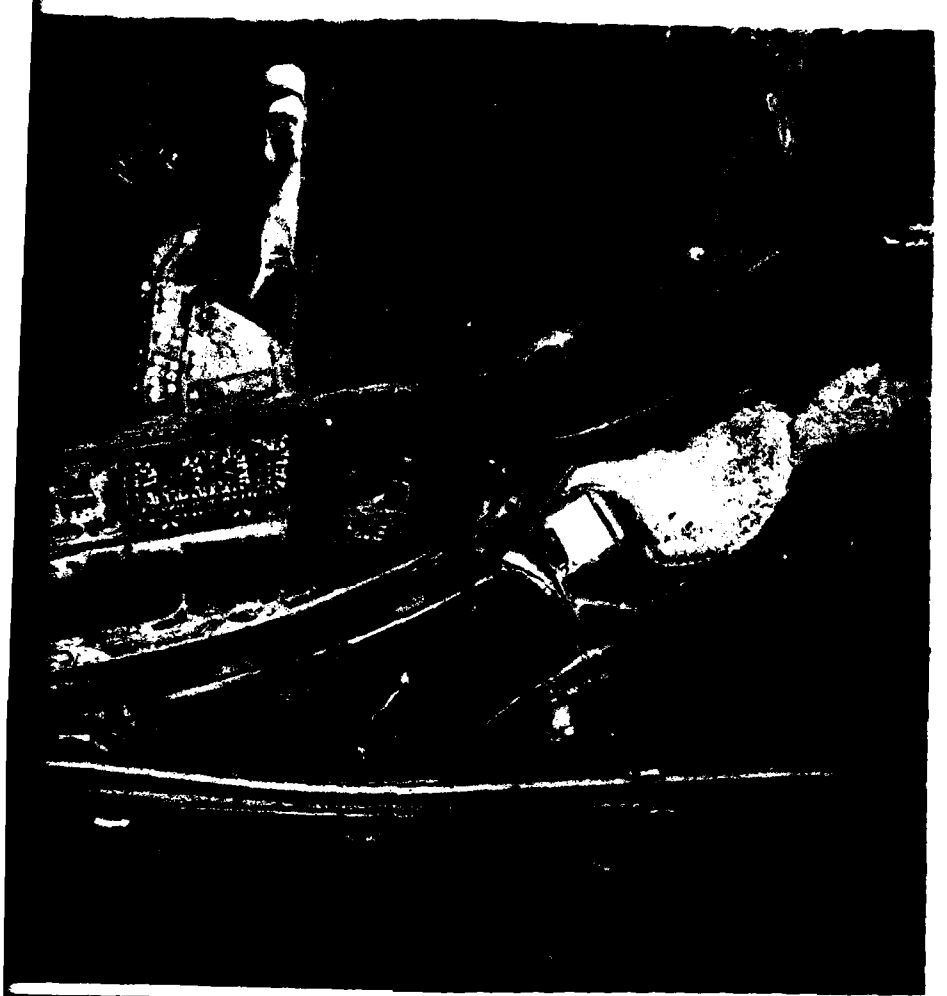
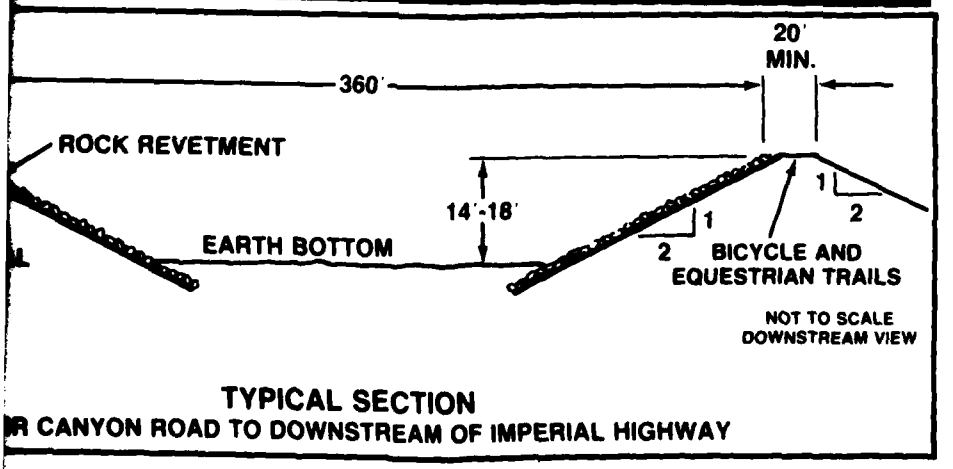
FIGURE 16

2 1 3

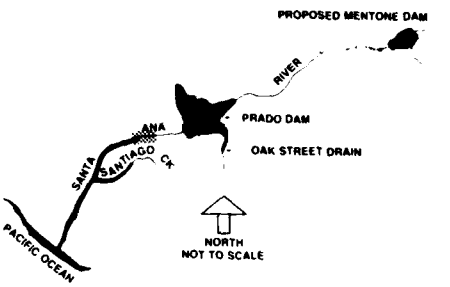
PENNSYLVANIA AVENUE





TYPICAL SECTION
R CANYON ROAD TO DOWNSTREAM OF IMPERIAL HIGHWAY

KEY



LEGEND

- PROJECT RIGHT OF WAY
- EXISTING DROP STRUCTURE/ STABILIZER
- PROPOSED DROP STRUCTURE/ STABILIZER
- • • • PROPOSED PROJECT TRAIL
- — — REPLACEMENT TRAIL
- ⊙ PROPOSED REST STOP

SCALE
1000 0 1000
FEET

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
WEIR CANYON ROAD TO
IMPERIAL HIGHWAY
RECOMMENDED PLAN
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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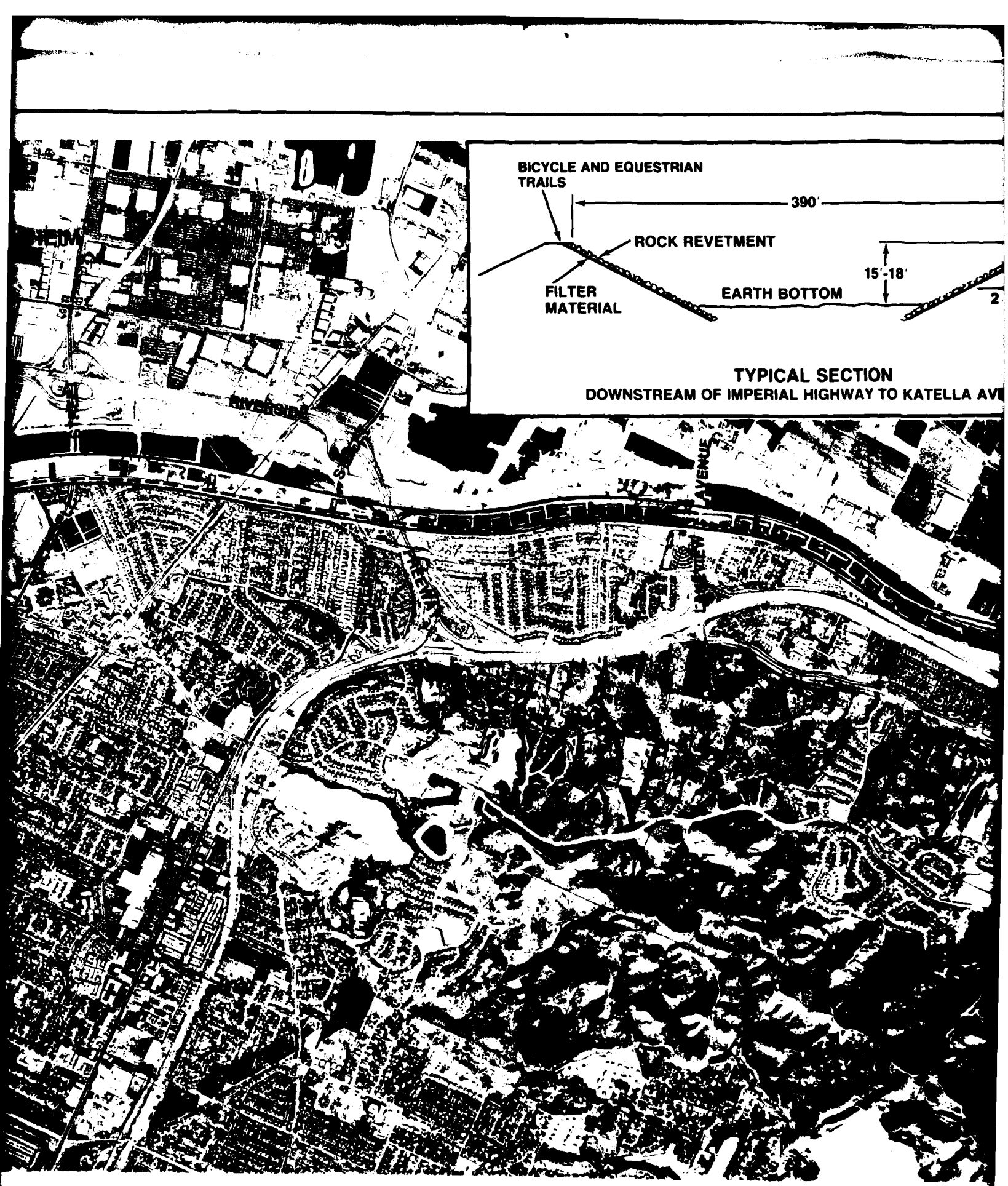
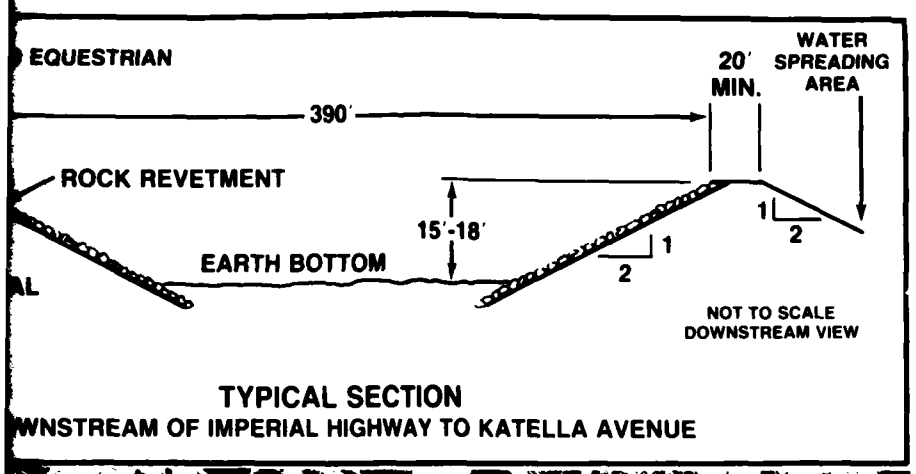
FIGURE 17

2 1 3

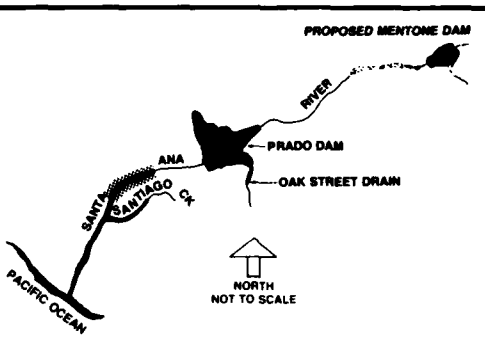
N
ANAHEIM
OAK ROAD
ORANGE FREEWAY


BICYCLE AND EQUESTRIAN TRAILS
390'
ROCK REVETMENT
15'-18'
FILTER MATERIAL
EARTH BOTTOM
2
TYPICAL SECTION
DOWNSTREAM OF IMPERIAL HIGHWAY TO KATELLA AVE
AVENUE
FREEWAY



TYPICAL SECTION
WNSTREAM OF IMPERIAL HIGHWAY TO KATELLA AVENUE

KEY



LEGEND

- PROJECT RIGHT OF WAY
- PROPOSED DROP STRUCTURE/ STABILIZER
- EXISTING DROP STRUCTURE/ STABILIZER
- REPLACEMENT TRAIL
- PROPOSED STAGING AREA

SCALE

0 ½ 1

MILE

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
LOWER SANTA ANA RIVER
(IMPERIAL HIGHWAY - KATELLA AVE)
RECOMMENDED PLAN
U.S. ARMY OF ENGINEERS
LOS ANGELES DISTRICT

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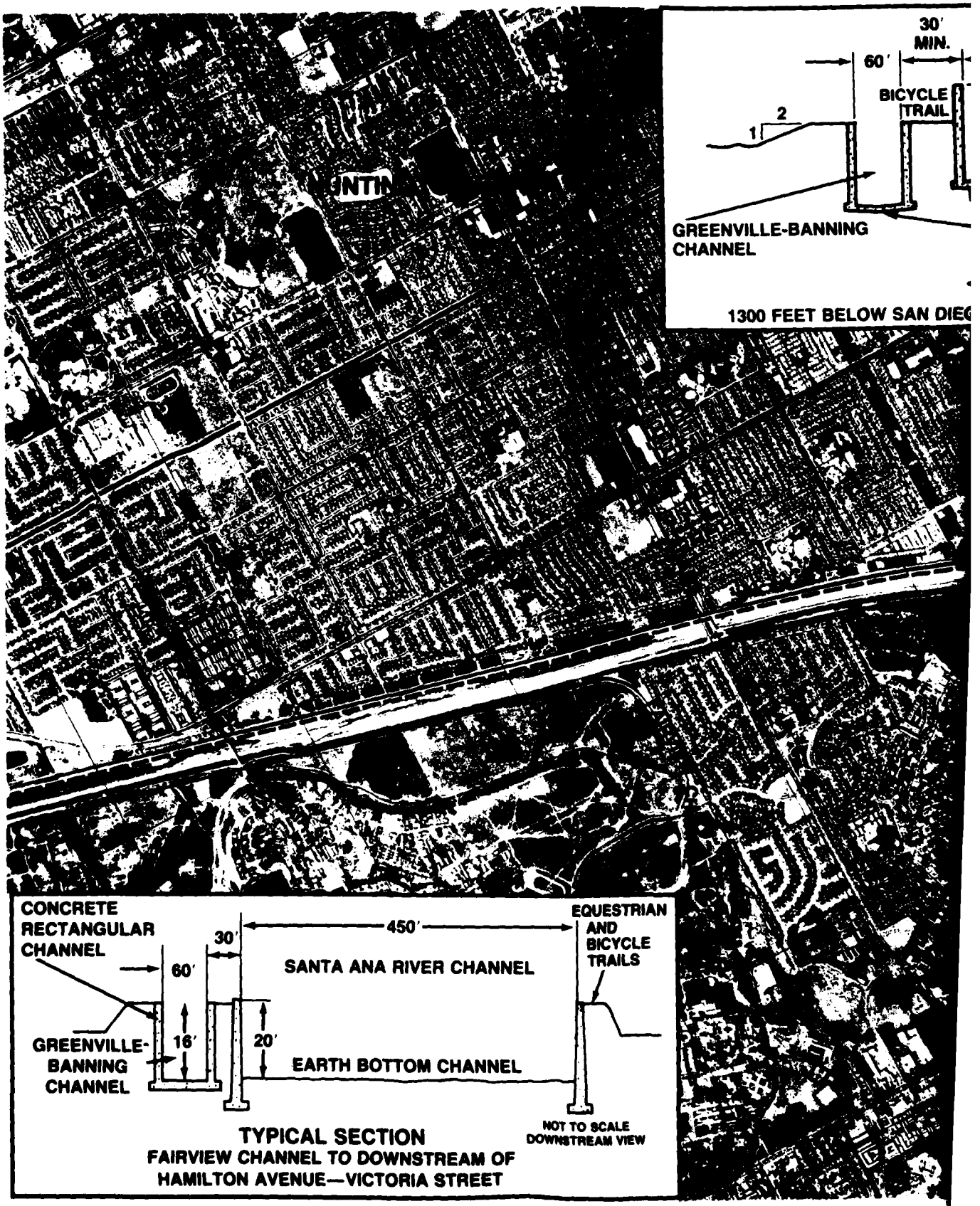
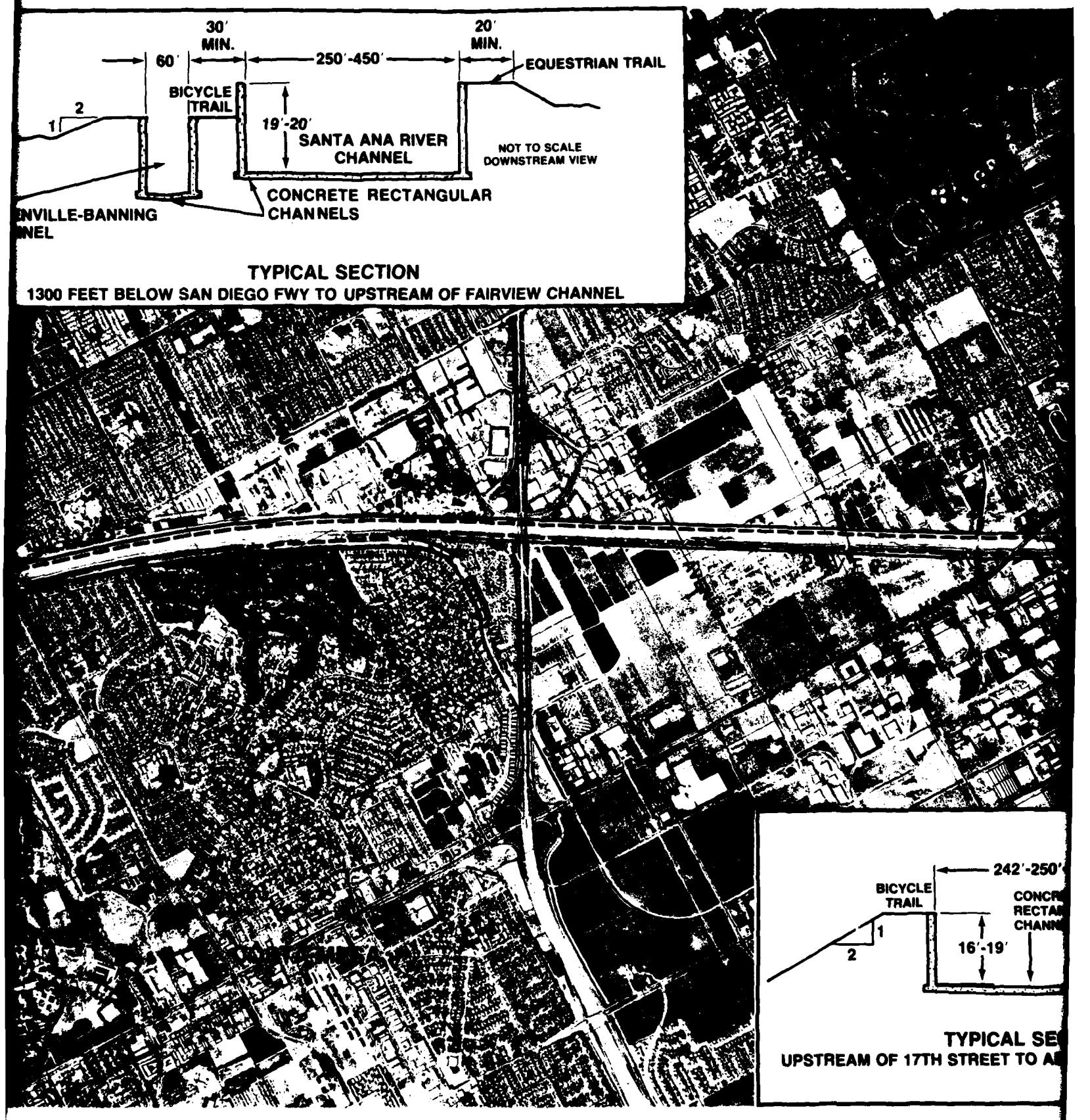
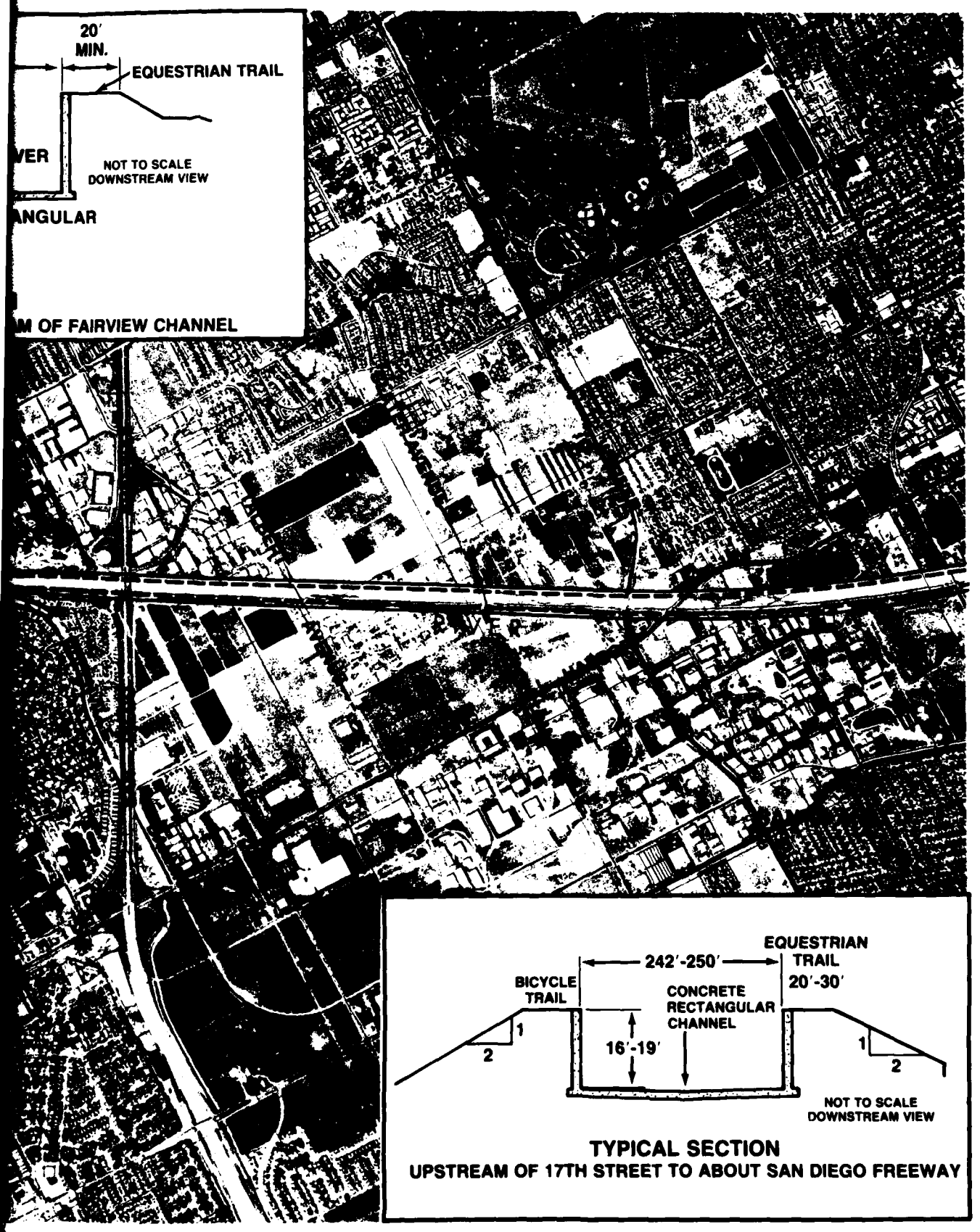
3

FIGURE 18



TYPICAL SECTION
FAIRVIEW CHANNEL TO DOWNSTREAM OF HAMILTON AVENUE—VICTORIA STREET

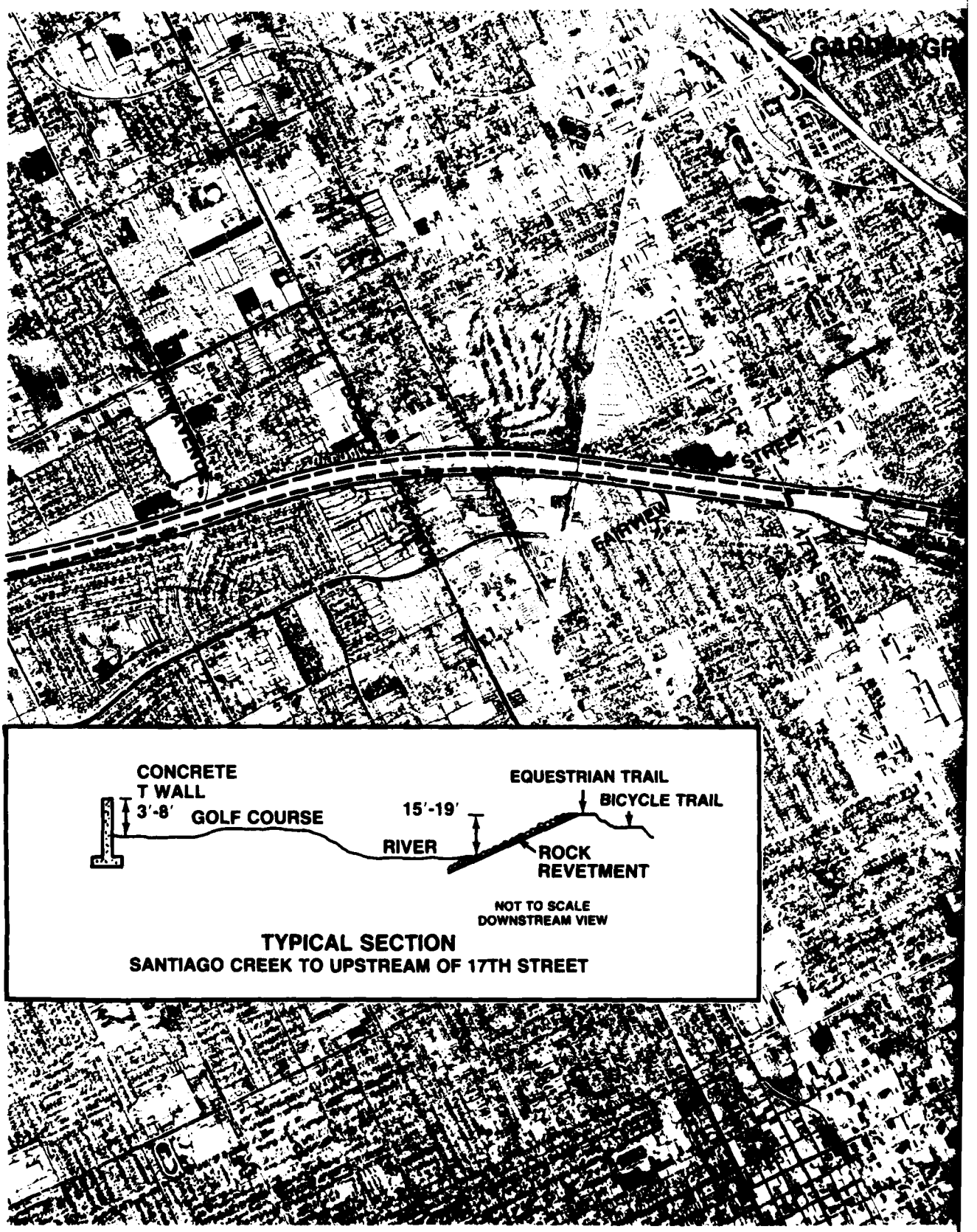

30'
MIN.
20'
MIN.
60'
250'-450'
EQUESTRIAN TRAIL
BICYCLE
TRAIL
2
1
19'-20'
SANTA ANA RIVER
CHANNEL
NOT TO SCALE
DOWNSTREAM VIEW
CONCRETE RECTANGULAR
CHANNELS
NVILLE-BANNING
NEL
TYPICAL SECTION
1300 FEET BELOW SAN DIEGO FWY TO UPSTREAM OF FAIRVIEW CHANNEL
242'-250'
BICYCLE
TRAIL
1
2
16'-19'
TYPICAL SE
UPSTREAM OF 17TH STREET TO A

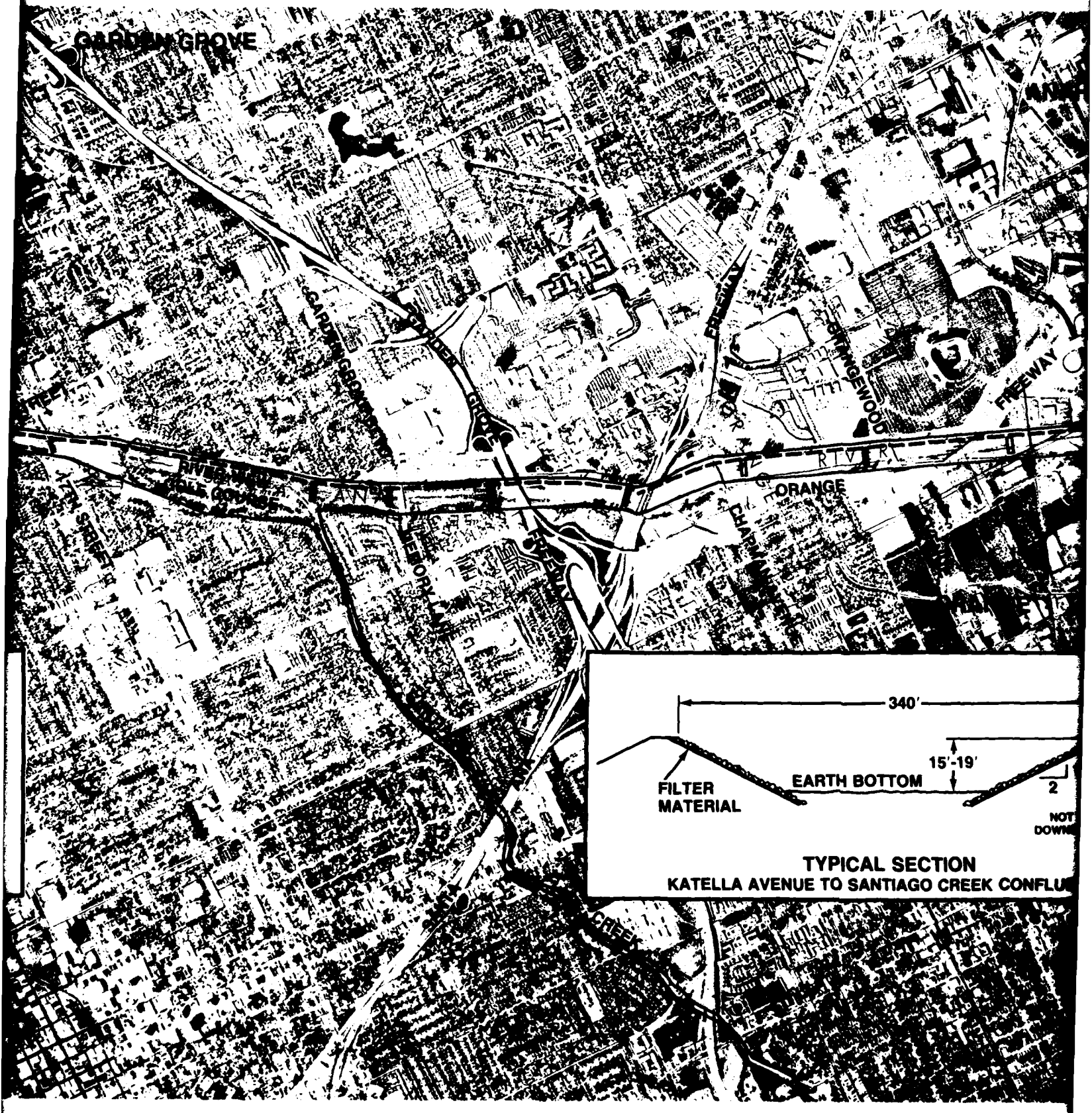


TYPICAL SECTION
UPSTREAM OF 17TH STREET TO ABOUT SAN DIEGO FREEWAY

S-160

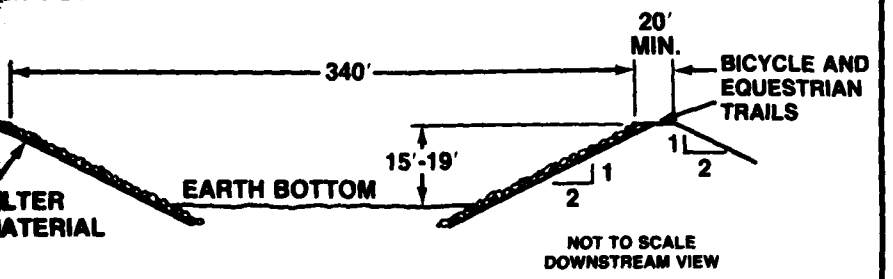
2 1 3


CONCRETE
T WALL
3'-8'
GOLF COURSE
15'-19'
RIVER
EQUESTRIAN TRAIL
BICYCLE TRAIL
ROCK
REVETMENT
NOT TO SCALE
DOWNSTREAM VIEW
TYPICAL SECTION
SANTIAGO CREEK TO UPSTREAM OF 17TH STREET



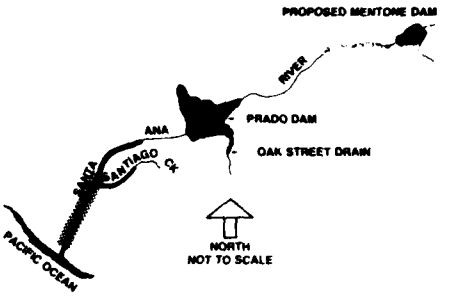
TYPICAL SECTION
KATELLA AVENUE TO SANTIAGO CREEK CONFLU

2



TYPICAL SECTION
KATELLA AVENUE TO SANTIAGO CREEK CONFLUENCE

KEY



LEGEND

- PROJECT RIGHT OF WAY
- PROPOSED DROP STRUCTURE/ STABILIZER
- EXISTING DROP STRUCTURE/ STABILIZER
- REPLACEMENT TRAIL
- PROPOSED REST STOP
- PROPOSED STAGING AREA

SCALE
0 ½ 1
MILE

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
LOWER SANTA ANA RIVER
(KATELLA AVE. TO
HAMILTON - VICTORIA BRIDGE)
RECOMMENDED PLAN
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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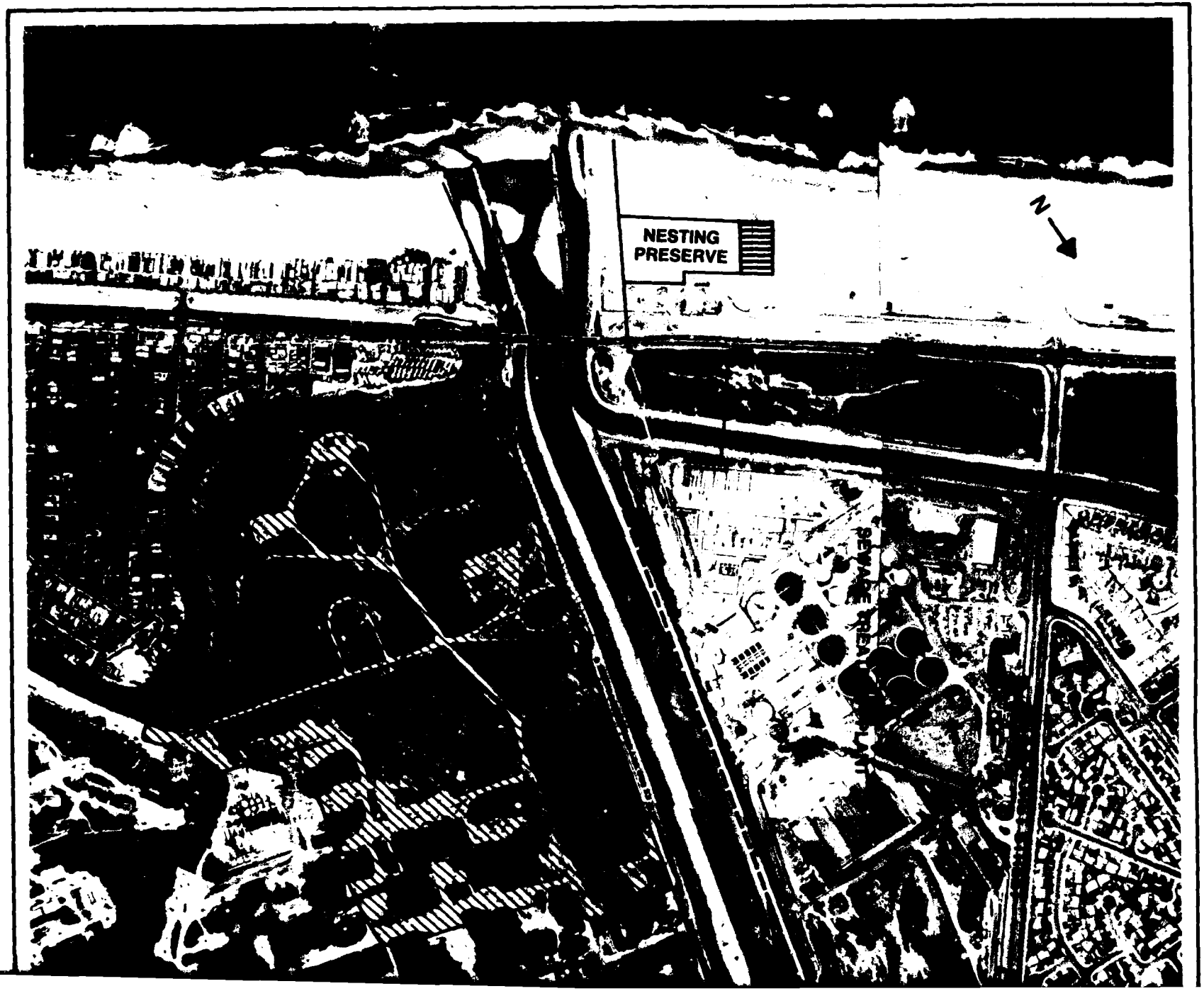
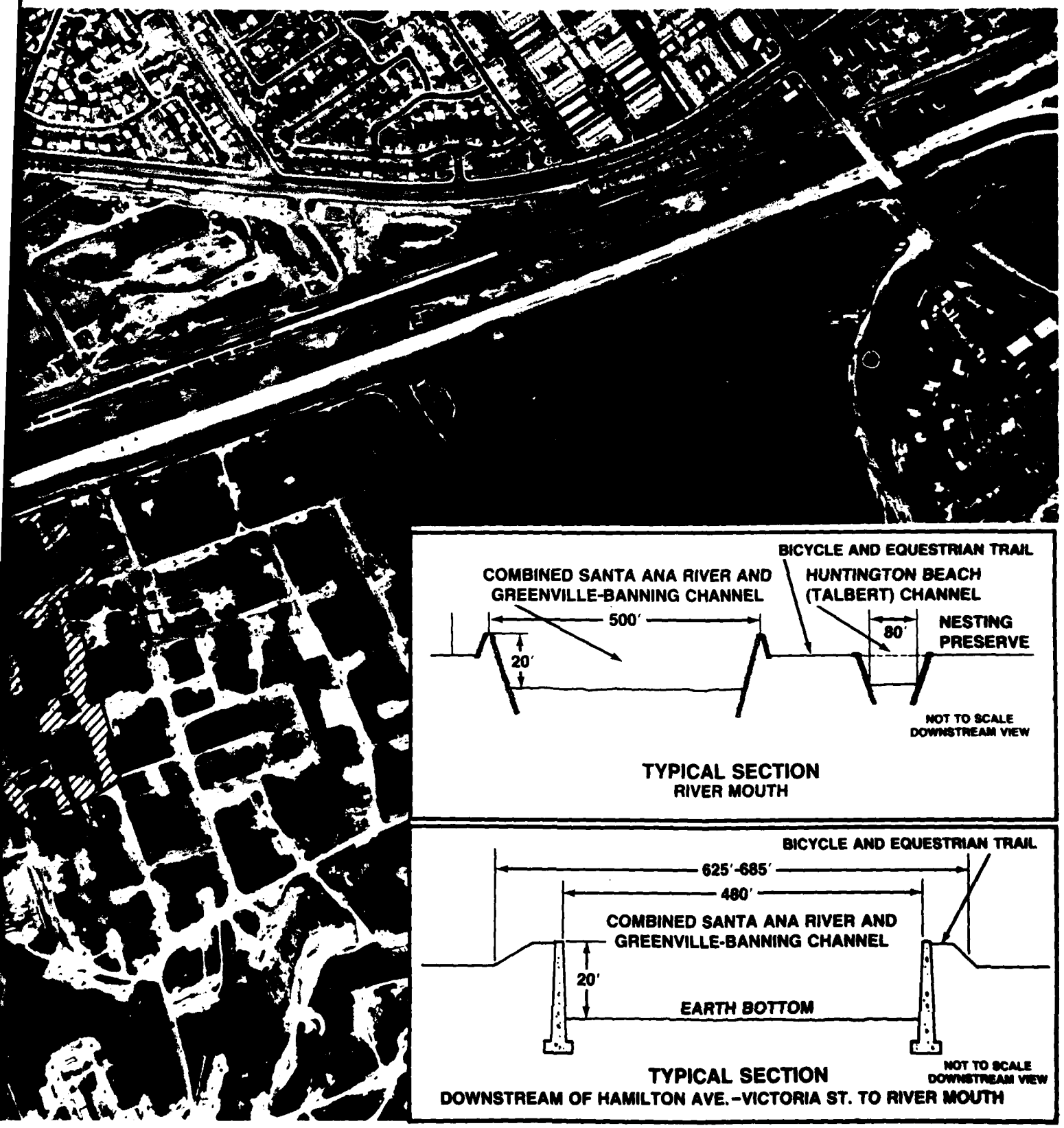
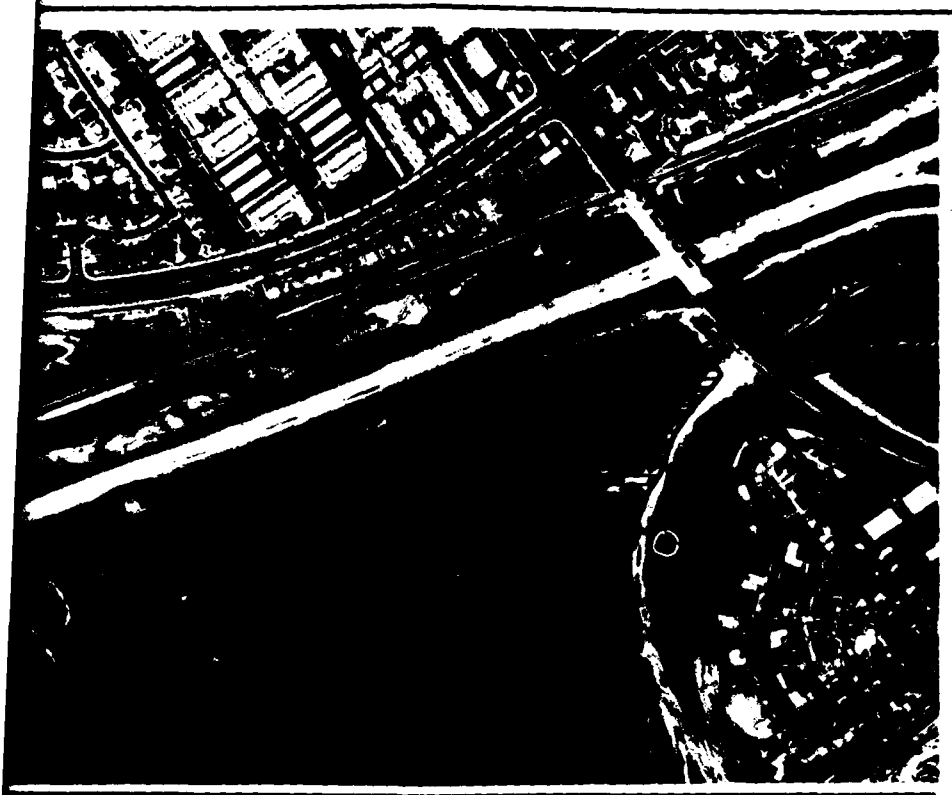
FIGURE 19

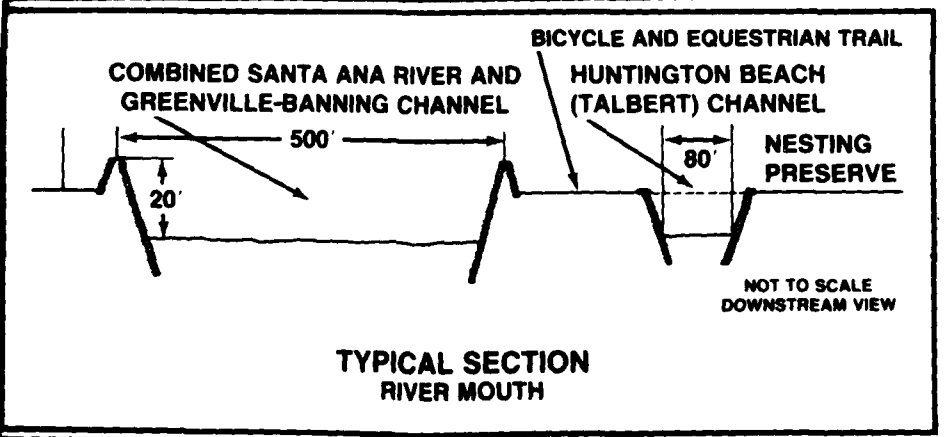

NESTING
PRESERVE
N



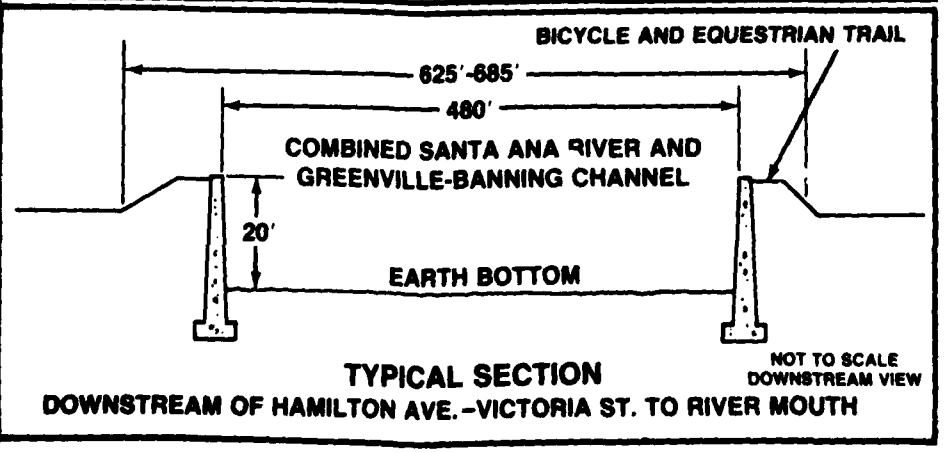
TYPICAL SECTION
RIVER MOUTH

TYPICAL SECTION
DOWNSTREAM OF HAMILTON AVE.–VICTORIA ST. TO RIVER MOUTH



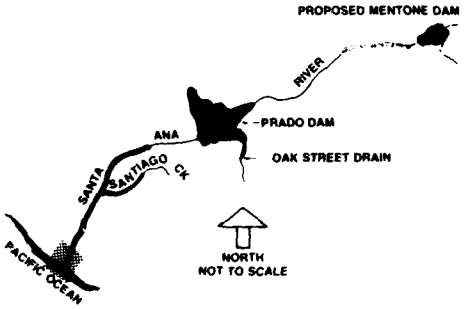


TYPICAL SECTION
RIVER MOUTH



TYPICAL SECTION
DOWNSTREAM OF HAMILTON AVE.-VICTORIA ST. TO RIVER MOUTH

KEY



LEGEND

- PROJECT RIGHT OF WAY
- PROPOSED MARSH RESTORATION
- MITIGATION FOR NESTING PRESERVE DAMAGE
- MITIGATION FOR VICTORIA POND DAMAGE
- REPLACEMENT TRAIL

SCALE
500 0 500
FEET

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
SANTA ANA RIVER MOUTH
(HAMILTON AVE - VICTORIA STREET TO THE OCEAN)

RECOMMENDED PLAN

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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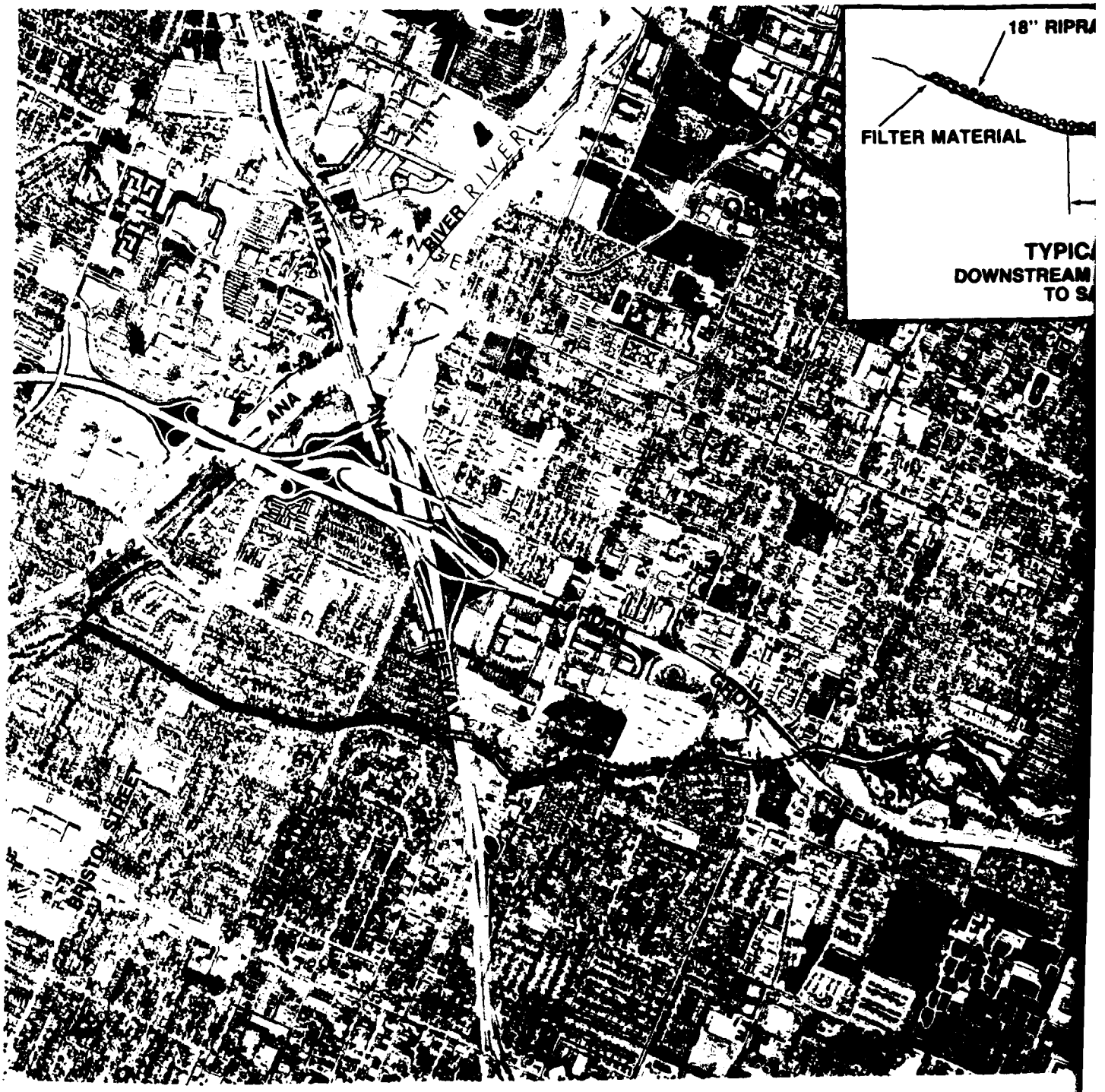
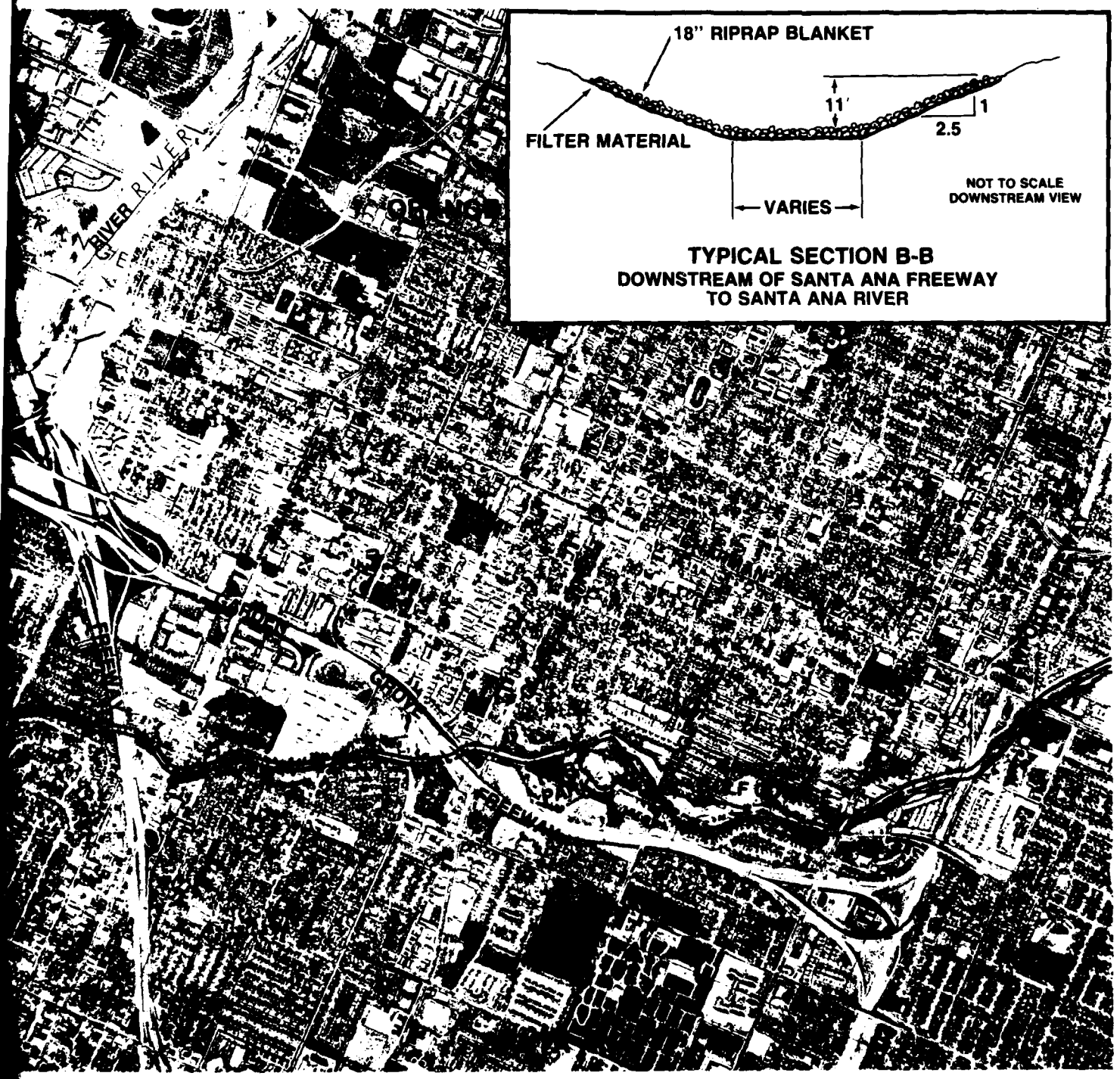
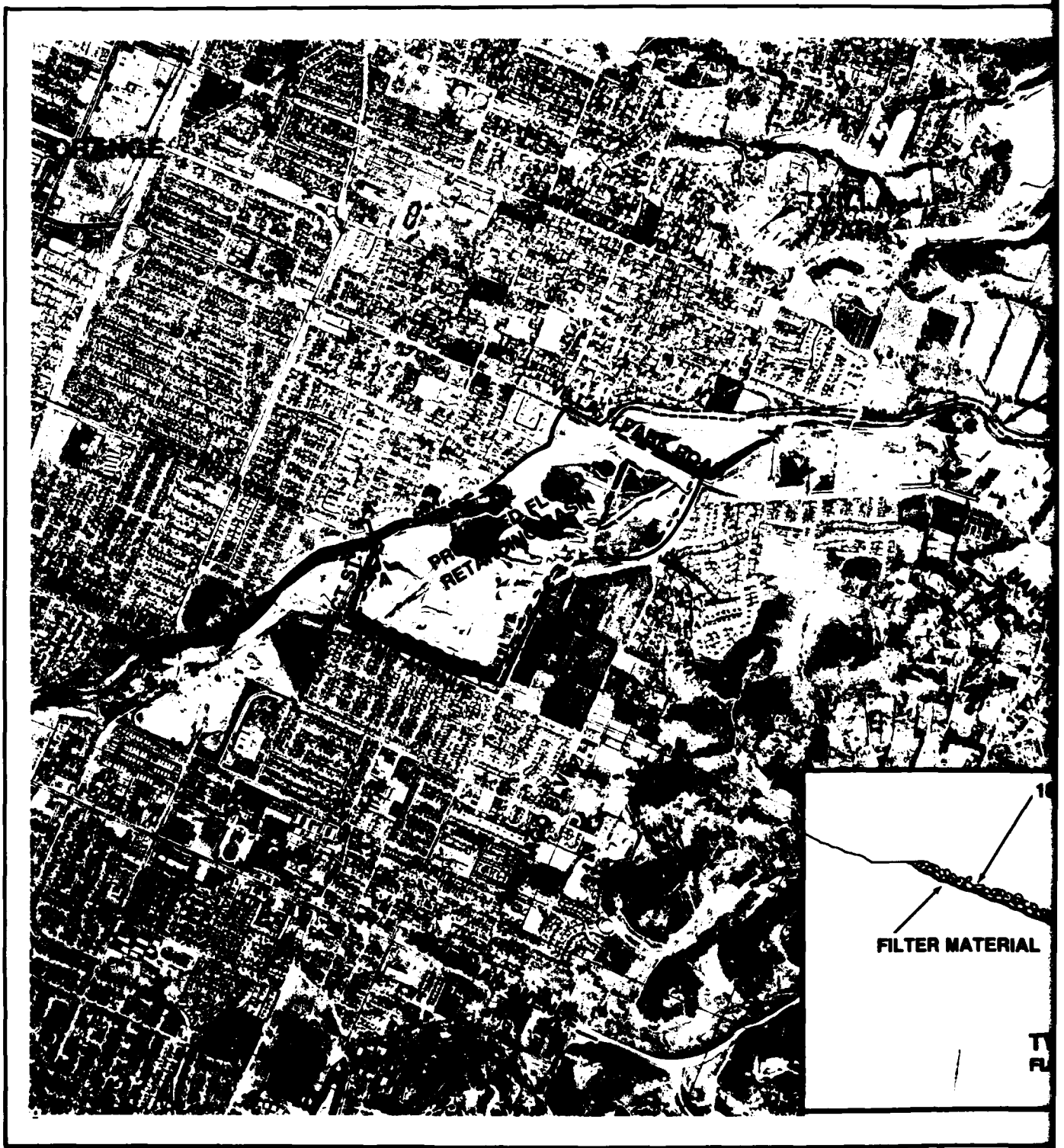
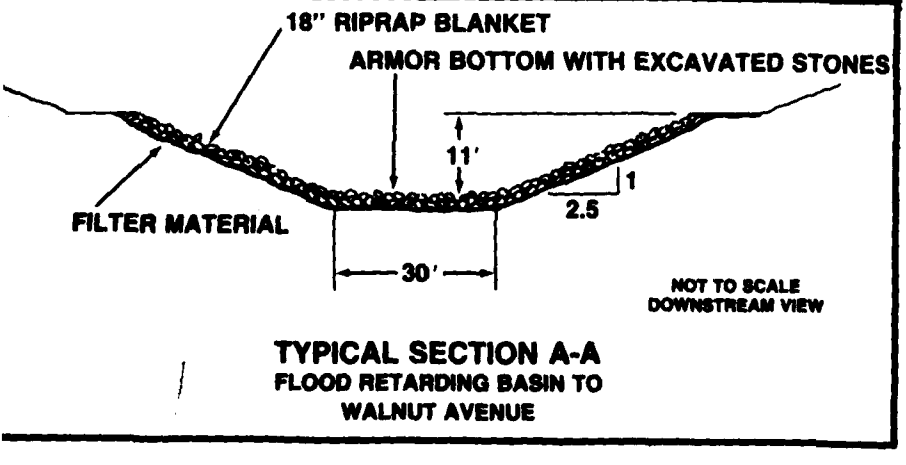
FIGURE 20


18" RIPRA
FILTER MATERIAL
TYPIC
DOWNSTREAM
TO S
SANTA ANA RIVER
ANA
GROVE
BRISTOL STREET



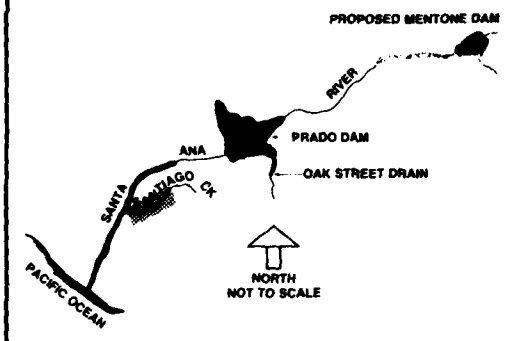
TYPICAL SECTION B-B
DOWNSTREAM OF SANTA ANA FREEWAY
TO SANTA ANA RIVER


PARK RD
FILTER MATERIAL



TYPICAL SECTION A-A
FLOOD RETARDING BASIN TO WALNUT AVENUE

KEY



LEGEND

- FLOOD RETARDING BASIN
- PROJECT RIGHT OF WAY
- FLOOD PLAIN MANAGEMENT
- PROPOSED PROJECT TRAIL
- PROPOSED STAGING AREA

SCALE

0 ½ 1

MILE

SANTA ANA RIVER, CALIFORNIA
PHASE I
GENERAL DESIGN MEMORANDUM
SANTIAGO CREEK

RECOMMENDED PLAN

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

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FIGURE 21

FIGURE 22

SANTIAGO CREEK POST-PROJECT STANDARD PROJECT FLOOD OVERFLOW

TABLE 19

COSTS OF THE RECOMMENDED PLAN,
(Value in $(1000), 7-1/8%, 100-Year Life)

September 1980

Construction Costs	Mentone Reservoir	Prado Reservoir	Santa Ana River below Prado Dam	Mitigation	Preservation	Santiago Creek	Total
Flood Control							
Construction	360,325	116,177	254,052	N/A	N/A	6,198	736,752
Rights-of-Way	21,500	92,230	19,040	367	3,853	3,500	140,490
Relocations	4,496	10,222	26,303	N/A	N/A	305	41,326
Subtotal	386,321	218,629	299,395	367	3,853	10,003	918,568
Recreation	6,070	13,149	740	N/A	N/A	410	20,369
Total	392,391	231,778	300,135	367	3,853	10,413	938,937
Annual Flood Control Cost							
Interest & Amortization	28,616	15,963	21,354	26	285*	713	66,957
Operation and Maintenance	950	330	1,330	--	--	30	2,640
Subtotal	29,566	16,293	22,684	26	285	743	69,597
Annual Recreation Costs							
Construction	433	938	53	--	--	29	1,453
Operation and Maintenance	408	822	50	--	--	24	1,304
Subtotal	841	1,760	103	--	--	53	2,757
Total Annual Costs	-30,407	18,053	22,787	26	285	796	72,354

* Includes $10,000 annual maintenance cost

TABLE 20

ECONOMIC JUSTIFICATION OF RECOMMENDED PLAN

	Santa Ana River	Santiago Creek	Total Project
Annual Flood Control Benefits			
Flood Damage Reduction	146,282	801	147,083
Savings in Flood Proofing	543	--	543
Total	146,825	801	147,626
Annual Flood Control Costs	68,854	743	69,597
Flood Control Benefit-to-Cost Ratio	2.1	1.1	2.1
Net Flood Control Benefits	77,971	58	78,029
Annual Recreation Benefits	4,660	75	4,735
Annual Recreation Costs	2,704	53	2,757
Recreation Benefit-to-Cost Ratio	1.7	1.4	1.7
Net Recreation Benefit	1,956	22	1,978

Total Project Benefits	152,361
Total Project Costs	72,354
Total Project Benefit-to-Cost Ratio	2.1
Total Project Net Benefits	80,007

SUMMARY COMPARISON WITH THE 1975 SURVEY REPORT PLAN

The principal changes in the recommended plan developed for this study are at Mentone Reservoir, Oak Street Drain, and Santiago Creek. Plans for the Santa Ana River channel from Prado Dam to the ocean remain relatively unchanged and the enlargement of Prado Reservoir is virtually the same as planned in 1975. The dam proposed at the Mentone site was redesigned to be more efficiently constructed. Only 2/3 as much material would be used in the embankment and the reservoir area would be reduced. The crests of dam and spillway were raised 13-1/2 feet to obtain the necessary storage volume and the spillway chute was shortened. The design for Mill Creek levee reconstruction is more definitive than in 1975. The redesign resulted in about a 25 percent savings in cost compared to the current cost of implementing the 1975 plan. Economic studies found the average annual amount of flood reduction benefits attributable to this dam had greatly escalated since 1975. The current finding is that Mentone Reservoir would be incrementally justified, even as a last-added increment.

As could be expected, costs have increased for implementing the All-River alternative since it was proposed in 1975 and submitted to Congress on September 14, 1978. Overall changes in cost are, in millions of dollars:

Mentone Reservoir	$336.4	$392
Prado Reservoir with Oak Street Drain	$167.7	$232
Lower Santa Ana	$221.5	$305
Santiago Creek	$ 15.1	$ 10
Total	$740.7	$939

These costs are not comparable in an absolute sense as several design adjustments have affected cost of some features of the plans. Mentone Dam, for example, will now require less material than originally estimated, and the plan for Santiago Creek has been reformulated.

At Prado Reservoir, slight refinements in a few areas were made to the guide taking line along elevation 566 feet on the basis of detailed topography obtained late 1979. Minor adjustments were made to design details of the embankment and the wing dike at the extremity needed to the enclose the reservoir. Detailed real estate appraisals and dam cost estimates were made for 2 reservoir levels but there was virtually no change of the basic plan. The Oak Street drain channel was lengthened to meet the new, existing debris basin. The size of channel was slightly reduced. The principal basis for the recommendation to include Oak Street Drain are the social disadvantanges to Corona for not being able to utilize certain lands that will be needed for enlarging Prado Reservoir to elevation 566. Phase I analysis showed that the social impact of the project on the communities surrounding Prado Reservoir was significant, and Section 122 of the Rivers and Harbors Act of 1970 provides for social mitigation where it is possible within the scope of the project. The Los Angeles District finds this necessary for the Oak Street Drain; this portion of the project is deemed critical by local

interests in the Prado Reservoir area. They feel that they must have flood control along the Oak Street Drain both to protect citizens along this waterway and to permit them to adjust to social and economic changes involved in the All-River Plan for the area.

Phase I analysis showed that the impact of the project on the communities surrounding Prado Reservoir was significant, and Section 122 of the Rivers and Harbors Act of 1970 provides for social mitigation where it is possible within the scope of the project. The Los Angeles District finds this necessary for the Oak Street Drain; this portion of the project is deemed critical by local interests in the Prado Reservoir area. They feel that they must have flood control along the Oak Street Drain both to protect citizens along this waterway and to permit them to adjust to social and economic changes involved in the All-River plan for the area.

The Santiago Creek plan was reformulated because of the wishes of local interests and the public. They wanted flood control storage upstream in gravel pits so that there would be less need for channelization. The majority view was that a lower level of flood protection would be acceptable (100-year flood protection) in order to have a non-concrete channel. Creekside residents want a more natural appearing channel with rocks and copious plant growth. The plan developed responds to local wishes.

In the Santa Ana River channel, minor refinements were made to the property acquisition line in the canyon reach. The natural channel plan is reaffirmed. In the urban reach, minor adjustments in channel width, depth, and gradient were made to reflect actual conditions now existing as to drop structions, bridges rebuilt, and other improvements. Two channels were combined into one for the last 1-1/2 miles of river. Other refinements at the mouth were made relative to marsh restoration and realinement of the Talbert channel.

The principal changes in the recommended recreation plan are for the floodway between Mentone and Prado; for the lower Santa Ana River; and for Santiago Creek. The recreation plans for Mentone and Prado Reservoirs have few changes. The current plan for Mentone includes one 50-acre recreational lake rather than the three interlocking lakes proposed in the 1975 plan. Prado Reservoir's recreation plan has been expanded to include one more recreational lake than proposed in the 1975 plan.

Since recreation cost sharing guidelines issued since the 1975 Survey Report prohibit the development of recreation outside of flood control rights-of-way, the current recreation plan has eliminated recreation from the Santa Ana River floodway between Mentone and Prado Reservoirs and from outside of flood control rights-of-way along the lower Santa Ana River. Another change to the lower Santa Ana River recreation plan is that the replacement cost for the recreational trails along the lower Santa Ana River has been reallocated from a recreation cost to a replacement of a utility cost.

Along Santiago Creek, the recreation plan, like the flood control plan, was completely reformulated.

IMPLEMENTATION RESPONSIBILITIES

Cost Allocation and Apportionment

In the 1975 Survey Report, apportionment of the costs of Alternative 6 among Federal and non-Federal interests was presented in accordance with existing legislation. Basically, the entire costs of Mentone and Prado Dam were seen as Federal costs and the remaining flood control features would be shared on the basis of the Federal Government paying construction costs and non-Federal interests providing lands, easements, rights-of-way, and relocations. Recreation costs would have been shared equally.

Cost apportionment is now, however, a cloudy issue. Review comments on cost sharing made by the Board of Engineers for Rivers and Harbors in 1976 and promulgation of a new cost sharing policy by the President in 1978 have created a situation where three different cost sharing proposals are conceivable. These three proposals are discussed below and presented in tables 21 and 22 (pages 177 and 178).

PROPOSAL A: COST APPORTIONMENT UNDER EXISTING LEGISLATION AND IN ACCORDANCE WITH THE 1975 SURVEY REPORT. Under this proposal, the 1975 Survey Report recommendations and existing legislation would be followed. All flood control costs at Prado Dam and at Mentone Dam would be a Federal responsibility. The Federal Government would pay for construction and all lands, easements, rights-of-way and relocations required for both dams. For all other flood control elements, local interests would be required to provide what are commonly referred to as the "a, b, c's" specified in the 1936 Flood Control Act. That is, local interests would provide all lands, easements, rights-of-way and perform all relocations required for all other flood control elements of Alternative 6. Features for mitigation would be shared by local and Federal interests in the same ratio as the flood control elements were shared. Features for endangered species would be a Federal cost.

PROPOSAL B: APPLYING THE PRESIDENT'S POLICY DIRECTLY. The President's policy calls for a greater involvement by the states in decisions affecting the development and management of water and related land resources and an increased responsibility in the financing of Federal water projects. This is to be accomplished by requiring the benefiting states to contribute 5 percent of the project cost for purposes without vendible outputs and 10 percent of the project cost for purposes with vendible outputs. Vendible outputs include only municipal and industrial water supply, agricultural water supply, and hydroelectric power--none of these uses are seen as full project purposes for the Santa Ana project and only the 5 percent rule would apply. This new policy also calls for the local sponsor to contribute 20 percent of the project's first cost assigned to the flood damage prevention purpose.

This policy, applied to the All-River Plan, would mean the State of California would contribute 5 percent of the cost of every element of the plan; the local sponsor would contribute 20 percent of the cost of all flood control elements of the plan; the local sponsor would contribute 20 percent of the mitigation features and 50 percent to the recreation features. The Federal Government would contribute 75 percent of the total cost for flood control, 75 percent of the cost for mitigation, 45 percent of the cost for recreation, and 95 percent of the cost for endangered species preservation.

PROPOSAL C: THE PRESIDENT'S POLICY APPLIED TO ALTERNATIVES 6 AND 7 AND THE BOARD POLICY APPLIED LAST. The Board of Engineers for Rivers and Harbors in their 7 December 1976 report recommended ". . .the Federal investment in the specific project eventually adopted for construction be limited to the Federal share developed by the Division Engineer for Alternative 7 . . ." The President's Policy was promulgated subsequent to the Board's comment. Therefore, if the President's Policy is applied to cost sharing first and then the Board's recommendations applied, an entirely different cost sharing proposal is possible.

TABLE 21

COST APPORTIONMENT FOR ALTERNATIVE 6
THE RECOMMENDED PLAN
($ x 1000)
PROPOSAL A

(Use 1975 Survey Report Cost Allocation Plan)

Alternative 6	Federal Share	State Share	Local Share
Flood Control (%)	862,353 (94.3)	--	51,995 (5.7)
Mitigation (%)	346 (94.3)	--	21 (5.7)
Preservation (%)	3,853 (100)	--	--
Recreation (%)	10,184 (50)	--	10,185 (50)
Total (%)	876,736 (93.4)	--	62,201 (6.6)

PROPOSAL B

(Apply the 1978 Water Policy Directive Directly)

Alternative 6	Federal Share	State Share	Local Share
Flood Control (%)	685,761 (75)	45,717 (5)	182,870 (20)
Mitigation (%)	275 (75)	19 (5)	73 (20)
Preservation (%)	3,660 (95)	193 (5)	--
Recreation (%)	9,166 (45)	1,018 (5)	10,185 (50)
Total (%)	698,862 (74.4)	46,947 (5.0)	193,128 (20.6)

TABLE 22

COST APPORTIONMENT FOR ALTERNATIVE 6
THE RECOMMENDED PLAN

PROPOSAL C

Step One:

Apply the President's Policy to Alternative 7

Alternative 7	Federal Share	State Share	Local Share
Flood Control (%)	636,967 (75)	42,464 (5)	169,858 (20)
Mitigation (%)	275 (75)	19 (5)	73 (20)
Recreation (%)	6,435 (45)	715 (5)	7,149 (50)
Total (%)	643,677	43,198	177,080

Step Two:

Limit Federal Share for Alternative 6 to Alternative 7

Alternative 6	Federal Share	State Share	Local Share
Flood Control (%)	633,307 (69.2)	45,717 (5)	235,324 (25.8)
Mitigation (%)	275 (75)	19 (5)	73 (20)
Preservation (%)	3,660 (95)	193 (5)	--
Recreation (%)	6,435 (31.6)	1,018 (5)	12,916 (63.4)
Total (%)	643,677 (68.6)	46,947 (5)	248,313 (26.4)

CONCLUSION AND RECOMMENDED COST SHARING POLICY. Phase I studies have developed some new information which was not available when cost apportionment policies were being formulated for the Survey Report. When the Board commented that the Federal cost for Alternative 6 should be limited to the Federal cost for Alternative 7, part of their argument was based on the fact that Alternative 6 cost the Federal Government more than $200 million more than Alternative 7 and the Mentone Dam element of Alternative 6 was not incrementally justified economically, that is, if the cost of constructing Mentone Dam were compared to the benefits it would generate if it were considered to be the last feature added to the overall project, the benefits would not offset its costs. Phase I studies have determined significant changes both to the amount of the differential between the two plans for Federal cost and to the justification of Mentone Dam as a last-added increment. Detailed studies conducted during this Phase I study have determined that the flood control and recreation cost differential between the two alternatives is now $75 million. Alternative 6 still involves a larger cost, but the cost is now only 9 percent greater than that for Alternative 7. The lessening of this cost gap is primarily due to the redesign of Mentone Dam during the Phase I study to reduce high costs associated with the inefficient Survey Report design and the fact that land values behind Prado Dam have escalated at a rate completely unforseeable 5 years ago. As Alternative 7 requires three times more land behind Prado Dam than Alternative 6, this escalates the cost of Alternative 7. Detailed studies also now show that Mentone Dam is justified as a last-added increment. Comparing the costs of Mentone Dam to the benefits it would provide as the last element of the plan constructed shows a benefit-to-cost ratio of 1.2 to 1.

Although Alternative 6 is still more expensive than Alternative 7, and Alternative 7 is still the most economically efficient plan, all elements of Alternative 6 are well justified, Alternative 6 costs only 5 percent more than Alternative 7, and the factors identified in the previous section on Comparison of Plans make Alternative 6 the preferred plan.

This new information does not necessarily discount the arguments for Proposal C. The argument that Federal cost should be limited to the Federal cost of the NED Plan can still be considered valid based upon economic efficiency arguments.

Regulations are clear in that the Corps of Engineers must follow the policy on cost sharing promulgated by President Carter in his June 1978 Water Policy Message to Congress. These regulations were not in effect at the time the Survey Report was released in 1975, but now clearly must be followed. Thus, Proposal A is not within the authority of the District Engineer to recommend. Proposal B is the Corps' recommendation for cost apportionment.

A detailed breakdown of cost apportionment under this proposal is displayed in table 23 (page 180). Also shown in this table, for comparison purposes, are the detailed cost apportionment under existing legislation (Proposal A) and under Proposal C.

TABLE 23

DETAILED COST APPORTIONMENT FOR
ALTERNATIVE 6, THE RECOMMENDED PLAN
(VALUE $(1000), 7-1/8%, 100-YEAR LIFE)

The Recommended Policy

Total Federal Share of Construction	698,862
Total State Share of Construction	46,947
Total Local Share of Construction	193,128
Total	938,937

Detailed Cost Apportionment:

	Mentone Dam	Prado Dam	Santa Ana River below Prado Dam	Mitigation	Preservation	Santiago Creek	Total
1. Flood Control							
a. Construction							
Federal Costs	289,741	163,972	224,546	275	3,660	7,502	689,696
State Costs	19,316	10,931	14,970	19	193	500	45,929
Local Costs	77,264	43,726	59,879	73	0	2,001	182,943
Total	386,321	218,629	299,395	367	3,853	10,003	918,568
b. Operation and Maintenance							
Federal Costs	950	280	--	--	--	--	1,230
State Costs	--	50	1,330	--	10	30	1,420
Local Costs	--	--	--	--	10	30	2,650
Total	950	330	1,330	--			
2. Recreation							
a. Construction							
Federal Costs	2,731	5,917	333	--	--	185	9,166
State Costs	304	657	37	--	--	20	1,018
Local Costs	3,035	6,575	370	--	--	205	10,185
Total	6,070	13,149	740	--	--	410	20,365
b. Operation and Maintenance							
Federal Costs	--	--	--	--	--	--	--
Local Costs	408	822	50	--	--	24	1,304
Total	408	822	50	--	--	24	1,304

TABLE 23 (Continued)

Existing Legislation

Total Federal Share of Construction	876,736
Total State Share of Construction	(No Required Share)
Total Local Share of Construction	62,201
Total	938,937

Detailed Cost Apportionment:

	Mentone Dam	Prado Dam	Santa Ana River Below Prado Dam	Mitigation	Preservation	Santiago Creek	Total
1. Flood Control							
a. Construction							
Federal Costs	386,321	215,782	254,052	346	3,853	6,198	866,552
Local Costs	0	2,847	45,343	21	0	3,805	52,016
Total	386,321	218,629	299,395	367	3,853	10,003	918,568
b. Operation and Maintenance							
Federal Costs	950	280	--	--	--	--	1,230
Local Costs	--	50	1,330	--	10	30	1,420
Total	950	330	1,330	--	10	30	2,650
2. Recreation							
a. Construction							
Federal Costs	3,035	6,574	370	--	--	205	10,184
Local Costs	3,035	6,575	370	--	--	205	10,185
Total	6,070	13,149	740	--	--	410	20,369
b. Operation and Maintenance							
Federal Cost	--	--	--	--	--	--	--
Local Costs	408	822	50	--	--	24	1,304
Total	408	822	50	--	--	24	1,304

Proposal C

	Flood Control Construction	Mitigation	Preservation	Recreation	Total
Federal Share	633,307	275	3,660	6,435	643,677
State Share	45,717	19	193	1,018	46,947
Local Share	235,324	73	--	12,916	248,313
Total	914,348	367	3,853	20,369	938,937

FEDERAL RESPONSIBILITIES. The presently estimated Federal share of the total first costs of the project is $698,862,000. The Federal Government would also assume an estimated annual cost of $1,230,000 for operation and maintenance of the dams and reservoirs. In addition to its financial responsibility, the Federal Government would design and prepare detailed plans and administer contracts for the construction of the project after Congressional authorization and funding and receipt of non-Federal assurances.

NON-FEDERAL RESPONSIBILITIES. The presently estimated non-Federal share of the total first cost of the project is $240,075,000, including $11,203,000 for recreational features. Provisions for payment of these costs are presented in the section titled "Recommendations." In addition, maintenance and operation of the proposed flood control channels would cost local interests $1,420,000 annually. Maintenance of the wildlife areas would be the responsibility of the U.S. Fish and Wildlife Service. Although operation and maintenance of the marsh is a Federal responsibility, the U.S. Fish and Wildlife Service could transfer operation and maintenance to the California Department of Fish and Game which would maintain the marshland as a wetlands preserve. The $10,000 annual maintenance cost would probably be assumed by CF&G and has tentatively been allocated to them in all cost tables. In addition, the State Department of Fish and Game would probably also accept responsibility for maintaining the wildlife lakes at Mentone and Prado Reservoirs. Maintenance and operation of the proposed recreational features, also a non-Federal responsibility, would cost an estimated $1,304,000 annually. Other general non-Federal responsibilities are presented in the section titled "Recommendations."

Plan Implementation

Implementation of the proposed improvements would be as follows:

1. Higher echelons of the Corps of Engineers, including the Board of Engineers for Rivers and Harbors and the Office of the Chief of Engineers, would review the report.

2. The Chief of Engineers would then seek formal review and comments by the Governor of California and interested Federal agencies at the Washington level.

3. After State and interagency review, and following the comments of the Office of Management and Budget regarding the relationship of the project to the program of the President, the Secretary of the Army would forward the final report of the Chief of Engineers to the Congress.

4. Project authorization would be contingent on Congressional action, which would include appropriate review and hearings by the Public Works Committees.

5. Following authorization of the project, the Chief of Engineers would, when appropriate, include funds for design and construction of the project in his budget requests.

6. The District Engineer would conduct surveys and materials investigations and would prepare designs, plans, and specifications, after which the Corps would invite bids and award a contract. At that time, Non-Federal, legally authorized sponsors would then be requested to give formal assurances of local cooperation.

7. Local interests would be responsible for operation and maintenance of other than dam and reservoir facilities in accordance with regulations prescribed by the Secretary of the Army.

It is not possible to accurately estimate a schedule for the Recommended Plan because of variables in the reviewing and funding processes. Once the project is authorized and initially funded, design and construction could reasonably be completed within a 13-year period if adequate funds were available.

Construction Sequence

Construction sequence is an important and controversial issue. All three local sponsors desire project elements slated for their county's benefit constructed as soon as possible. However, the immensity of the project requires that it be divided into separate elements and each element scheduled for construction over an estimated 9-year construction period.

For scheduling purposes, five separate elements were identified. Those four elements are Prado Dam, the Santa Ana River channel (including Santa Ana Canyon and marshland acquisition), Mentone Dam, and Santiago Creek. These elements are scheduled for construction as displayed on table 24 (page 185).

In developing this schedule, Prado Dam and the lower Santa Ana River channel were considered as essential to construct as nearly at the same time as possible. Construction of either feature by itself would not realize the full potential flood control benefit. If Prado Dam were constructed first and the channel later, the dam could not be operated as intended due to lack of downstream channel capacity. If the lower river channel was constructed much earlier, the channel would have much greater capacity than the controlled releases from the dam. But, uncontrolled spill from the reservoir could exceed the new channel's capacity and cause significant damage to the $304 million channel structure and to adjacent homes and businesses.

With this in mind, the benefits to be accrued from constructing each element first were determined and the items which would provide the largest immediate benefit were slated for early construction. This analysis determined that Prado Dam and the downstream channel would provide the most immediate benefit and these items were slated for early construction, with marsh restoration and movement of the least tern colony at the river mouth to take place before any channel improvements in this area.

Santiago Creek was determined to be a relatively minor construction item and was scheduled as early in the construction sequence as possible.

In cases where hardship might result if property acquisition were to follow the pattern of construction activity, advance purchase of property will be considered. This will decrease the social and economic impact of the construction on those whose property must be acquired for the project.

TABLE 24

DESIGN AND CONSTRUCTION SCHEDULE

PROJECT FEATURE	PROJECT COST ESTIMATE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12	YEAR 13
		1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q	1Q 2Q 3Q 4Q
PRADO DAM														
PHASE II GDM	4,000	1000	1000	1000	150	150								
PLANS & SPECS	5,030			1000	2200	930	300	100						
REAL ESTATE ACQUISITION	162,450				33000	33000	33000	2000	1450					
CONSTRUCTION	166,350					13750	35000	35000	18700	3900				
SANTA ANA RIVER CHANNEL														
PHASE II GDM	10,200	320	3700	3700	2560									
PLANS & SPECS	10,700				1700	1800	1800	1800	1800	1800				
REAL ESTATE ACQUISITION	46,000				15000	20000	6860	4220						
CONSTRUCTION	232,340					40000	40000	40000	40000	38000	34340			
MITIGATION & PRESERVATION	4,220			1500	2720									
MENTONE DAM														
PHASE II GDM	12,520		2520	5000	5000									
PLANS & SPECS	10,000				1000	2500	2500	2500	1500					
REAL ESTATE ACQUISITION	26,000					6000	7000	7000	6000					
CONSTRUCTION	337,000						33000	42000	43000	44000	44000	44000	44000	43000
SANTIAGO CREEK														
PHASE II GDM	270									100	170			
PLANS & SPECS	280											180	80	
REAL ESTATE ACQUISITION	3,000											1000	2000	
CONSTRUCTION	5,670												3500	2170
TOTAL	918,570	2,120	6,020	12,700	63,330	118,130	160,260	134,620	112,450	87,700	78,510	45,980	49,580	45,170

FUNDS IN THOUSANDS OF DOLLARS

ENGINEERING AND DESIGN | LAND ACQUISITION | CONSTRUCTION

RESOLUTION OF ISSUES

Introduction

At the beginning of the report, issues raised during the review of the Survey Report were identified and discussed. From this list, 15 issues were determined to be principal to the Phase I study direction. Conclusions of this Phase I study are not radically different from the conclusions of the 1975 Survey Report study. This section will discuss how the Phase I study addressed the issues and how they shaped the study conclusions.

Principal Issues

PRINCIPAL ISSUE 1: FEDERAL COST SHARING. This Phase I study determined that Alternative 6 is still the best overall plan and it is in the Federal interest to participate in its implementation. Although the argument is still valid that Federal cost sharing be limited to the Federal share for Alternative 7, the NED Plan, findings of this Phase I study demonstrate that it is in the Federal interest not to follow this argument. Mentone Dam now exhibits incremental justification. The cost differential for flood control features of the two plans is now only $75 million (instead of more than $200 million as estimated in 1975). The greater cost of Alternative 6 would eliminate the need to relocate 542 homes, 4 ranches, 55 dairies, and 14 businesses behind Prado Dam. This factor suggests that there is a definite Federal interest in all elements of Alternative 6 and cost sharing should follow normal Federal procedures.

PRINCIPAL ISSUE 2: READDRESSING SEVERAL ALTERNATIVES. This issue on readdressing certain alternatives was resolved by undertaking detailed studies on the NED Plan, Alternative 7, and developing detailed information on a new alternative, the All-Channel Plan. Local protection alternatives upstream of Prado Dam were not studied in detail as the Survey Report had found these plans unjustified, and conditions had not changed sufficiently since 1975 to warrant their restudy.

PRINCIPAL ISSUE 3: ADOPT PRESIDENT'S COST SHARING POLICY. The President's cost sharing policy has been adopted for the Recommended Plan.

PRINCIPAL ISSUE 4: CONFORMANCE WITH E.O. 11988. The Recommended Plan was determined to be in conformance with E.O. 11988, Flood Plain Management. This Executive Order encourages the preservation of flood plains in their natural state. Following the general procedures outlined in ER 1165-2-26 for complying with this order, a determination has been made that no practical alternative exists for locating the project in the Santa Ana River flood plain. The Recommended Plan, although in the base (100-year) flood plain, was formulated to minimize impacts upon the natural flood plain while providing SPF-year protection to existing development. Development induced by the project will be limited to a few gaps and vacant property mixed in with existing development in the flood plain. Benefits from the plan accrue to flood damage prevention to existing development, increased employment

opportunities during project construction, and increased recreation opportunities. Benefits were not taken for flood damage prevention to future development.

Considered alternatives to the recommended plan were similarly examined according to the objectives of Executive Order 11988. Under the Recommended Plan, the river reach from the Mentone Dam site to Prado Dam will not be channelized and the post-project SPF flood plain will be subject to flood plain management regulations and practices. All cities in the post-project SPF flood plain are currently enrolled in the National Flood Insurance Program. Plan requirements to manage the post-project flood plain are consistent with these cities regulations. The Recommended Plan's beneficial affects to the flood plain include the acquisition and preservation of about 1,500 acres of flood plain lands in the Santa Ana Canyon and 92 acres of salt marsh at the river mouth. Throughout the Phase I study period, the general public and local, State and Federal agencies were advised of the project plans and provided input into the plan. Table 5 of the FSEIS, a listing of the agencies and groups that received the draft GDM and DSEIS.

PRINCIPAL ISSUE 5: MARSH ACQUISITION JUSTIFICATION. Detailed studies performed during this Phase I study have demonstrated that marshland at the mouth of the river is extremely valuable habitat for several endangered species. Protection and preservation of this marshland is well-justified. Los Angeles District biologists have developed a preliminary conceptual marsh restoration plan. Further plans will be developed during Phase II GDM studies. (See paragraphs 5.62ff of the FSEIS for a full description of this initial plan.)

There is a strong case for acquisition and preservation of the marsh. The case is based on the value of the marsh as essential habitat for the Californina least tern, a Federal endangered species, on the overall value of the marsh to wildlife and fish resources, on the deteriorating condition of the marsh at present and in the future, and on the extreme difficulty involved in protecting the marsh without acquisition.

Marshlands in California are not plentiful. Of the few which existed before western settlement, over two-thirds have been destroyed. The percentage of original marshland remaining in Southern California is considerably lower. In general, the remaining marshlands have considerable ecological value. They provide habitat for a large number of aquatic birds and are nursery grounds for fish such as the top smelt, jack smelt, herring, and surf perch. They are habitat for intertidal invertebrate , such as clams and crabs. They are important "support systems" for marine organisms, providing food for marine fish and invertebrate organisms. A reduction in marsh area, thus, can be expected to reduce marine populations of fish and adversely effect other species which use the marsh and its products.

The marsh at the Santa Ana River mouth is both generally valuable as a marsh and particularly valuable as essential habitat for the California least tern, a Federal endangered species. Terns using the Huntington State Beach nesting area use the marsh as a food supply, and

changes in marsh conditions seriously affect the viability of this nesting colony. The least tern feeds in the marsh and the open ocean as an adult, but relies on the marsh during the critical period following fledging. At this time, the young must learn to fish, and the marsh provides a "training ground" for this. The continued viability of the Huntington State Beach nesting colony is thus closely linked to the viability of the marsh. Silting of marsh channels or blocking of the tidal flow to the marsh for any period of time could seriously reduce the food available to the least tern; if this occurred at the critical post-fledging stage of development, it could affect survival of young terns.

Even though some or all the marsh is technically under the protection of Section 404 of the Clean Water Act of 1977 and the California Coastal Commission, it is subject to both short-term and long-term degradation. Tidal flushing is currently inadequate, provided by a culvert which is frequently plugged with sand. The marsh becomes stagnant periodically, and the oxygen available for fish is reduced considerably during summer months, particularly when the culvert is plugged. The river channels must be dredged to keep channels open. Heavy rains during the past two years have kept the marsh relatively wet, but a period of dry years combined with poor tidal flows could seriously reduce the total wetland area.

Pressures to develop the marsh are also quite heavy. There are presently oil drilling rigs in operation, and the number can be expected to increase as decontrol of petroleum prices makes extraction of oil in the area more profitable. Increased drilling would bring new access roads, new equipment, and a higher danger of oil spill to the area. There is also very strong institutional pressure to consider constructing a marina in the area. The shortage of boat slips in Southern California has placed pressure on municipalities to develop all available areas where a harbor is constructable, and the Corps has been authorized by Congress to study marina feasibility in the Santa Ana River mouth. Pressure to develop all 400 acres of undeveloped land near the channel mouth will likely increase.

There are also a number of local development plans for the area. There are two roads proposed for development: Nineteenth Street is proposed for extension through part of the marsh and a highway from the Pacific Coast Highway to Hamilton-Victoria Avenue. Orange County also proposes a highway to run along the eastern edge of the marsh. Nearby wetlands have been urbanized in recent years and development trends are likely to continue unless there is positive action to preclude residential use of the marsh. Until a Local Coastal Program is developed, it is not known if a marina or housing development would be allowed or not.

Preservation and restoration of the marsh proposed for acquisition is not likely to be possible without acquisition of the land, despite what appears to be strong protection under Section 404 of the Clean Water Act and the California Coastal Act of 1976. Section 404 of the Clean Water Act does not provide adequate short-term protection of the area because it requires extensive and time-consuming legal action which

generally is begun only after a violation. For example, in 1979, Orange County removed a culvert which provided tidal flow to a 17-acre marsh to the west of the Talbert channel. A full year later, the Corps obtained a consent judgment against Orange County Flood Control District for failure to obtain a permit, but the culvert replacement was not a part of this judgment and the marsh has been totally dry for many months. Even if it is restored at a later date, it has been lost as a viable habitat for too long. The terns which would otherwise feed in the area have been forced to forage elsewhere. After-the-fact enforcement is not ample protection for animals which require daily food and cover. This short-term protection problem is complicated by the need to obtain right-of-entry (which the landowner has not yet granted) in order to inspect the marsh. Unless a permit is filled or an illegal fill can be documented (without on-site inspection), the Corps cannot enter the property to enforce Secton 404. In the short-run, then, the marsh cannot be maintained as viable habitat for the least tern solely on the basis of Section 404 enforcement.

Preservation in the long-run is also doubtful. There is currently no Local Coastal Plan covering the area, and there will not be such a plan before the deadline of January 1981. Currently, Orange County (about 90 percent of the proposed marsh restoration area is under their jurisdiction), has only completed a preliminary draft of one of the proposed local coastal plan's elements. Section 404 presents long-term protection problems as well. It will take affirmative action to stop the slow degradation of the marsh and to ensure that it is not filled in increments. If the marsh continues to be treated with benign neglect, it may cease to have significant value as a wetland and as a foraging area for the least tern and other birds. As its ecological value decreases, those wishing to develop it may increase pressure to do so, using its decreased value as justification for development.

The value of the marsh and the problems involved in protecting it under existing legislation, combined with the intense pressure to develop the marsh for residential, drilling, and marina purposes, make it highly unlikely that it will remain a viable ecosystem unless it is acquired, restored, and maintained as a part of this project. The Corps plan for the marsh is currently the only reliable means of preserving the habitat for the California least tern and for the other endangered species which uses the area, the light-footed clapper rail.

By restoring an additional 84 acres of marshland in this area and preserving it to ensure viability for an endangered species, the proposed marsh acquisition complies with provisions of the Endangered Species Act of 1973 (Sections 2c and 7a(1)). This action is also consistent with ER 1105-2-129, "Preservation and Enhancement of Fish and Wildlife Resources."

The purchase of marshlands makes positive contributions to the environmental quality objective. In every Federal water resources study the Corps must study items that contribute to environmental quality. Congress has established environmental quality as an equal objective to national economic development, and the Water Resources Council's Principles and Standards reflect Congressional intent. In this case,

the Corps is making positive contributions to the environmental quality objective by acquiring this endangered species habitat. The Corp's position is supported by the U.S. Fish and Wildlife Service, the State Department of Fish and Game, environmental groups and many other institutions and public groups.

PRINCIPAL ISSUE 6: PRESERVATION OF LEAST TERN HABITAT. Sufficient studies have been accomplished during the Phase I study to support the conclusion that adequate means for preserving least tern nesting habitat can be devised. Coordination with the U.S. Fish and Wildlife Service and the California Department of Fish and Game supports this conclusion. (See paragraph 5.67ff of the FSEIS.) Tentative plans call for moving a portion of the nesting preserve to the west of the existing preserve. Phase II studies will further address the feasibility and best method of relocating the least tern nesting site.

PRINCIPAL ISSUE 7: FLOODWAY ACQUISITION BETWEEN MENTONE AND PRADO DAMS. Adequate protection from flood damage in the reach between Mentone Dam and Prado Reservoir can be achieved by requiring the local sponsor to maintain and manage a designated floodway and floodway fringe as delineated by the Corps of Engineers (shown on Figure 13).

PRINCIPAL ISSUE 8: REFORMULATION OF RECREATION PLANS. The recreation element of the project has been completely reformulated to meet current policy guidance. Appendix G presents more detailed information on the reformulation study.

PRINCIPAL ISSUE 9: PRADO LAND ACQUISITION. Standard acquisition policies are not recommended for Prado Reservoir. The Phase I study reaffirms the 1975 Survey Report conclusions on real estate acquisition options. Most of the structures slated for acquisition are located in the outer fringes of the reservoir and would be subject to only very infrequent flooding. Since the reservoir guide taking line is the future standard project floodwater surface elevation plus 3-foot freeboard, none of these properties would likely be subject to a standard project flood until 30-50 years after project construction. Even then there would be little danger to people from large floods since the water rises slowly and many roads lead out of the fringe area. The properties on the fringe area would most likely not impact the operations of the dam.

There is a strong case for not forcing people in the fringe areas of Prado Reservoir to relocate. Non-agricultural residents of the area would find replacement property difficult to find and far more costly than their present residences, particularly in light of current interest rates. Relocation would also disrupt school attendance, work, and travel patterns in the area. Relocation of dairies in the area would require the owners to move significant distances, as far as Hemet, Victorville, or Bakersfield, to find replacement farms. Such a move could cause reduced profitability, marketing problems (due to distance), and could actually increase the cost of dairy products for Los Angeles customers. The strongest argument against acquiring these lands in fee and relocating residents, businesses, and farms is that the acquisition is not necessary for safe operation of the expanded reservoir. The

lands in question will not be subject to flooding except in rare cases (a 100- to 200-year frequency) and there is no compelling reason why this land should not continue in its current use.

PRINCIPAL ISSUE 10: WATER CONSERVATION. Studies of water supply storage behind Prado reaffirmed the Survey Report conclusions that operation for water supply would provide incidental benefits and would not be a full project purpose (see this Chapter under Water Conservation Potential). Alternatives for providing dedicated water supply storage at Prado Dam were investigated and found to be economically unjustified. Incidental operation of the Recommended Plan will result in conservation of an additional 3,500 acre-feet of water annually.

PRINCIPAL ISSUE 11: CULTURAL RESOURCE PROTECTION. Tentative plans to alleviate adverse effects of the project on cultural resources within Prado Reservoir include a program of protection, preservation, and data recovery. These plans are discussed on a site-by-site basis in the FSEIS beginning in paragraph 5.32. More detailed studies will be conducted during Phase II investigations to verify the site evaluations and impact assessments, and to provide information needed to formulate an effective program of preservation and data recovery.

PRINCIPAL ISSUE 12: CONSTRUCTION SEQUENCE. The Phase I study has determined the order of construction of project elements (see section on Construction Sequence in this Chapter). The order of construction will be:

Element	Year of Start of Construction	Years to Construct
1. Prado Dam	1st	3
2. Santa Ana River Channel	1st	6
3. Santiago Creek	2nd	1
4. Mentone Dam	3rd	8

The entire project will require 9 years to construct.

Marsh restoration and movement of the least tern colony and of Victoria Pond will be accomplished before river channel improvements are begun at the Santa Ana River mouth.

PRINCIPAL ISSUE 13: CHANGES IN OAK STREET DRAIN. Despite local changes in the Oak Street Drain, Phase I studies have determined that it is still in the Federal interest to construct Oak Street Drain as part of the construction of the Santa Ana River project. Besides the fact that there is a serious flood problem along Oak Street Drain, which can be alleviated by construction of the project, its construction will also mitigate adverse economic and social impacts associated with raising Prado Dam.

In analyzing the social and economic impacts of raising Prado Dam as required by with Section 122 of the Rivers and Harbors Act of 1970, to Riverside County and particularly the City of Corona, impacts were found

to be adverse and significant. The hardships imposed by the selected plan have repeatedly been enumerated by the local jurisdictions in their objections to raising the dam.

The most easily quantifiable impacts to Riverside County, and in particular to the City of Corona, are economic. Raising Prado Dam by 30 feet and the resulting taking of property will eliminate 100 existing jobs. Potential employment losses from taking of lands scheduled for commercial development will be approximately 3,200 for the Riverside County and the City of Corona. Local tax revenues will also decline as a result of taking of land from the tax base. Planned development of 30 houses worth $3.6 million will be eliminated.

The social impact of the project on this area can also be measured in human terms. The General Plan for the City of Corona will have to be changed significantly from the "without" condition as some of the land to be taken has been in residential/commercial use and much of it is currently zoned for commercial development. The city has planned carefully and zoned areas between the downtown and the existing Prado Reservoir area for industrial and residential use. For the city to adjust to this loss and maintain its planned growth, it must find other areas for these developments. Some of these lands are on the other side of the city and are currently in agricultural use. Residential or industrial development above the Oak Street Drain, for example, would take agricultural lands out of production and would be adjacent to U.S. Forest Service property which is subject to frequent fires.

Changing the General Plan will necessarily affect land use policies, zoning policies, and as a result the value of properties in the area. The character of neighborhoods may change as commercial development planned for one area is shunted into another. Relocating 29 families from the housing development located at Corona National Area, will place additional demands on the already tight housing market in the local area. In the short term at least, house prices can be expected to rise, although the extent of this is difficult to estimate.

These impacts are complicated by the uniqueness of the Corona area. The city sits between Prado Reservoir and the Chino Hills and is bounded on its other two sides by broad flat washes. It is a carefully planned community built around a circular town center with commercial, industrial, and residential developments distributed carefully to ensure a high quality of life for its residents. The dairy lands in the area are also unique within the Greater Los Angeles Metropolitan Area. No comparable lands exist within the geographic area and the rural atmosphere of the town is becoming increasingly rare in Southern California. Moving from such a community may impose some understandable hardships on current residents.

Many residents being asked to relocate will also suffer financial hardship. Those who purchased homes before costs spiraled will find it difficult to relocate in the current housing market, even given a fair market value payment for their property. With interest rates at approximately 12-16%, finding reasonably similar homes might be quite difficult, particularly for those on fixed incomes.

Providing additional flood free lands in the central corridor of the community of Corona will mitigate some of these impacts, as permitted by Section 122. This can be accomplished by stabilizing 8 acres of land along Oak Street Drain to replace lands taken by raising Prado Dam. To stabilize the channel would, first, reduce existing economic and social losses incurred by local jurisdictions from flooding. Several existing residential communities abut the channel and have been subject to recurrent flooding over the years. Floods in 1969 and 1978 did a total of $2.4 million dollars damage in this area. In 1978, an elderly woman suffered a heart attack during flood emergency evacuation of the trailer park to the east of the channel. Protecting these communities would reduce the fiscal burden on the city; reducing flood emergency costs will partially mitigate for loss of tax revenues.

In summary, the raising Prado Dam and taking 127 acres of the land from the City of Corona and will adversely affect the city's stability and plans for community development in an orderly fashion. It will place burdens on many individuals in the area. It will affect all aspects of community life in the city and county, which is not itself seriously threatened by the floods the project is designed to control. By improving the Oak Street Drain as a part of the project, the Corps will solve a serious existing flooding problem and give the city and county additional options for dealing with the disruption which the overall project will cause.

PRINCIPAL ISSUE 14: SANTIAGO CREEK PLAN REFORMULATION. The Santiago Creek plan has been completely reformulated based on local interest request.

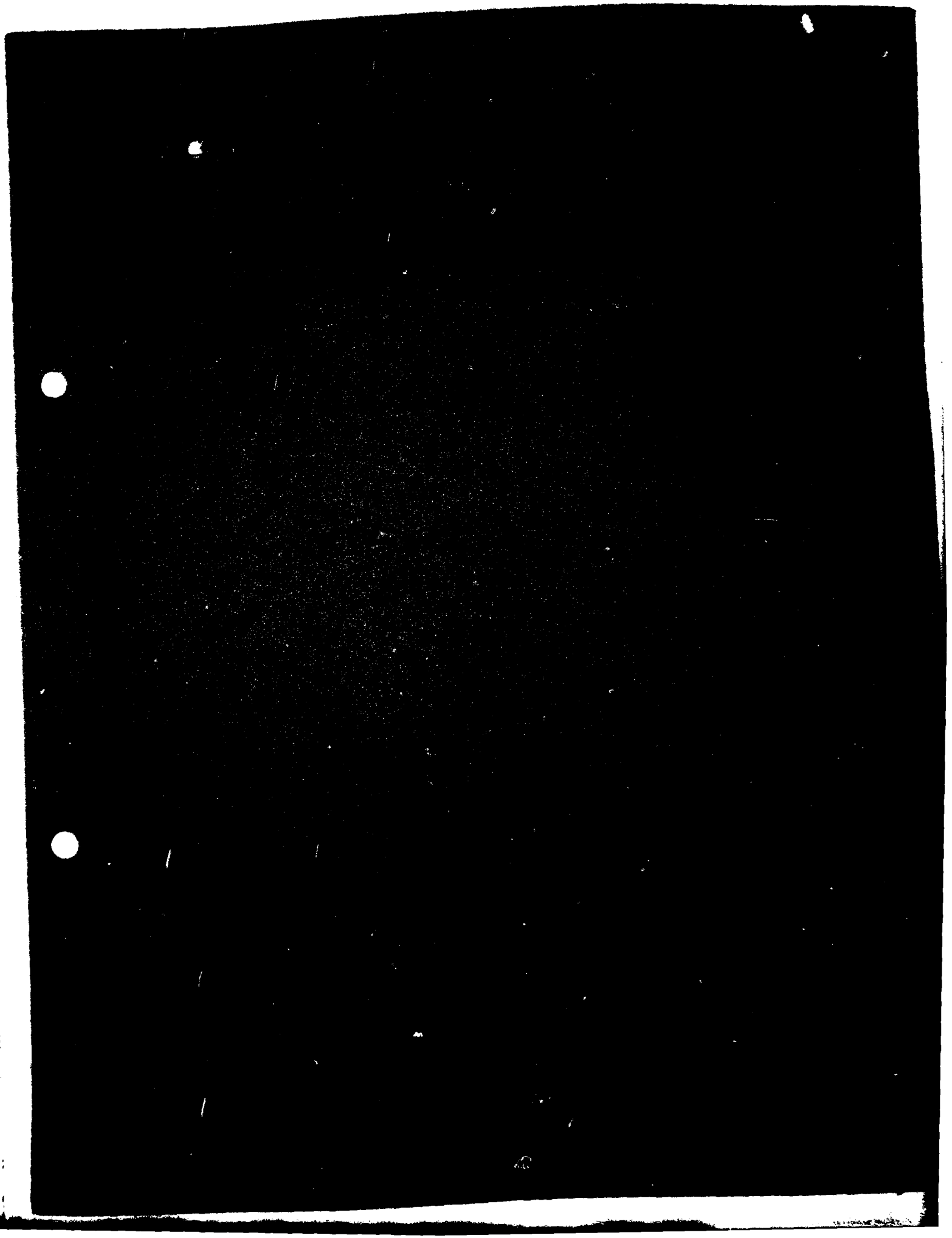
PRINCIPAL ISSUE 15: MICROCLIMATE AT MENTONE. Studies conducted during 1978-79 show that any changes in microclimate in the Mentone area as a result of construction and operation of Mentone Dam will be minor. The dam will not be used to impound water for long periods of time and thus will have minimal impact on air temperatures in the immediate vicinity. Appendix I presents more detailed information on the microclimatology study.

COORDINATION

A draft copy of the Main Report and Supplemental Environmental Impact Statement, dated July 1980, were sent to Federal, State, and local interests on July 17, 1980. Copies of all letters of comments received and the Corps' responses to them are included in Appendix A.

Four public meetings were held on August 19, 20, 26, and 27, 1980, to present the Recommended Plan. Appendix A includes a summary of comments made at these meetings and the Corps' responses to the comments.

Changes were made in the Main Report and Supplemental Environmental Impact Assessment, when applicable, to comply with the views, concerns, and comments expressed by letter and at the final public meetings.



9. RECOMMENDATIONS

The President, in his June 1978 water policy message to Congress, proposed several changes in cost sharing for water resources projects to allow States to participate more actively in project implementation decisions. These changes include a cash contribution from benefiting States of 5 percent of the first costs of construction assigned to nonvendible project purposes and 10 percent of the first costs of construction assigned to vendible project purposes.

The Santa Ana River project would produce flood damage prevention and recreation, outputs which are considered nonvendible. Project costs have been allocated to the outputs in accordance with established Federal policy. Of the $939 million total project first costs, $915 million have been assigned to flood damage prevention, $16 million have been assigned to recreation, and $4 million have been assigned to Endangered Species Preservation.

Application of the President's policy to the Santa Ana River project requires a contribution from the State of California of an estimated $47 million in cash.

The President also proposed that the present cost sharing requirements for the flood damage prevention projects be modified to require a cash or in-kind contribution equal to 20 percent of the first costs of construction assigned to the flood damage prevention project purpose. (In the case of reservoir projects, this cash or in-kind contribution is a new requirement. In the case of local protection type projects, this cash or in-kind contribution is in lieu of the existing requirement that local interests provide without cost to the United States all lands, easement, rights-of-way, and relocations or replacements necessary for the construction of the project.) Application of this policy to the Santa Ana River project would require that non-Federal interests make, in addition to the state contribution, a cash or in-kind contribution of an estimated $183 million (20 percent of $915 million). The local contribution for recreation will be an additional $10 million.

1. The Government will:

a. Acquire all lands, easements, rights-of-way, and perform all relocations required for construction of Prado and Mentone Dams and Reservoirs;

b. At Prado Reservoir, the Government will:

(1) Acquire in fee all property below existing reservoir taking line, elevation 556 feet, mean sea level (msl);

(2) Acquire in fee all property that is vacant at time of project authorization and situated between elevation 566 feet msl and elevation 556 feet msl; (Vacant lands,

those without residences, commercial establishments or intensive agricultural use, will be delineated further in Phase II studies. At present, they generally consist of open fields and woodlands.)

(3) Negotiate with landowners in cases where habitation prevails at time of project authorization and is situated between the proposed reservoir taking line and existing taking line. The Chief of Engineers shall have final authority to detemine which of the following options are appropriate to offer owners of the parcels in question, based on the requirements of the project:

(a) Fee acquisition,

(b) Flood proofing of habitable structures, with easements over open land,

(c) Flowage easement over the property for occasional flooding,

(d) Life estates, or,

(e) A combination of two or more of the above, as applicable;

c. Where the local sponsors' compliance with Section 2a and 2b below results in costs greater than 20 percent of the project first costs assigned to flood damage prevention, reimburse the local sponsors' for the excess costs.

2. The local sponsors shall, in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation specified below:

a. Provide all lands, easements, and rights-of-way for local protection structures (including channel improvement structures along the Oak Street Drain, the lower Santa Ana Channel, and Santiago Creek and the gravel pits along it) ;

b. Acquire interest in the 1,500-acre flood plain from Prado Dam to the proposed Weir Canyon Road for post-project releases from Prado Dam as delineated by the Secretary of the Army and manage and maintain these lands free from urban encroachment or other uses considered detrimental to either the flood control purpose of the project or open space and environmental features of the canyon area and in a manner in accordance with regulations prescribed by the Secretary of the Army;

c. Perform all alterations and modifications of highways, roads, streets, highway bridges, utilities, and irrigation and drainage facilities required in connection with the project;

d. Should the cost of compliance with a, b, and c above total less than 20 percent of the project first costs assigned to flood damage prevention, provide a cash or in-kind contribution sufficient to, when considered with a, b, and c above, equal 20 percent of the project first costs assigned to the flood damage prevention purpose;

e. Provide, without cost to the United States, all lands required solely for recreational purposes and contribute additional funds necessary to bring the total local contribution up to at least 50 percent of the total first cost of all recreational lands and facilities;

f. Hold and save the United States free from damages due to the construction, operation, and maintenance of the project, excluding damages due to the fault or negligence of the United States or its contractors;

g. Maintain and operate all local protection works and all recreation facilities after completion in accordance with regulations prescribed by the Secretary of the Army;

h. Prescribe and enforce regulations to prevent obstruction or encroachment on flood control works which would reduce their flood-carrying capacity or hinder maintenance and operation, and control development in the project area to prevent increases in floodwater flows which would affect the ability fo the project to meet project objectives;

i. In addition to the acquisition of lands, easements, and rights-of-way to be acquired by the local sponsors as deemed required for the Project by the Secretary of the Army, take whatever action is necessary to manage and maintain the designated floodways and floodway fringes in the affected watercourses and adjacent flood plains along the Santa Ana River from Mentone Dam to Prado Reservoir and along Santiago Creek from Walnut Avenue to Benton Way, as delineated by the Secretary of the Army so as to ensure the unobstructed passage of floodwaters of the post-project future standard project flood from Mentone Dam to Prado Reservoir and the future 100-year flood along Santiago Creek, while providing for limited use and development of the lands within such areas deemed compatible therewith, in accordance with regulations to be prescribed by the Chief of Engineers;

j. Comply with the requirements of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894, approved 2 January 1971;

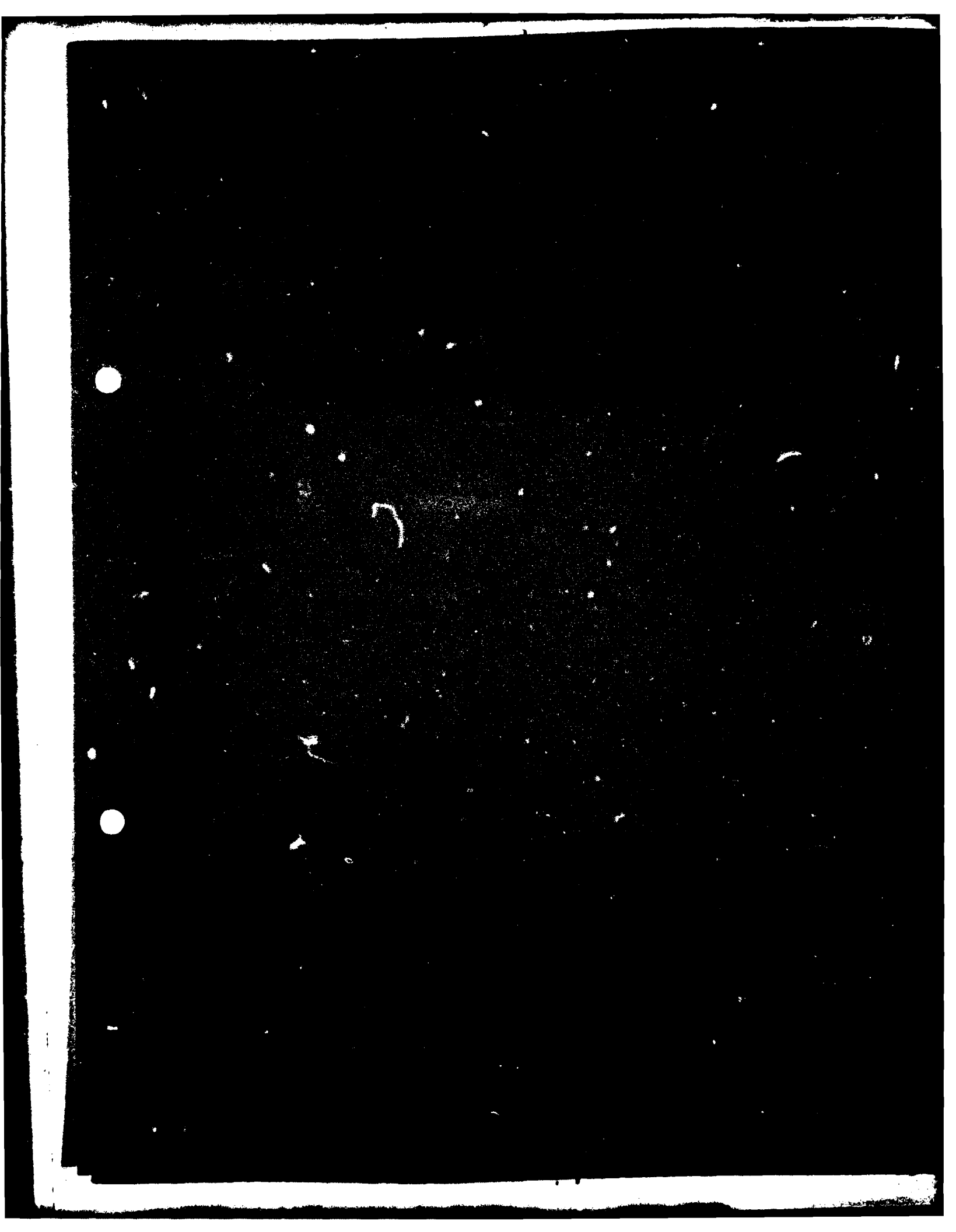
k. Assure access to all people on equal terms for approved recreational use;

l. Obtain the approval of the Secretary of the Interior to relocate as necessary for project construction those recreation properties which were acquired or developed with assistance from Land and Water Conservation Fund Act monies;

m. Give the Government a right to enter upon, at reasonable times and in a reasonable manner, lands which the Counties own or control, for access to the Project for the purpose of inspection, and for the purpose of repairing and maintaining the Project if such inspection shows that the local sponsors for any reason are failing to repair and maintain the project in accordance with the assurances hereunder and have persisted in such failure after a reasonable notice in writing by the Government delivered to the responsible local official. No repair or maintenance by the Government in such event shall operate to relieve the local sponsors of responsibility to meet their obligations as set forth in this Agreement, or to preclude the Government from pursuing any other remedy by law or equity;

n. Hold and save the United States free from all damages arising from water-right claims resulting from construction, maintenance, and operation of the Project.

3. The United States Fish and Wildlife Service shall be responsible for operation and maintenance of the 92-acre marsh preserve and the wildlife lands and features at Prado and Mentone Reservoir.



FINAL

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

SANTA ANA RIVER MAIN STEM

INCLUDING SANTIAGO CREEK

Counties of
Orange, Riverside, and San Bernardino,
California

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES, CALIFORNIA
SEPTEMBER 1980

FINAL

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

Santa Ana River Main Stem

Including Santiago Creek

Orange, Riverside, and San Bernardino Counties, California

Responsible lead agency: U.S. Army Engineer District, Los Angeles
Cooperating agencies: Counties of Orange, Riverside, and San Bernardino, California; and U. S. Fish and Wildlife Service

Abstract: The Santa Ana River Project will provide increased flood protection along the length of the Santa Ana River and two tributaries, Santiago Creek and Oak Street Drain. The Los Angeles District has reexamined alternatives considered in the 1975 Review Report and has essentially reaffirmed the selection of the 1975 recommended plan. Five alternative structural plans and the "No Action" alternative were examined for this Final Supplemental Environmental Impact Statement (FSEIS) which accompanies the Phase I General Design Memorandum (GDM). All structural plans provide Standard Project Flood (SPF) or greater protection along the Santa Ana River and Oak Street Drain. A one-hundred-year protection plan was developed for Santiago Creek. All plans provide for acquisition of the Santa Ana Canyon flood plain, and all plans except the two High Prado Plan alternatives provide for acquisition and restoration of a saltwater marsh at the Santa Ana River mouth. The five plans considered are as follows: (1) The All River Plan (Review Report alternative 6) is the recommended plan. It provides for constructing Mentone Dam, raising Prado Dam, and making channel improvements along the lower Santa Ana River, Santiago Creek, and Oak Street Drain. (2) The High Prado (NED) Plan (alternative 7) provides for raising Prado Dam higher than in the All River Plan, making the same channel improvements, but not constructing Mentone Dam. (3) An alternate High Prado Plan (alternative 5) is similar to the alternative 7 plan but involves a two-foot-lower taking line at Prado Dam; the two High Prado Plan variations are considered herein to be the same for the purposes of environmental impact analysis. (4) The All Channel Plan provides for a much wider Santa Ana River channel below Prado Dam, no raising of Prado Dam, and no construction of Mentone Dam or the Oak Street Drain. (5) The Environmental Quality Plan is similar to the High Prado Plan, but also includes restoring 200 acres of coastal salt marsh and removing most human-related land uses from Prado basin and the Santa Ana Canyon, as well as other lesser features.

This FSEIS supplements the September 1977 "Final Environmental Statement, Review Report on the Santa Ana River Main Stem--including Santiago Creek and Oak Street Drain--for Flood Control and Allied Purposes," filed on 25 September 1978. Copies of the Final Environmental Statement are available from the Los Angeles District Corps of Engineers.

If you wish further information on this statement, please contact:

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R NOTE: Information, displays, maps, etc. discussed in the Phase I GDM Main Report on the Santa Ana River Project are incorporated by reference in the FSEIS.

R = Revised from DSEIS.

LIST OF PREPARERS

The following people were primarily responsible for preparing this Supplemental Environmental Statement:

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Kathleen Kunysz	Environmental Plng.	Environmental Planning, Corps, 1-1/2 years	Environ. Plnr.
Richard Macias	Archeology	Archeologist, Corps, 2 years	Archeologist
Patricia Martz	Archeology	Archeologist, California Universities, 5 years; Archeologist, Corps, 3 years;	Archeologist
Brian Moore (project manager)	Civil Engineering	Civil Engineer, Corps, 10 years	Civil Engineer
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Laura Tschudi	Geography	Environmental Planning, Corps, 5 years	Geographer

LIST OF PREPARERS (Cont'd)

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FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

Santa Ana River Main Stem
Including Santiago Creek

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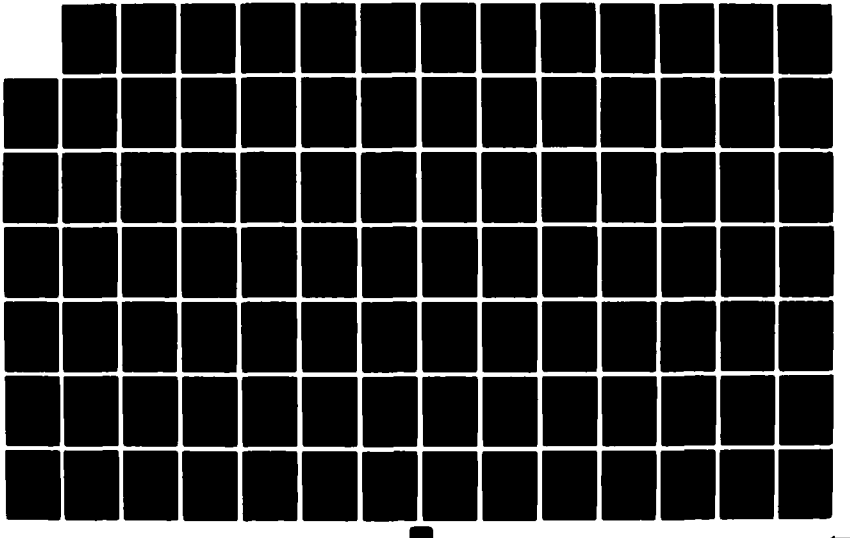

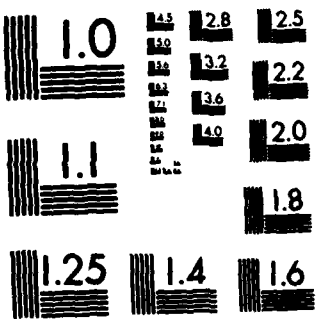

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Tables

Attachments

(Included following FSEIS)

Appendices

(Included as Appendix I to the GDM Main Report)

I. SUMMARY

1.01 MAJOR CONCLUSIONS AND FINDINGS. This Final Supplemental Environmental Impact Statement (FSEIS) supplements the September 1977 Final Environmental Statement (FES) which accompanied the "Review Report on the Santa Ana River Project" (alternately referred to in the Phase I Main Report as the "Survey Report"). This FSEIS addresses specific environmental issues (a) identified as significant from 1977 FES comments and from subsequent public involvement and local agency coordination meetings, and (b) raised by significant changes in or new information on the project alternatives or the environment. Wherever possible, the FSEIS references the 1977 FES or the current Phase I General Design Memorandum (GDM) Main Report rather than duplicating information. Five structural flood control alternatives for the Santa Ana River main stem were studied for the Phase I GDM, of which this Supplemental Statement is a part. The "No Action" alternative was also addressed. The alternatives are summarized below. Chapters 4 and 5 of the Main Report provide details on the alternatives and on the rationale for their selection. Chapters 4 and 5 of this Statement describe the significant environmental resources and the impacts of each project alternative on those resources. All five structural alternatives provide Standard Project Flood (SPF) or greater protection on the Santa Ana River main stem.

(a) The All River Plan (Review Report alternative 6) is the tentatively selected plan. It provides SPF protection while affecting relatively few dairies and residences in the Prado basin. Under it, the Corps will (1) construct Mentone Dam, (2) implement flood plain management between Mentone and Prado Dams, (3) raise the height of Prado Dam (raising the "taking line" or maximum flood elevation behind the dam by 10 feet to elevation 566 feet above mean sea level (msl)), (4) make channel improvements along the lower Santa Ana River, (5) acquire and preserve as open space the Santa Ana Canyon flood plain, (6) acquire and enhance 92 acres of Santa Ana River marsh, (7) make channel improvements along Santiago Creek and Oak Street Drain, and (8) construct recreational features. Principal environmental effects will include: (1) loss of mixed juniper woodland and coastal sage scrub habitat at Mentone Dam, (2) loss of riparian habitat at Prado Dam, (3) cultural resources impacts at Prado Dam, (4) improvement in overall project-related water quality, (5) recreation-related impacts at Mentone and Prado Dams, (6) preservation of Santa Ana Canyon open space and riparian vegetation, (7) loss of some California least tern nesting area, some marshland, and part of the Victoria Pond near the river mouth, (8) acquisition and restoration of 92 acres of coastal marshland, (9) disposal of suitable soil material on local beaches, and (10) possible reduction of ground water recharge potential in the Santiago Creek gravel pits.

(b) The High Prado Plan (Review Report alternative 7) is the National Economic Development (NED) Plan. It provides SPF protection with the highest net economic benefits of the alternatives considered. It proposes to further increase the height of Prado Dam beyond the

height increase of the All River Plan (raising the taking line to 582 feet (msl)), make similar channel improvements along the lower Santa Ana River and Oak Street Drain, and not construct Mentone Dam. The Santa Ana Canyon flood plain will be preserved, but only 8 acres of marsh will be acquired, for mitigation. Principal impacts will be similar to those for the All River Plan except that, because Mentone Dam will not be constructed, impacts (largely adverse) associated with Mentone Dam will not occur.

(c) An alternate High Prado Plan (Review Report alternative 5) was also given consideration. It is essentially the same as the alternative 7 High Prado Plan, but raises the Prado Dam reservoir taking line to only 580 feet (msl). Alternative 5 was considered because of the cost savings that could have resulted from not having to purchase the lands and developments that lie between elevations 580 and 582 feet (msl). The environmental impacts of both High Prado variations would be substantially the same. This FSEIS refers to both plan variations as the alternative 7 High Prado Plan, which has been determined to be the NED Plan. The remainder of the FSEIS will therefore refer to four structural alternatives for the project, rather than five.

(d) The All Channel Plan (Main Report alternative 11) involves enlarging the Prado Dam outlet works and spillway, and substantially widening and channelizing the Santa Ana River from below Prado Dam to the Pacific Ocean. This plan provides increased flood protection to Orange County while avoiding expense to upstream counties and impacts on dairies and residences in Prado basin. Prado Dam will not be raised in height and Mentone Dam will not be constructed. Oak Street Drain will not be improved. About 200 acres of marsh will be acquired and restored. Impacts will include removal of 128 homes, 20 acres of coastal marsh, most of the least tern nesting area, most of Victoria Pond, and most riparian vegetation in the Santa Ana Canyon.

(e) The Environmental Quality (EQ) Plan (Main Report alternative 10) is similar to the High Prado Plan but also provides for 200 acres of marsh acquisition and enhancement at the river mouth, removal of much agriculture and dairying from Prado basin to provide more wildlife habitat, removal of a mobile home park in the Santa Ana Canyon, reconstruction of Greenville-Banning channel above Victoria Street as a soft bottom channel rather than as a concrete channel in the other plans, and other features described in paragraph 3.12. The Environmental Quality Plan provides the maximum reasonable environmental enhancement while accomplishing the flood protection objective.

1.02 Two alternatives were studied in detail for Santiago Creek. The recommended plan provides 100-year flood protection by using upstream gravel pits for flood retention, with some rock revetment added downstream. This plan was formulated in response to local desires for a less structural solution than the 1975 Review Report plan. The Review Report plan--the other considered alternative--provides SPF protection without use of the gravel pits but with extensive concrete channelization. The Environmental Quality Plan for Santiago Creek

coincides with the recommended plan and adds acquisition and preservation of the unurbanized upper creek flood plain from Villa Park Road to Villa Park Dam. A No Action alternative was also considered.

1.03 The Corps of Engineers reaffirms the selection of the Review Report plan for Oak Street Drain, providing SPF protection by constructing a concrete channel up to a new existing county debris basin. Environmental Quality and No Action alternatives were also assessed.

1.04 The Corps of Engineers has determined that the All River Plan's added flood protection benefits combined with the incorporation of mitigation and enhancement features justifies the short-term and long-term adverse impacts associated with project construction. It is the District's conclusion that the proposed project is consistent with the goals of Executive Order 11988 (Flood Plain Management), Executive Order 11990 (Protection of Wetlands), and other regulations as described in paragraph 1.14. A Section 404(b)(1) ecological evaluation of proposed discharge or fill materials has been made following the evaluation guidance in 40 CFR 230.4, in conjunction with the evaluation considerations in 40 CFR 230.5. Appropriate measures have been identified and incorporated into the proposed plan to minimize adverse effects on the environment as a result of fill activities. Consideration has been given to the need for the proposed activity, the availability of alternate sites and methods of disposal that are less damaging to the environment, and such water quality standards as are appropriate and applicable by law. It was determined that the activities associated with the fill must have direct access or proximity to, or be located in, the water resources in order to fulfill the basic purpose of the proposed action. The fill placement sites for the Santa Ana River Project have been specified through the application of Section 404(b)(1) Guidelines.

1.05 AREAS OF CONTROVERSY. The concerned public agencies and local interests agree upon the need for additional flood protection along the lower Santa Ana River and the two project tributaries, Santiago Creek and Oak Street Drain. They agreed during Review Report preparation that the All River Plan should be the selected alternative. Certain aspects of the project have been controversial during the Phase I GDM studies and are noted below.

1.06 Some local interests desire that a small-boat marina be developed as part of the project in the open land east of the river mouth. The U.S. Fish and Wildlife Service (USFWS), the California Department of Fish and Game (CDFG), and California Coastal Commission (CCC) staff oppose any development that would eliminate rare coastal salt marsh habitat and valuable feeding grounds for the endangered California least tern. The tentatively selected plan in the Review Report and in the Phase I GDM provides for acquisition and enhancement of about 92 acres of marsh. The Santa Ana River channel improvement and marsh acquisition plans will not physically preclude the possibility of future marina development on adjacent lands, but some potential marina lands will be R

acquired and restored as marshland. The Corps is authorized but not funded to study marina feasibility, and such authority and study are not a part of the Santa Ana River Project.

1.07 The Review Report plan provided for acquisition and preservation of the Santa Ana Canyon flood plain as open space. Some local interests desire to construct residential and commercial developments in the flood plain (see paragraph 2.05 for further discussion). There has also been strong support for preservation of the canyon for its open space and habitat values, and as a natural stream channel for conveyance of floods without loss of those values. The Advisory Committee to the California Department of Water Resources in 1973 recommended that the natural conditions be "especially provided for to maintain the area's ecology," that mitigation measures "be provided to the extent that project features encroach upon the extremely valuable riparian habitat needed for the propagation of wildlife in this reach," and that efforts be made "to discourage urban encroachment" ("Environmental Impact Assessment, Santa Ana River Project," California Department of Water Resources, Southern District, 1973). Orange County's 1976 "Santa Ana River/Santiago Creek Greenbelt Implementation Plan" (pp. 65, 67) recommends "conservation of both flood plain and hillsides as an open, natural area, crest to crest, and suggests that this objective be accomplished by agricultural and open space easements, zoning, and public purchase of lands." The canyon is considered a valuable habitat and open space corridor by the USFWS and the CDFG. The Corps' recommended plan continues to be acquisition, and maintenance of the environmental amenities, of the Santa Ana Canyon flood plain.

1.08 With the raising of Prado Dam, 121 homes and 27 dairies in the reservoir area will be affected under the tentatively selected plan. Some residents of upstream communities feel they are being asked unfairly to sacrifice their property and their taxes to protect downstream communities in Orange County. Chapter 5 of the Main Report under the heading, "All River Plan, Alternative 6; Impact Assessment," discusses those affected and the options being offered to them.

1.09 Local citizens opposed the Review Report plan for Santiago Creek. They desired a less esthetically damaging alternative than a concrete channel. A new plan was formulated, providing lowered protection (100-year) and with only rock revetment added to portions of the existing channel rather than concrete. The City of Santa Ana opposed recreation trails along the channel within their City limits; proposed project trails within the City were therefore deleted. The new plan, developed through an extensive public involvement program, appears acceptable to local interests.

1.10 **UNRESOLVED ISSUES.** The following issues remained unresolved at the time of FSEIS preparation.

1.11 The widening of the Santa Ana River mouth will necessitate the relocation of the Talbert channel. The relocated channel will remove one-third of the existing least tern nesting area on the beach and four

acres of State beach lands. The California Department of Parks and Recreation opposes the relocation of nesting area at the expense of State beach lands (see letter of 26 March 1980 in Appendix I and California Resources Agency letter of 5 September 1980 in Appendix A), and suggests that the channel be alined downcoast, necessitating taking homes on the east side of the river. California Coastal Commission staff have also endorsed this concept. R

1.12 The widened Santa Ana River will eliminate about 8 acres of wetland along the edge of the planned marsh restoration site. It may also affect a small amount of wetland on the west side of the river, inland from Pacific Coast Highway. California Coastal Commission staff R have expressed concerns about the taking of wetlands in the coastal zone and about the project's consistency with the California Coastal Act (see paragraph 1.23 for further discussion).

1.13 The project recreation plan proposes development of recreation lakes and parks on 630 acres of land in the Prado Dam basin and 235 acres of land in the proposed Mentone Dam basin. Proposed recreational development in significant riparian areas at Prado and unique juniper woodland areas at Mentone has raised concerns by the USFWS and the CDFG about the impact of recreation on vegetation and wildlife resources of the two areas. The USFWS and the CDFG are also R concerned about effects of a proposed 1,000-acre borrow site on riparian vegetation and wildlife resource losses in Prado basin, and of a potential 2,300-acre borrow site on agricultural and wildlife areas south of Redlands.

1.14 RELATIONSHIP TO ENVIRONMENTAL REQUIREMENTS. Consideration of environmental laws, executive orders, and other policies in the planning process is noted as follows:

Federal

1.15 National Environmental Policy Act of 1969 (Public Law 91-190) as amended. All alternatives have been developed in accordance with the goals specified in Section 101 of the Act. The FSEIS has been prepared in accordance with Section 102 of the Act.

1.16 The Clean Water Act of 1977 (Public Law 95-217). In compliance with the requirements of EC 1105-2-97, entitled "Implementation of Section 404(r) of the Clean Water Act," the District will seek an exemption from the requirements of Sections 301, 402, and 404 of the Act by submitting the required 404(b)(1) water quality evaluation to Congress along with the DSEIS. The evaluation is included in this final SEIS as Attachment A.

1.17 Endangered Species Act of 1973, as amended. As required by Section 7 of the Act, the Los Angeles District requested a list of threatened and endangered species in the project area by letters to the USFWS dated 12 October 1979 and 27 December 1979. The USFWS responded by letters of 7 December 1979 and 5 March 1980, advising the

District of listed and proposed species. By letter of 31 October 1979, the District requested informal consultation for endangered species
R within the project area. The Draft Supplemental Environmental Impact Statement (DSEIS) served as the biological assessment required for Section 7 consultation under the Endangered Species Act. The USFWS
R submitted a Biological Opinion dated 1 October 1980 (see Appendix I) stating that the project will promote the conservation of the California least tern and the light-footed clapper rail, and is not likely to jeopardize the continued existence of the California brown pelican. The USFWS felt that the biological information was not available at the time for them to render a biological opinion on the salt marsh bird's beak and requested that consultation remain open on this species. The Los Angeles District responded to the Biological Opinion by letter dated 12 December 1980 (Appendix I), stating that the District has concluded, following a field survey of the marsh, that the bird's beak is probably not present but that the USFWS would be notified if the plant is found during Phase II biological surveys. The Biological Opinion also includes several recommendations for project features that would further the conservation of endangered species. The Corps of Engineers has generally concurred (in the 12 December 1980 letter) with all but one recommendation (concerning timing of beach replenishment).

1.18 Fish and Wildlife Coordination Act, as amended. In response to the requirements of this Act, the District has conducted ongoing coordination efforts with the USFWS and CDFG during the initial and current stages of planning. The USFWS has submitted planning aid letters dated 11 October 1979 and 7 February 1980 during the current planning effort. The USFWS' Supplemental Fish and Wildlife Coordination Act (FWCA) Report assessing the proposed project's effects is included in Appendix I to the Main Report; their summary position statement and the Corps' response are included as Attachment B to the FSEIS. The FWCA Report primarily addresses the All River Plan; however, the USFWS has considered the possible variations and alternatives to the All River Plan during the 1975 Review Report and current Phase I studies. The USFWS continues to support the All River Plan alternative as formulated in the 1975 Review Report. They have recommended certain additional project environmental features to offset what they perceive as project modifications that may affect fish and wildlife habitat. Coordination is continuing to assure agreement on feasible environmental features of
R the project. Continuous informal and formal consultation has been maintained with the CDFG. The USFWS has maintained coordination with the National Marine Fisheries Service regarding the project.

1.19 National Historic Preservation Act of 1966, as amended. A supplemental field reconnaissance survey has been contracted by the Corps to examine areas not covered in cultural studies for the 1975 Review Report and to verify some sites identified in the Review Report (see reference in paragraph 4.71). Areas affected by any of the proposed alternatives are addressed either in studies prepared for the 1975 report or the current supplemental report. Sites in the Prado

basin appear to be eligible for inclusion in the National Register of Historic Places as an Archeological District. The DSEIS and the field reconnaissance report were circulated to the State Historic Preservation Office (SHPO) and concerned Federal agencies for comment as part of the review process of the DSEIS. The SHPO commented that a Memorandum of Understanding (MOU) should be written to detail measures that should be taken to protect cultural resource values from adverse effects and which would ensure compliance with Section 106 of the National Historic Preservation Act (NHPA) (see California Department of Parks and Recreation letter dated 27 October 1980, in Appendix I). The SHPO comments included recommended measures for inclusion in the MOU; the Corps concurs with and will implement those measures in Phase II. Although the Advisory Council on Historic Preservation commented that the project was not yet in compliance with Section 106, subsequent informal agreement has been reached, based on Corps regulation ER 1105-2-460, that the Corps will forward all cultural resources correspondence to the Advisory Council; the Council will evaluate all coordination efforts and provide comments for Phase II planning. Consultation requirements to comply with the SHPO recommendations and with Section 106 of the NHPA will occur during Phase II. R

1.20 Executive Order 11988, Flood Plain Management, 24 May 1977. Under this order, the Corps of Engineers must take action to avoid development in the base (100-year) flood plain unless it is the only practicable alternative; to reduce hazard and risk associated with floods; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial value of the base flood plain. A determination has been made that no practicable alternative exists to locating the project in the flood plain of the Santa Ana River. Under the All River Plan, the river reach from the Mentone Dam site to Prado Dam will not be channelized and will be subject to flood plain management regulations and practices. In addition, about 1,500 acres of flood plain land in the Santa Ana Canyon and 92 acres of salt marsh at the river mouth will be preserved as open space as part of the All River Plan. Considered alternatives to the All River Plan were similarly examined with the objectives of Executive Order 11988 in mind.

1.21 Executive Order 11990, Protection of Wetlands. In developing the All River Plan, the Corps considered the plan's effect on the survival and quality of wetlands. About 1,500 acres of flood plain land within the Santa Ana Canyon and 92 acres of salt marsh at the mouth of the river will be acquired and preserved from future development as part of the recommended plan. By acquiring these two valuable areas, the Corps is in compliance with the goals of this Executive Order. The 9,741 acres of land in the Prado Dam basin will be enlarged to 11,202 acres under the All River Plan. Much of the existing reservoir area is wetland habitat and will be preserved. Most of the 1,461 acres to be acquired for the expanded reservoir area are agricultural lands that will continue to be used for grazing and farming. Wetland acreage in the Prado basin will be lost for borrow pits and recreation areas. The Santiago Creek gravel pits below Villa Park Road - intended as a soil R R

disposal site - occasionally contain ponded water following storms but typically maintain no significant wetland values. They will still contain ponded waters after project construction, replacing the limited wetland values. The Corps has prepared a 404(b)(1) water quality evaluation (Attachment A) which discusses impacts of the proposed project on wetlands within the project area.

1.22 Analysis of Impacts on Prime and Unique Farmlands in EIS, CEQ Memorandum, 30 August 1976. By letter of December 1979, the Soil Conservation Service (SCS), Redlands, has identified prime farmland at Prado reservoir and the Mentone Dam site. An additional SCS letter dated 4 March 1980 stated that two additional potential borrow sites are not classified as prime farmland. SCS letters are included in Appendix
R I. The SCS by letter of 5 September 1980 (Appendix A) commenting on the DSEIS indicated that prime farmlands have been adequately addressed. Paragraphs 5.10 and 5.47 discuss project effects on prime and unique farmland.

1.23 Coastal Zone Management Act of 1972, as amended. This act states that projects significantly affecting land or water uses in the coastal zone must be coordinated with appropriate State agencies. Coordination for the coastal elements of the Santa Ana River Project has been established with both the State Coastal Commission and the South Coast Regional Commission. The Federal Coastal Zone Management Act of 1972, Section 307 (title 16, USC Section 1456(c)) states that Federal actions must be consistent with local programs to the maximum extent practicable. Information required by the California Coastal Commission (CCC) to be provided in a consistency determination includes the following: a detailed description of the activity or development and any associated facilities (see Chapter 5 of the Main Report for this information), their coastal zone effects (see FSEIS Chapter 5, paragraphs 5.60 through 5.78 for this information), an analysis and determination of consistency of those effects with the California Coastal Management Plan, and comprehensive data and information sufficient to support the determination of consistency. Information to satisfy the latter two requirements is not available because a Local Coastal Plan for the Santa Ana River mouth area has not yet been developed under the California Coastal Management Plan. During preparation of DSEIS, meetings were held with CCC staff to identify concerns (see dates in paragraph 6.09). As a result, guidance was received from that agency by letter dated 4 June 1980 (see letter in Appendix I). The following paragraphs address the concerns outlined in that letter.

1.24 Section 30233 of the California Coastal Act of 1976 does not permit the construction of projects which have flood control as a principal purpose in wetlands of the coastal zone. Provisions for flood control would be allowed under the Act, but the principal purpose must be that of restoration of wetlands. Although the proposed project has as its primary purpose flood control, the project features will have an overall effect of restoration in the coastal zone through (a) the increase in channel width at the mouth of the river (providing a larger

feeding area for the California least tern), (b) restoration of 92 acres of marsh, (c) restoration of Victoria Pond, and (d) relocation of the California least tern nesting area. An additional requirement of Section 30233 of the Act stipulates that diking, filling, or dredging of a wetland or estuary will only be permitted if there is no feasible less environmentally damaging alternative (feasibility is defined with respect to time and economic, environmental, social, and technological factors). The only element of the proposed plan that CCC staff have indicated strong concern about is the alinement of the river channel and its impact on the least tern nesting site. Relocation of the channel downcoast of the present alinement has been considered and was found to be socially unacceptable as well as more costly. Realinement of the Talbert channel upcoast was considered, but received criticism as it would isolate a large portion of beach from the public and would bisect the least tern interim feeding area. The Corps has formally consulted with the USFWS regarding impacts on the nesting area and has agreed to replacement of nesting habitat lost as a result of construction of the project by extending the nesting area upcoast (see paragraph 5.67). Under the Endangered Species Act of 1973 as amended, the Corps is required to avoid jeopardizing the continued existence of an endangered species. It is anticipated that compliance with this Federal law will assure compliance with Section 30007.5 of the California Coastal Act of 1976, which requires that any conflicts be resolved in a manner which on balance is the most protective of significant coastal resources. R R

1.24 (a) Recent correspondence from the CCC has made provision for flood control as a primary purpose in degraded wetlands (CCC letter dated 8 October 1980, Appendix I). The CCC staff, in meetings held during Phase I studies, has maintained that the 92-acre marsh acquisition area does not constitute a degraded wetland, but has delegated responsibility for that determination to the California Department of Fish and Game. To date, no final designation regarding the degraded character of the wetlands has been made with respect to the Coastal Act. Based upon the available information, the proposed project action is considered to be consistent to the maximum extent practicable with the Coastal Zone Management Act (CZMA) of 1972. Consistency with the CZMA will be further addressed during Phase II advanced engineering and design studies as required by 14 CFR Part 930, Sections 930.37 and 930.38 (see also Corps memorandum in Appendix I, subject, "Coastal Act Consistency"). R

1.25 Implementation of the President's 2 August 1979 Environmental Message Directives on Wild and Scenic Rivers. The "Nationwide Rivers Inventory," Phase I (Department of the Interior Heritage Conservation and Recreation Service, Pacific Southwest Region, March 1980) indicates that no segments of the Santa Ana River are Wild or Scenic Rivers. Although it has esthetic values above and below Prado Dam, the project portion of the Santa Ana River essentially provides no potential as a wild and scenic river due to the influence of man in constructing flood control and urban improvements along the river. R

State

1.26 California Coastal Act of 1976. See paragraph 1.23 above.

1.27 California Environmental Quality Act (CEQA). The proposed alternatives are in compliance with the goals of CEQA.

Other

1.28 Local Ordinances and Policies. The proposed alternatives are not in conflict with local ordinances.

1.29 PREVIOUSLY PREPARED ENVIRONMENTAL STATEMENT. The Corps of Engineers prepared a Final Environmental Statement (FES) for the Review Report on the Santa Ana River Project in September 1977. Copies are available from the Los Angeles District. This final Supplemental Environmental Impact Statement (FSEIS) accompanies the Phase I General Design Memorandum (GDM). The FSEIS supplements the FES, addressing only specific issues which may involve significant project impacts. The issues studied herein were identified from a review of the FES and the comments received thereon; from meetings with concerned local, State, and Federal agencies; from public workshops; from changes in or new information on the project alternatives; and from new information about the affected environment.

1.30 The 1977 FES stated, in response to public and agency comments, that certain topics would be studied in the detailed design stage of the project. Some of these studies were conducted for the Phase I study where it was felt that they might affect plan formulation and selection. Remaining studies will be conducted during the Phase II GDM stage of detailed planning and design. Paragraph 4.06 provides further discussion of studies to be conducted in Phase II.

II. NEED FOR AND OBJECTIVES OF ACTION

2.01 *STUDY AUTHORITY.* Section 109 of the Water Resources Development Act of 1976 authorized preparation of the Phase I General Design Memorandum (GDM). Chapter 1 of the Main Report under "Study Authority" provides detailed project authorization information.

2.02 PUBLIC CONCERNS. Public comments were solicited during the Phase I planning process through public and agency meetings and workshops, and through public review of the draft GDM and DSEIS. Concerned groups agreed on the desire for increased flood protection along the Santa Ana River main stem and Santiago Creek. Principal areas of public concern identified through the public involvement and coordination program related to: (a) marsh and marina issues, (b) least tern nesting area impacts, (c) Santa Ana Canyon flood plain preservation, (d) replacement of recreational trails along the lower Santa Ana River, (e) Prado and Mentone basin borrow and recreation-related impacts, (f) home and dairy removal from Prado basin, (g) continuation of ground water recharge along the lower Santa Ana River and upper Santiago Creek, (h) level of protection and types of structural alternatives for Santiago Creek flood control improvements, and (i) plan selection as it relates to esthetic considerations along Santiago Creek. These areas of concern are summarized below. R

2.03 Many local citizen and agency groups appear to favor preserving and enhancing the marsh at the Santa Ana River mouth as a valuable environmental resource and as an endangered species habitat. Other local citizens favor development of a marina and oppose marsh acquisition if it would preclude a marina. The Corps of Engineers and the Federal and State wildlife agencies agree on the importance of acquiring, preserving, and enhancing 92 acres of coastal salt marsh, and reaffirm the Corps' 1975 decision to do so.

2.04 Wildlife interests have expressed concern that the project will remove one-third of the California least tern nesting area on the beach west of the river mouth. The least tern is classified as a Federal and State endangered bird species. The Corps will replace the affected nesting area by expanding it westward along the beach prior to flood control construction. This proposed action has prompted a concern by the California Department of Parks and Recreation regarding the loss of State beach lands.

2.05 Acquisition of the Santa Ana Canyon flood plain and preservation of its open space and habitat values were integral features of the 1975 report, with strong local support. However, in January 1980, the Orange County Board of Supervisors adopted a resolution requesting that the Corps modify its plan in order to allow some urban development in the canyon. Resolutions of August 1980 reiterated this request. One development group wishes to construct a residential and commercial center in the Horseshoe Bend area of the canyon, near Weir Canyon Road. Several other proposals for urban development involving the canyon flood plain have been proposed. Because of the canyon's value as R

a wildlife corridor and as open space in addition to its use for conveyance of post-project floodflows, the Corps continues to support the 1975 plan for Santa Ana Canyon flood plain acquisition.

2.06 Local citizens desire replacement of the bicycle and equestrian trails along the lower Santa Ana River in Orange County. The trails will be replaced as part of the project.

2.07 Recreational features of the project appear to be generally supported by local citizens. However, proposed recreational and borrow pit features in the Prado and Mentone Dam basins could substantially impact wildlife habitat areas. Wildlife agencies are concerned about large-scale recreation projects situated in particularly valuable
R habitat areas and about the elimination of riparian vegetation and wildlife habitat due to soil removal (borrow) activities.

2.08 Increasing the height of Prado Dam as part of the All River Plan will require the purchase and eventual removal of 121 homes, 27 dairies, 2 ranches, and 8 businesses from the Prado basin. Affected landowners are concerned about the options open to them (described in Main Report Chapter 5 under "All River Plan; Impact Assessment") and about the value of their property. The Counties of San Bernardino and Riverside are concerned about removal of dairies, which are important to the county economies. Because the High Prado Plan would require removal of even more homes and dairies (a total of 718 and 82 respectively), San Bernardino and Riverside Counties continue to support the All River Plan.

2.09 Santa Ana River waters are used by Orange County for ground water recharge along the lower Santa Ana River below Imperial Highway. Orange County wishes to maintain the recharge capability. Providing a water supply pool behind Prado Dam will enable water to be released more slowly over a longer period of time than is currently the case, so that
R the recharge can be maintained or increased. The City of Corona is concerned that the water supply pool may contribute to an increased water table which may flood some municipal basin facilities such as Corona Airport; Corps studies have concluded that recent water table problems were not contributed to by water conservation practices. Orange County is also concerned that the recharge potential of the Santiago Creek gravel pits be maintained. The recommended plan for Santiago Creek proposes depositing up to 6.5 million cubic yards of soil material from the Santa Ana River in the gravel pits. Deposition and compaction of this material to stabilize pit slopes could affect the recharge capability of the pits. This reduction will be offset by the recharge increase along the Santa Ana River.

2.10 Many residents along Santiago Creek opposed the 1975 Review Report recommended plan that would have provided SPF protection with a concrete channel. Through a series of public workshops, the Corps has reformulated the recommended plan to provide 100-year protection, avoiding use of a concrete channel by retaining floodwaters in upstream gravel pits. The new plan deletes previously recommended recreational

trails along portions of the creek where they are opposed by local groups.

2.11 The 1975 Review Report plan for Santiago Creek was unacceptable to many local residents in part because its proposed concrete channel would have been visually unpleasing. The channel would have eliminated masonry walls and vegetation in parks along the creek. The plan has been reformulated to preserve channel esthetics, as discussed in paragraph 5.82.

2.12 PLANNING OBJECTIVES. The project planning objectives are enumerated in Chapter 3 of the Main Report under "Planning Objectives." They are: (a) contributions to control flooding along the Santa Ana River and Santiago Creek; (b) preservation of the rural communities surrounding the Prado reservoir; (c) preservation of the ecological and open space values of the Santa Ana Canyon; (d) preservation and enhancement of the marsh at the river mouth; (e) provision of recreational opportunities as part of the project; and (f) provision of water conservation along the Santa Ana River and Santiago Creek.

III. ALTERNATIVES

3.01 PLANS ELIMINATED FROM FURTHER STUDY. Nine alternative flood control plans were considered in the 1975 Review Report. The All River Plan was selected as the recommended plan at the conclusion of that study. Because the Phase I GDM is essentially a reaffirmation study, detailed consideration of alternatives has been limited to the four most likely structural flood control alternatives as well as the "No Action" alternative. The four flood control alternatives studied are the All River Plan, High Prado Plan, All Channel Plan, and Environmental Quality Plan. Chapter 4 of the Main Report under "Review of Components" explains why these plans were selected for further study. Paragraph 3.08 of the FSEIS summarizes the alternatives; Chapter 5 of the Main Report describes the alternatives in detail. The All River Plan is the recommended plan.

3.02 WITHOUT CONDITIONS (NO ACTION). If no project is implemented, the lower Santa Ana River, Santiago Creek, and Oak Street Drain will continue to present flood threats, particularly to urbanized Orange County. Economic and social impacts of the No Action alternative are discussed in the Main Report, Chapter 5, under "No Action Plan." Principal changes in environmental conditions expected over the next 50 years if no project is constructed are summarized below.

3.03 It is estimated that up to about 40 percent of the proposed Mentone Dam site will probably be urbanized in the future with residential developments, resulting in the loss of coastal sage scrub and regionally unique juniper woodland. Impacts of soil removal at borrow sites to be needed for Mentone Dam impervious core material will not occur without the project (borrow sites are alternately proposed for either an agricultural area south of Redlands or within the Prado Dam reservoir area). The existing flood plain above Prado Dam may eventually be encroached upon by urban development.

3.04 No changes are expected to occur in the Prado Dam basin in the absence of the project. Existing structures and dairies will remain in the basin. It is anticipated that the Prado Dam spillway will be widened and a parapet wall added atop the dam as an interim measure to allow the dam to pass a maximum probable flood. Details on this modification are not available at this time. This modification is not expected to change basin land use conditions, nor will it increase flood protection downstream. Downstream from Prado Dam, the Santa Ana Canyon flood plain will be urbanized up to the floodway line, resulting in the loss of most riparian vegetation, of the canyon as a wildlife habitat and corridor, and of esthetically pleasing open space. Several large housing and commercial developments are currently proposed for this reach. Examples include the Santa Ana Valley Irrigation Company's R proposal for a commercial and residential development in the flood plain upstream of Weir Canyon Road, and the Bryant Ranch/Lomas de Yorba-Sur proposal to extend Esperanza Road up the canyon and develop a residential tract partially in the flood plain. Orange County has requested (see paragraph 2.05) that the Corps modify its plan in order

to allow the developments. Without the project, it is expected that the entire flood fringe will be developed.

3.05 No significant changes should occur along the lower Santa Ana River from Imperial Highway to the ocean. This reach is fully urbanized. The marsh and oil fields below Hamilton-Victoria Street may be replaced at some future date by a marina or residential or commercial development unless development is prohibited by the California Coastal Commission, or by the Corps under Section 404 or Section 10 regulatory authority. Development would remove an important food source for the
R endangered California least tern. The Least Tern Recovery Team and the USFWS consider the marsh area essential to the continued survival of the
R least tern. There are proposals to extend 19th Street across the marsh just north of the proposed project marsh restoration area, to construct a highway along the base of the bluffs at the northeast edge of the proposed project marsh, and to widen Pacific Coast Highway (PCH). These developments could affect marsh productivity. The existing bicycle and equestrian trails from Imperial Highway to PCH will not be affected if the project is not implemented.

3.06 Residences and parks line lowermost Santiago Creek. These conditions will not change in the absence of a project. However, increased flood protection will not be provided, so that these areas will continue to be subject to more frequent or severe flooding than would be the case with the project. Lands along Santiago Creek above Chapman Avenue are proposed for regional park development by Orange County. Should the Santa Ana River Project not be implemented, this park development may or may not occur, because about half of some of the land acquisition and recreational facility development costs would be borne by the project. Gravel extraction activities in the pits above Prospect Avenue will continue for several years. Ground water recharge potential in the gravel pits will probably not be altered unless the pits are filled in the future.

3.07 The No Action future conditions along upper Oak Street Drain will include removal of remaining citrus groves in favor of residential development. Areas adjacent to the lower channel are already urbanized.

3.08 PLANS CONSIDERED IN DETAIL. Four structural plans were considered during the Phase I planning process; these plans are summarized in the following paragraphs. The general environmental elements of each plan accompany the description of each plan. Details and implementation responsibilities on each plan can be found in Chapter 5 of the Main Report.

3.09 All River Plan. The All River Plan includes constructing Mentone Dam near Redlands, flood plain management of the Santa Ana River from Mentone Dam to Prado Dam (about 30 miles), increasing the height of Prado Dam and altering its release schedule, installing a concrete channel at the Oak Street Drain in Corona, acquiring and preserving the Santa Ana Canyon flood plain, widening and improving the lower Santa Ana River in Orange County, improving the Santiago Creek channel with rock

revetment and by using the gravel pits for (100-year) flood retention, acquiring and restoring 92 acres of coastal marsh at the Santa Ana River mouth, and replacing the affected areas of the California least tern nesting area and the freshwater Victoria Pond. The Corps, wildlife agencies, State and local agencies, and local groups agreed during Review Report and Phase I planning and coordination to the following environmental features of the plan.

(a) Mentone Dam. The dam will be 3.3 miles long and will be situated across a broad alluvial fan. A proposed recreation lake in the Mentone Dam basin will include provision for fish and wildlife. Borrow areas behind the dam will be revegetated where possible. The downstream face of the dam will be planted for esthetic and wildlife purposes with grasses and native shrubs. A site 12 miles south of the dam site may be used as a borrow site for Mentone Dam core material.

(b) Prado Dam. Prado Dam will be raised 30 feet in height and the taking line will be raised 10 feet (to elevation 566 feet (msl)). A 1,000-acre area in the basin may be used as a borrow site for Mentone Dam core material. Four recreation lakes are proposed for development in the basin. The lakes will provide fish and wildlife habitat values in addition to recreation use. Recreational trails will circle the basin's periphery. Duck ponds will be created, as noted in paragraph 1.31 of the 1977 FES. Extensive riparian vegetation in the basin area will continue to provide wildlife habitat. Cultural resources in Prado basin will be affected; these will be evaluated and appropriate measures taken to preserve or record them.

(c) Santa Ana Canyon. The 1,500-acre Santa Ana Canyon post-project flood plain will be acquired and maintained in its current status as open space.

(d) Marsh. About eight acres of marsh wetland will be acquired as direct mitigation for channel widening. An additional 84 acres will be acquired for preservation and enhancement of endangered species habitat. The resulting 92-acre marsh will be enhanced in phases with restoration of California least tern feeding features completed prior to initiation of flood control construction at the river mouth area. A biological monitoring program will be established to evaluate and modify the restoration plan during the construction period of the project.

(e) California Least Tern Nesting Area. The project will remove about one third of the 4.5-acre fenced nesting area on the beach. To offset this loss, a similar amount of fenced beach will be added to the nesting site at its western end. The relocation will occur during a non-nesting season prior to flood control construction at the river mouth, and will be monitored during the period of construction downstream from Victoria Street to evaluate its success.

(f) Victoria Pond. The project will eliminate one-third of the 13-acre Victoria Pond freshwater lagoon habitat. The affected area of the pond will be replaced adjacent to its current site, on lands owned by Orange County.

3.10 High Prado Plan. The High Prado Plan is the designated National Economic Development (NED) Plan. It includes raising Prado Dam and its taking line higher than in the All River Plan (to taking line elevation 582 feet (msl)), and not constructing Mentone Dam. Other structural features are similar to the All River Plan. Environmental features are similar to the All River Plan, except that (a) the impacts (primarily adverse) upstream of Prado basin associated with the construction of Mentone Dam are avoided and (b) only 8 acres of coastal marsh will be acquired.

3.11 All Channel Plan. The All Channel Plan provides for enlarging the Prado Dam outlet works and spillway and substantially widening the lower Santa Ana River from below Prado Dam to the ocean, with a concrete channel from about Imperial Highway to the ocean. The Santiago Creek plan will be the same as under the All River and High Prado Plans. Mentone Dam and Oak Street Drain will not be constructed. The Santa Ana Canyon riparian vegetation will probably be eliminated due to greatly increased floodflow releases from Prado Dam. The marsh acreage to be acquired and restored will be enlarged to about 200 acres to offset the substantially widened channel impacts on the marsh and least tern nesting site. The impacted least tern nesting area on the beach will be virtually eliminated. It will be replaced adjacent to the existing site under the same criteria as in the All River Plan. Victoria Pond will be largely eliminated by the widened channel; it, too, will be replaced.

3.12 Environmental Quality (EQ) Plan. The EQ Plan coincides structurally and environmentally with the High Prado Plan, with the following additional environmental features: (a) most agricultural land uses will be discontinued in Prado basin, allowing expansion of wildlife habitat; (b) the mobile home park in Santa Ana Canyon will be removed in favor of open space, esthetic, and wildlife values; (c) about 200 acres of marsh will be acquired and restored as preservation and enhancement of endangered species habitat, consistent with the USFWS definition of the least tern essential habitat; and (d) the Greenville-Banning channel from Victoria Street to Fairview channel will be soft bottom rather than concrete as in the All River Plan, enabling replacement and enhancement of wetland values. The EQ Plan for Santiago Creek coincides with the recommended 100-year plan and adds acquisition and preservation of the largely unmodified flood plain between Villa Park Road and Villa Park Dam (as delineated in "Flood Plain Information, Lower Santiago Creek," Los Angeles District Corps of Engineers, June 1973). Upper Oak Street Drain will be rock-revetted under the EQ plan rather than channelized with concrete, and where feasible will feature a widened and extensively landscaped right-of-way on either side of the channel. A possible alternative alinement of the Talbert channel is discussed in paragraph 5.68 as a potential EQ Plan addition.

3.13 COMPARATIVE IMPACTS OF ALTERNATIVES. The impacts of the alternatives on significant resources within the project area (as defined in the "Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act" (40 CFR Parts 1500-1508), November 19, 1978) and the plan

economics are summarized in Table 1, Comparative Impacts of Alternatives. The significant resources shown in the table are described in Chapter 4, Affected Environment, and the effects of each alternative on those resources are discussed in Chapter 5, Environmental Effects. Table 2 identifies those resources addressed in Chapters 4 and 5 which are significant for any or all of the project alternatives, for each respective project reach.

TABLE 1
Comparative Impacts of Alternatives
(Santa Ana River, California)

Reaches and Significant Resources	Base Condition	"Without" Condition No Action	All River Plan (Alternative 6)	High Prado (NED) Plan (Alternative 7)	All Channel Pl (Alternative 1
1. Mentone Dam					
Vegetation and Wildlife	Coastal sage scrub with unique mixed juniper woodland; some citrus groves. Varied mammal and bird life. Rodents food source for raptors.	Probable residential development of up to 40% (1,000 acres) of site: removal of some vegetation and citrus; removal of corresponding habitat.	Removal of 1,600 acres of sage scrub and juniper woodland, and up to 227 acres of citrus groves. Eventual partial scrub revegetation. Reduction of wildlife habitat for dam and spillway, borrow pit, recreation areas. Landscape dam face and borrow areas. Build wildlife guzzlers.	No Mentone Dam; no effect. Same as "Without" condition.	No Mentone Dam effect. Same "Without" condi
Water Resources	Good quality.	Some deterioration in bacteriological parameters due to urbanization; no project effect. Declining condition.	Improved chemical quality, worsened bacteriological quality. Increased recharge. Overall improvement.	No Mentone; no effect.	No Mentone; no effect.
Land Use	About 1,000 acres developable: now native semiarid vegetation and 227 acres citrus and other crops. 55 homes on site.	Probable urbanization of much of northern portion of site, incl. citrus groves.	Lands acquired for flood control; no development (except recreation; see below). Homes removed.	No Mentone; no effect.	No Mentone; no effect.
Prime and Unique Farmland	275 acres P&UF, mainly citrus crops.	Urbanization.	Acquisition of P&UF land by project, some removal for dam and recreation features. Some preservation of lands vs. urbanization without project.	No Mentone; no effect.	No Mentone; no effect.
Esthetics	Views of open space: natural vegetation, mountains.	Loss of open space to urbanization.	Preservation of open space; negative impact by dam structure on views of mountains. Landscape downstream face of dam.	No Mentone; no effect.	No Mentone; no effect.
Recreation	No recreation; informal walking, shooting.	Probable urbanization.	235 acres recreation including 50-acre lake with fishing, non-power boats, swimming, 1/3 area reserved for wildlife. Also picnicking, camping, playfields, trails.	No Mentone; no effect.	No Mentone; no effect.
2. Redlands Borrow Site (for Mentone Dam)					
Vegetation and Wildlife	Agricultural crops. Rodents, birds.	See Land Use below.	Short-term removal of habitat. Loss of agriculture. Possible conflict with State plans for wildlife sanctuary.	No Mentone; no effect.	No Mentone; no effect.
Land Use	2,300 acres agriculture (barley, oats).	Part is owned by State as mitigation lands for other project; no development if fully acquired by State as wildlife sanctuary.	Removal of topsoil, loss of agriculture.	No Mentone; no effect.	No Mentone; no effect.
3. Upper Santa Ana River (Mentone to Prado)					
Vegetation and Wildlife	Riverside to Prado excellent riparian vegetation and habitat of least Bell's vireo and yellow-billed	Flood plain management; no project-induced change.	Flood plain management. Narrowed SPF floodway allows some urban encroachment. Flood plain below Riverside nearly same as	No Mentone; no effect.	No Mentone; effect.

TABLE 1
Comparative Impacts of Alternatives
(Santa Ana River, California)

Base Condition	"Without" Condition No Action	All River Plan (Alternative 6)	High Prado (NED) Plan (Alternative 7)	All Channel Plan (Alternative 11)	Environmental Quality Plan (Alternative 10)
...stal sage scrub ...th unique mixed ...niper woodland; ...e citrus groves. ...ried mammal and ...rd life. Rodents ...od source for ...ptors.	Probable residential development of up to 40% (1,000 acres) of site: removal of some vegetation and citrus; removal of corresponding habitat.	Removal of 1,600 acres of sage scrub and juniper woodland, and up to 227 acres of citrus groves. Eventual partial scrub revegetation. Reduction of wildlife habitat *for dam and* spillway, borrow pit, recreation areas. Landscape dam face and borrow areas. Build wildlife guzzlers.	No Mentone Dam; no effect. Same as "Without" condition.	No Mentone Dam; no effect. Same as "Without" condition.	No Mentone Dam; no effect. Same as "Without" condition.
...od quality.	Some deterioration in bacteriological parameters due to urbanization; no project effect. Declining condition.	Improved chemical quality, worsened bacteriological quality. Increased recharge. Overall improvement.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
...bout 1,000 acres ...evelopable: now ...ative semiarid ...egetation and 227 ...cres citrus and ...ther crops. 55 ...omes on site.	Probable urbanization *of much of* northern portion of site, incl. citrus groves.	Lands acquired for flood control; no development (except recreation; see below). Homes removed.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
275 acres P&UF, ...ainly citrus crops.	Urbanization.	Acquisition *of P&UF* land by project, some removal for dam and recreation features. Some preservation of lands vs. urbanization without project.	*No Mentone; no* effect.	No Mentone; no effect.	No Mentone; no effect.
Views of open space: natural vegetation, mountains.	Loss of open space to urbanization.	Preservation of open space; negative impact by dam structure on views *of mountains. Landscape* downstream face of dam.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
No recreation; informal walking, shooting.	Probable urbanization.	235 acres recreation including 50-acre lake with fishing, non-power boats, swimming, 1/3 area reserved for wildlife. Also picnicking, camping, playfields, trails.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
Agricultural crops. Rodents, birds.	See Land Use below.	Short-term removal of habitat. Loss of agriculture. Possible conflict with State plans for wildlife sanctuary.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
2,300 acres agriculture (barley, oats).	Part is owned by State as mitigation lands for other project; no development if fully acquired by State as wildlife sanctuary.	Removal of topsoil, loss of agriculture.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
Riverside to Prado excellent riparian vegetation and habitat ...	Flood plain management; no project-induced change.	Flood plain management. Narrowed SPF floodway allows some urban encroach-... Flood plain below	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.

	Recreation	No recreation; informal walking, shooting.	Probable urbanisation.	235 acres recreation including 50-acre lake with fishing, non-power boats, swimming, 1/3 area reserved for wildlife. Also picnicking, camping, playfields, trails.	No Mentone; no effect.	No Mentone; effect.
2.	Redlands Borrow Site (for Mentone Dam)					
	Vegetation and Wildlife	Agricultural crops. Rodents, birds.	See Land Use below.	Short-term removal of habitat. Loss of agriculture. Possible conflict with State plans for wildlife sanctuary.	No Mentone; no effect.	No Mentone; effect.
	Land Use	2,300 acres agriculture (barley, oats).	Part is owned by State as mitigation lands for other project; no development if fully acquired by State as wildlife sanctuary.	Removal of topsoil, loss of agriculture.	No Mentone; no effect.	No Mentone; effect.
3.	Upper Santa Ana River (Mentone to Prado)					
	Vegetation and Wildlife	Riverside to Prado excellent riparian vegetation and habitat of least Bell's vireo and yellow-billed cuckoo.	Flood plain management; no project-induced change.	Flood plain management. Narrowed SPF floodway allows some urban encroachment. Flood plain below Riverside nearly same as now, so little effect on riparian habitat.	No Mentone; no effect.	No Mentone effect.
	Water Resources	Similar to Mentone. Good quality but deteriorating downstream.	No project effect. Declining conditions.	Same quality as Mentone, increased recharge (beneficial).	No Mentone; no effect.	No Mentone effect.
	Land Use	River unchannelized; leveed near Riverside. Natural vegetation and agriculture along river. Flood plain management of SPF flood plain.	No project-induced change. Possible long-term urban encroachment of existing flood fringe.	Narrowed SPF floodway; allows some future urban encroachment.	No Mentone; no effect.	No Mentone effect.
4.	Prado Basin					
	Vegetation and Wildlife	Extensive willow communities (50% of basin's 9,741 acres). Rest is grazing & agriculture lands and willow/upland interface. Rich habitat for many bird species, incl. least Bell's vireo and yellow-billed cuckoo (not Fed. endangered). Visited by bald eagles, peregrine falcons.	No change.	Increased water supply pool will eliminate some willow vegetation, increase aquatics. 1,440 acres willows and upland removed from basin for borrow pits and levees. 630 acres used for recreation; 350 acres of this as wildlife mgmt. area. Lakes provide some fish and wildlife values. Short-term construction noise, etc., impacts 1/3 of basin, esp. bird life. Gain 1,461 acres potential basin habitat but most remains as agriculture. Build duck ponds.	Increased water supply pool will eliminate some willow vegetation, increase aquatics. No borrow pit for Mentone Dam so no impacts. 440 acres willow/upland interface removed as borrow for raising Prado Dam and for levees. Recreation as under All River Plan. Gain 5,545 acres of potential habitat, but agriculture remains. Build duck ponds.	No change
	Cultural Resources	Several historic and prehistoric sites within existing taking line and subject to inundation.	No project change. Gradual, continuing deterioration.	Adverse impacts from borrow sites, recreation, increased (rare) flood levels.	Similar to All River Plan, but no Mentone borrow site impacts. Inundation impacts greater though rare.	No change
	Water Resources	Surface water good quality, ground water poor quality.	Can't be determined; may deteriorate as poor quality runoff increases but potential improvement as agriculture decreases.	Improvement to surface and ground water. Bacteriological quality probably worse.	Improvement to surface and ground water. Bacteriological quality probably worse.	Same as conditi

ion; informal hooting.	Probable urbanisation.	235 acres recreation including 50-acre lake with fishing, non-power boats, swimming, 1/3 area reserved for wildlife. Also picnicking, camping, playfields, trails.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
ral crops. birds.	See Land Use below.	Short-term removal of habitat. Loss of agriculture. Possible conflict with State plans for wildlife sanctuary.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
ees agriculture oats).	Part is owned by State as mitigation lands for other project; no development if fully acquired by State as wildlife sanctuary.	Removal of topsoil, loss of agriculture.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
e to Prado t riparian ion and habitat Bell's vireo low-billed	Flood plain management; no project-induced change.	Flood plain management. Narrowed SPF floodway allows some urban encroachment. Flood plain below Riverside nearly same as now, so little effect on riparian habitat.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
to Mentone. ality but rating eam.	No project effect. Declining conditions.	Same quality as Mentone, increased recharge (beneficial).	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
unchannelized; near Riverside. l vegetation riculture along Flood plain ment of SPF plain.	No project-induced change. Possible long-term urban encroachment of existing flood fringe.	Narrowed SPF floodway; allows some future urban encroachment.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
sive willow ities (50% of s 9,741 acres). s grazing & lture lands and w/upland inter- Rich habitat ny bird species, least Bell's and yellow- d cuckoo (not endangered). ed by bald s, peregrine ns.	No change.	Increased water supply pool will eliminate some willow vegetation, increase aquatics. 1,440 acres willows and upland removed from basin for borrow pits and levees. 630 acres used for recreation; 350 acres of this as wildlife mgmt. area. Lakes provide some fish and wildlife values. Short-term construction noise, etc., impacts 1/3 of basin, esp. bird life. Gain 1,461 acres potential basin habitat but most remains as agriculture. Build duck ponds.	Increased water supply pool will eliminate some willow vegetation, increase aquatics. No borrow pit for Mentone Dam so no impacts. 440 acres willow/upland interface removed as borrow for raising Prado Dam and for levees. Recreation as under All River Plan. Gain 5,545 acres of potential habitat, but agriculture remains. Build duck ponds.	No change.	Add 5,545 acres to basin. Terminate much agriculture/grazing, allowing extensive revegetation and habitat increase. Increased water supply pool will eliminate some vegetation, increase aquatics, as with High Prado Plan. Recreation lakes provide increased fish and wildlife habitat, less intensive recreation. Build duck ponds.
al historic and storic sites n existing g line and sub- to inundation.	No project change. Gradual, continuing deterioration.	Adverse impacts from borrow sites, recreation, increased (rare) flood levels.	Similar to All River Plan, but no Mentone borrow site impacts. Inundation impacts greater though rare.	No change.	Same as High Prado Plan.
oor water good ity, ground water quality.	Can't be determined; may deteriorate as poor quality runoff increases but potential improvement as agriculture decreases.	Improvement to surface and ground water. Bacteriological quality probably worse.	Improvement to surface and ground water. Bacteriological quality probably worse.	Same as "Without" condition.	Same as High Prado Plan. Removal of much dairying should further improve water quality.

TABLE 1 (Continued)
Comparative Impacts of Alternatives

Reaches and Significant Resources	Base Condition	"Without" Condition No Action	All River Plan (Alternative 6)	*High Prado* (MED) Plan (Alternative 7)	All Channel Pla (Alternative 1
(4. Prado Basin, Cont'd.)					
Land Use	Up to 5,000 acres riparian/woodland growth. Much dairy cattle grazing allowed. Many lands privately owned with flowage easement.	No change.	Acquire 1,461 acres for new taking line. Remove 121 homes, 27 dairies, 2 ranches, 8 agric. firms. Cattle grazing and agriculture allowed to continue. Add 630 acres of recreation lakes and parks. 29 homes removed in Corona.	Acquire 5,545 acres for new taking line. Affect 718 homes, 88 dairies and ranches, 25 businesses. Cattle grazing and agriculture allowed to continue. Recreation as under All River Plan. 244 homes removed in Corona.	No change.
Prime & Unique Farmland	3,366 acres P&UF, largely in agricultural and dairy use, within upper existing basin fringes.	No change.	Old plus 1,780 acres new P&UF lands acquired. Dairy structures removed, grazing and crops probably remain.	Additional acres P&UF acquired. Same effects as All River Plan.	No change.
Recreation	3 existing regional parks in basin (total 2,100 acres), 2 golf courses, 1 small airport, three small privately leased recreational areas.	Possible additional park development, not part of this project.	630 acres of new parkland, incl. 4 lakes (avg. 25 acres each) with fishing, non-power boating, swimming. Also picnic, camp, playfields, trails, 350-acre wildlife mgmt. area. Impacts on vegetation, wildlife, traffic, utilities, cultural resources.	Same as All River Plan.	Same as "Witho condition.
5. Santa Ana Canyon					
Vegetation and Wildlife	Riparian growth; also rustic riparian regional park. Potential habitat of least Bell's vireo and yellow-billed cuckoo. Visited by bald eagle, pereg. falcon.	Urban development of much of flood plain.	Preserve 1,500 acres of post-project flood plain vegetation and wildlife habitat. Some vegetation species to be washed away by increased Prado release schedule.	Same as All River Plan.	Acquire and pr serve from dev ment 1,630 acr flood plain. O increased Prad lease schedule eliminate most all vegetation
Water Resources	Same as Prado basin.	No project effect.	Improvement--same as Prado basin.	Improvement--same as Prado basin.	No change.
Land Use	Existing 150-acre regional park, golf course, mobile home park, citrus groves, 10 homes. Primarily riparian habitat corridor.	Residential and commercial development of much of flood plain.	1,500 acres of flood plain to be acquired; non-developable.	Same as All River Plan.	1,630 acres fl plain to be a non-developabl lease schedul damage existi golf course, Four homes re
Esthetics	Largely undeveloped open space/canyon/ riparian views. High esthetic value.	Urban development of open space. Loss of esthetics.	Preserve 1,500 acres of flood plain open space.	Same as All River Plan.	Preserve 1,63 of flood plai large Prado r remove most r vegetation.
6. Lower Santa Ana River (Imperial to Victoria)					
Water Resources	Recharge basins along river, substantial recharge. Quality same as Prado basin (poor).	No change.	Recharge increase due to seasonally lengthened Prado release schedule. Water quality also improved.	Same as All River Plan.	Recharge dec due to concre channel. Wat quality no c
Land Use	Fully urbanized along channel. Minimal habitat value. Open space above Victoria next to G-B channel	No change.	No significant change. Add 85 acres to project right-of-way. Seven miles of concrete channel will reduce wildlife habitat	Same as All River Plan.	Acquisition acres land homes, 25 b & 9 stables channel will wildlife ha

TABLE 1 (Continued)
Comparative Impacts of Alternatives

Base Condition	"Without" Condition No Action	All River Plan (Alternative 6)	High Prado (NED) Plan (Alternative 7)	All Channel Plan (Alternative 11)	Environmental Quality Plan (Alternative 10)
(d.)					
Up to 5,000 acres riparian/woodland growth. Much dairy cattle grazing allowed. Many lands privately owned with flowage easement.	No change.	Acquire 1,461 acres for new taking line. Remove 121 homes, 27 dairies, 2 ranches, 8 agric. firms. Cattle grazing and agriculture allowed to continue. Add 630 acres of recreation lakes and parks. 29 homes removed in Corona.	Acquire 5,545 acres for new taking line. Affect 718 homes, 88 dairies and ranches, 25 businesses. Cattle grazing and agriculture allowed to continue. Recreation as under All River Plan. 244 homes removed in Corona.	No change.	Add 5,545 acres to taking line. Same impacts as High Prado Plan, but most grazing and agric. removed from basin.
3,366 acres P&UF, largely in agricultural and dairy use, within upper existing basin fringes.	No change.	Old plus 1,780 acres new P&UF lands acquired. Dairy structures removed, grazing and crops probably remain.	Additional acres P&UF acquired. Same effects as All River Plan.	No change.	Same acres P&UF acquired as High Prado Plan. Lands preserved but most removed from agricultural and grazing uses.
3 existing regional parks in basin (total 2,100 acres), 2 golf courses, 1 small airport, three small privately leased recreational areas.	Possible additional park development, not part of this project.	630 acres of new parkland, incl. 4 lakes (avg. 25 acres each) with fishing, non-power boating, swimming. Also picnic, camp, playfields, trails, 350-acre wildlife mgmt. area. Impacts on vegetation, wildlife, traffic, utilities, cultural resources.	Same as All River Plan.	Same as "Without" condition.	Same as All River and High Prado Plans. More area of lakes devoted to fish and wildlife.
Riparian growth; also rustic riparian regional park. Potential habitat of least Bell's vireo and yellow-billed cuckoo. Visited by bald eagle, pereg. falcon.	Urban development of much of flood plain.	Preserve 1,500 acres of post-project flood plain vegetation and wildlife habitat. Some vegetation species to be washed away by increased Prado release schedule.	Same as All River Plan.	Acquire and preserve from development 1,630 acres of flood plain. Greatly increased Prado release schedule may eliminate most or all vegetation/habitat.	Same as All River and High Prado Plans but preserve 1,530 acres. Remove mobile home park from upper canyon, allow to revert to riparian vegetation.
Same as Prado basin.	No project effect.	Improvement--same as Prado basin.	Improvement--same as Prado basin.	No change.	Improvement--same as Prado basin.
Existing 150-acre regional park, golf course, mobile home park, citrus groves, 10 homes. Primarily riparian habitat corridor.	Residential and commercial development of much of flood plain.	1,500 acres of flood plain to be acquired; non-developable.	Same as All River Plan.	1,630 acres flood plain to be acquired; non-developable. Release schedule may damage existing park, golf course, citrus. Four homes removed.	Same as High Prado Plan but acquire 1,530 acres. Remove mobile home development (333 units, 30 acres).
Largely undeveloped open space/canyon/ riparian views. High esthetic value.	Urban development of open space. Loss of esthetics.	Preserve 1,500 acres of flood plain open space.	Same as All River Plan.	Preserve 1,630 acres of flood plain but large Prado releases remove most riparian vegetation.	Same as All River Plan; also remove mobile home park (30 acres), enhancing open space views in canyon.
Recharge basins along river, substantial recharge. Quality same as Prado basin (poor).	No change.	Recharge increase due to seasonally lengthened Prado release schedule. Water quality also improved.	Same as All River Plan.	Recharge decrease, due to concrete channel. Water quality no change.	Same as All River and High Prado Plans.
Fully urbanized along channel. Minimal habitat	No change.	No significant change. Add 85 acres to project right-of-way. Seven miles of concrete channel will	Same as All River Plan.	Acquisition of 230 acres land incl. 128 homes, 25 businesses, & 9 stables. Concrete	Same as All River and High Prado Plans.

Water Resources	Same as Prado basin.	No project effect.	Improvement--same as Prado basin.	Improvement--same as Prado basin.	No change.
Land Use	Existing 150-acre regional park, golf course, mobile home park, citrus groves, 10 homes. Primarily riparian habitat corridor.	Residential and commercial development of much of flood plain.	1,500 acres of flood plain to be acquired; non-developable.	Same as All River Plan.	1,630 acres fl plain to be a non-developabl lease schedule damage existi golf course, Four homes re
Esthetics	Largely undeveloped open space/canyon/ riparian views. High esthetic value.	Urban development of open space. Loss of esthetics.	Preserve 1,500 acres of flood plain open space.	Same as All River Plan.	Preserve 1,630 of flood plain large Prado re remove most ri vegetation.
6. Lower Santa Ana River (Imperial to Victoria)					
Water Resources	Recharge basins along river, substantial recharge. Quality same as Prado basin (poor).	No change.	Recharge increase due to seasonally lengthened Prado release schedule. Water quality also improved.	Same as All River Plan.	Recharge decre due to concret channel. Water quality no cha
Land Use	Fully urbanized along channel. Minimal habitat value. Open space above Victoria next to G-B channel (covered under river mouth issues).	No change.	No significant change. Add 85 acres to project right-of-way. Seven miles of concrete channel will reduce wildlife habitat	Same as All River Plan.	Acquisition of acres land in homes, 25 busi & 9 stables. channel will wildlife habi
Recreation	Bicycle and equestrian trails, Imperial to PCHwy (20 miles).	No change.	Trails replaced by project.	Trails replaced by project.	Trails replac project.
7. Marsh at SAR Mouth					
Vegetation and Wildlife	Coastal salt marsh vegetation and species of birds, mammals, fish, marine benthic organisms. Tidal channels. Least tern feeding area. Belding's sav. sparrow occasionally present, light-footed clapper rail may be present.	Oil extraction. Probable eventual marina or urbanization and loss of vegetation unless Section 404, Sec. 10, or State Coastal Act prevents development on portion or all.	Direct wetland vegetation loss 8 acres; impacts least tern feeding ecosystem. Acquire, preserve, and enhance 92 acres of marsh vegetation for marsh species, least tern feeding area, B. sav. sparrow and light-footed clapper rail habitat.	Direct wetland vegetation loss of 8 acres. Acquire 8 acres as mitigation. No marsh restoration. Impacts marsh ecosystem and least tern feeding area.	Direct marsh v tion loss of 2 Impact on mars ecosystem and tern feeding. quire and enha 200 acres mars associated upl Provide least feeding and ne
Land Use	Oil extraction, open space, coastal salt marsh, wetland.	Possible marina or urban development (unless prohibited by Federal and State wetland regulatory authority).	Widened SAR takes 8 acres + 92 acres marsh acquisition removed from potential development.	Same as All River Plan.	Widened SAR t total acres; 2 acres marsh a tion removed potential dev ment.
8. Other SAR Mouth Issues					
Least Tern Nesting Site	Fenced beach nesting area of 4.5 acres for Federal endangered species.	No change.	Removal of 1.5 acres of nesting site; replacement by expansion westward along beach. Related loss of additional 4 acres of State beach lands due to relocated Talbert channel.	Same as All River Plan.	Removal of mo nesting site; replacement t along beach a creating nest area in enlar marsh. Relat of 7 acres of beach lands.
Victoria Pond	Freshwater 13-acre pond area; substantial shorebird/waterfowl utilization. Least tern feeding area.	Proposed future county regional park; lands owned by Orange County.	Removal of 1/3 of pond; replacement adjacent to existing site.	Same as All River Plan.	Removal of mo pond; replace adjacent to ing site.
River Mouth Channels	Benthic and fish populations in tidal waters near mouth. Sandbar plugs mouth in summer. Periodic dredging of deposited sediments.	No change.	SAR minimal effect. Concrete Talbert channel eliminates revetment sideslope habitat. G-B channel combined into widened SAR below Victoria Street causes short-term marine life disruption, long-term increase in tidal wetland.	Same as All River Plan.	Essentially a All River Pla wider SAR. Co invert above Victoria. Ad impact greate Increase in wetland water

		as Prado basin.	Prado basin.		
150-acre park, golf mobile home itrus groves, a. Primarily habitat r.	Residential and commercial development of much of flood plain.	1,500 acres of flood plain to be acquired; non-developable.	Same as All River Plan.	1,630 acres flood plain to be acquired; non-developable. Release schedule may damage existing park, golf course, citrus. Four homes removed.	Same as High Prado Plan but acquire 1,530 acres. Remove mobile home development (333 units, 30 acres).
undeveloped ace/canyon/ n views. High c value.	Urban development of open space. Loss of esthetics.	Preserve 1,500 acres of flood plain open space.	Same as All River Plan.	Preserve 1,630 acres of flood plain but large Prado releases remove most riparian vegetation.	Same as All River Plan; also remove mobile home park (30 acres), enhancing open space views in canyon.
e basins iver, substan- charge. same as asin (poor).	No change.	Recharge increase due to seasonally lengthened Prado release schedule. Water quality also improved.	Same as All River Plan.	Recharge decrease, due to concrete channel. Water quality no change.	Same as All River and High Prado Plans.
rbanized hannel. habitat Open space ictoria next hannel d under river ssues).	No change.	No significant change. Add 85 acres to project right-of-way. Seven miles of concrete channel will reduce wildlife habitat	Same as All River Plan.	Acquisition of 230 acres land incl. 128 homes, 25 businesses, & 9 stables. Concrete channel will reduce wildlife habitat.	Same as All River and High Prado Plans.
and equestrian Imperial to (20 miles).	No change.	Trails replaced by project.	Trails replaced by project.	Trails replaced by project.	Trails replaced by project.
l salt marsh tion and species ds, mammals, marine benthic ms. Tidal la. Least eeding area. g's sav. sparrow tionally present, -footed clapper ay be present.	Oil extraction. Probable eventual marina or urbanization and loss of vegetation unless Section 404, Sec. 10, or State Coastal Act prevents development on portion or all.	Direct wetland vegetation loss 8 acres; impacts least tern feeding ecosystem. Acquire, preserve, and enhance 92 acres of marsh vegetation for marsh species, least tern feeding area, B. sav. sparrow and light-footed clapper rail habitat.	Direct wetland vegetation loss of 8 acres. Acquire 8 acres as mitigation. No marsh restoration. Impacts marsh ecosystem and least tern feeding area.	Direct marsh vegetation loss of 20 acres. Impact on marsh ecosystem and least tern feeding. Acquire and enhance 200 acres marsh and associated upland. Provide least tern feeding and nesting.	Direct wetland loss same as All River and High Prado Plans. Acquire, preserve, and enhance 200 acres of marsh vegetation. Enhance least tern feeding area, provide tern nesting area.
traction, open coastal salt , wetland.	Possible marina or urban development (unless prohibited by Federal and State wetland regulatory authority).	Widened SAR takes 8 acres + 92 acres marsh acquisition removed from potential development.	Same as All River Plan.	Widened SAR takes 20 total acres; 200 acres marsh acquisition removed from potential development.	Widened SAR takes 8 total acres; 200 acres marsh acquisition removed from potential development.
beach nesting of 4.5 acres for al endangered es.	No change.	Removal of 1.5 acres of nesting site; replacement by expansion westward along beach. Related loss of additional 4 acres of State beach lands due to relocated Talbert channel.	Same as All River Plan.	Removal of most of nesting site; replacement to west along beach and by creating nesting area in enlarged marsh. Related loss of 7 acres of State beach lands.	Same as All River Plan plus add nesting area in enlarged marsh acquisition.
ater 13-acre rea; substantial ird/waterfowl ation. Least eeding area.	Proposed future county regional park; lands owned by Orange County.	Removal of 1/3 of pond; replacement adjacent to existing site.	Same as All River Plan.	Removal of most of pond; replacement adjacent to existing site.	Same as All River and High Prado Plans.
ic and fish popu- s in tidal waters outh. Sandbar outh in summer. ic dredging of ted sediments.	No change.	SAR minimal effect. Concrete Talbert channel eliminates revetment sideslope habitat. G-B channel combined into widened SAR below Victoria Street causes short-term marine life disruption, long-term increase in tidal wetland.	Same as All River Plan.	Essentially same as All River Plan, but wider SAR. Concrete invert above Victoria. Adverse impact greater. Increase in tidal wetland water areas.	Same as All River and High Prado Plans.

TABLE 1 (Continued)
Comparative Impacts of Alternatives

Reaches and Significant Resources	Base Condition	"Without" Condition No Action	All River Plan (Alternative 6)	High Prado (NED) Plan (Alternative 7)	All Channel Plan (Alternative 11)
(8. Other SAR Mouth Issues, Cont'd.)					
Greenville-Banning Channel above Victoria Street	Softbottom channel, wetland growth in invert. Significant bird species in channel and adjacent wetland area. Least tern feeding area.	No change. Possible county park (or urban) development on open space adjacent to G-B Channel.	Concrete channel. Loss of softbottom and vegetation/habitat.	Same as All River Plan.	G-B combined with SAR as concrete channel; loss of softbottom and vegetation/habita
Least Tern Interim Feeding Area	15-acre fenced tern feeding area created by Orange County while they did channel work. Now drained of water, not functional. Subject of lawsuit over removal of culverts.	No change.	Loss of 2 acres of feeding area.	Same as All River Plan.	Same as All River Plan.
Beach Replenishment	Sandy beaches with groin fields, downcoast sand erosion. Replenishment from upcoast every 5 years (1.5 mcy). Changing seasonal littoral drift directions.	No change.	Deposition of up to 3.7 mcy of dredged SAR material on Newport Beach for replenishment. Possible impact on beach composition, marine life.	Same as All River Plan.	Same as All River Plan, but greater quantity.
9. Santiago Creek					
Vegetation and Wildlife	Exotic trees and shrubs along lower creek sides, landscaped parks along middle creek, minimal shrubs along upper project creek. Minimal wildlife.	No change.	Lower creek vegetation removed to install revetment. Park vegetation retained. Gravel pits when flooded will provide seasonal habitat. Possible recreation lake may provide fish habitat.	Same as All River Plan.	Same as All River Plan.
Water Resources	Substantial recharge potential in gravel pits. Water quality appears good.	No change.	Recharge potential will, and water quality could, be decreased by SAR fill placement and compaction in gravel pits.	Same as All River Plan.	Same as All River Plan.
Esthetics	Rustic vegetation along lower creek. Parks and masonry channel walls along middle creek. Open space/gravel pits along upper creek.	No change.	Remove lower creek vegetation. Retain parks and masonry walls. Convert pits to flood retention and possible recreation lake with landscaping. Esthetic treatment landscaping within right-of-way.	Same as All River Plan.	Same as All River Plan.
Recreation	Minimal informal walking along sections of creek. Local parks along middle reach.	No change. Orange Co. may develop parks at gravel pits.	Bicycle trails along project reaches, tie in with local trail reaches. Lake/park in gravel pits.	Same as All River Plan.	Same as All River Plan.
10. Oak Street Drain					
Esthetics	Open space/citrus groves along upper channel, homes and businesses along lower channel.	Probable residential development along upper channel, removing citrus groves and open space.	Concrete channel worsens esthetics vs. soft-bottom.	Same as All River Plan.	No project; no effect.
11. Endangered Species	California least tern nesting and feeding, Belding's savannah sparrow, and possible L.f. clapper rail in marsh at SAR mouth.	Eventual urban or marina development of marsh, unless preserved as Section 404/10 or Coastal Commission wetland.	Relocation of 1/3 of nesting area, restoration of 92 acres marsh. Preserve and enhance endangered species habitat.	Relocate nesting area. Acquire 8 acres marsh; no restoration.	Relocation of ma of nesting area, loss of 20 acres of marshland. R toration of 200 acres of marsh.
	Bird species in Santa Ana Canyon. Same as Prado (below).	Probable urbanisation of flood plain.	Preservation of Santa Ana Canyon flood plain habitat. Release schedule may alter vegetation types somewhat.	Same as All River Plan.	Canyon preserve most vegetation habitat largely due to large d releases.

TABLE 1 (Continued)
Comparative Impacts of Alternatives

Condition	"Without" Condition No Action	All River Plan (Alternative 6)	High Prado (NED) Plan (Alternative 7)	All Channel Plan (Alternative 11)	Environmental Quality Plan (Alternative 10)
ottom channel, nd growth in t. Significant species in channel djacent wetland Least tern ng area.	No change. Possible county park (or urban) development on open space adjacent to G-B Channel.	Concrete channel. Loss of softbottom and vegetation/habitat.	Same as All River Plan.	G-B combined with SAR as concrete channel; loss of softbottom and vegetation/habitat.	Softbottom G-B channel re-created (and widened). Vegetation and habitat restored, enhanced.
re fenced tern ng area created range County they did channel . Now drained of r, not functional. ect of lawsuit over val of culverts.	No change.	Loss of 2 acres of feeding area.	Same as All River Plan.	Same as All River Plan.	Same as All River Plan.
y beaches with n fields, down- t sand erosion. lenishment from east every 5 years 5 mcy). Changing onal littoral ft directions.	No change.	Deposition of up to 3.7 mcy of dredged SAR material on Newport Beach for replenishment. Possible impact on beach composition, marine life.	Same as All River Plan.	Same as All River Plan, but greater quantity.	Same as All River and High Prado Plans.
tic trees and shrubs ng lower creek es, landscaped parks ng middle creek, imal shrubs along er project creek. imal wildlife.	No change.	Lower creek vegetation removed to install revetment. Park vegetation retained. Gravel pits when flooded will provide seasonal habitat. Possible recreation lake may provide fish habitat.	Same as All River Plan.	Same as All River Plan.	Same as All River Plan. Also acquire and preserve S.C. canyon flood plain Villa Park Road to Villa Park Dam. Riparian growth, wildlife corridor.
stantial recharge tential in gravel ts. Water quality pears good.	No change.	Recharge potential will, and water quality could, be decreased by SAR fill placement and compaction in gravel pits.	Same as All River Plan.	Same as All River Plan.	Same as All River Plan. Add pits above Villa Park Road for possible recharge.
tic vegetation along er creek. Parks and sonry channel walls ong middle creek. en space/gravel pits long upper creek.	No change.	Remove lower creek vegetation. Retain parks and masonry walls. Convert pits to flood retention and possible recreation lake with landscaping. Esthetic treatment landscaping within right-of-way.	Same as All River Plan.	Same as All River Plan.	Same as All River Plan; also preserve upper creek as open space.
nimal informal walk- g along sections f creek. Local parks long middle reach.	No change. Orange Co. may develop parks at gravel pits.	Bicycle trails along project reaches, tie in with local trail reaches. Lake/ park in gravel pits.	Same as All River Plan.	Same as All River Plan.	Same as All River Plan. Possibly extend trail to Villa Park Dam.
pen space/citrus roves along upper hannel, homes and sinesses along wer channel.	Probable residential development along upper channel, removing citrus groves and open space.	Concrete channel worsens esthetics vs. soft-bottom.	Same as All River Plan.	No project; no effect.	Same as All River Plan but revetted channel and landscaped wider right-of-way improves project esthetics and maintains wildlife corridor and access to water.
alifornia least tern esting and feeding, olding's savannah parrow, and possible f. clapper rail marsh at SAR mouth.	Eventual urban or marina development of marsh, unless preserved as Section 404/10 or Coastal Commission wetland.	Relocation of 1/3 of nesting area, restoration of 92 acres marsh. Preserve and enhance endangered species habitat.	Relocate nesting area. Acquire 8 acres marsh; no restoration.	Relocation of most of nesting area, loss of 20 acres of marshland. Restoration of 200 acres of marsh.	Same as All River and High Prado Plans. Enlarged 200-acre marsh also provides new least tern nesting site.
nd species in Santa	Probable urbanization	Preservation of Santa Ana	Same as All River	Canyon preserved but	Same as All River and High

	masonry channel walls along middle creek. Open space/gravel pits along upper creek.		walls. Convert pits to flood retention and possible recreation lake with landscaping. Esthetic treatment landscaping within right-of-way.		
Recreation	Minimal informal walking along sections of creek. Local parks along middle reach.	No change. Orange Co. may develop parks at gravel pits.	Bicycle trails along project reaches, tie in with local trail reaches. Lake/park in gravel pits.	Same as All River Plan.	Same as All River Plan.
10. Oak Street Drain					
Esthetics	Open space/citrus groves along upper channel, homes and businesses along lower channel.	Probable residential development along upper channel, removing citrus groves and open space.	Concrete channel worsens esthetics vs. soft-bottom.	Same as All River Plan.	No project; no effect.
11. Endangered Species	California least tern nesting and feeding, Belding's savannah sparrow, and possible L.f. clapper rail in marsh at SAR mouth.	Eventual urban or marina development of marsh, unless preserved as Section 404/10 or Coastal Commission wetland.	Relocation of 1/3 of nesting area, restoration of 92 acres marsh. Preserve and enhance endangered species habitat.	Relocate nesting area. Acquire 8 acres marsh; no restoration.	Relocation of mos of nesting area, loss of 20 acres of marshland. Re toration of 200 acres of marsh.
	Bird species in Santa Ana Canyon. Same as Prado (below).	Probable urbanization of flood plain.	Preservation of Santa Ana Canyon flood plain habitat. Release schedule may alter vegetation types somewhat.	Same as All River Plan.	Canyon preserved most vegetation habitat largely due to large dam releases.
	Least Bell's vireo and yellow-billed cuckoo (Fed. Candidate species) in Prado basin; S.A. Canyon also habitat. B. eagle and pereg. falcon (Fed. & State endangered) visit both areas.	No change.	1,000-acre Prado borrow pit for Mentone, 340 acres pits for raising Prado, 100 acres for levees all remove habitat. 630 acres recreation impacts. Changed Prado release duration drowns some vegetation in bottomland willows. Adverse effects on species.	440 acres of borrow pits and levees remove habitat. Same recreation impacts. Release schedule water supply pool drowns some Prado bottomland willow habitat. No impacts in Prado of Mentone borrow pit since no Mentone Dam. Less adverse effects.	No change.
	L. Bell's vireo and yellow-billed cuckoo habitat along upper SAR Prado to Riverside.	Eventual urban encroachment in existing SPF flood fringe possible.	Flood plain management preserves most of lower flood plain but Mentone allows some urban encroachment at edges. Effects on endgrd. species areas below Riverside minimal.	No Mentone; no effect.	No Mentone; no effect.
12. Wetlands	Wetlands in marsh and at SAR mouth, S. Ana Canyon, Prado basin, upper SAR.	Probable marina or urban development of marsh at SAR mouth, unless preserved as wetland. Santa Ana Canyon flood plain urbanized. Prado no change. Upper SAR no change unless urban pressure on flood fringe below Riverside.	Loss of 8 acres at mouth, restoration of 92 acres of marsh. Preservation of Santa Ana Canyon flood plain from development. Prado basin and upper SAR minimal change, but Prado borrow pits affect wetlands.	Loss and replacement of 8 acres at mouth. Santa Ana Canyon acquired. No 1,000-acre Prado borrow pit impacts for Mentone.	Loss of 20 acres mouth; restore 2 acres marsh. Sa Ana Canyon acqui but large releas remove much vege tion. Prado and SAR no change.
13. Prime and Unique Farmland	275 acres at Mentone, 3,366 acres at Prado within 556' elev.	Urbanization at Mentone. No change in Prado.	Acquisition of 275 acres at Mentone, affect 5,146 acres (1,780 new) at Prado. Grazing and agriculture can remain. Lands saved from urbanization. Borrow pits and recreation remove 1,000 acres.	No project at Mentone. Acquire more P&UF at Prado. Grazing and agriculture same as All River Plan. Borrow pits and recreation remove at least 500 acres.	No Mentone; no No project-relat change at Prado.
14. Cultural Resources	Sites in Prado basin. Corps has preservation responsibilities under EO 11593.	No change.	Affect several sites at Prado. Will protect or recover significant sites as appropriate.	Affect more sites at Prado; same approach as in All River Plan.	No effect.
15. Plan Economics	Not applicable.	Not applicable.	Costs: $938,937,000 Net benefits: $80,007,000 B-C ratio: 2.1	Costs: $863,955,000 Net benefits: $91,952,000 B-C ratio: 2.4	Costs: $1,063,0 Net benefits: $51,259,000 B-C ratio: 1.7

nnel walls le creek. /gravel pits r creek.		parks and masonry walls. Convert pits to flood retention and possible recreation lake with landscaping. Esthetic treatment landscaping within right-of-way.			
nformal walk- sections Local parks dle reach.	No change. Orange Co. may develop parks at gravel pits.	Bicycle trails along project reaches, tie in with local trail reaches. Lake/park in gravel pits.	Same as All River Plan.	Same as All River Plan.	Same as All River Plan. Possibly extend trail to Villa Park Dam.
e/citrus long upper homes and s along nnel.	Probable residential development along upper channel, removing citrus groves and open space.	Concrete channel worsens esthetics vs. soft-bottom.	Same as All River Plan.	No project; no effect.	Same as All River Plan but revetted channel and landscaped wider right-of-way improves project esthetics and maintains wildlife corridor and access to water.
ia least tern and feeding, e savannah and possible pper rail at SAR mouth.	Eventual urban or marina development of marsh, unless preserved as Section 404/10 or Coastal Commission wetland.	Relocation of 1/3 of nesting area, restoration of 92 acres marsh. Preserve and enhance endangered species habitat.	Relocate nesting area. Acquire 8 acres marsh; no restoration.	Relocation of most of nesting area, loss of 20 acres of marshland. Restoration of 200 acres of marsh.	Same as All River and High Prado Plans. Enlarged 200-acre marsh also provides new least tern nesting site.
cies in Santa on. Same as low).	Probable urbanization of flood plain.	Preservation of Santa Ana Canyon flood plain habitat. Release schedule may alter vegetation types somewhat.	Same as All River Plan.	Canyon preserved but most vegetation lost, habitat largely lost, due to large dam releases.	Same as All River and High Prado Plans.
ll's vireo low-billed (Fed. Candidate) in Prado S.A. Canyon bitat. B. eagle eg. falcon State en- d) visit both	No change.	1,000-acre Prado borrow pit for Mentone, 340 acres pits for raising Prado, 100 acres for levees all remove habitat. 630 acres recreation impacts. Changed Prado release duration drowns some vegetation in bottomland willows. Adverse effects on species.	440 acres of borrow pits and levees remove habitat. Same recreation impacts. Release schedule water supply pool drowns some Prado bottomland willow habitat. No impacts in Prado of Mentone borrow pit since no Mentone Dam. Less adverse effects.	No change.	Same as High Prado Plan but more lands removed from human land uses, allowed to revert to habitat. No Mentone, so no adverse 1,000-acre borrow pit effect.
l's vireo and -billed cuckoo t along upper ado to River-	Eventual urban encroachment in existing SPF flood fringe possible.	Flood plain management preserves most of lower flood plain but Mentone allows some urban encroachment at edges. Effects on endgrd. species areas below Riverside minimal.	No Mentone; no effect.	No Mentone; no effect.	No Mentone; no effect.
nds in marsh and R mouth, S. Ana n, Prado basin, SAR.	Probable marina or urban development of marsh at SAR mouth, unless preserved as wetland. Santa Ana Canyon flood plain urbanized. Prado no change. Upper SAR no change unless urban pressure on flood fringe below Riverside.	Loss of 8 acres at mouth, restoration of 92 acres of marsh. Preservation of Santa Ana Canyon flood plain from development. Prado basin and upper SAR minimal change, but Prado borrow pits affect wetlands.	Loss and replacement of 8 acres at mouth. Santa Ana Canyon acquired. No 1,000-acre Prado borrow pit impacts for Mentone.	Loss of 20 acres at mouth; restore 200 acres marsh. Santa Ana Canyon acquired but large releases remove much vegetation. Prado and upper SAR no change.	Same as All River Plan but restore 200 acres marsh.
ores at Mentone, acres at Prado n 556' elev.	Urbanization at Mentone. No change in Prado.	Acquisition of 275 acres at Mentone, affect 5,146 acres (1,780 new) at Prado. Grazing and agriculture can remain. Lands saved from urbanization. Borrow pits and recreation remove 1,000 acres.	No project at Mentone. Acquire more P&UF at Prado. Grazing and agriculture same as All River Plan. Borrow pits and recreation remove at least 500 acres.	No Mentone; no effect. No project-related change at Prado.	Same as High Prado Plan but terminate most grazing and agriculture from Prado basin.
s in Prado basin. s has preservation nsibilities under 1593.	No change.	Affect several sites at Prado. Will protect or recover significant sites as appropriate.	Affect more sites at Prado; same approach as in All River Plan.	No effect.	Same as High Prado Plan.
pplicable.	Not applicable.	Costs: $938,937,000 Net benefits: $80,007,000 B-C ratio: 2.1	Costs: $863,955,000 Net benefits: $91,952,000 B-C ratio: 2.4	Costs: $1,063,673,000 Net benefits: $51,259,000 B-C ratio: 1.7	Costs: $885,888,000 Net benefits: $90,368,000 B-C ratio: 2.4

TABLE 2

Coverage of Significant Resource Impacts Resulting from Alternatives

	Vegetation & Wildlife	Cultural Resources	Water Resources	Land Use	Prime & Unique Farmland	Esthetics	Recreation
Santa Ana River Main Stem							
Mentone Dam	X		X	X	X	X	X
Redlands Borrow Site	X			X			
Upper Santa Ana River	X		X	X			
Prado Dam Reservoir Area	X	X	X	X	X		X
Santa Ana Canyon	X		X	X		X	
Lower Santa Ana River			X	X			X
River Mouth Marsh	X			X			
Other River Mouth Resources	X			X			
Santiago Creek	X		X			X	X
Oak Street Drain						X	

X= Potentially significant resource impact

IV. AFFECTED ENVIRONMENT

4.01 ENVIRONMENTAL CONDITIONS. The physical, social, and economic settings of the project area are described in Chapter 2 of the 1977 FES and in Chapter 3 of the Main Report under "Existing Conditions." Following is a brief overview of the river system.

4.02 The Santa Ana River basin is the largest drainage basin in southern California, encompassing 2,450 square miles. The river flows for about 66 miles through three counties--San Bernardino, Riverside, and Orange--and empties into the Pacific Ocean between Newport Beach and Huntington Beach. Along the upper basin, the river flows through semiarid vegetation and agricultural areas to Prado Dam. The Prado Dam reservoir area contains several thousand acres of riparian vegetation as well as regional parks, golf courses, and agricultural lands. The Santa Ana Mountains and the Chino Hills separate the upper basin from the coastal plain. The river passes through these ranges in the 8-mile-long Santa Ana Canyon, predominantly an open-space area of riparian vegetation. Below the Santa Ana Canyon, the river is fully channelized, traversing about 23 miles of the highly urbanized, flat coastal plain of Orange County.

4.03 Santiago Creek is a principal tributary of the Santa Ana River, flowing west for about 28 miles from the Santa Ana Mountains, and encompassing a drainage area of 102 square miles. The upper creek portion of the project above the City of Villa Park is generally unchannelized, with gravel extraction pits along the creek. The lower creek flows through nearly flat urbanized areas and has been channelized. Two dams (Santiago and Villa Park) are situated upstream from the project limits.

4.04 Oak Street Drain is a Santa Ana River tributary that flows through the City of Corona to the Prado Dam reservoir area. Its drainage area is 11.5 square miles. Citrus groves are situated along its upstream reach, with residential and commercial areas of the City of Corona along its downstream reach. The proposed project extends along the 3.3 miles of the improved channel.

4.05 SIGNIFICANT RESOURCES. Significant resources within the project area (Tables 1 and 2) are discussed in the following paragraphs. More detailed studies that were conducted on some of the resources are referred to in the discussions, as applicable, and are available in Appendix I to the Main Report. Because the Santa Ana River Project covers a large geographical area and includes several distinctive project features, significant resources are discussed herein by project reach or feature, in a progression from upstream to downstream reaches. For any given project reach, only those resources which are significant and which may be affected by any of the project alternatives are discussed in this chapter and in Chapter 5.

4.06 Certain additional resources identified in 1977 Final Environmental Statement comments and responses as being important, but

which are not expected to be significantly affected by the project or to influence plan selection, will be addressed in the Phase II studies as noted in the FES. Examples include short-term construction-related air quality, noise, and energy impacts; utilities relocation impacts; ground water recharge along Oak Street Drain; environmental effects of raising Highway 71; effects on Federal Highway projects; and maintenance of channels relative to vegetation removal. Other studies which were addressed in Phase I and which will be reassessed in Phase II are discussed in Chapter 5. One area of concern which was raised in the FES was studied in Phase I but was determined not to be significant: possible microclimatological citrus frost changes caused by Mentone Dam (see assessment in Appendix I). Geological hazards were also addressed (see Main Report Chapter 3 under "Existing Conditions" for discussion
R and Appendix D to the Main Report for geologic details).

SANTA ANA RIVER MAIN STEM

MENTONE DAM

4.07 VEGETATION. The proposed Mentone Dam site is on a broad alluvial outwash area on the Santa Ana River just downstream from its confluence with Mill Creek (see Figure 11 in the Main Report for project location). The site is one of fast-draining sands, cobbles, and boulders. The confluence of Mill and Plunge Creeks with the Santa Ana River has resulted in many braided channels in the outwash area. The river and the two tributary creeks provide a biological connection between the dam site and the San Bernardino Mountains. The following discussions of vegetation and wildlife are based on (a) limited biological surveys performed for the Corps between January and May 1980 by biologist consultants (see Appendix I, reports by Brattstrom and Hanes, 1980), (b) supplemental site surveys by Corps biologists, and (c) information contained in the Supplemental U.S. Fish and Wildlife (Service) Coordination Act Report prepared for the project (Appendix I).

4.08 The existing vegetation at the site is composed primarily of alluvial scrub and juniper woodland, with strips of riparian species along present and previous stream courses. The alluvial scrub is a mixture of native coastal sage scrub and chaparral elements; species include California buckwheat, chamise, prickly pear, yerba mansa, scalebroom, sumac, yucca, and California sagebrush. The alluvial scrub predominates in younger, perennially disturbed areas.

4.09 The most extensive and significant vegetation type at the site is juniper woodland, which is intermixed with the coastal sage scrub species. The juniper woodland is on the more stable, less recently disturbed areas of the alluvial plain. The California junipers attain a height of up to 12 to 15 feet; some are 80 to 90 years old. The Mentone area contains the largest stand of California junipers on the southern California coastal plain; this mixture of coastal sage scrub, chaparral, and juniper woodland is unique to a few alluvial fans of southern California. All of the on-site investigations to date suggest that the area of the Mentone Dam site supports a rich, diverse ecological entity

important in itself as a rare example of coastal juniper woodland, perhaps scientifically important to the understanding of the current distribution of juniper woodlands in California, and important to populations of raptors and other predators in the nearby San Bernardino Mountains.

4.10 Scattered, poorly formed stands of riparian woodland vegetation occur along the stream channels in the study area and are a minor component of the site's vegetation. Riparian growth is dominated primarily by small-statured California sycamore and such shrubs as mulefat. The larger riparian trees provide perching and nesting habitat for birds, especially raptors such as golden eagles, hawks, and owls. The study area also contains weedy vegetation species such as castorbean and tree tobacco that have invaded the water recharge ponds. No rare, threatened, or endangered species of plants have been found at the proposed project site.

4.11 WILDLIFE. Wildlife observed during field surveys included a rich, diverse variety of mammals, birds, and reptiles. The juniper woodland-coastal shrub areas contain the most productive habitat and highest species diversity in the area for both mammals and birds. The woodland provides food, shelter, and breeding areas for such common animals as gophers, ground squirrels, mice, rabbits, opossums, skunks, foxes, coyotes, and badgers. Common birds are western meadowlark, quail, mockingbird, raven, crow, California thrasher, starling, Anna's hummingbird, and red-tailed hawk. Rodents are a food source for the large mammalian and avian predator populations (foxes, coyotes, hawks, burrowing and great horned owls, golden eagles) which reside both in the project area and in nearby canyons and mountains. The availability of water in percolation ponds just east of the project site is a further attraction to wildlife, despite heavy use of the area by hunters and target-shooters. Five reptile species, including the secretive California legless lizard, were observed during the winter surveys. No fishery resources are present at the project site because of the intermittent nature of streamflow. No rare, threatened, or endangered animal species have been observed or reported in the Mentone Dam site area.

4.12 WATER RESOURCES. A study of water resources within the Santa Ana River basin was conducted in 1980 by ECOS Management Criteria (Tustin, California) under contract with the Los Angeles District. The report, entitled "Water Resources in the Upper Santa Ana River Basin," is included in Appendix I. Summaries of the report's findings are presented in this chapter and in Chapter 5 for each reach of the project where water resources could be significantly affected by the project.

4.13 Surface Flows. The Santa Ana River originates as a clear, cold mountain stream in the San Bernardino Mountains east of the Mentone area. At Mentone, the river has just emerged from the mountains and has entered the agricultural and urban East San Bernardino Valley. The river water quality at this point is still the high quality of a mountain stream, with Total Dissolved Solids (TDS) typically in the

range of 113-172 milligrams per litre (mg/l). (For domestic water, TDS below 500 mg/l is generally considered excellent quality, 500 to 1,000 mg/l is undesirable but acceptable, and over 1,000 mg/l is generally unacceptable, because of poor taste and hardness.) The dissolved solids are comprised of common minerals of low toxicity such as sodium and calcium carbonates, chlorides, and sulfates. Dissolved oxygen is near saturation (9-12 mg/l). Bacteriological quality is also good for base flow, as represented by a typical coliform count of 20/(per) 100 millilitres (ml). This water is of excellent quality for any general usage such as drinking water, or domestic, agricultural, or industrial usage. Storm flow waters have similarly good chemical quality (dissolved solids) but much lower bacterial quality; total coliform counts of 24,000/100 ml have been reported. Storm flow also typically carries high levels of silt. Base flow in the river is not continuous throughout the year at Mentone. Much of the flow during the dry season is diverted for agricultural and other usage. A significant amount also percolates into the highly permeable alluvial soil.

4.14 Ground Water. Ground water in the Mentone area is of similarly high quality (with one significant exception noted below) because it originates in and is continually recharged by runoff from the mountains. Dissolved solids are typically 150-300 mg/1. However, the chemical quality is not quite as high as the mountain streamwater, because lower quality urban and agricultural runoff and other factors also contribute to ground water. These factors--mainly agricultural runoff--have caused the exception to the generally high quality: ground waters in the Mentone-Redlands-Loma Linda area contain excessively high levels of nitrate (10-24 mg/1 as nitrate nitrogen). The limit recommended by the Environmental Protection Agency for nitrate in public water supplies is 10 mg/1 as nitrate nitrogen, or 45 mg/1 as nitrate ion.

4.15 LAND USE. The site selected for the proposed Mentone Dam is predominantly one of undeveloped open space with native coastal sage scrub-juniper woodland vegetation. About 55 homes are within the area to be affected by the project, as are 200 acres of citrus groves, 12 acres of avocado groves, and 15 acres of oat crops, most at the northern side of the planned right-of-way. There is strong and increasing pressure to subdivide and construct residences within the proposed dam site. It appears that up to 40 percent of the site (the northern portion) may be sufficiently safe from flooding that it could be subdivided and urbanized.

4.16 PRIME AND UNIQUE FARMLAND. The Soil Conservation Service (SCS), in a December 1979 letter (undated; included in Appendix I), stated that 275 acres of prime and/or unique farmland (P&UF) are within the area to be affected by the construction of Mentone Dam. The P&UF are situated north of Greenspot Road in the areas of citrus and avocado groves.

4.17 ESTHETICS. The site of the planned Mentone Dam is a gently sloping alluvial fan and outwash plain of coastal sage scrub and mixed juniper woodland. The site affords an essentially quiet area of open

space. The backdrop is an impressive view of the San Bernardino Mountains, rising up several thousand feet from the outwash plain a few miles north and east of the proposed dam site. Some residents of eastern San Bernardino, northern Redlands, and the lower alluvial fan slopes of the San Bernardino Mountains immediately north of the project have views of the open space plain and the mountains behind. The community of East Highlands, situated near the future downstream toe of the dam, has fine views of the mountains. Periods of smog, particularly in summer, frequently impair the view.

4.18 RECREATION. No formal recreation resources exist at the planned Mentone Dam area. Limited informal walking and firearm target practice occur there. Access to the Mentone area is via two-lane Greenspot Road.

REDLANDS BORROW SITE

4.19 VEGETATION AND WILDLIFE. A site 12 miles south of the proposed Mentone Dam site has been tentatively identified as a possible source of the 10 to 12 million cubic yards of impervious "borrow" (soil) material needed for the Mentone Dam core. (For a map of the borrow site, see Plate D-46 in Main Report Appendix D, "Geology, Materials and Soils.") Known as the Redlands site, it comprises 2,300 acres of gently sloping agricultural land on alluvial deposits in an undeveloped open space area of the San Jacinto Valley. The valley lies between The Badlands (hills) and the Bernasconi Hills. The site slopes gradually to the southeast toward a shallow depression off-site that contains privately owned duck ponds. In addition to agricultural crops (barley and oats) currently grown on the site, buckwheat, mustard, Russian thistle, sunflower, and red brome were observed by Corps biologists surveying the area. Infrequently seen plant species include jimson weed, Matilija poppy, lupine, and evening primrose. Minimal wildlife has been observed on the site. However, the availability of crops may provide a food supply for wildlife and serve to maintain the wildlife corridor of the San Jacinto Valley. A number of birds (red-tailed hawk, marsh hawk, cliff swallow, ash-throated flycatcher, barn owls, and burrowing owls) utilize the area for foraging purposes. Although the region is considered suitable habitat for the Stephen's kangaroo rat (a Federal Candidate threatened or endangered species), none was found at the site during limited sample trapping by Corps biologists. Bald eagles and peregrine falcons--both Federal endangered species--have been observed at the borrow area by California Department of Fish and Game personnel (personal communication with Bonnar Blong, CDFG, June 18, 1980).

4.20 LAND USE. Agriculture is the only current use of the potential Redlands borrow area. Barley and oat crops are being grown on the site, according to the Soil Conservation Service (SCS), which has designated the area as cropland having statewide significance in the production of food, feed, and forage crops. The SCS does not consider the land prime or unique farmland. San Bernardino County's General Plan designates the area as "agricultural" land use. The southwestern 650 acres of the site were recently purchased by the State of California Department of Water Resources as mitigation for the State's Lake Perris project. The State

plans to acquire more land in the near future adjacent to or on the potential borrow site, to enhance and preserve the area as a wildlife sanctuary. Their plans for the site may include development of wetland habitat or continuation of agriculture, the latter in part as a wildlife food supply.

UPPER SANTA ANA RIVER

4.21 VEGETATION. The river course between Colton and Riverside becomes more sandy and narrow than in the Mentone area and is partially controlled by levees. From the La Loma Hills area downstream to Mount Rubidoux, the river is leveed to protect the densely populated Riverside area. Below Mount Rubidoux, the river course meanders in its shallow natural entrenchment, past flat agricultural lands, along the base of the Norco bluffs, and into the Prado basin. Main Report Figure 13 shows this river reach. The following discussion of vegetation and wildlife resources in this reach is based on the reports noted in paragraph 4.07.

4.22 Vegetation in the upstream river reach from the proposed Mentone Dam site downstream to Mount Rubidoux consists primarily of opportunistic weedy species (e.g., cocklebur, mulefat, and thistle); R scattered willow, cattail, and bulrush; and some adjacent areas supporting disturbed coastal sage scrub elements. Overall, the flood plain and the immediately adjacent areas have been so disturbed by flood control activities that they retain limited habitat value. In contrast, the reach between Mount Rubidoux and Prado basin is biologically one of the most valuable reaches of the Santa Ana River. The active stream course with year-round flows supports ephemeral aquatic and emergent vegetation such as various filamentous algae, duck weed, pond weed, watercress, stick-tight, and scarlet monkey flower. Bulrush and cattails are common along the quiet backwaters. Willows, cottonwoods, giant reed, and cattails dominate a nearly impenetrable tangle of growth along some of the old abandoned meanders. During the summer, young sandbars support a sparse mixture of cocklebur and weedy annuals. Older sandbars often support clumps of giant reed, mulefat, sandbar willow, and black willow. Cottonwood, black willow, yellow willow, and red willow characterize areas of frequent inundation where the water table is high and velocities are not erosive. Old growth cottonwoods and sycamores, with a substory of shrubs and vines, grow along slopes of river banks and on old river terraces that are close to the water table. In summary, this river reach from Mount Rubidoux to Prado contains the richest, most diverse riparian habitat within the project area.

4.23 WILDLIFE. High vegetation diversity and perennial water flow in the Santa Ana River from Riverside to the Prado basin promote excellent wildlife species diversity. The rich and diverse habitat in this reach supports a large number of bird species. The width of the flood plain and the lushness of the vegetation provide the isolation necessary for the successful breeding of many species of birds that utilize riparian habitats. The large cottonwoods, sycamores, and some eucalyptus stands provide habitat for large local populations of red-shouldered hawks,

marsh hawks, and other raptors. Woodpeckers, flycatchers, herons, king fishers, and numerous perching birds use these trees for nesting and perching. The only rare, threatened, or endangered species of wildlife utilizing this river reach are the yellow-billed cuckoo, which is listed as rare by the State of California and is a Federal Candidate threatened or endangered species; and the least Bell's vireo, which has been reported in this reach (Goldwasser, 1978 for CDFG), and is a State endangered and Federal Candidate threatened or endangered bird species.

4.24 WATER RESOURCES. From the Mentone Dam site to the Prado basin, the quality of river water is determined by three components, the first two of which are seasonally variable. The first is the high quality natural stream base flow, which is intermittent, and generally absent during the dry season. Near Riverside, however, at the Riverside Narrows, natural flow reappears in the riverbed because of rising ground water. This natural flow is continuous year-round, although its flow rate undoubtedly varies with the season and with rainfall. The second component is storm flow, of high chemical quality but poor bacteriological quality, which occurs intermittently during the wet season and only very rarely during the dry season. The third component is treated municipal wastewater effluents, which are discharged continuously into the river channel by several municipalities along the river, starting with San Bernardino. These effluents are of much poorer chemical quality than the natural waters. Bacteriologically, however, they are of high quality, because they are required to be disinfected by chlorination.

4.25 Existing water quality in this reach of the river, therefore, is widely variable in both time and location. The variability tends to attenuate downstream of Riverside, particularly as the dry season advances. The surface flow at such a time and location may be considered as indicative of base flow quality for this reach, if the foregoing variations in time and location are borne in mind. The chemical quality of this water is substantially poorer than that at Mentone. The TDS content is 690-770 mg/1, dissolved oxygen is 3-6 mg/1, nitrate nitrogen is 8-10 mg/1, and small concentrations of many other pollutants (boron, fluoride, and phosphate) are present. The chemical quality of this water is fairly comparable to that of Colorado River water, which is not considered high quality but is acceptable for most beneficial uses. Bacteriological quality of river water in this reach is extremely variable. Total coliform counts of 20,000 to 140,000/100 ml have been reported. Agricultural drainage is responsible for some of the bacterial contamination, but does not fully explain it. In the wet season, the chemical quality of the water (dissolved constituents) improves, while suspended solids, turbidity, and bacterial levels are higher.

4.26 Ground water quality in this reach generally parallels surface water quality, although with much less variability with regard to location and time. The general trend is toward reducing quality from Mentone downstream. The TDS level is typically 550-650 mg/1. As one moves away from the river southward, TDS levels can be considerably higher, over 1,000 mg/1 in some locations.

4.27 LAND USE. The upper Santa Ana River from above the Mentone Dam site to the Prado Dam reservoir area is subject to Standard Project Flood (SPF) flood plain management by San Bernardino and Riverside Counties. The SPF flood fringe (outer portions of the flood plain) could be encroached upon, but urban pressures appear minimal in this area for the near future. The river is soft bottom, with levees to protect the urbanized Riverside area. Surrounding land uses are primarily sage-scrub vegetation along the upper reach, agriculture and cattle grazing along the middle reach, and dense riparian vegetation along the lower reach near the Prado Dam reservoir area.

PRADO DAM RESERVOIR AREA

4.28 VEGETATION AND WILDLIFE. The following discussion is based on the environmental reports noted in paragraph 4.07. Main Report Figure 14 shows the Prado basin. The most important resources of the Prado basin are its extensive and productive riparian and wetland habitats. The
R Prado reservoir contains the largest stand of mature forested woodlands remaining in southern California. An estimated 3,000 to 5,000 acres of riparian and wetland-type habitat (mostly willows with some cottonwoods and sycamores) currently exists. Cottonwoods and sycamores are substantially less numerous than willows in the reservoir. The former appear to be more vulnerable to the adverse effects of prolonged flooding typically occurring during the flood periods or because of retention of water for water conservation purposes.

4.29 The extent of the basin and its relative lack of public access (except in the park areas) provide important habitat values for resident and migratory bird species. Only the Salton Sea provides a larger, high-quality habitat for migratory waterfowl along the Pacific flyway in southern California. The basin also provides a permanent residence for various species of herons, flycatchers, and numerous species of raptors and perching birds. The areas of greatest wildlife values, in terms of species diversity and production, occur along the intermixed edges of the riparian and aquatic habitats and in areas where riparian habitats merge with higher-elevation open grassland and agricultural areas.

4.30 Much of the fringe area around Prado basin consists of agricultural lands (cultivated as well as dairy farms and related grazing) and grasslands. These areas are relatively low in rodent diversity, but several bird species such as starlings, cowbirds, house sparrows, barn owls, and meadowlarks utilize these areas for foraging purposes. In addition, extensive areas east of Prado Dam, and south of Prado Regional Park, are former coastal sage scrub habitat. A few native species remain but, since the areas have been heavily grazed for years, most of the area consists of grasses and introduced weeds. This area contains a number of avian species, and mammals such as harvest mice, gophers, ground squirrels, cottontails, jack rabbits, and coyotes, that utilize the basin primarily for feeding.

4.31 The willow woodland, by far the dominant vegetation type in Prado basin, has little diversity in terms of mammalian species due to frequent flooding. At times of high water, there are areas of open water in this thicket that are utilized by wintering waterfowl (shorebirds, ducks, geese, etc.). In addition, a large number of bird species (especially insect-eating species) utilize this habitat for shelter, nesting, and feeding. Among these are the secretive yellow-billed cuckoo and the least Bell's vireo. When Prado basin is flooded, only the tops of willows, sycamores, and poplars are visible. These trees are used as roosting sites for hawks, kites, great blue herons, ravens, and kingfishers, as well as golden and bald eagles. Hawks, kites, and ravens probably utilize the tops of these emergent trees as nesting sites regardless of the water levels within the reservoir. Golden eagles are thought to be an infrequent visitor within this area enroute to their nesting habitat in the Santa Ana Mountains. Bald eagles are thought to be a part of the wintering population at Lake Mathews, 10 miles southeast of Prado Dam, and may occasionally forage within the Prado Dam reservoir area.

4.32 There are four bird species of concern within Prado basin: bald eagle (Haliaeetus leucocephalus), peregrine falcon (Falco peregrinus), least Bell's vireo (Vireo belli pusillus), and yellow-billed cuckoo (Coccyzus americanus occidentalis). (a) Bald eagles--which are on both Federal and State endangered lists--have been sighted on several occasions foraging within the flooded willow woodlands. Two bald eagles were observed in February 1980 during a Corps study within the basin. (b) A USFWS biologist observed an immature peregrine falcon (also on both endangered lists) feeding in old field uplands near the Corona Airport. (c) Ten least Bell's vireos, a Federal Candidate subspecies and State endangered species, were observed (Goldwasser, 1978) at Prado reservoir and along the Santa Ana River near Norco during a CDFG breeding population survey. Least Bell's vireo utilizes extensive and dense willow habitats, usually next to a perennial stream. Most nests are found within 6 feet from the ground in thick riparian growth. (d) Two yellow-billed cuckoos, listed as rare by the CDFG and a Federal Candidate species, were sighted during a 1977 CDFG (Gaines) breeding population survey. A USFWS biologist observed a yellow-billed cuckoo in the reservoir about one-half mile west of Corona Airport in October 1979. This species appears to frequent habitat characterized by expanses of willows, generally in excess of 25 acres, with a dense understory. Table 3 lists known or suspected threatened and endangered species in the project area.

TABLE 3

Endangered and Other Protected Species Known or Suspected Within the Santa Ana River Project Area

Common Name	Scientific Name	Mentone	Prado	Santa Ana Canyon	Marsh	Other	Endangered Category
Fauna							
Bald eagle	Haliaeetus leucocephalus		F,M,V	M,V			LES, SP (endangered)
Peregrine falcon	Falco peregrinus		F,V	V			LES, SP (endangered)
California least tern	Sterna albifrons brownii				F,H,M	Beach: F,H,M,N	LES, SP (endangered)
Belding's savannah sparrow	Passerculus sandwichensis beldingi				F,H,N		FCS, SP (endangered)
Light-footed clapper rail	Rallus longirostris levipes				F,V		LES, SP (endangered)
Yellow-billed cuckoo	Coccyzus americanus occidentalis		F,H,N	H,F		Upper SAR	FCS, SP (rare)
Least Bell's vireo	Vireo belli pusillus		F,H,N	F,H		Upper SAR	FCS, SP (endangered)
Stephen's kangaroo rat	Dipodomys stephensi					Redlands borrow site (May occur)	FCS, SP (rare)
Flora							
Saltmarsh bird's beak	Cordylanthus maritimus maritimus				May occur		LES
Orange County Turkish-rugging	Chorizanthe staticoides maritimus				May occur		FCS
Laguna Beach live-forever	Dudleya stolonifera				May occur		FCS

Legend:

Utilization of Santa Ana River Project Area
- F - feeding
- H - suitable habitat
- M - migratory flyway
- N - nesting
- V - infrequent visitor

Federal
- LES - Listed Endangered Species
- FCS - Federal Candidate Species

State of California
- SP - State Protected (rare or endangered)

4.33 CULTURAL RESOURCES. The Prado Dam reservoir area contains cultural properties which are important to the prehistory and history of the region. Based on studies performed for the Corps (see reference in paragraph 4.71 and reports in Appendix I), 24 cultural properties have been identified within the project area. These include: (a) the Yorba-Slaughter Adobe, a listed National Register of Historic Places site; (b) two historic sites, three prehistoric sites, and one historic/aboriginal site which appear to be eligible for listing in the National Register; and (c) seven recorded sites which are isolated finds, severely disturbed, or otherwise do not meet National Register criteria. The six sites which appear to be eligible for the National Register are situated below the existing 556 (msl) taking line (maximum flood elevation) in Prado basin. The Yorba-Slaughter Adobe lies within the basin right-of-way, but is above the taking line at about 565 feet (msl). The base of the low bluffs near Mill Creek and the Santa Ana River may contain prehistoric sites; this area will be thoroughly investigated during Phase II studies. Table 4 (in Chapter 5) summarizes the cultural resources of Prado basin. (Note: additional cultural resources information developed during field studies conducted subsequent to preparation of the DSEIS has been incorporated into the FSEIS; see memorandum on Prado Dam cultural resources in Appendix I.) R R

4.34 WATER RESOURCES. Surface water quality in the Prado basin is determined largely by the same three factors discussed for the Mentone-to-Prado reach. River flow comprises a large part of the total flow into the basin. Additional tributary flows are some sewage treatment plant effluents which enter the basin via other channels. Ground water is close to the surface and contributes to wet season surface flow but does not normally contribute to dry season flow. During the past few years an additional intermittent contributing flow has come from State Water Project (SWP) water released via San Antonio Creek and Chino Creek for delivery to Orange County Water District ground water recharge basins. When the SWP water is not flowing, the quality of surface water in Prado basin is substantially the same as that of the river flow upstream of the basin to Riverside. When SWP water is flowing, the quality is improved proportionately, as the SWP water is of high quality. Under these circumstances, the TDS level drops to 400-500 mg/1. The dissolved oxygen content, however, rises to 7-11 mg/1. Rising ground water tables caused flooding problems in the vicinity of Corona Airport in spring 1980. Factors contributing to the flooding included successive seasons of above-average rainfall, large flows in Temescal Wash, perennial recharge from Corona's water percolation ponds, and short-term inundation from the flood control pool. R

4.35 Ground water quality in the Prado basin follows the same trend described above for the upstream river reach. The poor quality ground water south of the river reaches the Prado basin via its southeast extension along Temescal Wash. In this portion of the basin, extending to the middle of the basin, TDS levels reach 1250 mg/1, and nitrate reaches 116 mg/1 (26 mg/1 nitrate nitrogen).

4.36 LAND USE. Land uses in Prado basin were addressed in Chapter 2 of the 1977 FES. They are briefly summarized here. The predominant human land uses in the existing basin and in the new areas to be added are dairying (2,300 acres) and related grazing. Much of the reservoir area is privately owned, with flowage easements. Many homes and some agriculture-related businesses are situated within the new reservoir areas to be added. Respective numbers of affected dairies, homes, and businesses are summarized in paragraph 5.45 and presented in Chapter 5 of the Main Report. Other land uses within the existing Prado basin include three regional parks, two golf courses, one small-craft airport, and up to 5,000 acres (50 percent of the basin) of riparian-type woodland vegetation. The basin is an oasis of solitude and open space, and a significant wildlife habitat area.

4.37 PRIME AND UNIQUE FARMLAND. The Soil Conservation Service in a December 1979 letter (Appendix I) indicated that there are 3,366 acres of prime farmland within the existing Prado Dam taking line. These lands are generally near the upper basin fringes rather than in the bottomlands near Prado Dam.

4.38 RECREATION. Three regional parks have been developed on about 2,100 acres of the Prado Dam reservoir area. Two golf courses are in the basin. Private duck-hunting, pheasant-hunting, and dog-training clubs lease areas in the center of the reservoir area. Much of the basin potentially could be available for recreational purposes.

SANTA ANA CANYON

4.39 VEGETATION. Downstream from Prado Dam, the Santa Ana River flows through the narrow Santa Ana Canyon (see Main Report Figure 16). With the exception of about 3 miles of revetment along selected reaches at the flood plain edges, the river meanders naturally through the 8-mile-long canyon between Prado Dam and Weir Canyon Road. The Santa Ana Canyon reach is one of the most environmentally significant areas along the Santa Ana River. Although some modification of the area has occurred (e.g., Featherly Park, Green River Golf Course, citrus groves, mobile home park), the canyon reach of the river supports a relatively high-value riparian habitat with a more natural appearance than downstream reaches in heavily urbanized Orange County. The following descriptions of biological resources in the canyon are based on biological surveys performed by consultant, Corps, and USFWS biologists as referenced in paragraph 4.07.

4.40 Before Prado Dam was constructed in 1941, floodflows from the perennial upper Santa Ana River passed through the narrow canyon with enough force to remove most of the riparian flood plain vegetation. Occurring at frequencies of 20 to 30 years, these floods periodically returned the vegetation to early successional stages. Since 1941, Prado Dam has limited water releases in the canyon to about 6,000 cubic feet per second (cfs) and to about 300 cfs when floodflow releases are not necessary. These conservation releases maintain the high water table in

the canyon and the thick phreatophytic willow gallery along the margins of the stream course. The result is a smaller but more stable and mature riparian habitat than was originally present.

4.41 Considerable vegetation was lost in the 1969 flood as a result of controlled releases from Prado Dam. The riparian growth has reestablished well along existing channels and abandoned channels and meanders. Willows, cottonwoods, and sycamores are intermixed with riparian thicket bordering the water courses. Emergent riparian vegetation in this reach includes cattail, bulrush, duckweed, mulefat, giant reed, and stinging nettle. More mature vegetation along abandoned meanders and at higher elevations provides high habitat value and a source of rapid revegetation after floodflows subside. Species include large cottonwoods and tangles of wild grape and nettles. Areas not adjacent to the stream course support more xeric (dry-adapted) plant associations such as coastal sage scrub.

4.42 Citrus groves are common at the lower end of the Santa Ana Canyon. Hillsides on the north side of the canyon are dominated primarily by coastal sage scrub species, with patches of prickly-pear cactus and native grasses. Hillsides on the south side of the canyon are covered by chaparral, coastal sage scrub, grasses, and coast live oak.

4.43 No rare, threatened, or endangered plant species have been reported for the Santa Ana Canyon area.

4.44 WILDLIFE. The valuable riparian and upland vegetation in the Santa Ana Canyon provides habitat for diverse bird and mammal life, while the channel itself provides a corridor connection for wildlife movement between the Chino Hills and the Santa Ana Mountains. During a recent survey of canyon habitats by biological consultants (Appendix I), 43 species of birds were recorded, including great blue heron, red-shouldered hawk, white-tailed kite, ring-billed gull, California quail, Anna's hummingbird, and several species of woodpeckers. Nineteen species of mammals were recorded during the survey, including mice, rats, squirrels, gophers, skunks, raccoons, coyotes, and gray foxes. Also recorded were mosquito fish, two species of frogs, and western fence lizard. The endangered bald eagle and peregrine falcon are infrequent visitors in the canyon area. The Santa Ana Canyon contains habitat suitable for the yellow-billed cuckoo and least Bell's vireo, which are known to utilize habitat in Prado basin. During a 1978 field survey for CDFG (Goldwasser, 1978), Featherly Park in the canyon was censused twice (May, June), but no Bell's vireos were recorded.

4.45 WATER RESOURCES. Surface water quality in the Santa Ana Canyon is determined almost exclusively by the quantity and rate of release from Prado Dam. The canyon length is only about 8 miles, and there are no substantial tributaries, diversions, or uses in this reach. Bacterial levels are generally high, with total coliform counts usually ranging between 3,000 and 20,000 organisms/100 ml. Ground water quality parallels surface flow quality here. There is no significant ground

water basin underlying the canyon, which traverses a generally impervious formation separating the upper Santa Ana River basin from the lower basin.

4.46 LAND USE. The Santa Ana Canyon is predominantly a riparian and open space corridor. Other land uses include a 333-unit mobile home park, Green River Golf Course, citrus groves, and Featherly County Regional Park, a 150-acre rustic riparian park. There is intense pressure for residential and commercial development of the canyon flood plain, as discussed in paragraph 2.05.

4.47 ESTHETICS. The Santa Ana Canyon is a largely rural, riparian-vegetation, open-space corridor of significant esthetic value. This value is increased by the proximity of the canyon to heavily urbanized Orange County and by the increasing rarity of non-urban scenic canyons near urban centers of southern California. The unchannelized Santa Ana River meanders within the canyon flood plain through substantial riparian growth, the largest remaining stand of such growth in Orange County. Riparian and citrus vegetation support fairly abundant wildlife, as discussed in paragraph 4.44. As noted in paragraph 2.05, urbanization of the flood plain is desired by some local development interests. Such development would eventually mean the elimination of the esthetic values of the Santa Ana Canyon flood plain.

LOWER SANTA ANA RIVER (IMPERIAL HIGHWAY TO VICTORIA STREET)

4.48 WATER RESOURCES. The lower Santa Ana River basin has consistently poor surface water quality. Most of the surface water entering the lower basin comes from the upper reaches of the river and reflects upstream water uses and degradations. A large ground water basin exists from Imperial Highway to the ocean and is considered an important county water resource (221,000 acre-feet/year) of average water quality. From the ocean to approximately two miles upstream of the Santa Ana River mouth, the salinity levels become too high for domestic or agricultural water usage. In addition, the bacteriological quality of the water resource throughout the lower Santa Ana River is degraded.

4.49 LAND USE. Lands adjacent to the lower Santa Ana River channel are fully urbanized with residential and commercial development.

4.50 RECREATION. Off-street bicycling and equestrian trails extend the 20-mile length of the Santa Ana River from Imperial Highway to Pacific Coast Highway. Trails use the project service roads or, occasionally in the case of horses, a trail adjacent to the service road. Underpasses for trail users are provided at all street crossings except Adams Avenue.

SANTA ANA RIVER MOUTH MARSH

4.51 VEGETATION AND WILDLIFE. The tidal marsh to the east of the Santa Ana River mouth is a valuable coastal resource. The site is part of a 400-acre remnant of a once-vast marsh system that encompassed portions

of Newport Beach and Huntington Beach. Figure 20 of the Main Report provides an aerial photograph of the area. The marsh contains a predominance of wetland plant species, notably pickleweed (Salicornia sp.), sea blite (Suaeda californica), salt grass (Distichlis spicata), monanthochloe (Monanthochloe littoralis), sea lavender (Limonium californicum), alkali weed (Cressa truxellensis), frankenia (Frankenia grandifolia), and rabbit's foot grass (Polypogum sp.). Several species of ruderals occur in disturbed areas. Much of the southern 100 acres (the area proposed for project acquisition) is subject to tidal inundation. The only apparent tidal connection for the marsh is a 4-foot-diameter culvert connecting the marsh with the Greenville-Banning channel. Despite the restriction of tidal flushing and the presence of filled and diked areas, the area retains a predominance of marsh plant species and remains a functioning marsh ecosystem providing essential feeding, breeding, and nursery grounds for mammals, reptiles, marine fish, invertebrates, and birds. In the winter, the marsh is a resting ground for many migratory birds of the Pacific flyway. If essential coastal marsh habitats continue to be eliminated along the southern California coast, a vital link in the life cycle of these birds will be broken, resulting in reduced populations. At least two birds which utilize and one which may utilize this site have been classified as endangered species for this reason, including the Belding's savannah sparrow (Federal Candidate and State endangered species), the California least tern (Federal and State endangered), and the light-footed clapper rail (Federal and State endangered). The Corps of Engineers has been unable to obtain right-of-entry to the marsh; therefore, the above descriptions of biological resources are necessarily general. Right-of-entry for detailed biological studies will be obtained in Phase II.

4.52 LAND USE. The 400-acre parcel of land east of the Greenville-Banning channel and between Pacific Coast Highway (PCH) and Victoria Street is an undeveloped open space and wildlife habitat area. Petroleum extraction is the only current human use of the land. Tidal channels weave through about 100 acres near PCH. Much of the site appears to be wetland and would therefore be subject to Section 404, as well as Section 10, regulatory authority of the Corps of Engineers. It is also within the coastal zone and so is subject to regulatory jurisdiction by the California Coastal Commission. There is local desire to develop a marina on or adjacent to this site, as discussed in paragraph 1.06. R

OTHER SANTA ANA RIVER MOUTH RESOURCES

4.53 LEAST TERN NESTING SITE. The Huntington State Beach area to the west of the Santa Ana River mouth is the location of the California Least Tern Nesting Sanctuary (see Main Report Figure 20). This area is one of the very few nesting sites still utilized for courting, breeding, and nesting by the California least tern. It is one of the most productive least tern breeding sites in the State of California, with 95 breeding pairs in 1979. It is maintained by the State of California Department of Parks and Recreation. This fence-protected area encompasses 4.5 acres of sparsely vegetated beach sand. The protection

provided by the fence and the suitable nesting habitat are thought to be keys to the success of the colony. The proximity of the Santa Ana River channel, the Talbert channel, the marsh channels, and the Pacific Ocean to the nesting area provides a number of suitable waterways used as foraging areas; these constitute another vital factor in the success of the site. The portion of the site nearest to the channels appears to be utilized more heavily for nesting than the more remote areas, probably due to its proximity to channel food supply.

4.54 VICTORIA POND. A freshwater pond is located on the eastern side of the Greenville-Banning channel just south of the Hamilton-Victoria Street bridge. Referred to as Victoria Pond, this 13-acre area provides some diversity of habitat for waterfowl species within the coastal region. The water source is urban runoff. Victoria Pond is bordered primarily by mulefat, willows, and salt cedar. Dense patches of ditchgrass and algae growth are often evident on the pond's surface, attracting large numbers of water insects; these in turn provide a food supply for birds. The pond is utilized primarily by waterfowl and shore birds for resting and foraging purposes. Bird use diminishes considerably in the spring, but at that time the pond becomes an important foraging site for the California least tern (Massey, 1980; see reference in paragraph 5.73). The wetlands and adjacent open space uplands at the mouth of the Santa Ana River, such as Victoria Pond, are scarce coastal resources of considerable habitat value for a diversity of wildlife. Victoria Pond is included as essential habitat for the California least tern by the USFWS. The pond is part of a larger site owned by Orange County and intended for possible future development as a regional park.

4.55 RIVER MOUTH CHANNELS. U.S. Fish and Wildlife Service biologists surveyed the Greenville-Banning and Santa Ana River mouth flood control channels and the salt marsh tidal channel in April 1979 to inventory invertebrate fauna. The following description is excerpted from the USFWS 11 October 1979 planning aid letter (included in Appendix I). "Eighteen species of molluscs were identified from shells taken from dredge spoil removed from the Greenville-Banning channel. The molluscs included: little neck, gaper, bentnose, razor, and chione clams; mussels; and snails. Many of the old mollusc shells observed could have persisted for some time (10-30 years), being indicative of the previous habitat quality. Very few living invertebrate species (only a few polychaetes and razor clams) were found in either the Greenville-Banning or Santa Ana River channels. The lack of marine invertebrates may reflect the high velocity freshwater flows characteristic of these flood control channels. No extensive estuarine wetlands occur at the river mouth to absorb the shock of the often heavy winter season freshwater flows which probably kill most of the infauna in the Santa Ana River mouth. Limited recolonization probably occurs during the non-rainy season. In contrast, the tidal channel in the salt marsh had large populations of razor clams, polychaetes, and bentnose clams. Also, the tidal channel supported many snails, shore crabs, and small fishes." The benthic community, especially the large clam population, probably makes a significant contribution to the productivity of the channels for

fishery resources (e.g., clam larvae, gamete releases, direct feeding opportunities). The fish supported by the intertidal and benthic habitats are in turn fed upon by the California least tern. Sediments R
deposited in the channels are periodically dredged by Orange County in order to maintain a channel opening with the ocean. Dredging historically has averaged about 60,000 cubic yards per year since 1938, with dredging operations occurring about once every 10 years.

4.56 GREENVILLE-BANNING CHANNEL ABOVE VICTORIA STREET. Limited marsh/wetland growth occurs along the Greenville-Banning channel, especially between Hamilton-Victoria Street and about midway to Adams Avenue, where tidal influences cease. Although some cordgrass habitat occurs in the brackish waters, freshwater emergent wetlands dominated by cattails and bulrush prevail along this reach of the channel. This isolated wetland provides valuable shorebird habitat for foraging and resting purposes. The Orange County Environmental Management Agency (OCEMA) has tentative long-range plans to develop Fairview Regional Park on the nearby bluffs and adjacent to the channel.

4.57 LEAST TERN INTERIM FEEDING AREA. A highly disturbed salt marsh wetland habitat formerly cut off from tidal water flows, between the Santa Ana River channel and Brookhurst Street, and south of the Talbert channel, was restored by OCEMA in April 1979. About 15 acres of this 17-acre project were developed as a California least tern interim feeding habitat to assure that the county's project upgrading the flood protection capacity of the lower Santa Ana River channel nearby did not jeopardize the fish supply and survival of the least tern. Culverts were installed to the site from the Talbert channel, permitting tidal flows to enter the site. The area was recontoured, channels were added, and two freshwater ponds were created and stocked with mosquito fish for least tern feeding purposes. The restored wetland exhibited remarkable biological recovery and there was evidence that the tidal channels would sustain not only feeding California least terns but other wetland and water-associated wildlife as well. However, Orange County Flood Control District personnel removed the tidal culverts in October 1979, eliminating most of the developing habitat values. The Corps, with concurrence by the USFWS, filed suit against Orange County in an attempt to restore the site's tidal culverts, maintaining that the county violated a condition of their Section 404 permit (which allowed the site's restoration) by not obtaining a second permit before eliminating the restored habitat. The Orange County Flood Control District agreed R
to a consent decree enjoining them from failing to comply with all the conditions of the Section 404 permit, and requiring that they not prevent the site's restoration as a tern feeding area or wildlife refuge if safeguards are present to avoid risk of flooding or if the Flood Control District is relieved of liability for such flooding. Although the Talbert channel itself does not provide significant habitat values to waterfowl, California least terns forage in the channel during the nesting season.

4.58 ENDANGERED SPECIES. The Santa Ana River mouth area is of current or potential importance in the continuing existence and recovery of three endangered species of birds. A contracted study of endangered species at the river mouth was prepared for the Los Angeles District in 1980 by Barbara Massey (see reference in paragraph 5.73 and report in Appendix I) and is excerpted below.

4.59 California least tern (Sterna albifrons brownii). The California least tern once bred in abundance along much of the lower Pacific coast. As a result of urbanization of its coastal habitats, however, both nesting and feeding habitat have been drastically reduced, resulting in a reduction of its population to the extent that it is now on the Federal and State endangered species lists. California least terns nest on relatively flat, barren, sandy areas, 1 to 3 meters above the highest tide levels. The birds tolerate little or no vegetation in their nesting areas and require complete protection from disturbances by humans and predators. During the breeding season (April through August) and especially after the chicks are hatched, the survival of the least tern population is dependent upon an adequate nearby food source. Terns have been sighted feeding in the Talbert channel, the lower Santa Ana and Greenville-Banning channels, the marsh, Victoria Pond, and the ocean.

4.60 Light-footed clapper rail (Rallus longirostris levipes). The light-footed clapper rail, a marsh bird of the lower littoral zone, is on the Federal and State endangered species lists. Nesting in dense Pacific cordgrass (Spartina foliosa) at lower elevations, its eggs can apparently stand partial inundation. Less is known about the light-footed clapper rail than the other two birds discussed, and it has been an infrequent visitor within the project site.

4.61 Belding's savannah sparrow (Passerculus sandwichensis beldingi). The Belding's savannah sparrow is a small songbird which inhabits some coastal salt marshes of southern California. Due to the severe decline in its population in recent years, caused primarily by habitat destruction, the bird was placed on the State endangered species list in 1974 and is a Candidate for Federal endangered status. The sparrow has a close association with pickleweed (Salicornia), spending most of its life in or near dense stands of the plant in coastal high marsh. Not only is pickleweed the preferred plant in which it builds its nest, but the birds also eat the succulent growing tips of pickleweed branches. In February and early March 1980, a small number of Belding's savannah sparrows were sighted foraging in the marsh.

4.62 BEACH REPLENISHMENT. The predominant littoral drift of sand at the Santa Ana River mouth is downcoast. About 300,000 cubic yards of beach material along Orange County's coast are lost yearly to littoral erosion. Every five years, 1.5 million cubic yards (mcy) are replenished by the Corps of Engineers at Sunset Beach, 10 miles west and upcoast of the Santa Ana River mouth. The material is usually deposited between September and March, largely to avoid interfering with beach recreation. The beaches on the east side of the Santa Ana River are

receiving sand nourishment from the area west of the river. Beach erosion along the coast is a continuous process, however, necessitating constant replenishment.

SANTIAGO CREEK

4.63 VEGETATION AND WILDLIFE. Santiago Creek just below Villa Park Dam contains native and riparian vegetation in an unurbanized canyon. Limited revegetation is occurring in an abandoned gravel excavation pit near Loma Street. The pit contains ponded water following rains. Several water birds of undetermined species have been sighted in this pit and a nearby pit that is just above Villa Park Road. (Main Report Figure 21 provides an aerial photograph showing Santiago Creek.) The active gravel extraction pits below Villa Park Road contain minimal weedy vegetation, but do attract birds when ponded with water following rains. Patches of riparian growth are found downstream from Prospect Avenue. Many dense exotic trees and some bird life are found within Santiago Park along the middle project reach of Santiago Creek. From here to the Santa Ana River confluence, many mature exotic tree, shrub, and groundcover species grow along the trapezoidal soil sideslopes of the channel. Some are riparian species such as giant reed (Arundo donax) and willow (Salix sp.) growing near or in the creekbed. No significant wildlife habitat occurs along this reach. Because urban development abuts much of Santiago Creek, vegetation and associated wildlife are generally confined to the narrow channel corridor. No rare or endangered species of plants or animals are known to exist along the project portion of Santiago Creek.

4.64 WATER RESOURCES. The two gravel pits between Villa Park Road and Prospect Avenue often hold ponded water during the rainy season. Flows come from Villa Park Dam, from Handy Creek, and from other local runoff. The pits are significant for lateral ground water recharge potential. An analysis for the Orange County Water District by the PRC Toups Corporation ("Preliminary Santiago Creek Replenishment Feasibility Study," Orange County Water District, 1979) determined that the recharge potential of the pits ranges between 30,000 and 40,000 acre-feet per year. Although the pits are not now used for recharge purposes, the current average annual ground water recharge in the pits is about 3,300 acre-feet per year. Existing surface and ground water quality appears to be good, although recent data is not available.

4.65 ESTHETICS. Although it lacks the unique esthetic value of the Santa Ana Canyon, Santiago Creek has distinct esthetic qualities. Along the upstream project reach, the partially revegetated gravel pit areas above Villa Park Road offer open space values. The canyon from this point upstream to Villa Park Dam contains riparian growth. The actively mined gravel pits below Villa Park Road provide open space views but are otherwise unesthetic. The linear parks along the middle project reach of the creek have relatively high esthetic values. Mature trees and shrubs line both sides of the channel in Santiago and Hart Parks. Rustic rock masonry channel sidewalls, generally dating from the 1930s, are considered local cultural resources and are a source of civic

pride. The lower reach of the channel has exotic trees, shrubs, and ground cover growing along the creek's trapezoidal sideslopes. This vegetation improves the esthetics of the otherwise cobblestone invert and bare soil sideslopes for residents along the channel, for people on bridges crossing over the channel, and for visitors to Fisher Park overlooking the channel.

4.66 RECREATION. Only occasional, informal walking occurs in the cobbly Santiago Creek soft bottom invert now. Local parks along the middle channel reach--Hart, Santiago, and Fisher--have integrated the creek into their facilities. Hart Park uses a paved stretch of invert for parking; the park abuts both sides of the channel. Santiago Park is a narrow linear park focusing on the channel. The channel flows through Santiago Public Golf Course. Orange County has plans to develop regional parks along upper Santiago Creek.

OAK STREET DRAIN

4.67 ESTHETICS. The upper reach of Oak Street Drain features pleasing views of open space and citrus groves. The channel has a soft bottom invert and perpendicular soil sides retained by pipe-and-wire fencing. The lower portion traverses residential and commercial areas of the City of Corona. The channel along this reach is primarily concrete.

PROJECT-WIDE ISSUES

4.68 ENDANGERED SPECIES. Several Federal and State threatened, rare, and endangered species of fauna are known or are likely to exist within the project area. Table 3 illustrates the probable distribution of endangered species throughout the project reaches and their utilization of each reach. Species are discussed by project reach earlier in this chapter.

4.69 WETLANDS. Areas on both sides of the Santa Ana River mouth contain vegetation species characteristic of wetlands. Other project areas containing wetlands include portions of the Santa Ana Canyon, the lower Prado basin, and the upper Santa Ana River.

4.70 PRIME AND UNIQUE FARMLAND. The Soil Conservation Service (SCS) of the U.S. Department of Agriculture determines locations of prime and unique farmland (P&UF). The SCS, in letters of December 1979 (undated) and 4 March 1980 (both included in Appendix I), has indicated that there are P&UF in the Prado basin and at the proposed Mentone Dam site. Acres to be involved are discussed in paragraphs 4.16 and 4.37. The SCS has stated that no other P&UF are within the proposed project areas.

4.71 CULTURAL RESOURCES. A cultural resources reconnaissance was conducted by the Los Angeles District to locate and identify cultural properties which may be affected by the proposed Santa Ana River Project. This level of investigation consisted of a literature and records search and a sample field survey adequate to assess the general nature of the properties within the project area and the probable impact

of the alternative plans under consideration. The investigation was conducted in two parts: (a) Literature and records searches and sample field surveys were conducted by the Archeological Research Unit and the Department of History, both of the University of California, Riverside, in 1975 and 1976, respectively. The reports, entitled "Santa Ana River Project Description and Evaluation of Cultural Resources," Leonard, 1975; "Santa Ana River Project Description and Evaluation of Cultural Resources Appendixes: Field Data," Hall, 1975; and "Historical Resource Survey, Prado Flood Control Basin," Toby, et al, 1977, are on file at the Los Angeles District and the Archeological Research Unit in Riverside. (b) A site reconnaissance study to address additional areas added to the project since 1975 was conducted in 1980 by the Environmental Resources Group of Los Angeles. The study of the additional acreage consisted of a records and literature search and a sample field survey. The report, entitled "Santa Ana River and Santiago Creek: A Cultural Resources Survey," Stickel et al, 1980, was filed with the Archeological Research Unit, University of California, Riverside, and with the Society for California Archeology, Riverside Area Clearinghouse. The above reports are included in Appendix I to the Main Report. R

4.72 The only project area known to contain significant cultural resources that could be affected by the project is the Prado Dam reservoir area, as discussed in paragraph 4.33.

V. ENVIRONMENTAL EFFECTS

SANTA ANA RIVER MAIN STEM

MENTONE DAM

5.01 VEGETATION AND WILDLIFE. The construction of Mentone Dam as part of the All River Plan will necessitate the elimination of most habitat values in the project area associated with the juniper woodland. About 1,600 acres of alluvial scrub and juniper woodland habitat will be eliminated by construction of the Mentone Dam and spillway, by excavation (to depths of 20 to 60 feet) for a borrow and floodwater retention pit behind the dam, and by Mill Creek levee improvements. Proposed recreational development will affect an additional 235 acres. Elimination of the vegetation will in turn mean a reduction of wildlife habitat. Some habitat values will naturally recur after construction but will not be as significant as those currently existing. Revegetation planting as part of the project will hasten the vegetation recovery. Construction of wildlife guzzlers for a more sustained water supply will benefit wildlife, as discussed in paragraph 4.39 of the 1977 FES.

5.02 Over the life of the project, significant changes in vegetation are likely. The dam will act as a debris basin and will silt up, causing surface soil changes from sands, gravels, and cobbles to predominantly sands, silts, and muds. Frequent inundation (perhaps yearly) within the flood control basin, rising water tables, possible ground water ponding during successive abnormally wet seasons, and R settling of silts, sands, and perhaps clay particles may result in conditions sufficiently moist for willow and riparian growth. Any juniper woodland left within the 50-year floodline will die, as will the chaparral and sage scrub species. Willows, mulefat, and weedy annuals such as cocklebur will probably dominate the basin.

5.03 Substantial but currently unquantifiable initial losses will occur in those predator populations currently using the site (golden eagles, owls, hawks, coyotes, foxes, badgers). Some recovery of wildlife values will occur over the life of the project. However, the loss of such a large unit of mature coastal juniper woodland (some of the junipers exceeding 80 years) will be irretrievable.

5.04 No project-generated impacts will occur at Mentone under any alternative other than the All River Plan. The other alternatives do not involve construction of Mentone Dam and do not alter use of the site in any way. Should Mentone Dam not be constructed, however, it appears likely that the northern portion of the area and its vegetation and habitat will be converted to residential and other types of urban development.

5.05 WATER RESOURCES. A study of the significant impacts of the All River Plan on water resources of the Santa Ana River was conducted in 1980 by ECOS Management Criteria under contract with the Los Angeles

District. The report, entitled "Water Resources in the Upper Santa Ana River Basin" is inclosed in Appendix I of the Main Report. The following discussions of water resources impacts by respective project reach in this chapter are derived from ECOS' summary of their main report.

5.06 At Mentone Dam, and from there to Prado Dam, the impacts of the All River Plan will be temporary during the short periods in the rainy season when storm runoff water is impounded behind Mentone Dam and released during periods of up to three weeks. During these periods, a reservoir of surface water will exist temporarily behind Mentone Dam. This water will be of excellent chemical quality (100-200 mg/l TDS) but will be heavily laden with silt as well as bacteria. The proposed project will have a favorable impact on ground water, with respect to both quantity and quality. Waters impounded by the project will be precipitation runoff waters which are generally of good chemical quality. Although their bacteriological quality will not be good, this factor will not detract from the favorable impact on ground water quality.

5.07 In terms of water quality, construction of a reservoir at Mentone should not adversely affect existing plant or animal life in this area. (Effects of ponded water on vegetation are discussed under paragraph 5.01.) The buildup of silt behind the dam will likely create suitable habitat for weedy, annual plant species. As a result of the impounding of water, there may be a periodic increase in local populations of mosquitoes and/or other aquatic insects which have very short life cycles.

5.08 Because alternatives other than the All River Plan do not involve construction of Mentone Dam, they will have no effect on water resources of the Mentone area. In the absence of any project, increasing urbanization may alter water resource conditions, but these changes are unrelated to the Santa Ana River Project and are not used for comparative conclusions about the effects of the project.

5.09 LAND USE. Acquisition of about 3,100 acres of land for construction and operation of Mentone Dam under the All River Plan will permanently remove this land from possible future development. Fifty-five existing residences; 227 acres of citrus, avocados and oats; and four small businesses will be affected. Recreation features encompassing 235 acres are proposed for development within the reservoir area (see paragraph 5.12 for recreation discussion). No project-related impacts will occur at Mentone under any other alternatives because only the All River Plan includes construction of Mentone Dam. The future without any project will probably involve residential development of the northern 40 percent (1,000 acres) of the proposed Mentone Dam right-of-way.

5.10 PRIME AND UNIQUE FARMLAND. Construction of Mentone Dam as part of the All River Plan may necessitate removal of 275 acres of P&UF from potential production. The citrus and avocado groves will be affected,

but many appear inactive. Citrus groves may be leased back to private individuals for continued production. Only the All River Plan will affect P&UF at Mentone Dam, because the other alternatives do not include a dam or any other project features at this site. In the absence of any project, the P&UF areas will probably be removed in favor of residential developments in the near future.

5.11 ESTHETICS. The construction of Mentone Dam as part of the All River Plan will impair the views of the open space outwash plain and the San Bernardino Mountains for some residents in the vicinity of the dam. The dam will be about 220 feet high and 3.3 miles long. The view will be especially impaired for residents of the community of East Highlands near the downstream toe of the dam. To compensate somewhat, the downstream dam face will be landscaped with native grasses and shrubs with shallow root structures, as specified in the FES (paragraph 1.25). If Mentone Dam is not constructed, much of the dam and basin site will probably become urbanized, resulting in the future loss of some of the open space esthetic values of the site. The other project alternatives do not include construction of Mentone Dam; they will neither create esthetic impacts nor preserve open space.

5.12 RECREATION. Recreation facilities involving 235 acres are proposed for development within the proposed Mentone Dam reservoir area under the All River Plan (see Main Report Figure 12). Facilities may include a 50-acre lake for recreation (2/3 of surface area) and wildlife (1/3 of surface area), and featuring shoreline fishing, non-power boating, and swimming. Wildlife portions of the lake and shoreline will be separated from high-intensity human use areas. This lake area could make a positive contribution to wildlife values at the Mentone site. Proposed facilities will also include camping, picnicking, play fields, court games, and an equestrian center. Recreation will be located immediately north of the area to be excavated as the borrow pit behind the dam. Recreation will include equestrian and hiking trails in the basin. The recreation facilities will generate greatly increased automobile traffic with impacts on access road traffic densities (two-lane Greenspot Road), noise, and possibly local air quality. Increased noise from recreation activities may disturb wildlife. Utilities must be provided to the site, including access roads, water supply, sewage disposal, electricity, and public safety services. These, in turn, may contribute to impacts. The site selected for recreation will eliminate some of the citrus areas and the important juniper woodland habitat of the area. Large numbers of vehicles and people may disturb nearby wildlife. Site selection and effects of the recreation plan will be reassessed in Phase II. Only the All River Plan includes construction of Mentone Dam and its possible recreation features. The other plans would therefore not affect the site, and no recreation features would be constructed as part of the project. It appears likely that all of the area proposed for project recreation features will become urbanized in the near future should the project not be constructed. Thus, in comparison with the No Action alternative, recreational development will preserve or replace some of the existing open space of the site.

REDLANDS BORROW SITE

5.13 VEGETATION AND WILDLIFE. The proposed 2,300-acre Redlands borrow site, if utilized, will be excavated to a depth of between 5 and 10 feet in order to provide 10 to 12 million cubic yards of suitable impervious soil material for the core of Mentone Dam. Excavation of this area will permanently affect agricultural production of barley and oats, as well as temporarily remove wildlife habitat and disrupt the valley's wildlife corridor value. The latter impacts are not considered significantly adverse due to the limited wildlife values that currently exist within the area. The potential for erosion may be increased, and resulting depressions could become seasonal breeding areas for mosquitoes. Noise and air quality impacts will result from vehicles excavating soil and hauling it to Mentone Dam. The site will be returned to agricultural production after excavation, if feasible, or recontoured and revegetated to create habitat values. If this site is selected for borrow, environmental aspects of borrow activities will be reassessed in Phase II. Selection of this site may conflict with the State's plans to create a wildlife sanctuary, as noted in paragraph 5.14 below.

5.14 LAND USE. Excavation will remove from production up to 2,300 acres of farmland yielding 20 to 30 tons per acre annually of barley and oats, according to the Soil Conservation Service. Use of this site for borrow could conflict with the State of California's plans to create a wildlife sanctuary here. If this site is selected for borrow, planning coordination will be maintained with the California Departments of Water Resources and of Fish and Game to resolve goals for the site. This site will be used for borrow only (a) if the All River Plan is selected and Mentone Dam is constructed, and (b) if this is the selected borrow site, rather than one in Prado basin or elsewhere. Other alternatives do not include Mentone Dam and therefore would not involve or affect the Redlands site. The probable future of the site without the project is an agricultural area and wildlife sanctuary.

UPPER SANTA ANA RIVER

5.15 VEGETATION AND WILDLIFE. The All River Plan includes construction of Mentone Dam and implementation of flood plain management for the Mentone-to-Prado basin reach. With construction of Mentone Dam, standard project floodflows will be reduced (e.g., from 238,000 cfs to 144,000 cfs at one point). As a result, the present flood plain and floodway upstream from Mount Rubidoux will be reduced in width, as shown in Main Report Figure 13. With a more restricted floodway, the limited habitat values in this reach could be impacted by possible development to the new floodway line. Downstream from Mount Rubidoux, where vegetation and habitat values are extremely significant, the extent of the flood plain will not change significantly with construction of Mentone Dam. With careful adherence to accepted flood plain management practices, no significant adverse effects to vegetation or wildlife should occur in the Mount Rubidoux-to-Prado basin reach. However, with peak flows reduced by Mentone Dam, the existing floodway could be narrowed, conceivably allowing urban encroachment. Because the post-

project floodway has not been delineated, the degree of potential encroachment cannot be predicted at this time. The High Prado, All Channel, Environmental Quality, and No Action alternatives do not involve construction of Mentone Dam or any modification of the upper Santa Ana River flood plain. These alternatives will therefore not change the existing conditions on this reach of the river.

5.16 WATER RESOURCES. Under the All River Plan, the lower quality (700 mg/l TDS) base flow downstream from Mentone Dam will be improved in chemical quality--with TDS in the 100-300 mg/l range--but lowered in bacteriological quality. Bacteriological quality will be poor, based on limited data available to date. In the watercourse between Mentone Dam and Prado reservoir, beneficial impacts will result from the controlled release of good quality storm waters impounded by Mentone Dam, enabling greater quantities of higher quality water to percolate through the riverbed into the underlying ground water basins. It has been estimated that operation of Mentone Dam may result in the recharging of 26,000 acre-feet per year of water into the ground waters underlying the river from Mentone to the Prado basin. These are large and important underground water resources, providing much of the public water supply for the San Bernardino area as well as substantial amounts for Riverside, Corona, and other local communities. The addition of 26,000 acre-feet per year of high quality storm water, with a TDS in the range of 100-250 mg/l, will substantially benefit ground water resources and, indirectly, the public water supplies drawn from them. The favorable impact of the proposed project on ground water resources could have a small indirect impact of inducing or accommodating growth in the upper Santa Ana basin. However, this impact would be small and difficult to ascertain, as growth is not now limited by water supply, and the increase in ground water resources resulting from the project will not be a large proportion of the total resources affected. Regional economics may be favorably affected by the impact of the project on water supply quantity and quality. This is because water supplied by the project may take the place of similar quantities which might otherwise be imported at higher cost from northern California via the State Water Project. The creation of an impounding dam at Mentone will have little effect on the existing flora or fauna of the Santa Ana River between Mentone and Prado in terms of water quality, because of the projected short duration of water release to the river.

5.17 The other alternatives do not include Mentone Dam and will therefore not beneficially affect water resources. Future conditions without the project will depend upon effects of upstream land use and water treatment.

5.18 LAND USE. Construction of Mentone Dam as part of the All River Plan will provide increased flood protection to this reach of river, reducing the width of the existing Standard Project Flood (SPF) floodway that is subject to flood plain management. The newly protected area could conceivably then be encroached upon for urban land uses. If urbanization of western San Bernardino County increases in the future, development may occur on the narrowed post-project SPF flood fringe.

The potential for project-induced impacts will be the width difference between the existing SPF floodway and the post-project floodway. The difference between existing and post-project flood plains is shown in Main Report Figure 13. Floodways have not been delineated. Other alternatives will not alter the existing floodway because they do not include construction of Mentone Dam.

PRADO DAM RESERVOIR AREA

5.19 VEGETATION. Four project factors will affect biological resources in the Prado basin: borrow sites, recreation, the dam's operation schedule, and the right-of-way available. These factors are discussed below.

R 5.20 Borrow Sites. All three potential borrow sites within Prado basin will impact wetlands and/or interfacing uplands of high value to wildlife resources. Excavation of 10 to 12 million cubic yards from the proposed 1,000-acre borrow site necessary for Mentone Dam core material under the All River Plan will remove about 500 acres of riparian willow woodland and emergent wetland vegetation. This affected area represents about 10 percent of the basin's willow woodland. Privately managed duck ponds will be eliminated. About 500 acres of upland vegetation and grazed areas will also be excavated. Two other basin borrow areas will provide material for raising the height of Prado Dam, as shown on Plate
R D-45 in Appendix D to the Main Report. About 10 acres of woodland will be removed by use of the 150-acre site just east of the Prado Dam spillway, and about 100 acres will be removed by use of the 190-acre site. Remaining sage/scrub vegetation and grazing portions of the two sites will also be eliminated. Natural revegetation of all borrow sites may eventually occur. A limited recontouring and revegetation program will be implemented to partially replace valuable vegetation and habitat areas. The borrow sites could become beneficial open-water habitat for waterfowl following the rainy season. An additional 100 acres of basin lands will be disturbed by construction of new levees (see Main Report Figure 14); these will be landscaped with native shrubs to more quickly replace habitat values.

5.21 In addition to the physical loss of habitat, the noise generated by excavation and related construction operations such as haul roads and construction yards will reduce the habitat values of broad areas beyond the construction sites for the several years necessary to build Mentone Dam and raise Prado Dam. This could cause a significant, though short-term, adverse effect on migratory bird use of the basin, especially since large areas of prime waterfowl habitat will be disturbed during construction. Resident species less tolerant of human disturbance, such as hawks and owls, and riparian-dependent bird species, will be displaced. The latter group includes the yellow-billed cuckoo and the least Bell's vireo. Habitat values should eventually recover after project borrow activities cease.

5.22 The High Prado Plan does not involve construction of Mentone Dam and so will not involve excavation of or adverse impacts to the 1,000-

acre borrow site needed for the All River Plan. It will have the same or greater impact on the two smaller borrow sites. The All Channel and No Action alternatives involve no construction within the Prado basin. Impacts of proposed borrow sites will be reassessed in Phase II. Monitoring of construction activities should reduce project impacts on habitat areas peripheral to the borrow areas.

5.23 Recreation. Under the All River, High Prado, and Environmental Quality Plans, the proposed Prado basin recreation plan comprises about 630 acres. The All Channel Plan does not include recreational development in Prado basin, but, as with the No Action alternative, similar development could occur under authority of the "Prado Dam Recreation Master Plan," as discussed in paragraph 5.50. Impacts of recreation on biological resources cannot be precisely determined at this time because of the conceptual and preliminary nature of the recreation plans; effects of the plans will be reassessed in Phase II. Based upon the recreation facilities as described in paragraph 5.48 and on recreation areas located as shown in Map 6 of the 1977 Final Environmental Statement, it appears that about one-third of the total recreational acreage will be just north of Corona. This location may adversely affect the biologically rich interface between basin willow bottomlands and upland scrub vegetation. The larger recreation areas will be immediately north of the proposed 1,000-acre borrow site. Again, biologically important riparian-upland/grazing interface habitats will probably be affected, reducing or eliminating habitat values.

5.24 The recreation lakes proposed to be created will provide some beneficial fish and wildlife values, depending on the intensity of recreation uses established on and around the lake peripheries. High-intensity, disruptive uses involving large numbers of people and vehicular traffic would minimize wildlife values of the lakes and surrounding areas. Less intensive uses such as fishing, hiking, primitive camping, and the proposed 350-acre wildlife managment area will allow retention of most of the basin's wildlife values and, with careful management, could even enhance those values.

5.25 If the alternate recreation plan described in paragraph 5.49 is implemented, then one 400-acre lake will be developed within the 1,000-acre borrow site. About one-third of the lake's shoreline and surface area will be physically protected for fish and wildlife habitat purposes. However, use of the lake for intensive recreational purposes such as the proposed power boating and water skiing will cause wildlife values to be minimal. About 760 acres of ancillary recreation facilities around portions of the lake will eliminate or reduce wildlife values in those areas.

5.26 Under any recreation plan, public-use recreation areas will be buffered from adjacent wildlife areas to minimize human disturbance of wildlife. Construction-related impacts of recreational development will be similar to those described for borrow sites under paragraph 5.21 but will be of lower magnitude and shorter duration.

5.27 Operation Schedule. Under the All River, High Prado, and Environmental Quality Plans, a new release schedule will be implemented for Prado Dam. In comparison with the existing situation, more water will be held in the basin during high-frequency storms (e.g., 10-year storms), whereas releases will be much larger than the current case in low-frequency storms (e.g., 100-year storms). A water supply pool will hold water up to elevation 512 feet (msl) for more months of the year than occurs now, so that water may be released more slowly downstream, recharging ground water basins in Orange County. The result will be an increase in the depth and duration of ponded water in the basin. The depth of ponded floodwater in rare low-frequency storms will be greater under the High Prado Plan (up to 582 feet (msl)) than in the All River Plan (up to 566 feet (msl)). This ponding increase may drown such bottomland species as willows and cottonwoods if their bases are submerged for more than about three months. The effects of the increased inundation and the related raising of the water tables is expected to result in an expansion of the upper margin of the willow thicket habitat types at the expense of those less flood-tolerant cottonwood-willow riparian habitats. There will be no change from the existing situation under either the All Channel or No Action alternatives. Phase II studies will reassess the release schedule and the associated environmental effects.

5.28 Right-of-Way Available. The All River and High Prado Plans will expand the basin's current 9,741 acres by an additional 1,461 acres and 5,545 acres, respectively. These two alternatives provide for continuance of grazing and other agricultural land uses within the basin. These lands provide open space habitat for birds to roost and nest. Project acquisition of these areas will prevent their being urbanized in the future, thus preserving open space habitat values. The Environmental Quality Plan provides the same 5,545 additional acres as the High Prado Plan but will include termination of grazing and agricultural uses on lands situated in prime or high-potential habitat areas. These areas will be allowed to revegetate, increasing wildlife habitat acreage in the basin. The All Channel Plan and No Action alternatives will not change the basin right-of-way and so will not alter the existing right-of-way available.

5.29 WILDLIFE. Removal of a total of 1,340 surface acres of borrow material from the Prado basin under the All River Plan and 340 acres under the High Prado and Environmental Quality Plans will reduce basin habitat available for wildlife. Elimination of vegetation for recreational development will have similar effects. Another 100 acres will be disturbed by creation of new levees in the basin. Willows, sycamores, and other trees as well as emergent wetlands provide valuable habitat for waterfowl, wading birds, various songbirds, and lesser numbers of mammals. Taller trees are roosting sites for hawks, owls, herons, kingfishers, and occasional visiting bald and golden eagles. A USFWS biologist observed a yellow-billed cuckoo immediately adjacent to the proposed 1,000-acre borrow site; this area is prime habitat for the cuckoo and the least Bell's vireo (see Table 3 for notation of basin use by endangered and threatened species). Elimination and related

disturbance of substantial areas of trees would adversely affect the basin's avian and mammalian resources. It is estimated that up to one-third of the basin's habitat could be temporarily disrupted by construction activities. With revegetation of affected areas, most wildlife values are expected to return.

5.30 The proposed recreation lakes will provide habitat and resting areas for fish and water birds such as ducks, geese, and shorebirds if intensive human use of the lakes is minimized. Wildlife areas adjacent to lakes and other recreation areas will be buffered. The 400-acre lake alternative could provide greater habitat values than the recommended four-lake plan if such proposed activities as power boating, water skiing, and skeet shooting were not permitted. Small duck ponds will be created along Cucamonga/Mill Creek to provide and enhance wildlife habitat, as stated in paragraph 1.31 of the 1977 FES. The ponds will be designed in Phase II.

5.31 Prado Dam's water-impoundment and release schedule under the All River, High Prado, and Environmental Quality Plans will have limited long-term effects on wildlife similar to those described for vegetation earlier. Trees that will be drowned at lower basin elevations will tend to be replaced by other trees at the new higher-elevation water-ground interfaces, eventually replacing nesting and roosting areas for birds. Possible loss of flooded riparian areas combined with continuance of agricultural land uses at higher fringe elevations under the All River and High Prado Plans, however, will tend to reduce the riparian woodland habitat acreage available for birds and mammals. Removal of some agricultural areas to allow for natural revegetation under the Environmental Quality Plan will increase long-term habitat values. The All Channel Plan and the No Action alternative will not cause any flood-control-related effects upon basin wildlife because no construction will occur in the basin. Recreation may still be implemented with its potential beneficial and adverse wildlife impacts.

5.32 CULTURAL RESOURCES. The Prado Dam reservoir area contains significant cultural properties. The All River, High Prado, and Environmental Quality Plans will directly and indirectly affect several cultural resources through destruction or disturbance related to borrow pit activities, increased inundation levels, and possibly recreational development. Table 4 summarizes the cultural resources of the Prado basin.

5.33 Two cultural properties are situated within the proposed 150-acre borrow site just east of Prado Dam and will be directly impacted by this construction and/or by proposed recreational development. The sites (ACE-SAR-H2A, H2B) appear to represent remnants of circa 1920 to 1940 structures and trash associated with agricultural activities (see Historical Resource Survey report referenced in paragraph 4.71, sites ACE-SAR-H2A, H2B). Test excavations will be conducted in Phase II by a qualified historian to determine significance. If these properties are determined to be eligible for inclusion in the National Register, mitigation will consist of a data recovery program. R

TABLE 4
Preliminary Cultural Resources Site Data Inventory
Prado Basin

	Site (Previous numbers in parenthesis)	Resource	Condition	Significance	Impacts	
					Direct	Indirect
R	ACE-SAR-H2A, H2B	Historic sites	Structural remains, foundation, trash	Associated with agriculture circa 1920-40	Construction related to borrow pit & recreational development	Inundati due to 556' ta line
R	ACE-SAR-H2C	Historic site	"	"	Inundation due to 512' pool	"
R	ACE-SAR-H2D, ACE-PF-5, CSULB-2	Historic sites	"	"	None	"
R	ACE-PF-1, 2	Historic sites	Trash	"	"	Inundati to 580' line
R	ACE-PF-3	Lt. Cook memorial	Excellent	Not considered eligible. May have value to local community	Inundation due to 512' pool	Inundati to 556' taking
R	RIV-1098 (ACE-SAR-H3)	Historic site	Remnants of the Bandini-Cota Adobe. Partial adobe walls and foundation visible	Associated with early area settlement. Appears eligible for inclusion in National Register of Historic Places (NRHP)	Recreational Development	Constru related borrow undatio to exis taking Recreat develop Visual due to
	RIV-653	Prehistoric site	Prehistoric component of SBR-1098	Appears eligible for inclusion in NRHP	Recreational Development	
	SBR-1571 (ACE-SAR-H4)	Historic site	Adobe remnants little visible on surface	Associated with early area settlement. Appears eligible for inclusion in NRHP	None	Inundat to exis taking "Island due to pool
	SBR-2317 (ACE-SAR-H5)	Historic site	Yorba-Slaughter Adobe - museum	Currently listed on National Register of Historic Places	None	Inunda to 566 582' t
	RIV-100	Prehistoric/ historic	Possibly buried due to flood activity	Appears eligible for inclusion in NRHP	Construction activity related to borrow pit & recreational development. Inundation by	Inunda to exi taking

TABLE 4
Preliminary Cultural Resources Site Data Inventory
Prado Basin

Resource	Condition	Significance	Impacts		Phase II Investigations & Tentative Mitigation Plans
			Direct	Indirect	
Historic sites	Structural remains, foundation, trash	Associated with agriculture circa 1920-40	Construction related to borrow pit & recreational development	Inundation due to existing 556' taking line	Test excavation to confirm significance. Data recovery if warranted
Historic site	"	"	Inundation due to 512' pool	"	"
Historic sites	"	"	None	"	"
Historic sites	Trash	"	"	Inundation due to 580' taking line	"
Lt. Cook memorial	Excellent	Not considered eligible. May have value to local community	Inundation due to 512' pool	Inundation due to 556' and 580' taking lines	"
Historic site	Remnants of the Bandini-Cota Adobe. Partial adobe walls and foundation visible	Associated with early area settlement. Appears eligible for inclusion in National Register of Historic Places (NRHP)	Recreational Development	Construction related to borrow pit. Inundation due to existing 556' taking line. Recreational development. Visual integrity due to 512' pool	Protection and site avoidance from indirect impacts. Data recovery program in conjunction with cultural resources interpretative program
Prehistoric site	Prehistoric component of SBR-1098	Appears eligible for inclusion in NRHP	Recreational Development	"	"
Historic site	Adobe remnants little visible on surface	Associated with early area settlement. Appears eligible for inclusion in NRHP	None	Inundation due to existing 556' taking line. "Island" effect due to 512' pool	Preservation, test excavation to confirm significance
Historic site	Yorba-Slaughter Adobe - museum	Currently listed on National Register of Historic Places	None	Inundation due to 566' and 582' take lines	Protection and preservation
Prehistoric/ historic	Possibly buried due to flood activity	Appears eligible for inclusion in NRHP	Construction activity related to borrow pit & recreational development. Inundation by	Inundation due to existing 556' taking line	Test excavation to relocate and evaluate significance. Data recovery if warranted

	RIV-100	Prehistoric/ historic	Possibly buried due to flood activity	Appears eligible for inclusion in NRHP	Construction activity related to borrow pit & recreational development. Inundation by 512' pool	Inundation due to existing 55 taking line
	SBR-1543 (ACE-SAR-4)	Prehistoric	Large surface scatter	Appears eligible for inclusion in NRHP	None	Inundation due to existing taking line. Island effect due to 512' pool
	RIV-652	Prehistoric	Destroyed	None	None	None
	RIV-556	Prehistoric	Possibly buried due to flood activity	Appears eligible for inclusion in NRHP	Recreational development	Inundation due to existing 556' taking line
	SBR-2259	Prehistoric	Isolated find	None	None	"
R	ACE-IA-2	Prehistoric	"	"	"	"
	SBR-2260	Prehistoric	"	"	"	Inundation due to 512' pool and to existi 556' taking l
	SBR-1570 (ACE-IA-1)	Prehistoric	"	"	"	"
R	ACE-LEL-1	Prehistoric	"	"	"	Inundation due to existing 5 taking line
	SBR-2845 (ACE-LEL-2)	Prehistoric	Severely disturbed	Due to the disturbed nature of the site, does not appear eligible for inclusion in NRHP	"	Inundation due to 566' and 582' taki lines
	ERG/ACE-H2	Desi Arnaz Ranch, relatively recent construction	Occupied structures	Not considered eligible, may have value because of assoc. with a major figure in early television	"	Inundation due to 582' taking line
	RIV-1043 (ACE-LEL-3)	Prehistoric	Light scatter	Not eligible for inclusion in NRHP	"	None
	RIV-1042 (ACE-LEL-4)	Prehistoric	Sparse scatter	"	"	"
R	RIV-1040 (RIV-675)	Prehistoric	Destroyed	None	"	"
R	RIV-675	Prehistoric	Destroyed	"	"	"
	RIV-1041	Prehistoric	Isolated find	"	"	"

B

	flood activity	NRHP	to borrow pit & recreational development. Inundation by 512' pool	taking line	ate significance. Data recovery if warranted
Prehistoric	Large surface scatter	Appears eligible for inclusion in NRHP	None	Inundation due to existing taking line. Island effect due to 512' pool	Test excavation to evaluate significance. Preservation
Prehistoric	Destroyed	None	None	None	None
Prehistoric	Possibly buried due to flood activity	Appears eligible for inclusion in NRHP	Recreational development	Inundation due to existing 556' taking line	Test excavation to relocate and evaluate significance. Data recovery if warranted
Prehistoric	Isolated find	None	None	"	None
Prehistoric	"	"	"	"	"
Prehistoric	"	"	"	Inundation due to 512' pool and to existing 556' taking line	"
Prehistoric	"	"	"	"	"
Prehistoric	"	"	"	Inundation due to existing 566' taking line	"
Prehistoric	Severely disturbed	Due to the disturbed nature of the site, does not appear eligible for inclusion in NRHP	"	Inundation due to 566' and 582' taking lines	Test excavation to confirm significance. Data recovery if warranted
Desi Arnaz Ranch, relatively recent construction	Occupied structures	Not considered eligible, may have value because of assoc. with a major figure in early television	"	Inundation due to 582' taking line	Verification of association & community interest
Prehistoric	Light scatter	Not eligible for inclusion in NRHP	"	None	None. Outside project area
Prehistoric	Sparse scatter	"	"	"	"
Prehistoric	Destroyed	None	"	"	None
Prehistoric	Destroyed	"	"	"	"
Prehistoric	Isolated find	"	"	"	None. Outside project area

5.34 Three cultural properties--the Bandini-Cota Adobe (RIV-1098/ACE-SAR-H3), its prehistoric component (RIV-653), and an aboriginal/historic site (RIV-100)--are situated adjacent to the proposed 1,000-acre borrow site north of Prado Dam (see Plate D-45, Appendix D to the Main Report for borrow site location, and see ERG cultural resources report in Appendix I for discussion). These sites could be impacted directly or indirectly by borrow removal, construction vehicles, recreational development, and erosion or inundation due to the 512-foot (msl) water supply pool. All three cultural properties appear to be eligible for listing in the National Register of Historic Places. Due to the poor condition of the Bandini-Cota Adobe, to its potential for future deterioration through erosion and inundation, and to its value as an informational and educational resource, a long-term data recovery and interpretative program is recommended. The data recovery program will include the prehistoric component (RIV-653). The aboriginal/historic site (RIV-100) may be buried or destroyed as it was not relocated during the UC Riverside survey (reference in paragraph 4.71). Additional investigations will be conducted to attempt to locate and evaluate this site. If it is determined to be extant and eligible for the National Register, mitigation will consist of a data recovery program. R

5.35 Increased inundation levels under the All River, High Prado, and Environmental Quality Plans will affect cultural resources within the basin. All of the previously mentioned sites are located within the existing reservoir area taking line (556 feet (msl)). These could be subjected to inundation during a rare SPF or similar low-frequency flooding event. Sites ACE-SAR-H2C, ACE-PF-3, and RIV-100 will be directly impacted by the proposed 512-foot (msl) water supply pool. The Bandini-Cota Adobe (RIV-1098/ACE-SAR-H3) and RIV-653 may lose their visual integrity due to the proposed 512-foot (msl) pool. Recommendations regarding five of the sites within the existing taking line are discussed in the previous paragraphs. A discussion of the remaining 13 sites within the existing taking line is presented as follows: R

a. SBR-1571 (ACE-SAR-H4). This potentially eligible historic site consists of scattered fragments of adobe and artifacts which may be the remains of a circa 1800 structure. The site is located at the 530-foot (msl) elevation and could be subject to infrequent inundation. Test excavations will be conducted to determine the significance of the site and, if warranted, a program of protection and preservation will be implemented.

b. SBR-1543 (ACE-SAR-4). This prehistoric site appears to be eligible for listing in the National Register of Historic Places. It is situated within the existing taking line and is subject to low-frequency inundation and possible "island" effect of the proposed 512-foot (msl) water supply pool. Test excavations will be conducted to confirm this evaluation, and, if warranted, a program of protection and preservation will be implemented.

c. RIV-652. This prehistoric site was destroyed during construction of Prado County Park Museum and will not be affected by the project.

d. RIV-556. This prehistoric site appears to be eligible for listing in the National Register. In addition to the existing possibility of inundation, this site may be affected by proposed recreational development. Attempts to relocate the site during surface inspections were unsuccessful. Additional field investigations will be conducted during Phase II studies. If the site is located and determined to be significant, a data recovery program will be conducted prior to recreational development.

R e. SBR-2259, SBR-2260, SBR-1570, ACE-LEL-1, ACE-IA-2. These site designations consist of isolated prehistoric artifacts. Development is not proposed for these areas and further studies do not appear to be warranted.

R f. ACE-PF-5, CSULB-2, ACE-SAR-H2D. These historic sites appear to represent the remnants of circa 1920 to 1940 structures and trash associated with agricultural activities. Test excavations will be conducted in Phase II by a qualified historian to determine significance. If these properties are determined to be eligible for inclusion in the National Register of Historic Places, mitigation will consist of a data recovery program.

R g. ACE-PF-3. This is a recently constructed war memorial to "Lt. Cook." Ordinarily, monuments such as this are not eligible for inclusion in the National Register unless they have attained some special significance of their own. Phase II studies will document what significance this monument may have to the local community.

5.36 Five cultural properties--the Yorba-Slaughter Adobe (SBR-2317/ACE-SAR-H5), a prehistoric site (SBR-2845/ACE-LEL-2), a relatively recent
R farmstead (ERG/ACE-H2), and two historic sites (ACE-PF-1,2)--are situated at the 560-to-580-foot (msl) elevation. These sites are within the new taking line lands for the All River, High Prado, and Environmental Quality Plans. The Yorba-Slaughter Adobe is listed in the National Register of Historic Places. It is situated at about 565 feet (msl) and would be subject to inundation during a rare flood event. A plan for flood protection and continued preservation will be formulated for this property. The prehistoric site (SBR-2845) appears to be heavily disturbed and does not appear to be eligible for inclusion in the National Register of Historic Places. The site lies at an elevation of 560 feet (msl) and would be subject to rare low-frequency inundation. Test excavations will be conducted to determine significance. If the site is found to contain significant cultural materials, a program of data recovery will be conducted. The remaining site, ERG/ACE-H2, consists of farm structures of relatively recent construction, which reportedly are associated with Desi Arnaz, an early television personality. The property does not appear to meet National Register criteria; however, an attempt will be made to verify the association with Desi Arnaz and to determine whether the structures

have public value. The need for protective measures against infrequent inundation due to rare SPF or similar low-frequency events will be based on the results of this investigation. The two historic sites (ACE-PF-1, 2) will be tested by a qualified historian to determine their significance. If these sites are found to be significant, a program of data recovery will be conducted. R

5.37 Five prehistoric sites (RIV-1043/ACE-LEL-3, RIV-1042/ACE-LEL-4, RIV-1040/RIV-675, RIV-675, and RIV-1041) are situated adjacent to, but outside, the existing and proposed project areas. Table 4 provides a brief description of the sites which do not appear to meet National Register criteria. R

5.38 Based on the information provided through archeological investigations conducted for Phase I planning and summarized in paragraph 4.33 and above, the proposed All River Plan will have adverse impacts of varying severity on one site which is listed on the National Register and six sites which appear to be eligible. The plan will have a direct adverse impact on RIV-100 due to borrow and construction activities, recreational development, and increased frequency and duration of inundation due to the proposed 512-foot (msl) pool. The Bandini-Cota Adobe (RIV-1098/ACE-SAR-H3), is situated within a proposed recreational area and adjacent to the proposed 1,000-acre borrow site. It may be subject to adverse effects associated with recreational development and to construction activities associated with excavation and utilization of the borrow pit. The visual integrity of the adobe may be affected by the island or peninsula effect of the proposed 512-foot (msl) pool. RIV-653 is also located within the proposed recreational area and adjacent to the 1,000-acre borrow pit and may be adversly affected by recreational and borrow construction and activities. RIV-556 may be directly impacted by proposed recreational development. RIV-1543/ACE-SAR-4 and RIV-1571/ACE-SAR-H4 may possibly suffer adverse effects to their integrity due to the island effect of the proposed 512-foot (msl) pool, but will not otherwise be affected by this plan. The Yorba-Slaughter Adobe, (SBR-2317/ACE-SAR-H5) will be subject to rare, low-frequency inundation due to the proposed increase in the All River Plan taking line to 566 feet (msl). With the exception of the Yorba-Slaughter Adobe, all of the sites discussed under the All River Plan are subject to rare low-frequency flooding within the existing 556-foot (msl) taking line. It is possible that these sites would be inundated for a longer period of time during a low-frequency flood event due to the proposed increase in the taking line to 566 feet (msl).

5.39 The proposed High Prado and Environmental Quality Plans will have the same effects on the four National Register and eligible sites associated with recreational development. All of the sites could be exposed to low-frequency flooding for longer durations than the All River Plan. The proposed High Prado and Environmental Quality Plans will have the same island and peninsula effects as the All River Plan. Borrow sites for the High Prado and Environmental Quality Plans will have an adverse effect on two relatively recent historic sites which do

R not appear to meet National Register Criteria (ACE-SAR-H2A, H2B). Should the mitigation recommendations be implemented, it is expected that adverse effects on National Register properties will be avoided. The Corps will ensure that complete systematic surveys will be conducted during Phase II studies, as will efforts to coordinate all undertakings with concerned Native American groups.

5.40 The All Channel Plan and No Action alternative (or existing condition) will not involve taking excavation materials from or raising flooding levels in Prado basin, and therefore will not cause new effects on cultural resources. Cultural resources within the existing 556-foot (msl) elevation will receive protection under Executive Order 11593.

5.41 WATER RESOURCES. In the Prado basin, a reservoir of surface water
R will be impounded and, although temporary, may exist for part of the year during wet years. The All River, High Prado, and Environmental Quality Plans will substantially increase the quantity and duration of water storage in the reservoir, relative to the existing situation, and will improve the average chemical quality of the water by increasing the quantity of good chemical-quality storm water retained. Bacteriological quality of the impounded water will not be improved and may be worsened. The existing Prado reservoir already provides a considerable amount of better quality storm water for recharge use, and the proposed project will add substantially more. The favorable impacts on ground water quality and quantity will be significant in all ground water basins from Mentone Dam to Orange County downstream from Prado Dam. The improvement will be least in the ground water underlying the Prado
R basin. Operation of the project's flood release schedule and proposed water supply pool may influence the existing ground water problem on Federal lands in the vicinity of Corona Airport during successive years of above-average rainfall. The Los Angeles District is currently studying the influence of possible Prado reservoir water surface elevations on ground water in the Corona Airport area. Results of the studies will be presented in the Phase II GDM studies if determined to be significant.

5.42 Increasing the quantity of water in Prado reservoir will probably kill, by oxygen starvation, much phreatophytic vegetation in areas in which it now grows. This will result from the higher water levels which will be maintained. Areas of phreatophytes that will be particularly affected are those which will be submerged for several months or more; that is, areas of lowest elevation. The improved chemical quality of Prado reservoir water may be expected to improve the health and vigor of existing vegetation. Aquatic plants may increase in number. However, water quality impacts above the normal pool will not be significantly changed from the present condition, since waters reach these elevations only infrequently. The future presence of Mentone Dam under the All River Plan will not substantially alter water availability at Prado, because only large-storm floodflows will be impounded at Mentone Dam and not for more than a few weeks following such a storm. Mentone Dam will not be a long-term water storage reservoir.

5.43 Excessive eutrophication occurs at various locations within the Prado basin. The All River, High Prado, and Environmental Quality Plans will have several effects on eutrophication, some reducing it and some promoting it. By improving the average chemical quality of surface water in the basin, the project will reduce eutrophication by reducing nutrient concentrations. However, increasing the amount of water stored and the average length of time of storage will promote eutrophication. The net effect will probably be no improvement (reduction) in eutrophication, and may possibly be an increase.

5.44 Because they involve no water supply change at Prado Dam and hence no increase in water available for downstream recharge, the All Channel Plan and the No Action alternative should not cause any change in Prado basin water resources from the existing situation, or from upstream water quality, treatment, and runoff changes that may occur independently of the project.

5.45 LAND USE. The alternative plans will add the following respective acreages to the existing 9,741 acres of the Prado Dam reservoir area: All River, 1,461 acres; High Prado and Environmental Quality, 5,545 acres; and All Channel, 0 acres. All privately owned lands within the existing 556-foot (msl) taking line are to be acquired in fee. Lands within the expanded taking lines under the All River Plan (566 feet (msl)) or the High Prado/Environmental Quality Plans (582 feet (msl)) will be acquired. Some landowners above 556 feet (msl) will be offered life estates and other options as described in Chapter 5 of the Main Report under "All River Plan; Impact Assessment." Eventually all habitations and other non-floodable structures will be removed from within the selected expanded taking line. This will affect the following numbers of groups.

	All River Plan	High Prado/EQ Plan	All Channel Plan
Houses in basin	121	718	0
Dairies	27	82	0
Ranches & farms	2	6	0
Businesses	9	25*	0
Houses in Corona	29	244	0

*California Institution for Women also must be removed.

5.46 Dairying and agricultural land uses will probably be allowed to remain within the new taking line areas under the All River and High Prado Plans. Under the Environmental Quality Plan, many dairies, farms, and residences will be terminated in the basin in order to allow natural revegetation. This will provide increased wildlife habitat in the valuable vegetative bottomland-upland interface areas above the more frequently flooded basin bottomlands. Existing recreation activities will remain in the basin under all alternatives. New recreation facilities are proposed to be added as part of the project; details are provided in paragraph 5.48. No changes to the existing situation should occur with the All Channel Plan, or if no project is implemented.

5.47 PRIME AND UNIQUE FARMLAND. According to the Soil Conservation Service (see December 1979 letter in Appendix I), the All River Plan will affect 1,780 acres of prime and unique farmland (P&UF) not now in
R the basin. The SCS did not estimate P&UF acreages that could be affected by other project alternatives. Most existing agricultural use of these P&UF lands will probably be allowed to continue under both the All River and High Prado Plans. The Environmental Quality Plan will restrict much of the dairying and agricultural land use within the basin. The All Channel Plan and the No Action future condition will not change the existing situation. Within the existing Prado Dam 556-foot (msl) reservoir area, the All River Plan's proposed 1,000-acre borrow site for Mentone Dam material will necessitate the excavation of about 500 acres of P&UF. Excavation of the two smaller borrow sites (total 340 acres) for material to raise Prado Dam will affect about 150 acres of P&UF. Because they do not involve construction of Mentone Dam, the High Prado and Environmental Quality Plans will only affect the two smaller borrow sites. The All Channel Plan and the No Action alternative will not affect P&UF.

5.48 RECREATION. Four recreation lakes are proposed for development in Prado basin. Surface acreage will range between 15 and 40 acres per lake. Activities in the lakes will include shoreline fishing, nonpower boating, swimming, and fish and wildlife habitat. Some lakes might be oriented to active, intensive recreation, others to low-intensity uses such as fishing and fish and wildlife habitat. Associated facilities will include picnicking, camping (individual, group, and vehicle), a multipurpose game area, and a 350-acre wildlife management area with nature trails. Overall, about 630 acres will be devoted to recreational development. Recreation trails will circle the basin periphery, connecting the parks of the basin and providing a link with trails extending down the Santa Ana River to the ocean. These proposals are similar to recreation recommendations in the 1975 Review Report. Impacts were discussed in paragraph 4.75 of the 1977 FES. One change is the addition of a fourth lake, reportedly involving rehabilitation of an abandoned 20-acre fishing lake at the northeastern edge of the basin. Appendix G to the Main Report discusses possible recreation features in more detail. The above features could be developed under the All River, High Prado, or Environmental Quality Plans.

5.49 An alternate recreation plan for Prado basin involves development of a 400-acre lake to accommodate power boating, water skiing, sailing, fishing, swimming, and wildlife habitat (one-third of lake area). The lake will be constructed only if the All River Plan is implemented, if Prado basin is selected as the borrow site for Mentone Dam core material, and if this recreation plan is selected instead of the recommended four-lake plan. The lake will then be created in part of the 1,000-acre borrow site for Mentone Dam. Other recreation features will be similar to the four-lake plan, but the picnic, camping, and game areas will each be doubled in size. Overall, about 1,160 acres will be devoted to recreation under the alternate one-lake recreation plan.

5.50 Recreational park facilities will help to meet regional demands for outdoor recreation areas near major southern California urban centers. Recreational trails will link the park areas along the project and provide desirable off-street trail systems. Adverse impacts common to both Prado recreation plans may include: (a) permanent loss of wildlife habitat and open space, (b) disturbance to wildlife from automobile traffic and sports events, (c) disturbance or elimination of several cultural resources sites (as discussed in paragraph 5.32), (d) exceeding access road capacity, (e) local air quality impacts from increased traffic, and (f) utilities and public services impacts. In addition, the presence of power boating under the one-lake plan may substantially disrupt wildlife use of the area as well as contribute to water quality and fisheries impacts in the lake. Power boating and water skiing may disrupt the basin solitude. Environmental aspects of proposed recreation features will be reassessed in Phase II. Although the current All Channel Plan involves no recreation project in Prado basin, recreation may still be developed under the Code 710 cost-sharing program rather than as part of this project. In this case, the Corps' existing "Prado Dam Recreation Master Plan" (1976) would be used as a guideline for recreational development. This would also be the case if no project is implemented. The Master Plan provides for recreation lakes similar to the recommended four-lake plan. Recreation under the Environmental Quality Plan will include one or more of the four lakes being set aside primarily for fish and wildlife purposes, or the majority of the 400-acre lake being physically reserved and protected for those purposes. No power boating will be permitted with the EQ Plan. Site selection will attempt to avoid upland-bottomland vegetation/habitat interfaces where feasible, particularly with high-intensity activities.

SANTA ANA CANYON

5.51 VEGETATION AND WILDLIFE. All of the structural alternatives will require some additional revetment modification along the edges of the Santa Ana Canyon flood plain, adversely impacting a limited amount of natural and human-altered vegetation and habitat along the river. Project landscaping of modified levees and other project-disturbed areas should largely replace lost habitat.

5.52 New release schedules for the All River, High Prado, and Environmental Quality Plan alternatives will significantly modify the present vegetation in Santa Ana Canyon. Rates of release for storms with an average frequency of occurrence of once every 10 years or less will be reduced, but rates of release for storms with a frequency of once every 10 to 100 years will exceed the current rates by a factor of about two. The increased release rates will wash out much existing vegetation and cause more frequent habitat recycling over the life of the project. The net result will be a gradual shift away from mature riparian habitats to younger, denser stands of riparian vegetation consisting of willows, mulefat, and opportunistic species. (However, this condition will be similar to historical flooding conditions which existed in the canyon before Prado Dam was constructed.) Under the

first two alternatives, 1,500 acres of Santa Ana Canyon post-project flood plain will be acquired and preserved for wildlife habitat and open space. The Environmental Quality Plan will involve purchase of 1,530 acres (the additional 30 acres being the purchase of the mobile home park). With implementation of the All Channel Plan alternative, about 1,630 acres within the canyon flood plain will be acquired and preserved as open space. However, most riparian vegetation and habitat will probably be lost, due primarily to greatly increased floodflow releases from Prado Dam under this alternative, and due partly to increased revetment needed along certain flood plain reaches.

5.53 If no project is implemented, current intense local pressure to construct residential and commercial developments in the canyon will probably result in urbanization to the floodway limit. Such development will directly eliminate vegetation in the flood fringe and will render virtually unviable the remaining floodway as riparian habitat.

5.54 WATER RESOURCES. The All River, High Prado, and Environmental Quality Plans will have the effect of increasing the duration and chemical quality of the flow below Prado Dam in the Santa Ana Canyon. As in the Prado reservoir, bacteriological quality will not be improved and may be worsened. Hydrophytic vegetation density will increase, as water will be present for longer periods of time in the riverbed. The above project alternatives will have a beneficial impact on any existing fisheries in the study area and should have no adverse impact on any possible new fisheries. The All Channel and No Action Plans, effectively involving only release schedule changes from Prado, should cause no change in water quality from the existing situation. Ground water recharge in the canyon is insignificant, according to ECOS Management Criteria. Canyon or upstream urbanization that may occur whether or not the project is constructed could affect water quality; such effects are unrelated to this project.

5.55 LAND USE. The All River, High Prado, and Environmental Quality (EQ) Plans all include purchase of the Santa Ana Canyon post-project flood plain, which will result in preservation of the open space character of the area. Acreage to be acquired will be 1,500 acres under the first two plans, and 1,530 acres under the Environmental Quality Plan. (Note: the Review Report stated that 1,760 acres of flood plain would be acquired under the All River Plan; the actual flood plain to be acquired is the same as in the Review Report but the area measurement of 1,500 acres is now more accurate.) Most existing canyon developments (golf course, regional park, mobile home park) will be allowed to remain under the first two plans. The 30-acre mobile home park will be removed under the Environmental Quality Plan in order to restore the canyon to a more natural setting and increase its habitat and wildlife corridor value. Any remaining agricultural areas in the canyon will be moved back from the river under the Environmental Quality Plan, allowing a riparian corridor to reestablish. Implementation of the All Channel Plan will widen the canyon flood plain to be acquired, taking about 1,630 acres and four homes. Developments in the All Channel Plan flood plain will probably be severely damaged by large Prado Dam releases

during large storms. In the absence of any project, the canyon flood plain will probably become urbanized up to the floodway.

5.56 ESTHETICS. The All River, High Prado, and Environmental Quality Plans will preserve the open space, riparian, and relatively natural meandering-river esthetic values of the Santa Ana Canyon by acquiring the post-project flood plain necessary for anticipated Prado Dam releases. The Environmental Quality Plan will enhance the natural esthetic values by removing the mobile home park in the canyon and by allowing more riparian growth along the river (by moving agricultural areas away from the river). The All Channel Plan will acquire and maintain as open space 1,630 acres of the canyon, but large releases from Prado Dam will wash away most vegetation, preventing vegetation from reaching a mature state and thus reducing existing esthetic values. If no project is implemented, probable and imminent canyon flood plain urbanization will remove most or all esthetic values of the Santa Ana Canyon flood plain.

LOWER SANTA ANA RIVER (IMPERIAL HIGHWAY TO VICTORIA STREET)

5.57 WATER RESOURCES. Beneficial impacts to ground water resources in the lower Santa Ana basin of Orange County will result from the All River, High Prado, and Environmental Quality Plans. These alternatives will store larger quantities of storm water at Prado reservoir and will release them over a longer period, increasing the quantity available for ground water recharge (by 3,500 acre-feet per year) between Imperial Highway and Katella Avenue, and simultaneously improving the average chemical quality of water. The beneficial impact on quality will be pronounced, according to ECOS Management Criteria, as much of the water now going into ground water recharge in the lower Santa Ana basin is river base flow with TDS in the vicinity of 500-750 mg/l. The All Channel Plan will not change existing water quality but, because it involves a concrete channel, will eliminate 350 acres of existing surface area available for potential ground water recharge along the lower Santa Ana River. Because this recharge area is a primary source of Orange County's water supply, this impact will be adverse. Water resources under the No Action alternative will not be altered from the existing condition, except by future upstream land use and water treatment changes not directly related to the Santa Ana River Project.

5.58 LAND USE. The All River, High Prado, and Environmental Quality Plans should have negligible effects on existing or future land uses along the lower Santa Ana River. The channel will be widened but this will not necessitate taking homes, businesses, or significant new lands. About 85 additional acres will be required. The wider channel necessary under the All Channel Plan will necessitate acquisition of 230 acres of land, and acquisition and removal of 128 homes (of which 55 are mobile homes) and 34 businesses (25 commercial/industrial and 9 horse stables) along the widened Santa Ana River channel. Discussion of economic impacts is covered in Chapter 5 of the Main Report under "All Channel Plan; Impact Assessment." Future land use in the absence of any project is not expected to change from the existing situation.

5.59 RECREATION. All alternative plans will necessitate widening the lower Santa Ana River and removing the existing bicycle and equestrian trails that have been developed on channel service roads. The trails and street underpasses will be replaced in kind as part of the project. Portions of the existing trails were funded by the Land and Water Conservation Fund. Segments of the trails will be unusable during corresponding periods of channel construction. If no project is implemented, the existing trails will not be directly affected. However, the absence of increased project flood protection and the attendant damage to channel sideslopes during floods could contribute to deterioration of the trail underpasses. A recreation staging area proposed in the 1975 Review Report for a site at the Santa Ana River mouth has been deleted from Phase I plans. Such a feature could adversely affect the adjacent least tern interim feeding area (if the latter's function is restored) either by eliminating some of the feeding area's acreage or by disturbing bird species in the wetland feeding area. A safe trail user crossing of or under heavily traveled Pacific Coast Highway would also need to be studied if such a development were to be reconsidered.

SANTA ANA RIVER MOUTH MARSH

5.60 VEGETATION AND WILDLIFE. In the All River, High Prado, and Environmental Quality Plans, the eastward widening of the Santa Ana River and combined Greenville-Banning channel will necessitate elimination of about 8 acres of coastal salt marsh near Pacific Coast Highway (PCH). The All Channel Plan will eliminate 20 acres of marsh.

5.61 The All River Plan combines mitigation needs with habitat acquisition for the preservation and enhancement of endangered species by acquiring, enhancing, and preserving 92 acres of salt marsh--8 acres for mitigation and 84 acres for preservation and enhancement of endangered species habitat (as also recommended in the 1977 FES, R paragraph 4.38; also see memorandum in Appendix I entitled "Rationale for Santa Ana River Marsh Acquisition and Restoration"). The Least Tern Recovery Team had recommended that the Fish and Wildlife Service and the Secretary of the Interior consider the designation of a 200-acre area--including the 92-acre marsh site--at the Santa Ana River mouth as R critical habitat for the California least tern. The USFWS in July 1980 withdrew their proposal to designate critical habitat for the least tern under an administrative (rather than technical) rationale. The USFWS still considers the area essential habitat for the continued existence of the least tern. The High Prado Plan provides for acquisition of 8 acres to offset the 8 acres taken by the widened channel but provides for no additional habitat preservation and no enhancement. The Environmental Quality Plan provides for the acquisition of about 200 acres (8 acres mitigation, 192 acres preservation) of salt marsh. This added acreage over the All River Plan approximately coincides with the area designated as essential habitat by the USFWS for the least tern. It provides a greater area for a more viable, productive, and diverse marsh ecosystem, for a least tern nesting site, and for increased Belding's savannah sparrow and light-footed clapper rail habitat. The

All Channel Plan also provides for acquisition and enhancement of 200 acres of salt marsh (but a larger portion--20 acres--would be for mitigation purposes since the wider channel would destroy 20 acres of marsh/wetland vegetation) because this plan would jeopardize the remaining marsh ecosystem viability and least tern nesting site more than the other plans. The No Action alternative will not affect the existing declining marsh condition. Continuing poor tidal flushing, siltation, and localized filling may cause a further deterioration in the marsh. As urban pressures continue along the southern California coast, the area is increasingly desired by some local interests for a marina or residential development. The Corps of Engineers has regulatory authority over some of the area under the Section 404 and Section 10 permit process; impacts of such jurisdiction cannot be determined at this time. The California Coastal Commission also has regulatory authority over developments in the coastal zone.

5.62 Los Angeles District biologists have developed a preliminary conceptual marsh restoration plan based upon (a) similar previous plans for southern California, (b) recommendations from the USFWS, and (c) recommendations from Barbara Massey, a consultant expert in endangered species and marsh design criteria (see reference in paragraph 5.73). The Corps of Engineers was unable to obtain right-of-entry to the marsh site during Phase I studies to conduct biological and related studies necessary as a basis for a detailed marsh restoration plan. The marsh area will be surveyed during the Phase II GDM stage. Detailed marsh restoration plans will also be developed during the Phase II design stage. The plan is based on increasing tidal flushing in the existing marsh area, and recontouring the site as necessary to provide more tidal channels and elevations suitable for desired target species vegetation types. These tidal and vegetation zones, ranging from subtidal to upland areas, will in turn provide habitat for a diverse range of target species of estuarine and marine organisms, benthic invertebrates, fish, mammals, and birds.

5.63 As currently envisioned, about 10 to 15 acres of the 92-acre site will be above tidal influence. Most of this area will be adjacent to the new Santa Ana River dike and will be built up higher by placement of materials removed in recontouring the marsh. The dredged materials will be conditioned, recontoured, and planted with a mix of native dune and coastal sage scrub plants. Approximately 10 to 15 acres will be contoured as subtidal habitat. Of this subtidal area, approximately 2 acres will be developed as rocky intertidal, 1/4 acre will be planted experimentally with eel grass, and the remaining 7 to 12 acres of subtidal areas will be soft mud bottom habitat similar in nature to the existing subtidal areas. The remaining 65 to 70 acres of intertidal area will be divided into 10 to 15 acres of Pacific cordgrass, planted on low intertidal mud flats created by dredging presently filled-in areas; and 60 to 65 acres to be left as high marsh, planted with pickleweed and associated species. The Corps' Waterways Experiment Station (WES) in Vicksburg, Mississippi, has conducted preliminary analyses of alternative methods for providing increased tidal flushing to the marsh ("Littoral Processes Study, Vicinity of Santa Ana River

Mouth from Anaheim Bay to Newport Bay, California," WES, June 1980). Their findings are that 98 percent of the daily tidal range at the river mouth could be supplied to the marsh with more and/or wider tidal culverts. The most feasible and economical methods of accomplishing this will be studied during Phase II. Methods for maintaining tidal flows in the river mouth will also be determined in Phase II.

5.64 Increasing the extent of high-quality tidal marsh will be beneficial to the endangered species using and expected to use the marsh. It will increase the marsh's value as a nursery for marine fish, thereby improving feeding habitat for the least tern. It will increase nesting habitat for the Belding's savannah sparrow and it will provide more potential habitat for the light-footed clapper rail.

5.65 Land acquisition for and implementation of the restoration plan will be initiated prior to flood control construction at the river mouth, to provide feeding and habitat areas for species whose foraging areas will be eliminated during flood control channel construction activities. The plan will be implemented by areas or in stages over a period of up to five years, so that the entire site's habitat is not disrupted all at once. This procedure will allow monitoring of the restoration plan's success and refinement of the plan in succeeding stages. Monitoring will continue for the duration of Santa Ana River Project construction, in order to evaluate marsh restoration success. The appropriate agency to assume operation and maintenance of the restored marsh has not been determined but will probably be a fish and wildlife agency.

5.66 LAND USE. Acquisition and enhancement of 92 acres of marsh under the All River Plan will permanently remove this parcel of land from
R future development. It should not necessitate removal of the several oil wells on the site. It will not physically preclude the possibility of marina development on some other parcel of nearby land (see paragraph 1.06 for discussion of marsh/marina issue). The High Prado (NED) Plan involves acquisition of only 8 acres of additional land. The All Channel Plan will directly eliminate 20 acres of marsh. To compensate for this All Channel Plan impact and restore a viable ecosystem, about 200 acres of marsh will be acquired and preserved, removing these lands from possible future marina or residential development. The Environmental Quality Plan also provides for acquisition and restoration of about 200 acres of marsh. In the absence of any project, the site will probably continue in oil extraction operations until no longer economically profitable, and then will be proposed for conversion to a marina or residential development. Much of the site appears to be wetland, however, necessitating Section 404 and/or Section 10 permits from the Corps before filling operations may be conducted. The California Coastal Commission also has regulatory jurisdiction over the coastal zone area.

OTHER SANTA ANA RIVER MOUTH RESOURCES

5.67 LEAST TERN NESTING SITE. The widening of the Santa Ana River channel and the related relocation of the Talbert channel as part of the All River, High Prado, and Environmental Quality Plans will eliminate about 1.5 acres of the fenced 4.5-acre California least tern nesting site. Because this nesting site is one of the most successful in the State, all reasonable steps will be taken to avoid or minimize losses in its use by least terns. To offset the channel encroachment into the eastern third of the nesting site, the fenced habitat will be shifted westward along the beach by a similar amount. USFWS and CDFG biologists informally concur that the shift in habitat would probably not jeopardize the endangered least tern, providing that the relocation is accomplished during the non-nesting season, and that the relocation is completed prior to flood control construction at the mouth. The relocation of the fence at the nesting area will be implemented either by Orange County prior to project authorization or will be initiated as soon as possible after project authorization, and should be monitored by Corps, USFWS, and CDFG biologists to assess the degree to which the terns are willing to abandon favored nesting areas at the east end of the existing site and utilize newly acquired and protected nesting areas. Phase II studies will address the feasibility and best methods of relocating the least tern nesting site. Although this relocation will slightly reduce usable State beach acreage (by 1.5 acres), it is considered essential to retain a protected nesting area in order to maintain or enhance the least tern population.

5.68 The still-further westward relocation of the Talbert channel under the All Channel Plan will essentially eliminate the existing nesting site. Although the nesting area will be moved up the coast prior to project construction, the least terns may not readily adopt an entirely new nesting site. A nesting site will be created in the enlarged marsh that will be acquired and restored. The No Action project alternative would eliminate the need for any project-related disturbance of the existing nesting area. The Environmental Quality Plan elements formulated during the Review Report planning stage incorporated the Talbert channel alinement as it is proposed in the recommended All River Plan. Phase I studies have indicated that a realinement upcoast to just west of Brookhurst Street could have greater environmental benefits by avoiding direct losses to the least tern nesting area. However, this alternative has not been studied in terms of engineering feasibility or social acceptability.

5.69 VICTORIA POND. Widening of the Santa Ana River flood control channel in the All River, High Prado, and Environmental Quality Plans will eliminate an estimated 4.5 acres of the 13-acre Victoria Pond freshwater wetlands, or about half of the actual pond area. In the All Channel Plan, the width of the combined channel will effectively destroy the Victoria Pond. Because this freshwater wetland is unique in the area and provides important and diverse habitat for waterfowl species, its replacement has been incorporated into the project mitigation plan. The plan provides for restoration of the 4.5 acres of Victoria

Pond in the All River, High Prado, and Environmental Quality Plans, and the entire pond in the All Channel Plan. Main Report Figure 20 illustrates the proposed restoration area. The restoration will be on and adjacent to the existing site of Victoria Pond on lands owned by Orange County and intended eventually as part of their proposed Talbert Regional Park should funding for park development exist in the future. Coordination will be maintained with the County regarding availability of lands for re-creation of Victoria Pond. Restoration will include provision of a vegetative buffer zone and fencing. The USFWS (planning aid letter, 11 October 1979; Appendix I) suggested that they would favor a concept that not only re-creates the pond but also connects the Victoria Pond freshwater wetlands with the restored salt marsh wetlands (i.e., purchase of a corridor of land along the widened channel). Implementation would probably preclude future marina development in the area. The Corps of Engineers has stated during the Review Report planning that implementation of the Santa Ana River Project will not physically preclude the possibility of marina development. The No Action alternative will not alter the existing resource condition or its future.

5.70 RIVER MOUTH CHANNELS. The All River, High Prado, and Environmental Quality Plans will all have similar impacts on benthic and marine life in the Talbert, Santa Ana, Greenville-Banning, and salt marsh entrance channels. Relocation of the Talbert channel and excavation combining the lower Greenville-Banning channel into the to-be-widened Santa Ana River channel will cause short-term losses during construction. Sedentary benthic filter feeders (e.g., clams) will be killed, and mobile benthic organisms (e.g., polycheates) will be killed or displaced. The temporary loss of benthic habitat within the flood control channels may indirectly impact the food supply of the least tern. The All Channel Plan will result in the same types of impacts, but to a greater extent because the new channel will be still wider. Increased Prado releases under all plans may seasonally flush many organisms from the mouth channels into the ocean. An estimated average
R of 150,000 cubic yards of river sediments will be dredged from the lower
R channel yearly. Dredging is expected to occur on the average once every 10 years. Dredged materials are expected to be deposited in gravel extraction pits along Santiago Creek or at Lincoln Boulevard or, if found suitable, on the beach (see also State Resources Agency letter dated 30 October 1980 in Appendix I requesting beach deposition of suitable materials). Although the amount of material to be dredged will more than double the existing situation, the frequency of dredging is expected to remain the same as it has been, so that no significant new impacts are expected to occur. Dredging under the High Prado and Environmental Quality Plans will be essentially the same as for the All River Plan. It is estimated that dredging quantities under the All Channel Plan will be two to three times those of the All River Plan; disposal quantities and locations have not been specified for this alternative. No change will occur from the existing situation if no project is built. Studies will be conducted prior to project construction to assess the effects of construction and of freshwater flows and velocities on beaches and the benthic community in order to

minimize the impacts. Provision of a wider channel under all four structural alternatives will increase the area of tidal wetlands.

5.71 GREENVILLE-BANNING CHANNEL ABOVE VICTORIA STREET. The expansion of the Santa Ana River flood control channel between Hamilton-Victoria Street and the Fairview channel will necessitate the removal of 11 acres of freshwater emergent wetlands vegetation under the All River and High Prado Plans. The planned concrete Greenville-Banning (G-B) channel will permanently eliminate the habitat values of the existing soft bottom channel. If determined to be feasible during Phase II studies, the G-B channel will be constructed as a wider soft bottom channel rather than as a concrete channel, thus replacing and enhancing the wetland habitat values of the existing channel. The Environmental Quality Plan includes provision of the soft bottom channel. Plans will be coordinated with Orange County to possibly integrate the wider soft bottom design as an element of their proposed Fairview Regional Park. The All Channel Plan will combine the G-B channel into the concrete Santa Ana River channel, which will eliminate this wetland vegetation area. However, overall tidal wetland acreage will be increased under all plans. The No Action alternative will not alter the existing condition.

5.72 LEAST TERN INTERIM FEEDING AREA. In the All River, High Prado, All Channel, and Environmental Quality Plans, the relocation of Talbert channel will remove about 2 acres of the 15-acre least tern interim feeding area created and then abandoned by Orange County. If the tidal culverts to the interim area are reinstalled and the site again becomes a viable wetland foraging habitat, then the project may have a limited impact on least tern feeding areas. The enhanced marsh area on the east side of the Santa Ana River should compensate for this loss, and tidal culverts could be added to the new Talbert channel to provide tidal flows to the site. However, the interim site's future is uncertain: it may or may not be restored as a feeding area. The area is a wetland and as such is subject to Section 404 and California Coastal Commission jurisdiction. As a wetland, filling activities might not be permitted.

5.73 ENDANGERED SPECIES. A study of the significant impacts of the All River Plan on endangered species at the Santa Ana River mouth was prepared in 1980 by Barbara Massey under contract with the Los Angeles District. Entitled "Lower Santa Ana River, Orange County, California, Environmental Report: Avifauna," it is included in Appendix I to the Main Report. Part of the report's summary of All River Plan project impacts is presented below.

5.74 Light-footed clapper rail (Federal and State endangered species). Current use of the project area by the clapper rail is apparently negligible. Restoration of the (92-acre) salt marsh should have a strong favorable impact on the bird. The design of the salt marsh includes reestablishment of all of the littoral zones, restoration of a normal tidal prism, and an increase in overall acreage to ensure that the marsh is a healthy, self-sustaining entity. The restored salt marsh will ultimately provide much-needed additional year-round habitat for the rail, including habitat suitable for nesting.

5.75 Belding's savannah sparrow (State endangered species, Federal Candidate species). Current use of the project area by the sparrow is minimal: a small number inhabit the salt marsh during the winter months. Restoration of the salt marsh should have a favorable impact on the sparrow, as it will provide an invigorated habitat suitable for year-round use including nesting.

5.76 California least tern (Federal and State endangered species). Loss of habitat considered critical to the welfare of the California least tern will result from the flood control element of the project. Nesting and feeding habitat will be diminished through: (a) reduction of salt marsh habitat, (b) diminished freshwater pond habitat at Victoria Pond, (c) destruction of freshwater marsh habitat at Greenville-Banning channel, (d) probable reduction of marsh channels (i.e., culverts to interim feeding area) at Talbert channel, and (e) destruction of a portion of the nest site at Huntington State Beach. The Corps' plans to offset the above impacts of the All River Project are discussed under paragraphs related to each of the above areas. Those plans relate to enhancement of salt marsh habitat, replacement of Victoria Pond, possible replacement of some soft bottom Greenville-Banning channel habitat, and replacement of the nesting site. The Santa Ana River Project should not affect Talbert channel fisheries and is not related to the future disposition of the least tern interim feeding area. Should it be resolved that the interim site will be restored by Orange County, provision for tidal culverts could be incorporated into the Talbert channel design. Additionally, the widened Santa Ana River should provide increased long-term tidal food-source areas for terns and other birds.

5.77 BEACH REPLENISHMENT. The All River, High Prado, and Environmental Quality Plans may involve deposition of up to 3.7 million cubic yards (mcy) of suitable material from the Santa Ana River on Newport Beach beaches. At least 1.0 mcy are considered suitable for beach replenishment. (Non-suitable materials are planned for ultimate disposal in the Santiago Creek gravel pits.) The quantity of material under the All Channel Plan has not been determined but could be more than for the All River Plan. Intertidal and subtidal sand habitat may be adversely affected in the short-term. Infaunal organisms in this area will be killed during construction and mobile benthic organisms, such as crabs and fish, will be displaced. The pismo clam, considered a significant resource in this area, and the grunion could be temporarily affected. Some species restricted to the area to be covered, such as the sand crab (Emerita analoga), provide food for nearshore fish. Sandy intertidal and shallow subtidal habitat will be formed at the seaward edge of the fill and a community similar to the existing one will recolonize the new habitat. Another potential short-term impact from the construction of the project may be increased turbidity of offshore waters that could be unappealing to shoreline recreationists; this may be largely avoided by depositing much of the material during the winter. No long-term adverse impacts should result from beach replenishment. The No Action alternative will not alter the existing resource condition. Coordination will be maintained with the

Environmental Protection Agency during Phase II studies to assure acceptability of disposal material and deposition sites.

5.78 A beneficial impact resulting from the placement of material on the beach will be the replenishment of beach sand as a resource. However, the potential placement of up to 3.7 mcy of material along the coastline necessitates a detailed understanding of the coast's littoral processes. The Corps' Waterways Experiment Station is conducting studies of seasonal changes in littoral drift offshore from the Santa Ana River mouth. Data on the nature of the sediments to be deposited will be obtained during the Phase II GDM stage.

SANTIAGO CREEK

5.79 VEGETATION AND WILDLIFE. Under the recommended 100-year-protection plan, up to 6.5 million cubic yards of soil material from the Santa Ana River may be deposited in the gravel pits along the upper project portion of Santiago Creek. Main Report Figure 21 provides a map of the Santiago Creek project reach. The "Bond Pits" below Villa Park Road are the proposed deposit site. Additional deposition in the gravel pit at Loma Avenue above Villa Park Road could adversely affect wildlife to some degree by removing ponded water there. Possible recreational park development atop this deposition material could affect habitat values beneficially or adversely. Recreational development of the pits below Villa Park could provide fish habitat values and ponds for water birds to a greater extent and for more months of the year than is now the case.

5.80 The recommended plan will not affect vegetation in Santiago Park or other parks along the middle reach of the project. It will require removal of the extensive exotic, riparian and other vegetation along the lower creek (6,000 linear feet). The removal of lower Santiago Creek vegetation is not expected to have a significant effect on ecological resources due to the narrowness of the creek corridor and the apparent lack of wildlife. Impacts will be more esthetic than ecological. Revetment will also be added from Prospect Avenue to Walnut Avenue (3,400 linear feet). Some revegetation could be allowed to recur, and esthetic treatment landscaping will be planted within the right-of-way where possible. Grasses and small shrubs may be planted amidst the rock-revetted sideslopes. The Environmental Quality Plan will have impacts similar to the recommended 100-year plan except that the gravel pit and unurbanized canyon flood plain area from Villa Park Road to Villa Park Dam will be purchased and preserved, and the pits will be allowed to revegetate. The 1975 Review Report (SPF) plan will not involve upstream creek reaches but will replace the soft bottom channel with concrete from Grand Avenue to the Santa Ana River confluence (2.3 miles). All vegetation along this reach will be removed. If no project is constructed, the existing conditions will probably continue, unless urban pressures lead to local flood control improvements that reduce the flood plain width, allowing urban encroachment.

5.81 WATER RESOURCES. The recommended plan for Santiago Creek includes use of the gravel pits between Villa Park Road and Prospect Avenue to retain floodflows up to 100-year storms. Pit depth will be about 150 feet; only the top 30 feet of water will be used for flood retention. Up to 6.5 million cubic yards of excess soil material from the Santa Ana River may be deposited in the pits. Some soil material will be used to reduce and stabilize the slopes of the pits. Deposition and compaction of this material will reduce the current average annual ground water recharge in the pits (about 3,300 acre-feet per year) by up to 20 percent (or about 500 to 600 acre-feet per year). This loss will be offset by increasing the ground water recharge downstream of Prado Dam by 3,500 acre-feet per year as a result of raising Prado Dam and implementing a new dam water release schedule. If water is ponded in the pits for extended periods of time, water quality problems such as eutrophication could occur. An assessment of possible water quality concerns will be conducted when detailed design plans are developed during Phase II studies. The Environmental Quality Plan, which essentially coincides with the recommended plan for use of the pits, will have similar impacts. Additional water ponded in pits above Villa Park Road could increase ground water recharge. The 1975 Review Report plan will only involve downstream channelization and will therefore have no effect on water resources in the gravel pits. A concrete channel from Grand Avenue to the Santa Ana River could reduce ground water recharge. The short-term future condition in the absence of any project should be unchanged from the existing situation. Land use changes unrelated to the project may alter long-term conditions.

5.82 ESTHETICS. Along the upper channel reach of the project, the recommended plan may involve soil deposition in the gravel pits above Villa Park Road. Deposition of several million cubic yards of soil material here could alter or disrupt the open space views of the area. Possible development of project recreation parklands and esthetic treatment landscaping on the deposited material may offset this change. Deposition of soils in the gravel pits below Villa Park Road and use of the pits for flood water retention and recreation should improve the esthetic quality of these pits. The recommended plan will have minimal effect on the park landscaping and masonry walls along the middle channel reach. The project will cause removal of existing trees and shrubs along lower Santiago Creek, resulting in a worsened esthetic effect. Rock-revetted sideslopes will replace the existing soil sideslopes so that the revegetation potential will be minimal. Grasses and small shrubs will be allowed to grow between the revetment and esthetic treatment landscaping will be planted wherever possible. The Environmental Quality Plan coincides with the recommended plan except that the EQ Plan adds purchase and preservation of the flood plain between Villa Park Road and Villa Park Dam.

5.83 The 1975 Review Report plan would not involve or affect the upper channel reaches of the project. It would not impair open space views there, nor would it enhance them with parks or lakes, as the recommended plan could. The Review Report plan would provide a concrete channel and sidewalls from Grand Avenue to the Santa Ana River confluence, roughly

one-third of the overall project length. The concrete channel would require removal of the masonry walls along the creek and of many of the park trees and shrubs along the middle reach of the channel. It would eliminate the trees and shrubs along the lower creek reach as well. The overall esthetic effect of the Review Report plan would be distinctly adverse. The plan was opposed by local citizens in part because of esthetic impacts. Their opposition led the Corps to formulate the recommended 100-year-protection plan. In the absence of any project, esthetic values along lower and middle creek reaches will not be altered from the existing situation. Orange County may develop parks along upper Santiago Creek, improving esthetic values.

5.84 RECREATION. The recommended flood control plan should have minimal impact on existing parks along the middle portion of Santiago Creek. Recreation trails are proposed for development along portions of the creek as part of the recommended recreation plan, and a recreation lake and parks may be developed in the gravel pits as part of the project. Trails have been deleted from the City of Santa Ana portion of the channel because of local opposition. Recreation impacts may involve water quality and public safety aspects in gravel-pit lakes, and may increase traffic. Proposed recreation will be reassessed during Phase II. The Environmental Quality Plan will allow trail continuation up to Villa Park Dam. If no project is constructed, Orange County may still develop parks and trails along Santiago Creek.

OAK STREET DRAIN

5.85 ESTHETICS. Constructing a concrete channel will further degrade the remaining esthetic values of the Oak Street Drain channel and will make it more noticeable in its environment. Impacts will be most noticeable along the relatively rustic upstream reach of citrus grove areas. (Main Report Figure 15 provides an aerial photograph showing the Oak Street Drain area.) It appears probable that this upstream area will become urbanized, even in the absence of the project. Visual impact of the channel will still exist, however. Esthetic treatment landscaping will not significantly offset this esthetic impact because of insufficient right-of-way available for landscaping. A previously proposed project bicycle trail along the channel, using a paved channel service road and crossing streets at grade, has been deleted from the plan because of insufficient right-of-way and other design problems. Should such a trail be reconsidered, grade crossings and other features should be carefully designed to minimize safety hazards to trail users.

5.86 The Environmental Quality Plan will retain the soft bottom upper Oak Street Drain, increasing the channel's width and employing rock-revetted side slopes. This will increase wildlife access to the channel and its water supply, and will enhance the limited esthetic values remaining along the channel. The Environmental Quality Plan will also increase the right-of-way width along the channel where feasible, maintaining at least a 40-foot planting strip on each side of the channel and service road. This added portion will be extensively landscaped with native vegetation to maintain a wildlife corridor and to

enhance existing esthetic values, increasingly important as urbanization displaces the citrus groves and open space.

PROJECT-WIDE ISSUES

5.87 ENDANGERED SPECIES. Threatened, rare, and endangered species likely to be present in the project area are shown in Table 3. The most severe project impacts on endangered species are expected to be those affecting bird nesting and feeding areas at the Santa Ana River mouth, primarily of the California least tern. The Corps' proposals for replacing the affected nesting area are noted in paragraph 5.67, and plans for preserving and enhancing habitat at the river mouth are
R discussed in paragraph 5.63. Formal consultation with the USFWS under Section 7 of the Endangered Species Act of 1973 and with the California Department of Fish and Game has been implemented for all the project reaches.

5.88 WETLANDS. The project will affect wetlands at the mouth of the Santa Ana River, in the Santa Ana Canyon, in the Prado Dam reservoir area, and in the upper river area above Prado Dam. Paragraphs 1.16 and 1.21 discuss project wetlands relative to Section 404 and Executive Order 11990. Attachment A provides the Section 404 (b) (1) evaluation.

5.89 PRIME AND UNIQUE FARMLAND. The All River Plan will affect prime and unique farmland (P&UF) in the Prado basin and at the proposed Mentone Dam site. Dam material borrow sites and proposed recreational development within the reservoir areas may eliminate some P&UF from potential agricultural use. P&UF could also be affected by future decisions regarding ownership and leasing of land within the respective basins. The Soil Conservation Service (SCS) has indicated that there are no P&UF along any other project reaches (see Appendix I to the Main Report for copies of SCS letters). The other structural alternatives will not affect P&UF at the proposed Mentone Dam site.

5.90 CULTURAL RESOURCES. Tentative plans to protect, avoid, lessen, or compensate for the adverse effects of the proposed project include a program of protection, preservation, and data recovery. These plans are discussed on a site-by-site basis beginning in paragraph 5.32. Only the Prado basin is known to contain significant cultural resources which will be affected by the proposed project. Literature searches and reconnaissance-level surveys of the other project reaches have found no evidence of significant cultural resources that would be affected by any of the project alternatives. The information presented in this report is based on surface examinations. Test excavations will be conducted during Phase II investigations to verify the site evaluations and impact assessments, and to provide information needed to formulate an effective program of preservation and data recovery.

5.91 Copies of the cultural resources reconnaissance reports prepared by the University of California Riverside were forwarded to the Office of Historic Preservation and Interagency Archeological Services, Heritage Conservation and Recreation Service, in 1977. Comments are

unavailable at this time. Additional copies of these reports, together with the recent supplement to the initial reconnaissance investigations prepared by Environmental Resources Group, were forwarded to these agencies, and comments from the State Historic Preservation Officer (SHPO) were sought for inclusion in the final SEIS (see related correspondence in Appendices A and I). The SHPO requested that a Memorandum of Understanding be written detailing steps that should be taken to protect cultural resources values (see also paragraph 1.19 for further discussion of coordination on cultural resources). The results of the detailed cultural resources investigations to be conducted during Phase II studies, including final assessments of the eligibility of specific cultural properties for inclusion in the National Register of Historic Places and specific recommendations for all necessary mitigation, will be forwarded to the State Historic Preservation Officer, the Interagency Archeological Services of the Heritage Conservation and Recreation Service, and the Advisory Council on Historic Preservation, for review and comment. R

VI. PUBLIC INVOLVEMENT

6.01 PUBLIC INVOLVEMENT PROGRAM. The public involvement program conducted during the current study effort is summarized below. It is discussed in more detail in Appendix A to the Main Report. A Notice of Intent to prepare a DSEIS appeared in the Federal Register on 7 December 1979. The DSEIS and GDM were prepared and were submitted for public review on 17 July 1980; notice of their availability appeared in the 25 August 1980 Federal Register. After a 45-day review period, comments were incorporated and this Final SEIS and GDM were prepared. R

6.02 The scoping process was outlined in the December 1975 Review Report and, because the Phase I GDM effort was essentially a reaffirmation study, the public meetings for the Phase I study focused on informing the public of Corps plans and issues to be resolved, and on obtaining the comments of public agencies and citizens on the proposed project. Public meetings were held in Garden Grove (28 February 1979), Corona (1 March 1979), and San Bernardino (7 March 1979). A workshop was held in Costa Mesa on 23 January 1980 to inform the public of the selected plan as it relates to the Santa Ana River mouth, and to solicit comments. Workshops were held in Corona (19 February 1980) and Chino (20 February 1980) for area residents to discuss alternative plans for enlarging the Prado Dam reservoir area and alternative methods for acquiring the necessary property because of the enlargement.

6.03 The flood control plan for Santiago Creek was reformulated in response to local desires for a plan with less impact on adjacent residents. The Corps conducted a series of public workshops on Santiago Creek flood protection (Santa Ana, 28 November 1979; Orange, 29 November 1979, 18 December 1979, 30 January 1980, and 17 June 1980). These workshops were held to allow citizens a forum to express their concerns on flood protection and on recreation plans along the creek in light of changed local recommendations from those in the Review Report.

6.04 The Corps of Engineers mailed a public information brochure to affected and interested citizens and organizations in the areas around Oak Street Drain and the proposed Mentone Dam and reservoir to inform the public about progress of the project and to solicit comments. In August 1980, the Corps conducted a series of project-wide public meetings to present the draft report of the Phase I General Design Memorandum and the Draft Supplemental Environmental Impact Statement (DSEIS) to the public, and to obtain citizen and civic group comments on these reports. The public meetings were held in Corona (19 August 1980), San Bernardino (20 August 1980), Anaheim (26 August 1980), and Costa Mesa (27 August 1980). R

6.05 REQUIRED COORDINATION. Coordination efforts required under the December 1975 Review Report and the September 1977 Final Environmental Statement for the proposed project are discussed in those documents. The following discussion concerns only those coordination efforts required during preparation of the Draft and Final SEIS. During the current planning effort, the U.S. Fish and Wildlife Service (USFWS)

submitted planning aid letters dated 11 October 1979 and 7 February 1980, and a Supplemental Fish and Wildlife Coordination Act (FWCA) Report (Appendix I). In conjunction with preparation of these documents, Corps and USFWS personnel have met on a number of occasions to discuss project-related impacts and USFWS recommendations to mitigate anticipated adverse impacts. Formal consultation under Section 7 of the Endangered Species Act, as amended, was established. The USFWS
R submitted a Biological Opinion dated 1 October 1980 on project impacts to endangered species. The California Department of Fish and Game has been included in the coordination process through meetings, informal discussion, and formal comments with Corps personnel. The USFWS has maintained contact with the National Marine Fisheries Service (NMFS)
R concerning the project and the NMFS has formally commented on the project. Remaining required coordination with fish and wildlife agencies will consist of refinement of the mitigation measures and
R completion of consultation for endangered species.

6.06 The DSEIS and the 404(b)(1) water quality evaluation (Attachment A) were submitted to the Regional Water Quality Control Board, Santa Ana Region, for review and comment. However, because the FSEIS will be submitted to Congress, the Corps will seek an exemption from Sections 301, 402, and 404 of the Clean Water Act by including the evaluation as part of the FSEIS.

6.07 The Corps submitted the DSEIS and the required cultural resource
R report to the State Historic Preservation Officer and the Advisory Council on Historic Preservation for review and comment. Comments from these agencies are discussed in paragraph 1.19. The agencies requested more detailed information on project impacts and mitigation efforts for cultural resources. These studies will be conducted during Phase II advanced engineering and design studies.

6.08 The required coordination was established with the State Coastal Commission (see paragraph 6.09 below). A determination regarding consistency with the Coastal Zone Management Act is included in paragraph 1.23.

6.09 The Corps of Engineers has included concerned local governmental agencies in discussions on environmental issues. On 21 February 1980, separate meetings were held with City of Huntington Beach Planning and Environmental Resources Department personnel, City of Newport Beach planning personnel, and Costa Mesa planning personnel to discuss environmental concerns within their jurisdictions. The Coastal Commission also hosted four meetings (4 March, 13 March, 25 March, and 27 May 1980) for the Corps to coordinate plans for the Santa Ana River mouth area. Agencies represented at these meetings included the U.S. Fish and Wildlife Service, California Department of Fish and Game, California Department of Parks and Recreation, California Department of Transportation, Orange County Environmental Management Agency, Orange County Sanitation District, and the cities of Costa Mesa, Huntington Beach, and Newport Beach.

6.10 The DSEIS was distributed to concerned governmental agencies at all levels, to environmental groups, and to the interested public for review and comment. Comments are included in Appendix A to the Main Report, with responses where appropriate, and the GDM and FSEIS were revised where necessary to incorporate pertinent comments. R

6.11 STATEMENT RECIPIENTS. Agencies and groups among those to whom the Draft Supplemental Environmental Impact Statement was sent for review and comment are listed in Table 5. The project mailing list for individuals was extensive. Individuals and most of the interested groups on the mailing list were sent a public information publication summarizing the Draft Phase I GDM and DSEIS studies and findings, and explaining that copies of the GDM/DSEIS were available at local libraries, and from the Los Angeles District on request. Copies of the Final SEIS will be furnished to all interested agencies and individuals and all those who commented on the draft report (identified in the comments and responses section in Appendix A). Notices of the availability of the final report will be sent to all others on the project mailing list. R

6.12 PUBLIC VIEWS AND RESPONSES. Through the public meeting and workshop process, the Corps was able to obtain the views of concerned citizens and, where feasible, incorporate these views into the planning process (see Main Report Appendix A, Public Views and Responses). Briefly, there are two major areas of environmental concern in the project which arose during the public involvement program and review process--the wetlands at the mouth of the river and the Santa Ana Canyon area. (a) Although some local residents favor preserving and enhancing the salt marsh as a valuable environmental resource, others in the beach communities favor development of a new marina and oppose marsh acquisition if it would preclude a marina. The Corps and wildlife agencies agree on the importance of acquiring 92 acres of salt marsh for environmental preservation and enhancement and reaffirm the Corps' 1975 decision to do so. (b) In 1975 there was strong local support for maintaining the natural appearance of the river reach through the Santa Ana Canyon. However, Orange County adopted resolutions in January and August 1980 requesting that the Corps modify its plan in order to allow some development in the canyon. The Corps and the wildlife agencies concur on the importance of maintaining the canyon flood plain as a wildlife corridor and as open space. The Corps continues to support the 1975 plan to acquire the canyon flood plain. R

6.13 Several other environmental issues were addressed during the public participation program. (a) At the meetings and workshops, there was general public support for maintenance of a recreational trail corridor from the ocean to Prado reservoir. (b) There was some opposition to a recreational trail along Santiago Creek through the City of Santa Ana because of the narrowness of the creek in this reach; therefore, no trails are currently proposed through this area. (c) Prado area residents desired that a flood control project on the Santa Ana River minimize land acquisition needs in their communities. The Corps continues to recommend the All River Plan, which requires less

acquisition than plans that call for raising Prado Dam to a higher level. (d) The public had a major influence on the planning for the Santiago Creek element of the project. As a result of citizen concern, the plan was modified from the Standard Project Flood protection recommended in the 1975 Review Report to 100-year protection in order to minimize concrete channelization of the creek. (e) Additional discussion of controversial or unresolved issues is presented in paragraphs 1.05 and 1.10. Public concerns are noted in paragraph 2.02.

TABLE 5

Agency and Group Recipients of the Draft
Supplemental Environmental Impact Statement

Federal

Advisory Council on Historic Preservation

Department of Agriculture
- Soil Conservation Service
  - Area Conservationist
  - River Basin Planning Staff
- Forest Service

Department of Commerce
- Deputy Assistant Secretary and Director for Environmental Affairs
- National Marine Fisheries Service

Department of Defense
- U.S. Army Corps of Engineers
  - South Pacific Division, San Francisco
  - Institute for Water Resources, Ft. Belvoir, Virginia
  - Waterways Experiment Station, Vicksburg, Mississippi
- U.S. Naval Weapons Station, Seal Beach

Department of Energy, Representative Region IX

Department of Health and Human Services

Department of Housing and Urban Development
- Director, Southwest Area Office
- Administrator, Region IX

Department of the Interior
- Director, Office of Environmental Project Review, Washington D.C.
  - (The following agencies are among those that will receive copies of the supplemental draft through distribution from the above agency.)
  - Bureau of Land Management
  - Fish and Wildlife Service
  - Geological Survey
  - Heritage Conservation and Recreation Service, Pacific Southwest Region
  - Water and Power Resources Service (Bureau of Reclamation)

Department of Transportation
- Federal Aviation Administration
- Federal Highway Administration

Federal Railroad Administration
U.S. Coast Guard, Eleventh Coast Guard District, Long Beach

Environmental Protection Agency
Administrator, Region IX
Director, Office of Environmental Review

Federal Power Commission
Small Business Administration

State

Clearing House. The following state agencies, departments, and commissions were among the state offices to receive copies of the DSEIS through distribution from the clearing house and the State Resources Agency.
Governor's Office, Office of Planning and Research
Air Resources Board
California Coastal Commission; South Coast Regional Commission
California Water Commission
Department of Boating and Waterways
Department of Conservation
Department of Correction (facilities at Prado)
Department of Fish and Game
Department of Parks and Recreation
Department of Transportation (Caltrans)
Department of Water Resources
Office of Historic Preservation
Public Utilities Commission
Regional Water Quality Control Board, Santa Ana Region
State Assembly
State Coastal Conservancy
State Lands Commission
State Library
State Senate
Southern California Association of Governments
San Bernardino Associated Governments

Counties

Orange County
Board of Supervisors
Division of Forestry
Environmental Management Agency
Flood Control District
Harbor District
Harbors, Beaches and Park District
Office of Emergency Services
Planning Department
Sanitation District
Vector Control District

Riverside County
- Board of Supervisors
- County Clerk
- Flood Control and Water Conservation District
- Health Department, Environmental Health Services (Vector Control)
- Parks Department
- Planning Commission
- Road Department

San Bernardino County
- Board of Supervisors
- County Clerk
- Division of Transportation
- Environmental Analysis Division
- Flood Control District
- Planning Department
- Regional Parks Department
- San Bernardino County Museum

Cities (copies of the DSEIS were mailed to public libraries as well as to concerned city offices)

- Anaheim
- Chino
- Colton
- Corona
- Costa Mesa
- Fountain Valley
- Garden Grove
- Huntington Beach
- Loma Linda
- Newport Beach
- Norco
- Orange
- Riverside
- San Bernardino
- Santa Ana
- Villa Park
- Yorba Linda

Utilities and Transportation

- Chino Basin Municipal Water District
- Chino Basin Water Conservation District
- Crafton Mutual Water Company
- Cucamonga County Water District
- Etiwanda Water Company
- Fontana Union Water Company
- Gage Canal Company
- Metropolitan Water District of Southern California
- Riverside-Highland Water Company

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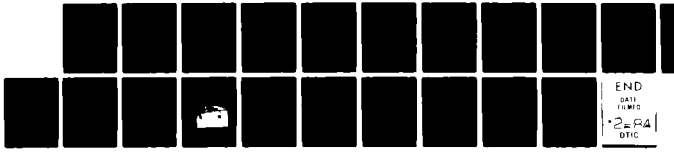

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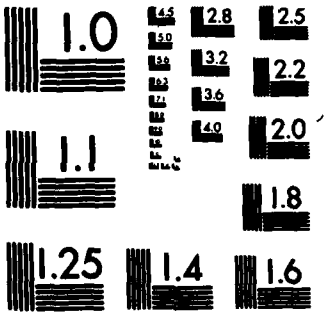

San Bernardino Valley Municipal Water District
Santa Fe Railroad Company
Southern California Water Company
Southern Pacific Transportation Company
Union Pacific Railroad Company
Western Municipal Water District of Riverside County

Colleges and Universities

California Institute of Technology, Pasadena
California State Polytechnic University, Pomona
California State University, Fullerton
California State University, Long Beach
Chaffey College
Claremont Colleges
Loma Linda University
Pomona College
Santa Ana College
Scripps Institution of Oceanography
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, Riverside
University of Redlands

Interested Groups

Associated Riding Clubs of Orange County
Balboa Coves Community Association, Newport Beach
Bow Hawks Archery Club
California Boating Council
California Bowmen Hunters and State Archery Association
California Wildlife Federation
Coastal Area Protective League
Committee of 100
Community Action Group--Corona
Corona Women Voters
East Highland Citrus Association
East Highlands Property Owners
Environmental Coalition of Orange County
Equestrian Trails--Corral 100
Friends of the Earth
Goldenwest Homeowners Association, Huntington Beach
Huntington Beach Historical Society
Huntington Beach Library and Cultural Resources Center
Huntington Beach Rotary Club
Huntington Harbour Property Homeowners Association, Huntington Beach
Huntington Seacliff Homeowners Association, Huntington Beach
Inland Action, Inc.
Inland Archery Association
Inland Council of Conservation Clubs

Intergovernmental Coordinating Council of Orange County
Isaak Walton League
League of Women Voters, Huntington Beach-Seal Beach
League of Women Voters of Orange County
League of Women Voters--San Bernardino
Meadowlark Homeowners Association, Huntington Beach
Mill Creek--Zanja Property Association
National Audubon Society
National Wildlife Federation
Newport Shores Community Association, Newport Beach
Newport Terrace Homeowners Association, Newport Beach
Orange County Bowmen
Orange County Coast Association
Orange County Wheelmen
Orange Park Association
People for Parks Committee
Riverside-Corona Resource Conservation District
Riverside County Open Space Resource Committee
Saddleback Equestrians, Orange
San Bernardino Audubon Society
Sea and Sage Audubon Society
Sierra Club, Angeles Chapter
Sierra Club, Orange County Group
Sierra Club, San Gorgonio Chapter
Sierra Club, Southern California Coastal Coordination
Summerfield Homeowners Association, Huntington Beach
The Outboard Boating Club of America
Tri-County Conservation League
United Dairymen's Association
West Newport Beach Improvement Association

ATTACHMENTS

TO THE

FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

ATTACHMENT A

SECTION 404 (b) (1)

WATER QUALITY EVALUATION

Santa Ana River Project Phase I GDM

Final Supplemental Environmental Impact Statement

SECTION 404 (b) (1) WATER QUALITY EVALUATION

Santa Ana River Project, California

Introduction. The following evaluation is provided in accordance with Section 404(b) (1) of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) as amended by the Clean Water Act of 1977 (Public Law 95-217). This evaluation deals with the All River Plan for the Santa Ana River Project.

I. PROJECT DESCRIPTION

A. Description of the proposed discharge of dredged or fill materials.

1. Mentone Dam. Fill material required in the construction of Mentone Dam will consist of approximately 66,000,000 cubic yards of sand, gravel, and impervious material (silt and clay) and 377,000 cubic yards of concrete. Ten to 12 million cubic yards of impervious material will be obtained from one of the following alternate sites:

a. Redlands Borrow Site.

b. Prado Dam Basin Borrow Site.

2. Prado Dam. Fill material required in the construction of Prado Dam will consist of approximately 2,220,000 cubic yards of fine silts, sand, and clay and 136,900 cubic yards of spillway concrete. The material will be obtained from the reservoir area.

3. Lower Santa Ana River. (See Table A-1 for a summary of channel excavation and deposition quantities and disposal sites.)

a. Weir Canyon Road to Katella Avenue. The fill material will consist of approximately 1,290,000 cubic yards of poorly graded gravelly sand. The excavation of 3,777,000 cubic yards of channel material will be utilized as structural backfill since the material is generally too coarse for use as beachfill. Excess material will be deposited in the Santiago Creek gravel pits and the Santa Ana River Lincoln Avenue pit.

b. Katella Avenue to 17th Street. The fill material will consist of approximately 855,000 cubic yards of poorly graded gravelly sand. The excavation of 1,186,000 cubic yards of channel material will be utilized as structural backfill since the material is generally too coarse for use as beachfill. Excess material will be deposited in the Santiago Creek gravel pits and the Lincoln Avenue pit.

c. Seventeenth Street to 1/4 mile below Hamilton-Victoria Street. The fill material will consist of approximately 1,978,000 cubic yards of poorly graded sandy invert and silty sand overbank. The excavation of 5,890,000 cubic yards of sandy invert materials may be

used as beachfill (up to 3,700,000 cubic yards) while the remaining overbank excavation material will probably be placed in the Santiago Creek or Lincoln Avenue pits.

d. One-fourth mile below Hamilton-Victoria Street to Ocean. The fill material will consist of approximately 806,000 cubic yards of sandy silt material that is too fine to be placed on the beach. The excavation of 1,850,000 cubic yards of sandy silt material may be selectively utilized as structural backfill or placed in the Santiago Creek or Lincoln Avenue pits.

4. Santiago Creek. The fill material will consist of approximately 840,000 cubic yards of gravelly sandy silts. The excavation of 740,000 cubic yards of material will be utilized as structural backfill and any excess material not suitable for construction purposes will be deposited in the Santiago Creek pits.

5. Oak Street Drain. The fill material will consist of approximately 154,000 cubic yards of gravelly silty sands. The excavation of 336,000 cubic yards of material will be used as structural backfill.

B. Description of the proposed disposal sites for dredged or fill material. The proposed Corps project along the Santa Ana River consists of the following elements:

1. Construction of a new dam (Mentone) upstream from Prado Dam near the towns of Mentone and East Highlands. The new upstream reservoir will be formed by constructing a crescent-shaped earthfill dam with an elevation of about 1,575 feet above mean sea level (msl), a base width of 2,700 feet, and a length of approximately 3.3 miles. Approximately 66,000,000 cubic yards of construction material excavated from behind the proposed dam site and 347,000 cubic yards of spillway concrete will comprise the estimated needs for the dam, reservoir and contiguous levee improvements.

2. Flood plain management of the reach between Mentone Dam and Prado Dam.

3. Improvement of the Oak Street Drain in the City of Corona. The recommended plan calls for the construction of 3.1 miles of rectangular concrete channel extending from the Riverside County debris basin (approximately 3,900 feet upstream from Ontario Avenue) to Temescal Creek located north of the City of Corona. The channel's base width will be 20 to 26 feet with a right-of-way of 64 feet. The channel walls will be 8 to 11 feet deep.

4. Modification of the existing Prado Dam and expansion of the existing Prado reservoir area. The existing reservoir will be enlarged by raising Prado Dam from its existing elevation of 566 feet (msl) to 596 feet (msl). Likewise, the spillway will be modified from its existing crest elevation of 543 feet (msl) to 563 feet (msl). From its

existing area of 9,741 acres at elevation 556 feet (msl), the reservoir will be expanded by 1,461 acres to 11,202 acres at elevation 566 feet (msl). The dam will be designed for a controlled release of 30,000 cfs.

5. Acquisition of the post-project Santa Ana Canyon flood plain from Prado Dam to Weir Canyon Road.

6. Improvement of the existing Santa Ana River flood control channel downstream from Weir Canyon Road.

a. From Weir Canyon Road to Katella Avenue, the recommended plan calls for 10 miles of earth-bottom channel with drop structures and rock-revetted side slopes.

b. From Katella Avenue to 17th Street the plan provides for 3 miles of earth-bottom channel with retaining walls, compatible with the Riverview Golf Course.

c. From 17th Street to 1/4 mile below the Hamilton-Victoria Street bridge, the plan calls for 8-1/2 miles of concrete rectangular channel between 250 and 450 feet wide, ranging from 17 to 23 feet deep with a right-of-way width averaging 400 feet.

d. From 1/4 mile below the Hamilton-Victoria Street bridge to the ocean, the plan calls for 1-1/2 miles of a single channel combining the Greenville-Banning and the Santa Ana River channels, using vertical concrete walls with a soft bottom width ranging from 480 to 520 feet and a total depth of 21 to 23 feet.

7. Improvement of the lower Santiago Creek channel consists of (a) using existing gravel pits between Villa Park Road and Prospect Avenue for flood retention, with an outlet at Prospect Avenue; and (b) adding revetted rock to the unimproved trapezoidal channel side slopes and invert from Prospect Avenue to Walnut Avenue and from about 1,000 feet above Flower Avenue to the Santa Ana River confluence.

a. Soil material must be excavated to provide space for the revetment, then replaced atop the levees behind the revetment. Excess material will be deposited in the existing gravel pits.

b. The pits between Villa Park Road and Prospect Avenue are to be used for flood control and ground water recharge once excavation of sand and gravel has ceased. The discharge sites for fill material are the pits described above. The fill material will be discharged by conventional construction methods. Construction is tentatively scheduled to commence during fiscal year 1993 and to be completed during fiscal year 1994. The discharge site should not require any future modification after completion of the project.

II. PHYSICAL EFFECTS (40 CFR 230.4-1(a)).

A. Reservoir excavation, dam construction, and improvements to the Mill Creek levee at Mentone will necessitate removal of about 1,600 acres of coastal sage scrub and mixed juniper woodland vegetation. The face of Mentone Dam and wildlife areas within the reservoir will be planted with coastal sage scrub species and grasses to partially mitigate losses within the area. Recreational areas will also be landscaped.

B. Expansion of the Prado Dam and spillway will necessitate the removal of approximately 100 acres of riparian vegetation near the existing dam, spillway, and new levee structures; 340 acres of riparian and upland vegetation for borrow materials needed to raise Prado Dam; and 1,000 acres of riparian and upland vegetation for soil material needed for the core of Mentone Dam. These impacts are considered adverse, because of the density, diversity, and maturity of such vegetation. Such impacts will be partially mitigated by replacing part of the disturbed vegetation with native species in affected areas within the reservoir.

C. The proposed project will retain and supplement natural vegetation in the Santa Ana Canyon. The recommended plan calls for extensive landscaping with native as well as introduced species, for esthetic treatment, noise buffering, visual buffering, and habitat restoration.

D. Construction of channel improvements along the lower Santa Ana River, the Oak Street Drain, and lower Santiago Creek will necessitate removal of vegetation within the existing channels. This vegetation consists of common weeds, minor quantities of landscaping plants, and small amounts of hydrophytic vegetation on the Santa Ana River between Weir Canyon Road and Ball Road. Loss of this vegetation is not considered significant because it has little natural value.

E. The widening of the lowermost Santa Ana River channel and the relocaton of the Talbert channel as part of the All River Plan will eliminate:

1. An estimated 4.5 acres of the 13-acre freshwater wetlands at Victoria Pond. (The affected area will be replaced.)

2. Approximately 11.0 acres of freshwater emergent wetland vegetation along the Greenville-Banning channel between Hamilton-Victoria Street and the Fairview channel.

3. An estimated 2.0 acres of the 15-acre California least tern interim feeding area.

4. Approximately 1.5 acres of the 4.5-acre fenced California least tern nesting site. (The affected area will be replaced.)

F. Widening the river channel between Hamilton-Victoria Street and Pacific Coast Highway will necessitate taking approximately 8 acres of salt marsh out of the larger 400-acre marsh and upland area, which is a remnant of the river's once extensive tidal system. Some marsh-associated natural vegetation will be destroyed. Considering the relative uniqueness of this type of vegetation in coastal southern California, this impact is considered adverse.

G. The tidal marsh to the east of the Santa Ana River mouth is vegetated principally by pickleweed and also contains sea lavender, sea blite, saltbush, and alkali heath. A small culvert between the marsh and the Greenville-Banning channel is apparently the only source of tidal water to the marsh. Poor tidal flushing and localized placement of fill have reduced the size and quality of the marsh habitat. Nevertheless, it remains a functioning marsh ecosystem providing habitat for three endangered species--the California least tern, the light-footed clapper rail, and the Belding's savannah sparrow. The first two of these are on both the California and Federal lists of endangered fauna, while the latter is on the State list.

H. The Belding's savannah sparrow feeds and rests within this marsh area and may also nest there. The light-footed clapper rail is only an occasional visitor. The California least tern, which nests at a nearby sanctuary on Huntington Beach, feeds on small fish taken from the tidal channels of the marsh as well as from tidal portions of the Santa Ana River, the Talbert channel, and the Greenville-Banning channel. Continued use of the Huntington Beach nesting site is dependent on maintenance of this food supply.

I. The Corps of Engineers will combine mitigation needs and habitat acquisition for the preservation of endangered species by acquiring 92 acres (8 acres mitigation, 84 acres preservation) of salt marsh and adjacent lands near the river mouth. Rehabilitation of the salt marsh will not only involve acquisition of the area but will also necessitate (1) construction of an effective means of tidal flushing; (2) regrading of the area to increase the intertidal area; (3) vegetative replanting with salt marsh species; and (4) consideration of constructing a protected nesting area for the California least tern.

III. *CHEMICAL-BIOLOGICAL INTERACTIVE EFFECTS (40 CFR 230.4-1(b)).*

The material proposed for discharge will meet the exclusion criteria. The earthfill for Mentone and Prado will be taken from respective nearby borrow sites and will be substantially the same as the substrate at the proposed disposal sites. Sites presently being considered as sources of material to be used for construction on the project will be sufficiently removed from sources of pollution to provide reasonable assurance that such material has not been contaminated by such pollution.

IV. DESCRIPTION OF SITE COMPARISION (40 CFR 230.4-1(c)).

A. Total sediment analysis (40 CFR 230.4-1(c)(1)). Not applicable.

B. Biological community structure analysis (40 CFR 230.4-1(c)(2)). Not applicable.

V. REVIEW OF APPLICABLE WATER QUALITY STANDARDS.

Placement of fill material will comply with applicable Environmental Protection Agency water quality standards. The District will seek an exemption from regulation for discharge under Sections 301, 402, and 404 of the Clean Water Act. Use of the material will not introduce toxic substances into the Santa Ana River.

VI. SELECTION OF DISCHARGE SITES (40 CFR 230.5) FOR DREDGED OR FILL MATERIAL.

A. Need for the proposed activity. The proposed flood control project is necessary to provide increased protection against flooding for agricultural, commercial, industrial, and residential land uses along the Santa Ana River.

B. Alternative sites and methods of discharge considered. Several alternative locations for deposition of material are being considered: (1) use of suitable material for the core of Mentone Dam and the extension of Prado Dam, (2) placement of up to 3,700,000 cubic yards of suitable material as beach replenishment, and (3) use of gravel pits along upper Santiago Creek and at Lincoln Avenue on the Santa Ana River for disposal of up to 6.5 million cubic yards of material.

C. Objectives to be considered in discharge determination (40 CFR 230.5(a)).

1. Excavation and placement of fill will destroy existing riparian vegetation within the construction areas, especially at the proposed Mentone and existing Prado Dam sites. Excavation and placement of fill within the floodway will alter the riverine ecosystem by (a) reducing diversity and density of vegetation, (b) concentrating and directing flows within the channel, and (c) introducing visual and ecological barriers which will inhibit the movement of fauna in and out of feeding, resting, and breeding areas. However, the planting of cottonwoods and willows will mitigate for some losses in diversity of vegetation and, as a result, provide food and cover for a variety of wildlife species.

2. Short-term effects of placement of fill will include increased noise and dust levels and disturbance and displacement of wildlife in and near construction areas and haul roads. The levees will impair views across the river but landscaping techniques will reduce the impact on esthetic values. Construction-related esthetic impacts will be limited to the construction and borrow areas and will be short-term.

D. Impacts on water uses at proposed discharge sites (40 CFR 230.5(6) (1-10)) are as follows:

1. Wells are located in and adjoining the proposed project boundary; however, the proposed discharge of fill material will have no significant impact on the municipal water supply.

2. The fishery resource within the Santa Ana River is quite limited due to low erratic flows and poor water quality. The proposed project will have little effect on the existing fishery resource with the exception of the tidal reach at the mouth of the river. It is anticipated that, with improved flows into the tidal channels of the salt marsh through the proposed new tidal gate, the value of these channels as fish spawning habitat will increase.

3. Although the placement of fill will eliminate about 100 acres of riparian vegetation at Prado Dam, and excavation will remove another 1,340 acres, these impacts will be partially compensated by revegetation with native species and increases in open water behind the dam site that will provide new habitat for aquatic wildlife such as wading birds, waterfowl, amphibians, and invertebrates. In addition, the improved tidal gate and the endangered species habitat restoration program at the mouth of the river are expected to enhance wildlife habitat values and to be especially beneficial to the Belding's savannah sparrow and the California least tern. The possibility also exists that light-footed clapper rails would be attracted to the area.

4. The proposed discharge of fill will have an insignificant impact on any formal or informal recreational uses of the channel.

5. No submerged vegetation of biological significance will be affected by the discharge of fill within the flood plain.

6. It is anticipated that material dredged from the lowermost Santa Ana River during regular operation and maintenance procedures, expected to average 90,000 cubic yards annually, will be placed on the beach.

E. Considerations to minimize harmful effects (40 CFR 230.5(c)(1-7)). All necessary factors are being considered in determining the site and disposal conditions to minimize the possibility of harmful effects. Four alternatives to the proposed All River flood control plan were investigated. Detailed descriptions of these plans are contained in chapter 5 of the General Design Memorandum and in paragraph 3.08 of the FSEIS. A brief description of each follows:

1. The High Prado Plan proposes to (a) increase the height of Prado Dam (raising the taking line to elevation 582 feet (msl)), (b) acquire and preserve the Santa Ana Canyon flood plain, and (c) make channel improvements along the lower Santa Ana River similar to those described in the All River Plan. Construction of Mentone Dam will not occur under this alternative. Although the channel dimensions will be

the same as the recommended All River Plan, only 8 acres of marsh at the Santa Ana River mouth will be acquired as mitigation, versus the 92 acres proposed for restoration as mitigation and enhancement of endangered species habitat in the All River Plan.

2. The Environmental Quality (EQ) Plan is essentially the same as the High Prado Plan, with the following exceptions. (a) It provides for the acquisition and enhancement of 200 acres of marsh at the river mouth. The restoration of 200 acres of marsh will greatly increase potential foraging habitat for the California least tern as well as provide nesting habitat for the Belding's savannah sparrow, the light-footed clapper rail, and the California least tern. (b) Much of the agricultural land use in Prado basin will be removed, allowing natural revegetation of these lands. (c) The Greenville-Banning channel between Hamilton-Victoria Street and the Fairview channel will be replaced as a soft bottom channel, rather than as a concrete channel in the All River and High Prado Plans. This will increase wetland surface area and vegetation.

3. The All Channel Plan involves enlarging the outlet works and spillway at Prado Dam, and substantially widening and channelizing the Santa Ana River from Prado Dam to the Pacific Ocean. Prado Dam will not be increased in elevation and Mentone Dam will not be constructed. As in the Environmental Quality Plan, approximately 200 acres of marsh will be restored. Under the All Channel Plan, from Hamilton-Victoria Street to the Pacific Ocean the river channel will be approximately 200 to 350 feet wider than in the All River Plan. This expansion of the Santa Ana River and related relocation of the Talbert channel westward will eliminate an estimated 20 acres of coastal marsh in addition to virtually eliminating the California least tern nesting area and the Victoria Pond. As mitigation for this plan, Victoria Pond and the California least tern nesting area will be relocated on adjacent lands. In addition, 200 acres of wetland marsh will be acquired and enhanced.

4. The No Action alternative will not affect the existing Santa Ana River resources. However, continued poor tidal flushing, siltation, and localized filling may cause a further deterioration of the existing saltwater marsh adjacent to the river channel.

VII. STATEMENT AS TO CONTAMINATION OF FILL MATERIAL IF FROM A LAND SOURCE (40 CFR 230.5(d)).

The material will meet the Environmental Protection Agency exclusion criteria (see section III). The earthfill will be substantially the same as the material at the deposition sites.

VIII. CONCLUSIONS AND DETERMINATIONS.

A. An ecological evaluation has been made following the evaluation guidance in 40 CFR 230.4, in conjunction with the evaluation considerations in 40 CFR 230.5. Appropriate measures have been identified and incorporated into the proposed plan to minimize adverse effects on the environment as a result of fill activities. Consideration has been given to the need for the proposed activity, the availability of alternate sites, and methods of disposal that are less damaging to the environment, and such water quality standards as are appropriate and applicable by law.

B. It was determined that the activities associated with the fill must have direct access or proximity to, or be located in, the water resources in order to fulfill the basic purpose of the proposed action.

IX. FINDINGS

The fill placement sites for the Santa Ana River Project have been specified through the application of the Section 404 (b)(1) Guidelines.

TABLE A-1

Summary of Santa Ana River Project Dredge and Disposal Quantities

Reach	Quantity of Excavated Material (cy)	Quantity and Location of Borrow (cy)	Quantity Utilized Within Reach (cy)	Excess (cy)	Disposal Site
Mentone Dam	61,000,000	Redlands or Prado Site 10-12,000,000	71,000,000	-	-
Prado Dam	1,000,000	Prado basin 3,100,000	4,100,000	-	-
Weir Canyon to Katella Avenue	3,777,000	-	1,290,000	2,487,000	Santiago Pits
Katella Ave. to 17th Street	1,186,000	-	855,000	331,000	Santiago Pits, 100,000 for Santiago Creek
17th Street to Hamilton Street	5,890,000	-	1,978,000	3,912,000	Santiago Pits or Lincoln Ave; 1,000,000 to 3,700,000 beachfill
Hamilton Street to ocean	1,850,000	-	806,000	1,044,000	Santiago Pits or Lincoln Ave.
Santiago Creek	740,000	Katella Ave. to 17th Street 100,000	840,000	-	-
Oak Street Drain	336,000	-	154,000	182,000	Used as backfill

ATTACHMENT B

U.S. FISH AND WILDLIFE SERVICE

SUPPLEMENTAL COORDINATION ACT POSITION STATEMENT

AND

CORPS RESPONSE

Santa Ana River Project Phase I GDM

Final Supplemental Environmental Impact Statement

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

SANTA ANA RIVER

SUPPLEMENTAL FISH AND WILDLIFE
COORDINATION ACT REPORT

REGION ONE

OCTOBER 1980

FISH AND WILDLIFE SERVICE EXECUTIVE STATEMENT

This is the Fish and Wildlife Coordination Act (FWCA) report on the fish and wildlife resources of the Santa Ana River ecosystem and an impact analysis of the proposed Santa Ana River Flood Control Project. It has been prepared under the authority and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.). This report supplements and updates our 1975 FWCA report. National Marine Fisheries Service (NMFS) and California Department of Fish and Game (CDFG) have reviewed the report.

The proposed Santa Ana River Main Stem, Santiago Creek, and Oak Street Drain Project is located within three southern California counties: San Bernardino, Riverside, and Orange. The primary purpose of the project is to provide flood control along the Santa Ana River, the largest river system in southern California. Additional project purposes include recreation, endangered species habitat preservation, and water conservation.

The Los Angeles District of the Corps of Engineers (Corps) recommends the All River Plan for flood protection along the Santa Ana River and its tributaries. The recommended plan consists of five main structural features: 1) construction of a dam and reservoir at Mentone and extension of the Mill Creek Levee; 2) enlargement and modification of the existing Prado Dam and Reservoir; 3) modification of the Santa Ana River Channel from Prado Dam downstream to the Pacific Ocean; 4) channel modification of lower Santiago Creek (tributary of the Santa Ana River); and 5) channel modification of Oak Street Drain (in the City of Corona).

Important nonstructural and/or environmental protection features of the project include: 1) floodplain management along the river between Mentone Dam and Prado Dam; 2) acquisition and protection of a 1,500-acre floodway through Santa Ana Canyon; 3) acquisition, restoration, and preservation of 92 acres of salt marsh wetlands and buffering uplands at the mouth of the Santa Ana River for compensation and endangered species preservation purposes; and 4) providing water conservation areas for groundwater recharge, recreation facilities, and/or wildlife mitigation at Prado Dam, Mentone Dam, along the Santa Ana River and project tributaries.

Land use activities (e.g. urban and agricultural development, flood control, water extraction) within the Santa Ana River project study area have significantly altered the function of this riverine ecosystem. Important biological resources still remain in the little developed Mentone area, within the existing Prado Reservoir, in the Santa Ana Canyon, and at the Santa Ana River mouth. Within the 70-mile long project study area, there are unique, scarce, endangered and regionally significant fish and wildlife resources. A unique juniper woodland community occurs on the mostly undeveloped outwash plain at Mentone. The largest willow forested wetland community in southern California is located within the existing Prado Reservoir. Downstream of Prado

Dam, the Santa Ana Canyon area supports the best remaining riparian woodland habitat along the lower Santa Ana River. Remnant estuarine wetlands located at the Santa Ana River mouth provide habitat for several endangered species. Additionally, listed and/or candidate endangered species are found in Prado Reservoir.

The proposed project will significantly impact this important riverine ecosystem. Mentone Dam will destroy unique intermixed outwash habitats. Some new aquatic and wetland habitats will be provided and some open space that probably would be developed without a project will be preserved. At Prado Reservoir, project construction (especially borrow areas) and extensive recreational developments will significantly impact regionally important biological resources that presently are only slightly impacted by man. Construction of four recreational lakes will provide some aquatic and wetland opportunities for wildlife. Project purchase of the Santa Ana Canyon floodway will do much to further the long-term preservation of this very valuable resource area. About 7 miles of existing Santa Ana River soft bottom flood control channel will be converted to concrete channel through a highly urbanized section of Orange County. At the Santa Ana River mouth, about 92 acres of highly modified estuarine wetlands will be purchased and restored to greater wildlife productivity, to preserve habitat for several endangered species.

In summary, the project will result in the following estimated unavoidable adverse impacts: 1) loss of 1,925 acres (1,200 permanent) of wildlife habitats with construction of Mentone Dam; 2) loss of 825 acres (425 permanent) of wildlife habitats at Prado Dam for borrow areas and recreational developments; 3) loss of 1,150 acres (300 permanent) of highly disturbed flood control channel habitats along the Lower Santa Ana River between Weir Canyon Road and Hamilton-Victoria Avenue; and 4) loss of 119 acres (58 permanent) of wildlife habitats at the Santa Ana River mouth. About 429 acres of wetlands and 1,554 acres of uplands will be permanently destroyed or altered by the project. About 2,036 acres of wetlands and uplands destroyed by the project should recover their capability to support fish and wildlife resources.

Our analysis of the project impacts, compensation features, and changes in the project since the 1975 FWCA report was prepared, reveals that long-term losses of public fish and wildlife resources are likely to occur with the present project design. In general, we have not changed our position as expressed in the 1975 FWCA report. However, to minimize short-term and irreversible losses and to protect or rehabilitate damage portions of the Santa Ana River ecosystem, we recommend the following measures be incorporated into and made a part of the project. These short and long term measures are proposed to partially compensate the expected and potential habitat losses, both avoidable and unavoidable. An annual report on these measures, their status, management, and effectiveness should be prepared by the Corps and made available to the public throughout the construction period.

Mentone Dam

1. At least 15 acres of the proposed 50-acre recreational lake should be designed and preserved to benefit fish and wildlife resources. Landscaping, fencing, and/or barriers to human intrusion should be designed to insure the area functions as a wildlife sanctuary.

2. Recreational developments and areas should be designed to avoid loss of the unique juniper woodland and other high quality intermixed outwash habitats within the proposed reservoir. These natural areas should be adequately buffered to prevent intrusions from recreational areas.

3. Local zoning ordinances should be enacted to protect juniper woodland and alluvial wash habitat from destruction by proposed residential development encouraged by the project west of Orange Avenue and north of the river.

4. All project lands should be dedicated for wildlife preservation and management purposes, except for structural components, operational areas, and proposed recreational areas. If existing agricultural uses are not continued on lease-back lands, these areas should be allowed to revert to natural habitat.

5. Cottonwoods and sycamores within the project area should be preserved where possible. Trees should be inventoried and similar or greater numbers planted in reservoir areas that are not vulnerable to prolonged inundation or flood scouring impacts. Alder and willow trees and alluvial wash shrubs should also be planted in suitable areas to help replace resource values lost during project construction. This vegetation is important as nesting, roosting, and cover habitat.

6. Location of the Redlands alternate borrow site to obtain construction materials for Mentone Dam should be coordinated further with the Fish and Wildlife Service (Service) and CDFG to insure it will not adversely impact existing wildlife resources or CDFG proposed land uses in the area.

Upper Santa Ana River - Mentone to Prado

7. Local governments should provide written assurances that maximum floodplain management will be practiced through this reach for future developments encouraged or accelerated by the presence of Mentone Dam. These written assurances should specify that developments will be precluded from encroaching on and destroying existing wetland and floodplain wildlife resource values. Specific assurances should be obtained that no channelization or additional structural flood control projects will be constructed in future years in this reach to be consistent with the President's Executive Order on Protection of Wetlands and Floodplain Management. It is especially critical to protect the high quality wetlands along the river between Mount Rubidoux and Prado Dam.

Prado Dam

8. Two of four recreational lakes should be designed and developed primarily as a wildlife sanctuary for educational and nature appreciation purposes. Innovative recreational design could be used to accommodate controlled access shoreline fishing into a portion of one or both of the lakes to encourage user involvement.

9. Planning and design of proposed recreational developments should be coordinated with the Service and CDFG to protect wetlands, retain high quality natural habitats, and preserve valuable uplands which interface and buffer the wetland areas. This could require elimination, redesign and/or relocation of recreational areas E, F, G, K, L, M, and N, as shown on Map 6 in the 1977 Final Environmental Statement (FES), to prevent adverse impacts on sensitive wetland/upland ecotone areas.

10. Design of recreational areas should use fencing, trail alignment, signing, etc. and restrict human intrusion into and protect adjacent wildlife areas including the upland and wetland buffer zones. It is important to protect natural upland habitats that interface with reservoir wetlands since they enhance overall wildlife diversity.

11. Cottonwood and sycamore trees should be preserved where possible. Those trees destroyed by the project should be replaced by an equal or greater number of trees. Replaced trees should be relocated where frequent inundation will not limit their habitat values. These trees are important as nesting, roosting, and cover habitat.

12. Agricultural lease-back lands bordering existing reservoir wetlands should be evaluated by the Corps in coordination with the Service and CDFG to determine if selective and voluntary termination of agricultural activities would protect sensitive habitat areas in the reservoir.

13. Additional studies are needed prior to completion of Phase II work on the project to determine the extent of Prado Reservoir used by the rare yellow-billed cuckoo and the candidate endangered species, least Bell's vireo. The objective is to insure that measures are taken to prevent adverse impacts to these sensitive species. The Service is willing to conduct these studies.

14. Location of any borrow sites in Prado Reservoir should be coordinated further with the Service and CDFG to avoid net losses of valuable wildlife resources. It is especially important to avoid losses of wetlands, and important interfacing upland habitats.

Santa Ana Canyon

15. The 1,500-acre floodway purchased through Santa Ana Canyon should be dedicated as natural open space for wildlife purposes and limited recreational uses.

16. Recreational trails and associated parking areas should be designed to protect the wildlife corridor values and make minimal encroachments into the wetlands and high value buffering uplands.

17. Agricultural lease-back lands that are not kept in production should be allowed to revert to natural habitats to protect and increase natural values in this important wildlife resource area. Land use activities not compatible with protecting the open space and environmental values should not be permitted.

18. As recommended in the Technical Information Volume of the December 1975 Corps Review report, revetted side slopes in Santa Ana Canyon should be covered with soil and seeded with native grasses. Native trees and shrubs should be provided where feasible.

Lower Santa Ana River - Weir Canyon to Imperial Highway

19. New or rebuilt drop structures in the soft bottom channel area should be designed (notched), if possible, to enhance development of wetland habitat.

Santiago Creek

20. Excess spoil materials obtained from widening and deepening the Santa Ana River and deposited in Santiago Creek borrow sites should be placed and revegetated so existing wetland resource values are protected or improved.

Santa Ana River Mouth - Hamilton-Victoria Avenue to Ocean

21. The Greenville-Banning Channel from Adams Avenue to about Hamilton-Victoria Avenue should be soft-bottom rather than concrete-lined to protect valuable wetland resources, including California least tern feeding habitat. This recommended soft-bottom feature should also be coordinated with the County of Orange to integrate project design with their adjacent park. A properly planned design could increase the potential for preserving wildlife resources and provide new passive recreational opportunities for park users (wildlife sanctuary).

22. Four and one-half acres of Victoria Pond wetlands destroyed by the project should be replaced by recreating similar habitat connecting to the remaining section of the pond. Design of the enlarged and recreated pond should be coordinated with the Service and CDFG to minimize the destruction of adjacent high quality vegetation, especially east of the pond. It should also include a 100-foot buffer from the pond edge to the closest continuously disturbed area. This can be accomplished by enlarging the pond south toward the adjacent old field habitat. This feature should be coordinated with Orange County concerning their future plans for park development here.

23. As recommended in the 1977 Corps Final Environmental Statement, a minimum of 92 acres of Santa Ana River estuarine habitat and adjacent uplands must be acquired and restored for compensation and preservation of endangered species. The marsh restoration plan being developed by the Corps should be coordinated with Service, NMFS, and CDFG personnel

for determination of the resource benefits to the endangered California least tern, light-footed clapper rail, Belding's savannah sparrow, and other water-associated wildlife.

24. If the Talbert Channel is relocated upcoast, the fenced California least tern nesting area should be relocated upcoast a similar distance on the recreational beach. Such a relocation should be attempted in stages several years prior to project construction to insure the new nesting area is utilized by least terns. The new area should be incorporated into the existing site before any of the existing area is removed. More adequate (higher) fencing also should be provided to prevent intrusion by recreational beach users. Should the nesting area relocation prove unsuccessful or loss of recreational beach be unacceptable to the State Parks Department, we would recommend alignment of the Santa Ana River Channel downcoast.

25. Widening the Santa Ana River Channel and modifying and/or relocating the Greenville-Banning and Talbert Channels should be completed as much as possible to prevent adverse impacts to California least tern feeding habitat which is normally used between April and August.

26. Prior to project-related destruction of existing endangered species feeding or nesting habitat at the river mouth, including the fenced nesting area, 92-acre acquisition area, and Victoria Pond, replacement nesting and feeding habitat that is successfully utilized by the California least tern should be provided.

27. Recreational trails and/or staging areas west of the river mouth should be designed or relocated so they do not adversely impact the 17-acre restored salt marsh (California least tern feeding area previously restored by Orange County) or adversely impact important buffering uplands.

28. The proposed disposal of up to 3.7 million cubic yards of suitable beach sand on Newport Beach should be coordinated with the Service, NMFS and CDFG to insure infaunal resources are not adversely impacted. The recreationally important pismo clam is of particular concern.

General

29. As emphasized in the Corps 1977 Final Environmental Statement and 1975 Review reports, all disturbed project areas at Huntone and Prado Dams, Oak Street Drain, Santiago Creek, and along the lower Santa Ana River from Prado Dam to the ocean should be landscaped with native vegetation having food and/or cover values for wildlife (especially dams, dikes, and recreational trails).

30. The Corps should coordinate closely with the Service and CDFG to develop O&M procedures for Huntone and Prado Dams that protect fish and wildlife resources along the Santa Ana River.

31. The Corps should closely coordinate the final selection of all borrow sites, the detailed development of the final recreational plans, and all compensation features for the Santa Ana River project with the Service and CDFG to insure that existing wildlife resources, including endangered species and locally unique flora and fauna, are protected.

Eighteen of the above thirty-one (31) recommendations require continued or future planning coordination. In addition, project features may be modified in your advanced studies phase. We therefore further recommend that additional detailed studies of fish and wildlife resources be conducted, as necessary, after the project is authorized, in accordance with Section 2 of the Fish and Wildlife Coordination Act; and that such reasonable modifications be made in the authorized project facilities. Specific investigations can be identified through our continued planning assistance, for which funding should be provided.

We believe the above recommendations will improve protection to important public fish and wildlife resources within the Santa Ana River ecosystem. The Service, therefore, would find the recommended flood control project acceptable with incorporation of these recommendations into the final project plans.

Area Manager

SPLED-EP 23 October 1980

MEMORANDUM FOR RECORD

SUBJECT: Review of Final Supplemental Fish and Wildlife Coordination Act Report Recommendations

Brian Moore (Santa Ana River Project Manager), John Kennedy (Supplemental EIS coordinator), and Susan Dougherty (project biologist) met on 9 June 1980 to discuss the recommendations included in the Draft Supplemental Fish and Wildlife Coordination Act (FWCA) Report. The Final Supplemental FWCA Report submitted by the USFWS for inclusion in the Final SEIS contains essentially the same 31 recommendations as in the Draft Supplemental FWCA Report; therefore, the Corps of Engineers' responses remain unchanged from those in the Corps memo of 27 June 1980 in the DSEIS responding to the Draft Supplemental FWCA Report. The following are the Corps' reprinted responses to the Final Supplemental FWCA Report's 31 recommendations.

a. The following Los Angeles District responses correspond to the 31 recommendations presented in the Final FWCA Report:

1. Concur. The present recreation plan at Mentone designates approximately 30% of the 50-acre lake to be preserved to benefit fish and wildlife resources. Landscaping, fencing, and/or barriers will also be incorporated into the plan.

2. Concur. Wherever possible, high-quality Mentone habitats (e.g., juniper woodlands) will be protected and buffered from the recreational areas.

3. The recommended All River Plan in the reach between Mentone and Prado Dams will require that the counties manage the post-project flood plain and not allow encroachment into the post-project SPF floodway, which will be somewhat narrower than the existing SPF floodway. Below Riverside, the post-project SPF flood plain nearly coincides with the existing SPF flood plain, so project-induced impacts here should be minimal. However, under flood plain management, the local agency may allow development up to the floodway both now and in the future, including even a concrete channel.

4. Concur. Citrus orchards to be acquired within the proposed Mentone Dam right-of-way will be purchased and, although lease-backs may be offered, it is unlikely that much citrus will remain. Other project lands not used for structural components, operational areas, and recreational areas will be reserved for wildlife habitat purposes.

5. Concur. We will try to preserve cottonwoods and sycamore trees where possible within the Mentone project area. Plantings will replace cumulative vegetation areas removed by the project.

6. Concur. The Corps has coordinated with the USFWS and CDFG on project plans for the Redlands borrow site to avoid or minimize adverse impacts and any conflicting planned land uses for the area. Detailed coordination will continue in the Phase II GDM stage of planning if this site is selected for borrow.

7. Local governments will give written assurances that flood plain management will be practiced for the Mentone-to-Prado post-project SPF floodway. This agreement will not specifically protect existing wetlands. The post-project flood plain in the valuable wetlands between Mt. Rubidoux and the Prado basin will be nearly the same as the existing flood plain.

8. One or perhaps two lakes could conceivably be primarily devoted to wildlife resources, although the current recreation proposal includes at least low-intensity activities (e.g., picnicking) at all four lakes. It is unlikely that any sponsor could be found to pay for wildlife lakes without some recreation being involved. The USFWS and CDFG will be consulted regarding design during Phase II studies.

9. Concur. The location of recreational areas will be coordinated with USFWS and CDFG before the plans are finalized to minimize adverse impacts on sensitive habitats.

10. Concur. Designing ways to minimize human intrusion into the wildlife areas will be coordinated with the USFWS and CDFG.

11. Concur. Cottonwoods and sycamore trees will be preserved where possible, but we cannot avoid flooding some trees within the flood control reservoir. The modified water conservation pool could cause a change from existing conditions.

12. The Phase I plan states that agricultural lands will be leased back indefinitely, as the Survey Report said. Any changes of this policy would have to be worked out in Phase II. Selective lease termination in sensitive habitat areas may be more feasible.

13. The endangered species status of the yellow-billed cuckoo and the least Bell's vireo is yet to be determined. Future studies of these species in Phase II will be conducted to assure the protection of endangered species.

14. Concur. Location of areas for Mentone Dam and Prado Dam construction activities will be coordinated with the USFWS and CDFG to minimize the loss of wetland and wildlife resources. Sites may be contoured and revegetated to promote the reestablishment of wildlife habitat.

15. Concur. The 1500-acre post-project flood plain through the Santa Ana Canyon will be maintained as natural open space for wildlife purposes and limited recreational uses (e.g., existing golf course, Featherly Park, proposed recreational trails).

16. Concur. Recreational trails and staging areas will be designed to protect the Santa Ana Canyon wildlife corridor values and make minimal encroachment into wetland and buffering upland areas.

17. Concur. Agricultural lands within the Santa Ana Canyon may be leased back to the owners on a risk-basis only. The citrus boundaries would be moved away from the river. Lands not kept in production could revert to natural habitats. Details will be worked out in Phase II. Permitted uses will be compatible with open space and environmental values.

18. Concur. As stated in the 1975 Review Report, the Corps will, wherever feasible, cover the revetted flood plain side slopes in Santa Ana Canyon with soil and seed them with native grasses. Trees and shrubs will be provided within the right-of-way to replace vegetation removed during construction activities.

19. Notched drop structures may not enhance wetland habitat along the lower Santa Ana River. The Corps will discuss this item further with USFWS during Phase II design studies.

20. Concur. Wetland resource values of the Santiago Creek gravel pits will be protected or enhanced to the extent feasible.

21. Concur. If found feasible during the Phase II studies, soft-bottom channel from about Adams Avenue (or Fairview channel) to Hamilton - Victoria Street will be incorporated into the plan, and will be coordinated with Orange County.

22. Concur. Replacement of Victoria Pond and re-creating similar habitat (including 100 feet of upland buffering area) is part of the Phase I plan and will be closely coordinated with Orange County since they own the land.

23. Concur. Restoration of 92 acres is part of the recommended All River Plan. The restoration plan will be coordinated with USFWS, CDFG, and NMFS.

24. Concur that affected least tern nesting area will be relocated upcoast on displaced recreational beach, prior to flood control construction. It is highly unlikely that the Santa Ana River channel will be relocated downcoast, because several homes would have to be taken.

25. Talbert Channel could conceivably be relocated with a minimum of impact on the least tern feeding area since the new channel could perhaps be dug during the winter months and after completion could be tied into the existing channel. Since the Greenville-Banning channel will be part of the Santa Ana River, its relocation could not be done separately. In addition, construction needs (i.e., dry season) would partially impact the tern's feeding areas between April and August. The construction impacts on the tern's feeding area should be minimized if the 92-acre marsh area is at least partially restored prior to construction of the lowermost Santa Ana River channel, as planned.

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26. Concur. The nesting area relocation and marsh restoration will be initiated prior to flood control construction. One problem that will be investigated in Phase II is how to provide proper tidal flows to the marsh before the SAR channel has been relocated. This will be closely coordinated with USFWS, CDFG, and NMFS.

27. Concur. Recreational trails will be located to avoid impacting the 17-acre restored marsh area. According to Corps recreation planners, the staging area is deleted from the Phase I recreation plan.

28. Concur. Beach replenishment plans will be coordinated with USFWS, CDFG, and NMFS.

29. Concur. All affected project channel, trail, and basin reaches will be landscaped with native and native-type materials, as appropriate.

30. Concur. The Corps will consult with USFWS and CDFG on O&M recommendations for Prado and Mentone Dams to protect fish and wildlife resources along the Santa Ana River.

31. Concur. Development of detailed recreation plans, selection of borrow sites, and mitigation/compensation features will be coordinated with USFWS and CDFG to ensure sensitive wildlife resources are protected.

b. Additional studies of fish and wildlife resources that could be affected by further project modifications will be conducted as necessary as part of the Phase II studies. Any significant project modifications will continue to be coordinated with the USFWS and CDFG.

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