FINAL

ENVIRONMENTAL STATEMENT

INT FES 79-60

SALT-GILA AQUEDUCT
A FEATURE OF
CENTRAL ARIZONA PROJECT

PREPARED BY
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
LOWER COLORADO REGION

DEPARTMENT OF THE INTERIOR

FINAL
ENVIRONMENTAL STATEMENT

INT FES 79-60

SALT-GILA AQUEDUCT
CENTRAL ARIZONA PROJECT

NOV 13 1979

Prepared by

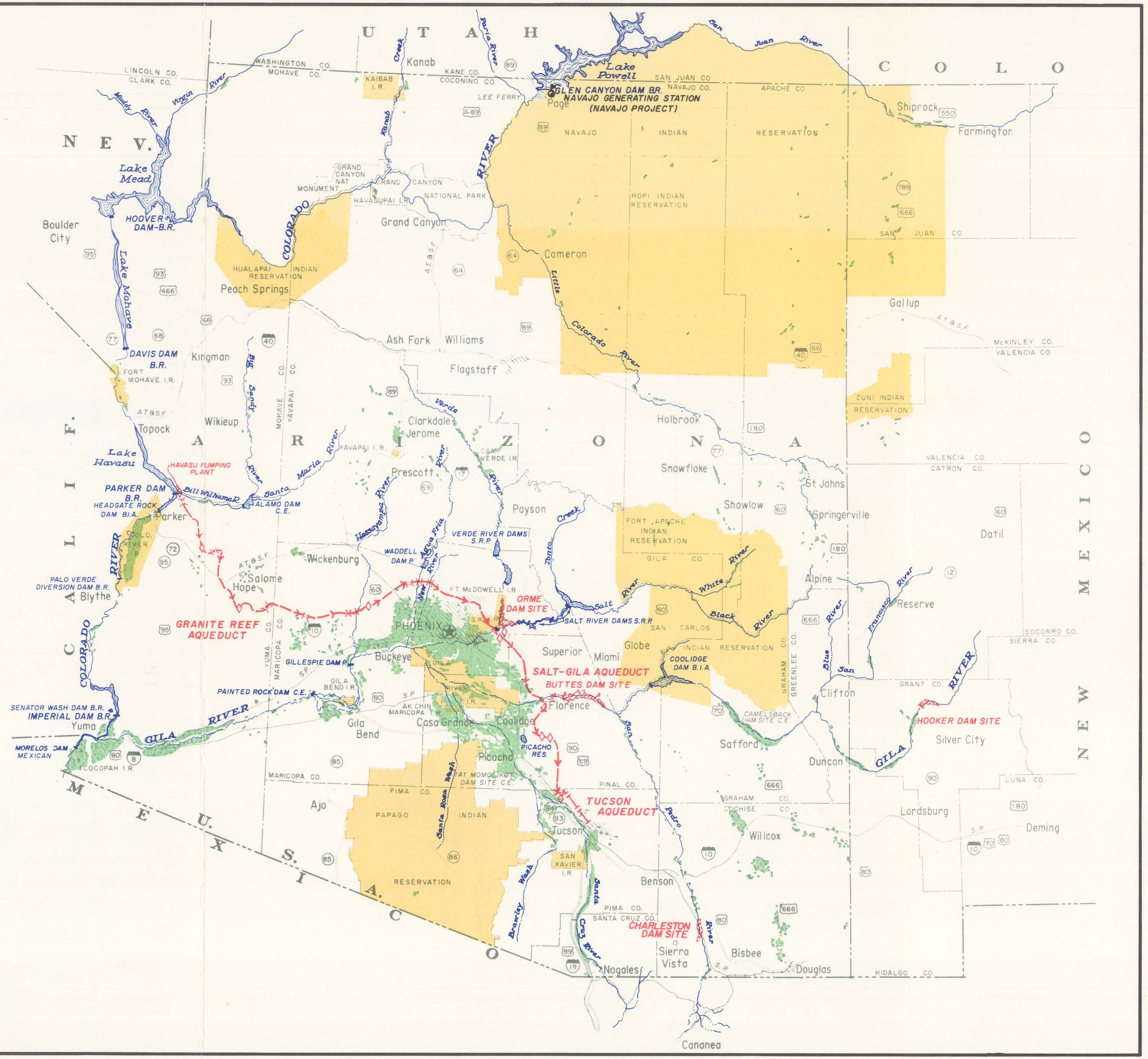
Bureau of Reclamation
Department of the Interior

R. Keith Higginson

R. Keith Higginson
Commissioner

1

On April 18, 1977, the Administration recommended that the Central Arizona Project be modified to eliminate Orme, Hooker, and Charleston Dams.



EXPLANATION

AUTHORIZED	UNDER CONSTRUCTION	EXISTING	FEATURES
			Aqueduct terminus
			Closed aqueduct
			Open aqueduct
			Dam and reservoir
			Generating station
			Pumping plant
			Siphon
			Tunnel
		I.R.	Indian reservation
			Water use areas

ABBREVIATIONS

B.I.A. Bureau of Indian Affairs
B.R. Bureau of Reclamation
C.E. Corps of Engineers
P. Private
S.R.P. Salt River Project

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT – ARIZONA – NEW MEXICO

GENERAL LOCATION MAP

25 0 25 50 75
SCALE OF MILES

MAP NO. 344-314-944
AUGUST 1968

N

REV. 5-79

SUMMARY

( ) DRAFT (X) Final Environmental Statement

Department of the Interior, Bureau of Reclamation, Lower Colorado Region

1. Type of Action (X) Administrative ( ) Legislative

2. Brief Description of Action

This statement describes the environmental impacts resulting from the construction and operation of the Salt-Gila Aqueduct and associated electrical transmission system. The aqueduct would convey Colorado River water from the terminus of the Granite Reef Aqueduct in southeastern Maricopa County to the beginning of the authorized Tucson Aqueduct in south-central Pinal County, Arizona. Water would enter the aqueduct at the Salt-Gila Pumping Plant forebay, be raised 74 feet (22.5 m), and would flow by gravity through the open, concrete-lined canal for 58 miles (93 km) to service areas in south-central Arizona. Construction of the feature is scheduled to begin in mid-1980, with project completion scheduled for 1985.

3. Summary of Environmental Impacts and Adverse Environmental Effects

The average annual delivery of 1.2 million acre-feet (1.48 billion cubic meters) of Colorado River water to the central Arizona service area would contribute to a decreased rate of ground-water drawdown and a possible reduction in earth subsidence due to decreased pumping from the ground-water reservoir. The Salt-Gila Aqueduct is a connecting link for proposed additional facilities which could serve about 550,000 people and provide about 420,000 acres of arable land with supplemental irrigation water in the Pinal and Pima County areas.

About 2,649 acres (1,072 ha) of mostly Sonoran desertscrub vegetation would be removed or severely disturbed by construction of permanent facilities. Associated wildlife populations would be lost within the 797 acres (323 ha) of habitat removed. Canal crossings and escape devices may be an integral part of the construction plan in order to reduce the potential drowning hazard to some wildlife and livestock. Off-aqueduct wildlife oases and watering sites may be provided to mitigate for habitat losses. Mitigation would be accomplished at the 58 known archeological or historical sites which would be disturbed or destroyed. About 6,518 acres (2,639 ha) would be committed to the right-of-way restricting alternative development and future land use.

4. Alternatives Considered

a. Alternative of no construction
b. No construction in conjunction with a program of water conservation
c. Alternative of delayed construction
d. Alternative aqueduct routes

5. Statements are Being Distributed to the Following

See attached list.

6. Date Final Statement Made Available to EPA and the Public

NOV 13 1979

DISTRIBUTION LIST

Salt-Gila Aqueduct Final Environmental Statement

Those entities marked with an asterisk (*) will receive the final EIS. The remaining entities, since they did not comment on the draft, will receive a Summary Description of the final EIS

A.1. Statements or Summary Descriptions to be distributed by the Commissioner, Bureau of Reclamation:

Department of the Interior:

*Director, Fish and Wildlife Service, Washington, D.C.

*Director, Heritage Conservation and Recreation Service, Washington, D.C.

*Director, National Park Service, Washington, D.C.

*Assistant Secretary for Indian Affairs, Washington, D.C.

*Director, Geological Survey, Washington, D.C.

*Director, Bureau of Mines, Washington, D.C.

*Director, Bureau of Land Management, Washington, D.C.

*Secretary, Department of State, Washington, D.C.

*Secretary, Department of Agriculture, Washington, D.C.

*Secretary, Department of Energy, Washington, D.C.

*Advisor on Environmental Quality, Federal Power Commission, Washington, D.C.

*Secretary, Department of Transportation, Washington, D.C.

*Director, Atomic Energy Commission, Washington, D.C.

*Secretary, Department of Health, Education, and Welfare, Washington, D.C.

*Secretary, Department of Labor, Washington, D.C.

*Secretary, Department of Air Force, Washington, D.C.

*Chairman, Interstate Commerce Commission, Washington, D.C.

*Assistant Secretary, Department of Army, Civil Works, Washington, D.C.

*Advisory Council on Historic Preservation, Denver, Colorado

*Regional Director, Department of Housing and Urban Development, San Francisco, California

*Regional Administrator, Environmental Protection Agency, San Francisco, California

A.2. Statements to be distributed by the Commissioner, Bureau of Reclamation, for information only:

*Honorable Dennis DeConcini, United States Senate, Washington, D.C.

*Honorable Barry M. Goldwater, United States Senate, Washington, D.C.

*Honorable John J. Rhodes, Member, United States House of Representatives, Washington, D.C.

*Honorable Bob Stump, Member, United States House of Representatives, Washington, D.C.

*Honorable Eldon Rudd, Member, United States House of Representatives, Washington, D.C.

*Honorable Morris K. Udall, Member, United States House of Representatives, Washington, D.C.

*Department of the Army, Environmental Planning Section, Corps of Engineers, Los Angeles, California

B. Statements or Summary Descriptions to be distributed by the Regional Director, Lower Colorado Regional Office, Boulder City, Nevada for information only:

Department of the Interior

*Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico

*Field Supervisor, Ecological Services, Fish and Wildlife Service, Phoenix, Arizona

*District Chief, Water Resource Division, U.S. Geological Survey, Tucson, Arizona

District Hydraulic Engineer, Conservation Division, Geological Survey, Sacramento, California

*Field Solicitor, Phoenix, Arizona

*Area Director, Bureau of Indian Affairs, Phoenix, Arizona

*Superintendent, Pima Agency, Sacaton, Arizona

*Superintendent, Papago Agency, Sells, Arizona

*Superintendent, Salt River Agency, Scottsdale, Arizona

*Coordinator, Fort McDowell Office, Scottsdale, Arizona

*State Director, Bureau of Land Management, Phoenix, Arizona

*District Manager, Bureau of Land Management, Phoenix, Arizona

*Chief, Bureau of Mines, Denver, Colorado

*Regional Environmental Officer, Office of the Secretary, Department of the Interior, San Francisco, California

*Regional Director, Heritage Conservation and Recreation Service, San Francisco, California

*Regional Director, National Park Service, San Francisco, California,

Chief, Western Office, Review and Compliance, Advisary Council on Historic Preservation, Denver, Colorado

Department of Agriculture

*State Director, Farmers Home Administration, Phoenix, Arizona

*State Conservationist, Soil Conservation Service, Phoenix, Arizona

*River Basin-Watershed Staff Leader, Soil Conservation Service, Phoenix, Arizona

*Regional Forester, U.S. Forest Service, Albuquerque, New Mexico

*Forest Supervisor, Tonto National Forest, Phoenix, Arizona

*State Executive Director, Agricultural Stabilization and Conservation Service, Phoenix, Arizona

District Conservationist, Soil Conservation Service, Coolidge, Arizona

Department of the Army

*District Engineer, Corps of Engineers, Los Angeles, California

*Study Manager, Phoenix Urban Study, Corps of Engineers, Phoenix, Arizona

Department of the Air Force

*Base Commander, Williams Air Force Base, Arizona

Department of Transportation

*Commander, 11th District, U.S. Coast Guard, Phoenix, Arizona

Environmental Protection Agency

*Arizona Branch, San Francisco, California

Department of Labor

*Area Director, Employment Standards Administration, Phoenix, Arizona

Department of Housing and Urban Development

*Director, Federal Housing Administration, Phoenix, Arizona

Department of Justice

*U.S. Attorney, Phoenix, Arizona

*Bureau of Prisons, Phoenix, Arizona

Interstate Commerce Commission

*Regional Manager, San Francisco, California

Department of Health, Education and Welfare

*Regional Director, Health, Education and Welfare, San Francisco, California

Department of Commerce

*Executive Director, Four Corners Regional Commission
Albuquerque, New Mexico

Department of Energy

*Administrator, Western Area Power Administration,
Golden, Colorado

*Area Manager, Western Area Power Administration,
Boulder City, Nevada

*District Manager, Western Area Power Administration,
Phoenix, Arizona

*James L. Kahan, representative of Senator Dennis DeConcini,
Phoenix, Arizona

*Thomas Dunlavey, representative of Senator Barry M. Goldwater,
Phoenix, Arizona

*Robert Scanlan, representative of Congressman John J. Rhodes,
Phoenix, Arizona

*Edna H. McDonald, representative of Congressman Bob Stump,
Phoenix, Arizona

*Michael J. Stubler, representative of Congressman Eldon Rudd,
Phoenix, Arizona

*Prior Pray, representative of Congressman Morris K. Udall,
Tucson, Arizona

The Arizona Republic
Phoenix, Arizona

The Phoenix Gazette
Phoenix, Arizona

Arizona Farmer-Ranchman
Phoenix, Arizona

*Casa Grande Dispatch
Casa Grande, Arizona

The Chandler Arizonan
Chandler, Arizona

Scottsdale Daily Progress
Scottsdale, Arizona

The Arizona Daily Star
Tucson, Arizona

Tucson Citizen
Tucson, Arizona

Associated Press
Phoenix, Arizona

United Press International
Phoenix, Arizona

Tempe Daily News
Tempe, Arizona

Mesa Tribune
Mesa, Arizona

Arizona Professional Engineer
Phoenix, Arizona

Salt River Project
Press Relations
Phoenix, Arizona

Copper Basin News
Kearny, Arizona

Dynamic Phoenix
Phoenix, Arizona

State Press
Arizona State University
Tempe, Arizona

Coolidge Examiner
Coolidge, Arizona

Eloy Enterprise
Eloy, Arizona

Florence Reminder and
Blade-Tribune
Florence, Arizona

Gila Bend Herald
Gila Bend, Arizona

Arizona Weekly Gazette
Phoenix, Arizona

Eastern Arizona Courier
Safford, Arizona

Times of Fountain Hills
Fountain Hills, Arizona

Wildlife Views
Phoenix, Arizona

Arizona Wildlife News
Phoenix, Arizona

Canyon Echo
Tucson, Arizona

SAEC Bulletin
Tucson, Arizona

Vermillion Flycatcher
Tucson, Arizona

Tucson Rod and Gun Club Bulletin
Tucson, Arizona

Southern Arizona Hiking Club Bulletin
Tucson, Arizona

Arizona Territorial
Tucson, Arizona

Green Valley News
Green Valley, Arizona

Arizona Waterways
Tucson, Arizona

Daily Reporter
Tucson, Arizona

United Press International
Tucson, Arizona

Oro Valley Voice
Tucson, Arizona

The Desert Airman
Davis-Monthan AFB
Tucson, Arizona

Arizona Daily Wildcat
University of Arizona
Tucson, Arizona

El Independiente
University of Arizona
Tucson, Arizona

Builder Architect Contractor Engineer
Phoenix, Arizona

Rocky Mountain Construction
Denver, Colorado

Engineering News - Record
New York, New York

Paradise Valley News Program
Phoenix, Arizona

Phoenix Magazine
Phoenix, Arizona

Central Phoenix Sun
Phoenix, Arizona

Parker Pioneer
Parker, Arizona

News Sun
Sun City, Arizona

Glendale News - Herald
Glendale, Arizona

C. Statements or summary descriptions to be distributed by the Regional Director inviting comments:

State of Arizona

*Office of the Governor, Phoenix, Arizona

*State Clearinghouse, Phoenix, Arizona

*Commission of Agriculture and Horticulture, Phoenix, Arizona

*Office of Economic Planning and Development, Phoenix, Arizona

Department of Transportation, Phoenix, Arizona
*Highway Division
Aeronautics Division

*Game and Fish Department, Phoenix, Arizona

*State Parks Board, Phoenix, Arizona

*State Land Department, Phoenix, Arizona

*Outdoor Recreation Coordinating Commission, Phoenix, Arizona

*Department of Health Services, Phoenix, Arizona

*Water Commission, Phoenix, Arizona

*Department of Economic Security, Phoenix, Arizona

*Department of Corrections, Phoenix, Arizona

*Department of Emergency and Military Affairs, Phoenix, Arizona

*Department of Mineral Resources, Phoenix, Arizona

*Bureau of Geology and Mineral Technology, Phoenix, Arizona

*State Historic Preservation Officer, Phoenix, Arizona

Advisory Commission on Arizona Environment, Phoenix, Arizona

*Indian Affairs Commission, Phoenix, Arizona

*Central Arizona Water Conservation District, Phoenix, Arizona

Department of Public Safety, Phoenix, Arizona

State of California

*Office of the Governor, Sacramento, California

*State Clearinghouse, Sacramento, California

*Department of Water Resources, Sacramento, California

*Colorado River Board of California, Los Angeles, California

State of Colorado

*Office of the Governor, Denver, Colorado

*State Clearinghouse, Denver, Colorado

*Colorado Water Conservation Board, Denver, Colorado

*Department of Natural Resources, Denver, Colorado

State of Nevada

*Office of the Governor, Carson City, Nevada

*State Clearinghouse, Carson City, Nevada

Department of Conservation and Natural Resources, Division of Water Resources, Carson City, Nevada

*Colorado River Advisory Commission, Las Vegas, Nevada

State of New Mexico

*Office of the Governor, Santa Fe, New Mexico

*State Clearinghouse, Santa Fe, New Mexico

*State Engineer, Santa Fe, New Mexico

*Interstate Stream Commission, Santa Fe, New Mexico

State of Utah

*Office of the Governor, Salt Lake City, Utah

*State Clearinghouse, Salt Lake City, Utah

Interstate Stream Commission, Board of the Water Resources, Salt Lake City, Utah

Assistant Attorney General, Salt Lake City, Utah

State of Wyoming

*Office of the Governor, Cheyenne, Wyoming

*State Clearinghouse, Cheyenne, Wyoming

*State Engineer, Cheyenne, Wyoming

Assistant Attorney General, Cheyenne, Wyoming

Maricopa County, Arizona

Board of Supervisors, Phoenix

*Flood Control District, Phoenix

Department of Health Services, Phoenix

*Highway Department, Phoenix

Department of Parks and Recreation, Phoenix

Planning Department, Phoenix

*Maricopa Association of Governments, Phoenix

Sheriff's Office, Phoenix

County Manager, Phoenix

Pinal County, Arizona

Board of Supervisors, Florence

*Florence Flood Control District

Magma Flood Control District

Picacho Flood Control District

Department of Health Services, Florence

*Highway Department, Florence

Department of Parks and Recreation, Florence

Planning Department, Florence

*Central Arizona Association of Governments, Florence

Sheriff's Office, Florence

Administrator, Florence

Pima County, Arizona

Board of Supervisors, Tucson

Gila County, Arizona

Board of Supervisors, Globe

Graham County, Arizona

Board of Supervisors, Safford

Greenlee County, Arizona

Board of Supervisors, Clifton

Grant County, New Mexico

County Commission, Silver City, New Mexico

Hidalgo County, New Mexico

County Commission, Lordsburg, New Mexico

Catron County, New Mexico

Reserve, New Mexico

Others

Mr. John Clonts, Western Archeological Center, National Park Service, Tucson, Arizona

Dr. John Douglas, Archeologist, Arizona State Office, Bureau of Land Management, Phoenix, Arizona

Dr. Dee F. Green, Assistant Director for Cultural Resources, U. S. Forest Service, Albuquerque, New Mexico

*Central Arizona Project Association, Phoenix, Arizona

Department of Hydrology and Water Resources, University of Arizona, Tucson, Arizona

*Center for Environmental Studies, Arizona State University, Tempe, Arizona

*Richard T. Golightly, Department of Zoology, Arizona State University, Tempe, Arizona

Division of Agriculture, Arizona State University, Tempe, Arizona

*Salt River Pima-Maricopa Community Council, Scottsdale, Arizona

*Fort McDowell Community Council, Fountain Hills, Arizona

*Gila River Community Council, Sacaton, Arizona

San Carlos Community Council, San Carlos, Arizona

*Ak-Chin (Maricopa) Community Council, Maricopa, Arizona

*Papago Community Council, Sells, Arizona

Papago Tribal Utility Authority, Sells, Arizona

Colorado River Tribes, Parker, Arizona

City of Phoenix, Phoenix, Arizona

City of Coolidge, Coolidge, Arizona

Town of Florence, Florence, Arizona

City of Glendale, Glendale, Arizona

City of Mesa, Mesa, Arizona

Public Works Director, City of Mesa, Mesa, Arizona

City of Tempe, Tempe, Arizona

Public Works Director, City of Tempe, Tempe, Arizona

City of Tucson, Tucson, Arizona

City of Scottsdale, Scottsdale, Arizona

City of Paradise Valley, Paradise Valley, Arizona

Town of Gilbert, Gilbert, Arizona

City of Chandler, Chandler, Arizona

Arizona Public Service Company, Phoenix, Arizona

Salt River Project, Phoenix, Arizona

*Mr. Al Colton, Environmental Division, Salt River Project, Phoenix, Arizona

*Metropolitan Water District of Southern California, Los Angeles, California

Chairman, State Agricultural Stabilization and Conservation Commission, Phoenix, Arizona

*Roosevelt Water Conservation District, Higley, Arizona

Roosevelt Irrigation District, Buckeye, Arizona

Queen Creek Irrigation District, Queen Creek, Arizona

Maricopa County Municipal Water Conservation District Number 1, Peoria, Arizona

*Arizona Association of Conservation Districts, Peoria, Arizona

East Maricopa County Natural Resource Conservation District, Chandler, Arizona

Eloy Natural Resource Conservation District, Casa Grande, Arizona

Florence - Coolidge Natural Resource Conservation District, Coolidge, Arizona

*New Magma Irrigation and Drainage District, Phoenix, Arizona

Chandler Heights Citrus Irrigation District, Chandler Heights, Arizona

*Central Arizona Irrigation and Drainage District, Eloy, Arizona

Buckeye Water Conservation and Drainage District, Buckeye, Arizona

*Irrigation and Electrical Districts of Arizona, Phoenix, Arizona

Mr. Michael Curtis, Attorney, Hohokam Irrigation and Drainage District, Phoenix, Arizona

San Tan Irrigation District, Chandler Heights, Arizona

Municipal Water Users Association, Phoenix, Arizona

*San Carlos Irrigation and Drainage District, Coolidge, Arizona

Arizona Farm Bureau Federation, Phoenix, Arizona

Arizona Archeological Council, Flagstaff, Arizona

Arizona Conservation Council, Phoenix, Arizona

*Museum of Northern Arizona, Flagstaff, Arizona

Arizona Water Sports Council, Phoenix, Arizona

National Audubon Society, New York, New York

Northern Arizona Audubon Society, Sedona, Arizona

Tucson Audubon Society, Tucson, Arizona

*Maricopa Audubon Society, Phoenix, Arizona

National Wildlife Federation, Washington, D.C.

Arizona Wildlife Federation, Phoenix, Arizona

Arizona Wildlife Federation, Tucson, Arizona

Sierra Club, Southwest Regional Conservation Committee,
Santa Fe, New Mexico

Sierra Club, Phoenix, Arizona

Sierra Club, Grand Canyon Chapter, Phoenix, Arizona

The Wildlife Society, Phoenix, Arizona

Environmental Defense Fund, New York, New York

Friends of the Earth, San Francisco, California

Valley Forward Association, Phoenix, Arizona

League of Women Voters of Arizona, Tucson, Arizona

*League of Women Voters of East Maricopa, Scottsdale, Arizona

League of Women Voters of Phoenix, Phoenix, Arizona

Pinal County Farm Bureau, Casa Grande, Arizona

Arizona State Horseman's Association, Phoenix, Arizona

American Society of Civil Engineers, Phoenix, Arizona

American Society of Civil Engineers, Tucson, Arizona

Arizona Society of Professional Engineers, Phoenix, Arizona

American Society of Landscape Architects, Phoenix, Arizona

Associated General Contractors of America, Arizona Chapter, Phoenix, Arizona

Arizona State AFL-CIO, Phoenix, Arizona

Phoenix, Building and Construction Trades Council, Phoenix, Arizona

*Arizona Historical Society, Tucson, Arizona

*Arizona State Museum, Tucson, Arizona

American Water Resources Association, Tucson, Arizona

Metro Phoenix Chamber of Commerce, Phoenix, Arizona

Scottsdale Chamber of Commerce, Scottsdale, Arizona

Mesa Chamber of Commerce, Mesa, Arizona

Tucson Chamber of Commerce, Tucson, Arizona

Arizona Bank, Phoenix, Arizona

First National Bank of Arizona, Phoenix, Arizona

Valley National Bank, Phoenix, Arizona

W. S. Gookin and Associates, Scottsdale, Arizona

*Frank Welsh, Citizens Concerned About the Project, Phoenix, Arizona

Southwestern Minerals Exploration Association, Tucson, Arizona

Southern Pacific Railroad, Tucson, Arizona

Magma Copper Company, Superior, Arizona

CONOCO Oil Company, Florence, Arizona

Electrical District No. 2, Coolidge, Arizona

Mountain Bell, Phoenix, Arizona

Desert Tortoise Council, San Diego, California

*Dr. Robert D. Ohmart, Tempe, Arizona

Dr. George Gumerman, Carbondale, Illinois

Dr. Roderick Sprague, Moscow, Idaho

*Betty Burge, Las Vegas, Nevada

*D. E. Creighton, Jr., Scottsdale, Arizona

Office of Arid Land Studies, University of Arizona
Tucson, Arizona

El Paso Natural Gas Company, El Paso, Texas

Arizona Power Pooling Association, Benson, Arizona

C. A. Pugh, Consulting Engineer, Scottsdale, Arizona

Dr. Mont Cazier, Tempe, Arizona

*Carolina Butler, Scottsdale, Arizona

Mr. Bert Fireman, Tempe, Arizona

Lynn Phetteplace, Phoenix, Arizona

*Office of Cultural Resource Management, Arizona State University, Tempe, Arizona

Z. Simpson Cox, Phoenix, Arizona

*Guy Bonnivier, Phoenix, Arizona

Ralph Gierisch, St. George, Utah

Florence Gardens Utility Co, Tempe, Arizona

Turner Ranch Water and Sanitation Co., Mesa, Arizona

*Maricopa-Stanfield Irrigation and Drainage District
Maricopa, Arizona

Desert Sage Water Company, Mesa, Arizona

*Earl Zarbin, Phoenix, Arizona

*Mr. John Nicholson, Hemet, California

Dr. James Schoenwetter, Tempe, Arizona

Arizona Cattle Growers Association, Phoenix, Arizona

Arizona Wool Growers Association, Phoenix, Arizona

Mr. William G. Bloedel, Rio Verde, Arizona

*R. W. Beck, and Associates, Seattle, Washington

*Mr. Jerry Grady, Casa Grande, Arizona

*Mr. Mel A. Everingham, Florence, Arizona

Mr. Dean Skaggs, Casa Grande, Arizona

*Mr. John Harambasic, Apache Junction, Arizona

*Mr. Gerald Hales, Mesa, Arizona

*Mr. Frank Birch, Apache Junction, Arizona

*Mr. Brook Lakes, Apache Junction, Arizona

*Mr. C. B. DeSpain, Marana, Arizona

Technology Research and Development, Inc., Oklahoma City, Oklahoma

Arthur D. Little, Inc., San Francisco, California

Paul Mosher, Paradise Valley, Arizona

Willdan Associates, Phoenix, Arizona

Arizona Water Company, Phoenix, Arizona

Environmental Defense Fund, Denver, Colorado

Sergent, Hauskins, & Beckwith, Phoenix Arizona

Matt Brennan, Coolidge, Arizona

John Otto, Florence, Arizona

Mark Brosseau, Tucson, Arizona

Beak Consultants, Portland, Oregon

David D. Smith & Associates, San Diego, California

The Wilderness Society, Silver City, New Mexico

C. R. Madsen, Florence, Arizona

Mr. Fred E. Goldman, Phoenix, Arizona

Mr. Arthur Pistor, Phoenix, Arizona

Mr. Steve Sutherland, Phoenix, Arizona

Yvonne D. Heilman, Tulsa, Oklahoma

Verne Grantham, Salida, Colorado

Mr. Doug C. Nelson, Phoenix, Arizona

Division of Comprehensive Planning, Clark County Courthouse, Las Vegas, Nevada, Attention: Mr. Richard W. Atwater

Mr. Clyde Vroman, Sun City, Arizona

San Carlos Indian Irrigation Project, Coolidge, Arizona

Mr. Albert Cutler, Scottsdale, Arizona

Coe & Van Loo Consulting Engineers, Inc., Phoenix, Arizona, Attention: Mr. Bert Cutler

Mr. William H. Wheeler, Phoenix, Arizona

Mr. R. M. Edmonston, Glendale, California

Ken McGinty, Phoenix, Arizona

Gilbert Lee, Monterey Park, California

Ms. Teresa Silleman, Phoenix, Arizona

Mr. Robert Landis, Phoenix, Arizona

Dennis W. Potter, Pierre, South Dakota

Bob Carricaburu, Santa Barbara, California

Leon Lutrick, Phoenix, Arizona

Gilbert T. Venable, Phoenix, Arizona

Desmond P. Kearns, Tucson, Arizona

Jim Perry, Phoenix, Arizona

Northwestern University, Evanston, Illinois

Woodward Clyde Consultants, San Diego, California

Idaho State University, Pocatello, Idaho

Humboldt State University, Arcata, California

Tucson Gas and Electric, Tucson, Arizona

Wiley Gregg, Phoenix, Arizona

PRC Toups Corporation, Orange, California

PRC Toups Corporation, Phoenix, Arizona

D. Statements or summary descriptions to be distributed by the Regional Director for public access:

Libraries-Arizona

Casa Grande Public Library, Casa Grande, Arizona

*Coolidge Public Library, Coolidge, Arizona

Flagstaff Branch Library, Flagstaff, Arizona

*Florence Public Library, Florence, Arizona

Green Valley Community Library, Green Valley, Arizona

Holbrook Public Library, Holbrook, Arizona

Navajo Community College, Many Farms, Arizona

Page Public Library, Page, Arizona

Clifton Public Library, Clifton, Arizona

Cochise College, Douglas, Arizona

Flagstaff City-Coconino County Library, Flagstaff, Arizona

*Pinal County Free Library, Florence, Arizona

Kingman City-Mohave Co. Library, Kingman, Arizona

*Mesa Public Library, Mesa, Arizona

*Arizona Department of Library Archives, Public Records, Phoenix, Arizona

*Central Arizona College Library, Signal Peak Campus, Coolidge, Arizona

Douglas Public Library, Douglas, Arizona

*University Library, Northern Arizona University, Flagstaff, Arizona

Old Dominion Library, Globe, Arizona

Lake Havasu City Public Library, Lake Havasu City, Arizona

Nogales Public Library, Nogales, Arizona

*Maricopa County Community College District, Phoenix, Arizona

*Governmental Reference Library, Tucson, Arizona

*Maricopa County Free Library, Phoenix, Arizona

*Phoenix Public Library, Phoenix, Arizona

Prescott City - Yavapai County Library, Prescott, Arizona

Yavapai College Library, Prescott, Arizona

Safford City-Graham County Library, Safford, Arizona

*Scottsdale Public Library, Scottsdale, Arizona

Sedona Public Library, Sedona, Arizona

Sierra Vista City Library, Sierra Vista, Arizona

Springerville Public Library, Springerville, Arizona

*Arizona Collection, Haden Library - Arizona State University, Tempe, Arizona

*Tempe Public Library, Tempe, Arizona

Tombstone Regional Branch Library, Tombstone, Arizona

*Pima College Library, Tucson, Arizona

*Tucson Public Library, Tucson, Arizona

*University Library, Documents Section, The University of Arizona, Tucson, Arizona

Roxanne Whipple Memorial Library, Winslow, Arizona

Arizona Western College Library, Yuma, Arizona

Yuma City County Library, Yuma, Arizona

*Velma Teague Library, Glendale, Arizona

Larsen Memorian Library, Lakeside, Arizona

Libraries-California

Law Center Library, University of Southern California Los Angeles, California

San Diego County Library, San Diego, California

Water Resource Archives, University of California at Los Angeles, Los Angeles, California

Libraries-New Mexico

Zimmerman Library, University of New Mexico, Albuquerque, New Mexico

New Mexico State Library, Santa Fe, New Mexico

Western New Mexico University Library, Silver City, New Mexico

New Mexico State University Library, Las Cruces, New Mexico

Silver City Library, Silver City, New Mexico

Libraries-Nevada

University of Nevada - Las Vegas Library, Las Vegas, Nevada

Libraries-Utah

Law Library, University of Utah, Salt Lake City, Utah

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(continued)

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

List of Tables

TABLE OF CONTENTS
(Continued)

List of Tables (continued)

TABLE OF CONTENTS
(Continued)

List of Tables (continued)

TABLE OF CONTENTS
(Continued)

List of Figures

TABLE OF CONTENTS
(Continued)

List of Figures (continued)

TABLE OF CONTENTS
(Continued)

List of Figures (continued)

TABLE OF CONTENTS
(Continued)

List of Figures (continued)

TABLE OF CONTENTS
(Continued)

Appended Material

Appendix A

Appendix B

Appendix C

Appendix D

I. INTRODUCTION

I. INTRODUCTION

This environmental impact statement (EIS) describes the proposed construction, operation, and maintenance of the Salt-Gila Aqueduct (SGA); one segment of the Central Arizona Project (CAP) aqueduct system extending through central Arizona from the Colorado River to the vicinity of Tucson, Arizona. The CAP was authorized by P.L. 90-537 on September 30, 1968, as a part of the Colorado River Basin Project Act. A brief legislative history and specific legislative requirements relevant to the CAP are presented in the overall final environmental statement (FES) for the project (USBR 1972a).

The primary purpose of the CAP is to furnish irrigation, municipal, and industrial water supplies to areas in central and southern Arizona and western New Mexico. Other project purposes and objectives are cited in Sections 102.(a) and 301.(a) of the authorizing legislation. Due to its magnitude, the project is divided into several features serving separate but interrelated functions. The location of the authorized features of the CAP is shown on the frontispiece and other maps throughout the statement.

To achieve compliance with the National Environmental Policy Act (NEPA) of 1969, a final overall comprehensive EIS was prepared for the total project and filed with the Council on Environmental Quality (CEQ) on September 26, 1972 (USBR 1972a). This statement committed the Bureau of Reclamation (USBR) to prepare an individual site-specific environmental statement for each major feature of the project.

Colorado River water will be lifted from Lake Havasu via the Havasu Intake Channel and Pumping Plant and will flow through the Buckskin Mountains Tunnel into the Granite Reef Aqueduct. An FES for the intake channel, pumping plant, and tunnel was filed with the CEQ in January 1973 and construction on the features is underway (USBR 1973a).

The Granite Reef Aqueduct will convey a maximum of 3000 cubic feet per second (85 cubic meters per second) of water from the outlet of the Buckskin Mountains Tunnel approximately 190 miles (306 km) to the vicinity of Phoenix, Arizona. The Granite Reef Aqueduct Transmission System is being constructed to supply power to the pumping plants and check structures along the aqueduct. The NEPA compliance documents were filed with the CEQ in January 1974 (USBR 1974) for the aqueduct and August 1975 (USBR 1975) for the transmission system. These two features are presently under construction.

A draft environmental statement (DES) for the Orme Dam and Reservoir was filed in May 1976 (USBR 1976a). Subsequently, in April 1977, the President recommended elimination of Orme from the project. Accordingly Reclamation is considering methods to identify suitable single-purpose and/or multifunctional solutions for CAP regulation and flood control for the Phoenix urban area (alternatives to Orme).

The Salt-Gila Aqueduct and associated transmission system are the subjects of this FES. The aqueduct would convey water from the terminus of the Granite Reef Aqueduct to service areas in Maricopa and Pinal Counties and on to the beginning of the authorized Tucson Aqueduct (Figures 2 & 3).

The Tucson Aqueduct is authorized to convey water from the terminus of the Salt-Gila Aqueduct to the vicinity of Tucson, Arizona, and planning investigations are now underway. The DES for the Tucson Aqueduct is expected to be filed with EPA in August 1980.

A distribution system is authorized to deliver CAP water to agricultural lands of the five central Arizona Indian tribes. A DES for the Indian Distribution System is scheduled to be filed with the EPA in August 1980.

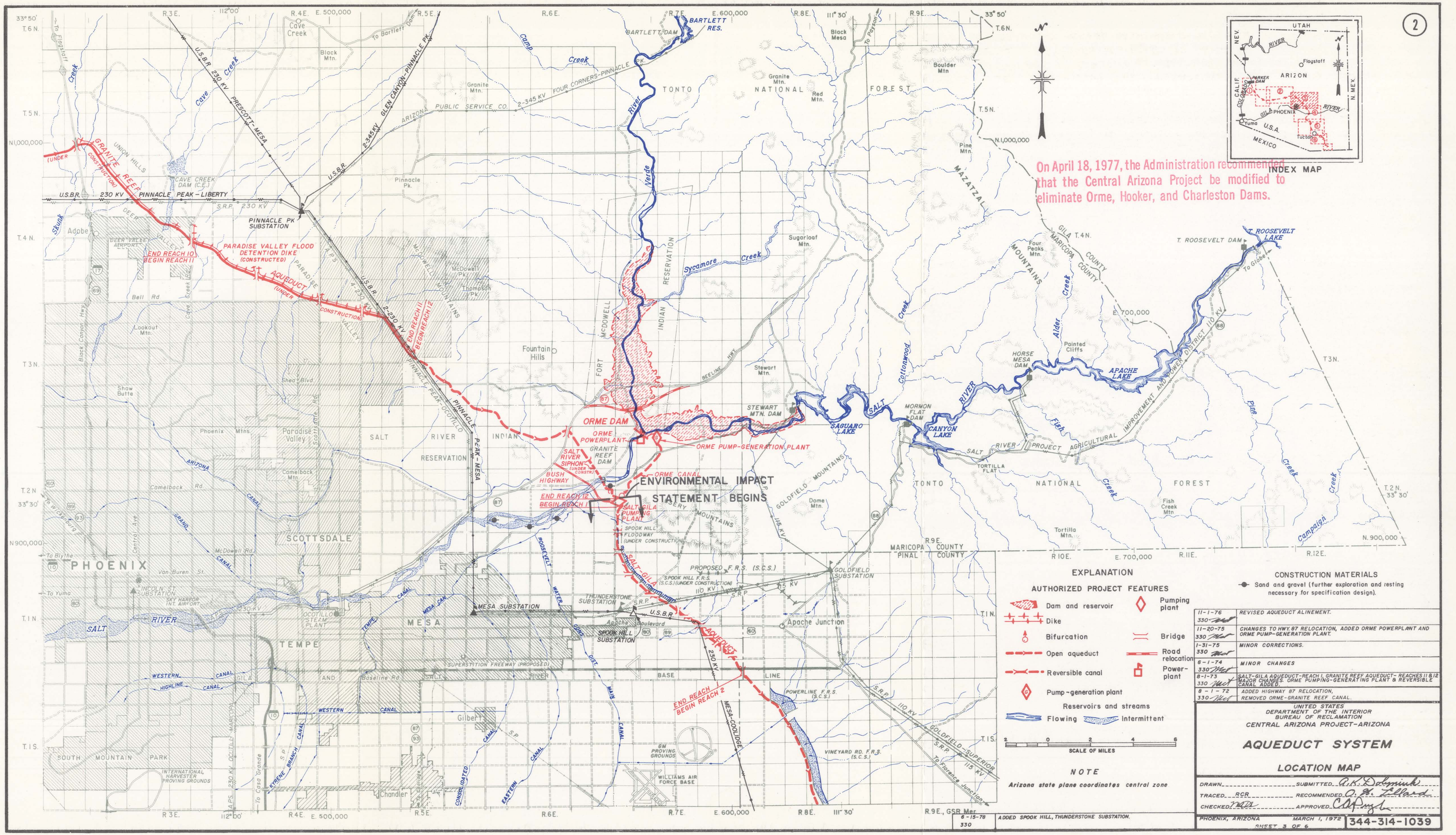
Buttes Dam and Reservoir site is located on the Gila River about 14 miles (23 km) east of Florence, Arizona. The dam is authorized to provide conservation of water, flood control, sediment control, and enhancement opportunities for recreation and fish and wildlife resources. A DES for this feature is expected to be filed with the EPA in October 1981.

Pending the resolution of issues raised during the 1977 review of the CAP with regard to Charleston Dam, no advanced planning or environmental studies are currently scheduled. In regard to Hooker Dam, the Bureau is currently programmed to conduct a feasibility study of Hooker Dam and Reservoir and suitable alternatives. Funding for this was made available in the fiscal year 1980 Appropriation Act, Public Law 96-69.

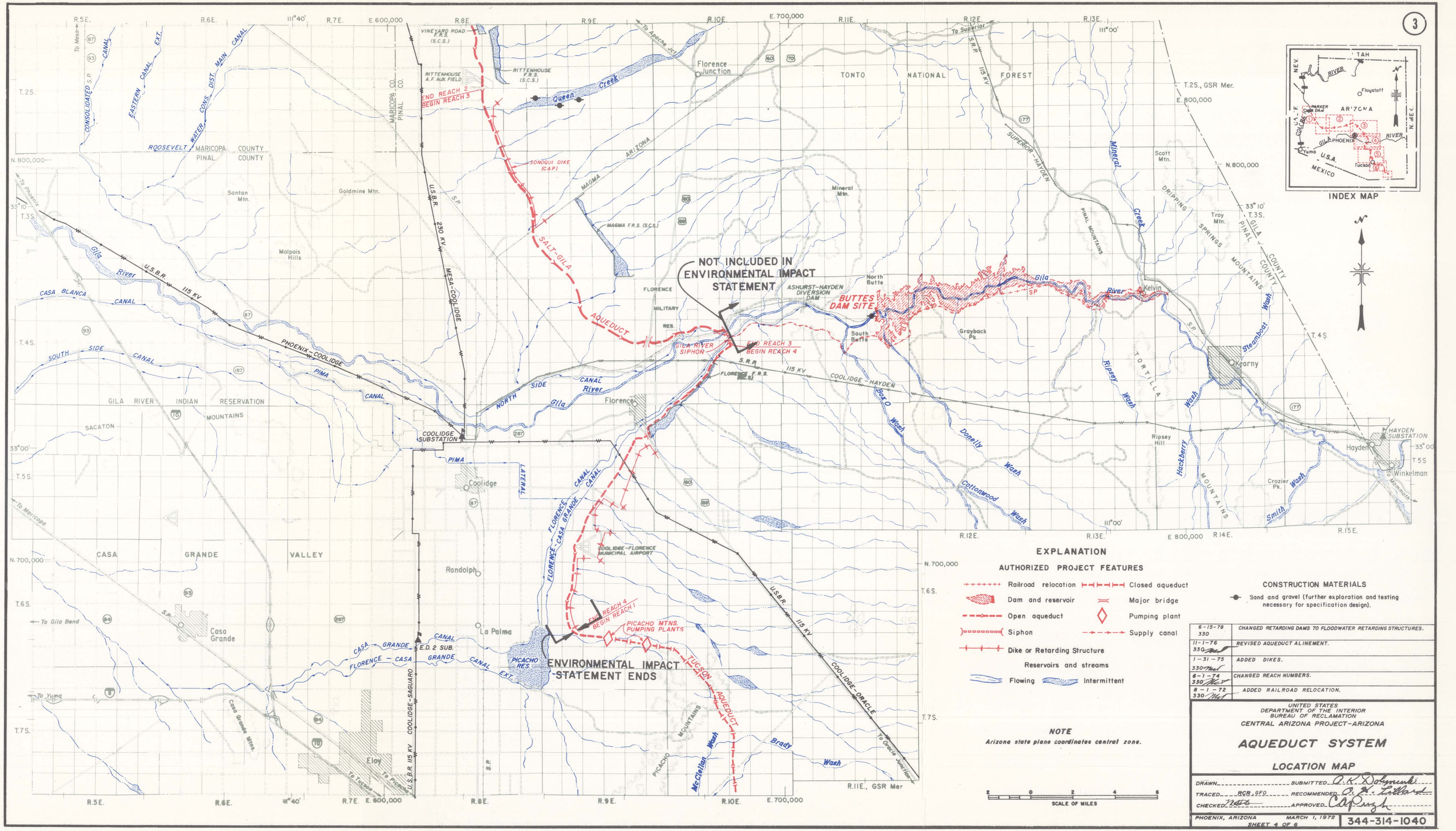
The authorized non-Indian irrigation and drainage facilities have not yet been scheduled for environmental investigations. Environmental assessments or statements will await decisions on non-Indian irrigation water allocations and loan applications from those entities requiring such facilities.

The state of Arizona (Arizona Water Commission) has submitted its recommendations for allocating non-Indian agriculture, and municipal and industrial water from the Central Arizona Project, to the Secretary of the Interior. The Department of the Interior and the Bureau of Reclamation are currently reviewing these recommendations and the process of examining the environmental impacts of various water allocation schemes has begun. The Indian irrigation water allocation environmental assessment and negative determination were completed on June 4, 1976.

Present schedules show that the Salt Gila Aqueduct construction would begin in February 1980. Due to the lack of finalized water allocations, exact delivery locations can not be determined at this time. Thus, references to turnout locations made in this statement are assumptions based on available data. The estimated 1978 cost for the Salt-Gila Aqueduct and associated transmission system is $122,000,000.



On April 18, 1977, the Administration recommended that the Central Arizona Project be modified to eliminate Orme, Hooker, and Charleston Dams.
2
INDEX MAP
ENVIRONMENTAL IMPACT STATEMENT BEGINS
ORME DAM
ORME POWERPLANT
ORME PUMP-GENERATION PLANT
GRANITE REEF DAM
SALT RIVER SIPHON (UNDER CONSTR.)
SALT-GILA PUMPING PLANT
END REACH 12 BEGIN REACH 1
END REACH 10 BEGIN REACH 11
END REACH 11 BEGIN REACH 12
END REACH 1 BEGIN REACH 2
PARADISE VALLEY FLOOD DETENTION DIKE (CONSTRUCTED)
GRANITE REEF AQUEDUCT (UNDER CONSTRUCTION)
SALT-GILA AQUEDUCT
PHOENIX
SCOTTSDALE
TEMPE
MESA
Chandler
Gilbert
Apache Junction
Fountain Hills
BARTLETT RES.
BARTLETT DAM
SAGUARO LAKE
CANYON LAKE
APACHE LAKE
T. ROOSEVELT LAKE
T. ROOSEVELT DAM
HORSE MESA DAM
MORMON FLAT DAM
STEWART MTN. DAM
Verde River
Salt River
TONTO NATIONAL FOREST
EXPLANATION
AUTHORIZED PROJECT FEATURES
Dam and reservoir
Dike
Bifurcation
Open aqueduct
Reversible canal
Pump-generation plant
Pumping plant
Bridge
Road relocation
Power-plant
Reservoirs and streams
Flowing
Intermittent
CONSTRUCTION MATERIALS
Sand and gravel (further exploration and testing necessary for specification design).
SCALE OF MILES
NOTE
Arizona state plane coordinates central zone
11-1-76 330 REVISED AQUEDUCT ALINEMENT.
11-20-75 330 CHANGES TO HWY. 87 RELOCATION, ADDED ORME POWERPLANT AND ORME PUMP-GENERATION PLANT.
1-31-75 330 MINOR CORRECTIONS.
6-1-74 330 MINOR CHANGES
8-1-73 330 SALT-GILA AQUEDUCT-REACH 1, GRANITE REEF AQUEDUCT-REACHES 11 & 12 MAJOR CHANGES. ORME PUMPING-GENERATING PLANT & REVERSIBLE CANAL ADDED.
8-1-72 330 ADDED HIGHWAY 87 RELOCATION, REMOVED ORME-GRANITE REEF CANAL.
6-15-78 330 ADDED SPOOK HILL, THUNDERSTONE SUBSTATION.
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT-ARIZONA
AQUEDUCT SYSTEM
LOCATION MAP
DRAWN
TRACED RCR
CHECKED
SUBMITTED
RECOMMENDED
APPROVED
PHOENIX, ARIZONA
MARCH 1, 1972
SHEET 3 OF 6
344-314-1039



3
INDEX MAP
NOT INCLUDED IN ENVIRONMENTAL IMPACT STATEMENT
ENVIRONMENTAL IMPACT STATEMENT ENDS
BUTTES DAM SITE
ASHURST-HAYDEN DIVERSION DAM
SALT-GILA AQUEDUCT
TUCSON AQUEDUCT
END REACH 2 BEGIN REACH 3
END REACH 3 BEGIN REACH 4
END REACH 4 BEGIN REACH 1
PICACHO MTNS. PUMPING PLANTS
GILA RIVER SIPHON
SONOQUI DIKE (CAP)
PICACHO RES.
TONTO NATIONAL FOREST
GILA RIVER INDIAN RESERVATION
CASA GRANDE VALLEY
Florence
Coolidge
Casa Grande
Eloy
Kearny
Hayden
Winkelman
Kelvin
Florence Junction
Randolph
La Palma
COOLIDGE SUBSTATION
HAYDEN SUBSTATION
EXPLANATION
AUTHORIZED PROJECT FEATURES
Railroad relocation
Closed aqueduct
Dam and reservoir
Major bridge
Open aqueduct
Pumping plant
Siphon
Supply canal
Dike or Retarding Structure
Reservoirs and streams
Flowing
Intermittent
CONSTRUCTION MATERIALS
Sand and gravel (further exploration and testing necessary for specification design).
6-15-78 330 CHANGED RETARDING DAMS TO FLOODWATER RETARDING STRUCTURES.
11-1-76 REVISED AQUEDUCT ALINEMENT.
1-31-75 ADDED DIKES.
8-1-74 CHANGED REACH NUMBERS.
8-1-72 ADDED RAILROAD RELOCATION.
NOTE
Arizona state plane coordinates central zone.
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT-ARIZONA
AQUEDUCT SYSTEM
LOCATION MAP
DRAWN
TRACED
CHECKED
SUBMITTED
RECOMMENDED
APPROVED
PHOENIX, ARIZONA
MARCH 1, 1972
SHEET 4 OF 6
344-314-1040

The Bureau of Reclamation intends to pursue the course of action provided for under Section 67(r) of the Clean Water Act of 1977 (Public Law 95-217). The Bureau will be exempt from applying for dredge and fill permits (404) from the Army Corps of Engineers. As discussed in Chapter II.C.3.b., it is proposed to construct a siphon under the normally dry Gila River. This construction would require discharge of fill material around and over the siphon. On August 15, 1978, the Los Angeles District, Corps of Engineers, identified the Gila River as a stream which comes under Section 404 jurisdiction. Since Queen Creek, where flow would be restricted by the construction of Sonoqui Dike may also be considered an intermittent stream, Section 404 jurisdiction may be exercised at some later date. The environmental statement discusses the impacts of discharging dredge and fill material into these waters at the project construction sites and the measures that would be employed to control or limit water pollution from these discharges. This information, which is indexed in Appendix C-4, is on the technical analysis contained in the environmental statement. This analysis is in accordance with Section 404(b)(1) of the Environmental Protection Agency's interim regulations published in the Federal Register on September 5, 1975. In addition, consideration has been given to Executive Order 11990 on the protection of wetlands throughout the document.

II. THE PROPOSED ACTION

II. THE PROPOSED ACTION

A. The Proposal

The proposed action addressed by this environmental statement involves the construction, operation, and maintenance of the Salt-Gila Aqueduct and associated electrical transmission system. The Salt-Gila Aqueduct would be an open concrete-lined canal 58 miles (93 km) in length, with an initial capacity of 2,750 cubic feet per second (78 cubic meters per second). As presently planned, the aqueduct would include 1 pumping plant, 1 siphon, 10 checks, and 10 turnouts. The electrical transmission system would include approximately 5.8 miles (9.3 km) of 69 or 115kV transmission line and one 69 or 115kV tap substation.

Construction of the aqueduct is scheduled by reaches and initial construction is expected to begin in 1980. About 5 years would be required for completion. Assuming the proposed schedule is maintained, water delivery from the aqueduct could be expected in 1985.

Scheduling for the construction of the Salt-Gila Aqueduct is subject to change and adjustment, depending upon administrative policies and congressional appropriation of construction funds. The length of each construction contract would vary from a 1- to 2-year period for the siphon and canal reaches to about 5 years for the pumping plant.

The data presented in this statement are based on conceptual designs determined to be suitable, representative, and feasible for the functions intended. They do not represent final construction designs. Plans and drawings of structures or systems are presented to provide an understanding of the structure and a perception of its magnitude. For the most part, structures common for this type of development would be utilized. The only unusual anticipated design problem relates to land subsidence, which is discussed in Chapter III.B.2. Except for refinements, the final designs should not depart significantly from those presented.

B. Purpose of the Aqueduct

The purpose of the Salt-Gila Aqueduct is to convey Colorado River water from the Granite Reef Aqueduct, now under construction, to the authorized Tucson Aqueduct and the central Arizona service areas in Maricopa and Pinal Counties. These service areas are within that portion of the middle Gila River Basin encompassing metropolitan Phoenix and the large agricultural developments of the two counties. According to the 1970 U.S. Census, approximately 59 percent (1,039,807) of Arizona's population is located in these two counties.

The two-county area is substantially dependent on ground water which is being pumped at rates significantly greater than can be replenished by natural recharge. As a result, ground-water levels during the period 1923-1977 have dropped over 200 feet (61 m) under large portions of the area and over 450 feet (137 m) in some local areas (Arizona Water Commission 1978).

This overdraft has required deepening many wells and has resulted in increased energy use due to the higher pump lifts. In addition, the general lowering of the ground-water levels has resulted in land subsidence. Up to about 12.5 feet (3.8 m) of subsidence has been observed in some areas since 1954 (Winikka et al. 1978). This change in topography has altered some of the floodflow patterns of the ephemeral streams and has increased erosion in gullies around the margins of the basins. A secondary physical result of the water-level decline appears to be earth fissuring. Fissures up to 8 miles (12.9 km) in length are evident in the basin. Locally, the fissures have damaged irrigation structures, homesites, and roadways as discussed and shown in Chapter III.B.2.

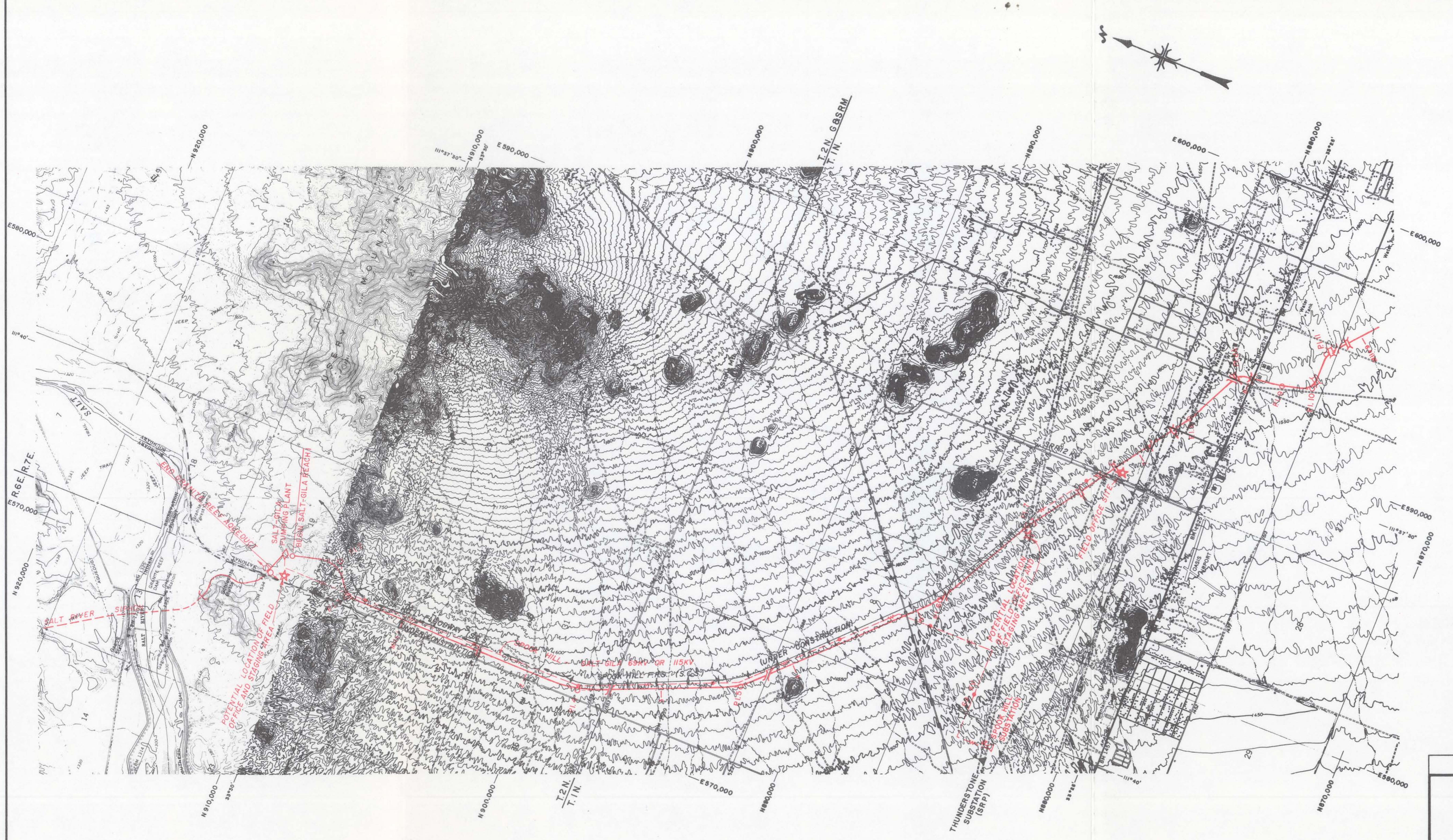
Communities and agricultural areas in and adjacent to the upper Gila River Basin, primarily in Grant County, New Mexico, would also benefit from the SGA through authorized supplemental uses allowed from the Gila River and its tributaries. Such benefits would be made possible through authorized exchange agreements with water users in Arizona receiving Colorado River water through the Salt-Gila Aqueduct. The exchanges would be accomplished in accordance with Sections 304(d), (e), and (f) of the Colorado River Basin Project Act (P.L. 90-537). Should these exchanges take place, they would be discussed in future specific environmental statements.

C. Description of the Aqueduct

1. Location and Route

The Salt-Gila Aqueduct would begin at the Salt-Gila Pumping Plant, located about 25 miles (40 km) northeast of Phoenix, Arizona at the terminus of the Granite Reef Aqueduct. From this location, the aqueduct would extend 58 miles (93 km) in a southerly direction to its terminus about 2 miles (3.2 km) northeast of Picacho Reservoir. This point is about 54 air miles (87 km) southeast of Phoenix. Figures 4 through 9 show the general location plan of the aqueduct and related structures. The final aqueduct location may vary slightly from that shown in those areas where subsidence and earth fissuring would require relocation, or if highly significant archeological sites discovered during construction would make it desirable to alter the alinement.

The CAP overall environmental statement described the Salt-Gila Aqueduct as being 90 miles (145 km) long with its terminus near Marana, Arizona (USBR 1972a). The Salt-Gila Aqueduct is now planned as 4 rather than 5 reaches, and would be 58 miles (93 km) long. The original Reach 5 of the Salt-Gila Aqueduct is now designated as Reach 1 of the authorized Tucson Aqueduct.



EXPLANATION

- Aqueduct
- Siphon
- Pumping plant
- Transmission line
- Retarding Structure
- Bridge
- Overchute
- Turnout
- Check structure
- Floodway
- Culvert

NOTES

Arizona state plane coordinate system, central zone.

Base map is a composite of the U.S.G.S. 7.5 minute quadrangle sheets, Buckhorn, Granite Reef Dam and Apache Junction, Arizona.

2000 0 2000 4000 6000
SCALE OF FEET

ALWAYS THINK SAFETY

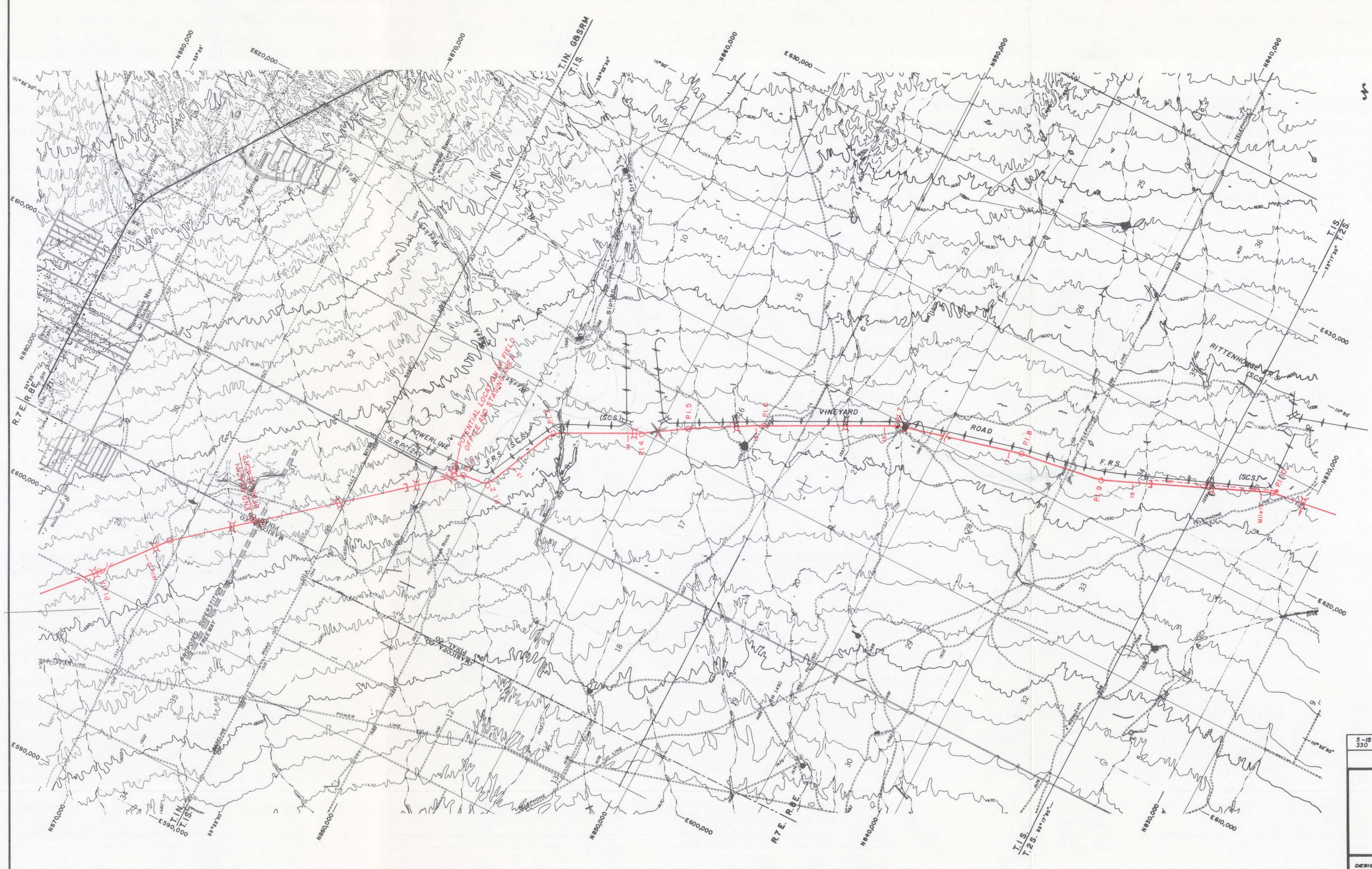
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT

REACH I

PLAN

DESIGNED	SUBMITTED [signature]
DRAWN HFJ	RECOMMENDED
CHECKED J.W.G.	APPROVED
PHOENIX, ARIZONA SHEET 1 OF 6 JUNE 1977	344-330-1796



EXPLANATION

- Aqueduct
- Transmission line
- Retarding Structure
- Bridge
- Culvert
- Check structure
- Overchute

NOTES

Arizona state plane coordinate system, centralzone.

Base map is a composite of the U.S.G.S. 7.5 minute quadrangle sheets, Superstition Mts., Desert Well and Apache Junction, Arizona.

2000 0 2000 4000 6000
SCALE OF FEET

5-15-79 330	REVISED PART OF VINEYARD ROAD FRS

ALWAYS THINK SAFETY

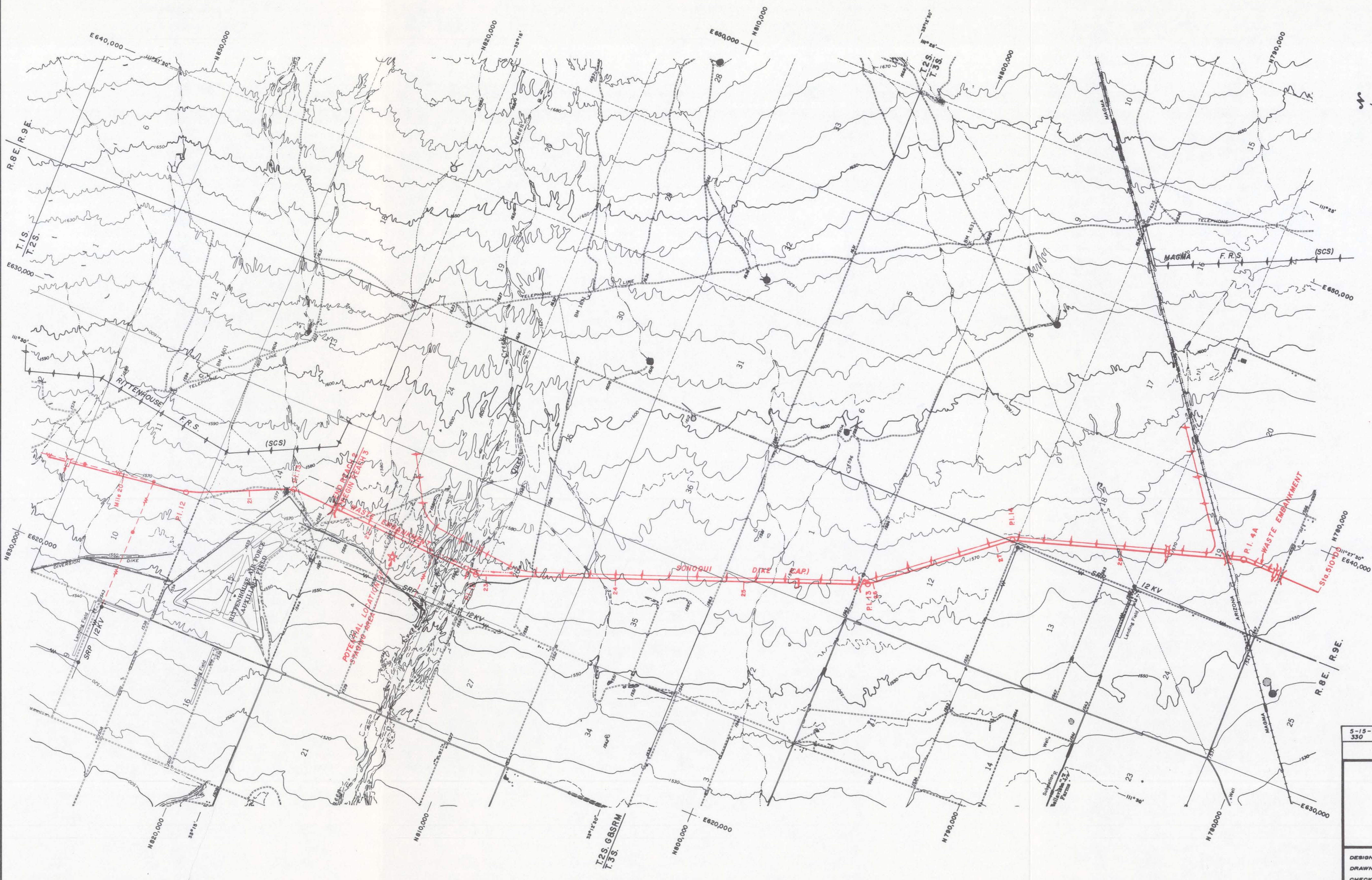
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT

REACHES 1 AND 2
PLAN

DESIGNED ____ SUBMITTED J. Krentz
DRAWN HFJ ____ RECOMMENDED ____
CHECKED L.W.G. ____ APPROVED ____

PHOENIX, ARIZONA SHEET 2 OF 6 JUNE 1977 344-330-1797



EXPLANATION

- Aqueduct
- Siphon
- Transmission line
- Dike
- Bridge
- Overchute
- Culvert
- Check structure
- Wasteway
- Retarding Structure

NOTES

Arizona state plane coordinate system, central zone.

Base map is a composite of the U.S.G.S. 7.5 minute quadrangle sheets, Magma, Superstition Mts., Desert Well and Sacaton N.E., Arizona.

2000 0 2000 4000 6000
SCALE OF FEET

5-15-79 330	RELOCATED SONOQUI DIKEANS ADDED WASTE EMBANKMENT

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

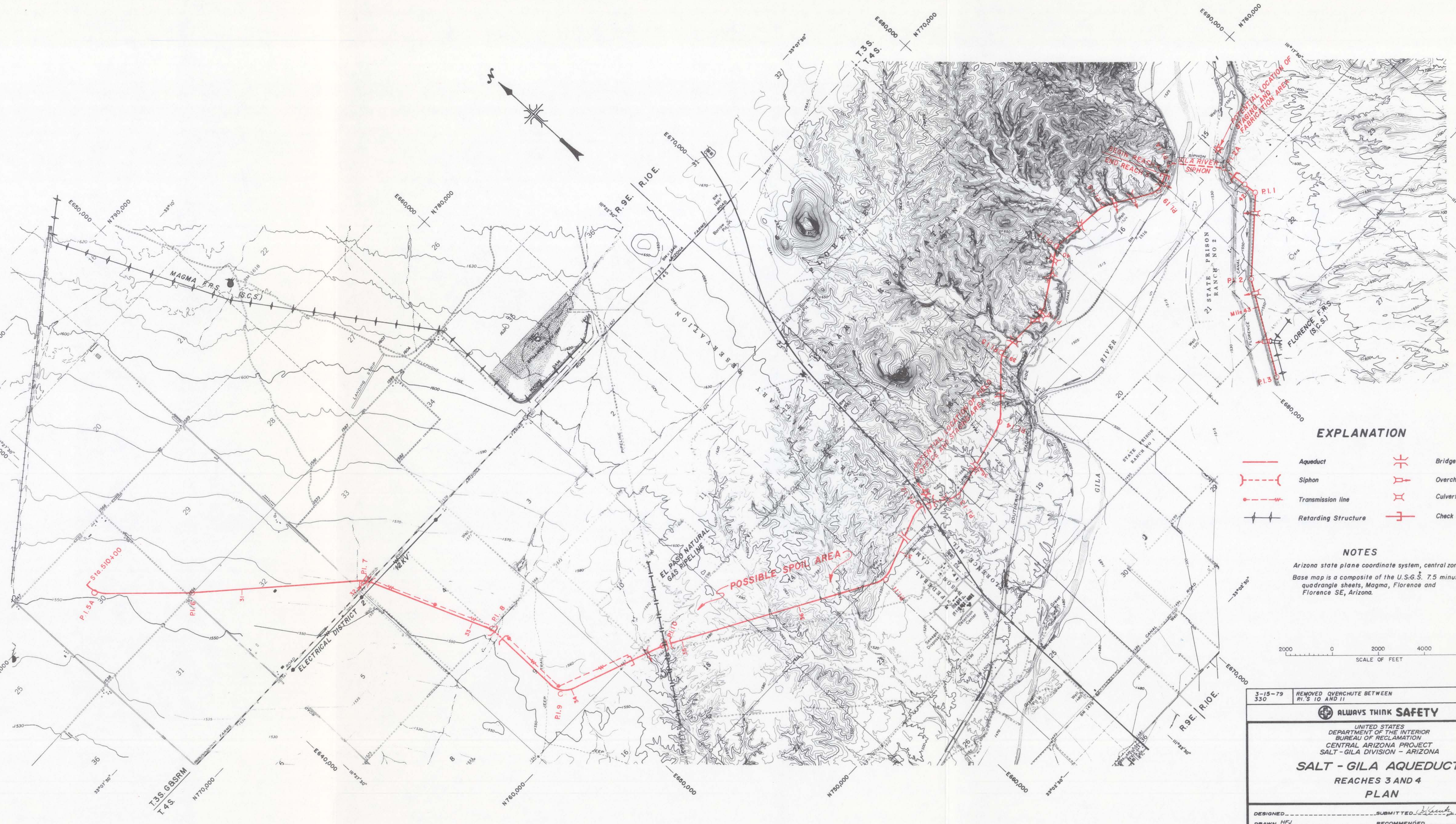
SALT - GILA AQUEDUCT

REACHES 2 AND 3
PLAN

DESIGNED ______ SUBMITTED J. Kreutz
DRAWN HFJ ______ RECOMMENDED ______
CHECKED J.W.G. ______ APPROVED ______

PHOENIX, ARIZONA SHEET 3 OF 6 JUNE 1977 344-330-1798

7



EXPLANATION

	Aqueduct		Bridge
	Siphon		Overchute
	Transmission line		Culvert
	Retarding Structure		Check structure

NOTES

Arizona state plane coordinate system, central zone.

Base map is a composite of the U.S.G.S. 7.5 minute quadrangle sheets, Magma, Florence and Florence SE, Arizona.

2000 0 2000 4000 6000
SCALE OF FEET

3-15-79 330	REMOVED OVERCHUTE BETWEEN P.I.'S 10 AND 11

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

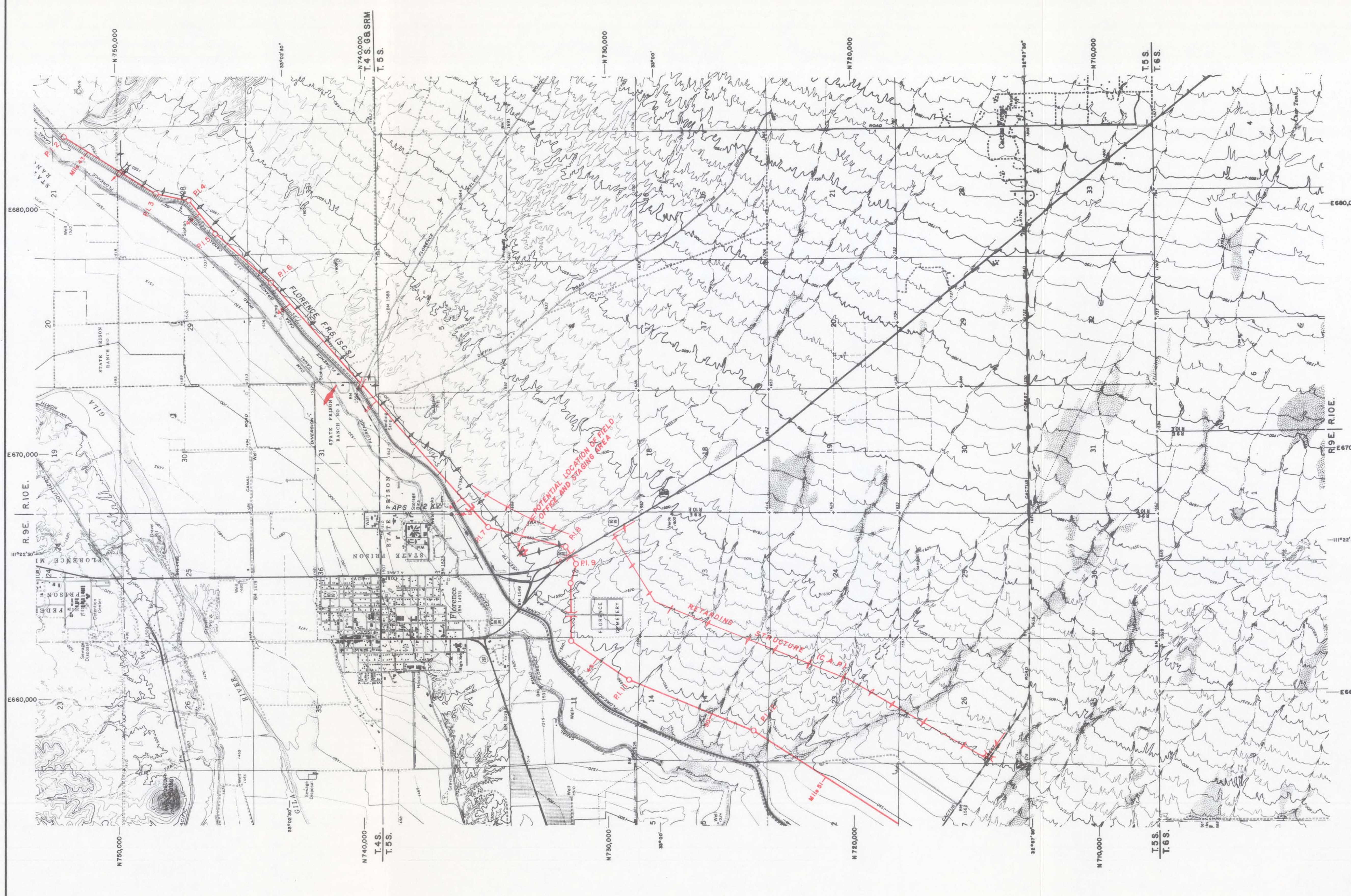
SALT - GILA AQUEDUCT

REACHES 3 AND 4

PLAN

DESIGNED ________ SUBMITTED [signature]
DRAWN HFJ ________ RECOMMENDED ________
CHECKED J.W.G. ________ APPROVED ________

PHOENIX, ARIZONA JUNE 1977 SHEET 4 OF 6 344-330-1799



EXPLANATION

- Aqueduct
- Transmission line
- Retarding Structure
- Bridge
- Overchute
- Culvert
- Check structure

NOTES

Arizona state plane coordinate system, centralzone.

Base map is a composite of the U.S.G.S. 7.5 minute quadrangle sheets, Florence, Florence S.E., Cactus Forest and Valley Farms, Arizona.

2000 0 2000 4000 6000
SCALE OF FEET

5-15-79 330	RELINED AQUEDUCT AROUND FLORENCE CEMETERY

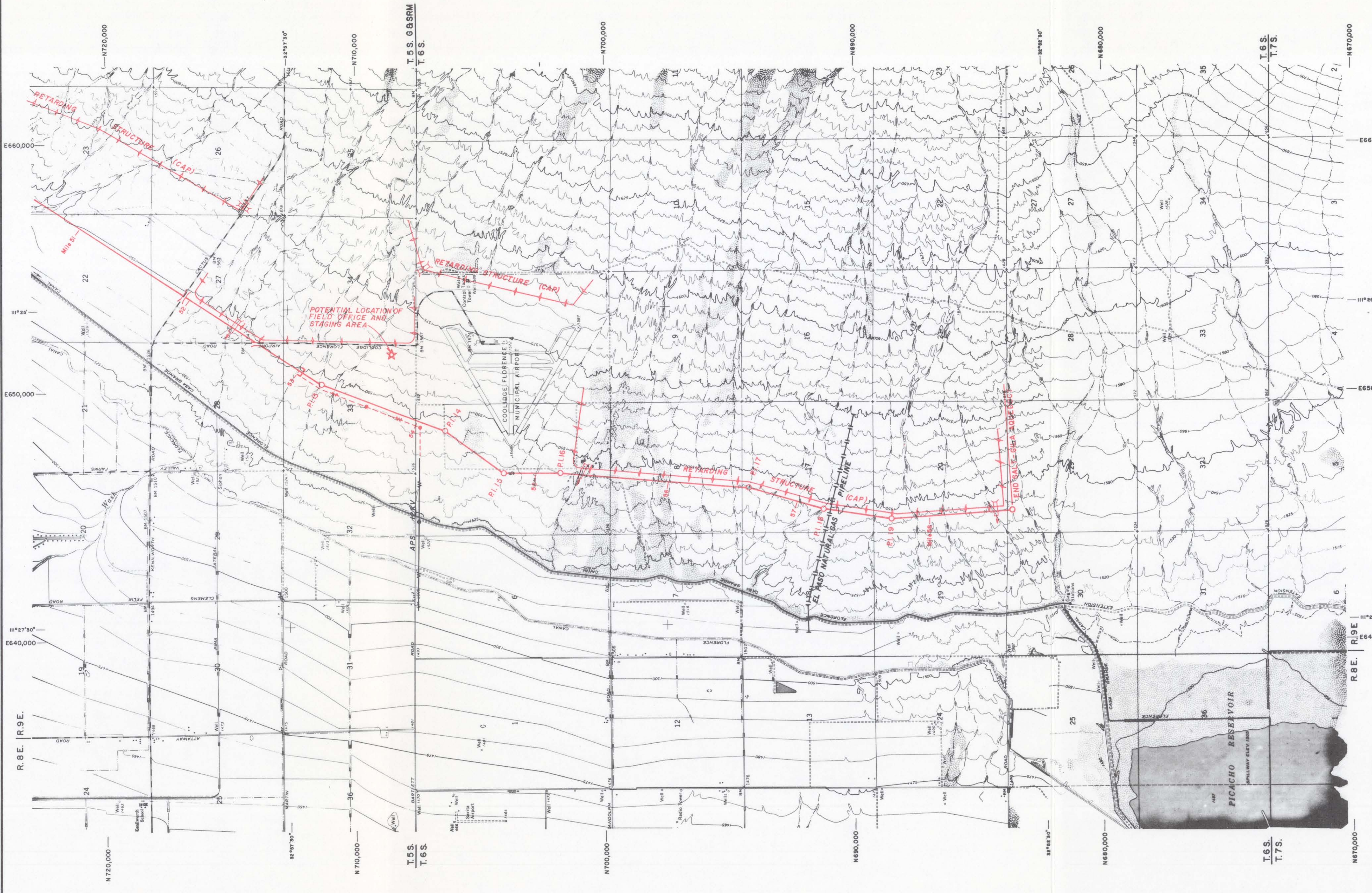
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT
REACH 4
PLAN

DESIGNED ____ SUBMITTED J. Kuntz
DRAWN HFJ ____ RECOMMENDED ____
CHECKED JLEG ____ APPROVED ____

PHOENIX, ARIZONA — SHEET 5 OF 6 — JUNE 1977 — 344-330-1800



EXPLANATION

- Aqueduct
- Transmission line
- Retarding Structure
- Bridge
- Check structure
- Culvert
- Overchute

NOTES

Arizona state plane coordinate system, centralzone.

Base map is a composite of the U.S.G.S. 7.5 minute quadrangle sheets, Valley Farms and Picacho Reservoir, Arizona.

2000 0 2000 4000 6000
SCALE OF FEET

5-15-79 330	CHANGED FRS TO A SOLID LINE. REMOVED WORD PROSED.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT
REACH 4
PLAN

DESIGNED______ SUBMITTED Kreutz
DRAWN HFJ______ RECOMMENDED______
CHECKED JWG______ APPROVED______

PHOENIX, ARIZONA — SHEET 6 OF 6 — JUNE 1977 — 344-330-1801

The four aqueduct reaches would range in length from 10 to 20 miles (16 to 32 km). The reaches were established primarily by geographic features along the aqueduct route and also to facilitate the consolidation of design data, program control, and award of individual construction contracts.

The Salt-Gila Aqueduct alinement begins at the terminus of the Granite Reef Aqueduct which is the forebay of the Salt-Gila Pumping Plant. The pumping plant would lift water 74 feet (22.5 m) from a forebay water surface elevation of about 1,493 feet (455 m) to a water surface elevation of about 1,567 feet (478 m) on the discharge side of the pumping plant. The Reach 1 aqueduct alinement begins at the pumping plant afterbay and follows Bush Highway south to McDowell Road, turning eastward to University Drive and Ellsworth Road, then southeast across Apache Boulevard (U.S. 60-80-89) and on to the north-south Maricopa-Pinal County line.

Reach 2 begins at the county line and continues in a southeasterly direction, traversing along the west side of the Soil Conservation Service (SCS) Powerline, Vineyard Road, and Rittenhouse Floodwater Retarding Structures (F.R.S.) to its terminus about 0.8 miles (1.3 km) north of Queen Creek.

Reach 3 begins at the terminus of Reach 2, just north of Queen Creek, and continues southeast for about 20 miles (32 km) to the Gila River, where it ends at the Gila River Siphon inlet.

Reach 4 of the aqueduct alinement begins at the Gila River siphon inlet and parallels the Florence-Casa Grande Canal for about 6 miles (9.7 km) to U.S. Highway 80-89, then traverses generally south towards its terminus about 2 miles (3.2 km) northeast of the existing Picacho Reservoir.

The aqueduct alinement was located to avoid as much developed land as practical and yet facilitate delivery of water to existing distribution systems and to provide the shortest possible Gila River crossing.

2. Aqueduct Design

The 58-mile (93 km) long aqueduct would be an open, concrete-lined, gravity-flow structure with a design capacity varying from about 2,750 cubic feet per second (78 cubic meters per second) at its beginning to about 2,250 cubic feet per second (64 cubic meters per second) at its terminus. Figure 10 shows the anticipated aqueduct section design and hydraulic properties. The canal right-of-way would normally be 250 feet (76 m), or 125 feet (38 m), on either side of centerline. Since the maximum top width of the canal is 80 feet (24 m), the upslope side of centerline would normally require 40 feet (12 m) for the canal, 20 feet (6 m) for the maintenance road, and 54 feet (16 m) for a typical waste embankment or dike (10 feet (3 m) high with 2:1 sideslopes and 14 feet (4 m) top width), which equals 114 feet (35 m) upslope of centerline. The downslope side requires a similar right-of-way to allow for discharge structures for overchutes and culverts. Table 1 summarizes the lengths and capacities of the four planned reaches.

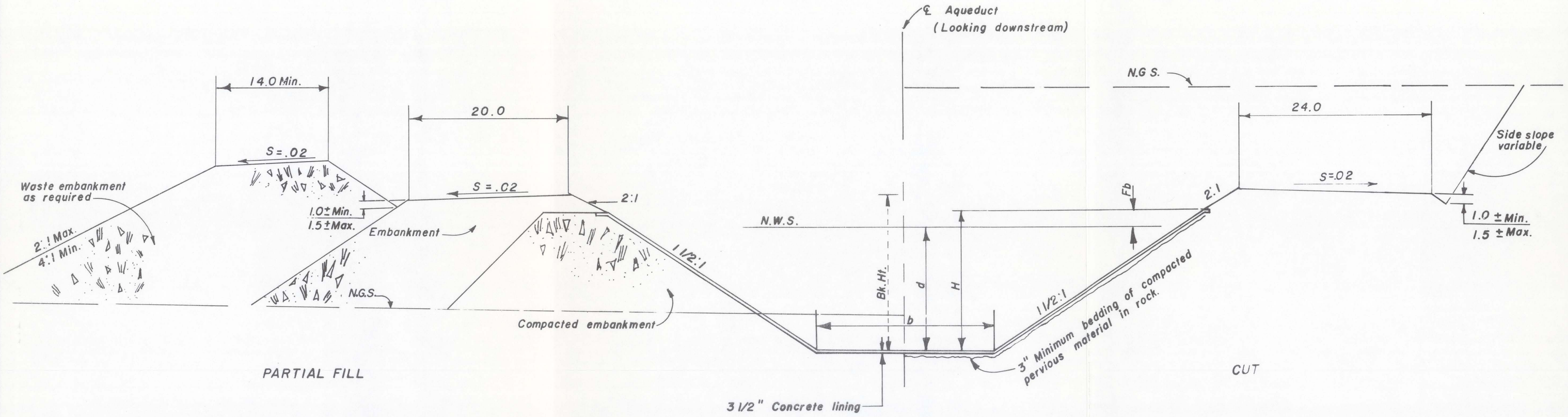
Table 1

Reach Locations and Capacities
Salt-Gila Aqueduct Central Arizona Project

Reach No.	Beginning At	Length (miles)	Capacity (ft^3/s)
1	Salt-Gila Pumping Plant	11.12	2,750
2	Maricopa-Pinal County Line	10.26	2,750
3	Section line between Sections 14 & 23, T. 2 S. R. 8 E.,	2.02	2,750
	Section line between Sections 26 & 35, T. 2S. R. 8 E.	8.19	2,600
	Arizona Farms Road	9.17	2,400
4	Gila River Siphon	16.71	2,250

A 24-foot (7.3 m) wide operating and maintenance (O&M) road would be located on the westerly side of the aqueduct. It would be generally uninterrupted for the entire length of the aqueduct, except at the siphon crossing, county roads, highways, railroads and cross drainage overchutes. The road would be suitably designed to handle O&M vehicle loading and traffic requirements under normal all-weather use. Where the O&M roads would pass through residential, commercial, industrial, farming or high O&M vehicle use areas, consideration would be given to paving, other forms of surfacing, or watering to reduce potential dust problems. A 20-foot (6.1 m) wide maintenance road would be located on the easterly side of the aqueduct. Use of this road would generally be restricted to maintenance vehicles, but design provisions would include all-weather use. The width of the O&M roads is required for wide vehicles passing and long vehicles working at 90 degrees to the canal, i.e. dredge turning 90 degrees to load a truck.

Public use of the O&M roads would be restricted by fences, gates, or barriers. There are no present plans for recreational use of the O&M roads but the potential exists for local development of hiking, biking, and riding trails elsewhere within the aqueduct right-of-way. These activities and facilities could be incorporated with the project only insofar as the use is consistent with the operations, maintenance, and safety of the aqueduct. Structures and portions of the aqueduct would be fenced to insure public safety, protect wildlife resources, or as required for project security. More details of the types of fencing needed for the various classes of hazard exposure can be found in Chapter II.G.



TYPICAL SECTION

HYDRAULIC PROPERTIES

Q	b	d	A	V	M	r	s	Lining Fb	H	Bank Ht.	b/d
2750	24	15.74	749.38	3.67	.016	9.28	.00008	2.16	17.9	20.1	1.52
2600	24	15.31	719.03	3.62	.016	9.08	.00008	2.09	17.4	19.6	1.57
2400	22	15.13	676.24	3.55	.016	8.83	.00008	2.07	17.2	19.4	1.45
2250	22	14.66	644.89	3.49	.016	8.61	.00008	2.04	16.7	18.9	1.50

THIS DRAWING SUPERSEDES 344-330-T-662

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT–ARIZONA

SALT-GILA AQUEDUCT

TYPICAL SECTION

DESIGNED ______ SUBMITTED ______
DRAWN ______ RECOMMENDED ______
CHECKED ______ APPROVED ______

PHOENIX, ARIZONA FEBRUARY 1979 344-330-T-745

The design of the aqueduct attempts to balance the excavation so that it does not exceed the quantity required for embankments and O&M roadways. If there is excess material excavated beyond that necessary for local construction use, the excesses, where economical, may be used for construction of flood training dikes or in reinforcing local embankments. Remaining excess excavated material would be disposed of at designated spoil areas along the alinement as described in Chapter II.I.3.

Fill material, when needed, would be obtained from the aqueduct prism or from not yet designated borrow areas adjacent to the aqueduct. Areas disrupted for borrow or spoil disposal use would be prepared and left in such a manner that wind and water erosion would be minimized.

Portions of the aqueduct within identified areas of land subsidence and earth fissures as discussed in Chapter III.B.2. would require special design. The Bureau of Reclamation has funded a study presently being conducted by the U.S. Geological Survey (USGS) to predict the amount of subsidence and the locations of areas subject to further earth fissuring in the vicinity of the aqueduct alinement. The object of the study is not to analyze the effects of subsidence on the aqueduct but the results would be used in confirming the final design and location of the aqueduct and in planning O&M activities. Extensive alinement relocation is not anticipated.

3. Aqueduct Components

a. Salt-Gila Pumping Plant

A pumping plant with an electrical capacity of about 26 megawatts would lift 2,750 cubic feet per second (78 cubic meters per second) of water 74 feet (22.5 m) from the Granite Reef Aqueduct into the Salt-Gila Aqueduct. The plant site (Figure 11) would be located south of the Salt River Siphon outlet in the northwest quarter of section 19, T. 2 N., R. 7 E., within the Tonto National Forest.

The plant would house a combination of vertically mounted, electric-motor driven pumping units, allowing operation over a wide range of pumping requirements. The range of pumping units would vary between 125 and 440 cubic feet per second (3.5 and 12.5 cubic meters per second). The pumping plant would have its own lubrication oil equipment and a portable oil pump skimmer and holding tank to protect against oil leaks.

Present concepts anticipate a low profile plant design with two buried concrete or steel discharge lines about 250 feet (76 m) long. A self contained storage building would be incorporated in the design of the pumping plant to provide for the safe storage of paints, chemicals, and other flammables. About 5 acres (2 ha) would be permanently required for the plant site and access road (Figure 4). About 15 additional acres (6 ha) would be temporarily disturbed by construction activities, including the forebay, contractor parking, staging area and access road from the Bush Highway. The aqueduct alinement south of the pumping plant is shown on Figure 12.

b. Gila River Siphon

Siphons are conduits or pipes which carry aqueduct water under rivers and drainage channels. Along the length of the Salt-Gila Aqueduct, one siphon is currently proposed for construction. The Gila River Siphon, located in Section 15, T. 4 S., R. 10 E., G&SRB&M, would be approximately 3,400 feet (1,036 m) long. The siphon, if single barrel, would be about 18 feet (5.5 m) in diameter and made of either steel pipe, prestressed concrete pipe, or monolithic concrete pipe. The siphon would be buried in the stream channel at a depth to be determined by hydrologic studies. This depth could vary from 5 to 15 feet (1.5 to 4.6 m).

During construction, a trench along the length of the siphon, approximately 100 feet (30.5 m) in width and up to 40 feet (12.2 m) in depth, would be constructed across the normally dry river channel. The siphon pipe would be placed in the bottom of the trench and the material excavated from the trench would be backfilled around the siphon. The fill material would be compacted by mechanical methods and water would be added as necessary, since the excavated material is normally too dry for optimum compaction. This water would likely be obtained from local wells. All excess excavated material would be removed from the river channel and the existing grade and bed elevation would be restored.

Figure 13 shows a typical siphon structure and Figure 14 shows siphon construction on the CAP Granite Reef Aqueduct.

c. Checks

Electrically operated radial gates would be placed in the aqueduct at approximately 6-mile (9.7 km) intervals. These gates, installed in reinforced concrete structures, constitute the check structures which permit control over water levels and flow rates in the aqueduct. The check gates could also be closed for dewatering portions of the aqueduct should repair be necessary. Figure 15 shows a two-gate check structure under construction on the Granite Reef Aqueduct. The top of the structure serves as maintenance access and support for the gate operating equipment. The structures would be fenced for public safety and no public access would be provided.

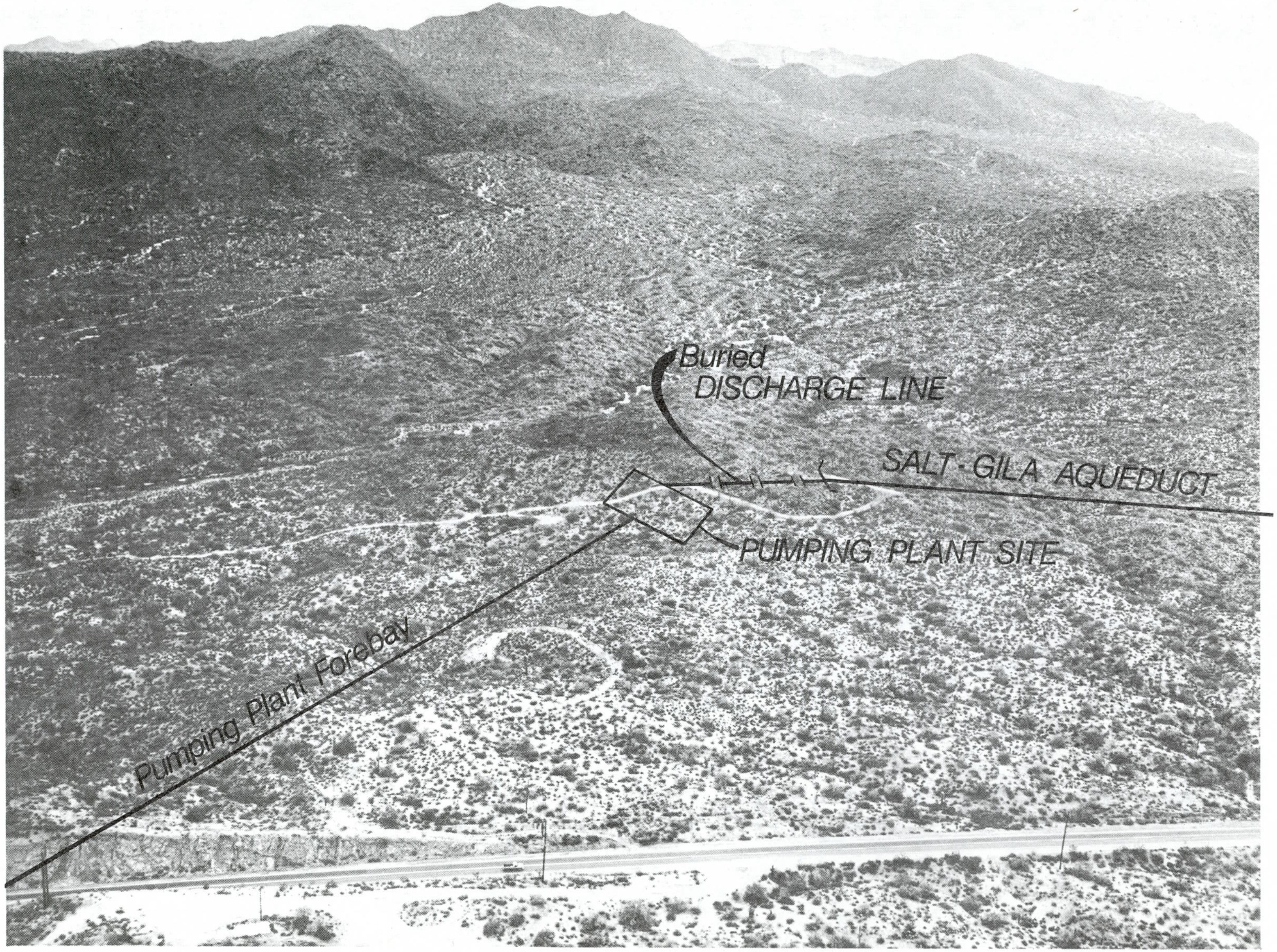


Figure 11--Salt-Gila Pumping Plant Site--Salt-Gila Aqueduct--Central Arizona Project. Aerial view east showing the location of the pumping plant, forebay, buried discharge lines, and aqueduct east of Bush Highway. The location is about 25 miles (50 km) northeast of Phoenix, Arizona. Photograph No. P344-300-02447 NA (0).

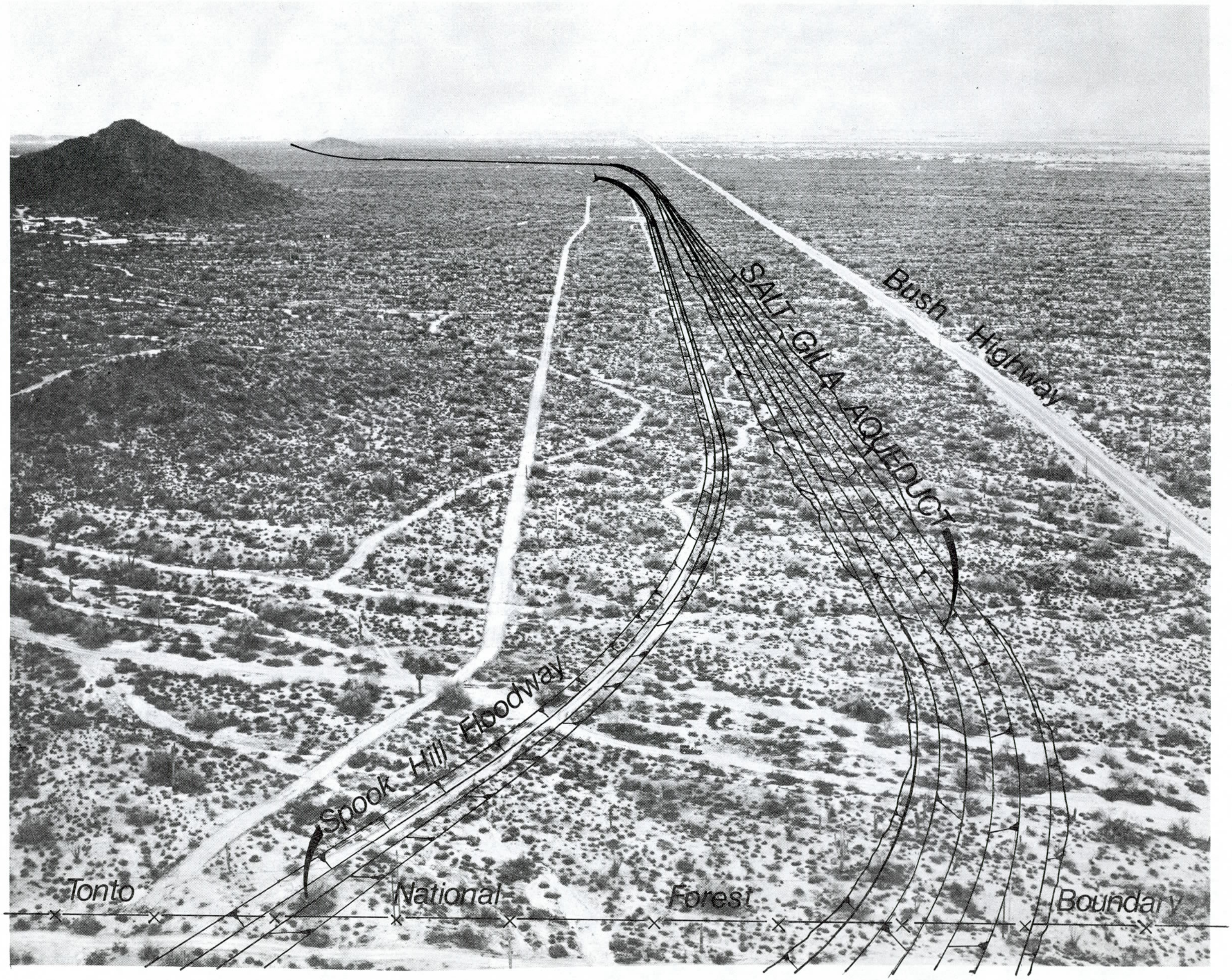
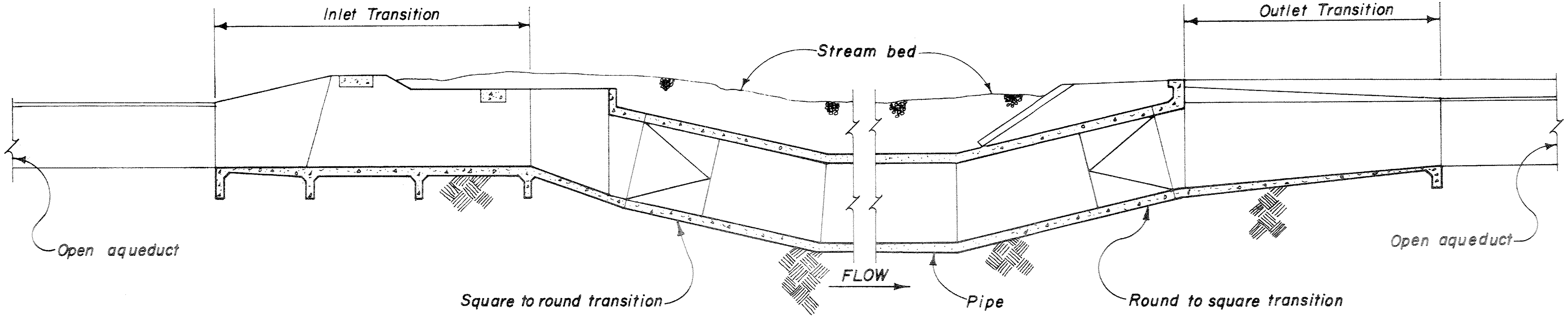


Figure 12--Reach 1 Area--Salt-Gila Aqueduct--Central Arizona Project. Aerial view south from the Tonto National Forest boundary showing an artist's concept of the aqueduct in Reach 1 and the Spook Hill Floodway (SCS). The plant association is typical of the Paloverde-Saguaro Community of the Sonoran Desert. Photograph No. P344-300-02496 NA (0).



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT GILA DIVISION- ARIZONA
TYPICAL SIPHON STRUCTURE

DESIGNED ______ SUBMITTED ______
DRAWN D.P.V. ______ RECOMMENDED ______
CHECKED ______ APPROVED ______

PHOENIX, ARIZONA JAN., 1978 344-330-T-658

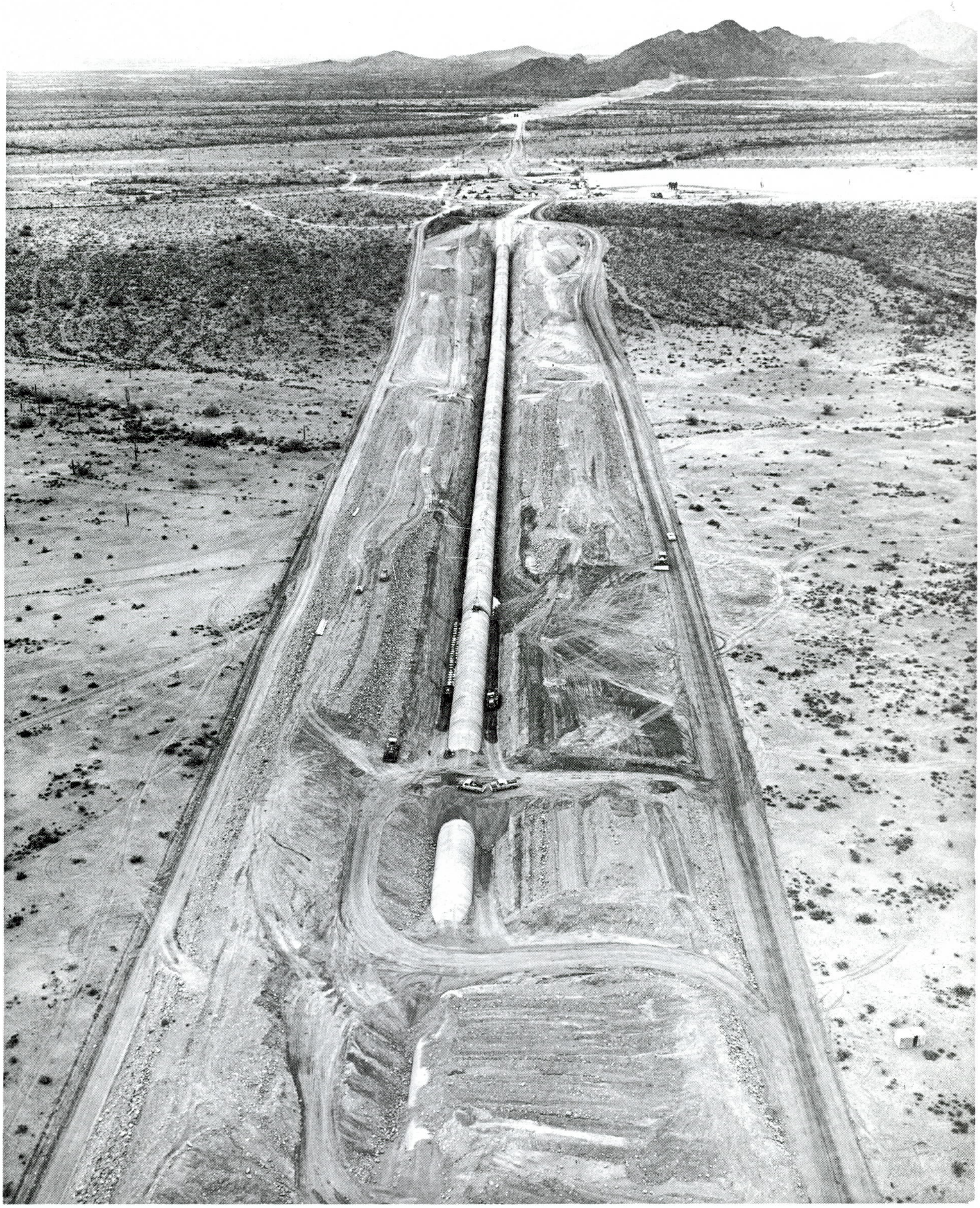


Figure 14--<u>Construction of Agua Fria River Siphon</u>--Granite Reef Aqueduct--Central Arizona Project. Aerial view east showing the backfilling operations at the partially completed siphon. New River Siphon can be seen in the upper part of the photograph. Photograph No. P344-300-02214.

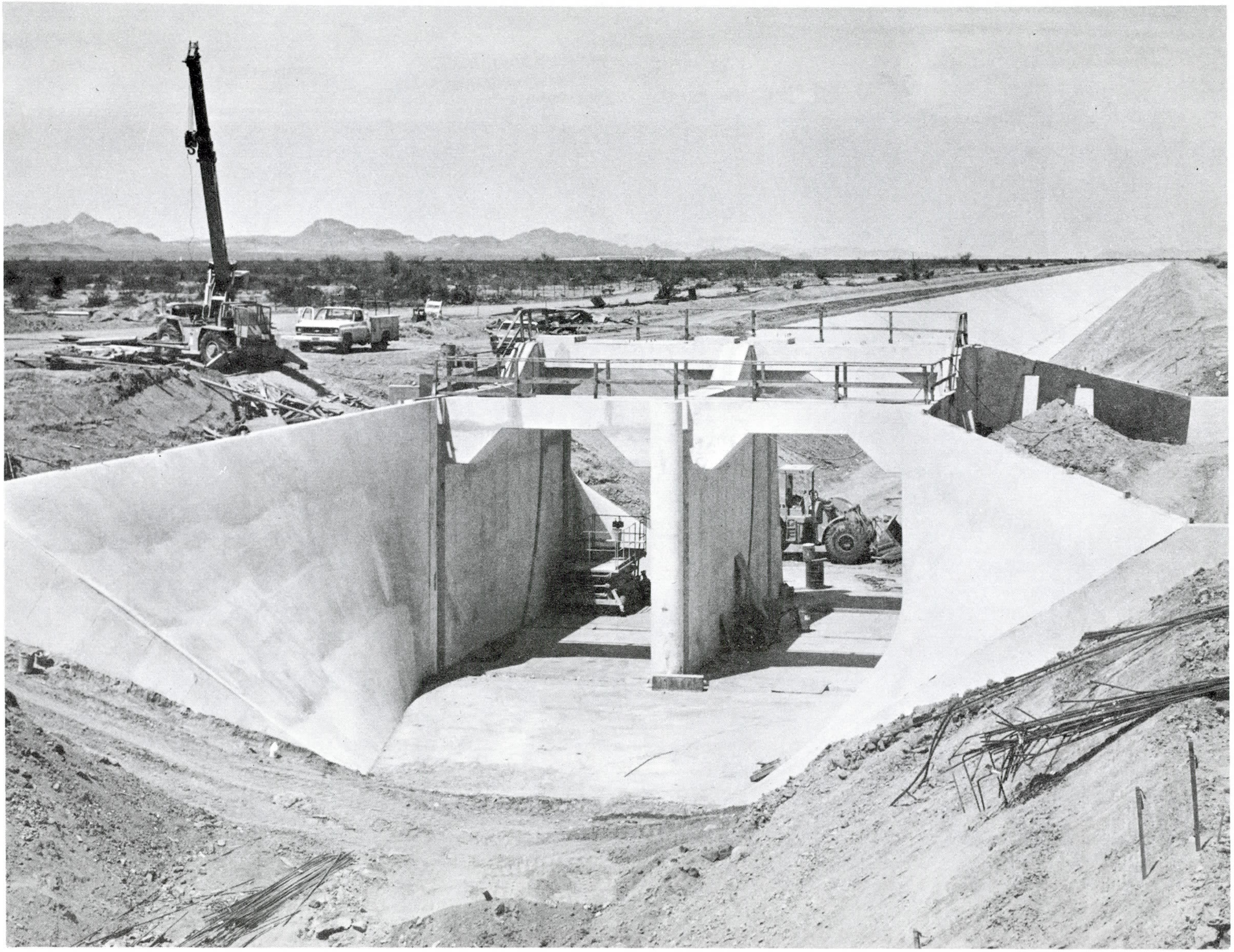


Figure 15--Check Structure Under Construction--Granite Reef Aqueduct--Central Arizona Project. A typical check structure similar to the type planned for the Salt-Gila Aqueduct. Check structures would be constructed at about 6-mile intervals. Photograph No. P344-300-02196.

d. Turnouts

Turnouts are devices constructed in the aqueduct for the purpose of diverting water to the use areas. Figure 16 shows a typical turnout structure on an aqueduct delivery system.

There are 10 turnouts anticipated along the Salt-Gila Aqueduct, with capacities varying up to about 660 cubic feet per second (18.7 cubic meters per second). The final capacities and locations would be determined following completion of water allocations and consultation with the prospective water users. Turnouts could be installed during or after aqueduct construction. The turnout gates would be electrically or manually operated and monitored by an automated control system. The specific impacts of the turnouts and the distribution systems would be covered in separate environmental documents for the agricultural and municipal and industrial water deliveries.

4. Cross Drainage Structures

Cross drainage facilities would be necessary where the aqueduct would interfere with the normal drainage patterns of the land it crosses. In some instances, the structures would be designed to maintain continuity of flow in natural drains while others would be designed to alter the local flow pattern. The latter might involve consolidating flows into a common collection point to facilitate crossing the aqueduct through one structure at a strategic or advantageous point. All structures would be designed to minimize drainage flow damages to the aqueduct.

To assure adequate protection against highly destructive flood flows, the cross drainage structures would be designed to accommodate flows having a magnitude of the 100-year frequency. The Sonoqui Dike across Queen Creek would be designed for the maximum probable flood.

Cross drainage structures would be of three types--overchutes, which carry water over the aqueduct; culverts, which carry water beneath the aqueduct; and detention structures, which collect and retard flows for economical passage across the aqueduct using smaller or fewer overchutes or culverts.

Figures 4 through 9 show the tentative locations of the presently identified cross drainage structures.

a. Overchutes

Two types of overchutes would be constructed on the Salt-Gila Aqueduct--the concrete box flume and the steel pipe overchute. Overchutes would be located where the water surface in the aqueduct would be near or below the natural ground surface.

Figures 17 and 18 show a box flume overchute and a pipe overchute of the type which would be employed along the aqueduct. The box flume overchutes along the Salt-Gila Aqueduct would vary in width up to 88 feet (27 m) and have side walls from 6 to 9 feet (1.8 to 2.7 m) in height. Cross drainage overchutes of less than 100 cubic feet per second (2.8 cubic meters per second) capacity are planned as pipe overchutes which would vary in diameter from 30 to 72 inches (0.8 to 1.8 m). Preliminary plans indicate that approximately 35 overchutes would be required for the Salt-Gila Aqueduct.

Abutments and a pier in the center of the aqueduct would support both box flume and pipe overchutes. Training dikes and flow channels would guide water into the overchutes. Where appropriate, the downstream end of the overchute would be equipped with hydraulic energy dissipators to slow flows, minimizing downstream erosion damage. Figure 19 shows a box flume overchute equipped with hydraulic energy dissipators.

The box flume overchutes could serve as crossings for foot traffic and wildlife where appropriate. It is possible for smaller wildlife to use pipe overchutes to cross the aqueduct. Overchutes located in isolated areas and designated as wildlife crossings would have a soil surface covering which would be restored periodically when disturbed by flows.

b. Culverts

Where the water surface of the aqueduct is well above the natural ground surface, or in areas of anticipated major subsidence, concrete pipe, steel pipe, or concrete box culverts would be used to convey cross drainage waters beneath the canal. For locations requiring large capacities, multibarrel culverts may be installed. Training dikes may be required to guide the flow to the culverts. Where required, hydraulic energy dissipating devices would be constructed to minimize downstream erosion.

Present plans indicate that the culverts required on the aqueduct could range in size from 24-inch (0.6 m) diameter pipe culverts to 8 foot x 8 foot (2.4 m x 2.4 m) box culverts. Figure 20 shows a typical culvert installation.

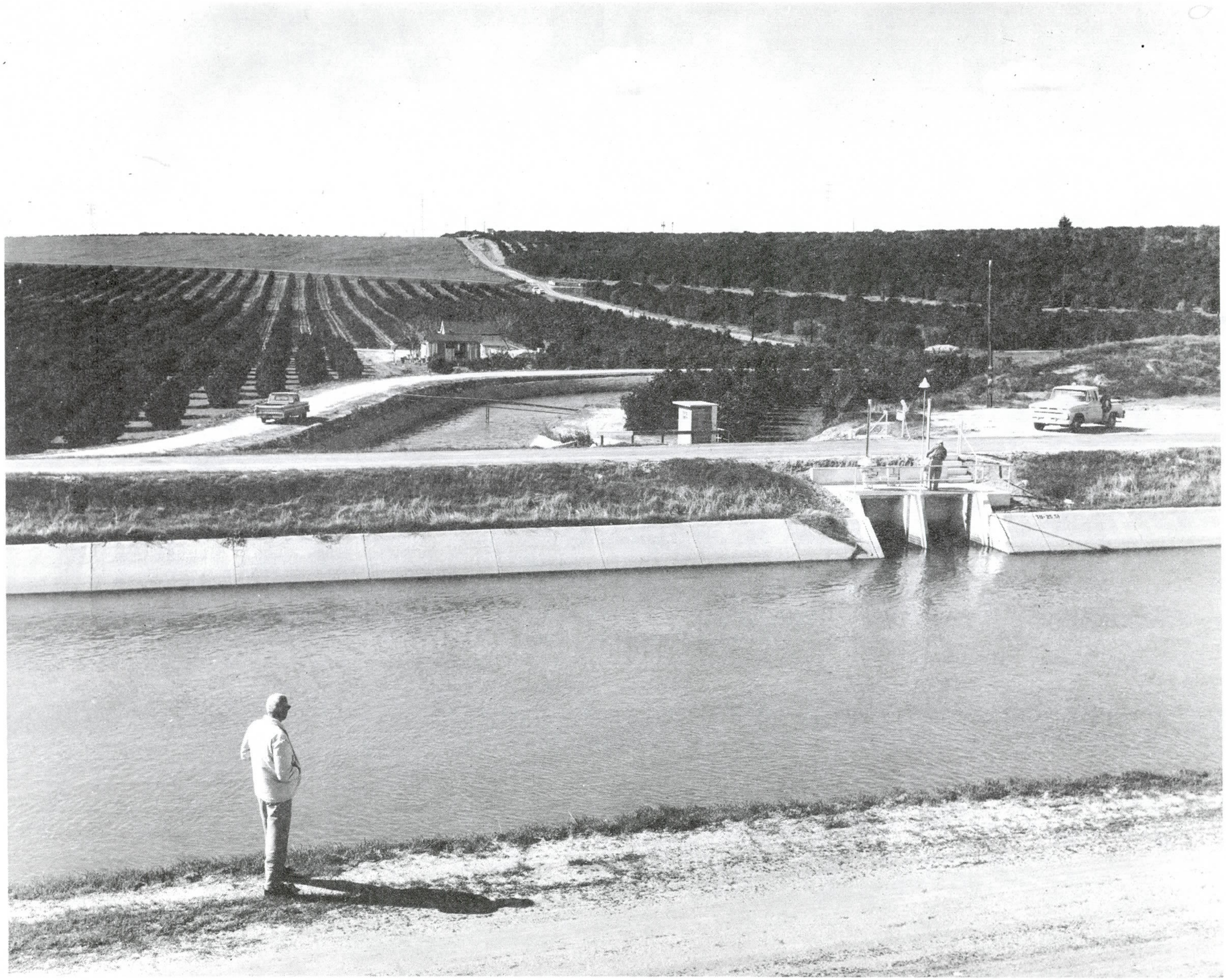


Figure 16--Typical Turnout--Friant Division--Central Valley Project--California. Typical turnouts similar to those planned for the Salt-Gila Aqueduct. Photograph No. P-(F)-200-5271.

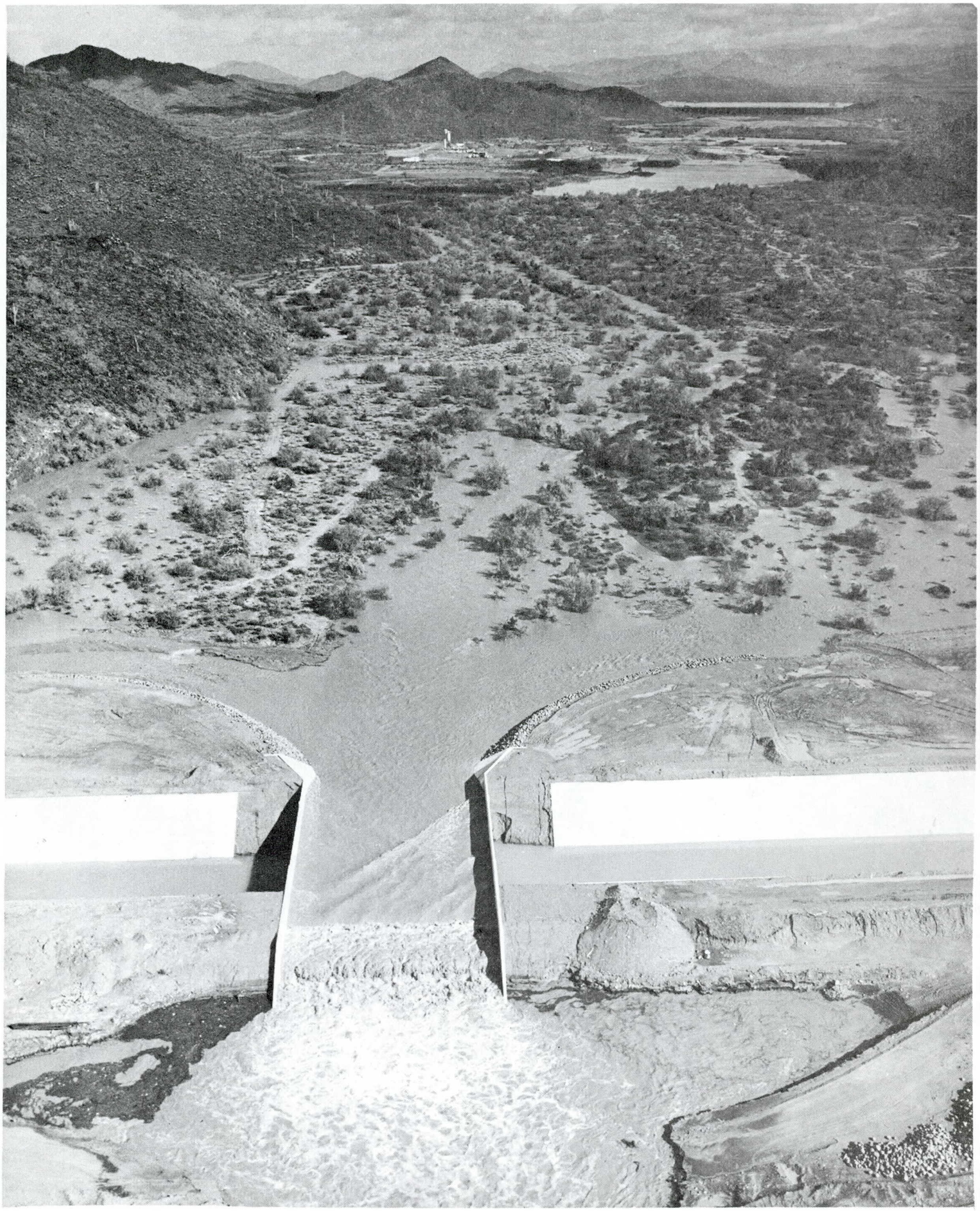


Figure 17--Box Flume Overchute--Granite Reef Aqueduct--Central Arizona Project. View of a box flume overchute carrying water from a winter storm. This structure is similar to those which would be constructed on the Salt-Gila Aqueduct. Photograph No. P344-300-02534 NA.

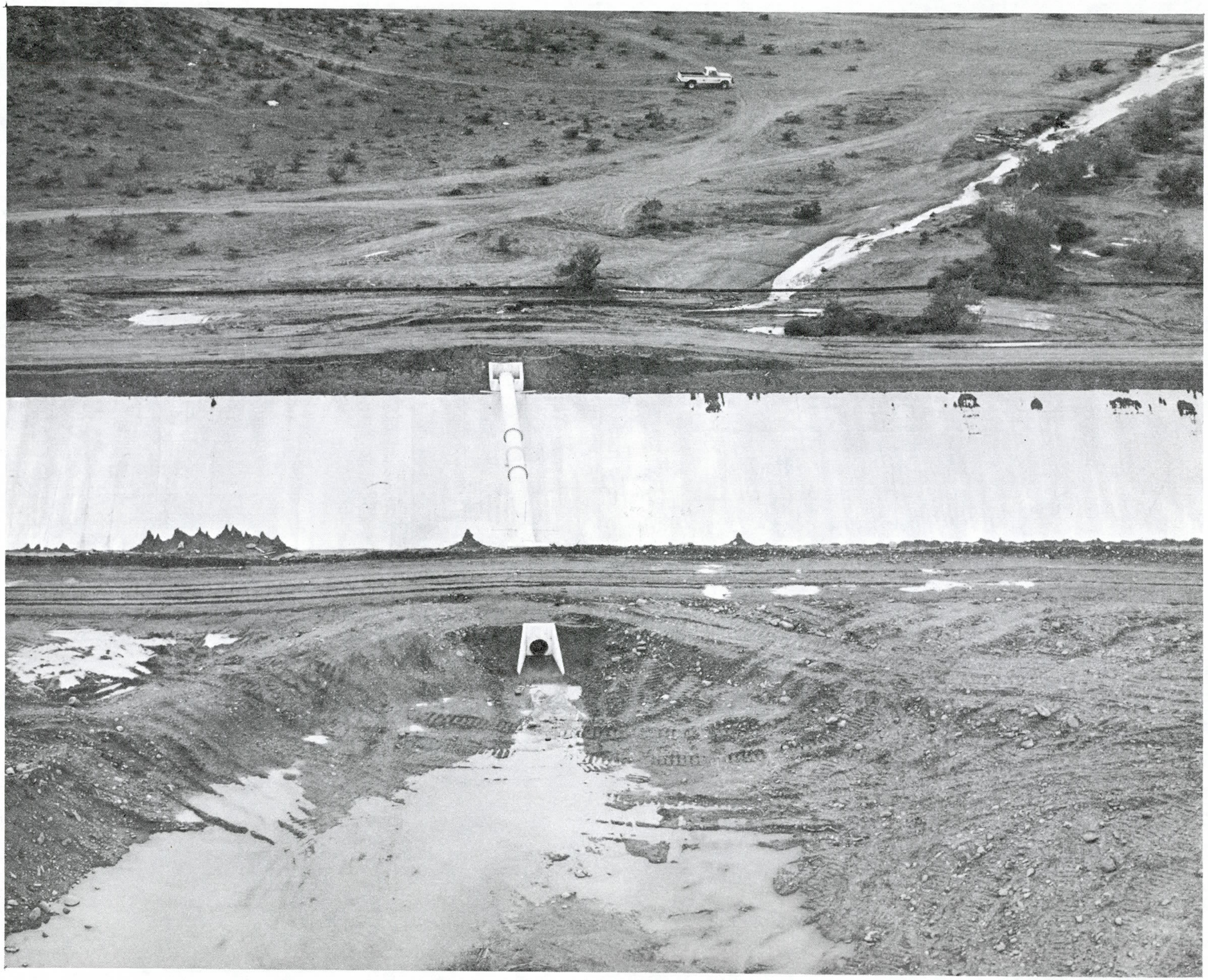


Figure 18--Pipe Overchute--Granite Reef Aqueduct--Central Arizona Project. Aerial view of a typical pipe overchute similar to those that would be constructed on the Salt-Gila Aqueduct. Photograph No. P344-300-02424 NA.

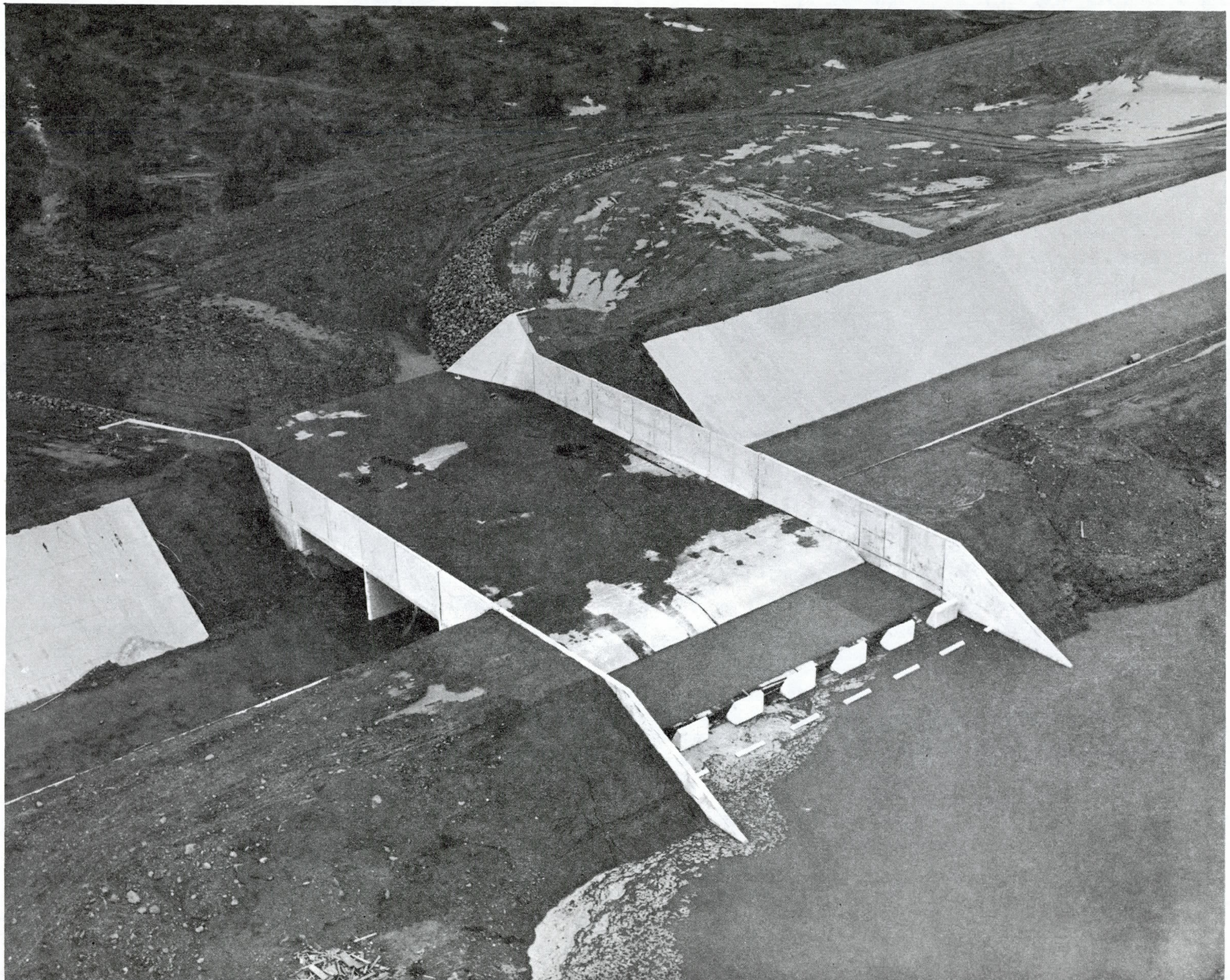
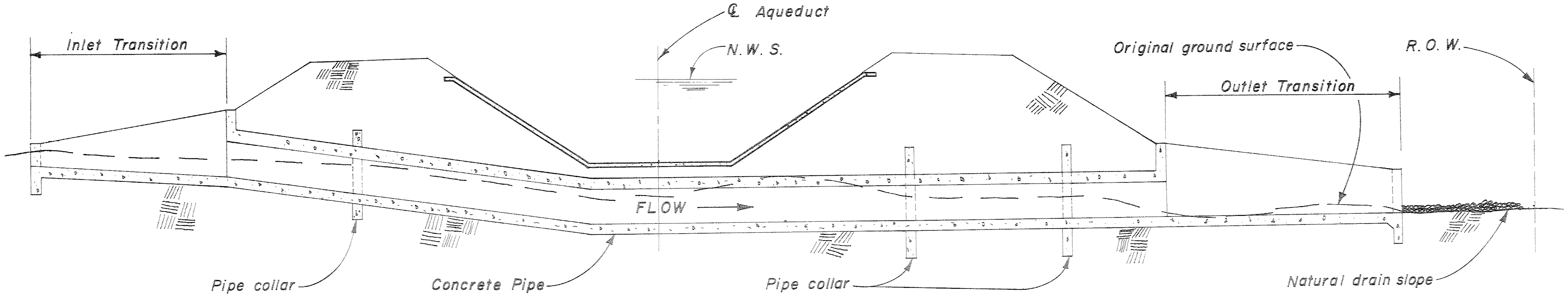


Figure 19--Box Flume Overchute--Granite Reef Aqueduct--Central Arizona Project. Aerial view showing a typical box flume overchute with hydraulic energy dissipators on the downstream side. This structure is similar to those that would be constructed on the Salt-Gila Aqueduct. Photograph No. P344-300-02426 NA.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

TYPICAL CULVERT STRUCTURE

DESIGNED	SUBMITTED J. Krantz
DRAWN D.P.V.	RECOMMENDED
CHECKED G.A.J.	APPROVED

PHOENIX, ARIZONA JAN. 1978 344-330-T-659

c. Training Dikes and Flow Channels

Training dikes and flow channels would be used to consolidate and direct flows from small drainage areas to cross drainage structures located elsewhere along the aqueduct. Training dikes would be designed with a minimum top width of 14 feet (4.3 m) and would vary up to 15 feet (4.6 m) in height. The steepest side slopes could vary from 1.5:1 to 2:1 and riprap protection would be provided where erosion potential is identified. Where necessary, flow channels would parallel the upstream slopes of the dikes. They would be constructed to a minimum depth of 2 feet (0.6 m) with a minimum bottom width of 10 feet (3 m). Figure 21 shows the typical training dike and flow channel design which would be used along the aqueduct.

d. Existing and Proposed Flood Protective Structures

The aqueduct alinement has been located to take advantage of the cross drainage protection provided by floodwater retarding structures already constructed or proposed for future construction by the Soil Conservation Service (SCS). Cooperative planning between the SCS and USBR provides the opportunity to use aqueduct excavation material for planned SCS structures.

Figures 4 through 9 show the structures built by the SCS which would provide cross drainage protection to the aqueduct. These include Powerline, Vineyard Road, Rittenhouse, Magma, and Florence Floodwater Retarding Structures (F.R.S.). The Spook Hill F.R.S., a feature of the Buckhorn-Mesa Project, (Figure 4) is under construction and would provide protection for approximately 6 miles (9.7 km) of Reach 1 of the aqueduct (SCS 1976). About one mile (1.6 km) of the Florence F.R.S. would be relocated to accommodate the aqueduct alinement near Florence.

The USBR proposed Sonoqui Dike would be constructed in Reach 3 across Queen Creek to the Magma Arizona Railroad. The 8-mile-long (12.8 km) structure would vary up to 22 feet (6.7 m) in height and include control outlets to allow discharges into Queen Creek and a channel parallel to the Magma Railroad. Approximately 1,315 acres (532 ha) of right-of-way would be required for this structure.

Four flood retarding structures are planned for Reach 4 of the aqueduct (Figure 9). They would range from about 2 to 4 miles (3.2 km to 6.4 km) in length and would consolidate flows from several drainages. A nondamaging rate of flow would be passed across the aqueduct at strategic points. The retarding structures would require approximately 2,018 acres (817 ha) of right-of-way.

Figure 22 shows two floodwater retarding structures constructed by the SCS.

5. Transportation and Utility Crossings

a. State and County Roads

About 24 vehicular bridges would be required to accommodate aqueduct crossings by major roads and highways. The bridges would vary from 20 to about 100 feet (6 to 30.5 m) in width depending on the type of road being crossed. Present plans contemplate bridge designs for HS-20 loadings. This is an American Association of State Highway and Transportation Officials (AASTHO) design standard for highway bridges. This loading allows for a moving load of a 20-ton (18 metric tons) tractor truck with 16-ton semi-trailer in each lane. The tentative locations of 22 bridges are shown in Figures 4 through 9. Two additional bridges would likely be required, but their locations have not been designated.

Crossing agreements which provide for the crossing of the various roads by the aqueduct would be entered into with the entity responsible for such roads. Figure 23 shows bridges used at the crossing of an Interstate highway by an aqueduct. Figure 24 shows a typical county road crossing.

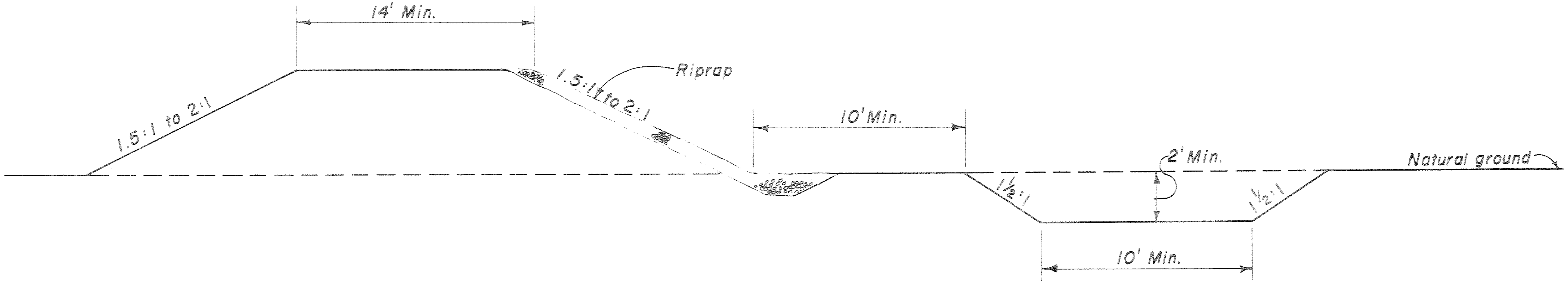
b. Railroad Crossings

The aqueduct would cross the Magma Arizona Railroad in Reach 3, about 11 miles (17.7 km) northeast of Florence, Arizona. The railroad would cross the aqueduct using a bridge designed for an E-80 railroad loading as recommended by the American Railway Engineering Association for mainline railroads. A crossing agreement would be entered into with the railroad company to provide for the crossing of its facilities by the aqueduct. The Florence-Kelvin line of the Southern Pacific Railroad would cross over the Gila River Siphon on compacted embankment, and no bridge would be required.

c. Pipelines and Miscellaneous Utilities

The aqueduct is expected to cross numerous underground water, sewer, telephone, and electric lines in urban areas along the alinement. Two major pipelines owned by El Paso Natural Gas Company would be crossed. The relocation of these lines would be negotiated with the right-of-way issuing authorities and the appropriate utilities during final designs of the aqueduct.

The aqueduct alinement would cross six high voltage power transmission corridors. No structural conflicts are presently foreseen. Should a conflict arise, accommodation would be sought through negotiations at the time of final aqueduct design. Figure 25 is a photograph showing a typical transmission line crossing over an aqueduct.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

TYP. TRAINING DIKE & FLOW CHANNEL

DESIGNED ____________ SUBMITTED ____________
DRAWN J.M.V. DRV ____ RECOMMENDED ____________
CHECKED ____________ APPROVED ____________

PHOENIX, ARIZONA   JAN. 1978   344-330-T-661

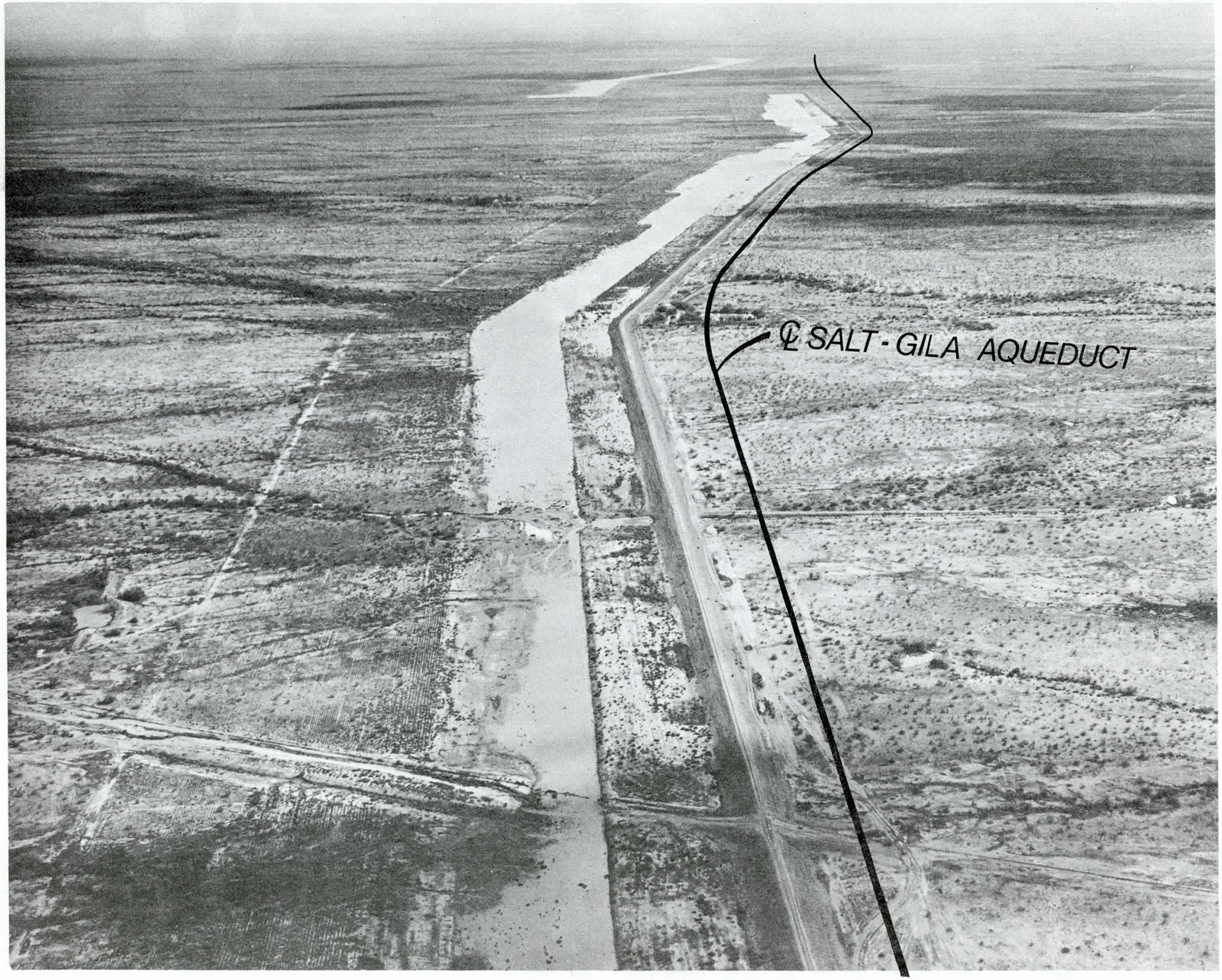


Figure 22--Soil Conservation Service Flood Retarding Structure--Salt-Gila Aqueduct--Central Arizona Project. Aerial view south showing Vineyard Road Floodwater Retarding Structure in the foreground and Rittenhouse Floodwater Retarding Structure in the background. These and additional SCS structures would protect about 30 miles of the Salt-Gila Aqueduct. Photograph No. P344-300-02558(O).

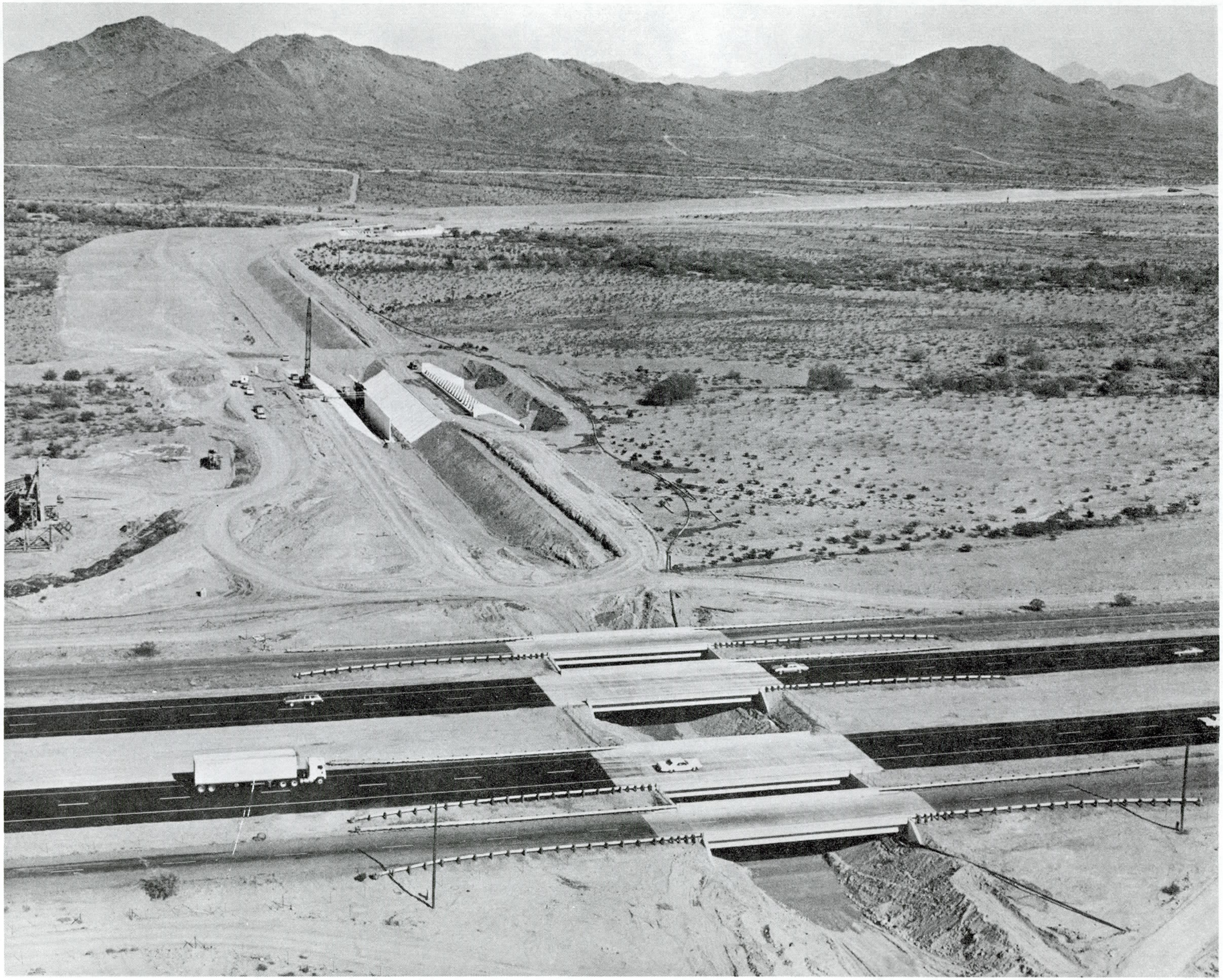


Figure 23--Typical State Highway Bridge--Granite Reef Aqueduct--Central Arizona Project. Aerial view showing the interstate highway bridges on I-17 north of Phoenix, Arizona. A similar type bridge would be used at State highway crossings. Photograph No. P344-300-02327 NA (O).

Figure 24--Typical County Road Bridge--Granite Reef Aqueduct--Central Arizona Project. Aerial view showing a typical country road bridge similar to the type that would be constructed on the aqueduct. Photograph No. P344-300-02423 NA.

Figure 25--Aqueduct Crossing by a Transmission Line--Granite Reef Aqueduct--Central Arizona Project. Aerial view of a high voltage transmission line crossing an aqueduct. Photograph No. P344-300-02418 NA.

d. Flood Control Channels and Pipe Drains

Provisions would be made so that existing flow channels from the SCS floodwater retarding structures would convey water across the aqueduct. In those cases where agricultural fields may be severed from their water supply, Reclamation would provide replacement wells or structures to convey water across the aqueduct.

D. Power and Transmission Facilities

1. General

Power for the Central Arizona Project electrical facilities will be supplied by the Navajo Generating Station at Page, Arizona. The Navajo Generating Station and attendant transmission system are described in the final environmental statement for the Navajo Project dated February 4, 1972 (USBR 1972b). The transmission system emanating from McCullough Switching Station and Westwing Substation to serve the electrical facilities for the Granite Reef Aqueduct is described in the final environmental statement for the Granite Reef Aqueduct Transmission System dated August 4, 1975 (USBR 1975).

Delivery of power from the Navajo Generating Station to the Salt-Gila Pumping Plant would be made by the existing transmission facilities connecting Westwing, Pinnacle Peak, Mesa and Coolidge Substations plus the proposed facilities described in this statement. Figure 26 shows the power transmission system serving the Central Arizona Project.

2. Salt-Gila Pumping Plant

The Salt-Gila Pumping Plant would be served by tapping the existing Mesa-Coolidge 230 kV line near the Salt River Project (SRP) Thunderstone Substation and constructing a 69 or 115 kV transmission line to the Salt-Gila Pumping Plant. The proposed Spook Hill Substation would serve as the tap. Average annual energy use of the Salt-Gila Pumping Plant would be about 100 gigawatt-hours. Figure 4 shows the proposed alinement of the transmission facilities.

From the Spook Hill Substation, the transmission line would run in an easterly direction for a distance of 0.8 mile (1.3 km) and then due north for a distance of 0.8 mile (1.3 km) until it joins the proposed Salt-Gila Aqueduct alinement. From this point the line would be routed northerly for a distance of 4.2 miles (6.8 km) along the east side of the proposed Salt-Gila Aqueduct between the aqueduct and the Spook Hill F.R.S. to the Salt-Gila Pumping Plant. Between 8 and 15 acres (3.25 and 6 ha) of new right-of-way would be acquired for the first 1.6 miles (2.6 km) of line. The remaining 4.2 miles (6.75 km) would utilize aqueduct right-of-way.

Reclamation's Spook Hill Substation would reduce the transmission voltage from 230 kV to provide 69 or 115 kV output. The facility would require about 5 acres (2 ha) and would include disconnect switches, a 230 kV transformer, a 230 kV circuit breaker, and a control building with its related equipment. The substation would be located adjacent to SRP's Thunderstone Substation (Figure 27) approximately 7.5 miles (12 km) west of Apache Junction in Section 18, T. 1 N., R. 7 E. G&SRB&M.

A 15,000-gallon (56.8 cubic meters) tank may be required for the temporary storage of high voltage transformer oil changes. Even though the tank would normally be empty, a spill prevention control and counter measure would be prepared to comply with oil spill prevention regulations.

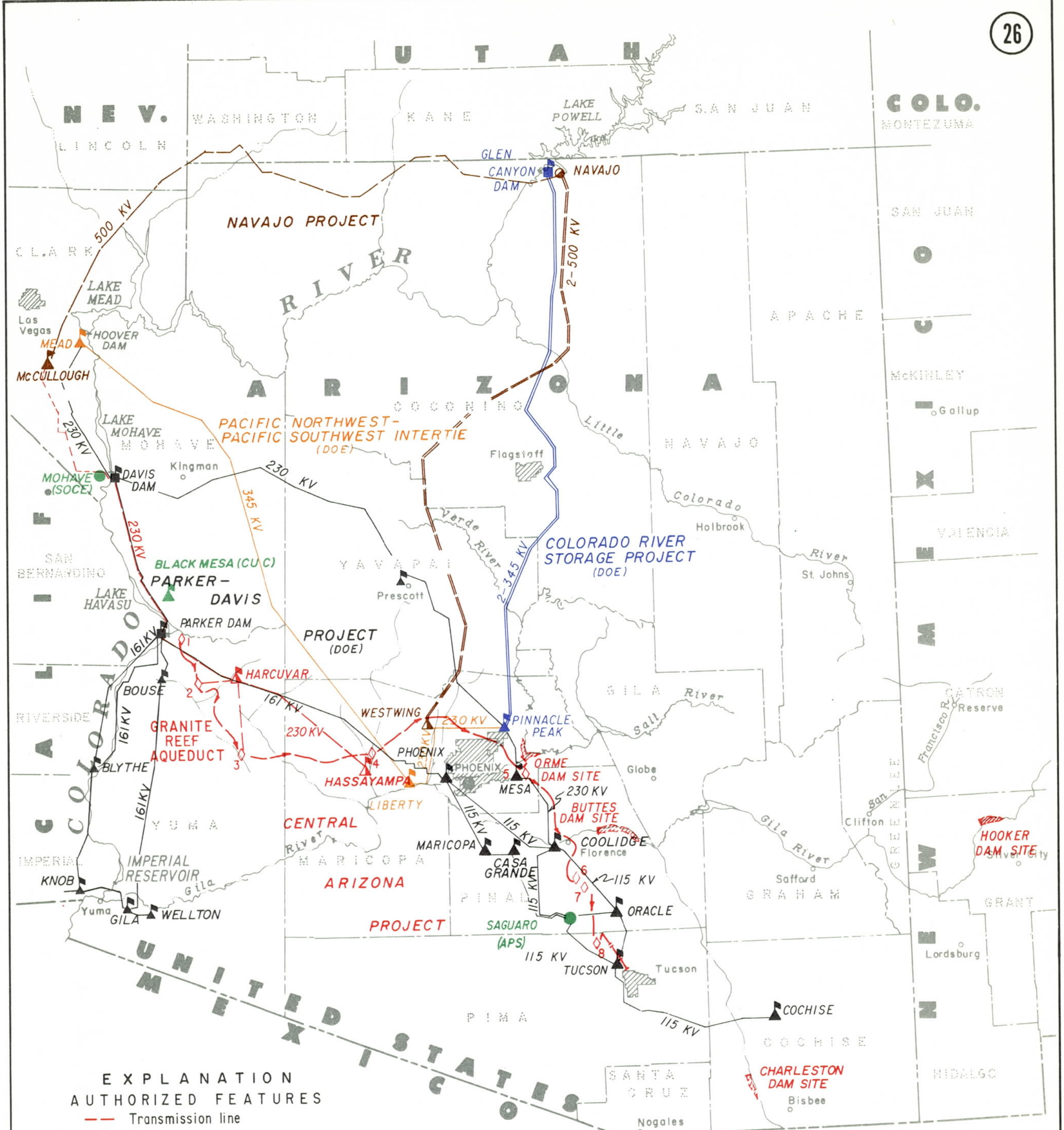
3. Check Structures

Power for check structures would be either from local existing distribution lines in the Salt-Gila Aqueduct area, or extend from the pumping plant to the check structures via buried cable on the aqueduct right-of-way. The method selected to supply power to the check structures would be determined by environmental, economic, and reliability constraints. Lines on the aqueduct right-of-way would be buried and lines off the right-of-way would be of overhead construction.

If local utility feeds to the check structures are utilized, agreements would be made with local utility companies for use and extension of their distribution lines to supply the check structures. Approximately 10 kilowatts per check structure would be required. Local utility companies in the immediate area of the Salt-Gila Aqueduct are Arizona Public Service Company, Salt River Project, Electrical District No. 2, and the San Carlos Irrigation Project. The locations of local distribution lines are shown on Figures 4 through 9.

Purchase of right-of-way and some land clearing would be necessary for line construction off the aqueduct right-of-way. The amount of new right-of-way (approximately 30 feet (9.1 m) wide) required for the lines would be determined when the location of the check structures has been fixed. About 3.25 acres (1.3 ha) of right-of-way is tentatively estimated for lines to the aqueduct right-of-way. Lines may run directly to the check structure or to the aqueduct right-of-way and then parallel the aqueduct via buried cable within its right-of-way to the check structures.

If pumping plant feeds to the check structures are utilized, cable would be buried along the aqueduct approximately 3 to 5 feet (0.9 to 1.5 m) below the operation and maintenance road. The cable would be in the distribution voltage range (4 kV to 13.2 kV) and extend from the Salt-Gila Pumping Plant to the terminus of the aqueduct.



EXPLANATION

AUTHORIZED FEATURES

- Transmission line
- Substation
- Open aqueduct
- Closed aqueduct
- Reservoir
- Pumping plant

1. Havasu	285 MW		5. Salt-Gila	18 MW
2. Bouse Hills	35 MW		6. Picacho Mtns No. 1	13 MW
3. Little Harquahala	35 MW		7. Picacho Mtns. No. 2	28 MW
4. Hassayampa	56 MW		8. Marana	9 MW

- Hydro power plant
- Steam power plant
- Navajo steam power plant
- Substation
- Substation (Navajo Project)
- Existing transmission line
- Transmission line (Navajo Project)

On April 18, 1977, the Administration recommended that the Central Arizona Project be modified to eliminate Orme, Hooker, and Charleston Dams.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CENTRAL ARIZONA PROJECT-ARIZONA

GENERAL LOCATION MAP

POWER TRANSMISSION SYSTEM

MAP NO. 344-330-309

30 0 30 60 90
SCALE IN MILES

MARCH 30, 1973
ORIGINAL TITLE GRANITE REEF AQUEDUCT REV. 6-78

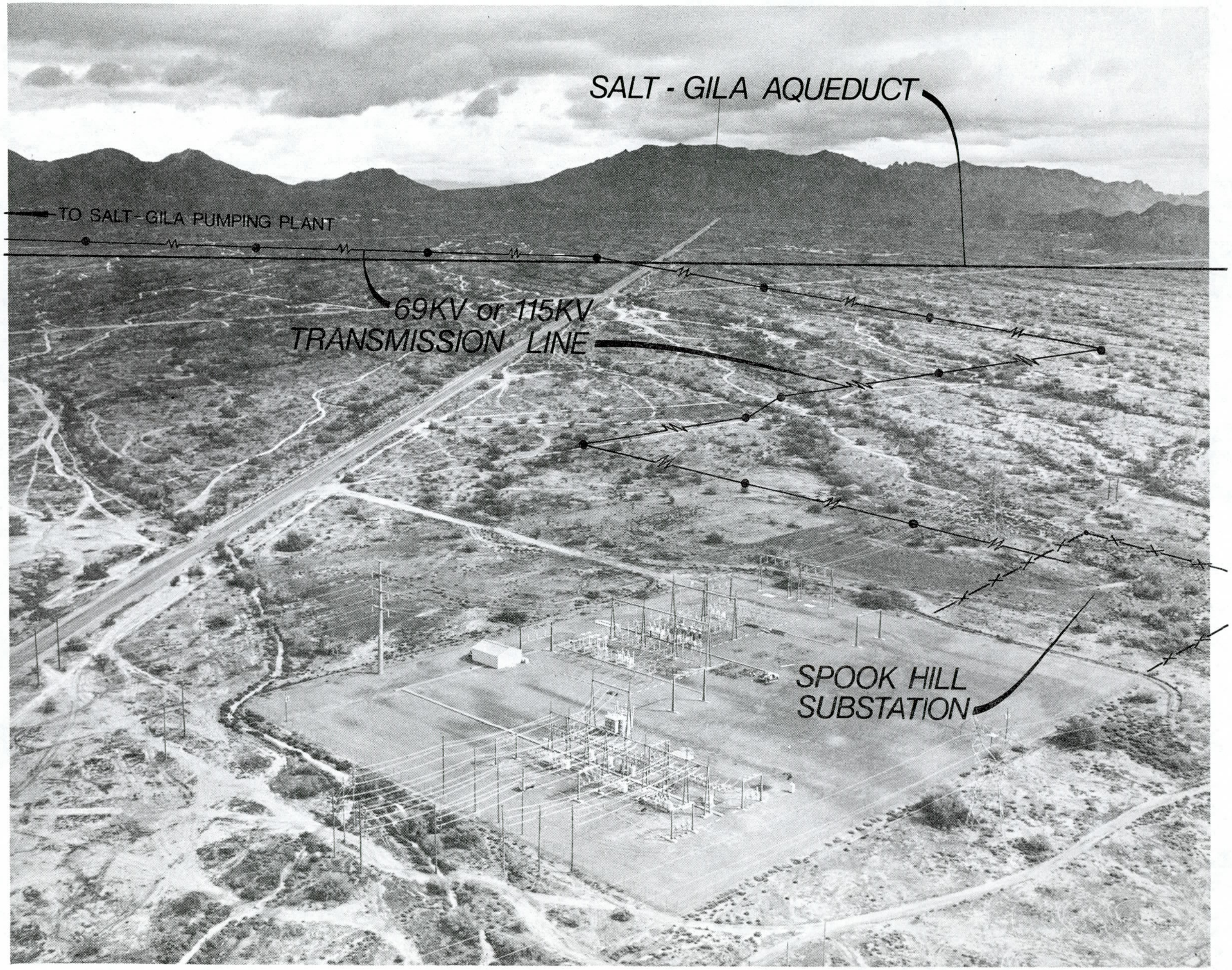


Figure 27--Thunderstone Substation--Salt River Project. Aerial view northeast showing the area where Spook Hill Substation would be constructed. Thunderstone Substation is located on Usury Pass Road northeast of Mesa, Arizona. Photograph No. P344-300-02497 NA (0).

An automated standby power source from either a motor-generator set, a hydraulic accumulator system, or a battery bank would be provided at each check structure for use in the event of an emergency. These would be located either underground or inside a control building at each check structure.

4. Power Transmission Facilities Design

Proposed transmission lines would utilize 69 or 115 kV wood or steel pole transmission structures. Structures would be of the one-pole type as shown in Figures 28 through 30. Wood poles would be treated to prevent deterioration from weathering effects. Each of the three-phase conductors would consist of one steel reinforced aluminum conductor. The phase conductors would be supported by insulators attached to the structures and an overhead ground wire would be installed near the top of the poles.

E. Operations Administration Facilities

The primary operations facility for the CAP aqueducts will be established near the Granite Reef Aqueduct northeast of Phoenix, Arizona (USBR 1974). The complex would probably include administrative offices, operations control building, workshops, and paved vehicle parking areas.

An auxiliary O&M facility would be established at a site adjacent to the Salt-Gila Aqueduct. The facility would probably include offices, workshops, equipment storage building, and a helicopter landing pad. The exact location of the auxiliary yard has not been established, but it is anticipated that 2 to 4 acres (0.8 to 1.6 ha) would be required. The outside equipment, storage, parking areas, and access roads would be paved or have a gravel surface, depending on the degree of use.

F. Project Right-of-Way

1. Right-of-Way Requirements

It is estimated that 6,518 acres (2,639 ha) would be required for the Salt-Gila Aqueduct and related facilities. Approximately 95 percent of the necessary land would be located in Pinal County with the remainder in Maricopa County. Right-of-way width for the Salt-Gila Aqueduct would be approximately 250 to 400 feet (76 m to 122 m) except for segments of the aqueduct which would have flood detention dikes and basins or where spoil areas along the alinement would require a wider right-of-way. The total right-of-way widths in areas with detention dikes would vary to a maximum of 4,500 feet (1372 m), dependent upon water storage requirements for each area. It is estimated that an additional 200 acres (81 ha) of right-of-way would be required for aggregate sources and associated haul roads.

2. Land Acquisition

The lands to be acquired for the construction, operation, and maintenance of the Salt-Gila Aqueduct and its appurtenant facilities would be obtained in a manner consistent with the laws and regulations pertaining to the Federal acquisition of land as well as the goals and provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646, 84 Stat. 1894). As provided in Part 211.1.6 and 211.1.7 of the Reclamation Instructions, the right-of-way for the aqueduct and detention dikes and basins would be acquired in fee simple title (USBR 1971). Easements would be acquired for the facilities appurtenant to the aqueduct such as access roads and drains.

The Salt-Gila Aqueduct would cross private, State, and Federal lands as depicted on Figure 31. Table 2 shows the acreage and percentage of land ownership within the right-of-way.

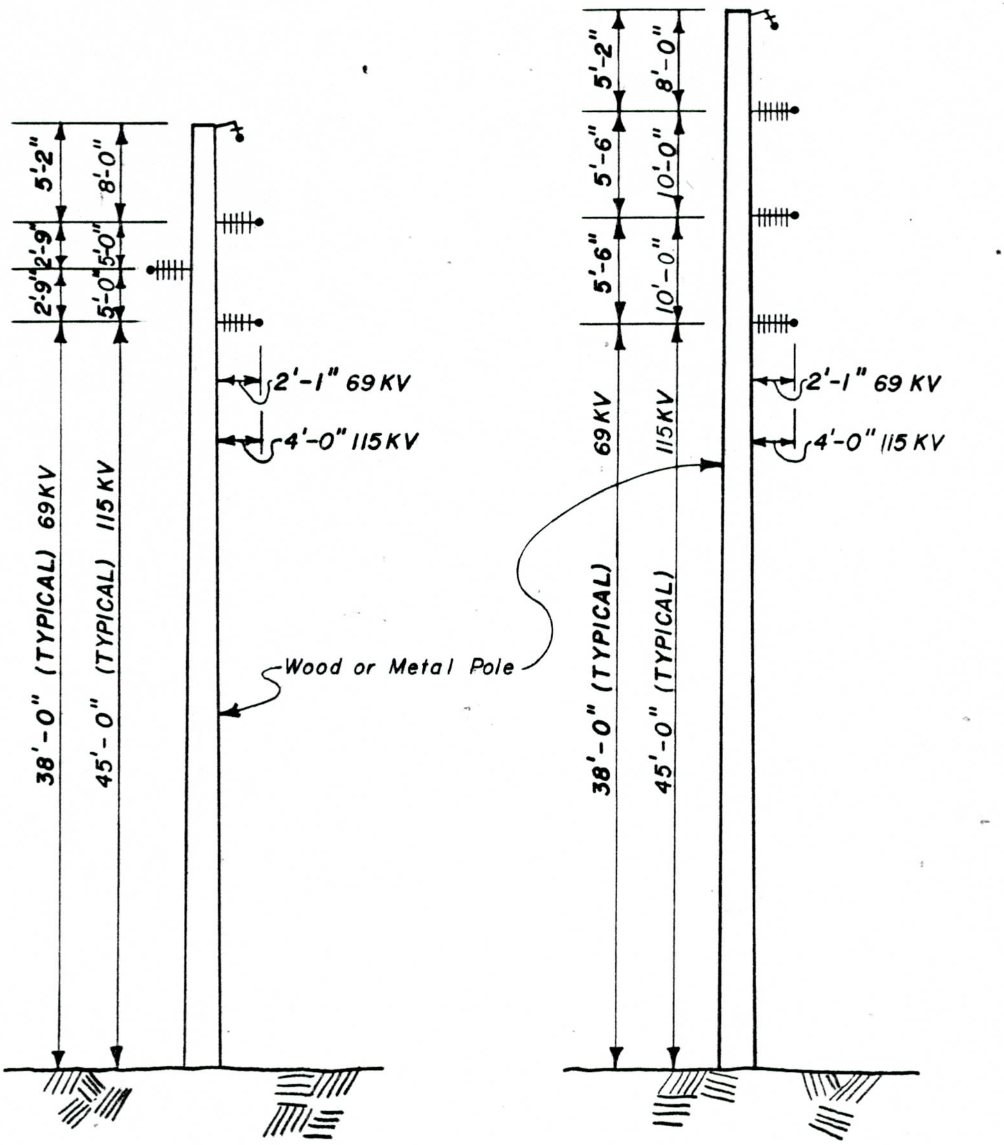
Table 2

Acreage and Percentage of Landownership
in the Right-of-Way
Salt-Gila Aqueduct - Central Arizona Project

Category	Acres	Percent
Federal	170	3
State	3,672	56
Private	2,676	41
Total	6,518	100

Appraisals of private lands or interests therein would be made according to the rules and procedures governing Federal acquisition of land as contained in the "Uniform Appraisal Standards for Federal Land Acquisition" (Interagency Land Acquisition Conference 1973). These standards are generally as follows: Upon determination of the just compensation, the landowners would be advised of this amount in writing. As provided by law, the initial offer presented to the landowners would be not less than the approved appraisal. The Bureau of Reclamation would make every effort to reach an amicable settlement and, in all cases where possible, would conduct its negotiations on a personal basis.

In the event that Reclamation would be unable to successfully negotiate a mutually acceptable contract for the necessary rights-of-way, a written notice would be issued to the property owner at least 90 days before the property would be required for construction purposes. Reclamation would then exercise its power of eminent domain and in-



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

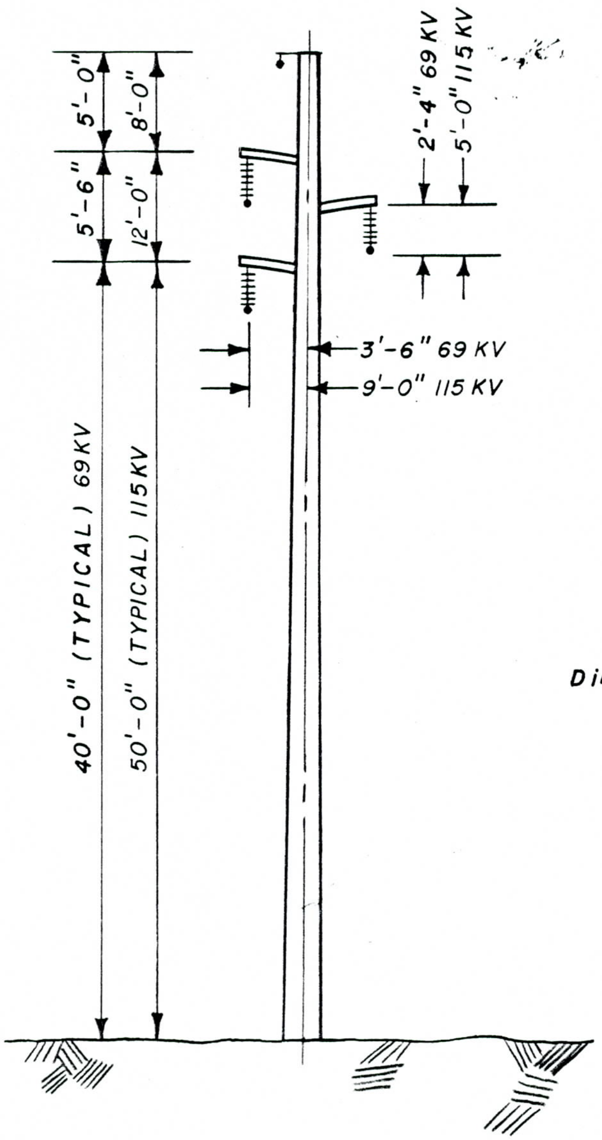
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

69 & 115 KV TRANSMISSION LINE
SINGLE CIRCUIT
ARMLESS POLE STRUCTURE

DESIGNED ____________ SUBMITTED George J. Hammer
DRAWN D.P.V. ____________ RECOMMENDED ____________
CHECKED pelly ____________ APPROVED ____________

PHOENIX, ARIZONA DECEMBER 1977 | 344-330-T-647



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

ALWAYS THINK SAFETY

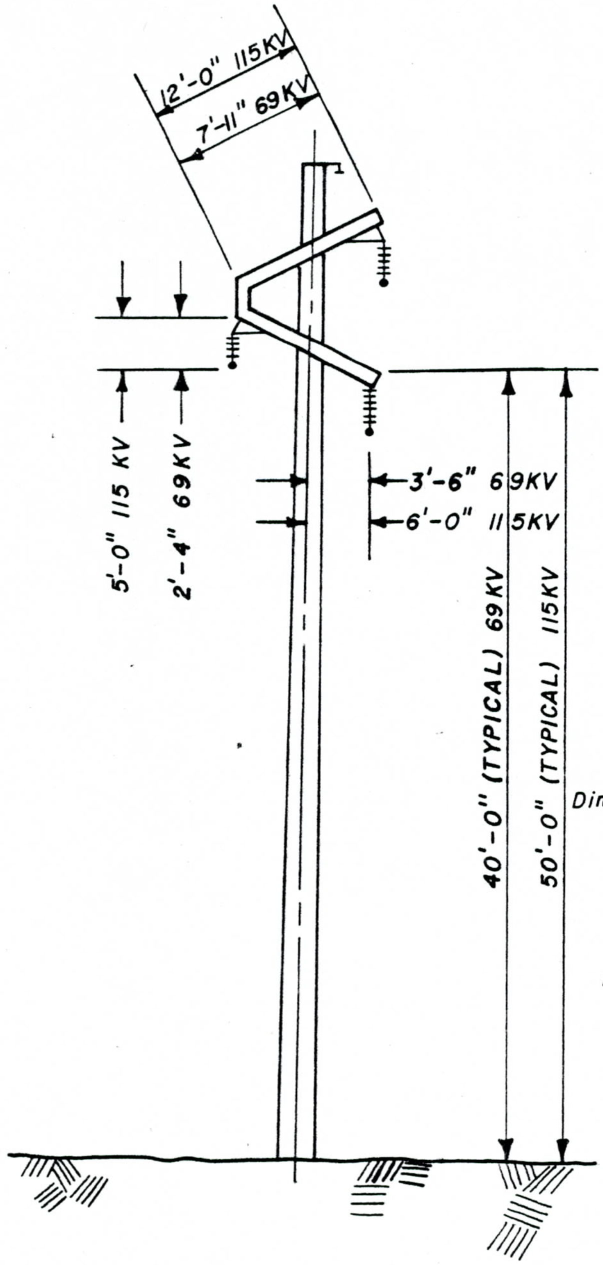
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

69 & 115 KV TRANSMISSION LINE
SINGLE CIRCUIT
TUBULAR STEEL STRUCTURE

DESIGNED ____	SUBMITTED George J. Hammer
DRAWN D.P.V.	RECOMMENDED ____
CHECKED [illegible]	APPROVED ____

PHOENIX, ARIZONA DECEMBER, 1977 344-330-T-648

Figure 30



NOTE

Dimensions shown are typical and may change when final designs are completed. They are indicated to show relative sizes of structures for comparison purposes only.

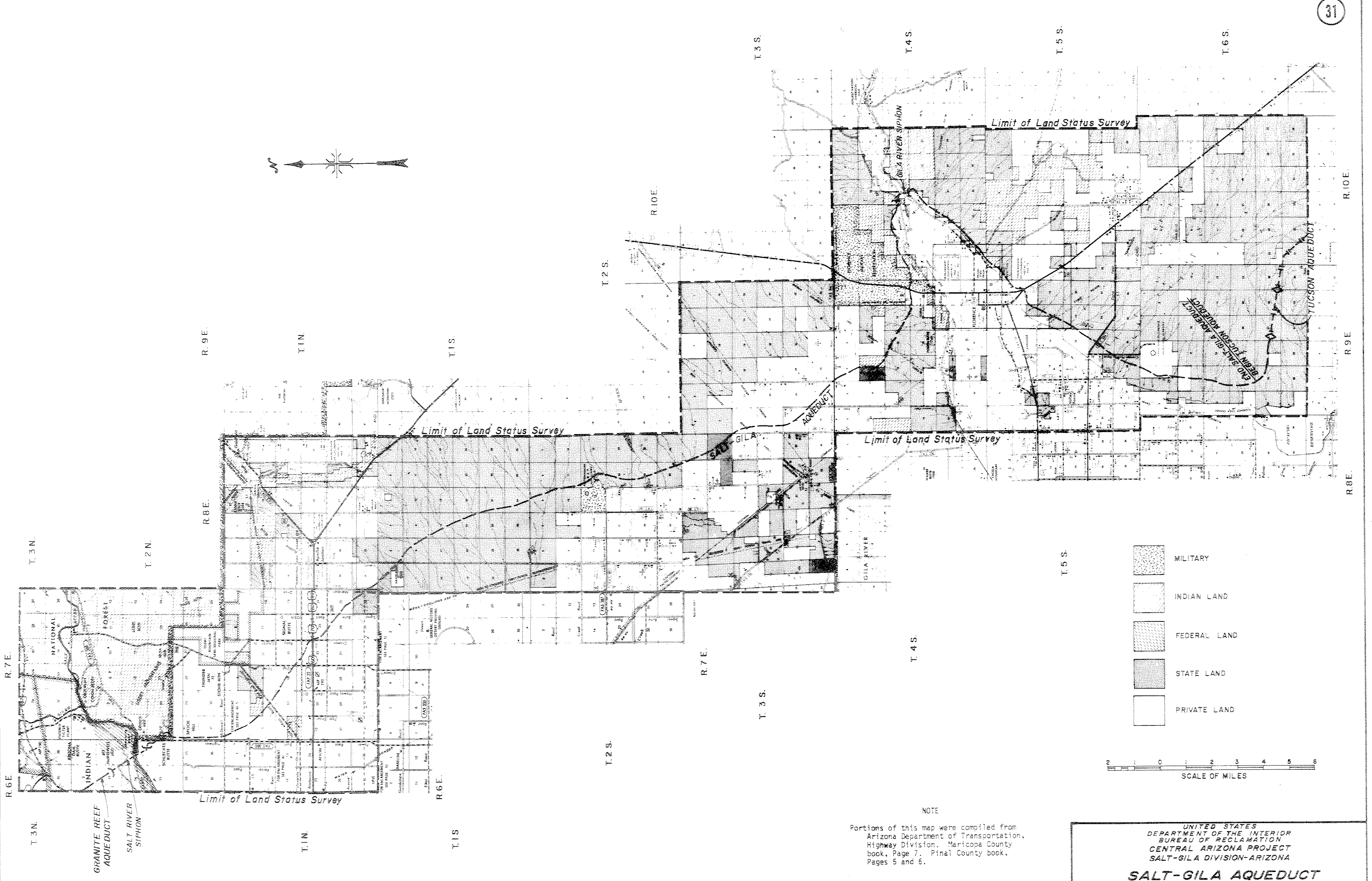
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

69 & 115 KV TRANSMISSION LINE
SINGLE CIRCUIT
WISHBONE WOOD POLE STRUCTURE

DESIGNED ____________	SUBMITTED George J Hammer
DRAWN D.P.V.	RECOMMENDED ____________
CHECKED JWB	APPROVED ____________

PHOENIX, ARIZONA DECEMBER 1977 344-330-T-649



NOTE

Portions of this map were compiled from Arizona Department of Transportation, Highway Division. Maricopa County book, Page 7. Pinal County book, Pages 5 and 6.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
LAND STATUS

DESIGNED	SUBMITTED
DRAWN R.M.G.	RECOMMENDED
CHECKED	APPROVED
PHOENIX, ARIZONA MARCH, 1978	344-330-2314

stitute formal condemnation proceedings to acquire the necessary interest in the property. If the construction would result in the displacement of individuals or businesses, the relocation would be accomplished before any construction would begin.

The procedures for acquiring State lands are dependent upon the method by which the State obtained its title to the land as well as the type of acquisition to be initiated. Acquisition of State lands by the relinquishment procedure as set forth in the fifth paragraph of Section 28, Arizona-New Mexico Enabling Act of June 20, 1910 (36 Stat. 557, 574), is applicable to lands obtained by the State via school grants (Sections 2, 16, 32, and 36), territorial land grants, or lands selected in lieu of school sections. Under this procedure, the Secretary of the Interior requests the State to relinquish to the United States the required lands and then select other Federal lands on an acre-for-acre basis in lieu of those relinquished.

Approximately 77 acres (31 ha) of the State land required for the Salt-Gila Aqueduct would not be subject to the relinquishment procedure. These lands were obtained by the State through exchanges with the Bureau of Land Management or by direct purchases. Acquisition of these lands could only be accomplished by condemnation proceedings or exchange. The State has indicated its preference for the exchange method wherein the State, through the Bureau of Land Management, selects from the Federal lands available an amount of land equal in value to replace those State lands required for the Salt-Gila Aqueduct. After the exchange is completed, the required lands would be placed under a Reclamation withdrawal. The two procedures outlined above are only applicable to fee acquisitions. Easements across State lands would be obtained by direct purchase in much the same way as easements across private lands would be acquired.

Public domain or Federal lands under the jurisdiction of the Bureau of Land Management which would be required for the Salt-Gila Aqueduct would be placed under an application for withdrawal reserving the land for Reclamation purposes pursuant to Section 204 of the Federal Land Policy and Management Act of 1976 (P.L. 94-579, 90 Stat. 2743). These withdrawal applications would segregate or withhold the lands from settlement, sale, location, or entry under the public land and mining laws. To allow for design changes, the withdrawal applications would include an area larger than actually necessary. Upon completion of construction, the withdrawal applications would be finalized only on those areas required for project purposes. In accordance with Section 11 of the Memorandum of Agreement between the Bureau of Reclamation and the Bureau of Land Management dated March 8, 1972, Reclamation would have permission to enter and initiate construction activities prior to the completion of the withdrawals. Those withdrawal applications covering lands not required for project operation and maintenance would be cancelled.

G. Fencing

Fencing would be provided along the aqueduct and at aqueduct structures to protect the structures or to prevent exposure of hazards to the public, domestic animals, or wildlife.

As the degree of hazard exposure may change for various reaches or components of the aqueduct prior to its construction, specific fencing is not now designated. However, the following briefly describes the classes of hazard exposure and the type of fencing that may be expected to apply (USBR 1973b).

Class A includes those portions of the aqueduct or components located adjacent to schools and recreational areas and subject to frequent visits by children. A fence 7 feet (2.1 m) high with 6 feet (1.8 m) of chainlink fabric and three strands of barbed wire would be required in these areas.

Class B includes those portions of the aqueduct or components located near or adjacent to urban areas or highways and subject to frequent visits by the public. An urban safety fence 5 feet (1.5 m) high with 4 feet (1.2 m) of chainlink fabric and three strands of barbed wire would be required in these areas.

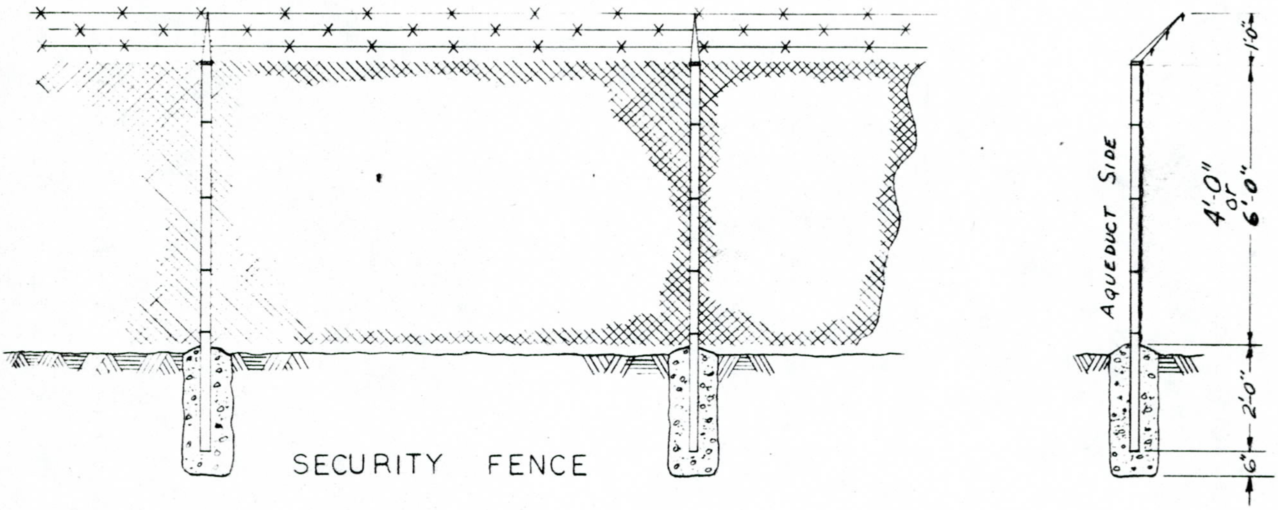
Class C includes those portions of the aqueduct or components located near or adjacent to farms or highways which could be subject to visits by children seeking recreation. A rural safety fence 5 feet (1.5 m) high with 47 inches (1.2 m) of woven wire and two strands of barbed wire would be required in these areas.

Class D includes those portions of the aqueduct or components which are far removed from any dwelling and subject to infrequent visits by operating personnel and occasional sportsmen. A woven wire stock fence 4 feet (1.2 m) high with 32 inches (0.8 m) of woven wire and three strands of barbed wire would be required in these areas.

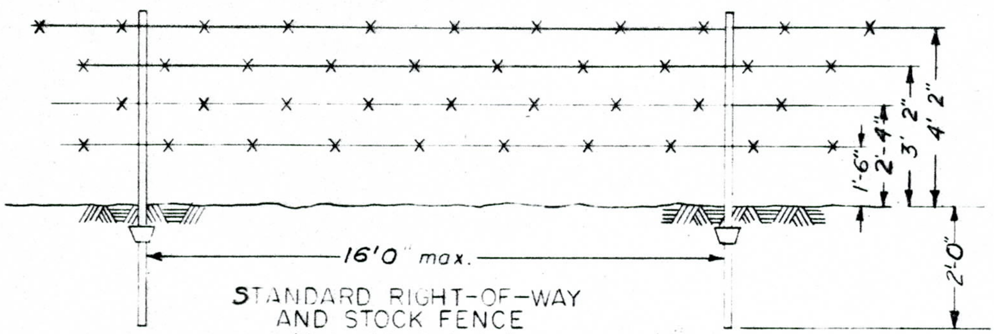
Class E includes those portions of the aqueduct or components which would be a hazard to domestic animals. A barbed wire stock fence approximately 4 feet (1.2 m) high with four strands of barbed wire would be required in these areas.

Class F includes those portions of the aqueduct or components which would be an extreme hazard to big game animals. These areas would require a fence 8 feet (2.4 m) high with 82 inches (2.1 m) of woven wire and two strands of barbed wire above and one strand below the woven wire.

Departures from the above classes may be deemed desirable or necessary, and would be accomplished on a need basis. Figure 32 shows typical fences of the type which could be employed along the Salt-Gila Aqueduct.



SECURITY FENCE



STANDARD RIGHT-OF-WAY
AND STOCK FENCE
(4 strand barbed wire)

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT

TYPICAL FENCES

DRAWN GFO	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED
PHOENIX, ARIZONA DEC. 1977	344-330-T-656

H. Safety Devices

Safety ladders for human escape would be installed opposite each other at 750-foot (229 m) intervals on each side of the aqueduct and immediately upstream of the pumping plant forebay, siphons, and checks. The ladders would be constructed from aluminum rod with yellow paint applied to the top portion of the concrete lining to designate their location.

Other escape devices would be installed across the aqueduct at various locations, especially upstream of such structures as the pumping plant and the siphon. These may include safety nets strung across the aqueduct extending below the water surface, and suspended cables with tracers or drop lines extending to the water surface.

The top portion of the side slopes of the canal lining extending vertically 5 feet (1.5 m) below the top of the lining would receive a nonskid, longitudinal brushed finish to facilitate exit by small animals which may fall in. The design of animal deflectors and escape ramps for the removal of big game from the aqueduct is under study by Reclamation and other interested agencies. If such escape devices prove feasible and practical, they would be installed in the aqueduct along selected reaches of known game concentrations and migration routes.

I. Construction Considerations

1. Temporary Construction Facilities

Reclamation would establish five or six temporary construction field offices near or on the alinement. These offices with storage and parking areas would require about 5 acres (2 ha) each. The contractors would be expected to establish temporary construction offices for each of the 8 to 10 expected major contracts. These areas would require about 10 acres (4 ha) each. Projected field office requirements are indicated on Figures 4 through 9. The actual location of the construction offices and workyards would be determined following award of the construction contracts.

2. Construction Roads

The 250- to 400-foot (76 m to 122 m) aqueduct right-of-way would generally be ample for most construction activities, but roads to connect with existing State and county roads may be necessary for delivery of construction material and access of workmen.

3. Construction Materials

Earthfill obtained from the canal prism would supply most of the embankment material necessary for construction of the aqueduct and training or retarding dikes associated with the aqueduct. Any additional fill material would be obtained from not yet designated borrow areas adjacent to the aqueduct.

Excess earth material may be used to increase the width of the adjacent existing SCS floodwater retarding structures or would be disposed of at designated spoil areas along the alinement. One major spoil and water ponding area of about 530 acres (215 ha) has been identified in Reach 3 just west of the Florence Military Reservation (Figure 7). The spoil material would be used to fill in drainages and low areas north of the alinement and would prevent cross drainage flows from entering the proposed CONOCO mining development downslope of the aqueduct.

No excess excavation material is anticipated in Reach 3 from the Magma Arizona Railroad to 1 mile south of Arizona Farms Road. This is an area of prime farmlands and any disturbance would be confined to a 250-foot (76 m) right-of-way.

Aggregate would be obtained from sources in the Gila River, Queen Creek, or other major washes near the alinement; or from commercial suppliers. The general locations of potential aggregate sources are shown on Figures 2 and 3. The final locations would depend on environmental and engineering studies of the suitability and potential yield of these sites. Approximately 350,000 cubic yards (267,600 cubic meters) of concrete aggregate would be required. An estimated 200 acres (81 ha) would be required for aggregate sources and associated haul roads.

Fill material, when needed, would be obtained from the aqueduct prism or from not yet designated borrow areas adjacent to the aqueduct. The specific location and size of the borrow areas cannot be finalized until construction contracts are awarded. The location of the borrow areas would usually be chosen by the contractor with the approval of the contracting officer. Reclamation would perform environmental analyses of any borrow areas outside the right-of-way in coordination with other interested agencies.

4. Construction Water Supplies

Contractors would be responsible for obtaining water for their construction activities. The sources would be from existing canals and new or existing wells in the area. The water would be transported to the construction site by pipelines or trucks. An average of approximately 45 acre-feet (55,500 cubic meters) of water would be required for each mile of construction.

5. Diversions During Construction

a. Transportation Crossings

Detours would be provided at about 27 public roadway crossings while vehicular bridges are being constructed at those sites. The remaining roads intersected by the aqueduct would either be permanently rerouted to bridge crossings or would be severed. In the latter case, cul-de-sacs would be provided, where possible, for turnaround. Shooflies would be provided for the Southern Pacific Railroad Florence-Kelvin line and the Magma Arizona Railroad during construction of the aqueduct.

b. Major and Minor Water Courses

Queen Creek and the Gila River are the largest ephemeral water courses to be crossed by the aqueduct. The periodic flows would be diverted around these sites and no unusual problems are anticipated during construction. All intercepted floodflows would be bypassed and would not be diminished or diverted to adjacent properties.

c. Existing Services and Facilities

The Florence-Casa Grande and North Side Canals of the San Carlos Project would be crossed by the Salt-Gila Aqueduct. The construction activities would be scheduled to avoid conflict with irrigation delivery schedules so that no interruption of water deliveries would occur.

Where service facilities such as water, sewer, telephone, or gas lines would be crossed, the manner and location of the crossing would be determined through negotiations between Reclamation and the owner of the line. SOHIO Transportation Company has proposed converting one of the El Paso Natural Gas lines crossed by the aqueduct to a crude oil pipeline (BLM 1976). Should a conversion take place, the crossing would be designed to preclude the potential pollution of project water from this source.

6. Safety, Environmental, and Standard Control Requirements

The environmental and safety concerns associated with the construction activities would be stipulated in the specifications prepared for each individual contract. The specifications outline the proposed construction activity and the methods to be used to insure safety and alleviate the environmental impacts associated with the construction. The specifications prepared by Reclamation serve as the basis for the contractor's bid and the document by which Reclamation would oversee the activities.

It is estimated that 8 to 10 major contracts would be awarded for construction of the Salt-Gila Aqueduct. The contracts would be for various portions and specific features of the aqueduct. Each would have an individual specification outlining the measures to be used to insure public and worker safety and protect the environmental concerns specific to that contract or construction activity.

Reclamation Instructions additionally outline methods and procedures to insure safety and preserve the environment during construction activities. The implementation of these instructions is expected to reduce construction-related impacts.

a. Construction and Public Safety

Safety conditions would be monitored by Reclamation to avoid situations which could result in accidents involving construction workers, visitors, or travelers in the area. Signs, flagmen, barricades, and other safety devices would be used to warn of potential hazards. Safety regulations would be written in accordance with applicable State and Federal laws. The enforcement of safety regulations is primarily a Reclamation responsibility, but could also involve State and other Federal agencies.

b. Blasting Control

The contractor would submit a blasting plan which would be evaluated prior to authorizing the initiation of blasting. Blasting is anticipated only at the Salt-Gila Pumping Plant site and in portions of the southernmost 6-mile (9.7 km) segment of Reach 3 of the Salt-Gila Aqueduct.

c. Dust Control and Air Pollution

Dust from contractor operations would be controlled by maintaining proper soil moisture conditions. The contractors would establish watering programs to maintain the proper moisture level but, during periods of high winds, dust could become a noticeable problem. Speed limits would be enforced based on the road conditions to reduce dust problems. Vehicles and equipment that show excessive emissions of exhaust gases would not be operated until corrective repairs or adjustments are made. The burning of combustible materials not needed in construction would be initiated only with concurrence of local pollution and fire authorities.

d. Noise Abatement

Reclamation has initiated a construction noise monitoring program to maintain acceptable sound levels. Noise pollution levels would not exceed 75 decibels during nighttime operations nor 80 decibels during daytime operations as measured outdoors from areas considered to be noise-sensitive.

e. Water Pollution Abatement

Specifications would require the contractor to prevent construction-related pollution of the underground aquifers and surface washes and rivers. The contractor would comply with applicable Federal and State laws and regulations concerning control and abatement of water pollution. Specific measures are presented in the construction specifications. For example, the specifications for Reach 3 of the Granite Reef Aqueduct contains the following section.

"1.6.4 PREVENTION OF WATER POLLUTION

"a. General-The contractor's construction activities shall be performed by methods that will prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into streams, flowing or dry watercourses, lakes and underground water sources. Such pollutants and wastes include, but are not restricted to, refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

"Unwatering work for structure foundations or earthwork operations adjacent to, or encroaching on, streams or watercourses shall be conducted in a manner to prevent muddy water and eroded materials from entering the streams or watercourses by construction of intercepting ditches, bypass channels, barriers, settling ponds, or by other approved means. Excavated materials or other construction materials shall not be stockpiled or deposited near or on streambanks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff or can in any way encroach upon the actual watercourse itself.

"Turbidity increases in a stream or other bodies of water that are caused by construction activities shall be limited to the increases above the natural turbidities permitted under the water quality standards prescribed for that stream or body of water. When necessary to perform required construction work in a stream channel, the prescribed turbidity limits may be exceeded, as approved by the contracting officer, for the shortest practicable period required to complete such work. This required construction work may include such work as diversion of a stream construction or removal of cofferdams, specified earthwork in or adjacent to a stream channel, pile driving, and construction of turbidity control structures. Mechanized equipment shall not be operated in flowing water except as necessary to construct crossings or to perform the required construction.

"Waste waters from aggregate processing, concrete batching, or other construction operations shall not enter streams, watercourses, or other surface waters without the use of such turbidity control methods as settling ponds, gravel-filter entrapment dikes approved flocculating processes that are not harmful to fish, recirculation systems for washing of aggregates, or other approved methods. Any such wastewaters discharged into surface water shall be essentially free of settleable materials. For the purpose of these specifications, settleable material is defined as that material which will settle from the water by gravity during a 1-hour quiescent detention period.

"b. Compliance with laws and regulations-The contractor shall comply with applicable Federal and state laws, orders, and regulation concerning the control and abatement of water pollution.

"The contractor shall also comply with the sanitation requirements of subpart D. of Occupational Health and Environmental Controls, of the Department of Labor Safety and Health Regulations for Construction."

f. Waste Material Disposal

Waste disposal would be accomplished through burning, burial, or removal to specified sites. Established land fills would be used where possible and burning would only be used when the responsible regulatory agencies approved. The contractor would be required to remove all unused construction materials and other rubbish from the work area after construction. If additional landfill sites are needed, written approval would be obtained for the Arizona Department of Health Services.

g. Erosion Control

All earthwork interrupted for any extended period would be left in such a manner as to discourage erosion caused by wind or rain. Excavated slopes would be constructed to intercept cross drainages, prevent erosion, and aid revegetation after construction. Steeper slopes would be terraced and smaller slopes corrugated.

h. Range Fire Control

The range fire control programs for lands adjacent to the aqueduct fall under several jurisdictions as described in this section.

(1) Forest Service Lands

About 0.6 mile (1.0 km) of Reach 1 extends through the Tonto National Forest. The fire control program of these lands is under the administrative control of the Mesa Ranger District.

(2) Private Lands

The State Forester has responsibility for suppression of fire on private lands located outside incorporated municipalities. Many local fire departments have agreements with the State for fire control within their local jurisdictions.

(3) BLM Lands

Fire control on lands under the jurisdiction of the Bureau of Land Management is generally accomplished by personnel of that agency aided by the Rural Metro Fire Department under an informal working agreement. The Bureau of Land Management also has working agreements with the counties and the Arizona National Guard in case additional assistance is necessary to combat large fires.

(4) State Lands

The State Forester is responsible for fire control on State lands. Fire suppression on some State land is accomplished through a cooperative agreement with the Forest Service under the Clark-McNary Act (1929) Section 2. Local fire departments suppress many of the local range fires where they fall within their local jurisdictions, and have agreements with the State in this regard.

i. Archeological and Historical Resources

A total of 70 archeological and historical sites were recorded along the proposed construction alinement. Through consultation with the Arizona State Historic Preservation Officer (SHPO) and the Keeper of the National Register of Historic Places, 63 of the sites have been determined to be eligible for inclusion in the National Register because they have the potential to yield important information about the prehistory and history of the area.

Although these 63 sites have been determined to be eligible for the National Register, many have been previously disturbed, and except for petroglyph panels at one site, none are of a historic, ethnic, or educational nature warranting preservation in place. It is anticipated that the proposed construction would result in damaging or destroying all or parts of 58 of these 63 sites. A plan to mitigate this damage through a program of professional data collection, analysis, and report preparation has been prepared (Stein 1979). The plan recommends that a determination of "no adverse effect" can be appropriately made in accordance with "Guidelines for Making 'Adverse Effect' and 'No Adverse Effect' Determinations for Archeological Resources in Accordance with 36 CFR Part 800" prepared by the Advisory Council on Historic Preservation (ACHP). The Arizona SHPO has concurred with this determination and documentation was submitted in May for the Council's review.

If this review indicates that a determination of "adverse effect" would be more appropriate, full consultations in compliance with Section 106 of the Historic Preservation Act of 1966 (P.L. 89-665) will be completed. In either case, a mitigative study will be undertaken prior to the initiation of construction.

If evidence of previously unrecorded historical or archeological data is discovered during construction, operations in the vicinity of the discovery would cease, and mitigation studies would be conducted prior to resuming construction. Funds for cultural resource studies are classified as nonreimbursable portions of Central Arizona Project appropriations in accordance with the Archeological and Historic Preservation Act of 1974 (P.L. 93-291).

j. Vegetation

Removal or transplanting of protected native plants, when required, would be coordinated with the Arizona Commission of Agriculture and Horticulture in accordance with the Arizona Native Plant Law (ARS, Chapter 7, Article 1). Revegetation of disturbed areas is discussed in Chapter III.C.1.

7. Construction Schedule

Construction of the Salt-Gila Aqueduct is expected to start in 1980 and take about 5 years to complete. Electrical substations, transmission line, and distribution line work would be scheduled to be completed by the time the pumping plant would be placed in service. The Salt-Gila Aqueduct system is expected to be in service in 1985. Figure 33 outlines the proposed sequence of construction.

J. Operations

1. Operating Criteria

Specific operating criteria have not been established for the Salt-Gila Aqueduct at this time. It is anticipated, however, that the Salt-Gila Pumping Plant would be operated to take advantage of available off-peak power. Energy used during the heavy power consumption periods (on-peak) is substantially more valuable than energy used during a time of low consumption (off-peak). In central Arizona the on-peak period is generally the daylight and early evening hours. The off-peak period is nighttime, weekends, and holidays.

Consistent with the amount of water to be moved through the Salt-Gila Aqueduct, efforts would be made to pump as much as possible during off-peak periods and as little as necessary during on-peak periods. This mode of operation would be beneficial to the region's power production capability as more on-peak power would be made available for other uses. Maximizing the use of off-peak pumping would impose fluctuations on the amount of water introduced into the Salt-Gila Aqueduct, which would be limited by the capacity of the aqueduct downstream from the pumping plant, and by the need for consistent deliveries to water users.

The concept of on-peak/off-peak pumping is the subject of ongoing studies for the entire CAP aqueduct system. The studies will eventually indicate the optimal operating criteria for the CAP aqueducts and pumping plants. While the amount of possible off-peak pumping would be enhanced with the availability of regulatory storage in proximity to the Salt-Gila Pumping Plant, studies have shown that off-peak pumping can be accomplished to a limited extent utilizing the limited amount of storage within the aqueduct prism. During periods of reduced water demands, the aqueduct prism can be filled during off-peak hours and

Figure 33

Proposed Construction Sequence 1/
Salt-Gila Aqueduct - Central Arizona Project

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Salt-Gila Pumping Plant						
Pumps and Valves	Feb			Dec		
Structures	July		Apr			
Motors	Aug			June		
Completion			Mar			Sep
Reach 1						
Canal Construction	Sep		Sep			
Structures and Completion				Aug	May	
Reach 2						
Canal Construction		June		June		
Structures and Completion				Aug	May	
Reach 3						
Canal Construction	June		June			
Structures and Completion				Aug	May	
Reach 4						
Canal Construction			Feb	Feb		
Gila River Siphon			Feb	Feb		
Structures and Completion				Aug	May	
Supervisory Control		April				June
Transmission Lines and Substation			Feb	Jan		
Total Lapse Schedule						
Salt-Gila Division	Feb		5 years - 7 months			Sep

1/ Subject to change contingent upon receipt of necessary appropriations by Congress, due to construction economies of scale, or due to unforeseen delays.

drawn down during on-peak hours rather than pumping at a constant daily rate. This ability is reduced considerably, however, as water demands approach the capacity of the aqueduct.

2. Aqueduct

The Salt-Gila Aqueduct would operate under varying flow conditions, both daily and seasonally. Near capacity flows would be expected during the spring and summer months, and during daily off-peak energy demand periods. Medium to low flows would be expected through the fall and winter months. This flow variation does not mean that the aqueduct water surface would fluctuate widely. The depth of water in the aqueduct would be controlled by check gates at various locations along the aqueduct to maintain near constant water surface levels under various flow requirements.

Water deliveries would be scheduled in response to orders from the water users. Some flexibility may exist for making periodic, and in some cases, last minute changes to water orders and delivery schedules, except during periods of disrupted aqueduct service requiring curtailment of some or most water deliveries. Curtailment could result from several uncontrollable occurrences such as extended power outages or equipment failure.

Aqueduct operations would be monitored, coordinated, and directed from the primary O&M facility. The facility would control the operation of the entire CAP water conveyance system through a computer-assisted control system, expected to consist of a central computer and associated communication and remote monitoring equipment.

3. Pumping Plant

The operation of the Salt-Gila Pumping Plant would be coordinated with water deliveries from the Granite Reef Aqueduct, meet water delivery demands along the Salt-Gila Aqueduct, and optimize the use of available off-peak power. Downstream reaches of the aqueduct would be operated to maintain relatively constant water-surface elevations.

4. Transmission Facilities

The operation of the Salt-Gila Aqueduct electrical transmission facilities and the existing transmission system would be performed by Western Area Power Administration personnel on a coordinated basis that would monitor the transmission facilities continuously. Should an adverse situation occur on the aqueduct or transmission system, steps would be taken to minimize any disturbances which may affect the interconnected power system and aqueduct operation. If power for check structures is obtained from local existing distribution lines, operation would be coordinated with the utility that provides the service.

5. Coordination with Water User Entities

Close coordination would be maintained between CAP water user entities and the Salt-Gila Aqueduct operating organization. Regular meetings would be held to discuss CAP water availability, annual user allocations, projected yearly water and power operations, and other pertinent topics. The operating organization would also coordinate with the water user entities to discuss monthly and daily water operations, water delivery scheduling, and a variety of operation and maintenance problems.

6. Communication System

The primary communication control system for the Salt-Gila Aqueduct may require construction of overhead lines or buried cables. A secondary or backup system would be necessary and may require construction of overhead lines or buried cables on an alternate route, or some other communication form such as radio or microwave. Voice-grade communications would be through commercial telephone circuits or radio systems.

K. System Maintenance

1. Aqueduct

The following are expected to be the maintenance activities associated with operating the aqueduct:

1. Daily equipment and security surveillance
2. An approved program of weed prevention and control
3. An approved program of pest control
4. Dust and erosion control
5. Concrete lining maintenance and repair
6. Control structure maintenance and repair
7. Maintenance of operating roads
8. Periodic cleanout of cross drainage structures
9. Maintenance of wildlife mitigation features
10. Maintenance and repair of fencing
11. Maintenance of communication and control systems

Major aqueduct maintenance such as concrete lining repair, check structure maintenance, and trashrack repair or replacement may require short periods of dewatering in an aqueduct section. When possible, these activities will be scheduled during periods of lowest water demands to minimize disruption of service. Personnel would drive and/or fly the aqueduct daily on routine maintenance inspections.

Sediment accumulations in the aqueduct are not expected to be significant, but along with sunlight, could contribute to aquatic moss and algae growth in the aqueduct, impeding efficient waterflow. Aquatic weed growth is expected to be a maintenance problem only in the spring through fall months. Approved chemicals may be used to control or eradicate moss and algae growth in the aqueduct.

Bankline weeds, Russian thistle, and grasses would be burned, mowed, or removed by mechanical means, or sprayed with permissible herbicides, whichever method or methods prove most effective. Blowing weeds would be expected to enter the aqueduct, requiring periodic removal from trashracks or at check structures.

Pesticides may also be used if their use is allowed in an approved pest control program. It is expected that some mosquito and other insect control would be necessary in areas along the aqueduct such as floodwater detention basins. All pest and weed control programs, along with any proposed chemical usages would be subject to coordination with, and review and approval by, the EPA and other appropriate agencies and parties.

Erosion of embankments and retarding structures resulting from storm runoff or wind action would be repaired as required. Wind-blown and waterborne sediments would require periodic removal from the aqueduct to prevent loss of conveyance capacity and to inhibit growth of mollusks such as the Asiatic clam (*Corbicula sp.*). The method of removal could be by dragline or by other specialized equipment compatible with the aqueduct lining. The removed sediments would be disposed of at designated spoil areas under applicable rules and regulations.

Concrete lining maintenance would consist mainly of inspection and cleaning. Repairs to cracks or holes in the lining would be made using commercially available repair materials.

Routine maintenance of check structures and turnouts would include inspection, cleaning, lubricating, and occasional repainting. Repair and overhaul of the operating machinery would be performed as necessary.

2. Pumping Plant

The Salt-Gila Pumping Plant would probably be visited daily by O&M personnel. Maintenance at the plant would consist of periodic inspection and testing of control equipment, dismantling of pumps for inspection, repair or replacement of pump-unit components, cleaning and repair of pump motors, repair of auxiliary equipment, and cleaning and recoating of interior and exterior surfaces of plant equipment and facilities. Replacement of major items such as pump impellers, stator windings, rotor windings, thrust bearings, station service transformers, and motor controls would be performed as necessary.

The slopes around the pumping plant would be planted with native desert vegetation. Security fencing (at least 7 feet (2.1 m) in height) would be installed around the site.

Electrical power to the pumping plant would be provided by above-ground transmission lines. A small domestic filter and treatment facility could be installed at the pumping plant to provide in-plant potable water. Domestic sewage at the plant would be discharged to a septic tank or other acceptable sewage treatment facility.

3. Cross Drainage Facilities

Cross drainage structures would require very little maintenance other than periodic inspections and infrequent cleaning and minor concrete repair. Steel pipe overchutes would be repainted as required. The soil surface of designated wildlife crossings would be restored if disturbed by floodflows.

4. Power and Transmission Facilities

The maintenance of the transmission system would be performed by Western Area Power Administration (WAPA) personnel in the manner and schedule presently employed for the existing Parker-Davis Project system. Monthly surveillance by helicopter of the lines and weekly inspection of the substations would be utilized to determine the type and schedule of maintenance crew work.

Maintenance of distribution facilities to the check structures would be provided by Reclamation, WAPA, or the utility that provides the service.

III. ANALYSIS OF IMPACTS OF PROPOSED ACTION ON EXISTING ENVIRONMENT

III. ANALYSIS OF IMPACTS OF PROPOSED ACTION ON EXISTING ENVIRONMENT

A. Introduction

Chapter III of this statement follows a revised format which should result in a clearer understanding of the problems and benefits associated with the proposal. This chapter, using subheadings by specific areas of interest, includes a description of the present environment, the identified impacts of the proposed action on the present environment, mitigation plans to lessen the impact, and the net effect of the proposal. This should provide the reader with a better understanding of what would be lost or gained by the proposed action. Tables and figures have been extensively used to give the reader an appreciation of the present environment with respect to the proposed action. Chapter IV summarizes the unavoidable adverse impacts that can not be mitigated or reduced.

B. Environmental Quality

1. Esthetics

The changes in scenic quality of the area to be crossed by the Salt-Gila Aqueduct would be of two types--those associated with construction activities and the long-term changes from the presence of the aqueduct and attendant transmission facilities.

The presence of the aqueduct would alter the existing scenic quality of the area. The visual disturbance would vary along the aqueduct alinement, depending upon a number of factors: (1) the scenic quality of the area involved, (2) the extent of existing disturbance of the area from man's activities, (3) the visibility of the proposed feature, depending on its profile, the environmental setting, and location of nearby roads and highways, and (4) the potential number of viewers.

The Salt-Gila Aqueduct would pass through an area of wide valleys and scattered mountains with Sonoran desertscrub vegetation. All areas along the alinement have been disturbed by man's activities, although some to a lesser extent than others. About 40 percent of the aqueduct alinement would parallel existing SCS floodwater retarding structures, and the presence of the aqueduct in those areas would not be highly noticeable because of its low profile. In general, the aqueduct would be most visible where the structures would parallel or cross major roads and where the alinement would cross areas of urban development. Aqueduct-related structures such as retarding structures and transmission lines would be imposed onto an open desert landscape. In some areas these structures would interrupt the line and color of the natural horizon.

To minimize the visual changes caused by such features, all Reclamation proposed dikes would be furrowed and seeded with native or xeric adapted species. In addition, areas disturbed by construction would be reshaped and contoured to restore a form more consistent with the preconstruction conditions. The slopes around the Salt-Gila Pumping Plant would be planted with native desert vegetation to beautify and assist in erosion control.

The aqueduct alinement begins at the Salt-Gila Pumping Plant forebay just south of the Salt River Siphon outlet. A low profile plant with buried discharge lines would be constructed to lessen its visual intrusion in this undeveloped area. The northern 6 miles (9.7 km) of Reach 1 would pass through desert terrain west and south of the Usery Mountains. Along this section of the aqueduct, the Spook Hill FRS is under construction by the SCS. This structure will have a maximum height of 25.3 feet (7.7 m) and be visible from Bush Highway (SCS 1976:5).

The aqueduct would pass through several miles of urban area near Apache Junction. The most distinctive land form and the area of highest scenic quality near the alinement is the Superstition Mountain area just east of Apache Junction. Portions of the aqueduct would be visible to travelers approaching this area from the west along Apache Boulevard or the proposed Superstition Freeway. From the proposed freeway south to Queen Creek the aqueduct would again be bounded on the east by existing SCS floodwater retarding structures, and would result in little additional visual intrusion.

The proposed Sonoqui Dike would extend from just north of Queen Creek to the Magma Arizona Railroad, and would be visible from Queen Creek Road, which intersects the aqueduct alinement in this area. South of the railroad, the aqueduct would pass through nearly level desert and agricultural land for approximately 3 miles (4.8 km). The visual change from open desert would be minimal in this area, since the aqueduct would not be skylined and would be visible only from a short distance. Where the aqueduct approaches the vicinity of Florence, the structures would be visible to a greater number of viewers. The aqueduct would follow a ridge for approximately 1 mile (1.6 km) west of its intersection with Highway 80-89, and would be visible from the highway and the nearby subdivisions.

The alinement from the Gila River to the south is parallel to and easterly of the existing Florence-Casa Grande Canal, (San Carlos Project) which has developed considerable vegetation along its eastern bank (see section III.C.1.a. for a discussion of vegetation). This vegetation would tend to screen the aqueduct from view from the west side where the Arizona State Prison facilities are located. The proposed Reclamation retarding structures near the Coolidge-Florence airport would be noticeable from the desert areas to the east.

The proposed Spook Hill Substation would be constructed immediately adjacent to SRP's Thunderstone Substation approximately 7.5 miles (12 km) west of Apache Junction. The transmission line would pass through desert terrain for 1.6 miles (2.6 km) to the aqueduct, then north along the alinement 4.2 miles (6.8 km) to the pumping plant. Portions of the line would be visible from roads and a residential area. The first 1.3 miles (2.1 km) would border a proposed county golf course and 0.7 mile (1.1 km) would pass through a proposed city of Mesa recreation area.

Transmission lines may also be constructed from existing distribution lines to check structures at about 6-mile (9.7 km) intervals along the aqueduct. Lines on the aqueduct right-of way would be buried and lines off the right-of-way would be of overhead construction. The overhead transmission lines would utilize single pole wood or steel structures described in Chapter II.D.4.

The principal change in the esthetic values of the area would be the addition of another man-made feature to the open desert landscape. The construction of the aqueduct, dikes, and transmission facilities would cause visual changes, but whether these changes in scenery are esthetically pleasing or displeasing is a matter of personal preference.

2. <u>Geology and Ground Water</u>

The geologic environment of the Salt-Gila Aqueduct is characterized by deep structural basins filled with alluvial and lacustrine deposits. The basins formed during Late Miocene between 12 to 17 million years ago. As the basins formed they were filled first by lake deposits and later by alluvial fans and deposits by through flowing streams.

Significantly, the basins have a maximum known depth of about 9,000 feet and appear to have been tectonically stable for the past 12 million years. The great thicknesses of alluvial and lacustrine deposits that fill the basins have been subjected to stress by the overdraft of ground water during the past 55 years. Fissures or earth cracks have formed at the land surface in response to the dewatering. Also, the land has subsided over much of the aqueduct service area reaching a maximum of more than 12 feet.

From historical seismic data, earthquakes causing damage to the aqueduct are considered improbable. Seventeen earthquakes with epicentral intensities greater than V and with a maximum intensity of VIII, on the Modified Mercalli Scale, have been recorded since 1880 within 200 miles of the aqueduct.

There are no known ore deposits in bedrock under the alinement and a canal would not preclude prospecting for or developing ore bodies adjacent to the canal.

Geologic hazards such as fissures, subsidence, seismicity, and collapsible soils would be fully considered in the design, construction and operations of the aqueduct.

The overall geologic impact of the aqueduct is positive because it reduces the overdraft of ground water. The rate of occurrence of land subsidence and earth fissuring, which are the primary responses to overdraft, will diminish.

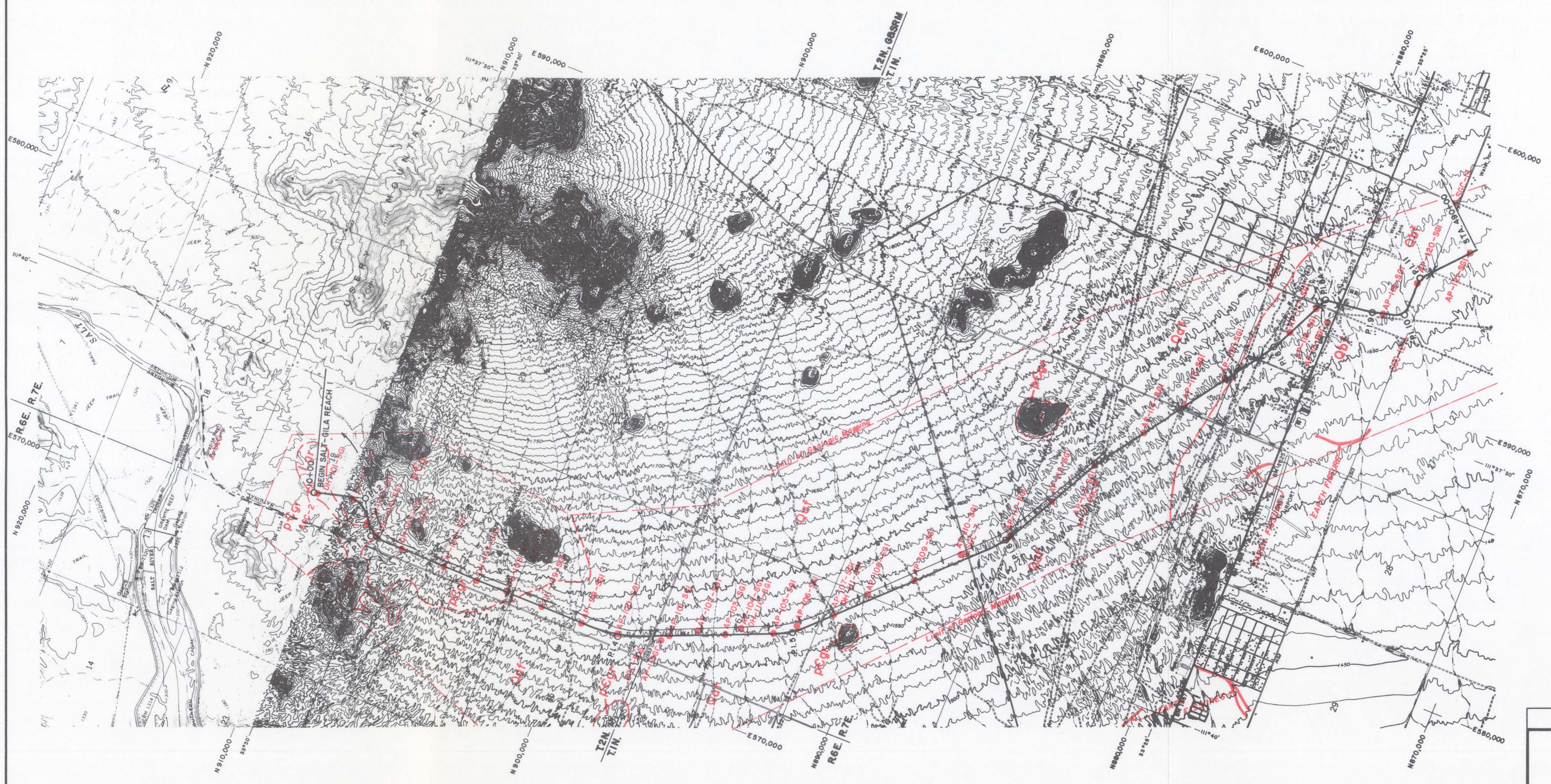
a. Introduction

Significant geological changes occurring within the project area are land subsidence and earth fissures. Both of these changes are related to ground-water level declines produced by heavy pumping. They affect the land use in the service areas of the proposed Salt-Gila Aqueduct and would also affect the design, construction, and operation of the Aqueduct. Even though it is not a specific project objective and will not solve the long-term problem the completion of the Aqueduct and the importation of surface water would reduce the rate of overdraft of groundwater which in turn would reduce the rate of subsidence and frequency of earth fissuring. Other geological factors considered include possible damage to the canal from earthquakes, foundation materials, and the restriction of mining within the right-of-way.

Investigations of geology and ground-water occurrence in the central Arizona basins include studies by the Bureau of Reclamation and the Geological Survey over the past 30 years. Currently the USBR and USGS are jointly conducting a major study of land subsidence and earth fissuring in the area of the aqueduct. The objectives of the study are to estimate the amount of future subsidence and to outline the areas subject to earth fissuring. These studies include 27 deep test holes drilled to depths ranging from 500 to 2,000 feet (152 to 610 m), about 57 miles (85 km) of seismic surveys and other geophysical measurements, and construction of a deep, high capacity production well to perform an aquifer stress test. These investigations are mostly complete and were successful in achieving their objectives. Shallow test drilling to obtain foundation data was done during feasibility and preconstruction stages. Locations of the above test holes are shown on Figures 34 through 40.

b. Geologic Setting

The proposed Salt-Gila Aqueduct alinement is along the eastern margins of two deep, elongated basins located within the Basin and Range Physiographic Province (Fenneman 1930). In the vicinity of the aqueduct, which is near the eastern edge of the province, the elevation ranges from 1,430 feet (436 m) to 5,130 feet (1564 m) above mean sea level. The basins are broad and nearly flat, but rise gently toward the adjacent mountains. The Salt, Gila, and Santa Cruz Rivers drain the area. These rivers experience periodic flows throughout their length



NOTES

Arizona state plane coordinates system, central zone.

***Base Map** is a composite of U.S.G.S. $7\frac{1}{2}$ minute quadrangle sheets Granite Reef Dam, Buckhorn, and Apache Junction, Ariz.*

Reference Drawing

For Geologic Legend, Explanation and Notes see Drawing No. 344-330-2387.

2000 0 2000 4000 6000
SCALE OF FEET

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

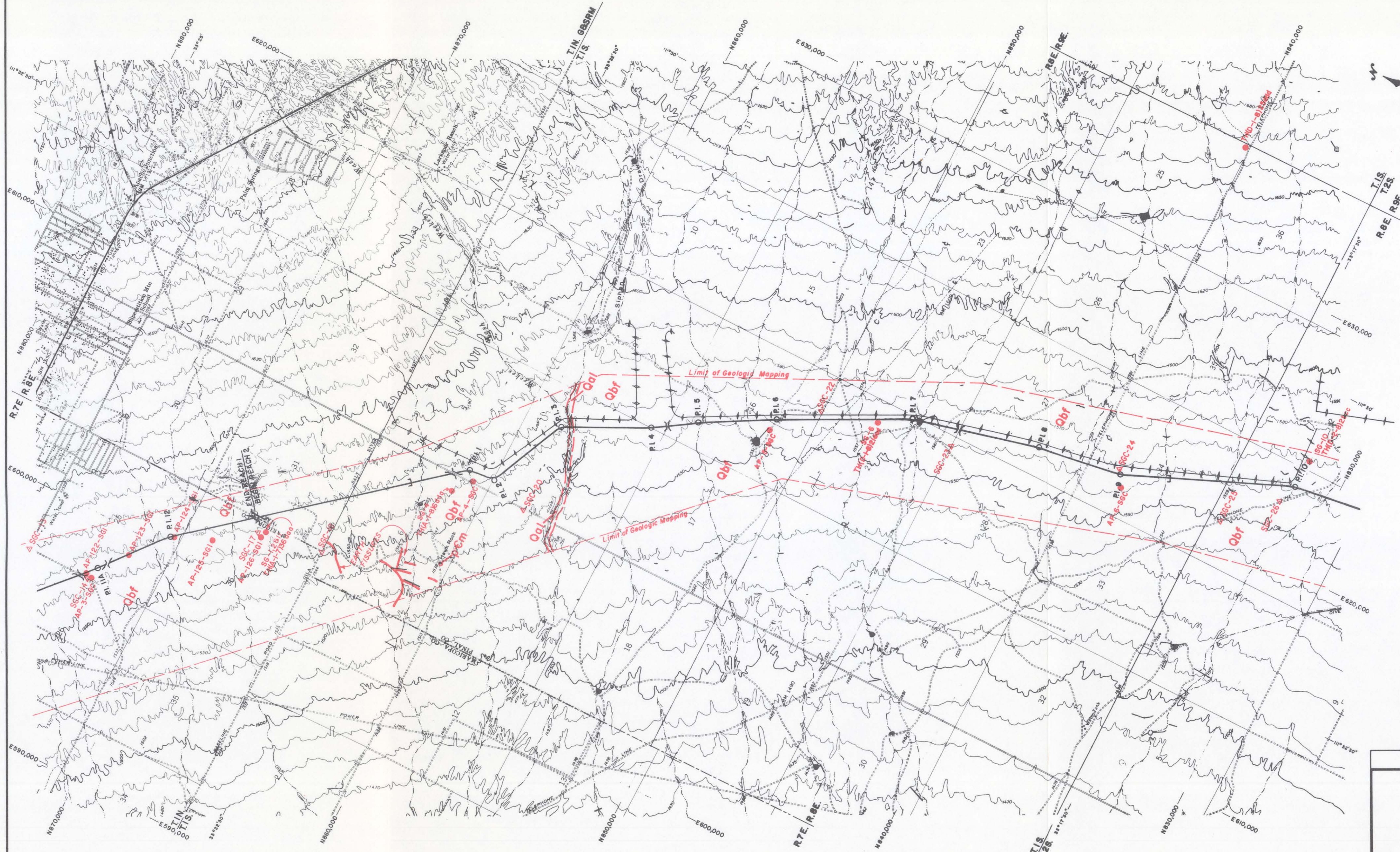
SALT - GILA AQUEDUCT

GEOLOGY

EARTH FISSURES AND SUBSIDENCE

DESIGNED Richard H Raymond | SUBMITTED Paul D. Wold
DRAWN HFJ | RECOMMENDED
CHECKED Richard H Raymond | APPROVED

PHOENIX, ARIZONA
SHEET 1 OF 6
JUNE 1977
344-330-2107



NOTES

Arizona state plane coordinates system, central zone.

Base Map is a composite of U.S.G.S. 7½ minute quadrangle sheets Apache Junction, Desert Well, and Superstition Mts. SW, Ariz.

Reference Drawing

For Geologic Legend, Explanation and Notes see Drawing No. 344-330-2387.

2000 0 2000 4000 6000
SCALE OF FEET

ALWAYS THINK SAFETY

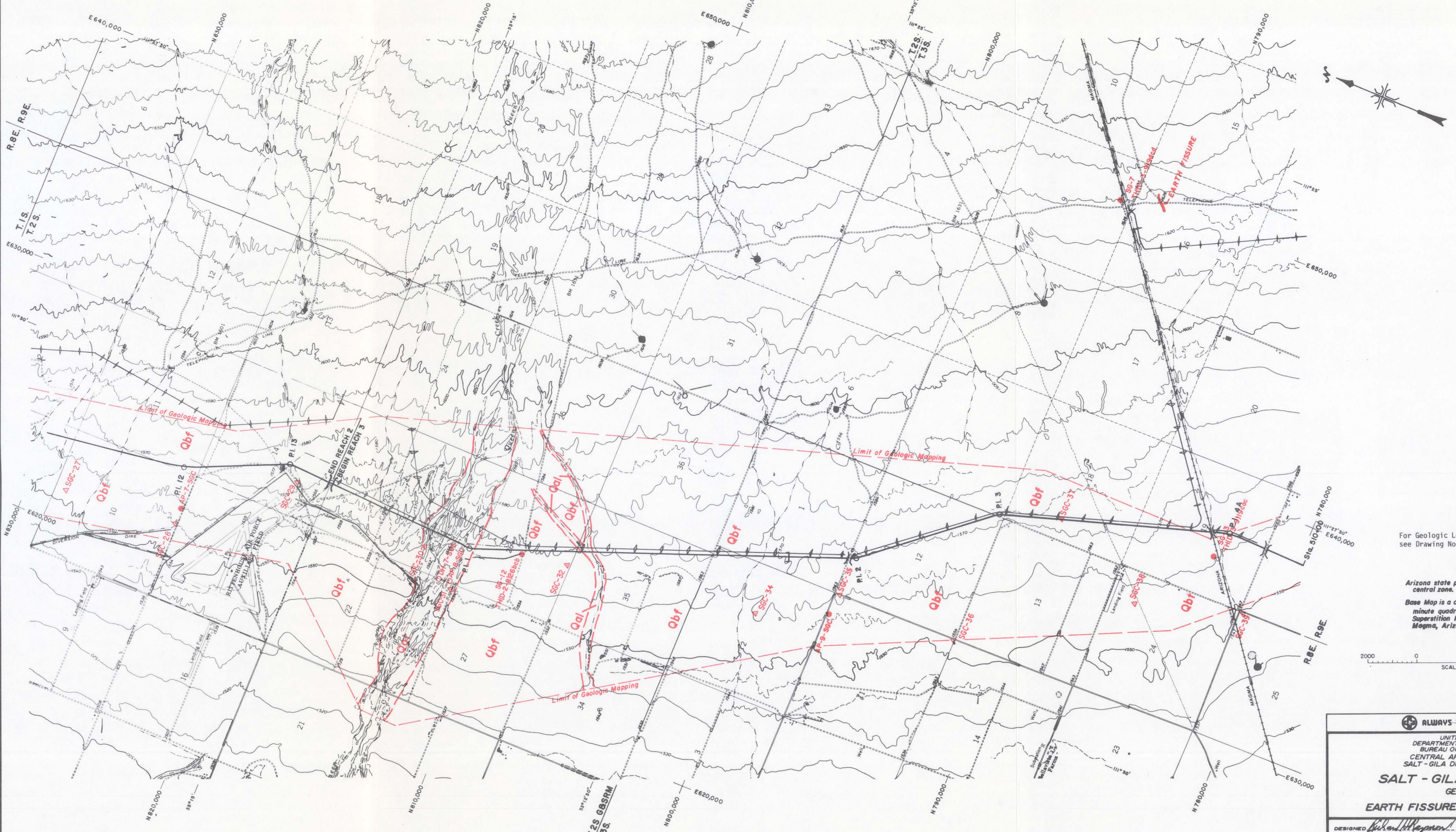
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT
GEOLOGY

EARTH FISSURES AND SUBSIDENCE

DESIGNED Richard H. Raymond SUBMITTED Paul D. Wold
DRAWN HPJ RECOMMENDED
CHECKED Richard H. Raymond APPROVED

PHOENIX, ARIZONA SHEET 2 OF 6 JUNE 1977 344-330-2108



Reference Drawing

For Geologic Legend, Explanation and Notes see Drawing No. 344-330-2387.

NOTES

Arizona state plane coordinate system, central zone.

Base Map is a composite of U.S.G.S. $7\frac{1}{2}$ minute quadrangle sheets Desert Well, Superstition Mts. SW, Sacaton NE, and Magma, Arizona.

2000 0 2000 4000 6000
SCALE OF FEET

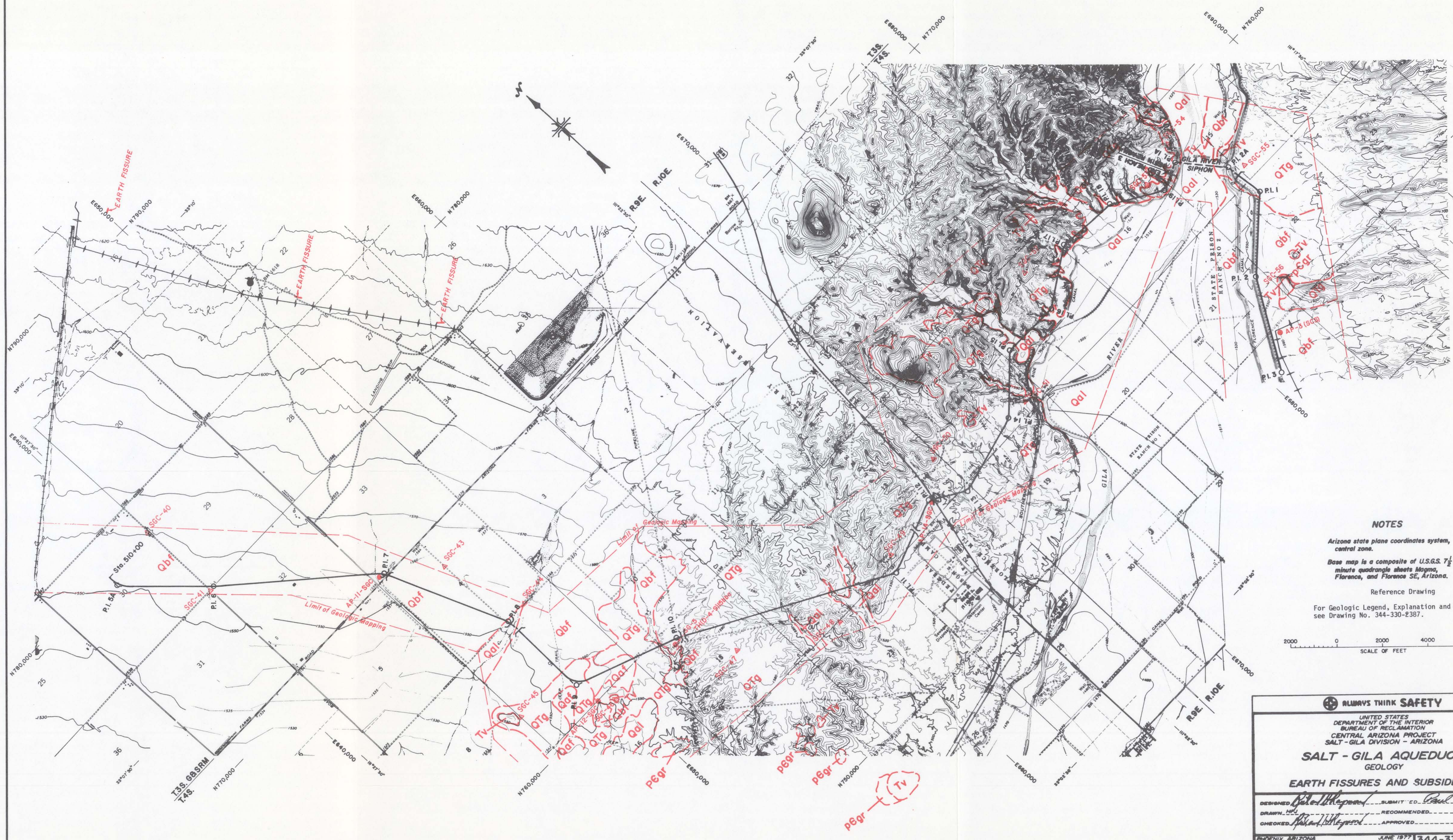
ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT
GEOLOGY
EARTH FISSURES AND SUBSIDENCE

DESIGNED Richard H. Raymond SUBMITTED Paul D. Wold
DRAWN HFJ RECOMMENDED
CHECKED Richard H. Raymond APPROVED

PHOENIX, ARIZONA SHEET 3 OF 6 JUNE 1977 344-330-2109



NOTES

Arizona state plane coordinates system, central zone.

Base map is a composite of U.S.G.S. $7\frac{1}{2}$ minute quadrangle sheets Magma, Florence, and Florence SE, Arizona.

Reference Drawing

For Geologic Legend, Explanation and Notes see Drawing No. 344-330-2387.

2000 0 2000 4000 6000
SCALE OF FEET

ALWAYS THINK SAFETY

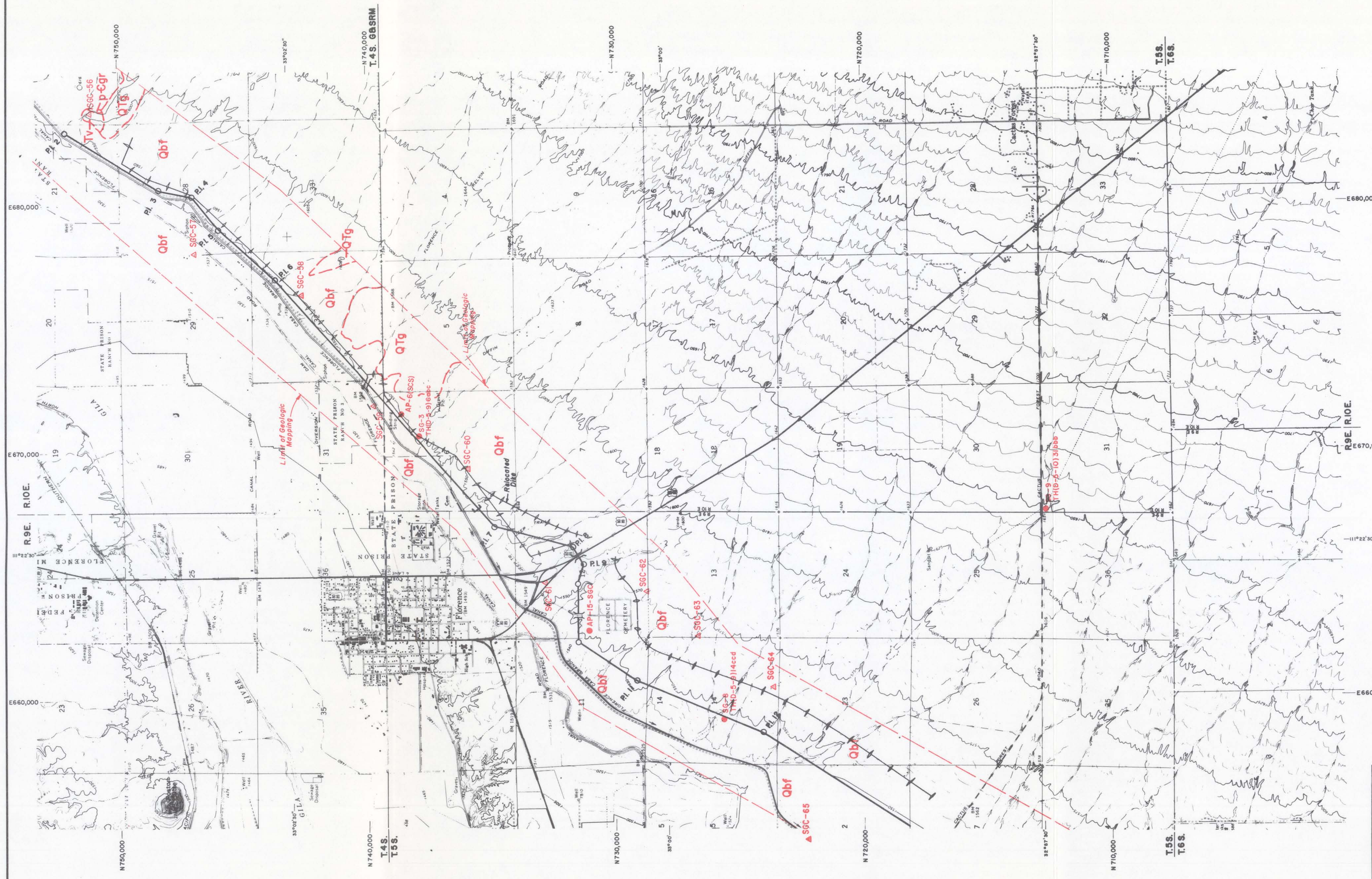
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT
GEOLOGY

EARTH FISSURES AND SUBSIDENCE

DESIGNED Robert H. Raymond SUBMITTED Paul D. Wold
DRAWN HFJ RECOMMENDED
CHECKED Richard H. Raymond APPROVED

PHOENIX, ARIZONA SHEET 4 OF 6 JUNE 1977 344-330-2110



NOTES

Arizona state plane coordinates system, central zone.

Base Map is a composite of U.S.G.S. 7½ minute quadrangle sheets Florence, Florence SE, and Valley Farms, Arizona.

Reference Drawing

For Geologic Legend, Explanation and Notes see Drawing No. 344-330-2387.

2000 0 2000 4000 6000

SCALE OF FEET

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

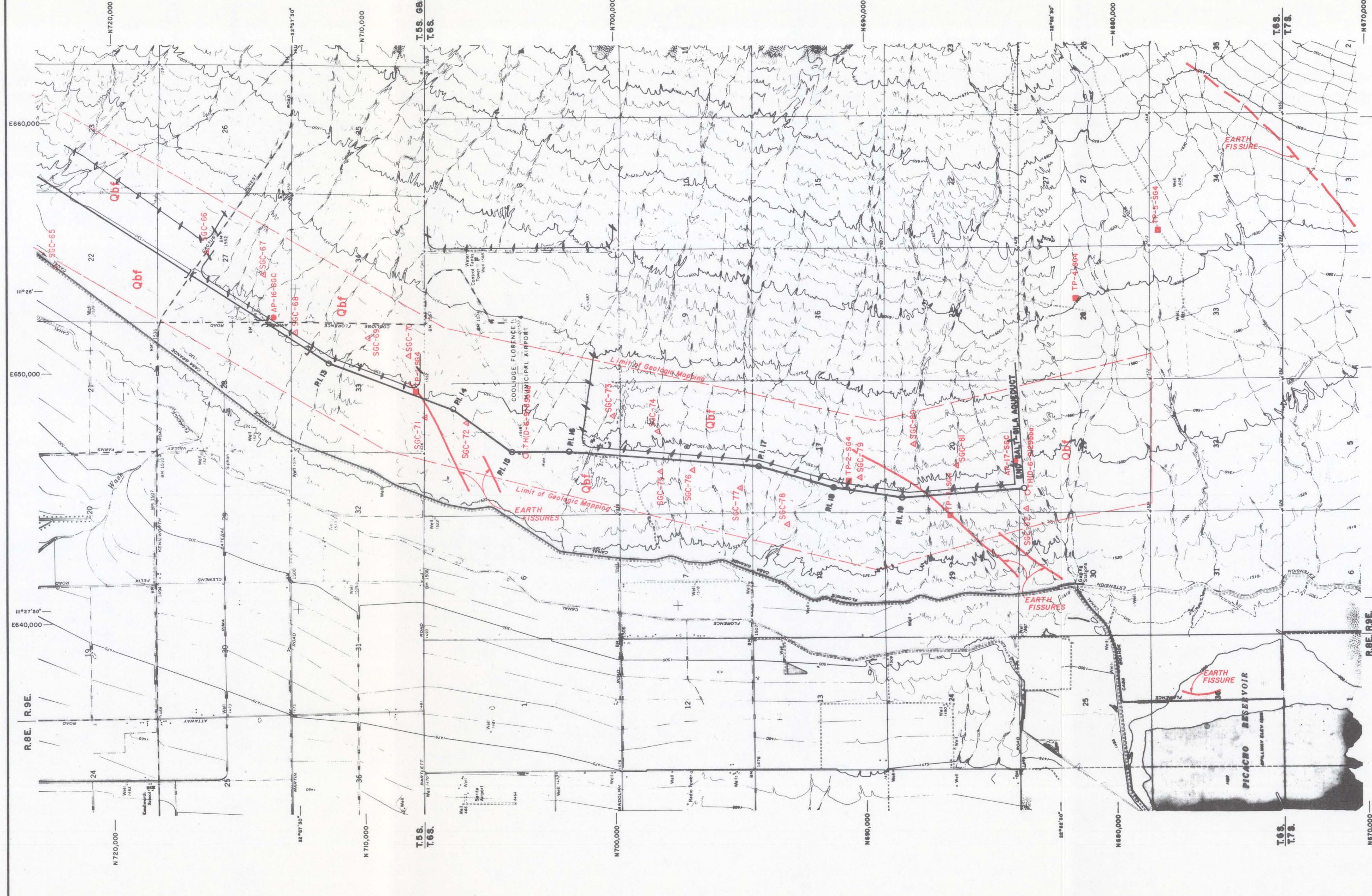
SALT - GILA AQUEDUCT

GEOLOGY

EARTH FISSURES AND SUBSIDENCE

DESIGNED ____ SUBMITTED ____
DRAWN HFJ RECOMMENDED ____
CHECKED ____ APPROVED ____

PHOENIX, ARIZONA JUNE 1977 SHEET 5 OF 6 344-330-2111



NOTES

Arizona state plane coordinate system, central zone.

Base map is a composite of the U.S.G.S. 7.5 minute quadrangle sheets, Valley Farms and Picacho Reservoir, Arizona.

Reference Drawing

For Geologic Legend, Explanation and Notes see Drawing No. 344-330-2387.

2000 0 2000 4000 6000
SCALE OF FEET

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT - GILA DIVISION - ARIZONA

SALT - GILA AQUEDUCT

GEOLOGY

EARTH FISSURES AND SUBSIDENCE

DESIGNED Richard H. Raymond	SUBMITTED Paul D. Wold
DRAWN HFJ	RECOMMENDED
CHECKED Richard H. Raymond	APPROVED
PHOENIX, ARIZONA JUNE 1977 SHEET 6 OF 6	344-330-2112

(40)

EXPLANATION

GEOLOGIC UNITS

Quaternary

Qal — ALLUVIUM: Channel deposits; unconsolidated to compact; lenticular; coarse to fine, subangular to subrounded, clean to silty sand; containing lenses of coarse to fine, subrounded to rounded, hard gravel including occasional cobbles and boulders.

Qbf — BASIN FILL DEPOSITS: Unconsolidated to moderately caliche cemented; lenticular; mostly fine silty sand and sandy to clayey silt with minor lenses of silty mostly fine, hard gravel; may include a thin veneer of loose silty to clean sand and scattered fine gravel across the surface or in developed drainages.

Qaf — ALLUVIAL FAN DEPOSITS: Unconsolidated to strongly caliche cemented; lenticular; coarse to fine, silty to clean sand with smaller amounts of coarse to fine silty gravel, scattered cobbles and boulders.

QTg — TERRACE DEPOSITS: Strongly to weakly caliche cemented; lenticular; coarse to fine sand; fine, hard gravel and cobbles of granite, schist, granite gneiss, quartzite, limestone and various volcanic rock types; interbedded zones of caliche cemented silt and fine silty sand; mostly deposited as gravel terraces adjacent to the Gila River flood plain.

Tertiary

Tv — VOLCANIC ROCKS: Undifferentiated volcanic rocks consisting mainly of flows of andesitic to basaltic composition with tuff and agglomerate. Most outcrops are of flow rocks; the tuff and agglomerate are less resistant to erosion and are less well exposed.

Laramide

Lgr — YOUNGER GRANITE: Light gray, hard and dense to soft and friable in severely weathered zones; lightly to heavily stained by iron oxides; fine to coarse grained, gneissic to granitic texture; irregularly spaced joints and fractures.

PreCambrian

p€m — QUARTZITE: Light gray; hard and dense, fractured and sheared quartzose rock; occurs as two small isolated outcrops collectively known as Hawk Rock.

p€gr — PRECAMBRIAN GRANITE: Gray; hard and dense to soft and friable in severely weathered zones and locally decomposed to depths as great as 19 feet; mostly coarse grained, porphyritic, phenocrysts of feldspar up to 3 inches long; massive to blocky; moderately to closely spaced joints and fractures, many filled by calcite, caliche cement or iron oxides; occasionally covered by veneer of fine clean to silty sand.

SYMBOLS

Symbol	Meaning
— — —	Approximate contact between geologic units.
△ SGC-2	Horizontal and vertical control point.
● DH-102-SG1 or SG-10	Drill hole
● AP-101-SG1	Auger hole
● TH(D-2-8)-2bcc	Test hole
○ TH(D-6-9) 5bda	Proposed test hole
■ TP-2-SG4	Test pit

NOTES

Arizona state plane coordinates, central zone.

Complete Tabulation of Bench Marks as shown on Drawings 344-330-2104 and 2105.

Reference Drawings

For Geology see Drawing Nos. 344-330-2107 through 344-330-2112.

GEOLOGY BY Richard H Raymond DATE 5/31/78

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT

GEOLOGIC LEGEND, EXPLANATION, AND NOTES

GEOLOGY Richard H Raymond SUBMITTED Paul D. Wold
DRAWN JMV RECOMMENDED
CHECKED Richard H Raymond APPROVED

PHOENIX, ARIZONA MAY 31, 1978 344-330-2387 induced by natural runoff, and in some areas, such as the Santa Cruz River south of Tucson, flow continuously due to effluent discharges. Short reaches of each of these rivers are also wet from time-to-time as a result of irrigation return flows. However, the riverbeds are generally dry within the basins because river water is diverted into canals before reaching the basins. Typically, the Basin and Range Province is characterized by a series of mountains with intervening basins. These physiographic forms reflect tilting of large blocks of the earth's crust and later crustal downfaulting. The basins contain a thick accumulation of sediments and some volcanic rocks.

The last 53 million years of geologic history in central Arizona has been reconstructed by radio-active isotope dating of volcanic rocks by Damon (1964, 1966, 1968, 1970), Damon and Biekerman (1964), Damon and others (1973), and Eberly and Stanley (1978); and by studies of the sediments by Cooley (1973 a and b), and Pierce (1972, 1974, 1976).

Mountain building during these 53 million years took place in two stages. In the first stage the crust was faulted and tilted with accompanying volcanism. In the second stage, which ended about 10.5 to 6 million years ago, the present day basins and ranges were formed by high angle, large displacement block faulting, which was also accompanied by volcanism. The gravity map on Figure 41 shows the configuration of the basins.

Sediments accumulated in the basins that were formed by the crustal deformations. The complex stratigraphy of the sediments of the basins have been divided into two major units, an older and a younger.

The older (lower) unit contains consolidated sediments with volcanics, all of which were deposited in broad interior depressions formed prior to the second stage of deformation. Deposition of the younger (upper) unit began after the second stage of deformation and can be divided into two subunits. The lower subunit was deposited when the basins were closed and drainage was internal and they typically contained thick playa deposits of silt, clay, and sand with evaporite deposits of anhydrite, gypsum, and halite. Nearly 6,000 feet (1830 m) of anhydrite was penetrated by a well in the Eloy Picacho Basin. Coarse grained alluvium also accumulated in fans that surround and interfinger with the playa and evaporite deposits. This pattern of basin fill deposition continued until some time between 10.5 and 6 million years ago when surface levels were reached that permitted through flowing drainage.

From the time through flowing drainage was developed to the present, sedimentation in the basins has been principally in the form of coalescing alluvial fans. The alluvium is typically coarse-grained near the mountains grading to fine-grained toward the center of the basins. Through flowing streams also deposited coarse-grained deposits into the finer-grained basin fill.

The upper unit contains the principal aquifers of central Arizona where water has accumulated over thousands of years. The aquifers of the upper subunit are generally unconfined to semiconfined. In the lower subunit the aquifers are semiconfined to locally confined.

c. Ground-Water Occurrence and Development

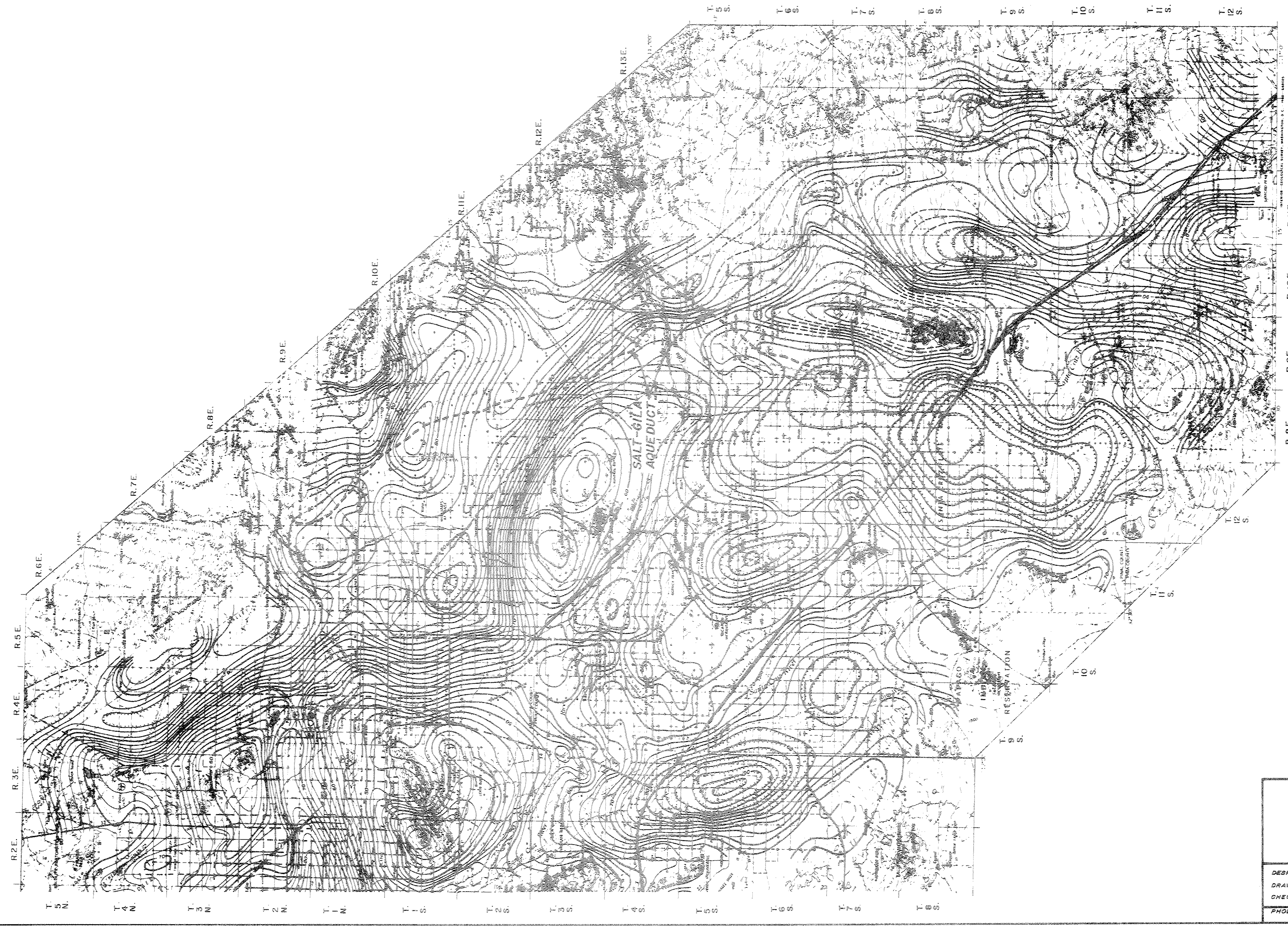
Large amounts of ground-water are pumped yearly from the basins in the service areas of the proposed Salt-Gila Aqueduct and constitute a large portion of the total water supply for the area. Pumping of ground-water exceeds recharge which has resulted in lowering of the water table.

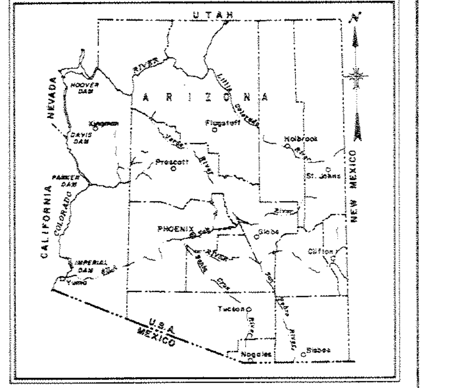
Ground-water occurs mainly in the basin sediments and is contained in the pores between sediment grains. The surrounding mountains contain little ground-water and form an effective barrier to water flow. Although the basin deposits are at least 9,000 feet (2744 m) thick in the Salt River Valley and Santa Cruz Basins adjacent to the aqueduct, the major usable ground water is in the upper 1,200 feet (366 m) of the deposits (Laney, et al. 1978b, Cooley 1973, a and b). Below this depth several factors limit the production of useable water. The finer-grained deposits at depth under much of the basins are less productive and contain in places high concentrations of salts (USBR 1976b, Hardt and Cattany 1965, Hardt et al. 1964, Anderson 1968). Pumping costs also increase with depth (USBR 1976b). Recharge is believed to be mainly from irrigation and return flows and leakage from irrigation canals and ditches with minor amounts from sporadic flows in the Salt, Gila, and Santa Cruz Rivers, and the many small gullies and washes in the area (USBR 1976b).

Based on data from 1952 to 1964 (USBR 1976b) an overdraft of ground-water of 768,000 acre-feet (947 million cubic meters) per year occurred in the Eloy-Coolidge and the Paradise Valley-Chandler-Queen Creek subareas. These subareas include the aqueduct service areas and the eastern Phoenix suburbs. Annual pumpage was estimated to be 1.33 million acre-feet, (1.64 billion cubic meters) and the annual recharge was 562,000 acre-feet, (693 million cubic meters).

The ground-water level is dropping 3 to 8 feet (0.9 to 2.4 m) per year in the service areas (Laney 1976). The blue contours on Figure 42 show the amount of decline in the ground-water level between 1923, the date of the first available depth to water map of the area (Anderson 1968), and 1976 for the northern portion of the figure and 1977 for the southern portion. Figure 42 indicates that by 1978 the ground-water level had declined over 200 feet (61 m) in much of the area and locally over 450 feet (137 m). Depth to water from ground surface in 1976 ranged generally from over 100 feet to over 500 feet (30+ to 152+ m).

Importation of surface water through the aqueduct would supplement ground-water use, would reduce or stabilize the pumpage and





LOCATION MAP

NOTE

Base from U.S. Geological Survey, Geophysical Investigations Map GP-615 published 1968.

4 0 4 8 12

SCALE OF MILES

CONTOUR INTERVAL 200 FEET
GRAVITY CONTOUR INTERVAL 2 MILLIGALS

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT

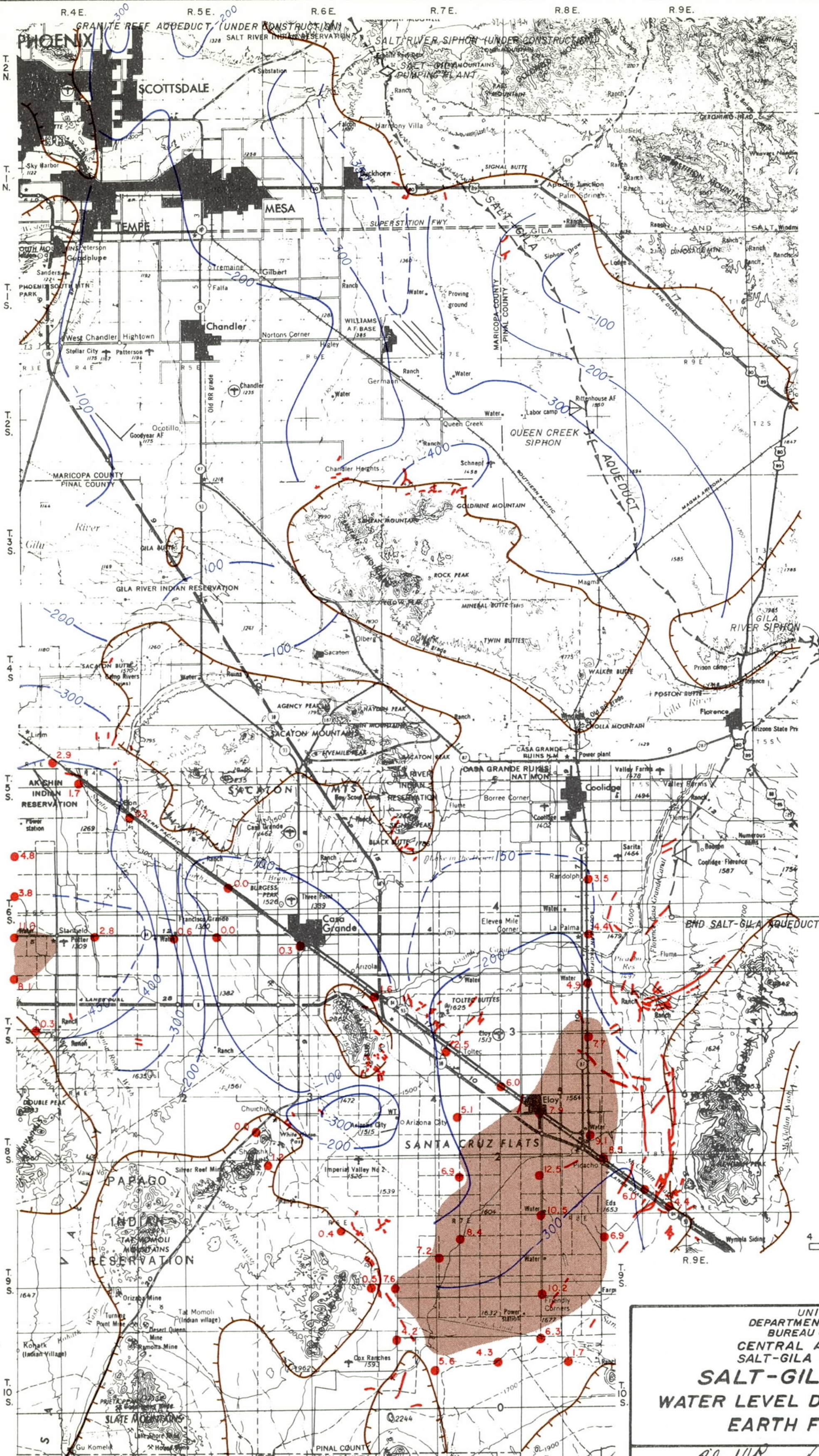
GEOLOGY

BOUGUER GRAVITY MAP

DESIGNED [signature] SUBMITTED [signature]
DRAWN [signature] RECOMMENDED
CHECKED [signature] APPROVED

PHOENIX, ARIZONA JAN. 6, 1978
SHEET OF

344-330-2241



EXPLANATION

Approximate boundary of main water bearing unit.

—100— Contour of water level decline 1923 to 1976-77.

7.9 Representative subsidence in feet 1954 to 1977.

Generalized location of earth fissures.

This area represents subsidence greater than 7 feet.

NOTE

Data from U.S. Geological Survey, U.S. Bureau of Reclamation and Arizona Department of Transportation, 1978.

4 0 4 8

SCALE OF MILES

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
WATER LEVEL DECLINE 1923-1976, 1977
EARTH FISSURES 1977

GEOLOGY *Roland H. Raymond*	SUBMITTED *Paul D. Wold*
DRAWN R.M.G.	RECOMMENDED
CHECKED *Roland H. Raymond*	APPROVED
PHOENIX, ARIZONA APRIL, 1978	344-330-2315

thus reduce the decline of, or in some areas stabilize the water table in the service area. Computer model projections by the Arizona Water Commission (1978a) indicate that the overall effect of the aqueduct would stabilize or raise the water table in some of the service area and reduce the total decline in the water table over the life of the project.

d. <u>Impacts Related to Ground-Water Development</u>

Water level declines caused by overdraft of ground water have produced two significant impacts on the geology: (1) land subsidence, and (2) earth fissures.

The Bureau of Reclamation and the Geological Survey, by memorandum of agreement, began an investigation in 1977 to estimate the amount of subsidence and delineate the areas subject to earth fissuring along the proposed aqueduct alinement. The study includes drilling of test holes for the installation of compaction and water level recorders, for pump-out water testing, and to obtain core samples for laboratory consolidometer testing. Also included are surface and borehole geophysical surveys to determine bedrock configuration and types and characteristics of alluvial material. While the dimensions of the mountains are obvious, it requires geophysical investigative techniques and deep test drilling to determine subsurface configuration of the basins.

(1) <u>Land Subsidence</u>

Land subsidence caused by overdraft of the ground water has occurred in the vicinity of the aqueduct and service areas. This land subsidence, also known as deep subsidence as opposed to shallow subsidence or hydrocompaction, is a slow regional process. It results in a downward change in the basins' base level relative to the mountains causing an increase in slopes and gradients. The increased gradients cause accelerated headward erosion of gullies and washes. The subsidence has altered the gradients in distribution systems and irrigated fields and has caused the collapse of well casings (Schumann and Poland 1970).

Extensive resurveying of the southern part of the aqueduct service area in Pinal County in 1977 by the Geological Survey shows that an area of over 100 square miles (Figure 42) had subsided more than 7 feet (2.1 m) since 1952 and that one point south of Eloy had subsided 12.5 feet (3.8 m). Recent resurveying has not been done for the northern part of the service area in eastern Maricopa County and therefore the current extent of subsidence is unknown. The last resurvey in 1967 showed the greatest subsidence in this area was 3.8 feet (1.1 m) at a benchmark near Queen Creek (Elliot 1969). However, in 1968 two depressions of the ground-water table roughly corresponded to two centers of subsidence (USBR 1976). Water level measurements by the Geological Survey in 1976 indicate that these water table depressions have merged and more general deepening of the water level has occurred (Laney et al 1978). Because of this water level decline, subsidence is expected to have also increased and become more general in this area.

The mechanics by which dewatering of unconfined and confined aquifers causes subsidence are discussed at length by Poland and others (1975). In general, it occurs as a result of soil consolidation due to the loss of bouyancy as water is removed from unconfined aquifers and by vertical seepage stress as water is removed from confined aquifers. Ground-water is stored in central Arizona basins under confined, semiconfined, and unconfined conditions, and therefore, both mechanisms apply to a degree. Subsidence occurs in direct ratio to water level decline and has been reported by Poland and others (1975); Schumann and Poland (1970), Winikka, (1964), Winikka and Wold, (1976). Water level declines together with subsidence are shown on Figure 42.

Subsidence/water level or head decline ratios, and amounts and rates of subsidence vary considerably from place to place in central Arizona. These ratios depend on, among other things, the type and thickness of compactible materials, permeability of materials, bedding relationship of compactible materials to permeable materials, and whether the aquifer is confined or unconfined.

The consolidation of sediments directly affects the storage capability of the aquifer. After consolidation the sediments have less storage capacity than before consolidation. The volume of the consolidation is equal to the volume of lost water storage capacity. The subsidence in the Eloy area represents over a million acre-feet (billion cubic meters) of lost aquifer water holding capability (Winikka et al. 1978).

Benchmarks, established in 1971 along the proposed aqueduct alinement (for locations see Figures 34 through 40), have been resurveyed yearly (Figures 43 and 44). The resurveys indicate subsidence occurs in three areas along the aqueduct. The maximum amount of subsidence measured is about 1.2 feet (0.37 m) south of Apache Junction, about 0.5 feet (0.15 m) near Queen Creek, and about 0.5 feet (0.15 m) at the south end of the alinement near Picacho Reservoir. The subsiding areas form gentle downwarps of the land surface without abrupt changes in slope.

Post construction subsidence along the aqueduct would locally change the invert gradient of the canal causing local sags in the canal and allowing water to overflow. Design and construction practices have been developed in subsiding areas outside of Arizona to overcome the effect of subsidence and prevent overflow. These, in effect, deepen the canal (add freeboard) so that the water surface will always have the desired gradient, regardless of the gradient of the canal bottom. The operating water levels in the canal in the area around Apache Junction would be placed several feet below the natural ground surface. This would provide for a like amount of future subsidence. Also, additional freeboard in the form of higher canal lining can be added to the canal wherever and whenever additional subsidence may occur. Since deep subsidence is a gradual phenomenon and dependent on the amount of future ground-water decline, the greatest economy will be to provide freeboard for only part of the maximum subsidence during construction, and later raise the lining.

Subsidence in the vicinity of the aqueduct has been investigated by the Bureau of Reclamation and Geological Survey in order to estimate the amount and location of possible future subsidence as a function of water level decline. Three independent methods were used to estimate subsidence: (1) representative cores were tested for consolidation, (2) subsidence - water or head decline ratios from areas determined to be similar to the aqueduct area were compared, and (3) the reaction of a compaction recorder which penetrates the entire alluvial section to aquifer stressing was monitored. These methods are each used in conjunction with detailed studies of the alluvium and its aquifers to project future subsidence along the aqueduct alinement.

The impact of importation of surface water through the aqueduct on subsidence would be positive. By importing surface water to supplement ground-water use, ground-water overdraft would be reduced or locally stopped, which would reduce water table declines, which in turn would slow the rate of subsidence.

(2) <u>Earth Fissures</u>

Earth fissures or cracks in the alluvium of basins that have experienced large water level declines, occur on the margins of the basins adjacent of the Salt-Gila Aqueduct alinement. They range in length from several tens of feet to over eight miles (12.8 km) and are commonly first seen after heavy rains (Peterson 1962, Robinson and Peterson 1962). The fissures themselves are only a fraction of an inch wide (Schumann and Poland 1970, Laney 1976, Winikka and Wold 1976) but may be hundreds of feet deep (Holzer 1976). With the application of irrigation water or after a rainstorm the fissures intercept surface water flows and act as drains as shown on Figure 45. Water flowing into the fissures sometimes causes them to erode rapidly giving them a gully-like appearance (Kam 1965). The gullies are commonly as much as 10 feet (3 m) wide, by 10 feet (3 m) deep, and over a 1,000 feet (305 m) long. Typical fissures are shown in Figures 45 through 51. Some fissures continue to open after their first appearance while others become dormant and fill in with debris (Boling and Carpenter 1978). They have not been observed in crystalline rock.

The first reported earth fissure in central Arizona was found in 1927 (Leonard, 1929). By the 1950's and early 1960's fissures had become common in several areas along the margins of the basins. For a time in the late 1960's and early 1970's a few new earth fissures were reported. From 1976 to 1978, however, new fissures have been discovered and old ones have lengthened and become more complex.

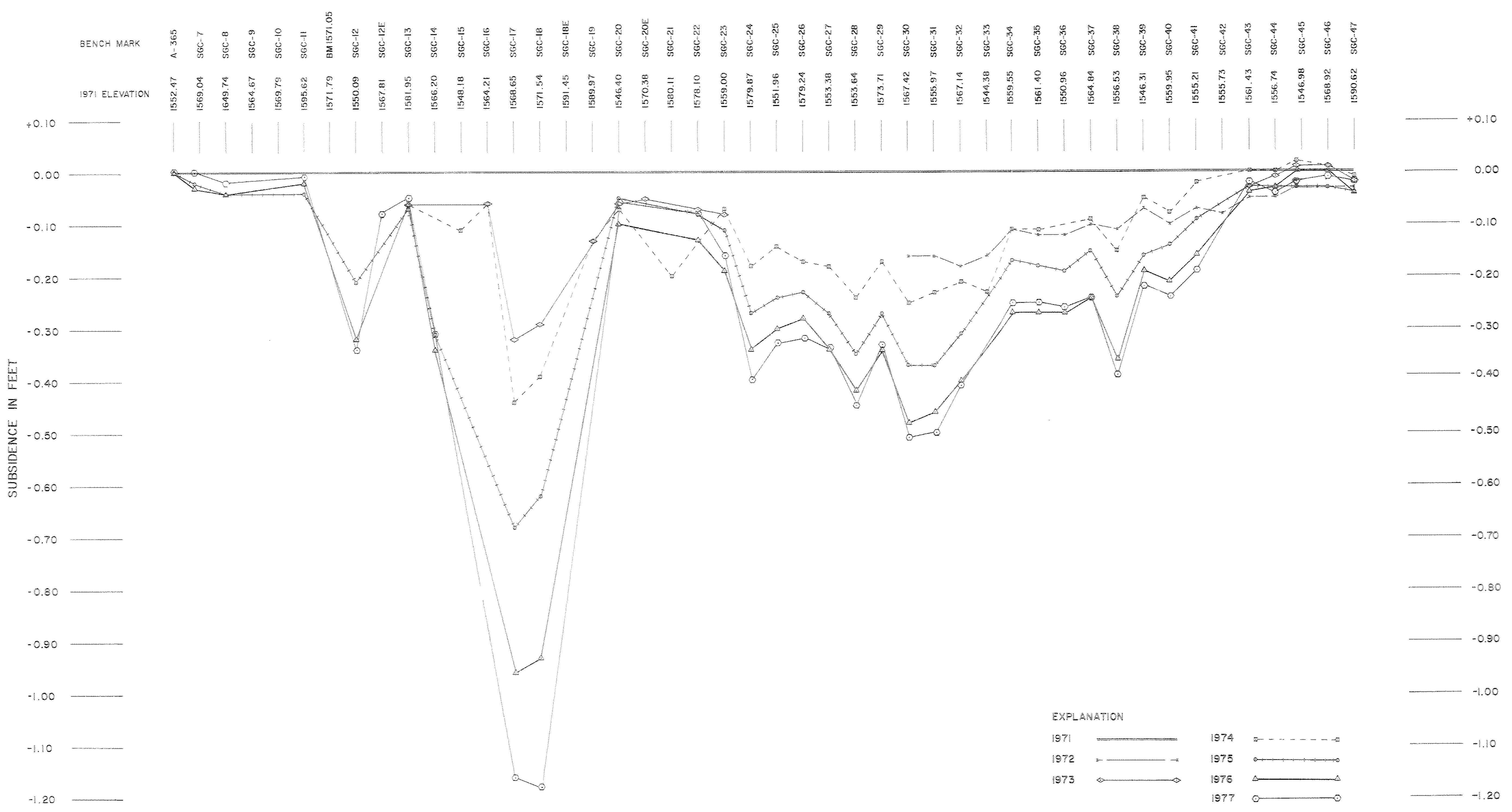
The exact mechanism that produces fissures is speculative, but the association of fissures with areas of large water-level declines in alluvial basins in southern Arizona is clear (Schumann and Poland 1970, Winikka and Wold 1976, Laney et al. 1978a). The new fissures often have sharp edges and exhibit no evidence of lateral movement and appear to be tensional breaks (Heindl and Feth 1955, Schumann and Poland 1970). The trends of many of the fissures conform to zones of steep gravity gradients that may reflect buried fault scarps along the perifery of the subsiding basin. The movement appears to be simple horizontal separation of the landblocks on either side of the break; thus, as suggested by Heindl and Feth (1955), the fissures are believed to be tensional breaks (Schumann and Poland 1970).

A few fissures have developed vertical displacements. The most notable of these is the Picacho fissure which is about 8 miles (12.8 km) long and is located along the northwest side of the Picacho Mountains and south of the terminus of the Salt-Gila Aqueduct. It has developed a maximum local vertical offset of about 1.5 feet (0.46 m) (Peterson 1962, Winikka 1964, Winikka and Wold 1976, Holzer 1976, Holzer and Davis 1976).

It has also been speculated that the Picacho fissure (about 8 miles (12.8 km) south of the aqueduct) is coincident with a tectonic fault and that the vertical offset on the fissure is along the pre-existing fault plane (Holzer, 1976 and 1978). However, the mechanism producing the vertical offset is aseismic (nonearthquake) and is related to ground-water withdrawal.

The Water Resources Division of the Geological Survey and the Bureau of Reclamation began a joint investigation in 1977 to forecast subsidence and identify areas subject to earth-fissure formation. Preliminary results of this study show that earth fissures often form in distinct geological regimes that can be identified by geophysical techniques including seismic and gravity surveys. Two distinct but related geological regimes have been identified using these geophysical techniques.

In one regime, most fissures for which subsurface information is available formed in the unconsolidated basin alluvium over narrow rock protuberances (see a. in Figure 52). These fissures are near the margins of the basins in which substantial ground-water declines have occurred. Most of the fissures are in areas where the thickness of the alluvium is less than 1,000 feet. The relationship between fissure locations and hard-rock protuberances found in this study confirms the conclusions of Robison and Peterson (1962), Schumann and Poland (1970), Anderson (1973), Jennings (1977), and unpublished work by the Army Map Service in 1968. Similar results have been determined by an independent study conducted in 1978 by the Geologic Division of the Geological Survey (Jachens, written commun., 1979).



NOTES:

1. The horizontal component of this graph is dimensionless, therefore there is no direct relationship between vertical displacement and horizontal distance to be interpreted from this graph.

2. Bench marks not leveled to in suceeding years (such as SGC-16) indicate that said marks were destroyed or unrecoverable.

3. Accuracy is approximately ± 0.02 ft.

4. Location of Bench Marks shown on Dwgs. 344-330-2107 thru 2112.

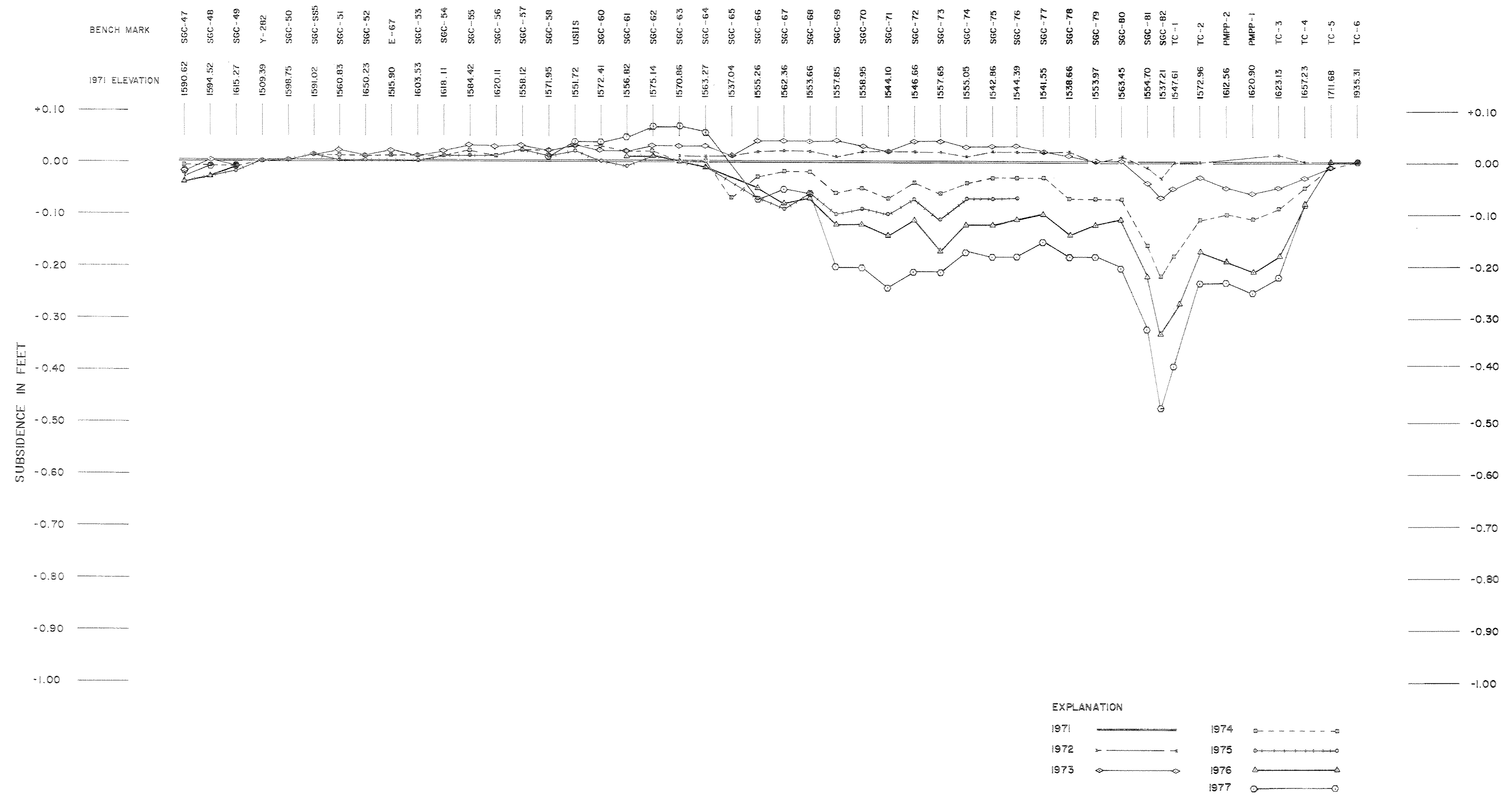
Rev. 2-3-78

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION - ARIZONA

SALT-GILA AQUEDUCT
SUBSIDENCE DETECTION LEVELING
BUSH HIGHWAY TO SGC-47
1971-1976

DESIGNED Richard H. Raymond SUBMITTED Paul D. Wold
DRAWN D.P.V. RECOMMENDED
CHECKED Richard H. Raymond APPROVED

PHOENIX, ARIZONA SHEET 1 OF 2 OCT. 6, 1977 344-330-2104



NOTES:

For Notes see Drawing No. 344-330-2104

Location of Bench Marks shown on Dwgs. 344-330-2107 thru 2112.

Rev. 2-3-78

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
SUBSIDENCE DETECTION LEVELING
SGC-47 TO PICACHO PUMP
1971-1976

DESIGNED Roland H. Haymond SUBMITTED Paul H. Wold
DRAWN R.P.V. RECOMMENDED
CHECKED Roland H. Haymond APPROVED

PHOENIX, ARIZONA OCT. 6, 1977 SHEET 2 OF 2 | 344-330-2105

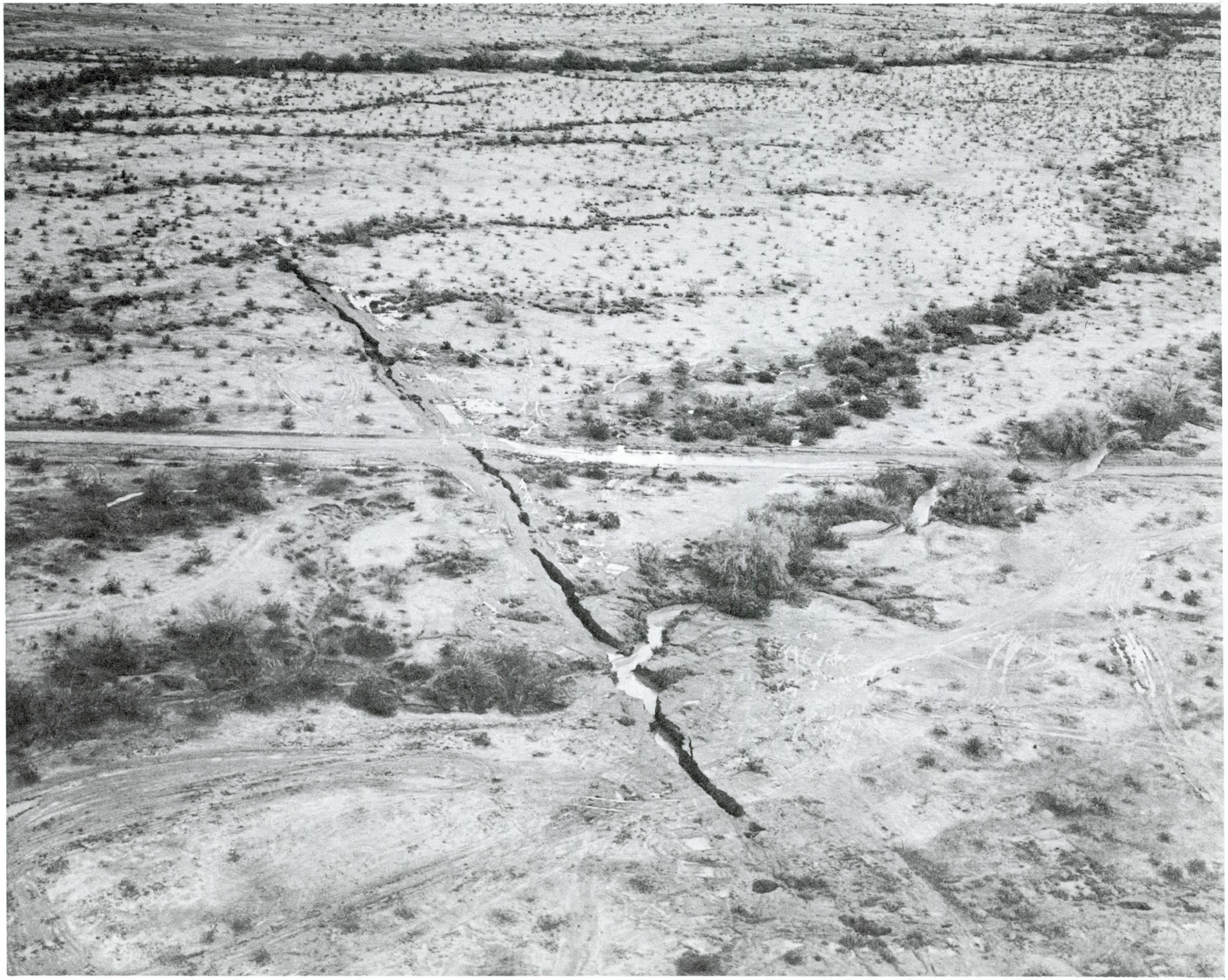


Figure 45-Earth Fissure--Salt-Gila Aqueduct--Central Arizona Project. Aerial view of an earth fissure in Section 6, T. 1, R. 8 E., G&SRB&M. The fissure is south of Apache Junction, Arizona, near the aqueduct alinement. Note water in the wash flowing into the fissure. Photograph No. P344-300-2501.

Figure 46.--Earth Fissure South of Apache Junction--Salt-Gila Aqueduct--Central Arizona Project. Large earth fissure in Section 6, T. 1 S., R. 8 E., G&SRB&M. Note caving of block into eroded pipe at bottom of fissure. Photograph No. 344-300-2510.

Figure 47--Earth Fissure South of Apache Junction--Salt-Gila Aqueduct--Central Arizona Project. Large earth fissure which eroded and caved after the 1978 winter rains. Note loose block of soil on the left. Photograph No. P344-300-2508.

Figure 48--Picacho Mountains Earth Fissure--Central Arizona Project. Aerial view of recent fissures paralleling the older, longer fissure along Picacho Mountains northeast of Interstate 10. Note that vegetation has grown along the older fissure. Photograph No. P344-300-02154.

Figure 49 .-Earth Fissures Near Interstate 10--Central Arizona Project. Aerial view showing earth fissure crossing Interstate Highway 10 southeast of Eloy, Arizona. The highway has been repaired numerous times. Photograph No. P344-300-01456.

Figure 50 --Earth Fissures Near Urban Development--Central Arizona Project. Aerial view south of Sacaton Mountains showing earth fissures near an urban development. Photograph No. P344-300-4364 NA.

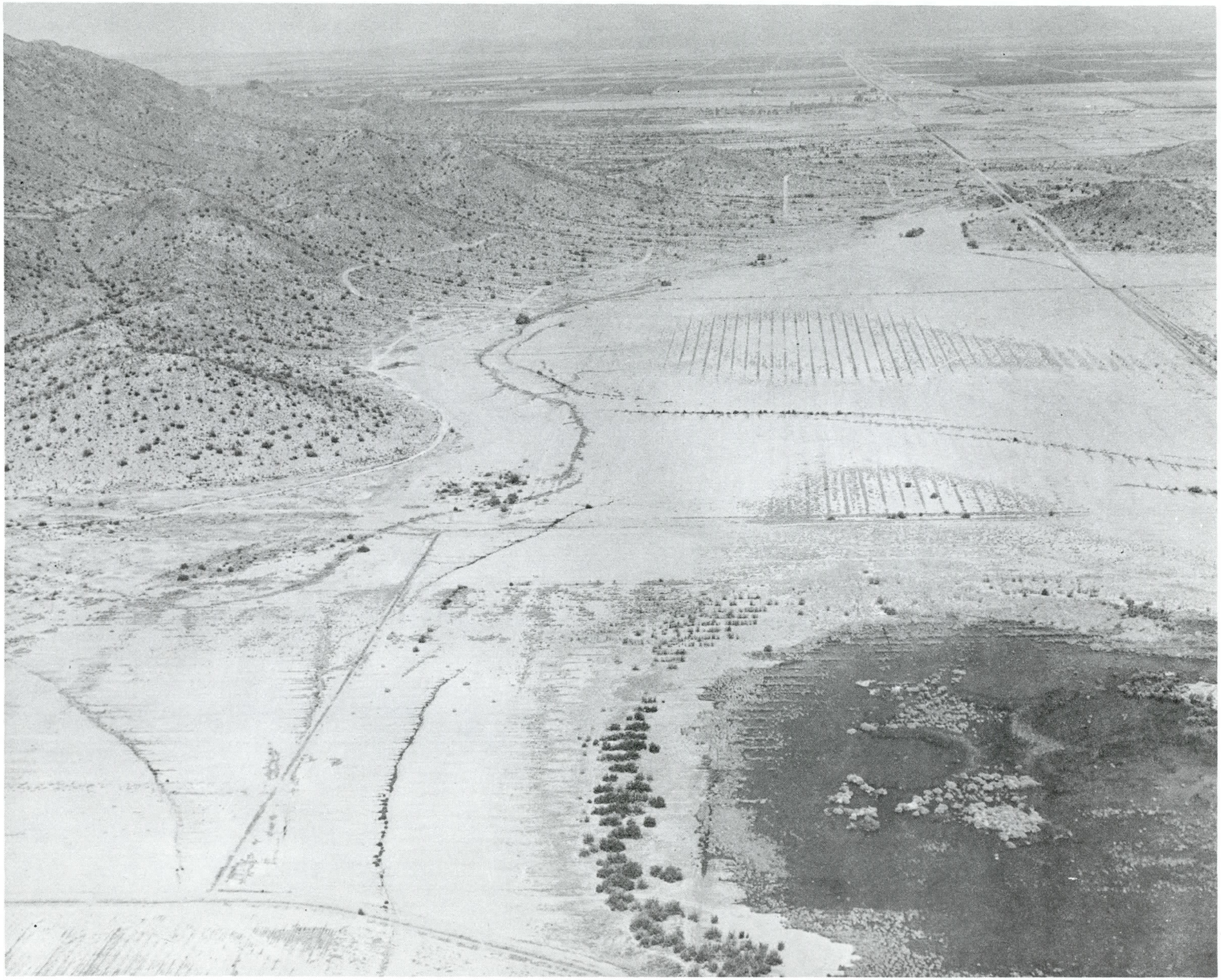
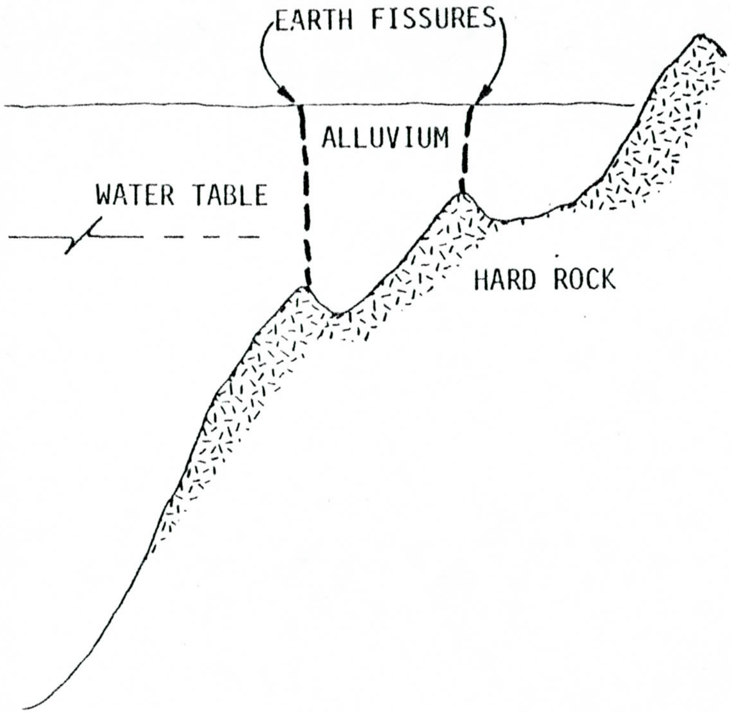
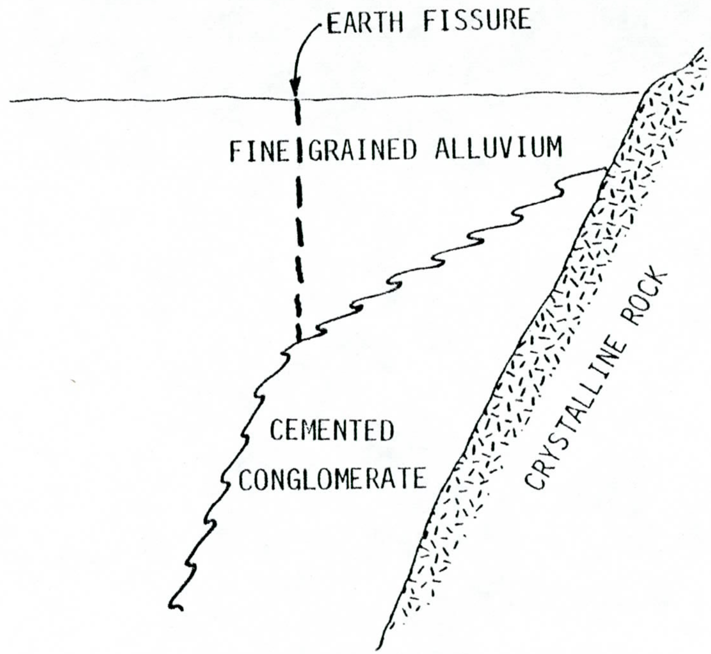


Figure 51 Earth Fissures West of Eloy, Arizona--Central Arizona Project. Aerial view of earth fissures west of Eloy at the base of the Casa Grande Mountains. These and similar cracks are believed the result of groundwater overdrafting. Photograph No. P344-300-01461.



a. Diagramatic cross-section showing the relationship of earth fissures to buried protuberances of hard rock.



b. Diagramatic cross-section of the relationship of the fissure along the Picacho Mountains to an inflection in the contact between cemented conglomerate and fine-grained alluvium.

FIGURE ______ CROSS SECTIONS SHOWING THE RELATIONSHIP BETWEEN EARTH FISSURE LOCATION AND THE UNDERLYING GEOLOGY

Figure 52

The other geologic regime is found in the area south of the 8-mile-long fissure along the Picacho Mountains, about 8 miles south of the Salt-Gila Aqueduct. Seismic and drill hole data collected by the U.S. Geological Survey (Pankratz and others, 1978 and Holzer, T. L., 1978) indicated that this fissure is in unconsolidated to weakly consolidated basin alluvium over an inflection in the contact with a cemented conglomerate (see b. in Figure 52). Geophysical explorations did not find this geological regime along the alinement of the aqueduct.

Known active earth fissures do not presently cross the alinement of the Salt-Gila Aqueduct. The fissures shown crossing the south end of the alinement on Figure 46 are lineations mapped in the late 1960's. Close observations of trenches across these lineations did not locate previous or present fissures, and geophysical investigations did not find the subsurface geological features common to fissures. In addition, gullies in the same location are present on aerial photos taken in 1936, a time prior to major ground-water decline in the area. It is therefore concluded that these lineaments are not earth fissures.

Data from the joint Geological Survey - Bureau of Reclamation study delineate five places along the canal alinement where earth fissures may form in the future. Post construction fissuring under the aqueduct would cause leakage. However, if new fissures develop under the aqueduct and cause leakage, operation of check structures in the canal would limit the amount of leakage. Design considerations for the canal would include measures to reduce or eliminate damage to the structure from possible fissuring, as well as strategic location of the check structures.

The impact of importation of surface water through the aqueduct on fissuring would be positive. By importing surface water to supplement ground-water use, ground-water overdraft would be reduced or locally stopped, which would reduce water table declines, which in turn would reduce or stop the development of fissures.

Most fissures have formed in undeveloped or agricultural areas. As a result, damage from earth fissures has for the most part been confined to roads, irrigated fields, and unlined irrigation canals and related structures. One rural house was reported destroyed. There are fissures now in developed areas between Mesa and Apache Junction. No damage has yet been reported. Housing developments are now being built in previously agricultural areas, some of which are near earth fissures. Figure 50 shows a fissure near a development in Pinal County. There is now a development near the fissures shown in Figure 51. McCalley and Gum (1975) concluded that the economic loss caused by earth fissures and subsidence was less than the cost of bringing water in to stop them. Regardless of the amount of money saved by a reduction in fissuring, the prevention or slowing down of the rate of fissuring would be one of the beneficial financial and social impacts of the project.

e. Seismicity

Based on seismic history, Algermissen and Perkins (1969) show that the project is in an area with a 90 percent probability of not having ground shaking with a horizontal acceleration exceeding 0.04 g (gravity) in a 50-year period. This probability for maximum horizontal ground acceleration is equivalent to a source earthquake having a return period of 475 years. The project is in an area of historically low seismicity.

f. Foundation Geology

Figures 34 through 40 show the surface geology and location of exploration along the Salt-Gila Aqueduct. Unconsolidated to caliche cemented basin fill or alluvium will constitute the foundation over the majority of the alinement. Granite crops out near the Salt River at the beginning of the Aqueduct and volcanics crop out near the Gila River and are the only rock that will be encountered.

All materials have adequate foundation characteristics for the contemplated structures. Expansive materials and low density material are expected locally. Designs would be developed to accommodate these problems on a site-by-site basis.

g. Mining

The occurrence of mineral deposits in bedrock have occupied Arizona mining interest for many years and active prospecting is continuing. A narrow mineralized belt in bedrock trends easterly from Poston Butte to the Ray Mines and passes beneath the aqueduct about two miles (3.2 km) east of Poston Butte. A commercial grade copper deposit has been outlined in this belt by Continental Oil Company at Poston Butte. If commercial grade deposits are present in the bedrock below the aqueduct, their ultimate development would have to be by mutual agreement between the Federal Government and mining interests.

Sand and gravel deposits within the aqueduct right-of-way are negligible compared to that available in adjacent areas, and therefore, restricting their ultimate development would not be a significant impact. Placer deposits of magnitite sand are also known to be present in central Arizona basins. However, none were found in explorations for the canal right-of-way.

3. Soils

Most of the aqueduct alinement is through broad valleys which are filled with alluvial material. The soils that have developed from this material have little or no horizon development. These old valley soils are derived from the modification of unconsolidated waterlain deposits which originated from a variety of formations of which granites and related rocks appear to have predominated. The texture is characteristically loams and sandy loams on the surface.

Of lesser importance are the soils of the transitional area between the mountains and valleys which developed from the debris from the mountain. These soils are generally extremely shallow and contain large quantities of sand and gravel.

All the soils of the alinement have not been classified in detail under the system adapted in the National Cooperative Soil Survey of 1965. The classification system is under continual study and all areas have not been classified. Soil associations of the Aridisol, Entisol, and Mollisol orders have been mapped. The soils do not present any unusual problems in the design of the feature due to their permeability, strength, drainage conditions, shrink-swell potential, grain size, plasticity, or reaction. Construction of the facilities and access roads would require the compaction of the majority of the right-of-way. Areas not needed within the right-of-way by permanent facilities would be scarified to stimulate moisture movement into the profile and revegetation of disturbed areas.

Soil and water erosion is a problem with the soils in their natural condition and disturbance of the soils by construction would increase this problem. Seldom is the moisture content suitable to keep the soil from becoming airborne under windy conditions. During construction, the soil would be watered to reduce erosion, and after completion of the facilities those areas not needed would be scarified to leave the surface in a roughened condition. Water erosion would be reduced by the construction of dikes and the furrowing of dikes and other selected areas to harvest water. The harvesting of water would stimulate revegetation that over a period of time (up to 30 years) would return the area to a near natural condition.

4. Hydrology

a. Surface Water

Naturally occurring runoff along the aqueduct alinement is typical of central Arizona, being highly erratic in rate and volume, usually sediment laden, and present only in direct response to local precipitation. Even very small drainage areas can, on occasion, produce runoff rates far in excess of the aqueduct carrying capacity. If cross-drainage protective structures were not provided, considerable damage to the aqueduct and its components would result at least annually and perhaps more frequently. These structures would prevent cross-drainage flows from entering the aqueduct.

The aqueduct would cross under the Gila River by siphon. The Gila River immediately below the Ashurst-Hayden Dam is subject to periods of flow and has, in recent years, flowed continuously for several months. Also, small, sporadic discharges to the Gila River channel are normally made at the dam several times each year for sediment control. The peak discharges expected to occur at the Gila River Siphon site for different return periods are listed below. These values were derived from frequency curves developed for Buttes Dam and Reservoir, an authorized feature of the CAP. They apply as well to the siphon site with an adjustment of up to 1,000 cubic feet per second (28.3 cubic meters per second) for diversion at Ashurst-Hayden Dam for irrigation water to the San Carlos Irrigation Project.

<u>Return Period</u> <u>Peak Discharge</u> (ft^3/s) <u>(m^3/s)</u>

1 year - 2,250 cubic feet per second (64 cubic meters per second)
2 years - 8,540 cubic feet per second (242 cubic meters per second)
5 years - 16,800 cubic feet per second (475 cubic meters per second)
10 years - 25,000 cubic feet per second (707 cubic meters per second)
25 years - 40,000 cubic feet per second (1132 cubic meters per second)

The substrate of the riverbed is saturated only when surface water is present, since the depth to ground water was more than 140 feet (43 m) in the Gila River in 1972 (USBR 1976b). Since the riverbed is usually dry and there is no water column present, no physical impairment of the water column would occur due to construction or operation of the aqueduct siphon. Because the material to be backfilled around the siphon would be the same material excavated from the siphon trench, no chemical-biological interactive effects would occur.

Structures which provide flood protection to downstream areas have been constructed by the SCS and include Powerline, Vineyard Road, Rittenhouse, Magma, and Florence Floodwater Retarding Structures (Figures 4 through 9). These structures presently protect about 24 miles (38.6 km) of the alinement of the Salt-Gila Aqueduct. The structures cause the runoff from the area controlled to be detained and released down improved channels at non-damaging rates. Discharges from the Powerline Road, Rittenhouse Road, and Vineyard Road F.R.S. are conveyed to the Gila River through the Powerline and RWCD floodways or released through gated pipes down washes to satisfy water rights to maintain vegetation adjacent to the washes. Discharges from the Magma F.R.S. are conveyed by the Magma channel to the Gila River. Florence F.R.S. releases are also conveyed to the Gila River through the Florence outlet channel. Temporary impoundment of floodwaters behind the various retarding structures increases the infiltration into the ground-water basins and promotes deposition of sediment load behind the structures.

The Spook Hill F.R.S. is presently under construction by the SCS as a part of the Buckhorn-Mesa Watershed project (SCS 1976:45-59). This structure will protect an additional 6 miles (9.7 km) of aqueduct alinement and the developing urban areas downstream.

The construction and operation of the Salt-Gila Aqueduct may produce several impacts on the hydrology of the area. In the general sense, the aqueduct would be imposed upon and potentially disrupt the natural drainage patterns in areas presently not protected by floodwater retarding structures, thereby influencing the magnitude and rate of downstream flow, ground-water recharge, sediment deposition, and erosional patterns. Whether such impacts occur and are "significant" is largely dependent on the drainage course being encountered by the aqueduct and the physical means employed to cross that drainage course.

The plan described in Chapter II proposes additional floodwater retarding structures in two areas: the Sonoqui Dike along Reach 3 from Queen Creek to the Magma Arizona Railroad, and a series of four structures along the southern portion of Reach 4.

The Sonoqui Dike, about 8 miles (12.9 km) in length, would control floodwaters from 256 square miles (660 square km) of drainage area. Storage volume behind Sonoqui Dike would be 8,500 acre-feet (10,500,000 cubic meters) and peak outflow would be 1,100 ft^3/s (31 cubic meters per second) to Queen Creek, and 120 ft^3/s (3.5 cubic meters per second) into a channel along the Magma Railroad. These outflows would cross the aqueduct by means of two overchutes. An undetermined portion of the runoff would be retained by the structure as infiltration. The watershed is estimated to yield about 4,600 acre-feet (5.6 million cubic meters) of sediment in 50 years, of which about 3,300 acre-feet (4 million cubic meters) would be deposited in the detention basin. The remaining 1,300 acre-feet (1.6 million cubic meters) would continue to pass dwonstream. Since Queen Creek is not a perennial stream and therefore supports no aquatic resource, the retention of this quantity of sediment would have only limited beneficial impact on the Queen Creek channel downstream from the aqueduct alinement. Sonoqui Dike would be designed to have a limited amount of surface water storage, sufficient only to provide aqueduct long-term sediment retention capability. This storage would be contingent upon securing any necessary water rights by the constructing agency. As a result of construction of Sonoqui Dike, no physical impairment of the water column nor chemical-biological interactive effects are expected to occur.

The Reach 4 retarding structures would vary in length from 2 to 4 miles (3.2 to 6.4 km) and would control about 131 square miles (339 square km) of drainage area upstream of the Salt-Gila Aqueduct. Under present conditions, runoff from these areas flows through small washes and overland flow into Picacho Reservoir. With the structures in place, runoff would be redirected to designated washes downstream of the aqueduct and proceed into the existing Florence-Casa Grande Canal and Picacho Reservoir. The detention of floodwaters behind these structures would increase infiltration in the detention basins, thereby increasing the opportunity for ground-water recharge in the detention basins. This would be offset by less ground-water recharge for the area downstream of the structures. Surface flows to Picacho Reservoir would be reduced in rate, but not significantly in volume. The increase in the length of time when fresh surface water flows are entering the reservoir would not have any effect on the water quality or quantity of the reservoir.

The area yields about 25 acre-feet (30,800 cubic meters) of sediment load per year of which 90-95 percent would be deposited in the detention basin. The remainder would continue to pass downstream.

Approximately 41 miles (66 km), or about 71 percent of the total length of the Salt-Gila Aqueduct would be protected from cross drainage by some form of floodwater retarding structure. In other areas, floodwater conveyance structures such as siphons, overchutes, and culverts would be constructed. These would result in minimal, if any, disturbance to the natural drainage channels and runoff alterations would usually be negligible.

The influence area of these conveyance structures is very local, usually within 50 to 100 feet (15 to 30 m) in the upstream direction to 100 to 300 feet (30 to 91 m) downstream. Within this influence area, some sediment deposition and erosional patterns are the most likely changes to be noticed as compared to the natural setting. It can not be predicted in advance how any of these cross drainage structures would alter the local environment. However, should operating experience with the Salt-Gila Aqueduct show that certain structures would, in fact, be causing more than casual changes (severe erosion, for example), appropriate remedial measures such as bank protection or structural modifications would be undertaken.

b. Ground Water Use and Recharge

Seepage losses from the Salt-Gila Aqueduct are estimated to occur at a rate of 0.1 cubic foot per square foot (0.03 cubic meter per square meter) of wetted surface per day. Seepage losses by aqueduct reaches are estimated in Table 3 based on this sustained rate.

Table 3
Expected Seepage Losses by Aqueduct Reaches
Salt-Gila Aqueduct--Central Arizona Project

	Average Annual Seepage Losses (acre-feet)	(cubic meters)
Reach 1	4,000	4,934,000
Reach 2	3,700	4,562,000
Reach 3	7,000	8,880,000
Reach 4	5,500	6,167,000
Total	20,200	24,543,000

These losses would, for the most part, migrate downward toward the water table and eventually be lost to evapotranspiration or become recharge. An estimated 75 percent or more of the seepage losses should become recharge, although it is not possible to determine when the seepage would reach the water table. An increase in vegetation density along the canal is not anticipated as a result of canal seepage.

While ground-water recharge in the affected basins would be increased by aqueduct seepage, the amounts are not expected to significantly affect the total amounts of ground water in storage, the water table elevation, or subsidence in the area. The impact of the Salt-Gila Aqueduct on ground-water conditions in the area is the expected reduction of ground-water pumping in the basin as Colorado River water imported into the area replaces a portion of that being pumped.

Public interest in artificial ground-water recharge has increased in recent years, particularly as it relates to the CAP. Current plans of the State and the Bureau of Reclamation do not contemplate the use of Salt-Gila Aqueduct waters for artificially recharging the ground water. Should sufficient State and local support develop in favor of allocating a portion of CAP water supplies to artificial ground-water recharge the action proposed in this environmental statement would not preclude that outcome.

c. Water Quality

The extent of chemical or organic pollution has not been determined for local floodflows. Neither the Arizona Department of Health Services (ADHS) nor the EPA has a water quality monitoring program for runoff from the several watersheds traversed by the aqueduct alinement, with the exception of the Gila River. Currently, the State of Arizona is in the process of updating its water quality standards.

Reclamation will comply through whatever action is appropriate at the time to all new standards as they become official. However, the new draft standards indicate no impact on the Salt-Gila Aqueduct or vice versa.

The Gila River is intermittent from the Ashurst-Hayden diversion dam to the confluence with the Salt River, where waste-water effluent produces perennial flows for several miles. Queen Creek is also an intermittent stream. Due to the intermittent nature of both Queen Creek and the Gila River, at and below the Salt-Gila Aqueduct crossings of these riverbeds, no impacts of surface water quality are anticipated.

Some ground water from local wells would be used for compaction during backfilling of the siphon but would conform with applicable effluent limitations and water quality standards. There are no public water supply intakes in proximity to the siphon site and backfilling operations in the Gila River would have no impact on municipal water supplies.

None of the runoff from the area is used directly except as it may be captured by stockponds for livestock watering. The primary pollutant in the runoff water is sediment. Sediment concentration in discharges from the floodwater retarding structures would be reduced due to the deposition of sediments in the detention basins. Sediment concentration would remain unaltered in areas in which cross drainage would be provided by the siphon, overchutes, or culverts. Some local scour erosion may occur downstream of the outlets of the detention basins.

An average of approximately 850,000 acre-feet (1 billion cubic meters) annually is expected to be delivered into the Salt-Gila Aqueduct under water allocations being proposed by the Arizona Water Commission (AWC 1977c, AWC 1979) and the Department of the Interior (DOI 1976) at the time this statement was prepared. Of the water delivered into the aqueduct, some 20,200 acre-feet per year (25 million cubic meters per year) would be lost to aqueduct seepage (see Table 3), 2,400 acre-feet per year (2.9 million cubic meters per year) would be lost to evaporation from the exposed water surface, about 625,000 acre-feet (770 million cubic meters) annually would be delivered out of the aqueduct to Salt-Gila water users, and the remainder would flow onto the proposed Tucson Aqueduct. Of the water delivered out of the aqueduct, a portion will be lost to seepage and evaporation in delivery systems, as yet undefined.

The principal impact of these seepage losses will be to increase the quantities of recharge reaching the underlying ground-water aquifers. However, some water quality impacts may also be experienced. Whether these quality impacts are ultimately adverse or beneficial would likely vary from location to location and from user to user. The only anticipated adverse impact aqueduct seepage may have on a given ground-water body would be an increase in salinity. The magnitude of increase cannot be determined due to lack of specific data on other recharge sources and its chemical composition, chemistry of the soil profiles through which seepage would percolate, or how seepage may be laterally dispersed during its downward mitigation. What is known, is that the ground-water aquifers in the area of the aqueduct route are very large, and contain millions of acre-feet of water. Seepage contributions to these vast underground seas should be insignificant.

The biological quality of the water to be imported was analyzed in a study conducted by Reclamation on the Bill Williams arm of Lake Havasu in 1974 (Deason 1975). The study was designed to look at the bacterial quality of water near the intake structure of the Lake Havasu Pumping Plant, a feature of the Central Arizona Project. The parameters investigated were specifically designed to determine the fecal coliform bacteria densities of the Bill Williams arm during selected time periods from October 1973 through September 1974. Fecal coliform bacteria are used to indicate the presence of pathogenic organisms. Bacterial analysis revealed that fecal coliform bacteria ranged from 0-40 bacteria per 100 milliliters of water. These low counts indicate that the Colorado River water which would be pumped to the central Arizona areas would not contribute undesirable bacteriological components to inland Arizona.

In the absence of any control action, the quality of Colorado River water in Lake Havasu is projected to degrade with continued development in the basin. The Seven Colorado River Basin States, however, have joined with the Environmental Protection Agency in the establishment of salinity regulations for the Colorado River and in securing passage of the Colorado River Basin Salinity Control Act (P.L. 93-320) of June 1974. Title I of the Act authorized construction of (1) a desalting complex near Yuma, Arizona; (2) a concrete-lined replacement canal for the first 49 miles (78 km) of the unlined Coachella Canal; and (3) protective and regulatory ground-water pumping unit which includes two well fields within 5 miles of the Arizona-Sonora Boundary. Title II of the Act authorized four salinity control units and provides for the continued investigation of 12 other units.

The four authorized units include Paradox Valley Unit, Colorado; the Grand Valley Units, Colorado; the Crystal Geyser Unit, Utah; and the Las Vegas Wash Unit, Nevada. Major structural features of the initial control units involve construction of facilities such as wells, dikes, pipelines, pumps, desalters, and evaporation ponds to collect and dispose of saline water. Non-structural unit features consist of management assistance to water users for limiting excess water applications to irrigated lands.

In addition, the Arizona Water Quality Control Council adopted, in November 1975, amendments to the Water Quality Standards for Surface Waters of Arizona, in part as follows:

> "The flow weighted average annual salinity in the Lower Main Stem of the Colorado River System shall be maintained at or below the average value found during 1973....

"Salinity levels in the Lower Main Stem may temporarily increase above the 1972 levels if control measures to offset the increases are included in the Plan of Implementation. However, compliance with 1972 levels shall be a primary consideration.

"The flow weighted annual salinity for the year 1972 are:

Below Hoover Dam	723 mg/l
Below Parker Dam	747 mg/l
Imperial Dam	879 mg/l...."

Since it is the intent of Arizona, in cooperation with the other Basin States, to stabilize the future salinity of the Colorado River at 1972 levels or below, diversions by the CAP from Lake Havasu should contain salinity concentrations not exceeding an average of 747 mg/l. Based on recent Reclamation studies, annual salinity concentrations can be expected to range from about 590 mg/l to about 920 mg/l in the future. The expected average salinity to the SGA is approximately 755 mg/l and it is expected to increase by less than 5 mg/l by the time it reaches terminus of the SGA.

The salinity of the imported Colorado River water is lower than the Gila River, but generally higher than the Salt and Verde Rivers in central Arizona. Measured salinity of the Salt River below Stewart Mountain Dam has historically ranged between 342 mg/l and 1,300 mg/l, with an average of 620 mg/l. The Verde River below Bartlett Dam has ranged from 116 to 550 mg/l, with an average of 260 mg/l. Salinity in the Gila River at Kelvin averaged 842 mg/l between 1968-1972 (AWC 1975).

The salinity of the Colorado River would be less than the current pumped ground water in the service area. Ground-water salinity in the SGA service area varies greatly, both areally and with depth. In the Eloy-Coolidge area, salinity of the ground water ranges from less than 500 mg/l up to 17,000 mg/l. In the Maricopa-Stanfield area, it varies from less than 1,000 mg/l to more than 3,000 mg/l. Ground-water quality is generally good in the Paradise Valley-Chandler-Queen Creek area with salinity less than 1,000 mg/l over much of the area. It does vary, however. One area west of Chandler exceeds 6,000 mg/l. Ground water salinity in the Komatke-Sacaton area varies from concentrations of 600 mg/l to more than 4,000 mg/l (USBR 1976b). Average salinity for the water pumped in Maricopa, Pinal, and Pima Counties has been estimated to be 955 mg/l for the period 1965-69 (AWC 1975).

U.S. Public Health Service (USPHS) standards recommend that domestic water supplies should not exceed salinity concentration of 500 mg/l if more suitable supplies are available. The use of CAP water will comply with the USPHS recommended standards because there are no more suitable water supplies available. Since the average TDS of ground water currently used in the area is estimated to be 955 mg/l, CAP water is more suitable than most current ground-water sources. The domestic water currently being used in Maricopa, Pinal, and Pima Counties has a salinity content between 400-1000 mg/l (USBR 1972a). The World Health Organization states that no harmful permanent physiological effects have been observed on humans drinking water with the salinity ranging from 2,000 to 4,000 mg/l. In general, the CAP water is not expected to have any adverse impacts on the population. Table 4 presents some typical samples of the chemical composition of Colorado River water at Parker Dam and at selected well sites in the service area of the Salt-Gila Aqueduct.

The hardness of CAP Colorado River water will typically be about 360 mg/l as calcium carbonate. This hardness is appreciably higher than all local surface-water supplies but is less than most local ground-water supplies. The hardness of ground-water supplies in the Salt River Valley ranges up to 600 mg/l. The fluoride content of Colorado River water is typically about 0.4 mg/l. Local water supplies in the service area frequently exceed USPHS recommended limits of 0.8 mg/l for fluoride content (USBR 1972a). Table 5 shows the chemical water quality data for the Colorado River for the period October 1963 through September 1973. The quality of Colorado River water has shown some improvement over the past several years as compared to Table 5 data. However, the reasons for the improved quality are not fully understood so that it is not possible to predict if the trend is only temporary or long-term.

The salinity concentration at the Colorado River was assumed to average 747 mg/l. Based on that inflow concentration, the salinity to the Salt-Gila Aqueduct is expected to be 755 mg/l, the increase due only to evaporation losses from the Granite Reef Aqueduct. Delivery of CAP water at this concentration into the service area is expected to import approximately one ton of dissolved salts per acre-foot of water. The water would be used as a replacement for ground water. Thus, while the project would bring in new salt load to the Basin, such importation would work to reduce the total application of salts to the land. Considering that the ground-water quality does vary throughout the area, this effect would be modified by the specific relationships of the quality of the ground water and applied surface water at each point in the service area.

Figure 53 shows the average monthly salinity concentrations at Parker Dam during the 1970-1975 period of records. The decreasing concentrations during the higher water use summer months is attributed to increased levels of river flow from storage reservoirs at this time of year which tend to dilute the more saline irrigation return flows to the lower Colorado River. Since this seasonal fluctuation in salinity concentrations is small, three percent or less of the average annual salinity, impacts on CAP water users should be insignificant and will probably go unnoticed.

Table 4
Typical Chemical Composition of Colorado River Water

(Units: Milligrams/liter)

Location	Well I.D. No. 1/	Samples	Electrical Conductivity 2/	T.D.S.	Ca	Mg	Na	Cl	SO_4	HCO_3	CO_3	F	NO_3	B
Colorado River Below Parker Dam 3/	N/A	5/30/65	1200	785	98	28	118	104	332	154	0	-	2.10	-
		9/01/65	1240	795	99	30	119	114	345	152	0	-	1.20	-
		5/01/67	1130	721	94	28	109	99	304	156	0	-	1.20	-
		9/01/67	1070	712	85	27	103	92	287	146	0	0.4	1.10	0.2
		3/29/74	1160	748	93	30	110	92	310	173	0	0.5	0.43	0.1
		9/30/74	1090	696	78	30	90	87	280	150	-	0.3	0.18	0.1
		3/10/77	1100	721	84	29	110	91	280	159	0	0.3	0.14	0.3
		9/12/77	1070	688	81	30	100	88	280	160	0	0.4	0.14	0.1
Gila River Indian Reservation	8019 4/	6/11/66	1500	975	122	19	160	220	314	127	0	2.2	18.00	0.5
Florence	8418 5/	2/03/67	1500	975	124	44	177	220	356	220	0	1.1	16.00	0.0
	8422 5/	2/03/67	800	520	51	8	173	149	108	259	0	1.1	0.00	0.0
Sacaton	8163 4/	7/21/66	1200	780	109	36	86	132	260	161	0	0.6	19.00	0.1
Casa Grande	8410 4/	2/03/67	900	585	70	17	97	74	128	66	0	0.4	4.00	0.1
	8423 4/	2/03/67	1000	650	90	16	129	180	152	132	0	1.0	60.00	0.0
Coolidge	8404 4/	1/20/67	2100	1365	188	37	195	580	130	142	0	0.9	23.00	0.1

1/ Data from "The Quality of Arizona's Domestic, Agricultural, and Industrial Waters" Report 256, February 1970, University of Arizona Agricultural Experiment Station.

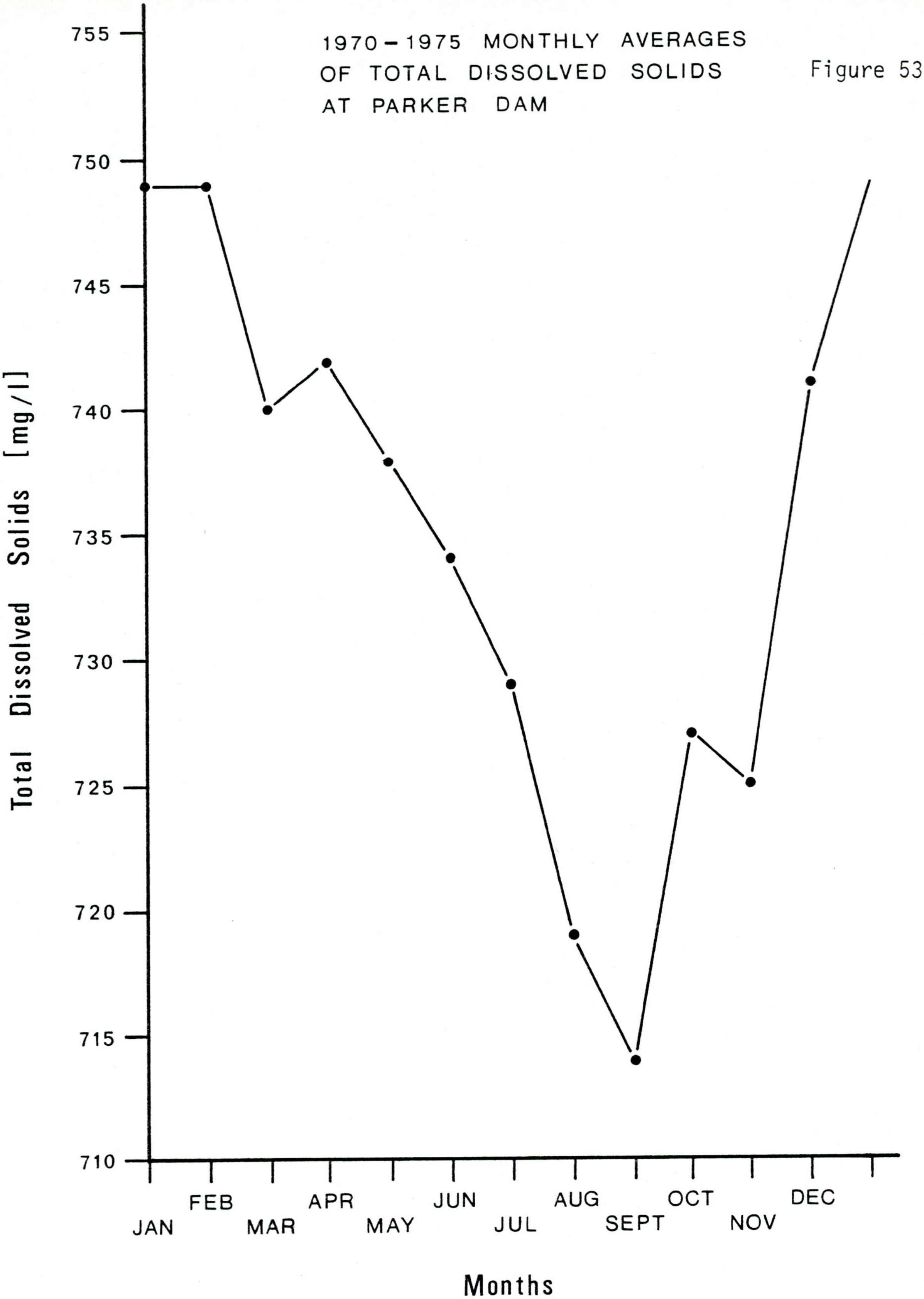
2/ Units: Micromhos/cm.

3/ Data from USBR "Quality of Water, Colorado River Basin" Progress Report No. 9, January 1979.

4/ Agricultural Well

5/ Domestic well.

Figure 53



Source: Quality of Water Colorado River Basin, Progress Report No. 9, January 1979, USBR

344-330-T-779

Table 5

Chemical Water Quality Data
for the
Colorado River Below Parker Dam

	Concentrations in mg/l		
	Minimum	Maximum	Average
Sodium	83	130	102
Bicarbonate	110	177	151
Sulfate	194	380	301
Fluoride	0.2	0.7	0.4
Nitrate	0.01	4.4	1.2
Phosphate	0.01	0.01	0.01
Boron	0.03	0.22	0.15
Hardness as $CaCO_3$	248	380	338
Total Dissolved Solids	536	826	732
pH	6.9	8.4	---
Temperature	$47^{o}F$	$83^{o}F$	---

Period of Record: October 1963-September 1976

Average Annual Streamflow: 1964-1973 6,623,900 acre-feet

1951-1973 7,937,700 acre-feet

The effects and disposition of the salt load contained in the downward percolating recharge waters is a complex subject. Individual ionic constituents of the water can be exchanged and/or precipitated as the water moves through the aquifer in a series of chemical reactions between the water and the alluvium. The salt concentrations in excess of the solubility of the ground water may be left behind in the subsurface in the depth interval between the plant root zone and the water table. In most parts of the project area, this depth interval is hundreds of feet. Although it cannot be said that the additional salt load from the project water would not have some effect on the quality of the ground-water resource, the history of the water use and mineral content of the ground water in the area indicates such effects would be a minor impact in the project area as a whole and probably undetectable.

Additional analyses of the impacts resulting from the delivery of water to the use areas will be included in the environmental documents for the agricultural and M&I allocations.

5. Climate

The route of the proposed Salt-Gila Aqueduct is located within the Lower Sonoran Life-Zone (Lowe 1964). The climate is characterized by long hot summers; short mild winters; sparse rainfall; low relative humidity; high rates of evaporation; and a high percentage of sunny days.

There are two distinct sources of moisture, with precipitation generally occurring in midsummer and midwinter. Winter precipitation is associated with Pacific air moisture moving into the area from the Northwest. Winter rains may last for several days and usually occur as low intensity showers over a large area. Summer precipitation generally comes from the southeast or southwest, from moist Tropical Atlantic or Tropical Pacific air masses (Lowe 1964:10). Summer thunderstorms, which usually cover only small areas, are intense and of short duration, and produce many of the destructive flash floods well known in the Southwest.

Temperature and precipitation data from two weather stations along the aqueduct alinement are presented in Table 6.

The combination of high temperatures and low humidity causes high rates of evaporation and transpiration. The mean annual lake evaporation for this area is 68 to 70 inches (1.7 to 1.8 m) (Pacific Southwest Interagency Committee 1971). Although there would be losses of water from evaporation, the Salt-Gila Aqueduct would have no impact on the climate of the region. The flow of water and increased evaporation would cause a more humid microclimate within the aqueduct prism, which would change the composition of invertebrate species utilizing the immediate area (Chapter III.C.2.e).

Table 6

Climatological Data
Salt-Gila Aqueduct - Central Arizona Project

	Apache Jct.		Florence	
	Jan.	July	Jan.	July
Temperature				
Average Maximum	65.1	103.3	66.8	106.1
Average Minimum	34.9	72.8	36.1	74.0
Mean Number of Days				
Max. Temp 90° and Above	0	30	0	31
Min. Temp 32° and Below	11	0	11	0
Average Total Precipitation/Year	9.22 in.		9.84 in.	
Average Snowfall/Year	Trace		0	

Source: Arizona Community Profiles 1976; Green 1964.

6. Sound

The Salt-Gila Aqueduct would generally be located in open desert areas with relatively low sound levels except when airplane flyovers temporarily increase sound to undesirable levels. The areas of the highest sound level are near the major highways in the Apache Junction area. Table 7 shows sound level recordings made in 1973 at four locations near the alinement.

Construction sound levels which would be an annoyance to communities and residents near the alinement would be controlled by following the guidelines of the EPA publication "Community Noise" (EPA 1971) and HUD noise assessment guidelines (Schultz and McMahon 1971). Construction specifications would require the contractor to comply with applicable Federal, State, and local laws and regulations concerning the prevention, control and abatement of excessive noise. Sound levels would be monitored during construction by Reclamation inspectors to assure compliance to the standards on sound. Noise pollution levels would not exceed 75 decibels during nighttime operations nor 80 decibels during daytime operations as measured outdoors from areas considered to be noise-sensitive. The construction of similar features on the Granite Reef Aqueduct through the populated area of Paradise Valley has not resulted in excessive sound levels nor discomfort to the residents.

Blasting is anticipated only at the Salt-Gila Pumping Plant site and in portions of the southernmost 6-mile (9.7 km) segment of Reach 3 of the Salt-Gila Aqueduct. Blasting would occur only during daylight hours and during times of favorable weather conditions. The contractor's blasting plan would be subject to approval by the contracting officer and would provide for the protection of persons, the work, and public or private property. Concentrated population centers are located in excess of 2 miles (3.2 km) from the anticipated blasting sites and would not be adversely affected. Approximately 80 rural residences are located within 2 miles (3.2 km) but beyond 1,000 feet (305 m) of the blasting sites. Sound levels within the vicinity of the blasting sites would exceed 80 decibels for short periods of time. Wildlife may be temporarily displaced from the immediate blasting area by the increased sound levels.

The operation of the completed aqueduct would result in very little increased sound except during periods of maintenance when heavy equipment would be operated for short periods.

7. Air Quality

There are four air quality monitoring locations which provide representative data from which to assess air quality parameters in the vicinity of the Salt-Gila Aqueduct. These include the towns of Florence and Coolidge in Pinal County, Marana in Pima County, and the General Motors Proving Grounds located adjacent to the Williams Air Force Base in Maricopa County.

Table 7

Base Sound Level Study 1/
Salt-Gila Aqueduct - Central Arizona Project

Site No.	Location	Date	Starting Time	Sound Level Measurement dBA	
				Minimum	Maximum
1	SGA alinement and Apache Boulevard	9-21-73	9:14 a.m.	44	86
2	SGA alinement and Baseline Road	9-21-73	10:55 a.m.	25	66
3	SGA alinement east of Rittenhouse Air Force Auxiliary Field	9-21-73	12:15 p.m.	26	46
4	SGA alinement east of Picacho Reservoir	8-31-71	10:54 a.m.	28	52

1/ A 20-minute time interval was used for the sound studies. The recordings were made with an impulse precision sound level meter attached to a level recorder.

The ADHS and the EPA have each set air quality standards for Arizona on six air pollutants - carbon monoxide, hydrocarbons, nitrogen dioxide, oxidants, sulfur dioxide, and particulates. Table 8 shows these standards for both ambient and emergency episode conditions. Of these six pollutants, only particulates are measured at all four monitoring sites. Hydrocarbons, carbon monoxide, nitrogen oxides, and oxidants are primarily derived, directly or indirectly, from internal combustion engines and are generally monitored only in large urban areas. None of the four representative air quality monitoring locations measure or report on hydrocarbon or carbon monoxide concentrations. Sulfur dioxide concentrations are monitored at all except the Marana site, and oxidants are monitored only at Florence (ADHS 1974-1977). The limited amount of air quality data being collected is indicative of the types of air quality problems associated with each monitored area. The pollutants not being monitored are not generally perceived to be problems in those areas.

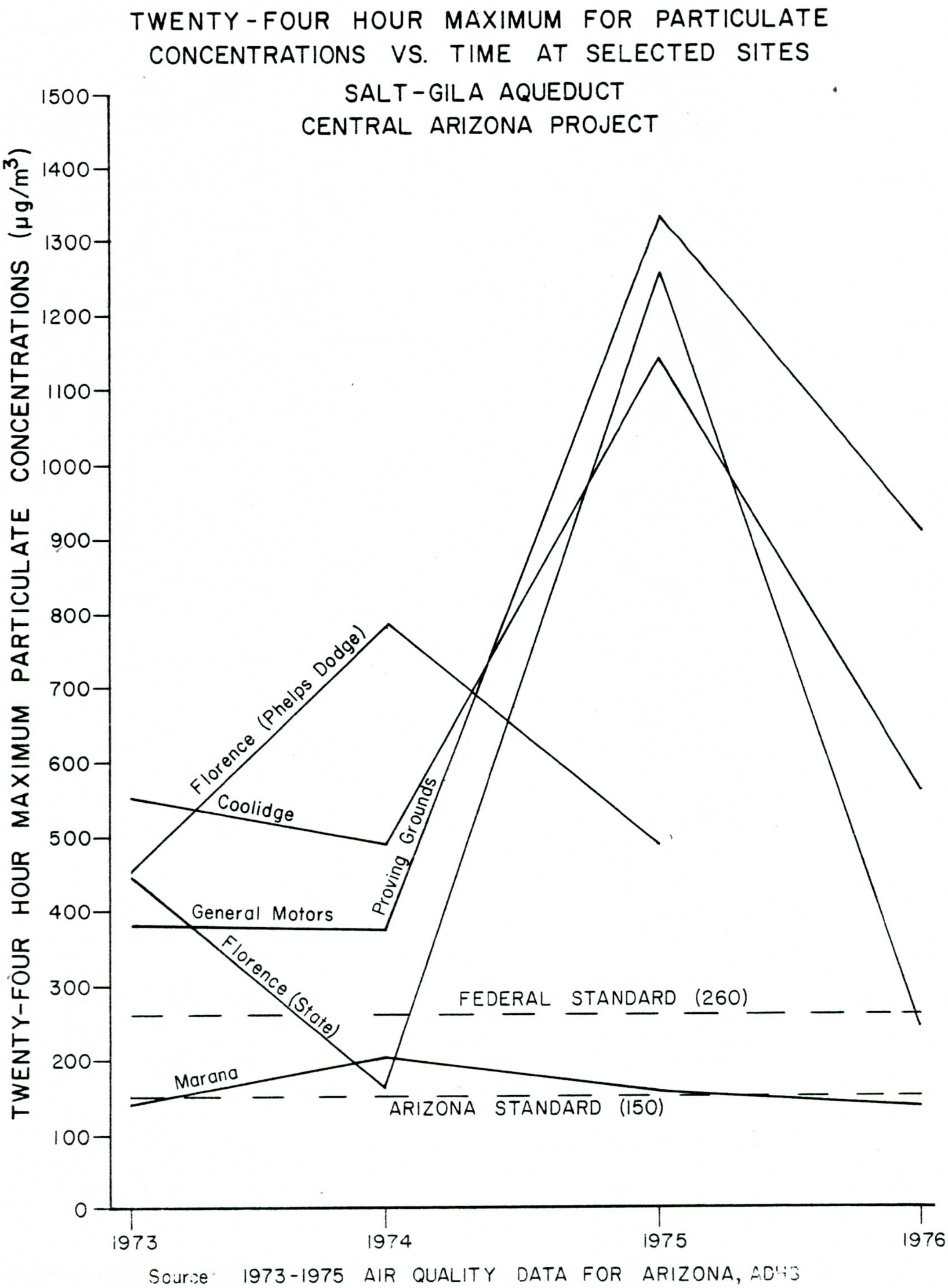
Beginning in 1974, the ADHS has published annual reports of air quality data in Arizona from which the following data have been extracted. Figures 54 and 55 show particulate concentrations for daily maximum and annual geometric mean, respectively, as compared to the existing standard for particulates. In both cases, it can be seen that the Arizona standards are typically exceeded at all four sites. This is likely due to the predominately fugitive dust sources such as agricultural land, disturbed desert, and unpaved roads at these sites which can produce large concentrations of airborne particulate matter, even under moderately windy conditions. Table 9 shows the total number of violations of the 24-hour particulate standards.

Oxidants, nitrogen dioxide, and sulfur dioxide concentrations are below the ambient air quality standards (ADHS 1974-1977). Figures 56 through 58 display these data.

Table 10 shows the sources and estimated quantities of the six pollutants expected to be emitted during construction of the Salt-Gila Aqueduct, the only time during which any significant amounts of these pollutants are expected to occur in association with the proposed action. These data were developed using estimates of equipment types and usage expected in constructing the aqueduct, and EPA emission factors for the various types of construction equipment (EPA 1975).

Relating the data from Table 10 to ambient air quality standards is extremely tenuous because of the limited air quality data and the complex methodology to relate them. Such factors as wind speed and direction, effective depth of thermal mixing and diffusion, and contractor's use of construction equipment by type, location, and duration, among others, would need to be considered and are not generally available. However, the potential pollutant concentrations resulting from aqueduct construction activities can be approximated. Assuming that all the pollutant discharges shown on Table 10 occur simultaneously along

Figure 54



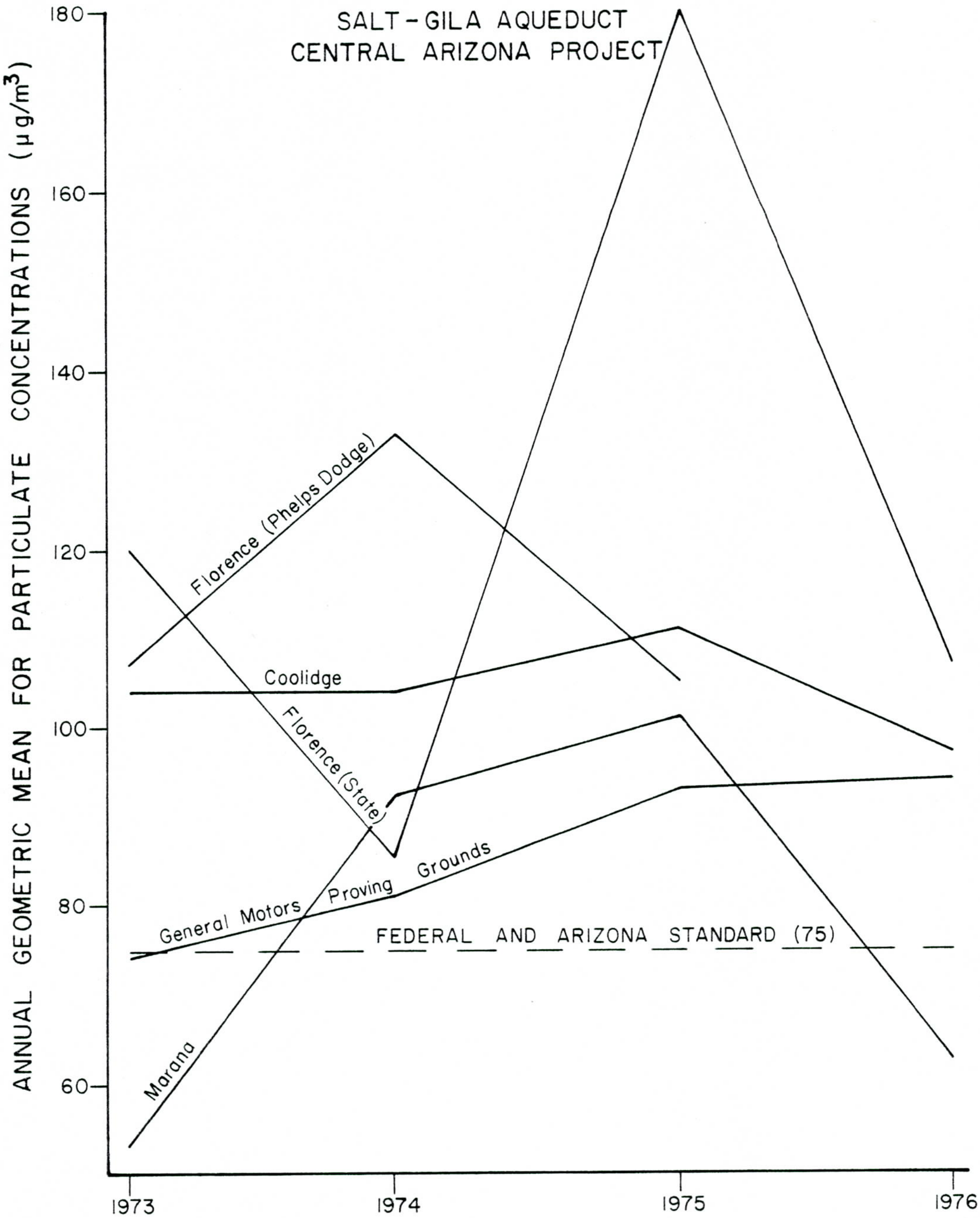
Source: 1973-1975 AIR QUALITY DATA FOR ARIZONA, ADHS

Note: Florence (Phelps Dodge) station discontinued in June 1975

344-330-T-709

Figure 55

ANNUAL GEOMETRIC MEAN FOR PARTICULATE CONCENTRATIONS
VS. TIME AT SELECTED SITES

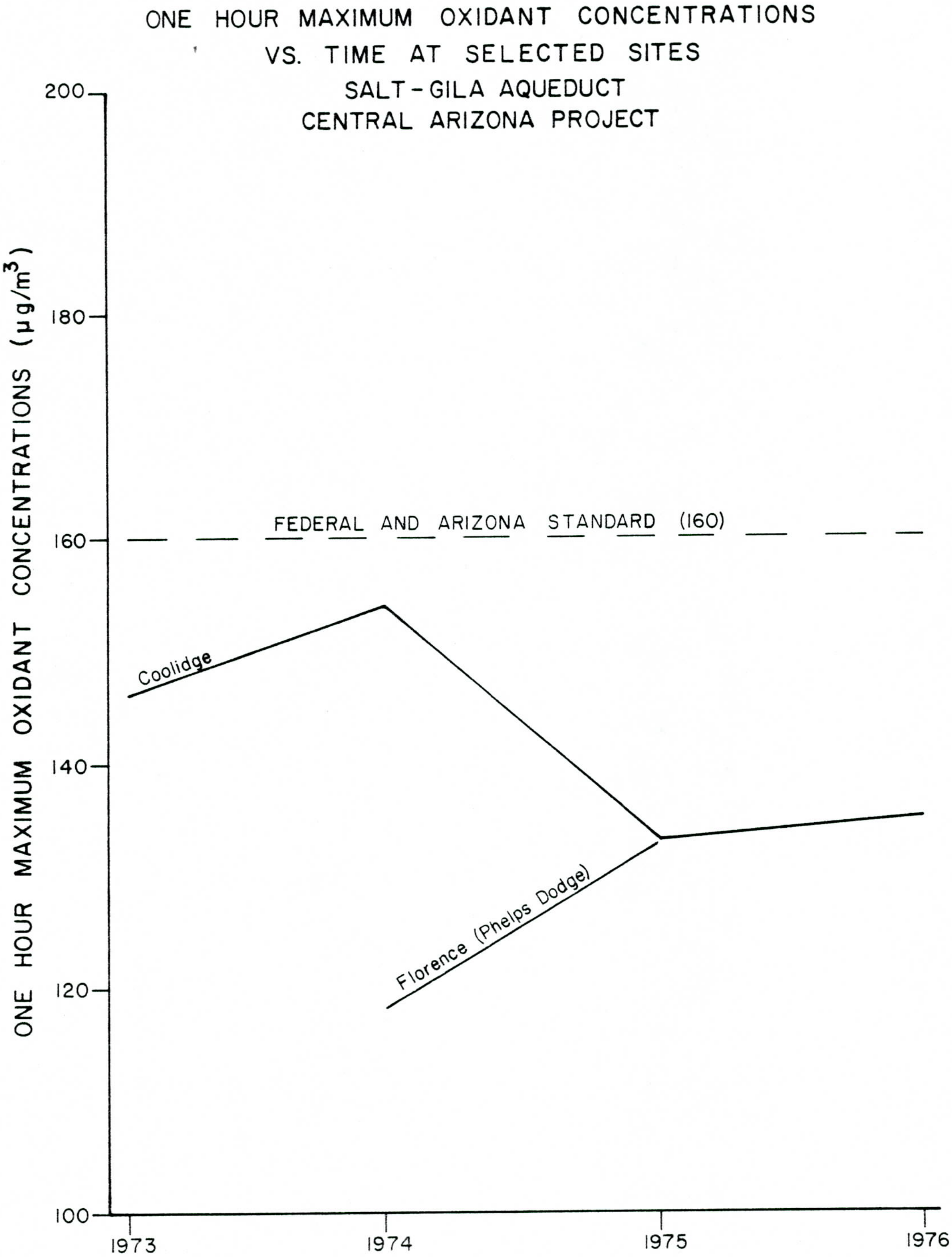


Source: 1973-1975 AIR QUALITY DATA FOR ARIZONA, ADHS

Note: Florence (Phelps Dodge) station discontinued in June 1975.

344-330-T-708

Figure 56

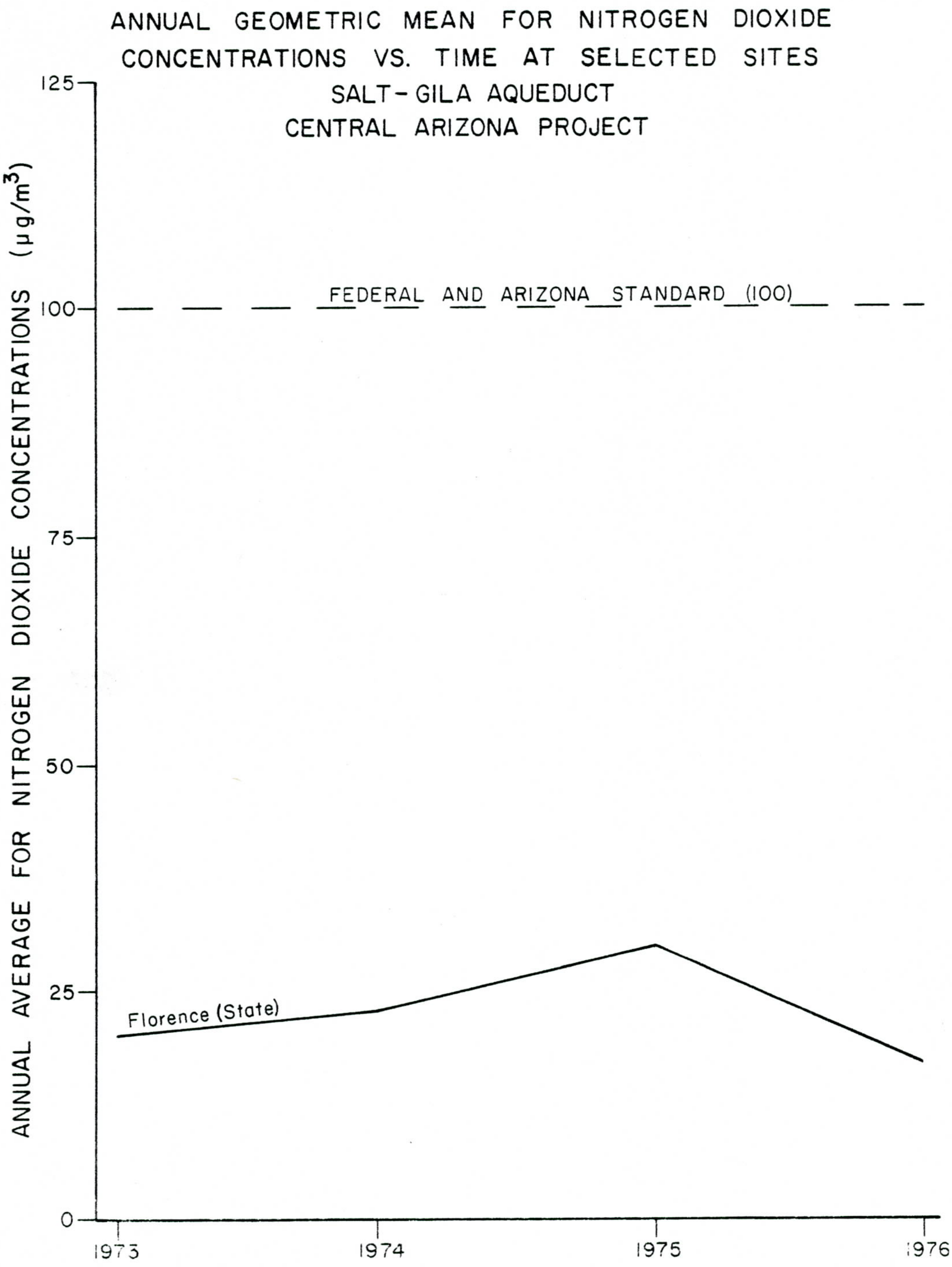


Source: 1973-1975 AIR QUALITY DATA FOR ARIZONA, ADHS

Note: Florence (Phelps Dodge) station discontinued in June 1975.

344-330-T-710

Figure 57

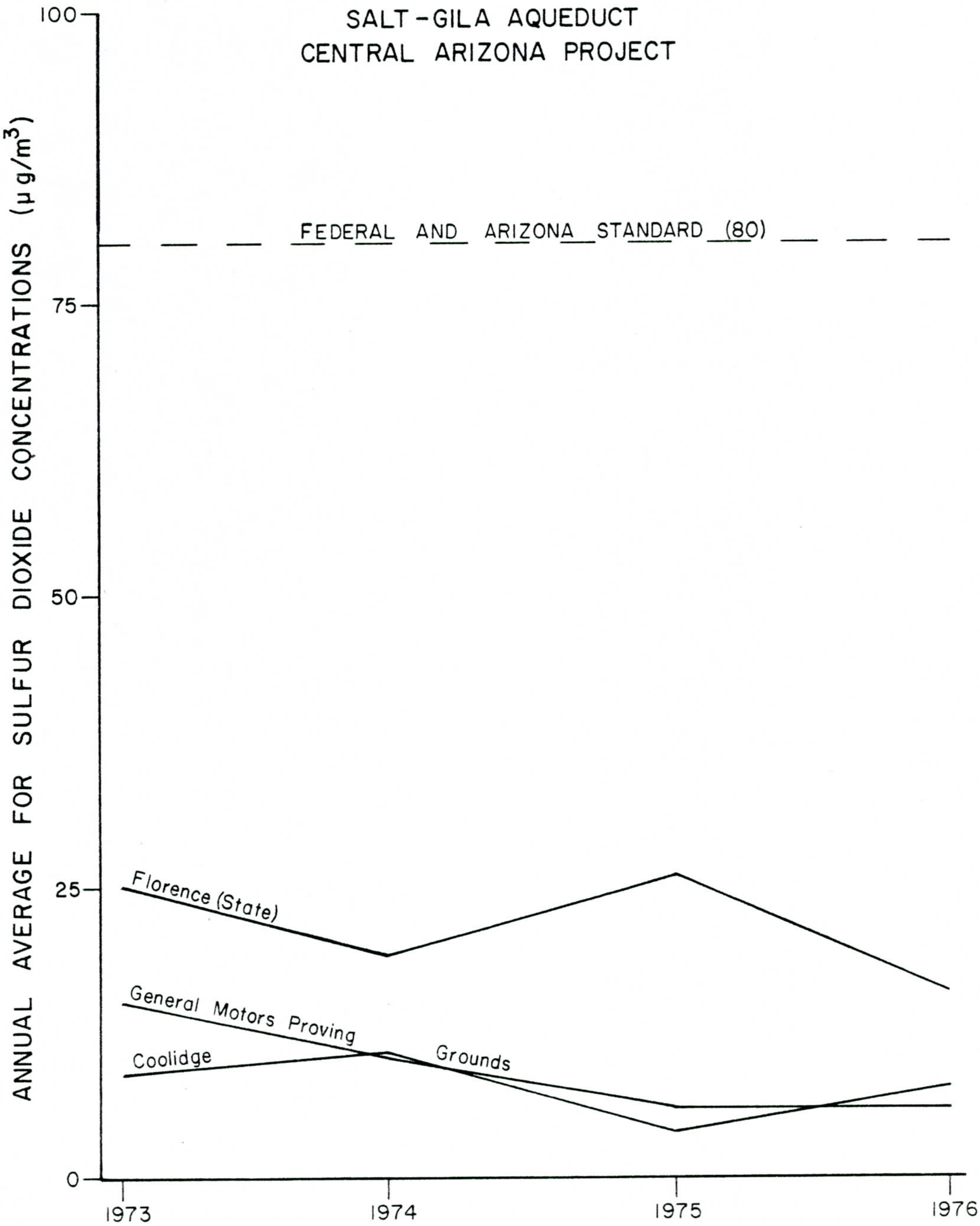


Source 1973-1975 AIR QUALITY DATA FOR ARIZONA, ADHS

344-330-T-711

Figure 58

ANNUAL AVERAGE FOR SULFUR DIOXIDE CONCENTRATIONS
VS. TIME AT SELECTED SITES
SALT-GILA AQUEDUCT
CENTRAL ARIZONA PROJECT



Source: 1973-1975 AIR QUALITY DATA FOR ARIZONA, ADHS

344-330-T-712

Table 8

Summary of Ambient Air Quality Standards

Pollutant	Averaging Time	Arizona Standard	Federal Standards 1/ Primary	Secondary
Carbon monoxide	1 hr	40	40	40
	8-hr	10	10	10
Hydrocarbons	3-hr (6-9 a.m.)	160	160	160
Nitrogen dioxide	annual	100	100	100
Oxidants	1 hr	160	160	160
Particulates	24-hr	150	260	150
	annual (Geom. Mean)	75	75	60
Sulfur dioxide	3-hr	1,300	--	1,300
	24-hr	365	365	--
	annual	80	80	--

Summary of Emergency Episode Levels

Pollutant	Averaging Time	Ariz.	Fed.	Ariz.	Fed.	Ariz.	Fed.	Significant Harm 2/ Fed
Carbon Monoxide	1 hr	--	--	--	--	--	--	144
	4-hr	--	--	--	--	--	--	86.3
	8-hr	23	17	34	34	46	46	57.3
Nitrogen dioxide	1 hr	1,130	1,130	2,260	2,260	3,000	3,000	3,750
	24-hr	280	282	560	565	750	750	938
Oxidants	1 hr	400	200	800	800	1,200	1,000	1,200
Particulates	24-hr	375	375	625	625	875	875	1,000
Sulfur dioxide	24-hr	1,050	800	1,600	1,600	2,100	2,100	2,620
Sulfur dioxide and particulates combined	24-hr	75,000	65,000	251,000	261,000	393,000	393,000	490,000

Source: Federal Standards - Federal Register, Vol. 36, April 30, 1971, pp:8186 - 8201
Arizona Standards - Arizona Official Compilation of Regulations and Rules, R9-3-201 through R9-3-206.

Note: Units are ug/m^3 except for carbon monoxide which has units of mg/m^3 and sulfur dioxide and particulates combined which has units of (ug/m^3)^2.

Reference conditions are 25°C and 760 mm Hg.

1/ Not to be exceeded more than once per year.

2/ Arizona has no significant harm levels.

Table 9

Total Number of Violations of the 24-Hour Particulate Standard

Site	Operator	1973 State 1/ (ug/m3)	1973 Federal 2/ (ug/m3)	1974 State 1/ (ug/m3)	1974 Federal 2/ (ug/m3)	1975 State 1/ (ug/m3)	1975 Federal 2/ (ug/m3)	1976 State 1/ (ug/m3)	1976 Federal 2/ (ug/m3)
Florence	State	18	1	5	0	20	11	7	0
Florence	Phelps Dodge	229	19	150	13	49 3/	2 3/	-	-
Coolidge	Phelps Dodge	226	27	122	10	116	8	22	5

Source: Arizona Department of Health Services, Phelps Dodge Corporation.

1/ State Standard: 150 micrograms per cubic meter.

2/ Federal Standard: 260 micrograms per cubic meter.

3/ Data only from January to May.

Table 10

Expected Construction Equipment and Light Vehicle
Pollutants 1/ Emitted During Construction
Salt-Gila Aqueduct - Central Arizona Project

Vehicles	Carbon Monoxide	Exhaust Hydrocarbons	Nitrogen Oxides	Oxidants	Sulfur Oxides	Particulants
Heavy Duty Construction	0.103	0.037	0.540	0.009	0.034	0.026
Light Duty Construction	0.050	0.004	0.006	-	-	-
Commuter	0.250	0.019	0.032	-	-	-
Total	0.403	0.060	0.578	0.009	0.034	0.026

1/ Tons per day.

Note: Appendix Tables C-1.1 through C-1.4 show more detailed analysis.

one reach with a length of 12 miles (19.3 km), width of 600 feet (183 meters) and vertical mixing of 100 feet (30 meters); the concentrations shown in Table 11 would result.

Table 11 shows that impacts of construction activities on air quality would be insignificant as compared to the Arizona ambient air quality standards. For example, if the oxidant concentration resulting from construction shown in Table 11 (0.06 ug/m^3) was added to the maximum one hour oxidant concentration recorded in the aqueduct area (154 ug/m^3 at Coolidge in 1974, Figure 56), the resulting concentration would be increased by less than 0.4 of one percent, still below the Arizona and Federal standard.

Dust control would be the primary concern during construction, particularly since present concentrations of particulates already exceed ambient air quality standards. Construction specifications would require the contractor to carry out proper and efficient measures to comply with local air pollution regulations or to reduce dust nuisances. The contractor would be responsible for preventing any nuisance to persons, or damage to crops, orchards, cultivated fields, and dwellings resulting from dust originating from his operations.

C. Biota

Reclamation contracted for studies to inventory the biological resources of the Salt-Gila Aqueduct area (see Chapter VIII.D.). Researchers under the direction of Dr. Robert Ohmart, Arizona State University (ASU), inventoried the nongame mammals, birds, herpetofauna, and vegetation. The study included data on species diversity and density by habitat types for an 11-month period in 1975 (Schwartzman et al. 1976). As a part of the studies, permanent transects were established at 16 locations within a 2-mile (3.2 km) wide corridor along the alinement for inventorying existing conditions and Reclamation monitoring of impacts that could result from construction and operation of the aqueduct.

Ronald G. Horejsi of the Arizona Game and Fish Department (AGFD) directed a study of the large and small game and predator species including inventory and density information. This report, through a series of maps, shows the significant areas of mule deer, javelina, Gamble's quail, dove, and cottontail-jackrabbit populations in the vicinity of the alinement (Horejsi 1976).

The U.S. Fish and Wildlife Service (FWS) studied the area as part of its overall Central Arizona Project Advance Planning Report, prepared under authority of, and in accordance with, provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) (FWS 1976). The report developed recommendations for the mitigation of impacts due to construction and enhancement of the environment after construction and has been updated to more accurately reflect the proposed actions (FWS 1978). Many of the recommendations such as wild-

Table 11

Potential Pollutant Concentrations Resulting from Construction Emissions
Salt-Gila Aqueduct - Central Arizona Project

Pollutant	Averaging Time 1/	Concentration (ug/m^3)	Standard (ug/m^3)
Carbon Monoxide	1 hour	0.36 2/	40 2/
	8 hours	0.04 2/	10 2/
Hydrocarbons	3 hours	1.28	160
Nitrogen dioxide	Annual	0.05	100
Oxidants	1 hour	0.06	160
Sulfur dioxide	3 hours	0.72	1300
	24 hours	0.003	365
	Annual	0.003	80
Particulates	24 hours	0.002	150
	Annual	0.002	75

1/ For averaging times of 8 hours or more, a normal wind speed of 2 miles (3.2 km) per hour is assumed. For averaging times less than 8 hours, wind conditions are assumed for the worst conditions - zero velocity.

2/ Units are mg/m^3

life crossings, fencing, escape devices, oases, and catchments contained in the report would be analyzed for inclusion in the design of aqueduct features. For example the FWS 1976 report recommended 24 wildlife oases and specified their location. The 1978 update recognized the need to revise the number and location of oases based on information available at the time of design. Reclamation clearly anticipates development of the oases, but their actual implementation will depend on coordination with the FWS and the AGFD.

A team of representatives from the FWS, AGFD, Bureau of Land Management (BLM), and Reclamation would analyze and make recommendations concerning the need for deer-proof fencing, wildlife crossings, escape devices, oases, catchments, and other wildlife mitigation and enhancement measures. Finalization of the number, design, and placement of these features would be made as definite design data for the aqueduct becomes available.

The results of the completed studies in combination with studies by Reclamation biologists are summarized in this biota section. Additional data on the biological resources of the area can be found in the individual study reports, which are available from the Regional Director, USBR, Boulder City, Nevada, 89005.

Reclamation would also carry out a continuing program of research and monitoring of the long-term impacts and ecological changes resulting from the construction and operation of the aqueduct. This program would study changes caused by the importation of Colorado River biota, response of vegetation to the severence of ephemeral drainages, behavioral response and movement patterns of wildlife related to disruption of habitats and territories, the efficiency of crossing structures in maintaining animal movement between severed wildlife populations and evaluation of the effectiveness of oases and other mitigation features.

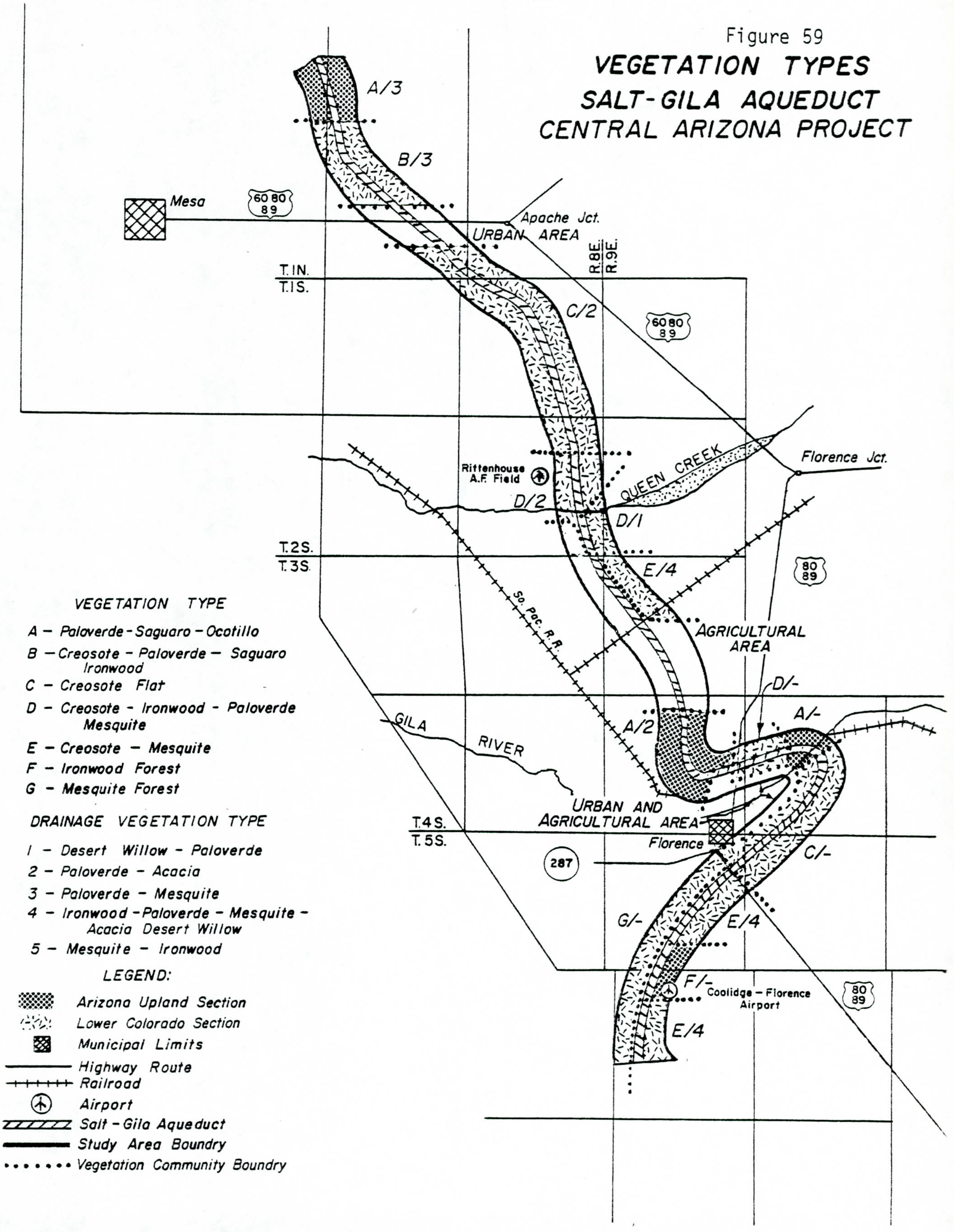
1. Vegetation

a. General

The vegetation of the project area is characteristic of the Southwestern Desertscrub Formation, Lower Sonoran Life-Zone, which includes most of southern Arizona (Lowe 1964). Within this life zone, the 2-mile (3.2 km) wide study area can be generally described as an ecotone formed by the transition from the lower Colorado section in the west to the Arizona upland section in the east (Figure 59). The majority of aqueduct alinement passes through the lower Colorado section and is typified by creosotebush associations on sandy and loamy soils of the flat plains or the slightly sloping terrain of the low bajadas. Dominant vegetation is creosotebush (*Larrea tridentata*) and bursage (*Ambrosia spp.*).

Figure 59

VEGETATION TYPES
SALT-GILA AQUEDUCT
CENTRAL ARIZONA PROJECT



SOURCE: Schwartzmann et al. 1976.

344-330-T-707

Arizona upland section occurs primarily on the low hills and upper bajadas with coarser soils and is represented in the study area by the paloverde-saguaro association. The plant association includes several species of small leaf trees, shrubs, and cacti. The dominant forms are little-leaf paloverde (Cercidium microphyllum), ironwood (Olneya tesots), brittlebush (Encelia farinosa), ocotillo (Fouquieria splendens), saguaro (Cereus giganteus), and several species of cholla and pricklypear (Opintia spp.). Table 12 is a list of plant species identified in the Salt-Gila Aqueduct area. The best development of the paloverde-saquaro association occurs on the northern end of the alinement and in the vicinity of the Gila River.

Table 12

Plant Species Identified on Permanent Transects
Salt-Gila Aqueduct - Central Arizona Project

Common Name	Scientific Name	Plant Community PVS	M	C	W
Jointfir	Ephedra spp.	X	X		
Red brome	Bromus rubens	X			
Schismus	Schismus arabicus	X	X	X	X
Rigid spiny herb	Chorizanthe rigida	X			
California buckwheat	Eriogonum fasciculatum	X			
Rockpurslane	Calandrinia spp.	X			
False-mesquite	Calliandra eriophylla	X			
Catclaw acacia	Acacia greggii		X	X	X
Whitethorn acacia	Acacia constricta	X	X		
Honey mesquite	Prosopis velutina		X		
White ratany	Krameria grayi	X			
Little-leaf paloverde	Cercidium microphyllum	X		X	
Blue paloverde	Cercidium floridum	X			X
Ironwood	Olneya tesota	X			
Filaree	Erodium cicutarium	X	X	X	
Fagonia	Fagonia californica	X			
Creosotebush	Larrea tridentata	X	X	X	X
Squawbush	Condalia spanthulata	X			
Desertmallow	Sphaeralcea ambigua		X		
Saguaro	Cereus giganteus	X		X	
Hedgehog cactus	Echinocareus engelmannii	X			
Barrel cactus	Ferocactus wislizeni	X			
Fishhook cactus	Mammillaria spp.	X			
Engelmann prickly pear	Opuntia phaeacantha	X			X
Pencil cholla	Opuntia arbuscula	X	X		
Christmas cactus	Opuntia leptocaulis	X			
Teddybear cactus	Opuntia bigelovii	X			
Buckhorn cholla	Opuntia acanthocarpa	X			
Ocotillo	Fouquieria splendens	X			
Fiddleneck	Amsinckia spp.	X		X	X
Wolfberry	Lycium spp.	X	X		
Wolfberry	Lycium pallidum		X		
Anderson wolfberry	Lycium andersonii		X	X	
Desertwillow	Chilopsis linearis				X
Plantain	Plantago spp.	X		X	
Plantain	Plantago purshii	X			

Source: Schwartzmann et al. 1976.

Note: PVS = Paloverde-saguaro, M = Mesquite, C = Creosotebush, W = Wash

Table 12 (Continued)

Common Name	Scientific Name	Plant Community PVS	M	C	W
Plantain	*Plantago insularis*	X			
Turpentinebush	*Haplopappus spp.*		X		
Desertbroom	*Baccharis sarothroides*				X
Burrobrush	*Hymenoclea monogyra*			X	X
Bursage	*Ambrosia confertiflora*		X		
White bursage	*Ambrosia dumosa*	X			
Bursage	*Ambrosia deltoidea*	X	X	X	
Brittlebush	*Encelia farinosa*	X			X
Woolly-daisy	*Eriophyllum lanosum*	X			

The variety of vegetation types illustrated on Figure 59 is indicative of the transitional nature of the area from lower Colorado to Arizona upland. The vegetation types were derived from a visual analysis of the study area (Schwartzman et al. 1976). Those listed as A, F, and G are generally associated with the Arizona upland section while types B, C, D, and E are associated with the lower Colorado section.

b. Vegetative Analysis

Site specific data on the vegetation were collected to gain the best comparative analysis of the study area flora and for use with the wildlife surveys completed in conjunction with the ASU study. The data were collected using a modified line intercept technique at four locations on each of the 16 permanent 1-mile transects which had been located in vegetatively homogenous sites in the study area. These vegetatively homogenous sites, for the sake of convenience, were designated communities and named for the visually dominant plants, plant group, or topographic setting.

Each of the four communities were analyzed to determine the percentage of absolute ground cover and the relative dominance, density, and frequency of plant species within the communities (Table 13).

A summation of the relative dominance, density, and frequency for each plant species provided an index (importance value) of comparison for plant species within each respective community (Table 13). As indicated in the name, this index shows the relative importance of a particular species and is based soley on size, occurrence, and physiognomy in a particular community. The importance value is strictly an index of vegetational characteristics of a community and bears no intentional relationship to the zoological characteristics of the community. The statistical advantage of the index is to "smooth" out the variations in numerical data. This procedure makes it easier to compare relationships between species in a particular community and to analyze changes in community composition over time.

The following paragraphs briefly describe the four representative plant communities on which the majority of biological information contained is this statement was based.

(1) Creosotebush Community

The creosotebush community (Figure 60) comprises the largest area to be affected by the project (Table 14) with approximately 4,435 acres (1,795 ha) which would be impacted within the right-of-way. About 610 acres (247 ha) would be permanently lost.

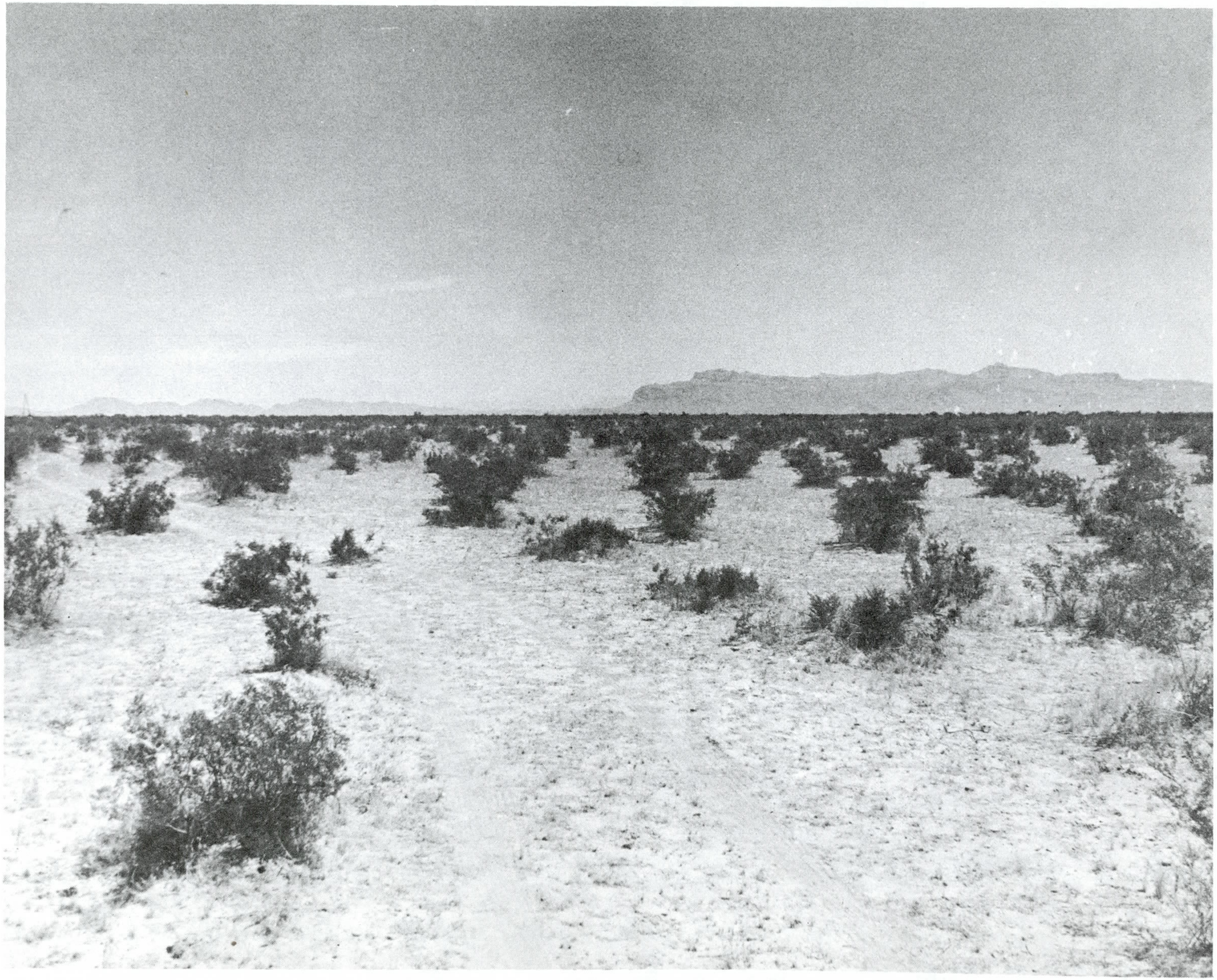


Figure 60--Creosotebush Plant Community--Salt-Gila Aqueduct--Central Arizona Project. Typical creosotebush plant community showing a predominance of creosotebush and bursage. The grass, schimus (*Schismus sp.*) as seen in this photograph provide a dense cover in the spring of 1978 due to abundant winter rains. Photograph No. SGA-EIS 006 (HG).

Table 13

Plant Species Occurring in Each Community Type
With Absolute Cover of 0.1 Percent or Greater

	Paloverde-Saguaro		Mesquite		Creosotebush		Wash	
	Cover (%)	Importance Value	Cover (%)	Importance Value	Cover (%)	Importance Value	Cover (%)	Importance Value
Creosotebush	11.1	110.1	4.9	53	10.2	211.0	5.3	111.9
Bursage	9.1	101.5	2.8	30.5	1.7	54.2		
Brittlebush	1.2	11.6					.75	35.8
Little-leaf paloverde	5.4	20.5			2.2	18.0		
Blue paloverde							6.7	29.8
Jointfir	0.5	2.7						
Ironwood	1.7	5.3						
White ratany	1.3	20.3						
Wolfberry			1.3	15.8				
Anderson wolfberry					1.1	13.1		
Turpentinebush			4.9	61.3				
Mesquite			17.9	119.2				
Desertbroom							1.9	13.8
Burrobrush							3.0	64.3
Catclaw acacia							4.3	29.2
Other	3.0	27.2	.4	19.4	0.1	3.4	.8	13.8
TOTALS	33.3	299.2	32.2	299.2	15.3	299.7	22.7	298.6

Source: Schwartzmann et al. 1976.

Table 14

Estimated Acreage of Impacted Areas Within the Right-of-Way for Each Plant Community and Land Use 1/
Salt-Gila Aqueduct - Central Arizona Project

	Permanent Loss	Long-Term 2/ Disturbance	Short-Term 3/ Disturbance	No Disturbance 4/	Total
Desert Range	797	1,852	3,233	133	6,015
Creosotebush	(610)	(1,226)	(2,599)	(113)	(4,548)
Paloverde-Saguaro	(167)	(565)	(557)	(19)	(1,308)
Mesquite	--	(5)	(10)	--	(15)
Wash	(20)	(56)	(67)	(1)	(144)
Urban	103	--	--	--	103
Irrigated Farm Land	400	--	--	--	400
Total R-O-W	1,300	1,852	3,233	133	6,518 5/

1/ Vegetative communities as defined by Schwartzmann et al. 1976. The land use in these plant communities is generally livestock grazing.

2/ Areas with long-term vegetative disturbance may require 30 years or more for recovery of near-natural conditions.

3/ Areas where dust and sound of construction activities may temporarily disturb vegetation and wildlife or areas upstream of dikes which may be subject to infrequent inundation.

4/ Areas acquired as uneconomic remainders and not needed for project facilities.

5/ An additional area downstream from the aqueduct would be impacted by the severance of ephemeral drainages. The actual number of acres affected would depend on the final design of cross drainage structures. An additional acreage would be disturbed for aggregate source and haul roads, tentatively estimated at 200 acres. The decision whether to develop new aggregate sources or to utilize existing commercial suppliers would be made by the contractor after the award of construction contracts.

The low percentage of vegetative ground cover [1/] (15.3 percent), the overwhelming dominance of creosotebush and bursage, and the relegation of tree species to ephemeral drainages are all characteristic of creosotebush associations in the lower Colorado section. Comparison of the importance values (Table 13) gives an indication of the dominance of creosotebush in the community. Little-leaf paloverde and Anderson wolfberry (Lycium andersonii) were generally associated with the ephemeral drainages within the community. Several other plant species occurred in the creosotebush community but had extremely low cover values with correspondingly low importance values.

(2) Paloverde-Saguaro Community (Figures 61 and 62)

The overstory of this community is composed of paloverde, saguaro, and ironwood with an understory dominated by bursage. This is a floristically rich community with several species occurring on the transects (Table 13). The paloverde-saguaro community is generally representative of the Arizona upland section with the exception of the high occurrence of creosotebush. This high occurrence is indicative of the transitional nature of the vegetation types in the area.

Creosotebush and bursage dominate this community as shown by their importance values of 110.1 and 101.5, respectively. The saguaro is visually dominant in this community but its vertical physiognomy resulted in low cover values and a correspondingly low importance value as sampled by the line intercept technique.

The principal areas of occurrence of the paloverde-saguaro vegetation type within the project area are between the Salt-Gila Pumping Plant site and McDowell Road, between Arizona Farms Road and U.S. Highway 80-89, and near the Gila River Siphon site (Figure 63). The total acreage of this association to be disturbed within the project right-of-way is about 1,289 acres (522 ha) (Table 14).

(3) Mesquite Community (Figure 64)

The mesquite community is more mesopyhtic than the two communities described above. Total ground cover is approximately equal to the paloverde-saguaro community, but the dominant species, mesquite (Prosopis velutina) and turpentinebush (Haplopappus spp.) normally occur in areas with higher available soil moisture.

1/ All ground cover values for the community descriptions represent an absolute percent of ground covered by the canopy of the vegetation on the transects.

The overstory in this community is composed of mesquite and wolfberry (Lycium sp.) with importance values of 119.2 and 15.8, respectively. The importance value of the understory species are turpentinebush, 61.3; creosotebush, 53; and bursage, 30.5.

This vegetation type occurs principally along the east side of the Florence-Casa Grande Canal south of Florence (Figure 65). The aqueduct alinement lies adjacent to but not within this community and permanent disturbance of this community is not anticipated (a discussion of this vegetation is presented later in this section). However, about 5 acres (2 ha) of the mesquite community would suffer long-term disturbance and 10 acres (4 ha) would be temporarily impacted by increased dust or human activities (Table 14).

(4) Wash Community (Figure 66)

The analysis of this community was derived from transects located in Durham Wash on the east side of the Picacho Mountains and in Queen Creek. Durham Wash is no longer within the aqueduct alinement since the original Reach 5 of the Salt-Gila Aqueduct has been transferred to the Tucson Division. Queen Creek (Figure 66) is of comparable size and vegetation composition to Durham Wash and would be crossed by the aqueduct. The information included in Table 12 for the wash community is presented as being representative of large ephemeral washes within the study area. The vegetation of the smaller desert drainages which occur in the paloverde-saguaro and cresotebush communities have been included in the vegetative analysis of those communities. Approximately 20 acres (8 ha) of wash vegetation would be permanently lost in the Queen Creek Siphon area. A total of 56 acres (23 ha) of wash vegetation along the aqueduct would suffer long-term disturbance and 67 acres (27 ha) would suffer short-term disturbance (Table 14).

The Gila River Siphon site and a portion of the Sonoqui Dike site (Figures 63 and 66) are located in channels which contain flowing water only in response to flooding or localized heavy rains. Although historically the Gila River was a perennial stream, and Queen Creek was an intermittent tributary of the Gila River, neither can be properly described as wetlands under the 1977 FWS classification system for wetlands and deep-water habitats of the United States (FWS 1977). According to the FWS criteria, wetland is defined "as land where the water table is at, near or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes"; or, lacking soils and vegetation, wetlands "can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep water habitats" (FWS 1977). Neither hydric soils nor hydrophytic vegetation are present at the siphon site. Although surface water is occasionally present in both channels, its occurrence is not annual or regular, and neither site is located adjacent to or within vegetated wetlands or deep-water habitats. Hence, the siphon and dike sites

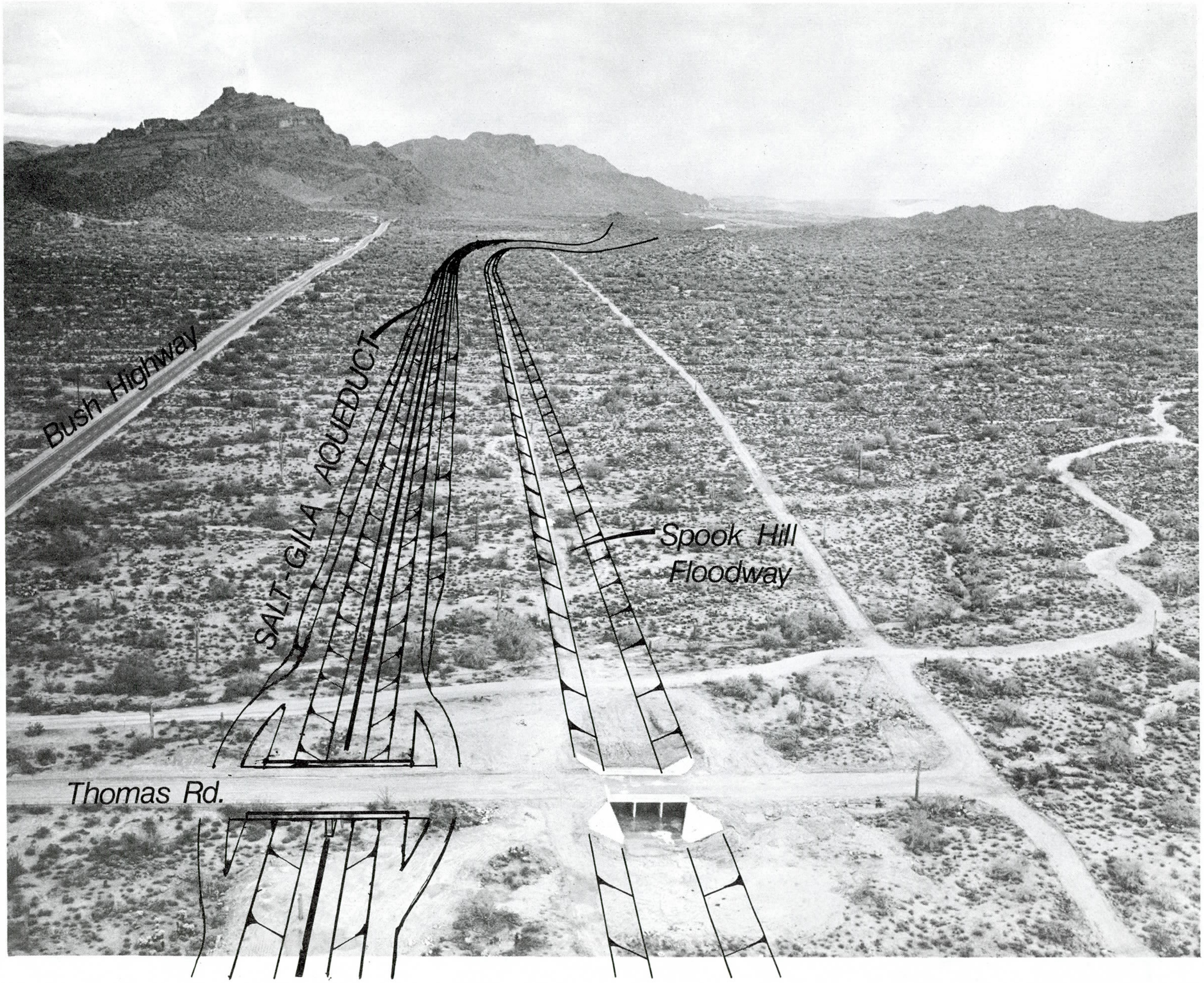


Figure 61--Paloverde-Saguaro Plant Community--Reach 1--Salt-Gila Aqueduct--Central Arizona Project. Aerial view north from Thomas Road showing an artist's concept of the aqueduct and Spook Hill Floodway (SCS). The floodway is presently under construction. Photograph No. P344-300-02494 NA (0).

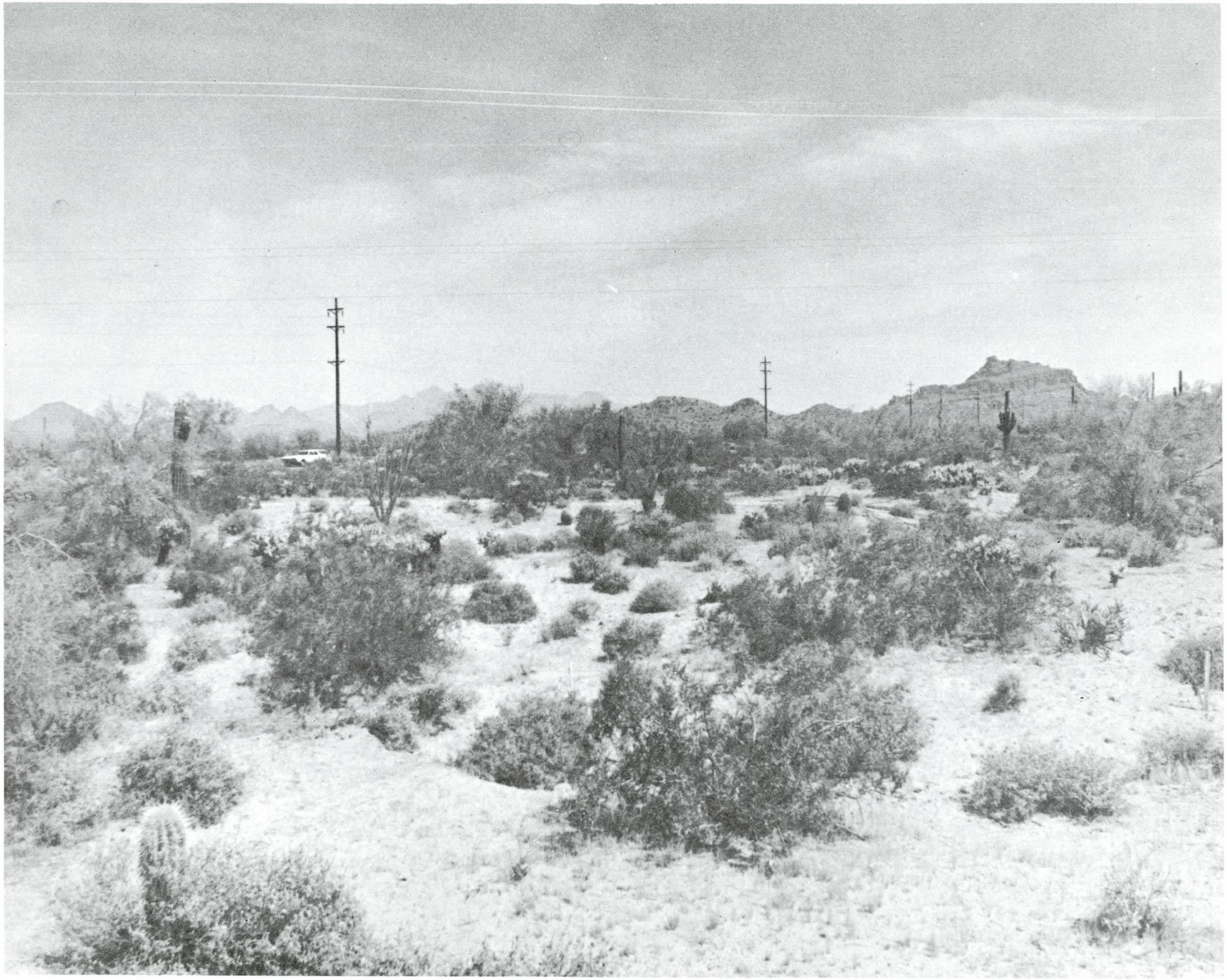


Figure 62--Paloverde-Saguaro Plant Community--Salt-Gila Aqueduct--Central Arizona Project. View of a typical paloverde-saguaro plant community in the northern part of Reach 1. Photograph No. SGA-EIS 005 (HG).

Figure 63--Gila River Siphon Area--Aerial view showing Gila River crossing and a portion of Reach 3 of Salt-Gila Aqueduct-Central Arizona Project. Photograph No. P344-300-01737 NA.

Figure 64--Mesquite Plant Community--Salt-Gila Aqueduct--Central Arizona Project. Typical mesquite plant community located in Reach 4 near the proposed alinement. Note the overwhelming dominance of mesquite. Photograph No. SGA-EIS 004 (HG).

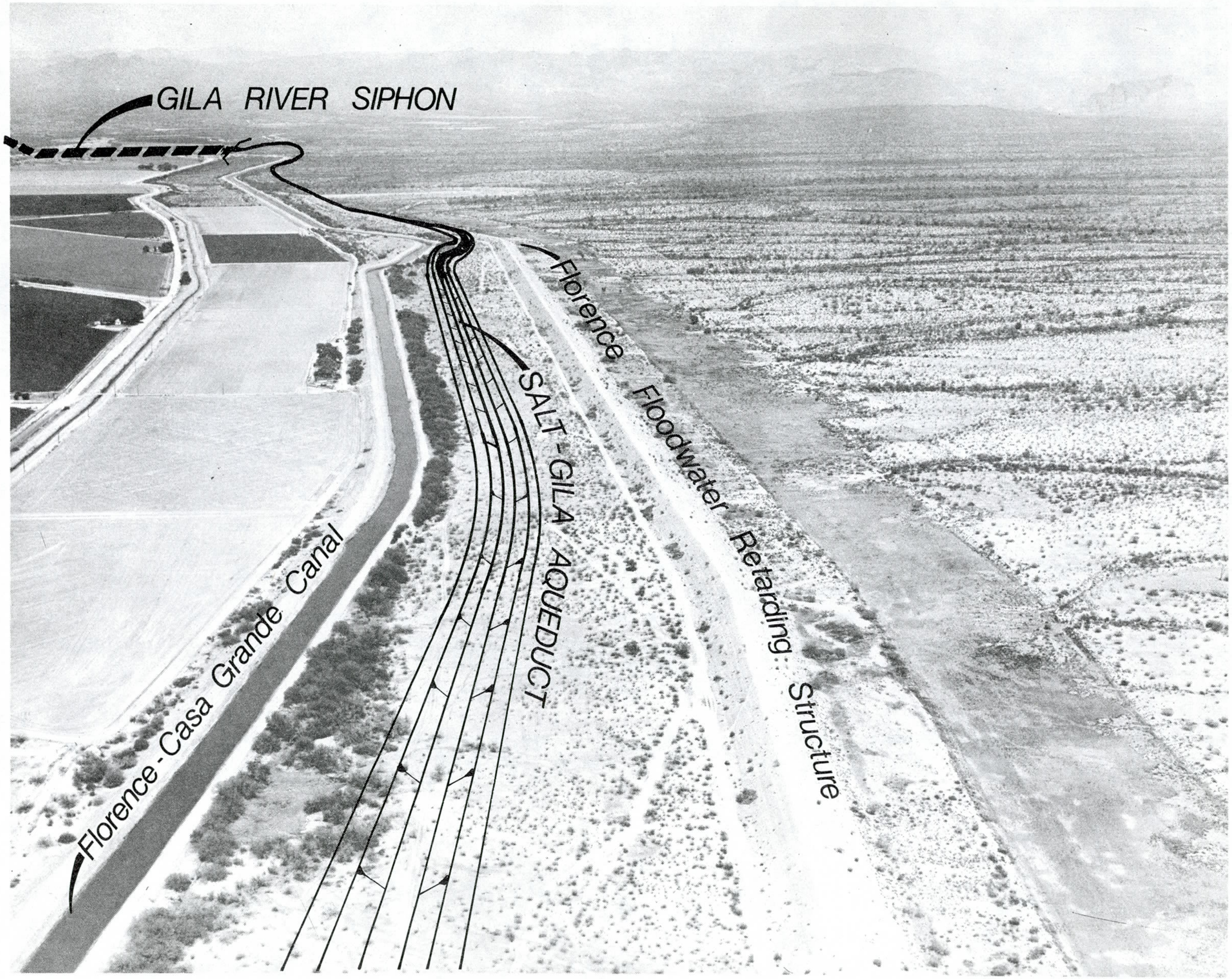


Figure 65--Vegetation Along the Florence-Casa Grande-Canal--Reach 4-Salt-Gila Aqueduct--Central Arizona Project. Aerial view northeast between the Florence-Casa Grande Canal (San Carlos Project) and Florence Floodwater Retarding Structure (SCS). Note the vegetation that has developed on the upstream side of the canal which provides habitat for wildlife. The vegetation is predominately mesquite. The vegetation on the dike and borrow areas has developed naturally subsequent to construction of the retarding structure. Photograph No. SGA-EIS 002 (HG) (O).

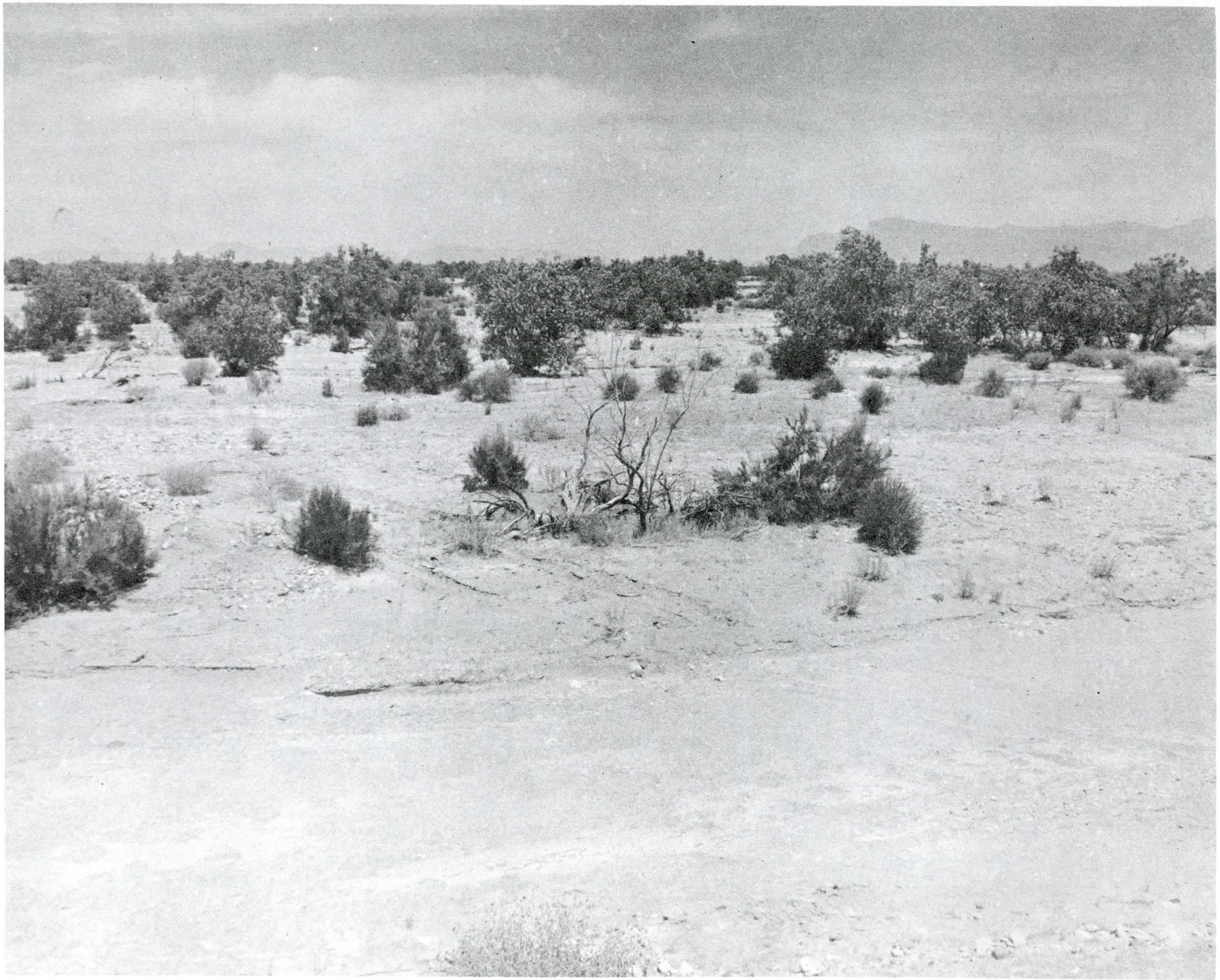


Figure 66--Wash Plant Community--Salt-Gila Aqueduct--Central Arizona Project. Typical view of Queen Creek looking north along the alinement. Dominant vegetation is desert willow. Photograph No. SGA-EIS 003 (HG).

cannot be classified as wetland, and no impacts to wetland vegetation or wildlife would occur.

Two areas of special importance to wildlife are located in close proximity to the project area. These are Picacho Reservoir and the area along the east side of the Florence-Casa Grande Canal between Picacho Reservoir and Cactus Forest Road. These areas would not be disturbed by the project, although some change in the rate of inflow into Picacho Reservoir may be expected due to the construction of floodwater retarding structures.

Picacho Reservoir, (Figure 67) located approximately 2 miles (3.2 km) southwest of the aqueduct terminus, is a marsh-like area of approximately 2,100 acres (850 ha) used for storage of San Carlos Project irrigation water. Dominant vegetation is composed of stands of mesquite, saltbush (*Atriplex sp.*), and creosotebush on the outer edges with saltcedar, (*Tamarix pentandra*), bulrush (*Scirpus sp.*), Gooding willow (*Salix Goodingii*), and cattails (*Typha domingensis*), forming the marshy areas within the reservoir. The reservoir has not been studied in relation to the aqueduct as it does not lie within the project impact area.

A portion of the area along the east side of the unlined Florence-Casa Grande Canal has been studied in conjunction with the ASU study and is delineated on the vegetation map (Figure 59) as mesquite thicket. This mesquite forest exists in a narrow dense stand on and immediately adjacent to the canal berm. The composition of the mesophytic vegetation contrasts sharply with the xerophytic vegetation immediately to the east. This contrast is probably the result of increased available soil moisture due to canal seepage and periodic sheet runoff from the adjacent desert area.

Disturbance of vegetation would occur throughout the project area due to construction activities and would continue throughout the life of the project. This disturbance would be in three principal forms. Permanent removal of all vegetation would occur due to the construction of the aqueduct and associated permanent structures. Long-term modification of vegetation would occur in the Gila River siphon area, borrow areas, spoil areas, upstream and downstream areas of protective dikes, and the dike faces. Temporary disturbance of unquantified duration would probably occur in fringe areas of all the construction sites along the aqueduct route due to dust and human intrusion. The wildlife associated with the lost and disturbed vegetation would also be lost or displaced as discussed in Chapter III. C. 2. Domestic grazing animals would also be reduced by about 38 animal units per year by the loss of grazing on about 6,015 acres (2434 ha) which would come under Reclamation ownership.

In order to construct the aqueduct and associated permanent structures it would be necessary to permanently remove native vegetation from approximately 797 acres (323 ha) within the aqueduct right-of-way (Table 14). This estimate includes all permanent structures for the aqueduct, power substation, transmission lines, operation and maintenance roads, and protective dikes. Approximately 76.5 percent or 610 acres (247 ha) would be permanently removed from the creosotebush community, 21 percent or 167 acres (68 ha) from the paloverde-saguaro community, and 2.5 percent or 20 acres (8 ha) from the wash community.

The mesquite community as described by Schwartzmann et al. (1976) would not be permanently lost by the construction of the project. However, approximately 5 acres (2 ha) would suffer long-term disturbance and about 10 acres (4 ha) would be temporarily disturbed.

In addition, two dense pockets of vegetation which have a dominant mesquite overstory would be permanently affected by the construction. The first area consists of a stockpond and associated vegetation located in Reach 2. The second area is located in Reach 4 south of the Florence cemetery and consists of mesquite and cresotebush supported by irrigation runoff. Within these two areas approximately 10 acres (4 ha) of vegetation, as well as the stockpond, would be removed. Because of their vegetative composition and isolation, these areas were not included in the mesquite community described by Schwartzmann (1976) and are not listed as such on the various tables in this chapter.

Long-term modification of the vegetative composition and/or cover would result from the removal and subsequent revegetation of areas not required for permanent structures or the operation and maintenance of the project. Such areas would include borrow areas, spoil areas, haul roads, siphon areas, dike faces, construction staging areas, and other areas where the vegetation would be disturbed to the point where unassisted recovery is unlikely.

A modification of vegetation would also occur in upstream and downstream areas surrounding the retarding structures. These structures would be designed to release impounded water down the ephemeral drainages. The structures would sever sheet flows, concentrating and channeling them into the drainages on the upstream side. This would cause a more xeric condition on the area between the washes on the downstream side while creating a more mesic condition within the washes themselves.

On the upstream side of the retarding structures the temporary impoundment of floodflows would increase water infiltration into the soil causing a more mesic condition. In time the vegetation in this area would be modified due to increased plant-available water.

Temporary disturbance would occur throughout the project area due to increased dust and human activities. These temporarily disturbed areas would probably recover from these impacts within a few years.

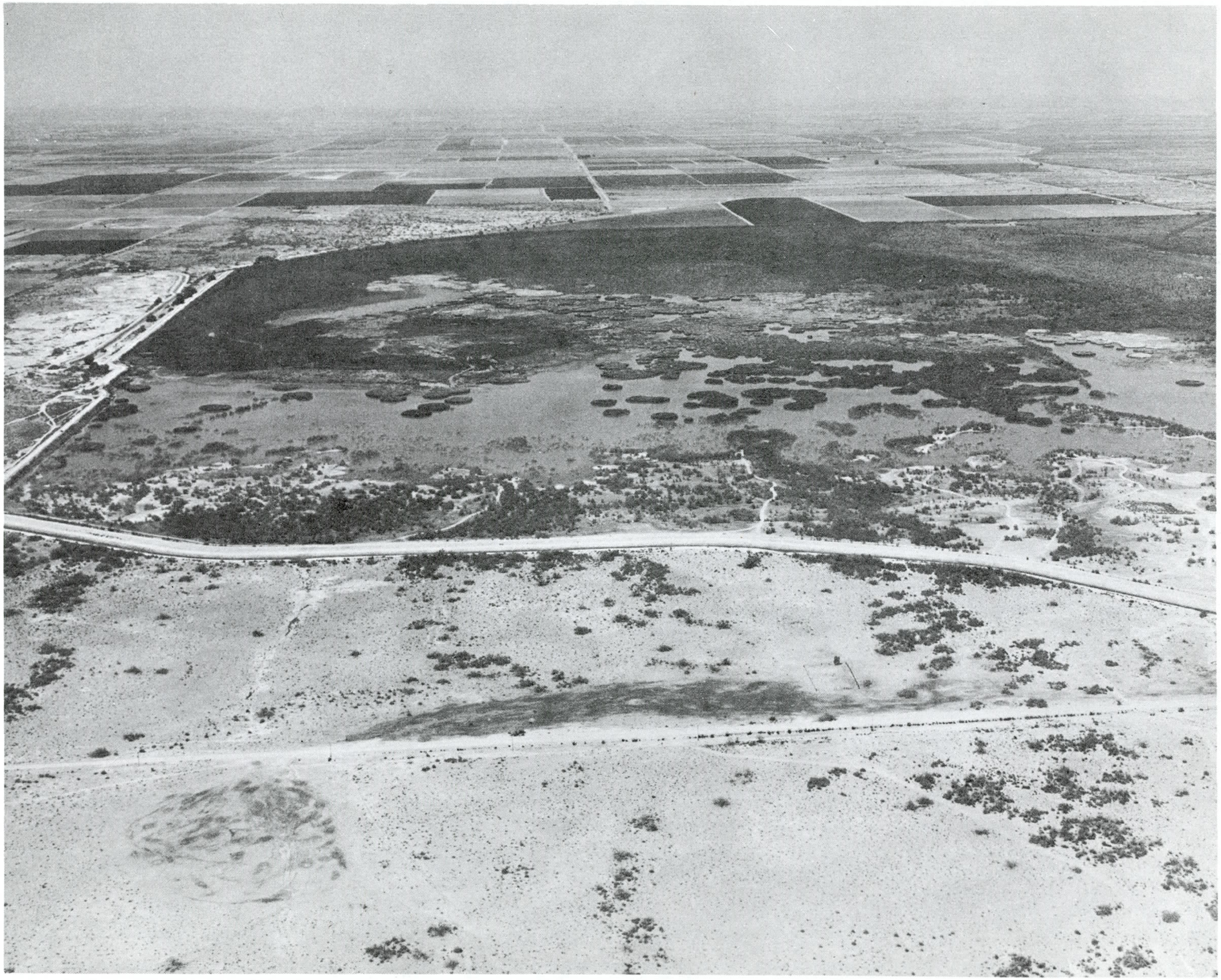


Figure 67--Picacho Reservoir--San Carlos Project. Aerial view west showing the vegetation within the reservoir area. The reservoir surrounded by Sonoran Desert and farmland provides high quality habitat for numerous wildlife species. Photograph No. SGA-EIS 001 (HG).

Picacho Reservoir and the mesquite thicket adjacent to the Florence-Casa Grande Canal would not be permanently affected by the construction of the aqueduct. The protective dikes in the southern portion of Reach 4 would be designed to maintain the periodic floodflow through the ephemeral drainages, precluding adverse impacts due to the operation of the dikes. Surface flows to Picacho Reservoir would be reduced in rate, but not significantly in volume, and the reservoir is not expected to be affected by the dikes.

During construction all trees, native shrubbery, and vegetation which are not specifically required to be removed for construction purposes would be preserved and protected from any damage that may be caused by the construction operations and equipment. Special care would be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavation, dumping, chemical damage, or other operations; and the contractor would be required to adequately protect such trees by use of protective barriers or other approved methods. The removal of trees or shrubs would be permitted only after prior approval by Reclamation in cooperation with the Arizona Agriculture and Horticulture Commission (see Appendix C.2-2).

Investigations by Reclamation on Reach 11, Granite Reef Aqueduct, have shown that revegetation of disturbed areas is possible without supplemental water (Figure 68). The technique which has proven most successful involves replacement of topsoil, scarifying the soil surface, and broadcasting endemic and/or xeric adapted plant seed immediately following completion of construction. Data collected to date indicate that nonirrigated revegetation is superior to irrigation supported revegetation because the supplemental water produces dense stands of water-dependent plants. When irrigation is discontinued, the available soil moisture is quickly depleted, resulting in severe water stress and a large die-off. Data are still being collected on this testing program and will be published. Other alternatives are being considered which could aid in increasing vegetation establishment rates. Among these are rock mulching, the introduction of ephemeral species for temporary ground cover, and additions or deletions to the currently recommended seed mix.

Revegetation recommendations for the Salt-Gila Aqueduct would vary according to the type and extent of disturbance from construction and the applicability of demonstrated seeding techniques. Supplemental seeding would not take place in areas needed for operation and maintenance of the aqueduct, nor in areas where the success of such seeding is highly improbable. These areas would include O&M spoil areas where material removed from the aqueduct would be periodically dumped, and floodwater detention basins where periodic inundation would alter species composition and natural recovery of some plant cover is likely.

Revegetation efforts would prove valuable in other disturbed areas such as dike faces, siphon areas, spoil areas, construction haul roads, and staging areas. The recommended revegetation techniques for these areas includes replacement of topsoil, horizontal furrowing of Reclamation dikes, scarification of disturbed areas (Figure 69), and broadcast seeding of xeric adapted species. The currently recommended seed mix includes, but is not limited to, desert saltbush (Atriplex polycarpa), quail bush (Atriplex lentiforis), brittlebush (Encelia farinosa), triangle-leaf bursage (Ambrosia deltoidea), and creosotebush (Larrea tridentata). Revegetation is expected to be accomplished on approximately 1,852 acres (749 ha).

The establishment of oases along the aqueduct route as outlined in the overall CAP FES is being studied jointly by FWS, BLM AGFD, and Reclamation for the purpose of partially replacing destroyed vegetation and as habitat for wildlife. Although a final design for these oases has not been made, present proposals call for a small concrete slab with a shallow depression in the center. The slabs would be placed within the aqueduct right-of-way near existing washes or mesquite stands. A continuous flow (1 acre-foot or less per year) would maintain the water level in the bowl and the overflow would induce vegetation growth around the concrete slab. A heavy stand of woody plants may become established around the concrete slab and provide water, limited food and cover for wildlife. The placement of oases is dependent upon results of proposed oases studies.

All Salt-Gila Aqueduct construction activities would be excluded within a 2-mile (3.2 km) radius of Picacho Reservoir and from the westerly right-of-way boundary of the aqueduct to the Florence-Casa Grande Canal within Reach 4 (Figure 70). This buffer zone would preclude even the incidental impacts of construction of the project in this area.

Revegetation would take place on about 1,852 acres (749 ha) (long-term impact areas, Table 14) of the 2,649 acres (1072 ha) of destroyed or severely disturbed vegetation within the right-of-way resulting in a permanent loss of 610 acres (247 ha) of creosotebush community, 167 acres (68 ha) of paloverde-saguaro community, and 20 acres (8 ha) of wash community. An additional acreage of vegetation outside the right-of-way (about 200 acres (81 ha)) would be removed or severely disturbed. These areas would include aggregate sources and haul roads and would be selected following an environmental evaluation coordinated with interested agencies.

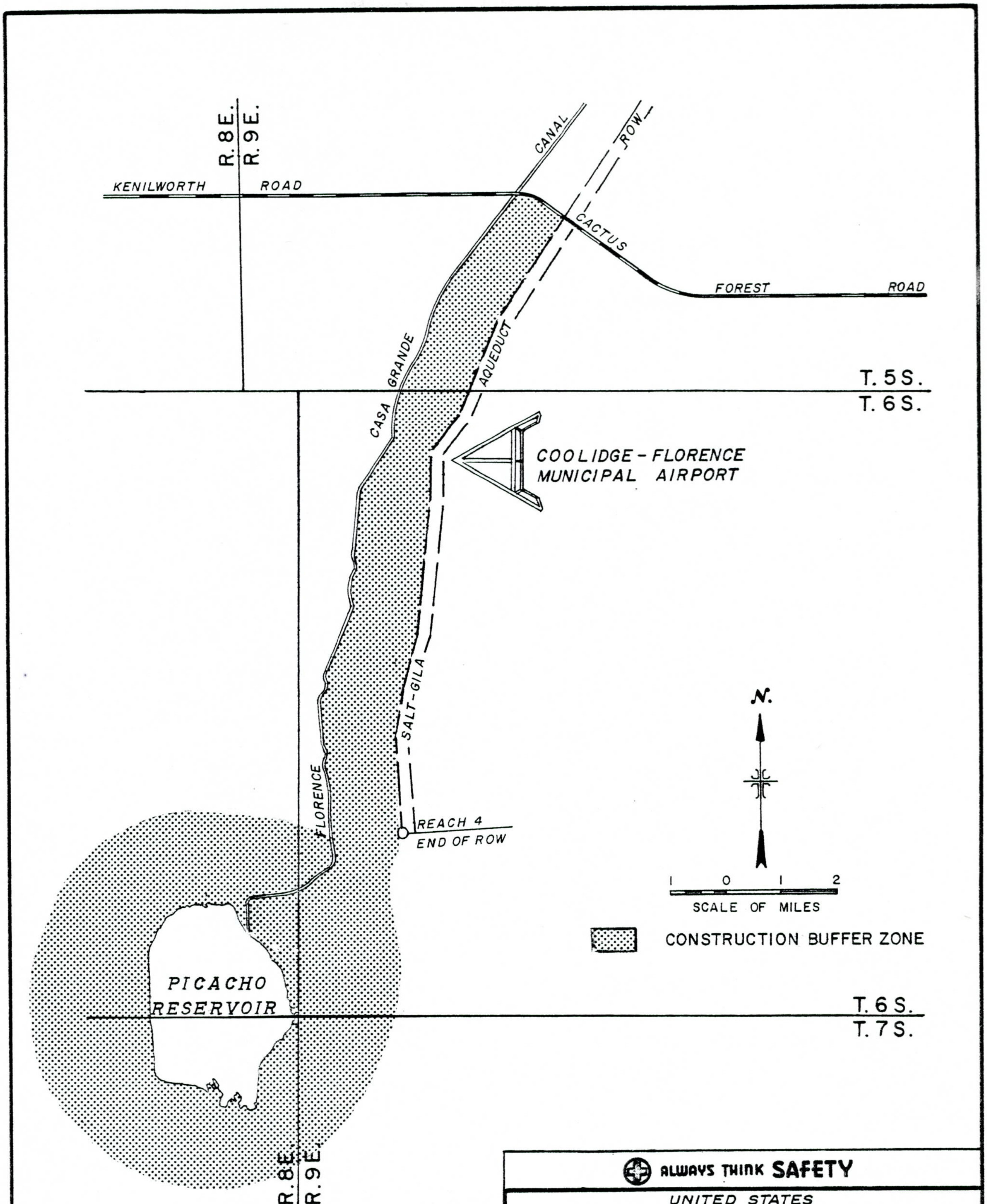
c. Special Status Plants

There are no listed endangered or threatened plant species known to exist on the aqueduct alinement.

In July 1975 and in June 1976 the FWS published review notices which proposed the listing of 170 plant species which are considered threatened or endangered in Arizona. With the aid of information supplied by the BLM, a list of these proposed threatened or endan-

Figure 68.--Revegetation Paradise Valley Flood Detention Dike--Granite Reef Aqueduct--Central Arizona Project. Aerial view east toward Scottsdale Road showing the horizontal furrows and seeded saltbush that was established without supplemental water. The dike was seeded in August 1975 after completion of construction and this photograph was taken about 28 months later in December 1977. Photograph No. P344-300-02386.

Figure 69--Scarification of Construction Disturbed Areas--Granite Reef Aqueduct--Central Arizona Project. Aerial view east of the eastern portion of Reach 5A showing that disturbed areas have been scarified to stimulate natural revegetation. Seeds from the surrounding vegetation will be carried into the area naturally resulting in a natural appearance after a number of years. Photograph No. 344-300-02368.



ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
CONSTRUCTION BUFFER ZONE

DESIGNED ____________ SUBMITTED ____________
DRAWN D.R.V. ____________ RECOMMENDED ____________
CHECKED ____________ APPROVED ____________

PHOENIX, ARIZONA MARCH 1978 344-330-T-684

GPO 845-353

gered plants which may occur along the aqueduct alinement has been compiled. Biological field studies along the alinement have not revealed the presence of any of the proposed species. The plants listed in Appendix Table C-2.1 represent the species identified as occurring in habitats similar to the habitats of the aqueduct alinement. A review of the literature has revealed no information dealing specifically with the proposed threatened or endangered plants for any locations along the alinement.

If any of the proposed plant species are listed as threatened or endangered prior to or during construction, a field inspection would be made to determine if any of the listed threatened or endangered plants occur within the aqueduct right-of-way. If a listed species is identified, Reclamation would take the appropriate action as required by the Endangered Species Act. Likewise, should any listed threatened or endangered plant species be discovered in the Queen Creek or Gila River crossing areas, the appropriate action would be taken as required by the Act.

The State of Arizona has enacted legislation (Arizona Native Plant Law, Chapter 7, Arizona Revised Statutes) for the protection of native flora. Reclamation would require all project contractors to notify the Arizona Commission of Agriculture and Horticulture at least 60 days prior to construction requiring removal of any plants listed as protected (Appendix Table C-2.2). The Commission would then notify the contractor of the options for the disposition of the plants.

2. Wildlife

a. Mammals

The AGFD studied the large and small game mammal and predator populations of the Salt-Gila Aqueduct alinement (Horejsi 1976). The study area consisted of a 2-mile (3.2 km) wide strip from the Granite Reef Diversion Dam to the vicinity of Marana. Mule deer (*Odocoileus hemionus*) and javelina (*Dicotyles tajacu*) were counted from two aerial surveys, one in March and the second in September. Each survey consisted of aerial observation by two observers for 4 hours per day for 3 days from a slow moving helicopter at an approximate altitude of 100 feet (30.5 m).

During the March survey four mule deer were located; a buck, doe, and two fawns. These four deer were observed at the north end of the Picacho Mountains, 5 to 7 miles (8 to 11.2 km) east of the present aqueduct terminus. Seven mule deer were located during the September survey. Two does and a fawn were observed near the site of the proposed Gila River Siphon and one fawn, one doe, and two bucks were seen in the vicinity of the March sitings and along the east side of the Picacho Mountains. Deer tracks were observed in the mesquite thicket south of Coolidge-Florence airport but no sitings were recorded for the vicinity. No deer were observed north of the Gila River. Although white-tailed deer (Odocoileus virginanus) were potentially expected, none were observed in the study area.

Nineteen herds of javelina were observed in the study area. Two of these herds were observed along the aqueduct alinement in the vicinity of the Gila River Siphon and near the Florence Military Reservation. The other 17 herds were observed in the same area as the deer sitings in the northeast corner of the Picacho Mountains (5 to 7 miles (8 to 11.2 km) from the terminus) and southward along the east side of the mountain range to the vicinity of Red Rock (23 miles (37 km) south of the terminus). A total of 53 javelina were observed during the March survey and 49 during the September survey. These numbers included 9 and 13 juveniles in March and September, respectively. The average herd size in March was 5.3 individuals for 10 herds and 5.4 individuals for 9 herds in September.

In a separate study by ASU, observers reported mule deer and javelina in all community types within the study area (Schwartzmann et al. 1976). This study was primarily designed to survey the vegetation and nongame wildlife of the aqueduct area. This report was not designed to collect frequency data on large game mammals, but does report that mule deer and javelina were commonly observed.

Observations by ASU researchers add to those made by the AGFD survey in that javelina were sited on the east side of the aqueduct alinement near Granite Reef Dam 1/ , west of Florence Gardens Subdivision, and southeast of Coolidge-Florence airport. The latter two sitings are in the vicinity of the AGFD observations and may be the same herds. All other reported sitings of mule deer and javelina appear to correspond closely with the AGFD survey.

The AGFD report concluded that the Salt-Gila Aqueduct study area supported a low population of mule deer and that the habitat was marginal for deer and "...probably no better for javelina...." (Horejsi 1976).

Several methods were used by the AGFD and ASU to determine the presence and relative abundance of predatory mammals. ASU used direct observation and the AGFD used direct observation plus a scent station survey and dusted plots along the secondary roads of the study area. The coyote was the most abundant of the predators found, followed by the kit fox, bobcat, badger, and an unidentified species of skunk.

Small nongame mammals were inventoried by ASU using trapping grids on each of the 16 transects at least once every 6 weeks

1/ J. L. Schwartzmann 1977: personal communication, biological researcher, A.S.U.

for 10 months. Each grid consisted of 90 snap traps set for 3 consecutive nights. The mammal densities were obtained on the basis of 270 trap nights (90 traps x 3 nights). A total of 47 grids were run in the paloverde-saguaro community, 27 in the creosotebush community, 20 in the mesquite community, and 12 in the wash community. The 106 trapping grids, representing 28,620 trapping nights, captured 2,419 animals representing 12 species.

Table 15 details the total number of captures for each species in the four plant communities and their relative abundance per 270 trap nights per month for the 10-month study period. These figures give an estimate of the relative abundance and type of small mammals occurring in each community. However, data obtained from the census method used are highly dependent on animal activity and capture susceptibility. Therefore, they represent only estimates and are not absolute densities.

Several mammals were observed along the aqueduct alinement but were not trapped (Table 16). The striped skunk and hispid cotton rat were seen only in the irrigated areas. Porcupines were observed three times. Two of these observations were in the paloverde-saguaro community and one in a wash in the creosotebush community. Raccoon and valley pocket gopher were observed along the Florence-Casa Grande Canal. Badgers were seen in all habitats of the study area.

The principal impact of the Salt-Gila Aqueduct would be a loss of habitat due to construction activities. This loss would have the greatest effect on small mammals, which have relatively small home ranges as compared to free roaming mammals such as mule deer and javelina. In accordance with the density data for small mammal use of the 797 acres (323 ha) of vegetation that would be permanently lost, there would be corresponding loss of small animal species as indexed in Table 15. An unquantified portion of the populations displaced from the 1,852 acres (749 ha) of long-term disturbed vegetation would be permanently lost due to intraspecific and interspecific competition for habitat. Although the area is considered marginal habitat for deer and javelina, the existing populations of large mammals may find the canal a barrier to movement and would lose approximately 20 acres (8 ha) of desert wash habitat, an important source of food and cover, as well as 777 acres (314 ha) of other desert habitat. The actual loss of large animals as a result of construction of the physical facility would probably not be measurable. Predators would be affected to the extent that some portion of their food base would be lost.

The Gila River crossing site has been included in the wash and paloverde-saguaro vegetation community types (Schwartzmann et al. 1976) (Chapter III.C.1.b.). There is no wetland or wetland associated wildlife which would be adversely affected by construction of the aqueduct and siphon.

Table 15

Small Mammal Captures and Relative Abundance for Plant Communities
Salt-Gila Aqueduct - Central Arizona Project

	Paloverde-Saguaro		Creosotebush		Mesquite		Wash	
	Captures	Abundance Index	Captures	Abundance Index	Captures	Abundance Index	Captures	Abundance Index
Cactus mouse *Peromyscus eremicus*	27	0.5	2	0.1	70	3.5	9	0.7
Bailey's pocket mouse *Perognathus baileyi*	144	3.6	4	0.2	76	2.9	19	1.6
Merriam's kangaroo rat *Dipodomys merriami*	444	8.5	315	10.3	199	7.8	168	10.7
White-throated woodrat *Neotoma albigula*	54	0.8	18	0.6	10	0.4	1	0.1
Harris' antelope ground squirrel *Ammospermophilus harrisi*	33	0.7	0	-	0	-	0	-
Round-tailed ground squirrel *Spermophilus tereticaudus*	3	0.1	26	0.9	1	0.1	2	0.1
Southern grasshopper mouse *Onychomys torridus*	14	0.3	8	0.3	7	0.3	6	0.4

Source: Schwartzmann et al. 1976.

Note: Data based on 270 trap nights for a 10 month study period.

	Paloverde-Saguaro		Creosotebush		Mesquite		Wash	
	Captures	Abundance Index	Captures	Abundance Index	Captures	Abundance Index	Captures	Abundance Index
Deer Mouse *Peromyscus maniculatus*	5	0.1	2	0.1	28	1.0	4	0.2
Desert pocket mouse *Perognathus Penicillatus*	82	2.0	17	0.6	48	2.3	65	4.1
Arizona pocket mouse *Perognathus amplus*	382	8.3	54	1.7	4	0.1	0	-
Rock pocket mouse *Perognathus intermedius*	58	1.4	0	-	0	-	0	-
Relative Trapping Success (% of Total)	30.2%		18.8%		25.1%		25.8%	
Number of Species	12		10		9		8	
Total Number of Trap Grids	47		27		20		12	
Total Number of Trap Nights	12690		7290		5400		3240	

Table 16
Relative Abundance of Mammals Observed
Salt-Gila Aqueduct-Central Arizona Project

Common Name	Scientific Name	Relative Abundance
Antelope jackrabbit	*Lepus alleni*	Very common locally
Black-tailed jackrabbit	*Lepus californicus*	Very common
Rock squirrel	*Spermophylus variegatus*	Uncommon
Valley pocket gopher	*Thomomys bottae*	Common locally
Desert kangaroo rat	*Dipodomys deserti*	Common locally
Hispid cotton rat	*Sigmodon hispidus*	Common locally
Porcupine	*Erethizon dorsatum*	Uncommon
Coyote	*Canis latrans*	Common
Kit fox	*Vulpes macrotis*	Uncommon
Gray fox	*Urocyon cinereoargenteus*	Uncommon
Raccoon	*Procyon lotor*	Common locally
Badger	*Taxidea taxus*	Common
Striped skunk	*Mephitis mephitis*	Common locally
Mountain lion	*Felis concolor*	Rare
Bobcat	*Lynx rufus*	Uncommon
Javelina	*Dicotyles tajacu*	Common
Mule deer	*Odocoileus hemionus*	Common

Source: Schwartzmann et al. 1976.

The aqueduct and flooded detention basins would present a drowning hazard to the animal populations of the area. This impact would be offset partially by a non-skid, longitudinal brush finish on the top portion of the aqueduct lining extending 5 feet (1.5m) vertically below the top, which may facilitate small animal escapes.

The Bureau, in cooperation with FWS, AGFD, and Wellton-Mohawk Irrigation and Drainage District is investigating the efficiency of large mammal escape devices for canals. The scope of this investigation is solely to evaluate the effectiveness of different designs of escape devices. Reclamation anticipates that preliminary results of this investigation will be available by late 1979. The more acceptable of these devices will be employed on the Salt-Gila Aqueduct and other aqueducts of the Central Arizona Project where it is jointly determined that they would be beneficial. Where significant densities of large game mammals are identified, portions of the aqueduct would be fenced with deer proof fencing to prevent deer and javelina loss and to guide the animals to suitable crossings.

Loss of habitat would be partially offset by the establishment of dependable wildlife oases and water catchments which would provide water, limited food, and cover. Reclamation is presently working with the FWS and other concerned agencies in the development and implementation of these structures.

b. Birds

The avifauna of the Salt-Gila Aqueduct area were studied by the AGFD (Horejsi 1976) and by researchers from ASU (Schwartzmann et al. 1976). The AGFD study concerns only the game birds in the area - mourning dove, white-winged dove, and Gambel's quail. The ASU report includes these three species as well as non-game species observed in the 2-mile (3.2 km) wide study area.

ASU researchers identified 126 bird species within the 2-mile (3.2 km) wide, 70-mile (112 km) long study area along the aqueduct area during the 11-month study. Forty-four of these species were seen in the study area but not recorded on the community transects (Appendix Table C-2.3). The aquatic birds listed on this table were observed primarily along the Florence-Casa Grande Canal or near the stockponds in the study area.

Eighty-two bird species were recorded on the community transects and the density of each species calculated on the basis of individuals per 100 acres (40 ha) (Appendix Table C-2.4). The ASU researchers used the "Emlen Technique" and others, when appropriate, to calculate the bird densities. Table 17 summarizes the data collected by the ASU study for each community.

The highest average density and greatest average number of species for the four community types was recorded for the wash community. The lowest average density of birds was recorded in the creo-

Table 17

Comparative Data for Avifauna Populations by Plant Community
Salt-Gila Aqueduct - Central Arizona Project

Average No. of Birds /100 Acres /Month	Highest No. of Birds /100 Acres (month)	Total No. of Species Observed	Average No. of Species/Month	Highest No. of Species Recorded (month)	Breeding Pair Density /100 Acres (months)	Total No. of Breeding Species Recorded	Species Specific to Community
Wash Community							
181.3	239 (Dec.)	65	24.5	32 (April)	147 (March, April) 9.5 (April, May)	16	Red-tailed Hawk (March, April) Inca Dove (October Great Horned Owl (June thru Sept., Dec.) Rough-winged Swallow (October) Yellow-headed Blackbird (September) Red-winged Black Bird (October) Black-headed Grosbeak (April, July)
Mesquite Community							
121.3	212 (April)	53	21.1	26 (April, July)	112 (March, April) 12 (April) May)	15	Ground Dove (March thru June, Aug. Sept.) Robin (February)
Paloverde-Saguaro Community							
73.5	95 (July)	47	18.1	27 (April)	74.5 (March, April) 4.5 (April, May)	14	Harris Hawk (July, October) Costa's Hummingbird (February, April) Screech Owl (August)
Creosotebush Community							
63.1	102 (April)	63	19.6	31 (April	27 (March, April) 3 (April, May)	13	Rough-legged Hawk (May) Killdeer (November, December) Burrowing Owl (April, November) Cassin's Kingbird (July) Cliff Swallow (July) Gray Viero (February) Warbling Viero (May) Lark Bunting (May)

Source: Schwartzmann et al. 1976.

Note: Data based on 11-month study period.

sotebush community while the paloverde-saguaro community had the lowest average number of species observed on the transects. Breeding pair densities were obtained during March, April, and May. A total of 19 species (Table 18) were considered to be breeding in the area. The wash community had the greatest density and number of species of breeding birds followed by the mesquite community, paloverde-saguaro community, and the creosotebush community.

The monthly fluctuations in number of species and density are shown on Figures 71 and 72. As can be seen from these graphs, both density and the number of species occurring on the transects were highest during March and April. This is probably due to spring migration and breeding. Two species, the cactus wren and the curve-billed thrasher, occurred in all four communities in every month during the study. Thirty-four species occurred in all four communities while 21 species occurred in only one community. Appendix Table C-2.5 lists the bird species observed by month (February through September).

The most common species encountered during the study were Gambel's quail, mourning dove, cactus wren, curve-billed thrasher, black-tailed gnatcatcher, house finch, Verdin, common flicker, and Gila woodpecker. The Gambel's quail, mourning dove, and phainopepla occurred in the greatest density in the wash community. In the creosotebush community Gambel's quail and cactus wren occurred most often. In the mesquite and paloverde-saguaro communities Gambel's quail, mourning dove, cactus wren, and Verdin were the most common.

Two additional bird species have been observed in the Queen Creek area of the alinement by subsequent investigators (Cross 1978a). These are Le Contes thrasher and Cassin's sparrow. To date there is no density information available for these species in the aqueduct area.

The ASU researchers compared the results of their study to the results of several other studies of bird densities in desert biome and concluded that the Salt-Gila study area is basically comparable to similar areas in the arid Southwest. Differences are to be expected, however, when comparisons are made as climatic and topographic features differ with different geographical locations. Often interpretation of plant community structure is not consistent, resulting in varying interpretations of the data.

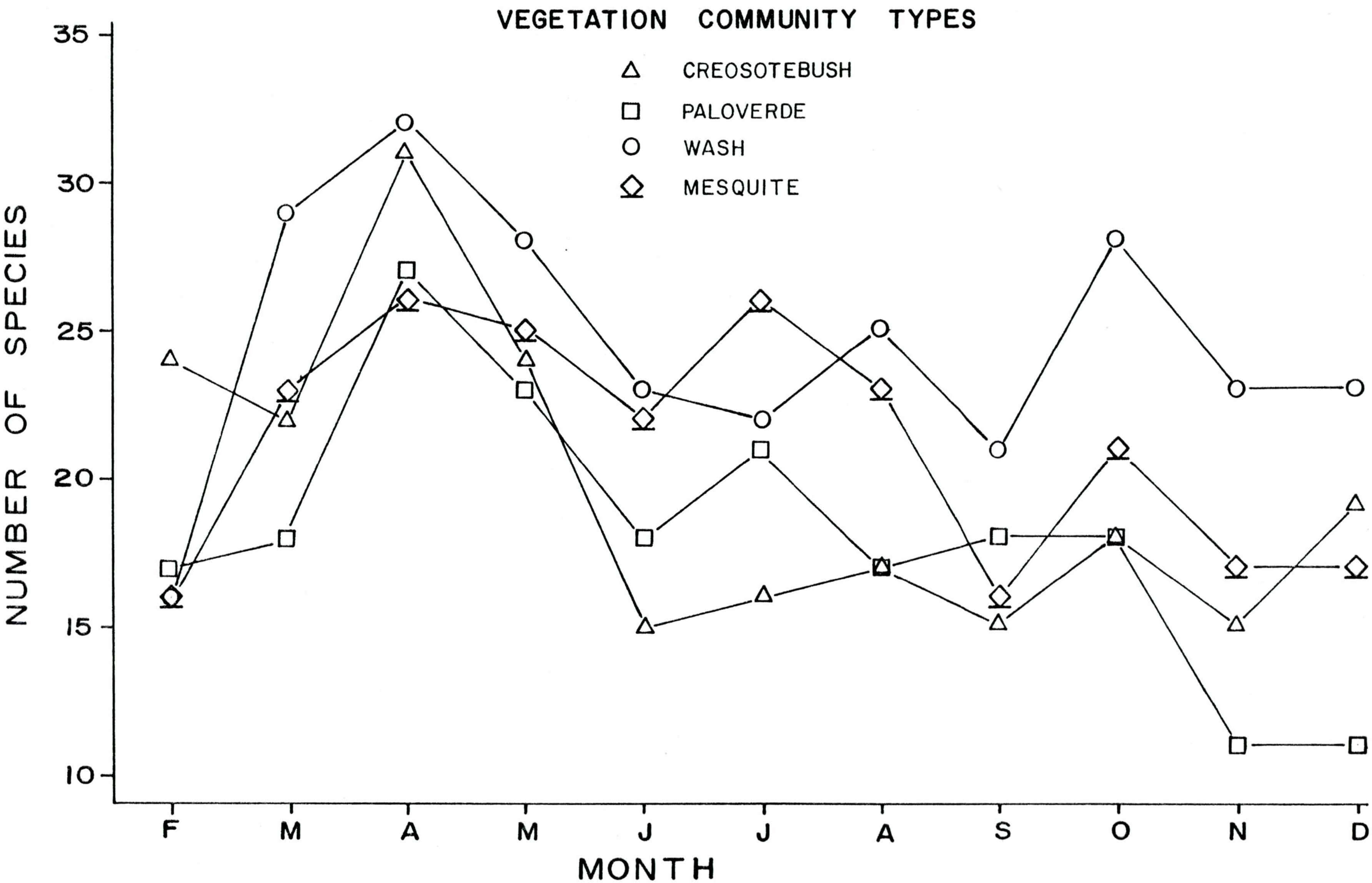
The surveys completed by the AGFD on game birds in the study area are not directly comparable to the ASU report. This is probably reflective of a different interpretation of plant community structure and methodology. The AGFD study used spring call counts and nest surveys for estimating dove populations and spring call counts and fall flush census for quail estimates. The estimated population for the entire study area of approximately 77,650 acres (31,437 ha) was computed by the AGFD to be 3,350 Gambel's quail, 17,950 mourning dove, and 2,880 white-winged dove.

Table 18

Average Breeding Bird Pairs per 100 Acres for March and April
Salt-Gila Aqueduct - Central Arizona Project

Species	Wash	Mesquite	Paloverde-Saguaro	Cresotebush
Red-tailed Hawk	1	-	-	-
Gambel's Quail	20	5.5	18	2.5
Mourning Dove	14.5	48.5	5.5	8.5
Ground Dove	-	5	-	-
Black-chinned Hummingbird	-	-	5	-
Common Flicker	6.5	4.5	4.5	3
Gila Woodpecker	12	2	2.5	0.5
Ladder-backed Woodpecker	2.5	4.5	1	-
Ash-throated Flycatcher 1/	7	4.5	4.5	2.5
Verdin	5	12	6.5	1.5
Cactus Wren	9.5	11	7.5	3
Curve-billed Thrasher	6	4	3.5	3
Black-tailed Gnatcatcher	3.5	9	4.5	0.5
Phainopepla	51.5	3	-	-
Loggerhead Shrike	1.5	0.5	1.5	0.5
Lucy's Warbler	2.5	7.5	-	0.5
House Finch	7	-	3.5	2.5
Brown Towhee	6.5	-	-	-
Black-throated Sparrow	-	2.5	3	1.5
TOTAL	156.5	124	71	30

Source: Schwartzmann et al. 1976.
1/ Average computed from April and May



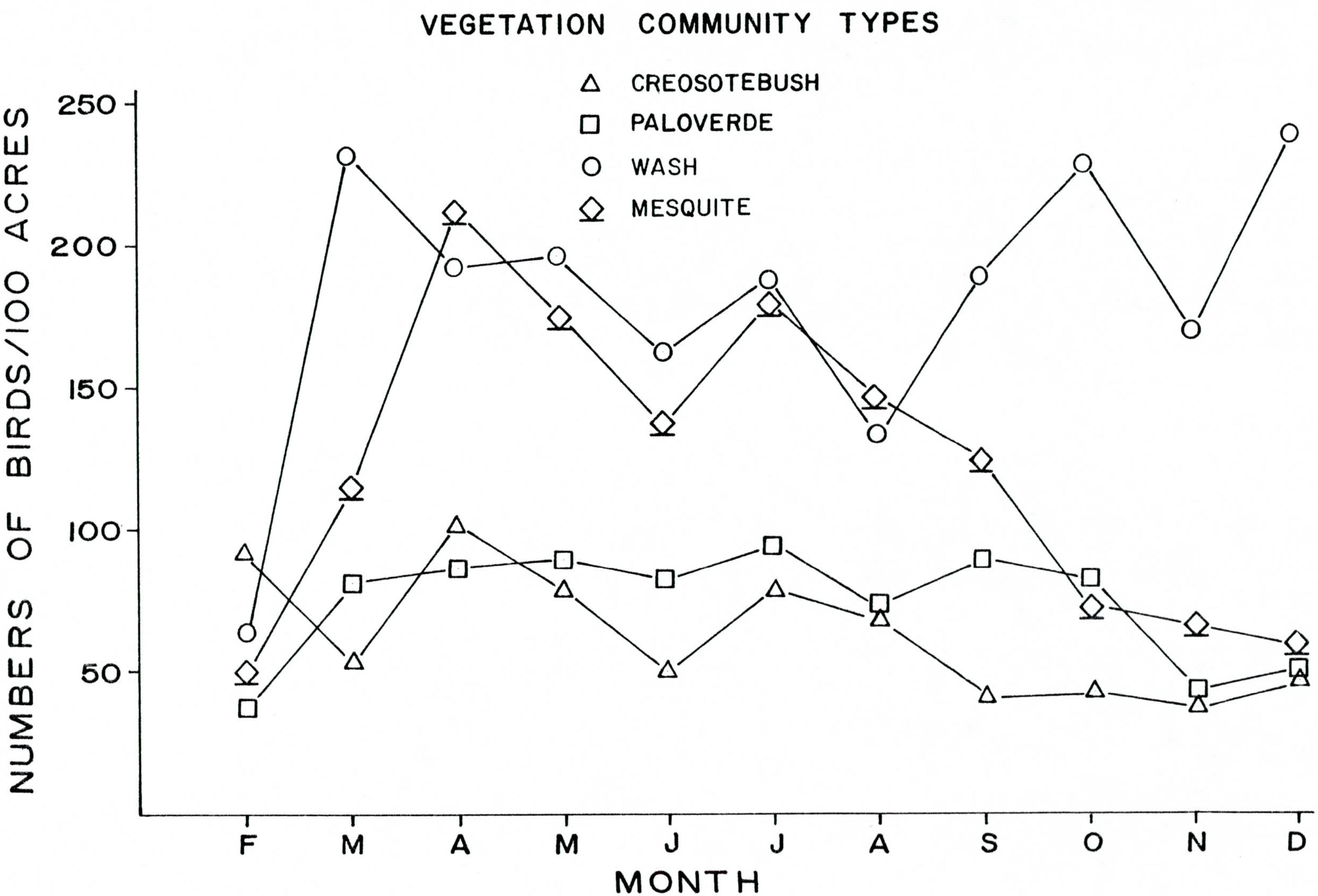
NUMBER OF AVIAN SPECIES OBSERVED PER MONTH IN EACH PLANT COMMUNITY

SALT-GILA AQUEDUCT, CENTRAL ARIZONA PROJECT

Source: Schwartzmann et al. 1976.

344-330-T-705

Figure 71



AVERAGE MONTHLY AVIAN DENSITIES FOR EACH PLANT COMMUNITY

SALT-GILA AQUEDUCT, CENTRAL ARIZONA PROJECT

Source: Schwartzmann et al. 1976.

Figure 72

344-330-T-706

Based on the estimates of breeding bird densities from the study conducted by ASU in 1975, (Table 18) a projection of breeding birds lost as a result of the project can be made. Table 19 is an example of the Gambel's quail and mourning dove losses due to construction.

Table 19
Example of Projected Construction Losses of Gambel's Quail and Mourning Dove

	Acres of Habitat Lost	Number of Quail/100 Ac.	Total Number Lost	Number of Mourning Dove/100 Ac.	Total Number Lost
Creosotebush	1836	2.5	45.9	8.5	156.1
Paloverde-saguaro	732	18.0	131.7	5.5	40.3
Mesquite	5	5.5	0.3	48.5	2.4
Wash	76	20.0	15.2	14.5	11.0

The figures in Table 19 represent the maximum number lost during construction. The maximum projected permanent loss as a result of the project is estimated in Table 20. The indicated construction losses would be reduced as a result of a revegetation program discussed in Chapter III.C.1.

Table 20

Example of Projected Permanent Losses of Gambel's Quail and Mourning Dove

	Acres Habitat	Quail per 100 acres	Total Quail	Mourning Dove per 100 acres	Total Mourning Dove
Creosotebush	610	2.5	15.3	8.5	51.9
Paloverde-saguaro	167	18.0	30.1	5.5	9.2
Mesquite	---	----	----	---	----
Wash	20	20.0	4.0	14.5	2.9

Without knowing the specific environmental factors that limit dove and quail populations in the area an exact determination cannot be made as to what proportion of these breeding birds would be lost. For example, if the limiting factor is the lack of nesting sites, then it can be assumed that all of these birds and their production would be lost. However, if the limiting factor is the lack of water then it could be assumed the aqueduct and associated mitigation measures would benefit the dove and quail populations in the aqueduct area.

The primary impact on the avifauna of the Salt-Gila Aqueduct area would be from the removal of vegetation (Table 14). Due to the loss of habitat, an unquantified portion of the avifauna inhabiting the construction zone would be lost due to their inability to compete successfully for replacement habitat.

Following construction, selected disturbed areas not required for operation and maintenance of the aqueduct would be reseeded (Chapter III.C.1.b.). The reseeding would partially offset the impacts of construction by providing an energy source for primary consumers which would in turn provide a food source for predators. Once the vegetation becomes established it would provide partial restoration for the lost habitat. The establishment of the proposed wildlife catchments would provide a source of dependable water away from the aqueduct while the oases would provide water and a limited amount of food and cover along the aqueduct alinement.

The overall, long-term affect on the avifauna of the area due to the permanent loss of 1,300 acres (526 ha) of habitat (which includes approximately 500 acres (202 ha) of urban and agricultural habitat) would be a reduction in the total population. This reduction may be offset by the oases, catchments, and green-up areas behind the dikes. However, quantification of this would have to await the findings of the monitoring program (Chapter III.C.).

c. Fish and Amphibians

There is no fishery resource on the proposed aqueduct alinement. However, according to the Fish and Wildlife Service, there is a possibility that fish from Lake Havasu would become established in the Salt-Gila Aqueduct and provide an opportunity for fishing along the aqueduct (FWS 1978). The establishment of this fishery cannot be determined until after water deliveries begin in 1985. After the initiation of water deliveries, Reclamation would undertake a cooperative effort with interested agencies and the general public to ascertain the existence of a fishery, public requirements for access, and types of facilities required. These facilities may be partially funded by Reclamation with the balance coming from a sponsoring agency under P.L. 89-72. These facilities would need to be constructed and operated within the scope of Reclamation's legal requirement for aqueduct operations, maintenance, public health, and safety. Should a fishery be established, a fish salvage plan would be developed to prevent fish losses during periods of aqueduct dryup for maintenance. This cooperative effort would include a study of the potential for 10-acre (4 ha) fishing lakes proposed by the FWS along the CAP aqueduct system (FWS 1976).

Because the Queen Creek and Gila River crossing sites are located in normally dry streambeds, there is no benthic community or fishery which would be disturbed by the siphon and dike construction or operation.

Amphibians in the area are primarily found in the unlined stocktanks which contain water throughout the major part of the year and temporary rainwater pools. A study of amphibians occurring along the alinement was undertaken in conjunction with other field studies. It is believed that only eight species representing three families are likely to inhabit the stocktanks of this area (Stebbins 1966 and Schwartzmann et al. 1976). These species are:

	Occurrence
Family Pelobatidae	
Couch's spadefoot, Scaphiopus couchi	Confirmed
Western spadefoot, Scaphiopus hammondi	Confirmed
Family Bufonidae	
Colorado River toad, Bufo alvarius	Confirmed
Woodhouse's toad, Bufo woodhousei	Probable
Red-spotted toad, Bufo punctatus	Probable
Great Plains toad, Bufo cognatus	Confirmed
Family Ranadae	
Leopard frog, Rana pipiens	Probable
Bullfrog, Rana catesbeiana	Confirmed

The tiger salamander (Ambystoma tigrinum) has been reported as possibly occurring along the aqueduct alinement (Schwartzmann et al. 1976). This species is used as fish bait and has been widely introduced into the warm-water fisheries in the state (Lowe, 1964). The tiger salamander occurs in Lake Havasu and there is a high probability that the species will be introduced into the CAP aqueduct system.

Adverse impacts on amphibians would be localized, occurring only where stocktanks are removed because of construction or in dewatered areas downstream of protective dikes. As presently proposed, the alinement would pass through only one stocktank located downstream of the SCS Vineyard Road Floodwater Retarding Structure in Reach 2.

Habitat replacement and possible enhancement for amphibians could be achieved by implementation of the wildlife oases and catchments. This, however, would depend on the final design of these watering devices. Ponding of water behind floodwater retarding structures and dikes could also enhance amphibian populations. The addition of the oases, catchments, and green-up areas behind the dikes would cause a net increase in habitat for amphibians in the area.

d. Reptiles

The herpetofauna of the aqueduct alinement were surveyed by ASU researchers (Schwartzmann et al. 1976) using can traps in each vegetative community checked at least once a week from March to November. This trapping method was supplemented by hand collection on the established transects.

A total of 12 species of snakes and 11 species of lizards, including the Gila monster (Heloderma suspectum), were observed within the study area. The total number of captures and the diversity of species varied within the four communities. The greatest number of captures occurred in the paloverde-saguaro community while the greatest number of species occurred in the wash and creosotebush communities (Tables 21 and 22). The desert tortoise (Gopherus agassizi) was observed in the paloverde-saguaro plant community in the Granite Reef Dam area near the pumping plant site.

Three reptile species occurred only in the creosotebush community--the banded sand snake (Chilomeniscus cinctus), leopard lizard (Crotaphytus wislizenii), and the regal horned lizard (Phrynosoma solare). Two species occurred only in the wash community: the night snake (Hypsiglena torquata) and the longtailed brush lizard (Urosarus graciosa). Only one species was found to be specific to the paloverde-saguaro community, the Western ground snake (Sonora semiannulata). The most common snakes of the study area were the Western diamondback (Crotalus atrox) and the coachwhip (Masticophis flagellum), which were found in all four communities. The most common lizards were the Western whiptail (Cnemidophorus tigris) and the desert spiny lizard (Sceloporus magister).

Several species of reptiles were expected to occur in the study area but were not seen, probably because of limited spring and summer rainfall and the lack of preferred habitat type. Table 23 lists these species. Subsequent investigations have collected a Western shovel-nosed snake (Chionactis occipitalis) and desert horned lizard (Phrynosoma platyrhinos) (Cross 1978a).

The herpetofauna within the aqueduct alinement would be eliminated by the destruction of the habitat due to construction of permanent structures. Some loss of individuals would also occur through drowning in the aqueduct. The aqueduct would have a non-skid, longitudinal brush finish on the upper 5 vertical feet (1.5 m) of the canal lining which may decrease loss of lizards and snakes in the aqueduct. Indirect impacts would include habitat modification resulting from the bisection of ephemeral drainages, which will limit unrestricted access to these drainages. Crossings to be provided would minimize the restriction and maintain movement across the canal.

e. Invertebrates

The invertebrate fauna of the Arizona deserts includes many orders of animals. A list of invertebrates at the confluence of the Salt and Verde Rivers and along the Gila River east of Florence compiled for Reclamation indicates that more than 30 orders representing more than 177 families occur in these areas. This report goes on to state the invertebrates have expanded into every possible niche. "These are aquatic and terrestrial groups; subterranean and aboreal species...." "Nor do the invertebrates find an equal when it becomes necessary to adapt and survive under changing conditions." (Cazier 1972.)

Table 21

Snakes Collected Within Each Plant Community
February through October 1975
Salt-Gila Aqueduct - Central Arizona Project

	Plant Community				
	PVS	C	M	W	Total
Common kingsnake *Lampropeltis getulus*	-	-	5	1	6
Gopher snake *Pituophis melanoleucus*	5	1	7	3	16
Mojave rattlesnake *Crotalus scutulatus*	4	2	4	5	15
Banded sand snake *Chilomeniscus cinctus*	-	2	-	-	2
Long-nosed snake *Rhinochelius lecontei*	4	3	3	2	12
Glossy snake *Arizona elegans*	-	2	2	4	8
Coachwhip *Masticophis flagellum*	12	4	1	5	22
Western diamondback rattlesnake *Crotalus atrox*	12	3	3	7	25
Western patchnosed snake *Salvadora hexalepis*	3	1	-	1	5
Sidewinder *Crotalus cerastes*	4	2	-	-	6
Night snake *Hypsiglena torquata*	-	-	-	1	1
Western ground snake *Sonora semiannulata*	1	-	-	-	1
Total	45	20	25	29	119
% of Total	38	17	21	24	100
Number of Species	8	9	7	9	12

Source: Schwartzmann et al. 1976.

Note: PVS = Paloverde-Saguaro Community
M = Mesquite Community
C = Creosotebush Community
W = Wash Community

Table 22

Lizards Collected Within Each Plant Community
March through October 1975
Salt-Gila Aqueduct - Central Arizona Project

	Plant Community				
	PVS	C	M	W	Total
Side-blotched lizard *Uta stansburiana*	8	18	1	6	33
Western whiptail *Cnemidophorus tigris*	29	15	11	5	60
Leopard lizard *Crotaphytus wislizenii*	-	2	-	-	2
Banded gecko *Coleonyx variegatus*	3	3	-	-	6
Gila monster *Heloderma suspectum*	-	1	2	2	5
Desert spiny lizard *Sceloporus magister*	8	8	12	12	40
Long-tailed brush lizard *Urosaurus graciosus*	-	-	-	5	5
Zebra-tailed lizard *Callisaurus draconoides*	8	-	-	4	12
Desert iguana *Dipsosaurus dorsalis*	-	1	-	1	2
Tree lizard *Urosaurus ornatus*	1	-	7	2	10
Regal horned lizard *Phrynosoma solare*	-	1	-	-	1
Total	57	49	33	37	176
% of Total	32.4	27.8	18.7	21.0	99.9
Number of Species	6	8	5	8	11

Source: Schwartzmann et al. 1976.

Note: PVS = Paloverde-Saguaro Community; C = Creosotebush Community; M = Mesquite Community; W = Wash Community

Table 23

Snake and Lizard Species Expected to Occur
Along the Alinement
Salt-Gila Aqueduct - Central Arizona Project

Common Name	Scientific Name
Western blind snake	Leptotyphylops humilis
Spotted leaf-nose snake	Phyllorhynchus decurtatus
Saddled leaf-nose snake	Phyllorhynchus browni
Sonora whipsnake	Masticophis bilineatus
Black-necked garter snake	Thamnophis cyrtopsis
Mexican garter snake	Thamnophis eques
Checkered garter snake	Thamnophis marcianus
Western shovel-nosed snake	Chionactis occiptalis
Western black-headed snake	Tantilla phaniceps
Sonoran lyre snake	Trimorphodon lambda
Arizona coral snake	Micruroides euryxanthus
Black-tailed rattlesnake	Crotalus molossus
Tiger rattlesnake	Crotalus tigris
Arizona black rattlesnake	Crotalus viridis
Chuckwalla	Sauromalus obesus
Greater earless lizard	Holbrookia texana
Chihuahua whiptail	Cnemidophorus sonore

Source: Schwartzmann et al. 1976.

There are no shellfish populations in the Queen Creek and Gila River crossing sites which would be disturbed by construction or O&M activities.

The invertebrates inhabiting the 1,300 acres (526 ha) to be occupied by permanent aqueduct structures would be lost. The flow of water through the aqueduct may cause long-term ecological changes by creating a more humid microclimate within the immediate aqueduct area. These changes would include niche diversification caused by the water and an introduction of species from the Mohave Desert region and Lake Havasu. Any impacts to invertebrates whether beneficial or adverse are unquantifiable due to lack of data.

f. Special Status Wildlife

No animal species presently listed in the Federal Register as threatened or endangered are known to inhabit the Salt-Gila Aqueduct impact area (42 F.R. 36420). However, the U.S. Fish and Wildlife Service is currently reviewing the status of the desert tortoise (Gopherus agassizi) (43 F.R. 37662). No threatened or endangered species are known to inhabit the Queen Creek or Gila River crossing sites. The trenching and backfilling operations during construction of the Gila River siphon and the construction of the Sonoqui Dike would not jeopardize the existence of, or destroy or modify critical habitat of such species.

Two Arizona special status animals occur along the Salt-Gila Aqueduct alinement: the Gila monster (Heloderma suspectum) and the desert tortoise. These species are listed in "Threatened and Unique Wildlife of Arizona" (AGFC 1978) as Group III animals. The Group III designation indicates that these species may be in jeopardy in the foreseeable future.

The Gila monster was observed in two areas immediately adjacent to the aqueduct alinement. Two sightings were made in the Queen Creek area and six sightings in an area surrounding the Coolidge-Florence airport (Schwartzmann et al. 1976). Subsequent investigators have identified 13 Gila monsters in these two areas (Cross 1978a). The population density for the Queen Creek area is estimated at six individuals per square mile (259 ha) 1/.

Within the area of the present alinement two tortoises were sighted in the paloverde-saguaro community near Granite Reef Dam. The desert tortoise is not present in a high density along the SGA alinement. However, it was found in "...very high concentrations...." in the Picacho Mountains about 3.5 miles (5.6 km) south of the proposed terminus of the aqueduct (Schwartzmann et al. 1976). The ASU study reports that 17 tortoises were found in a 0.5 square mile area (129.5 ha) and that 10 of these individuals were located within a 0.25 square mile area (64.8 ha). This area in the Picacho Mountains may represent the highest known density of desert tortoises in Arizona. The

1/ Robert D. Ohmart 1978: personal communication significance of this concentration would be included in the Tucson Aqueduct Environmental Impact Statement.

The results of a general survey investigation (Schwartzmann et al. 1976) prompted supplemental investigations of the effects of the aqueduct on Gila monster and desert tortoise populations in portions of the Salt-Gila Aqueduct.

A draft report of the Gila monster investigations, which will be completed in 1979, suggests that a 1-year study is insufficient to determine impacts and mitigation for this long lived animal. However, the investigation has determined that the Gila monster does have the ability to swim and remain submerged for long periods of time and is also able to climb (Cross 1978b). These abilities may allow the Gila monster to enter and leave the aqueduct with little danger of drowning.

The Bureau of Land Management and Bureau of Reclamation cosponsered a project to determine desert tortoise distribution in parts of Arizona. These lands included only a small portion of Reach 4 of the proposed Salt-Gila Aqueduct and no tortoise population was identified. The study did not identify specific mitigation for the desert tortoise. Reclamation biologists will monitor the area of the aqueduct prior and after construction to determine if further studies are needed for desert tortoise populations.

Preliminary findings of these studies confirm that the detrimental effects on these species would include the death or injury of individuals during construction, loss of habitat, and disruption of movement patterns which could potentially disrupt gene flow between the separated populations. The loss of desert tortoises due to drowning is probable because of their poor swimming abilities (Schwartzmann 1976). The Gila monster does have the ability to swim and remain submerged for long periods of time and is also able to climb (Cross 1978b). These abilities may allow the Gila monster to enter and leave the aqueduct with little danger of drowning.

In an effort to lessen the dangers of the construction and operation on the desert tortoise and Gila monster, contractor crews and Reclamation personnel would be discouraged from collecting or disturbing these species. These personnel would be advised of AGFD regulations pertaining to the protection of these two species. Exclusionary devices such as curbing or small mesh fencing could be erected in selected areas to prevent tortoises from entering the aqueduct.

The studies indicate that monitoring will be needed during construction to assess long-term effects and mitigation. The aqueduct may adversely affect individuals or populations of these species within the immediate area of the alinement. However, these impacts would be localized and would not endanger or threaten the species as a whole. The tortoise and Gila monster may be benefited by the green-up areas around the oases and behind the detention dikes.

D. Land Use

Lands crossed by the Salt-Gila Aqueduct fall into a variety of land-use categories including agricultural, urban, and undeveloped desertland. Beginning at the Salt-Gila Pumping Plant, the aqueduct would pass through the Tonto National Forest for about 0.6 miles (approximately 20 acres) which has been withdrawn for Reclamation purposes. An area of urban development exists from the national forest boundary to the Maricopa-Pinal County line. The development of the area includes isolated single-family dwellings on small-acreage tracts, small subdivisions with improvements, commercial property along Apache Boulevard, and undeveloped land being held for development. The undeveloped land in this reach of the aqueduct has a highest and best use as potential subdivision due to its proximity to the urban area of Mesa and Apache Junction. This potential is reflected in higher property values.

Where the Salt-Gila Aqueduct enters Pinal County, most of the land is desert, owned by the State, and leased for grazing purposes. Along Reaches 3 and 4 of the aqueduct there are approximately eight sections of irrigated farmland, seven of which are designated as "prime irrigated farmlands" by the SCS. By definition, the value of these lands is derived from their general advantage as cropland due to soil and water conditions. Reach 3 of the aqueduct traverses the Florence Gardens Subdivision as well as the operations area proposed CONOCO Copper Project. The remaining portion of the aqueduct would involve mostly undeveloped desertland with the exception of approximately 37 acres (15 ha) now being used for military purposes.

The principal land use impact associated with the proposal is the severence of established neighborhoods and prime irrigated agricultural lands. Bridges would be constructed to provide travel between the severed areas, but it would not be as free as at present resulting in some inconvenience. Prime irrigated farmland would be acquired reducing the total acreage of lands designated as prime in Arizona which is estimated at more than 1 million acres.

The land use categories of agriculture, grazing, mining, utilities, transportation , military, and Arizona State Prison are summarized in a tabular format beginning on the following page.

	Present	Impact Due to Construction	Mitigation	Remarks
1.	Agriculture			
	Lands under irrigation are devoted to cotton, alfalfa, and small grains. Seven sections of land along the proposed right-of-way have been designated as prime irrigated farmlands by the Soil Conservation Service.	Approximately 180 acres of prime irrigated farmlands would be required for the Salt-Gila Aqueduct. Five farms would be divided by the aqueduct. An additional 220 acres of irrigated land which is under lease from the State would also be required for construction purposes.	Farmers would receive just compensation for their land including damages for the replacement of any facilities, i.e., concrete ditches, wells, or releveling of land, if necessary. Construction schedules would permit farmers to harvest existing crops. In those instances where the irrigated fields are severed from their water source, provisions would be made to sustain the water supply.	About 24 bridges would provide access across the aqueduct. Reclamation would offer to purchase any uneconomic remainders resulting from Reclamation acquisition (P.L. 91-646, Sec. 301 (9)).
2.	Grazing			
	Livestock, predominately cattle, graze the desertlands through which the aqueduct would pass. The lands average about 4 animal units per section per year.	Grazing would be lost on about 6,015 acres of land required for the Salt-Gila Aqueduct with a resulting loss of about 38 animal units per year.	Livestock crossings and additional stockponds would be provided where necessary and justifiable where grazing areas are severed by the aqueduct. The decision on where and how many livestock crossings would be required would be based on negotiations with the land owners based on the number of cattle, the location of stock ponds, and how the grazing lands are divided by the canal. Fencing would be provided to protect the livestock. Just compensation would be paid to State lessees for their improvements if acquired.	Since the grazing conditions in the desert are marginal, the loss of grazing acreage due to the proposed SGA would be minimal.

Present	Impact Due to Construction	Mitigation	Remarks
3. Mining			
According to a BLM Report entitled "Central Arizona Project Impact Study, Arizona-New Mexico, April 26, 1968" (BLM 1968), the only known occurrence of minerals along the Salt-Gila Aqueduct is the concentration of magnetite iron (black sands) in the alluvial valley fill. Based on available information, it is estimated that four 160-acre placer mining claims might conflict with the aqueduct. The aqueduct would also traverse the operations area of the proposed Continental Oil Company (CONOCO) Copper Project.	Bureau of Land Management would do further investigations to locate any mining claims, and those within the aqueduct right-of-way would be adjudicated by BLM. The operation of the proposed CONOCO copper project would be limited or modified to the extent of operating on both sides of the aqueduct.	Claims ascertained to be valid would be acquired by the same procedures as private lands. To the extent practicable, Bureau of Reclamation has advanced its location work in the area and modified the alinement to accommodate the proposed CONOCO copper project.	As a result of applications to purchase State lands by the Continental Oil Company for its proposed mining project in Pinal County, Arizona, right-of-way requirements of the Salt-Gila Aqueduct through Sections 14, 15, and 23, T. 4 S., R. 9 E., G&SRB&M were finalized. Not only was CONOCO able to continue its negotiation with the State unhampered by Central Arizona Project but SGA right-of-way through these sections was secured.
4. Utilities - a. Power			
Rights-of-way for the following transmission lines would be crossed by SGA rights-of-way: Salt River Project 110 & 115-kV lines in Sec. 16, T. 1 N., R. 7 E. G&SRB&M 110-kV line in Sec. 18, T. 3 S., R. 9 E. G&SRB&M 115-kV line in Sec. 21, T. 4 S., R. 10 E., G&SRB&M Coolidge-Hayden proposed 500-kV line in Sec. 6, T. 1 S., R. 8 E. G&SRB&M DOE - WAPA Coolidge Oracle, 115-kV line in Sec. 14, T. 5 S., R. 9 E., G&SRB&M Two crossings of Mesa-Coolidge 230-kV line in Secs. 22 and 23, T. 1 N. R. 7 E., G&SRB&M Several low voltage lines would also be under-crossed by the proposed aqueduct.	The overall impact would be minimal. However, the proposed aqueduct could require either the relocation of a tower or structure, or possibly an adjustment in the height of the line to meet minimum clearance standards or as a result of actual construction activities.	Any relocation or modification of facilities to accommodate the aqueduct would be done at the expense of Reclamation by either Reclamation's contractor or the utility company.	Reclamation negotiated a master contract with Arizona Public Service for the undercrossing of all its facilities by the aqueduct. A similar agreement would be entered into with the Salt River Project and any other owners of utility lines in the area.

Present	Impact Due to Construction	Mitigation	Remarks
b. Communications			
There are numerous telephone lines owned by Mountain Bell and American Telephone and Telegraph along the proposed aqueduct alinement.	Buried pipelines would have to be lowered or encased. The proposed aqueduct could involve the relocation of a pole or installation of a taller pole to meet minimum clearance standards. Electromagnetic interference from transmission lines would cause disruption of AM radio reception within the transmission lines right-of-way.	Any relocation or modification to accommodate the aqueduct would be accomplished at Reclamation's expense by either the contractor or the respective telephone company.	The Bureau of Reclamation entered into contracts with the Mountain States Telephone and Telegraph Company and American Telephone and Telegraph Company to provide for the crossings of rights-of-way and relocation of certain facilities as they conflict with or interfere with features of CAP.
c. Pipelines			
El Paso Natural Gas (EPNG) Company pipelines are located in Secs. 15 and 23, T. 4 S., R. 9 E., and Sec. 17, T. 6 S., R. 9 E., G&SRB&M and would be crossed by SGA rights-of-way.	The facilities in these sections would be relocated to a depth exceeding that of our aqueduct.	Reclamation would reimburse EPNG for the relocation of its facilities including the cost and expense of all work as well as the acquisition of additional right-of-way if necessary.	A contract between the Bureau of Reclamation and EPNG provides for the crossing of respective rights-of-way as well as the relocation of EPNG natural gas lines and related facilities as a result of the construction or operation and maintenance of the CAP.
5. Transportation - a. Railroads			
Facilities for Magma Arizona Railroad and Southern Pacific Railroad cross Section 19, T. 3 S., R. 9 E., and Section 15, T. 4 S., R. 10 E., G&SRB&M respectively.	Right-of-way for the Salt-Gila Aqueduct through these sections would require the construction of a bridge for the railroad facilities and temporary detours to provide uninterrupted service.	Any relocation of facilities, construction of detours, or acquisition of temporary easements would be at the expense of Reclamation.	Relocation agreements would be entered into between Reclamation and the respective railroad company to provide for relocation of facilities and crossings of respective rights-of-way.

Present	Impact Due to Construction	Mitigation	Remarks
b. Roads			
Numerous Federal, State, and County highways now carry traffic through the area. Figures 4 through 9 show the network of roads in the area.	Rights-of-way for the Salt-Gila Aqueduct would cross numerous county roads as well as the following highways: U.S. 80/89 - Sec. 13, T. 4 S., R. 9 E., ; Sec. 12, T. 5 S., R. 9 E., G&SRB&M U.S. 60 - Sec. 23, T. 1 N., R. 7 E., G&SRB&M Proposed Interstate - Sec. 36, T. 1 N., R. 7 E., G&SRB&M Construction of the Salt-Gila Aqueduct could result in some changes in traffic patterns because of road modifications or relocations.	About 24 vehicular bridges would be constructed. These would include all State, Interstate, and U.S. Highway crossings as well as any additional roads selected by the county for retention within its road system. Any construction of bridges, detours, or acquisition of additional rights-of-way would be accomplished at the expense of Reclamation. At those locations where bridges would be constructed, detours would be provided to insure a continuous flow of traffic.	Provisions for the bridging of State highway crossings would be covered in a master crossing agreement between the Bureau of Reclamation and the Arizona Department of Transportation. Reclamation would negotiate a similar agreement with any other entities, i.e., city or county, having jurisdiction over roads to be bridged. The design standards for the bridges and road approaches would comply with the current minimum standards as established by the respective agency for its road system.
c. Airports			
The Coolidge-Florence Municipal Airport serves the communities of Florence and Coolidge and the surrounding agricultural and industrial areas.	The airport is not expected to be affected during construction and operation of the aqueduct.	Construction activities would be monitored to assure that no disruption of activities would occur.	
6. Military			
Two Air Force installations are near the aqueduct alinement. Williams Air Force Base is 6 miles (9.6 km) west and Rittenhouse Auxiliary Air Field is about 1/2-mile (.8 km) west. The Air Force has plans to reactivate the Rittenhouse Air Field in the future and the aqueduct would pass through State lands where the Air Force has an air navigation easement.	The operation of the two Air Force facilities is not expected to be affected by the aqueduct due to its alinement following the contour of the lands.	None necessary.	Representatives of the Air Force have concurred that the proposed location of the aqueduct would not interfere with their plans to reactivate Rittenhouse Auxiliary Air Field as a flight training base.
The aqueduct would pass through a portion of the Florence Military Reservation used by the Arizona National Guard for training exercises and gun emplacements for artillery fire	The alinement of the aqueduct would require a 1.0-mile (1.6 km) long strip of about 26 acres (11 ha) located in Sec. 24, T. 4 S., R. 9 W., within the Florence Military Reservation.	A bridge would be constructed to allow free access to the lands south of the aqueduct. The capacity of this bridge is under study by Reclamation and the National Guard.	None.
7. Arizona State Prison			
The main facilities of the Arizona State Prison are located in Section 31, T. 4 S., R. 10 E., G&SRB&M, east of Florence and northwest of the aqueduct alinement.	Approximately 15 acres (6 ha) of undeveloped desertland within the State Prison Ranch No. 2 would be required by the diagonal crossing of the Gila River Siphon through the NE¼ SW¼ of Section 15, T. 4 S., R. 10 E., G&SRB&M. This acquisition would leave a triangular-shaped remainder of approximately 30 acres (12 ha) of undeveloped desertland northwest of the siphon.	Acquisition through procedures described in Chapter II.F.2.	Construction of the Salt-Gila Aqueduct would not affect any current plans for upgrading the Arizona State Prison facility.

8. Urban

The right-of-way for the Salt-Gila Aqueduct would cross areas of urban development along Reach 1 from the Tonto National Forest boundary to the Maricopa-Pinal County line and further south where Reach 3 crosses the Florence Gardens Subdivision. In late 1973 discussions among representatives of the Flood Control District of Maricopa County (FCDMC) and Reclamation were held concerning a joint right-of-way acquisition program for the Spook Hill F.R.S. and Reach 1 of the Salt-Gila Aqueduct. The SCS in conjunction with the FCDMC planned to construct the Spook Hill F.R.S.which would provide flood protection for a portion of the proposed aqueduct. Since the right-of-way for the floodwater retarding structure was parallel and adjacent to the proposed aqueduct and about 30 ownerships involved requirements for both projects, it was agreed to expedite the acquisition program and coordinate with the SCS to assure fair and consistent land values as well as create a minimum amount of disturbance to the respective landowners.

Reclamation proceeded with its acquisition program on Reach 1 of the Salt-Gila Aqueduct under the authority of the final overall environmental statement for the Central Arizona Project (USBR 1972a), not only to accommodate the FCDMC but to also minimize CAP acquisition costs by acquiring subdivided lands before development, where possible. In addition, the Maricopa County Planning and Zoning Department has been coordinating approval of subdivisions within the area to reflect the alinement of the Salt-Gila Aqueduct. Therefore, disturbance to the overall development of this area was minimized by the land acquisition program. As a result, approximately 242 acres (98 ha) required for Reach 1 have already been acquired. Relocation services were provided by Reclamation in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, for 36 individuals, families or businesses displaced as a result of acquisitions along Reach 1. Table 24 summarizes the various forms of relocation performed. Ample time was available to provide adequate advisory services for each relocatee and all displaced persons were able to locate comparable facilities from the available market. There are three relocations in Reach 1 remaining to be completed pending the decision to proceed with construction.

Acquisition of rights-of-way through the Florence Gardens Subdivision located in Sections 13 and 24, T. 4 S., R. 9 E., G&SRB&M, Arizona, began in September 1977. Fifty-five contracts involving the acquisition of 0.14 acre (0.06 ha) lots within this subdivision have been signed. These lands were vacant at the time of acquisition and any significant delay would have probably resulted in the displacement of numerous people with resulting increased acquisition costs. Approximately 22 acres (8.9 ha) are yet to be acquired within this subdivision.

Table 24

Relocation Summary

Salt-Gila Aqueduct - Central Arizona Project

Displacee	Purchased Replacement Property	Rental Replacement Property	Moving Expenses Only 1/	Moving and Related Expenses	Total
Owner-Occupant	15	1	2		18
Tenants	9	2	5		16
Business				2	2
Total	24	3	7	2	36

1/ These individuals were generally in occupancy for less than 90 days and, therefore, only eligible for the expense incurred for moving their personal property.

102

9. Ownership

Table 25 summarizes the ownership of lands that would be required for the Salt-Gila Aqueduct. Approximately 3,595 acres (1,455 ha) of other Federal lands would be selected by the State in lieu of those State lands relinquished to Reclamation for construction purposes. An additional unquantified acreage would be selected for the 77 acres (31 ha) of State land exchanged to Reclamation. Since the lands to be acquired by the State may not actually be selected for several years, no assessment of the effects of the land exchanges can presently be made.

A total of 206 property owners would be affected by acquisition of their property. Of this number, 151 properties have already been acquired. Of the 151 acquisitions, 36 individuals, families, or businesses were relocated. Of the remaining 55 properties to be acquired, 2 relocations would be required.

E. Sociocultural Effects

1. Population

The Salt-Gila Aqueduct area extends from the Salt River in southeast Maricopa County to the Picacho Reservoir in north central Pinal County. The communities within the project area include, but are not limited to those requesting Central Arizona Project water served by the Salt-Gila Aqueduct. These same communities would also be affected by the construction of the Salt-Gila Aqueduct in terms of potential employment, service facilities and housing on a short-term basis. A brief profile of each of the affected communities is presented in Appendix B. Table 26 lists the estimated present and projected populations of affected counties and communities.

Arizona's population has been separated into five main racial classifications: White, 72.0 percent; Spanish heritage, 18.7 percent; Indian, 5.6 percent; Negro, 3.0 percent; other, 0.7 percent (Arizona Statistical Review 1977). Similar racial distribution data for Maricopa and Pinal Counties and the major communities within those counties are shown on Table 27. The age distribution for both counties is shown in Table 28 and is considered representative of conditions in the individual cities and towns.

Construction of the aqueduct is not expected to cause significant changes in the population size or the racial or age distribution of the communities in the area. A study conducted by Reclamation on the Granite Reef Aqueduct segment of the CAP indicates that approximately 75 percent of the workforce are local workers (Chalmers and Anderson 1977). Thus, substantial migration of non-local workers into central Arizona is not anticipated for the project. It is anticipated that the maximum employment will be approximately 600 persons at the peak of construction, with not more than 150 persons classified as non-local. Because the aqueduct alinement lies between the two largest cities in Arizona

Table 25

Summary of Land Ownership
Salt-Gila Aqueduct - Central Arizona Project

Reach	Private miles	Private acres	State miles	State acres	Federal miles	Federal acres	Total miles	Total acres
1	9.4	245	0.9	28	0.8	42	11.1	315
2	0.5	16	9.4	470	0.3 1/	11 1/	9.9 0.3 1/ 10.2	486 11 1/ 497
3	10.6	1,536	6.1	1,129	2.5 1.0 1/ 3.5	71 26 1/ 97	19.2 1.0 1/ 20.2	2,736 26 1/ 2,762
4	6.6	879	9.4	2,045	0.7	20	16.7	2,944
Total	27.1	2,676	25.8	3,672	4.0 1.3 1/ 5.3	133 37 1/ 170	56.9 1.3 58.2	6,481 37 6,518
Percentage	47	41	44	56	9	3		

1/ These lands are being used by the military.

Table 26

Present and Projected Populations

Community	1975 Population	2000 Estimated Population
Maricopa County	1,256,500	2,297,000
Pinal County	88,387 (1977)	123,764
Apache Junction	7,800	26,430
Casa Grande	13,600	24,190
Chandler	20,035	92,700
Coolidge	6,710	9,700
Eloy	6,495	8,955
Florence	2,925	3,910
Gilbert	3,600	45,500
Glendale	71,290	154,800
Mesa	117,099	223,500
Phoenix	699,005	1,042,100
Scottsdale	78,065	106,400
Tempe	94,065	184,000

Source: Maricopa Association of Governments 1977; Central Arizona Association of Governments 1977; Arizona Statistical Review 1977.

Table 27

1970 Racial Distribution of Population

	Total	White	Indian	Negro	Other
Maricopa	967,522	914,464	11,159	32,872	9,027
Pinal	67,916	57,516	6,405	3,008	987
Apache Junction	2,390	2,388		1	1
Casa Grande	10,536	9,593	151	701	91
Chandler	13,763	13,060	161	456	86
Coolidge	4,651	4,100	190	271	90
Eloy	5,381	4,361	112	663	245
Florence	2,173	2,061		90	22
Gilbert	1,971	1,927		5	39
Glendale	36,228	35,514	109	141	464
Mesa	62,853	61,434	348	789	282
Phoenix	581,562	542,510	5,893	27,896	5,263
Scottsdale	67,823	67,119	249	123	332
Tempe	62,907	61,514	304	450	629

Source: U.S. Bureau of Census 1971a.

Table 28
Age Distribution of Population

Age Group	Maricopa County	Pinal County
under 5 years	109,600	8,900
5-9	101,725	8,675
10-14	101,350	8,675
15-19	132,125	10,300
20-24	126,950	9,675
25-29	102,900	5,525
30-34	89,300	4,975
35-39	74,225	4,475
40-44	66,175	4,375
45-49	65,025	4,600
50-54	65,450	4,575
55-59	59,590	3,975
60-64	52,225	3,325
65 and over	152,975	7,650
Total	1,299,975	89,700

Source: Estimated by the Arizona Department of Economic Security, Office of Planning, 1977.

(Phoenix and Tucson), local workers would be available in both the small and larger cities.

Potential secondary population growth resulting from the importation of Colorado River water into central Arizona will be discussed in the appropriate environmental statement or assessments for delivery of water to the use areas. Until the water allocations are made and it is known where and how the water is to be used, it is impossible to quantify or fully discuss the potential impacts on population growth in central Arizona.

2. <u>Economy</u>

The Maricopa-Pinal County area has a diversified economy which is expanding rapidly. These two counties in 1975 provided approximately 58 percent of the agricultural income of Arizona. (Arizona Crop and Livestock Reporting Service 1975.) Agricultural production can be found primarily in rural areas surrounding the communities of Chandler, Gilbert, and Glendale in Maricopa County and throughout Pinal County. Table 29 shows the distribution of crop acreage by county as of 1976.

Mining activity is an important part of the economy, particularly in the Coolidge-Florence and Casa Grande Areas. The CONOCO Copper Project is located approximately 2 miles (3.2 km) northwest of Florence and is in its initial stages of development. Mining activities in the Casa Grande area include ASARCO and Hecla Mines.

The economic base is now expanding to include the manufacturing, travel, and tourism industries. The developing economy is due to the "Sunbelt" climate, relaxed style of contemporary living, moderate cost of living, and ideal "new business" conditions of low taxes and ample labor supply. Table 30 shows employment by industry in the project area.

Acquisition of 2,676 acres (1083 ha) of private land from the tax rolls would reduce annual tax revenues by approximately $48,170. Approximately 400 acres (162 ha) of irrigated farmland with associated improvements would be acquired for the right-of-way. This would mean the loss of an estimated $325,000 per year in farm products from the economy plus associated tax revenues. Five farm properties would be divided by construction of the aqueduct. This could cause some loss of efficiency of operation, although no net loss of income is anticipated. Construction would result in 38 relocations, of which 36 have already been accomplished. Social disruption from this would be minimized by the provisions of the Uniform Relocation Assistance and Real Property Aquisition Policies Act of 1970. It is possible that land values and land use adjacent to the aqueduct could be affected by the construction of the aqueduct. An adverse impact would occur if the esthetic value of the land were reduced and the potential for urban development reduced.

Table 29

Distribution of Crop Acreage by County
1976

Crop	Maricopa County	Pinal County
Alfalfa	90,000	18,000
Cotton	145,650	109,250
Citrus	23,510	1,040
Grains	151,300	137,000
Vegetables	22,150	5,800
Other	59,200	11,500
Total	491,810	282,590

Source: Arizona Statistical Review 1977.

Table 30

Employment by Industry

Industry	Maricopa County (1977)	Pinal County (1977)	Phoenix (1970)	Mesa (1970)	Casa Grande (1970)
Agriculture	11,400	1,850	6,938	845	276
Mining	500	8,150	729	375	103
Construction	28,200	750	34,301	3,829	349
Manufacturing	82,700	3,075	78,351	7,794	489
Transportation and Utilities	24,400	675	19,699	1,228	128
Communication	--	--	6,216	369	48
Wholesale and Retail Trade	121,500	3,525	85,581	9,014	824
Finance and Real Estate	34,100	500	24,760	1,698	152
Services	88,600	2,250	39,293	3,663	442
Professional and Educational Services	1/	1/	53,708	6,110	777
Public Administration	85,500	5,900	20,775	1,921	214
Other	40,800	2,200	--	--	--
Total	517,700	28,875	370,350	36,846	3,802

Source: U.S. Bureau of the Census 1971a.

1/ Included in Other category.

In the first 50 years of aqueduct operation, tax losses from land acquisition are estimated to be $3,000,000. This loss would be offset by the sales and income taxes generated by aqueduct construction. The project is expected to generate $5,847,070 in Federal, State, and local income taxes and $2,904,840 in state and city sales tax from direct expenditures for construction equipment, parts, and material. A first-time sales tax gain of $648,000 resulting from expenditures made by construction personnel and their families is expected. The overall impact in the Phoenix metropolitan area would be minimal. Some of the smaller outlying communities near the construction sites would have short-term benefits from increased local expenditures by construction personnel.

Within the project area, particularly Maricopa County, there is a strong demand for new housing. With the improved economic picture, developing economy, and large influx of new residents, there was a substantial increase in residential building in 1977. Approximately 20,000 new housing units were estimated to be constructed in Maricopa County in 1977 with an estimated 100,000 units needed for the period 1977-1980. Nationally, the median price of a new home is over $50,000 while a comparable home in the Phoenix metropolitan area ranges from $35,000 to $45,000.

Within Pinal County, the housing situation varies from that of Maricopa County due to a lower level of population increase and smaller size communities. In the city of Casa Grande, for example, approximately 85 dwelling units per month were started in 1976, while approximately 25 dwelling units per month are being started in the Coolidge-Florence area. The price range of homes in Casa Grande is $20,000 to $35,000 with home prices in the Coolidge-Florence area from $20,000 to $30,000.

Local housing supply-demand situations in the project area appear to be adequate to meet the small influx of non-local workers anticipated for this project. Because there would be no substantial changes in the supply and demand for housing; there would be little or no change on land values, purchase price or rental cost of housing due to construction of the Salt-Gila Aqueduct.

3. Income and Employment

The level of personal income continues to rise within the project area with an increase in the Phoenix area of approximately 12 percent in 1977. This reflects, in part, the overall employment picture. In 1977 an estimated 21,000 new jobs were recorded in the Phoenix metropolitan area. Table 31 shows the 1977 median income for the counties and communities in the project area. Table 32 shows poverty status by county and community.

Unemployment data as of March 1978 shows an unemployment rate of 5.7 percent for Maricopa County and 11.5 percent for Pinal County. Unemployment rates for some of the cities and towns within the project area are shown on Table 33.

Table 31

Estimated 1977 Median Income

Area	Median Income
Maricopa County	$ 16,999
Pinal County	13,677
Apache Junction	n/a
Casa Grande	13,975
Chandler	14,058
Coolidge	13,480
Eloy	10,250
Florence	n/a
Gilbert	n/a
Glendale	15,671
Mesa	16,350
Phoenix	16,898
Scottsdale	21,600
Tempe	18,827

Source: Estimated by the Arizona Department of Economic Security, Office of Planning, 1977.

Table 32

Income Less Than Poverty Level

Area	Families	% of All Families
Maricopa County	21,818	8.9
Pinal County	2,660	17.4
Apache Junction	n/a	n/a
Casa Grande	415	16.5
Chandler	434	12.3
Coolidge	199	17.1
Eloy	378	33.8
Florence	n/a	n/a
Gilbert	n/a	n/a
Glendale	1,064	11.8
Mesa	1,158	7.1
Phoenix	12,969	8.8
Scottsdale	731	4.2
Tempe	814	5.8

Source: U.S. Bureau of Census 1971a.

Table 33
Unemployment Rates by Communities

		Percentage Unemployed
Apache Junction	estimated	7.0
Casa Grande		10.3
Chandler		8.0
Coolidge		9.7
Eloy		17.9
Florence		8.4
Gilbert		6.0
Mesa		5.7
Phoenix		5.6
Scottsdale		4.5
Tempe		4.9

Source: Data obtained from Arizona Department of Economic Security, Labor Statistics Division, March 1978.

The Salt-Gila Aqueduct would be constructed in four reaches with an estimated 2-year construction period for each reach. Average direct monthly employment would be 100-150 workers per reach with the average monthly payroll between $225,000 and $300,000 per reach.

Construction personnel would include equipment operators, maintenance personnel, laborers, masons, carpenters, iron workers and electricians. These personnel would be obtained primarily from the Phoenix and Tucson metropolitan areas with the remaining labor force from the smaller communities nearer the construction sites. The relatively high percentage of local workers would provide several benefits: employment opportunities for unemployed or underemployed residents, minimal disruption of families and local housing demand, and maximum efficiency in labor utilization.

The employment generated in the service and material products sectors of the economy is more difficult to determine. The estimated construction cost is $122,000,000. Major items of work include earthwork excavation for the aqueduct, dike construction, and concrete lining. Approximately $20,000,000 would be spent on earthwork, $8,000,000 for Queen Creek Crossing and Sonoqui Dike, $42,000,000 for concrete lining and piping, $19,000,000 for the pumping plant, $1,639,000 for the transmission line and substation and $10,700,000 for lands and rights. These are the major items with the remainder divided among various features. These and other construction items would generate employment in such areas as equipment maintenance and repair, fuel for equipment, materials, manufacturing, processing and sales, (primarily concrete, steel and lumber) and transportation.

The aqueduct alinement is in proximity to three Indian Reservations and communities with large Hispanic populations. The actual onsite or direct employment of minority workers would probably not significantly change from those percentages currently in the construction trades.

The construction trade is extremely cyclical. Changes in income of construction workers would vary depending upon previous employment conditions. For those previously unemployed, income would certainly be beneficial on an individual basis. The construction could benefit specific trades with a concurrent reduction in unemployment compensation payments.

4. Education

Educational opportunities are readily available within both Maricopa and Pinal Counties. Maricopa County, and in particular the Phoenix metropolitan area, offers a variety of 2-year and 4-year post-high school educational institutions including the Maricopa County Community Colleges, Arizona State University, American Graduate School of International Management, and Grand Canyon College. Central Arizona College (a 2-year educational facility) is located approximately 6 miles (9.7 km) west of Coolidge and offers a wide range of vocational and college preparatory courses. Table 34 shows the level of education by county and community in the project area. Since in-migration of construction workers is not anticipated, there would be no anticipated expansion on the educational system in response to aqueduct construction.

5. Service Facilities

Due to the predominance of the State's population within Maricopa County, the majority of the larger medical facilities are located in the Phoenix metropolitan area. Eleven major hospitals are located in the Phoenix metropolitan area. Pinal County medical facilities include the Hoemako Cooperative Hospital and the West Pinal Family Health Center in Casa Grande, a 95-bed hospital in Coolidge, and a 120-bed hospital in Florence.

Primary transportation facilities include air, bus, and railroad lines serving major communities within the project area. Sky Harbor International Airport, located in Phoenix, serves nine major airlines. Other air facilities include Falcon Field in Mesa; Casa Grande, Francisco Grande, Chandler, Coolidge-Florence, Eloy, Glendale, and Scottsdale Municipal Airports. Railroad facilities in the area include the Southern Pacific Railroad Company and the Atchison, Topeka and Santa Fe Railroad Company. Bus service is provided by Greyhound, Continental Trailways, and Grayline Systems while Phoenix Transit serves the Phoenix metropolitan area on an intracity basis.

Table 34

Education by County and Community for Persons 25 Years Old and Over

Area	Percent Completing 4 Years of High School or More	Median School Years Completed
Maricopa County	60.1	12.3
Pinal County	42.2	10.7
Apache Junction	n/a	n/a
Casa Grande	48.1	11.7
Chandler	57.1	12.2
Coolidge	47.5	11.5
Eloy	27.6	8.5
Florence	n/a	n/a
Gilbert	n/a	n/a
Glendale	55.6	12.2
Mesa	60.0	12.3
Phoenix (SMSA) 1/	60.1	12.3
Scottsdale	77.9	12.8
Tempe	77.0	12.8

Source: U.S. Bureau of the Census 1971a.

1/ SMSA = Standard Metropolitan Statistical Area.

The majority of the cities and towns within the project area receive electrical service from the Arizona Public Service Company or the Salt River Project. Natural gas service is generally provided by APS. Some of the larger communities have municipally owned public utilities. Water service is provided either by locally owned municipal systems or privately owned systems such as the Arizona Water Company in Coolidge and Florence. Sources of water range from surface water from the Salt and Verde Rivers to ground water from wells or a combination of both systems. Telephone service is provided by Mountain Bell.

It is not anticipated that any substantial changes will occur in the social services sector. Services such as medical institutions, public transportation and utilities would not be affected since substantial in-migration is not expected to take place. Vehicular traffic would be minimally disrupted due to construction of bridges and the reduction of speed through construction areas. Relocations of utility facilities may result in minor local disturbance of service. If a significant outage of service is to be experienced, notification of residents would be made through the media. Local restaurants, gasoline service stations and other retail facilities could expect a temporary moderate increase in demand for services during construction.

F. Archeological and Historical Resources

1. History of Human Use of the Project Area

Archeological research has shown that the American Southwest has been occupied by human societies since at least 10,000 B.C. and possibly several thousand years earlier (Martin and Plog 1973, McGregor 1965, Willey 1966). Archeologists refer to these earliest inhabitants as Paleo-Indians (Figure 73). Paleo-Indian societies were sparsely scattered across the landscape and probably organized in small nomadic bands that lived by gathering wild foods and hunting various species of Pleistocene megafauna including mammoth, bison, horse, camel, and dire wolf. By about 7000 B.C. the megafauna disappeared, perhaps because of overhunting and/or because the climate became warmer and drier as the continental ice sheet of the last Ice Age receded to the north.

During the next 7,000 years, commonly called the Archaic Period, societies continued to live by nomadic hunting and gathering of wild foods. Archeologists refer to this adaptation throughout the interior Western United States as the Desert Culture Tradition (Jennings 1957). The regional Desert Culture manifestation within south-central Arizona is called the Cochise Culture (Sayles and Antevs 1941).

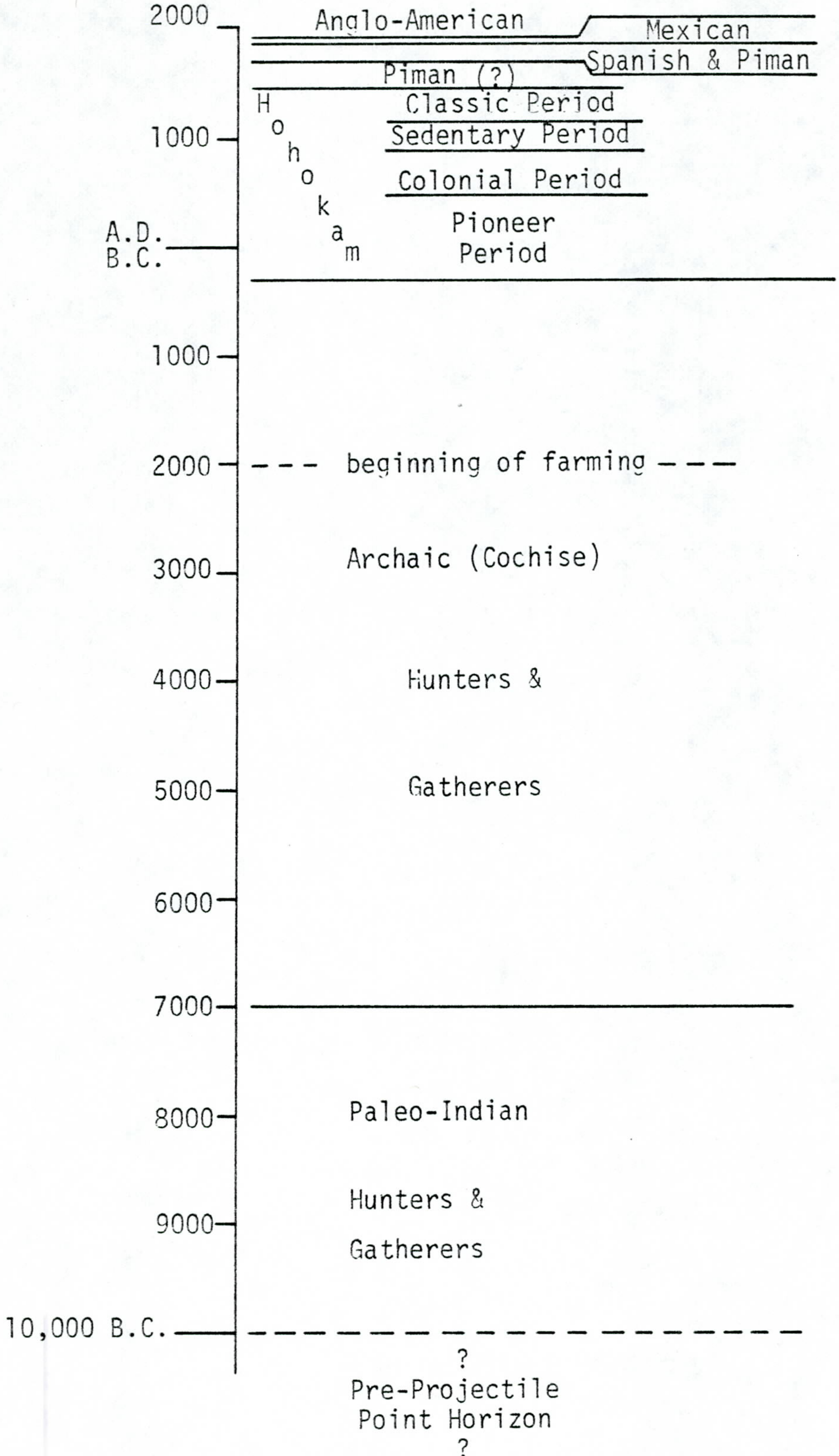
Although minor changes in stone tool styles and manufacturing techniques occurred during the Archaic Period, the Cochise Culture represented a relatively stable adaptation to a semi-arid environment. Around 2000 B.C., during the latter part of the Cochise Period, corn was introduced into the Southwest and other crops such as beans and squash were subsequently acquired (Mangelsdorf 1974). The early varieties of these crops were relatively unproductive, and the basic hunting-and-gathering subsistence practices in central and southern Arizona were not modified significantly until a new culture known as the Hohokam entered the Salt and Gila River Valleys.

Although the dating and origins of the Hohokam culture are controversial, a widely accepted hypothesis is that the Hohokam originated as a migration of people from west-central Mexico at 300 B.C. (Haury 1976). The Hohokam population grew and expanded its territory during the next 17 centuries. The Hohokam practiced sedentary farming supported by a canal irrigation technology. They also developed craftsmanship in the working of stone, shell, and pottery. By A.D. 1400 or 1450, the Hohokam towns and villages were abandoned for still unexplained reasons. Archeologists have divided the Hohokam occupation into four major periods on the basis of changing artifactual and architectural styles (Figure 73).

Spanish explorers and priests first entered the American Southwest in the 16th century but the first documented visits to the Gila River area of central Arizona are those of Father Kino in 1694, 1697, 1698, and 1699 (Hayden 1924). At that time this area was the northern boundary of the territory of the Upper Piman tribes (cf. Spicer 1962). Whether these Gila River Pimas were descendants of the Hohokam is an unresolved question. During the Spanish contact period, nomadic Yavapai lived to the north and the Apache were moving into the mountainous areas to the northeast and east. No Spanish towns were ever established as far north as the Gila River Pima Territory and the closest Spanish mission was San Xavier del Bac located in the vicinity of Tucson. The Gila River Pimas were friendly with the Spanish and considered them to be allies against the Apaches who began to raid the Upper Piman tribes and Spanish settlements at the beginning of the 18th century. The Gila River Pima actually never received any military support from the Spanish.

Direct Spanish interaction with the Gila River Pimas was limited, but the presence of the Spanish to the south, plus increasing pressures from the Apaches to the east and from Yuman tribes to the west, led to substantial modification of Gila River Pima culture. These changes included a constriction of tribal boundaries and an increase in population density, development of irrigation and increased agricultural production (particularly of wheat which was acquired from the Spanish), growth of a more complex tribal structure, and creation of an alliance with the Maricopa located to the west (Winter 1973).

The Spanish era ended in 1821 with the Mexican War of Independence. The official Mexican policy toward native tribes was substantially different from the Spanish program but resulted in no major changes among the Upper Piman tribes because the policies were never implemented. In 1848 the area north of the Gila River was acquired by the United States as a result of the Mexican American War. The area south of the Gila was acquired in 1853 as part of the Gadsden Purchase.



Culture History Chronology for Central Arizona.

Fur trappers following the Gila River initiated Anglo-American contacts in central Arizona in the 1820's. Intensity of contact increased as the gold rush to California began in 1849. Increased travel and settlement created a market for agricultural goods, and the Pimas, who were practicing irrigation agriculture at the time, responded by increasing their agricultural production dramatically (Doelle 1976:18). The Pimas were friendly with Americans, willing to trade, and generously gave of their food to needy travelers. The Pimas provided support to the American settlements by resisting the raiding Apache and Yavapai until the U.S. Army subdued the two tribes and relegated them to reservations in the 1870's.

A portion of the Pima territory was surveyed as a reservation in 1859. A decade later the reservation was increased from 64,000 to 145,000 acres (25,911 to 58,704 ha) but still did not include all the land the Pimas claimed. More land was subsequently added until today the Gila River Indian Reservation includes 371,932 acres (150,580 ha) (Dutton 1975).

As the Anglo-American population grew, the amount of land farmed increased and the supply of water for irrigation along the Gila River could no longer maintain the Piman farming economy. In the 1860's many Pimans and Maricopas began migrating to the north and started farming along the Salt River. The Gila River Pima farming economy collapsed in the 1870's due to lack of water for crops. A second reservation was established for the Pima and Maricopa Indians along the Salt River in 1879. Today the Salt River Indian Reservation encompasses 45,627 acres (18,472 ha) (Dutton 1975).

Arizona achieved territorial status separate from New Mexico in 1863 and during the next two decades the rate of settlement increased dramatically (Trimble 1977). The towns of Florence and Phoenix were founded in the 1860's and Tempe and Mesa in the 1870's (Barnes 1960). Farming and cattle grazing were the primary enterprises of the new settlers. The discovery of silver in the mountains northeast of Florence in the 1870's created a "boom" era which faded by the beginning of the 20th century as the ore was exhausted. Arizona was granted statehood in 1912. The Anglo-American occupation of central and southern Arizona has been based primarily upon farming, grazing, and mining. Water supplies in the Salt River Valley were stabilized considerably upon completion of Roosevelt Dam in 1911 and the subsequent construction of five other major dams on the Salt River system. Coolidge Dam was built on the Gila River to store irrigation water, but the reservoir has been dry 11 times since its completion in 1928. After World War II the rate of urbanization increased rapidly and reflects the continuing growth of the tourism industry, and the development of retirement communities.

2. Inventory and Assessment Procedures

To determine whether the proposed construction of the Salt-Gila Aqueduct would affect any significant resources related to the prehistory and history of the area, the site inventories maintained by the Arizona State Historic Preservation Office, Arizona State University, the Arizona State Museum, and the Museum of Northern Arizona were reviewed. Because of the inadequacy of existing survey information for the project area, Reclamation funded on-the-ground inventory surveys along both the originally investigated feasibility alinement and the currently proposed construction alinement.

The initial cultural resource reconnaissance surveys along the Central Arizona Project aqueduct system were made in 1968 and 1969. These studies were designed to determine only the general nature of any archeological and historical sites present along the feasibility alinement and did not provide intensive coverage of the project area. Portions of the aqueduct system now designated as the Salt-Gila Aqueduct were surveyed by Arizona State University (Dittert, Fish and Simonis 1969) and the Arizona State Museum (Kayser and Fiero 1969). These two reconnaissance surveys overlapped somewhat in the vicinity of the Gila River, but basically Arizona State University studied the aqueduct route north of the Gila River while the Arizona State Museum surveyed that portion of the route south of the river.

In 1972, after the feasibility alinement was field staked, an intensive survey was made by the Arizona State Museum (Grady et al. 1973). Additional sites were subsequently recorded in the vicinity of the aqueduct route in conjunction with a railroad relocation alinement survey made by the Arizona State Museum as part of the survey of the proposed Buttes Reservoir area (Debowski et al. 1976).

The construction alinement currently proposed differs somewhat from the feasibility alinement which was inventoried during the earlier surveys. The Museum of Northern Arizona (MNA) completed an intensive survey of about 11,115 acres (4,500 ha) along the proposed construction alinement in 1978. About 25 percent of this survey area overlaps the feasibility alinement survey area.

Each of the completed survey reports has included assessments of the sites found. The integrity of most of the recorded sites has not been irreversibly destroyed by previous construction, vandalism, or natural erosional forces and as a result they may have the potential to yield important information about the prehistoric or historic human occupation of the project area. Such potential qualifies a site for listing on the National Register of Historic Places ("Procedures for the Protection of Historic and Cultural Properties," 36 CFR 800). Listing on the Register does not necessarily imply a recommendation for preservation in place; it does indicate that such resources should be duly considered during the planning of Federal projects, and protected where feasible to do so. However, if such projects do adversely affect sites eligible for listing on the Register, Federal agencies are authorized to spend funds to mitigate any unavoidable damage or destruction. In accordance with 36 CFR 63, "Determinations of Eligibility for Inclusion in the National Register of Historic Places," the Arizona State Historic Preservation Officer and the Keeper of the National Register have been consulted to formally determine which of the recorded archeological and historical sites are eligible for listing on the National Register.

3. Cultural Resource Base of the Project Area

The site inventory maintained at the Arizona State Historic Preservation Office includes three prehistoric and eight historic sites recorded within the general vicinity of the Salt-Gila Aqueduct projects area as shown in Figure 74.

The prehistoric sites include the Escalante ruin group located northwest of Florence. This is a group of important Hohokam sites that have been excavated and studied prior to development of an open pit copper mine by CONOCO (Doyel 1975). Both of the other prehistoric sites, Casa Grande and the Adamsville Ruin, are large late Hohokam Period sites. Both are listed on the National Register of Historic Places and, in addition, Casa Grande is a designated National Monument.

Three of the historic sites are related to the founding of Euro-American towns in the 1860's. These include Maryville north of the Salt River, and Adamsville along the Gila River. Both of these settlements are now abandoned. The third includes hundreds of historic structures in Florence (Sobin 1977)). Among these structures are the original Pinal County courthouse (constructed in 1878) and the second county courthouse (constructed in 1891). Both are listed on the National Register of Historic Places. A district nomination is also being prepared for the original Florence townsite.

Two other historic sites are located in the Florence area. One is Hunt Highway which is a road built in 1913-1914 during the administration of George W. P. Hunt, the first Governor of Arizona. The other site is Poston's Butte. Charles Poston, who is known as the father of Arizona for the role he played in securing territorial status for Arizona, is buried in a pyramid tomb on top of this 300-foot (91 m) hill. During travels through the Orient in the 1860's, Poston became imbued with the Parsee religion and upon his return he began building a sun worship temple on Poston's Butte, but it was never completed. The butte is listed on the Arizona State Register of Historic Places.

Two other historic sites, related to early mining activities, are located in the mountainous area east of the aqueduct alinement. Goldfield is an abandoned gold mining camp founded in the 1890's. The Butte-Cochran charcoal ovens are five beehive-shaped masonry charcoal kilns which were built and used in the 1880's in conjunction with ore smelting at the now abandoned town of Butte. These ovens are listed on the National Register.

The last State inventory historic site is the Granite Reef Diversion Dam which was built across the Salt River in 1906-08 in conjunction with the construction of Theodore Roosevelt Dam. This structure is a feature of the first multipurpose Federal Reclamation project. A recently completed study investigated the workmen's campsite that was used when the dam was constructed (Brown 1978).

The cultural resource inventory surveys funded by Reclamation in the Salt-Gila project area have resulted in the recording of a total of 85 archeological and historical sites. Only four of these had been discovered by archeologists prior to the initiation of Reclamation-funded surveys. Of the 85 recorded sites, 70 are located in the vicinity of the proposed construction corridor (see Appendix C-3). (The other 15 sites were either studied as mitigation for other projects (1 site), completely or substantially collected during previous surveys (4 sites), not relocated or redesignated by subsequent surveys (3 sites), or are located along major divergences between the construction and feasibility alinements (7 sites). Of these 70 sites, 63 have been determined to be eligible for listing in the National Register of Historic Places.

Only one of the sites eligible for the Register dates from the historic period (Table 35). It consists of the foundation of a Sonoran style adobe house that marks the remains of a homestead granted in 1891. Almost 90 percent of the Register-eligible sites date from the prehistoric Hohokam period, primarily from the later Sedentary and Classic Periods. Two of the sites, plus a component of one of the Hohokam sites, may date from the earlier Archaic Period. Lack of diagnostic surface artifacts makes it impossible to assign four of the sites to a culture period, but they probably date from either the Archaic or Hohokam occupations.

More than three-fourths of the Register-eligible sites consist of surface scatters or shallow deposits of artifacts which primarily represent remains of temporary campsites, prehistoric fields, stone tool manufacturing areas, or places where wild foods were gathered and processed. Six of the sites contain moderately deep cultural deposits (12 to 20 inches (0.3 to 0.5 meter)) and nine others have relatively deep deposits (20 to 40 inches or more (0.5 to 1 meter)). Many of the 15 sites with moderate and deep deposits probably represent Hohokam village sites. Actual remnants of house structures have been encountered by limited test excavations at four of these sites.

Previous construction of floodwater retarding structures and roads, agricultural development, vandalism, and natural erosion have disturbed or destroyed portions of many of the sites eligible for the Register. About two-thirds of these sites are in only poor to fair condition. Sixteen of the surficial and shallow sites and four of the sites with moderately deep and deep deposits are in good condition.

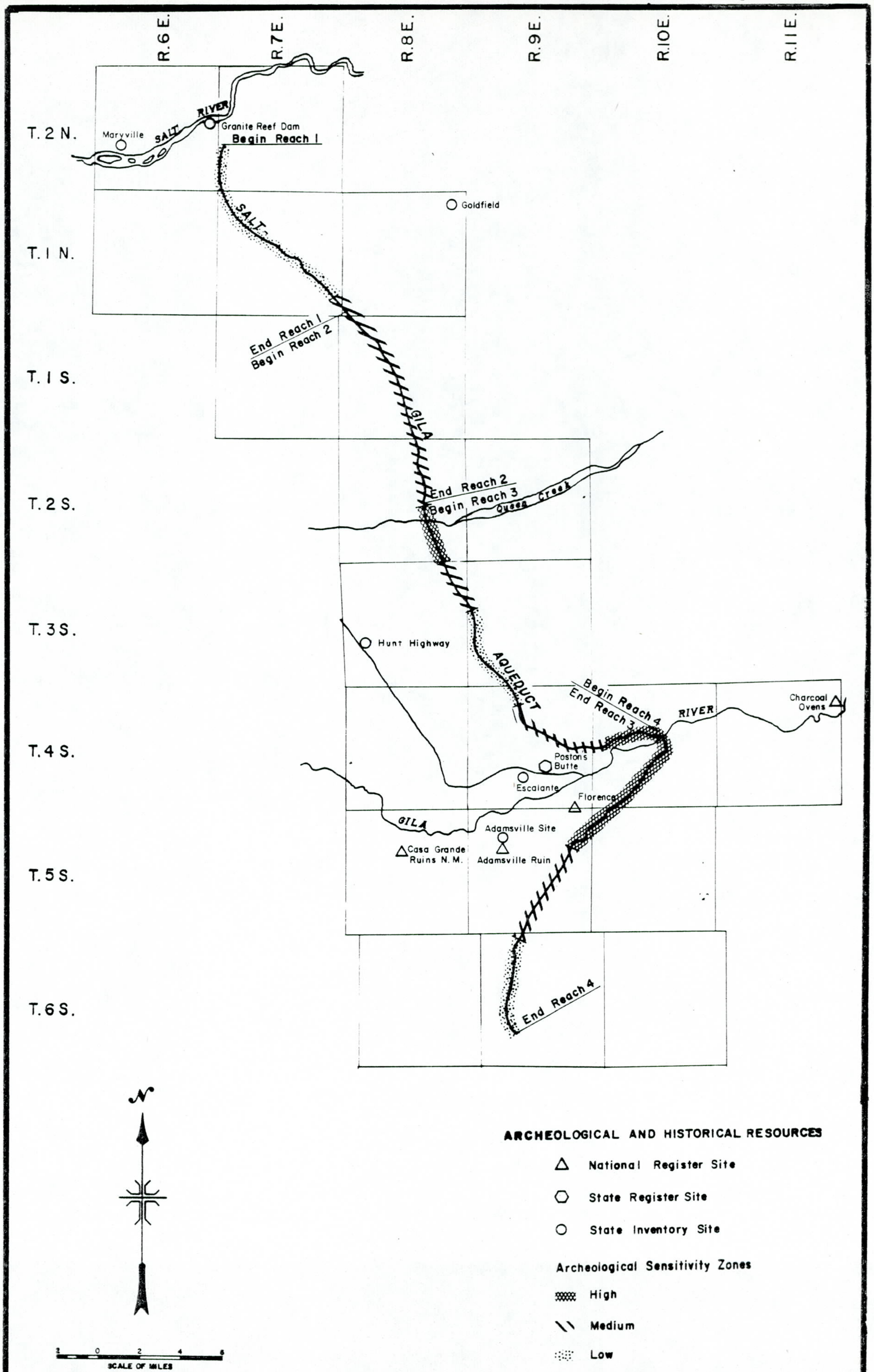

R.6E.
R.7E.
R.8E.
R.9E.
R.10E.
R.11E.
T.2N.
T.1N.
T.1S.
T.2S.
T.3S.
T.4S.
T.5S.
T.6S.
SALT RIVER
Maryville
Granite Reef Dam
Begin Reach 1
Goldfield
SALT
End Reach 1
Begin Reach 2
GILA
End Reach 2
Begin Reach 3
Queen Creek
Hunt Highway
AQUEDUCT
Begin Reach 4
End Reach 3
RIVER
Charcoal Ovens
Postons Butte
Escalante
Florence
GILA
Adamsville Site
Casa Grande Ruins N.M.
Adamsville Ruin
End Reach 4
N
SCALE OF MILES
ARCHEOLOGICAL AND HISTORICAL RESOURCES
National Register Site
State Register Site
State Inventory Site
Archeological Sensitivity Zones
High
Medium
Low

Table 35

Summary of Characteristics of Cultural Resource Sites
Eligible for the National Register of Historic Places
Salt-Gila Aqueduct - Central Arizona Project

	Culture Period				Condition			Depth			
	Archaic	Hohokam	Historic	Unknown	Poor	Fair	Good	Surface	Shallow	Moderate	Deep
Reach 1		1				1		1			
Reach 2		14			3	8	3	3	9		2
Reach 3	2 plus another possible component at one of the Hohokam sites	17	1	3	2	9	12	5	13	1	4
Reach 4		24		1	10	9	6	3	14	5	3
Total	2 (plus another possible component)	56	1	4	15	27	21	12	36	6	9

NOTE: See Appendix C-3 for a detailed list of sites

The results of the inventory surveys have been used to define cultural resource sensitivity zones. Areas in which no sites, previously studied sites, or areas with very few surficial and shallow sites have been defined as low sensitivity zones on Figure 74. Areas containing medium densities of sites which consisted primarily of surficial and shallow sites or disturbed sites with deeper deposits are defined as medium sensitivity zones. High sensitivity zones are defined as areas with relatively high densities of all types of sites or medium densities of undisturbed sites. About 35 percent of the 60-mile (97 km) alinement transect can be classified as low sensitivity zones, 40 percent as medium sensitivity, and 25 percent as high sensitivity zones. High sensitivity zones occur along Queen Creek and the Gila River which were intensively occupied areas in prehistoric times.

The significance of the recorded archeological and historical sites can be evaluated in several dimensions including legal, monetary, educational, recreational, ethnic (including religious and spiritual), historical and scientific (cf. Dixon 1977, Glassow 1977, Moratto and Kelly 1976, Raab and Klinger 1977, Schiffer and House 1977, Scovill et al. 1977, Thompson 1979). As mentioned above, 63 of the recorded sites have been determined to be significant according to legal criteria. However, none of the recorded sites are within a National Park nor have any been designated National Historic Landmarks. None of the sites need to be preserved in place to fulfill the purposes set forth in the State Historic Preservation Plan. With the exception of a single set of petroglyph panels, which will be avoided, none of the sites have the potential for significant in-place exhibits. Although the local Piman Indians may be descendants of the prehistoric Hohokam and have a special regard for archeological sites, none of the sites to be affected have any particular historic or cultural significance for the local Piman reservation communities. None of the cultural resource survey reports have recommended realinements because other similar sites would undoubtedly be encountered in adjacent areas.

The primary significance of the recorded sites lies in their historic and scientific values. Further research at the recorded sites would increase knowledge and understanding of how earlier societies, particularly the Hohokam, adapted to the local environment and how they changed over the centuries, thus enhancing the historical perspective of our own society. Results of professional studies could have educational significance for a public much larger than professional archeologists.

4. Analysis of Predicted Impacts

Analysis of the conceptual design of the Salt-Gila Aqueduct indicates that 58 of the Register eligible sites would be affected by the proposed construction (Table 36). All of these are prehistoric, archeological sites. Some additional impact areas would be identified during later stages of project planning. These could include borrow and spoil areas, construction yards, access roads, and minor alinement changes. These areas would be surveyed for archeological and historical

TABLE 36

Analysis of Predicted Impacts Upon Archeological and Historical Sites
Salt-Gila Aqueduct - Central Arizona Project

Reach	Sites Recorded	Sites Not Eligible for the National Register (Not Significant)	Significant Sites That Will Be Avoided	Significant Sites Where Impacts Will Be Relatively Minimal	Significant Sites Where Impacts Will Be Limited To Increased Flooding	Number of Sites Eligible for Mitigative Study
1	3	2 AZ U:10:1(MNA)(totally collected) AZ U:10:2(MNA)(no integrity)	0	0	0	1
2	15	1 AZ U:10:4(MNA)(less than 50 yrs old--will not be affected by construction)	1 AZ U:10:18(MNA)	0	0	13
3	23 (includes Queen Creek Archeological District)	0	3 AZ U:15:18(MNA) AZ U:15:36(MNA) AZ U:15:42(MNA)	1 AZ U:15:30(MNA) (petroglyphs can probably be left in place - only margin of site affected)	3 AZ U:15:40(MNA) AZ U:15:41(MNA) AZ U:15:43(MNA)	20 (including Archeological District)
4	29 (includes Florence Archeological District)	4 AZ U:15:14(MNA) (no integrity) AZ U:15:15(MNA) (no integrity) AZ U:15:17(MNA) Cemetery - will be avoided) AZ AA:3:7(MNA) (less than 50 yrs old - will be avoided)	1 AZ U:15:37(MNA)	1 AZ U:15:31(MNA) (only margin will be affected)	3 AZ AA:3:5(MNA) AZ AA:3:6(MNA) AZ AA:3:10(MNA)	24 (including Archeological District)
Total	70	7	5	2	6	58 1/

NOTE: See Appendix C-3 for a detailed list of sites.

1/ This analysis is based upon conceptual designs and cannot be considered final until detailed and final construction designs and plans are developed. Such designs could alter the extent of impacts at any given site but any overall changes are expected to be relatively minor. Some additional impact areas for borrow areas, access roads, construction yards, and minor alinement changes may be identified. These are not expected to exceed 5 to 10 percent of the area that has been surveyed and if any sites are identified, many can probably be avoided.

sites as they are identified. Many of these potential impact areas have already been surveyed and it is estimated that no more than four to eight additional sites might be discovered in these areas. Any sites which are discovered would be avoided where practical. If evidence of previously unrecorded historical or archeological data is discovered during construction, operations in the vicinity of the discovery would cease and any appropriate mitigation studies would be conducted prior to resuming construction.

The extent and type of impact upon the recorded sites will not be uniform at all sites. Analysis of the conceptual designs indicates that five significant sites could be avoided by the proposed construction. Two others would be only minimally disturbed. (The petroglyph panels, which have some potential as an in-place exhibit, would be left intact.) Six other sites are located behind proposed dikes and the effects of the project would be limited to occasional flooding. The effect of periodic inundation upon archeological resources has not been rigorously documented but can be expected to be adverse in many instances (Carrell, Rayl and Lenihan 1976). The remaining 50 Register eligible sites would be severely disturbed or destroyed by direct construction activities.

Construction of the aqueduct would also create secondary impacts upon archeological and historical sites not located within the district impact zones but in the vicinity of the aqueduct. Such sites may have their environmental settings altered, which could reduce their integrity and complicate their interpretation. Because much of the project area has already been disturbed by previous construction, roads and agricultural activity, this type of collective impact would not be great. Construction activity and increased access along maintenance roads may result in more human visitation, which could increase vandalism and inadvertent damage to sites.

The potential secondary effects upon historical buildings in Florence which may result from having a major construction project in the vicinity have been evaluated. Blasting activities are not anticipated within 2.5 miles (4 kilometers) and should not affect any historic buildings in Florence . Most construction workers are expected to commute from the Tucson and Phoenix areas and impacts stemming from short-term growth and any new or temporary housing within Florence are expected to be minimal.

Delivery of water through the aqueduct cannot be used to expand agricultural development except on Indian reservations. Municipal and industrial allocations may result in more urbanization and development which could destroy other archeological and historical sites. Impacts stemming from water allocations will be evaluated in other separate environmental analyses.

5. Proposed Mitigation Plan

The Museum of Northern Arizona has prepared a plan for mitigating predicted construction impacts upon the sites determined to be eligible for the National Register of Historic Places (Stein 1979). The mitigation will consist primarily of professional data recovery studies which will include site mapping, artifact collection, excavation, analysis, and report preparation. Several research questions appropriate for orienting these studies have been identified and fieldwork will be coordinated with the construction schedule so that it can be completed before construction begins. It is estimated that the fieldwork, laboratory analysis, and report preparation will require approximately 12 worker years of effort. Funds for these studies will be classified as nonreimbursable portions of CAP allocations in accordance with the Archeological and Historic Preservation Act of 1974 (P.L. 93-291).

Arrangements will be made for long-term curation of the data and artifacts collected. Efforts will be made to disseminate the results of the professional study to the general public. Such efforts may involve brochures or a book written in laymen's terms, tours of excavations in progress, and traveling exhibits.

The Arizona State Historic Preservation Officer has concurred with Reclamation's determination that the proposed mitigation studies can be appropriately accomplished under a determination of "no adverse effect" in accordance with the "Guidelines for Making 'Adverse Effect' and 'No Adverse Effect' Determinations for Archeological Resources in Accordance with 36 CFR Part 800" prepared by the Advisory Council on Historic Preservation (ACHP). Documentation concerning this determination was provided to the ACHP for the Council's review. If the ACHP does not concur with this determination, further consultations and negotiation of a Memorandum of Agreement will be made in accordance with Section 106 of the Historic Preservation Act of 1966 (P.L. 89-665).

G. Recreation

Existing recreation resources adjacent to the Salt-Gila Aqueduct include the 9.5 acre (3.8 ha) Maricopa County Oasis Park located near Apache Junction, 0.5 mile (0.8 km) south of U.S. 60-80-89 at 108th Street (Signal Butte Road) (Maricopa Planning and Zoning Department 1970). The Salt-Gila Aqueduct right-of-way would pass through the western edge of this park. Maricopa County wuld receive just compensation for the required lands, and could possibly purchase replacement lands next to the park. The construction and subsequent operation and maintenance of the aqueduct would not seriously affect the long-term park operation; however, moderate degradation of visual quality may be expected. During construction of the aqueduct, low to moderate noise and dust problems may result. Appropriate measures to control the dust problem, such as construction area watering, may be required. As the main feature of the park is a community center, noise pollution problems can be minimized by scheduling of community and construction activities to avoid conflict. The completed aqueduct may present a safety hazard due to its proximity to a high use recreation area. This hazard would be minimized by the construction of Class A fencing as discussed in Chapter II.G.

Bush Highway Recreation Area is also adjacent to the Salt-Gila Aqueduct alinement. This area, which has recently been renamed the Spook Hill Recreation Area is located 1.5 miles (2.4 km) north of Apache Boulevard by way of Usery Pass Road. The existing development is a 5-acre (2.3 ha) picnic area operated by Maricopa County Parks and Recreation Department. However, the county and City of Mesa are planning an extensive development centered near the intersection of Usery Pass Road and the proposed extension of Brown Road which surrounds the existing picnic area. Southwest of the aqueduct, Maricopa County Parks and Recreation Department will operate an 18-hole regulation golf course, an 18-hole executive golf course, a driving range, and the normal attendant facilities. The City of Mesa plans to build and operate a recreation center and day use area adjoining the golf complex.

Upslope of the aqueduct the SCS and FCDMC are constructing the Spook Hill F.R.S. The City of Mesa plans to operate a variety of day use facilities in the detention basin of this structure. The activity areas here are similar in type to the proposed development along the Paradise Valley Flood Detention Dike in Reach 11 of the Granite Reef Aqueduct (USBR 1974). The Salt-Gila Aqueduct and adjacent Spook Hill F.R.S. are considered a stimulus to recreation development at this location due to the additional Federal ownership in the area.

At the Gila River Siphon crossing, the present recreational activities include hiking, hunting, and off-road vehicle use. There would be no adverse effect on these activities from the siphon construction or operation.

Along the remainder of the aqueduct right-of-way, dispersed recreation activities occur. Activities include horseback riding, off-road vehicle use, and small game and bird hunting. The aqueduct would have a minimal effect on these activities.

Various State, county, and private agencies have expressed their desire for the incorporation of multipurpose trails along the entire CAP aqueduct system (Arizona Highway Department 1973). The feasibility of these trails, along with overnight areas, and day-use visitor facilities at the Salt-Gila Pumping Plant are being investigated as a part of the continuing recreation planning function of the Bureau of Reclamation. Visitor facilities including viewing rooms, restrooms, picnic areas, and parking areas at the Salt-Gila Pumping Plant could utilize a portion of the area temporarily disturbed by construction activities.

H. Other Agency Programs

This section is summarized in a tabular format beginning on the following page.

H. Other Agency Programs

	Function in Construction Area	Impact Due to Construction	Remarks
1. Federal			
a. Bureau of Land Management (BLM)	Administers most of the Federal land through which the aqueduct would pass. The area is within its Central Arizona planning unit.	The aqueduct would require about 128 acres (52 ha) of land presently under BLM administration of which the majority has been placed in a disposal category. Survey markers which are part of the cadastral survey would require referencing prior to disturbance. Mining claims under jurisdiction of BLM would require field investigations, validity determinations, and hearing procedures	An additional workload is expected for this agency due to impacts on the cadastral survey, validity determinations of mining claims, realinement of grazing allotments, location of livestock crossings and water supplies.
b. Soil Conservation Service (SCS)	Conducts soil surveys, determines prime and unique farmlands, assists farmers in farm planning, and plans small watershed flood control projects.	The aqueduct would require 180 acres (73 ha) that have been designated as prime farmland. None of these lands are expected to be designated as unique farmlands when the Service completes its determinations. The realinement of farm ditches and changes in field patterns due to aqueduct crossings would require assistance in redesign of new systems. About 1 mile (1.6 km) of the Florence Floodwater Retarding Structure would be relocated to accommodate the aqueduct alinement, but flood protection would be maintained.	The acreage of prime farm lands lost would be minor when compared to the large acreage of prime farmlands that are expected to receive water from the aqueduct. Additional prime farmlands could be developed in the same area if existing laws and regulations for the area would allow the development of additional agricultural lands. The construction of the Lower Queen Creek F.R.S., proposed under P.L. 83-566, would preclude construction of the Sonoqui Dike described in this report.
c. Bureau of Indian Affairs (BIA)	Provides technical assistance to the Gila River Indian Reservation and operates the San Carlos Project.	The San Carlos Project would receive water from the Salt-Gila Aqueduct for agricultural uses on the Gila River Indian Reservation This would result in the modification of existing distribution and irrigation systems. The Florence-Casa Grande and North Side Canals of the San Carlos Project would be crossed by the aqueduct downstream from Ashurst-Hayden Diversion Dam as described in Chapter II.	The BIA is expected to have an increased requirement for technical assistance for the Gila River Indian Reservation due to anticipated delivery of water from the Salt-Gila Aqueduct. Coordinaation will be required to cross the existing canals of the San Carlos Project with no disruption of service.
d. Bureau of Prisons	Operates the Federal Detention Center in Florence about 0.5 miles (0.8 km) from the aqueduct alinement.	The aqueduct is not expected to affect the operation of the Federal Detention Center.	

		Function in Construction Area	Impact Due to Construction	Remarks
e.	Corps of Engineers	Plans, constructs, and operates water resource and flood control projects.	No impact on local Corps projects or plans.	Final design of the Queen Creek and Gila River crossings will utilize floodflow studies performed by the Corps.
f.	Fish and Wildlife Service (FWS)	Provides assistance in the planning, design, and operation of the aqueduct under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat 401, as amended; 16 USC 661 et seq.) and under contract with Reclamation.	Further refinement in fish and wildlife mitigation and enhancement measures proposed in the advance planning report would be required.	Additional contracts and assistance in the coordination of the design of proposed mitigation and enhancement measures would be needed for assistance in the finalization of plans.
g.	Air Force	Maintains Rittenhouse Auxiliary Air Field located within one-half mile (0.8 km) of the aqueduct alinement.	No interference with potential flight operations is anticipated.	
h.	Forest Service	Administers the Tonto National Forest through which a portion of the aqueduct would pass.	About 0.6 mile (1 km) of the aqueduct alinement passes through the Tonto National Forest. About 20 acres (8.1 ha) would be required for the aqueduct and pumping plant right-of-way.	
i.	Heritage Conservation and Recreation Service	Maintains the National Register of Historic Places.	Determines which sites are eligible for inclusion on the National Register of Historic Places.	Identified archeological and historic sites have been analyzed for inclusion on the National Register of Historic Places.
j.	Advisory Council on Historic Preservation	Advises the President and Congress on matters involving historic preservation.	The Council reviews proposed projects and comments on the predicted effects upon archeological and historical sites.	A Memorandum of Agreement will be negotiated with the Council if it is formally determined that the project will result in "adverse effects" upon archeological and historical resources.
k.	Environmental Protection Agency (EPA)	Develops guidelines on air and water quality for the State and local areas.	Coordination would be required to insure that construction and maintenance activities would not contribute to air or water pollution.	

	Function in Construction Area	Impact Due to Construction	Remarks
l. Geological Survey (USGS)	Earth movement monitoring.	USGS is conducting studies on subsidence and earth fissuring in the aqueduct area. Construction of the aqueduct is expected to have no effect on these phenomena.	Special aqueduct designs would be developed for specific areas of subsidence and earth fissures.
m. Department of Transportation	Assists the State Department of Transportation in the construction of Federal designated highways.	Bridge crossings would be required on U.S. Highways Nos. 60-80-89 and 80-89.	
n. Interstate Commerce Commission	Regulates railroad traffic and rates.	Crossings would be made of the Southern Pacific and Magma Arizona Railroads as shown on Figures 4 through 9.	
o. Department of Energy (DOE) Western Area Power Administration (WAPA)	Provides design data input for construction of Federal power transmission facilities, operates and maintains Federal power transmission facilities.	Will operate and maintain the Salt-Gila Aqueduct and Pumping Plant transmission facilities.	None
2. State of Arizona			
a. Land Department	Administers, leases, and sells the lands of the State of Arizona.	Approximately 3,672 acres 1,487 ha) of land owned by the State of Arizona will be acquired for right-of-way purposes. Of this acreage, 220 acres (89 ha) are in irrigated agriculture.	The State would select other Federal lands in lieu of those exchanged or relinquished.
b. Department of Agriculture & Horticulture	Administers the protected plant species in the aqueduct area.	The requirements of 6,015 acres (2,435 ha) of desert lands containing several species of protected plants will require coordination under the provisions of the Native Plant Act.	Coordination on the disposal of these plants will be necessary with this agency so as many as possible can be transplanted to other areas for landscaping purposes.
c. Water Commission (AWC)	Plans for the development, conservation, and utilization of all waterways, watersheds, subterranean waters, groundwater basins, and water resources.	Makes recommendations for allocation of non-Indian water delivered to irrigation districts and municipalities via the aqueduct.	
	Provides technical assistance to SCS for flood control planning.	Curtailment of planning on Lower Queen Creek Watershed Project.	
d. Department of Public Safety	Maintains the safety of the traveling public on State highways.	Aqueduct crossings would be made of State Highways 60-80-89 and 80-89 as shown on Figures 4 through 9.	Coordination with the Department of Public Safety would be necessary to assure the safe travel of the public through construction areas via detours.
e. Arizona Game and Fish Department (AGFD)	Manages fish and wildlife resources in the aqueduct area.	The Department would be involved in developing fish and wildlife mitigation concepts with the Fish and Wildlife Service and Reclamation.	Coordination with AGFD would be necessary to develop wildlife enhancement measures and determine fishery resource potential within the aqueduct area.
f. Department of Corrections	Operates the State Prison 1 mile (1.6 km) east of Florence and 0.5 mile (0.8 km) north of the aqueduct.	The aqueduct is not expected to affect the operation of the prison although 15 acres (6 ha) of undeveloped desert land would be required.	Coordination would be maintained during the construction period to keep the administration informed of construction activities near the prison.

	Function in Construction Area	Impact Due to Construction	Remarks
g. Department of Transportation-Highway Division	Constructs and operates the Federal and State Highway System	Detours would be provided at about 24 highways and roads while bridges are being constucted at those sites (Figures 4 though 9).	
h. Department of Emergency and Military Affairs	Maintains a National Guard training facility on the Florence Military Reservation.	Reach 3 of the aqueduct would cross the Florence Military Reservation, requiring about 26 acres 11 ha) of right-of-way.	A bridge would be provided for access to that portion of the reservation severed by the aqueduct.
i. Department of Health Services (ADHS)	Regulates public and semipublic water supplies and waste treatment facilities. Enforces water pollution abatement measures. Responsible for solid waste disposal and burning.	Construction would not affect local water supplies. Imported Colorado River water would be distributed by the aqueduct to various communities and irrigation districts. Written approval would be needed for burning, landfills, and solid waste disposal.	
j. Parks Board	Selects, acquires, preserves, and maintains areas of natural features, scenic beauty, and historical and scientific interest for the education, pleasure, recreation, and health of the people.	The aqueduct would not affect any areas managed by the Arizona State Parks Board.	
k. Bureau of Geology and Mineral Technology (GMT)	Provides a wide range of services in the fields of geology, metallurgy, and mining in response to public inquiries and requirements of State government.	None anticipated	The Bureau of GMT will review the draft statement in relation to geologic hazard and mineral resources.
l. State Historic Preservation Officer (SHPO)	Administers the National Register and Grants program on the State level.	The SHPO reviews and comments on the impacts of construction upon archeological and historical resources.	The SHPO is involved in planning mitigative data collection studies at affected sites.
m. Office of Economic Planning and Development	Coordinates planning in Arizona to stimulate statewide economic activity; is the lead State agency in the 208 program.	Made population projections which served as basis for allocation of municipal and industrial water delivered via the aqueduct.	

3. Counties

a. Maricopa

Flood Control District (FCDMC)	Design and implementation of flood control projects for the entire county. Will operate and maintain the Spook Hill Floodwater Retarding Structure along Reach 1 of the aqueduct.	The Spook Hill Floodwater Retarding Structure would provide cross-drainage protection for about 6 miles (9.7 km) of the aqueduct.	Coordination would be necessary for water releases from flood retarding dams and joint use of right-of-way in Reach 1.

	Function In Construction Area	Impact Due to Construction	Remarks
aricopa County (cont'd)			
Health Service	Enforcement of health standards and regulations.	Aqueduct operation would result in water quality changes and introduction of Colorado River biota into the area.	
Highway Department	Maintains and designs county highways.	About 11 bridges would be provided at road crossings by the aqueduct in Maricopa County. Figures 4 and 5 show the location of these crossings.	Coordination would be required throughout the design phase and construction to maintain the normal flow of traffic. No delays of any significance are anticipated on county highways due to the construction activities.
Parks and Recreation	Designs and operates parks, trails, and other county activities.	The aqueduct would pass through the edge of Oasis Park near Apache Junction. Bush Highway Recreation Area is adjacent to the alinement.	Just compensation for required lands.
Planning Department	Prepare and approve plans for subdivisions and other county activities.	Land acquisition for the Salt-Gila Aqueduct has been and would be coordinated with the Planning Department, particularly in urban and potential urban areas.	
Sheriffs Office	Enforcement of trafficand other laws at the county level. Enforces the safety regulations on county highways.	Minor traffic delays and detours during construction of the vehicular bridges would require coordination with the Sheriffs Office.	
inal County			
Flood Control Districts	Design and implementation of flood control projects for the county. Operates and maintains the floodwater retarding structures along Reaches 2, 3, and 4 of the aqueduct (see Chapt. II.C.4.d.).	Existing flood-water retarding structures would provide cross-drainage protection for much of the aqueduct. A portion of the Florence Floodwater Retarding Structure would be relocated to accommodate the aqueduct alinement. The Sonoqui Dike would provide flood control for Queen Creek.	Coordination would be necessary for water releases from the retarding structures.
Health Services	Enforcement of health standards and regulations.	Aqueduct operation would result in water quality changes and introduction of Colorado River biota into the area.	
Highway Department	Maintains and designs county highways.	About 1C vehicular bridges would be provided for roads and highways in Pinal County. Figures 5 through 9 show their locations.	Coordination would be required throughout the design phase and construction to maintain the normal flow of traffic. No delays of any significance are anticipated on county highways due to the construction activities.

	Function In Construction Area	Impact Due to Construction	Remarks
Pinal County (cont'd)			
Parks and Recreation	Designs and operates parks, trails, and other county activities.	Minimal impacts are expected on such activities as horseback riding, off-road vehicle use, and small game and bird hunting.	
Planning Department	Prepare and approve plans for subdivisions and other county activities.	Land acquisition for the Salt-Gila Aqueduct has been and would be coordinated with the Planning Department, particularly in urban and potential urban areas.	
Sheriffs Office	Enforcement of trafficand other laws at the county level. Enforces the safety regulations on county highways.	Minor traffic delays and detours during construction of the vehicular bridges would require coordination with the Sheriffs Office.	

I. Summary of Significant Environmental Impacts

The significant environmental impacts are summarized in Table 37.

J. Summary of Environmental Mitigation and Commitments

Throughout this environmental statement, commitments have been made concerning mitigation of adverse impacts and enhancement of the environment, during both construction and operation of the aqueduct. The significant commitments are summarized by environmental concern in the following list. The chapter numbers are included, in parentheses, below as a reference to the actual discussion in this report. The biological studies enumerated below would be evaluated by Reclamation in cooperation with the AGFD and FWS, and the recommended mitigation and enhancement measures would be considered and implemented if justifiable. The scope and nature of the mitigative studies at identified archeological sites would be determined in consultation with the Arizona State Historic Preservation Officer, the Keeper of the National Register of Historic Places, and Advisory Council on Historic Preservation.

Wildlife

Overchutes designated as wildlife crossings would have a soil surface covering which would be restored periodically when disturbed by flows. (II. C. 4. a.)

The top portion of the side slopes of the canal lining extending 5 feet below the top of the lining would receive a nonskid, longitudinal brush finish. (II. H.)

A team of representatives from FWS, AGFD, BLM, and USBR will analyze and make recommendations concerning mitigation and enhancement measures. (III. C.)

Results of Wellton-Mohawk investigations would be used to evaluate appropriate escape devices for the SGA. (III. C. 2. a.)

Reclamation will research and monitor long-term impacts and ecological changes resulting from construction and operation of the SGA and the importation of Colorado River biota. (III. C.)

Present proposals call for an unquantified number of oases. (III. C. 1. b.)

Deer proof fencing and/or escape devices would be provided where it is jointly determined (with FWS) that they would be beneficial (III. C. 2. a.)

Loss of habitat would be partially offset by the establishment of oases and water catchments. (III. C. 2. a.)

Table 37

Summary of Significant Environmental Impacts
Salt-Gila Aqueduct - Central Arizona Project

Area of Impact	Identified Impact	Mitigation/ Compensation	Residual Impact
Agriculture	Loss of 400 acres (162 ha) prime farmland	Relocation and compensation	Loss of production
Esthetic	Construction of the physical structure	Revegetation	Visual intrusion of a man-made structure
Vegetation	Disturbance of 5,882 acres (2,381 ha) of mostly desert-scrub vegetation	Revegetation of 1,852 acres (750 ha) of vegetation	Permanent loss of 797 acres (323 ha) desert-scrub vegetation
Wildlife	Loss of wildlife in 6,385 acres (2,585 ha). Drowning potential, disruption of terrestrial wildlife movement	Wildlife crossings, escape devices, fencing, revegetation, permanent watering facilities	Permanent loss of 1,300 acres (526 ha) of wildlife habitat and its inhabitants
Recreation	Severance of a corner of Oasis Park	Land purchase and fencing	Safety hazard to drowning
Lands	Acquisition of 6,518 acres (2,639 ha) of mostly desertland for the principal purpose of construction and operation of the aqueduct	Allowance of limited use for potential fishing, and other recreational uses	Exclusion of 6,518 acres (2,639 ha) from another specific type of land use
Archeology	Disturbance of 58 sites eligible for the National Register of Historic Places	Research and study of sites	Permanent loss of the actual sites and possibility of later study
Social	Division of urban areas	Bridges	Restriction of free access
Social	Acquisition of 206 properties and relocation of 38 individuals, businesses, or families.	Compensation under P.L. 91-646.	Loss of rights to the specific property
Unquantified	Mingling of Colorado River water with water in central Arizona area	Undefined	Unquantified
Unquantified	Potential for reintroduction of Colorado River biota into central Arizona area	Undefined	Unquantified

The establishment of catchments would provide a source of dependable water away from the aqueduct, and oases would provide water and limited food and and cover along the aqueduct alinement. (III. C. 2. a.).

Reclamation would ascertain the existence of a fishery and establish a fish salvage plan during aqueduct dryup for maintenance. (III. C. 2. c.).

Contractor crews would be discouraged from collecting or disturbing desert tortoise or Gila monsters during construction. These personnel would be advised of AGFD regulations pertaining to the protection of these two species. (III. C. 2. f.)

Vegetation

Removal of protected native plants would be coordinated with Arizona Commission of Agriculture and Horticulture. (III. C. 1. c.)

Reach 4 dikes would maintain periodic floodflows through ephemeral drainages, precluding adverse impacts to the mesquite forest downstream. (III. C. 1. b.)

All trees, native shrubbery, and vegetation not required for construction would be preserved and protected from damage. (III. C. 1. b.)

Alternatives are being considered to aid in increasing vegetation establishment rates including rock mulching, introduction of ephemeral species for temporary ground cover, and additions or deletions to the currently recommended seed mix. (III. C. 1. a.)

Data collected on revegetation program will be published. (III. C. 1. b.)

Revegetation recommendations for disturbed areas such as dike faces, siphon areas, spoil areas, construction haul roads, and staging areas include replacement of topsoil, horizontal furrowing of dikes, scarification of disturbed areas, and broadcast seeding of xeric adapted species. (III. C. 1. b.)

Revegetation would take place on 1,852 acres (750 ha) of destroyed vegetation (longterm impact areas). (III. C. 1. b.)

Construction activities would be excluded within a 2-mile radius of Picacho Reservoir and the westerly right-of-way boundary of the Florence-Casa Grande Canal in Reach 4. (III. C. 1. b.)

A field inspection would be made if any of the proposed threatened or endangered plants which may occur in the area are listed prior to or during construction. (III. C. 1. c.)

Selected disturbed areas not required for O&M of the aqueduct would be seeded. (III. C. 1. b.)

Revegetation of the areas not required for permanent facilities would be accomplished through seeding and landscaping programs. (V.)

Air Quality

Dust would be controlled by maintaining proper soil moisture. (II. I. 6. c.)

Vehicles that show excessive emissions of exhaust gases would not be operated until corrective repairs or adjustments are made. (II. I. 6. c.)

No burning of combustible materials would take place without concurrence of local pollution and fire authorities. (II. I. 6. c.)

The contractor would be responsible for preventing nuisance to persons, or damages to crops, orchards, cultivated fields, and dwellings resulting from dust originating from his operations. (III. B. 7.)

Erosion

Borrow and spoil areas would be prepared and left in such a manner that wind and water erosion would be minimized. (II. C. 2.)

Earthwork interrupted for any extended period would be left in such a manner as to discourage erosion caused by wind or rain. Excavated slopes would be constructed to intercept cross drainage, prevent erosion, and aid revegetation. (II. I. 6. g.)

Erosion of embankments and retarding structures would be repaired. (II. K. 1.)

Construction disturbed areas would be treated either mechanically or by revegetation to reduce the potential of wind erosion. (III. B. 3.)

Esthetics

The slopes around the pumping plant would be planted with native desert vegetation to beautify and assist erosion control. (II. K. 2.)

Reclamation dikes would be furrowed and seeded with native or xeric adapted species. (III. B. 1.)

Areas disturbed by construction would be reshaped and contoured to restore a form more consistent with the preconstruction conditions. (III. B. 1)

The Salt-Gila Pumping Plant would be low profile with buried discharge lines to lessen the visual disturbance. (III. B. 1.)

Cultural Resources

Any additional identified impact areas will be surveyed for cultural resources and any significant sites discovered will be avoided where feasible or incorporated into mitigative studies. (III. F. 3.)

Mitigative data collection studies will be made at significant archeological and historical sites that cannot be avoided prior to construction in accordance with a plan reviewed by the Arizona SHPO and the ACHP. (III. F. 3.)

A program for disseminating the results of professional mitigative studies to the general public will be developed. (III. F. 3.)

Sound

Noise pollution levels would not exceed 75 decibels during nighttime operations nor 80 decibels in daytime. The exception would be brief periods of blasting at two remote sites. Blasting would occur only during daylight hours and during times of favorable weather conditions. (III. B. 6.)

Agriculture

Where agricultural fields are severed from their water supply, Reclamation would provide replacement wells or structures to convey water across the aqueduct. (II. C. 5. d.)

No excess excavation material is anticipated in Reach 3 from the Magma Arizona Railroad to 1 mile south of Arizona Farms Road and any disturbance would be confined to the normal 250-foot right-of-way. (II. I. 3.)

No interruption of San Carlos Project water deliveries would occur. (II. I. 5. c.)

Livestock crossings and additional stockponds would be provided when necessary and justifiable based on negotiations with the landowners. (III. D. 2.)

Interruption of Services and Facilities

Provisions would be made so that existing flow channels from SCS floodwater retarding structures would convey water across the aqueduct. (II. C. 5. d.)

A 20-foot-wide roadway bridge would be constructed to provide access to the severed portion of the Florence Military Reservation. (III. D. 6.)

Fencing

Class A fencing would be erected along the right-of-way through Maricopa County's Oasis Park. (III. G.)

Cleanup

The contractor would remove all unused construction materials and other rubbish from the work area after construction. (II. I. 6. f.)

Overall

The final locations of aggregate sources would depend on environmental studies of the suitability of those sites. (II. I. 3.)

The suitability of aggregate sources and haul roads would be determined by an environmental evaluation coordinated with interested agencies. (III. C. 1. b.)

K. Cumulative Effect of This and Other Federal Projects

1. Water

a. Floodwater Retarding Structures

As discussed in II.C.4., the Salt-Gila Aqueduct would be constructed in conjunction with several existing and proposed floodwater retarding structures. These structures would ultimately control runoff from nearly 400 square miles (1036 square km) of drainage area upstream from the aqueduct providing cross drainage protection to the aqueduct and downstream areas.

The primary water-related impact of the floodwater retarding structures is a relocation in the infiltration of runoff into the ground. Historically, runoff from the area upstream from the aqueduct alinement seldom reached perennial streams and was depleted largely by evaporation, transpiration, and infiltration. No reliable estimates can be made of the portion of the total runoff which became ground-water recharge, but the percentage was probably small (Arizona Water Commission 1975:2).

When precipitation of sufficient magnitude causes runoff in the normally dry washes flowing from the mountain fronts toward the desert floor, the high infiltration rates of the washes reduce the flow rapidly. The infiltrated water usually evaporates or is used by plants along the washes. Some ultimately recharges the ground water. The existing and proposed floodwater retarding structures would act to concentrate infiltration in the detention basins, thereby enhancing the likelihood of ground-water recharge. In comparison to the large receiving ground-water basins, the relocation or change in amount of recharge associated with the retarding structures is minor and would have no discernable impacts on total ground water in storage, amount of overdraft, or land subsidence.

It is estimated that an average of 55 acre-feet (67,800 cubic meters) of water per year from the watersheds controlled by floodwater retarding structures to be located upstream of the Salt-Gila Aqueduct would be captured and stored behind the structures. The SCS has constructed or is constructing 6 of the 11 retarding structures proposed along the aqueduct alinement. Reclamation is proposing to construct the remaining 5 structures.

The SCS is also proposing to construct the Roosevelt Water Conservation District (RWCD) Floodway to reduce floodwater and sediment damage to irrigated, range, and urban lands downslope of the floodway. The floodway would provide an outlet for floodflow releases from the existing and proposed upstream floodwater retarding structures. The floodway would be located immediately upstream of the RWCD Canal and extend southward through the Gila River Indian Reservation to the Gila River. This proposal would result in increased inflows and sediment in the Gila River (SCS 1977).

b. Aqueduct Seepage Losses

Seepage losses of water from the Salt-Gila Aqueduct would be controlled by a concrete lining, but an estimated 20,200 acre-feet (25 million cubic meters) per year would still seep from the aqueduct. This seepage, though lost to the CAP water delivery system, would ultimately become a new source of ground-water recharge in the Salt River Valley and Lower Santa Cruz ground-water basins. While a portion of the seepage losses would be consumed by plants and evaporation, an estimated 75 percent or more should percolate to the ground water.

Additional components of seepage losses would occur from construction of delivery and distribution systems serving the various water users along the aqueduct. It is not yet fully determined who would receive project water, or in what quantities. Neither have the potential delivery systems been defined. Therefore, the magnitude, extent, and location of the delivery system losses can only be approximated at this time. Assuming deliveries of CAP water out of the Salt-Gila Aqueduct would average 625,000 acre-feet (770 million cubic meters) per year and delivery system losses to be about 10 percent, about 62,500 acre-feet (77 million cubic meters) per year of additional potential ground-water recharge would be available in the area. This, when added to the aqueduct seepage losses, could provide a positive impact on the declining water tables in the area. In addition to the seepage losses an additional 2,400 acre-feet (2.9 million cubic meters) annually are expected to be lost through surface evaporation.

c. <u>Aqueduct Water Deliveries</u>

Ground-water recharge in the service area of the Salt-Gila Aqueduct would be further enhanced by the application of CAP water to its various uses. While the amount of recharge could vary widely, depending on the type of use, the introduction of this new water source would have a beneficial effect on ground-water conditions in central Arizona. Use related recharge may be insignificant in some municipal and industrial applications, but a beneficial effect would result from reducing the need to extract ground water to meet the municipal and industrial demands. CAP water service contracts for agricultural uses require that no new lands can be irrigated, exclusive of Indian lands, and that each acre-foot of project water received be offset by an acre-foot of water which would have been pumped from the ground water.

Public concern has been expressed over the potential degradation of ground-water quality by the introduction of Colorado River water into central Arizona. The net effect of importing from the Colorado River a level of salts comparable to the same quantity that is pumped in solution from the ground-water reservoirs in a similar volume of water is approximately equal. The total dissolved solids (TDS) of Colorado River water expected at the terminus of the Granite Reef Aqueduct is estimated to be 755 milligrams per liter (mg/l) (USBR 1976a). This compares favorably with the average of 955 mg/l for pumped water of production wells within the project area (Arizona Water Commission 1975). Concerning the importation of salts, the substitution of project water for pumped and treated effluent water could result in a net reduction of salts available at the soil surface in the service area.

d. <u>Lower Colorado River</u>

The impact of the CAP on the Lower Colorado River will be limited to the reach between Hoover and Parker Dams. Some additional releases will be made from Lake Mead to accommodate project diversions, but a large portion of the CAP requirement will come from a transfer of diversions now going to California through the Metropolitan Water District just above Parker Dam. The long-term diversion is expected to be about 1.2 million acre-feet (maf) (1.5 billion cubic meters) annually, which assumes full development levels of all prior water rights in Arizona along the mainstream at that time, including court decreed rights of Indian reservations adjacent to the river in Arizona and Mexican treaty entitlements. Water in excess of the above requirements of downstream users will be available only during periods when excess flows or incipient excess flows from Lake Powell or Lake Mead are available as specified in Sections 301(a) and 602(a)(3) of P.L. 90-537. Most of this excess will be diverted to the CAP and will not pass Parker Dam. Annual diversions for the project will range from an estimated minimum of 0.38 maf (4.7 million cubic meters) during periods of extreme drought, to a maximum of 2.2 maf (2.7 billion cubic meters), during periods of surplus water availability. The amount of diversion in any one year will depend upon water-supply conditions and the extent of Upper Colorado River Basin development, neither of which is expected to restrict project diversions during the early years of the CAP.

The projections of Colorado River water available to the CAP are based on long-term records of Colorado River runoff (1906 to the present), projections of development of other water uses within the Upper and Lower Colorado River Basins, and is consistent with the known body of laws governing the distribution of Colorado River waters.

Diversion of Colorado River water to the CAP will not result in significant changes in water level fluctuations at Lakes Mead, Mohave, and Havasu. Average long-term water levels at Lake Mead may be lower than those experienced historically because of the combined effect of future increased diversions in both the Upper and Lower Basins. Currently an effort is made each year to regulate the water levels at Lake Mead to allow for higher water-surface elevations during the spring to enhance the survival of young-of-the-year bass which utilize terrestrial vegetation for protective cover. This effort will continue in the future.

The present streamflow regimen between Hoover Dam and Parker Dam will be altered slightly by increased releases from Hoover Dam for the project. However, daily and monthly patterns of flow in river stages will remain essentially the same, based in part on power release requirements. Lake Mohave has sustained algae blooms during the summer months. The increased volume of water moving through Lake Mohave will serve to dilute nutrients causing the bloom and should promote a slightly fresher state.

The CAP diversions will not affect the magnitude of releases below Parker Dam during normal or dry years. In years of above-normal releases of excess water from Hoover Dam, a portion of the excess could be diverted by the CAP as specified by the authorizing act. Project diversions will be in compliance with applicable laws and regulations.

Present and projected salinity levels in the Colorado River are a serious concern. The present salinity levels in the lower Colorado River are caused by the relatively high salinity of the river as it enters the basin, contributions from salt springs on the river and its tributaries, return flows from irrigation, and water losses from evaporation and transpiration.

The diversion of water by the CAP will have negligible long-term effect on the salinity of the river from Lee Ferry to the Mexican Border. Project diversions are based on the availability of water in Lake Mead. The factors which determine that availability are wholly independent of the CAP as are the resulting salinity levels between Lee Ferry and Hoover Dam. To the extent that water releases from Lake Mead for the CAP will exceed those now being made, the river may experience improved water quality from Hoover Dam to Lake Havasu. This may or may not be offset by full development of present water rights or contracts in that reach of the river.

Water releases from Parker Dam normally will not be affected by the diversion of water for CAP. Therefore, there will be no net effect on salinity in the reach of the river below Parker Dam due to the project. Water releases at Parker Dam will be affected only in those infrequent and short periods when Lake Mead would have excess releases without the additional demand of CAP.

Nevertheless, the salinity of the Colorado River is projected to increase substantially over the next 50 years unless specific actions to control salinity increases are instituted. Increased development of presently unused water rights in the Upper Basin will result in diversions from the river, evaporation from new reservoirs, and return flows from newly irrigated land. All of these factors will contribute to an increase in salinity of the river as it reaches the Lower Basin at Lee Ferry. Decreased releases from the Upper Basin will also increase the concentration effect of the salt input from such high salinity sources as Blue Spring and the Virgin and Muddy Rivers. Increased development along the river in the Lower Basin will, through return flows, contribute to increased salinity levels. This development will be primarily on Indian lands and wildlife refuges.

The objective of Title II of the Colorado River Water Quality Improvement Program (P.L. 93-320) is aimed at maintaining or reducing the TDS of the Colorado River at levels not to exceed the 1972 average at Imperial Dam. Construction of the first 4 features of Title II are already underway or are in the advanced planning stage. The four authorized units include Paradox Valley Unit, Colorado; the Grand Valley Units, Colorado; the Crystal Geyser Unit, Utah; and the Las Vegas Wash Unit, Nevada. Major structural features of the initial control units involve construction of facilities such as wells, dikes, pipelines, pumps, desalters, and evaporation ponds to collect and dispose of saline water. Non-structural unit features consist of management assistance to water users for limiting excess water applications to irrigated lands.

2. Land

Construction of the authorized Central Arizona Project would require the acquisition of rights-of-way across approximately 62,500 acres (25,300 ha) of private, State, and Federal land. Of this acreage approximately 6,518 acres (2,639 ha) would be required for the Salt-Gila Aqueduct and appurtenant structures as discussed in Chapter II.F.1.

The large majority of land crossed by the proposed Salt-Gila Aqueduct is undeveloped creosotebush desert with the exception of the Mesa-Apache Junction and Queen Creek areas which are in transition to urban development. Although the Salt-Gila Aqueduct would eliminate a small portion of the lands from being developed for active urbanization, the combined effect of this and related flood control projects would enhance the overall development of the general area by reducing flood potential.

3. Recreation

The SCS Spook Hill floodwater retarding structure and the Salt-Gila Aqueduct in the Spook Hill area would be positive influences on the development of much-needed recreation facilities in southeastern Maricopa County. The retarding structure provides protection for the golf course and day-use areas below the aqueduct. Above the structure, the detention basin provides an ideal location for flood-proof facilities such as the recreation complex proposal discussed in Chapter III.G. The Salt-Gila Aqueduct and associated dikes could have a cumulative beneficial impact if other recreational facilities are developed in conjunction with existing or planned recreational areas along the alinement.

4. Archeological and Historical

The Arizona State Historic Preservation Office estimates that hundreds of archeological and historical sites are recorded annually within Arizona in conjunction with Federal or Federally-regulated projects. Subsequently mitigative data collection studies are made at most of these sites. This represents a substantial increase over the pace of archeological and historical research within the State as of a decade ago. Although this increased research can be considered a major beneficial impact because it has enhanced knowledge about the prehistory and history of the area, this evaluation must be tempered with the realization that it also constitutes increasing depletion of a nonrenewable resource base.

Additional features of the CAP located in the vicinity of the Salt-Gila Aqueduct include the continuation of the aqueduct system to Tucson, Buttes Reservoir, and possibly a regulatory storage reservoir as an alternative to the authorized Orme Dam and Reservoir. No adequate archeological and historical survey has yet been made along the Tucson Aqueduct. It would be approximately the same length as the Salt-Gila Aqueduct, but would probably require a narrower right-of-way. It is estimated that 50 or fewer sites would be affected by construction of the Tucson Aqueduct. An archeological and historical survey made in the Buttes Reservoir area recorded 272 sites (Debowski et al. 1976). A survey of the Orme Reservoir area recorded 178 sites (Canouts 1975). If some regulatory storage reservoir were built in the vicinity of the authorized Orme Dam site an undetermined percentage of these sites would be affected.

The SCS has been authorized to construct the Buckhorn-Mesa Watershed Project and the Roosevelt Water Conservation District

Floodway. Approximately 40 archeological sites will be affected by these projects (Cartledge and Weaver 1974, Rice 1977). Seventeen archeological sites were affected by construction of 42 miles (62 km) of the Coronado Project 500 kV transmission line from the Kyrene Substation to the Tonto National Forest boundary (Antieau 1977).

During the 1960's, prior to the enactment of legislation providing for increased protection of cultural resources, the SCS constructed Powerline, Vineyard Road, Rittenhouse, Magma, and Florence Floodwater Retarding Structures. No archeological and historical surveys were made prior to construction of these structures but it is possible that scores of sites were affected by this construction.

Although rigorous survey data are not available, it can be estimated that recent and projected Federal projects in the vicinity of the Salt-Gila Aqueduct may affect some 300 to 500 archeological and historical sites. No data exist to compare this magnitude of impact with the impacts stemming from non-Federal development and vandalism.

5. Biota

Construction of the Salt-Gila Aqueduct and related structures would require the removal of approximately 797 acres (323 ha) of Lower Sonoran vegetation. An additional 5,721 acres (2,316 ha) would be included in the right-of-way for the aqueduct and may be disturbed to some extent by construction and operations. The entire authorized Central Arizona Project including the Salt-Gila Aqueduct would result in approximately 62,500 acres (25,300 ha) of wildlife habitat being disturbed to some extent during the life of the project. The loss or disturbance of this habitat would result in the loss of a portion of the wildlife which are dependent on the habitat.

Table 38 shows the terrestrial wildlife habitat that would be eliminated or substantially modified by construction of the Central Arizona Project. The designs have not been completed for all features therefore the acreages have been estimated based on present information. These data were developed in cooperation with the Fish and Wildlife Service for the Interior Department Water Projects Review in 1977 and are gross acreages which do not reflect current land use. The Salt-Gila Aqueduct required about 4.9% of the lands to be permanently eliminated, 1.4% of the long-term disturbed lands, and 0.1% of the temporary distrubed lands required by the authorized project.

Table 38

Terrestrial Wildlife Habitat Eliminated or Substantially Modified by the Authorized Central Arizona Project

Feature	Permanently Eliminated (Acres)	Long-term Disturbed (Acres)	Temporarily Disturbed (Acres)	Wildlife Type 1/
Colorado River Aqueduct System (including Navajo Project)				
Habitat Type:				
Desert Upland	9,300	4,090	10,935	1,2,3,4,5,6,9 10
Riparian	0	10	15	1,2,3,4,5,6,7, 8,9,10
Riverine	0	0	0	
Orme Dam and Reservoir 2/				
Habitat Type:				
Desert Upland	4,180		12,200	1,3,4,5,6,9,10
Riparian	4,700	Indeterminate	1,950	2,4,6,9,10
Riverine	820		250	2,6,7
Buttes Dam and Reservoir				
Habitat Type:				
Desert Upland	2,540		1,960	1,2,3,4,5,6,9, 10
Riparian	1,700	Indeterminate	300	1,2,3,4,5,6,9 10
Riverine	300		50	1,2,6,7
Charleston Dam & Reservoir 2/				
Habitat Type:				
Desert Upland	3,420		1,430	1,3,4,5,6,9,10
Riparian	670	Indeterminate	270	1,2,3,5,6,9,10
Riverine	10		0	2,6
Hooker Dam & Reservoir 2/				
Habitat Type:				
Desert Upland	840		150	1,2,3,4,5,6,9, 10
Riparian	270	Indeterminate	80	1,2,4,5,6,9,10
Riverine	50		10	2,6,8
Total CAP				
Habitat Type:				
Desert Upland	20,280	4,090	26,675	See individual feature
Riparian	7,340	10	2,615	
Riverine	1,180	0	310	

1/ Wildlife Key:

1. Big game
2. Furbearers
3. Upland game animals
4. Rodents
5. Upland game birds
6. Raptors
7. Shorebirds
8. Waterfowl
9. Songbirds
10. Reptiles and amphibians

2/ These features were recommended for elimination from the project by President Carter on April 18, 1977 and resolution of this recommendation has not been completed.

IV. SUMMARY OF UNAVOIDABLE ADVERSE IMPACTS

IV. SUMMARY OF UNAVOIDABLE ADVERSE IMPACTS

Chapter III discussed the anticipated environmental impacts of the Salt-Gila Aqueduct and proposed enhancement and mitigation measures. This chapter describes the adverse impacts which can not be wholly mitigated. Several of the adverse impacts would be temporary and related to construction activities. Impacts which relate to the presence and operation of the aqueduct would be permanent.

A. Environmental Quality

1. Esthetics

Intrusion of man-made structures through about 58 miles (93 km) of agricultural, urban, and desertlands would have adverse esthetic impacts. The right-of-way includes 400 acres (162 ha) of irrigated farmland, 103 acres (42 ha) of urban lands, and 6,015 acres (2,435 ha) of desert rangelands. Construction-related disturbance to vegetation would be visible for several years. Even after revegetation, the aqueduct, transmission lines, and topographic changes from borrow pits and flood protective structures would remain visible on the landscape. The magnitude of the adverse impacts cannot be quantified as they would differ in various locations and to individual observers.

2. Water Quality

The aqueduct is expected to deliver an average of 625,000 acre-feet (770 million cubic meters) of Colorado River water annually to use areas in south-central Arizona. The salinity of the imported Colorado River water is lower than that of the Gila River, but generally higher than the Salt and Verde Rivers in central Arizona. The salinity of the Colorado River would be less than the average of current pumped ground water in the service area.

The hardness of CAP Colorado River water will typically be about 360 mg/l as calcium carbonate. This hardness is appreciably higher than all local surface-water supplies but is less than most local ground-water supplies.

In addition, a total of about 20,200 acre-feet (25 million cubic meters) of seepage would be lost annually from the aqueduct.

3. Sound

Sound levels would increase up to 80 decibels during construction which could be temporarily disturbing to some residents and wildlife living near the construction area.

4. Air Quality

Fugitive dust and other pollutants would increase due to construction. After construction, unpaved O&M roads are expected to produce a minor increase in fugitive dust.

B. Biota

About 797 acres (323 ha) composed of 610 acres (247 ha) creosotebush community, 167 acres (68 ha) paloverde-saguaro community, and 20 acres (8 ha) wash community of existing vegetation would be lost due to the construction of permanent facilities. Existing plant associations amounting to 1,852 acres (750 ha) composed of 1,226 acres (496 ha) of creosotebush community, 565 acres (229 ha) paloverde-saguaro community, 5 acres (2 ha) mesquite community and 56 acres (23 ha) wash community would be severely disturbed due to construction and could require up to 30 years to revegetate to a similar density. The wildlife associated with the lost (797 acres) and severely disturbed (1,852 acres) habitat would be lost or would disperse into the surrounding areas, where due to interspecific and intraspecific competition between the resident and displaced individuals, a loss of a number of individuals would occur.

The aqueduct would present a drowning hazard to terrestrial animals as well as a barrier to movement.

Vegetation communities down slope of the aqueduct and dikes would be affected by the construction of dikes and the severance of natural drainage systems. The blockage of ephemeral desert washes and sheet flows across the desert floor would cause a more xerophytic condition downstream while creating a more mesophytic condition upstream of the aqueduct. This would result in a decrease in plant vigor downstream with a resultant change in carrying capacity for wildlife existing there. The change in soil moisture conditions upstream would probably cause a change in plant species composition with a resultant change in wildlife species and numbers. This situation may be detrimental to wildlife species dependent upon a more xeric environment.

The importation of Colorado River biota and possible introduction of nonendemic species into central Arizona may have an adverse effect on the biota of the Salt-Gila water service area. The effect, if it occurs, would be long term and probably restricted to aquatic flora and fauna.

C. Land Use

Approximately 6,518 acres (2639 ha) would be changed from its existing ownership to aqueduct usage. A total of 206 property owners would be affected by acquisition of their property. Of this number, 151 properties have already been acquired. Of the 151 acquisitions, 36 individuals, families, or businesses were relocated. Of the remaining 55 properties to be acquired, 2 relocations would be required. Several subdividers had to redesign and replat their proposed subdivisions to accommodate the aqueduct alinement.

D. Agriculture

Five farm properties would be divided by construction of the aqueduct resulting in reduced efficiency of operation and productivity. About 180 acres (73 ha) of prime farmland would be lost. Transportation patterns would be affected by construction of the aqueduct because of the closure of some farm-to-market roads in rural areas.

E. Sociocultural Effects

An unquantified affect would be the hindrance of social exchange among local residents due to the severence of neighborhoods. Residents in proximity to the aqueduct would be affected by encroachment of the aqueduct into their immediate neighborhood since urban streets would be severed resulting in limited access to the residents. Removal of private land from a tax revenue status would reduce tax revenues by approximately $43,400 annually. Total tax revenues lost due to acquisition of right-of-way for the Salt-Gila Aqueduct are estimated to be $3,000,000 during the first 50 years of aqueduct operation. Acquisition of farmland would result in the loss of an estimated $325,000 per year in farm products with an additional unquantified loss of associated tax revenues.

F. Archeological and Historical

Mitigation of construction impacts upon archeological and historical sites is limited to current research theory, methods, techniques, and funding. Because of the normal development of archeological research procedures, more data could be gathered from any given site if it were excavated and studied 10 or 20 years from now rather than next year. At the same time, a complete moratorium of archeological field research would almost surely stop the development of research procedures.

Because the mitigation study will employ sampling techniques, all sites will not be intensively studied and all sites selected for excavation will not be completely excavated. The data lost through sampling is considered an acceptable trade-off for benefits of economy and efficiency, but despite good sampling designs and thorough excavation practices, some contextual information and other data are inevitably lost in converting sites into museum collections. There is also a possibility that the surveys have not recorded all sites that would be impacted and unless they are recognized prior to construction their loss would be an adverse impact.

G. Recreation

Recreational use of Maricopa County's Oasis Park is estimated at about 35,350 user-days for fiscal year 1977-78. Moderate noise and fugitive dust would occur intermittently at the park for up to about 2 years during construction activities. The aqueduct would pass through the edge of Oasis Park potentially reducing the size of the 9.5-acre (3.8 ha) park to about 6.1 acres (2.4 ha). Additional long-term adverse impact would be moderate degradation of the park's visual quality and a possible safety hazard not fully mitigated by Class A fencing.

H. Other Agency Programs

The Lower Queen Creek Watershed Project would not likely be authorized for construction by the SCS if Reclamation constructs the proposed Sonoqui Dike. The full benefits of the SCS-proposed project would not be realized if the Reclamation-proposed action is undertaken.

I. Cumulative Federal Programs

Construction of the authorized features of the CAP would require the acquisition of approximately 62,500 acres (25,300 ha) of private, State, and Federal lands. The SCS Buckhorn-Mesa Watershed Project would require a total of approximately 1,412 acres (572 ha) near the aqueduct alinement. The adverse impacts of these and other Federal land acquisitions in the project area include the relocation of persons and businesses and the removal of private land from a tax revenue status. These impacts cannot presently be quantified.

Although unquantified, the loss of native flora and fauna resulting from this and other Federal programs is presently not considered critical with respect to the total resource of the Sonoran Desert in the Southwest. However, the current rate of loss is increasing due to this and other Federal projects.

Federal developments and programs are resulting in a substantial cumulative adverse impact upon archeological and historic resources. Although most of the sites affected are studied before they are disturbed, their loss, nevertheless, represents a commitment of nonrenewable resources. As development continues more sites will be disturbed and destroyed.

J. Possibilities and Risks of Catastrophes and Man-Caused Accidents

Catastrophes are generally related to the loss of life and property due to quirks of nature or the failure of man-made structures. Often natural phenomena such as storms and earthquakes cause man-made structures to fail, increasing the possibility for a catastrophe. The Salt-Gila Aqueduct would not contribute to or increase the possibility of a catastrophe. The design, intent, and location of protective dikes (Chapter II.C.4.d.) would be to provide protection for the aqueduct from heavy runoff, and there would be no greater risk from flood to downstream areas than existed prior to construction of the aqueduct.

The presence of the aqueduct would not increase the downstream flow rate should one of the retarding structures fail because the aqueduct is designed with the water surface located below natural ground in the area of the structures.

The operating water surface in the aqueduct would be generally below the natural ground surface, minimizing the potential for water losses resulting from breaks in the aqueduct. Earthquake potential in the aqueduct area is remote (Chapter III. B. 2.e.). Should one occur, however, and cause a break in the aqueduct, water could be lost from the fill sections which span natural washes. The conveyance capacity of these natural washes is normally sufficient to fully contain the lost water and no downstream flood damage to man-made structures would be expected. The amount of water lost during such a break would be minimized by isolating the break through emergency operation of the check structures.

The phenomena of subsidence and earth fissures are on-going processes in the central Arizona area (Chapter III. B. 2. d.). Fissuring in the worst condition, would result in damage to a small section of the canal prism. An unexpected break could result in a maximum loss of about 600 acre-feet (740,000 cubic meters) of water. This water in all probability would be lost to the fissure and the operation of the check gates would prevent further loss of water, resulting in no anticipated damage to downstream property.

V. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

V. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The Salt-Gila Aqueduct would be capable of providing portions of Maricopa and Pinal Counties of Arizona with over 30 million acre-feet (37 billion cubic meters) of Colorado River water over the first 50 years of project water deliveries.

The water currently used in these counties is being pumped from ground-water basins underlying the area and, to a lesser extent, from surface supplies from the Salt and Gila Rivers. An overdraft situation exists in the area with withdrawals of ground water exceeding recharge by approximately 750,000 acre-feet (925 million cubic meters) annually (Chapter III.B.2.). The construction of the Salt-Gila Aqueduct should have the long-term effect of lessening this overdraft situation and slowing the rate of land subsidence and earth fissuring caused by the mining of ground water (Chapter III.B.2.).

Short-term disturbances to the environment would occur during the construction phase of the project as discussed in Chapter III. These short-term disturbances would be mitigated during construction to the fullest extent possible. Approximately 797 acres (323 ha) of land on the 6,518-acre (2,639 ha) right-of-way would be occupied by physical facilities such as the pumping plant and aqueduct and would be unavailable for other uses during the life of the project. Revegetation of the areas not required for permanent facilities would be accomplished through seeding and landscaping programs.

Table 39 summarizes the short- and long-term impacts associated with the Salt-Gila Aqueduct.

Table 39

Relationships and Tradeoffs Between Short-Term Uses and Long-Term Productivity
Salt-Gila Aqueduct - Central Arizona Project

Resource	Short-Term	Long-Term	Tradeoffs
Esthetics	Construction would create visual intrusions having their greatest impacts in the short term	Revegetation and landscaping would lessen visual impact and achieve improved compatibility with natural features, although all constructed facilities would produce some residual esthetic impact	None identified
Topography	Construction would require modification of existing topography	Continued modification of topography	None identified
Subsidence and Earth Fissure	None identified	Reduction in rate of subsidence and earth fissuring due to a decrease in ground-water pumping	None identified
Geology	None identified	None identified	None identified
Soils	Localized soil losses would increase slightly from wind and water erosion	Construction of retarding dikes would reduce local soil erosion	Localized short-term wind and water erosion would be traded for reduction in localized water erosion downstream of retarding dikes
Earthquake Hazard	None identified	None identified	None identified
Mineralization	None identified	6,518 acres would be unavailable for mining should mineralization be discovered	The project allocation process is expected to allocate water supplies to the mining industry
Surface Water	Disruption of local drainage patterns	Additional water for agriculture, urban, and other uses in the service area	Short-term disruption of ephemeral local surface water runoff would be traded for long-term surface water supplies averaging 400,000 acre-feet annually
Ground Water	Use of water for construction operations	Decrease in ground-water pumping and some increase in ground-water recharge from aqueduct seepage and retention of ephemeral surface water.	Short-term use of ground water for construction would be traded for increased ground-water recharge from aqueduct seepage and decreased ground-water pumping.

TABLE 39

Resource	Short-Term	Long-Term	Tradeoff
Water Quality	None identified	Importation of moderately saline water from the Colorado River	Replacement of declining ground-water supplies having increasing salinity with Colorado River water of moderate salinity
Climate	None identified	None identified	None identified
Air Quality	A temporary slight increase in pollutants (exhaust emissions and fugitive dust) would result from construction of the aqueduct	None identified	None identified
Vegetation	2,649 acres would be lost or modified	1,852 acres would be seeded in a net loss of 797 acres	Loss of vegetation downstream from the aqueduct would be traded for an increase in density upstream
Wildlife	Construction would disturb 6,385 acres of wildlife habitat for a short period of time	Populations would stabilize although possibly of a different composition due to the loss of 1,300 acres of habitat and associated wildlife	Aqueduct would provide a possible fishery resource
Agriculture	Loss of 180 acres of privately owned prime farmland and 220 acres of State leased irrigated lands	Water supplies may allow agricultural lands with declining water tables to stay in production	Imported water may sustain economic farm operations which may otherwise revert to desert
Grazing	Loss of 6,015 acres of grazing lands	Loss of 6,015 acres of grazing lands	None identified
Urban	About 103 acres of urban land would be acquired for aqueduct construction	The construction of the aqueduct and related flood control project would enhance the overall development of the general area by reducing flood potential	
Socioeconomic	Jobs for construction trades	Water resource to maintain a stable economy	Commitment of human and natural resources to the aqueduct system
Archeological-Historical	Mitigative data collection from 58 sites prior to their destruction or disturbance	Collected artifacts and information preserved but sites lost to further study	Immediate information about resource traded for future research potential
Recreation	Construction activities would cause noise and dust affecting Oasis Park activites	Moderate visual degradation and loss of 3.4 acres at Oasis Park due to proximity of aqueduct. However, aqueduct construction would stimulate recreation development at the Spook Hill Recreation Area	Moderate effects on existing recreational facilities and activities vs. increased recreational development in Spook Hill area

VI. IRREVERSIBLE & IRRETRIEVABLE COMMITMENTS OF RESOURCES

VI. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The construction and operation of the Salt-Gila Aqueduct would irreversibly and irretrievably commit renewable and nonrenewable physical, biological, and cultural resources. Human, economic, water, land, energy, biotic association, historical, and archeological resources would be removed from further or alternative commitment.

A. Water

The decision to divert Colorado River water via the Salt-Gila Aqueduct to the farms and communities of Maricopa and Pinal Counties is a commitment of water resources. This resource, although committed for a long-term period, would not be irreversible or irretrievable if the national interests determined a higher commitment for an alternative purpose. The long-term average annual diversions of about 1.2 million acre-feet (1.48 billion cubic meters) of Colorado River water by the CAP would be considered by many to be an irreversible commitment. The evaporation loss of about 2,400 acre-feet (2.9 million cubic meters) annually from the Salt-Gila Aqueduct would result in an irretrievable reduction in the water supply.

B. Land and Associated Resources

There would be a commitment totaling 6,518 acres (2,639 ha) of Federal, State, and private lands for the construction of the aqueduct which would preclude any future land development of this acreage.

1. Land

The right-of-way would include about 400 acres (162 ha) presently devoted to irrigated crops but this is a small commitment when compared to the 774,400 acres (313,500 ha) of cropped irrigated land located in Maricopa and Pinal Counties (Arizona Statistical Review 1977). Approximately 6,015 acres (2,135 ha) of desertscrub grazing lands would also be committed. This loss would not be significant when compared to the 18,963,000 (7.7 million ha) acres of similar desertscrub grazing land in Arizona (Pacific Southwest Interagency Committee 1971). Some of this grazing land would be lost to urbanization in the absence of the proposal. Approximately 103 acres (42 ha) that have been used for urban purposes would be committed to the construction and operation of the aqueduct. Construction of the aqueduct would sever five farming operations and recreational desertlands and would result in a disruption of travel over undedicated roads and trails between the separated areas.

2. Mineral

Approximately 350,000 cubic yards (268,000 cubic meters) of sand and gravel suitable for concrete aggregate would be committed to construction. These resources would come from borrow areas near the aqueduct alinement or from commercial sources. Presently there are no known mineral resources that would be committed by the proposal except for those mined elsewhere to furnish the raw materials needed for construction supplies and equipment.

3. Biota

About 777 acres (315 ha) of desertscrub and 20 acres (8 ha) of desert wash riparian vegetation would be permanently removed by the proposal. The loss of 797 acres (322 ha) of native vegetation, although significant, is very minor when compared to the 18,963,000 acres (7.7 million ha) of Sonoran desertscrub in Arizona. The aqueduct would require no commitment of riverine riparian habitat which for some species is the highest quality habitat in the Sonoran Desert.

A portion of the wildlife population displaced due to the loss of habitat and construction activities would be irretrievably lost due to their inability to compete for suitable replacement habitat. No federally-listed threatened or endangered wildlife species would be affected by the aqueduct. Colorado River biota may be introduced into Central Arizona which would constitute an irreversible committment.

4. Archeological and Historical

Although mitigation studies would be made at the sites located along the proposed aqueduct alinement, not all information contained in these sites can be collected. This lost information can not be retrieved once the sites are destroyed.

5. Recreation

The Salt-Gila Aqueduct right-of-way would pass through Maricopa County's Oasis Park, severing a portion of the park to the west of the aqueduct.

6. Esthetics

There would be irreversible esthetic impacts in some areas due to excavation scars, embankment slopes, and the imposition of man-made structures onto the natural desert landscape. Many of the scars would be reduced over a period of time due to revegetation and landscaping but topographic changes would be lasting.

7. Economics

In constructing the aqueduct, fuel and lubricants used by motorized equipment and vehicles would be lost to any alternative uses.

The following estimated quantity of construction materials would be irretrievable commitments to the project:

Cement	93,239 tons	(84,585 metric tons)
Concrete Aggregates	350,000 cubic yards	(268,000 cubic meters)
Reinforcing steel	6,258 tons	(5,677 metric tons)

Commitment of other minor construction materials, equipment wear, and depreciation have not been quantified.

During the operation and maintenance phase of the proposal additional unquantified amounts of construction materials, fuels, lubricants, pesticides and herbicides would be required. Energy generated at the Navajo Generating Station for use in operating the Salt-Gila Pumping Plant would require an annual commitment of about 39,000 tons (36,000 metric tons) of coal and 4,500 barrels (714 cubic meters) of fuel oil.

Based on 1978 estimates the cost of the Salt-Gila Aqueduct and Transmission System is estimated to be $122,000,000. Public Law 90-537, under which construction of the Central Arizona Project was authorized, has committed public funds to the project. Approximately 70 percent of the Central Arizona Project construction cost will be repaid to the Federal treasury by the water and power users who benefit from the project. Operation and maintenance charges would also be paid by the water users.

VII. ALTERNATIVES TO PROPOSED ACTION

VII. ALTERNATIVES TO PROPOSED ACTION

This chapter discusses the alternatives to the proposal described in Chapter II. The aqueduct would convey water from a water-surface elevation of 1,567 feet (478 m) at the discharge side of the Salt-Gila Pumping Plant to a water-surface elevation of 1,538 feet (471 m) at the beginning of the authorized Tucson Aqueduct. These elevations have been selected to avoid developed urban and agricultural lands, and yet facilitate delivery of water to the use areas. Major departures from the proposed alinement would not maintain the desired elevations without additional pumping plants or extensive earthwork. Minor deviations are possible for environmental and economic reasons, but major alinement changes are not practical. Some deviations of the final alinement may be made to accommodate archeological sites of high significance to preserve the cultural resource and avoid costly mitigation studies. The study of the alinement will continue until the final designs are accomplished to assure the most advantageous location that obtains the most optimum balance between environmental impacts and economic considerations.

Alternative methods of transporting the large volumes of CAP water such as by pipeline were reviewed and found to be unreasonable early in the development of the proposal. Based on a 2,750 cubic feet per second capacity, a 19 foot (5.8 m) diameter underground pipeline system alternative is estimated to cost about $10,500,000 per mile compared to $1,500,000 per mile for an open aqueduct. In addition, an underground pipeline would require about 2.2 times as much energy to move the same amount of water. From an economic and commitment of energy standpoint an open aqueduct offers a more reasonable and significantly more cost effective alternative.

Alternative sources of water were discussed in previous environmental statements and are not considered in this statement. The overall Central Arizona Project Final Environmental Statement (USBR 1972a) contains a complete discussion of alternative water sources.

The alternative for water conservation in the areas to be supplied by the Salt-Gila Aqueduct was considered. However, as shown by the discussion on the following pages even with a strictly enforced water conservation program in force, there would not be enough savings to offset the future requirements of the area.

The following sections discuss the alternatives considered during the development of the proposal. If an alternative transmission system or aqueduct component other than those described in this statement is chosen, an environmental assessment of those changes would be made.

A. No Construction

1. CAP Water Delivery and Operations

If the Salt-Gila Aqueduct were not constructed, water deliveries would not be possible to the CAP service area located generally south and east of the Salt River Project service area. The excluded area would include, among others; the cities of Tucson, Casa Grande, Florence, and Coolidge; the Gila River, Ak Chin, and Papago Indian Reservations; and numerous irrigation districts in Maricopa, Pinal, and Pima Counties. Potential water deliveries or exchanges with southern Arizona mines would be excluded. Users in New Mexico would not be able to increase their consumptive use of Gila River waters as authorized by P.L. 90-537, since waters would not be available for the necessary exchanges in Arizona. Not constructing the Salt-Gila Aqueduct would preclude construction of the Tucson Aqueduct, the remaining authorized segment of the CAP Colorado River water delivery system. Ground-water pumping for agricultural uses in the Salt-Gila service area would continue, and the present rates of subsidence and fissuring would continue or perhaps increase.

Without the aqueduct, existing water users would have to continue to rely on existing local ground-water sources until forced by economics and other factors to reduce their water use. Continued use of existing ground-water sources would result in a continuation of the overdraft problems currently being encountered. These problems include falling water tables, increased pumping costs, degrading water quality, land subsidence, and earth fissuring.

Flood protection facilities that are part of the aqueduct design and provide an incidental downstream benefit would not be constructed. Similar flood control facilities may be constructed under other Federal or local programs provided they are independently justifiable.

CAP operations would be limited to the Granite Reef Aqueduct system and service area, extending to the Phoenix vicinity. Under present and projected patterns of development within central Arizona, the water needs of this area would not fully utilize the system's capacity nor Arizona's remaining entitlement to Colorado River water. Assuming no correlative adjustments in the economy in response to a decision not to be construct the aqueduct, the average annual CAP import of Colorado River water would be reduced from 1.2 million acre-feet (maf) (1.5 billion cubic meters) to about 0.9 maf (1.1 billion cubic meters), a difference of about 0.3 maf (370 million cubic meters) per year. The water would continue to be used in other areas of the basin and Arizona would not be able to use that portion of their entitlement. While more water would be available in the Colorado River Basin for other uses, a net loss to Arizona in terms of its total water supply could result.

Less pumping energy would be needed to import CAP waters. The total amount of water imported would be reduced by about one-quarter, and the water would be transported over significantly reduced distances.

The project's pumping energy needs would be reduced by about 900 gigawatt hours per year on the average. Thus, the uncommited pumping energy could be marketed within the Southwest and, potentially, contribute to the reduction of the need for new power generating facilities.

A more likely scenario to that described above is that the economy would adjust and respond to this alternative by directing more than the currently anticipated water uses into the service area of the Granite Reef Aqueduct so as to fully utilize the available Colorado River supplies. Under this scenario, Arizona would lose little, if any, Colorado River water, and CAP pumping energy needs would be reduced about 400 gigawatt-hours per year, reflecting reduced overall transportation distances.

This alternative would preclude the impacts to the environment resulting from the construction and operation of the aqueduct. These impacts have been discussed in Chapters III. and IV. The lands and rights-of-way discussed in Chapter II.F. would not be necessary and the related impacts discussed in Chapter III.D. would be eliminated.

Employment benefits in terms of monthly payroll of an estimated $225,000 per reach would not be realized nor would the employment generated in the service and material industries due to construction of the aqueduct. Sales and income taxes generated by direct expenditures for construction equipment, parts, and materials would not be realized nor would the overall impact of increased tax revenues and employment opportunities.

2. No Construction in Conjunction with a Program of Water Conservation

This alternative is based on the findings of the Arizona Water Commission (AWC) in its report entitled "Water Conservation. Arizona State Water Plan, Phase III, Part I," which indicates that water conservation may be practiced in Arizona without creating financial hardships or major changes in lifestyle. The Bureau of Reclamation, in compliance with the President's Water Policy Directive of July 12, 1978, is modifying its contracting procedures to require users of municipal and industrial water from Reclamation's projects to adopt community water conservation plans. Additional measures to encourage water conservation are being taken with regard to deliveries of agricultural water supplies. Proposals for eliminating currently authorized structural features of the CAP would likely require Congressional attention.

In general, per capita water use in central Arizona is not extravagant compared with use in other areas with similar climates. For example, the average use rate in Arizona from public water systems plus rural domestic use, but excluding self-supplied industry, is about 220 gallons per capita per day. Comparable use rate figures are 250 gpcd in Albuquerque, New Mexico, and 372 and 338 gpcd for the Colorado River desert and San Joaquin Basin area of California, respectively (AWC 1978 b). Arizona's farmers are among the most efficient in the United States in terms of water use (AWC 1977b). Nevertheless, estimated annual ground-water pumpage in Maricopa and Pinal Counties in 1970 was 3,164,000 acre-feet (3.9 billion cubic meters) resulting in an estimated ground-water overdraft of 1,522,000 acre-feet (1.87 billion cubic meters) annually in the two counties (AWC 1975). Without the importation of additional surface water, dramatic reductions in water use would be necessary to significantly reduce this mining of ground water.

Much of the emphasis relating to water conservation has been placed on the potential savings by urban water users. Urban water conservation could be achieved by a number of measures; including improved irrigation practices outside the home, conversion to desert landscaping themes, conversion to low water using fixtures and appliances, leak detection and repair, public education, wastewater reuse, water pressure reduction, and alternate or increased pricing schemes. However, in 1970 less that 7 percent of the total statewide water depletion resulted from urban uses. Regardless of how effective urban water conservation programs may be, Arizona would not realize large reductions in State water depletions because of the relatively small magnitude of urban use. Moreover, many conservation techniques reduce water withdrawals and cause an equal reduction in wastewater flows which are often the basic supply of some other use.

The potential reduction in water depletion from implementing the AWC recommended urban water conservation measures may be estimated. The AWC estimated a potential reduction of urban water depletion by 51,000 acre-feet (63 million cubic meters) annually by 1980, which equals a 10.3 percent reduction in depletion resulting from urban water conservation measures (AWC 1977a). Since water depletion for urban uses in Maricopa and Pinal Counties in 1970 was estimated at 195,000 acre-feet (240 million cubic meters) annually, the water depletion savings from urban water conservation could have equalled approximately 20,085 acre-feet (25 million cubic meters) annually if the measures had been implemented in 1970.

In 1970, agricultural water depletions represented 89 percent of the statewide total (AWC 1977b). Thus the greatest potential for water conservation is on farms, where irrigation system improvements and improved management practices could result in significant water savings. Water-saving techniques such as land leveling, soil moisture and crop stress monitoring, and delivery and distribution system improvements are costly relative to the present cost of water in most areas. Reclamation Irrigation Management Service (IMS) programs have averaged about $3.50 per cropped acre per year in three irrigation districts along the Colorado River. The Salt River Project estimates that its IMS program costs approximately $3.10 per acre annually (AWC 1977b). However, if implemented it is estimated that such intensive irrigation management programs could result in a 10 to 15 percent reduction in agricultural water depletions (AWC 1977b). Since water depletions for irrigated agriculture in Maricopa and Pinal Counties in 1970 were estimated at 2,511,000 acre-feet (3.1 billion cubic meters) annually, the water depletion savings from agricultural water conservation programs could have been approximately 251,100 to 376,650 acre-feet (310 million to 465 million cubic meters) annually (AWC 1975).

Conservation efforts in mineral industry, steam-electric power, and fish and wildlife uses are not anticipated to result in any significant reduction of State water depletions. This is because use of water by the mining industry accounts for only about 3 percent of the State's depletions and steam-electric power and fish and wildlife uses total a little over 1 percent. Agricultural and urban water conservation efforts could result in an estimated total potential savings in water depletion of 271,085 to 396,735 acre-feet (334 million to 489 million cubic meters) annually in Maricopa and Pinal Counties. This reduction in water depletion could have resulted in a total reduction of the existing ground-water overdraft by an estimated 20 percent (332,400 acre-feet or 410 million cubic meters annually) under the 1970 conditions. Although significant, this reduction would still have left a 1970 overdraft of an estimated 1,189,590 acre-feet (1.47 billion cubic meters) annually in the two counties.

The findings of the AWC indicate that significant water savings in Arizona can be realized only through changes in use habits on the farm and, to a lesser extent, outside the home. Water used but not consumed inside the home is generally collected by sewer systems, treated, and made available for nondomestic reuse. Thus, very little or no absolute savings in water can be realized from reductions in use within homes in a sewered community (AWC 1977b).

The environmental impacts resulting from the water conservation measures discussed by the AWC would be mostly economic and social in nature. Agricultural water conservation can be achieved through expanded IMS programs, delivery and distribution system improvements, and conversion to methods of irrigation which require less water and change in cropping patterns. Most of these programs all require sizeable capital investments. It appears that financial support would be necessary to accomplish the high-cost conservation measures, such as by Government tax incentives or credits, or subsidies to farmers who utilize professional IMS programs. The more efficient use of water on the farms would probably result in the loss or reduction of vegetation around irrigated fields which has grown in response to field drainage from flood irrigation. Lining of water distribution systems which deliver water to the farms would significantly reduce adjacent vegetation.

A reduction in water use outside the home can be achieved through more efficient plant and lawn irrigation practices, elimination of winter rye grass lawns, or conversion to landscaping themes which do not require large amounts of water. Replacing lawns and exotic trees with desert flora could result in local moderate adverse impacts of less shade and warmer temperatures.

A reduction of water use inside the homes is also emphasized by the AWC, not because it will result in an absolute saving of water, but because it will save the energy associated with developing, purifying, and distributing of the supply saved. The conversion to low water using fixtures and appliances such as low flow shower heads and toilets would require moderate capital outlays. Water pressure reduction has been cited as a potential conservation measure. It could result, however, in adverse impacts on water users at higher elevations and on fire protection. Proper pressure and flows would have to be assured at all fire hydrants and in areas of higher elevation and the necessary changes would probably be quite expensive (AWC 1977b).

Another potential adverse impact resulting from urban water conservation is the possibility of water rate increases. Rate increases often come about because successful water conservation programs result in reduced revenues to the supply agency. Because the agency must continue to meet its fixed costs, additional revenue often must be generated by substantial and unpopular rate increases.

The AWC has concluded that water conservation in Arizona can be practiced without creating financial hardship or major changes in lifestyle. The question then becomes one of how the conservation measures would be implemented and what would be the impacts resulting from the method of implementation. The AWC has recommended a public education campaign through the schools and media to instill a "water consciousness" in the public. Without the cooperation of the public, water conservation could only be accomplished through higher water prices or the enactment and enforcement of water-use restrictions. The AWC has rejected the former alternative, concluding that "Municipal customers are not likely to accept a rate structure higher than that necessary to pay system costs as a means to effect water conservation" (AWC 1978b).

Increased government action will probably be necessary to accomplish any water conservation measure. In cases where sizeable initial expenditures are necessary to accomplish water savings, such as in agriculture, government subsidies or tax incentives would probably be required. Water law clarification would be necessary to define and restrict nonbeneficial uses of water. Court action could be taken by the State to deny water appropriations for unnecessary or nonbeneficial uses. Conservation through ground-water recharge with surplus water would have local and downstream environmental and legal impacts, and would likely require changes in existing water law in Arizona. Under existing law, ground-water belongs to the land and the property owner could pump from a recharged basin without helping to pay the costs associated with the recharge. City and local governments could adopt ordinances and building codes which would restrict or preclude flood irrigation, regulate lawn watering, limit turfed areas and artificial lakes, and require low-flow toilets and shower heads.

B. The Alternative of Delayed Construction

Postponement of the construction of the Salt-Gila Aqueduct would result in a delay in delivery of Colorado River water to the central Arizona service areas, including Tucson. Although the Granite Reef

Aqueduct would not be completed for another 5 years, sufficient lead time is required to finalize design and construct the Salt-Gila Aqueduct to place it in timely service. If the Granite Reef Aqueduct goes into limited service prior to the completion of the Salt-Gila Aqueduct, the Central Arizona Project would forego use of 25 to 50 percent of the water available annually because of the inability to make deliveries to the entire CAP service area.

The amount of water use foregone in Arizona for the years during which there was no Salt-Gila Aqueduct in service would, of course, be a function of the water available from the Colorado River and the concurrent demand in the areas serviceable from the Granite Reef Aqueduct. Thus, for every year that deliveries cannot be made to demand areas south and east of the Salt River Project service area, the State of Arizona would forego use of that amount of water which might otherwise have been diverted from the Colorado River under its entitlement. At the same time an equivalent amount of ground-water would be pumped which would further deplete the ground-water resources.

Should Colorado River water supplies be available in normally expected amounts (delivery of 2.8 maf (3.45 billion cubic meters) per year to Arizona's entitlement), Arizona would forego use of about 400,000 acre-feet (493 million cubic meters) per year or more of Colorado River water for each year that the aqueduct is postponed. This reflects increased water deliveries to users along the Granite Reef Aqueduct, assuming those users have sufficient capacity in their distribution system to accept excess waters. It is anticipated that a much greater amount than this would be allocated to water users along the Salt-Gila and Tucson Aqueducts (current USBR estimate is about 800,000 acre-feet (986 million cubic meters) per year).

During extended dry cycles on the Colorado River, Arizona's use of Colorado River water would not be impacted by postponing the Salt-Gila Aqueduct. During these periods, all waters available to the CAP could be used along the Granite Reef Aqueduct.

Considering the present and projected situation in the Colorado River storage system, the most likely water supply conditions to exist in the mid-1980's would be neither dry nor normal, but surplus. Should surplus supplies be available, Arizona would have the opportunity to deliver in excess of its entitlement which could further reduce underground pumping. No advantage could be taken of this opportunity without construction of the Salt-Gila Aqueduct, and Arizona would forego from 700,000 to as much as 1,000,000 acre-feet (863 million to 1.2 billion cubic meters) for each surplus year of postponed construction.

Inflationary trends since January 1968 have burdened the Central Arizona Project with a 10-year construction cost escalation of about 195 percent or compounded average annual rate of about 7 percent. The 1977 rate of escalation was estimated to be 6 percent.

Future cost escalation may continue at nearly the same rate. For example, a 5-year delay could add about $40 million to the Salt-Gila Aqueduct cost if inflation continued at the 1977 level of 6 percent.

A short-term postponement (1 to 2 years) of construction would require a compressed schedule to meet the water delivery date of 1985. The construction schedule time compression would force deadlines and increase expenditures, particularly in pumping plant construction where pumps and motors are designed and manufactured to meet specific requirements.

The construction industry is subject to extreme fluctuations in employment, and the relatively steady employment offered by the Central Arizona Project can be a stimulus to the central Arizona economy. Postponement would defer the economic stimulus.

Postponement would also impact the Central Arizona Project repayment posture. Inasmuch as the irrigators would pay on the basis of water delivered, the repayment of project costs would lag because of the lesser water supply. In addition, increased costs due to postponement would result in an increased repayment obligation. Although this impact is not as severe as might appear, it does place unnecessary burden on the repayment structure of the project. Deficiencies of payment from water sales may be partially offset by increased sales of power.

The primary environmental impacts would remain the same as described in Chapter III, but assuming the same completion date of 1985 the accelerated rate of construction resulting from a short-term postponement would result in a reduction of priorities for environmental concerns. For example, compressing the scheduling of mitigation studies at archeological and historical sites could result in incompletely planned and poorly organized data collection projects.

The impacts on land acquisition and use would be similar to those discussed in connection with the original proposal, although probably more severe because of inflationary acquisition costs and potential urbanization.

C. Alternative Aqueduct Routes

Historically, a canal generally along the alinement of the Salt-Gila Aqueduct was contempleted prior to 1897. A USGS 1903 Report shows this alinement as the proposed Hudson Reservoir and Canal Company's Canal (USBR 1976 a, Figures 39 and 40).

Initial Reclamation concepts for the Salt-Gila Aqueduct (USBR 1947a) considered a 1,275 cubic foot (36 cubic meters) per second capacity aqueduct, originating at Stewart Mountain Dam on the Salt River where water was to be diverted on an exchange basis with SRP. In 1963 (USBR 1963) the plan considered originating the aqueduct at Granite Reef Dam on the Salt River. Water was to be pumped from behind Granite Reef

Dam to about elevation 1510, (460 m) where it was to flow by gravity in the Salt-Gila Aqueduct for about 70 miles (112 km) to its terminus near the existing Picacho Reservoir. In both the 1947 and 1963 plans, the alinement generally followed the 1,500-foot (457 m) contour south along the Bush Highway, then continued southeasterly between Mesa and Apache Junction and on to the Gila River siphon crossing, about 2 miles (3.2 km) north of Florence, Arizona. From the Florence area, the alinement continued south to the Picacho Reservoir area on a route west of and parallel to the San Carlos Project Florence-Casa Grande Canal (USBR 1947b and USBR 1963). The historic route was governed by controlling elevations near Magma and the aqueduct was to pass near the fringes of local cultivated areas. This alinement passed through the town of Florence and required a 2-mile (3.2 ha) long siphon to cross the Gila River. Figure 74 shows the 1947 historic route.

The historic route (Figure 75) requires the removal of approximately 50 percent more Arizona upland type vegetation, and 25 percent less Lower Colorado type vegetation (see Chapter III.C.1.). Due to present land use patterns, the historic route would affect less native vegetation and a greater amount of urban and agricultural acreage. Use of Picacho Reservoir as a terminus would destroy valuable waterfowl habitat.

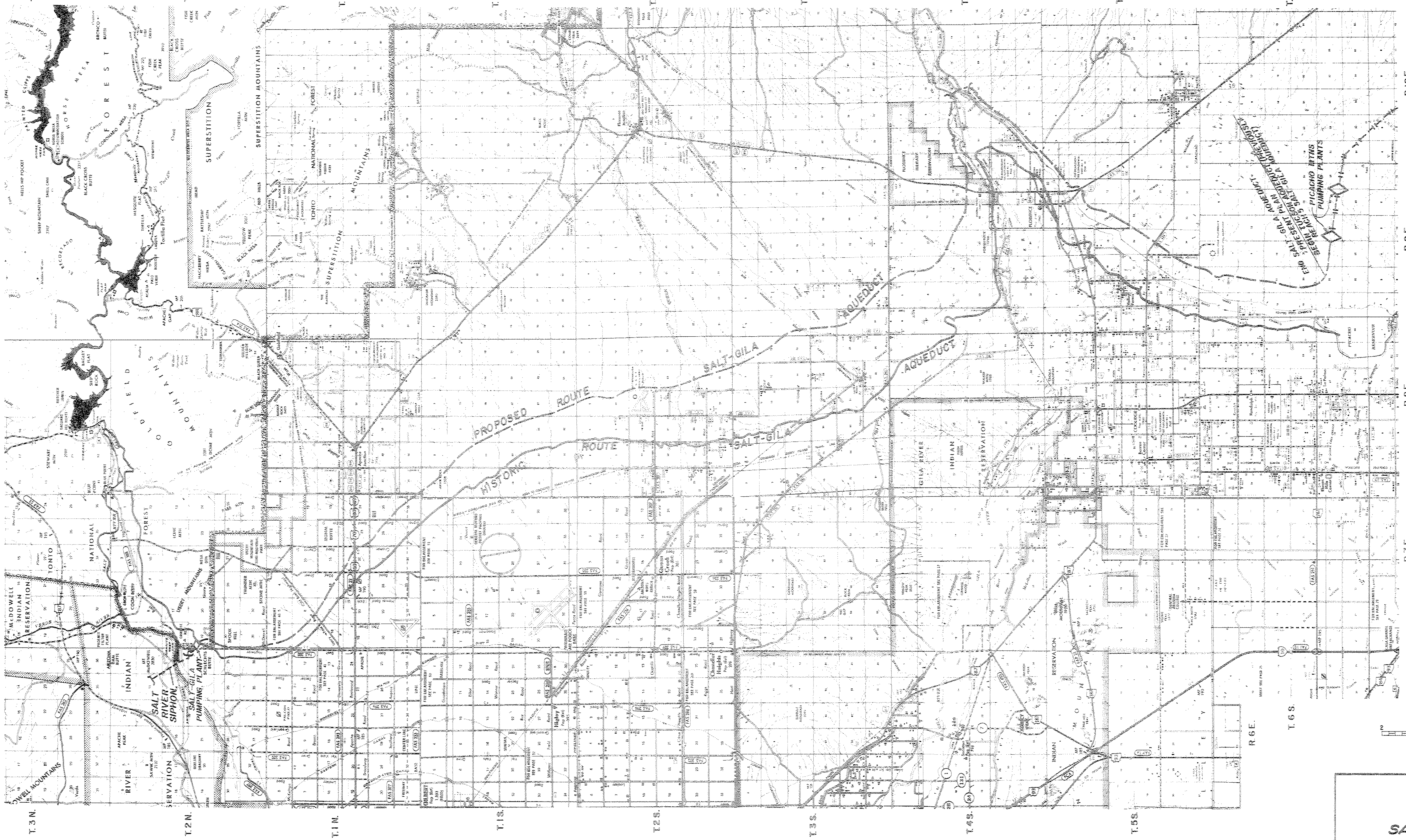
No archeological and historical surveys were made along the historical route shown in Figure 75. There is no reason to suspect that construction along this route would have less impact upon archeological and historical resources than along the currently proposed route. In fact, because the route runs through the town of Florence it would adversely affect a major historical district within the original townsite.

The historic route would result in a more costly and complicated land and rights-of-way acquisition program since it involves approximately 5 times more agricultural lands than the proposal (USBR 1972c) as well as additional urban areas in the city of Florence.

Since 1963 the CAP aqueduct system, including the Salt-Gila Aqueduct, has undergone numerous realinements and redesignations. These changes were due to urban growth patterns (affecting right-of-way costs and water demands), evolving environmental concerns and other factors. The proposed route is a result of this evolutionary location process and represents the latest economic location. A comparison of the impacts of the proposed alinement and the historic route is presented in Table 40.

Table 40
Comparison of the Proposed Alinement
and the Historic Route Alternative
Salt-Gila Aqueduct - Central Arizona Project

	Proposed Alinement	Historic Route Alternative	Remarks
Esthetics	The structure would be about 58 miles in length, 47 of which would be imposed on open desert landscapes, 5 miles through farmland, and 6 miles through developed urban areas.	The structure would be about 59 miles in length, of which about 22 miles would be imposed on open desert landscapes, 26 miles through developed farmlands, 7 miles through urban areas, and 4 miles across the CONOCO mining development near Florence, Arizona.	If built along the historic alinement, the aqueduct would be seen by more viewers since the alinement would pass through 22 additional miles of urban and developed agricultural areas. The visual intrusion of the aqueduct may not be as noticeable in these areas, however, since the landscape already reflects extensive changes due to man's activities.
Geology	--------	No significant difference.	--------
Soils	--------	No significant difference.	--------
Hydrology	About 11 miles of new dikes would be necessary for cross-drainage protection for the aqueduct. The alinement parallels existing SCS structures which provide flood protection for an additional 30 miles of the canal.	At least 7 miles of new dikes would be necessary for cross-drainage protection for the aqueduct. Additional dikes may be needed as the existing SCS structures may not furnish all the necessary protection.	
Climate	--------	No significant difference.	--------
Sound	Noise pollution due to construction would be most noticeable in urban areas along 6 miles of the aqueduct alinement.	Noise pollution due to construction would be most noticeable in urban areas along about 7 miles of the aqueduct alinement	Noise pollution could potentially disturb a greater number of people along the historic alinement, particularly in Florence, Arizona.
Biota			
Vegetation	Sonoran desert plant communities would be lost or disturbed along 47 miles of the aqueduct alinement.	Sonoran desert plant communities would be lost or disturbed along about 22 miles of the alinement. Use of Picacho Reservoir as a terminus would destroy valuable vegetation and wildlife habitat.	The loss of desert vegetation is not considered significant in terms of the total acreage of these plant communities in the Southwest. Construction along the historic alinement is not desirable because of the importance of Picacho Reservoir as waterfowl habitat. No plant species listed as threatened or endangered are known to exist along either alinement.
Wildlife	Natural wildlife habitat would be lost or disturbed along 47 miles of the alinement. Farmland which also provides habitat for wildlife would be lost along 5 miles of the alinement.	Natural wildlife habitat would be lost or disturbed along 22 miles of desert-scrub crossed by the alinement. Farmland habitat would be lost along 26 miles of the alinement.	Some species are more dependent on habitat created by irrigated agriculture and would be more severely disturbed by the historic alinement. However, no commercial fur bearers, fisheries, or listed threatened or endangered species would be impacted by either alinement.
Air Quality	About 11 miles of urban and farmland would be affected by construction dust.	About 33 miles of urban and farmland would be affected by construction dust.	Potential damage to crops and nuisance from dust would be significantly greater if the aqueduct were constructed along the historic alinement. Consideration would have to be given to paving or surfacing the O&M roads along an additional 22 miles of the alinement.



2 0 2 4 6
SCALE OF MILES

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
SALT-GILA DIVISION-ARIZONA

SALT-GILA AQUEDUCT
HISTORIC AND PROPOSED ROUTES

DESIGNED .... SUBMITTED [signature]
DRAWN R.M.G. .... RECOMMENDED ....
CHECKED J.W.G. .... APPROVED ....

PHOENIX, ARIZONA APRIL 17, 1978 344-330-2337

TABLE 40 (continued)

	Proposed Alinement	Historic Route Alternative	Remarks
Land Use Agriculture	About 5 miles of the aqueduct alinement would cross prime farmlands.	Prime farmlands would be required along 26 miles of the alinement.	Construction along the historic alinement would require an additional 1,600 acres of farmland and the loss of about an additional $1.2 million in lost farm products plus associated tax revenues.
Grazing	About 47 miles of the aqueduct alinement would be through desertland suitable for grazing.	About 22 miles of the aqueduct alinement would be through desertland suitable for grazing.	Construction along the proposed alinement rather than the historic alinement would result in the loss of about 17 more animal units per year.
Mining	No mining developments would be affected.	The alinement would cross through about 4 miles of the CONOCO mining development near Florence, Arizona.	Construction along the historic alinement would result in disruption of the mining development and would probably increase acquisition and construction costs.
Utilities	Severence of power transmission lines, telephone lines, and pipelines would occur throughout the alinement but the majority are in about 11 miles of the alinement through the developed areas.	Severance of power transmission lines, telephone lines, and pipelines would occur throughout the alinement but the majority would be in about 37 miles of the alinement through the developed areas.	The impacts due to severence and relocation of utility lines would be greater if the aqueduct were constructed along the historic alinement due to its location through more developed and urban areas.
Transportation	Bridges would be required on 24 Federal, county, and farm to market roads. Two railroad crossings would be required.	About 40 bridges on Federal, county, and farm to market roads would be required. Three railroad crossings would be required.	Because a greater portion of the historic alinement is located through developed and urban areas, more bridge crossings would be required causing an increase in construction costs. Minor and undedicated roads would be severed without bridges and would result in more disruption of travel and severance of neighborhoods.
Planning	The route has been taken into consideration in planning studies by county and other organizations.	The route would affect the town of Florence and rural areas severing roads and established movement patterns.	The relocation from the historic to the proposed route has resulted from advanced planning and coordination with city and county organizations.
Military	About 1 mile of the aqueduct alinement crosses the Florence Military Reservation.	No effect.	A bridge would be provided to mitigate the severence of the military reservation and no net impact is anticipated.
Sociocultural Population	Urban lands would be acquired for 6 miles of the alinement and the residents relocated.	Urban lands would be acquired for 7 miles of the alinement and the residents relocated. The town of Florence would be divided by the aqueduct.	Impacts due to the relocation of residents would be greater along the historic route because of alinement through the town of Florence.
Income and Employment	--------	No significant difference.	--------
Education	No effect.	The alinement would pass through the area of Florence High School and could be disruptive during the construction phase.	

TABLE 40 (continued)

	Proposed Alinement	Historic Route Alternative	Remarks
Archeological and Historical Resources	Relatively undisturbed areas with significant cultural resources would be required along 47 miles of the alinement.	The alinement crosses through about 22 miles of relatively undisturbed area with suspected significant cultural resources. This proposal would also pass through and adversely impact the Florence Historical District.	The Florence townsite includes hundreds of historic structures, some of which are on, or have been nominated to, the National Register of Historic Places. Because of this, the proposed route is preferable from the viewpoint of cultural resources, even though more undisturbed lands and possible prehistoric sites would be adversely affected.
Recreation	The proposal could be used to complement existing and planned parks such as the Bush Highway Recreational Area near Apache Junction. The SCS Spook Hill Floodwater Retarding Structure could be incorporated with the aqueduct to become a recreation complex.	This alternative would not lend itself to integration with the existing park system.	
Other Agency Programs	--------	No significant difference.	--------

VIII. CONSULTATION & COORDINATION

VIII. CONSULTATION AND COORDINATION

A. During Development of the Proposal

The proposal was developed after extensive discussion and coordination with numerous concerned Federal, State, and local organizations that have interests in the area. The majority of these agencies are listed in Table 41.

B. During Development of the Draft Environmental Statement

Various organizations, both public and private, participated in providing information and data for this draft statement.

1. Coordination Notice to Clearinghouses

In response to the Office of Management and Budget's A-95 Circular, procedure notices were submitted to the Arizona and California State Clearinghouses on August 20, 1974. These notices announced that a draft environmental statement was being prepared for the Salt-Gila Aqueduct feature of the Central Arizona Project. Comments on the feature were requested from various State and local organizations. Table 42 shows the results of this effort. The specific comments and concerns expressed by these agencies have been discussed in the text of this document.

Table 41

Organizations Contacted for Input into the
Salt-Gila Aqueduct Proposal and Draft Environmental Statement
Salt-Gila Aqueduct - Central Arizona Project

Federal Agencies	Areas of Interest
1. Bureau of Land Management (BLM)	land acquisition, cadastral surveys, and wildlife resources
2. Soil Conservation Service (SCS)	floodwater retarding and outlet structures, prime farmland, flow channels, and revegetation
3. Bureau of Indian Affairs (BIA)	San Carlos Project operation
4. Bureau of Prisons	Federal Detention Center operation
5. Bureau of Mines	mining activity
6. Corps of Engineers	flood hydrology
7. Air Force	Rittenhouse Auxiliary Airfield operation
8. Fish and Wildlife Service (FWS)	fish and wildlife resource coordination
9. National Park Service	archeological and historical resources
10. Advisory Council on Historic Preservation	archeological and historical resources
11. Environmental Protection Agency (EPA)	air and water quality
12. Geological Survey (USGS)	subsidence and earth fissuring
13. Department of Transportation	highways
14. Forest Service	land acquisition and wildlife resources
15. Interstate Commerce Commission	railroads
16. Heritage Conservation and Recreation Service	archeological and historical resources and recreation

Table 41 (Continued)

Federal Agencies	Areas of Interest
17. Department of Commerce	Bureau of Census publications on 1970 Census of Population and Socioeconomic Characteristics
18. Field Solicitor-Interior	Coordination on SCS F.R.S. structures
State of Arizona	
1. Lands Department	land acquisition
2. Agriculture and Horticulture Commission	protected plants
3. Water Commission (AWC)	water resources
4. Department of Public Safety	disruption of travel
5. Game and Fish Department (AG&FD)	wildlife resources
6. Department of Corrections	state prison operation
7. Department of Transportation (Highway Division)	bridges and disruption of travel
8. Department of Transportation (Aeronautics Division)	regional airport planning
9. Department of Emergency and Military Affairs	Florence Military Reservation operation
10. Department of Health Services (ADHS)	air and water quality
11. Parks Board	archeological and historical resources
12. Bureau of Mines	subsidence and mineral resources
13. State Historic Preservation Officer (SHPO)	archeological and historical resources
14. Office of Economic Planning and Development	community profiles for cities and towns in Salt-Gila Aqueduct area

Table 41 (Continued)

Maricopa County	Areas of Interest
1. Flood Control District (FCDMC)	flood control, cross drainage, floodwater retarding structures, and flow channels
2. Department of Health Services	air and water quality
3. Highway Department	bridges and traffic disruption
4. Department of Parks and Recreation	recreation
5. Planning Department	land use and traffic movements
6. Sheriffs Office	traffic disruption
7. Maricopa Association of Governments	population projects for Maricopa County and communities within the county

Pinal County	
1. Magma Flood Control District	flood control, cross drainage, floodwater retarding structures, and flow channels
2. Florence Flood Control District	flood control, cross drainage, floodwater retarding structures, and flow channels
3. Picacho Flood Control District	flood control, cross drainage, floodwater retarding structures, and flow channels
4. Department of Health Services	air and water quality
5. Highway Department	bridges and traffic disruption
6. Department of Parks and Recreation	recreation
7. Planning Department	land use and traffic movements
8. Sheriffs Office	traffic disruption
9. Central Arizona Association of Governments	population projections for Pinal County and communities within the county

Table 41 (Continued)

Communities	Areas of Interest
1. Apache Junction	disruption of services and traffic, socioeconomic effects, roads, and bridges
2. Florence	cemetery, socioeconomic effects, roads and bridges
3. Coolidge	Coolidge-Florence Municipal Airport and socioeconomic effects
Other Organizations	
1. San Carlos Project	water service disruption and joint use of facilities
2. Salt River Project (SRP)	service disruption, relocation of facilities, and addition to Thunderstone Substation
3. Arizona Public Service (ASP)	electrical service disruption, tie to substation, connection for check operation, and relocation of facilities
4. Southern Pacific Railroad	bridges
5. El Paso Natural Gas Company	disruption of service and relocation of facilities
6. CONOCO	mineral resources, location of aqueduct, and socioeconomic studies for Casa Grande-Florence area.
7. Gila River Indian Community	water service disruption and design of aqueduct
8. Queen Creek Irrigation and Drainage District	flood control
9. New Magma Irrigation and Drainage District	acquisition of lands, flood control, and design of aqueduct
10. Florence Gardens Subdivision	design of aqueduct and bridges land acquisition

Table 41 (Continued)

Other Organizations	Areas of Interest
11. Governors Commission on Arizona Environment	effects of proposal
12. Electrical District No. 2	connection for check operation, relocation of facilities, and disruption of service
13. Mountain Bell	disruption of service and relocation of facilities,
14. Central Arizona Water Conservation District	design, construction, operation, and maintenance of proposal
15. Chambers of Commerce	data on community profiles, public utilities and educational services

Table 42

Responses to Coordination Notices to
State Clearinghouses (OMB A-95)
Salt-Gila Aqueduct - Central Arizona Project

No.	Entity	Date of Response	No Comment	No Conflict	Supported	Specific Comments
1.	Office of Economic Planning and Development	11-13-74	X			
2.	Civil Rights Division, Department of Law	10-22-74				X
3.	Real Estate Department	10-11-74	X			
4.	Mineral Resources Department	10-11-74	X			
5.	Commission of Agriculture and Horticulture	10-18-74				X
6.	Environmental Planning Division Department of Highways	10-25-74				X
7.	Arizona Power Authority	10-15-74	X			
8.	Department of Health Services	10-24-74				X
9.	State Water Commission	10-18-74			X	
10.	Department of Land	10-21-74				X
11.	Center for Environmental Studies Department of Anthropology Arizona State University	10-16-74	X			
12.	Arizona Bureau of Mines	10-16-74	X			
13.	Southwestern Minerals Exploration Association	10-29-74				X
14.	City of Scottsdale	10-24-74				X
15.	Resources Agency of California	11-25-74	X			

2. Coordination with Federal, State, and Local Agencies Providing Input Material

During the preparation and data collection period for this statement, additional agencies were contacted. Table 41 is a listing of those agenices. The FWS and AGFD have cooperated in the development of fish and wildlife mitigation plans and will continue to assist Reclamation in the development of mitigation plans. The working draft of the EIS was reviewed by these agencies.

C. Public Involvement

The primary emphasis in the public involvement program was to obtain input from public and private agencies through the A-95 review process. During the planning process the technical staff in various fields of study (economics, engineering, biology, etc.) met with professional staff members of other agencies to discuss and exchange ideas. Through the process of consultation and coordination various concerns have been recognized and addressed in this document.

On August 23, 1978, approximately 250 interested persons, organizations, and agencies were contacted concerning the publication and filing of the draft environmental statement. Copies of the draft were sent for review and comment to the agenices, private organizations, and individuals listed on the distribution list in the front of the statement.

D. List of Consultants and Special Studies

Table 43 is a list of consultants and their respective areas of study relating to the Salt-Gila Aqueduct Environmental Statement.

Table 43

Consultants for Special Studies
Salt-Gila Aqueduct - Central Arizona Project

Biological Resources

Arizona State University - Inventory of birds, nongame mammals, herpetofauna, and vegetation

Arizona Game and Fish Department - Inventory of game and predator species

Fish and Wildlife Service - Wildlife mitigation measures

University of Arizona - Study of Gila monsters 1/
Ms. Betty Burge - Study of the desert tortoise in western Arizona 1/ 2/

Archeological and Historical Resources

Museum of Northern Arizona - Construction alinement cultural resource survey and preparation of a mitigation study plan

Arizona State Museum - Reconnaissance and feasibility alinement cultural resource surveys

Arizona State University - Reconnaissance cultural resource survey

Subsidence

U.S. Geological Survey 1/ - Study of subsidence and earth fissuring

---

1/ Studies not completed. Data from preliminary findings is presented in this document.

2/ In cooperation with BLM Desert Tortoise Survey.

E. Public Review of Draft Environmental Statement

The availability notice for the draft environmental statement was published in the Federal Register on January 9, 1979. About 600 copies were distributed to various interested segments of the public for review. The comment period was originally set to end February 23, 1979, but was extended to March 19, 1979 to allow additional comments.

Three public hearings were conducted during the review period to receive public comments. The public meetings were announced in the local papers but the attendance at these meetings was extremely light.

Additional information on the public review and comments can be found in the following sections and Appendix D.

1. Public Hearing Comments

A total of 31 people spoke at public hearings on the draft environmental statement for the Salt-Gila Aqueduct, a feature of the Central Arizona Project (CAP). These hearings were held at three communities near the proposed aqueduct alinement. The public hearing dates and locations were published in the Federal Register January 26 and February 9, 1979. In addition, local newspapers carried several press releases on the time and locations of the hearings. Each hearing consisted of an afternoon and evening session to allow maximum participation by the public.

The first public hearing was held at Coolidge, Arizona, on February 21, 1979. There were 19 speakers, representing irrigation districts, communities, and private parties. The second public hearing was held at Apache Junction, Arizona, on February 23, 1979. There was a total of seven speakers at the two sessions. The third public hearing was held at Mesa, Arizona, on March 12, 1979, with a total of five speakers at the two sessions. The public hearing transcripts are available for review at the Lower Colorado Regional Office, Boulder City, Nevada, and the Arizona Projects Office, Phoenix, Arizona.

Of the 31 presentations made at the public hearings, 24 were in favor of the proposed action, one person (who made three presentations) was actively opposed to the project, and the remaining four addressed specific concerns raised by the environmental statement. Table 44 is a list of these people who made presentations at the public hearings. Reclamation's responses to those public hearing comments that raised substantive issues or voiced specific concerns are presented following Table 44. Responses to those individuals who supplemented their oral presentations with written comments are found in Appendix D.

Table 44

List of Speakers at Public Hearings
Salt-Gila Aqueduct Draft Environmental Statement
Central Arizona Project

Coolidge, Arizona - February 21, 1979

Name	Representing
Mr. Rolf Wagner	City of Coolidge
Mr. Rich Johnson	Central Arizona Project Association
Mr. Norris Soma	San Carlos Irrigation and Drainage District
Mr. Dalton Cole	Hohokam Irrigation and Drainage District
Mr. C. B. DeSpain	Cortaro-Marana Irrigation District
Dr. Mel A. Everingham	Pinal County Development Board
Mr. James Henners	Arizona Association of Natural Resources Conservation Districts
Mr. Jerry Grady	Individual
Mr. Thomas Caywood	Maricopa Stanfield Irrigation and Drainage District
Mr. Jim Savage	Central Arizona Irrigation and Drainage District
Mr. R. J. Ellis	Maricopa-Stanfield Irrigation and Drainage District
Mr. Hugh Guinn	City of Casa Grande
Ms. Carolina Butler	Individual
Mr. William D. Baker	New Magma Irrigation and Drainage District
Mr. Wilber Wertz	Individual
Mr. Henry Kochsmeier	Individual
Mr. Terry Maldin	Individual
Mr. Donny Laughlin	Individual
Mr. Will Watkins	Individual

Apache Junction - February 22, 1979

Name	Representing
Mr. Donovan Mr. Kramer	Casa Grande Valley Newspaper, Inc.
Mr. James Alverson	R. W. Beck and Associates
Mr. Dean Skaggs	Casa Grande Elementary Schools
Ms. Carolina Butler	Individual
Mr. John Harambasic	Individual
Mr. Gerald Hales	Individual
Mr. Frank Birch	Individual
Mr. Brook Lakes	Individual

Table 44 (continued)

Mesa - March 12, 1979

Name	Representing
Mr. Tom Clark	Arizona Water Commission
Ms. Betty Eilers	Gray Panthers
Ms. Carolina Butler	Individual
Mr. Guy Bonnivier	Individual
Mr. Grant Ward	Roosevelt Water Conservation District

Comments of Mr. William D. Baker, Secretary of New Magma Irrigation and Drainage District at Coolidge, Arizona (February 21, 1979).

Comment No. 1

"Our specific comments on the EIS are as follows: On the alinement, while there has been no direct consultation with our District in reviewing our engineering reports with the draft environmental impact statement, it would appear that if the alinement could be moved what appears to me to be about one (1) or (2) miles east, it would seem to be that we will not cut -- that the alinement would not cut farms in half. And yet the alinement would then still be protected by diking that is already there. If this could be done and I -- because of the shortness of time we have not had adequate engineering to determine if it's still -- if it were moved it would still be on a contour line.

"It would appear to cut land acquisition costs for the government. It would certainly appear to leave less environmental impact directly on the land involved and the farms involved could continue to operate with a minimum of costs, despite the statement in the EIS that dividing farms by a structure as large as this does not increase costs -- farming. And I will dispute that statement and I will tell you that triangulation of farmland will greatly increase the costs of production."

Reply

The relocation of the aqueduct alinement through the irrigated agricultural land of New Magma Irrigation and Drainage District is discussed in the reply to written comments made by Mr. James V. Williamson and Mr. William D. Baker which are found in Appendix D. It is expected that the severence of the farmland by the aqueduct would result in higher farming costs due to smaller fields and shorter irrigation runs. The cost of acquisition of these lands will reflect damage severence to the surrounding lands.

Comment No. 2

"The size of the canal -- we are centainly gratified by the amendment to the draft environmental impact statement increasing the size to twenty-seven hundred (2,700) ft^3/s; however, we doubt if this size is sufficient to serve all users below the Salt River. We will have more specific comments on this, but what we believe is that a peak day in July, I thing even the twenty-seven hundred (2,700) ft^3/s capacity will probably be inadequate to serve not only New Magma in that area of the canal, but also downstream I believe that the rest of the areas in Pinal County and even down in the Pima County would be adversely impacted."

Reply

The size of the aqueduct is discussed in the reply to written comments by Mr. James V. Williamson found in Appendix D.

Comment No. 3

"We are also concerned over the exact location of the cutdown in size. The draft environmental impact statement shows a decrease of approximately two hundred and fifty (250) ft^3/s capacity at quote "Arizona Farms Road." Since our district has approximately two (2) to three (3) more miles of land within the boundaries of the District south of Arizona Farms Road and our preliminary engineering plans would show at least two (2) turnouts south of that point, we would greatly be concerned over the exact location of that."

Reply

The exact turnout locations would be determined in consultation with the individual district to be served. Present engineering studies have indicated no need for a larger size of aqueduct south of Arizona Farms Road.

Comments of Mrs. Carolina Butler at Coolidge, Arizona (February 21, 1979)

Comment

Mrs. Butler spoke in support of the "no construction" alternative. Citing the AWC recommendations for agricultural allocation of CAP water, she stated that agriculture in Pinal County would get the "biggest share" of CAP water. She stated that the agricultural interests had overdrafted the ground water for their own uses, and now that water depths have dropped drastically and land subsidence had become a problem, the Federal Government was coming to their rescue with the Central Arizona Project. Mrs. Butler also stated that the project was unfair to the taxpayers in the Phoenix metropolitan area who have to help pay for the project but do not need the water.

Reply

The AWC has made recommendations for the allocation of CAP water to agriculture, but these allocations have not been approved and finalized by the Secretary of the Interior. The AWC recommendations allocate more CAP water to agricultural users during the early years of the project, when more Colorado River water will be available for diversion, and when the needs of M&I users are less. As time passes, more of the

CAP water will be transferred from agricultural users to M&I users (the M&I allocation would increase from about 282,000 acre-feet in 1985 to about 500,000 acre-feet in 2034, according to recommendations of the AWC). In addition, Indian and M&I uses of CAP water have priority over non-Indian agricultural users in the event of a shortage.

Taxpayers in the 3-county CAP service area pay only about 29 percent of CAP costs allocated to the CAWCD through ad valorem taxes. The remaining 71 percent of CAWCD reimbursable costs is borne by M&I and agricultural water users, and revenue from power sales. Non-SRP service areas of the Phoenix metropolitan area do have a need for CAP water, as evidenced by their expressions of interests to the Central Arizona Water Conservation District (CAWCD). Together, the cities of Phoenix, Glendale, Mesa, and Scottsdale filed letters of commitment with the CAWCD to contract for M&I water in the amounts of 65,700 acre-feet in 1985 rising to 286,000 acre-feet in 2034. This latter figure is about twice the amount recommended to these cities by the AWC.

Comments of Mrs. Carolina Butler at Apache Junction, Arizona (February 22, 1979)

Comment No. 1

Mrs. Butler suggested the use of manure from the Fort McDowell Indian Reservation for use in reestablishment of vegetation on dikes and within flood pools. The manure contains seeds of mesquite that have been scarified in the digestive processes of the cattle.

Reply

Reclamation has and is continuing to experiment with methods and species for use in the seeding effort. This method will be investigated where applicable.

Comment No. 2

Mrs. Butler suggested that the center portion of the canal remain unlined to aid in ground-water recharge.

Reply

The authorizing legislation required the lining of all canals to conserve the water resource.

Comment No. 3

Mrs. Butler would like to be informed of significant changes in the proposal.

Reply

Should the proposed action described in this FES change significantly prior to construction, a supplement to the environmental statement would be published and the public would be informed.

Comment of Mr. Brook Lakes, at Apache Junction (February 22, 1979)

Comment

Mr. Lakes was concerned that Picacho Reservoir would be affected by the aqueduct.

Reply

Picacho Reservoir, located near the end of the aqueduct, would not be affected by the construction. A buffer zone is planned to protect this area during construction (Chapter III. C. 1. b.).

Comments of Mr. Frank Birch, at Apache Junction (February 22, 1979)

Comment

Is there any way to find out to what degree the big agri-business people will benefit from the CAP, or is this going to be one of those things we will have to wait 5 or 10 years until future studies will be taken to find out?

Reply

The water is being allocated to the five central Arizona Indian Reservations and municipal and industrial users in addition to the agricultural interests. Agricultural water has the lowest priority during periods of shortages and the water is not expected to benefit any particular group more than another.

Comment of Mr. Gerald Hales and Mr. John Harambasic at Apache Junction, Arizona (February 22, 1979)

Comment

These individuals are concerned about the lack of a bridge on Baseline Road south of Apache Junction. An area of 80 acres has been subdivided for industrial uses and the aqueduct alinement would block their access east of Baseline Road.

Reply

Pinal County Highway Department has been contacted and expressed no interest in a bridge on Baseline Road. Baseline Road is not an improved road in this area at the present time and no bridge is planned.

Comments of Mrs. Carolina Butler at Mesa, Arizona (March 12, 1979)

Comment

Mrs. Butler stated that the DES was deficient since the socio-cultural effects discussed in Capter III. E. were left out of Chapter III. K. "Cumulative Effects of This and Other Federal Projects." Specifically, she stated that the greatest environmental impact of the SGA would not be from the construction itself, but rather would be the greater population growth resulting from the additional water supply.

Reply

The social effects of increased employment, Federal acquisition of land, and others are discussed in Chapter III. E. and do not require repeating in III. K. The impacts of water delivery on population growth are not discussed in this statement due to the uncertainty of the water allocations. The impacts of CAP water delivery would be more appropriately discussed in the environmental statements or assessments for the water distribution systems. The Salt-Gila Aqueduct will serve as a connecting link to these distribution systems, but will not, itself, deliver water for direct usage. Recommendations for the allocation of CAP water for non-Indian use are made to the Secretary of the Interior by the Arizona Water Commission. The AWC transmitted its recommendations for M&I allocations to the Secretary in June 1977. The AWC recommended agricultural allocation is expected to be sent to the Secretary in June 1979. These are only recommendations, however, and are subject to change as the Secretary has the sole and legal responsibility for allocation of project water. An allocation of CAP water for Indian irrigation use was made by the Secretary in October 1976. Subsequently, representatives of the Salt River and Gila River Indian Communities filed lawsuits seeking to modify the allocation. The suits are currently inactive, pending the outcome of ongoing water rights negotiations. In light of these circumstances, the Indian agricultural allocation cannot be considered as final.

Comments of Ms. Betty Eilers, Gray Panthers, at Mesa, Arizona (March 12, 1979)

Comment

Ms. Eilers is concerned that the project is not needed and is costly to the retired individuals.

Reply

The Governors of Arizona, both houses of the State Legislature, and the Congress of the United States have seen a need for the project to reduce overdrafting of the ground-water supply in central Arizona. The project has been reviewed and found to be needed by the State.

It is doubtful if the CAP will be any more costly to the retired segment than many other population segments. The younger taxpayers of today will be the retired taxpayers of tomorrow and they will then share and need the benefits of the project.

2. Written Comments

Written comments on the draft environmental statement were received from 60 individuals, organizations, and governmental agencies. Appendix D contains the replies on their questions. The specific comments in the individual letters are marked with a number in the right-hand margin, and the letter is followed with Reclamation's replies to the specific numbered comments. General comments are not marked, and the letter is followed by a general reply. Table 45 is a summary of the comments and area of concern.

Table 45

List of Those Who Submitted Written Comments
and Their Concerns

Salt-Gila Aqueduct Draft Environmental Statement
Salt-Gila Aqueduct, Central Arizona Project

Commenter	Concern
Individuals and Private Organizations	
John R. Nicholson	subsidence
D.E. Creighton, Jr.	overall
League of Women Voters	conservation
Arizona State Reclamation Association	none
Citizens Concerned About the Project	principles and standards eval., conservation
R. W. Beck and Associates	aqueduct size and turnouts
Carolina Butler	projectwide
Richard Golightly	kit fox
Guy Bonnivier	wildlife losses
Rawlins, Ellis, Burrus, & Kiewit	aqueduct size and turnouts
Pinal County Farm Bureau	none
Maricopa Audubon Society	overall
Federal Government Agencies	
Western Area Power Admin. DOE	alinement of transmission system
Area Office, HUD	none
Bureau of Mines, DOI	mineralization
Advisory Council on Historic Preservation	continued coordination
Geological Survey	none
Phoenix Service Office, HUD	none
Arizona State Office, BLM	wildlife impacts
Pacific Region, HCRS	none
Corps of Engineers, Dept. of Army	none
Federal Energy Regulatory Commission	none
Center for Disease Control, PHS, HEW	seepage, lands
Department of Air Force	none
Department of Agriculture	overall
Fish and Wildlife Service	wildlife
Environmental Protection Agency	conservation - water quality

Table 45 (continued)

Arizona State Agencies

Water Commission	overall
Division of Emergency Services	none
State Parks Board	none
Central Arizona Association of Governments	none
Indian Affairs Commission	none
58th Civil Engineers Squadron DEEV	none
208 Section, OEPAD	none
Econonmic Section, OEPAD	none
Department of Corrections	none
Maricopa Association of Governments	regional airport and recreation
Bureau of Geology and Mineral Technology	none
Agriculture and Horticulture Department	protected plants
Mineral Resource Department	none
Historical Society	none
AORCC	recreation
Center of Public Affairs	economics
Office of Planning, Department of Economic Security	none
Power Authority	none
Civil Rights Division, Assistant Attorney General	none
State Land Department	none
Arizona Game and Fish Department	wildlife resources
Department of Health Services	none

Maricopa County Agencies

County Highway Department	none

Other State Agencies

Governors Office of Planning Coordination, State of Nevada	none
Engineers Office, State of Wyoming	Colorado River water use by Arizona
Colorado River Board of California	none
Planning Coordinator, State of Utah	none
Executive Department State of Wyoming	Arizona diversions of Colorado River water
Division of Planning, State of Colorado	none

Table 45 (continued)

Commenter	Concern
Other State Agencies (continued)	
Division of Water Resources, State of Colorado	none
Department of Agriculture, State of Wyoming	terminal storage
Resources Agency of California, State of California	conservation
Division of Policy and Planning Coordination, State of Utah	none

APPENDED MATERIAL

APPENDIX A

Appendix A
References Cited

Algermissen, S. T. and D. M. Perkins
1976 A Probabalistic Estimate of Maximum Acceleration in Rock in Contiguous United States. USGS Open file Report 76-416.

Anderson, S. A.
1973 Investigation of the Mesa earth crack, Arizona, attributed to differential subsidence due to groundwater withdrawal. Unpublished M.S. thesis, Arizona State University, Tempe, Arizona.

Anderson, T. W.
1968 Electrical Analog Analysis of Ground-water Depletion in Central Arizona. U.S. Geological Survey, Water Supply Paper 1860.

Antieau, John M.
1977 Investigations of Archaeological Sites Along the 500 kV Tonto National Forest Boundary to Kyrene Transmission Line Route, Coronado Station Project, Pinal and Maricopa Counties, Arizona. Office of Cultural Resource Management, Department of Anthropology, Arizona State University, Tempe, Arizona.

Arizona Community Profiles
1976 Arizona Community Profiles. Arizona Office of Economic Planning and Development. Phoenix, Arizona.

Arizona Crop and Livestock Reporting Service.
1975 Arizona Agricultural Statistics, Phoenix, Arizona

Arizona Department of Health Services (ADHS)
1974 Air Quality for Arizona, Annual Reports. Phoenix, Arizona.
1977

Arizona Game and Fish Commission (AGFC)
1978 Threatened and Unique Wildlife of Arizona. Phoenix, Arizona.

Arizona Highway Department
1973 Arizona Bikeways Program. Phoenix, Arizona.

Arizona Statistical Review
1976 Arizona Statistical Review, 32nd Annual Edition. Valley National Bank of Arizona. Phoenix, Arizona.

1977 Arizona Statistical Review, 33rd Annual Edition. Valley National Bank of Arizona. Phoenix, Arizona.

Arizona Water Commission
1975 Arizona State Water Plan. Phase I, Inventory of Resources and Uses. Phoenix, Arizona.

1977a Arizona State Water Plan, Phase II, Alternative
Futures. Phoenix, Arizona

1977b Water Conservation in Arizona, A Report to
Governor Raul H. Castro (DRAFT). Phoenix, Arizona.

1977c Letter dated June 22, 1977, from Kel Fox, Chairman to Cecil Andrus,
Secretary of the Interior, on recommended CAP water allocations
to M&I users.

1978a Projected Water Uses, Supplies, and Groundwater Conditions in
Selected Basins in Arizona. A Baseline Conditions Report to
the Groundwater Management Study Commission. Phoenix, Arizona.

1978b Water Conservation, Arizona State Water Plan. Phase III,
Part I. Phoenix, Arizona.

1979 Memorandum dated January 24, 1979, from AWC staff, to Commissioners,
Subject: CAP Agricultural Water Allocations.

Barnes, Will C.
1960 Arizona Place Names. Revised and Enlarged by Byrd H. Granger,
University of Arizona Press, Tucson, Arizona.

Boling, J. K. Jr. and M. C. Carpenter
1978 Small Scale Movements of Earth Fissures in South-Central Arizona
(abstract). Geological Society of America, Abstracts with Programs
10(3):97.

Brown, Patricia Eyring
1978 Archeological Investigations at Arizona U:6:2(ASU), An Historic
Site on the Banks of the Salt River, Maricopa County, Arizona.
Office of Cultural Resource Management Report 32, Department
of Anthropology, Arizona State University, Tempe, Arizona.

Bureau of Land Management (BLM)
1968 Central Arizona Project Impact Study, Arizona - New Mexico.
Phoenix, Arizona.

1976 Draft Environmental Statement, Crude Oil Transportation System:
Valdez, Alaska to Midland, Texas (as proposed by SOHIO Trans-
portation Company). California State Office, BLM, Department
of the Interior

Canouts, Valetta (assembler)
1975 An Archaeological Survey of the Orme Reservoir. Archeological
Series No. 92. Arizona State Museum, Tucson, Arizona.

Carrel, Toni, Sandra Rayl, and Daniel Leinham
1976 The Effects of Freshwater Inundation of Archeological Sites through Reservoir Construction: A Literature Search. Cultural Resources Management Division, National Park Service, Washington, D.C.

Cartledge, Thomas R. and Donald E. Weaver Jr.
1974 An Archaeological Reconnaissance Survey of the Buckhorn-Mesa Flood Control Project. Report prepared for Soil Conservation Service. Department of Anthropology, Arizona State University, Tempe, Arizona.

Cazier, M. A.
1972 A Compilation of the Invertebrate Fauna of the Environs of the Orme, Buttes, Charleston, and Hooker Reservoir Sites. Arizona State University, Tempe, Arizona.

Central Arizona Association of Governments
1977 CAAG 208 Program, Population Report (CAAG 208/434). Florence, Arizona.

Chalmers, J. A. and E. J. Anderson
1977 Economic/Demographic Assessment Manual, Current Practices, Procedural Recommendations, and a Test Case. Prepared for the Bureau of Reclamation by Mountain West Research, Inc. under Contract No. 7-07-DR-50180. Tempe, Arizona.

Cooley, M. E.
1973a Map showing distribution and estimated thickness of alluvial deposits in the Tucson area, Arizona. U.S. Geological Survey Map I-844-C.

1973b Map showing distribution and estimated thickness of alluvial deposits in the Phoenix area, Arizona. U.S. Geological Survey Map I-845-C.

Cross, John K.
1978a Progress Report, Identification of Impacts of the Salt-Gila Aqueduct, Central Arzona Project, on the Gila Monster (Heloderma suspectum) and Development of a Mitigation Plan. USBR contract No. 8-07-32-V0040. April 5, 1978, University of Arizona, Tucson, Arizona.

1978b Annotated Literature Review on the Ecology of the Gila Monster (Heloderma suspectum). USBR Contract No. 8-07-32-V0040. University of Arizona, Tucson, Arizona.

Damon, P. E. (compiler)
1964 Correlation and Chronology of Ore Deposits and Volcanic Rocks. Annual Progress Report COO-689-42, Contract AT (11-1)-689 to U.S. Atomic Energy Commission. Geochronology Labs, University of Arizona, Tucson, Arizona.

1966 Correlation and Chronology of Ore Deposits and Volcanic Rocks. Annual Progress Report COO-689-40, Contract AT (11-1)-689 to U.S. Atomic Energy Commission. Geochronology Labs, University of Arizona, Tucson, Arizona.

1968 Correlation and Chronology of Ore Deposits and Volcanic Rocks. Annual Progress Report COO-689-100, Contract AT(11-1)- 689 to U.S. Atomic Energy Commission. Geochronology Labs, University of Arizona, Tucson, Arizona.

1970 Correlation and Chronology of Ore Deposits and Volcanic Rocks. Annual Progress Report COO-689-130, Contract AT(11-1)-689 to U.S. Atomic Energy Commission. Geochronology Labs, University of Arizona, Tucson, Arizona.

Damon, P. E. and M. Bickerman
1964 Potassium-Argon Dating of Post-Laramide Plutonic and Volcanic Rocks within the Basin and Range Province of Southeastern Arizona and Adjacent Areas. Arizona Geological Society Digest VII:68-78.

Damon, P. E., M. Shafiguillah, and D. J. Lynch
1973 Geochronology of Block-faulting and Basin Subsidence in Arizona. Geological Society of America Annual Meeting, Abstracts with Programs 5(7):590.

Deason, Wayne O.
1975 A Bacterial Investigation of the Bill Williams Arm, Lake Havasu, Arizona. Environmental Office, Lower Colorado Region, Bureau of Reclamation.

Debowski, Sharon S., Anique George, Richard Goddard, and Deborah Mullon
1976 An Archaeological Survey of the Buttes Reservoir, Volumes 1 and 2. Archaeological Series No. 93, Arizona State Museum, University of Arizona, Tucson, Arizona.

Dittert, Alfred E. Jr., Paul R. Fish, and Don E. Simonis
1969 A Cultural Inventory of the Proposed Granite Reef and Salt-Gila Aqueducts, Agua Fria River to Gila River. Anthropology Research Paper No. 1, Arizona State University, Tempe, Arizona.

Dixon, Keith A.
1977 Applications of Archaeological Resources: Broadening the Basis of Significance. In Conservation Archaeology, Edited by M. B. Schiffer and G. J. Gumerman, Academic Press, New York. pp. 277-290.

Doelle, William H.
1976 Desert Resources and Hohokam Subsistence: The Conoco Florence Project. Archaeological Series No. 103, Arizona State Museum, Tucson, Arizona.

Doyel, David E.
1975 Excavations in the Escalante Ruin Group, Southern Arizona. Archaeological Series No. 37, Arizona State Museum, Tucson, Arizona.

Dutton, Bertha P.
1975 Indians of the American Southwest. Prentice-Hall Inc., Englewood Cliffs, New Jersey.

Eberly, L. D., and T. B. Stanley Jr.
1978 Cenozoic Stratigraphy and Geology History of Southwestern Arizona. Geological Society of America Bulletin 89(6):20.

Elliot, M. R.
1969 Investigation of a Vertical Displacement of Ground Surface, Phoenix-Mesa Area, Arizona. U.S. Geological Survey Duplicated Report.

Environmental Protection Agency (EPA)
1971 Community Noise. Prepared by Wyle Laboratories under Contract 68-04-0046 for U.S. EPA Office of Noise Abatement and Control, Washington, D. C.

1975 Compilation of Air Pollutant Emission Factors, 2n Edition. Research Triangle Park, North Carolina.

Fenneman, N. M.
1930 Physical Division of the United States. U.S. Geological Survey Map (scale 1:700,000).

Fish and Wildlife Service (FWS)
1976 Central Arizona Project. Fish and Wildlife Coordination Act Advance Planning Report. Phoenix, Arizona.

1977 Classification of Wetlands and Deep-water Habitats of the United States (An Operational Draft). U.S. Department of the Interior, October 1977.

1978 Salt-Gila Aqueduct: Report Update. Phoenix, Arizona.

Glassow, Michael A.
1977 Issues in Evaluating the Significance of Archaeological Resources. American Antiquity 42(3):413-420.

Grady, Mark, Sandra Kemrer, Sandra Schultz and William Dodge
1973 An Archaeological Survey of the Salt-Gila Aqueduct. Archaeological Series No. 23, Arizona State Museum, University of Arizona, Tucson, Arizona.

Green, Christine R. and William D. Sellers
1964 Arizona Climate. University of Arizona Press, Tucson, Arizona.

Haury, Emil W.
1976 The Hohokam: Desert Farmers and Craftsmen, Excavations at Snaketown, 1964-1965. University of Arizona Press, Tucson, Arizona.

Hayden, Carl (compiler)
1924 A History of the Pima Indians and the San Carlos Irrigation Project. 89th Congress, 1st Session, Document No. 11. U.S. Government Printing Office, Washington, D. C.

Hardt, W. F., R. E. Cattany, and L. R. Kister
1964 Basic Ground-Water Data for Western Pinal County: Arizona Land Department. Water Resources Report No. 18.

Hardt, W. F. and R. E. Cattany
1965 Description and Analysis of the Geohydrologic System in Western Pinal County, Arizona. U.S. Geological Survey open file report.

Heindl, L. A. and J. H. Peth
1955 Piping and earth cracks--a discussion. Am. Geophys. Union Transcripts 36(2):342-345.

Holzer, T. L.
1976 Ground Failure in Areas of Subsidence Due to Ground Water Decline in the United States. Publication No. 121 of the International Association of Hydrological Sciences. Proceedings of the Anaheim Symposium, December 1976, pp. 423-433.

Holzer, T. L.
1978 Results and interpretations of exploratory drilling near the Picacho fault, south-central Arizona. U.S. Geological Survey open file report 78-1016.

Holzer, T. L. and S. N. Davis
1976 Earth Fissures Associated with Water Table Declines (abstract). Geological Society of America, Abstracts with Programs 8(6):923.

Horejsi, Ronald G.
1976 Final Report on the Field Studies of the Large and Small Game and Predator Species of the Proposed Salt-Gila Aqueduct. Research Division, Arizona Game and Fish Department, Phoenix, Arizona.

Interagency Land Acquisition Conference
1973 Uniform Appraisal Standards for Federal Land Acquisitions. U.S. Government Printing Office, Washington, D. C.

Jennings, J. D.
1957 Danger Cave. Society for American Archaeology, Memoir 14.

Kam, William
1965 Earth cracks, a cause of gullying: in Geological Survey Research 1965, U.S. Geological Survey Prof. Paper 525-B.

Kayser, D. W. and D. C. Fiero
1969 An Archaeological Survey of the Tucson Aqueducts, Central Arizona Project. Arizona State Museum, University of Arizona, Tucson, Arizona.

Laney, R. L.
1976 Water-level Declines, Land Subsidence and Earth Fissures in South-Central Arizona. Arizona Water Commission, 20th Annual Arizona Watershed Symposium Proceedings, pp. 30-39.

Laney, R. L., Richard H. Raymond, and Carl C. Winikka
1978a Maps Showing Water Level Declines, Land Subsidence, and Earth Fissures in South-Central Arizona. U.S. Geological Survey Water-Resources Investigations 78-83 Open File Report.

Laney, R. L., P. P. Ross, and G. R. Littin
1978b Maps Showing Ground-Water Conditions in the Eastern Part of the Salt River Valley Area in Maricopa and Pinal Counties, Arizona, 1976. USGS Water Resources Investigations Open File Report 78-61.

Leonard, R. J.
1929 An Earth Fissure in Southern Arizona. Journal of Geology 37:765-774.

Lowe, Charles H.
1964 The Vertebrates of Arizona. University of Arizona Press, Tucson, Arizona.

Mangelsdorf, Paul C.
1974 Corn, Its Origin, Evolution and Improvement. Belknap Press, Cambridge.

Maricopa Association of Governments
1977 Proposed Regional Development Guide. Transportation and Planning Office, Phoenix, Arizona.

Maricopa Planning and Zoning Department
1970 A Park, Recreation, and Open Space Study. Maricopa County, Arizona.

Martin, Paul S. and Fred Plog
1973 The Archaeology of Arizona. Doubleday Natural History Press, Garden City, New York.

McCalley, Charles, and Russel Gum
1975 Land Subsidence: An Economic Analysis. Water Resources Bulletin 11(1):148-154.

Moratto, Michael J. and Roger E. Kelly
1976 Significance in Archaeology. Kiva 42(2):193-202.

Pacific Southwest Interagency Committee
1971 Lower Colorado Region - Comprehensive Framework Study. Prepared by the Lower Colorado Region State - Federal Interagency group for the Pacific Southwest Interagency Committee.

Peirce, H. W.
1972 Red Lake Salt Mass. Arizona Bureau of Mines Field Notes 2(1):4-5.

1974 Thick Evaporites in the Basin and Range Province - Arizona Fourth Symposium on Salt. Northern Ohio Geological Society 1:47-55.

1976 Tectonic Significance of Basin and Range Thick Evaporite Deposits. Arizona Geological Society Digest X:325-339.

Peterson, D. E.
1962 Earth Fissuring in the Picacho Area, Pinal County, Arizona. Unpublished M. S. Thesis, University of Arizona, Tucson, Arizona.

Poland, J. F., B. E. Lofgren, R. L. Ireland, and R. G. Pugh
1975 Land Subsidence in the San Joaquin Valley, California, as of 1972. U.S. Geological Survey Professional Paper 437-H.

Raab, L. Mark, and Timothy C. Klinger
1977 A Critical Appraisal of "Significance" in Contract Archaeology. American Antiquity 42(4):629-634.

Rice, Glen E.
1977 An Archaeological Management Program for the Roosevelt Water Conservation District Floodway. Office of Cultural Resource Management Report 77-137, Department of Anthropology, Arizona State University, Tempe, Arizona.

Rice, Glen E. and Don E. Simonis
1977 An Archaeological Survey of a Portion of the Queen Creek Delta, Pinal County, Arizona. Office of Cultural Resource Management Report 31, Department of Anthropology, Arizona State University, Tempe, Arizona.

Robinson, G. M. and D. E. Peterson
1962 Notes on Earth Fissures in Southern Arizona. U.S. Geological Survey Circ. 466:1-7.

Rodgers, James B.
1975 Archeological Investigations at AZ U:10:51 (ASU), Maricopa County, Arizona. Report prepared for Soil Conservation Service by Department of Anthropology, Arizona State University, Tempe, Arizona.

Sayles, E. B. and Ernst Antevs
1941 The Cochise Culture. Gila Pueblo Medallion Papers No. 29. Globe, Arizona.

Schiffer, Michael B. and John H. House
1977 An Approach to Assessing Scientific Significance. In Conservation Archaeology, edited by M. B. Schiffer and G. J. Gumerman. Academic Press, New York. pp. 249-257.

Schultz, Theodore J. and Nancy M. McMahon
1971 Noise Assessment Guidelines. Prepared for the U.S. Department of Housing and Urban Development, BBN Report No. 2176, Washington, D.C.

Schumann, H. H. and J. F. Poland
1970 Land Subsidence and Earth Fissures, Groundwater Withdrawal in South-Central Arizona, U.S.A. Land Subsidence: Tokyo International Association of Hydrological Sciences 88(1):295-302.

Schwartzmann, J. L., W. F. Laudenslayer, R. D. Ohmart, and R. W. Smith
1976 Field Studies of the Nongame Mammals, Birds, Herpetofauna, and Vegetation Analysis of the Proposed Salt-Gila Aqueduct. Department of Zoology, Arizona State University, Tempe, Arizona.

Scovill, Douglas, Garland J. Gordon, and Keith M. Anderson
1977 Guidelines for the Preparation of Statements of Environmental Impact on Archeological Resources. In Conservation Archaeology, edited by M. B. Schiffer and G. J. Gumerman, Academic Press, New York. pp. 43-62. (originally printed in 1972)

Sobin, Harris J. (editor)
1977 Florence Townsite A.T.: Final Report of Florence Townsite Historic District Study. Harris Sobin and Associates, Tucson, Arizona.

Soil Conservation Service (SCS)
1976 Final Environmental Statement, Buckhorn-Mesa Watershed, Department of Agriculture, June 1976, Phoenix, Arizona.

1977 Draft Environmental Statement, Roosevelt Water Conservation District Floodway, Arizona. (USDA-SCS-EIS-WS-ADM-76-3-(D)-AZ) Phoenix, Arizona.

Spicer, Edward H.
1962 Cycles of Conquest: The Impact of Spain, Mexico, and the United States on the Indians of the Southwest, 1533-1960. University of Arizona Press, Tucson, Arizona.

Stebbins, Robert C.
1966 A Field Guide to Western Reptiles and Amphibians. Boston: Houghton Mufflin Co.

McGregor, John C.
1965 Southwestern Archaeology, Second Edition. University of Illinois Press, Carbondale, Illinois.

Moratto, Michael J. and Roger E. Kelly
1976 Significance in Archaeology. Kiva 42(2):193-202.

Pacific Southwest Interagency Committee
1971 Lower Colorado Region - Comprehensive Framework Study. Prepared by the Lower Colorado Region State - Federal Interagency group for the Pacific Southwest Interagency Committee.

Peirce, H. W.
1972 Red Lake Salt Mass. Arizona Bureau of Mines Field Notes 2(1):4-5.

1974 Thick Evaporites in the Basin and Range Province - Arizona Fourth Symposium on Salt. Northern Ohio Geological Society 1:47-55.

1976 Tectonic Significance of Basin and Range Thick Evaporite Deposits. Arizona Geological Society Digest X:325-339.

Peterson, D. E.
1962 Earth Fissuring in the Picacho Area, Pinal County, Arizona. Unpublished M. S. Thesis, University of Arizona, Tucson, Arizona.

Poland, J. F., B. E. Lofgren, R. L. Ireland, and R. G. Pugh
1975 Land Subsidence in the San Joaquin Valley, California, as of 1972. U.S. Geological Survey Professional Paper 437-H.

Raab, L. Mark, and Timothy C. Klinger
1977 A Critical Appraisal of "Significance" in Contract Archaeology. American Antiquity 42(4):629-634.

Rice, Glen E.
1977 An Archaeological Management Program for the Roosevelt Water Conservation District Floodway. Office of Cultural Resource Management Report 77-137, Department of Anthropology, Arizona State University, Tempe, Arizona.

Rice, Glen E. and Don E. Simonis
1977 An Archaeological Survey of a Portion of the Queen Creek Delta, Pinal County, Arizona. Office of Cultural Resource Management Report 31, Department of Anthropology, Arizona State University, Tempe, Arizona.

Robinson, G. M. and D. E. Peterson
1962 Notes on Earth Fissures in Southern Arizona. U.S. Geological Survey Circ. 466:1-7.

Rodgers, James B.
1975 Archeological Investigations at AZ U:10:51 (ASU), Maricopa County, Arizona. Report prepared for Soil Conservation Service by Department of Anthropology, Arizona State University, Tempe, Arizona.

Stein, Pat
1978 Mitigation Plan for the Salt-Gila Aqueduct. Museum of Northern Arizona, Flagstaff.

Trimble, Marshall
1977 Arizona: A Panoramic History of a Frontier State. Doubleday, Garden City, New York.

U.S. Bureau of the Census
1971a Census of Population: 1970, General Social and Economic Characteristics, Final Report PC(1)-C4 Arizona. U.S. Government Printing Office, Washington, D.C.

1971b Census of Population: 1970, General Population Characteristics, Final Report PC(L)-B4 Arizona. U.S. Government Printing Office, Washington, D.C.

Thompson, Raymond H.
1979 Beyond Significance. American Society for Conservation Archeology Newsletter 5(6): 15-21.

U.S. Bureau of Reclamation (USBR)
1947a Report on Central Arizona Project. Project Planning Report No. 3-8b.4-2. Boulder City, Nevada.

1947b Report on Central Arizona Project Appendices. Project Planning Report No. 3-8b.4-2. Boulder City, Nevada.

1963 Supplemental Report, Central Arizona Project. Project Development Report 260. Boulder City, Nevada.

1971 Reclamation Instructions. Series 210 Land, Part 211, Policy and Basic Requirements, Washington, D.C.

1972a Final Environmental Statement, Central Arizona Project. Department of the Interior, FES 72-35, Boulder City, Nevada.

1972b Final Environmental Statement, Navajo Project. Department of the Interior, FES 72-1, Boulder City, Nevada.

1972c Definite Plan Report, Central Arizona Project. Arizona - New Mexico. Appendix F - Project Lands.

1973a Final Environmental Statement, Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel. Department of the Interior, FES 73-2, Boulder City, Nevada.

1973b General Design Standards, Design Standards No. I. Engineering and Research Center, Denver, Colorado.

1974 Final Environmental Statement, Granite Reef Aqueduct. Department of the Interior, FES 74-5, Boulder City, Nevada.

1975 Final Environmental Statement, Granite Reef Aqueduct Transmission System. Department of the Interior, FES 75-66, Boulder City, Nevada.

1976a Draft Environmental Statement, Orme Dam and Reservoir. Department of the Interior, DES 76-17, Boulder City, Nevada.

1976b CAP Geology and Ground Water Resources Report, Maricopa and Pinal Counties, Arizona. Phoenix, Arizona.

1977 Final Environmental Statement, Southern Nevada Water Project, Second Stage, Boulder City, Nevada

1978 Project Data Sheet for Central Arizona Project, Arizona - California - New Mexico - Nevada - Utah. Department of the Interior, PF-65(11-76), Phoenix, Arizona.

U.S. Department of the Interior (USDI)
1976 Secretarial Allocation of Project Water for Indian Irrigation Use. Published October 18, 1976, in the Federal Register.

Wigal, D. D.
1973 A survey of the nesting habitats of the white-winged dove in Arizona. Special Report No. 2. Ariz. Game and Fish Dept., Phoenix. 37 pp.

Willey, Gordon R.
1966 An Introduction to American Archaeology, Volume 1: North and Middle America. Prentice-Hall, Englewood Cliffs, New Jersey.

Winikka, C. C.
1964 Subsidence in the Eloy-Picacho Area. Proceedings of the 11th Arizona Land Surveys Conference. Arizona Engineering Experiment Station, University of Arizona, Tucson, Arizona. pp. 39-43.

Winikka C. C. and P. D. Wold
1976 Land Subsidence in Central Arizona. Publication No. 121 of the International Association of Hydrological Sciences, Proceedings of the Anaheim Symposium, December 1976. pp. 95-103.

Winter, Joseph C.
1973 Cultural Modifications of the Gila Pima: A.D. 1697-A.D. 1846. Ethnohistory 20(1):67-77.

APPENDIX B

Appendix B
Community Profiles

Apache Junction

Apache Junction is a community in Pinal County which is dependent upon recreation and retirement as its economic base. Extensive developments in the area serve the many retired residents as well as the winter visitors. Apache Junction's close proximity to the metropolitan Phoenix area (about 40 miles (64 km)) is an important factor in its population and economic growth.

Arizona Route 88 and U. S. Highways 60-80-89 extend through Apache Junction. Transportation services are provided to this area by Greyhound Bus as well as Sky Harbor International Airport, 40 miles (64 km) west, and Falcon Field, 15 miles (24 km) west. Medical services within the area include eight doctors. Hospitals and other medical facilities are available in the Phoenix metropolitan area. Educational facilities include two elementary, one junior high, and one senior high school with a total enrollment of approximately 1,850 students.

Casa Grande

Casa Grande is located midway between Phoenix and Tucson and is the largest community in Pinal County. Casa Grande's economy, once strongly agriculturally oriented, is becoming more diversified with manufacturing, retail sales, mining and tourism activities. Recreation and tourism have increased with the spring training site of the San Francisco Giants baseball team approximately 4 miles (6.4 km) west of the city. The agribusiness sector in the Casa Grande area consists of more than 40 firms dealing in fertilizers, feed grains, farm machinery and other farm supplies. Renewed mining activity in the area includes the ASARCO mine, Lakeshore mine and CONOCO's Florence Project. The Florence Project is a pilot mine and, as a major development, could employ up to 2,000 persons. Casa Grande is located near the intersection of Interstate 8, leading west to San Diego, and Interstate 10, the major route between Phoenix and Tucson. State routes 84, 93, 187, and 287 connect Casa Grande with other western Pinal County communities. Transportation services are provided by six truck lines, two bus lines and Southern Pacific Railroad Company. Air facilities include the Casa Grande Municipal Airport and the Casa Grande - Francisco Grande Airport located within 10 miles (16 km) of the city.

Educational facilities in the area range from six public schools and one private parochial elementary school to the 2-year Central Arizona College where enrollment is approximately 5,000 students.

Medical services are provided by the Hoemako Cooperative Hospital and the West Pinal Family Health Center as well as an estimated 30 physicians in the area.

Chandler

Chandler, located about 15 miles (24 km) southeast of Phoenix, has begun to develop as a manufacturing center with the development of the Pima-Chandler Industrial Park and the Williams Field Road Business Park adjacent to Interstate 10. Williams Air Force Base serves as a major source of employment for the city residents and provides valuable income to the local economy. Chandler offers many scenic and recreational activities and is the home of the first exclusive resort hotel in Arizona, the San Marcos Hotel.

The economy of Chandler is a mix of agriculture, light manufacturing and tourism. Cotton, livestock, alfalfa, small grains, citrus and vegetables are the principal crops of the area which provide the major source of agricultural income. In addition, Spreckel's $20 million sugar processing plant processes the local sugar beet crop.

Chandler is located approximately 8 miles (12.8 km) east of Interstate 10 and is connected to other communities by State Routes 87 and 93. Airport facilities are provided by the Chandler Municipal Airport and Phoenix Sky Harbor International Airport. Medical facilities include one 42-bed hospital and approximately 20 physicians. Educational facilities include seven elementary schools, two junior high schools, and two senior high schools with a total enrollment of over 7,000 students. Mesa Community College, a 2 year institution, is located approximately 8 miles (12.8 km) northwest of Chandler and Arizona State University about 14 miles (22.4 km) northwest in Tempe.

Coolidge

Coolidge is an agriculturally oriented community located 56 miles (89.6 km) southeast of Phoenix. It serves as a distribution and service center for agricultural producers and provides agricultural equipment and supplies and personal services for farm families. Approximately 20 percent of total employment in Coolidge results from service firms primarily oriented toward agribusiness activities. Transportation facilities include the Southern Pacific Railroad Company, Greyhound and Continental bus lines and the Coolidge-Florence Municipal Airport. Medical facilities include a 95 bed hospital as well as approximately 10 physicians. Educational facilities include five elementary and junior high and public high schools. Central Arizona College, a 2-year college located approximately 6 miles (9.6 km) west of Coolidge, offers a wide range of vocational and college preparatory courses.

Eloy

Eloy is located in the center of the Phoenix-Tucson "growth corridor" approximately 60 miles (96 km) south of Phoenix and 53 miles (85 km) north of Tucson. Eloy lies in the Santa Cruz Basin, one of the

State's most fertile agricultural areas. Within Eloy there are four industrial parks being developed to provide a more diversified economic base. Three manufacturing firms are already established. Eloy is located near Interstate 10 and State Routes 87 and 93 and is served by the Southern Pacific Railroad Company and Greyhound bus lines. Air facilities are available at the Eloy Municipal Airport. Educational facilities in the area include four elementary and two high schools.

Florence

Florence is located midway between the two major cities of Arizona-Phoenix and Tucson. One of the oldest cities in the State, it became the county seat of Pinal County in 1875. Florence is primarily an agricultural community producing cotton, cattle, sugar beets, grains and grapes. Florence has substantial government employment with several Federal agencies located in the community as well as the Arizona State Prison. Government employment represents approximately 24% of the total employment and mining activities provide 27% of the total employment. Mining operations will have a major impact on the Florence economy with the continued development of the CONOCO Copper Project. It is expected that approximately 1,600 to 2,000 permanent workers will be employed by CONOCO with the majority of the workers living in or moving to the Florence area.

Florence is located near Arizona Route 87 and 177 and has no regularly scheduled air passenger or air freight service, although charter service is available at the Coolidge-Florence Municipal Airport. Bus service in Florence is provided by Greyhound and railroad service is provided by Southern Pacific on a traffic demand schedule. Educational facilities in Florence include one elementary and junior high school (enrollment - 700) and one high school (enrollment - 300). Vocational education is available at the high school and community college level.

Central Arizona College is located about 16 miles (25.6 km) southwest of Florence and has an enrollment of about 5,000 students. Medical facilities in Florence include the 120 bed Pinal General Hospital which has three full-time physicians on its staff. There are seven physicians plus one dentist and one chiropractor maintaining practices in the city as well as two doctor-operated clinics and two locally owned pharmacies.

Gilbert

Gilbert is a small agricultural community approximately 25 miles (40 km) from Phoenix which produces a variety of agricultural products including cotton, sorghum, alfalfa, citrus and livestock. As a result of residential and commercial growth occurring in the Gilbert area, contract construction is an expanding economic sector. The community has a substantial retail sector which is also expanding to meet the goods and services needs of the area.

Transportation facilities include I-10 and Arizona Routes 60, 87, 89, and 93, Southern Pacific Railroad, Chandler Municipal Airport and Sky Harbor International Airport. Medical facilities include four hospitals and complete medical and dental services. Educational facilities include two elementary schools (enrollment - 1,576), one public high school (enrollment - 585), and Mesa Community College located 7 miles (11.2 km) northwest of Gilbert.

Glendale

Glendale, formerly a small agricultural community, has become a medium sized multi-based city. There are scattered areas of agricultural production and several small manufacturing firms also located here. Transportation includes I-17 and Arizona Routes 60, 87, and 93, Santa Fe Railroad, Sky Harbor International and Glendale Airports. Medical facilities include the Northwest Samaritan Hospital and complete medical and dental facilities. Educational facilities include three elementary school districts and eight high schools, as well as Glendale Community College and the American Graduate School of International Management.

Mesa

Mesa is located 16 (25.6 km) miles east of Phoenix and is sometimes called the market and tourist cross-roads city of the West. Transportation services are provided by Falcon Field Municipal and Sky Harbor International Airports, Southern Pacific Railroad, and interstate and intrastate trucking over five major highways. Agriculture and related enterprises furnish a year-round stimulus to the Mesa economy with a 52 week growing season. In addition, a variety of both large and small industrial operations are located in the city including metal fabrication, citrus packaging and food processing. Educational facilities include Mesa Community College, 4 high schools, 25 elementary schools, and 6 junior high schools. Medical facilities include 3 local hospitals with a total of 630 beds and many other available medical services.

Phoenix

Phoenix is the capital of Arizona and the hub of the State's population growth. Over half of the State's population lives in Maricopa County. It is estimated that more than five million travelers and tourists annually visit Phoenix and its environs. Phoenix has a varied and growing economy with manufacturing, agriculture, tourism, and service industries all playing an important role. Manufacturing activity in the Phoenix metropolitan area accounts for approximately three-fourths of all manufacturing activity in the State.

Educational opportunities in the Phoenix area are outstanding with over 100 elementary and high schools available. Maricopa County has 45 elementary school districts, 11 high school districts, and 11 unified (elementary-high school) districts. Post-high school education is offered at several schools within the city. Grand Canyon College, a 4 year liberal arts college, is owned and operated by the Arizona Southern Baptist Convention. Maricopa County Skill Center, Maricopa Technical Community College and Phoenix College offer programs in both technical and liberal arts fields of study.

Five major hospitals are located in downtown Phoenix and six other hospitals are located throughout the Phoenix metropolitan area.

Transportation facilities are available at the Sky Harbor International Airport (8 major airlines) which is 3 miles (4.8 km) from downtown Phoenix, and railway service offered by Southern Pacific and the Atchison, Topeka and Santa Fe.

Gila River Indian Reservation

The Gila River Indian Reservation is located in both Maricopa and Pinal Counties approximately 35 miles (56 km) south of Phoenix. The 372,000 acre (150,546 ha) reservation was established in 1859 for the Pima and Maricopa Indians living near the Gila River. The Gila River Indian Community (GRIC) headquarters are located at the community of Sacaton, one of 23 reservation settlements.

Agriculture is one of the principal economic activities of the Reservation providing approximately 10 percent of the Indian employment. There are approximately 36,000 acres (14,569 ha) in production of cotton, small grains, sorghums, and lettuce. Related industries involved in processing of agricultural products provide employment opportunities for reservation residents. Industrial and commercial activities have increased recently because of development of three industrial parks which are attracting manufacturing firms. Gila River Indian Enterprises is a wholly owned reservation-chartered corporation that manufactures heavy canvas goods under government contract. Current employment is approximately 90 persons with an annual payroll of $400,000. Dela Enterprises, located in the Pima-Coolidge Industrial Park, employs 85 persons in the manufacture of flares. Other economic activities include the Gila River Arts and Crafts Center. Tourism and recreation activities have increased as a result of the Firebird Lake and the Pima-Hohokam National Monument developments. Population of the reservation in 1976 is estimated to be 8,600. An additional 2,000 Gila River community members live adjacent to the reservation.

Education facilities include six elementary schools and two high schools with an estimated enrollment of 1,700 pupils. In addition, the Gila River Career Center at Sacaton offers vocational education in a variety of areas.

Medical facilities include the Indian Health Service Hospital at Sacaton with a staff of 70, the Department of Human Resources with a staff of 60, the National Institute of Health, and the American Indian Nursing Home of Maricopa Colony. Through these facilities, community health representatives operate programs in alcohol, drug abuse, and health education.

Ak Chin Indian Reservation

The Ak Chin Indian Reservation, located in Pinal County approximately 50 miles (80 km) south of Phoenix, was established in 1912 for the Maricopa Indians. The 21,840 acre (8,839 ha) reservation is primarily agriculturally oriented with approximately 5,000 acres (2023 ha) of cotton, wheat and small grains. Approximately 90 percent of the Indian employment is agriculture-related with the remaining employment in light industry and services.

Population of the Ak Chin Indian Community is 332 with approximately 50 percent of the community under 16 years of age. Educational facilities are available through the public schools in the community of Maricopa or the Indian boarding schools operated by the Bureau of Indian Affairs. Additional educational facilities are available at Central Arizona College, Arizona Junior College and the Gila River Career Center.

Medical facilities include the Indian Health Service Hospital at Sacaton on the Gila River Indian Reservation and the Phoenix Indian Medical Center in Phoenix.

Papago Indian Reservation

The Papago Indian Reservation is located in south-central Arizona and consists of three separate segments comprised of eleven districts. The main reservation and the largest community on the reservation is located at Sells, the Tribal Headquarters. The Gila Bend District is located northwest of the main reservation and the San Xavier District is located to the east near Tucson.

The population of the Reservation is estimated to be 8,500 with approximately 30 percent of this population within the Sells District. An additional 3,600 tribal members live near the reservation.

The major economic activities are ranching and agriculture which provide 42 percent of the employment. Thirty-two percent of the employment is provided by government agencies. Mining employment is expected to improve with the development of reservation copper deposits. The San Xavier District of the reservation has developed an industrial park.

Additional employment opportunities will result from expanding reservation construction activities. Construction of the Sells Livestock Complex and several tourism facilities will contribute to reservation development.

Educational facilities include one elementary and junior high school and Baboquivari High School which offers vocational education programs. Medical facilities include one 50-bed public health service hospital, eight doctors, two dentists and two community health medics.

APPENDIX C

1. AIR QUALITY
2. BIOTA
3. CULTURAL RESOURCES

Table C-1.1

Expected Pollutants Emitted by Commuter Vehicles Used for Transporting Tucson Metro Area Employees to the Jobsite Salt-Gila Aqueduct - Central Arizona Project

		Pollutants 1/		
Year	No. of Employees to Reach 4 2/	Carbon Monoxide	Exhaust Hydrocarbons	Nitrogen Oxide
1	0	0	0	0
2	0	0	0	0
3	20	91.7	7.1	11.7
4	20	91.7	7.1	11.7
5	10	45.9	3.6	5.9

1/ Pounds per day.

2/ Three employees per vehicle and 150 miles round trip.

Table C-1.2

Expected Pollutants Emitted by Commuter Vehicles Used for Transporting Florence-Coolidge Area Employees to the Jobsite
Salt-Gila Aqueduct - Central Arizona Project

	Number of Employees 2/			Pollutants 1/		
Year	Reach 3 3/	Reach 4 4/	Siphon 5/	Carbon Monoxide	Exhaust Hydro-carbons	Nitrogen Oxide
1	35			21.0	1.6	2.7
2	35			21.0	1.6	2.7
3	35	30	25	41.5	3.6	5.8
4		30	25	20.5	1.6	2.7
5	10	10	8	13.8	1.2	1.9

1/ Pounds per day.

2/ Three employees per vehicle.

3/ 20 miles round trip.

4/ 10 miles round trip.

5/ 15 miles round trip.

Table C-1.3

Expected Pollutants Emitted By Commuter Vehicles Used for Transporting
Phoenix Metro Area Employees to the Jobsite
Salt-Gila Aqueduct - Central Arizona Project

	Number of Employees 1/						Pollutants 2/		
Year	Reach 1 3/	Reach 2 4/	Reach 3 5/	Reach 4 5/	Pumping Plant 3/	Siphon 5/	Carbon Monoxide	Exhaust hydro-carbons	Nitrogen Oxide
1	90		40			25	438.3	34.0	56.0
2	90		40			15	389.4	30.2	49.8
3		45	40	30	60		529.1	41.0	67.6
4	30	45	10	30	60	5	471.4	36.5	60.2
5	30	15	10	10	20	5	242.7	24.7	31.0

1/ Three employees per vehicle.

2/ Pounds per day.

3/ 60 miles round trip.

4/ 100 miles round trip.

5/ 140 miles round trip.

Table C-1. 4

Total Expected Construction Equipment and Light Vehicle Pollutants Emitted
Salt-Gila Aqueduct - Central Arizona Project

	Operation 1/				Total Expected Pollutants (Tons)					
Equipment	Days/ Year	Yrs.	Units /Year	Total Equipment Days	Carbon Monoxide	Exhaust Hydro-carbons	Nitrogen Oxides	Oxidants	Sulfur Oxides	Particulates
Scraper-Loader	186	4	6	4,464	25.981	11.180	111.011	2.559	8.267	7.243
Drag-Line	150	2	1	300	0.497	0.189	2.725	0.037	0.171	1.675
Heavy Truck (over 10 tons)	200	4	10	8,000	43.034	13.968	244.095	3.598	14.533	8.184
Stone Crusher	200	4	2	1,600	2.653	1.007	14.533	0.196	0.913	0.892
Concrete Plant	200	4	3	2,400	3.980	1.511	21.800	0.294	1.370	1.338
Road Scraper	90	4	1	360	2.095	0.902	8.953	0.206	0.667	0.584
Water Truck	240	4	3	2,880	15,492	5,028	87,874	1.295	5.232	2.946
Backhoe	150	4	5	3,000	4.974	1.888	27.249	0.368	1.712	1.672
Light Vehicle 2/	240	4	23	22,080	48.191	3.736	6.158	--	--	--

Note: One day is equivalent to 8 hours

1/ USBR estimates.

2/ 50 miles per day.

Table C-2.1

Proposed Threatened or Endangered Plants Which May Occur Within the Alinement
Salt-Gila Aqueduct - Central Arizona Project

Family	Species	Proposed Status	General Locality	Typical Habitat and Elevation
Crassulaceae	Echeveria collomae	Endangered	Gila, Maricopa, Pinal, and Yavapai Co.	Rocky slopes and hillsides, 1550' - 6000'
Crassulaceae	Echeveria rusbyi	Endangered	Pima, Greenlee, Pinal, and Graham Co.	Rocky slopes and ledges in full or partial shade, 2500' - 5300'.
Fabaceae	Astragalus lentiginosus var. maricopae	Endangered	Maricopa Co.	Washes and roadsides, 1100' - 4300'
Cactaceae	Opuntia phaeacantha var. flavispina	Threatened	Pima and Maricopa Co.	Desert flats, washes, and hillsides, 1250' - 3500'
Cactaceae	Ferrocactus acanthodes var. Eastwoodiae	Threatened	Pima and Pinal Co.	Rocky ledges, 1300' - 3800'
Cactaceae	Neolloydia erectocentra var. ereotocentra	Threatened	Pima, Cochise, and Pinal Co.	Grassy hillsides, rocky slopes, washes, and alluvial soils, 1300' - 4300'
Cactaceae	Neolloydia erectocentra var. acunensis	Threatened	Pima, Maricopa, and Pinal Co.	Desert flats and hills, 1300' - 2300'
Asteraceae	Erigeron lobatus	Threatened	Pima, Maricopa, Pinal, Yuma, Coconino, Mohave, and Graham Co.	Rocky slopes, washes, roadsides, 1200' - 4000'
Asteraceae	Hymenoxys quinquesquamata	Threatened	Pima, Cochise, Pinal, Santa Cruz, and Navajo Co.	Roadside ditch, 1300' Pine-oak woodland, 5000' - 7500'
Asteraceae	Pectis rusbyi	Endangered	Pima, Maricopa, Pinal, and Yavapai Co.	Rocky slopes, eroded hillsides, roadsides, desert grasslands, associated with Larrea in some areas. 2500' - 4200'

Table C-2.2

Applicable Sections of
Arizona Native Plant Law

Arizona Revised Statutes, Chapter 7, Article 1. Protection
Section 3-901

B. The following shall constitute certain protected native plants that are prohibited from collection except for scientific or educational purposes under permit from the commission of agriculture and horticulture: Washingtonia filifera (fan palm), lysiloma thornberi (ornamental tree), bursera fagaroides (elephant tree), cereus schottii (senita or "old one"), cereus thurberi (organ pipe cactus), toumeya papyracantha, toumeya peeblesiana, neoevansia diguetii (dahlia cactus) pediocactus paradinei, all pediocactus species, all sclerocactus species and all agave arizonica.

C. The following shall constitute the protected group of plants:

1. All species of the following families: liliaceae (lily family), amaryllidaceae (amaryllis family), orchidaceae (orchid family), crassulaceae (orpine family), cactaceae (cactus family).

2. All species of the following genera: aquilegia (columbine), lobelia (lobelia), dodecatheon (shooting star), primula (primrose), fouquieria (ocotillo).

3. The following species: atriplex hymenelytra (desert holly), cercis occidentalis (western redbud), dalea spinosa (smoke tree), holacantha emoryi (crucifixion thorn), fremontia californica (flannel bush), pinus aristata (bristlecone pine), rhus kearneyi (kerney sumac), sapium biloculare (Mexican jumping bean) and sabastiana pavoniana (Mexican jumping bean).

4. The following species of live or dead plants or parts thereof shall include: prosopis juliflora (common or honey mesquite), prosopis pubescens (screwbean mesquite), cerecidium microphyllum (little leaf palo verde), cercidium floridum (blue palo verde), parkinsonia aculeatal (jerusalem thorn, long leaf palo verde), olneya tesota (ironwood tree).

Table C-2.3

Avian Species Observed in the Salt-Gila Aqueduct Area
Not on Community Transects
Central Arizona Project

Common Name	Scientific Name
Western Grebe	*Aechmophorus occidentalis*
Great Blue Heron	*Ardea herodias*
Canada Goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Gadwall	*Anas strepera*
Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
American Wigeon	*Anas americana*
Shoveler	*Anas clypeata*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Canvasback	*Aythya valisineria*
Lesser Scaup	*Aythya affinis*
Bufflehead	*Bucephala albeola*
Turkey Vulture	*Cathartes aura*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Swainson's Hawk	*Buteo swainsoni*
Ferruginous Hawk	*Buteo regalis*
Golden Eagle	*Aquila chrysaetos*
Marsh Hawk	*Circus cyaneus*
Caracara	*Caracara cheriway*
American Coot	*Fulica americana*
Common Snipe	*Capella gallinago*
Western Sandpiper	*Calidris mauri*
Roadrunner	*Geococcyx californianus*
Barn Owl	*Tyto alba*
Elf Owl	*Micrathene whitneyi*
White-throated Swift	*Aeronautes saxatalis*
Black Phoebe	*Sayornis nigricans*
Tree Swallow	*Iridoprocne bicolor*
Barn Swallow	*Hirundo rustica*
Common Raven	*Corvus corax*
Hermit Thrush	*Catharus guttatus*
Mountain Bluebird	*Sialia cunucoides*
Water Pipit	*Anthus spinoletta*

Source: Schwartzmann et al. 1976.

Table C-2.3 (Continued)

Common Name	Scientific Name
Solitary Vireo	*Vireo solitarius*
Brewer's Blackbird	*Euphagus cyanocephalus*
Great-tailed Grackle	*Cassidix mexicanus*
Lawrence's Goldfinch	*Spinus lawrencei*
Rufous-crowned Sparrow	*Aimophila ruficeps*
Lincoln's Sparrow	*Melospiza lincolnii*

Table C-2.4

Avian Species Densities in the Four Plant Communities
Salt-Gila Aqueduct - Central Arizona Project

	Birds/100 Acres/Month Plant Community			
	PVS	M	C	W
Unidentified hawk species			0.18	
Red-tailed Hawk *Buteo jamaicensis*				0.36
Rough-legged Hawk *Buteo lagopus*			0.09	
Harris' Hawk *Parabuteo unicinctus*	0.18			
Sparrow Hawk *Falco sparverius*	0.09		0.09	0.09
Gambel's Quail *Lophortyx gambelii*	18.09	7.36	12.18	24.36
Killdeer *Charadrius vociferus*			0.18	
White-winged Dove *Zenaida asiatica*	1.27	1.73	0.36	2.36
Mourning Dove *Zenaida macroura*	6.0	33.45	5.00	23.09
Ground Dove *Columbina passerina*		1.45		
Inca Dove *Scardafella inca*				0.18

Source: Schwartzmann et al. 1976.

Note: Data based on 11 month study period and includes only species observed from established transects. PVS = Paloverde-Saguaro M = Mesquite, C = Creosotebush, W = Wash.

Table C-2.4 (Continued)

	Birds/100 Acres/Month Plant Community			
	PVS	M	C	W
Screech Owl *Otus asio*	0.09			
Great Horned Owl *Bubo virginianus*				0.45
Burrowing Owl *Speotyto cunicularia*			0.18	
Lesser Nighthawk *Chordeiles acutipennis*	0.82	0.09		
Black-chinned Hummingbird *Archilochus alexandri*	1.09			0.36
Costa's Hummingbird *Calypte costae*	0.27			
Common Flicker *Colaptes auratus*	3.09	3.54	2.64	3.73
Gila Woodpecker *Centurus uropygialis*	2.54	1.73	1.00	8.64
Ladder-backed Woodpecker *Dendrocopos scalaris*	0.73	2.18	0.27	1.91
Western Kingbird *Tyrannus verticalis*	0.09	0.18	0.09	0.82
Cassin's Kingbird *Tyrannus vociferans*			0.09	
Wied's Crested Flycatcher *Myiarchus tyrannulus*	0.54	0.73		0.45
Ash-throated Flycatcher *Myiarchus cinerascens*	1.54	4.00	1.27	3.64
Say's Phoebe *Sayornis saya*		0.45	1.09	0.82

Table C-2.4 (Continued)

	Birds/100 Acres/Month Plant Community			
	PVS	M	C	W
Empidonax Flycatcher *Empidonax spp.*	0.18	1.45	0.36	0.64
Horned Lark *Eremophila alpestris*			0.27	0.09
Violet-green Swallow *Tachycineta thalassina*			0.09	0.09
Rough-winged Swallow *Stelgidopteryx ruficollis*				0.09
Cliff Swallow *Petrochelidon pyrrhonota*			0.36	
Verdin *Auriparus flaviceps*	8.0	9.7	3.54	12.45
Unidentified wren species			0.09	0.18
House Wren *Troglodytes aedon*	0.09		0.09	0.09
Bewick's Wren *Thryonames bewickii*		0.18		0.18
Cactus Wren *Campylorhynchus brunneicapillus*	8.45	19.9	5.36	15.64
Rock Wren *Salpinctes obsoletus*	0.45	0.09	0.09	0.27
Unidentified thrasher species			0.18	
Mockingbird *Mimus polyglottos*	0.09	2.00	0.45	2.91
Bendire's Thrasher *Toxostoma bendirei*	0.09	0.36	1.09	0.91
Curve-billed Thrasher *Toxostoma curvirostre*	3.09	4.91	2.54	6.00

Table C-2.4 (Continued)

	Birds/100 Acres/Month Plant Community			
	PVS	M	C	W
Crissal Thrasher *Toxostoma dorsale*		0.27	0.45	3.36
Sage Thrasher *Oreoscoptes montanus*			0.09	0.54
Robin *Turdus migratorius*			0.18	
Blue-gray Gnatcatcher *Polioptila caerulea*	0.09	0.18		0.18
Black-tailed Gnatcatcher *Polioptila melanura*	5.27	5.00	0.82	6.54
Ruby-crowned Kinglet *Regulus calendula*	0.36	0.18	0.45	1.18
Phainopepla *Phainopepla nitens*	0.09	0.91	1.54	20.09
Loggerhead Shrike *Lanius ludovicianus*	1.09	0.91	1.18	1.85
Starling *Sturnus vulgaris*	0.27	0.27	2.54	0.36
Bell's Vireo *Vireo bellii*		0.36	0.18	0.73
Gray Vireo *Vireo vicinior*			0.18	
Warbling Vireo *Vireo gilvus*			0.09	
Lucy's Warbler *Vermivora luciae*	0.27	2.73	0.36	2.09
Yellow Warbler *Dendroica petechia*		0.18	0.09	
Yellow-rumped Warbler *Dendroica coronata*	0.82	0.27	1.00	4.18

Table C-2.4 (Continued)

	Birds/100 Acres/Month Plant Community			
	PVS	M	C	W
Black-throated Gray Warbler *Dendroica nigrescens*		0.09	0.09	0.18
Townsend's Warbler *Dendroica townsendi*			0.27	0.18
MacGillivray's Warbler *Oporornis tolmiei*		0.54		0.09
Wilson's Warbler *Wilsonia pusilla*	0.09	0.64	0.18	0.18
House Sparrow *Passer domesticus*			0.09	0.18
Meadowlark *Sturnella spp.*	0.09	0.09	0.73	0.36
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*				0.18
Red-winged Blackbird *Agelaius phoeniceus*				0.09
Hooded Oriole *Icterus cucullatus*			0.09	2.73
Scott's Oriole *Icterus parisorum*	0.09			0.09
Northern Oriole *Icterus galbula*	0.18	0.18	0.09	0.27
Brown-headed Cowbird *Molothrus ater*	0.36	1.45	0.18	2.18
Western Tanager *Piranga ludoviciana*	0.09	0.09	0.09	
Cardinal *Cardinalis cardinalis*		0.09		0.09
Pyrrhuloxia *Pyrrhuloxia sinuata*		1.18		1.27

Table C-2.4 (Continued)

	Birds/100 Acres/Month Plant Community			
	PVS	M.	C	W
Black-headed Grosbeak *Pheucticus melanocephalus*				0.36
House Finch *Carpodacus mexicanus*	2.54	1.36	1.27	5.45
Green-tailed Towhee *Chlorura chlorura*	0.54	2.73	0.54	0.36
Rufous-sided Towhee *Pipilo erythrophthalmus*	0.09			0.27
Brown Towhee *Pipilo fuscus*	0.36	2.54	0.27	5.27
Abert's Towhee *Pipilo aberti*		0.36	0.09	
Lark Bunting *Calamospiza melanocorys*			1.9	
Unidentified sparrow species	0.18	0.09	0.18	0.82
Savannah Sparrow *Passerculus sandwichensis*		0.09		0.18
Vesper Sparrow *Pooecetes gramineus*		0.09	0.27	0.18
Lark Sparrow *Chondestes grammacus*		0.27	0.18	
Black-throated Sparrow *Amphispiza bilineata*	2.82	3.54	0.64	0.45
Sage Sparrow *Amphispiza belli*	0.45	0.82	1.18	0.54
Chipping Sparrow *Spizella passerina*	0.09		0.54	

Table C-2.4 (Continued)

	Birds/100 Acres/Month Plant Community			
	PVS	M	C	W
Brewer's Sparrow *Spizella breweri*	0.73	2.0	3.18	4.09
White-crowned Sparrow *Zonotrichia leucophrys*	0.45	3.0	1.45	2.0
Average Density/100 Acres/Month	73.5	121.3	63.1	181.3
Total Number of Species	47	53	63	65
Average Number of Species Occuring per month	18.1	21.1	19.6	24.5

Table C-2.5

Bird Species Observed by Month (February through December)
For All Plant Communities 1/
Salt-Gila Aqueduct--Central Arizona Project

	F	M	A	M	J	J	A	S	O	N	D
Red-tailed Hawk		X	X	X	X						
Rough-legged Hawk				X							
Harris' Hawk						X					
Sparrow Hawk		X							X		
Gambel's Quail	X	X	X	X	X	X	X	X	X	X	X
Killdeer										X	X
White-winged Dove				X	X	X	X				
Mourning Dove	X	X	X	X	X	X	X	X	X	X	X
Ground Dove		X	X	X	X		X	X			
Inca Dove									X		
Screech Owl							X				
Great Horned Owl					X	X	X				X
Burrowing Owl			X							X	
Lesser Nighthawk					X	X	X	X	X		
Black-chinned Hummingbird		X	X	X	X		X				
Costa's Hummingbird	X		X								
Common Flicker	X	X	X	X	X	X	X	X	X	X	X
Gila Woodpecker	X	X	X	X	X	X	X	X	X	X	X
Ladder-backed Woodpecker		X	X	X	X	X	X	X	X	X	X
Western Kingbird			X	X	X	X					
Cassin's Kingbird						X					
Wied's Crested Flycatcher		X		X	X	X	X				
Ash-throated Flycatcher		X	X	X	X	X	X	X			
Say's Phoebe	X	X	X					X	X	X	X
Empidonax Flycatcher			X	X	X	X	X	X	X		
Horned Lark	X										X
Violet-green Swallow			X	X							
Rough-winged Swallow			X						X		
Cliff Swallow						X					
Verdin	X	X	X	X	X	X	X	X	X	X	X
House Wren		X	X							X	
Bewick's Wren		X								X	
Cactus Wren	X	X	X	X	X	X	X	X	X	X	X
Rock Wren			X						X	X	
Mockingbird	X	X	X	X	X	X	X	X		X	X
Bendire's Thrasher	X	X	X		X	X	X		X		
Curve-billed Thrasher	X	X	X	X	X	X	X	X	X	X	X
Crissal Thrasher				X	X	X	X	X	X	X	X
Sage Thrasher		X	X								
Robin	X										
Blue-gray Gnatcatcher			X						X		
Black-tailed Gnatcatcher	X	X	X	X	X	X	X	X	X	X	X
Ruby crowned Kinglet	X	X	X							X	X
Phainopepla	X	X	X	X	X				X	X	X
Loggerhead Shrike	X	X	X	X	X	X	X	X	X	X	X
Starling		X	X	X	X		X	X	X	X	X
Bell's Vireo		X	X	X			X				
Gray Vireo	X										
Warbling Vireo				X							
Lucy's Warbler			X	X	X	X	X				
Yellow Warbler				X							
Yellow-rumped Warbler	X	X	X	X					X	X	X
Black-throated Gray Warbler									X		
Townsend's Warbler				X				X			
MacGillivray's Warbler			X	X							
Wilson's Warbler	X			X					X		
House Sparrow		X									
Meadowlark	X	X	X						X	X	X
Yellow-headed Blackbird								X			
Red-winged Blackbird									X		
Hooded Oriole				X	X	X	X				
Scott's Oriole						X		X			
Northern Oriole				X		X					
Brown-headed Cowbird			X	X	X	X	X				
Western Tanager						X	X				
Cardinal	X				X						
Pyrrhuloxia			X	X	X	X	X				
Black-headed Grosbeak				X		X					
House Finch	X	X	X	X	X	X	X	X	X	X	X
Green-tailed Towhee			X	X		X		X	X	X	
Rufous-sided Towhee								X	X		
Brown Towhee	X	X	X	X	X	X	X	X	X	X	X
Abert's Towhee		X	X		X						
Lark Bunting				X							
Savannah Sparrow			X								X
Vesper Sparrow		X	X						X		
Lark Sparrow		X		X					X		X
Black-throated Sparrow	X	X	X	X	X	X	X	X	X	X	X
Sage Sparrow	X	X	X					X	X	X	X
Chipping Sparrow			X							X	X
Brewer's Sparrow	X	X	X	X				X	X		
White Crowned Sparrow	X	X	X					X	X	X	X

1/ Compiled from Schwartzmann, et al. 1976.

Appendix C-3

Archeological and Historical Sites Recorded Along The
Salt-Gila Aqueduct Proposed Construction
Alinement and Related Facilities

Reach 1:

Site No.	Other Designations	Condition	Ownership	Description
AZ U:10:1(MNA)	NA15,610	Totally collected	Private	35 sherds and lithics distributed in 2 small (5 m diameter) loci; surficial; Hohokam-Yuman
AZ U:10:2(MNA)	NA15,611	No integrity	Private	Two concentrations (194 m, 52 m in diameter) of lithics and Gila Plain pottery; surficial; Hohokam
AZ U:10:3(MNA)	NA15,612	Fair, eroding	Federal & State	90 x 30 m sherd and lithic scatter, surficial; Sedentary Hohokam

Note:

"shallow deposition"	=	$<$ 30 cm cultural deposition
"moderate deposition"	=	30-50 cm cultural deposition
"deep deposition"	=	$>$ 50 cm cultural deposition
(MNA)	=	Museum of Northern Arizona
(ASM)	=	Arizona State Museum
(ASU)	=	Arizona State University

Source: Stein 1979

Reach 2:

Site No.	Other Designations	Conditions	Ownership	Description
AZ U:10:7(ASM) AZ U:10:4(MNA)	NA15,613	Fair, Building dismantled	Private	Historic house foundation, trough, out building and trash dating from the 1920s or 1930s; surficial; Anglo
AZ U:10:5(MNA)	NA15,614	Poor; Heavy sheet wash	State & private	Five low-density loci of sherds, lithics, ground stone; surficial; Sedentary - Classic Period Hohokam
AZ U:10:6(MNA)	NA15,615	Good, Relatively undisturbed	State	157 x 53 , scatter of 75 sherds and a few chert lithics; shallow deposition; late Colonial Period Hohokam
AZ U:10:11(ASM) AZ U:10:7(MNA)	NA15,616	Good: Relatively undisturbed	State	Small sherd and lithic scatter with possible roasting pit(s); shallow deposition; possible late Colonial, Sedentary and Classic Hohokam
AZ U:10:8(MNA)	NA15,617	Fair: Material eroding rapidly	State	225 x 75 m sherd and lithic scatter; shallow deposition; Classic Period Hohokam
AZ U:10:9(MNA)	NA15,618	Poor: Disturbed by cattle, construction and erosion	Federal and State	Possible habitation site which has been severly disturbed; undisturbed portion within direct impact area is surficial; Sedentary Period Hohokam
AZ U10:5(ASM) AZ U10:10(MNA)	NA15,619	Fair: Some sheet wash	State	170 x 75 m sherd and lithic scatter with two roasting pits; shallow deposition; Classic Period Hohokam

Reach 2: (cont'd)

Site No.	Other Designations	Conditions	Ownership	Description
AZ U:10:11(MNA)	NA15,620	Fair, Some sheet wash	State	155 x 61 m sherd and lithic scatter with roasting pit; shallow deposition; possible Sedentary-Classic Period Hohokam
AZ U:10:6(ASM) AZ U:10:12(MNA)	NA15,621	Fair, Partially destroyed, partially intact	State	Multi-component habitation site with pit houses, trash mounds; deep deposition; late Colonial - Sedentary Period Hohokam
AZ U:10:13(MNA)	NA15,622	Fair	State	22 x 20 m sherd and lithic scatter; shallow deposition; Sedentary Period Hohokam
AZ U:10:14(MNA)	NA15,623	Poor, Heavily eroded	State	70 x 50 m sherd, lithic and ground stone scatter; surficial; Sedentary Period Hokoham
AZ U:10:8(ASM) AZ U:10:15(MNA)	NA15,624	Fair, Partially destroyed, but pit(s) intact	State	Roasting pit(s) with low density of sherds, lithics, ground stone; pits deep (base 0.6m), Classic Period Hohokam; may be associated with habitation site that was destroyed by Vineyard Road Flood Retarding structure
AZ U:10:16(MNA)	NA15,625	Fair	State	24 x 8 m sherd scatter with small roasting pit; shallow deposition; Classic Period Hohokam

Reach 2: (cont'd)

Site No.	Other Designations	Condition	Ownership	Description
AZ U:10:52(ASU) Az U:10:52(ASM) AZ U:10:17(MNA)	NA15,626	Fair: Pits intact, but heavily sheet washed	State	Nine or more roasting pits scattered over large alluvial plain along intermittent washes; plainware, lithics, ground stone; shallow deposition; Hohokam
AZ U:10:18(MNA)	NA15,728	Good	State	30 m diameter, moderately dense concentration of artifacts; no features evident but may be present below several centimeters of cultural deposition; Hohokam

Reach 3:

Site No.	Other Designations	Condition	Ownership	Description
Az U:14:31(ASU) AZ U:14:2(MNA)	NA15,627	Fair: Features intact, but site area is sheet washed	State	Ball-court-shaped feature, 3 small rock rings and low density of artifacts on terrace above Queen Creek; shallow deposition; Classic and possibly Sedentary Hohokam components
AZ U:15:2(MNA)	NA15,628	Good; But little cultural material	Private	Four flake tools and two manos in an area 22 m in diameter; surficial; cultural affiliation unknown
AZ U:15:3(MNA)	NA15,629	Good: Relatively undisturbed	State	Dense concentration of sherds, lithics, ground stone in area 100 x 70 m; shallow deposition, Sedentary Period Hohokam
AZ U:15:4(MNA)	NA15,630	Good: Relatively undisturbed	Private	60 x 28 m artifact scatter; shallow deposition Hohokam

Reach 3 (cont'd)

Site No.	Other Designations	Condition	Ownership	Description
AZ U:15:5(MNA)	NA15,631	Fair: But Little cultural material	Private	Two roasting pits with several lithics, two manos, one Gila Plain sherd, possible Archaic and Hohokam site
AZ U:15:6(MNA)	NA15,632	Poor: May be result of secondary deposition	Federal	Small sherd and lithic scatter; surficial; Hohokam
AZ U:15:7(MNA)	NA15,633	Fair: Some erosion	Federal	Two concentrations of lithic material, shallow deposition, cultural affiliation unknown
AZ U:15:8(MNA)	NA15,634	Good: But little cultural material	Federal	25 x 17 m scatter of 25 sherds and one lithic; shallow deposition; Classic Period Hohokam
AZ U:15:18(MNA)	NA15,645	Poor: Adobe walls have fallen	Private	Sonoran-style-adobe house foundation marking the remains of a homestead received by Mexican-American in 1891
AZ U:15:28(ASU) AZ U:15:19(MNA)	NA15,645	Good: Relatively undisturbed	Federal	150 x 60 m artifact scatter; 2-3 roasting pits with sherds, lithics; shallow deposition; Classic Period Hohokam
AZ U:15:25(MNA)	NA15,661	Good, But little cultural material	State	Sleeping circle-sized rock ring measuring 3 m in diameter, one graver in association; surficial possibly Archaic
AZ U:15:26(MNA)	NA15,662	Good: But little cultural material	State	Sleeping circle-sized rock ring measuring 2.7 m in diameter, no artifacts in association; surficial; possibly Archaic

Reach 3 (cont'd)

Site No.	Other Designations	Condition	Ownership	Description
AZ U:15:48(ASM) AZ U:15:27(MNA)	NA15,663	Fair: Partially disturbed	State & Private	Cobble-walled structure measuring 24 x 12 m with dense concentration of artifacts; rock pile features; shallow deposition; Sedentary - Classic Period Hohokam
AZ U:15:28(MNA)	NA15,664	Fair: Gravitational erosion	State	Petroglyphs, 3-roomed structure and dense lithic remains; shallow deposition; Hohokam
AZ U:15:29(MNA)	NA15,665	Good: Relatively undisturbed	State	Low cobble platform or mound, 1-3 circular cobble rooms and small trash mound; moderate deposition Hohokam
AZ U:15:30 AZ U:15:15(ASM) AZ U:15:30(MNA)	NA15,666	Fair: Upper components disturbed	State & Private	Large habitation site with 30 or more structures, trash mounds, and petroglyphs; deep, although disturbed by agriculture; late Colonial - Sedentar Hohokam
AZ U:15:36(MNA)	NA15,672	Good: But little cultural material	State	4 m area with rock ring, roasting pit, two Gila Plain sherds, and 2 basalt flakes; shallow deposition; Hohokam
AZ U:15:38(MNA)	NA15,756	Fair: Some disturbance from military activity & construction	Federal, State & Private	Extensive, low density lithic scatter on benches above the Gila; surficial; cultural affiliation unknown

Reach 3 (cont'd)

Site No.	Other Designations	Condition	Ownership	Description
AZ U:15:7(ASU) AZ U:15:39(MNA)	NA15,771	Fair: Sheet washed	State	1000 x 250 m sherd scatter with discrete lithic concentrations, 3-10 m in diameter; shallow deposition; Late Colonial-Sedentary Hohokam
AZ U:15:3(ASU) AZ U:15:40(MNA)	NA15,772	Fair: Partially disturbed by road and vandalism	State	600 x 200 m sherd and lithic scatter with structure(s); deep; Classic Hohokam
AZ U:15:10(ASU) AZ U:15:41(MNA)	NA15,773	Good: Some sheet washing	State	100 x 50 m sherd and lithic scatter, material sparse; probably shallow; Colonial Hohokam
AZ U:15:11(ASU) AZ U:15:42(MNA)	NA15,774	Good: Some vandalism	State	600 x 375 m artifact scatter with 12 trash mounds from 10-20 m in diameter; calcined skull fragment canal, deep; Sedentary Hohokam
AZ U:15:12(ASU) AZ U:15:43(MNA)	NA15,775	Good: Some vandalism	State	800 x 600 artifact scatter with 3 trash mounds and possible reservoir 50 m in diameter; 2 oval stone ovens; deep; Sedentary Hohokam

Reach 4:

Site No.	Other Designations	Condition	Ownership	Description
AZ U:15:9(MNA)	NA15,635	Poor: May be partially destroyed by dam	State	175 x 150 m concentration of sherds and lithic along possible prehistoric canal; moderate deposition; Classic Period Hohokam
AZ U:15:10(MNA)	NA15,636	" "	State	40 x 34 m artifact concentration; shallow deposition; Sedentary - Classic Hohokam
AZ U:15:12(MNA)	NA15,638	" "	State	20 x 16 m artifact scatter with 3 cores 10 flakes, 1 Gila Plain sherd; shallow deposition; Hohokam
AZ U:15:13(MNA)	NA15,639	" "	State & private	App. 70 artifacts in concentration; shallow deposition; Hohokam
AZ U:15:14(MNA)	Florence 8:2 (Gila Pueblo) NA15,640	Destroyed No integrity	State & private	Two-story adobe pueblo recorded in 1928 but since destroyed by flood retarding structure; Classic Period Hohokam, possibly with pre-classic component
AZ U:15:15(MNA)	NA15,641	Destroyed: No integrity	Private	165 m area with hundreds of artifacts, possibl habitation site, destroyed by construction; Sedentary - Classic Period Hohokam
AZ U:15:16(MNA)	NA15,642	Poor: May be partially destroyed by dam	Private	Dense concentration of artifacts in area 100 x 80 m; possibly a trash area associated with habitation site; late Colonial - Classic Period Hohokam

Reach 4 (cont'd)

Site No.	Other Designations	Condition	Ownership	Description
AZ U:15:37(MNA)	NA15,643	Fair: Some vandalism	State	Dense concentration artifacts in area 180 x 140 m; two small trash mounds; pit houses may be present; but none found during testing; shallow deposition; Sedentary - Classic Period Hohokam
AZ U:15:17(MNA)	NA15,644	Intact	Private	The Florence Cemetery, still in use, contains several hundred gravesites; dates to 1910's: reflects diverse ethnic heritage of Florence
AZ AA:3:2(MNA)	NA15,647	Fair: Sheet washed	Private	Two small concentrations of sherds with one metate fragment; shallow or surficial; Sedentary - Classic Period Hohokam
AZ AA:3:3(MNA)	NA15,648	Poor: largely destroyed	State	Portion of prehistoric canal with a few artifacts in association; moderate deposition; Hohokam
AZ AA:3:4(MNA)	NA15,649	Good: Relatively undisturbed	State	Roasting pit with 40 plainware sherds, few lithics and several pieces ground stone; shallow deposition; Hohokam
AZ AA:3:5(MNA)	NA15,650	Good: Relatively undisturbed	State	App. 100 artifacts in an area 23 m in diameter; shallow deposition; Classic Period Hohokam
AZ AA:3:6(MNA)	NA15,651	Fair: Some sheet washing	State	24 m area of artifacts with roasting pit; shallow deposition; Classic Period Hohokam
AZ AA:3:7(MNA)	NA15,652	Poor: Structures dismantled, recent trash dumped on site	Private	Sewage treatment plant with Imhoff tank; portion of World War II military base at what is now the Coolidge - Florence Municipal Airport

Reach 4 (cont'd)

Site No.	Other Designations	Condition	Ownership	Description
AZ U:15:20(MNA)	NA15,653	Fair: Partially destroyed, partially intact.	State	125 m habitation site with trash mound, pits, possible canal and agricultural features; deep deposition, in excess of 1 m in some areas; Classic Period Hohokam
AZ U:15:21(MNA)	NA15,654 Mesquite Flats Ruin (Midvale Files, ASU)	" "	Private	60 x 45 m habitation site with perhaps 10 pit houses; deep, 0.6 m deposition; Late Colonial through Classic Period Hohokam
AZ U:15:22(MNA)	NA15,655	" "	Federal & private	100 x 90 m artifact scatter; moderate deposition; Classic Period Hohokam
AZ U:15:19(ASM) AZ U:15:23(MNA)	NA15,656	" "	Federal	Too large, dense trash mounds, adobe compound; moderate deposition; Classic Period Hohokam
AZ U:15:24(MNA)	NA15,657	" "	Federal	52 x 34 m artifact scatter; shallow deposition; Classic Period Hohokam
AZ AA:3:8(MNA)	NA15,658	Poor: Heavy sheet wash	State	75 x 48 m scatter of 10 Gila Plain sherds, one mano, five flakes; surficial; Hohokam
AZ AA:3:9(MNA)	NA15,659	Poor: Trampled by cattle	State	24 x 20 m sherd scatter; shallow deposition; Sedentary - Classic Period Hohokam
AZ AA:3:10(MNA)	NA15,660	Good: But little cultural material	State	24 m sherd and lithic scatter; shallow deposition; Sedentary - Classic Period Hohokam

Reach 4:

Site No.	Other Designations	Condition	Ownership	Description
AZ U:15:13(ASM) AZ U:15:46(ASM) AZ U:15:31(MNA)	NA15,667	Good: Relatively undisturbed	Federal, State & private	Extensive quarry and testing area with app. 30 rock piles believed to be agricultural features; surficial; Classic Period Hohokam
AZ U:15:32(MNA)	Remnant of Los Canales Ruin (midvale Files, ASU) NA15,668	Poor: Heavily sheet washed	Private	50 m area of pounding tools, sherds, lithics; shallow deposition; late Colonial - Sedentary Period Hohokam
AZ U:15:33(MNA)	Remnant of Los Canales Ruin NA15,669	Fair: Partially destroyed, partially intact	Private	90 x 75 m concentration of flakes, ground stone, sherds; habitation units may be present; deep; in excess of a meter in some of the areas tested; Sedentary - Classic Period Hohokam
AZ U:15:34(MNA)	NA15,670	Good	Private	Two concentrations of artifacts, 6 m and 14 m in diameter; sub-surface features may be present; moderate deposition; Sedentary - Classic Period Hohokam
AZ U:15:47(ASM) AZ U:15:35(MNA)	NA15,671	Good	State	12 m lithic scatter; surficial; cultural affiliation unknown, possibly Hohokam

Appendix C-4
Section 404(b) (P.L. 92-500) Evaluation
Queen Creek and Gila River Crossings
Salt-Gila Aqueduct, Central Arizona Project

A. Introduction

The Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) require a Corps of Engineers permit, under Section 404 of the act, for the discharge of dredged or fill material into navigable waters. The Clean Water Act of 1977 amended Section 404 by adding subsection(r) which provides a procedure by which Federal water projects may be exempted from securing a Corps of Engineers permit. As discussed in Chapter II.C.3.b., it is proposed to construct a siphon under the normally dry Gila River. This construction would require discharge of fill material around and over the siphon. On August 15, 1978, the Los Angeles District, Corps of Engineers, identified the Gila River as a stream which comes under Section 404 jurisdiction. Since Queen Creek, where flow would be restricted by the construction of Sonoqui Dike, may also be considered an intermittent stream, Section 404 jurisdiction may be exercised at some later date. Accordingly, it is intended that this EIS be used to qualify for exemption to the 404 permit process under Section 404(r), of P.L. 92-500, as amended. Information on the effects of discharge of fill material during construction of the proposed Gila River Siphon and Sonoqui Dike is included within the text of the statement.

B. Project Description

1. Description of Proposed Discharge of Dredged or Fill Material

a. Purpose

Gila River-- Siphons are conduits or pipes which carry aqueduct water under rivers and drainage channels. Along the length of the Salt-Gila Aqueduct, one siphon is currently proposed for construction. The Gila River Siphon would be approximately 3,400 feet (1,036 m) long. The siphon, if single barrel, would be about 18 feet (5.5 m) in diameter and made of either steel pipe, prestressed concrete pipe, or monolithic concrete pipe. The siphon would be buried in the stream channel at a depth to be determined by hydrologic studies. This depth could vary from 5 to 15 feet (1.5 to 4.6 m).

Queen Creek--A portion of Sonoqui Dike would cross Queen Creek. This dike would be about 8 miles (12.9 km) in length and control flood waters from 256 square miles (660 square km) of drainage area. Approximately 1,400 feet (427 m) of the dike would be located in the Queen Creek channel area. Storage volume behind Sonoqui Dike would be 8,500 acre-feet (10,500,000 cubic meters) and peak outflow would be 1,100 ft^3/s (31 cubic meters per second) to Queen Creek, and 120 ft^3/s (3.5 cubic meters per second) into a channel along the Magma Railroad. These outflows would cross the aqueduct by means of two overchutes. An undetermined portion of the runoff would be retained by the structure as infiltration. The watershed is estimated to yield about 4,600 acre-feet (5.6 million cubic meters) of sediment in 50 years, of which about 3,300 acre-feet (4 million cubic meters) would be deposited in the detention basin. The remaining 1,300 acre-feet (1.6 million cubic meters) would continue to pass downstream.

b. Location

Gila River--Section 15, T.4S., R.10E. GSRB&M (Figure 7)

Queen Creek--Section 23, T.2S., R.8E. GSRB&M (Figure 8)

c. Quality of Materials Proposed for Discharge

Gila River--Excavation of about 200,000 to 250,000 cubic yards (153,000 to 191,000 cubic meters) of material would be required for the buried siphon. The material excavated would be used for backfilling at the completion of construction.

Queen Creek--The construction of Sonoqui Dike with overchutes would require about 1,250,000 cubic yards (956,400 cubic meters) of fill material. Only about 60,000 cubic yards (45,900 cubic meters) would be placed in the Queen Creek channel area.

d. Method of Discharge

Gila River--During construction, a trench along the length of the siphon, approximately 100 feet (30.5 m) in width and up to 40 feet (12.2 m) in depth, would be constructed across the normally dry river channel. The siphon pipe would be placed in the bottom of the trench and the material excavated from the trench would be backfilled around the siphon. The fill material would be compacted by mechanical methods and water would be added as necessary, since the excavated material is normally too dry for optimum compaction. This water would likely be obtained from local wells.

Queen Creek--The Sonoqui Dike would be a rolled earth embankment.

2. Physical Effects (40 CFR 230.4-1(a))

a. Potential Destruction of Wetlands

No areas of wetlands, Types I-V, occur within the proposed construction area.

Effects On:

1. Food chain production--N/A
2. General wetland habitat--N/A
3. Nesting, spawning, rearing and resting sites for aquatic or land species--NA. About 35 acres (14 ha) of land usable by wildlife would be lost.
4. Wetlands set aside for aquatic environment study or santuary refuges--N/A
5. Natural drainage characteristics--N/A
6. Sedimentation patterns--N/A
7. Salinity distribution--N/A
8. Flushing characteristics--N/A

9. Current patterns--N/A

10. Wave action, erosion, or storm storm damage protection--N/A

11. Storage areas for storm and flood waters--N/A

12. Prime natural recharge areas--N/A

b. Effects on Water Column (40 CFR 230.4-1(a)(2))

The substrate of the riverbed is saturated only when surface water is present, since the depth to ground water was more than 140 feet (43 m) in the Gila River in 1972 (USBR 1976b). Since the riverbed is usually dry and there is no water column present, no physical impairment of the water column would occur due to construction or operation of the aqueduct siphon. Because the material to be backfilled around the siphon would be the same material excavated from the siphon trench, no chemical-biological interactive effects would occur.

Effects On:

1. Reduction in light transmission--N/A

2. Esthetic values--N/A

3. Direct destruction effects on nektonic and planktonic populations--N/A

c. Covering of Benthic Communities (40 CFR 230.4-1(a)(3))

Because the Queen Creek and Gila River crossing sites are located in normally dry streambeds, there is no benthic community or fishery which would be disturbed by the siphon and dike construction or operation.

d. Other Effects (40 CFR 230.4-1(a))

Queen Creek--The present geometry of the stream bottom upstream of the embankment and in the impoundment areas would be modified. The velocity of the water will be slowed resulting in a deposition of sediment in the impoundment area. Effects downstream of the embankment will not be significant.

Gila River--All excess excavated material would be removed from the river channel and the existing grade and bed elevation would be restored resulting in no change.

C. Chemical - Biological Interactive Effects (40 CFR 230.4-1(b))

1. Exclusion Requirement

The materials to be used in the construction of the protective dike and siphon meet the exclusion criteria as outlined in the 404 guidelines. The materials are of the naturally occurring rock material in the area with most particle sizes larger than silt and are from a source that is removed from sources of pollutants. Also, they would not be moved by currents away from their site of deposit. The concrete materials used in the manufacture of the siphon pipes would not result in pollutants being discharged in the river.

Except for temporary increases in turbidity during the construction period, constituents would meet applicable State and Federal water quality standards.

During construction the impacts associated with mixing of fill with stream water should not be significant. The sites of fill would be dewatered, if necessary, during construction. The fill would not be placed directly in the stream.

A request for water quality certification as required by Section 401, Public Law 92-500, as amended, would be submitted to the Arizona Department of Health Services and would be obtained prior to construction activities that require a Section 404 permit.

2. <u>Water Column Effects of Chemical Constituents</u>

   Not required under 40 CFR 230.4-1(b)(1).

3. <u>Effects of Chemical Constituents on the Benthic Community</u>

   Not required under 40 CFR 230.4-1(b)(1).

D. <u>Total Sediment Analysis (40 CFR 230.4-1(c)(1))</u>

The chemical make-up of the fill material to be discharged is not polluted, therefore, this analysis is not applicable.

E. <u>Biological Community Structure Analysis (40 CFR 230.4-1 (c)(2))</u>

The fill material contains no toxic materials that would adversely impact the biological community, therefore this analysis is not applicable.

F. <u>Alternatives Considered</u>

No action. Other water sources and locations were considered. These alternatives were rejected primarily for reasons of economics, environmental, engineering and/or lack of comparable functional capability.

G. Objectives to be Considered in Discharge Determination (40 CFR 230.5(a))

The Gila River Siphon site and a portion of the Sonoqui Dike site (Figures 63 and 66) are located in channels which contain flowing water only in response to flooding or localized heavy rains. Although historically the Gila River was a perennial stream and Queen Creek was an intermittent tributary of the Gila River, neither can be properly described as wetlands under the 1977 FWS classification system for wetlands and deep-water habitats of the United States (FWS 1977). According to the FWS criteria, wetland is defined "as land where the water table is at, near or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes"; or, lacking soils and vegetation, wetlands "can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deep water habitats" (FWS 1977). Neither hydric soil nor hydrophytic vegetation are present at the siphon site. Although surface water is occasionally present in both channels, its occurrence is not annual or regular, and neither site is located adjacent to or within vegetated wetlands or deep-water habitats.

Effects On:

1. Chemical, physical, and biological integrity of aquatic ecosystem (40 CFR 230.5(a)(1))--NA

2. Food Chain--No significant impact on the food chain is anticipated.

3. Diversity of Plant and Animal Species--The density of some plant and animal species may be reduced and some may increase.

4. Movement into and out of feeding, spawning, breeding and nursery areas--N/A

5. Wetland areas having significant functions of water quality maintenance--There will be no wetlands impacted.

6. Areas that serve to retain natural high waters or flood waters--There are no areas presently serving to retain natural high waters or floodwaters that will be impacted by proposed discharge of fill.

7. Turbidity--Turbidity increases during construction shall be kept to permitted increases under the prescribed water quality standards for the affected stream. Construction would take place when there would normally be very little or no flow and should, therefore, cause no harmful increases in turbidity. There would be the possibility of a dike being constructed while the siphon is installed. The material for the dike would be removed from the channel.

8. Esthetic, recreation and economic values--

Esthetics--All borrow and construction areas will be graded for drainage and appearance, and revegetated. Where possible, facilities are designed and constructed to fit with local esthetics.

Recreational and economic values--Very little recreation activity takes place in the areas affected by the proposed discharge of fill material.

9. Water quality (pollution)--

Construction activities will be in compliance with the Arizona Water Quality Standards and regulations specified in NPDES Permit, if required. The Bureau would also apply to the State for water quality certification.

H. Water Uses at the Proposed Disposal Site (40 CFR 230.5(b)(1-10)

1. Municipal water supply intakes--N/A

2. Shellfish--There are no shellfish populations in the Queen Creek and Gila River crossing sites which would be disturbed by construction of O&M activities.

3. Fisheries--N/A

4. Wildlife--

The two sites of discharge would have no effects on wildlife. Project impacts on wildlife are discussed in Chapter III. of the environmental statement.

5. Recreation activities

The impacts of the project on recreation are discussed in Chapter III. of the environmental statement.

6. Threatened or endangered species

There would be no impact on endangered or threatened species. Should any listed threatened or endangered plant species be discovered in the Queen Creek or Gila River crossing areas, the appropriate action would be taken as required by the Act.

7. Benthic life--N/A

8. Wetlands--N/A

9. Submersed vegetation--N/A

10. Size of disposal sites--N/A

11. Coastal zone management programs--N/A

I. Contamination of Fill Material if From a Land Source (40 CFR 230.5.d)

The fill material to be used in construction of the diversion structure is removed from sources of pollutants and would be free of contaminants.

J. Determine Mixing Zone

The impacts associated with mixing of fill with water would not be significant. The areas where fill is placed will be dewatered if necessary. Fill will not be placed directly in stream. The stream channel will be diverted from area of actual fill.

K. <u>Determine if 40 CFR 230 Precludes Discharge</u>

Placement of proposed fill material will not have an economic impact on navigation and anchorage if the proposed sites are used or not.

APPENDIX D

Pinetop,AZ 85935

January 15th 1979

Regional Diredtor

Bureau of Reclamation

Box 427

Boulder City NV

Re- Draft Environmental

Statement Salt-Gila Aqueduct

Central Arizona Proj.

Dear Sir.

Thanks for sending me the copy of the above statement.

I would like tokhow if the Reaches which have subsidence will be preF*** Consolidated as like reaches of the San Luis Canal of The Central Valley Project?. which were built in same type of Subsidence areas. in California Please send two copies of the Final Satement when released in June 1979. Thanks for sending me the copies for review.

Sincerely,

John R Nicholson

John R Nicholson

P.O. Box 779

Pinetop,AZ 85935

Reply to comments made by John R. Nicholson (January 15, 1979)

Reply:

As subsidence studies being conducted by the USGS are still under way, the exact method of construction through subsidence areas along the aqueduct has not yet been specified. However, as the subsidence in question is for the most part a slow continuous consolidation process over a large portion of the basin and occurring through variable depths, preconsolidation along the aqueduct would not be effective, except as it may be required in local areas where unsuitable foundation soils would require replacement and/or compaction to provide sound structural foundation for the aqueduct and its components.

To deal with the potential problems of general subsidence in these areas where it may occur, the aqueduct design will require provisions to allow for later modification suitable to reestablish necessary hydraulic grades when and if there is grade loss in the aqueduct due to the subsidence, or where there may be local failure caused by differential displacement. The latter would be more likely to occur in the peripheral areas of the subsidence basin where cracking or fissuring is apt to occur.

DEPARTMENT OF ENERGY
Western Area Power Administration
P.O. Box 200
Boulder City, Nevada 89005

JAN 30 1979

IN REPLY
REFER TO: G2200

Mr. Manuel Lopez, Jr.
Regional Director
Lower Colorado Region
Bureau of Reclamation
Department of the Interior
P.O. Box 437
Boulder City, Nevada 89005

Attention: LC150

Dear Mr. Lopez:

Your letter of January 4, 1979 transmitted a copy of the Draft Environmental Statement on the Salt-Gila Aqueduct. We have reviewed this Draft Environmental Statement and would like to present the following comments:

1. Article II.D.1. on page 14, paragraph 2 -- The first sentence of this paragraph should read "Delivery of power from the Navajo Generating Station to the Salt-Gila Pumping Plant would be made by the existing transmission facilities connecting Westwing, Pinnacle Peak, Mesa, and Coolidge Substations plus the new facilities or alternatives described in this statement." **1**

2. Article VII.D. -- Under the Alternatives to Proposed Action Section, an Item D should be added to cover the "Alternative Power and Transmission Facilities." The alternatives described in the September 15, 1978 letter to Mr. R. A. Olson from Mr. Manuel Lopez, Jr. (signed by Mr. Campbell) should be listed in this new section as alternatives. A copy of this letter is enclosed for your ready reference. **2**

Since the method of serving power to the Salt-Gila Pumping Plant is not yet firm, we feel it is imperative that the alternate proposals for supplying this power and energy be included in the Environmental Impact Statement.

Sincerely,

R. A. Olson
Area Manager

Enclosure

cc: Projects Manager
Arizona Projects Office
Department of the Interior
Bureau of Reclamation
Suite 2200, Valley Center
201 North Central Avenue
Phoenix, Arizona 85073

United States Department of the Interior
BUREAU OF RECLAMATION
LOWER COLORADO REGIONAL OFFICE
P.O. BOX 427
BOULDER CITY, NEVADA 89005

OFFICIAL FILE C
RECEIVED SEP 18 1978
Action: 620
Action Taken (Initials)

Date	Initials	To
		100
9/18		600
		620

File

IN REPLY REFER TO: LC-650
650.

SEP 15 1978

Mr. R. A. Olson
Area Manager
Western Area Power Administration
P.O. Box 427
Boulder City, Nevada 89005

Dear Mr. Olson:

The Arizona Projects Office is in the process of preparing design data for the Salt-Gila Aqueduct, which includes a transmission line to serve the Salt-Gila Pumping Plant. As proposed in the Environmental Impact Statement (EIS), the existing Mesa-Coolidge 230-kV Transmission Line would be tapped in the vicinity of Salt River Project's Thunderstone Substation and a small substation (Spook Hill Substation) would be constructed adjacent to Salt River Project's Thunderstone Substation. Major equipment at Spook Hill Substation would consist of a 230-kV power circuit breaker, 230/69-kV transformers, and disconnect switches. A 69-kV line would extend from Spook Hill Substation to the Salt-Gila Pumping Plant. The majority of the 69-kV line would be routed along Reach 1 of the Salt-Gila Aqueduct. Several alternative proposals have been made for serving the Salt-Gila Pumping Plant:

Proposal No. 1. Adding a 69-kV bay to the 69-kV bus in the existing Salt River Project's Thunderstone Substation and constructing a 69-kV line to Salt-Gila Pumping Plant. This would require wheeling over the Salt River Project's 230-kV system and may require additional transformer capacity at Thunderstone Substation.

Proposal No. 2. Routing the Mesa-Coolidge 230-kV Transmission Line into Salt River Project's Thunderstone Substation and adding the 69-kV features in Proposal No. 1.

Proposal No. 3. Having Salt River Project wheel power over their 230-kV and 69-kV systems to provide Central Arizona Project power and energy to the Salt-Gila Pumping Plant. This would require upgrading and extending an existing

Salt River Project 69-kV line that extends from Thunderstone to the vicinity of the Salt-Gila Pumping Plant and possibly providing additional transformer capacity at Thunderstone Substation.

We would appreciate your assistance in evaluating the above alternative methods of serving the Salt-Gila Pumping Plant, with a view towards making a decision by November 1, 1978. Although the above proposals appear to be the most viable alternatives, there may be other alternatives which we are unaware of and which you may wish to consider.

As discussed with Mr. Forman of your staff, personnel from this office and the Arizona Projects Office will be available to meet with you on September 22, 1978 in your offices at 10:00 a.m.

Sincerely,

Anthony J Campbell

Acting for Manuel Lopez, Jr.
Regional Director

In duplicate

cc: Projects Manager, Arizona Projects Office, Phoenix, Arizona
District Manager, Western Area Power Administration, Phoenix, Arizona

Reply to comments made by Department of Energy, Western Area Power Administration (January 30, 1979)

Reply No. 1:

The text has been changed to reflect this comment.

Reply No.2:

Power transmission facilities for the Salt-Gila Pumping Plant were originally described as alternatives in a working draft of the environmental statement. Details of the discussion were eliminated during the review process because the various power transmission arrangements are not true alternatives to the proposed aqueduct. If Reclamation makes a decision to construct power transmission facilities other than those described in the FES, an environmental assessment of that proposal would be made, and the appropriate actions taken to assure NEPA compliance. This would be accomplished in cooperation with WAPA and other interested agencies, based on information available at the time the decision must be made.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
AREA OFFICE
2500 WILSHIRE BOULEVARD, LOS ANGELES, CALIFORNIA 90057

REGION IX
450 Golden Gate Avenue
P.O. Box 36003
San Francisco, California 94102

January 22, 1979

IN REPLY REFER TO:

9.2SS

Office of The Regional Director
Administration Building
Bureau of Reclamation
Boulder, New Jersey 89005

Gentlemen:

Subject: Salt-Gila Aqueduct, Central Arizona Project
Draft Environmental Impact Statement

We have reviewed the captioned document and have no comments to offer on it. It will not be necessary to send this office a copy of the Final Environmental Impact Statement.

Thank you for the opportunity to review the document.

Sincerely,

Roland E. Camfield, Jr.
Area Manager

STATE OF NEVADA
GOVERNOR'S OFFICE OF PLANNING COORDINATION
CAPITOL COMPLEX
CARSON CITY, NEVADA 89710
(702) 885-4865

OFFICIAL FILE COPY

RECEIVED JAN 22 1979

Action:

Action Taken (Initials)

Date	Initials	To
		~~900~~
FBS	1-29	150

File

January 18, 1979

Mr. Manuel Lopez, Jr., Regional Director
United States Department of the Interior
Bureau of Reclamation
Lower Colorado Regional Office
P.O. Box 427
Boulder City, Nevada 89005

RE: SAI NV # NA - PROJECT: Salt-Gila Aqueduct

Dear Mr. Lopez:

Thank you for the opportunity to review the above-referenced project.

Since the proposed project is not within Nevada jurisdiction, the State Clearinghouse has no comment.

Sincerely,

Robert M Hill

Robert M. Hill
State Planning Coordinator

RMH:md

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

State Engineer's Office

BARRETT BUILDING CHEYENNE, WYOMING 82002

January 25, 1979

Copy sent to APO
200
400
600
700 2/1/79

Manuel Lopez, Jr., Regional Director
Bureau of Reclamation, U.S.D.I.
Lower Colorado Regional Office
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lopez:

The Draft Environmental Statement on the Salt-Gila Aqueduct, a segment of the Central Arizona Project (CAP) authorized by P. L. 90-537 on September 30, 1968 as a part of the Colorado River Basin Project Act, has been reviewed.

From the review, it is noted that this section of the aqueduct with an initial design capacity of 2,500 cubic feet per second and its service area is capable of utilizing all of the water delivered by the Granite Reef Aqueduct, the preceding adjacent section with a design capacity of 3,000 cubic feet per second. While this capacity supports a quantity of water which is within the limits of the amount of the State of Arizona's entitlement of Colorado River water as established by the Supreme Courts Decree in Arizona v. California, it would be of value if a summary were included listing all the diversions of Colorado River water made in the state.

The receipt of information relative to progress on the CAP and being afforded the opportunity to comment on documents relative to this work is appreciated.

Sincerely yours,

George L. Christopulos

GEORGE L. CHRISTOPULOS
State Engineer

GLC/llw
cc: State Planning Coordinator

Reply to comments made by Wyoming State Engineer's Office (January 25, 1979)

Reply:

A complete listing of all diversions from the Colorado River in each of the Lower Basin States of Nevada, California, and Arizona is reported annually, beginning in 1964, by the Bureau of Reclamation in compliance with Article V of the Arizona v. California decree. The report titled Compilation of Records in Accordance with Article V of the Decree of the Supreme Court of the United States in Arizona v. California Dated March 9, 1964 is published annually. This report is available from the Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada.

Reproduction of these published records was beyond the scope of this environmental statement. However, the requested summary is furnished as follows:

Summary of Uses of Lower Colorado River Mainstream Water Within The State of Arizona

(Acre-Feet)

Calendar Year	Diversions	Allowable Return Flows	Consumptive Use
1964	1,816,210	689,034	1,127.176
1965	1,687,535	679,004	1,008,531
1966	1,766,873	693,818	1,073,055
1967	1,816,889	709,995	1,106,894
1968	1,894,622	725,382	1,169,240
1969	1,886,541	748,456	1,138,085
1970	2,006,178	806,303	1,201,441
1971	2,085,575	790,605	1,296,930
1972	2,059,006	855,809	1,203,043
1973	2,099,840	831,096	1,268,744
1974	2,110,689	785,058	1,325,631
1975	2,126,468	768,465	1,358,003
1976	1,968,848	720,828	1,248,020
1977	1,917,981	686,707	1,231,274
1978	Data available about January 1980		

OFFICE OF THE DIRECTOR

United States Department of the Interior

BUREAU OF MINES
2401 E STREET, NW.
WASHINGTON, D.C. 20241

OFFICIAL FILE COPY

RECEIVED FEB 26 1979

Action Taken .... (Initials)

Date	Initials	To
		150

File

February 16, 1979

DES-79/1

Memorandum

To: Regional Director, Bureau of Reclamation, Boulder City, Nevada

From: Director, Bureau of Mines

Subject: Draft environmental statement, Salt-Gila Aqueduct, Central Arizona Project

A reconnaissance of this aqueduct route was made by engineers from the Bureau of Mines in the fall of 1967, and it was concluded that construction of this aqueduct would have no significant adverse effect on known mineral resources or on then existing mining activities. This was reported in memoranda covering mineral resources conflicts of the project to your Regional Director, Boulder City, Nevada, from the Bureau of Mines Denver office on March 4, 1968, and the Commissioner of Reclamation from the Director of the Bureau of Mines on October 19, 1971.

No additional information on mineral resources in regard to this segment of the project has come to our attention, and we concur with the statement on mineral resources on page 25 of the Summary Description that outside of the construction materials used no known mineral resources would be committed to the project.

We appreciate the opportunity to review your statement.

Roger Markle

Roger A. Markle
Director

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

STATE OF CALIFORNIA—THE RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

COLORADO RIVER BOARD OF CALIFORNIA
107 SOUTH BROADWAY, ROOM 8103
LOS ANGELES, CALIFORNIA 90012
(213) 620-4480

February 6, 1979

United States Department of the Interior
U. S. Bureau of Reclamation
Lower Colorado Regional Office
Post Office Box 427
Boulder City, Nevada 89005

Gentlemen:

We have reviewed the Draft Environmental Statement on the Salt-Gila Aqueduct (DES 79-1) filed with the Environmental Protection Agency on January 4, 1979, and have no comments. We appreciate the opportunity to comment on this draft environmental statement.

Sincerely yours,

M. B. Holburt

Myron B. Holburt
Chief Engineer

Advisory Council On Historic Preservation

1522 K Street NW.
Washington D.C.
20005

OFFICIAL FILE COPY

RECEIVED FEB 9 1979

Action:		
Action Taken (Initials)		
Date	Initials	To
2/9/79	CT	150

File copies to APC, W.O. E&R 200 400 600 700

February 6, 1979

Mr. Manuel Lopez, Jr.
Regional Director
Bureau of Reclamation
Lower Colorado Regional Office
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lopez:

This is in response to your request of January 4, 1979, for comments on the draft environmental statement (DES) for the proposed Salt-Gila Aqueduct, a feature of the Central Arizona Project.

It is apparent that the Bureau of Reclamation understands its compliance responsibilities under Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. Sec. 470f, as amended, 90 Stat. 1320), and will carry them out in the future. The Council, therefore, looks forward to working with you at the appropriate time.

Should you have questions or require assistance, please call Mrs. Jane King of the Council's Denver Office at (303) 234-4946, an FTS number.

Sincerely,

Louis S. Wall

Louis S. Wall
Chief, Western Office
Review and Compliance

Bureau of Reclamation

Lower Colorado Region

Memorandum

To: F. Phillip Sharpe   Date: 2-14-79

From: Ms. Sharon Paris

Subject: Telephone Conversation

Participants

Ms. Sharon Paris, Lower Colorado Region, Bureau of Reclamation

Mrs. Copeland, National Center, Geological Survey

Summary

The Geological Survey has no comments on DES 79-1

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Phoenix Service Office
Arizona Bank Building
101 North First Avenue, Suite 1800
Phoenix, Arizona 85003

February 8, 1979

OFFICIAL FILE COPY
RECEIVED FEB 12 1979
Action:
Action Taken (Initials)

Date	Initials	To
2/12/79	C1	150

File

copy to APO, W.O., ERC
200, 400, 600,
700

1521

United States Department of the Interior
Bureau of Reclamation
Attn: Manuel Lopez Jr., Regional Director
Lower Colorado Regional Office
P.O. Box 427
Boulder City, Nevada 89005

Subject: Draft Enviroment Statement for the Salt-Gila Aqueduct-
A Feature of Central Arizona Project.

This is in reply to your request to review the above titled Draft Enviromental Statement.

After study and review of the draft and the area encompassed by the project, we find there are no serious adverse impacts that would effect those areas covered by this office.

We appreciate the opportunity to review and comment on the draft statment.

John Evans

John Evans
Supervisor

Scott M. Matheson
Governor

Kent Briggs
State Planning Coordinator

OFFICIAL FILE COPY

RECEIVED FEB 12 1979

Action:

Action Taken .... (Initials)

Date	Initials	To
		150

File

Copy to APO, W.O., ERC, 200, 400, 600, 700

STATE OF UTAH
Office of the
STATE PLANNING COORDINATOR
118 State Capitol
Salt Lake City, Utah 84114
(801) 533-5245

February 8, 1979

Anthony D. Campbell
Acting Regional Director
U.S. Dept. of the Interior
Bureau of Reclamation
Lower Colorado Regional Office
P.O. Box 427
Boulder City, Nevada 89005

Dear Mr. Campbell:

The Utah State Environmental Coordinating Committee has reviewed the Environmental Statement on the Salt-Gila Aqueduct. The Committee offers no comment.

Thank you for the opportunity to comment.

Sincerely,

Lorayne Tempest

Lorayne Tempest
Assistant State Planning Coordinator

LT/jb
790129088

IN REPLY REFER TO

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ARIZONA STATE OFFICE
2400 VALLEY BANK CENTER
PHOENIX, ARIZONA 85073

Arch CAP

FEB 16 1979

Memorandum

To : Regional Director, Lower Colorado Regional Office, Bureau of Reclamation, Boulder City, Nevada 89005

From : State Director, BLM, Arizona

Subject: Review of Draft Environmental Statement - Salt-Gila Aqueduct, Central Arizona Project

We are pleased to submit to you review comments on the Draft Environmental Statement and the Summary Document.

Summary Document:

Page	Comment	
11	7. Biota. - Add to the summary an indication of the significance of the high densities of desert tortoise, highest known in Arizona (L. M. Porzer and J. Swartzman, ASU). We understand the Gila monster densities at Queen Creek are significantly high.	1
12	7.6 Wildlife, and DES page 74, paragraph 2. - The principal impact will be long term over a large area, but not necessarily because of construction activities only. Loss of habitat results in fewer individuals in the future generations. The barrier to migration created by the canal will change large mammal use patterns of the surrounding area, thus impacting the habitat.	2
13	Paragraph 1. - The drowning hazard is quite important and should be so emphasized.	3
	Paragraph 3. - The wildlife oases are an enhancing measure which is worthwhile, but they will not necessarily benefit 95% of the affected species because they are adapted to xeric conditions. Consequently, the oases will not substitute for the lost desert habitat.	4
	Paragraph 4, and DES page 130. - Although reseeding will be carried out, the success appears to be overstated, and the program does not appear to address the replacement of long-lived perennial saguaro and palo verde which are very important ecological constituents.	5

Page

18 The adverse impacts shown in Table I do not correspond to those shown in the body of the draft environmental statement. **6**

Draft Environmental Statement

13 Item 5c., First paragraph, last sentence should be clarified to include the participation of R/W issuing authorities and parties in the relocation negotiations. **7**

24 Item 3. - Change the first sentence to read: "Fire control of lands under the jurisdiction of the Bureau of Land Management is generally accomplished by personnel of that agency aided by the Rural Metro Fire Department under a proposed working agreement." **8**

58 Item 1. Vegetation. - This section is basically adequate although it lacks information which would provide a more complete understanding of the vegetation. A map showing where the transects are located would indicate how complete the coverage is along the aqueduct alignment. **9**

BLM's policy on threatened and endangered plants is that the proposed species are also provided full protection under the Endangered Species Act. Did Schwartzmann's study involve any on-site inspection for the species listed in Table C-2.1 within lands administered by BLM? Did any studies occur specifically to locate threatened or endangered species, or were they just watched for while the transects were run? **10**

Fol. 61 Figure 59. - The vegetation types in this figure do not correspond directly to the plant community discussions. **11**

66 Paragraph 3. - Thirty-four animal units/year are estimated to be lost. Does this take into consideration the reduction of ephemeral production downstream from the aqueduct, including lands which are not administered by Bureau of Reclamation? If not, this should be calculated.

67 Paragraph 4. - The significance of the creation of more xeric conditions between the major drainages downstream of the aqueduct has not been addressed. Also the extent of that influence should be discussed and quantified since it will change the carrying capacity for both native fauna and domestic livestock on lands administered and owned by other than Bureau of Reclamation. **12**

74 Paragraph 3, and Page 85, Paragraph 3. - The drowning aspect is very serious and continual and is not treated as such. The mitigation to this provided by the non-skid longitudinal brush finish on the upper five vertical feet of the lining is made to appear more effective than it will likely be. There are very few small mammals and reptiles that **13**

are able to escape a flow of 2500 c.f.s. Certain moisture-seeking snakes (Lampropeltis, Leptotyphylops, and Thamnophis) will be the most severely impacted by the aqueduct, as they seek out and prefer moist areas. In addition, the habitat modification created by bisection of ephemeral drainages will impact these species as the lessened amount of moisture downwash from the aqueduct will create lessened total acres of suitably moist habitat.

---

76 Paragraph 1 and elsewhere. - The proposed mitigation measure which will establish oases and water catchments will create an additional series of environmental effects. They will create artificial habitat that will favor increases of moisture-related flora and fauna. **14**

The number of species that would benefit are few. in addition, by favoring large increases of these few moisture-related species, ecological imbalance will occur. Many of the natural food chains and predator/prey relationships will be disrupted or altered--perhaps to the degree that all but a few species could be disadvantaged. This will not really replace or mitigate the lost xeric habitat.

---

76 Harris hawks have been found on BLM land immediately south of the proposed Butte Dam site. This locality includes one of the two highest densities of this rare raptor in Arizona. It is the only site on BLM lands. The other high density site is on private lands in the Cave Creek vicinity slated for development. Since the Cave Creek population is likely to undergo stress and numbers reduction, the population immediately south of the proposed Butte Dam is very important to the species. **15** The dam could directly affect Harris hawk nesting habits and prey base. Other long-term impacts would be the high-intensity use of lands surrounding the new reservoir, especially during the spring-summer nesting season.

---

79 Was Dr. Ohmart's 1975 study a general study covering all the vegetation distributed along the canal, or was it a specific study addressing each specific vegetative association along the canal system? Data obtained **16** from general surveys or inventories cannot be used directly to indicate impacts on specific habitat systems.

---

81 Paragraph 5. - Native amphibians are adapted to the desert environment and occur throughout the area. In addition to the stock tanks, they use **17** naturally ponded rainwater for breeding. Dirt tanks have provided additional habitat and therefore larger populations.

---

82 Paragraph 2. - Impacts from the loss of dirt tanks would only affect populations artifically supported by dirt tanks--not the natural population **18** structure.

---

86 Table 20. - The title should be modified to include the concept that **19** these species are in addition to the species collected.

Page

86 Table 20. - The accepted generic name for the Chihuahua whiptail is (Cnemidophorus exanguis (Stebbins, 1966). 20

87 We suggest that you check the status of Lampropeltis getulus splendida. Approximately one year ago, we were requested to provide input on the population status of this subspecies of kingsnake. 21

88 Paragraph 3. - The probability of Gila monsters surviving submergings in the aqueduct is very slim because their ability to remain submerged is not necessarily effective in water moving at 2500 c.f.s. The mitigation methods listed in this section will not mitigate Gila monster drownings. 22

88 The bisection of the washes by the aqueduct will seriously reduce the intermittent water downstream of the aqueduct. This will affect the foraging capacity of desert tortoises, among other species. 23

121 H. Other Agency Programs. - The proposed Butte Dam and reservoir is in the area of two BLM wilderness program Inventory Units (Initial inventory, January/February 1979). Both of these Units (which are roadless areas of over 5,000 acres) are presently slated for the Intensive Inventory stage to further examine their potential for future evaluation for wilderness. 24

122 Item 1a. First column last sentence should read "The area is within its Central Arizona Planning Unit." In the 3rd column, the first sentence is an unsupported conclusion. We do not expect any change to the disposal program. The aqueduct may further fragment land patterns. 25

129. An additional mitigation measure which we believe is necessary is the construction of an 18" barrier the length of both sides of the aqueduct to keep the desert tortoise and Gila monster out. 26

A mitigation measure which should be considered is to cover the aqueduct. This would eliminate the long-term mortality and interference with mammal movement. It would also prevent loss of significant amounts of water by evaporation.

Chapter IV.

The unavoidable impacts for visual, vegetative, wildlife, agricultural, socioeconomic, and some of the recreational resources that were discussed in the preceding chapter are not identified. Those adverse impacts that are mentioned should be quantified. 27

We hope the information contained in this reply will be useful in the preparation of the Final Statement.

Associate

cc:
WO (260)
DM, Phoenix District

Reply to comments made by Bureau of Land Management (February 16, 1979)

Reply Nos. 1 and 2:

The text of the Summary Description has been changed in Section B.7.b. to reflect comments 1, 2 and 3.

Reply No. 3:

See reply No. 13.

Reply No. 4:

See reply No. 14.

Reply Nos. 5 and 6:

The text of the Summary Description has been changed in Section B.7.a. to reflect these comments.

Reply No. 7:

The text in Chapter II.C.5.c. has been changed to include the right-of-way issuing authorities.

Reply No. 8:

The text in Chapter II.I.6.h. has been changed to reflect the Bureau of Land Management fire control practices.

Reply No. 9:

Chapter III.C.1. has been rewritten and subsection b. Vegetative Analysis has been added to provide a more complete understanding of the vegetation. An additional map was not considered appropriate since a transect map is included in the published report.

Reply No. 10:

The ASU study (Schwartzmann et al., 1976) was undertaken prior to the listing of the proposed Threatened and Endangered Plants and no subsequent studies have been undertaken to discover if these plants do exist along the alinement except for a literature search for the species listed in Appendix Table C2.1. If any of the proposed plants are encountered on BLM lands Reclamation will comply with BLM policy.

Reply No. 11:

The text in Chapter III.C.1.b. has been changed to explain more clearly the difference between vegetation types and plant communities.

Reply No. 12:

This comment addresses the concept of loss of ephemeral vegetation between drainages downstream of the aqueduct due to a reduction of sheet runoff. In general terms sheet runoff occurs during heavy rainstorms on soils which are not capable of entirely absorbing the quantity of water generated by the storm. This excess water flows over the soil surface and into natural drainages and is carried off downstream. As production of ephemeral vegetation is dependent upon plant available soil moisture (i.e. absorbed moisture) in some instances the water which runs off has no value for the ephemerals. The sheet runoff does have a value for the maintenance of the vegetation along the drainages and this aspect has been addressed in the statement. The loss and/or gain of ephemeral production has not been quantified.

Reply No. 13:

The Bureau recognizes the impact but believes that non-skid finish will reduce the impact. The text also addresses additional escape devices in Chapter III.C.2.a. which will help reduce drowning losses.

Reply No. 14:

The oases are presented as mitigation for disturbance to wash habitats. The water catchments, while artificial in nature, have been used very effectively by game management agencies, including the Arizona Game and Fish Department and Bureau of Land Management to obtain and enhance wildlife populations, without causing an ecological imbalance.

Reply No. 15:

The area under discussion is outside the Salt-Gila Aqueduct impact area. In the eventuality that construction of Buttes Dam would effect Harris Hawk populations, the impacts would be displayed in an environmental statement. It is also assumed that BLM will continue to manage BLM lands so as to eliminate such problems as destruction of nest sites by recreationists or general habitat destruction such as overgrazing.

Reply No. 16:

Dr. Ohmart's 1975 study was a general study of the vegetation. Although it is recognized that the data obtained from such studies cannot be used directly to calculate specific impacts, data are included to provide the nontechnical reader an appreciation of the potential construction impacts on two well recognized wildlife species and their habitats.

Reply No. 17:

The text in Chapter III.C.2.c. has been changed by including naturally ponded rainwater as habitat for amphibians.

Reply No. 18:

These tanks are now a part of the existing habitat and are very important components to the natural populations.

Reply No. 19:

The referenced table is explained in the preceeding text (III.C.2.d.).

Reply No. 20:

In this statement, *C. sonore* is a synomym for *C. exanguis*.

Reply No. 21:

We re-checked the status of this species and found that it occurs in elevated grassland in southeast Arizona. Because of the dissimilar habitats and lower elevation of the project area, it is extremely unlikely that this snake will be affected.

Reply No. 22:

The volumetric flow rate (ft 3/s) is not a measure of the velocity of the water in the aqueduct. As discussed in the statement the maximum expected velocity of water in the aqueduct is about 3.7 feet per second. As to the probability of Gila monster drownings, a Reclamation contracted study (Cross, per. com.) indicates that the Gila monster, like every other lizard ever tested, is capable of propelling itself through the water and is likely to have few problems with the expected water velocities in the aqueduct. However, during operation, the aqueduct will be monitored for wildlife drownings. Should such drownings prove to be a problem, Reclamation would develop feasible programs to minimize the losses of wildlife.

Reply No. 23:

See Reply No. 12.

Reply No. 24:

This area is not within the scope of this statement.

Reply No. 25:

The text in Chapter III.H.1.a. has been changed to reflect BLM's expectation of no change in the disposal program.

Reply No. 26:

In California, an 18 inch tortoise barrier has been found to be ineffective. However, should an effective and acceptable design be developed, it may be used in areas of high tortoise density or where significant losses occur.

Covering the canal has been studied and the idea rejected primarily due to cost factors. The potential for wildlife losses in the Salt-Gila Aqueduct area does not justify the expense. Wildlife mortality can be more effectively mitigated through the proposed measures.

Reply No. 27:

Chapter IV has been revised to include a discussion of the residual impacts that are identified in chapter III.I. Additional quantification has been supplied where obtainable, but it is not possible to quantify all impacts prior to actual construction.

DAVID E. CREIGHTON, JR., P.E. 7308 E. Fillmore St. Scottsdale, AZ. 85257

February 16, 1979

LACO 5 6 . 1

Mr. Manuel Lopez, Jr.
Regional Director
Bureau of Reclamation
P.O. Box 427
Boulder City, NV. 89005

Copy to APO

Dear Mr. Lopez:

The modified format used to present the environmental impacts for the Salt Gila Aqueduct Draft Environmental Statement enables a more rapid comparison and grasp of the specific environmental components than earlier formats.

There are several items where the discussion and presentation is not clear and the omission of a descriptive quantification hinders impact interpretation.

Clarification is needed for the Sonoqui Dike or the SCS Lower Queen Creek Watershed Project, and the relationship to the aqueduct for the area of the detention basin, the extent of supplemental borrow from the detention basin area and vegetation impact, the responsibility for environmental statement coverage, and the reality of probable construction agency. **1**

The water rights aspects incumbent in the retarding structure water storage should be integrated into the discussion and relation to SCS and RWCD. From the information given, this area of the report appears deficient. **2**

II.I.5.b., p.21. Is the probability of floodflows on the Gila River really "extremely low", or is it that no unusual problems may be anticipated from the periodic uncontrolled flows escaping Ashurst-Hayden and passing the siphon site. Closer agreement should show with the Surface Water discussion on page 41. **3**

The relationship of the connection to the Buttes Supply Canal and the San Carlos Project in relation to the commitment made in the overall CAP FES needs clarification. **4**

A more complete presentation should be made of the alternative operation possibility of using surplus Colorado River flows to the extent of system capacity for groundwater recharge to assure Arizona is able to fully utilize its adjudicated Colorado River water. It appears that during some years of surplus waters on the Colorado River, that a portion of Arizona's entitlement would spill to the Gulf of Lower California in the absence of jointly planned arrangements and procedures to insure that supplies are used during low use demand seasons (December, January, February). **5**

A summary tabulation would display more adequately the total R-O-W area of 5870 acres showing information by reaches for land use, vegetation community and impacts which range from complete alteration for the construction and facility location through disturbed for detention basins subject to hypothetical short-term immersion, the impact of spoil areas (520 acres), and the Sonoqui Dike and Reach 4 detention basins. **6**

A discrimination of short-term disturbance between mechanical and floodwater retarding would be informative. A suggested revision format based on Table 13 to display the total habitat groups and impacts for the total R-O-W is enclosed. 7

Table 12 (p. 62) and the examples presented in Tables A and B (p.80) indicate the problem present with sampling and statistical data presentation. The lack of specific plant identification of saguaro in the palo verde-saguaro community and only 5% palo verde while the creosotebush at 11% cover is greater than the 10% creosotebush cover in the creosotebush community causes a confusion of statistical data and descriptive discussion. Review of Tables A and B which appear to be late inserts appear to use breeding pair data from Table 17 to project direct population impacts. Clarification or qualification is suggested for both these examples. 8

The Maricopa County Oasis Park (p. 120) has no size reference to place the 3.4 acre segment required for R-O-W in perspective for impact. The lack of a clear quantification and summarized urban land use values is indicated by the differing values indicated or implied. 9

The tabulation for III.D. Land Use and the 1 through 5 tabular display followed by the textual display for 6, 7, 8, and later G. Recreation does not provide a uniform quality of presentation or ease in evaluating qualitative information. 10

III.H.2.a. (p. 124) should identify that 220 acres of irrigated lands are leased. The relation of the Department of Energy, Western Area Power Administration should be added to III.H. 11

Additionaly, a suggested consolidation of the land use and ownership data by reaches is enclosed. A display of this nature would assist in clarifying otherwise seeming inconsistent areas for Sonoran desert vegetation, desert range, urban, and irrigation and their relation to the aqueduct and insure that where multiple use is made of land that this may be indicated with some degree of quantification. The page 139 reference to Lower Sonoran vegetation for the Salt Gila Aqueduct and total CAP area appears inaccurately simplistic for a complicated subject and project. The inclusion of urban and agricultural lands as Lower Sonoran is improper. The use of values of 61,500 acres on pp. 137, 139, the sum of 62,500 acres for Table 34A, p.140, and 56,800 acres on p. 143 for seemingly the same value should be reconciled. With the apparent spread of 3975 acres between the identified impacted areas of 1745 acres displayed in Table 13, p. 63, and the 5420 acres used on p. 148 and numerous other locations should be clarified. 12

VII.A.2. p.155, par 3. The "local moderate adverse impacts" would extend to a regional impact on power resources and the attendant energy related factors of fuel, cooling water, and transmission systems for a comparable level of air conditioning. 13

In the Alternatives discussion, the historical perspective should include a reference based on Figures 39 and 40 and reference 6.42 from the INT DES 76-17 (Orme Dam) which indicate that a predecessor Salt Gila Canal was contemplated prior to 1897 (U.S.G.S. Water Supply and Irrigation Paper). 14

I would appreciate receiving a copy of the FES, the individual biological resource study reports mentioned on page 58 anda copy of Dr. Ohmart's raptor study.

I recommend that this statement be expeditiously processed with these comments through the FES phase in order to expedite the construction of the Salt Gila Aqueduct and completion of this long planned comprehensive water resource project which has been too often delayed and hampered for inconsequential reasons.

Sincerely,

D. E. Creighton, Jr.

D. E. Creighton, Jr.

Enclosures: 2

Table 13

Estimated Acreage of Impacted Areas Within the Right-of-Way for Each Habitat Group and Plant Community 1/
Salt-Gila Aqueduct--Central Arizona Project

Habitat Group	Permanent Loss	Long-Term Disturbance 2/	Short-Term Disturbance Mechanical Inmersion (Esplit out)	No Disturbance	Sub Total	Total
Desert Plant Community						
Creosotebush	750	345	120	—	1,215?	—
Paloverde-Saguaro	225	70	30	—	325?	—
Mesquite	--	5	10	—	15?	—
Wash	10	150	30	—	190?	—
Sub Total	985	570	190	—	1,745	5420?
Urban	~~200~~ pg 148 ~~150~~ 50? ~~200~~	--	--	--		50? 150? to 200+
Irrigated Agriculture pg 128, 128, 148	400	--	--	--		400
Total	?	?	?	?		5,870 Table 34 p. 128 148 pg 14, 17, 137, 139, 142

Apod. route 6± miles x 200' ÷ 5280 ÷ 43560 = 145 acres

Florence Gardens. ? P — Purchased lots. ?

Note: An additional area downstream from the aqueduct would be impacted by the severance of ephemeral drainages. The actual number of acres affected would depend on the final design of cross drainage structures.

1/ Vegetative communities as defined by Schwartzmann et al. (1976).

2/ Areas with long-term vegetative disturbance may require 30 years or more for recovery of near-natural conditions.

SALT-GILA AQUEDUCT
Land Use and Ownership
(acres)

	Reaches 1	2	3	4	TOTAL
Land Use				pg 148	5420 400 200 6020 5420? pg 147, 148
Desert Range *	X	X	X	X	
Urbanized	X 250± pg 94	X	X 30± pg 94	X 200 p 148	50 ? 270± pg 94
Irrigation pg 122 - 180 Ac. pg 128 400 Ac.		pg 90 - 180 Ac. + 220 Ac. Az SLD Σ= 400	X	X?	400 pg 104, 148
Corrections			X ?	15 X pg 97	15
Transportation 3/					
Airport				X	X
Roads					
Improved	X	X	X	X	X
Unimproved	X	X	X	X	X
Railroads			X	X	X
Pipelines	X	X	X	X	X
Transmission Lines	X	X	X	X	X
Telephone Lines	X	X	X	X	X
Water Works	X	X			
Recreation pg 120, 121, 143	3				3
Military			Spoil Area 530		
Air Field		11 X			11
Maneuver Area			X		
Impact Area 3/			26 X		26
Status					
Private	245	16	1271	879	2411
State	28	297	1163	1823	3311
Federal	20	11	97	20	148
	293	324	2531	2722	5870 ? pg 148 Σ=6020

* Multiple purpose

**

Reply to comments made by David E. Creighton, Jr. (February 16, 1979)

Reply No. 1:

The text has been changed to reflect this comment. A revised description of Sonoqui Dike is presented in chapter II.C.4.d. and is shown on the supporting maps. The impacts from construction of the dike and detention basin are included in chapter III. Since the SCS has discontinued planning of the Lower Queen Creek Watershed Project and the project has yet to be authorized for construction, it would appear that Sonoqui Dike will be constructed by Reclamation as described in this statement.

Reply No. 2:

Additional discussion relative to water rights has been added to chapter III.4.a.

Reply No. 3:

A list of peak discharges expected to occur at the siphon site has been added to chapter III.B.4.a. The discussion in chapter II.I.5.b. has been changed to show closer agreement with the "Surface Water" discussion.

Reply No. 4:

A connection between Buttes Reservoir and the Salt-Gila Aqueduct is under consideration as an element of the Buttes Dam proposal and if adopted, will be described in the Buttes Dam environmental statement.

Reply No. 5:

Additional discussion has been added to chapters III.B.4.b. and VII. A.1. While ground-water recharge is mentioned several times in this statement, there was no intention of implying that CAP waters would be used directly for artificial ground-water recharge. In assessing the impacts of the Salt-Gila Aqueduct, it is necessary to recognize, however, that some recharge will take place incidental to the transport and use of CAP water.

Reply No. 6:

The text has been amended to include a table displaying the acreages of disturbance similar to the suggested format.

Reply No 7:

The referenced table has been amended to show the floodwater detention impacts.

Reply No. 8:

The text has been changed to explain more clearly the difference between communities and plant types. Although it is recognized that breeding pair data cannot be used to directly project population impacts, the referenced tables are included to provide the nontechnical reader an appreciation of the potential construction impacts on two well known wildlife species and their habitats.

Reply No. 9:

The total acreage of Oasis Park is 9.5 acres (3.9 ha). Chapter III.G and chapter IV.F. have been changed to include this information.

Reply No. 10:

The Military and Arizona State Prison land use sections have been included on the tabular display for ease of reference. The discussion of urban land use and urbanization did not lend itself to tabular display and has been retained in narrative format.

Reply No. 11:

Chapter III.H.2. has been changed to reflect these comments.

Reply No. 12:

The quantification of disturbed acreage has been supplemented in chapter III. Included are acreages for land use as well as vegetation impacts. The references to Lower Sonoran vegetation have been corrected.

Reply No. 13:

The utilization of trees, shrubs, and ground covers having a lower water requirement would not necessarily increase energy requirements. The planting designs would have to consider the heating and cooling energy requirements as well as the water use to achieve a balance between the two uses.

Reply No. 14:

An addition to the text has been made to reflect this comment.

Department of Local Affairs
Colorado Division of Planning

Philip H. Schmuck, Director

STATE OF COLORADO
NIL SINE NUMINE
1876

Richard D. Lamm, Governor

OFFICIAL FILE COPY

RECEIVED FEB 22 1979

Action:		
Action Taken (Initials)		
Date	Initials	To
		150
File		

February 16, 1979

Mr. Manuel Lopez, Jr.
Regional Director
Bureau of Reclamation
Lower Colorado Regional Office
P. O. Box 427
Boulder City, Nevada 89005

SUBJECT: Draft Environmental Impact Statement
Salt-Gila Aqueduct: A Feature of
Central Arizona Project

Dear Mr. Lopez:

The Colorado Clearinghouse has received the above-referenced Environmental Impact Statement and has distributed it to interested state agencies. Comments received from the Division of Water Resources are enclosed for your information.

Thank you for the opportunity to review this matter.

Sincerely yours,

SOEllis/MK
Stephen O. Ellis
Principal Planner

SE/MK/vt
Enclosure

cc: Office of the Governor
Department of Natural Resources

520 State Centennial Building, 1313 Sherman Street, Denver, Colorado 80203 (303) 892-2351

PINAL COUNTY FARM BUREAU

PINAL COUNTY'S VOICE OF
AGRICULTURE
THE BASIC INDUSTRY

410 N· Marshall
~~120 WEST WILSON~~
CASA GRANDE, ARIZONA 85222
PHONE: (602) 836-2511

OFFICIAL FILE C
RECEIVED FEB 20 1
Action:
Action Taken

Date	Initials	T
		13

File

February 15, 1979

Regional Director
The United States Bureau of Reclamation
Lower Colorado Region
P·O· Box 427
Boulder City, Nevada 89005

Dear Sir,

The signatures that you see below will be those of the members of the Pinal County Farm Bureau Board of Directors who attended a regular meeting tonight· Copy to

The signatures mean that their authors commend the Bureau for advertising about the Salt-Gila aqueduct and the proposal for a reservoir close to Tucson·

Some of us have filled out the environmental impact questionaires that accompanied the ads·

We are confident that the Bureau will properly evaluate the data received·

The purpose of this letter is to express general approval of the Central Arizona water project as a whole - especially since much work has already been done on it·

Very truly yours,

Wayne Wuertz

Wayne Wuertz
President

Bob Wells

D-36

United States Department of the Interior

HERITAGE CONSERVATION AND RECREATION SERVICE
PACIFIC SOUTHWEST REGION
SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO: DES 79/1

1201.1

OFFICIAL FILE COPY
RECEIVED FEB 22 1979

Action:		
Action Taken		(Initials)
Date	Initials	To
		150
File		

FEB 20 1979

Memorandum

To: Regional Director, Bureau of Reclamation

From: Regional Director

Subject: Draft Environmental Statement: Salt-Gila Aqueduct, Central Arizona Project

We have reviewed the subject statement and have no comments to offer.

John D. Cherry

John D. Cherry

cc: Director, Office of Environmental Affairs, BR, WASO

BRUCE E. BABBITT, GOVERNOR
Arizona Water Commission
222 NORTH CENTRAL AVENUE, SUITE 800
Phoenix, Arizona 85004
TELEPHONE (602) 258-7561

Feburary 23, 1979

Mr. Manuel Lopez, Jr.
Regional Director
Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lopez:

The revised format of the Salt-Gila Aqueduct Draft Environmental Statement (INT-DES-79-1) has assisted the review process. The statement gives a comprehensive display to the environmental impacts, the mitigation measures to be pursued, and the residual impacts for the described segment of the Central Arizona Project.

No substantive environmental problems or issues have been omitted from the discussion. Enclosed are several comments on segments where clarification would enhance the completeness and quality of the statement.

I recommend that the final Environmental Statement be quickly prepared with the minor clarification needed for the comments received and that early construction be initiated for this important segment of the Central Arizona Project.

Sincerely,

Wesley E. Steiner

Wesley E. Steiner
Executive Director

Enclosure

COMMENTS ON SALT-GILA AQUEDUCT

CENTRAL ARIZONA PROJECT

DRAFT ENVIRONMENTAL STATEMENT

(INT-DES-79-1)

Several of the items and topics appear in several locations throughout the statement. These specific comments should be correlated with other statement sections not specifically referred to.

---

1. Figure 3. The proposed Sonoqui Dike (CAP) appears to have the SCS configuration to extend north of Queen Creek rather than as shown on Figure 6. **1**

---

2. Chapter II.C. Description of Aqueduct, 1. Location and Route. The extent of changes from, or connection with the Buttes Supply canal and the main canal of the San Carlos Project **2**
should be clarified. The overall CAP-FES (FES 72-35) made a definite statement that a connection would be made at the Gila River Siphon.

---

3. Chapter III. The revised format used to display the description of the environment and the analysis of impacts improves the understanding and assists the review process. **3**

---

4. Chapter III. B.L. Esthetics. The existence of the Arizona State Prison facilities along the 6 mile alignment portion between the Gila River Siphon and U.S. Highway 80 would be germane to the esthetic description and impact.

---

5. Chapter III. B.2.c. pg. 35, paragraph 4. The possibility of groundwater recharge using aqueduct transported surface water is consistently mentioned in Chapters II and III. A little more in- **4**
tense handling of the subject might satisfy the requirements for environmental display should the issue become important.

---

6. Chapter III. B.4.c. pg. 45. Mention should be made here and on page 137 that the quality of Colorado River water has **5**
in fact improved over the past several years.

---

7. Chapter III. C.l.a. Table 13, pg. 63, with a total R-O-W area of 5,870 acres (Table 2), a tabulation of all habitat and communities with degree of change is suggested. Urban, agri- **6**
culture, and desert lands could be shown to have change ranging from permanent loss to no disturbance. This tabulation could

also indicate grazing, military, or other functional or institutional uses.

8. Chapter III. D. Land Use. The tabulation indicated above to clarify and expand Table 13 would be useful as a base to consolidate the 7 identified land uses in this section. The lack of readily identifiable quantification for the components of the 5,870 acres could be overcome with a display by identified aqueduct reaches.

---

9. Chapter III. C.2.c. Fish and Amphibians, pg. 81. The allocation of a specific water supply for 10 acre fishing lakes has been a very chimerical concept which may be socially desirable. Have specific commitments been received from the proponent agencies **7**
in support fo their justification, demonstration of the lake facility feasibility, and the agencies acceptance of economic responsibility for allocated and O & M costs? If not, the implications made in this section may be premature.

---

10. Chapter III. H. Other Agencies, pg. 122 and following. Suggest addition of Department of Energy, Western Area Power Administration to this listing. **8**
The Soil Conservation Service, Lower Queen Creek Watershed Project and relation of Sonoqui Dike is very obscure as to full extent of SCS benefits accrued to USBR through construction of Sonoqui Dike.

Federal 1.b. SCS. From the cruptic remark that Sonoqui Dike would preclude implementation of the Lower Queen Creek Watershed **9**
Project it would appear that complex impacts may result. An explanation comparing the Sonoqui Dike and CAP System accomplishments with the possible LQCWP should be added for impact description.

State of Arizona. 2.b. (pg. 124) appears to indicate a **10**
total area of 5,420 acres is to be cleared, rather than the values indicated on Table 13, pg. 63. Rewording may clarify or reformating Table 13 might also clarify.

---

3 c. The AWC provides technical assistance to SCS in coor- **11**
dination of flood control planning for the Sonoqui Dike and LQCWP.

---

11. Chapter III k.5. Biota, pages 139-140. The "approximately
61,500 acres of Lower Sonoran vegetation for" the "entire authorized **12**
CAP" including the Salt Gila Aqueduct and the Navajo Project appears to be an inadvertent generalization.

---

12. Chapter IV. Esthetics, A.1. A land use tabulation showing
the agricultural, urban, and multiple use desert lands would assist **13**
in understanding and relating to the 5,870 acres. The difference in values here and on pages 139, 140 should be reconciled and explained.

---

13. Chapter V. Paragraph 2, Line 3. Add Salt River to surface sources or qualify as probable services from Salt-Gila Aqueduct. Table 35. Mining-long term. The acreage non-availability is significant only if economically recoverable minerals are present. **14**

V. Table 35, Wildlife. The characterization of the apparent total urban, agricultural, and desert lands habitat classifications appear to be considered as equal value wildlife habitat. A more adequate display of land use associated with habitat communities should be made. V. Table 35. Agriculture and Grazing. Acreages and the omitted several hundred acres of urban lands in the Apache Junction and Florence Gardens acquired subdivision parcels could be more effectively displayed than they have been. **15**

14. Chapter VI. B.1. Land, pg. 148. The 5,870 acres which appear identified as 400 acres irrigated cropland, 5,420 desert scrub grazing, and about 200 acres urban indicate an overlap in labelled use. Clarification is suggested. **16**

15. Chapter VII. A.1., pg. 152. Paragraph 4. The basis for the conclusion that CAP imports without the Salt-Gila aqueduct would be reduced by 300,000 acre-feet per year is not developed. Alternative assumptions could yield dramatically different conclusions. **17**

16. Chapter VII. A.2., pg. 155, Paragraph 3. A further impact from eliminating or reducing shade trees and landscaping would be increased energy requirements for air conditionsing. One program would be counter productive to another with different impacts. **18**

17. Chapter VIII. C. Public Involvement, Paragraph 2. The "publication and filing of the draft environmental statement on August 23, 1978" has a legal connotation possibly not intended for a "working draft" for which notice publication in Federal Register and formal review period was not fulfilled. **19**

18. Appendix B. Pg. B-1. An election approved the incorporation of Apache Junction shortly before the filing date of this statement. Casa Grande - the location of the Francisco Grande training grounds "west" of Casa Grande should be checked. **20**

Reply to comments made by the Arizona Water Commission (February 23, 1979)

Reply No. 1:

The referenced figure in the draft statement was in error. However, the plan for Sonoqui Dike has been revised and the alinement now extends north of Queen Creek. The figures have been changed to show the correct alinement.

Reply No. 2:

A connection between Buttes Dam Reservoir and the Salt-Gila Aqueduct is under study as an element of the Buttes Dam proposal and, if adopted, will be described in the Buttes Dam environmental statement.

Reply No. 3:

The text has been changed to reflect this comment.

Reply No. 4:

While ground-water recharge is mentioned several times in this statement, there was no intention of implying that CAP waters would be used directly for artificial ground-water recharge. In assessing the impacts of the Salt-Gila Aqueduct, it is necessary to recognize, however, that some recharge will take place incidental to the transport and use of CAP water. A paragraph has been added to Chapter III.B.4.b. regarding the use of aqueduct-transported surface water for artificial ground-water recharge.

Reply No. 5:

Additional discussion has been added to Chapter III.B.4.c.

Reply No. 6:

The referenced table has been amended to show land use and plant communities in the format suggested.

Reply No. 7:

No specific commitments have been received. The text of Chapter III. C.2.c. has been supplemented to clarify the proposed study.

Reply No. 8:

The Department of Energy, Western Area Power Administration has been added to Chapter III.H. The SCS has discontinued planning of the Lower Queen Creek Watershed Project and the project has yet to be authorized for construction. It is apparent that Sonoqui Dike will be constructed by Reclamation as a part of the Salt-Gila Aqueduct and will function as a canal protective structure. At this time, the extent of SCS benefits accruing to Reclamation have not been computed.

Reply No. 9:

The Sonoqui Dike as described in Chapter II.C.4.d., would be built as part of the Salt-Gila Aqueduct to provide cross-drainage protection to the canal. The SCS Lower Queen Creek Watershed Project (LQCWP) is described in the Watershed Plan and Environmental Impact Statement-Lower Queen Creek Watershed (SCS 1979). The SCS project has yet to be authorized for construction and the SCS has discontinued planning of this project. A comparison of the benefits and impacts of Sonoqui Dike vs. LQCWP is beyond the scope of this statement.

Reply No. 10:

The text has been changed to reflect this comment.

Reply No. 11:

The function of the AWC has been rewritten in Chapter III.H.3.c. to reflect this comment.

Reply No. 12:

The text in Chapter III.K.5. has been changed to be consistent with the referenced table. The vegetative impacts from the Navajo Project were inadvertently included as "Lower Sonoran" in the draft statement.

Reply No. 13:

The text has been changed to reflect this comment.

Reply No. 14:

The final statement has been changed to reflect these comments.

Reply No. 15:

The land use and plant community data have been supplemented in Chapter III. The impacts to wildlife habitat were only assessed by plant community, and the total habitat acreage has been adjusted accordingly. An "urban" section has been added to the referenced table.

Reply No. 16:

The text has been changed to reflect this comment.

Reply No. 17:

Additional material has been included in Chapter VII.A.1. to clarify the basis for the 300,000 acre-feet per year conclusion and to present an alternative set of assumptions yielding a different conclusion.

Reply No. 18:

The utilization of trees, shrubs, and ground covers having a lower water requirement would not necessarily increase energy requirement. The planting designs would have to consider the heating and cooling energy requirements as well as the water use to achieve a balance between the two uses.

Reply No. 19:

The text has been changed to reflect this comment.

Reply No. 20:

The text has been changed to reflect these comments.

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2711
LOS ANGELES, CALIFORNIA 90053

OFFICIAL FILE COPY
RECEIVED FEB 26 1979

Action	
Action Taken	(Initials)

Date	Initials	To
		150

File

SPLED-E

20 February 1979

Mr. Manuel Lopez, Jr., Regional Director
US Department of the Interior
Bureau of Reclamation
Lower Colorado Regional Office
P.O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lopez:

This is in response to a letter from your office dated 4 January 1979 which requested review and comments on the Draft Environmental Statement for the Salt-Gila Aqueduct, A Feature of the Central Arizona Project, Int. DES 79-1.

The proposed plan does not conflict with existing or authorized plans of the Corps of Engineers. We have no comments on the environmental statement other than to note the document is accurate and well written.

We suggest that close coordination of future planning of this or any other proposed work continue to be maintained between our respective offices. Please feel free to contact, at your convenience, our Mr. Joseph R. Dixon, Project Manager for the Salt-Gila Study, FTS telephone 8-261-6781, and/or Captain Michael Thuss, Study Manager for the Tucson Urban Study, FTS telephone 8-762-6796.

Thank you for the opportunity to review and comment on this statement.

Sincerely yours,

T. C. Nishikawa
for NORMAN ARNO
Chief, Engineering Division

WYOMING
EXECUTIVE DEPARTMENT
CHEYENNE

ED HERSCHLER
GOVERNOR

Feburary 20, 1979

Mr. Manuel Lopez, Jr., Regional Director
Bureau of Reclamation, U.S.D.I
Lower Colorado Regional Office
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lopez:

The Draft Environmental Statement on the Salt-Gila Aqueduct, a feature of the Central Arizona Project, has been reviewed by personnel in several of our state agencies. We appreciate the opportunity to comment on information and documents relative to this work and any further progress on the Central Arizona Project.

We note that the Salt-Gila Aqueduct's initial design capacity of 2,500 cubic feet per second has been increased to 2,750 cubic feet per second subsequent to the filing of the draft statement. The final environmental statement should detail the design changes and environmental impacts associated with this increased capacity. **1**

With the State of Arizona's entitlement of Colorado River water established by the Supreme Court Decree in Arizona v. California, we feel it would be valuable to include a listing of all Arizona diversions of Colorado River water in the final environmental statement. **2**

We would appreciate being notified of and having the opportunity to review and comment on any other design changes of this feature as well as any future developments within the Central Arizona Project.

Yours sincerely,

Ed Herschler

EH/pct

Reply to comments made by Governor Herschler, State of Wyoming (February 20, 1979)

Reply No. 1:

As indicated by the Supplemental Information Notice dated February 1, 1979, the details of the design changes and associated environmental impacts are reflected in this document. No impacts other than those previously described were identified although some impacts increased slightly in magnitude.

Reply No. 2:

Complete listings of all diversions from the Colorado River in each of the lower basin States of Nevada, California, and Arizona are reported annually, beginning in 1964, in compliance with Article V of the Arizona v. California decree. The report titled Compilation of Records in Accordance with Article V of the Decree of the Supreme Court of the United States in Arizona v. California Dated March 9, 1964, is published annually. This report is available from the Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada.

Reproduction of these published records was beyond the scope of this environmental statement. However, an annual summary for Arizona is furnished as follows:

Summary of Uses of Lower Colorado River Mainstream Water Within The State of Arizona

(Acre-Feet)

Calendar Year	Diversions	Allowable Return Flows	Consumptive Use
1964	1,816,210	689,034	1,127.176
1965	1,687,535	679,004	1,008,531
1966	1,766,873	693,818	1,073,055
1967	1,816,889	709,995	1,106,894
1968	1,894,622	725,382	1,169,240
1969	1,886,541	748,456	1,138,085
1970	2,006,178	806,303	1,201,441
1971	2,085,575	790,605	1,296,930
1972	2,059,006	855,809	1,203,043
1973	2,099,840	831,096	1,268,744
1974	2,110,689	785,058	1,325,631
1975	2,126,468	768,465	1,358,003
1976	1,968,848	720,828	1,248,020
1977	1,917,981	686,707	1,231,274
1978	Data available about January 1980		

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333
TELEPHONE: (404) 633-3311

February 11, 1979

Director, Office of Environmental
  Affairs
U. S. Department of the Interior
Bureau of Reclamation
Washington, D.C. 20240

Dear Sir:

We have reviewed the draft environmental statement on the Salt-Gila Aqueduct, Central Arizona Project. We are responding on behalf of the Public Health Service.

The subject report has been reviewed for potential vectorborne disease impacts. Seepage from irrigation canals is the major concern from our viewpoint in that seepage collections provide breeding habitats for vector mosquitoes. Seepages developing near residential centers should be monitored for mosquito production and the proper steps taken to eliminate the defect in the canal lining. It may be necessary to provide chemical control if serious vector breeding problems develop. **1**

With the exception of the potential vector problems, health and safety issues have been adequately addressed for this phase of the Central Arizona Project aqueduct system. / We do suggest, however, that the final EIS indicate who specifically has responsibility for the operation and maintenance of this completed phase, and, to the extent possible, describe specific operation criteria. **2** / In addition, potential impacts on the remaining portions of the overall project with respect to the operation or possible shutdown of the Salt-Gila Aqueduct should be discussed. **3**

Regarding the necessary relocation of 39 families, individuals, or businesses, the only mention of their welfare is that "ample time is allowed for relocation." Each benefit provided to these relocated persons should be summarized in the final EIS. It should be noted whether or not adequate housing and property is available for these families and individuals. **4**

Thank you for the opportunity of reviewing this statement. We would appreciate receiving a copy of the final statement when it is issued.

Sincerely yours,

Frank S. Lisella

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Bureau of State Services

Reply to comments made by Center for Disease Control, Public Health Service, Department of Health Education and Welfare (February 11, 1979)

Reply No. 1:

The nature of the soils along the alinement are such that seepage could create problems only in fill sections of the canal. The concrete lining of the canal would be maintained and repaired as necessary to prevent such problems. However, if such problems do occur in these areas or in floodwater detention basins adjacent to the canal, mosquito and other insect control would be accomplished. Certified pesticides would be used in approved pest control programs to remove the potential vector problem. These pest control programs would be coordinated with the appropriate agencies.

Reply No. 2:

No ultimate operating entity for the Salt-Gila Aqueduct has been identified at this time. The Bureau of Reclamation typically performs operation and maintenance (O&M) during the first several years to attain operational reliability. O&M may then be turned over to a local operating authority through agreements and contracts with the Secretary of the Interior. The local authority must, however, be financially capable, competent, and willing to assume O&M responsibilities. Should no willing, competent organization exist, the Bureau would continue to perform O&M.

Specific operating criteria for the Salt-Gila Aqueduct are being developed over an extended period of years. The aqueduct is not an independent project, but an integral part of a larger system of connected aqueducts and proposed reservoirs. Some of this system has yet to be defined, located, and sized. Until the whole system is fully defined, specific criteria for aqueduct operations are not meaningful.

Reply No. 3:

The potential impacts on the remaining portions of the Central Arizona Project, should the proposed action be deferred or abandoned, are discussed in Chapters VII.A. and VII. B. The impacts on the remaining features during a possible shutdown of the aqueduct will be highly dependent upon the cause and duration of shutdown. Many hypothetical situations can be drawn and evaluated in which impacts on the remaining system could vary from none to concurrent shutdown. Lacking full definition of the system, however, shutdown related impacts on the remaining system will be unknown or speculative.

Reply No. 4:

The relocations are accomplished under the Uniform Relocation Assistance and Real Property Aquisition Policies Act of 1970 Additional information on relocation is found in Chapter II.F. and III.D.8.

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D. C. 20426

February 6, 1979

Mr. Al R. Jonez
Director, Office of Environmental
Affairs
U.S. Bureau of Reclamation
Washington, D. C. 20240

Dear Mr. Jonez:

I am replying to your request of January 4, 1979 to the Federal Energy Regulatory Commission for comments on the Draft Environmental Impact Statement for the Salt-Gila Aqueduct, Central Arizona Project. This Draft EIS has been reviewed by appropriate FERC staff components upon whose evaluation this response is based.

The staff concentrates its review of other agencies' environmental impact statements basically on those areas of the electric power, natural gas, and oil pipeline industries for which the Commission has jurisdiction by law, or where staff has special expertise in evaluating environmental impacts involved with the proposed action. It does not appear that there would be any significant impacts in these areas of concern nor serious conflicts with this agency's responsibilities should this action be undertaken.

Thank you for the opportunity to review this statement.

Sincerely,

JH Heinemann

Jack M. Heinemann
Advisor on Environmental Quality

RICHARD D. LAMM
Governor

C.J. KUIPER
State Engineer

DIVISION OF WATER RESOURCES

Department of Natural Resources
1313 Sherman Street - Room 818
Denver, Colorado 80203
Administration (303) 839-3581
Ground Water (303) 839-3587

JAN 16 1979
DIV. OF PL[illegible]

January 10, 1979

MEMORANDUM

TO: STEPHEN O. ELLIS, STATE CLEARINGHOUSE

FROM: DR. JERIS A. DANIELSON, DEPUTY STATE ENGINEER

SUBJECT: SALT-GILA AQUEDUCT: A FEATURE OF CENTRAL ARIZONA PROJECT DRAFT ENVIRONMENTAL STATEMENT

We appreciate the opportunity to review the subject Environmental Statement. This office has no comment on the statement.

Jeris A. Danielson

Jeris A. Danielson

JAD/WWB:mvf

SIGNOFF

OMB Approval No. 29–R0218

FEDERAL ASSISTANCE

2. Applicant's application — a. Number; b. Date 19 Year Month Day

3. State application identifier — a. Number AZ 79-80-0001; b. Date Assigned 1979 01 12 (Year month day)

Leave Blank — FEB 22 1979 — Jo Ann Youngblood

1. Type Of Action (Mark appropriate box)
- ☐ Preapplication
- ☐ Application
- ☐ Notification Of Intent (Opt.)
- ☐ Report Of Federal Action

Section I - Applicant / Recipient Data

4. Legal Applicant/Recipient
- a. Applicant Name : Bureau of Reclamation
- b. Organization Unit : Lower Colorado Regional Office
- c. Street/P.O. Box : Post Office Box 427
- d. City : Boulder City e. County :
- f. State : Nevada g. Zip Code : 89005
- h. Contact Person (Name & telephone no.) : Mr. Manuel Lopez, Jr., Regional Dir. (702) 293-2161

5. Federal Employer Identification No.

6. Program (From Federal Catalog)
- a. Number 15●599
- b. Title Unknown

Department of the Interior, Bureau of Reclamation

7. Title and description of applicant's project SALT-GILA AQUEDUCT, A FEATURE OF CENTRAL ARIZONA PROJECT - INT DES 79-1 - DRAFT ENVIRONMENTAL IMPACT STATEMENT

Salt-Gila Aqueduct - an open concrete-lined canal approx. 58 Mi in length, extending from about 25 Mi NE of Phoenix, to about 2 Mi NE of Picacho Reservoir, would receive water from Granite Reef Aqueduct and would furnish agricultural, municipal & industrial water supplies to service areas in Maricopa & Pinal Counties. It is divided into 4 reaches, varying in length from 11 to 20 Mi.

8. Type of applicant/recipient
- A–State
- B–Interstate
- C–Substate District
- D–County
- E–City
- F–School District
- G–Special Purpose District
- H–Community Action Agency
- I– Higher Educational Institution
- J– Indian Tribe
- K–Other (Specify): Federal Agency

Enter appropriate letter: K

9. Type of assistance
- A–Basic Grant
- B–Supplemental Grant
- C–Loan
- D–Insurance
- E–Other

Enter appropriate letter(s): E

10. Area of project impact (Names of cities, counties, states, etc.) Maricopa and Pinal Counties, Arizona

11. Estimated number of persons benefiting

12. Type of application
- A–New
- B–Renewal
- C–Revision
- D–Continuation
- E–Augmentation

Enter appropriate letter: A

13. Proposed Funding

a. Federal	$	.00
b. Applicant		.00
c. State		.00
d. Local		.00
e. Other	1	.00
f. Total	$ 1	.00

14. Congressional Districts Of: a. Applicant; b. Project 01 02 03 04

15. Type of change For 12c or 12e
- A–Increase Dollars
- B–Decrease Dollars
- C–Increase Duration
- D–Decrease Duration
- E–Cancellation
- F–Other Specify:

Enter appropriate letter(s)

16. Project Start Date Year month day 19

17. Project Duration Months

18. Estimated date to be submitted to federal agency 19 Year month date

19. Existing federal identification number

20. Federal agency to receive request (Name, city, state, zip code)

21. Remarks added ☐ Yes ☐ No

Section II - Certification

22. The Applicant Certifies That

a. To the best of my knowledge and belief, data in this preapplication/application are true and correct, the document has been duly authorized by the governing body of the applicant and the applicant will comply with the attached assurances if the assistance is approved.

b. If required by OMB Circular A-95 this application was submitted, pursuant to instructions therein, to appropriate clearinghouses and all responses are attached:

	No response	Response attached
(1) Arizona State Clearinghouse	☐	☐
(2) Region I Clearinghouse (MAG)	☐	☐
(3) Regi n V Clearinghouse (CAAG)	☐	☐

23. Certifying representative — a. Typed name and title; b. Signature; c. Date signed Year month day 19

Section III - Federal Agency Action

24. Agency name

25. Application received 19 Year month day

26. Organizational Unit

27. Administrative office

28. Federal application identification

29. Address

30. Federal grant identification

31. Action taken
- ☐ a. Awarded
- ☐ b. Rejected
- ☐ c. Returned for amendment
- ☐ d. Deferred
- ☐ e. Withdrawn

32. Funding

a. Federal	$	.00
b. Applicant		.00
c. State		.00
d. Local		.00
e. Other		.00
f. Total	$	.00

33. Action date 19 Year month day

34. Starting date 19 Year month day

35. Contact for additional information (Name and telephone number)

36. Ending date 19 Year month day

37. Remarks added ☐ Yes ☐ No

38. Federal agency A–95 action

a. In taking above action, any comments received from clearinghouses were considered. If agency response is due under provisions of Part 1, OMB Circular A-95, it has been or is being made.

b. Federal Agency A-95 Official (Name and telephone number)

FORM TO BE COMPLETED BY REVIEWING AGENCY

To:

Charles A. Ott, Jr. Director
Div. of Emergency Services
5636 East McDowell Rd.
Phoenix, AZ 85008

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
☒ Comments as indicated below

Comments: (Use additional sheets if necessary)

1. The Division of Emergency Services accepts the proposal as written due to your statement that "there would be no greater risk from flood to downstream areas that existed prior to construction of the aqueduct."

D-54

Reviewer's Signature Mark Fooks   Date 1/29/79

Title Planner   Telephone 273-9887

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Michael A. Ramnes, Director
Arizona State Parks Board
1688 W. Adams   Room 109
Phoenix, Arizona 85007

State Application Identifier (SAI)

JAN 12, 1979   State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- [x] No comment on this project
- [ ] Proposal is supported as written
- [ ] Comments as indicated below

Comments: (Use additional sheets if necessary)

D-55

Reviewer's Signature Allen W. Gross

Date 18 Jan 79

Title EPII

Telephone 255-4174

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO: Mr. John Blackburn, Exec. Dir.
Central Arizona Association
of Governments
P.O. Box JJ (1810 Main St.)
Florence, AZ 85232

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- [x] No comment on this project
- [ ] Proposal is supported as written
- [ ] Comments as indicated below

Comments: (Use additional sheets if necessary)

D-56

Reviewer's Signature Valerie Fener Date Feb 2 1979

Title Environmental Planner Telephone [illegible]

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Mr. Clinton M. Pattea
Executive Secretary
Indian Affairs Commission
1645 West Jefferson St.
Phoenix, AZ 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- [x] No comment on this project
- [ ] Proposal is supported as written
- [ ] Comments as indicated below

Comments: (Use additional sheets if necessary)

D-57

Reviewer's Signature Clinton M. Pattea Date 2-19-79

Title

Telephone

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Mr. Adron Reichart
58th Civil Engineers Squadron,
DEEV
Luke Air Force Base, AZ 85309

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- [x] No comment on this project
- [ ] Proposal is supported as written
- [ ] Comments as indicated below

Comments: (Use additional sheets if necessary)

Reviewer's Signature.. Date..................

Title.................................. Telephone..................

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Dean Moss
OEPAD-208 Section
1700 W. Washington, Rm. 505
Phoenix, AZ 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- ☐ No comment on this project
- ☒ Proposal is supported as written
- ☐ Comments as indicated below

Comments: (Use additional sheets if necessary)

Reviewer's Signature William Dean Moss Jr. D-59

Date 16 JAN 1979

Title 208 Task Force

Telephone 255-3833

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Bob Hathaway
OEPAD-Economic Development Section
1700 West Washington, Room 505
Phoenix, AZ 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- [x] No comment on this project
- [ ] Proposal is supported as written
- [ ] Comments as indicated below

Comments: (Use additional sheets if necessary)

D-60

Reviewer's Signature .... Date 1/19/79

Title .... Telephone 5705

Mr. Barry A. Winters
Acting Grants Coordinator
Dept. of Corrections
1601 West Jefferson
Phoenix, AZ 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

om: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

s project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

se return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above.
se contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☒ Proposal is supported as written
☐ Comments as indicated below

omments: (Use additional sheets if necessary)

D-61

viewer's Signature Barry A. Winters Date 1-24-79

: Grant Coord. Telephone 255-3324

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO: John J. DeBolske, Exec. Dir.
Maricopa Ass'n of Governments
1820 W. Washington Street
Phoenix, AZ 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

0116

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
☑ Comments as indicated below

Comments: (Use additional sheets if necessary)

D-62

Reviewer's Signature .... Date ....

Title .... Telephone ....

MARICOPA ASSOCIATION OF GOVERNMENTS

1820 WEST WASHINGTON PHOENIX, ARIZONA 85007 (602) 254-6308

January 15, 1979

TO: Jim Reynolds, MAGTPO

FROM: Clearinghouse Staff Contact: Jack Tevlin

SUBJECT: PROJECT NOTIFICATION AND REVIEW

Applicant: Bureau of Reclamation

Project Title SALT-GILA AQUEDUCT, A FEATURE OF CENTRAL AH ZONA PROJECT.......

State Application Identifier: 79-80-0001

MAG Log Number: 0116

Date Due: February 6, 1979

A copy of an A-95 application form AZ-189 along with supporting project documentation is attached for your review and comment in accordance with requirements of OMB Circular A-95. Please review the proposal as it affects the plans and programs of your agency and register your reponse below. Please return ONLY THIS completed form by the date noted above.

- ☐ No comment on the above project
- ☐ Proposal is supported as written
- ☐ Project is unfavorable (Reason stated below)
- ☒ Comments are attached

Please contact the applicant and advise the Clearinghouse should you desire a conference with the applicant, further information or need additional time for review.

Ronald W. Rasa
Authorized Representative

MAGTPO
Agency

Comments on Salt-Gila Aqueduct - Environmental Statement 1/30/79

The proposed project does not appear to conflict with Maricopa Association of Governments' Regional Plans or Policies. We do wish, however, to make the following comments regarding the project.

1. In the Environmental Statement, Chapter III, Section D, Subsection 8a., page 96, the statement pertaining to inclusion of a Regional Airport in the 1973 Arizona Airport System Plan is inaccurate. A concept for a Regional Airport in the vicinity of the city of Florence was examined during the preparation of the Plan as a special study, but was never included in the final plan. **1**

2. In the same Chapter, Section G, Recreation, page 120, a map defining the location of the Aqueduct route in relation to State, regional, county and city parks, particularly the Maricopa County Oasis Park, would be helpful to reviewers in examining the impacts of aqueduct construction. **2**

   The Section could also be more detailed in its description of the Oasis Park facility as to its size, degree of use and type of use. Ramifications of severing a portion of the park cannot be properly assessed given the information presently contained in the Section.

Reply to comments made by Maricopa Association of Governments (January 15, 1979)

Reply No. 1:

The concept of a regional airport in the vicinity of Florence is not included in the Arizona Department of Transportation current planning period (through the year 2000). The section has been deleted from the environmental statement.

Reply No. 2:

The only parks adjacent to the aqueduct route are the parks discussed in Chapter III.G. A map locating non-impacted parks would not provide additional information beyond that provided in the statement.

Oasis Park is described in Chapters III.G. and IV.G. The only usage data available are visitor days since Maricopa County Park and Recreation Department does not collect more detailed data.

FORM TO BE COMPLETED BY REVIEWING AGENCY

Dr. William H. Dresher, Director
Arizona Bureau of Geology &
Mineral Technology
University of Arizona
Tucson, Arizona 85721

State Application Identifier (SAI)			
JAN 12, 1979	State AZ	No.	79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above.
Please contact the clearinghouse if you need further information or additional time for review.

☒ No comment on this project
☐ Proposal is supported as written
☐ Comments as indicated below

Comments: (Use additional sheets if necessary)

JAN 1979
COLLEGE of MINES
UNIVERSITY OF
ARIZONA

D-66

Reviewer's Signature William H. Dresher   Date 1-24-79

Title Director   Telephone 626-1943

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Mr. James R. Carter, Director
Agriculture & Horticulture Dept.
421 Capitol Annex West
Phoenix, Arizona 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

RECEIVED JAN 1? 1979

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
☒ Comments as indicated below

Comments: (Use additional sheets if necessary) In developing and construction of the aqueduct, provisions should be made to comply with the requirements of the Arizona Native Plant Law ARS 3-901 A and 3-904 E. which requires the that the Commission be notified of any destruction or removal of protected native plants. The notification requirement is sixty days for state land and thirty days for federal land.

D-67

Reviewer's Signature RACountryman Date 2-15-79

Title Assistant Director, Compliance Telephone 255-4373

Reply to comments made by Agricultural and Horticultural Department (February 15, 1979)

<u>Reply</u>:

A commitment was made in Chapter III.C.1.c., for a notification period of sixty days for State and Federal lands.

O:

Mr. John Jett, Director
Mineral Resources Department
Fairgrounds, Mineral Building
1826 West McDowell Road
Phoenix, Arizona 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☒ No comment on this project
☐ Proposal is supported as written
☐ Comments as indicated below

Comments: (Use additional sheets if necessary)

D-69

Reviewer's Signature: JH Jett

Date: 1-14-79

Title:

Telephone:

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Mr. Sidney B. Brinckerhoff, Dir.
Arizona Historical Society
949 East Second Street
Tucson, AZ 85719

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- [x] No comment on this project
- [ ] Proposal is supported as written
- [ ] Comments as indicated below

Comments: (Use additional sheets if necessary)

D-70

Reviewer's Signature Sidney B. Brinckerhoff

Date Jan. 23, 1979

Title Director

Telephone 882-5775

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Mr. Lyle A. Bair, Acting Dir.
AORCC
1333 W.Camelback, Suite 206
Phoenix, AZ 85013

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
☒ Comments as indicated below

Comments: (Use additional sheets if necessary)

This office encourages the consideration of recreational development/opportunities along the canal as much as possible, especially reach 1 & 3 since they are in close proximity to urbanized centers.

D-71

Reviewer's Signature Lyle A. Bair

Date 1-19-79

Title Acting Director

Telephone 255-5013

Reply to comments made by Arizona Outdoor Recreation Coordinating Commission (January 19, 1979)

Reply:

As stated in Chapter III.G. the Bureau of Reclamation will continue to evaluate federally-managed lands to identify sites which have potential for recreational development. A minimal right- of-way is being acquired for the Salt-Gila Aqueduct and the opportunities for recreational developments consist primarily of hiking, biking, and riding trails. If other opportunities are identified, efforts will be made to develop facilities using the authority of Public Law 89-72, Federal Water Project Recreation Act of 1965.

FORM TO BE COMPLETED BY REVIEWING AGENCY

O:

Dr. James Becker
Center for Public Affairs
Arizona State University
Tempe, Arizona 85281

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: **Arizona State Clearinghouse**
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

lease return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above.
lease contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
x☒ Comments as indicated below

Comments: (Use additional sheets if necessary) The information in this statement does not make clear that the negative impacts and/even with/their mitigating measures are offset by benefits which are certain.

D-73

Reviewer's Signature R. J. Seder

Date Jan. 18, 1979

Title Prof. Center for Public Affairs

Telephone 965-3926

Reply to comment made by Center for Public Affairs, Arizona State University (January 8, 1979)

Reply:

The beneficial environmental effects of the proposal are documented in chapters III.B.2. (subsidence, ground-water drawdown), III.B.4.b. (recharge), and III.E.2.3. (economy, income, and employment). These beneficial environmental effects are monetarially quantified where possible, however, a net benefit display is not included in the environmental statement since many benefits and disbenefits can not be quantified in monetary terms.

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Dr. Guy Spiesman, Acting Chief
Office of Planning
Dept. of Economic Security
1717 West Jefferson
Phoenix, AZ 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- [x] No comment on this project
- [ ] Proposal is supported as written
- [ ] Comments as indicated below

Comments: (Use additional sheets if necessary)

D-75

Reviewer's Signature .... Date ....

Title .... Telephone ....

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Mr. Les Ormsby, Admin.
Arizona Power Authority
1810 West Adams Street
Phoenix, Arizona 85005

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

☒ No comment on this project
☐ Proposal is supported as written
☐ Comments as indicated below

Comments: (Use additional sheets if necessary)

D-76

Reviewer's Signature Les Ormsby Date 1/16/79

Title Telephone

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Mr. Arthur Garcia, Exec Dir.
Assistant Attorney General
AZ Civil Rights Division
1645 W. Jefferson Street
Phoenix AZ 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- [x] No comment on this project
- [ ] Proposal is supported as written
- [ ] Comments as indicated below

Comments: (Use additional sheets if necessary)

D-77

RECEIVED
JAN 16 1979
ARIZ. CIVIL RIGHTS DIVISION

Reviewer's Signature Arthur G. Garcia

Date

Title Executive Director

Telephone 255-5263

FORM TO BE COMPLETED BY REVIEWING AGENCY

TO:

Andrew L. Bettwy, Comm.
State Land Dept.
1624 W Adams, 4th fl.
Phoenix, AZ 85007
ATTN: Jeff Yaeger

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

From: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security
Indian Affairs
Mineral Resources
Game & Fish
Transportation
Ag. & Hort.
Az. Mining Ass'n
Public Safety
Corrections
Arid Lands Studies
Environmental Studies
Archaeological Research
Center for Public Affairs
Museum of Northern Arizona
Renewable Natural Resources
Az. Historical Society
Az. State Museum
SW Minerals Exploration
Az. Bu. of Geology & Mineral Tech.
Salt River Indian Clearinghouse
Williams Air Force Base
Luke Air Force Base
Advisory Commission on Az. Environment
Emergency Services
Prescott Historical Society
OEPAD: D. Moss
B. Hathaway

Health
Power
Water
Parks
Land
AORCC
Civil Rights
Region I
Region V

This project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

Please return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above. Please contact the clearinghouse if you need further information or additional time for review.

- ☐ No comment on this project
- ☐ Proposal is supported as written
- ☒ Comments as indicated below

Comments: (Use additional sheets if necessary)

The State Land Department has an on going involvement in the Salt-Gila Aqueduct of the C.A.P. More than 50% of the route will utilize state land. The SLD requests as early as possible, that the Bureau should send survey plats and legal descriptions of the lands to be taken by reconveyance and those to be taken by exchange or trade.

D-78

Reviewer's Signature Jeff Yaeger

Date 2/1/79

Title Administrative Assist

Telephone 255-4625

Reply to comments made by the State Land Department (February 1, 1979)

Reply:

Bureau of Reclamation personnel are in contact with the Arizona State Land Department, and the appropriate information will be transmitted to the State as it becomes available.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

OFFICIAL FILE COPY

RECEIVED MAR 5 1979

Date	Initials	To
3-15	JPS	150

27 FEB 1979

Regional Director
Administration Building
Bureau of Reclamation
Boulder City, NV 89005

Dear Sir,

We appreciate the opportunity to review the draft environmental statement on the Salt-Gila River project as invited in Mr. Jones' letter of January 4, 1979. The project has no apparent impact on the Air Force; therefore, we have no comments at this time.

Sincerely,

Hisao Yamada

HISAO YAMADA, Colonel, USAF
Chief, Environmental Planning Division
Directorate of Engineering & Services

cc: Mr. Al R. Jones
Director
Office of Environmental Affairs
Bureau of Reclamation

The Maricopa Audubon Society
4619 East Arcadia Lane • Phoenix, Arizona 85018

OFFICIAL FILE COPY
RECEIVED MAR 5 1979

Action:
Action Taken .... (Initials)

Date	Initials	To
3-15	7AS	150

File

February 27, 1979

Mr. Manuel Lopez, Jr.
Regional Director
Bureau of Reclamation
P.O. Box 427
Boulder City, NV 89005

Dear Mr. Lopez:

The following are our comments directed to the Draft Environmental Impact Statement (EIS) on the Central Arizona Project's Salt-Gila Aqueduct for consideration and incorporation into the final EIS.

The decision of where regulatory storage of CAP water will take place is a crucial precedent to the final design of this aqueduct. Until the regulatory system is determined, it is not practicable to determine what the water carrying capacity of the aqueduct should be. This EIS fails to consider the impact the regulatory system will have on the design and operation of the aqueduct; and, should the aqueduct be finalized before the regulatory system is decided upon, what impact the aqueduct's design will have upon the regulatory storage decision.

The search for alternatives to Orme Dam is presently expected to require considerable study and time until May 1982. The aqueduct's **1**
expected construction start in March 1980 will not allow time for a regulatory storage alternative to Orme to be chosen. In the absence of any explanation in the EIS, we can only conclude the current aqueduct's size is designed with the assumption that Orme Dam, or a relatively similar dam, will be constructed and provide regulatory storage. We are concerned that the determination of the aqueduct's size and route and the aqueduct's early construction would affect the desirability of or even preclude such alternatives as (1) groundwater recharge from existing reservoirs for flood control, (2) SRP -- CAP exchanges for regulation and flood control, or (3) using proposed dams south of Orme that may or may not be along the presently proposed aqueduct route.

The alternatives section of the EIS should consider alternative sizes for the aqueduct , explaining for each size: (1) its rationale and the factors considered in determining the size, (2) its cost, (3) its relation to water allocations, both Indian and non-Indian, and (4) its relation to the possible locations of regulatory storage. **2**

Is the current aqueduct's designed size, as reported in the supplemental information notice dated February 1, 1979, different than the size of the aqueduct as presented to and authorized by Congress in 1968? If so,

DEDICATED TO CONSERVATION OF WETLANDS IN AN ARID ENVIRONMENT how much of an increase or decrease is this? Is this considered a substantial design change? What is the difference in cost?

Would the present aqueduct locations and design permit the use of the proposed Buttes dam (as well as the Florence dam site and Tat Momolikot dam) for regulatory storage? We would also like to know whether choosing the current route over the historical route may affect the possible utilization of the proposed Florence dam or the proposed Buttes dam for regulatory storage, and if so, in detail, what the effects will be. **3**

On page two of the EIS it is stated that, "Environmental investigations for these dams (Hooker and Charleston) will be scheduled when this issue is resolved (to construct them or not)." We object to the assumption that these dams will be built that is implied by this statement. Considering the fact that the current administration has eliminated them from the CAP, we should think that the administration's views would be reflected by the Bureau. Also, the statement subverts the purpose of the EIS process -- in addition to identifying environmental problems to solve or mitigate, EIS preparation is designed to help decision-makers decide whether to proceed with a project or choose an alternative. We hope the Bureau will thoroughly study the environmental consequences of the alternatives proposed to replace these eliminated dams before the issue is resolved. **4**

It is our understanding that an environmental assessment is currently being done on the Indian water allocations. If this is so, we do not see how a final negative determination could have been made on the Indian irrigation allocations as reported on page two of the EIS. Would you please clarify this matter. **5**

There were several places in the EIS that mention how floodwaters would pass under or over the aqueduct. Is the aqueduct at any place designed to ever carry floodwaters? If so, how would the aqueduct be utilized to do this? If not, why not? **6**

The paragraph in "Analysis of Impacts, K. Cummulative Effect of This and Other Federal Projects, e. Aqueduct Water Deliveries" is an extremely inadequate treatment of the problem of importing salty Colorado River water into central and southern Arizona. It is incorrect to compare the imported water's salt content to the average salt content of existing water supplies because this eliminates the great variations in water quality. Thus, delivery of CAP water to some may create an improvement in water quality, but in other cases may present a severe degradation of water quality. We feel this section must be expanded to accurately portray the specific impacts this water will make. **7**

We believe the final EIS should include discussion of linking the aqueduct to existing Salt River Project (SRP) water supplies. Should SRP ever be in a position to sell water to users in southern Arizona, it makes sense that they utilize an existing aqueduct rather than having to build an entirely new one. If this is not feasible with the current design, an alternative design should be considered. **8**

We were pleased to find the alternative of water conservation considered, although this was an overly general and inadequate treatment of the subject. The Bureau should examine this alternative in greater depth than what seems to be a rehash of the Arizona Water Commission's 1977 report. There should be discussion of a plan of implementing currently available water conservation techniques in the CAP service area, where these techniques would be applicable, and a full benefit-cost analysis for the various techniques so that water conservation would get a fair comparison to the costs of construction and completion of the CAP. **9**

The benefit-cost analysis of retiring farmland must also be presented and compared with conservation methods and CAP construction costs. This lack of economic data and b/c analysis of the project versus other environmentally harmonious project alternatives is one of the significant shortcomings of the EIS. **10**

In light of the questions we raise in this letter, and of the sudden change in the planned size of the aqueduct, we request that you publish a supplemental Draft EIS that covers these issues for public comment before the Final EIS is filed. **11**

Sincerely,

Robert A. Witzeman

Robert A. Witzeman, M.D.
President

RAW/kd

cc: Gil Venable
Phil Shea
Z. Simpson Cox

Reply to comments made by Dr. Robert A. Witzeman, President, Maricopa Audubon Society (February 27, 1979)

Reply No. 1:

The decision concerning the most appropriate capacity of the Salt-Gila Aqueduct was made so as to not preclude any decision with respect to regulatory storage. Due to the uncertainty of future conditions, some judgment trade-offs were required in identifying the most appropriate capacity. The following perspectives concerning cost were helpful in making the decision:

1. The present incremental cost of the aqueduct is about 2 percent per 100 ft 3/s of capacity (approximately $2 million per 100 ft 3/s).

2. Present worth cost savings are significant if the largest justifiable size were to be constructed now as opposed to constructing a lesser size and finding at some future date that the aqueduct's capacity must be enlarged.

3. If the decision on size were postponed until all of the uncertain conditions affecting the size had been resolved, greater construction costs would result due to inflation during the delay.

The proposed route of the aqueduct will not affect the desirability or preclude any of the regulatory storage alternatives currently under study.

Reply No. 2:

The aqueduct's proposed capacity is consistent with the 1968 congressional authorization wherein no specific capacity was identified for the Salt-Gila Aqueduct. The capacity increase from 2,500 to 2,750 ft^3/s is not significant from a design viewpoint. The cost increment for the capacity increase is about $5 million or about 5 percent of the total cost.

Reply No. 3:

No aspects of the present Salt-Gila Aqueduct location or design preclude the use of the proposed Buttes or Florence Dam sites or Tat Momolikot Dam for regulatory use, nor does selection of the proposed route over the historic route preclude utilization of these sites for regulatory storage.

Reply No. 4:

The text in Chapter I has been changed to reflect this comment. If the issue is resolved in favor of continuing advanced planning studies, Reclamation will schedule environmental investigations of all reasonable alternatives, as well as these dams.

Reply No. 5:

An environmental analysis is currently being prepared for the Arizona Water Commission recommended M&I water allocations. As stated in chapter I of the DES, a negative determination for the allocation of CAP water for Indian irrigation use was completed on June 4, 1976. The Secretary's allocation of this water was published in the Federal Register on October 18, 1976. As part of the advance planning process for the Indian Distribution Division, environmental assessments are being prepared to determine the appropriate NEPA compliance document(s) for this element of the CAP.

Reply No. 6:

The aqueduct is designed to prevent the entry of floodwaters into the canal. Along most of the Salt-Gila Aqueduct alinement, cross-drainage protection is provided by existing or proposed floodwater retarding structures. In other areas, overchutes or culverts are provided to pass flows over or under the aqueduct, so as to minimize downstream environmental impacts that would be caused by the severence of drainages. The introduction of floodwaters into the aqueduct would significantly increase the amount of sediment and other undesirable constituents in the aqueduct waters. The increased cost of operation and maintenance as well as downstream environmental losses would not be off-set by the water savings.

Reply No. 7:

Chapter III.B.4.c. has been expanded to more adequately discuss these aspects of water quality. Table 4 has been added to compare Colorado River water with specific ground-water sources in the service area.

Reply No. 8:

Linkage of the aqueduct with SRP water supplies may be technically feasible, but would require upstream diversion and a linking canal, or pumping facilities in the vicinity of Granite Reef Diversion Dam. The construction of such linking facilities was not authorized by Congress as a part of the CAP and is not discussed in this EIS. However, there is nothing in the design of the SGA which would preclude such future action should sufficient public interest be expressed and the concept proves feasible from institutional, economic, environmental, and social standpoints.

Reply No. 9:

The investigation of water conservation was made to determine if conservation was a reasonable alternative to the proposal. Our investigation was based upon conservation measures developed and recommended by the AWC in Phase III-Part 1 of the Arizona State Water Plan. The AWC's findings indicate that conservation measures could result in a 10 to 15 percent reduction in agricultural water depletions and about 10 percent reduction in depletion for urban uses. As stated in Chapter VII.A. of the statement, such water savings would equal about 330,000 acre-feet per year in Maricopa and Pinal Counties, as opposed to the Salt-Gila Aqueduct which would deliver 625,000 acre-feet per year to Maricopa and Pinal County users. Water use in Maricopa and Pinal Counties resulted in a ground water overdraft of about 1,500,000 acre-feet in 1970 in the two counties. Obviously, neither conservation nor the SGA can alone resolve the problems of ground water depletion. Based on these findings, it was concluded that while water conservation is a desirable and necessary adjunct to the SGA, it is not, of itself a reasonable alternative to the proposed action.

These conservation measures developed by the AWC and the actions needed to implement them are listed below:

Urban Water Conservation Techniques	Implementation
1. voluntary reduction in water use by individuals	public education programs on State and local level
2. conversion to low water-using fixtures and appliances	water fixture standards established by local ordinances (such as revised building codes) or State legislation
3. improved irrigation practices outside the home and conversion to desert landscaping	land use and waste prevention ordinances by local governments; local restrictions on alternate day lawn watering; tax incentive
4. leak detection and repair	leak detection programs by local government or water purveyors, metering
5. alternative or increased pricing schemes	water pricing structure changes at local level

Agricultural Water Conservation Technique	Implementation
1. improved delivery systems (lining)	State tax incentives or subsidies for professional IMS programs; lining can be provision for use of the water (as in the CAP)
2. improved irrigation water management (land leveling, soil moisture, and crop stress monitoring)	Irrigation Management Service (IMS) programs are available in some areas through the Bureau of Reclamation, Salt River Project, and some private companies. State or Federal subsidies could increase their use.
3. crop selection	the conversion to low water-using crops can be encouraged by Federal and State agencies, but requiring such conversion is not recommended because of the probable disruption of supply-demand relationships.

As the above discussion indicates, the Bureau of Reclamation has limited jurisdiction in implementing most of the enumerated conservation techniques. However, Reclamation strongly supports water conservation and is implementing conservation measures such as canal lining in those areas within its jurisdiction.

Use of Central Arizona Project water will be subject to a number of water conservation measures specified in the master repayment contract. Specifically, (1) CAP water cannot be used for irrigation of lands not having a recent irrigation history (except Indian lands): (2) agricultural subcontractors will reduce pumping of ground water by the amount of project water received; (3) the subcontractors' canals and distribution systems will be adequately lined to prevent excessive losses; (4) no ground water can be pumped from a CAP subcontractor's service area for use outside that service area (unless drainage is required); (5) the contractor and subcontractors may not sell or otherwise dispose of project water for use outside the contractor's service area; (6) irrigation water may be transferred to M&I purposes if no longer required for irrigation or where lands receiving project water have been converted to M&I use; (7) the subcontractor must establish and provide the U.S. with land, water use, and crop census records. In addition to these measures outlined in the repayment contract, Reclamation is evaluating the potential for requiring IMS, changed cropping patterns, and other improved water use programs on the farm as means of achieving significant water conservation.

Reclamation has also recognized, indirectly, the need for urban water conservation by CAP M&I contractors. The CAP M&I water allocations recommended by the AWC reflect improved efficiency in water use through time. The AWC staff applied a uniform rate of 200 gallons per capita per day (gpcd) for those applicants below 3,000 foot elevation and 180 gpcd for those about 3,000 feet. They further projected an additional 25 percent reduction in per capita use on a straight line basis to year 2034 (150 gpcd or 135 gpcd). This indicates the staff belief that existing use patterns are in some instances excessive and the allocation reflects a need for improved efficiency and changing use habits. Although the Secretary of the Interior has not yet approved the AWC recommended allocation, Reclamation concurs with the AWC methodology and strongly supports the concept of declining allocations through time to encourage reduction in per capita water use.

Reply No. 10:

Retirement of agricultural land may be a viable method by which to effect a balance between water supplies and demands. However, under existing law the decision to retire farm lands rests entirely with each individual farm owner, and is not a decision to be made by the Secretary of the Interior. Such action is not current Federal policy, nor is it an authorized CAP action.

Current USBR and Department of the Interior policy requires EIS's to evaluate impacts relating to economic development, employment, and social and cultural well being, as well as the natural environment. Quantification of these impacts is displayed in Chapter III.E. The benefit/cost analysis for the CAP is readily obtainable from other sources and has been previously furnished to your organization.

Reply No. 11:

The comments provided on the DES and the minor change in the aqueduct design do not constitute significant change meriting a supplemental DES.

WYOMING
EXECUTIVE DEPARTMENT
CHEYENNE

ED HERSCHLER
GOVERNOR

March 1, 1979

Manuel Lopez, Jr., Regional Director
Bureau of Reclamation, U.S.D.I.
Lower Colorado Regional Office
P.O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lopez:

Enclosed are additional comments received in our office for your consideration.

If we should receive further comments they will be forwarded to you immediately.

Thank you,

State Planning Coordinator's Office

CO:mee

STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Department of Agriculture

TELEPHONE: (307) 777-7321 CHEYENNE, WYOMING 82002

ARRY J. BOURRET, COMMISSIONER

M E M O R A N D U M

DATE: January 19, 1979

TO: Don Daiss

FROM: Dan Hartley *Dan Hartley*

SUBJECT: Salt-Gila Aqueduct A Feature of Central Arizona Project

I have reviewed the Draft Environmental Statement for the Salt-Gila Aqueduct A Feature for Central Arizona Project, and offer the following comments.

The Salt-Gila Aqueduct is a very necessary part of the Central Arizona Project. In my review I find no effects the aqueduct will have upon agriculture. Without the aqueduct being finished the Central Arizona Project will not be able to function. Some Agriculture land will be used for the aqueduct, but additional land will come into production.

The Salt-Gila Aqueduct is a very necessary project and should be allowed to continue on schedule.

DH/rw/jb
cc; Larry J. Bourret, Commissioner

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Department of Agriculture

TELEPHONE: (307) 777-7321 CHEYENNE, WYOMING 82002

LARRY J. BOURRET, COMMISSIONER

M E M O R A N D U M

DATE: February 1, 1979

TO: State Planning Coordinator
Wyoming State Clearinghouse

FROM: Don Daiss, Assistant Commissioner
Wyoming Department of Agriculture

SUBJECT: Salt-Gila Aqueduct
A Feature of Central Arizona Project

We received the attached comments for your consideration.

We appreciate the opportunity to review the draft.

DDjh

Interagency

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

March 1, 1979

Mr. Manuel Lopez, Jr.
Office of the Regional Director
Administration Building
USDI, Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lopez:

This is in response to Mr. Al R. Jonez' January 4, 1979, letter transmitting for our review and comment the draft environmental statement on the Salt-Gila Aqueduct, Central Arizona Project, U.S. Department of the Interior, Bureau of Reclamation.

While the draft statement treats in some detail a very complex proposal, our review has revealed an area of primary concern.

For the past several years, the Forest Service (FS) has been negotiating with the Bureau of Reclamation (BuRec) and the Salt River Project (SRP) for a memorandum of understanding that would spell out management responsibilities over BuRec withdrawn lands in the Tonto National Forest. The latest version of the proposed memorandum of understanding was rejected by the FS because it contained the premise that the BuRec and SRP need only notify the FS of their intention to undertake some activity or project, but, that the FS must obtain BuRec's approval to issue permits within the withdrawal area. The same problem could occur with determining the jurisdiction of and approval authorities for improvements to be constructed in connection with the Salt-Gila Aqueduct and pumping plant. From past experience, we believe that a land use agreement between the FS and BuRec is the proper form of authorization and that the final environmental statement recommend that negotiations for this type of authorization be initiated. 1

Additional comments are enclosed for your use in finalizing the statement. We appreciate the opportunity to comment on this document.

Sincerely,

Barry R. Flamm

BARRY R. FLAMM
Coordinator
Office of Environmental
Quality Activities

Enclosure

cc:
John R. McGuire, Chief, Forest Service
R. M. Davis, Administrator, SCS
Al R. Jonez, Director, Office of Environmental Affairs, USDI, Washington, D.C.

U.S. DEPARTMENT OF AGRICULTURE

Additional Comments on Draft Environmental Statement

for

Salt-Gila Aqueduct
Central Arizona Project

Summary Description

In general this is an excellent summary of project proposals and impacts. Suggestions and question include:

Page 3. Cross Drainage Structures - Is the upslope protection from floodwater complete to the extent that overflow sections along the canal are not needed? 2

Page 4, paragraph 4, sentence 3 - suggest "Maximum" be "Steepest." 3

Page 4, paragraph 6 - suggest adding, "If the Lower Queen Creek floodwater retarding structure, which is now being investigated by the SCS under PL 83-566, is constructed, the Sonoqui Dike would not be required. The proposed Queen Creek siphon could also be replaced by the open concrete canal section." 4

Page 9, 4. Hydrology - The effect of a lower but longer duration of outflow, particularly upon downstream channels (stability, losses, etc.), is not addressed. 5

Page 14, 8. Social and Economic - The threat or hazard to human life, such as drownings, is not addressed. 6

Page 24, paragraph 5, sentence 2 - Many of the washes do not have capacity but are braided systems of channels built up and altered by sediment deposition. 7

Draft Environmental Statement

Fig. 3, Aqueduct System Location Map - The Sonqui Dike should not extend across Queen Creek Channel. 8

Page 5, C. 1., paragraph 1, sentence 5 - According to page 117, the alignment may also be altered for archeological sites discovered during construction. 9

Page 6, paragraph 2 - Should include a description of the alignment of the Spook Hill floodway and floodwater retarding structure. 10

Page 6, 2. Aqueduct Design - SCS has experienced some buckling and cracking of long concrete-lined floodways that are exposed to high and fluctuating temperatures for long periods. Although the proposed aqueduct will be water filled most of its life, the adequate consideration to joint construction and protection is necessary during the period prior to filling to allow ample length extension without damage. 11

In addition, the DEIS indicates that a small segment (0.6 miles) of the aqueduct alignment may cross the Tonto National Forest. Twenty acres would be required for this alignment plus a pumping plant. The locations are immediately adjacent to the forest boundary in an area of considerable existing and proposed development on private land. 12

Page 8, paragraph 3, sentence 3 - This sentence seems to be in conflict with the objectives described on page 33. 13

Page 8, 3.a., paragraph 1, sentence 1 - It seems inappropriate to describe the capacity of a pumping plant in terms of energy requirements. 14

Page 10, 4. Cross Drainage Structures - It is questioned whether or not the provisions for bypassing floodwater are complete to the extent that no overflow features are planned within the aqueduct. This question is particularly raised when looking at the water in the aqueduct as shown in Figure 17. 15

Fig. 20 - The drawing may be more typical if the outlet showed energy dissipation features. 16

Page 12 or page 37 - No reference is made to the effects of subsidence and fissures on the flood retarding dikes or proposed flood portective structures. The water storage poses some threat should subsidence cause cracks or fissures to appear across the embankment. 17

Page 12, c., paragraph 1, sentence 3 - The maximum sideslopes would be better expressed as the "steepest" sideslopes since the larger the ratio, the flatter the slope. 18

Page 21, 5.b., - Construction scheduling could be planned during the low potential runoff period (April thru June) to reduce the hazards due to flooding from Queen Creek and Gila River. 19

Page 25, J. 1., Operating Criteria - It is not clear as to how off-peak period energy use can be implemented without a regulatory reservoir to provide continuous delivery of irrigation water. **20**

Page 27, System Maintenance , 1. Aqueduct - This section should include a description of major maintenance work that would be scheduled during periods of lowest water use. **21**

Page 32, paragraph 3, sentence 2 - It is difficult to imagine anyone of the opinion that a disruption of the natural scenery by construction of the aqueduct, dikes, and transmission facilities would be pleasing. **22**

Figures 33 through 54 - The report would be improved by sequentially numbering these figures. **23**

Page 39, paragraph 5, sentence 6 - The validity of this sentence is questioned. Housing developments are being built in previously agricultural areas. **24**

Page 41, 4. Hydrology, a. Surface Water, paragraph 2, sentence 3 - Flow occurs more often and for longer durations, especially in the Gila River, than this sentence portrays. **25**

Page 42, paragraph 1, sentences 3 and 4 - Most of the floodwater stored in these structures is released into the Powerline Floodway. The Powerline Floodway discharges into the RWCD Floodway, which currently ends at Highway 87. Floodwater from the RWCD Floodway reaches the Gila River at a location near the St. Johns Indian Mission School at 51st Avenue by overland flow through the Gila River Indian Reservation. **26**

Page 42, The Magma floodwater retarding structure, located in Reach 3, provides protection to the CAP Aqueduct although the structure is about two miles upslope from the canal. Also, the Florence floodwater retarding structure in REach 4 provides immediate protection to the aqueduct. **27**

Page 46, paragraph 1, sentence 3 - This statement indicates an increase in the salinity to the SGA of only 1 mg/l; the accuracy of an estimate so refined is questioned. **28**

Page 68, paragraph 4 - Recommended seen mix consists of only shrubs; suggest adding Lehman Lovegrass (Eragrostis lehmaninana), Fountaingrass, Pennisetum setaceum (Fuppelii), and desert globemallow, Sphaeralcea ambiqua to get a little variety and better erosion control. **29**

Page 87, f. Special Status Wildlife, paragraph 2 - A list entitled, "Threatened and Unique Wildlife of Arizona," was officially approved by the Arizona Game and Fish Commission during a meeting on October 20-21, 1978, in Tucson. **30**

Page 122, b. Soil Conservation Service (SCS), Remarks, sentence 3 - It would be more appropriate to say, "The construction of the Lower Queen Creek floodwater retarding structure, proposed under PL 83-566, would preclude the construction of Sonoqui Dike as presented in this report." **31**

Page 133, k. 1. a., paragraph 2, sentence 1 - This sentence should be corrected to read, "The primary water-related impact of the floodwater retarding structures is to prevent flood damage." **32**

Reply to comments made by the Department of Agriculture (March 1, 1979)

Reply No. 1:

We agree that the land-use agreement executed on April 27, 1979 by the Forest Service, Salt River Project, and Bureau of Reclamation is needed to insure cooperation in the performance of the respective responsibilities of the three agencies within the Tonto National Forest.

Regarding the use of Reclamation-withdrawn lands within the Tonto National Forest for the Salt-Gila Aqueduct and Pumping Plant, we question the need for a similar land-use agreement at this time. One reason for this position is that there is not a third party, such as the Salt River Project, involved in the construction of these features of the Central Arizona Project. We believe that the existing Memorandum of Understanding between the Bureau of Reclamation and the Forest Service together with exisiting decisions and regulations adequately reflects the responsibilities and relationships between the two agencies concerning the use of withdrawn lands within the national forest. To date, we have tried to work very closely with the Forest Supervisor concerning any Central Arizona Project activities within the forest and we suggest additional meetings to discuss preconstruction and construction work satisfactory to both agencies. In lieu of a formal agreement, we would suggest an exchange of letters between the Forest Supervisor and the Projects Manager documenting the understandings reached at these meetings. Another reason that we feel that a land-use agreement is not appropriate is that the amount of forest lands involved is de minimis. Only 0.6 mile of right-of-way crosses the extreme southwest edge of the forest.

Reply Nos. 2 through 7:

The text of the Summary Description has been changed to reflect these comments.

Reply No. 8:

The referenced figure of the draft statement was in error. However, the plan for Sonoqui Dike has been revised, and the alinement now extends north of Queen Creek. The figures have been changed to show the correct alinement.

Reply No. 9:

Chapter II.C.1. has been revised to include the possibility of alinement changesto avoid highly significant archeological sites.

Reply No. 10:

The alinement of the Spook Hill floodway and floodwater retarding structure is shown on the appropriate figures and the relationship of the FRS to the SGA is described in Chapter II.C.4.d. Since these SCS structures are not a part of the Reclamation proposed action, we do not feel that they need to be further described in Chapter II.C.1.

Reply No. 11:

The concrete lining of this aqueduct will be monitored and the results of current research on the Granite Reef Aqueduct will be used to determine appropriate protection measures for the aqueduct lining prior to filling.

Reply No. 12:

The information supplied by this comment is displayed in several places in the statement.

Reply No. 13:

The objectives of the study, as stated in Chapter III.B.2.a., are to estimate the amount of future subsidence and to outline the areas subject to earth fissuring. The object of the study is not to determine the structural effects of subsidence on a completed aqueduct, but rather is to confirm final aqueduct location and design, and to assist in planning O&M activities.

Reply No. 14:

Pumps are normally rated by water volumetric terms while the motors necessary to drive those pumps are described by energy requirement. Therefore, pumping plant description using both parameters is appropriate.

Reply No. 15:

No overflow features (wasteway and/or emergency spillways) are planned within the Salt-Gila Aqueduct, as cross-drainage structures will be designed to accommodate flows having a magnitude of 100-year frequency. The referenced figure shows Reach 10 of the Granite Reef Aqueduct, which was under construction during the heavy rains of the winter of 1977-78. The accumulation of water shown in the aqueduct was the result of cross drainage from areas along the reach with incomplete construction of training dikes and flow channels, plus rainfall on the O&M roads and within the aqueduct prism.

Reply No. 16:

Because the use of hydraulic energy dissipators depends on the hydraulic gradient of the specific structure, they are not appropriate in all cases, and are not shown as "typical" on the referenced figure.

Reply No. 17:

The process of subsidence is not anticipated to cause structural problems in the floodwater retarding structures. Concerning fissuring, floodwater retarding structures are proposed for construction by Reclamation as part of the Salt-Gila Aqueduct in areas where there is a history of, or anticipated reaction from fissuring. The canal protective structures would be monitored so that if fissuring does develop, maintenance can be performed before significant problems occur.

Reply No. 18:

The text in chapter II.C.4.c. has been changed to reflect this comment.

Reply No. 19:

In order to protect the construction, it is anticipated that the contractor would plan his construction schedule in accordance with low runoff periods.

Reply No. 20:

The text has been changed in Chapter II.J. to clarify the relationship between regulatory storage and the ability to maximize off-peak pumping.

Reply No. 21:

The text has been changed in Chapter II.K.1 to describe the types of major maintenance anticipated during low water demand periods.

Reply No. 22:

The imposition of man-made structures onto natural landscapes causes visible changes, but we are not prepared to make the value judgment that all such changes are always displeasing to every viewer. For example, the sight of the blue water in the All American Canal may be, to some, a pleasant change from the natural scenery along I-8 near Yuma. To others, the presence of the canal in the Imperial Sand Dunes may be viewed as an unpleasant disruption of the landscape.

Reply No. 23:

The figures have been sequentially numbered in the final statement.

Reply No. 24:

The text in Chapter III.B.2.d. has been changed to correct a typographical error which changed the meaning of the sentence.

Reply No. 25:

The text in Chapter III.B.4.a. has been amended to more accurately describe the flow characteristics of the Gila River at the proposed aqueduct crossing.

Reply No. 26:

The text has been amended in Chapter III.B.4.a. to include the information provided by this comment.

Reply No. 27:

The text has been amended in Chapter III.B.4.a. to include the information concerning Magma and Florence floodwater retarding structures.

Reply No. 28:

Under the proposed action the only mechanism for increasing salinity of waters introduced to the Salt-Gila Aqueduct is evaporation from the exposed water surface, estimated to average approximately 2,400 acre-feet annually. Based on presently proposed, but still preliminary, allocations of CAP water, evaporation could represent less than 0.5 percent of water introduced to the aqueduct. Given the preliminary nature of water allocations, a key ingredient in accurately estimating salinity increases, it is agreed that the estimate contained in the draft statement is too refined. To reflect this uncertainty the statement has been changed to indicate a salinity increase of less than 5 mg/l.

Reply No. 29:

The recommended seed mix, as described in the statement, is not limited to the listed species. The species presently being used have been found to be the most adaptable to the harsh conditions along the alinement. The use of annuals such as *Spaeralcea spp*. will begin this fall on selected areas of the Granite Reef Aqueduct. The suggested use of Lehman lovegrass and fountaingrass is inadvisable as these species are best adapted for elevations above 3,000 feet.

Reply No. 30:

Chapter III.C.2.f. has been changed to recognize the Commission's approval of the list.

Reply No. 31:

Chapter III.H.1.b. has been changed to reflect the more appropriate wording.

Reply No. 32:

The prevention of flood damage is the reason for the existence of the floodwater retarding structures. However, in terms of the hydrology discussion being presented, the primary water-related impact is a relocation in the infiltration of runoff as described in Chapter IV.K.1.a.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

AREA OFFICE, ARIZONA - NEW MEXICO
2953 W. INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85017

March 9, 1979

Memorandum

To: Projects Manager, Bureau of Reclamation, Arizona Projects Office, Phoenix, Attn: 150

From: Acting Area Manager, Phoenix

Subject: Review of January 4, 1979 Draft Environmental Statement, Salt-Gila Aqueduct (CAP)

Attached are our comments concerning the above-mentioned statement. We appreciate the opportunity your office afforded us in our August 2, 1978 review of the first preliminary draft statement (dated June 9, 1978). We are unable to review the next preliminary draft and most of the additional comments are due to that fact. New biological information has also come to our attention requiring additional comment.

Thank you for this opportunity to review the Draft Salt-Gila Aqueduct Statement.

Philip W. Norton

Attachment

cc:
Regional Director, BR, Boulder City

120.1

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

AREA OFFICE, ARIZONA - NEW MEXICO
2953 W. INDIAN SCHOOL ROAD
PHOENIX, ARIZONA 85017

March 9, 1979

Memorandum

To: Regional Director, Bureau of Reclamation, Lower Colorado Region, Boulder City, Neveda

From: Acting Area Manager, Phoenix

Subject: Review of January 4, 1979 Draft Environmental Statement, Salt-Gila Aqueduct (CAP)

Thank you for the opportunity to review the Draft Environmental Statement for the Salt-Gila Aqueduct portion of the Central Arizona Project. The following general comments concern the Draft Statement and would thereby apply to the Summary Description, as appropriate. Specific comments then follow with page notation.

It appears that most fish and wildlife resource descriptions and general
mitigation concepts for the direct impacts within the right-of-way of
the selected alternative are adequately described in this Statement.
However, description of impacts on and mitigation for resources such as 1
the kit fox are lacking (specific comments follow). Other direct and
indirect project effects and their significance and mitigation are not
discussed as per the Council on Environmental Quality's (CEQ) Regula-
tions for NEPA Implementation (Federal Register Vol. 40, No. 230,
11/29/78). Direct effects of spoil areas, aggregate sources, and haul 2
roads are mentioned but a thorough analysis and mitigation formulation
is not provided in this Statement. Direct and indirect effects of State 3
selection of more than 3,000 acres of federal lands in exchange for
those used by this project are not discussed. Indirect effects of
project-induced population growth are not discussed although it is 4
mentioned on page 100 of the Statement that since allocations were
unknown impacts on population growth were unknown. Nor do we find in
the discussion impacts of the possible fluctuations of water available
for delivery to the Salt-Gila Aqueduct; i.e., if the total amounts of
water available to CAP fluctuates to a low of 380,000 acre feet during 5
drought, what does this mean to the amount of water in the Salt-Gila
Aqueduct and subsequently, groundwater pumping? Such information as has
been mentioned above should be provided with other project data in one
impact statement before the alternative-selection process takes place.

In keeping with President Carter's directive of July 12, 1978 (Subject: Environmental Quality and Water Resources Management) a commitment should be made in this Statement concerning environmental mitigation measures. Mitigation measures should be formulated so that in project appropriation requests, the Bureau would include designated funds for all environmental mitigation required for the project. Mitigation funds would also be spent concurrently and proportionately with project construction funds throughout the life of the project. **6**

The alternatives section appears to be underemphasized. CEQ's Regulations for NEPA implementation stress that environmental analyses are to concentrate on other alternatives, as well as the agency's proposed alternative. In particular the discussion of the major alternative to an open-aqueduct, the pipeline alternative, is limited to its dismissal for economic and energy reasons. Indeed, dollar and energy costs are important considerations in "reasonableness" of alternatives but it would be more consistent with current water project planning procedures to take the more environmentally optimizing pipeline alternative and display it equally with the more economically optimizing open-aqueduct alternatives. Thus, decisionmakers and the public could compare the dollar cost of construction and environmental consequences of each major alternative. This would also be of benefit in preparation of the "Record of Decision" since the pipeline alternative could be identified as the "environmentally preferable" but unselected alternative. (CEQ Regulations, FR 40: 230) **7**

Also, a GAO report has been recently quoted as saying, "It appears that (the reclamation bureau) is using an overly optimistic estimate of the /Colorado River/ basin's water supply to predict future problems'... The report recommends that the Bureau of Reclamation be directed to develop a series of water management alternatives for the Colorado River basin." How then would this impact the delivery of water through the Salt-Gila Aqueduct and the types of conservation alternatives that might be developed under those water management authorities? **8**

Throughout the Statement, mention is made that provision of Central Arizona Project water will significantly reduce groundwater overdraft. There appears to be some dissension on that subject. The Statement should include conclusions of the April 1977 U.S. Department of the Interior Water Projects Review for the Central Arizona Project: **9**

> "With water delivery at the projected (if uncertain) rate of 1.2 million acre-feet per year, the Central Arizona Project would be able to supply about 55 percent of the existing groundwater overdraft. Projections of the Arizona Water Commission indicate that, assuming a 10 percent decline in agriculture by 2020 and continued rapid growth of population and industry, the overdraft in 2020 will be 80 percent of its

current level even with the water from the Central Arizona Project. If Central Arizona Project water deliveries were to fall to their possible low of 380 thousand acre-feet per year, they would represent only 17 percent of the existing overdraft. Hence, the issue of mining of groundwater in central Arizona will not be resolved by or in the very long run even significantly affected by the Central Arizona Project. Rather, the groundwater mining issue is one of what levels of groundwater depletion are acceptable or appropriate, and when will Arizona take the actions needed to achieve these levels." 9

and

"By providing short-term relief to water supply pressures, construction of the Central Arizona Project may put off the day when pressures for groundwater reform become intense enough to overcome long-standing opposition. Construction of the Central Arizona Project may even further inhibit reform."

Specific comments:

Summary page, Summary of Environmental Impacts and Adverse Environmental Effects, paragraph two.

It is stated that escape devices will be an integral part of the construction plan. This Service has not recommended inclusion of escape devices and in fact finds them, so far, to be an inadequate solution to animal loss problem. By making this statement, the Bureau is precluding the possibility of more effective solutions. 10

Page 11, Overchutes, fourth paragraph.

It is implied that box flume overchutes will be used as big game crossings (soil surface covering has been recommended for big game crossings only). If this is the case, we assume that box flume overchute design has been changed from those constructed along Granite Reef Aqueduct. The Granite Reef Aqueduct Team has stated that the overchute design was not compatible with big game use. 11

Also, it is important to include in the Statement findings of your research studies on small mammal use of the overchutes. We understand that some species of mammals will not use these structures and are, therefore, separated from those populations on the other side of the canal. 12

Page 17, last paragraph and Table 2.

It appears that Arizona will be able to select over 3,000 acres of federal land in exchange for those used for the Salt-Gila Aqueduct. This could result in an additional 3,000 acres of loss to wildlife habitat depending upon land use changes. Description of the exchange lands and their intended use and mitigation for losses need to be disclosed in this document if full impacts of this project are to be analyzed. **13**

Page 43, first full paragraph.

It is stated that flows to Picacho Reservoir will be maintained by redirecting runoff to designated washes downstream of the aqueduct. Figure 9 shows one overchute in the beginning of Reach 4, so how will flows across the majority of the reach be accomplished? **14**

Page 67, paragraph three.

Acreages are estimated for long-term disturbance of right-of-way vegetation (Table 13 on page 63). Similar estimates are necessary here for other areas of long-term modification, i.e., borrow areas, spoil areas, construction staging areas, haul roads, etc. as loss of this habitat will mean long-term loss to wildlife. **15**

Page 67, paragraph seven.

The statement on flows to Picacho Reservoir is confusing. Picacho Reservoir is within the drainage area to be controlled as described on page 43, paragraph one, of this Statement and therefore will be affected by the dikes. **16**

Page 69, paragraph two.

Impacts, alternatives and mitigation measures for spoil areas, aggregate sources, and haul roads should be described in this Environmental Statement. **17**

Page 70, Mammals

It has recently come to our attention that kit fox (*Vulpes macrotis*) occur in some numbers along Reach 2 of the Salt-Gila Aqueduct, within the right-of-way and adjacent areas. Kit fox is a high interest wildlife species and is listed as "unique" in U.S. Forest Service's *Unique Wildlife of the Southwestern Region*, 1975. Charles H. Lowe, with the University of Arizona, has stated that of the native predators; i.e., coyote, bobcat, weasel, otter, porcupine, foxes, and skunks; the kit fox is a "seriously endangered species in Arizona." **18**

"It is extremely unfortunate that Kit fox habitat is being destroyed in the Sonoran Desert by widespread farming, mining, and urban land destruction momentum that may not be reversible. This animal is far more sensitive to man's land use practices than is the coyote. A few are left to-day in the Phoenix-Tucson area..."

(Lowe, L.H. 1972. Report on Proposed APS Cholla 345 KV Transmission Lines Study Area, Arizona 11/72.)

Kit fox are highly susceptible to human intrusion and are easily trapped and shot. This species would be impacted by destruction of dens within the right-of-way, disruption of territories, increased access and human pressures downstream and possibly upstream of the aqueduct and drowning. Impacts on this species need to be described and appropriate mitigation measures formulated. Access roads and the proposed staging area in Reach 2 need careful evaluation. **18**

The Aqueduct cuts through State lands in this area. The State Urban Lands Task Force in their January 1979 report recommended preservation of trust lands identified by the State Land Department as containing valuable environmental features. The remaining kit fox habitat may be worthy of study for preservation under this process.

Page 74, paragraph two, sentence one.

A major long-term impact of Aqueduct implementation is that it creates a barrier to animal movements. This barrier to small mammal movement is evidenced by studies along Granite Reef Aqueduct. Large mammal movement will be impaired by the Aqueduct and has been documented by several studies along existing lined canals and other man-made structures.

Yet another impact which should be included is that of increased human use due to improved access. Some areas along the Aqueduct will not suffer much from Aqueduct-associated access. Yet, other areas will be subjected to increased use due to improvement and/or creation of roads by the contractors for delivery of construction material and access of workmen. Repeated travel over trails or roads causes mortality to resident vertebrates by crushing, wounding, or harassing (such as shooting) animals. Continual use of areas by vehicles reduces re-cruitment into vertebrate populations. **19**

Page 74, paragraph two, last sentence.

Bats and their relative abundance are given in the Arizona State University report on page 74. (Schwartzmann, J.L. et al.) **20**

Page 76, Birds.

It has recently come to our attention that Harris' hawks nest in Reach 1, Salt-Gila Aqueduct. For on-site impacts, the Bureau should check with Mr. Wayne Whaley, a University of Arizona student who is in the process of publishing on the Harris' hawk in Arizona. Mr. Whaley has also noted some apparent transmission line electrocution problems with Harris' hawks and should be knowledgeable about appropriate aqueduct transmission line design in these areas. **21**

Page 80, Tables A and B.

Since losses for nongame birds, mammals, reptiles, and amphibians are not shown, it seems unnecessary to single out two species of game birds for this type of analysis. **22**

Page 87, Special Status Wildlife, paragraph two.

The Arizona Game and Fish Commission has approved "Threatened and Unique Wildlife of Arizona," dated October 21, 1978. **23**

Page 88, paragraph four.

Contractors' crews would have an adverse impact on resident species. Crews will be in areas for a considerable period of time and will represent a concentrated, high level of human disturbance to the resident communities. We can expect losses from crushing, shooting, harassing, and collecting. Contractors and their employees should comply with environmental standards as they must comply with economic and design standards. Discouraging the collection of animals will not reduce impacts due to harassment, crushing, or shooting. We, therefore, suggest standards for wildlife protection be included in the contract. **24**

Page 121, fourth full paragraph.

Recreational facilities at the Salt-Gila Pumping Plant should be rigorously evaluated in terms of its compatibility with the Forest Service's Recreational Plan for the Lower Salt River. Any facilities which would encourage additional human impacts on the Salt River riparian areas beyond that planned and provided for in the overall management plan should be discouraged. **25**

Page 147, page two of Table 35.

The vegetation and wildlife sections of the Table are really too abbreviated to do justice to impacts and tradeoffs. If this Table is to be used as a summary document, concerns and losses as discussed in our comments in this letter should be incorporated. Concerning the specific information presented: **26**

1. Loss of vegetation downstream may not be equalled by an increase upstream and this disparity should be indicated. **26**

2. Most populations of the original wildlife species would exist at a reduced level. "Stabilize" by itself imparts a rather neutral action that should be qualified to reflect the reduced levels.

3. Wildlife losses and fisheries gains should be displayed in the separate columns as the concepts of wildlife mitigation and fisheries enhancement are separable.

Page 149, Biota, paragraph two.

For all practical purposes, wildlife "displaced" by the Aqueduct are lost. The description here of "a portion of the wildlife population" intimates that a high number may escape adverse impact, a conclusion that is incorrect. **27**

Philip W. Norton

cc:
Director, Arizona Game and Fish Dept., Phoenix
Director, Office of Env. Affairs, BR, Washington, D.C.
USFWS, Office of Env. Coordination, Washington, D.C.
USFWS, Regional Director (ES), Albuquerque
USFWS, Field Supervisor (ES), Phoenix

Reply to comments made by Fish and Wildlife Service (March 9, 1979)

Reply No. 1:

The draft EIS was printed and was being reviewed in our Washington office prior to the publication date of the new CEQ regulations. Even though the new guidelines do not take effect until July 30, 1979, we have made an effort to be consistent with their requirements where possible.

Reply No. 2:

While the total area to be disturbed is documented, the specific location and size of individual aggregate sources and haul roads can not be finalized until construction contracts are awarded. Reclamation will consult with the Service on potential problems associated with the use of lands whose location is not specifically described in the statement. This commitment should minimize wildlife resource losses.

Reply No. 3:

As discussed in Chapter III.D.9. the lands to be acquired by the State may not actually be selected for several years. Due to the selection procedure and the backlog of lands remaining to be selected, it is highly unlikely that the specific in lieu lands for the SGA can be disaggregated from any other in lieu selection. Therefore, changes in land use cannot be anticipated and an assessment of the effects of the SGA land exchanges is unreasonable.

Reply No. 4:

We feel that the impacts of CAP water delivery would be more appropriately discussed in the environmental statements or assessments for the water distribution systems. The Salt-Gila Aqueduct will serve as a connecting link to these distribution systems, but will not itself deliver water for direct usage. Recommendations for the allocation of CAP water for non-Indian use are made to the Secretary of the Interior by the Arizona Water Commission. The AWC transmitted its recommendations for M&I allocations to the Secretary in June 1977. The AWC recommended agricultural allocation is expected to be sent to the Secretary in June 1979. These are only recommendations, however, and are subject to changes as the Secretary has the sole and legal responsibility for allocation of project water. An allocation of CAP water for

Indian irrigation use was made by the Secretary in October 1976. Subsequently, representatives of the Salt River and Gila River Indian Communities filed lawsuits seeking to modify the allocation. The suits are currently inactive, pending the outcome of ongoing water rights negotiations. In light of these circumstances, the Indian agricultural allocation cannot be considered as final.

An extensive environmental assessment contracted to Dames & Moore was completed in March 1979. The report discusses in detail the potential for population growth with and without a CAP M&I water allocation. However, the growth attributable to CAP M&I water use is expected to be only 4% greater than the population without CAP water in the year 2034. Population growth and its resulting indirect effects will apparently occur even in the absence of CAP M&I water use.

Reply No. 5:

Water would continue to be delivered through the entire CAP aqueduct system even during drought years as the water use priorities for Granite Reef water user area are the same as those for the Salt-Gila area and the Tucson area. Ground water pumping will increase with decreased water deliveries from CAP but to a lesser extent than would have been the case without CAP.

Reply No. 6:

Chapter III.J. of the draft statement lists the Environmental commitments made concerning mitigation. Although specific procedures for implementing the President's July 12, 1978, directive have not yet been developed by the Water Resources Council, the Bureau of Reclamation is making every effort to comply with the spirit and intent of the directive. Project appropriation requests will include funds designated for all environmental mitigation required for the Project. Efforts will be made to insure that, within reason, mitigation funds will be spent concurrently and proportionately with project construction funds throughout the life of the Project.

Reply No. 7:

The new CEQ regulations, which do not take effect until July 30, 1979, stress that agencies shall "rigorously explore and objectively evaluate all reasonable alternatives. . . ." In this context a 2,750 cfs pipeline would cost approximately seven times as much as equivalent capacity open canal (about $10,500,000 per mile, vs. $1,500,000 per mile), would require over twice as much energy (about 26,000 tons of coal and 3,000 barrels of fuel oil would be committed annually to the SGA if open canal), and thus does not meet the test of "reasonableness."

Reply No. 8:

Because the question is hypothetical, asking for conclusions and results of studies not yet conducted, we are unable to give specific answers of how a given water management plan would impact the delivery of water through the Salt-Gila Aqueduct or what would be the associated water conservation alternatives. As of the date of this environmental statement, the Bureau of Reclamation has not been directed to develop alternative water management plans for the basin.

Reply No. 9:

The two cited paragraphs from the April 1977 Interior review of the CAP have not been included in the final statement. These conclusions deal with the whole of the project and are not necessarily specifically applicable to the Salt-Gila Aqueduct segment. The general impacts relating to the entire CAP were adequately addressed in the overall programatic environmental statement on CAP (INT FES 72-35) and need not be readdressed in this feature statement. The impact of the project on ground-water withdrawal will become evident after final allocations of CAP water have been made. Such impacts will be fully discussed in the environmental assessments or statements for the water allocations.

Reply No. 10:

Such a positive statement concerning the use of escape devices should not have been made in the executive summary. As stated in Chapter III.C., the need for escape devices, fencing, crossings, oases, and catchments would be determined by a team of representatives from FWS, AGFD, BLM, and Reclamation.

Reply No. 11:

This paragraph states that flume overchutes could serve as wildlife crossings where appropriate. Where these box flumes are not appropriate or the configuration of the structure cannot be altered, then a suitable structure will be provided if determined to be reasonable and acceptable.

Reply No. 12:

The study was initiated to "evaluate the barrier effect of an aqueduct constructed with various crossing structures." The structures consisted of a three barrel culvert across the aqueduct and a wash siphon, similar to a flume overchute, across Cave Creek. The data collected did not indicate certain species were unable to use the crossing structures. The study concluded that some crossings of homing mammals do occur (for the tested species) and this presents a potential for gene flow between separated subpopulations.

Reply No. 13:

See Reply No. 3.

Reply No. 14:

As discussed in Chapter III.B.4.A., the Reach 4 retarding structures will have outlets which will direct flows into designated washes and across the aqueduct into the existing Florence-Casa Grande Canal and Picacho Reservoir. The referenced figure does not show these outlets and overchutes since their locations have not yet been finalized, and will require further engineering analyses. The only overchute shown in Reach 4 is located to interface with an outlet from the existing Florence F.R.S. (SCS). Once the outlets from the Reclamation retarding structures are specified, then the overchutes may be located and designed.

Reply No. 15:

The specific location of borrow areas, spoil areas, aggregate sources, and haul roads are finalized as construction designs are completed and/or construction contracts awarded. Chapter II.I.3. of the DES gives an estimate of 200 acres for required aggregate sources and associated haul roads. The same chapter also identifies a 530-acre spoil and water ponding area in Reach 3. Reclamation will consult with the FWS on potential problems associated with the use of lands whose location is not specifically described in the statement to minimize losses to wildlife resources.

Reply No. 16:

The text in Chapter III.C.1.b. has been changed to clarify this confusion.

Reply No. 17:

The general location of potential aggregate sources are shown on Figures 4 through 9. These potential sites, along with established commercial suppliers comprise the alternatives for aggregate sources. The location of haul roads, of course, will depend upon which of the alternative aggregate sources are chosen. The final choice(s) among the aggregate source alternatives will be made based on environmental and engineering studies of the suitability and potential yield of these sites. Whatever choice is made, the magnitude of the resulting impacts would be minor, relative to the proposed action (approximately 200 acres vs 6,500 acres). Impacts would be of the same type as those described throughout Chapters II and III.

Only one spoil area has presently been identified. It will be within the aqueduct right-of-way and is described in the impact and mitigation analysis in Chapter III.

Reply No. 18:

Impact and mitigation for this species and other predators are described in Chapter III.2.a. Further information is contained in the replies to Richard T. Golightly, Jr. (See Appendix D).

Reply No. 19:

See Reply No. 5 to comments made by Richard T. Golightly, Jr. (Appendix D).

Reply No. 20:

The referenced sentence in the draft statement was partially in error. However, the conclusion that "no adverse impacts on bats are anticipated" is based upon available data and our professional opinion.

Reply No. 21:

Reclamation has been aware of Harris hawks in Reach 1 for quite some time. Communications between Reclamation personnel and Mr. Whaley have occurred on numerous occasions. No adverse impacts have been reported due to construction of the nearby SCS Spook Hill FRS or the several power transmission lines in the area. Standard design for Reclamation transmission lines provides ample clearance for large raptors.

Reply No. 22:

See Reply No. 9 to comments made by the Arizona Game and Fish Department. (Appendix D)

Reply No. 23:

The text in Chapter III.C.2.f. has been changed to acknowledge the Game and Fish Commission approval of the threatened wildlife list.

Reply No. 24:

The contractors and other field representatives are required to comply with State laws which cover these types of activities.

Reply No. 25:

As stated in the referenced paragraph, the possibility of providing these facilities is being investigated; final plans have not been developed. A decision regarding the type and extent of facilities to be provided in and adjacent to the Salt-Gila Pumping Plant will not be made until the management direction for the lower Salt River is established.

Reply No. 26:

The referenced table presents only a summary. Additional information on impacts can be found in the appropriate chapters.

Reply No. 27:

The suggestion that all wildlife or an entire population will be lost denies the basic ecological tenet of dynamic stability. Various species of wildlife will be affected and those numbers lost to the overall population will be directly proportionate to the amount of habitat permanently lost. It is extremely doubtful that an entire species of wildlife will be lost or even seriously effected by the project.

LEAGUE OF WOMEN VOTERS OF EAST MARICOPA

A NON-PARTISAN ORGANIZATION DEVOTED TO PUBLIC SERVICE IN THE FIELD OF GOVERNMENT

6125 East Indian School Road
Scottsdale, Arizona 85251

180.

March 3, 1979

Bureau of Reclamation
Lower Colorado Regional Office
P. O. Box 427
Boulder City, Nevada 89005

Thank you for sending us a copy of the Draft ~~Environmental~~ Statement on the Salt-Gila Aqueduct for review. The League of Women Voters supports citizen participation in planning and management decisions concerning water and land and appreciates the opportunity to comment on this statement. The Salt-Gila Aqueduct is in an area of interest to our local League.

We were pleased with your consideration of water quality, beginning on page 40. Hopefully the intent of Arizona, with the cooperation of other Basin States, to stabilize future salinity of the Colorado River at 1972 levels or below will be realized. In any case, we expect the impact of delivered water on water quality to differ from one use area to another. Thus we look forward to the additional analyses to be included in your statements concerning the agricultural and M&I allocations.

On page 150, under Economics, it is stated that: "During the operation and maintenance phase of the proposal, additional unquantified amounts of construction materials, fuels, lubricants, pesticides and herbicides would be required." No attempt is made here to evaluate the completeness of the discussion of economics. However the reference to pesticides and herbicides leads us to ask about the planned use of these materials. Are herbicides to be used in vegetation modification? **1**
(Perhaps this is explicitly mentioned somewhere in the statement?) What use is to be made of pesticides? Are possible environmental impacts of such uses considered? Public awareness of issues concerning the use of pesticides and herbicides is high in this area. Good information on planned uses and anticipated effects would be helpful.

On page 156, in the concluding paragraph on the alternative of No Construction in Conjunction with a Program of Water Conservation, we feel the Bureau's treatment of increased **2**
government action to accomplish water conservation and its impact on the human environment is one-sided. It may be true

that "some" would view such actions as restrictions on personal liberties and unnecessary government meddling in the lives of private citizens, with an adverse impact on the human environment. (No doubt "some" view certain governmental actions involved in the construction of the Salt-Gila Aqueduct in the same light.) However many residents of Arizona reach a different conclusion as they face continued overdraft of ground water, expanding demands for our water supplies, and very little chance of importing additional water in the future at any reasonable cost. With or without the Salt-Gila Aqueduct, many agree that governmental actions which lead to some changes in the way we presently use a scarce resource are overdue. I enclose as evidence a copy of the League of Women Voters of Arizona's new water law position which represents a statewide consensus reached after two years of study. We hope you will consider it as another viewpoint which should be reflected in discussing impact on human environment.

Ann DeBano

- Ann DeBano
Natural Resources Chair

WATER LAW POSITION

Consensus Adopted and Announced by the State Board, Feb. 15, 1979.

Arizona Water Laws should:

1. Reflect the hydrologic cycle and treat all water as interrelated.
2. Recognize and provide for physical differences between the various areas of the state.
3. Define and quantify ground and surface water rights.
4. Assure that domestic and municipal use have the highest priority and that other priorities recognize the socio-economic needs of the different areas of the state.
5. Consider priority of use and coordination of planning for water and land, if water rights are transferred.
6. Provide authority to:
   a) monitor water use,
   b) limit non-beneficial or wasteful use,
   c) limit new water uses in areas of long-term shortages, and
   d) decide which users should have priorities in times of shortages.

The administration for the above should be determined at the state level with emphasis on implementation and enforcement at the regional or local level.

7. Require conservation of water by large individual users, such as large industries and agricultural entities, and encourage conservation by all other users. Tax incentives should be utilized.

-- League of Women Voters of Arizona

Reply to comments made by the League of Women Voters of East Maricopa (March 3, 1979)

Reply No. 1:

Approved herbicides may be used in the control of undesirable vegetation that would interfere with the operation of the system or provide a seed source for spreading to other areas via the aqueduct. The use of herbicides will be held to a minimum due to the problems associated with their use. Biological and mechanical controls will be used where possible. The text has been amended in Chapter II.K.1. to clarify this issue.

Reply No. 2:

We agree that the referenced conclusion does not adequately reflect all points of view. The subject discussion has been deleted from the final environmental statement.

Governor
BRUCE E. BABBITT

Commissioners:
FRANK FERGUSON, JR., Yuma, Chairman
MILTON G. EVANS, Flagstaff
C. GENE TOLLE, Phoenix
WILLIAM H. BEERS, Prescott
CHARLES F. ROBERTS, O.D., Bisbee
Director
ROBERT A. JANTZEN

Asst. Director, Operations
PHIL M. COSPER

Asst. Director, Services
ROGER J. GRUENEWALD

ARIZONA GAME & FISH DEPARTMENT

2222 West Greenway Road Phoenix, Arizona 85023 942-3000

February 27, 1979

120.1

F. Phillip Sharpe
Bureau of Reclamation
Lower Colorado Regional Office
P. O. Box 427
Boulder City, Nevada 89005

Re: Salt-Gila Aqueduct DES

Dear Mr. Sharpe:

This Department has received and reviewed the above-referenced DES. It is evident that considerable effort has been invested in the preparation of this draft and you are to be commended for its present form.

The attached comments are indexed by the page and paragraph to which they apply and are offered as assistance in preparing the FES.

We appreciate the opportunity to review this DES and hope that our comments may be useful in preparing the final document.

Sincerely,

Robert A. Jantzen, Director

Richard L. Stephenson

Richard L. Stephenson, Wildlife Specialist
Planning and Evaluation Branch

RLS:dd

Attachment

Arizona Game and Fish Department
Attachment
to Letter of February 27, 1979

Figure 3.

The ending location of the Salt-Gila Aqueduct shown on the General Location Map at the very beginning of the DES is different from that shown on Figure 3. **1**

Page 20, para. 5

The borrow and spoil areas as well as all additional roads should be identified and related impacts identified. These items, including relevent mitigation measures, should be included in this statement rather than being addressed in a separate document. **2**

Page 57, para. 3

If the recommendations of the FWS, which are mentioned, are to be analyzed, why is this material (or a synopsis) not presented. **3**

Page 59, Table 11

Nomenclature for Honey mesquite in this area has not yet been changed from Prosopsis juliflora var. velutira. **4**

Page 62

The "importance" values referred to in Table 12 and page 64, para. 1, should be more clearly defined. **5**

Page 71, para. 4

"mammal densities" The values referred to are relative abundance estimates and are not "densities". The term "density" is also incorrectly used on page 74, para. 2. **6**

Page 74, para. 2

"greatest effect on small mammals..." The effect (extirpation) would probably be the same for many other small vertebrate, especially herptiles. **7**

Page 78

It is surprising that no mention of Harris Hawks in the Paloverde-Saguaro communities. Our field people freqently observe them in the general vicinity of the proposed aqueduct. **8**

Page 79, para. 5 and 6; Page 80, Tables A & B

The Arizona Game and Fish Department did not compute these total numbers of quail and doves. Density estimates for these species cannot be multiplied by the total number of acres to produce the total number lost. If it could, it would be a minimum number instead of the "maximum number"(Table A) since the original estimates were made during a year of low population levels. Also, this number would represent the annual loss, not total loss. **9**

Page 87, para. 3

"Threatened and Unique Wildlife of Arizona" was approved by the Arizona Game and Fish Commission on October 21, 1978. 10

Page 147

Under "Wildlife", the statement that populations would "stabilize" with a "different composition" is misleading and avoids mentioning the loss. Also, the "tradeoffs" listed for both "vegetation" and "wildlife" do not appear to be compensatory for the losses. A "possible" fishery, for example, is not a direct tradeoff for wildlife losses. 11

Page 149, para. 2

"due to their inability to compete" The loss is due to the loss of habitat not inability to compete. This phrasiology also occurs on page 80, last paragraph. 12

Reply to comments made by the Arizona Game and Fish Department (February 27, 1979)

Reply No. 1:

The general location map was first published in 1968 and has been used ever since in its original form. Although this map is not in total agreement with Figure 3 of the draft, the minor disconformity mentioned does not warrant the costly redrafting and printing of a new map.

Reply No. 2:

The extent of haul roads, borrow areas and waste embankments are not totally and precisely quantifiable at present. The estimated magnitude of these disturbances as well as the impacts and mitigation for these areas are generally addressed in Chapter III. although final quantities are contingent on construction designs.

Reply No. 3:

The recommendations of the FWS are discussed throughout Chapter III.C.

Reply No. 4:

The nomenclature of Prosopsis juliflora var. velutira (sic) has been changed (Lehr 1978; Isely 1973) and is becoming the accepted usage in academic circles.

Reply No. 5:

The text in Chapter III.C.1.b. has been changed to clarify the meaning and use of the importance values.

Reply No. 6:

The text has been changed to avoid the confusing semantics, although the terms "density" and "abundance" are fully explained in Chapter III.C.2.a.

Reply No. 7:

The referenced discussion concerns small mammals; the discussion of other small vertebrates, including "herptiles," is found in appropriate sections of Chapter III.C.2.

Reply No. 8:

The Harris Hawk is listed in Appendix Table C-2.4 as occurring in the Paloverde-Saguaro Community but was not found nesting in the study areas.

Reply No. 9:

The AGFD did estimate the total number of dove and quail for the study area (Horejsi 1976). The estimate of the effects on two well known species are provided in an effort to inform the non-biologically oriented reader of the difficulity and methods for quantifying animal losses. The method utilized is consistent with the method used by Wigal (1973), biologist for the AGFD, during his dove nesting studies.

Reply No. 10:

Chapter III.C.2.f. has been revised to reflect the Commission's approval of the list.

Reply No. 11:

The referenced table in Chapter V has been revised to reflect the losses of wildlife habitat. It is recognized that the listed trade-offs are not always compensatory.

Reply No. 12: The main theme on the referenced pages is that wildlife population will be reduced in some unquantified proportion to the amount of habitat destroyed. This loss of wildlife primarily results because the carrying capacity of the surrounding habitat is temporarily exceeded. Additional losses are attributable to distruction of vegetation within the right-of-way. It should also be noted that statements to the effect that all wildlife within the disturbed/destroyed habitat will be lost is a gross oversimplification of the problem. Wildlife populations are maintained through the mechanism of dynamic equilibrium not ridged stability.

ARIZONA

OFFICE OF THE GOVERNOR

OFFICE OF

ECONOMIC PLANNING AND DEVELOPMENT

1700 West Washington, Rm. 505

General Offices of OEPAD • 4th Floor

OFFICIAL FILE COPY

RECEIVED MAR 1 1979

Action:

Action Taken

Date	Initials	To
		150

File

February 27, 1979

Mr. Manuel Lopez, Jr., Regional Dir.
Bureau of Reclamation
Lower Colorado Regional Office
P.O. Box 427
Boulder City, NV 89005

Re: Salt-Gila Aqueduct, A Feature of Central Arizona Project
INT DES 79-1 - Draft Environmental Impact Statement
S.A.I. #79-80-0001

Dear Mr. Lopez:

Enclosed is a copy of a response concerning the above project which was received by us after our Signoff to you.

Sincerely,

Jo Youngblood

Mrs. Jo Youngblood, Supervisor
Arizona State Clearinghouse
JY:ss
Encl.

Mailing Address: Executive Tower Room 505 • 1700 West Washington • Phoenix, Arizona 85007

FORM TO BE COMPLETED BY REVIEWING AGENCY

Dr. Suzanne Dandoy, Director
Department of Health Services
1740 West Adams Street
Phoenix, Arizona 85007

State Application Identifier (SAI)

JAN 12, 1979 State AZ No. 79-80-0001

:om: Arizona State Clearinghouse
1700 West Washington Street, Room 505
Phoenix, Arizona 85007

Economic Security	Health
Indian Affairs	Power
Mineral Resources	Water
Game & Fish	Parks
Transportation	Land
Ag. & Hort.	AORCC
Az. Mining Ass'n	Civil Rights
Public Safety	
Corrections	Region I
Arid Lands Studies	Region V
Environmental Studies	
Archaeological Research	
Center for Public Affairs	
Museum of Northern Arizona	
Renewable Natural Resources	
Az. Historical Society	
Az. State Museum	
SW Minerals Exploration	
Az. Bu. of Geology & Mineral Tech.	
Salt River Indian Clearinghouse	
Williams Air Force Base	
Luke Air Force Base	
Advisory Commission on Az. Environment	
Emergency Services	
Prescott Historical Society	
OEPAD: D. Moss	
B. Hathaway	

:his project is referred to you for review and comment. Please evaluate as to:

(1) the program's effect upon the plans and programs of your agency
(2) the importance of its contribution to State and/or areawide goals and objectives
(3) its accord with any applicable law, order or regulation with which you are familiar
(4) additional considerations

:ease return THIS FORM AND ONE XEROX COPY to the clearinghouse no later than 17 working days from the date noted above.
:ease contact the clearinghouse if you need further information or additional time for review.

☐ No comment on this project
☐ Proposal is supported as written
☒ Comments as indicated below

:omments: (Use additional sheets if necessary)

See Attached Sheet.

D-126

:eviewer's Signature R. Bruce Scott Date FEB 22 1979

:itle ASSISTANT DIRECTOR
ARIZONA DEPT OF HEALTH SERVICES
DIV. OF ENVIRONMENTAL HEALTH SERVICES Telephone

Feb. 2, 1979

TO: Robert L. M[illegible], P.E., Chief
Environmental Planning

FROM: Barry Abbott, Manager
Solid Waste Section
Bureau of Sanitation

W.R. Williams

RE: "208" Interim Output Comments
A-95 Clearinghouse Reviews

This is in response to the State A-95 Clearinghouse request for review and comment on DRAFT ENVIRONMENTAL STATEMENT prepared by DEPT. OF INTERIOR, entitled SALT-GILA AQUEDUCT, A FEATURE OF C.A.P., dated JAN. 4, 1979.

The Bureau staff has reviewed this document for consistency with our current program and anticipated long-term needs. Specific comments are:

P.23 1. Burning of wastes is subject to limitations and requires written approval before commencement. **1**

P.23 2. Approved landfills must be used for disposal of all garbage, rubbish, and solid waste. If no established, approved landfills are available, use of another site requires written approval by the Bureau of Sanitation of A.D.H.S. **2**

P125 3. Apparently preparers are unaware of solid waste disposal requirements. No consideration has been given to the impacts of either proper or improper solid waste disposal. **3**

cc: File

Reply to comments made by Barry Abbott, Manager, Solid Waste Section, Bureau of Sanitation, Department of Health Services, State of Arizona (February 22, 1979)

Reply No. 1:

As indicated in Chapter II.I.6., prior to the burning of waste material written approval will be obtained from the Arizona Department of Health Services.

Reply No. 2:

An addition has been made to Chapter II.I.6.f. to reflect this comment.

Reply No. 3:

Chapter II.H.2.j. has been changed to recognize the responsibilities of the Arizona State Department of Health Services for solid waste disposal and burning.

OFFICE OF THE SECRETARY
RESOURCES BUILDING
1416 NINTH STREET
95814
(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Navigation and Ocean Development
Department of Parks and Recreation
Department of Water Resources
Department of Forestry

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

Air Resources Board
Colorado River Board
San Francisco Bay Conservation and Development Commission
Solid Waste Management Board
State Lands Commission
State Reclamation Board
State Water Resources Control Board
Regional Water Quality Control Boards
Energy Resources Conservation and Development Commission
California Coastal Commission
California Conservation Corps
~~State Coastal Conservancy~~

THE RESOURCES AGENCY OF CALIFORNIA

SACRAMENTO, CALIFORNIA

OFFICIAL FILE COPY
RECEIVED MAR 12 1979
Action:
Action Taken (Initials)
Date MAR 9 1979 Initials To
150
File

U. S. Department of the Interior
Bureau of Reclamation
Post Office Box 427
Boulder City, NV 89005

The State of California has reviewed the Draft Environmental Statement for the Salt-Gila Aqueduct, a feature of the Central Arizona Project, and the draft of the Summary Description on the same subject, which were submitted through the Office of Planning and Research in the Governor's Office.

The State's comment is as follows:

Water conservation was discussed in the report as an alternative to reduce the demand for the project, but the water saving was considered to be insufficient to be worthwhile. However, water conservation should have been considered as a way to reduce the demand; and therefore, the capacity and cost of the aqueduct. Otherwise, the proposed project would appear to be contrary to President Carter's policy.

The review was in accordance with Part II of the U. S. Office of Management and Budget Circular A-95 and was coordinated with the Departments of Water Resources, Food and Agriculture, Health Services, Transportation, Conservation, Fish and Game, and Parks and Recreation; the Solid Waste Management, State Water Resources Control, and Air Resources Boards; and the Energy and State Lands Commissions.

We appreciate having been given an opportunity to review these documents.

Sincerely,

Charles K Fellows
for L. FRANK GOODSON
Assistant Secretary for Resources

cc: Director of Management Systems
State Clearinghouse
Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814
(SCH. 79012268)

Reply to comments made by the Resource Agency of California (March 12, 1979)

Reply:

Even if all the conservation measures identified were fully implemented, the demand for water in the project service area would still exceed the aqueduct's delivery capacity. The sizing of the aqueduct is not limited by demand requirements in central Arizona, but rather is constrained by the available supply of the Colorado River.

Arizona State Reclamation Association

1124 ARIZONA TITLE BLDG · TEL 253-2136 · PHOENIX, ARIZONA 85003

OFFICIAL FILE COPY
MAR 14 1979
Action: 150
Action Taken .... (Initials)

Date	Initials	To
3/14	jnt	100
		150

File

March 12, 1979

Mr. Manuel Lopez
Regional Director
Bureau of Reclamation
P.O. Box 427
Boulder City, Nev. 89005

Dear Manny:

If the Central Arizona Project is to fulfill the complete purpose for which it was authorized by the Congress in 1968, the Salt-Gila Aqueduct unit of the water delivery system must be built. The draft environmental statement covering that unit is an essential action before construction can be started.

I commend the Bureau of Reclamation for its timely completion of the draft statement. Our examination of that statement indicates that it meets the requirements, including adequate consideration of alternatives.

The National Administration's budget request for fiscal year 1980 proposes beginning construction of the Salt-Gila Pumping Plant as well as Reaches 1 and 3 of the aqueduct. It is, therefore, essential that the final E.I.S. statement be filed promptly following review of the draft if construction is to proceed on schedule for completion by 1985.

Sincerely,

Rich Johnson

Rich Johnson
President

RJc

STATE OF UTAH
Scott M. Matheson
Governor
Kent Briggs
State Planning Coordinator

Division of Policy and Planning Coordination
Intergovernmental Relations Section
Lorayne Tempest, Assistant State Planning Coordinator
124 State Capitol
Salt Lake City, Utah 84111
533-4981

A/95
State Clearinghouse
533-4976
533-4971

Environmental Coordinating Committee
533-5794

Human Resources Coordinating Committee
533-6081

A/85
Federal/State Coordination
533-6083

Federal Resource Information Center
533-4983

March 15, 1979

Manuel Lopez, Jr.
Regional Director
U.S. Department of Interior
Bureau of Reclamation
Lower Colorado Regional Office
P.O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lopez:

The Utah State Environmental Coordinating Committee has reviewed the Notice-Supplemental Information and the Draft Environmental Statement for the Salt-Gila Aqueduct. The Committee offers no comment.

Thank you for the opportunity to comment.

Sincerely,

Lorayne Tempest

Lorayne Tempest
Assistant State
Planning Coordinator

LT/jb

790129088

MARICOPA COUNTY HIGHWAY DEPARTMENT

3325 WEST DURANGO STREET • PHOENIX, ARIZONA 85009

R. C. ESTERBROOKS, P.E.
COUNTY ENGINEER

F. H. LATHROP, P.E.
DEPUTY COUNTY ENGINEER

MARICOPA COUNTY ARIZONA

March 7, 1979

U. S. Department of Interior
Bureau of Reclamation
Lower Colorado Regional Office
P. O. Box 427
Boulder City, Nevada 89005

Attention Mr. Manuel Lopez
Regional Director

Gentlemen:

Re: Salt-Gila Aqueduct

It is the opinion of the Maricopa County Highway Department that the proposed enlargement of the Salt-Gila aqueduct should be incorporated in the design. It is apparent that the benefits would heavily outweigh any environmental objections. The impact appears to be negligible.

The potential for additional capacity should provide a desirable cost-benefit ratio.

Very truly yours,

R C Esterbrooks

R. C. Esterbrooks, P.E.
Director of Public Works
and County Engineer

FHL:mr

cc: Mr. Charles W. Miller

Citizens Concerned About the Project

P.O. Box 2628 • Phoenix, Arizona • 85002

OFFICIAL FILE COPY

RECEIVED MAR 19 1979

Action:

Action Taken ....(Initials)

Date	Initials	To
		150

File

March 14, 1979

Regional Director
Bureau of Reclamation
Box 427
Boulder City, Nevada

Dear Sirs:

Our major objection to the Draft Environmental Statement on the CAP Salt-Gila Aqueduct is the lack of economics. We consider our pocketbook part of our environment. Where is the benefit-cost analysis? Does this (and every other) segment have the same b/c ratio as the entire CAP? We do not believe this document complies with the Principles & Standards. 1

You state CAP imports would be reduced by 0.3 maf if this segment is not built. You note that conservation can save up to 0.396 maf in Maricopa and Pinal Counties (how about Pima?). Might conservation be less expensive than the aqueduct? Where is the analysis? 2

Have you considered retirement of agricultural land? At 5 af/acre, 60,000 acres could be retired to realize 0.3 maf. At the $1000/acre figure used by Arizona's water commissioner, this would only cost $60 million while this aqueduct costs $111 million. 3

Why is the usable groundwater limited to 1200 feet? Is this a physical or an economical limitation? For agriculture or cities? Doesn't Flagstaff go to this depth now? How much water is stored to this depth? I believe it is more than 600 maf while the overdraft is only 2 maf. 4

What is wrong with mining groundwater? How does it differ from coal, copper, etc.? If its wrong, why don't we stop it? 5

Are earth fissures the main problem? Please quantify the damages caused by them. Why are these fissures a threat to homes not yet built? Can't we predict their occurence? If they are such a problem, why do you downgrade them with reference to your canal? 6

Doesn't Orme Dam have some relationship to this canal? If so, how can you proceed, especially since "major alinement changes are not practical." Might not Orme alternatives dictate such changes? For instance, SRP exchanges might make the 1947a Stewart Mountain Dam or the 1963 Granite Reef Dam tie-ins more practical. 7

You indicate the comparative cost of pipe vs. canal. What is the additional cost per mile of lining the canal to reduce seepage? Since seepage is not a loss of water, is the cost justified? Is there a less expensive way to reduce evaporation, which is a loss? 8

Under conservation, you discuss required changes in Arizona water law. Have they been made? Didn't the President condition reinstatement of the CAP on jsut such changes? 9

Unfortunately time does not permit a more in-depth analysis. I hope these comments are helpful.

Sincerely,

F J Welsh

Frank Welsh
Executive Director

D-134

Reply to comments made by Citizens Concerned About the Project (March 14, 1979)

Reply No. 1:

Current USBR and Department of the Interior policy requires environmental impact statements to evaluate impacts relating to economic development, employment, and social and cultural well being, as well as the natural environment. Quantification of these impacts is displayed in Chapter III.E. The benefit cost analysis for the project is readily obtainable from other sources and has been previously furnished to your organization. In accordance with current policy, benefit/cost ratios are not computed for individual project features, and in the case of the SGA, a separate analysis is not considered to be appropriate.

Reply No. 2:

No attempt was made to estimate the conservation opportunities in Pima County as part of this environmental statement since it lies outside the direct service area of the Salt-Gila Aqueduct. Conservation in Pima County will be discussed, however, in the planned draft environmental statement for the Tucson Aqueduct, expected to be filed with EPA in August 1980.

Whether conservation efforts of the magnitude described in Chapter VII.A.2, would be more or less expensive than the Salt-Gila Aqueduct, is not the essential point in the decision to construct the aqueduct. The aqueduct is necessary to deliver Colorado River water to portions of Maricopa and Pinal Counties, the direct service area, and also, to deliver water to the Pima County area (Tucson, etc.), the indirect service area. Even if conservation efforts in the direct service area could eliminate the need for CAP water therein (all current data indicate that this is not physically, let alone economically possible), an aqueduct would still be needed to supply the indirect service area. Phases I and II of the Arizona State Water Plan have demonstrated the essential need for CAP water in both these areas to achieve orderly balance between supply and demand, even with significant water conservation efforts. Therefore, it is concluded that investments in water conservation will be necessary in addition to, not in lieu of, aqueduct construction.

Reply No. 3:

Retirement of agricultural land may be a viable option available to the State to affect a balance between water supplies and demands. For example, the Arizona Water Commission in its Phase II Arizona State Water Plan concluded that to attain a balance between water supplies and demands would require the reduction of 649,000 acres of harvested cropland between 1975 and 2020. This reduction assumes that water would be available from the Central Arizona Project. If the CAP were not constructed, additional reduction in croplands would be required to effect a balance. Therefore, the suggested alternative has been considered and dismissed as unreasonable since it would not fulfill the principal project objective of reducing ground-water overdraft by utilizing Arizona's entitlement of Colorado River water to achieve a reasonable balance between supply and demand.

In addition, the comment wrongly implies that the only purpose and function of the Salt-Gila Aqueduct is to provide 0.3 million acre-feet to agriculture. As described in Chapters II.B and IV.A., the aqueduct would convey approximately 625,000 acre-feet of Colorado River water annually from the Granite Reef Aqueduct, now under construction, to the authorized Tucson Aqueduct and the central Arizona service areas in Maricopa and Pinal Counties. Most of this region is dependent on ground water which is being severely overdrafted. Failure to construct this aqueduct would deny the region access to Colorado River water and force continued reliance on ground-water mining. The uses of Colorado River water provided by the aqueduct are not limited to agriculture, but include municipal, industrial, and Indian uses as well.

Reply No. 4:

Available data on ground water in storage in central Arizona is limited to the depth of 1,200 feet below land surface, and is neither a physical nor an economic limitation. The deposits below generally 1,200 feet depth were deposited in a different geologic environment than those above 1,200 feet. Below 1,200 feet depth the material was deposited by interior drainage and consist of playa and/or lacustrine deposits. This means the drainage entered the basin but did not leave it. Because of this there was an accumulation of mostly fine and very fine grained deposits that contain a high percentage of salts. Above generally 1,200 feet depth the material was deposited by through flowing streams. Those deposits are coarser grained and because the streams were through flowing, do not contain the concentration of salts. In summary, the material below 1,200 feet depth is too fine grained to have a large yield of water and the water it does yield is generally of poorer quality than that above 1,200 feet.

Whether this depth or any other depth restricts its use by cities or farms would depend on several factors, including the economic availability of other water sources, and would need to be evaluated on a case-by-case basis.

The city of Flagstaff is known to have wells extending well below a depth of 1,200 feet to provide municipal water to supplement its erratic surface-water supplies, an ample demonstration that 1,200 feet is neither a physical nor an economic limit in this case.

According to Table 13, of the Arizona State Water Plan, Phase 1, July 1975, by the Arizona Water Commission, ground water in storage to 1,200 feet below land surface in Pima County is 216 million acre-feet; in Pinal County, 120 million acre-feet; and in Maricopa County, 291 million acre-feet, a total of 627 million acre-feet.

Reply No. 5:

The problems associated with long-term mining of ground water in central Arizona are adequately described in the Arizona State Water Plan and in this environmental statement (See Chapter III.B.2).

It is the magnitude and scope of the problems, rather than the rightness or wrongness of mining, that prompts mitigating action such as the CAP.

The differences between mining water (necessary to life itself) and coal or copper, are sufficiently self-evident so as to need no elaboration here. The CAP is a part of the State and Federal effort to reduce ground-water mining in central Arizona and overcome its associated problems.

Reply No. 6:

Earth fissures are recognized as a problem as discussed in Chapter III.B.2.d. This discussion has been revised to reflect recent knowledge obtained in the USBR/USGS studies of the aqueduct area. The quantification of earth fissure damage has been estimated by McCalley and Gum (1975) as referenced in this statement.

Reply No. 7:

The Salt-Gila Aqueduct is analyzed in this environmental statement as an integral part of the total CAP aqueduct system. The decision concerning the most appropriate route of the SGA was made so as to not preclude any decision with respect to regulatory storage. Due to the uncertainty of some other future conditions, some judgment trade-offs were required in identifying the most appropriate route. As discussed in Chapter VII, the suggested historic alinement would obviously have significant environmental and institutional effects and this route is, therefore, concluded to be less appropriate.

Reply No. 8:

While seepage losses from the aqueduct are, at least in part, returned to the underlying ground water, it is true that these losses are not lost from the region's total water supply. Such losses do affect, however, supplies available to produce repayment revenues and the ultimate beneficiaries of these waters. The logic that CAP is intended to reduce ground-water overdraft and unlined aqueducts promote seepage, thereby increasing ground-water recharge and reducing overdrafts, overlooks the economic aspects of the problem. CAP is to be financed, to a significant extent, by water sales revenues. Promoting nonrevenue-producing losses of water where economically avoidable would be inconsistent with the intent of the project, the purposes for which Congress authorized its construction (with lined aqueducts), and the President's current water policy which emphasizes water conservation efforts.

In years past, it was Reclamation policy to require economic justification for inclusion of canal lining in a Reclamation project. Current policy is quite the opposite; canals must be lined unless economics dictate otherwise.

Canal lining also provides, in many cases, a reduction in evaporation losses. Unlined earth canals are typically broad and shallow in cross section to keep velocities in the canal below eroding limits. This exposes the maximum surface area to evaporative losses. Lined canals can withstand much greater velocities, allowing deeper, narrower cross sections and minimum exposed surface areas. Reclamation has been engaged in research of evaporation suppression and reduction methods for many years. None has been found which can be cost effectively applied to the Salt-Gila Aqueduct.

Reply No. 9:

Changes in Arizona ground-water law have not been made prior to the preparation of this final environmental statement. Under Arizona law, however, a ground-water management study commission has been formed and charged with making recommendations for constitutional or statutory amendments regarding ground water by December 31, 1979.

President Carter, as a result of the Water Projects Review in 1977, recommended that further funding of the CAP be made contingent upon further study of ground-water supplies and institution of ground-water regulation and management by the State of Arizona. The Administration strongly supports the efforts of the Arizona Groundwater Management Study Commission in its efforts to effect strong reforms to Arizona ground-water law. As the Commission completes its work and submits recommendations to the State legislature, and as the State legislature acts upon those recommendations, the Administration will evaluate the effectiveness of the ground-water reforms in the context of the Congressional authorization for the CAP.

R. W. BECK AND ASSOCIATES

ENGINEERS AND CONSULTANTS

PLANNING
DESIGN
RATES
ANALYSES
EVALUATIONS
MANAGEMENT

GENERAL OFFICE
TOWER BUILDING
SEATTLE, WASHINGTON 98101
206-622-5000

FILE NO. PP-4100-WG1-MW
PP-4103-WG1-MW
PP-4113-WG1-MW
3101

March 14, 1979

Regional Director
U. S. Bureau of Interior
Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Sir:

Submitted herewith is a paper containing comments on the draft Environmental Statement of the Salt-Gila Aqueduct of the Central Arizona Project. This paper is submitted on behalf of three irrigation districts within Pinal County that will receive water supplies from the Aqueduct or from its southerly extension, the Tucson Aqueduct. These districts are New Magma Irrigation and Drainage District, Maricopa-Stanfield Irrigation and Drainage District and Central Arizona Irrigation and Drainage District.

The major concerns of the Districts based on the description of the Salt-Gila Aqueduct provided in the Environmental Statement are related to two aspects of the system.

1. The capacity of the Aqueduct to meet a reasonable share of irrigation peaking requirements.

2. The location and capacity of turnouts to the District canal systems.

The Districts strongly support construction of the Salt-Gila Aqueduct and of the Central Arizona Project. Regulatory storage at Orme Reservoir or at another reservoir site in reasonable proximity to the Salt-Gila Aqueduct is needed to provide operational flexibility and to most economically achieve the objectives of the Central Arizona Project.

We appreciate the opportunity to comment on the draft Environmental Statement and look forward to working with the Bureau of Reclamation to find acceptable solutions to the Districts' concerns as described in the paper.

Very truly yours,

R. W. BECK AND ASSOCIATES

James V. Williamson

James V. Williamson
Partner and Manager
Major Civil Works Department

JVW/drs

Enclosure

cc: Joe C. Cooper
James L. Savage
John E. Smith
Brock Ellis
William Baker

March 14, 1979

COMMENT

ON

SALT-GILA AQUEDUCT DRAFT ENVIRONMENTAL STATEMENT

I. Purpose

This paper has been prepared as commentary on the draft environmental statement of the Salt-Gila Aqueduct issued by the Bureau of Reclamation in January 1979. The Comments presented herein are submitted on behalf of New Magma, Maricopa-Stanfield, and Central Arizona Irrigation and Drainage Districts. These Districts are applicants for allocations of water from the Central Arizona Project (CAP) and are situated to take their supplies from the Salt-Gila or Tucson Aqueduct.

II. Support For Program

The Districts strongly support the Central Arizona Project and, in particular, construction of the Salt-Gila and Tucson Aqueducts. The aqueducts will be beneficial to the Districts by providing a supplemental supply of irrigation water which will reduce the present overdraft of the ground water basin. The overdraft condition has resulted in very substantial lowering of ground water levels which in turn has caused increased cost of pumping and requirements for deepening of many wells. The lowering of ground water has also caused land subsidence and earth fissuring in some areas. Importation of the CAP water supply will allow the continuation of irrigated agriculture in the central part of Arizona as an economically viable enterprise, although this supply will be substantially diminished in quantity in the future.

The Districts urge implementation of the proposed aqueduct system as rapidly as possible.

III. Aqueduct Capacity

Aqueduct capacity should be selected to meet reasonable peak demand requirements of irrigation. For irrigation, the timing of delivery of supply increments within the cropping season is a critical factor in determining the net benefit realized by use of an annual supply. It is desirable that the Salt-Gila Aqueduct be capable of delivering to the districts their demand in the highest semi-month of the year. Analysis of proposed cropping patterns and climatic data indicate that in the second half of June, on the average, one cubic foot per second of capacity at the CAP aqueduct turnout should be supplied for each 65 acres of land under irrigation. This rate of water use takes into account continued ground water pumping at the estimated safe yield rate and the reuse of drainage water equivalent to about 10% of the total water applied to fields. The capacity requirements for each of the Districts based on the above criteria are given in Table I. These data are shown for two conditions of total water allocation as recently proposed by the staff of the Arizona Water Commission, and the estimated water available in both 1985 and 2005.

The above peaking requirements are for average year climatic conditions during the highest half month and do not reflect extreme peaks that will occur, say, once in five or ten years. The extreme condition could add another 15% to 20% to the delivery requirement for peaking. Such extreme peak demands occur in periods of hot, windy weather combined with low humidity causing very high rates or evapotranspiration by crops.

The requirements for CAP capacity as indicated in Table I for the three Districts are in total a large portion of the presently planned capacity of the Salt-Gila Aqueduct at Granite Reef. Other recipients of CAP supplies are not included in the tabulation. Recognizing the design limitation in the Granite Reef Aqueduct of 3,000 cfs at its terminus, it may be impractical to design the Salt-Gila to meet the maximum semi-month demands as included in Table I unless terminal regulatory storage is provided. The Project Act authorized such storage at Orme Dam and Reservoir, the construction of which is strongly advocated by the Districts. As a minimum, however, regardless of regulatory storage availability, for peaking purposes the CAP Aqueducts should be capable of delivering the average demand in the maximum usage month of the year. Analysis shows that July is the peak month for irrigation demand under normal climatic and cropping conditions. The total for July ranges from about 16% to 18% of the annual volume of water delivered. With the Salt-Gila Aqueduct delivering water to agricultural users at the average demand rate in the month of July, substantial additional irrigation water will have to be provided by the Districts to meet peak requirements described above. This additional water would be provided by ground water pumping, utilizing existing wells to the extent praticable, and would place a considerable financial burden on the Districts.

Estimates were made of the total volume of water that would be delivered by the Salt-Gila and Tucson Aqueducts based on possible allocations of water to agricultural users as recently released by the staff of the Arizona Water Commission. These estimates and the estimated demand for water in July based on 18% of the annual total volume are presented in Table II. CAP water for municipal and industrial purposes is not included, except that 57,000 acre-feet were assumed delivered annually to Pima County users of all types, increasing to 77,400 in 2005. Indian allocations for those served by the Salt-Gila or Tucson Aqueduct are taken as 239,400 acre-feet in both 1985 and 2005 for the Ak Chin, Gila River and Papago reservations as specified by the Secretary of Interior.

As shown in Table II, the above considerations result in required discharge capacities of the Salt-Gila Pumping Plant and first reach of the aqueduct of 3,040 cfs and 3,080 cfs in 1985 for the alternative allocation methods advanced by the State. These discharge rates which would provide average demand in the month of July exceed the currently proposed capacity of the aqueduct system.

Although the Table shows peak demand decreasing in 2005, increases in M & I water deliveries concurrent with decreases in agricultural water are not accounted for in the estimates. Since M & I peak demand characteristics are similar to those of agriculture, it may be expected that peak July demand is likely to remain near the level indicated for 1985.

It is urged that the Bureau of Reclamation carefully consider peaking requirements of irrigated agriculture in determining final design capacity for both the Salt-Gila and Tucson Aqueducts. The Districts are pleased that the Bureau recently has increased proposed design capacity in the Salt-Gila from 2,250 cfs to 2,750 cfs in the upper reach and from 1,350 cfs to 2,250 cfs in the lower terminal reach. However, as shown in Table II, additional capacity is needed to deliver a reasonable proportion of peak demands on the system in 1985. **1**

IV. Turnout Locations

Page 10 of the Draft Environmental Statement indicates that a total of ten turnouts are anticipated along the Salt-Gila Aqueduct with capacities **2** varying from 3 cubic feet per second to about 660 cubic feet per second. Preliminary design of a distribution system to serve the New Magma Irrigation and Drainage District shows requirement for turnouts at 12 locations. Required turnout capacities for serving the New Magma District have not yet been determined because they are dependent on final water allocations from the State.

The Maricopa-Stanfield District will require one turnout at the extreme downstream end of the Salt-Gila Aqueduct near Picacho Reservoir. This turnout will require substantial capacity to serve the District since Maricopa-Stanfield is one of the major recipients of water, as indicated in the preliminary allocations. The Ak Chin reservation may also be served from this turnout. **2**

Preliminary planning indicates that two turnouts to supply the Central Arizona District will probably be located on the Tucson Aqueduct in the vicinity of the Picacho Mountains. Pumping plants and one turnout will probably be located near Red Rock.

The Bureau has indicated its willingness to consult with the Districts in determining the final number, location and capacity of all required turnouts. This procedure is expected to eliminate potential problems.

V. Aqueduct Alignment

The alignment as presented in the environmental statement is generally satisfactory to the Districts. However, with regard to the New Magma District, the proposed alignment cuts diagonally through the service area for about 4 miles in Township 3S and Township 4S, Range 9E. The land lying east of the aqueduct, all or portions of 9 sections, lies above the hydraulic gradient of the aqueduct and can only be served by supplemental pumping. In some cases developed irrigated lands will suffer severence damage by the aqueduct location; possibly these damages could be minimized by minor alignment adjustments. **3**

VI. Operation

Page 25 of the Draft Environmental Statement says that operation of the Salt-Gila Pumping Plant will utilize off-peak power to the extent possible, consistent with the amount of water to be delivered. If both canal and pumping plant capacities were increased a greater utilization of off-peak power could result. However, there may be undesirable hydraulic conditions in the canal with surges resulting from highly fluctuating flows. The Districts concur in the criteria stated on page 26, to the effect that (a) the system will be operated to minimize daily variations and discharge, and (b) it will maintain critical deliveries during periods of disrupted aqueduct operations. This latter is interpreted as provision minimum flow at all times to prevent significant damage to irrigated crops due to disrupted water supply.

It is suggested that consideration be given to providing a storage facility near the pumping plant that would allow greater utilization of off-peak power for pumping and would also provide additional operational flexibility in meeting peak demands for irrigation. 4

VII. Construction Schedule

The Districts are satisfied with the proposed construction schedule that shows work beginning in 1980 and completion of the Salt-Gila Aqueduct in 1985. It is important to have the system in service by 1985 so that benefits can begin to accrue to those entities that will make substantial investments in construction of distribution systems. The Bureau is urged to vigorously pursue implementation of the project in accordance with the schedule established.

VIII. Environmental Impacts

The Districts believe that the primary environmental impacts of the Salt-Gila Aqueduct will be beneficial. The aqueduct will help alleviate the decline in ground water and should reduce land subsidence and earth fissuring. The water supply will allow continuation of a highly productive irrigated agriculture, and will serve other water demands also.

Potential adverse impacts to wildlife, vegetation, and archaeological or historic sites will be minimized to acceptable levels by the proposed design of the aqueduct system. Proposed measures to mitigate habitat losses appear adequate.

TABLE 1

ESTIMATED PEAKING REQUIREMENTS(1)

FOR PROPOSED WATER ALLOCATIONS(2)

District	State Allocation Method	Allocated Amount Ac-ft/Yr		Peak CAP Delivery Requirements, cfs	
		1985	2005	1985	2005
Central Arizona	Least-Cost Model	262,546	131,273	872	436
	Proration	200,990	101,690	667	338
Maricopa-Stanfield	Least-Cost Model	284,856	142,428	946	473
	Proration	228,380	115,540	758	384
New Magma	Least-Cost Model	90,138	45,069	299	150
	Proration	48,500	24,500	161	81

(1) To meet estimated greatest half-month demand in average year, less groundwater safe yield and reuse of drainage water.

(2) Arizona Water Commission Staff Memorandum dated January 24, 1979

TABLE II

ESTIMATED PEAK-MONTH WATER REQUIREMENT

AT SALT-GILA PUMPING PLANT

State Allocation Method	Estimated Total Annual Delivery[(1)]		Peak Month Demand[(2)]			
	Acre-feet		Volume Acre-feet		Average Discharge cfs	
	1985	2005	1985	2005	1985	2005
Least-Cost Model	1,036,000	687,000	186,000	124,000	3,040	2,010
Proration	1,048,000	694,000	189,000	125,000	3,080	2,040

(1) Based on delivery to all entities receiving water allocations for delivery downstream of Salt-Gila PP, including agricultural, Pima County (57,000 ac-ft in 1985 and 77,400 ac-ft in 2005) and Indian agricultural (239,000 ac-ft/yr).

(2) Month of July, estimated as 18% of total annual delivery.

Reply to comments made by James V. Williamson, R. W. Beck and Associates (March 14, 1979)

Reply No. 1:

With regard to the Aqueduct's capacity, you suggest, "It is desirable that the Salt-Gila Aqueduct be capable of delivering to the districts their demand in the highest semi-month of the year." In making that suggestion you have necessarily made the underlying assumption that the Central Arizona Project (CAP) is a "full service" irrigation project. This assumption is not consistent with the CAP purposes.

The amount of water available for importation by CAP to central Arizona will only partially offset the current level of ground-water overdraft. As a result, the CAP will, for the most part, be incapable of completely replacing the current volume of water being pumped by central Arizona's agricultural users (the primary contributors to the overdraft). With the completion of the CAP, agricultural users receiving CAP water should therefore, plan on using their current sources conjunctively with the CAP supplies.

Keeping these factors in mind, the Salt-Gila Aqueduct has been planned with capacity sufficient to enable delivery of a maximum year supply, under a conjunctive use ("supplemental service") concept of operation. This approach to CAP system design minimized the Federal investment and at the same time maximized the Federal benefit by enabling delivery of the entire supply. Recipients of CAP water should plan to "peak" using their current supply systems.

Translating these considerations into CAP peaking capability, the CAP will be capable of delivering 11 percent of a maximum year supply in each peak month. In years with less than maximum supplies, the peaking capability would, of course, be greater. The 11 percent limit on entity diversion is specified in the CAP draft M&I and agricultural water service subcontracts. Wording is provided in the subcontracts to allow for modification of the allowable monthly percentage as specific conditions may dictate.

You recognized in your letter the part played by regulatory storage in capacity considerations. It should therefore be clear that the full potential of the planned capacity of the Salt-Gila Aqueduct may not be realized without regulatory storage.

In light of the above capacity concepts, it will be important for most CAP allottees to plan to use current sources of supply conjunctively with CAP water to enable use of their entire annual CAP allocation.

Reply No. 2:

The draft statement estimate of 10 turnouts was predicted on Reclamation assumptions regarding water allocations and assuming only one turnout per allottee. It is recognized that some users may require more than one turnout for efficient water delivery. The actual number of turnouts from the Salt-Gila Aqueduct will remain undefined until all water allocations are final, user plans for water distribution systems are completed and reviewed by Reclamation, and consultations have taken place.

Twelve turnouts to service the New Magma Irrigation and Drainage District would appear to be very advantageous to the district, but pose several problems for aqueduct operations. Under current design concepts, each turnout would be equipped with a remote control device to allow turnout control by the CAP remote control system. Cost of such devices may be $3,000 to $5,000 each.

Additional turnouts also add to the complexity of the system to be controlled, increasing computer hardware and software requirements. On the other hand, minimizing the number of turnouts decreases the complexity in day-to-day operations, reduces the chances of human operator errors in turnout scheduling, and minimizes investments in supporting computer equipment.

It is not intended that this environmental statement restrict in any way the number of turnouts which may ultimately be needed to provide adequate and efficient water-user service.

Reply No. 3:

The alinement presently selected was located to provide the least amount of disturbance to the farms. To relocate the alinement around the agricultural lands would require additional pumping of 60 feet; or several miles of canal excavation varying up to 80 feet in depth. This would still require pumping to deliver water to the service area. The present alinement is located to provide a balanced section for excavation and embankment. The ditches that are used to deliver irrigation water would be siphoned under the canal. The supply and head ditches would be relocated prior to construction so the land use would not be interrupted.

Reply No. 4:

As discussed in Chapter I, Reclamation is considering methods to provide for CAP regulation as alternatives to the authorized Orme Dan and Reservoir. We agree with the supposition that greater off-peak pumping could be achieved and greater operational flexibility would result if storage were provided near the Salt-Gila pumping plant.

Testimony on Draft Environmental
Impact Statement on Salt-Gila Aqueduct
CENTRAL ARIZONA PROJECT (CAP) March 19, 1979

I would like the attached, "The Central Arizona Project and the Arizona news Media" entered into the record of this draft EIS, perhaps under sub-paragraph C. Public Involvement. I cannot help but be critical of the inadequate coverage of the public hearings held on this draft EIS. Nothing else will have greater impact on Arizona than the Central Arizona Project and the U.S. Bureau of Reclamation cannot by itself inform the public about it. The attached sheet was mailed to the following: The Arizona Republic, Arizona Daily Star, Tucson Citizen, Phoenix TV Channels 3, 5, 8, 10, 12, KDKB radio, KOY radio, KTAR radio.

OFFICIAL FILE COPY
ARIZONA PROJECTS OFFICE
RECEIVED MAR 23 1979

Date	Initials	To

INF Copy

Carolina Butler

Carolina Butler (Mrs.)
11837 N. Paradise Drive
Scottsdale, Ariz 85254
(602) 948-6824

The Central Arizona Project and the Arizona News Media

More than 27 years ago (9-10-51) in the first of four articles in NEWSWEEK, the late columnist, Raymond Moley, was concerned enough about the expensive Central Arizona Project (CAP) to chide the U.S. Senate for giving more attention to foreign policy. "We and our children may be paying for it (the CAP) long after Truman, MacArthur, Chiang, Mao, and Stalin are dead," he wrote.

Even then, Raymond Moley, a national columnist, was concerned about how much the CAP was going to cost. Why aren't you concerned?

Yesterday I attended the third and last public hearing held by the U.S. Bureau of Reclamation on the DRAFT ENVIRONMENTAL IMPACT STATEMENT on the latest segment of the CAP, the Salt-Gila Aqueduct. (Mar 12 in Mesa, Feb 21 in Coolidge, Feb 22 in Apache Junction.)

To my observation, no news person from any medium was present to cover any of these hearings. The one news person I saw was Mr. Donovan Kramer, publisher of several papers in Pinal County who testified in Apache Junction for swift completion of the $1.7 billion CAP. Mr. Kramer is a director of the special-interest lobby headquartered in Phoenix called the Central Arizona Project Association.

Incredible.

The public in Arizona is entitled to something better from the Arizona news media. Nothing else will transform Arizona more from what it is today than the Central Arizona Project. Quoting from a letter from Prof. Dean E. Mann, author of "The Politics of Water in Arizona," now at the University of California at Santa Barbara, he wrote:

> "It is a serious question whether Phoenix and Tucson need more water so they can grow to become like Los Angeles. Would that we had been more far-sighted in California."

Back to the economics - With the recently announced Arizona Water Commission recommendations for CAP water allocations for agriculture, the seemingly dull DRAFT ENVIRONMENTAL IMPACT STATEMENT reads like a bomb.

Raymond Moley is not around anymore. Who will ask for the taxpayers: How much will the CAP cost? And who will pay for it? And who will benefit? What happened to the taxpayers' revolt? To fiscal restraint? Is this how to balance the federal budget? And much more.

Carolina Butler

Carolina Butler (Mrs.), taxpayer
11837 N. Paradise Drive
Scottsdale, Ariz 85254
948-6824

March 13, 1979

Testimony on Draft Environmental
Impact Statement on Salt-Gila Aqueduct
CENTRAL ARIZONA PROJECT (CAP)

March 19, 1979

These comments are with reference to:

III. ANALYSIS OF IMPACTS OF PROPOSED ACTION ON EXISTING Environment

2. Economy (p. 100)

On the date of the Apache Junction public hearing I picked up the Florence (Pinal County seat) newspaper, 2-22-79, and was stunned to see more than 76 full newspaper pages listing delinquent tax parcels in Pinal County so it seems the local residents are not prospering from agriculture in that county so why maintain agriculture in Pinal County by building the $1.7 billion (latest estimate, I believe) Central Arizona Project? These 76 newspaper pages are herewith submitted as part of my comments. 1

Since Pinal County agriculture will get the biggest share of CAP water (per proposed Arizona Water Commission recommendations) and since Pinal County agriculture employs such few people (p. 103), are these Pinal County crops (p. 102) so important to the national supply to justify the enormous use of water and energy to produce them and justify the enormous cost of the CAP? 2

Table 27 (p. 103) states that 1,850 persons are employed by Pinal County agriculture. How many farms is that? Are we talking about the $1.7 billion CAP rescuing only 35 farms? See Arizona Statistical Review page 53 herewith submitted as part of my comments. 3

Carolina Butler

Carolina Butler (Mrs.)
11837 N. Paradise Drive
Scottsdale, Ariz 85254
(602) 948-6824

BUSINESS ESTABLISHMENTS AND EMPLOYMENT BY COUNTY 1976

County	Number of Employees	Number of Establishments	County	Number of Employees	Number of Establishments
Apache	3,702	273	Navajo	10,969	929
Cochise	9,715	1,132	Pima	106,310	8,177
Coconino	11,615	1,276	Pinal	17,156	1,064
Gila	8,290	550	Santa Cruz	5,229	461
Graham	2,204	325	Yavapai	8,427	1,163
Greenlee	*	106	Yuma	12,850	1,353
Maricopa	351,333	24,554	Statewide	996	320
Mohave	7,420	876	TOTAL	559,521	42,559

*Withheld to avoid disclosure of operations of individual establishments.

NUMBER OF BUSINESS ESTABLISHMENTS BY INDUSTRY IN ARIZONA 1976

County	Agriculture & Forestry	Mining	Contract Construction	Manufacturing	Transportation & Utilities
Apache	—	5	19	18	13
Cochise	11	7	104	37	55
Coconino	4	1	111	54	56
Gila	3	14	38	21	20
Graham	7	4	29	9	13
Greenlee	—	2	2	3	5
Maricopa	383	51	2,471	1,506	505
Mohave	5	8	139	50	30
Navajo	4	5	70	54	42
Pima	113	53	798	300	183
Pinal	35	16	90	54	48
Santa Cruz	1	2	31	15	32
Yavapai	9	8	139	56	56
Yuma	48	2	127	48	47
Statewide	2	—	9	4	4

County	Wholesale Trade	Retail Trade	Finance Ins. & R/E	Services	Unclassified
Apache	8	119	17	72	2
Cochise	61	461	88	283	25
Coconino	67	481	83	393	26
Gila	33	232	27	149	13
Graham	30	132	21	77	3
Greenlee	3	54	8	26	3
Maricopa	2,050	6,810	2,469	7,651	658
Mohave	36	318	58	206	26
Navajo	44	392	61	235	22
Pima	506	2,433	931	2,669	191
Pinal	64	429	74	239	15
Santa Cruz	95	154	37	85	9
Yavapai	44	419	95	310	27
Yuma	105	451	116	383	26
Statewide	4	55	13	47	182

Source: U.S. Department of Commerce, Bureau of the Census, **County Business Patterns 1976.**

Arizona Statistical Review 34th Annual Edition

Sept 1978 - Valley Nat'l Bank of Arizona

Reply to comments made by Carolina Butler (March 19, 1979)

Reply No. 1:

In the Arizona Reminder and Blade Tribune of February 22, 1979, published in Florence, Arizona, several pages were devoted to listings of properties upon which there were delinquent taxes. In a cursory review of these properties we find very few which could be classified as crop producing or agricultural properties. The majority of the properties appear to be lots within potential subdivisions or possibly land speculation purchases. In discussions with the Pinal County Treasurer's Office they indicate that (1) this large listing of delinquent tax properties is not unusual and (2) it is not an indication of a faltering economy in Pinal County. The discussion on Pinal County agriculture and its relationship to local and national crop production conditions, agricultural employment and CAP water allocations is a complex subject which if fully analyzed would far outweigh the required analysis for NEPA compliance.

Reply No. 2:

In the Salt-Gila draft environmental impact statement we have attempted to show the importance of agriculture to the Pinal County economy in terms of crop production; direct employment in agriculture; and the impact of the farming enterprise upon agricultural services in the county such as soil and crop preparation services, farm labor and management services, and animal and veterinary services.

Although there is a small percentage of employment within the agriculture industry; the percentage is no less than the employment in the agriculture industry in Maricopa County, Phoenix or Casa Grande. It should be noted that every industry provides both direct and indirect employment opportunities overlapping into other industries with a beneficial impact to the community.

Reply No. 3:

The employment data shown in the statement indicates that 1,850 persons are employed in the agricultural industry in Pinal County. This employment does not represent "farms." Rather this employment represents those industries such as crop planting, harvesting, cotton ginning, livestock services, and farm labor and management services which provide support services to the farming community. Therefore, the number of people employed is not directly related to the number of farms in Pinal County.

It should be clarified at this time that the 35 business establishments in Pinal County classified under agriculture and forestry refers to the agricultural support services mentioned above - not farms. According to the 1974 Census of Agriculture, Pinal County, Table 1, page IV-67, there are 525 farms within Pinal County which support and are supported by the 35 agriculture establishments referred to earlier.

The Central Arizona Project is an investment of an estimated $1.7 billion not to "rescue 35 farms' but rather to bring a substitute water supply to Central Arizona for use by not only agricultural entities but also municipal and industrial entities, and Indian interests.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca. 94105

OFFICIAL
REC'D MAR 20 1979

Action:		
Action Taken		
Date	Initials	
File		

Project #D-IBR-K28006-AZ

Mr. F. Phillip Sharp
Regional Environmental Officer
Bureau of Reclamation
Lower Colorado Regional Office
Box 427
Boulder City NV 89005

MAR 16 1979

Dear Mr. Sharp:

The Environmental Protection Agency has received and reviewed the draft environmental statement for the SALT GILA AQUEDUCT, CENTRAL ARIZONA PROJECT.

EPA's comments on the draft environmental statement have been classified as Category ER-2. Definitions of the categories are provided on the enclosure. The classification and the date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the environmental statement.

EPA appreciates the opportunity to comment on this draft environmental statement and requests three copies of the final environmental statement when available.

If you have any questions regarding our comments, please contact Betty Jankus, EIS Coordinator, at (415)556-6695.

Sincerely,

Sheila M. Prindiville
for Paul De Falco, Jr.
Regional Administrator

Enclosure

Water Conservation

Chapter 7 of the DEIS discusses conservation of water as an alternative to the proposed action. However, the discussion is incomplete since the actions needed to achieve conservation have not been included. The FEIS should address this deficiency since both the EPA and the State of Arizona encourage conservation of water resources as a response to the identified problem of depletion (State-EPA Agreement, January, 79 (see p. 3)). **1**

The Section 208 Plan for Maricopa County also identifies depletion of groundwater as a major problem. The FEIS should address depletion as a problem in itself, independent of the related problems of land settling and fissures. It should assess impacts of this proposal on the depletion problem and describe mitigation in the form of a conservation program. **2**

In addition to stipulating that CAP water may not be used to irrigate new lands and must be offset by reduced groundwater pumping (p. 135), the Bureau should require maximum efficiency and the use of irrigation management systems developed in cooperation with the Water Commission, the State Department of Health Services, the Office of Economic Planning and Development, local 208 planning agencies, and other interested parties (see p. 154). Measures to be considered should include improved irrigation management, canal lining, and changes in cropping patterns. **3**

Some of the available measures can be implemented without sizeable capital investment, contrary to the claims in the DEIS (p. 155).[1] **4**

The Maricopa Association of Governments already has an extensive program under way to reduce in-house use. The FEIS should explain and justify the statement that conservation is not anticipated in the mineral, power, and fish and wildlife areas (p. 154) and then develop conservation measures. **5**

In sum, the FEIS should describe conservation measures in more detail, estimate specific savings and indicate how the Bureau and/or other agencies will implement conservation measures.

[1] The "Proceedings of the National Conference on Irrigation Return Flow Management" (May, 1977) is a good reference with an extensive bibliography. It is available from the Department of Agriculture, Colorado State University, Ft. Collins, Colo. 80523.

Water Quality Impacts

Chapters 3 & 4 of the DEIS fail to adequately discuss the impacts of the proposed action on surface waters, groundwater, and drinking supplies. Salinity impacts in particular should be described in more detail.

The Joint Statement Regarding Environmental Management Strategy of EPA and the State of Arizona (Jan. 1979) identifies four problems which are affected by the proposed action. They are: 1) increasing salinity of Colorado River water which makes it difficult and expensive to use, 2) impairment of designated beneficial uses of water due to pollution, 3) contamination of drinking water supplies, and 4) deterioration of groundwater quality. EPA is charged with protecting "the chemical, physical, and biological integrity of the Nation's waters" (Clean Water Act, Section 101) and the safety of drinking water supplies under the Safe Drinking Water Act. **5A**

Specific sections of the DEIS which need to be revised to address these problems are as follows:

Page 23: The FEIS should describe specific measures which will be used to protect surface and ground waters during construction, and the FEIS should coordinate development of these measures with EPA and State and local 208 planning agencies. **6**

Page 28: The DEIS proposes to use algaecides, herbicides and pesticides in and along the canal. A more detailed description is required of the impact of these potentially toxic materials on water quality, particularly that water used for drinking. Alternative measures should be evaluated for accomplishing the same purpose. These measures should be developed in coordination with EPA and other relevant parties. **7**

Page 44: The DEIS states 1) that there are no water quality standards for the Gila River below Ashurst-Hayden Dam and 2) that Queen Creek and that portion of the Gila River would not be affected by the proposed action because they are ephemeral streams. Both statements are inaccurate. Standards exist which apply to all surface waters in the State (Arizona Revised Statutes R9-21-206 and 207), and, under the "tributary rule" (ARS, R9-21-205(A)), the beneficial uses designated **8** for Painted Rock Lake apply to the affected portion of the Gila River. The FEIS should address the impacts on Queen Creek and the Gila River, any violations of standards which might occur, and appropriate mitigation measures. The FEIS should also recognize the State's current program to revise water quality standards. **8**

Page 45: The FEIS should indicate whether the seepage of CAP water will pollute any groundwater aquifers, and, if so, what mitigation will be carried out. **9**

Page 46: The DEIS notes that this water will exceed the recommended level of dissolved solids for drinking water. The FEIS should specify the quality of the water and compare it to the maximum contaminant levels and recommended levels which have been established for drinking water. (40 CFR 141, 12/24/75) The impact of the high TDS level and other constituents on users should be discussed and mitigation should be included. The FEIS should also indicate whether the estimate of 755-756 mg/l of TDS in the Aqueduct includes allowance for evaporation during storage. **10**

Page 48: The FEIS fails to address the impacts of importing the saline Colorado River water into central Arizona. The following information should be provided: **11**

a. the total mass of salt to be imported in the water.

b. the range of salinity concentrations at different seasons and under different flow conditions.

c. the assumptions, especially for evaporation, and calculations which led to the salinity estimates.

d. the anion-cation composition of the imported water as compared with the groundwater.

In addition, more detailed analysis should be provided comparing CAP water with groundwater (including salinity) at different times, in different areas, regularly or intermittently. The FEIS should address this issue.

Page 128: The impact of mingling CAP water with existing supplies should be defined and quantified in the FEIS. Mitigation measures should be included to address negative impacts. **12**

Page 137: EPA expects the quality of the Colorado River to be maintained, in accordance with state adopted-federally approved water quality standards, with the cooperation of the States and the Bureau, as described on page 46. The FEIS should describe measures which are being taken to protect the Colorado River. **13**

General Comments

The FEIS should include more information or corrections with respect to the following items:

Chapter 3: On many issues it is indicated that impacts cannot be fully assessed until design occurs. The FEIS should include as full an assessment as possible of those impacts, including ranges of effects, and indicate those agencies which will be consulted during design and construction. **14**

Page 33: The Salt, Gila and Santa Cruz Rivers are not necessarily dry. In addition to natural runoff, sewage effluent and irrigation return flows are often present. **15**

Page 35: The statement that only water in the upper 1,200 feet of the local aquifers is usable should be explained. **16**

Page 96: Section 208 planning being carried out by the Maricopa Association of Governments (MAG), the Central Arizona Association of Governments (CAAG), and the State of Arizona should be recognized. MAG issued a draft final 208 plan in December, 1978; CAAG a final in October, 1978; and the State a draft in January, 1979. Preparation of the FEIS should be carried out in close cooperation with these agencies and coordination should be indicated in the FEIS. **17**

Page 100: The DEIS does not address indirect impacts of this proposal, citing the uncertainty of allocations. The FEIS should address this issue as fully as information allows. Included should be ranges of possible allocations, information on how allocations will be set, impacts assessed and mitigation developed. Particular attention should be paid to the potential for the proposal to increase water demand in central Arizona. **18**

Page 135-6: The DEIS estimates long-term average diversion of 1.2 million acre-feet per year from the Colorado. The FEIS should indicate what assumption this is based on and whether actual long-term flows have been taken into account. The impact of the project on releases below Parker Dam during low-flow years should also be assessed. **19**

Page A-7: The Maricopa Association of Governments has an extensive set of reports addressing water quality problems in central Arizona which should be reflected in the FEIS. **20**

EIS CATEGORY CODES

Environmental Impact of the Action

LO--Lack of Objections

EPA has no objection to the proposed action as described in the draft impact statement; or suggests only minor changes in the proposed action.

ER--Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU--Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1--Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2--Insufficient Information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3--Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the impact statement.

If a draft impact statement is assigned a Category 3, no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

Reply to comments made by the Environmental Protection Agency
(March 16, 1979)

Reply No. 1:

The actions needed to achieve water conservation in Arizona are discussed in Chapter VII.A.2. These conservation measures and the actions needed to implement them were developed by the State of Arizona and are discussed in the report "Water Conservation. Arizona State Water Plan Phase III, Part I" (Arizona Water Commission 1978). The municipal and industrial (urban) and agricultural water conservation measures and potential means of implementation are listed below.

Urban Water Conservation Techniques	Implementation
1. voluntary reduction in water use by indivuduals	public education programas on State and local level
2. conversion to low water-using fixtures and appliances	water fixture standards established by local ordinances (such as revised building codes) or State legislation
3. improved irrigation practices outside the home and conversion to desert landscaping	land use and waste prevention ordinances by local governments; local restrictions on alternate day lawn watering, tax incentive
4. leak detection and repair	leak detection programs by local government or water purveyors, metering
5. alternative or increased pricing schemes	water pricing structure changes at local level

Agricultural Water Conservation Techniques	Implementation
1. improved delivery systems (lining)	State tax incentives or subsidies for professional IMS programs; lining can be provision for use of the water (as in the CAP)
2. improved irrigation water management (land leveling, soil moisture and crop stress monitoring)	Irrigation Management Service (IMS) programs are available in some areas through the Bureau of Reclamation, Salt River Project, and some private companies. State or Federal subsidies could increase their use.
3. crop selection	the conversion to low water-using crops can be encouraged by Federal and State agencies, but requiring such conversion is not recommended because of the probable disruption of supply-demand relationships.

As the above discussion indicates, the Bureau of Reclamation has limited jurisdiction in implementing most of the enumerated conservation techniques. However, Reclamation strongly supports water conservation and is implementing conservation measures such as canal lining in those areas within its jurisdiction (see Reply No. 3).

Reply No. 2:

The Bureau of Reclamation is aware of the referenced Section 208 Plan and agrees that ground-water depletion is a major problem. While it is difficult to separate the ground-water depletion problem from the related problems of subsidence and fissuring, Reclamation recognizes that the importation of CAP water into central Arizona can alleviate the rate of ground-water depletion through the year 2034. In itself, this offers an opportunity for Federal, State, and local officials to confront the depletion problem through economic, legislative, and institutional changes. Reclamation is willing to work with all concerned, including the EPA, to solve this complex problem.

The impact of the SGA on ground-water depletion would be positive, since non-Indian CAP agricultural deliveries must be offset by reduced ground-water pumping. Although final CAP agricultural allocations have not been made, the two recommendations published by the AWC indicate that the magnitude of these agricultural deliveries from SGA would be either about 69 percent of 74 percent of the total CAP non-Indian agricultural deliveries, which average 660,000 acre-feet per year over the life of the project. The proposal will not entirely solve the ground-water depletion problem; one of the principal objectives of the CAP. However, the proposal will have a beneficial effect on ground-water depletion. The conservation measure described in Replies 1 and 3 would further mitigate the problem of ground-water depletion.

Reply No. 3:

The Bureau of Reclamation strongly supports the efficient use and conservation of water. For example, the Salt-Gila Aqueduct, like the rest of the CAP aqueduct system, will be lined to prevent excessive water losses. Further, the use of Central Arizona Project water will be subject to a number of water conservation measures specified in the master repayment contract. Specifically, (1) CAP water cannot be used for irrigation of lands not having a recent irrigation history (except Indian lands); (2) agricultural subcontractors will reduce pumping of ground water by the amount of project water received; (3) the subcontractors' canals and distribution systems will be adequately lined to prevent excessive losses; (4) no ground water can be pumped from a CAP subcontractor's service area for use outside that service area (unless drainage is required; (5) the contractor and subcontractors may not sell or otherwise dispose of project water for use outside the contractor's service area; (6) irrigation water may be transferred to M&I purposes if no longer required for irrigation or where lands receiving project water have been converted to M&I use; (7) the subcontractor must establish and provide the U.S. with land, water use, and crop census records.

In addition to these measures outlined in the repayment contract, Reclamation is evaluating the potential for requiring IMS, changed cropping patterns, and other improved water use programs on the farm as means of achieving significant water conservation. It is the policy of the Bureau of Reclamation to encourage IMS programs to more effeciently use water on Reclamation projects or projects applying for Reclamation loans.

Reply No. 4:

This is true. Not all of the available measures (i.e., changed cropping patterns) require sizable capital investments. The text in Chapter VII.A.2. has been changed to reflect this comment.

Reply No. 5:

The referenced statement has been reworded as follows to better reflect its intended meaning: "Conservation efforts in the mineral industry, steam-electric power, and in fish and wildlife uses are not anticipated to result in significant reduction of State water depletions. This is because use of water by the mining industry accounts for only about 3 percent of the State's depletions and steam-electric power and fish and wildlife uses total a little over 1 percent." Reclamation has minimal jurisdiction over such uses in the State since legislative authorities do not currently exist. It would thus be inappropriate for Reclamation to impose conservation measures.

Reply No. 5-A:

Reclamation recognizes the problems identified in the joint statement regarding Environmental Management Strategy of EPA and the State of Arizona, and EPA's legislative mandate to protect the integrity of the Nation's waters and the safety of drinking water supplies. Chapter III of the FEIS has been revised to adequately discuss the impacts of the proposed action. The surface water discussion has been revised in Chapter III.B.4.a.; ground water in III.B.5.b., and drinking supplies and salinity in Chapter III.B.4.c.

Reply No. 6:

Additional material has been included in Chapter II.I.6.2. to describe specific measures. In concert with the State and the EPA, Reclamation will determine which permits are required to protect surface and ground water during construction. As required by EPA regulations (40 CFR 125) a National Pollutant Discharge Elimination System (NPDES) permit would be obtained, if necessary, to minimize water pollution from point sources during the construction process. If quantities of oil are stored for construction purposes, the contractor will be required to prepare and submit an SPCC plan to the contracting officer for his approval.

Reclamation will continue to maintain contact with EPA and State and local 208 planning agencies. Non-point sources of water pollution will be controlled in accordance with the 208 planning program. As required by 40 CFR 230, we have conducted a review of the dredge and fill activities associated with construction (see Appendix C-4) and we are using the 404r exemption. We will implement the commitments made in the 402, 404, 311, and 208 programs during construction to avoid potential surface-and ground-water pollution.

Reply No. 7:

The DES proposes the use of "approved chemicals," "approved herbicides," and "certified pesticides" under control programs "coordinated with appropriate agencies." It is intended to use only those chemicals that fully comply with DOI, EPA, and Arizona regulations then in effect, and under programs approved by EPA and other agencies, so as not to introduce any toxic materials into the aqueduct. Several paragraphs in Chapter II.k.1. have been rewritten to clarify this intent.

Reply No. 8:

Chapter III.B.4.c. has been revised in part to address the referenced comments. Reclamation recognizes that standards exist for all surface waters in the State and that the State is in the process of updating its water quality standards. As recognized in Reply 6 (above), Reclamation will comply with Sections 208, 311, 402, and 404 to prevent violations of standards which might occur during construction, and implement appropriate measures to prevent water pollution of surface- and ground-water supplies.

Reply No. 9:

Additional discussion has been added to Chapter III.B.4.c., to explain anticipated quality impacts of aqueduct seepage on the local ground-water aquifers. If necessary, appropriate mitigation would be carried out on a site by site basis depending on local conditions.

Reply No. 10:

Chapter III.B.4.c. was expanded to indicate the USPH's standards have not been exceeded and the TDS level to the consumer will be generally lower than ground water currently used in the area. The estimate of 755 mg/l does include the increases due to evaporation and storage.

Reply No. 11:

a) The water quality discussion in Chapter III.B.4.c. has been amended to include information on the total mass of salts to be imported. Based on salinity concentrations estimated for the terminus of the SGA, the delivery of CAP water is expected to import approximately 1 ton of dissolved salts per acre-foot of water. However, the SGA salinity concentration of 755 mg/l compares favorably with the average salinity of ground-water pumped in the three-county CAP service area (955 mg/l) (AWC 1975). Thus, while the project would bring a new salt load into the basin, such importation would work to reduce the total application of salts to the land. Considering that the ground-water quality does vary throughout the area (as discussed in Chapter III.B.4.c.), this effect would be modified by the specific relationships of the quality of the ground water and applied surface water at each point in the service area.

b) Figure 53, which depicts seasonal variations in the salinity of the Colorado River, has been added to Chapter III.B.4.c. The graph shows that the highest average monthly salinity concentration at Parker Dam is about 748 mg/l and occurs during September. The lowest monthly average salinity concentration is about 714 mg/l and occurs during September. The decreasing concentrations during the higher water use summer months are attributed to increased levels of river flow from storage reservoirs at this time of year which tend to dilute the more saline irrigation return flows to the Lower Colorado River.

c) The salinity calculations are estimated based on the exposed surface area of water in the aqueduct (which can be accurately defined from the physical configuration of the canal) and the rates of evaporation known to occur in the area traversed by the aqueduct (published monthly by the Department of Commerce in CLIMATOLOGICAL DATA). For the purposes of the salinity estimate, a normal operating water depth in the canal was assumed. It was also assumed that the pan evaporation figures from CLIMATOLOGICAL DATA were applicable to the water in the canal.

d) Table 4 has been added to Chapter II.B.4.c., which displays selected anions and cations of both Colorado River water and typical ground-water sources in the Salt-Gila Aqueduct service area. The variability of salinity of the ground water in the service area is also shown on Table 4, as well as in the discussion in Chapter III.B.4.c. As discussed, the quality of ground water in the service area varies areally and at depth, but should not vary significantly through time. The seasonal variations of salinity in the Colorado River are shown on Figure 53. Including estimates for increased salinity due to evaporation, the salinity of the Colorado River water delivered from the SGA would vary from 724 mg/l to 755 mg/l.

Reply No. 12:

The proposed action, of and by itself, does not cause the mingling of Colorado River water with other local waters, except that seepage losses may join other sources of ongoing recharge and mingle within the ground water. This impact is discussed in Chapter III.B.4.c. It is recognized, however, that CAP waters will be used by some as a supplemental source of water along with other existing supplies. The decision to mingle these several supplies lies with each individual water user entity. Should mitigation measures be required, their development would be the responsibility of each water using entity .

Reply 13:

These measures which are part of the Colorado River Basin Salinity Control Act are described in Chapter III.B.4.c. and Chapter III.K.1.d. The Irrigation Management Service (IMS) programs described in Replies 1 and 3 are also expected to decrease salinity in the Colorado River by reducing saline irrigation return flows.

Reply No. 14:

The final statement has been updated to include quantification of impacts where possible, and in some cases, ranges of effects where specific quantification is not available. Reclamation's impact on other agency programs is discussed in Chapter III.4. and those agencies which will need to be consulted during design and construction are specified by environmental concern in Chapter III.

Reply No. 15:

Chapter III.B.2.b. has been amended to reflect areas of the major river courses influenced by natural runoff, effluent flows, and/or irrigation return flows.

Reply No. 16:

The intent of the referenced statement was not to imply that waters below a depth of 1,200 feet are unusable, only that most major uses are being made from this region of the aquifers. Further clarification has been added to Chapter III.B.2.c. and Reply No. 4 to the comments from Citizens Concerned About the Project.

Reply No. 17:

Reclamation has and will continue to maintain coordination with these agencies. We have received copies and have reviewed the 208 plans of these entities. The potential impacts of importing Colorado River water into central Arizona via the CAP have been recognized by these agencies in their 208 planning. The draft statement for the SGA was submitted to these agencies for review and no specific conflicts were raised between the Salt-Gila Aqueduct and the Section 208 plans of the agencies (see Appendix D for comments submitted by CAAG, OEPAD - 208 Section, and MAG, respectively).

Reply No. 18:

The impacts of CAP water delivery would be more appropriately discussed in the environmental statements or assessments for the distribution systems. The Salt-Gila Aqueduct will serve as a connecting link to these distribution systems, but will not itself deliver water for direct usage. Recommendations for the allocation of CAP water for non-Indian use are made to the Secretary of the Interior by the Arizona Water Commission. The AWC transmitted its recommendations for M&I allocations to the Secretary in June 1977. The AWC recommended agricultural allocation is expected to be sent to the Secretary in June, 1979. These are only recommendations, however, and are subject to change as the Secretary has the sole and legal responsibility for allocation of project water. An allocation of CAP water for Indian irrigation use was made by the Secretary in October, 1976. Subsequently, representatives of the Salt River and Gila River Indian Communities filed lawsuits seeking to modify the allocation. The suits are currently inactive, pending the outcome of ongoing water rights negotiations. In light of these circumstances, the Indian agricultural allocation as now defined may not be considered as final.

Reply No. 19:

This EIS and the proposed action does not, of itself, provide the means to connect central Arizona with the Colorado River. Other project features, specifically the Havasu Pumping Plant and Intake Channel, the Buckskin Mountains Tunnel, and the Granite Reef Aqueduct and Transmission System; are all prerequisite to introducing Colorado River water into the Salt-Gila Aqueduct. Each of the above comments has been addressed in previous EIS's on the overall CAP and on the prerequisite features, namely INT FES 72-35, 73-2, 74-5, 75-66. The following, for example, is quoted from FES 73-2, Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, pages 59 and 60"

"The impact of the Havasu Pumping Plant on the Colorado River will be limited to the reach between Hoover and Parker Dams. Some additional releases will be made from Lake Mead to accommodate project diversions, but a large portion of the CAP requirement will come from a transfer of diversions now going to California. The long-term diversion is expected to be about 1.2 million acre-feet (maf) annually, which assumes full development levels of all prior water rights in Arizona along the mainstream at that time, including court decreed rights of Indian reservations adjacent to the river in Arizona and Mexican Treaty entitlements. Water in excess of the above requirements of downstream users will be available only during periods when spills or incipient spills from Lake Powell or Lake Mead are available as specified in Sections 301(a) and 602(a)(3) of P.L. 90-537. Most of this excess will be diverted to the CAP and will not pass Parker Dam. Annual diversions for the project will range from an estimated minimum of 0.38 maf during periods of extreme drought, to the designed capacity of the aqueduct of 2.2 maf, during periods of surplus water availability. The amount of diversion in any one year will depend upon water-supply conditions and the extent of Upper Basin development, neither of which is expected to restrict project diversions during the early years of the CAP.

"The CAP diversions will not affect the magnitude of releases below Parker Dam during normal years. However, additional downstream uses, primarily on Indian lands and wildlife refuges, will increase the release requirement from Lake Havasu by 200,000 to 300,000 acre-feet per year by the early 1980's. Also, in years of above-normal releases or spills from Hoover Dam, a portion of the spills could be pumped into the Granite Reef Aqueduct as specified by the authorizing act. Project diversions will be in compliance with the "Law of the River," as discussed earlier in this statement."

For purposes of better understanding within this EIS, however, a paragraph has been added to Chapter III.K.1.d., to discuss the more salient assumptions used in projecting the project's supplies of Colorado River water.

Reply No. 20:

The cited MAG reports were provided to and reviewed by the Bureau of Reclamation. The reports provide a useful background for water quality problems in central Arizona and were used as such in the preparation of the Salt-Gila Aqueduct draft and final EIS's. Because the reports dealt most specifically with wastewater, they were not directly applicable to the water quality discussion for the Salt-Gila Aqueduct.

ARIZONA STATE
UNIVERSITY TEMPE, ARIZONA 85281

DEPARTMENT OF ZOOLOGY

OFFICE
MAR 30 1979

Initials	To
	105
	150

March 28, 1979

Mr. Dick Bauman
U. S. Bureau of Reclamation
Arizona Project Office
Valley Center
201 N. Central
Phoenix, AZ 85073

Dear Dick,

I have enclosed a copy of the letter that was requested by the U. S. Fish and Wildlife Service concerning kit foxes along Reach 2 and 3 of the Salt-Gila Aqueduct. Hopefully this information will be of value in the preparation of the final environmental statement. If clarification or expansion of specific comments are necessary I would be glad to do so either verbally or in writing. Thank you for your consideration.

Sincerely,

Richard T. Golightly
Department of Zoology

RG/lc
enclosure

ARIZONA STATE
UNIVERSITY — TEMPE, ARIZONA 85281

DEPARTMENT OF ZOOLOGY

March 7, 1979

Mrs. Sue Monroe
U.S. Fish and Wildlife Service
2934 West Fairmount Avenue
Phoenix, Arizona 85017

Dear Sue:

I have enclosed the information you requested. Hopefully this information will be helpful to you.

If I can be of further help, feel free to call.

Sincerely,

Richard T. Golightly, Jr.
Department of Zoology

RTG/sc

Enclosure

KIT FOX INFORMATION

1) Kit fox inhabit sandy soils characteristic of alluvial fans and basin sediments. Though occasionally occurring in sandy washes, populations are heaviest on the gentle sloping fans. I believe this essentially creates pockets of kit foxes on these fans which provide surplus animals for emigration to less desirable habitat.

2) Kit foxes probably require sandy soils for two reasons:
   a) Their food base (small rodents, especially kangaroo rats).
   b) Their denning behavior absolutely requires such soils for excavation.

3) Home ranges of non-reproductive kit foxes approximate 2 to 3 square miles, parts of which may be used on an alternating basis.

4) We have not ascertained whether kit foxes can swim.

5) The foxes do not appear territorial, but their hunting behavior is still not well defined.

6) They are primarily nocturnal, which often causes their numbers to be underestimated.

7) Kit foxes are not as adaptable as other North American canids such as the coyote. The foxes are naive and easy prey to exploitive humans. They are readily trapped and easily shot.

The picture of the kit fox that emerges from our studies is one of a species with very strict and defined habitat requirements. Due to increasing competition with man for desirable habitat, fox numbers are probably declining statewide. This does not imply that all kit fox populations are declining, only that the animals are losing habitat and do not adapt to changes. In fact, we have located some areas in the state where kit foxes are relatively numerous.

One such area is the alluvial plain transected by reaches 2 and 3 of the Salt Gila Aquaduct. My study near the Vineyard Dam on reach 2 indicates a very dense concentration of the foxes. In some areas close to the "right of way" and two areas on the "right of away" the density of kit fox dens in good repair is as high as 6 plus dens per hectare. Other areas in the state where kit foxes are reported to be locally heavy include the plains adjacent to the Picaho Mountains and along the eastern edge of the Sierra Estrellas.

Comments on the environmental statement for the Salt Gila Aquaduct (DES79-1) (concerning kit foxes only):

1) On page 75 of the report kit foxes are listed as uncommon. I know by working for two years along reach 2 of the project that kit fox numbers are very high. Censusing foxes is difficult and easy to underestimate, especially for a predator like the kit fox, whose biology is so poorly understood. **1**

2) On page 74 the statement indicates that the only impact on predators will be the loss of a food base from disturbed land. This is probably true for most predator species, but not the kit fox. Numerous dens and potential den sites will be lost during construction. Further, these naive foxes pay little attention to modifications by man; I have observed kit fox dens built in the middle of dirt roads. Unfortunately, I doubt that kit foxes denning on the "right of way" will leave in advance of heavy equipment, and some mortality should be anticipated when the earth is scraped or filled. **2**

3) The report indicates (page 74) that the canal may present a barrier to movements by some species. I consider this to be potentially the greatest impact on kit fox population. Since kit foxes are strictly limited by their habitat, the population is essentially located on an island. The proposed canal would cut this island creating two small populations. It is unknown at what point the size of the population becomes so critically small as to experience genetic death due to limitation on gene flow and variation. Further, the foraging areas would be disrupted and flexibility to normal environmental variation decreased. It is conceivable that one or both of these small populations might over time be extirpated. Unfortunately, little or no data exist on kit foxes concerning these parameters. Therefore, I believe it is important that the canal present little or no barrier to fox movements. I believe the overshoots described on page 129 will provide for some of this communication between sides of the canal. The foxes will most likely make use of road bridges over the canal. However, I am concerned that they may not uses culverts beneath the canal due to the length of the passage. The spacing of bridges over the canal will facilitate some movement across the canal, but considering the movement patterns of the foxes I doubt the bridges by themselves will be adequate. Some additional open above-ground crossings would be an improvement. **3**

4) Excavation of extra fill dirt, if necessary in kit fox areas will have the additional impact on dens and foxes as described in number 2 above. **4**

5) The naive nature of the fox will make him an easy target for increased human activity in the area. **5**

Reply to comments made by Richard T. Golightly, Jr. (March 7, 1979)

Reply No. 1:

The variability in abundance noted here is due to the difference in survey methods employed by the ASU and AGFD investigators. While the ASU report indicated the kit fox to be uncommon, the AGFD reports that of the mammal predators in the area, the occurrence of kit fox is second only to the coyote.

Reply No. 2:

Some wildlife mortality is anticipated during excavation of the canal prism. However, preconstruction watering and other intensive human activity prior to excavation will likely cause some animals to abandon their dens and relocate to other areas.

Reply No. 3:

The decision to use culverts, pipe overchutes, or flume overchutes for cross drainage structures is generally based on topography and drainage area upstream of the structure. The need and design for single purpose animal crossings will be evaluated and implemented if justified as discussed in Chapters III.C. and III.J.

Reply No. 4:

Borrow areas for obtaining earth fill materials would be adjacent to the aqueduct and subjected to the same preconstruction activities as discussed in Reply No. 2. Additional excavation would be required to produce concrete aggregates, but this excavation would take place in areas not considered to be kit fox habitat.

Reply No. 5:

Once construction is completed, increased human activity induced by the Salt-Gila Aqueduct should be minimal, since the R-O-W will be fenced, and no public access will be provided to the O&M roads.

3629 W. Minnezona
Phoenix, AZ. 85019
March 17, 1979

Bureau of Reclamation
PO Box 427
Boulder City, Nevada, 89005

To Whom it May Concern:

Enclosed is a personal evaluation of the environmental impact of the Salt-Gila Aquaduct. I was told at the public hearing that you would accept this statement if it was postmarked by 3/19/79. Please accept and consider the enclosed statement.

Thank you for the opportunity to voice my opinion.

Sincerely,

Guy Bonnivier

Guy Bonnivier

I would like to comment on the environmental impact of the Salt-Gila Aquaduct. These comments support my oral presentation of 3/12/79 at the public hearing in Mesa, AZ. .

No research has been done that includes possible effects of the canal upon birds of prey. By placing such a large and conspicuous water source in an arid environment, birds will be attracted from migration flights to the water. Hawks, owls and other raptors have been known to drown in great numbers in metal stock tanks throughout the western U.S. and the practise of placing escape devices in tanks is growing in popularity. The similarities between tanks and canals are basic, available water with it's natural attraction qualities plus no secure place for a bird to perch and drink or bathe. Further complicating matters on the CAP will be current velocity which will pull birds (and animals) from the banks if footholds slip. The $1\frac{1}{2}$ to 1 slope may be sufficient for a bird or animal to hold temporarily but while attempting to maneuver the current velocity will come into play and once in the stream there will be no possible way for animal or bird to pull itself out.

The situation for mammals is similar and has been proven many times in studies on other canals, the most thourough and publicized being big-game drownings. The wildlife studies on CAP are the first step in attempting to alleviate the drownings, however serious doubts exist as to whether or not enough pertinent data can be collected and analyzed to cover the wide degree of variances involved in a project of CAP's magnitude, especially when focus is upon big-game species. The presence of the aquaduct will be influential, presently in a negative aspect, but, the tables could be turned and positive enhancement values could be attained if measures were taken now while CAP is in it's infancy.

The economics of fencing will most likely prevent a total fencing of the canal and even if this was not true, what about birds flying in and animals capable of burrowing under? Escape ramps, a very fine alternative to big-game drownings, pose many functional difficulties when dealing with panic-stricken animals. Wildlife impact studies should include more than just the present population analysis, escape device experimentations, adjacent watering techniques and bridge crossings. A thourough evaluation of a combination escape ramp, water oasis, game crossing and attractive vegtative area should be included in present wildlife impact studies. This system should prove to be highly successful if it were designed to create a large "pond" of dead water with a sloping bottom. ildlife would be naturally attracted to the vegetation on the pools edge especially if measures were taken to control vegetative growth along the canal perimeter. An animal or bird would be in a much more natural element at a watering oasis such as this and if an animal were to cross the canal he would most likely do so here. The slight slope of the bottom of the pond would place the animal in the water at his own pace thus eliminating the panic situation associated with falling into deep water from the $1\frac{1}{2}$ to 1 sloped bank. The lack of panic would allow the animal to remain focusing on the opposite side which would have a similar oasis and pond. The only elements that may prevent a relatively smooth crossing will be the deep water and current velocity which can be partially negotiated with a floating styrofoam boom as is used in the Richmond Escape device. The boom may prove to be more successful if used along with the flashing system designed to scare animals away from the boom itself. The boom should be placed slightly downstream from the crossing. The oasis-crossing system would be a valuable asset to wildlife especially in lower density areas where game numbers and migrations are seasonal or questionable. A safe form of available water and elimination of many of the canal's hazards will enhance wildlife numbers and credit the CAP with environmental foresight.

Additional benefits of the combination type design would be almost complete elimination of bird drownings for they would be attracted to the safe water areas and a spawning area created in the backwaters of the pond. Fish eating birds such as the Bald Eagle and Osprey would benefit from the additional spawning grounds along with a recreational resource for people.

The total backwater area should be large enough to create a subatantial pool in order to be fully effective. Slope and surface of the ramp should be experimented with, concrete vs earthen materials, corrugated vs brushed finish, various sloping degrees that prove successful in creating the needed backwater. The most critical factor which will determine success or failure will be the spacing of the areas along the canal. Sufficient intervals must be determined and will most likely differ with game population statistics found during the study. A point to stress must be that not enough is presently known about desert dwelling wildlife and we must also plan for those small pockets of wildlife that may spend short periods of time migrating or living temporarily in isolated areas. A two year study may not pick up on these isolated herds and thus the importance of having too many oasis areas rather than too few is essential.

The costs of these combination wildlife areas should allow a frequent scattering along the canal and less expensive than total fencing. The design should be more effective and yet less expensive than placing an equal number of escape devices plus adjacent watering holes. The available safer crossing would be an added benefit of this design.

While the bureau is studying alternatives for wildlife this design system should be closely considered for it's many positive effects. Many of the wildlife deaths that have been considered a part of CAP's cost can be eliminated to create healthier populations along the canal.

Please refer to exhibits A and B from the public hearings of 3/12/79.

Reply to comments made by Guy Bonnivier (March 17, 1979)

Reply:

A literature search conducted by Reclamation biologists did not disclose any significant problems regarding drowning losses of large predator birds in large canals. However, large predator birds may drown in the SGA and as indicated in Chapters III.C. and III.J., an intensive monitoring program will be conducted to identify any such problem. Other commitments documented in Chapter III. will result in the type of mitigation facility which you describe in your comments. Your recommendations appear to have merit and will be evaluated for effectiveness and acceptability through the process described in Chapter III.

RAWLINS, ELLIS, BURRUS & KIEWIT
ATTORNEYS AT LAW
SUITE 2300 VALLEY BANK CENTER
PHOENIX, ARIZONA 85073
(602) 257-5700

March 19, 1979

Mr. Manuel Lopez, Jr.
Regional Director
BUREAU OF RECLAMATION
Lower Colorado Region
P. O. Box 427
Boulder City, Nevada 89005

Re: Draft Environmental Statement
Salt-Gila Aqueduct
Central Arizona Project

Dear Mr. Lopez:

On behalf of the New Magma, Maricopa-Stanfield, and Central Arizona Irrigation and Drainage Districts, we present this statement on the Draft Environmental Statement on the Central Arizona Project's proposed Salt-Gila Aqueduct. The New Magma, Maricopa-Stanfield, and Central Arizona Irrigation and Drainage Districts are applicants for allocations of agricultural water from the Central Arizona Project and are situated to take Colorado River water from the Salt-Gila or Tucson Aqueducts.

The Districts strongly support the Central Arizona Project and, in particular, construction of the Salt-Gila Aqueduct. Completion of this aqueduct will provide a supplemental supply of water which will reduce the present overdraft of the groundwater basins. Consequently, delivery of Colorado River water through the Salt-Gila Aqueduct will contribute to the continued prosperity and economic stability of agriculture and its supporting urban communities in Maricopa and Pinal Counties. In addition, construction of the Salt-Gila Aqueduct provides a means for delivery of Colorado River water to several Indian tribes and the City of Tucson.

The Districts recommend that the Bureau of Reclamation consider carefully peaking requirements of irrigated agriculture in determining final design capacity for both the Salt-Gila and Tuscon Aqueducts. The Districts are pleased that the Bureau recently increased the proposed design capacity in the Salt-Gila **1**

Aqueduct from 2,250 cubic feet per second (cfs) to 2,750 cfs in the upper reach and from 1,350 cfs to 2,250 cfs in the lower terminal reach. However, additional capacity is needed to deliver a reasonable proportion of peak water demands through the system in 1985. Increasing the capacity of the Salt-Gila Aqueduct does not appear to cause any significant change in the environmental impact as presented in the Draft Environmental Statement.

The Districts request that the Bureau of Reclamation review the proposed location of the Salt-Gila Aqueduct, and that the Bureau consult with the Districts prior to designating the final aqueduct location. Re-alignment of the Salt-Gila Aqueduct one to two miles east of the proposed location would result in significant cost-savings. Such re-alignment would prevent existing farm operations from being severed by the aqueduct, and would reduce land acquisition costs, but yet the aqueduct as re-aligned would still take advantage of existing and proposed flood protective structures of the Soil Conservation Service. 2

The Districts urge construction of the proposed Salt-Gila Aqueduct as soon as possible. Delay in construction will result in increased construction costs, postponement of Arizona'a use of its remaining entitlement of Colorado River water, increased use of groundwater and pumping energy, and postponement of the repayment of Project costs. In addition, the timely completion of the Central Arizona Project and, in particular the Salt-Gila Aqueduct, will result in substantial farm and urban employment benefits as well as increased tax revenues in central Arizona.

The Draft Environmental Statement is consistent with our understanding of the federal requirements. Potential adverse impacts to wildlife, vegetation, and archaeological or historic sites will be mitigated or minimized to acceptable levels by the proposed design of the Salt-Gila Aqueduct.

The Districts also encourage the Bureau of Reclamation to develop and implement an effective solution for flood control along the Salt and Gila Rivers and the regulatory storage of Central Arizona Project water. Such a program would result in a more efficient use of water resources, would reduce potential flood hazards to human lives and property, and would contribute to the stability of vegetation and wildlife in the Salt-Gila floodplain.

Sincerely,

WILLIAM D. BAKER
for
RAWLINS, ELLIS, BURRUS & KIEWIT

WDB/ps

Copies to:

James E. Alverson
Principal Engineer
R. W. Beck and Associates
200 Tower Building
Seattle, Washington 98101

Central Arizona Irrigation & Drainage District

Maricopa-Stanfield Irrigation & Drainage District

New Magma Irrigation & Drainage District

Reply to comments made by William D. Baker; Rawlins, Ellis, Burrus and Kiewit (March 19, 1979)

Reply No. 1:

This comment seems based on the assumption that the Central Arizona Project (CAP) is a 'full service' irrigation project. This assumption is not consistent with the CAP purposes.

The amount of water available for importation by CAP to central Arizona will only partially offset the current level of groundwater overdraft. As a result, the CAP will, for the most part, be incapable of completely replacing the current volume of water being pumped by central Arizona's agricultural users (the primary contributors to the overdraft). With the completion of the CAP, agricultural users receiving CAP water should, therefore, plan on using their current sources conjunctively with the CAP supplies.

Keeping these factors in mind, the Salt-Gila Aqueduct has been planned with capacity sufficient to enable delivery of a maximum year supply, under a conjunctive use ("supplemental service") concept of operation. This approach to CAP system design minimizes the Federal investment and at the same time maximizes the Federal benefit by enabling delivery of the entire supply. Recipients of CAP water should plan to "peak" using their current supply systems.

Translating these considerations into CAP peaking capability, the CAP will be capable of delivering 11 percent of a maximum year supply in each peak month . In years with less than maximum supplies, the peaking capability would, of course, be greater. The 11 percent limit on entity diversion is specified in the CAP draft M&I and agricultural water service subcontracts. Wording is provided in the subcontracts to allow for modification of the allowable monthly percentage as specific conditions may dictate.

Reply No. 2:

The alinement presently selected was located to provide the least amount of disturbance to the farms. To relocate the alinement around the agricultural lands would require additional pumping of 60 feet ±; or several miles of canal excavation varying up to 80 feet in depth. This would still require pumping to deliver water to the service areas. The present alinement is located to provide a balanced section for the excavation and embankment. The ditches that are used to deliver irrigation water would be siphoned under the canal. The supply and head ditches would be relocated prior to construction so the land use would not be interrupted.