FINAL

ENVIRONMENTAL STATEMENT

HAVASU INTAKE CHANNEL
HAVASU PUMPING PLANT
AND
BUCKSKIN MOUNTAINS TUNNEL

FES 73-2

A FEATURE OF THE
CENTRAL ARIZONA PROJECT

Prepared by
DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

Lower Colorado Region

DEPARTMENT OF THE INTERIOR

FES 73 - 2 1

FINAL
ENVIRONMENTAL STATEMENT

AUTHORIZED
HAVASU INTAKE CHANNEL, HAVASU PUMPING PLANT, AND BUCKSKIN MOUNTAINS TUNNEL
CENTRAL ARIZONA PROJECT
ARIZONA-NEW MEXICO

Prepared by
Bureau of Reclamation
Department of the Interior

JAN 15 1973

Ellis L. Armstrong
Commissioner

Interior-Reclamation,B.C., Nev. 12-72

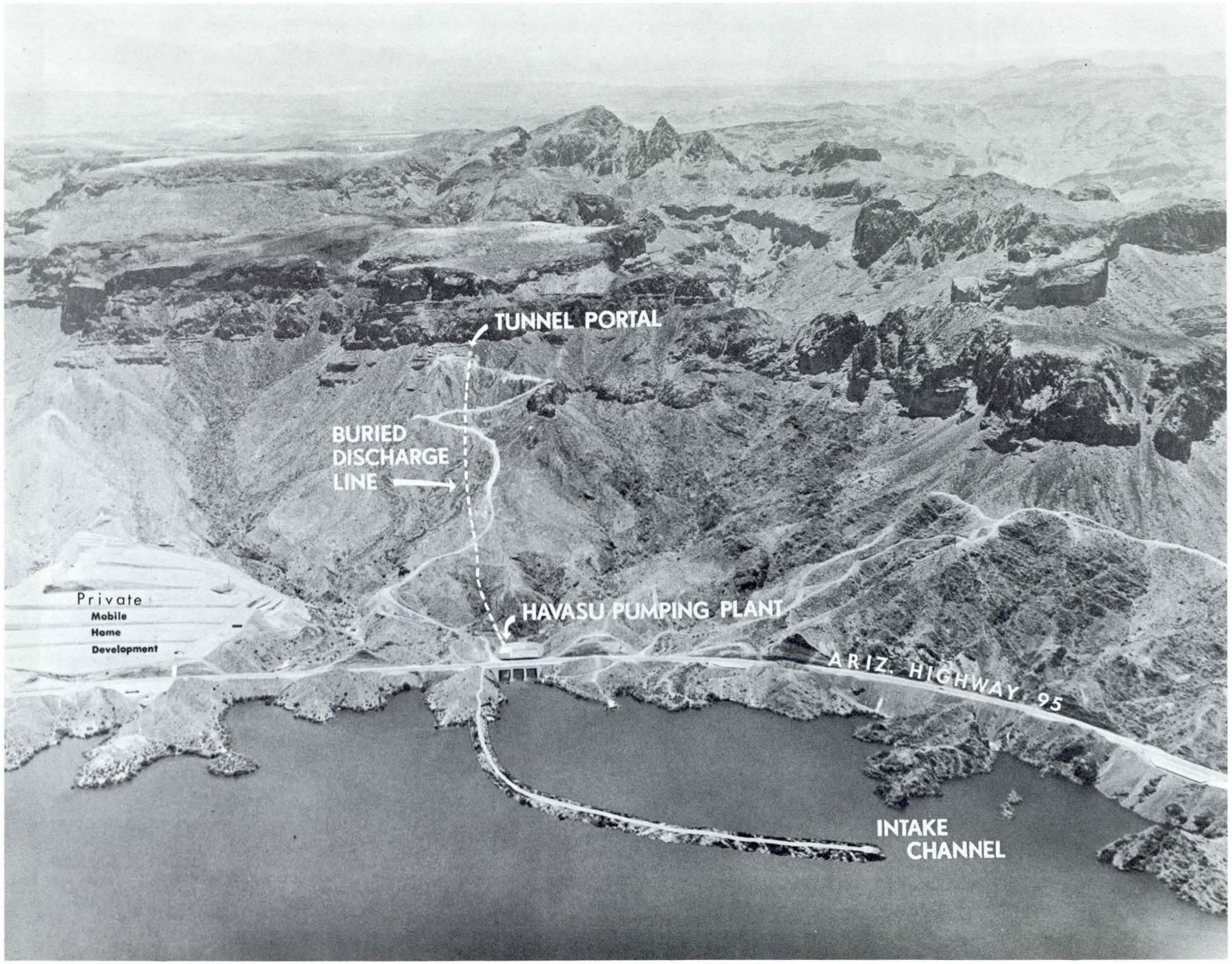


Figure 1

Artist's Conception of Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel (Inlet Portal). Photograph No. P344-300-12523

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 on the Havasu feature involves the construction of the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel on the south shoreline of the Bill Williams arm of Lake Havasu in Arizona. These facilities will enable water to be pumped from the Colorado River at Lake Havasu to the Central Arizona Project service area. Initial construction of the feature is scheduled to begin in early 1973, with project completion scheduled for about 1981.

3. Summary of environmental impacts and adverse environmental effects:
A long-term average of 1.2 million acre-feet of water will be pumped annually from Lake Havasu for multiple-purpose uses. This new supply of water will be used to provide flexibility in meeting the demand for water imposed by municipal, industrial, and agricultural uses.

Construction of the Havasu feature will have minimum effect on the environment of the construction site. The esthetic value of the immediate area will be altered during construction and partially restored upon completion of construction. Construction activities will result in a minimal impact to the biota in the area. About 200 acres of land supporting mostly desert shrub vegetation will be needed for construction activities.

4. Alternatives considered:
   a. Alternative diversion points
   b. Alternatives for individual segments of the feature
   c. Alternative power sources
   d. The alternative of no action
   e. Alternative water sources

5. List of entities from whom comments have been requested or received with responders indicated by "*"

See attached list.

6. Date made available to CEQ and the public:

Draft statement: March 7, 1972

Final statement: JAN 15 1973

HAVASU FEATURE

LIST OF FEDERAL, STATE, AND LOCAL ENTITIES FROM WHOM COMMENTS HAVE BEEN REQUESTED OR RECEIVED WITH RESPONDERS INDICATED BY "*"

FEDERAL AGENCIES

* Department of Agriculture, Washington, D.C.
* Department of Agriculture, Soil Conservation Service, Phoenix, Arizona
Department of Defense, Washington, D.C.
* Department of Health, Education, and Welfare, Washington, D.C.
* Department of Transportation, Washington, D.C.
* Department of Housing and Urban Development, Phoenix, Arizona
* Department of the Army, Corps of Engineers, San Francisco, California
* Environmental Protection Agency, San Francisco, California

DEPARTMENT OF THE INTERIOR AGENCIES

Commissioner, Bureau of Indian Affairs, Washington, D.C.
* Bureau of Indian Affairs, Phoenix, Arizona
* Director, Bureau of Land Management, Washington, D.C.
* Director, Bureau of Mines, Washington, D.C.
* Bureau of Mines, Denver, Colorado
* Director, Bureau of Outdoor Recreation, Washington, D.C.
* Director, Bureau of Sport Fisheries and Wildlife, Washington, D.C.
* Director, Geological Survey, Washington, D.C.
* Director, National Park Service, Washington, D.C.

STATE AND LOCAL ENTITIES

Governors of *Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming
State Clearinghouses of Arizona, California, Colorado, Nevada, *New Mexico, Utah, and Wyoming

* Advisory Commission on Arizona Environment, Phoenix, Arizona (2 letters)
Arizona Conservation Council, Phoenix, Arizona
Arizona Electric Power Cooperative, Inc., Benson, Arizona
Arizona Game and Fish Department, Phoenix, Arizona
* Arizona Highway Department, Phoenix, Arizona
Arizona Public Service Company, Phoenix, Arizona
Arizona State Land Department, Phoenix, Arizona
* Arizona State Parks Board, Phoenix, Arizona
Arizona State Reclamation Association, Phoenix, Arizona
Arizona State Soil Conservation Service, Phoenix, Arizona
* Arizona Water Commission, Phoenix, Arizona
Arizona Wildlife Federation, Phoenix, Arizona
Central Arizona Water Conservation District, Mesa, Arizona
Colorado Plateau Environmental Advisory Council, Flagstaff, Arizona
* Museum of Northern Arizona, Flagstaff, Arizona
DNA - A Legal Services Program, Chinle, Arizona
Mohave County Board of Supervisors, Kingman, Arizona
* Salt River Project, Phoenix, Arizona
* Sierra Club, Southwest Regional Conservation Committee, Tucson, Arizona

STATE AND LOCAL ENTITIES (Continued)

State Chairman of Environmental Quality Programs for League of Women Voters, Sedona, Arizona
Tucson Gas and Electric Company, Tucson, Arizona
* Arizona Water Sports Council, Phoenix, Arizona
Maricopa County Board of Supervisors, Phoenix, Arizona
Yuma County Board of Supervisors, Yuma, Arizona
* Maricopa County Flood Control District, Phoenix, Arizona
Maricopa Association of Governments, Phoenix, Arizona
Tucson Urban Area Regional Reviewing Committee, Tucson, Arizona
Frank Welsh, Tempe, Arizona
Arizona Environmental Health Association, Scottsdale, Arizona
Arizona Republic, Phoenix, Arizona
Yuma Valley Rod and Gun Club, Yuma, Arizona
* Arizona Consulting Engineers Association, Phoenix, Arizona
Arizona Society of Architects, Tucson, Arizona
American Society of Civil Engineers, Mesa, Arizona
Arizona Outdoor Recreation Coordinating Commission, Phoenix, Arizona
Department of Economic Planning and Development, Phoenix, Arizona
Sierra Club, Grand Canyon Chapter, Tucson, Arizona
American Water Resources Association, Tucson, Arizona
Colorado River Board of California, Los Angeles, California
Department of Water and Power, Los Angeles, California
Sierra Club, Los Angeles, California
* The Resources Agency of California, Sacramento, California
* Native American Rights Fund, Boulder, Colorado
National Wildlife Federation, Washington, D.C.
* Clark County Comprehensive Health Planning Council, Las Vegas, Nevada
* Colorado River Commission of Nevada, Las Vegas, Nevada
Nevada Department of Fish and Game, Las Vegas, Nevada
* Four Corners Regional Commission, Farmington, New Mexico
New Mexico Interstate Stream Commission, Santa Fe, New Mexico
* New Mexico Department of Game and Fish, Santa Fe, New Mexico
Western New Mexico State University, Silver City, New Mexico
* Museum of New Mexico, Santa Fe, New Mexico
* Utah Department of Natural Resources, Salt Lake City, Utah

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (Continued)

TABLE OF CONTENTS (Continued)

APPENDED MATERIAL

APPENDIX A

Appendix A contains copies of comments received by the Bureau of Reclamation from Federal, state, and local entities on the March 1972 draft (DES 72-40), together with 23 separate replies which have been prepared thereto.

APPENDIX A (Continued)

APPENDIX B

APPENDIX C

CHAPTER I

DESCRIPTION OF THE PROPOSAL

I. DESCRIPTION OF THE PROPOSAL

A. Location [121, 132]

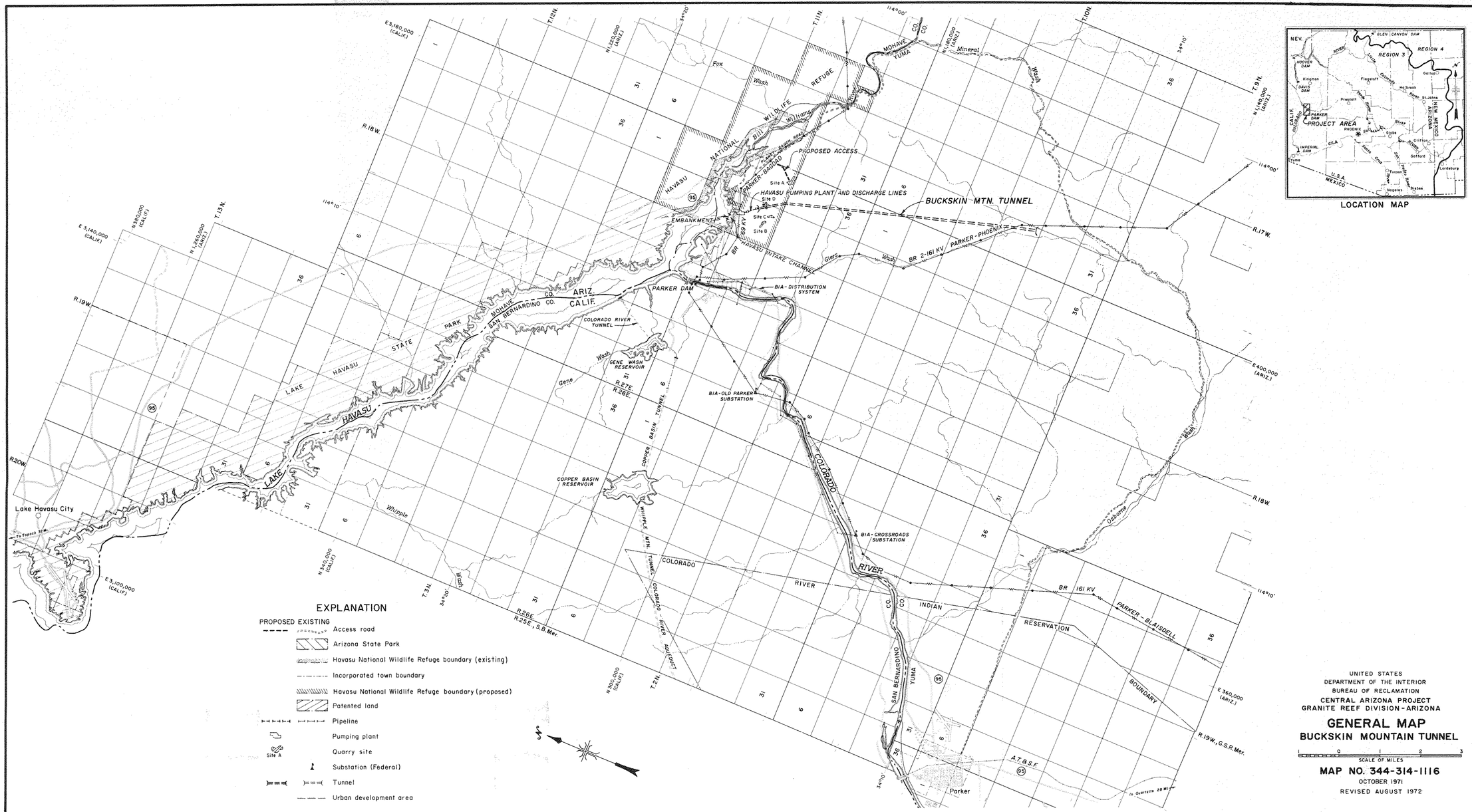
Water for the Central Arizona Project (CAP) will be diverted from Lake Havasu in Yuma County, Arizona, on the Colorado River (see Figure 2). The Havasu Pumping Plant will be located on the south shoreline of the Bill Williams arm of Lake Havasu approximately 2-1/2 miles upstream from Parker Dam and about 20 miles by road northeast of Parker, Arizona, on Arizona State Highway 95. The intake channel will be formed between the south shore of the Bill Williams arm of Lake Havasu and a landform embankment. The embankment will extend outward from the south shore in a natural appearing nonlinear sinuous alinement with a generally northwesterly bearing for about one-half mile. The intake channel will pass under Arizona State Highway 95 about 400 feet northwest of the pumping plant. The discharge lines from the pumping plant will travel 3,000 feet upslope (southeasterly) to the inlet portal of the Buckskin Mountains Tunnel (see Figure 3). The tunnel will be excavated through the Buckskin Mountains for about 35,000 feet in a southeasterly direction to the outlet portal near Osborne Wash (see Figure 2).

The intake channel will be located within the existing boundaries of the Havasu National Wildlife Refuge. The Havasu National Wildlife Refuge was established by Executive Order 8647 on January 22, 1941, with subsequent adjustments, and includes lands withdrawn specifically for Bureau of Reclamation purposes on January 31, 1903, September 8, 1903, and June 4, 1930. The Havasu Pumping Plant, discharge lines, and the Buckskin Mountains Tunnel will be located within lands under Reclamation application for withdrawal for the CAP, Applications Nos. AR 031307, dated February 19, 1962; A 997, dated May 17, 1967; and A 1267, dated August 24, 1967. Except for a small corner of the pumping plant, these structures are outside the existing boundaries of the Havasu National Wildlife Refuge.

B. Legislative History, Authorization, and Requirements

1. Legislative History [1-7, 10, 97, 98, 126]

At the request of the Colorado River Basin States (Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming), Congress passed an act on August 19, 1921, giving consent to the states to negotiate and enter into a compact for the equitable apportionment of the water supply of the Colorado River. This agreement, known as the Colorado River Compact, was signed in Santa Fe, New Mexico, on November 24, 1922. The Compact divides the entire Colorado River Basin into two parts, the Upper Basin and the Lower Basin, separated at a point on the river in northern Arizona known as Lee Ferry. Article III(a) of the Compact apportions to the Upper Basin and to the Lower Basin in perpetuity the exclusive beneficial consumptive use of 7,500,000 acre-feet each of water per year from the Colorado River system. Article III(b)



Interior-Reclamation, B.C., Nev.

Figure 2

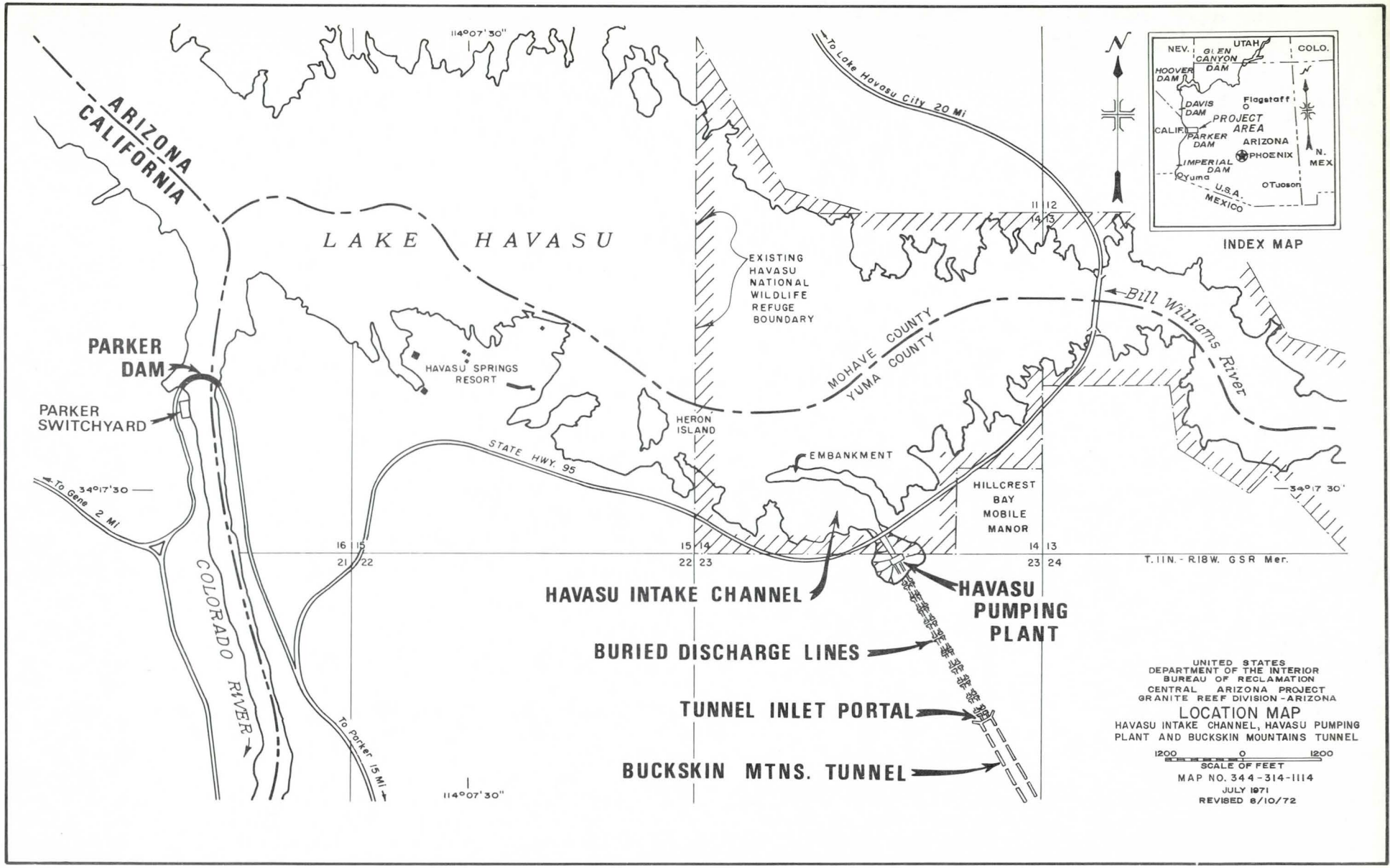

ARIZONA
CALIFORNIA
LAKE HAVASU
PARKER DAM
PARKER SWITCHYARD
HAVASU SPRINGS RESORT
EXISTING HAVASU NATIONAL WILDLIFE REFUGE BOUNDARY
MOHAVE COUNTY
YUMA COUNTY
Bill Williams River
HERON ISLAND
EMBANKMENT
STATE HWY. 95
HILLCREST
BAY
MOBILE
MANOR
To Lake Havasu City 20 Mi
To Gene 2 Mi
To Parker 15 Mi
COLORADO RIVER
114°07'30"
34°17'30"
T. 11N. - R18W. GSR Mer.
HAVASU INTAKE CHANNEL
HAVASU PUMPING PLANT
BURIED DISCHARGE LINES
TUNNEL INLET PORTAL
BUCKSKIN MTNS. TUNNEL
INDEX MAP
NEV.
UTAH
COLO.
GLEN CANYON DAM
HOOVER DAM
DAVIS DAM
Flagstaff
PROJECT AREA
CALIF.
PARKER DAM
ARIZONA
PHOENIX
N. MEX
IMPERIAL DAM
Yuma
Tucson
U.S.A.
MEXICO
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA
LOCATION MAP
HAVASU INTAKE CHANNEL, HAVASU PUMPING PLANT AND BUCKSKIN MOUNTAINS TUNNEL
1200 0 1200
SCALE OF FEET
MAP NO. 344-314-1114
JULY 1971
REVISED 8/10/72

Figure 3

apportions an additional 1,000,000 acre-feet annually for beneficial use to the Lower Basin.

In 1928, Congress passed the Boulder Canyon Project Act authorizing construction of the Boulder Canyon Project. The act and its subsequent amendment by the Boulder Canyon Project Adjustment Act directed the Secretary of the Interior to make investigations and publish reports of the feasibility of projects for irrigation, generating electric power, and other purposes in the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

In 1944, the Bureau of Reclamation and the State of Arizona entered into a contract for the expenditure of $400,000 for a cooperative investigation of the utilization of Colorado River water in Arizona. This investigation resulted in the Central Arizona Project Report which was submitted to the Secretary of the Interior on December 19, 1947. The Secretary's findings relative to CAP were submitted to Congress in September 1948. Preliminary hearings on the CAP were actually started in 1947 in the Senate and House of Representatives in advance of submittal of the report. A favorable vote on the CAP (52-28) was obtained in the Senate, but in 1951 the House Committee on Interior and Insular Affairs postponed action until such time as Arizona's right to the use of Colorado River water was adjudicated or settled by other means.

In the summer of 1952, the State of Arizona initiated an interstate suit in the Supreme Court of the United States against California and others to confirm its title to Colorado River water. On June 3, 1963, the Supreme Court rendered an opinion on Arizona's entitlement to Colorado River water. Subsequently, on March 9, 1964, the Supreme Court decree in Arizona v. California confirmed Arizona's entitlement to 2,800,000 acre-feet annually of the first 7,500,000 acre-feet of Colorado River mainstream flow available to the three Lower Basin States plus 46 percent of flows in excess of 7,500,000 acre-feet.

On June 4, 1963, the day following the Supreme Court opinion, bills to authorize the CAP were introduced in both Houses of Congress. From 1963 through 1968, many additional bills and amendments were introduced proposing different versions of the CAP, and hearings were held yearly.

The most significant bills considered were:

a. S. 1658, introduced June 4, 1963.

b. H.R. 4671, introduced February 9, 1965.

c. H.R. 3300, introduced January 23, 1967.

d. S. 1004, introduced February 16, 1967.

Different versions of the CAP were passed by the United States Senate (S. 1004, August 7, 1967) and the House of Representatives (H.R. 3300, May 16, 1968). S. 1004 cleared a conference committee on August 1, 1968, and was approved by both House and Senate. The compromise version became Public Law 90-537 with the approval of President Johnson on September 30, 1968.

During the long legislative history of the CAP, many environmental issues were examined by various congressional committees. Persons and groups demanding that environmental consequences of the CAP be considered presented their views to a responsive Congress. Hualapai (Bridge Canyon) and Marble Canyon Dams on the Colorado River were dropped from the CAP as a result of opposition from environmental groups. A decision was made by the Congress and the Department of the Interior that a thermal electric generating station was a feasible alternative to provide pumping energy and financial assistance to the CAP.

In consideration of environmental concerns over effects of the dams on the Grand Canyon area, the Secretary of the Interior directed the Bureau of Reclamation to reevaluate and study all possible power alternatives for the CAP. Studies led to a recommendation that the Federal Government participate with public and private power utilities in the development of a large coal-fired thermal power unit which later became known as the Navajo Generating Station. It was this revised power development program and recognition of the Mexican Treaty obligation as a National responsibility which provided the final catalyst for quick Congressional approval and authorization of the CAP.

2. Legislative Authorization 97, 98, 103

The CAP was authorized under Public Law 90-537 on September 30, 1968, as part of the Colorado River Basin Project. The first construction contract will be the excavation of the Havasu Pumping Plant site and construction of the Havasu Intake Channel embankment followed by separate construction contracts for the pumping plant and discharge lines, switchyard, site completion, tunnel, and transmission line. Separate supply, installation, and completion contracts will be awarded for the transformers, pumps, and motors. Those contracts will be for construction, fabrication of machinery, equipment and parts, and for installation and completion of structures.

This environmental statement, concerning work authorized for the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, is submitted in compliance with Public Law 91-190, the National Environmental Policy Act of 1969. An overall Final Environmental Statement for the entire CAP was filed with the Council on Environmental Quality on September 26, 1972 (FES 72-35).

3. Legislative Requirements 4, 6, 7, 106

Public Law 90-537, the Colorado River Basin Project Act, authorizes construction of CAP subject to a number of specific requirements and

restrictions. Generally, these conditions are imposed in order to assure that existing rights are protected or that operation of the CAP is consistent with National Policies and preferred water management practices. The requirements relevant to this statement are listed below:

a. Protection of Current Rights to Water Affected by the CAP

All contracts for CAP water will be subordinate to all rights to Colorado River water perfected at the time the Boulder Canyon Project Act became effective (June 25, 1929), all rights decreed by the Supreme Court in Arizona v. California, and all contracts made pursuant to the Boulder Canyon Project Act between the Secretary of the Interior and Arizona, California, and Nevada users existing at the time of authorization. CAP diversions from the Colorado River shall be limited so that California diversions can be maintained at 4,400,000 acre-feet annually. Nevada is not required to share shortages in any proportion greater than would have been imposed in the absence of the 4,400,000 acre-feet priority to California.

b. Provisions Regarding Irrigation of Lands and Irrigation Systems

Congress imposed certain operational and contractual requirements upon the CAP. Public Law 90-537 requires that (1) CAP water not be made available for irrigation of lands that do not have a recent history of irrigation, except in the case of Indian lands, and fish and wildlife refuges and management areas; (2) controls must be in effect which prohibit the expansion of irrigation from aquifers affected by the CAP; (3) canals and distribution systems transporting CAP water must be lined to prevent excessive losses; (4) for a period of 10 years from the date of enactment, no water can be delivered for the production of surplus crops on newly irrigated lands; and (5) no ground water may be exported from the service area unless drainage is required. These provisions are recognized in the master repayment contract between the Central Arizona Water Conservation District and the Department of the Interior, Bureau of Reclamation.

C. Purpose [39, 42, 132]

The Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel are the initial works of the Granite Reef Aqueduct and are considered a major feature of the CAP. This feature will provide for pump diversion of Colorado River water from Lake Havasu behind Parker Dam and conveyance of the water through the Buckskin Mountains to the start of the Granite Reef Aqueduct open section. The Granite Reef Aqueduct, to be considered in a separate detailed environmental statement, will carry project water from the tunnel outlet portal for about 190 miles to its terminus near the Phoenix metropolitan area. Colorado River water for the CAP will be distributed from the

Granite Reef Aqueduct and from the terminus of the Granite Reef Aqueduct through the Salt-Gila Aqueduct to water-deficient municipal, industrial, and agricultural areas in Maricopa, Pinal, and Pima Counties, Arizona, or diverted into Orme Reservoir for regulatory storage when water demands are less than the flow in the Granite Reef Aqueduct. Colorado River water temporarily stored in Orme Reservoir will be distributed later during periods of peak demands. The expanding Phoenix and Tucson metropolitan areas will receive CAP water. The Havasu complex, as a part of the CAP, will also provide water for significant new outdoor recreation opportunities in the Phoenix metropolitan area, and for fish and wildlife enhancement.

The primary purpose of the Havasu Intake Channel is to minimize wear on the pumping units by keeping sediment deposition within Lake Havasu and excluding its abrasive action from the pump seals. The embankment of the intake channel will form a barrier which will reduce the amount of sediment conveyed into the pumps.

The landform dike which forms the intake channel will provide for additional recreational opportunities in an area that presently enjoys heavy recreational use. The new lakeshore formed by the embankment is expected to be open to foot travel for such uses as picnicking, fishing, and swimming on the lake side of the embankment. It is also expected that the embankment will create additional bass spawning habitat. A parking area adjacent to Arizona State Highway 95 is planned to accommodate the visitors expected on the embankment. This parking area will provide a rest area and scenic viewpoint for travelers passing through the vicinity. Pumping of water through the intake channel is expected to create a circulatory and mixing effect on mainstream flows and within the relatively still waters of the Bill Williams arm. This mixing effect should improve the water quality of the Bill Williams arm.

The Havasu Pumping Plant will lift Colorado River water about 800 feet from the intake channel through buried discharge lines to the inlet portal of the Buckskin Mountains Tunnel. The pumping plant will also include visitor facilities which will provide the public with an explanation of the purpose of the project. The visitors' facilities will enhance day-use recreational opportunities in the area by providing a point of significant additional interest.

The Buckskin Mountains Tunnel was selected on the basis of engineering, economic, and environmental considerations over alternatives of cut-and-cover pipeline or open canal, and will convey Colorado River water through the Buckskin Mountains to a point near Mineral and Osborne Washes, where the open section of the Granite Reef Aqueduct will begin.

Power for the pumping plant will be obtained from the Navajo Generating Station. The pumping plant will be connected to the Parker Powerplant Switchyard, which in turn will be connected to the Navajo Project delivery points.

D. General Description of the Feature [92, 132]

The facilities described herein are part of the CAP features authorized under Section 301 of Public Law 90-537. These facilities include the Havasu Intake Channel, Havasu Pumping Plant and appurtenances, transmission line facilities for the pumping plant, and the Buckskin Mountains Tunnel. An artist's conception of the intake channel, pumping plant, and tunnel inlet portal is shown on the frontispiece, Figure 1.

The intake channel, through which water will be drawn, will be formed between the lakeshore and a landform dike extending into the lake. Materials excavated from the pumping plant site will be used to construct the dike. A bridge will be used to cross the channel for Arizona State Highway 95. The Havasu Pumping Plant will house six 500-cfs pumping units to raise Colorado River water 800 feet through the discharge lines to the inlet portal of the Buckskin Mountains Tunnel. Construction of the pumping plant will include structure excavation, erection of the pumping plant structure, and construction of two 13-foot-diameter discharge lines. The Buckskin Mountains Tunnel will convey Colorado River water about 35,000 feet through the Buckskin Mountains to the start of the open section of the Granite Reef Aqueduct. The tunnel will be a concrete-lined structure, circular or horseshoe-shaped, depending on the mode of construction. Electric power for the pumping plant will be obtained directly from the Parker switchyard.

The facilities of the Havasu complex are described in more detail below.

1. Intake Channel [62]

The intake channel will be located in Section 14, T. 11 N., R. 18 W., GSRB&M, within the Bill Williams arm of Lake Havasu approximately 2-1/2 miles upstream from Parker Dam and about 14.5 air miles northeast of Parker, Arizona. The channel will be within the boundaries of the Bill Williams River portion of the Havasu National Wildlife Refuge.

The intake channel is necessitated by the heavy sediment inflow from the Bill Williams River which, if not controlled, would cause excessive wear on the pumping plant machinery. The embankment, which will form the intake channel, will provide protection from sediment deposition in the pumping plant forebay.

The site of the intake channel was selected using sediment studies and several alternative location studies (refer to Chapter VIII for discussion of alternatives), and is placed so that the intake channel will not be adversely affected during the first 100 years by the estimated average annual sediment inflow of 170 acre-feet from the Bill Williams River. Sediment deposition studies for the Bill Williams arm of Lake Havasu were made in 1963, 1964, and 1968. Following completion of

Alamo Dam, 40 miles upstream on the Bill Williams River, the studies were further revised during August 1970 to provide final design data for use in locating the Havasu Pumping Plant and intake channel. Estimates indicate that sediment deposits on the south side of the lake will accumulate only to the bottom elevation of the channel by about year 2071. Sediment deposits will not result in the creation of a land bridge to Heron Island which would allow predators ready access to the great blue heron colony which uses the island as a nesting and rearing area. Protection of the great blue heron colony is discussed in detail in Chapter III of this statement.

The landform embankment will be nonuniform in cross section and alinement and is designed to approximate the configurations and colorations of the natural peninsulas that finger out from the Buckskin Mountains into Lake Havasu in this area. This plan is designed to minimize alteration of the natural and scenic values of the shoreline area. This landform concept is illustrated by the frontispiece. No excavation will be required across the shoreline finger ridges under this plan. The open-water area within the intake channel will approximate 60 acres. The embankment itself will occupy about 10 acres of surface area and displace approximately 280 acre-feet of water.

The minimum crest elevation of the landform embankment will be 456 feet, which is 8.5 feet above the normal operating water-surface elevation of Lake Havasu. Design plans provide for a varying width and volume for the embankment depending on the amount of material that is available. The embankment will have a minimum crest width of 30 feet. The varying widths of the embankment will emulate the natural fingers and peninsulas protruding into Lake Havasu in the area. The length of the embankment from Arizona State Highway 95 will be about 2,400 feet.

Materials excavated from the pumping plant site during the first year of construction should be adequate to construct the initial embankment. Additional material for enhancing the appearance of the embankment and for wave erosion protection will be available from structural excavation of the pumping plant and tunnel during the first 4 to 5 years of construction at the site. The natural angle of repose of the material during placement will determine the side slopes of the embankment. The use of native materials will control the coloration of the embankment. Larger size excavated material will be used where needed to control erosion from wave action in the lake. An unpaved access road, with one or two turnarounds, will extend the length of the embankment. Vehicular use of this road will be limited to maintenance purposes. Public access will be limited to foot travel for recreational purposes such as picnicking, fishing, and swimming on the lake side of the embankment. An unpaved parking area will be provided adjacent to Arizona State Highway 95 to serve as a public rest area and scenic view point.

The landform embankment will be constructed by dumping materials excavated from the pumping plant site into the lake and allowing them to settle, displacing the low density lake sediment now covering the bottom of the lake. Dust developed during the moving of material will

be controlled as described in Chapter IV. Water jetting of lake sediment will be performed from a barge a short distance ahead of the fill operation. To minimize turbidity, jetting pressure will be limited to that needed to gently move the sediment to break its cohesion. This method of construction was selected on the basis of vane shear testing which indicates that the in-place shear strength of the soft silt clay sediment material ranges from about 0.5 psi to 1.0 psi at depths of 25 and 35 feet below the water surface, respectively. The displacement of the lake sediment will be controlled by the shape of the advancing end of the embankment structure, the jetting pattern ahead of the fill, and the rate of placement of fill materials.

Existing Arizona State Highway 95 will serve as a cofferdam in the intake channel during construction of the pumping plant. Protective concrete pads will be placed adjoining the highway shoulders in the area where heavy construction equipment will cross the roadway during construction of the landform embankment.

The portion of the highway crossing the intake channel will be excavated after completion of a temporary detour to handle highway traffic. This excavated channel section will be the only shoreline excavation that is required. A three-span precast, prestressed, concrete-beam bridge will be constructed across the channel section. The design of the bridge will be esthetically compatible with the design of the pumping plant structure. Material excavated from the channel section may be used to fill around the pumping plant.

The intake channel, through which a maximum flow of 3,000 cfs will be drawn, will have a bottom elevation of about 424 feet. Flow velocities will vary within the intake channel. In the main channel, the flow velocity will approximate 0.13-foot per second. Between the highway crossing and the pumping plant intake, the flow velocity will increase to approximately 1.3 feet per second. These flow velocities were estimated using an operating level in Lake Havasu of 447.5 feet, an average channel depth of 23.5 feet, and an average main channel width of 1,000 feet. The average annual operating level (water-surface elevation) of Lake Havasu for the past 16 years has been about elevation 447.5. The maximum fluctuation for this same time period was about 6 feet from a high of about 451 feet to a low of about 445 feet. Maximum reservoir drawdown under normal operation will not be below water-surface elevation 440. This elevation is governed by Article 15 of the contract dated February 10, 1933 (Symbol and Number Ilr-712), between the Metropolitan Water District of Southern California and the United States for construction of Parker Dam. With lower or higher operating water levels, the intake channel flow velocities will increase or decrease, respectively, but only to a minor extent.

2. Pumping Plant

A pumping plant, which will raise a maximum flow of 3,000 cfs of Colorado River water from an average elevation of 447.5 to about

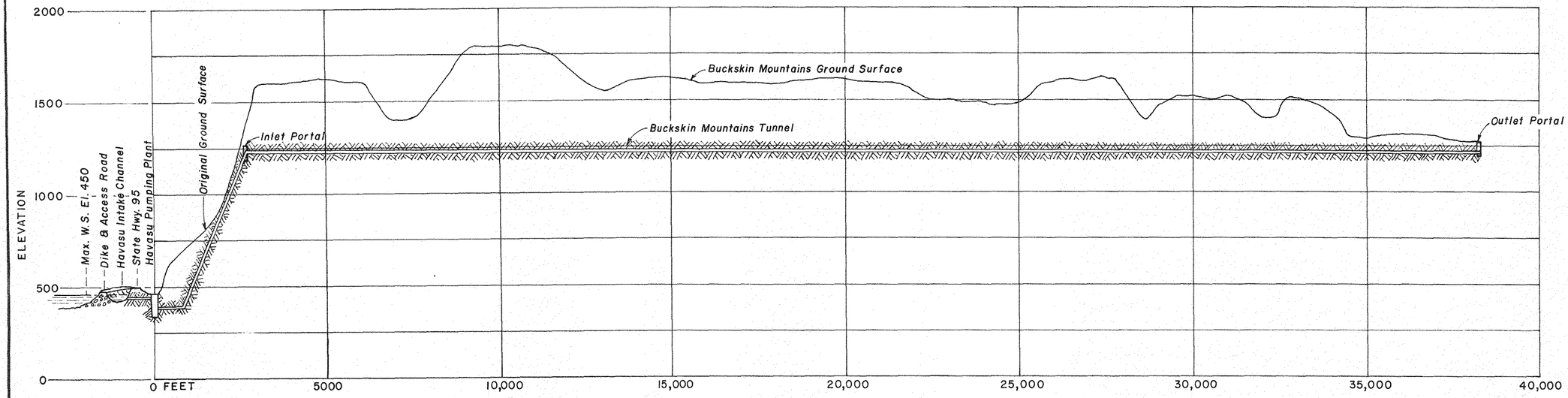
elevation 1250, will be required in the vicinity of the Buckskin Mountains. The site selected for the pumping plant is situated on the south side of existing Arizona State Highway 95 and about 500 feet inland from the lake shoreline. The pumping plant will be located in Sections 14 and 23, T. 11 N., R. 18 W., approximately 3/4-mile south of the Arizona State Highway 95 bridge at the Bill Williams River. About 20 acres of land will be required for construction of the plant and discharge lines.

The pumping plant will be basically an underground structure with the top of the main deck at elevation 458.4, or essentially flush with the surrounding service area. The only portions of the structure to be appreciably above grade will be a visitors' facility, the service building equipped with a crane to handle pumping equipment, and the transformers with their associated electrical equipment. A portion of the service building and the visitors' facility will be visible from the highway but only from certain angles and within a reach of approximately 600 feet along the highway. (See Figures 1 and 4.) The standard trashracks to be included to prevent intake of large debris will extend about 9 feet above the normal water surface elevation of Lake Havasu.

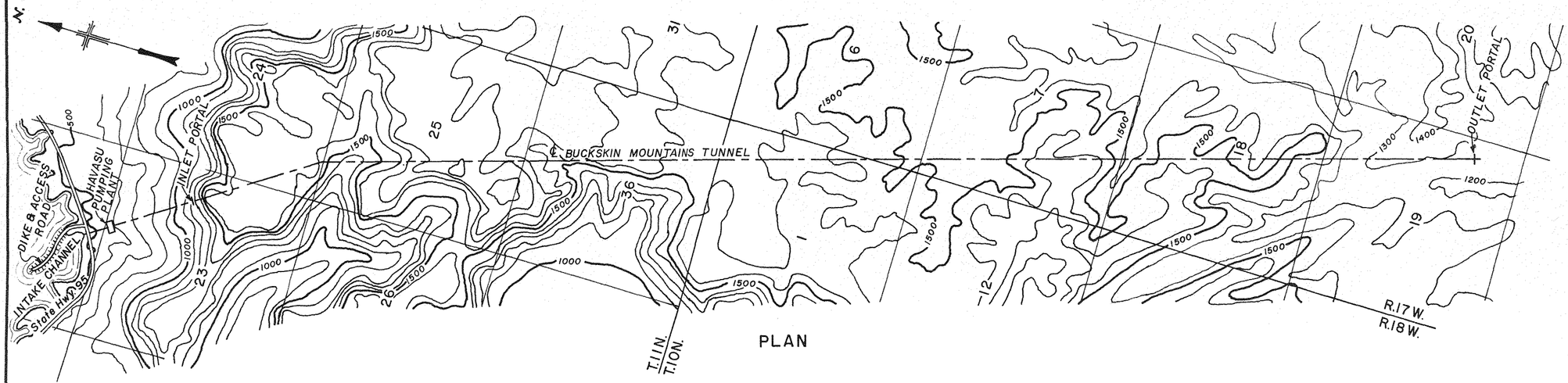
The structure will be 306.5 feet long and 117 feet wide at the main deck elevation. The main portion of the structure will be 111.4 feet high, extending from subgrade elevation 347 to the main elevation of 458.4. The subgrade elevation will be 100.5 feet below the normal operating water-surface elevation in Lake Havasu. The top of the service building will be the highest part of the structure. It will extend 35.5 feet above the main building deck or to elevation 493.9. The service building and visitors' facility, both of which are located on the northeast end of the main structure, will be 66.3 feet wide and 129.5 feet long.

The pumping plant will house six electric motor-driven 500-cfs pumps with a total capacity of 3,000 cfs. The motors and auxiliary equipment will require an electric input of 285 megawatts. The pumps, spaced approximately 38 feet on centers, and associated equipment will occupy six levels of the multilevel structure. The pumps will raise Colorado River water 800 feet via two 13-foot-diameter discharge lines into the inlet portal of the Buckskin Mountains Tunnel. The discharge lines, extending 3,000 feet up the hillside, will be buried with about 20 feet of backfill which will be shaped to conform to the original terrain as nearly as possible.

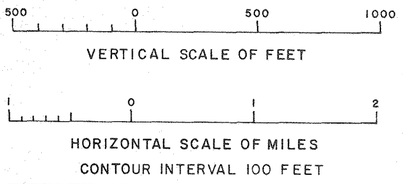
Site preparation for the pumping plant will require excavation of approximately 750,000 cubic yards of material. This material and the material excavated later for the underground portion of the pumping plant structure will be used in construction of the embankment for the intake channel. Surface exposure of the excavated area, which is planned to be semicircular in shape, will extend 750 feet into the wash and adjacent ridges south of the highway. Excavation procedures will include guidelines for blasting as discussed later in Chapters III and IV. The excavation plan will provide for an 85-foot-wide level area at elevation 456



PROFILE



PLAN



CONTOUR INTERVAL 100 FEET

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION—ARIZONA

INTAKE CHANNEL THRU TUNNEL OUTLET PORTAL

DESIGNED	SUBMITTED
DRAWN R.M.G.	RECOMMENDED
CHECKED	APPROVED
PHOENIX, ARIZ. OCTOBER, 1972	344-330-162

Figure 4

from the rear of the pumping plant structure to a channel designed to prevent floodflows from entering the pumping plant area. Beyond this point, excavation into the slope of the mountain will follow a 1:1 side slope, with a 10-foot-wide berm at about every 40-foot rise in elevation. Under this plan, four berms will be needed with the last berm located at elevation 610. The difference in elevation between the service yard and the highest berm will be about 154 feet. Flatter slopes may be required in localized sections. The maximum width of the overall cut area will be about 600 feet.

The pumping plant site is considered the most suitable site based on a combination of engineering and geologic studies, foundation conditions, locations studies for the discharge lines and tunnel, environmental considerations, and construction and operating costs. The proposed site also accommodates a discharge pipeline profile having little, if any, side hill location and requires a shorter discharge line than any of the other locations studied.

Two hundred and eighty-five megawatts of electric power will be delivered to the pumping plant from the Parker switchyard. This capacity is required for the 326,400 horsepower of the pumping units and to compensate for losses associated with transformers and auxiliary equipment. A 230-kv transmission line, about 1-1/2 miles long, will extend from the Parker switchyard to a small spreading yard located about 0.6 mile west of the pumping plant. The line will probably utilize steel, single-circuit, free-standing towers. The spreading yard will be equipped with improved appearance pothead supports and structures. Underground cables will be used between the spreading yard and the pumping plant.

The 230-kv transmission line will cross the Colorado River about 1,200 feet downstream from Parker Dam. After crossing the river, the line will follow the route of the existing Parker-Bagdad 69-kv line which ascends from the river valley to a low ridge in the Buckskin Mountains. (See Figure 2.) For the most part, the line will be hidden from view by the natural terrain between the river valley and where it crosses Arizona State Highway 95. The new line may permit removal of the 69-kv line between the pumping plant site and the Parker switchyard.

Excavation required for site preparation and the pumping plant structure may necessitate some drilling and blasting. All drilling will be performed with drilling apparatus equipped with water or chemical dust-control systems or other equivalent means of controlling dust. The dust resulting from drilling will be controlled within safe hygienic limits as specified in the "Threshold Limit Values of Airborne Contaminates," published by the American Conference of Governmental Industrial Hygienists.

All areas around the pumping plant disturbed by project construction will be restored to their original appearance as nearly as possible.

The construction access road will be modified after completion of construction to provide access to the pumping plant, visitors' facility, and parking area.

Figure 5 shows the site of the Havasu Pumping Plant and Havasu Intake Channel as it existed in May 1969. The private mobile home development has several units now in place. Figure 1 is an artist's conception of the site after all construction work is completed.

3. Buckskin Mountains Tunnel

The Buckskin Mountains Tunnel will convey project water pumped from Lake Havasu 6.8 miles through the Buckskin Mountains for direct discharge into the open section of the Granite Reef Aqueduct. The tunnel will be about 35,000 feet long, either machine-bored for a 20-foot-diameter (finished) circular section, or drilled and blasted by conventional means for a 19-foot-6-inch-diameter (finished) horseshoe-shaped section. The tunnel will be lined with about a 20-inch-thick layer of concrete. The slope of the tunnel will result in a 33-foot differential between the inlet portal, located in Section 23, T. 11 N., R. 18 W., and the outlet portal which is near Osborne Wash in Section 19, T. 10 N., R. 17 W. The tunnel alinement from the inlet portal will follow a S. 31°30'47" E. bearing, for about 3,600 feet, then it will curve slightly and continue on a S. 16°11'28" E. bearing to the outlet portal.

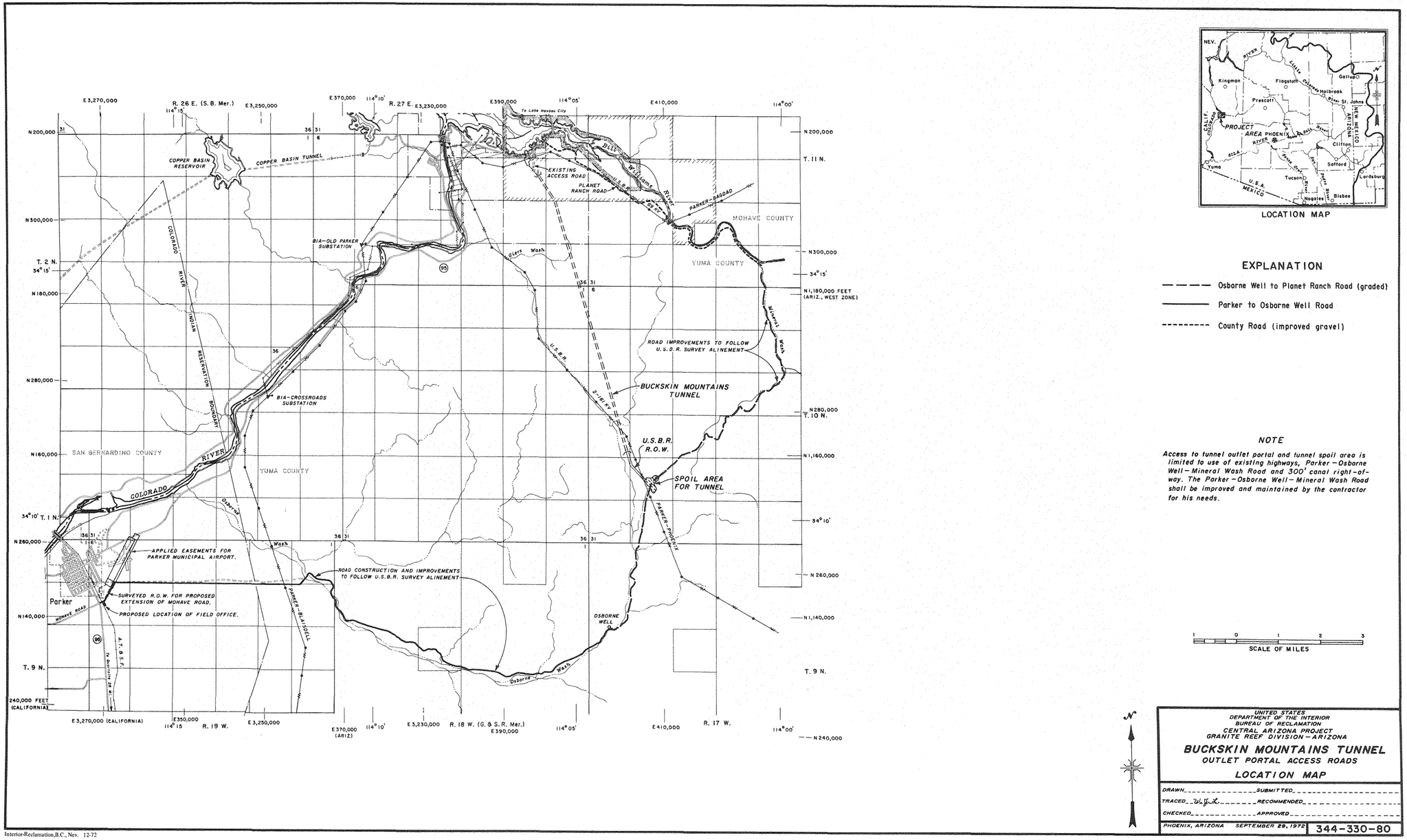
The tunnel inlet portal will be located at the foot of a vertical butte about 800 feet above the pumping plant and 400 feet below the top of the mesa. A cut will be necessary for the inlet portal and a small parking area. The inlet portal will form a transition between the two 13-foot-diameter discharge pipes and the tunnel section. Although the concrete portal structure will be about 35 feet high, a substantial portion will be underground and only the top 14 feet of the gate control housing will be visible from either the highway or lake. An access road adjacent to the pumping plant site from Arizona State Highway 95 up the hillside to the inlet portal will be required. After completion of the tunnel, this access road may be used for maintenance of the gates in the tunnel inlet.

The Osborne Wash road which runs east from Parker will be used as construction access to the south portal or tunnel outlet. The contractor will be responsible for the condition and maintenance of this road or any other road which is used in the construction area for performing the work or for traveling to and from the worksites. Figure 6 shows the existing Osborne Wash and Mineral Wash roads leading to the outlet portal.

About 5 acres will be needed for a construction staging site in the vicinity of the outlet portal. This area is presently scarred with

Figure 5

Site Location of Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel (Inlet Portal) on South Shore of Bill Williams Arm of Lake Havasu.
Photograph No. P344-300-9851



LOCATION MAP

EXPLANATION

- Osborne Well to Planet Ranch Road (graded)
- Parker to Osborne Well Road
- County Road (improved gravel)

NOTE

Access to tunnel outlet portal and tunnel spoil area is limited to use of existing highways, Parker – Osborne Well – Mineral Wash Road and 300' canal right-of-way. The Parker – Osborne Well – Mineral Wash Road shall be improved and maintained by the contractor for his needs.

1 0 1 2 3
SCALE OF MILES

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

BUCKSKIN MOUNTAINS TUNNEL
OUTLET PORTAL ACCESS ROADS
LOCATION MAP

DRAWN	SUBMITTED	
TRACED W. J. K.	RECOMMENDED	
CHECKED	APPROVED	
PHOENIX, ARIZONA SEPTEMBER 28, 1972	344-330-80	

Interior-Reclamation,B.C., Nev. 12-72

Figure 6

abandoned mines and prospectors' access roads. Any changes made to the terrain by project construction will be obliterated after completion of the work. Temporary powerlines for construction purposes will be required to each of the tunnel portals. When the tunnel is completed, these lines will be removed and their paths restored as nearly as possible to original condition.

About 700,000 cubic yards of tunnel excavation will be required. Some of the material excavated from the inlet portion of the tunnel may be used to enhance the inlet embankment previously described, or used as material for a public parking area on the lakeshore. This material will be dampened to avoid a dust problem during handling.

Material or spoil which is removed from the outlet portal of the tunnel will be spread in gullies to blend with the natural landforms or deposited in other selected areas and shaped to conform with the natural contours of the existing terrain. The excavated spoil, when deposited in gullies, may require stabilization to prevent erosion and subsequent transport to downstream areas. Dampening of this material and possibly the areas where it is deposited will also alleviate dust problems. Water from Lake Havasu will be available to the contractor for this purpose or for any other construction activity.

The tunnel lining will require about 180,000 cubic yards of concrete. The aggregates used in the manufacture of the concrete may be obtained on Reclamation-withdrawn land about 10 miles southwest of the tunnel outlet in the Osborne Wash area. The 10 to 20 acres that may be disturbed will be graded after construction is completed to conform with the surrounding landscape. Alternatively, all materials used in the manufacture of concrete may be obtained from commercial sources.

4. Power Source and Transmission Requirements [37, 38, 114, 132]

In general, this section discusses the provisions for supplying the 285-megawatt electric load of the Havasu Pumping Plant. Details of the transmission system for the CAP will be included in later individual environmental statements. Because of fluctuating load conditions in the Pacific Southwest interconnected power system, direction reversal of electric power flow will occur in the transmission lines. In order to understand possible flow patterns that will be available to the Havasu Pumping Plant, as well as other CAP pumping units, it is necessary to describe the concept of the backbone transmission system to be used for the CAP. The load requirement of the Havasu Pumping Plant is by far the largest single power demand in the CAP.

For the purpose of supplying power to the CAP and augmenting the Lower Colorado River Basin Development Fund, the Secretary of the Interior was authorized and directed by Section 303 of the CAP Act to determine and recommend a plan to Congress within 1 year of the effective date of the Act. The Secretary filed his report with Congress on September 30, 1969, recommending that the Federal Government participate

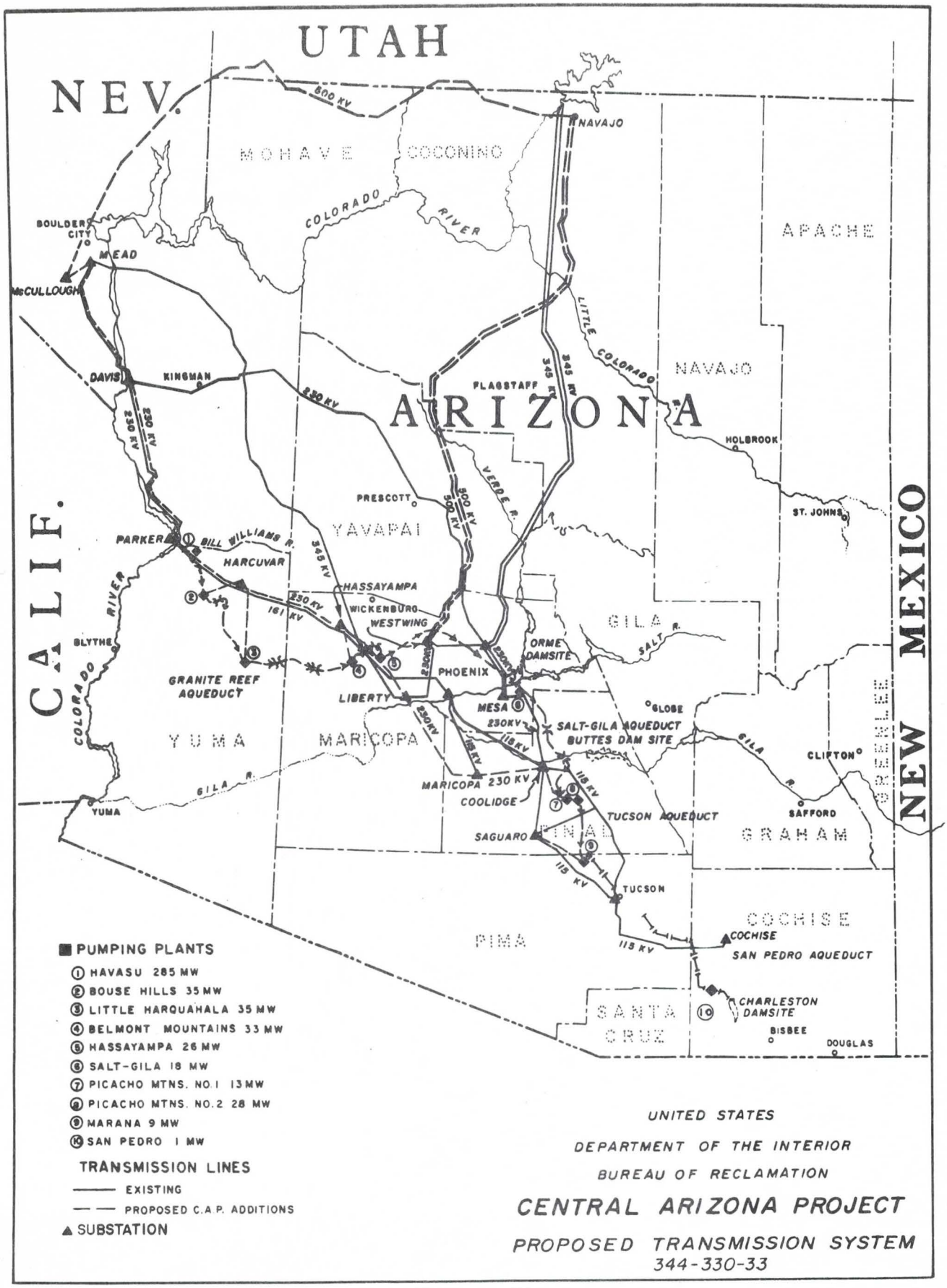
in a thermal-generating powerplant as the most suitable alternative for supplying the power requirements of the CAP. On December 12, 1969, the Secretary signed contracts providing for participation by the United States in the Navajo Project which consists of a thermal powerplant complex near Page, Arizona, and the Western and Southern Transmission Systems. Taking into account manufacturers' warranties, motor efficiencies, power transformers, station auxiliary losses, and transmission losses, the Secretary's report indicated that the electric capacity required at the powerplant to serve the CAP operating at full hydraulic capacity of 3,000 cfs would be 561 megawatts. The Navajo plant was initially designed for a rated capacity of 2,310 megawatts in the units. The Secretary of the Interior contracted for entitlement of 24.3 percent of this capacity for the CAP. The remaining capacity is shared by five non-Federal participants in the Navajo Project. The net plant capacity has been reduced 60 megawatts due to the addition of additional air quality control equipment, as discussed on pages 36-43 of the overall CAP final environmental statement.

The Navajo Project points of power delivery via the Western and Southern Transmission Systems are at the McCullough Switching Station and the Westwing Substation. McCullough Switching Station is located near Boulder City, Nevada. The Westwing Substation is situated near Phoenix, Arizona. As a part of the Pacific Northwest-Pacific Southwest Intertie system, the Westwing Substation will be interconnected to the Liberty-Pinnacle Peak circuit. This interconnection will require only about 1-1/2 miles of double-circuit line. The Mead Substation, located about 15 miles northeast of the McCullough Switching Station, will be interconnected with the McCullough Switching Station by either a new line or by contractual arrangements over existing circuits via the Eldorado Substation. In addition to the use of these interconnections as a part of the Pacific Southwest power grid system, the interconnections will also provide a path for power flow between the Navajo Project and the primary takeoff points for the CAP transmission system, i.e., the Mead and Liberty Substations.

The 230-kv backbone transmission system for CAP, which will be an integrated Federal system serving many functions, will connect the Mead Substation to the Liberty Substation. The lines required will consist of the Mead-Davis 230-kv Transmission Line No. 2, the Davis-Parker 230-kv Transmission Line No. 2 (which will tie to the existing Parker Powerplant Switchyard), and the Parker-Liberty 230-kv Transmission Line. Figure 7 presents a schematic sketch of the system concept. With these transmission lines, it will be possible to deliver power from the Navajo Project to the Havasu Pumping Plant either through the McCullough Switching Station or the Westwing Substation, depending on the overall load demands in the Pacific Southwest power grid system. The Havasu Pumping Plant will be connected to the Parker switchyard as discussed earlier in Section D.2.

5. Communication System [132]

Microwave channels to provide communication circuits and telemetering circuits from the Navajo Generating Station are being


UTAH
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NAVAJO
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GILA
GRAHAM
COCHISE
SANTA CRUZ
PINAL
TINAL
ARIZONA
800 KV
NAVAJO
COLORADO RIVER
BOULDER CITY
MEAD
McCULLOUGH
DAVIS
KINGMAN
230 KV
230 KV
230 KV
FLAGSTAFF
345 KV
345 KV
LITTLE COLORADO
HOLBROOK
ST. JOHNS
PRESCOTT
500 KV
500 KV
VERDE R.
PARKER
BILL WILLIAMS R.
HARCUVAR
345 KV
HASSAYAMPA
WICKENBURG
WESTWING
230 KV
161 KV
BLYTHE
COLORADO RIVER
GRANITE REEF AQUEDUCT
LIBERTY
PHOENIX
230KV
ORME DAMSITE
SALT R.
GLOBE
MESA
230KV
118KV
SALT-GILA AQUEDUCT
BUTTES DAM SITE
230KV
118KV
GILA R.
CLIFTON
SAFFORD
MARICOPA 230 KV
COOLIDGE
118 KV
YUMA
GILA R.
SAGUARO
TUCSON AQUEDUCT
115 KV
TUCSON
COCHISE
118 KV
SAN PEDRO AQUEDUCT
CHARLESTON DAMSITE
BISBEE
DOUGLAS
PUMPING PLANTS
1 HAVASU 285 MW
2 BOUSE HILLS 35 MW
3 LITTLE HARQUAHALA 35 MW
4 BELMONT MOUNTAINS 33 MW
5 HASSAYAMPA 26 MW
6 SALT-GILA 18 MW
7 PICACHO MTNS. NO.1 13 MW
8 PICACHO MTNS. NO.2 28 MW
9 MARANA 9 MW
K SAN PEDRO 1 MW
TRANSMISSION LINES
EXISTING
PROPOSED C.A.P. ADDITIONS
SUBSTATION
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
PROPOSED TRANSMISSION SYSTEM
344-330-33

Figure 7

provided and developed by the Project Manager (Arizona Public Service Company) for the Navajo Project Southern Transmission System. A communication system will also be necessary to provide status monitoring of the Havasu Pumping Plant and related structures. The radio communication and microwave system required for construction and operation of the Havasu complex will utilize already existing and developed sites on the Parker-Davis Project communications system. The only required addition to the system will be antennas to provide radio and microwave channels from the pumping plant complex to the base station.

E. Function of the Feature [132]

In general, the Gila River Basin with its principal tributaries from above Painted Rock Dam to the upper reaches of the river in southwestern New Mexico will be the area of principal benefit from the water diverted by the Havasu Pumping Plant. This area encompasses the metropolitan areas of Phoenix and Tucson and the large agricultural complex located primarily in Maricopa, Pinal, and Pima Counties in central Arizona. It is to these areas in central Arizona that direct delivery of Colorado River water can be made. Communities and agricultural areas located in and adjacent to the upper Gila River watershed primarily in Grant County, New Mexico, may also receive the additional water made available through exchange agreements between the CAP and central area water users in Arizona receiving Colorado River water.

Exchange water has been requested which would permit an increase in outdoor recreation and fish and wildlife enhancement through development and operation of upstream lakes on Gila River system tributaries.

1. General Operating Criteria [4, 6, 7, 9, 10]

The Colorado River will be the major source of CAP water. Releases from Glen Canyon Dam will be governed by coordinated long-range operating criteria as required by Public Law 90-537. Glen Canyon releases and intervening inflow between Glen Canyon Dam and Lake Mead are regulated by Hoover Dam, which is operated under provisions of the Boulder Canyon Project Act and the Boulder Canyon Project Adjustment Act. Releases from Hoover Dam are made to meet contractual commitments to water users in Arizona, California, and Nevada, including water rights as stipulated in the Supreme Court decree in Arizona v. California and the obligations of the Mexican Water Treaty.

The annual Colorado River diversion to central Arizona will range from an estimated minimum of 0.38 million acre-feet during extreme drought to the designed capacity of about 2.2 million acre-feet during periods of surplus water availability. The long-term average diversion will be about 1.2 million acre-feet annually. The Secretary of the Interior, working with state agencies, conservation and irrigation districts, and within the state water-law structure, will make specific water allocations and

subsequent contracts based on the availability of Colorado River water and the local water-supply conditions and needs.

2. Feature Operating Criteria 33, 34, 41, 98, 124-125, 131, 136-138

As required by Public Law 90-537, water for the CAP will be diverted from Lake Havasu on the Colorado River. Choice of the diversion structure was made after a study of alternative methods for water delivery to the Granite Reef Aqueduct. These alternatives are discussed in Chapter VIII and in the final overall environmental statement for the CAP.

Operation of the Havasu Pumping Plant in diverting the major portion of Arizona's remaining entitlement to Colorado River flows will be in accordance with Section 301(a) of Public Law 90-537 and Article 8.10 of the contract between the United States and the Central Arizona Water Conservation District. Capacity in the Granite Reef Aqueduct in excess of 2,500 cfs may be utilized in the daily operations of the project so as to maximize CAP benefits. The use of such capacity will not result in the annual diversion of a quantity of water in excess of the CAP's legal entitlement under the Colorado River Basin Project Act. Section 602(a) of the Act states: "In order to comply with and carry out the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, and the Mexican Water Treaty, the Secretary shall propose criteria for the coordinated long-range operation of the reservoirs constructed and operated under the authority of the Colorado River Storage Project Act, the Boulder Canyon Project Act, and the Boulder Canyon Project Adjustment Act. To effect in part the purposes expressed in this paragraph, the criteria shall make provision for the storage of water in storage units of the Colorado River storage project and releases of water from Lake Powell in the following listed order of priority: (1) releases to supply one-half the deficiency described in article III(c) of the Colorado River Compact, if any such deficiency exists and is chargeable to the States of the Upper Division, but in any event such releases, if any, shall not be required in any year that the Secretary makes the determination and issues the proclamation specified in section 202 of this Act; (2) releases to comply with article III(d) of the Colorado River Compact, less such quantities of water delivered into the Colorado River below Lee Ferry to the credit of the States of the Upper Division from other sources; and (3) storage of water not required for the releases specified in clauses (1) and (2) of this subsection to the extent that the Secretary, after consultation with the Upper Colorado River Commission and representatives of the three Lower Division States and taking into consideration all relevant factors (including, but not limited to, historic stream-flows, the most critical period of record, and probabilities of water supply), shall find this to be reasonably necessary to assure deliveries under clauses (1) and (2) without impairment of annual consumptive uses in the upper basin pursuant to the Colorado River Compact: PROVIDED. That water not so required to

be stored shall be released from Lake Powell: (i) to the extent it can be reasonably applied in the States of the Lower Division to the uses specified in article III(e) of the Colorado River Compact, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell, and (iii) to avoid anticipated spills from Lake Powell."

The Colorado River water pumped by the Havasu Pumping Plant will, through hydrologic coordination and water exchange provisions, make possible vital and essential basin-wide water uses including new water resources development in western New Mexico. Final operating criteria for the aqueduct system will be established from coordinated operation studies of the entire Colorado River and Gila River systems during the preparation of the definite plan report, water service contract negotiations, and preparation of standard operating procedures.

CHAPTER II

DESCRIPTION OF THE ENVIRONMENT

II. DESCRIPTION OF THE ENVIRONMENT

A. Climate [72, 75]

The Havasu feature is located in the arid Sonoran Desert portion of the southwestern United States. The climate of this area is characterized by long, hot summers, and short, mild winters; low annual rainfall; low relative humidity; high evaporation; and a high percentage of days of possible sunshine.

There are two distinct moisture sources. Winter precipitation is associated with moisture moving into the area from the Pacific Ocean, while the Gulf of Mexico supplies moist air for most of the region's summer rains. Winter rains, sometimes lasting for several days, usually occur as gentle showers over a large area. Local summer thunderstorms, which usually cover only small areas, are usually of high intensity and of short duration and produce many of the destructive flash floods well known in the Southwest.

The annual precipitation in the Parker area averages about 5 inches. The temperatures reported by the Environmental Data Service for Parker during 1971 are an annual average of 71.6° F., with a January average of 52.6° F., and an average of 95.8° F. for July. Summer temperatures are commonly in excess of 100° F. and have reached a maximum of 120° F. The minimum recorded winter temperature is 20° F. The average frost-free period in the area is in excess of 300 days.

B. Topography [76, 92]

The work area is generally in the northwestern part of the Buckskin Mountains and the lower end of the Bill Williams River valley - inundated by an arm of Lake Havasu. The topography of the area is dominated by The Mesa, an 18-square-mile dissected plateau of volcanic rocks lying at an elevation of about 1,500 to 1,800 feet. The maximum relief ranges from about 250 feet in the southeast to about 1,400 feet on the north side along the Bill Williams River. The plateau is edged by cliffs up to 600 feet high, and moderate to steep slopes extend from the cliffs down to the lowlands.

The topography of The Mesa and the adjacent areas strongly affects the type and location of proposed structures. A tunnel is required through The Mesa because of engineering and environmental problems that would be encountered in constructing an open aqueduct on the steep talus-covered slopes over or around the plateau. The elevation of the tunnel is controlled by the elevation of the plains along the aqueduct route south and east of The Mesa. The inlet portal needs to be located as far west as topographically possible in order to be near deep water in Lake Havasu, away from the encroaching Bill Williams delta. The pumping plant should be located generally downslope from the portal site. Since the Bill Williams arm contributes to sediment buildup in the lake along its south shore, a protective dike is needed north of the pumping plant inlet to maintain an open waterway.

The topographic environment along the Bill Williams River has been modified by the construction of Parker Dam and impoundment of Lake Havasu in 1938 and subsequent construction of Arizona State Highway 95, a transmission line with access roads, and a privately-owned, 270-space trailer court near the pumping plant site. Sediment from the Bill Williams River has covered much of the original topography in this portion of the lake and has formed a delta of approximately 1,890 acres. Much of this delta is presently occupied by phreatophytic and hydrophytic vegetation in the upper reach of the Bill Williams arm and provides good wildlife habitat. This vegetation starts about 3/4 mile northeast of the intake channel site, and then grows progressively more dense upstream in the Bill Williams arm. The intake channel and pumping plant site is along the south shore of Lake Havasu. A portion of the site occupies the former flood plain of the Bill Williams River (see Figure 8). Ridges and hills on the side of the valley are partially submerged, resulting in several small islands and peninsulas along the south lake shore. Heron Island, the largest of the islands which is about 2 acres in size and rises about 170 feet above normal water level, lies about 1/4 mile to the west of the tip of the intake channel embankment (see Figure 9).

The peninsula from which the dike will originate is a narrow, smooth ridge about 350 feet wide at the submerged base and rises 80 feet above the lake floor, with an average slope of about 3 horizontal to 1 vertical. The submerged slopes are generally less steep. North of the submerged base of the ridge, the topography is flat and smooth due to a cover of soft lake sediment, but the prelake flood plain floor under the sediment probably had shallow channels and other low relief features. The intake channel will be located partly between natural peninsulas and will reach inland a few hundred feet up a canyon. The channel will be extended into the lake by constructing a free-form dike from the end of the eastern peninsula northwest onto the submerged flood plain.

The pumping plant site is upslope to the south on the same ridge that forms the abutment for the free-form dike. At this site, the ridge is about 250 to 350 feet wide, rising up to 120 feet above the gully bottoms. The topography is irregular due to gullies and small cliffs. Construction of the pumping plant will require excavating through the ridge to an elevation well below that of the adjacent canyon bottoms. The pumping plant site takes advantage of a smooth surface with a minimum of cross-drainage problems for the discharge lines to the Buckskin Mountains Tunnel portal, and a topographically suitable intake channel area.

The discharge lines from the pumping plant will extend about 3,000 feet up a relatively smooth talus slope to the base of the cliffs on the edge of The Mesa. The slope increases gradually from about 15 percent along the lower end of the alinement to about 60 percent at the portal site. About halfway up the slope the alinement crosses a natural drainage channel about 100 feet wide and 10 feet deep.

The Buckskin Mountains Tunnel inlet portal is near the base of cliffs in the volcanic cap of The Mesa, and the tunnel will penetrate

Figure 8

Site Location of the Havasu Feature in the Former Flood Plain Area of the Bill Williams River. Photograph No. P344-300-9852

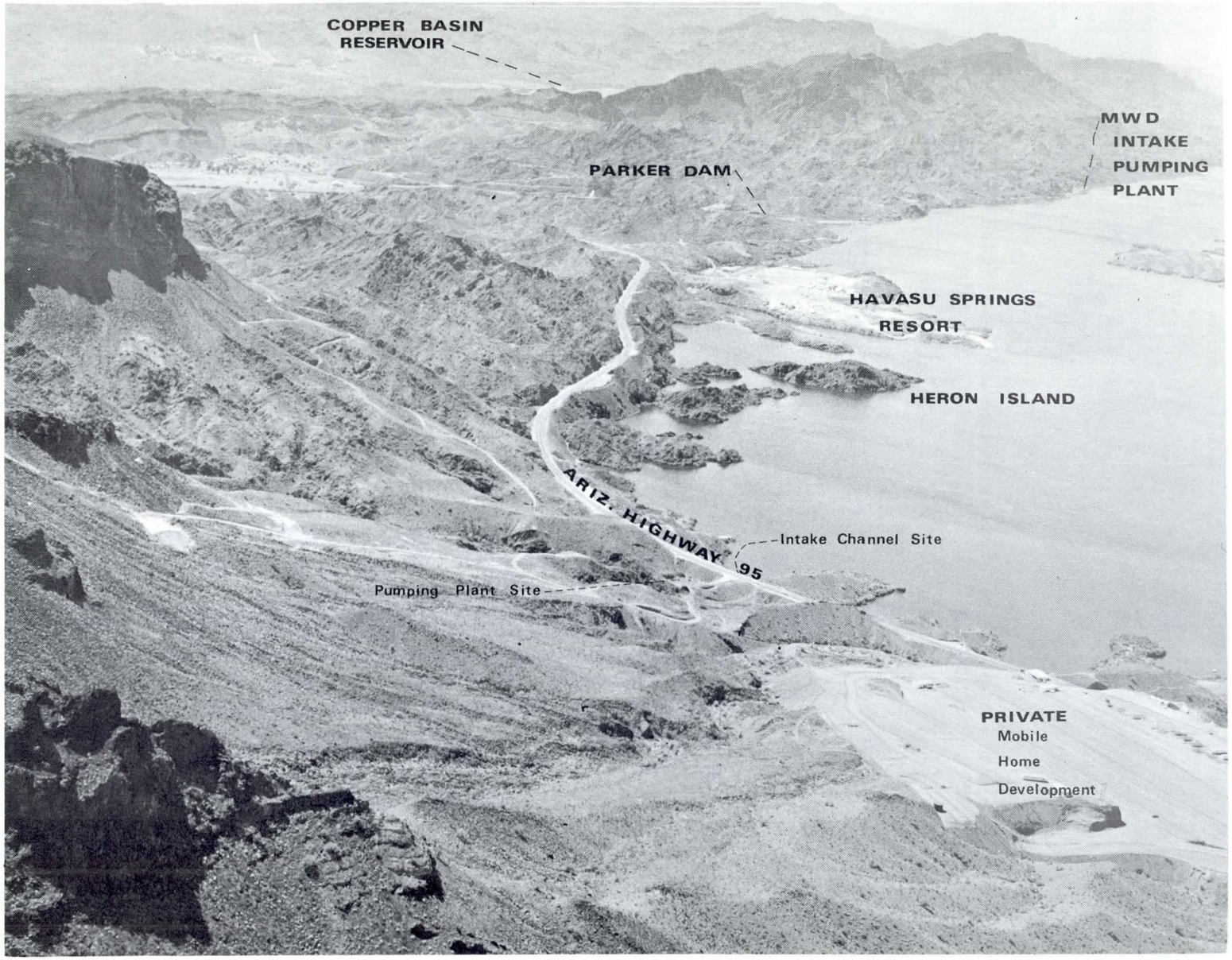

Figure 9

View of Heron Island, Havasu Springs Resort, and private mobile home development in relation to project site. Photograph No. P344-300-13147

The Mesa from northwest to southeast. Tunnel grade will be about 200 to 600 feet below The Mesa land surface, except under a few canyons or washes that have been eroded to within 50 feet of grade. One slight bend is required near the northern end to avoid a canyon that cuts deeply into the plateau. The tunnel will exit at a low ridge on the southeastern edge of The Mesa alongside Osborne Wash.

C. Geology [76, 77, 89-92]

The area consists basically of fault-block mountain ranges with intervening alluvium-filled basins. Two distinct generations of structures are apparent. An older generation of ranges was partially covered by a thick accumulation of alluvium and by volcanic rocks. Subsequently, large scale faulting and tilting produced a younger generation of mountains which incorporate the volcanic rocks and basin-fill deposits. Finally, the land surface has been strongly modified by geologically recent stream erosion and deposition.

All of the events and conditions described above are represented in the area of the proposed structures. The Mesa, a prominent topographic feature of the Buckskin Mountains and the site of the Buckskin Mountains Tunnel, is a plateau capped by a slightly tilted sequence of volcanic rocks. Tilting and uplift of the plateau occurred on faults along the Bill Williams River, including faults at and near the site of the Havasu Pumping Plant and intake channel. The volcanic rocks forming The Mesa overlie gneiss and sandstone mountains and alluvial deposits which fill the old valleys, and these materials are all represented on the north slope of The Mesa between the tunnel portal and Lake Havasu. The surface is mostly covered with relatively thin deposits of soils and rock fragments including: (1) talus on the steep slopes below the volcanic rocks of The Mesa, (2) river sand and gravel along the Bill Williams River, and (3) lake and delta sediments under Lake Havasu.

The geologic conditions and processes at the specific structure sites influence to a considerable degree their location, design, construction methods, and costs. The intake channel embankment, designed to prevent the encroachment of the Bill Williams River delta into the pumping plant inlet, will be founded on competent river alluvium overlain by soft lake sediment up to 26 feet thick. The design and construction methods will accommodate the soft mud on the lake bottom which will allow the fill material to settle deeply into it. The embankment will abut a partially submerged ridge of weakly to moderately cemented sandstone and conglomerate that will provide an adequate foundation for the structure.

The Havasu Pumping Plant site is about 500 feet inland from the south shoreline of the lake on the same ridge as the embankment abutment. About 800 feet from the end of the ridge, a large inactive fault separates the sedimentary rocks on the north from gneiss on the south. The pumping plant foundation is located entirely on the gneiss, which is a better foundation material than the faulted, clayey sandstone to the north.

The Mesa from northwest to southeast. Tunnel grade will be about 200 to 600 feet below The Mesa land surface, except under a few canyons or washes that have been eroded to within 50 feet of grade. One slight bend is required near the northern end to avoid a canyon that cuts deeply into the plateau. The tunnel will exit at a low ridge on the southeastern edge of The Mesa alongside Osborne Wash.

C. Geology [76, 77, 89-92]

The area consists basically of fault-block mountain ranges with intervening alluvium-filled basins. Two distinct generations of structures are apparent. An older generation of ranges was partially covered by a thick accumulation of alluvium and by volcanic rocks. Subsequently, large scale faulting and tilting produced a younger generation of mountains which incorporate the volcanic rocks and basin-fill deposits. Finally, the land surface has been strongly modified by geologically recent stream erosion and deposition.

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The excavation for the pumping plant, being considerably larger than the actual plant foundation, will include, besides gneiss, minor amounts of sedimentary rocks, unconsolidated soils, and andesite occurring as thin vertical dikes.

As mentioned previously, the discharge lines from the pumping plant to the Buckskin Mountains Tunnel portal will extend up a relatively smooth talus slope. The talus, composed of gravel-size to boulder-size fragments of andesite with a matrix of silty sand, is from about 10 to 30 feet thick. Gneiss underlies the talus along most of the lower two-thirds of the alinement. In the lower part of the upper one-third, the talus covers an area a few hundred feet wide of fine-grained sand and weak sandstone. In the upper few hundred feet of alinement the talus covers the lower portion of the volcanic-rock sequence that caps The Mesa. The discharge lines will be buried in trenches excavated into the talus, and slightly into underlying materials where the talus is thin. The talus provides easy excavation, suitable materials for bedding and backfill, and generally a stable foundation. On steeper slopes where the talus may be loose and unstable, the trenches will be cut sufficiently deep into underlying materials to provide a proper foundation.

At the route and elevation under consideration, the Buckskin Mountains Tunnel will penetrate, in its entirety, a volcanic assemblage of nearly horizontal andesite lava flows, interlayered pyroclastic rocks ranging from tuff to boulder agglomerate, and vertical dikes. Some intervals will be entirely in massive hard andesite, some will be entirely in soft tuff or agglomerate, and others will be in multiple layers of varying hardness. An absence of mineralization was found during the geologic drilling and exploration program by Reclamation. The drilling program consisted of about 5,800 feet total length of core drilling at 22 holes, ranging in depth to about 500 feet and to at least 10 feet below the tunnel grade. Although isolated pockets of mineralization could be encountered, there is little indication that such pockets would be of commercial value. No gas or significant waterflows are anticipated, and the tunnel will have no effect on local ground-water conditions.

There is no evidence that any of the local faults have been active in historical times. No damaging earthquakes have been recorded in the area, although the Lake Havasu vicinity has experienced a few minor tremors since Parker Dam was constructed. Regionally, the feature is within an area of little seismic activity. While shocks, related to epicenters in the seismically-active Salton Trough about 100 miles to the southwest, may be felt in the Parker area, these shocks will probably be in the Modified Mercalli V-VII range. Little to no damage would be experienced by project facilities within this range, or by ground motion associated with this earthquake range. No landslides have been identified in the project area, indicating little possibility that landslides may be triggered by future seismic activity.

D. Vegetation 11-16, 76, 121

Vegetation in the area is extremely sparse consisting of species that are of Sonoran and Mohave Desert origins. This area is a transition zone between the two deserts. Vegetation species are more typically Sonoran, while the sparseness of species is characteristic of Mohave. The rock ridges, canyons, and talus slopes leading upward from the lakeshore to the top of The Mesa are dotted sparsely with catclaw, saguaro, barrel, cholla and hedgehog cacti, creosote bush, ironwood, smoketree, ocotillo, and mesquite. Small stands of saltcedar and paloverde trees are also found along the shorelines and bottoms of wash areas. Seeds of seasonal grasses and flowering plants are present in the soil to germinate, grow, and produce new seed when winter or summer storm rainfall is adequate to trigger the response from the appropriate seed. Often several seasons will elapse before the proper moisture conditions occur.

The vegetation of the lake marsh area and upstream riparian area of the Bill Williams segment of the Havasu National Wildlife Refuge includes cattail, reed, tule, saltcedar, willow, mesquite, baccharis, arrowweed, and cottonwood. None of the marsh and riparian vegetated areas will be affected by construction of the Havasu feature. The vegetation on the ridges and slopes above the influence of the ground-water level in the river bottom and Lake Havasu is typical of the Sonoran-Mohave Desert.

The Arizona Agricultural and Horticultural Commission will be consulted regarding clearing of native vegetation and transportation and replanting of any salvaged plants.

E. Fish and Wildlife - Vertebrates and Invertebrates 35, 100

There are many species which are numerous, prolific, and capable of competing with other species in order to establish and occupy a niche. These include species managed as a renewable resource for game purposes. Other species which are limited in numbers and which are or may be declining in population have been classified and designated as rare, endangered, peripheral, or status undetermined by the Bureau of Sport Fisheries and Wildlife in the publication, "Rare and Endangered Fish and Wildlife of the United States" (1968). These four designations are defined as follows:

Endangered: An endangered species or subspecies is one whose prospects of survival and reproduction are in immediate jeopardy. Its peril may result from one or many causes - loss of or change in habitat, overexploitation, predation, competition, disease. An endangered species must have help or extinction will probably follow.

Rare: A rare species or subspecies is one that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens. Close watch of its status is necessary.

Peripheral: A species or subspecies whose occurrence in this country is at the margin of its natural range. Special attention may be needed to retain them in the United States.

Status Undetermined: A species or subspecies which has been suggested for rare or endangered classification, but about which further information is needed to clarify its status.

Species which are managed for game purposes and species which are included in the rare and endangered species list are discussed in the sections on fish, amphibians and reptiles, birds, mammals, and in other fish and wildlife discussions. Only species which are endangered are listed by the Bureau of Sport Fisheries and Wildlife in Appendix D, 50 CFR 17. This official list is periodically revised, the current list being dated October 13, 1970.

Individual states also classify species as rare or endangered within that state. Such a state classification may not be recognized by an adjoining state or BSFW's list.

1. Invertebrates

The invertebrate fauna at Lake Havasu are considered to have stabilized since the construction of Parker Dam and Lake Havasu. The insects especially have successfully invaded, exploited, and established themselves in environmental "niches."

There are aquatic and terrestrial groups; subterranean and arboreal species; aquatic forms living as climbers on vegetation, sprawlers on the bottom, burrowers in the bottom, free ranging, close clinging, and vegetation inhabitating forms; there are plant and animal parasites; parasites on parasites; scavengers; carnivores; predators; copriphags; saprophags; phytophags on all the species of plants, and on all the parts of the plants, roots, trunks, stems, leaves, flowers, and seeds; there are ground and plant nesting species; symbiotic relationships between plant and insect, animal and insect; oligolectic and polylectic pollinators; poisonous and nonpoisonous forms and a few whose relationship to the whole is nebulous. No other group of animals so completely dominates the environment. Nor do the invertebrates find an equal when it becomes necessary to adapt and survive under changing conditions. Neither the construction of the feature nor the slight change in the circulation pattern of water in Lake Havasu due to project pumping is expected to have an appreciable effect upon the invertebrates.

2. Fish [80, 86, 94, 100, 116]

Table 1 in the Appended Material lists the 13 species of fish that occur in the vicinity of the Havasu Intake Channel. Lake Havasu provides a warm water game fishery of introduced species, supporting variable populations of largemouth and striped bass, crappie, sunfish, and catfish. Important nongame species of fish include large numbers

of carp and threadfin shad, and numerous populations of other introduced species such as fathead minnows and shiners.

a. Native Fishes [24, 25]

Native species of fish originally found in the reach of the Colorado River now occupied by Lake Havasu were Colorado River squawfish, humpback sucker, flannelmouth sucker, bonytail chub, and woundfin. It is possible that swift-water forms of speckled dace and humpback chub also existed. According to ichthyologists, humpback suckers, flannelmouth suckers and bonytail chub are occasionally caught in this area. During aquatic surveys in Lake Havasu in 1972, about a 7-pound humpback sucker was captured and released in the Bill Williams arm. All the aforementioned species of fish are found in other parts of the Colorado River drainage.

Little is known of the fish fauna of the Bill Williams River from Alamo Dam to Lake Havasu. Since the completion of Alamo Dam by the Corps of Engineers in 1968, lands downstream from the Alamo Dam have been extensively cleared and developed for irrigated farming. The irrigation water supply comes from ground-water pumping. As long reaches of the Bill Williams River are dry for extended periods every year, an effective barrier to fish movement exists. This area is also out of the area of influence of project facilities.

In recent years decreasing amounts of basic food production in Lake Havasu have contributed to a depression of the game fish population. Fishing participation and success have been further reduced by the high incidence of recreational boating.

b. Rare and Endangered Species [100]

Rare and endangered fish included in the Bureau of Sport Fisheries and Wildlife's 1968 "Rare and Endangered Fish and Wildlife of the United States" are not known to exist in Lake Havasu. The humpback sucker, which is listed as status undetermined, is rarely encountered in Lake Havasu. The California Department of Fish and Game designates the humpback sucker and the bonytail chub as rare in California. The Arizona Game and Fish Department does not designate rare species.

The Colorado River squawfish is found in the upper Colorado River basin, but has not been found below Hoover Dam in recent years. The Colorado River squawfish is currently listed as endangered in the 1968 edition of the Bureau of Sport Fisheries and Wildlife's "Rare and Endangered Fish and Wildlife of the United States." The woundfin, which before 1900 lived in the lower Gila River, is now found only outside the area in the Virgin River above Lake Mead.

3. Terrestrial Vertebrates [17-23, 80]

More than 750 species and subspecies of terrestrial vertebrates occur in the lower Colorado region. Over 40 of these species of wildlife provide hunting, ranging from highly prized big game to nongame species. Many other species, mostly small mammals and birds, provide enjoyment for the nonhunting outdoorsman for nature study and photography.

a. Amphibians and Reptiles [19, 35, 100]

The herpetofauna has not changed radically in the watershed area due to man's activities.

Table 2 in the Appended Material lists the amphibians and reptiles that are found in the feature area. The list includes 25 species of snakes, 21 species of lizards, four species of turtles, and 10 species of amphibians (frogs and toads). None of the species of reptiles or amphibians found in the Lake Havasu area is considered rare or endangered by the Bureau of Sport Fisheries and Wildlife. The reticulate Gila monster (Heloderma suspectum suspectum) and the desert tortoise (Gopherus agassizi) are listed as status undetermined species in the 1968 edition of the "Rare and Endangered Fish and Wildlife of the United States."

b. Birds [18, 80, 85, 86, 117, 118, 133]

In general, the species of birds found in an area depends on the type of vegetation. As is true with other forms of life found in and adjacent to the project area, the bird fauna is very diverse. This is due to the great diversity of habitats. By referring to the description of the vegetation presented earlier, it may be seen that even within a small area there are many different habitats. Of greatest significance is the riparian community, which provides habitats for the most abundant and diverse bird fauna. By listing a few of the many varied habitats within the riparian community, the diversity becomes apparent. There are open water marsh areas, thickets, a few tall trees, shrubs, and tall grass areas.

Table 3 in the Appended Material lists the 264 species of birds, with critical life history data, observed and identified by personnel of the Havasu National Wildlife Refuge. Most species listed are found in the riparian and marsh habitats, the closest being in the Bill Williams delta about 3/4 mile from the Havasu Intake Channel. These species will be occasional and/or accidental visitors to the actual project area.

A letter dated November 21, 1969, from the Bureau of Sport Fisheries and Wildlife, with the concurrence of the Arizona Game and Fish Department, stated that Heron Island (outside the refuge) is used by about 15 pairs of great blue heron as a nesting and rearing area, from March through July of each year. (See Figure 10.) The physical

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Figure 10

View of great blue heron and nesting area on Heron Island.
Photograph No. P344-300-13051

condition of Heron Island will not be altered during or after construction of the intake channel and pumping plant, nor will the island be connected to the mainland during construction and subsequent operation of the pumping plant.

The Lake Havasu area, which is on the Colorado flyway, has an annual flight estimated at about 1/4 million birds. The Havasu National Wildlife Refuge attracted about 132,000 migratory waterfowl in the 12-month period ending August 31, 1970. The Bill Williams Delta area attracts a relatively small number of these migratory waterfowl, and is considered a minor stopover area. (See Figure 11.) Table 3 in the Appended Material indicates the time of year each species occurs in the area.

The Yuma clapper rail is the only rare or endangered species resident in the area and it is restricted to marsh habitat, the closest being 3/4 mile from the feature area. The Yuma clapper rail is a summer resident in some alkaline cattail marshes along the lower Colorado River north to the Bill Williams River delta, which is at the southeast end of Lake Havasu, and in the Topock Swamp near Needles. In 1972, a census of the Yuma clapper rail showed that 14.8 percent of the Refuge rail population occurred on the Bill Williams section, 27.6 percent in the Topock Gorge, and 57.6 percent in the Topock Marsh. In the Bill Williams River area, a total of 21 birds responded. All birds were in the cattails above the Arizona State Highway 95 bridge. None of the habitat of the Yuma clapper rail will be affected by the CAP.

The peregrine falcon and the prairie falcon are seasonal or transient inhabitants of the project feature area. The bald eagle is a rare winter visitor to the general area.

c. Mammals [17, 21, 23, 28, 35, 57, 95, 100, 127, 128, 134]

Several species of small mammals are well distributed throughout the area and include coyote, badger, skunk, jackrabbit, fox, and various ground squirrels.

The Sonoran pronghorn antelope is endangered and was formerly distributed widely in grassland areas throughout the lower Colorado region, but recent reports indicate that it is not present in the Havasu area. The spotted bat, a naturally occurring rare mammal, has a reported range of Oregon, California, Idaho, Montana, Wyoming, Colorado, New Mexico, Arizona, and Nevada. The spotted bat has been reported only four times prior to 1967 in Yuma and Maricopa Counties in Arizona. In light of the range and infrequency of observation, it is not anticipated that the Havasu feature or the CAP will have adverse impact on this species.

Figure 11

View of Bill Williams arm wildlife habitat in the vicinity of Arizona State Highway 95 bridge crossing approximately 3/4 mile from Havasu feature site. Photograph No. P344-300-9853

Other species of bats may be seen in the early evening around the rivers. Shrews use the thick grass and thickets along the water's edge. Muskrat and beaver live along the rivers and in marshy areas. Small native rats, mice, ground squirrels, and rabbits are found in the cottonwood-willow woodlands and desert habitat.

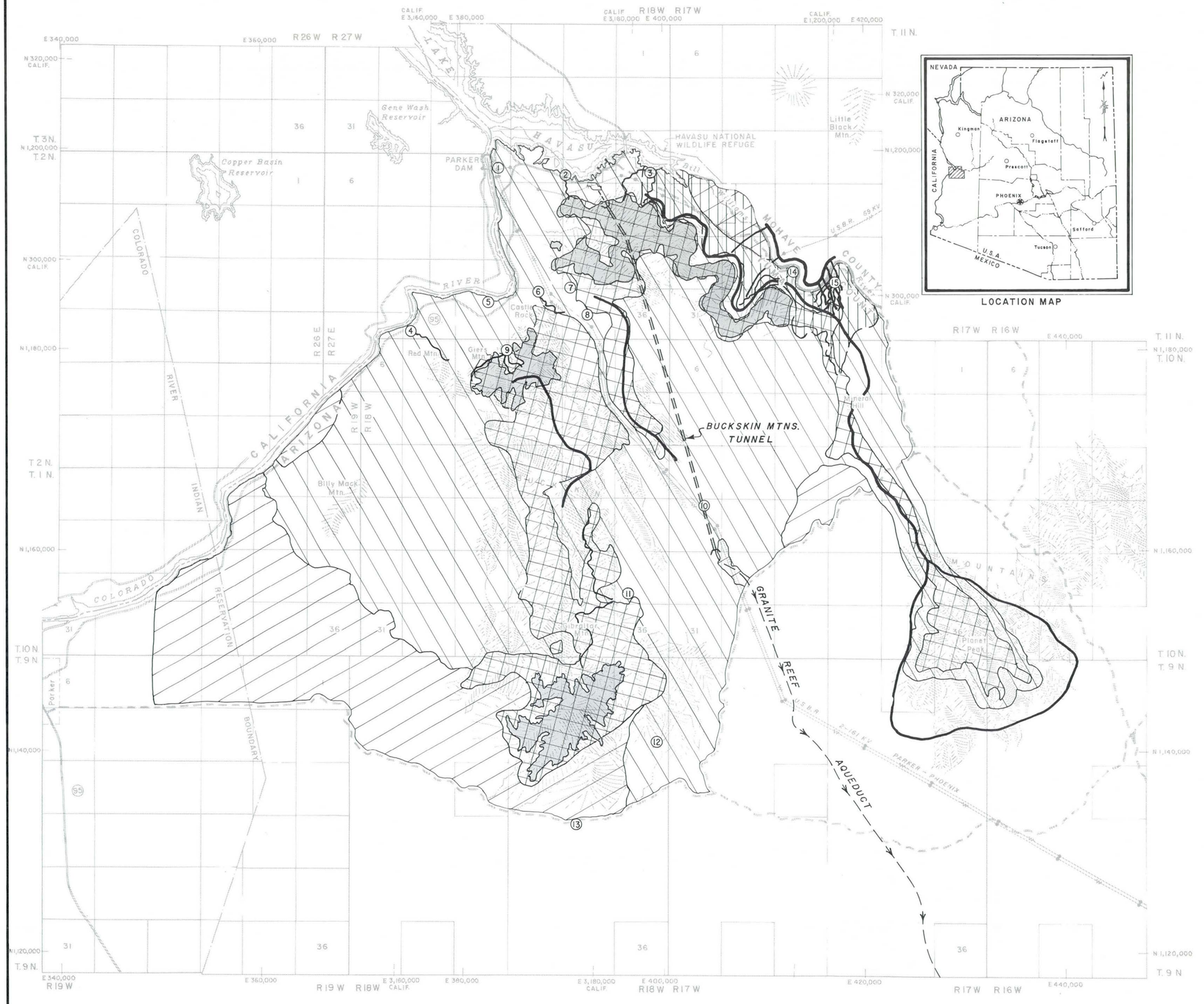
Table 4 in the Appended Material lists the mammals found in and adjacent to the feature area. This area is not the exclusive habitat for these species.

Desert mule deer and desert bighorn sheep are the only big-game wildlife species within the feature area. Hunting of big game is permitted within the Refuge boundary. There is controlled seasonal permit hunting under Arizona's comprehensive game management program for deer and bighorn sheep in the adjoining Buckskin Mountains and lands adjacent to the Bill Williams arm. Habitat for the desert bighorn outside the Refuge includes the Buckskin Mountains where the population has been estimated to be about 50 animals. No permits for hunting bighorn sheep in the Buckskin Mountains area have been issued since 1970. Figure 12 shows the location of the bighorn sheep habitat.

Construction of Arizona State Highway 95 and private recreational development in the area have modified migratory routes of the desert bighorn. With these barriers, bighorn sheep still come to the lakeshore for watering and browsing. Deer have a less restrictive range and are usually observed on lands further upstream on the Bill Williams arm. Deer counts for the Bill Williams section, made by Bureau of Sport Fisheries and Wildlife biologists of the Havasu National Wildlife Refuge, indicate an average of seven to nine deer inhabit these Refuge lands regularly.

Feral burros range from north of the Bill Williams River to the Mineral Wash area south of the Bill Williams River and up the northeast-facing slope of the Buckskin Mountains. There is an area of competition between the bighorn sheep and the burros, especially along trails to water on the Bill Williams River. Figure 12 depicts the area of overlapping occurrence and competition. There is no evidence that burros occur along the tunnel route, at the tunnel portal sites, or in the immediate pumping plant area. Feral horses are not found in the Buckskin Mountains area due to the lack of forage and water. Horses are found to the south on the Colorado River Indian Reservation, but with the development of the reservation lands and the removal of mesquite bosques and other native habitat, the untamed horse population on the reservation is decreasing.

There are no rare or endangered species of mammals found in the feature area.



LOCATION MAP

EXPLANATION

- Burro use area
- Water routes
- Area having general year-round sheep populations
- Lower density area--may have high summer concentrations near Colorado River
- Poor sheep use--single sheep seen on occasion
- Sheep migration routes
- Lambing areas
- ② Sheep trails and watering areas

① Parker Dam Tunnel Pond--light use.
② Havasu Point--summer use.
③ Bill Williams Delta--summer use.
④ Red Mountain Wash--little use.
⑤ Giers Basin Shore Line--good summer use.
⑥ Giers Wash Seep--fair summer use if not dry.
⑦ Goat Spring--good use year round but dry most of time.
⑧ Game and Fish Catchment #628--some use year round.
⑨ Lamb Spring Development--good use year round--very heavy summer use--flows 60 gal. per hr. all year.
⑩ Game and Fish Catchment #629--very little use.
⑪ Mammon Wash Natural Tanks--when not dry they get good use.
⑫ Black Tank--seldom any sheep use.
⑬ Bobs Well--no known sheep use.
⑭ Bill Williams River Water Site
⑮ Bill Williams River Water Site--fair sheep use--heavy burro use.

NOTES

1. This drawing compiled from information developed by the Arizona Game and Fish Department in cooperation with the Arizona Water Commission and Bureau of Reclamation.
2. Arizona state plane coordinates east zone.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION-ARIZONA

BUCKSKIN MOUNTAINS AREA

BIGHORN SHEEP AND BURRO USE PATTERNS

SCALE OF MILES 1 0 1 2 3

MAP NO. 344-330-176

NOVEMBER 21, 1972

Interior-Reclamation,B.C., Nev. 12-72

Figure 12

F. Ecological Relationships [76, 130]

Desert ecological communities in general are considered relatively tolerant to extreme natural stresses. In order for the desert biota to survive in the extreme temperature and low moisture conditions, they have modified their life forms and adapted successfully into the hardy forms found in a desert environment. Erosion rates of desert soils are variable from low to high depending on soil structure, particle size, cohesiveness, plant cover, and other factors. Erosion results from strong winds or intense rainfall and storm runoff. Soils are sometimes low in quality. The sparse desert vegetation, resulting from the climatic and geologic regimen, has limited the diversity and forms of animal life. Species known to exist historically are now extinct. Long periods of isolation in the severe desert environment have caused evolutionary changes in some species. Species that could not evolve became extinct. In a transitional zone such as the area surrounding the Havasu site, species complexity may become less diverse as the specific life zones tend to overlap.

Grassland, chaparral, and woodland communities are progressively more stable ecological systems. Each provides more cover, forage, and water storage, and thus is able to support larger populations of animals. To some extent, large stands of vegetation modify micro-climatic conditions within them due to increased humidity from plant transpiration. The only significant stands of vegetation in the vicinity of the feature are the phreatophyte and hydrophyte communities that have developed since 1938 along the delta of the Bill Williams arm, 3/4 mile from the pumping plant site. The condition of vegetation indicates the vegetative response of a desert river area to impoundment by a dam and resulting sediment delta formation.

Natural successional changes have occurred in many ecological communities, especially the riparian community. In addition, changes due to change in climate, man's activities, and other factors have made visible differences in several of the ecological communities in the Bill Williams arm and the Havasu National Wildlife Refuge area.

Since completion of Parker Dam, the introduced saltcedar has spread rapidly along the shores of Lake Havasu and in the Refuge area on the Bill Williams River.

Activities associated with human habitation have resulted in a significant impact on some desert areas. Relatively small areas of the desert have been modified by introducing water and transforming desert-land to marshes, agricultural and urban land uses. Dropping of the water table due to ground-water overdraft has also resulted in replacement of marsh and riparian areas with desert shrub. This has occurred further up the Bill Williams River as a result of irrigated farming and construction of Alamo Dam. The desert's ecology has been affected

to some degree by the construction of highways, canals, and other improvements; use of off-road areas by recreational vehicles; and conducting of military training operations. Roads across desertlands often change the drainage patterns in the area, and it can be many years before vegetation is reestablished in the disturbed areas.

G. Recreation and Land Use [29, 32, 81, 87, 116, 119, 120-122]

Lake Havasu is one of the fastest growing recreation areas in the western United States. Recreation use of the Lake Havasu area increased from 1,602,225 visitors in 1970, to 1,970,724 visitors in 1972. The most popular recreation uses of the area are boating, fishing, camping, swimming, sightseeing, waterskiing, picnicking, and hunting in that order. Lake Havasu City, Arizona, 18 miles north of the Havasu feature site is a fast growing resort and resident community. It is becoming a center for tourists as a result of developments such as the relocation of the London Bridge. The 1970 census reported a population of 5,300 for the Lake Havasu area. The California side of Lake Havasu includes lands of the Chemehuevi Indian Reservation.

Parker, Arizona, is located 20 miles by road south of the pumping plant site. Parker and Lake Havasu City are connected by Arizona State Highway 95, which is the only highway running north and south in the area on the east side of the river. The Parker strip is a high-use recreation area on the Colorado River extending 16 miles up the river to Parker Dam. The project area is 2-1/2 miles east of Parker Dam. The Parker strip consists of water-oriented recreation facilities and homesites developed by Federal, state, commercial, and private interests. The 16-mile strip along the Colorado River contains many permanent homes, vacation cottages, motels, trailer lots, and mobile home parks. The Buckskin Mountains Colorado River State Park is located approximately 3 miles below Parker Dam in Arizona. According to a 1969 report prepared for the Department of the Interior by the University of Southern California Research Institute, there were more than 1,124,000 visitor-days on the 16-mile Parker strip during 1968. Visitation to Buckskin Mountains Colorado River State Park increased from 79,538 in 1970, to 84,299 in 1971.

Havasu Springs Resort, located on a peninsula 1-1/2 miles west of the proposed inlet to the intake channel, is the primary center for recreational activities on the Bill Williams arm of Lake Havasu (see Figure 13). This concession area includes boat docking facilities, a restaurant, a store, and two motels. The lessee has submitted plans to develop additional beaches and day-camp recreation areas. Hillcrest Bay Mobile Manor, a privately-owned, 270-space trailer park, is being developed immediately to the east of the pumping plant site on an isolated parcel of private land adjacent to the Bill Williams arm section of the Havasu National Wildlife Refuge. Presently there are only a few trailers in the park, but a significant population increase is anticipated.

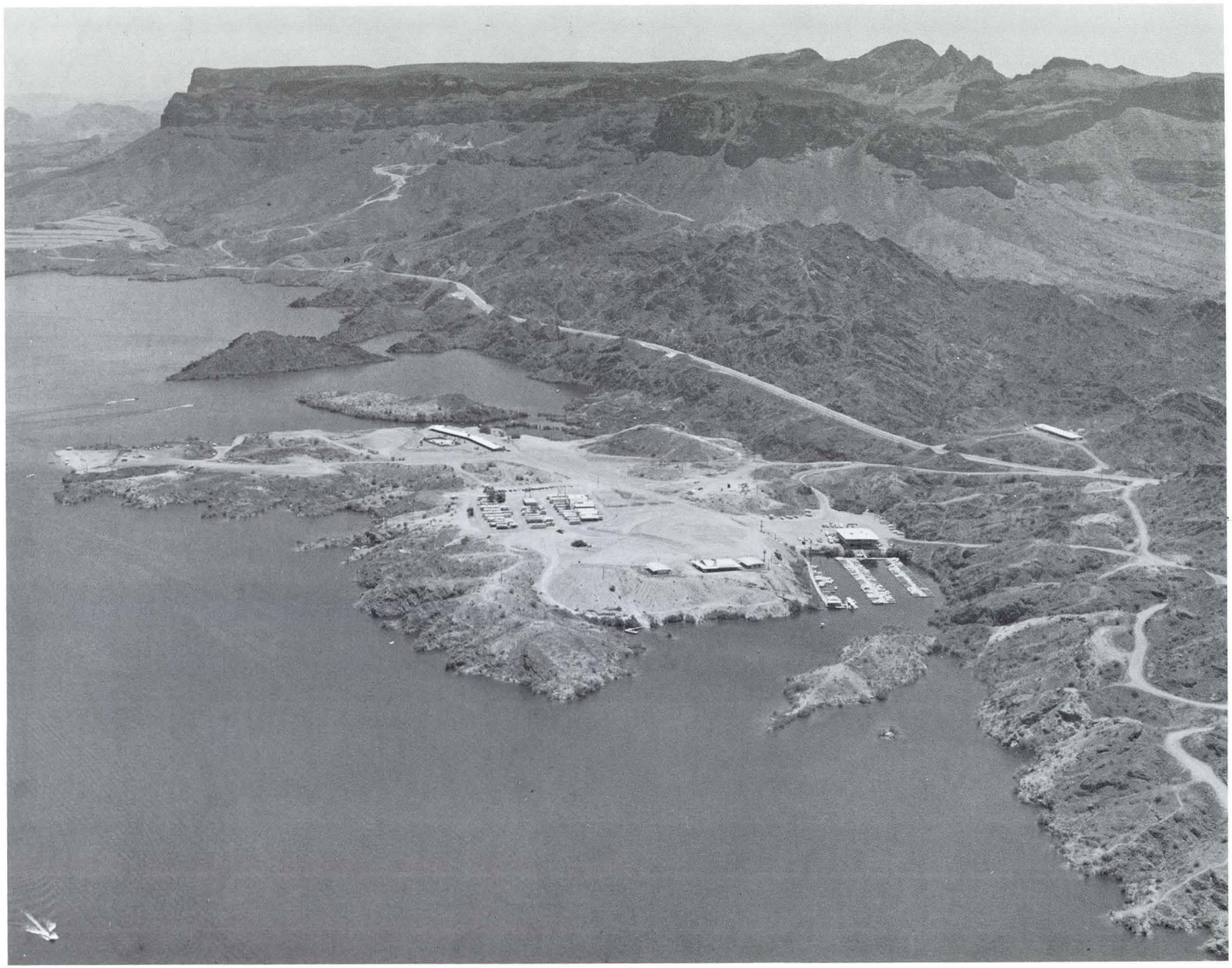


Figure 13

Location of Havasu Springs Resort in relation to Heron Island and the feature site.
Photograph No. P344-300-11520

The Havasu National Wildlife Refuge, formerly the Havasu Lake National Wildlife Refuge, was established by Executive Order 8647 on January 22, 1941. As shown in Table 1, the original area was 43,003.60 acres.* The Refuge included lands in Arizona and California from the Topock Marsh south along the Topock Gorge to the Bill Williams River. The Refuge includes lands withdrawn specifically for Reclamation purposes on January 31, 1903, September 8, 1903, and June 4, 1930. The Havasu Pumping Plant and discharge lines and the Buckskin Mountains Tunnel will be located within lands under Reclamation application for withdrawal for the CAP, Applications Nos. AR 031307 dated February 19, 1962, A 997, dated May 17, 1967, and A 1267, dated August 24, 1967. With the exception of one corner of the pumping plant, these structures are outside the boundary of the Havasu National Wildlife Refuge.

The Havasu National Wildlife Refuge has varied in area from its initial establishment to the present time. As the lower Colorado River has become an increasingly popular recreation area, with strong demand to meet the requirements of people, the land management program has been in a state of flux in response to Federal, state, local, and private goals. With increasing recreational use of the river, the Refuge boundaries were adjusted to eliminate those lands and water areas that were receiving heavy motorized use and pressure for development. By March 1968, the Refuge embraced 21,931.36 acres. The present area of the Refuge covers 40,255.31 acres between Lake Havasu City and Needles, including the Topock Gorge, and the Topock Marsh, and 1,239.6 acres on the Bill Williams River arm of Lake Havasu. (See Figure 14.) The Planet Ranch Road from Arizona State Highway 95 on the south side of the river crosses the southern boundary of the Refuge several times in traversing the length of the Bill Williams segment of the Refuge.

Application was made in 1957 and 1958 by the Bureau of Sport Fisheries and Wildlife for expansion of the refuge by 5,800.00 acres (as shown on Figure 2), but action has not been completed.

Properly licensed sportsmen may hunt and fish within the Refuge in accordance with state game and fish agency rules, and regulations of the Bureau of Sport Fisheries and Wildlife that have been promulgated for the specific Refuge.

Sightseeing from several turnoff points along Arizona State Highway 95 is the most significant recreation use of the shoreline area of the Bill Williams arm. Little hiking or off-road use occurs in this area of the Havasu Intake Channel and pumping plant due to the rough terrain. The peninsulas offer boat and shoreline fishing opportunities. Aquatic studies performed in 1972 by the Bureau of Reclamation, Bureau of Sport Fisheries and Wildlife, California Department of Fish and Game, Arizona Game and Fish Department, and others show that, with the exception of channel catfish, that area of Lake Havasu is relatively poor in game fishes.

*Table 1 also lists dates and acreages involved in changes affecting the Refuge.

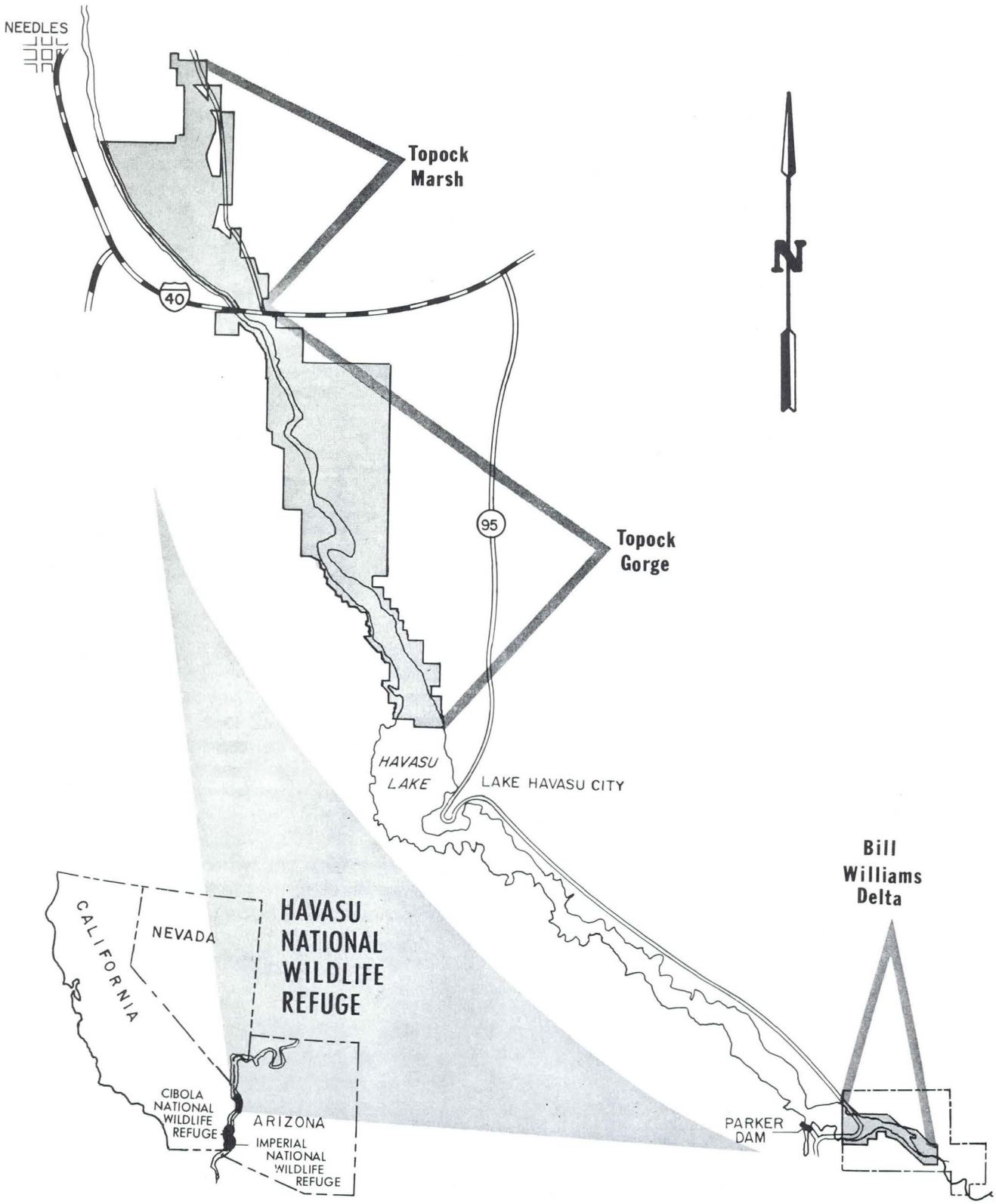
Table 1

CHRONOLOGY OF HAVASU NATIONAL WILDLIFE REFUGE BOUNDARY ADJUSTMENTS**

		Acres		Remarks
E.O. 8647 January 22, 1941		43,003.60	*	Original acreage. Refuge established.
P.L.O. 559 February 11, 1949	+	2,757.00		Addition of a number of small tracts to round out boundary.
		45,760.60	*	
		45,761.44	*	Official acreage. No explanation for additional .84 of an acre.
P.L.O. 2852 January 4, 1963	-	80.00		Deletion on boundary north of Lake Havasu City south of present boundary. No reason for deletion found in files.
		45,681.44	*	
P.L.O. 3099 June 4, 1963	-	1,351.00		In accord with LCRLUP. Lands on California side of river above Topock Bridge with high recreation potential, including San Bernardino County's Park Moabi.
		44,330.44	*	
BR Transfer November 16, 1964	+	10.00		Administrative site in town of Needles.
		44,340.44	*	
P.L.O. 3522 January 8, 1965	-	10,143.56		In accord with LCRLUP. Arizona lands bounding Lake Havasu with high recreation potential.
		34,196.88	*	
P.L.O. 3720 July 6, 1965	-	12,189.47		In accord with LCRLUP. California lands bounding Lake Havasu with high recreation potential.
		22,007.41	*	
P.L.O. 4374 March 4, 1968	-	76.05		In accord with LCRLUP. Relinquished for expansion of Park Moabi.
		21,931.36	*	
P.L.O. 4417 May 20, 1968	+	19,525.33		In accord with LCRLUP and 1958 withdrawal application as amended. Addition of Needles Mountains and small tracts in March and Gorge Units of refuge.
		41,456.69		
P.L.O. 4533 September 30, 1968	+	38.22		Unintentional omissions from P.L.O. 4417. Present acreage of refuge - round off to 41,500.
		41,494.91	*	
Pending Withdrawal	+	5,800.00		In accord with LCRLUP. Public lands at Bill Williams Delta in 1958 withdrawal application as amended.
		47,294.91		

*Total after action.

**Data provided by Havasu National Wildlife Refuge, Bureau of Sport Fisheries and Wildlife.



Sketch showing the boundaries and present area of the entire Havasu National Wildlife Refuge.

Figure 14

The Buckskin Mountains area to the south of the pumping plant site has been used extensively, and increasingly in some locations, by four-wheel-drive recreation vehicles and two-wheeled power cycles and trail bikes. This form of recreation use has adversely affected the esthetic and scenic values of the area and probably had some detrimental effect on the bighorn sheep population.

H. Special Esthetic Values, Historical or Archeological Sites [26, 40, 101, 102, 115]

The natural geologic formations and topography of the area have esthetic values because of the proximity to a high-use recreation area and a state highway. Buckskin Mountains, with numerous ridges, canyons, and plateaus, offer a rugged setting for viewing and picture taking from either the lake or the highway.

An earlier archeological reconnaissance survey of the area contracted under the supervision of the National Park Service, indicated that no historical or archeological sites existed in the construction area. A subsequent detailed field examination identified a lithic tool quarrying site (Arizona L:16:1) on top of The Mesa in the general area of the tunnel alinement. This site will not be disturbed during construction. There are no sites or structures in the project area currently listed in the National Register of Historic Places or the National Registry of Natural Landmarks.

I. Landownership [32, 76]

The required right-of-way for the Havasu feature falls on Federal lands, except for a small section of the 230-kv transmission line. These public domain lands are under Reclamation withdrawal.

J. Environmental Quality in the Feature Area

1. Air [67]

The increase in air pollution problems along the lower Colorado River is a result of recreational and farming practices. Typical problems result from fuel-burning recreation vehicles, including boats and transportation systems, and from agricultural burning.

Uncontrolled agricultural burning is not a major problem in the Havasu area. Air pollution controls and improved agricultural practices have actually improved conditions over those of a few years back. Under State of Arizona air pollution laws, primary jurisdiction over pollution matters is vested in the Arizona State Air Pollution Control Division of the Department of Health. An installation and operating permit is required for equipment which may cause pollution or which is installed to control pollution.

Natural weather activities often introduce large quantities of solid particulates (dust and sand) into the air during short periods of time. Atmospheric pressure gradients also cause air from the southern California metropolitan area to mix with the relatively clear desert air.

2. Water

Existing conditions affecting water quality and public health along the Colorado River and in the feature area are as follows:

a. Presence of potentially water-borne disease.

b. Open surface-water irrigation systems.

c. Bacteriological quality of water supplies at some recreation areas' not meeting USPHS standards.

d. Chemical, bacteriological, and other pollution resulting from irrigation return flows and municipal and industrial wastes.

e. Contamination of the river and Lake Havasu by runoff from natural mineral deposits, unsewered recreation developments, and other solid wastes.

f. Presence of mosquitos, ticks, fleas, and other vectors that may increase health hazards.

3. Noise

Sound levels vary within the Lake Havasu area. In open desert and riparian areas, natural sound is generated by animals, winds, thunder, and rain. The most common noises resulting from man's activities in these areas would be occasional airplanes traversing the area and/or off-road vehicles (such as a jeep or motorcycle). Noise levels are generally at acceptable levels. The population density is low and sound produced is generally from natural sources.

K. Colorado River [3, 61, 113, 132]

A detailed description of Colorado River flows and salinity was presented on pp. 72 to 75 of the final overall environmental statement for the CAP. However, due to the importance of this matter and its relationship to the Havasu feature, a similar description is presented below.

The Colorado River Basin is divided into the Upper and Lower Basins by the Colorado River Compact. The legally designated dividing point between the two is Lee Ferry, located in the mainstream of the Colorado River, 1 mile below the mouth of the Paria River. This is about 17 miles downstream

from Glen Canyon Dam. From Lee Ferry, the Colorado River flows through the Grand Canyon into Lake Mead which is formed by Hoover Dam, 370 miles downstream from Glen Canyon Dam. Lake Mead (active storage capacity 26,159,000 acre-feet) provides most of the storage and regulation of the lower Colorado River. Proceeding downstream, Davis Dam and Lake Mohave, Parker Dam and Lake Havasu, Headgate Rock Dam, Palo Verde Diversion Dam, Senator Wash Dam and Reservoir, and Imperial Dam and Reservoir provide for reregulation of streamflows, and storage and diversion of the river's waters for various uses. Imperial Dam, located 28 miles above the Northerly International Boundary, is the last major diversion point on the Colorado River for users in the United States.

1. Flow 2, 4, 6, 7, 9, 75, 105

The Colorado River is subject to a number of legal documents generally referred to as the "Law of the River," and these documents concern the interests of the United States, seven western states, and Mexico. These documents are referred to here and referenced in this statement with regard to water rights pertaining to the Colorado River, and especially the Lower Basin.

Historically, the Colorado River runoff or undepleted flow at Lee Ferry has varied from 5 to 24 million acre-feet annually. Many authorities investigating the runoff of the Colorado River have estimated the average annual long-term runoff as between 13 and 15 million acre-feet. At the present time the Upper Basin is using less than half of its apportionment provided by the Colorado River Compact. In the Lower Basin, annual releases from Hoover Dam to meet the current water requirements of Mexico, Arizona, and California are about 7.9 maf. Most of the small present requirements of Nevada are met directly from Lake Mead. The Mexican Water Treaty of 1944 allocates to Mexico 1.5 maf of Colorado River system waters annually, to be increased in years of surplus to 1.7 maf and reduced proportionately during extraordinary drought. The U.S. Supreme Court Decree in Arizona v. California (1964) established Indian water rights for the irrigation of 136,636 acres below Hoover Dam in Arizona, California, and Nevada. These priority rights are for a total annual diversion of 905,496 acre-feet from the Colorado River, or the quantity of mainstream water necessary to supply the consumptive use requirements of the irrigated land. Among other things, the decree reaffirmed the Boulder Canyon Project Act apportionment of water provided by Article III(a) of the Colorado River Compact, so that if sufficient water is available for release to satisfy 7,500,000 acre-feet of annual consumptive use in the three Lower Basin States, the apportionment is as follows:

State	Consumptive Use (acre-feet)
California	4,400,000
Arizona	2,800,000
Nevada	300,000
Total	7,500,000

The long-term diversion is expected to be about 1.2 maf, 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. It is estimated that annual diversions to CAP will vary between a minimum of 0.38 maf during extreme drought and a design maximum of 2.2 maf during periods of surplus water availability. The amount of diversion in any one year will depend on water supply conditions and the extent of Upper Basin development, neither of which is expected to restrict CAP diversions during the early years of the CAP.

All water requirements below Hoover Dam are satisfied from releases from Lake Mead and tributary inflow downstream. In the past 10 years, no water has been released from Hoover Dam in excess of scheduled downstream consumptive use requirements. Diversions to the CAP, plus changes in other uses along the mainstream, will result in a net increase in release requirements from Lake Mead. The major part of future increases in use along the mainstream in Arizona will be from planned development on Indian reservations and wildlife refuges.

The amount of water released into the Lower Basin from the Upper Basin will decrease as additional development is realized in the Upper Basin. As a result of these increased demands on the river, the average availability of Colorado River water for diversion by the Havasu feature will decrease from a projected level of 1.64 million acre-feet in 1980 to 0.90 million acre-feet in 2030.

The normal CAP diversions will come from a reduction of over 650,000 acre-feet per year in diversions from Lake Havasu to California which presently exceeds its entitlement, and from additional releases from Lake Mead.

Flows into Lake Havasu behind Parker Dam will be less than releases from Lake Mead by the amount of river losses occurring in this reach. The additional water releases for CAP will be diverted from Lake Havasu. They will not affect the magnitude of releases below Parker Dam. 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.

2. Salinity [60, 64, 65, 75, 93]

High levels of dissolved mineral salts in surface and ground waters are a major water quality problem in the entire Lower Colorado River Basin. With few exceptions, most surface- and ground-water supplies have mineral salt concentrations exceeding 500 ppm, and many exceed 1,000 ppm. This salinity limits some municipal, industrial, and agricultural uses.

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The Colorado River enters the Lower Basin at Lee Ferry already containing an average of some 600 ppm of dissolved mineral salts. Nearly 8.7 million tons of these dissolved solids are transported into the Lower Basin from the Upper Basin annually. From Lee Ferry the river varies in salinity on its course to the Gulf of California, reaching about 734 ppm below Hoover Dam, 726 ppm at Parker Dam, and 845 ppm at Imperial Dam above Yuma. The increased salinity is due principally to inputs from saline springs and the concentrating effects of consumptive use, return flows, and reservoir evaporation.

At least seven salt springs contribute some 685,000 tons of salt annually to the lower Colorado River directly, or to its perennial tributaries - the Virgin and Little Colorado Rivers. Blue Spring alone discharges some 547,000 tons annually at a point on the Little Colorado River only 13 miles from its confluence with the Colorado River. The Little Colorado River contributes salts of the sodium chloride type to the Colorado River while the Virgin River contributes sulfates as well as sodium and other chlorides. Salts of the calcium-sodium-sulfate type predominate in the Colorado River from Lee Ferry to Imperial Dam. Little change in the proportions of chemical constituents is noted in this reach of the river and irrigation return flows do not have a material impact on that composition. However, below Imperial Dam irrigation return flows cause a shift to predominately sodium chloride type salts in the river on the remainder of its course to the International Boundary.

Collectively, these salinity problems adversely affect the quality of the water reaching Morelos Dam for diversion for irrigation in the Mexicali Valley in Mexico. This is a serious problem, recognized as one of National concern by Congress in P.L. 90-537, and acknowledged as recently as August 1972 of this year when President Nixon designated Herbert Brownell, Jr. to head an interagency task force to study the problem. The salinity of the entire 710 miles of the lower Colorado River from Lee Ferry to the International Boundary is likewise an increasingly serious problem. Without a comprehensive salinity control program, salinity is projected to increase from 30 to 40 percent from the present modified level of 851 ppm TDS at Imperial Dam to a range of from 1120 to 1200 ppm TDS with the anticipated effects of future developments. (Percentages revised from Central Arizona Project Final Environmental Statement to reflect information in "Quality of Water, Colorado River Basin, Progress Report No. 6 (Draft dated January 1973).") This increase will be primarily due to consumptive use from such developments and water uses as municipal and industrial diversions, irrigation, and thermal power production. Evaporation from new reservoirs and return flows from newly irrigated land will contribute to increased salinity. There will be no return flows to the Colorado River from water diverted to the CAP.

The Department of the Interior has underway an investigative program to study the Colorado River water quality problem. The responsibility for investigation and possible implementation presently rests with the Bureau of Reclamation, with other Interior agencies such as the Office of Saline Water, the Office of Water Resources Research, the Geological

Survey, the Bureau of Land Management, the Bureau of Sport Fisheries and Wildlife, the Bureau of Outdoor Recreation, and the Bureau of Mines assuming cooperative roles. The objective of the program is to investigate areas where specific actions may be applied to control salinity increases in the lower mainstream of the Colorado River. The factors to be considered include: (1) consequences of various salinity levels, (2) evaluation of salinity sources, (3) kinds of salinity control actions needed, (4) economic viability of proposed control actions, (5) public acceptance and commitment to the proposals including appropriate cost-sharing arrangements, (6) potential impacts of evolving technology, and (7) relationships within a basinwide management plan.

L. Projected Future Environment of the Feature Area Without the Feature as a Part of Central Arizona Project [122, 123]

The projected future environment of the Havasu feature area without the project would be very similar to present conditions. The development of Lake Havasu City, the construction of Arizona State Highway 95, and the farming, mineral and mining activities that utilize the Planet Ranch road have all modified the natural environment. The development of the private mobile-home complex to the east of the pumping plant site has substantially modified the appearance of the shoreline landscape. Future developments will be limited by the land available for private development. Application has been made by the Bureau of Sport Fisheries and Wildlife to expand the Bill Williams arm segment of the Havasu National Wildlife Refuge by 5,800 acres. With or without the project, this expansion would be on desertlands north of the Bill Williams arm, south into the Buckskin Mountains, and eastward along the river. In the absence of the project, the impacts discussed in Chapters III and IV of this statement would not occur.

If current trends continue unaltered, there would be a general deterioration of the water supply and quality in the lower Colorado River due to increased development and return flows by users upstream from the Havasu Pumping Plant.

A gradual change in land use would continue due to recreational pressures. Land use studies of the Bill Williams River area and the new Parker townsite east of the Colorado River Indian Reservation are presently being made by the Bureau of Land Management, Arizona State Land Department, and potential land developers. This would involve state "in lieu" selections resulting from the New Mexico and Arizona Enabling Act. The new Parker townsite would involve lands initially requested as concrete aggregate borrow areas for the Havasu feature.

Existing recreational resources (especially water-oriented) would not be appreciably altered in the absence of the Havasu feature. Recreational facilities in central Arizona dependent upon the CAP as a whole would not be available to help meet the increasing recreation demand.

Archeological resources which might have been affected by the feature, through detailed studies, have been shown to be nonexistent. Therefore, there could be no damage in the absence of the Havasu feature due to the usual weathering and pilferage.

The general physical environment would change little. Geology, topography, and climate would be little affected by changes resulting from the construction of the Havasu feature, as a part of the CAP, or the changes which would occur without it.

Without the feature some fish species which may be adversely affected by the pumping plant operation would not be disturbed. It is also likely that recreational pressure on the existing fishery would increase, further stressing present fish populations, especially of native fishes.

The lack of the Havasu feature should not have any adverse effects on rare or endangered fish and wildlife nor cause any species to become rare or endangered within the area. Habitat areas would not be affected unless an adverse developmental program is instituted in the area.

In the absence of the Havasu Pumping Plant the CAP, which is economically attractive to water users who propose to use CAP water for M&I and agricultural purposes, would not be built. Some of the Indian tribes of central Arizona are numbered among these potential users. Denial of CAP water would slow the economic progress and development of the Indian groups that would otherwise occur with CAP water.

In the central service area, ground-water quality would deteriorate due to the necessity of using poorer quality water to meet the rising demand. Overall, this decline would probably be small, but more pronounced in some areas than in others. Surface supplies would remain approximately the same in quality. In the area of the Havasu feature, there would be no discernible effect on ground water or surface water.

In the absence of the Havasu feature the CAP aqueduct system from the Colorado River authorized to meet specific needs, would not be built. This would not preclude construction of some of the reservoirs. Without the reservoirs, no land would be inundated, and no temporary or permanent disturbance resulting from the CAP to fish, wildlife, or vegetation would occur. However, water shortages, subsidence, and other existing problems in the central service area would continue.

Some of the changes, such as economic development, would be moderately affected by failure to divert water for the CAP. The agricultural segment and agricultural supporting and processing segments of the economy would be adversely affected as agricultural production decreased due to a reduced water supply. Other factors of the overall environment would also feel the effects. For the most part, the degree to which all the environmental and social aspects would be felt in the absence of diversion of Colorado River water would depend on the individual and governmental responses which would be made by the people of central Arizona and western New Mexico.

CHAPTER III

ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

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This chapter discusses the impacts which will be associated with the Havasu complex. Measures which will minimize adverse effects, mitigate losses, or enhance resource values are discussed later in Chapter IV. A complete understanding of the impacts of the project is possible only after reading both chapters and involves a comprehensive knowledge of the many facets of ecological and environmental components.

Construction of the Havasu feature will require about 200 acres of right-of-way. Except for some private land along the transmission line route, the lands involved consist of either Reclamation withdrawn land or land under application for withdrawal.

Over the approximate 9-year construction period, no significant impact on life forms such as plants, wildlife, fish and other aquatic life, or on existing recreation and residential developments will occur. Construction of this feature will involve sequential construction contracts, the first of which will be for the Havasu Pumping Plant site preparation and construction of the embankment for the Havasu Intake Channel. Award of this contract will be followed in about 1-3 months by an award of contract for the construction of the Buckskin Mountains Tunnel. The site preparation contract is expected to require approximately 15 months for completion, and a contract for major structural excavation and construction of the pumping plant will be awarded shortly after completion of the site preparation. The pumping plant contract, which in its initial phase will involve major structural excavation for the pumping plant and later major excavation for the discharge lines, will also include concrete construction and interior work on the pumping plant. The final years of construction at the site will involve completion work, e.g., installation of pumps, motors, control equipment inside the pumping plant, and construction of the transmission line from the Parker Powerplant Switchyard. The most significant environmental concern will be the effect of construction upon the biological values of that portion of the lake that is within the Bill Williams segment of the Havasu National Wildlife Refuge. Subsequent to construction, the only visible portions of the Havasu feature will be the intake channel embankment, parking area, transmission line, and the above-ground visitors and service building at the otherwise entirely underground Havasu Pumping Plant. The visibility of the pumping plant will be restricted by Arizona State Highway 95 which crosses the intake channel at about elevation 495, and by the adjacent ridges that limit the sector of visibility from the highway and from the lake surface. The highway grade is higher than the pumping plant structure.

A. Definitions for Impact Evaluation

The evaluation of environmental impacts is dependent on definitions and criteria or standards. Impacts may be beneficial, adverse, or

problematical. The definitions outlined in the overall CAP statement and also used in this statement are:

1. Beneficial environmental impacts are those that directly or indirectly improve the environment.

2. Adverse environmental impacts are those that directly or indirectly degrade the environment.

3. Problematical environmental impacts are those whose effects are unknown, have not been tested, or may be the result of some other action but attributed to this action.

The environment includes the interaction of climate, soil, and biotic factors that act upon any living organism. Environment also includes the aggregate of social and cultural conditions that influence the life of an individual or community.

B. General Statement of Impact [70]

The Havasu Pumping Plant, Intake Channel, and Buckskin Mountains Tunnel will have varied impacts upon a number of different aspects of the environment. Some of these impacts will be beneficial and others adverse. Still other impacts are as yet unquantified. Certain impacts will be beneficial in some respects and adverse in others. For purposes of this section on the overview of the impacts of the Havasu feature, the impacts have been divided into two categories: (1) impacts on natural resources; and (2) impacts on people. The impacts on natural resources will have secondary impacts on the human environment as well. Impacts more directly affecting people will in most instances indirectly affect the natural resources in the project area.

1. Natural Resource Impacts

The first noticeable impact will be from construction activities at the feature site. These activities will disrupt and have some adverse impact on the natural environment locally, which will be the greatest during the initial phase of construction. Mitigating factors discussed hereafter and in Chapter IV will confine the impact from these activities principally to the immediate area around the various facilities.

Land-related impacts will include the 200 acres of right-of-way required for the project. Vegetation will be disturbed and removed during construction of the feature. Vegetational disturbance and removal will be small compared to the overall area. Vegetative clearing will be primarily centered at borrow areas, the pumping plant site, and transmission line footings.

Steps outlined in Chapter IV will be taken to minimize drownings at the tunnel outlet portal. Increased recreational use associated with the embankment of the intake channel has problematical impact on wildlife resources.

There will be some impacts on the natural resources of the feature area which are not quantifiable at the present time. These are enumerated later in this chapter as unquantified amenities. No significant mineral resources will be lost due to construction of the feature. Mineral resources along the tunnel alinement have not been in evidence during the geologic exploration drilling program. The Bureau of Mines suggested that exploration might indicate mineralization.

The project's impact on air and noise quality in general is expected to be small. Noise levels during construction will temporarily disrupt some wildlife movement patterns.

Normal operation of the Havasu Pumping Plant, as a part of the CAP, will require increased water releases from Lake Mead. These releases will have a beneficial effect on the flow and salinity of the river between Hoover Dam and Lake Havasu. Neither the flow nor the salinity level of the river below Parker Dam will be adversely affected by diversions of water for the CAP. The quality of the water diverted to the central service area of Arizona will be better than much of the present ground water being pumped, but generally of lesser quality than the surface waters now being controlled and used in the central service area. Thus, mixing of these waters will have both beneficial and adverse impacts on water quality in various parts of the central service area. Salinity-control programs presently under study on the Colorado River if found feasible and implemented could improve the quality of Colorado River water whether diverted from Lake Havasu for the CAP or released for downstream uses.

2. Human Impacts [122, 123]

Construction of the Havasu feature, as a part of the CAP, will have generally beneficial human impacts. There will be considerable direct and indirect employment related to construction activities. Adverse impacts due to noise and dust will be small, since construction of this feature will occur away from population centers, and the construction specifications include controls for them.

Land-related impacts on the human environment directly attributable to this feature are problematical, as are those related to population growth and location. Demographic projections for the adjacent area indicate an increase in population and concomitant land use. These projections are not exclusively dependent upon construction of the project. Indications are that the population growth along the Colorado River is primarily from southern California recreation pressures. Diversion of Arizona's remaining entitlement in Colorado River water will aid in stabilizing the agricultural industry in the central service area of Arizona and will prolong such land use and the agricultural industry segments of the economy. This stabilizing influence will not materially affect the conversion of agricultural lands for housing and other related uses as population expands in the central service area.

The major human impacts of the feature will be related to employment levels in construction and operation, length of residence, and family-related activities upon the business and local governmental service sectors of the feature area. This will occur within the commuting area for the employees.

The project will increase the supply of water available for M&I and agriculture uses, and help minimize the cost of water. Less ground-water pumping will be needed in central Arizona and the project will facilitate a generally stabilizing effect on the agricultural segment of the Arizona economy. Stabilizing of irrigated agriculture will have a peripheral wildlife benefit in that a number of bird species are benefited by the proximity of grain crops to their habitat areas.

There will be no unmitigated impact on the archeological resources of the feature area. An intensive program to survey and assess these resources has been completed for the feature.

There will be adverse impacts where construction involves localized areas now relatively untouched by man's activities and some esthetic impacts even in those areas already heavily used or impacted by such activities. The facilities formed by the feature will have beneficial esthetic impacts for some and adverse impacts for others, depending on individual orientation.

The feature, as a part of CAP, will divert water for irrigation and other purposes on Indian lands. In the central service area of Arizona, Indian irrigated agriculture, as well as non-Indian, has been hampered by water shortages.

The above overviews regarding the impacts of the feature are discussed in greater detail in the following sections of this chapter.

C. Direct Impact of the Proposed Action

The first part of this section presents overall impacts associated primarily with construction activities. Such impacts are generally temporary in nature. This is followed by a more detailed description of the more permanent type impacts of operation and maintenance of the feature.

1. Impacts Related Primarily to Construction Activities

General and specific sections of construction specifications and Bureau of Reclamation policy state the care to be exercised in the preservation or protection of natural landscape during construction activities.

a. Borrow Areas

The use of areas for borrow will be restricted and controlled. Materials excavated from the pumping plant site will be used to construct the landform embankment of the intake channel. Additional material excavated from the tunnel inlet portal may also be used in the embankment. Borrow areas will be needed principally for concrete aggregate during tunnel and pumping plant construction. The location of the aggregate borrow area is shown on Figure 15. Only 10-20 acres of the total area shown (approximately 1,849 acres) will be needed for construction. Some of the area shown along the Osborne Wash is under consideration for a new Parker townsite to be located outside the Colorado River Indian Reservation. In the event the townsite is established, the borrow areas could be utilized in development of golf courses and other appropriate recreational areas.

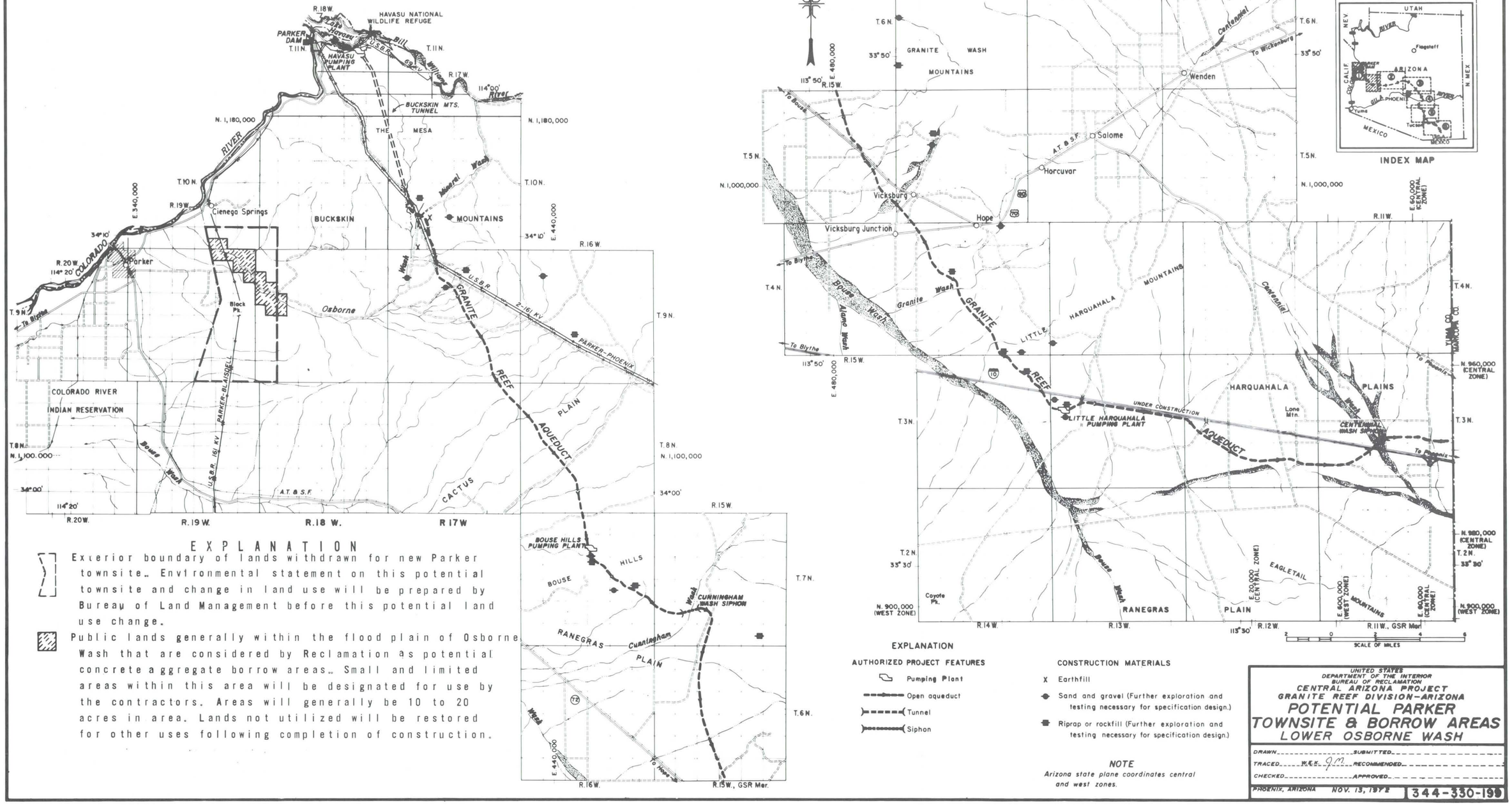
Excavation of an estimated 180,000 cubic yards of material will result in removal of existing vegetation on the 10-20 acres involved, and temporarily displace associated wildlife. The extent of the impact on esthetic values, natural vegetation, and wildlife habitat will be considered in choosing the final location, size, and configuration of the borrow pits. Normally, no seeding or replanting of the borrow areas will be required under the general construction specifications. In areas where removal of topsoil will be required to provide access to the desired material, the topsoil will be replaced. The replaced topsoil should contain adequate seed for revegetation.

Restoration of borrow areas will be accomplished by reshaping the pits to blend them with surrounding terrain. The areas will be left with gradual slopes and drainage features to prevent erosion and undesirable ponding of water. The area will be scarified or ripped on the contour to create a rough surface capable of entrapping moisture, thereby enhancing natural and supplemental revegetation. The moisture entrapment may provide temporary water for wildlife and vegetation. Stagnation of the water and possible mosquito breeding may also occur at times.

Precipitation will generally control the recovery time necessary for vegetation and earth materials to reach a level of esthetic acceptance for each segment of the Havasu feature. Limited restoration of native vegetation will be attempted when it is feasible.

b. Construction Access Roads and Camps

Construction access roads will be necessary to facilitate the work and allow safe travel of construction personnel. (See Figure 6.) Existing roads or trails in the area will be used to the maximum extent possible for access to the construction area. An access road from Arizona State Highway 95, adjacent to the pumping plant site up the hillside to the inlet portal, will be required.



EXPLANATION

Exterior boundary of lands withdrawn for new Parker townsite. Environmental statement on this potential townsite and change in land use will be prepared by Bureau of Land Management before this potential land use change.

Public lands generally within the flood plain of Osborne Wash that are considered by Reclamation as potential concrete aggregate borrow areas. Small and limited areas within this area will be designated for use by the contractors. Areas will generally be 10 to 20 acres in area. Lands not utilized will be restored for other uses following completion of construction.

EXPLANATION

AUTHORIZED PROJECT FEATURES

- Pumping Plant
- Open aqueduct
- (Tunnel
- (Siphon

CONSTRUCTION MATERIALS

- X Earthfill
- Sand and gravel (Further exploration and testing necessary for specification design.)
- Riprap or rockfill (Further exploration and testing necessary for specification design.)

NOTE

Arizona state plane coordinates central and west zones.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION-ARIZONA

POTENTIAL PARKER TOWNSITE & BORROW AREAS LOWER OSBORNE WASH

DRAWN _____ SUBMITTED _____
TRACED W.E.K. RECOMMENDED _____
CHECKED _____ APPROVED _____
PHOENIX, ARIZONA NOV. 13, 1972 344-330-199

Figure 15

The existing Osborne Wash, Mineral Wash, and Planet Ranch Roads will be used for access to the tunnel outlet. Indiscriminate creation of new trails will be controlled on Federal lands under provisions of Executive Order No. 11644 and regulations to be promulgated and published in the Federal Register. The value of these regulations is dependent upon the response and support given by the citizenry to their development and enforcement. The Arizona Game and Fish Department has recently informally requested that Reclamation exercise its authority in closing off points of vehicular access to The Mesa portion of the Buckskin Mountains from the Parker-Davis Project transmission system maintenance roads or other access roads. This would need to be a cooperative undertaking with the Bureau of Land Management in promulgating regulations for control of off-road vehicles on public lands and the Arizona Game and Fish Department in establishing a roadless area under Arizona laws.

A minor amount of road improvement on Yuma County roads will be required for access to the construction areas. Existing roads will generally have to be improved to handle the necessary increase in construction traffic. Existing roads in good condition and capable of handling the anticipated increase in traffic will have to be maintained in their present or improved condition.

Construction roads and on-site equipment storage areas necessary for orderly construction will be located within the right-of-way whenever possible. Construction access roads will be closed to the general public. The closed roads should limit the contractor's liability, promote public safety, and prevent unnecessary disturbance of surrounding unspoiled desert areas. Upon completion of construction, all used or useless equipment, supplies, buildings, and personal property will be dismantled and/or removed from the construction area and disposed of in an acceptable manner and in conformance with current policy. Temporarily disturbed areas will be restored or returned as nearly as practicable to the original condition or to compliment the natural surroundings.

With the exception of a 5-acre construction staging site in the vicinity of the outlet portal and perhaps some small temporary trailer camps, there will be no new camps for construction personnel. Temporary water and sewage facilities meeting the requirements of Federal and Arizona State health laws will be established. Temporary trailer camps will be provided with portable chemical facilities when other appropriate methods of sewage disposal are not available. Residential and related developments at Parker and Lake Havasu City, and on private land along Arizona State Highway 95 between those two towns and in the general area of construction will provide temporary housing, material storage, and construction field office sites. The sanitation facilities in these towns and along the Parker strip may have to be supplemented to meet the increase in temporary population. These problems will be met by the local communities in compliance with applicable regulations of the Arizona State or County Health

Departments and the Environmental Protection Agency. One area of concern may be the occasional construction worker who would utilize a camp trailer or pickup-type camper for a short duration of time within the construction vicinity. Control of this aspect will be difficult and is the primary responsibility of the landowner. Contractor's employees may be discouraged from this practice by contractual relationships, and the establishment of adequate facilities within the right-of-way boundaries or nearby communities or on private lands.

Environmental impact of these construction facilities will be temporary in nature. The removal of buildings and facilities will eventually return the area to the basic original condition. The temporary disturbance of wildlife and esthetic values will be eliminated soon after construction is completed, although revegetation may require several years.

c. Waste Material Disposal

For the most part, materials excavated for the pumping plant, discharge lines, and tunnel inlet will be used in the intake channel embankment. Disposal areas required for material excavated from the outlet portal of the tunnel will be evaluated along with aggregate borrow areas to lessen any negative impacts on the environment. The tentative location of the disposal area is shown on Figure 6. The disposal of excavated waste material will cause a loss of about 57 acres of existing vegetation and esthetic values in and around the deposit area. Wildlife in the immediate vicinity will be disrupted by the activity. Waste material will be placed in low profile areas and shaped to conform to natural lines and existing terrain.

Some topsoil containing vegetation, seeds, and material will be moved during construction. To the extent possible, the material will be redeposited in selected areas in such a manner that the upper layer will support native vegetation. Planting of native vegetation will be accomplished whenever feasible.

d. Dust

Inherent with thunderstorms, windstorms, construction, travel, and other activity in this desert region is the ever-present dust problem. General construction specifications will require that the contractor provide efficient measures to reduce the dust nuisance which originates from his operation. Watering devices and other acceptable methods of abatement will be used. For access roads in use over a lengthy construction period, asphaltic road surfacing may be adopted in lieu of sprinkling.

Temporary discomfort to people and wildlife may occur in rare instances. However, this discomfort will not exceed that experienced during periods of high winds or duststorms in the area.

e. Storage of Materials

Delivery schedules for necessary materials, lead time, and remoteness of the construction area dictate the need for temporary storage of materials. Storage areas in close proximity to the construction area are desirable for economic handling and onsite distribution or utilization of the materials. Security and vandalism protection are needed for these areas. The storage areas will generally be located either on or adjacent to the right-of-way. The areas will generally be incorporated with temporary construction camps. A storage area in Parker near the railhead will also be required.

Disturbance of vegetation and wildlife is anticipated during the use of storage areas. Material storage areas will be fenced, and will have wood or metal buildings and open storage space. These areas will serve only as temporary receiving and distribution centers to assure a smooth flow of materials for the construction program. Upon completion of construction in the area, the facilities will be removed and the area restored as nearly as possible to its original condition.

f. Equipment Storage and Service Areas

Construction equipment will require a certain amount of periodic maintenance and repair. Due to the contractor's investment in equipment, it is imperative that down-time on each unit is minimized. The contractor will generally establish equipment service areas near the right-of-way or service the equipment within the right-of-way. Service areas will generally disrupt the environment because of the continual activity, noise, and problems associated with repair and maintenance of heavy-duty equipment. Vegetation in these relatively small areas will be destroyed and any wildlife present will be displaced. Temporary buildings will generally be used for service facilities. The duration of the facilities at the Havasu complex will probably be about 8 to 9 years.

Oil, diesel fuel, grease, and solvents may be spilled on the ground during maintenance activities. Such waste products will be controlled as much as possible to avoid water pollution in case of flash flood or runoff. Other waste products will generally be collected and disposed of in an acceptable manner and in accordance with current policy. Equipment service areas will require extra effort to return them to conditions that will support vegetation and will be compatible with the original conditions.

g. Lighting

Adequate equipment and supplemental lighting will be required to support nighttime construction activities in a safe manner. The

length of the workday, economic utilization of equipment, and the number of shifts necessary to meet the required contract deadlines are prerogatives of the contractor. In addition, extreme desert heat may force the contractor to adjust working hours to provide for tolerable working conditions. Adequate lighting will also be required in areas of materials storage, equipment service, office, and any camps to provide necessary security. Due to the remote nature of most of the construction sites, lighting should not affect populated areas, but wildlife will be disturbed.

h. Noise [135]

Large earthmoving equipment produces a high level of noise. The noise associated with heavy equipment operation is highly objectionable in confined areas or near developed areas. The greatest relative increase in noise level will occur during the nighttime. Use of equipment on a round-the-clock basis is not uncommon in the construction industry. But due to the remoteness of the construction area, no great disturbance of the populace is expected.

Blasting will be required in some instances. Blasting will be permitted only after adequate provisions have been made to protect persons, the work, and the public or private property. Precautions will also be taken to prevent scattering of rocks or debris outside the work area. A special effort will be made to avoid unnecessary disturbance to residences of the mobile home park, and to Heron Island discussed later.

Wildlife will be displaced by the noise, but will return to the area after noise levels diminish.

i. Increase in Traffic [128]

Vehicular and pedestrian accidents may be greater than normal during the construction period due to the increased traffic. Desert heat, off-highway travel, and substandard roads when used for traveling to and from the construction area during all hours of the day present hazardous conditions. Safety provisions will be included in construction specifications to minimize safety hazards caused by heavy construction equipment traffic. In heavy use areas such as Highway 95 at the pumping plant site, the contractor will be required to provide competent flagmen or guards to control public traffic and other equipment with a minimum of inconvenience and delay to the public.

Only those personnel associated with construction will be allowed on the closed access roads, thereby eliminating a major safety concern. Construction personnel traveling through the local area will be controlled by the state and local traffic regulations.

Wildlife in the Bill Williams portion of the Havasu National Wildlife Refuge will be disturbed by increased traffic. Completion of

construction will permit wildlife to return to the areas with minimal detrimental effects. Traffic on the Planet Ranch and Mineral Wash Roads may cause some disturbance to bighorn sheep, burros, and other wildlife in localized areas adjacent to the roads. The Osborne Wash Road from Parker will be the primary access route to the tunnel outlet portal. Arizona State Highway 95 will experience an increased traffic load between Parker and Lake Havasu City and the pumping plant site.

j. Erosion of Disturbed Areas

Wind action and periodic rainfall may cause erosion of the disturbed areas. Erosion control will be required at the cut slopes for the pumping plant, discharge lines, tunnel portals, and in some disposal areas. Where possible, the topsoil will be removed, stockpiled, and replaced to provide a good soil base for restoration of the desert vegetation. On the long steep slopes of the discharge lines, the backfill will be treated to minimize erosion until new growth is reestablished. Where steep cut slopes require blasting or where rock protection is required for stability, the latest techniques will be used to minimize esthetic impairment.

k. Water Supply for Construction

Obtaining water for construction will be the contractors' responsibility. The contractors will be allowed to pump water from Lake Havasu as one source of supply. In the tunnel outlet portal area, the contractor may elect to drill wells, or install a temporary surface pipeline from Lake Havasu. In either case, the natural terrain will remain in its undisturbed state, or be restored as nearly as possible. Procedures for obtaining and disposing of water used for construction will be in accordance with standard Reclamation construction guidelines.

l. Disturbance of Vegetation

As previously mentioned, disturbance of vegetation during construction will be reduced to a minimum. Restoration of disturbed vegetation will be accomplished by such revegetation techniques as transplanting, seeding where appropriate, and/or special preparation of the disturbed areas to accelerate maximum natural regrowth. The technique best suited to each individual soil area and plant species will be employed following careful evaluation. Native vegetation will be salvaged where practicable, especially vegetation protected by law. Vegetative habitat is not sufficiently extensive to be a major influencing factor on wildlife disturbance.

Vegetation at the site of the feature is extremely sparse, particularly at the pumping plant site which will be one of the principal areas of disturbance. Accordingly, construction of the Havasu feature will not have a significant impact on vegetation. Of the 200 acres

required for right-of-way, only about 40 acres will be required for the permanent structures including the pumping plant discharge lines, tunnel portals, transmission line footings, dike, new access roads, and improvement of existing roads. The remaining area used for construction purposes will generally be left in a condition that will facilitate revegetation, and in the long term may be expected to support successional stage regrowth. It is expected that saltcedar growth will eventually be established along the landform embankment forming the intake channel dike. There is no marsh growth in the area of the intake channel. The sparse vegetation along the tunnel route on the top of The Mesa is supported exclusively by precipitation and will not be disturbed. No significant vegetational communities will be destroyed.

m. Temporary Disturbance of the Bill Williams Portion of the Havasu National Wildlife Refuge

The intake channel, which will be located within the Havasu National Wildlife Refuge (HNWR), will occupy approximately 60 acres of the open water area of the Bill Williams portion of the refuge. In addition, about 10 acres will be needed for the intake channel embankment. The 70 acres involved will not disturb any riparian or marsh areas. The tunnel and the major part of the pumping plant will be located outside the boundaries of the HNWR. The tunnel will follow a course southeast from the south shore of the Bill Williams arm of Lake Havasu and will not cross or pass near the Bill Williams River delta which is a significant marsh area within this portion of the refuge. Therefore, none of the delta area of the Bill Williams River or its attendant upstream vegetation will be affected. The tunnel and most of the Havasu Pumping Plant will be underground.

Once construction is completed, there will be little evidence of disturbance in HNWR area except for the intake channel. Operation and maintenance of the Havasu feature will cause no disturbance to big game mammal or waterfowl migration patterns through the Buckskin Mountains and into the refuge.

n. Fish and Wildlife 17, 18, 21, 28, 29, 35, 53, 85, 94, 95, 100, 116, 117, 118, 121, 127, 128

Based on behavior patterns of most wildlife in the area, it has been determined that the species which move out of an area during construction will probably return after construction. Some wildlife loss associated with construction activity will be permanent. Upon completion and subsequent operation of the project, an additional source of water may be available for the wildlife at the Buckskin Mountains Tunnel inlet and outlet portals.

The most significant areas in the Bill Williams portion of the HNWR consist of the marsh habitat on the Bill Williams River delta, the riparian habitat along the Bill Williams River, and the riparian vegetation along the shoreline of Lake Havasu. The Havasu feature

will be located about 0.8-mile from any significant marsh areas of the delta and construction activities should have little, if any, effect on the better wildlife habitat of the refuge. Subsequent to construction, the feature itself will have insignificant effect on wildlife, except for possible disturbance from increased use of the Planet Ranch Road. Except for a temporary disturbance of about 1 year, during construction of the 3,000-foot-long discharge lines between the pumping plant and the inlet portal of the tunnel, migration routes for part of the approximately 50 desert bighorn sheep presently ranging in the Buckskin Mountains area will be relatively undisturbed by the feature. (See Figure 12.) Additional traffic on the Planet Ranch Road, as well as construction personnel traveling to the tunnel outlet portal from Lake Havasu City, would cause disturbance to the burro use area and would cross the migration route from the Buckskin Mountains to Planet Peak. Test drilling along the tunnel alinement indicated that the rock formations are not saturated and there will be no dewatering of rock formations during construction. Most springs identified on topographic maps and in Figure 12 in these mountains are intermittent and dependent upon the occurrence and intensity of above-normal precipitation.

Disturbance of desert resident species such as the cactus wren, gilded flicker, and Gila woodpecker will be negligible. Construction activity with its attendant noise, dust, and increased human presence, could disturb the great blue heron colony on Heron Island. In the spring of the year, approximately 15 pair of great blue heron nest on Heron Island located about 4,500 feet northwest of the pumping plant site. Heron Island will not be physically touched during construction of the Havasu feature. The embankment forming the intake channel will not reach the island nor come within about 1/2-mile of it. Subsequent sediment deposition in Lake Havasu during operation of the feature will not form a land bridge to the island.

The most likely impact on the colony would result from blasting noise. Blasting will be controlled to the extent possible to coincide with periods of least activity of the heron colony. Minimum practical amounts of explosives for economical rock breakage will be used. Noise from blasting, which will probably occur no more than once a day during the blasting program, should be minimal and no more significant than sonic booms which are common in the area. In general, total construction activity involving heavy equipment and blasting will probably generate no greater noise and human disturbance than currently exists around the island from powerboat activity and recreational use of Lake Havasu. Presently, the most significant recreational uses of the Bill Williams arm of Lake Havasu are fishing, motor boating, and water skiing.

Since the Havasu feature avoids the primary habitat of the Bill Williams portion of the wildlife refuge, it will not affect

the stopover point for migratory waterfowl. None of the habitat of the Yuma clapper rail included on the United States List of Endangered Fish and Wildlife will be affected. The only such habitat in close proximity to the Havasu feature is above and below the bridge where Arizona State Highway 95 crosses the Bill Williams River, 0.8-mile or more from the site.

Potential adverse impacts on fish have been considered during project planning. Preliminary assessments indicated that very few fish in comparison to the overall fish population of Lake Havasu will move through the intake channel and be adversely affected by pumping operations. These fish would be types oriented to open water movement and feeding, such as threadfin shad and striped bass. It is expected that the intake channel embankment should provide a new brood area for the largemouth bass in the lake.

The need for a device to prevent fish movement into the pumps has been considered. The report of July 1, 1972, by the Arizona Game and Fish Department differs somewhat from preliminary assessments. This report states in part "We cannot now fully agree with previous opinions that only a few pelagic fish would be adversely affected by the pumping operations. It is likely that a fish screen device, either physical or electrical, will be necessary either now primarily for catfish or in the future years to protect an increasing population of striped bass. . . ." The report based this conclusion on several points. The Bill Williams arm differs from the rest of Lake Havasu in that the arm area experiences moderate to heavy turbidity and siltation due to seasonally variant flows from the Bill Williams River. This fact, coupled with recent investigations and fisherman interviews, led to the conclusions that the major immediate impact of intake channel construction would be on channel catfish. Additionally, once the area stabilized, it would become increasingly suitable for other fish as well, including striped and largemouth bass, green sunfish, and bluegill.

The report further recommends that a monitoring program be set up for the first year of operation to determine fish losses. If at that time protective devices appear unwarranted, the report recommends a 5-year followup of less extensive sampling to substantiate the findings. The report does not recommend the type of fish screening device but suggests that the information secured from the monitoring program would be available for design considerations.

The Bureau of Reclamation, with the assistance of the Arizona Game and Fish Department, California Department of Fish and Game, Bureau of Sport Fisheries and Wildlife, U. S. Coast Guard, and the University of Nevada at Las Vegas, has initiated a monitoring program to compare the habitat and fish species presently in the Bill Willaims arm with those in future years. A copy of the first year's Progress Report on Lake Havasu Aquatic Impact Study should be available about January 1, 1973.

Experience to date by California fishery management personnel concerning the intake pumping plant of the Metropolitan Water District of Southern California, which pumps directly from the main body of Lake Havasu 4 miles to the northwest, does not demonstrate that fish are being pumped to an extent adverse to the population.

o. Turbidity During Construction

The turbidity resulting from construction activities will have no significant effect on sedimentation in Lake Havasu. Fish and wildlife and recreation will be little affected by occasional intermittent or temporary turbidity.

For the most part, the area affected will be limited to the immediate vicinity of the landform embankment. During construction of the embankment, lake sediments will be displaced and these sediments, combined with fine particles from the material being dumped, will cause a temporary localized increase in turbidity. The initial portion of the landform embankment will be built during the first year of construction at the site. Placement of additional materials on the embankment during the subsequent 3 to 4 years of construction, such as constructing freeform expansions and rock protection for the embankment, will also occasionally increase turbidity. Existing turbidity within the Bill Williams arm is characterized as moderate to heavy due to storm runoff and floodflows that carry heavy sediment loads. That fact plus the water depth, quantity of materials deposited, and the time for displaced sediment to settle indicate that the affect of turbidity arising from construction will be small and only of a temporary nature. The ecology of the lake bottom underlying the proposed landform embankment will be severely disrupted. This disruption, which will occur over an area of about 10 to 12 acres, will have a negligible effect on the overall lakebed ecology of the Bill Williams arm.

Stipulations concerning techniques to be employed will be included in construction specifications with a view toward reducing turbidity to a minimum, especially during the initial phase of construction of the embankment structure.

p. Sociological [68, 69, 122]

The town of Parker, Arizona, in Yuma County, was established at its present location in 1905 near a railroad crossing of the Colorado River. The town is named in honor of General Eli Parker, Commissioner of Indian Affairs, and curiously, Earl H. Parker, the locating engineer for the railroad. The town had a 1970 population of 1,948. Lake Havasu City, established in 1963, is a planned community development of the McCulloch Corporation. Lake Havasu City has gained international recognition as a result of the recent relocation of the London Bridge within its confines. The Lake Havasu City area has a population of approximately 5,000.

The 9-year construction program for the Havasu feature can be expected to have a significant affect on the population and economic levels of these two communities. Subsequent to construction, there will be a reduction in population and economic activity. However, because of the ever-increasing use of the Havasu area for recreational and retirement living, it is expected that the post construction transition for Parker and Lake Havasu will be less than has been experienced in the past in other areas.

It is expected that the economic and population impacts of construction will have less effect on Lake Havasu City than Parker. This is due in part to the fact that Parker is the nearest railroad shipping point and will also be the location of the Bureau of Reclamation field office. Construction personnel will be expected to find housing and related community services mostly in Parker and Lake Havasu City. It is anticipated that the influx of construction personnel, together with the employment of local residents in construction, will result in an increased need for employment in support industries, educational institutions, and other community service facilities which will provide increased employment opportunities. Public Laws 81-815 and 81-874 established programs of financial assistance for school construction and maintenance and operation in areas affected by Federal activities (impacted areas program). The estimated population increase associated with construction and service industries for the Havasu complex, together with construction of the Granite Reef Aqueduct as far as Hope and the Bouse Hills Pumping Plant, is shown in the following tabulation:

Construction Year	Population From Basic Employment	Nonbasic Employment	Total Population
1	375	375	750
2	1,350	1,350	2,700
3	2,100	2,100	4,200
4	2,250	2,250	4,500
5	2,325	2,325	4,650
6	2,325	2,325	4,650
7	2,175	2,175	4,350
8	1,350	1,350	2,700
9	450	450	900

During the early part of the construction period, highway traffic will increase between the communities of Parker and Lake Havasu City, both as a result of use by construction workers and the moving of heavy equipment to the site. As construction work advances, there will be an increase in railroad movement into the Parker area transporting heavy construction equipment and equipment for installation in the pumping plant. This will result in increased movement of bulky equipment on the highway from Parker to the construction site. Where contractors are required to use roads for access to the work, they will

be required to maintain them and to provide dust abatement measures in accordance with standard Bureau of Reclamation procedures.

The increase in temporary and permanent population in Parker and Lake Havasu City will probably result in some increased hunting and fishing pressure and recreational use of the total recreation resource including the Bill Williams arm of Lake Havasu.

q. Archeological and Historical [26, 27, 40, 101, 102, 115]

The Havasu feature site was surveyed by the Arizona State Museum to determine the extent of any archeological resources in the area. The only resource disclosed by this survey was a lithic tool quarry of minor significance in the general area of the tunnel alinement which will not be disturbed by construction or subsequent operation and maintenance of the feature. To further insure that archeological values are preserved, on-the-ground checking will be performed in advance of construction, and monitoring will be accomplished during construction for any sites not visible on the surface in the feature area.

r. Topography

The topography will be altered at the pumping plant site by site preparation for the pumping plant. This will be a permanent impact. The trench excavation, pipe installation, and subsequent backfill over the discharge pipelines will result in minor topographic impact. The access road to the tunnel inlet portal will be a permanent impact upon the slope of the mountain, as will the tunnel inlet portal in the cliff face. The tunnel itself will not cause an impact except as it relates to the material excavated and placed in disposal areas. The intake channel embankment will form a manmade peninsula-like structure in the lake. The borrow area for concrete aggregate will cause a depressed section where the material is removed, but reshaping requirements will reduce the noticeable effects.

s. Mineralization

No significant mineral locations have been identified in the feature site. Assessment of core drilling along the tunnel alinement showed no significant mineralization. The drilling program consisted of a total length of about 5,800 feet of core drilling at 22 holes ranging in depth to about 500 feet and to at least 10 feet below the tunnel grade. There is the possibility that a few mineralized pockets may be encountered during excavation of the tunnel, although there is no indication that such pockets would be of commercial value.

t. Economic Resources

Quantities of cement, sand, gravel, and earth, and tons of metal, wood, and other materials will be used in the construction of the feature. The estimated cost of the proposed action based on the 1972 cost index is $114,000,000. The estimated quantities of such materials include:

Concrete:	220,000	cu.yds.
Gravel	145,000	cu.yds.
Sand	50,000	cu.yds.
Cement	156,600,000	lbs.
Steel:		
Reinforcement	5,100,000	lbs.
Structural	6,500,000	lbs. (including tunnel supports)
Miscellaneous	50,000	lbs.
Other:		
Piping	130,000	lbs.
Discharge pipes	10,350,000	lbs.
Cranes	350,000	lbs.
Timber	770,000	b.f.
Stoplogs	100,000	lbs.
Valves and Controls	350,000	lbs.
Electric Motors (6)	54,400	hp (each)
Pumps (6) @ 820 Ft. TDH	500	cfs (each)
Total Excavation	1,700,000	cu.yds.

u. Earthquake Hazard

Reclamation's structural design for earthquake hazard is standard procedure. The shock level intensity is assigned for the probable Modified Mercalli range. This design policy minimizes the potential impact of earthquakes on the stability of Reclamation structures. No landslides have been evident in the Havasu feature area, and there is little possibility that landslides would be triggered by future seismic activity.

2. Impacts Related Primarily to Physical Operation and Maintenance of the Feature

Operation and maintenance of the Havasu complex and diversion of water from the Colorado River will have a minor impact upon the feature area, and upon the Colorado River, but a more pronounced impact on the central Arizona service area. The impacts are discussed on the following page.

a. Operation [129]

Automatic controls for operation of the Havasu Pumping Plant and electric equipment will minimize human activities at the plant, resulting in less attendant disturbance. There will be a constant low-intensity sound emitted from the plant facilities. Since the pumps and motors will be enclosed within the building, the range of this sound will be limited to the immediate vicinity of the pumping plant. The transformers will have a low humming sound. In addition, lights will be provided to facilitate safety, observation, and maintenance activities during the night.

Noise and light will be buffered by using shielding and screening consisting of baffling, vegetation, walls, and other devices. The low-intensity sound and light levels at night will not have a significant impact on wildlife or on human activity in the area.

b. Maintenance

Human activities and vehicular traffic along maintenance roads, coupled with frequent patrol of the Granite Reef Aqueduct to the tunnel outlet portal, will cause only minor disturbance to wildlife. The use of fencing and gates to control public use or access to project facilities will help minimize the disturbance.

Current operating plans call for an annual 1-month dry-up period for repair and painting of underwater devices, such as gates, gate lifting devices, pumps, and appurtenant equipment. In addition, there may be an emergency dry-up due to storm damage to the aqueduct system beyond the tunnel outlet portal. Periodic drainage, as well as accidental outage, will cause a minor loss of any aquatic fauna and plants in the system.

Aquatic weeds, mosses, algae, ditchbank weeds, and freshwater clams will need to be controlled in the intake channel, pumping plant, discharge lines, and tunnel. Unchecked aquatic growth has been shown to reduce the water-carrying capacity of similar systems up to 80 percent of their designed capacities. In the Yuma, Arizona, area the introduced tilapia, Tilapia mossambicca, has been successfully used in drains to control pondweed and algae. This fish consumes aquatic growth, but dies when the water temperature drops below approximately 55° F. Problems associated with introduced species will be thoroughly studied before any such program is considered for the project.

The tunnel environment will be essentially without light except near the outlet portal. Minor aquatic organism growth will attach to the wetted perimeter. Waterborne sediment is expected to

remain suspended or be carried along the invert by velocity of the water. Fresh-water clams may grow within the tunnel. If chlorination is not used, periodic cleaning by brushing or scraping of the concrete surface may be required to remove the aquatic growths which would then be removed from the tunnel by washing and sluicing. These wasted materials would be discharged by sluicing into the upper portion of Osborne Wash. The magnitude of water discharged would be absorbed by the sands and gravels of the stream channel and would not reach the Colorado River. The suspended material would deposit on the sand and gravel and dehydrate. An example of the tunnel cleaning machine is shown in Figure 16.

In the event that fresh-water clams develop and create shell deposits within the tunnel, a mechanical loader for loosening the deposits would be used. Transportation by sluicing or mechanical hauler as necessary would be used to remove the shells and residual clams from the tunnel to a sanitary fill area. This fill area could probably be located in the tunnel spoil waste area on the upstream slope of Osborne Wash adjacent to the Granite Reef Aqueduct.

Additional discussion of the problems anticipated with undesirable aquatic biota and proposed methods of control is included later in section C.2.i. "Herbicides and Pesticides."

c. Quality of Water at the Pumping Plant

Project pumping through the intake channel will provide a mixing and circulatory effect by bringing in mainstream flows into the Bill Williams arm of Lake Havasu. This mixing should reduce natural turbidity and slow the overall rate of eutrophication within the Bill Williams arm. Accordingly, a minor quality improvement is foreseen in the waters of the Bill Williams arm as a result of this action. No quality deterioration of mainstream flows will occur as a result of the construction and operation of the Havasu Pumping Plant.

d. Salinity in the Colorado River [93]

As discussed in Chapter II, 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 via the Havasu Pumping Plant will have negligible long-term effect on the salinity of the river from Lee Ferry to the Mexican Border. Project diversions are based on

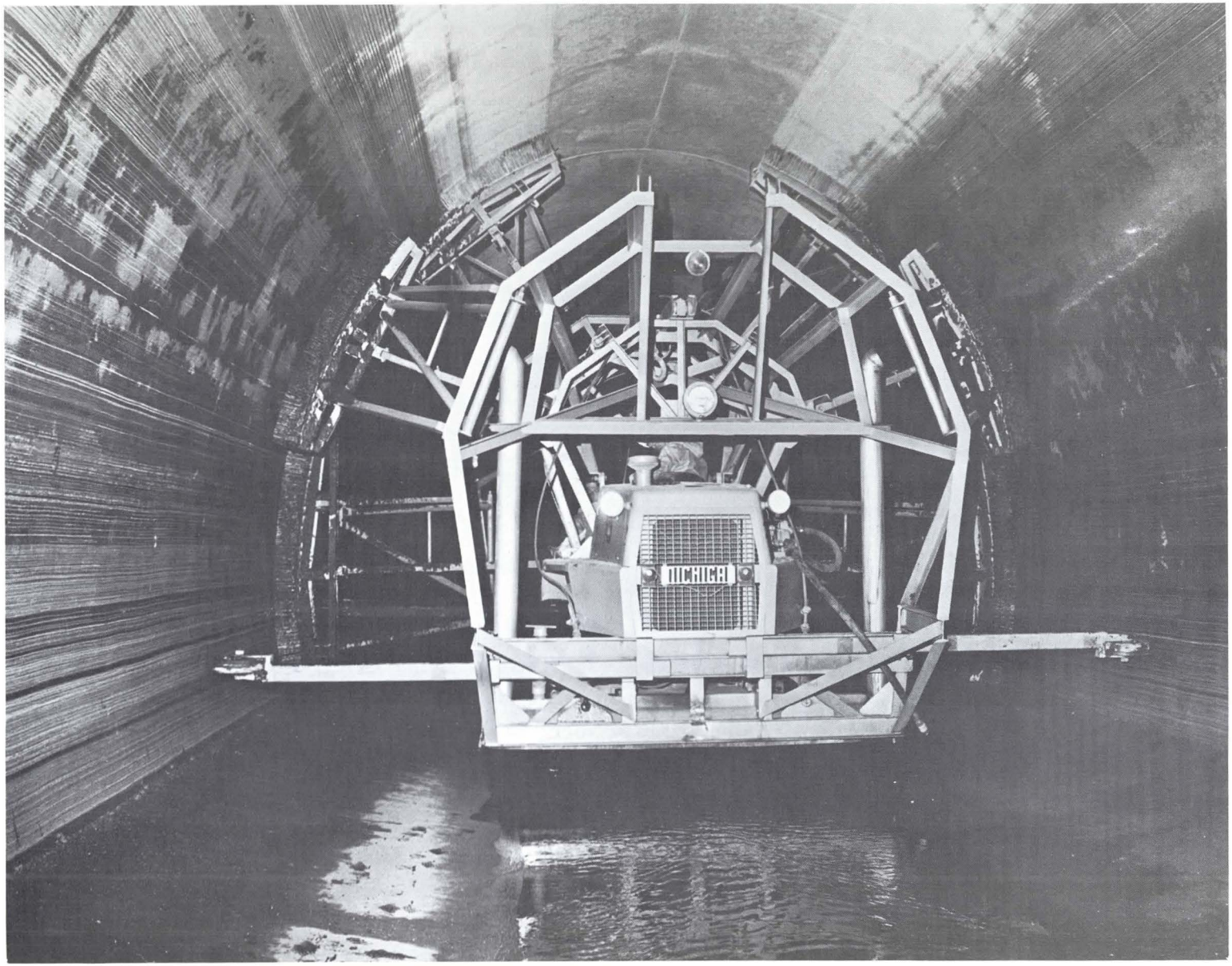


Figure 16

View of typical tunnel-cleaning machine being used. (Metropolitan Water District of Southern California photograph.)

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. The circulation and mixing effect caused by project pumping will not affect the salinity of the water in Lake Havasu.

As discussed in Chapter I, section K, 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 spilled 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, both above and below Parker Dam and Lake Havasu.

e. Water Quality (Salinity) Effect of Delivered Water

This item is indirectly related to the Havasu feature and is covered on pages 115 to 117 of the CAP overall final environmental statement. Similar material is included here, however, because of the relationship of the diversion to the central service area of CAP.

The quality of Colorado River water delivered to users in central Arizona will be lower than local surface supplies that are presently being used. However, the CAP Colorado River water will be of better quality than the current, as pumped, average water quality in the service area and better than, or nearly equal to, that of the treated waste water available in the Phoenix and Tucson areas. This is based on the 1965-1968 level of total dissolved solids of 726 ppm at Lake Havasu, and the assumption that long-range plans will be

implemented, as referred to earlier, to control future salinity increases in the Colorado River.

The production wells in the central Arizona area produce water ranging from 300 ppm to 4,500 ppm total dissolved solids. The average concentration as pumped in 1965 was 955 ppm. Currently treated waste waters in the Phoenix and Tucson areas have about 900 ppm and 650 ppm of total dissolved solids, respectively. The present ground-water supply provides approximately 60 percent of the current usage from all sources.

Surface-water quality in the CAP area ranges from about 280 ppm of total dissolved solids in the Verde River, to about 700 ppm in the Salt River at Stewart Mountain Dam, and to about 630 ppm in the Gila River at Buttes Dam site.

For irrigation use, Colorado River water is classified as C3-S1, indicating that it is suitable for growing salt-sensitive crops on soils having good leaching capability or moderately tolerant crops on soils with poor leaching capability. Based on the U. S. Salinity Laboratory Classification System, the sodium absorption ratio (SAR) is about 2.4 which is in the very low range. This is important because waters with a high SAR may not be suitable for an irrigation supply. There is significantly more calcium and magnesium in Colorado River waters than local waters, which will tend to keep soils permeable by exchanging with sodium on the clay particles.

U. S. Public Health Service (USPHS) standards recommend that domestic water supplies should not exceed 500 ppm total dissolved solids. This limit, based primarily on taste considerations, is often exceeded in the Colorado River basin and those southern California areas to which Colorado River water is diverted, and in local Arizona waters. In some areas the total dissolved solid content ranges over 4,000 ppm. Most of the domestic water currently used in Maricopa, Pinal, and Pima Counties has a total dissolved solids content between 400 and 1,000 ppm.

The hardness of CAP Colorado River water will typically be about 360 ppm. 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 ppm.

The fluoride content of Colorado River water is typically at about 0.4 ppm. Local water supplies in the service area frequently exceed USPHS recommended limits of 0.8 ppm for fluoride content.

Colorado River water will transport a salt load into the central Arizona area. The water will be used as a replacement for ground water, which on the average, is of poorer quality than the

imported water. Thus, while the imported water will bring in a new salt load to the basin, such importation will work to reduce the total application of salts to the land. Considering that the ground-water quality varies throughout the area, the effects will be dependent on the specific relationships of the quality of the ground water and applied surface water at each point in the service area. Analyses of historical data on the use and mineral content of the ground water in the area indicate such effects will be minor in the CAP area as a whole and probably undetectable.

The evaporation of Colorado River water during transit will have a minor effect on concentration of total dissolved salts in the imported water. The actual effect of evaporation losses on water quality will vary with the amount of water diverted, the point of delivery, and the season. Maximum water quality degradation will occur at the most distant delivery point when the diversion at Lake Havasu is at a minimum during the hot summer. Normal annual evaporation will be relatively uniform from year to year. Over 60 percent of these losses will occur during the May-September period. A minimum diversion of 500 cfs during this period would produce a water quality degradation of about 6 percent between the Havasu complex and the end of the Salt-Gila Aqueduct. Similarly, a 500-cfs diversion during the winter would produce a degradation factor of less than 2 percent.

f. Impact on the Flow of the Colorado River [2-4, 6, 7, 9]

The pattern of flow through the Bill Williams arm will be altered to some extent by the minor current or circulation effect resulting from project pumping and the flow through the intake channel. The flow velocity, approximating 0.13 foot per second in the intake channel, will be generally unnoticeable in the arm and totally unnoticeable in Lake Havasu.

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.

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. Water levels at Lake Mead are currently regulated 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.

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 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.

g. Impact of the Colorado River Water Upon the Service Area

Diversion of Colorado River water by the Havasu Pumping Plant, as a part of the CAP, will result in the availability of additional water in the central service area. The water will be used to support municipal and industrial development, irrigated agriculture, fish and wildlife management, and outdoor recreation programs in central Arizona. In providing this additional water, the CAP will relieve to some extent the dependency of urban areas on ground-water supplies which are already being overdrafted.

With respect to CAP water used for irrigated agriculture, only those developments which have a recent history of irrigation may receive CAP water. The authorizing legislation, however, exempts

Indian reservations and permits use of CAP water to develop new agricultural land on these reservations.

Ground-water pumping is presently creating an average annual overdraft of about 2.1 maf in the CAP service area. With CAP completed, the average annual overdraft between 1980 and 2000 is projected to be less than 900,000 acre-feet. The immediate effect of the imported water will be to reduce substantially the rate of decline in ground-water levels in central Arizona. Depths to ground water presently range from 20 to over 500 feet in the CAP area, with portions of the primary aquifer in the ground-water reservoirs being completely dewatered and some areas approaching basement rock. By the time CAP begins delivery, more than 20 percent of the agricultural area to be served by CAP is projected to have pump lifts exceeding 500 feet.

With one of the primary objectives of CAP being to stabilize ground-water declines, computer model projections by the Arizona Water Commission of ground-water conditions between 1980 and 2000 indicate a general decline of 25 to 100 feet over this period. In general, areas having ground-water lifts of over 500 feet will have the least decline, because further economic agricultural water use will require the use of CAP water in most areas and because the ground-water resource in some of these areas will be nearly exhausted. Areas with ground-water lifts of less than 250 feet in the initial years of CAP will experience the greatest declines between 1980 and 2000, because ground water can still be withdrawn at a comparatively low cost.

During the initial years of CAP delivery, almost all agricultural areas using CAP water will experience water level increases. Some areas will meet their entire water requirement with CAP water; but as the CAP supply decreases in these areas, the deficit will have to be met with ground water and this trend will reverse. By the year 2000, probably all areas using CAP water will be reexperiencing ground-water declines. However, all areas served by CAP water must have lined distribution systems. As these areas return to greater ground-water dependence, less ground water will need to be pumped than with previous unlined systems, with a resultant water savings and reduction in costs of operation. Thus, the overall application of Colorado River water in the service area will not totally eliminate long-term ground-water overdraft or water level declines. It will, however, significantly retard the rate of withdrawal and decline, especially during the earlier years following completion of the CAP. Long-range needs for ground and surface waters will depend on population growth and economic trends in the CAP area.

h. Impact on Indian Water Rights [6, 7]

Concern has been voiced relative to the effect of the project on existing water rights of the Indian reservations in the lower Colorado River basin and the ultimate allocation of water to reservations in the central service area.

The five Colorado River main stem reservations below Hoover Dam have had their water rights adjudicated and decreed by the Supreme Court in the case of Arizona v. California. These are the Fort Mohave, Chemehuevi, Colorado River, Yuma, and Cocopah reservations. Their diversion rights provided under the decree are presented in Table 2. These decreed water rights, including those not presently utilized, will not be affected by the diversion of water to central Arizona. In addition to these five main stem reservations, the water rights of 18 other reservations were asserted in Arizona v. California, but not adjudicated. These 18 reservations claimed only rights on tributaries, rather than rights on the main stem of the Colorado River. This fact alone should prevent the possibility of CAP's interfering with these rights. In any event, the CAP will not be operated in derogation of these or any other unadjudicated prior rights.

In any period during which reduced storage and discharge cause there to be insufficient water supply to satisfy the requirements of all main stem water users, main stem water rights of earlier priority than CAP - including Indian, contract and other rights - will be satisfied first and diversion amounts for the CAP will be reduced accordingly.

i. Herbicides and Pesticides

The Havasu Intake Channel dike will be rock-faced on one or both side slopes using materials removed from the pumping plant site and tunnel. The pumping plant and tunnel will be concrete and steel which offers the minimum opportunity for plants, algae, snails, or clams to become established. During the first few years of operation, until a point of stabilization is reached when the system is used to capacity, some undesirable biota could be troublesome.

It is anticipated that algae and submersed and emergent vegetation will grow along banks of the inlet channel. Several species of mollusks will become established in the inlet channel and pumping plant forebay. Algae will cling to constantly moist walls of water conduits in the pumping plant, the discharge lines and inside the tunnel. It is not possible to forecast the extent of these infestations which will depend upon velocity of the water which in turn will be determined by the rate of pumping. Lack of sunlight and oxygen will also limit growth of these organisms. Control or suppression measures will conform to acceptable practices having no effect upon desirable species. Toxic chemicals which would contaminate the water supply will not be used.

TABLE 2

DIVERSION RIGHTS (ACRE-FEET) OF EACH OF THE 1/ COLORADO RIVER MAIN STEM INDIAN TRIBES AS PROVIDED UNDER THE SUPREME COURT DECREE IN ARIZONA V. CALIFORNIA

Tribe	Arizona	California	Nevada	Total
Fort Mohave	96,416	13,698	12,534	122,648 2/
Chemehuevi	0	11,340	0	11,340
Colorado River	662,402	54,746	0	717,148 2/
Yuma	3/	51,616	0	51,616
Cocopah	2,744	0	0	2,744
Totals	761,562	131,400	12,534	905,496

1/ From Bureau of Indian Affairs (PSWP - January 1964).

2/ The Supreme Court did not determine boundaries in cases of controversy. Figures shown are those recommended by the Special Master, and subsequently adopted by the Court in its decree.

3/ Indian Homesteads included with non-Indian lands of Yuma Project (USBR).

Submersed aquatic plant species found in Lake Havasu are expected to establish primarily along the sides of the inlet channel as silt collects in the rock crevices. Chemical suppression is considered impractical with the herbicides now available, considering the large quantity of water that would require treatment. Mechanical removal of the plants from the inlet channel is considered impractical. Trashracks will be required on the pump intakes to catch debris and broken plants which may be carried from the channel or the lake by wind and current. Emergent plants, primarily cattail or tules, will eventually grow in some sections of the inlet channel as a fringe along the waterline. Extensive growth is not anticipated because of the rock-faced banks and the sheer slope into deep water. Periodic maintenance either by chemical control or by physical removal of the cattails, tules, saltcedar, willows, etc., within the zone of capillarity above the waterline may be required. In the event chemical control should be necessary, applications of 2,4-D, Dalapon, Diquat or other herbicides will be made from a sprayer carried in a boat, or by using a hand-spray wand from a truck-mounted sprayer moving along the operating road. In either event the herbicide solution will be directed into the banks so that a minimum of spray or spray drip enters the water. Leakage from the sprayer will be held to a minimum by using formulations and emulsifying agents that insure the maximum amount of herbicide will hit and stay on the target plants. Plant suppression techniques will be periodically scheduled so that the vegetation never becomes established and mature. Therefore, wildlife, and especially birds, will not be endangered by feeding on regrowth or young plants.

Some of the mollusk forms now found in Lake Havasu will become established in the inlet channel and in dead-water spaces in the pumping plant forebays. No problem is anticipated from these organisms within the pumping facilities or tunnel, as water velocities should carry the eggs and larva stages of snails and clams through the system into the aqueduct. Screening or filtering is not feasible considering the quantity of water. There is insufficient knowledge relative to use of chemicals to control mollusks in expanses of water comparable to the inlet channel. These organisms will be suppressed largely by biological control (i.e., natural predators); however, if sandbars favorable to mollusk reproduction develop, then mechanical or chemical methods will be necessary to maintain balance between mollusks and their predators. Chemical control may be practical as certain compounds are specific to mollusks and will not kill other life forms. Heavy metals will not be used unless absolutely necessary. If heavy metals are used, all life will be affected. Copper will not be used if at all possible. Chlorine and phenols are possible chemicals that may be used for suppressing mollusks without hazard to wildlife or fish. Use of phenols should be closely studied as low parts per million may impart an odor in the potable water after chlorination.

Several forms of algae including those living under conditions of minimum oxygen and sunlight can be expected to cling to the concrete walls of the pumping plant discharge lines and in the tunnel. It is conceivable that algae can establish to the degree where efficiency is

impaired but should this occur, algae will have to be removed. Growth can be physically removed by scaling or brushing. An example of a tunnel cleaning machine was presented earlier in section C.2.b. Periodic dry-up of the system for annual maintenance review will retard this growth, especially if air movement is induced to a degree that the concrete dries the algae. There is little or no opportunity within the pumping plant forebay, the pumping plant discharge lines, or the tunnel for biological control of algae. Algaecides sprayed or painted on the concrete or steel surfaces may be effective. The formulations and techniques are unknown at this time. One practical method of controlling algal growths is the use of copper sulfate. By using this solution in small concentrations, the algae is controlled yet other forms of life are not affected. The foregoing is an example of the types of methods that will be used when control of algae is absolutely necessary.

The policies and regulations of the Department of the Interior and the Environmental Protection Agency will control the use of herbicides and pesticides.

j. Recreation

No long-term adverse impact of the Havasu feature on recreation is expected. The landform embankment structure is expected to increase recreational benefits by providing for fishing, sightseeing, and swimming (lake side only).

3. Other Impacts

Impacts of the Havasu feature not specifically identified in the material above are presented below. This pertains mostly to the effects of the transmission line and communication system, and an evaluation of disturbance to esthetic values.

a. Esthetic Values and the Pumping Plant, Tunnel, and Intake Channel

The Havasu Pumping Plant and intake channel will be located between an existing 270-space trailer park and the Havasu Springs Resort. A transmission line, access roads, and Arizona State Highway 95, traverse the area in the feature site. In the Bill Williams arm of Lake Havasu, extensive water-oriented recreational activity currently exists. Accordingly, it is expected that the impact of the pumping plant, intake channel, and inlet portal on the esthetic values of this area will in the long term be minor. Final plans in regard to landscape treatment for the pumping plant site and landform embankment have not been made. Bureau of Reclamation design criteria require that full consideration be given to improving the appearance of these structures. It is expected that natural vegetation will propagate along the perimeter of the embankment structure.

At the normal operating water-surface elevation of 447.5 in the intake channel, the exposed vertical portion of the northwest side of the pumping plant intake structure will be about 11 feet. At the the minimum water-surface operating elevation of 440, the exposed vertical surface of the pumping plant will be about 18.5 feet. The major major portion of the pumping plant structure will be underground and totally out of view. Arizona State Highway 95, crossing over the intake channel at elevation 495 via a concrete bridge, will provide a screening effect in terms of visual observation of the pumping plant from Lake Havasu itself. The bridge and highway which will be located about 475 feet northwest of the pumping plant structure will be approximately 36.5 feet above the top of the main pumping plant deck. (See Figure 4.) Accordingly, the only portions of the pumping plant structure which will be visible from the bridge crossing will be the visitors' facility and service building, and the transformers which are presently expected to be located on the deck of the pumping plant, with their associated electric equipment and switching gear.

b. Transmission Line [54, 63, 96]

The integrated transmission system will deliver power to the existing Parker switchyard as described earlier in Chapter I. About 1-1/2 miles of 230-kv line followed by 0.6 mile of underground cable will connect the Parker switchyard with the Havasu Pumping Plant. The 1-1/2-mile line will be mostly hidden from view by the natural terrain. Since the new line will parallel an existing facility, the need for additional access roads for construction and maintenance will be minor.

Design of the transmission line and the small spreading yard at the beginning of the buried cable will conform with the "Environmental Criteria for Electric Transmission Systems," as published by the Departments of the Interior and Agriculture. These criteria have been developed to minimize the effects of transmission line construction on the environment. Other appropriate environmental design criteria, such as the Western Systems Coordinating Council's "Environmental Guidelines," will also be used. In order to further minimize overall impacts, the existing 69-kv transmission line between the pumping plant area and the Parker switchyard may be removed at a later date.

Vegetation losses will be confined generally to the area of the tower footings, the small spreading yard 0.6 mile from the pumping plant, and the small trench excavation for the buried cable duct. The area under the conductors will not require clearing. Wildlife will undoubtedly be temporarily disturbed during construction activities. The line will have only minor impact on esthetic values of the area due to the presence of the existing 69-kv line, and the background and character of the terrain involved.

c. Communication System [54]

The communication and microwave systems required for the Havasu feature will utilize already existing and developed sites on the Parker-Davis Project communication system. The addition of microwave antennas at the base station will have no identifiable environmental impacts.

D. Unquantified Amenities

Some aspects of the proposed action remain unquantifiable at this time. The purpose of this section is to recognize that such aspects of the project exist so that methods and procedures can be developed to study and assess them. Five examples are presented below. Others that may be identified in later stages of project development will receive similar consideration.

1. The effect of the intake channel embankment on fishery habitat in the Bill Williams arm is not fully known. It is anticipated that the coarse protective material on the slopes of the embankment will provide significant bass spawning habitat. As discussed in Chapters III and IV, an initial study for assessment of the overall impact is underway. Data obtained from this and subsequent phases of the study will be used to quantify the effects.

2. Similarly, the full effect of the Havasu pumping operations on fish life in the Bill Williams arm is unquantifiable at this time. Preliminary assessments and experience gained from similar pumping operations at MWD's intake on the west side of Lake Havasu indicate that little effect will occur. Chapters III and IV reflect action which is being taken to fully evaluate the matter.

3. It is anticipated that construction activities will not have any long-term effect on the great blue heron colony on Heron Island. Subsequent disturbance of the colony that might occur from visitors to the project, or increased recreational use of the area, cannot be fully assessed at this time.

4. The effect that increased employment forces working in the feature area may have on wildlife populations is not fully known.

5. Due to heavy use of the Havasu area by recreationists and tourists, it is not expected that decreased employment and economic levels following construction will be as significant as in past years on similar projects. The full effect of this transition period, however, cannot be quantified at this time.

CHAPTER IV

MITIGATION MEASURES AND

AIR AND WATER QUALITY ASPECTS

IV. MITIGATION MEASURES AND AIR AND WATER QUALITY ASPECTS

A. General

This chapter presents an overview of the tangible environmental considerations for the Havasu feature. They are presented under three separate headings: (1) standard Reclamation rules for design and construction; (2) protective measures and mitigation features included under P.L. 90-537 as a project cost; and (3) proposed enhancement measures not authorized under P.L. 90-537.

Bureau of Reclamation policy provides criteria for improved appearance of structures and preservation of landscape at its installations. These criteria are applicable in the planning, design, construction, and operation of all facilities in an effort to minimize the impact on the environment.

Measures included are those which have been adapted or added to the project in order to provide environmental protection. Mitigation features are included as replacement or substitution for losses incurred as a result of construction. Protective measures and mitigation features are provided to protect fish and wildlife, recreation, esthetic values, and other environmental qualities.

Potential enhancement includes additional features that are recognized by the Bureau of Reclamation and recommended by cooperating land-use agencies as being desirable, beneficial, and important undertakings, but which were not part of the CAP during the Congressional authorization process.

1. Research and Monitoring

The environmental impact of this feature will be assessed as a part of the research and monitoring program being developed for the CAP. This program will include all aspects of environmental life systems that may be affected and will continue through the preconstruction, construction, and operation phases.

As discussed in Chapter III, the initial phase of the monitoring program to assess losses of fish and other aquatic biota in Lake Havasu resulting from construction and operation of the Havasu feature has been undertaken. Data obtained in this initial phase and subsequent phases will be evaluated to determine whether protective measures are required. An initial study of the requirements for fish screens in the intake channel has also been completed.

In cooperation with the Arizona Game and Fish Department, Arizona Water Commission, Bureau of Sport Fisheries and Wildlife, and the Bureau of Land Management, the migration routes and habits

of the burro and bighorn sheep in the Buckskin Mountains area have been studied. (See Figure 12.) These studies will aid in shaping final design and construction activities so that minimum impact to these species will occur.

In addition, studies by Reclamation are continuing on improvement of construction methods and materials, as well as structure design, in order that each component of the Havasu feature will maximize environmental quality. An example is whether the transformers should be located on the roof or to the rear of the pumping plant. Either location may require screening to reduce the visual impact.

2. Analyzing Alternatives

To maximize environmental quality and to decrease adverse impacts, alternatives to project facilities have been analyzed. These are discussed in Chapter VIII. Typical of choosing an alternative method is the decision to bury the transmission line for 0.6 mile between the pumping plant and the small spreading yard to eliminate the esthetic impact.

3. Standard Reclamation Rules for Design and Construction

Bureau of Reclamation Instructions provide criteria for improving the appearance of structures, and preserving the landscape at all installations. These criteria are applied in the planning, design, construction, and operation phases of all facilities. An example of implementation of these criteria is the recent change in design of the intake channel and pumping plant. Reevaluation of design criteria for these structures has resulted in a more environmentally-oriented design than was presented in the September 1971 Draft of Environmental Statement for the CAP. The intake channel dike as now designed is a free-form land-fill structure to be constructed with materials that will blend with the local terrain, be accessible for limited public use, and provide additional largemouth bass brood area. The pumping plant has been redesigned as a lower profile structure to blend in esthetically with the mountain background; the transmission line will be buried for 0.6 mile to the pumping plant; the discharge lines to the tunnel portal will be buried; and the areas disturbed by construction above the pumping plant will be restored to their original appearance as nearly as possible.

Specific requirements which are included in the Reclamation Instructions and are applicable to the Havasu complex include:

a. Locating the required structures to take advantage of the natural topography.

b. Designing the structures to be compatible with the surrounding area.

c. Improving the appearance of the structures so as to be environmentally compatible with the surroundings.

d. Establishing cut and fill slopes to blend with natural terrain.

e. Concealing the required waste areas and borrow pits.

f. Locating construction activities and access roads along the natural contour of the land and where possible along the alinement of the maintenance roads.

g. Clearing only the minimum amount of vegetation during construction.

h. Restoring the damaged areas and scars to as natural a condition as possible.

i. Revegetating the damaged areas where necessary.

j. Landscaping the features to improve their esthetic value.

k. Installing soft lights, where appropriate, required for work and protection of the facilities.

l. Designing the pumping plant and electric facilities to eliminate harmful and bothersome noise levels.

Construction contractors will be required by specifications provisions to reduce the adverse impacts by:

a. Controlling construction operation so as to minimize the amount of right-of-way required.

b. Restoring the areas that are disturbed to a natural landform.

c. Maintaining heavy equipment in a condition that will preclude excessive air pollution.

d. Providing construction equipment with devices that minimize noise pollution.

e. Maintaining access and haul roads with water or other treatment to minimize dust.

f. Keeping waste water returns to a minimum.

Special measures to protect the environment, such as those which have been developed in specifications to protect the great blue heron colony at Lake Havasu, will be incorporated into all of the construction specifications as each requirement is identified. With regard to the great blue heron colony, the specifications for construction of the

pumping plant and tunnel will require control of blasting operations so that a minimum of disturbance to the colony will occur, particularly during its nesting period. This is discussed more fully in section B.1. of this chapter.

Excess earth materials accumulated during tunnel construction will be placed in low profile areas, and shaped to conform with existing terrain. Disposal areas will be revegetated to as near natural conditions as possible. Should quarry sites be required for rock protective material, they will be selected in remote areas. After removal of the required material, the quarry sites will be left in a condition that will minimize the impact on esthetic values and will not endanger people or wildlife.

The 230-kv transmission line and spreading yard will be designed and constructed in accordance with the Department's "Environmental Criteria for Electric Transmission Systems" and other appropriate Reclamation guidelines to minimize visual modification of the natural surroundings. The towers will be located along the alinement of the existing 69-kv line to minimize disturbance of new terrain. The spreading yard will be constructed using modern low-profile electric devices. Insulators, hardware, and related materials are all designed to reduce electronic interference to a minimum.

B. Protective Measures and Mitigation Features Included as a Part of the Feature [94, 95, 128]

During construction, many protective measures are utilized for the safety of the public, private property, wildlife, and other aspects of the environment. Many of the impacts of construction are temporary in nature, and will be mitigated by restorative actions required in the construction specifications.

1. Blasting

Blasting will be used at various times to facilitate rock removal during excavation for the pumping plant site, pumping plant structure, discharge lines, tunnel inlet portal and tunnel. These areas are adjacent to a mobile-home parking area, Arizona State Highway 95, and Heron Island which supports a rookery for the great blue heron. Most of the blasting in these areas will be accomplished during the first 4 years of the 9-year construction period. Contractors will be required to submit a blasting program for each blasting activity or series.

When blasting is used, it will be performed in accordance with the provisions of Subpart U, Blasting and the Use of Explosives, of the Department of Labor regulations entitled "Safety and Health Regulations for Construction," the applicable provisions of the Bureau of Reclamation Supplement thereto and the Arizona State regulations. These regulations

contain extensive provisions for the safe handling and use of explosives. Some of the provisions, in part, of Subpart U of the regulations are as follows:

a. The employer shall permit only authorized and qualified persons to handle and use explosives.

b. When blasting is done in congested areas or in proximity to a structure or highway or any other installation that may be damaged, the blaster shall take special precautions in the loading, delaying, initiation, and confinement of each blast with mats or other methods so as to control the throw of fragments.

c. Insofar as possible, blasting operations above ground shall be conducted between sunup and sundown.

d. All loading and firing shall be directed and supervised by competent persons thoroughly experienced in this field.

In addition to the standard provisions for the protection of persons and property, careful planning and controls will be exercised to minimize disturbance of the residents of the mobile home park and disruption of nesting activity of the great blue heron. As necessary, blasting will be controlled to coincide with periods of least activity of the heron colony.

Normal construction technique dictates that blasting will occur anytime from once a day during some portions of the blasting period to as infrequently as once every 2 weeks. The first blasts will be comparatively small and will be closely monitored to confirm assumptions made concerning the character of the rock and noise levels. The contracting officer will require the contractor to submit a controlled blasting plan which incorporates monitoring of all blasts with an approved type seismograph to avoid exceeding the acceptable limits.

The initial blasting at the tunnel inlet portal will produce relatively more noise than will subsequent shots as the face of the tunnel advances within the rock mass. Sound levels from the rounds fired within the tunnel will diminish to a relatively low level of sound reaching the trailer park site or Heron Island as the face advances. The sound will be characterized by a low rumble rather than by a sharp crack. The economics of tunnel excavation and lining are such that the contractor avoids to the maximum extent possible loading and blasting with more explosive material than is required to meet the minimum excavation quantity. This is to avoid explosive materials costs for overbreakage, excessive handling to remove the overbreakage, and placing additional concrete to fill the space of the overexcavation. This will also avoid rock fragment throw outside the immediate work area.

The sound levels from blasting operations are greatly influenced by atmospheric conditions including wind direction and velocity and inversion layers and levels. The mandatory safety precautions include a series of blasting signals generated by an air-operated warning signal. Because of their sound level and frequency, signals will probably be more noticeable than the lower frequency sound wave resulting from the detonation.

Warning Signal--1 minute series of long blasts 5 minutes prior to blast signal.

Blast Signal--Series of short blasts 1 minute prior to shot.

All Clear Signal--A prolonged blast following the inspection of the blast area.

2. Control of Construction Traffic

The contractor will be required to obtain a permit from the Arizona State Highway Department or Yuma County Highway Department before beginning any construction work involving Arizona State Highway 95 or other public roads where the construction operations will be in progress. The contractor will be required to provide adequate traffic control measures to insure against accidents and avoid damage, injury, or unnecessary delay to passing traffic.

3. Dust Control

During performance of the construction work, the contractor will be required to institute and maintain efficient measures to reduce dust and to prevent dust from becoming a nuisance or damaging persons or property.

4. Landscape and Vegetation Protection

Environmental quality protection will be required by the landscape provision. The contractor will be required to exercise care in preserving the natural landscape in the vicinity of the work, and to conduct operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings. Except where clearing is required for permanent structures, and for approved construction roads, borrow areas, and excavation operations, all trees, native shrubbery, and vegetation will be preserved and protected from damage ordinarily caused by contractor construction operations and equipment.

5. Restoration and Cleanup after Construction

Construction roads that are no longer required by the contractor will be made impassable to vehicular traffic, and the surfaces will be scarified and left in a condition which will facilitate natural

revegetation. On abandonment, all camp, storage, and construction buildings including the concrete footings and slabs, and all construction materials and debris will be removed from the site leaving the camp area in a neat and natural appearing condition.

6. Gates and Fencing

Permanent protection measures will include gated maintenance roads to exclude public access to the tunnel, and fenced transformer and tunnel portal areas, as required, to protect the public and the bighorn sheep.

C. Enhancement Aspects

The landform embankment that will form the intake channel is designed to serve as a recreational facility. The dike, with its 30-foot-minimum top width, will lend itself to fishing, picnicking, and swimming (lake side). The embankment should also create an excellent bass spawning habitat. It is planned that excavated material from the feature will be available for construction of a parking area near the intake channel. The parking area together with the visitors' facility in the pumping plant will provide a rest area and scenic attraction for the public.

The contractor will be required to improve and maintain the Osborne Wash access road from Parker to the tunnel outlet portal construction site. This road, running east from Parker through the Colorado River Indian Reservation, is in poor condition. Following the completion of construction, the road should be acceptable to Yuma County as an improved road, providing better access from Parker to the Yuma County line and the Planet Ranch Road on the north.

Construction activity and the accompanying construction personnel will increase the economic potential of the area. Local businesses will reflect this economic enhancement. As a long-range benefit, a maintenance and operating crew will be required for the pumping plant and the electrical facilities, adding to the annual income of the communities.

D. Potential Enhancement Measures Not Authorized under Public Law 90-537

In general, the policy of the Bureau of Reclamation is to provide, as part of the initial construction, those mitigation features or facilities initially identified as falling under the provisions of the Fish and Wildlife Coordination Act, P.L. 85-624 (72 Stat. 563), or other applicable guidelines. In working with Federal and state agencies on the CAP, additional features have been identified which cannot be classified as mitigation but would, nevertheless, be complementary to the project. These are defined as enhancement measures, and are not required or designed to replace or substitute for a loss resulting from the project. Enhancement facilities are considered as being in addition to, or as adding value to the project.

Although such facilities are not authorized in P.L. 90-537, land and water conservation funds or Dingell-Johnson and Pittman-Robinson money may be available to state and local agencies for construction and/or operation and maintenance of these facilities. Federal and state agencies, counties, or certain municipalities may wish to participate in development, administration, and operation and maintenance of these facilities.

Two typical examples are described below. Other sound proposals may be identified later after more extensive evaluations by all appropriate agencies can be undertaken as a part of their on-going programs.

1. Parks-Recreation Potential

The Arizona Water Sports Council in its letter of comment on May 1, 1972, recommended that six lanes of boat launching ramps; parking space for 300 to 400 cars and boat trailers; and picnic, recreation, and restroom facilities be provided in connection with the Havasu Intake Channel. The council recognized that these facilities, in addition to replacing inadequate facilities near Parker Dam, would require separate financing which it suggests be provided by state-administered grants and local funds.

Cooperative studies are being made with Federal, state, and local recreation and fish and wildlife agencies to develop the Havasu facilities for appropriate public use. Consideration will be given to construction of these facilities and their operation.

2. Bighorn Sheep Watering Facilities

Personnel of the Arizona Game and Fish Department have, as a spin-off of the bighorn sheep study recently completed, recommended that a tap be made at the Buckskin Mountains Tunnel to provide a water supply point at least in the steep, rocky, prime-use area to the west of the tunnel alinement and near the inlet portal area. An additional water point was recommended for the top of The Mesa. This would require a pump lift of some 400 feet and a power source for the pump. This enhancement item would expand potential use and increase value of habitat on the top of The Mesa.

E. Historic and Archeological Sites [40, 101, 102]

Pursuant to the National Historic Preservation Act of 1966, P.L. 89-665 (80 Stat. 915) the Advisory Council on Historic Preservation and the National Park Service, Department of the Interior, have adopted procedures and criteria to further the Nation's historic preservation program, including the expansion of the National Register of Historic Places and initiation of a grant-in-aid program for historic preservation. The National Register of Historic Places and the National Registry of

Natural Landmarks identified in the Federal Register through August 5, 1972, have been checked and no listed sites will be influenced or affected by the Havasu feature.

The State Liaison Officers and the National Park Service have indicated that there are no unlisted sites or areas of state historical interest that would be affected by development of the Havasu complex.

All construction activities of the Havasu complex will be based on final archeological surveys. The final locations of material borrow sites and disposal areas in the same general area will be carefully selected.

A detailed archeological survey of the Havasu complex was made in April 1972. The only site found during this survey was Ariz. L:16:1, a lithic tool quarry. This quarry is on The Mesa at an elevation of 1560 and is located on the tunnel right-of-way about 77 meters northwest of Drill Hole 114. A faint man-made trail crosses the eastern part of the site in a northeast-southwest direction, but it is not currently being used by animals.

The following recommendation was made concerning this site. Since Ariz. L:16:1 lies on top of The Mesa, well above the tunnel grade, there is little danger that it will be disturbed by tunnel blasting or boring. Disturbance of the site would result primarily from establishing drill holes and constructing roads to these drill holes. Inasmuch as this aspect of the project has been completed, surface changes resulting from construction should not occur. Excavation of Ariz. L:16:1 is not feasible because of the character of the site. This particular archeological resource does not merit listing on the National Register of Historic Places, nor is it considered a major scientific finding. Thorough surface survey, collection, and recording have been completed for the site and all pertinent information is on file in the Arizona State Museum. On the basis of the survey report, the National Park Service will issue archeological clearance for all areas that were covered.

CHAPTER V

UNAVOIDABLE ADVERSE EFFECTS

V. UNAVOIDABLE ADVERSE EFFECTS

In Chapter III, impacts whether beneficial or adverse were listed and discussed. In Chapter IV, measures to mitigate adverse impacts or to protect and enhance the environmental quality were presented. This chapter is intended to outline the adverse impacts which cannot be avoided, i.e., adverse impacts discussed in Chapter III which will not be fully mitigated by measures presented in Chapter IV.

Several of the adverse impacts will be associated with the construction activities, while others will be related to operation and maintenance, or simply the existence of some of the structures. A comprehensive review of Chapters III and IV is considered a prerequisite to a thorough understanding of the material presented below.

A. Impacts Related Primarily to Construction Activities

Disturbance of fish and wildlife during construction will be minor. The existing low quality bass spawning habitat in the vicinity of the intake channel will be disturbed by construction of the 2,400-foot-long embankment. This spawning habitat was evaluated during underwater aquatic observations by Reclamation divers and others as discussed in Chapter III. The initial embankment will be completed in about 1 year of work, but additional placement of materials on the embankment will extend periodically through about the 4th or 5th year of construction at the site. During construction of the Havasu feature, additional human activity and related noise, particularly blasting noise, may disturb the great blue heron colony. No long-term effects on the colony are expected. Increased traffic on the access roads to the outlet portal may cause minor disturbance to birds resident in the better habitat of the refuge in the Bill Williams arm. The Havasu feature will have no significant effect on the decreasing population trend of the bighorn sheep.

Disturbance of localized areas of vegetation will occur. Vegetative cover is sparse to nonexistent in the feature area. Some flora protected and regulated by state law from wanton destruction or removal without permit may be affected. In an area where such species are likely to be disturbed during construction, the Arizona Agricultural and Horticultural Commission will be consulted regarding appropriate salvage and disposition of the plants.

There will be additional sound and lighting, as well as dust, litter, and traffic problems, during the construction period. Controls in construction specifications, as well as screening and soundproofing devices will lessen the impact.

Approximately 200 acres of right-of-way will be required for the work on the Havasu feature. This right-of-way will involve only Federal lands, except for a small parcel of private land on the 230-kv line. Adverse impacts resulting from commitment of this land for project purposes will be minor in relation to the lands remaining.

Roads will be needed for construction purposes. These may have some adverse impacts on esthetic values of the existing environment. Some of these roads will be used for operation and maintenance of the project, while others will be returned to natural-like conditions.

The concrete aggregate borrow areas, disposal areas, and construction staging site will remain visible on the landscape for many years after construction even with proposed contour shaping and revegetation programs. These areas will thus have reduced habitat and esthetic values, and will be more susceptible to erosion than surrounding desert areas. For the most part, these areas are in relatively remote locations and will only be visible on land to the occasional venturesome observer traversing the Buckskin Mountains. A total of about 82 acres is involved.

B. Impacts Associated Primarily with the Feature

The area in which the feature will be constructed has undergone considerable manmade change since the completion of Parker Dam and the impoundment of Lake Havasu in 1938. There are three private developments in the immediate area adjacent to the pumping plant site. The largest of these is a 270-space mobile home resort which occupies about 40 acres immediately to the east of the pumping plant site. The smaller two developments are in the Havasu Springs area. Stripping and terracing of the Buckskin Mountains foothills have been done in conjunction with the private developments. Arizona State Highway 95 traverses the lakeshore area adjacent to the feature and crosses the Bill Williams River about 3/4 mile from the proposed pumping plant.

The area will undergo further alteration from its present state as a result of the feature. The intake channel, pumping plant, tunnel portals, and surface portion of the transmission line will thus have an esthetic impact on the environment. To some, this may be seen as an adverse impact, but to others a benefit. On the whole, it might best be assessed as a change in the environment rather than a negative aspect of the project.

Of the total 200 acres needed for project construction, only about 117 acres will be needed permanently for operation and maintenance purposes. This includes about 11 acres required for the pumping plant, and about 19 acres for new and improved access roads, discharge lines, tunnel portals, and transmission line footings. There will be a reduction in the surface area of Lake Havasu of about 10 acres due to construction of the intake channel embankment, but this is considered minor compared to the overall open water surface area of the lake.

Some fish could pass through the intake channel into the pumping plant, with few surviving the impact of the pumps. Fish screens or other protective devices are being evaluated for installation ahead

of the pumps to minimize any adverse impact and to reduce the possibility of introduction of Colorado River aquatic biota into the Salt-Verde River systems.

The open section of the tunnel outlet portal may cause the loss of some wildlife, especially small game which can enter through protective fencing and other systems designed to exclude large mammals. This section will cause only minor hindrance to movement and migration of wildlife in the area.

The pumping diversion and importation of Colorado River water will contribute salts to the central Arizona area. This may ultimately have an effect on soil fertility and ground-water quality in the area. This potentially adverse impact is not yet fully quantified, but analyses to date indicate that the impact will be small.

CHAPTER VI

THE RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

VI. THE RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY 68, 122, 127

The Havasu feature is the diversion works for and a major feature of the multipurpose CAP which will help achieve a better long-term water resource balance in the CAP area. The CAP will reduce the present overdraft of ground water, improve the control and storage of surface flows (both normal and floodflows), increase the effectiveness of the irrigation systems of the service area by reducing the sediment transport in local surface waters, and provide water-oriented recreational facilities for man's use and enjoyment.

Most of the disturbance to people and wildlife caused by construction activities will cease as components of the feature are completed. In view of the small acreage required permanently for the feature, the long-range effect of the project on productivity of native vegetation for wildlife is considered minor. Impacts associated with individual components will be localized in scope and will result in only minor impact on the total environmental quality of the area. The cumulative impacts of all of the individual features of the CAP are evaluated and assessed in the overall environmental statement for CAP.

During construction, disturbance of the great blue heron nesting on Heron Island may result on a short-term basis. No long-term effects on this species are anticipated.

Decreased use of the project area by desert bighorn sheep and its presently decreasing population are attributed to increased recreational use along the Colorado River, the Bill Williams arm of Lake Havasu, Arizona State Highway 95, the recreational mobile-home development on the limited private landholdings adjacent to the Havasu National Wildlife Refuge, and the increased accessibility and penetration of the Buckskin Mountains by off-road vehicles. Construction activities will not result in further decreased use of the Buckskin Mountains area by bighorn sheep. There will be no significant long-term impact on the desert bighorn due to operation and maintenance of the Havasu complex.

While a temporary disturbance of the relatively low-quality bass spawning habitat at the intake channel site will occur during construction, the long-term effect on spawning areas should be a net gain of an estimated 2,400 feet of good habitat on both sides of the landform embankment. Since this impact and its relation to long-term impacts are somewhat unquantified, a before-and-after study of bass spawning potential along the shoreline and the landform embankment has been initiated by Bureau of Reclamation divers and biologists in cooperation with other interested agencies. The observations will be continued during construction and into the operation phase so that the full impact of the project can be ascertained.

Esthetically, the area will be permanently changed from what presently exists. Lessening of long-term effects on esthetic values of the area will be accomplished through restoration of areas temporarily used during construction, and by landscape treatment to achieve compatibility with natural features and developments located nearby.

The proposed 9-year construction period for the Havasu complex will have a short-term economic benefit primarily along the Colorado River on the Arizona side from Lake Havasu City south to Parker, Arizona. About 9 million man-hours of time will be required to construct the feature. Some minor economic benefit may also be experienced at Blythe, California, which is about 47 miles south of Parker, Arizona, on Interstate Highway 10 and the Colorado River. Local economies in these areas will be stimulated both from employment in the construction work and employment in other sectors of the economy, e.g., service stations, restaurants, housing, service utilities, and manufacturing. Temporary housing, utilities, and educational facilities may be required.

A few long-term jobs will also be provided in the operation and maintenance of the Havasu feature. Long-term economic and sociological gains will generally also occur as a result of the water diverted through the Havasu complex and in direct proportion to the regional impact of the overall CAP.

The Havasu complex at Lake Havasu should increase visitor use of the area to view the feature in operation. The intake channel embankment will also provide long-term recreation benefits in fishing, picnicking, sightseeing, and swimming.

CHAPTER VII

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Resource commitments for the Havasu feature will occur. Water and land resource commitments will be made, as will commitments of electric power, construction materials, and public funds. In addition, there will be commitments in terms of resources diminished by and therefore committed to the feature, such as vegetation.

A. Water

The decision by the Congress and the people of the State of Arizona to divert the major portion of Arizona's remaining entitlement to Colorado River water for use in central Arizona is a water resource commitment. The long-term average diversion will be about 1.2 maf per year.

B. Land, Mineral, and Vegetation

Land and associated vegetation will be committed to the project. The Buckskin Mountains embrace in excess of 60,000 acres of land, which is classified as Sonoran Desert. Of this total, only about 200 acres of typical Sonoran Desert land required for construction of the Havasu complex will be affected. Of the 200 acres, only about 117 acres needed for operation and maintenance of the feature are considered irreversible. There will be an insignificant reduction of 10 acres of water-surface area or displacement of approximately 280 acre-feet of water in Lake Havasu due to construction of the landform embankment for the intake channel.

A detailed geologic mapping and exploration program along the tunnel alinement shows no mineralization. The tunnel will penetrate volcanic rocks in its entirety. These rocks, in this general area, do not contain indications of significant mineralization.

C. Power [37, 114]

To supply the energy requirements of the CAP pumping plants, the Secretary of the Interior signed contracts providing for participation by the United States in the Navajo Project, which consists of a thermal powerplant near Page, Arizona, and associated transmission facilities. Thus, the CAP requires the commitment of a power resource, which will be 24.3 percent of the Navajo Generating Station capacity. The Havasu Pumping Plant requires 285 megawatts.

The commitment of coal resources and the associated changes in landform and esthetic value in connection with the construction and operation of the Navajo Project are covered under the final Navajo environmental statement filed with the CEQ on February 4, 1972.

D. Fish and Wildlife, Recreation, and Esthetic Values [35, 100, 128]

Losses to fish and wildlife will be minor. Special mitigation considerations and features as discussed in Chapter IV will reduce the effects, particularly at the intake channel and outlet portal. There is no expected impact on rare or endangered species. None of the habitat of the Yuma clapper rail will be affected by the project.

Once the Havasu facilities have been constructed and placed into operation, there will be a public demand and expectation for their continued use. If boat launching facilities are constructed on the intake channel embankment, these, together with the scenic attraction of the intake channel and pumping plant, will cause a long-term change in the public use patterns of the Bill Williams arm of the lake.

Even with grading and contouring, disturbed desert areas are generally slow to revegetate. Revegetation will be accomplished through successional stages. Aggregate borrow areas must be considered a resource commitment in terms of materials removed. Disposal areas could also constitute a commitment in the Buckskin Mountains area where about 700,000 cubic yards of tunnel excavation material will be placed on about 57 acres.

E. Historical and Archeological Sites [26, 40, 101, 102, 115]

Final assessment of the Havasu feature by the National Park Service has been completed. No commitment of archeological or historical resources will occur.

To further reinsure that no valuable materials are lost, field investigations will continue before and during construction in concrete aggregate borrow areas, disposal areas, or other localized areas. Should any sites be located, excavation and/or salvage work will be accomplished.

F. Economic Values

Large quantities of cement, sand, gravel, and earth, and tons of metal, wood, and other materials will be used in the construction of the feature. The estimated cost of the proposed action based on the 1972 cost index is $114,000,000.

Public funds have been and will be committed to the feature. About 70 percent of the construction cost will be repaid to the Federal treasury by the water and power users who benefit directly from the CAP. By provisions of Public Law 89-72, the joint CAP costs and one-half of the separable construction costs for fish and wildlife and recreation purposes are nonreimbursable. Costs allocated to flood control in the National interest are also nonreimbursable.

CHAPTER VIII

ALTERNATIVES TO PROPOSED ACTION

VIII. ALTERNATIVES TO PROPOSED ACTION

In the course of study involved in planning the CAP, several alternatives for the Havasu feature were examined. These alternatives were locational and functional and are discussed below.

A. Alternative Diversion Points Considered for CAP [5, 33, 34, 41, 124, 125]

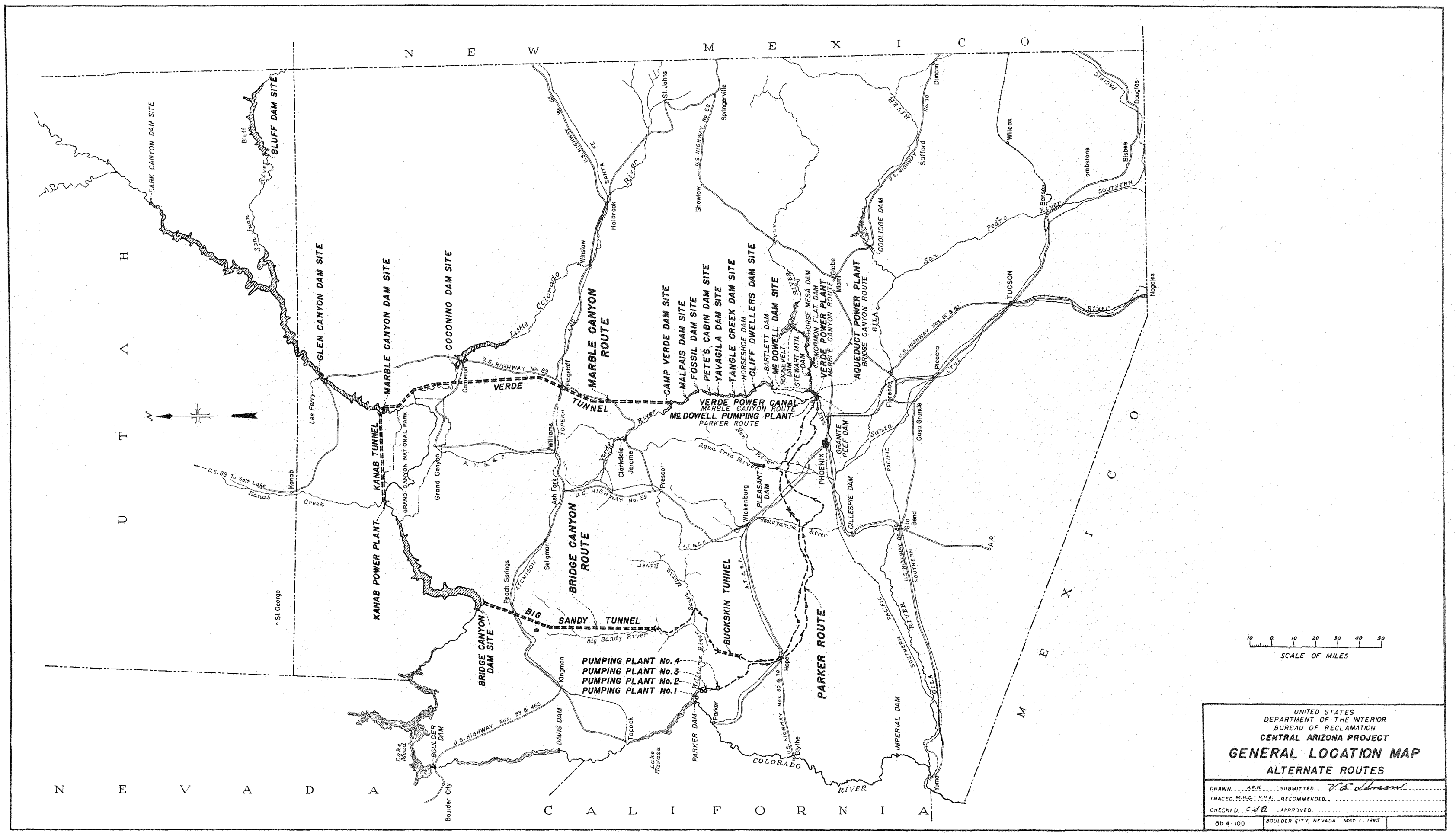
Initial conceptualization of diversion of Colorado River water to central Arizona occurred in 1894. Somewhat later studies began focusing on routes for delivery of Colorado River water to the central Arizona area. Preliminary field surveys, data collection, and analyses of alternative plans to deliver this water began in the early 1920's. These early studies considered numerous diversion routes. Three routes - Marble Canyon, Bridge Canyon, and Parker (Granite Reef) - were chosen to be analyzed in detail for comparative evaluation. Figure 17 gives the general location of these routes. The results of these studies were documented in two Bureau of Reclamation planning reports in 1945 and 1947. These primary routes were discussed and considered during the course of Congressional hearings on the authorization of the CAP. All three routes were designed to deliver water to a reservoir in central Arizona approximating the present concept of Orme Reservoir.

The Parker Route is the route concept authorized for construction by Section 301(a) of Public Law 90-537 as the Granite Reef Aqueduct. Besides their geographical differences, one salient difference between the route chosen and the alternatives rejected is that the Granite Reef route will not necessitate construction of another reservoir on the Colorado River. This is not true of the other two routes. A discussion of the two major alternatives to the Granite Reef route follows.

1. Marble Canyon (Verde River) Route

This route called for a 143-mile tunnel from the proposed Marble Canyon Reservoir to the Verde River at which point diverted Colorado River water would flow down the natural channel of the river through a series of reservoirs and powerplants to a regulating reservoir on the Salt River near Granite Reef Diversion Dam. It was eliminated because of the adverse impacts on the environment at the portals and service control centers, the extensive time required for construction, and a greater cost.

The amount of spoil material from excavation would present a disposition problem and the tunnel passing through several geologic formations with differing water-yielding capabilities would remove water from the overlying formation resulting in a lowering of the water table in the rock masses along the tunnel alinement. This could, in turn, influence the water resources in the vicinity of Flagstaff and the San Francisco Peaks that are relied upon by native vegetation, range cattle operations, and municipal systems.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BLUFF DAM SITE
DARK CANYON DAM SITE
GLEN CANYON DAM SITE
MARBLE CANYON DAM SITE
COCONINO DAM SITE
MARBLE CANYON ROUTE
CAMP VERDE DAM SITE
MALPAIS DAM SITE
FOSSIL DAM SITE
PETE'S CABIN DAM SITE
YAVAGILA DAM SITE
TANGLE CREEK DAM SITE
HORSESHOE DAM
CLIFF DWELLERS DAM SITE
BARTLETT DAM
ROOSEVELT
STEWART MTN. DAM
HORSE MESA DAM
MIDDLE VERDE
MC DOWELL DAM SITE
VERDE POWER PLANT
MARBLE CANYON ROUTE
COOLIDGE DAM
AQUEDUCT POWER PLANT
BRIDGE CANYON ROUTE
VERDE TUNNEL
VERDE POWER CANAL
MARBLE CANYON ROUTE
MC DOWELL PUMPING PLANT
PARKER ROUTE
KANAB TUNNEL
KANAB POWER PLANT
BRIDGE CANYON ROUTE
BIG SANDY TUNNEL
BUCKSKIN TUNNEL
PARKER ROUTE
PUMPING PLANT No. 4
PUMPING PLANT No. 3
PUMPING PLANT No. 2
PUMPING PLANT No. 1
BRIDGE CANYON DAM SITE
GRANITE REEF DAM
PLEASANT DAM
GILLESPIE DAM
DAVIS DAM
PARKER DAM
IMPERIAL DAM
BOULDER DAM
Lake Mead
Lake Havasu
COLORADO RIVER
Bluff
San Juan River
Lee Ferry
Kanab
Kanab Creek
U.S. 89 To Salt Lake
St. George
Boulder City
Grand Canyon
GRAND CANYON NATIONAL PARK
Cameron
Flagstaff
Winslow
Holbrook
Little Colorado
Williams
Ash Fork
Jerome
Clarkdale
Prescott
Peach Springs
Seligman
Kingman
Topock
Parker
Blythe
Yuma
Wickenburg
Hassayampa River
Agua Fria River
Verde River
Salt River
PHOENIX
Florence
Casa Grande
Picacho
Eloy
Maricopa
Ajo
TUCSON
Nogales
Benson
Tombstone
Bisbee
Douglas
Willcox
Safford
Duncan
Morenci
Globe
Miami
Showlow
Springerville
St. Johns
Santa Fe
U.S. HIGHWAY No. 66
U.S. HIGHWAY No. 60
U.S. HIGHWAY No. 70
U.S. HIGHWAY No. 80 & 89
U.S. HIGHWAY No. 89
U.S. HIGHWAY Nos. 93 & 466
U.S. HIGHWAY Nos. 60 & 70
A. T. & S. F.
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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GENERAL LOCATION MAP
ALTERNATE ROUTES
DRAWN. K.R.N. SUBMITTED.
TRACED. M.H.C.; M.M.A. RECOMMENDED.
CHECKED. C.S.A. APPROVED
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BOULDER CITY, NEVADA MAY 1, 1945

Figure 17

These considerations and the impact of Marble Canyon Dam on canyon areas and its effects on the flow of the Colorado River were principal reasons for dropping this proposal from the CAP.

2. Bridge Canyon (Big Sandy) Route

This route required the construction of a dam at the Hualapai site (Bridge Canyon) on the Colorado River, a 78-mile tunnel to the Big Sandy River and subsequent canal structures from the Bill Williams River in a southerly route to Cunningham Wash and eastward to its terminus at the potential Orme Reservoir. Construction of the dam did not receive Congressional approval [Sections 303(a) and 605, P.L. 90-537] as a result of testimony based on adverse environmental effects in the reservoir area, such as loss of riparian habitat and animal communities within the area of inundation at Bridge Canyon, alteration of esthetic values of the river, changes in downstream flow patterns, and displacement of stream-dwelling vertebrates and invertebrates by reservoir conditions and by those species more adapted to reservoir environment. This tunnel route concept also is economically inferior to the Parker pump route.

B. Alternatives Considered for Individual Segments of the Feature [132]

The pumping plant site and tunnel that were selected and discussed in this statement are considered most suitable based on a combination of engineering and geological studies of foundation conditions, location studies for discharge lines and tunnel, environmental considerations, and construction and operating costs. Selection of the proposed pumping plant site was further influenced by a geological study in the area that was completed in 1965. This study recommended that the pumping plant be located so as to provide a foundation entirely of gneiss, since location of the plant on a sandstone foundation north of the gneiss-sedimentary rock contact would be inadvisable due to the suspected low-bearing strength and instability of the sandstone when saturated. The site selected also affords a discharge pipeline profile having little if any sidehill location and requires a shorter discharge line than any of the other sites and locations studied.

1. Alternative Routes Considered for the Buckskin Mountains Area

Figure 18 shows the location of the four alternatives discussed below. All of these alternative routes would provide for pumping water to a common elevation of approximately 1225.

a. Alternative Route No. 1

Alternative Route No. 1 would skirt the north slope of the Buckskin Mountains along the Bill Williams River. It would continue along the Buckskin Mountains up the Mineral Wash drainage area following its eastern facing slopes and cross through a saddle between

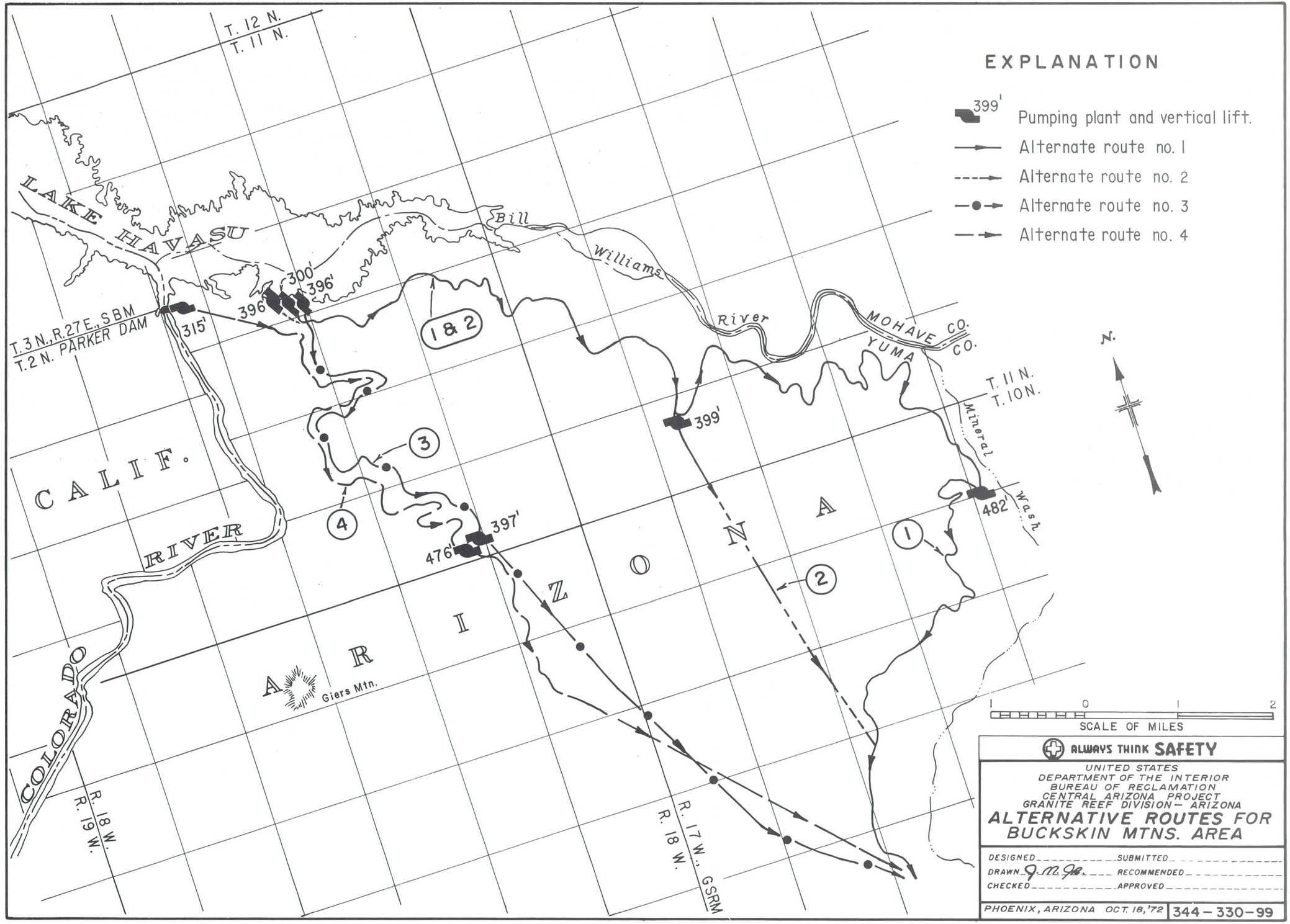
EXPLANATION
399' Pumping plant and vertical lift.
Alternate route no. 1
Alternate route no. 2
Alternate route no. 3
Alternate route no. 4
T. 12 N.
T. 11 N.
LAKE HAVASU
Bill Williams River
MOHAVE CO.
YUMA CO.
T. 3 N., R. 27 E., SBM
T. 2 N. PARKER DAM
315'
300'
396'
396'
1 & 2
399'
T. 11 N.
T. 10 N.
Mineral Wash
482'
3
4
397'
476'
CALIF.
RIVER
COLORADO
ARIZONA
Giers Mtn.
R. 18 W.
R. 19 W.
R. 17 W., GSRM
R. 18 W.
N.
1 0 1 2
SCALE OF MILES
ALWAYS THINK SAFETY
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION — ARIZONA
ALTERNATIVE ROUTES FOR BUCKSKIN MTNS. AREA
DESIGNED
DRAWN
CHECKED
SUBMITTED
RECOMMENDED
APPROVED
PHOENIX, ARIZONA OCT. 18, '72
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Figure 18

the Mineral Wash and Osborne Wash drainage areas, with delivery of water to the Osborne Wash area. Tunnels would be avoided wherever possible. Two pumping plants would be required with 300- and 482-foot lifts, respectively.

b. Alternative Route No. 2

Alternative Route No. 2 would also follow the north slope of the Buckskin Mountains for about 4.6 miles and then enter a 3.3-mile tunnel and travel in a southerly direction to the Osborne Wash area. This route would require 2 miles of open canal, four tunnels having a total length of 5.6 miles, and two pumping plants with lifts of 396 and 399 feet, respectively.

c. Alternative Route No. 3

Alternative Route No. 3 would follow the western slope of the Buckskin Mountains for about 3.5 miles and then enter a 3.9-mile tunnel and continue in a southeasterly direction to the Osborne Wash area. This route would require 1.7 miles of open canal, two tunnels having a total length of 5.3 miles, and two pumping plants with lifts of 396 and 397 feet, respectively.

d. Alternative Route No. 4

Alternative Route No. 4 would eliminate the intake channel because the intake would be located near Parker Dam and away from the sediment delta. This route, like Alternative Route No. 3, would follow the western slope of the Buckskin Mountains but in a southerly direction for 7.5 miles, then through a 2.9-mile-long tunnel in a southeasterly direction to the Osborne Wash area. Approximately 5.1 miles of this route would be open canal, with three tunnels totaling 4.3 miles in length, and two pumping plants with lifts of 315 and 476 feet, respectively.

2. Alternatives Considered for the Intake Channel [53, 88]

One alternative to the intake channel which was considered was the construction of a 10,000-acre-foot-capacity sediment barrier dam on the Bill Williams arm about 1 mile upstream from the pumping plant site. This alternative was eliminated because of higher estimated construction costs, excessive evaporation losses, and the irreversible adverse effects on the Havasu National Wildlife Refuge. A major portion of the littoral zones associated with the productive shallow area within the Refuge depends on the sediment delta and phreatophyte growth upstream from the site.

Studies of the alternative intake channels considered the impact on the environment and ecology of the area; impact on recreation facilities, both present and future; sediment deposition levels; and

construction costs. The results and recommendations of these alternative studies include the intake channel design recommended in this statement and 7 other alinements or variations contained in the "Report of Ad Hoc Committee on the Evaluation of Inlet Channel to the Havasu Pumping Plant - Central Arizona Project," dated October 23, 1970. A general layout of the selected and alternative intake channels is shown on Figure 19. A discussion of the various alternatives follows:

a. Route A - Intake Channel Located through Present Marina Cove

Route A would be a channel which would pass through the Havasu Springs Resort marina where the lessee presently has docking facilities and a concrete block building housing a store, restaurant, and motel. This route would probably require at least partial cancellation of the lessee's concession.

Since the marina and cove are the principal assets of the concessionaire, the United States would probably have to cancel the concession contract and pay compensation to the concessionaire as provided in the concession contract. If the concession contract were canceled, the United States could reissue the lease subject to the Government's right-of-way and could sell the remaining improvements to a new lessee. However, without the marina and cove, the value of the concession would be greatly diminished. It is questionable whether the area could be readily leased to another concessionaire without the natural cove since it is difficult to construct and maintain docking facilities on other portions of the peninsula.

The probable compensation for canceling out the leasehold is difficult to determine at this time. The concession has a very high potential since it has an almost exclusive location on the Bill Williams arm of Lake Havasu. Due to the fact that there is only a small amount of privately owned land in this area and also due to the ruggedness of the terrain, it would be almost impossible to construct a similar type of recreation development within several miles of this facility.

As with all alternatives, the primary inlet from the lake would have to be provided with safety facilities. A bridge would be required for access across the channel. The Route A inlet grade would be above the estimated 100-year sediment deposition level.

b. Utilizing Route A and Replacing the Marina Facilities

This alternative would use Route A for the channel as described above and replace the marina facilities by excavating a new cove on the west side of the peninsula and rebuilding marina and other service facilities equal to those now existing.

This alternative was rejected because the furnishing of an equivalent marina area would require such extensive space that much of the present and proposed developments would be eliminated.

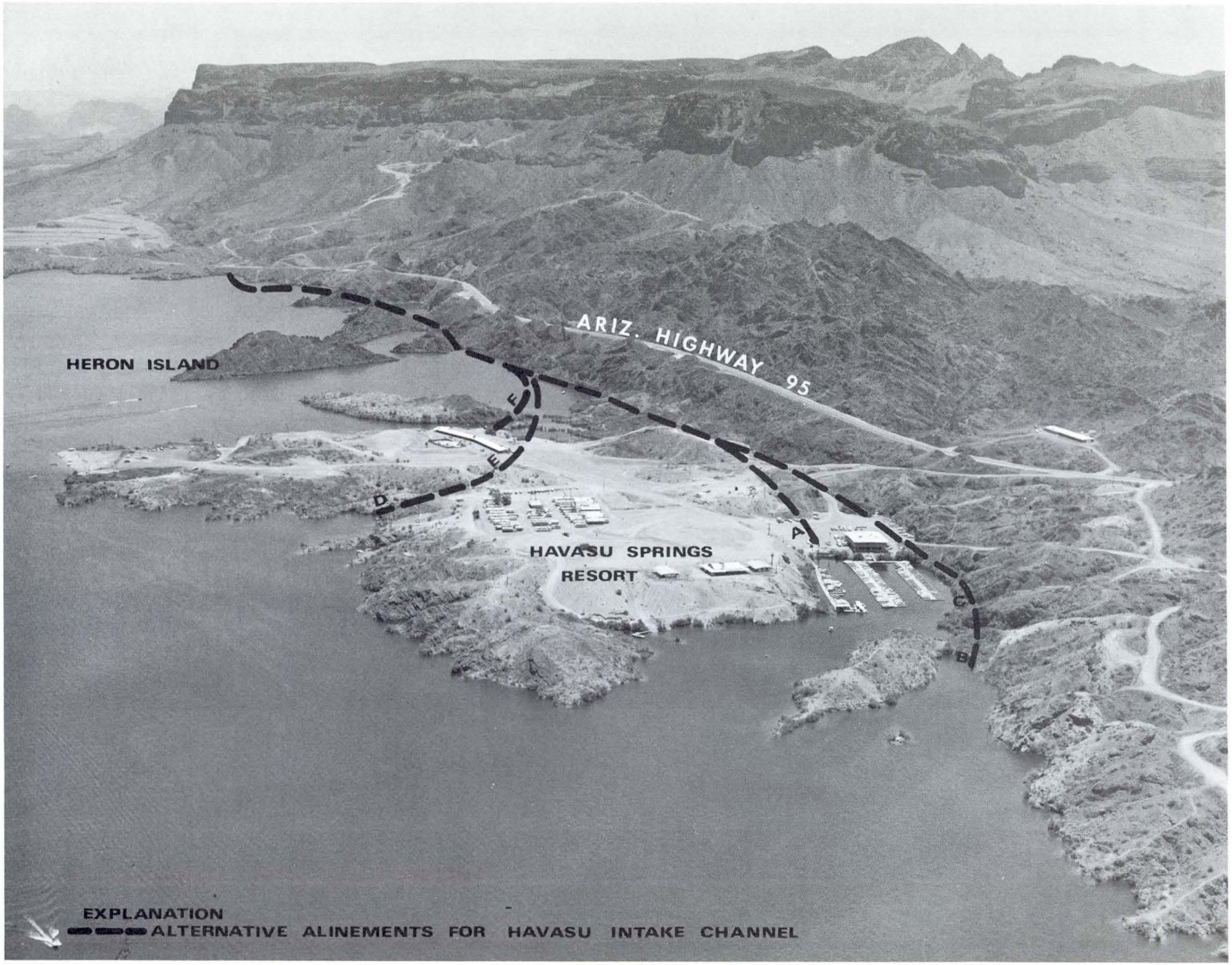


Figure 19

View of Havasu Intake Channel Alternatives A, B, C, D, E, and F in relation to Havasu Springs Resort and proposed pumping plant site. Photograph No. P344-300-13148

c. Route B - Open Cut South of Marina

The advantages of this alternative are: (a) the intake point to the lake would be located where there is little, if any, public use, and (b) there would be no interference with present and proposed future marina facilities.

The cut required for the channel would be quite large, ranging up to 200 feet in width and approximately 100 feet in depth. Although cuts in similar rock, due to uniform coloration throughout the rock, do not present a noticeable difference in appearance, a cut of this magnitude necessarily would have impact on the environment. There would be a hazard during construction operations inasmuch as blasting would have to be performed within 70 to 80 feet of the existing buildings with the attendant risk of damage to these buildings. This route, because of the size of the cut, would present a greater safety hazard to the public than any of the other alternatives considered. Access to the existing facilities would require a major bridge over the channel. The inlet grade would be above the estimated 100-year sediment deposition level.

d. Route C - Tunnel South of Marina Facilities

Construction-wise, this route is the most expensive of the alternatives considered. There would be a hazard during construction of the tunnel inasmuch as blasting would have to be performed within 70 or 80 feet of the existing buildings. However, the route would present several advantages, namely (a) less impact on the environment and the resort area during construction and operation than all the alternatives considered with the possible exception of Route F, (b) no access bridge would be necessary, (c) the intake would be located at a point where there is little public use, and (d) operation and maintenance costs would be minimal. The intake grade would be above the 100-year sediment deposition level.

e. Route D - Buried Conduit Through Peninsula to North Side

The environmental impact would be less than for Routes A and B but would be higher than the impact for Routes C, E, and F, as the present use of the inlet on the north side of the peninsula for boating and swimming would have to be discontinued and a protective inlet structure constructed. Further, there would necessarily be considerable interference with the lessee's operations during construction of the buried conduit as the cut would run directly across the middle of the developed property. The estimate of damages that may be claimed by the lessee is undeterminable. However, it seems certain that the lessee would demand payment for damage to his operations. With this route, an access bridge would not be required. The intake grade would be above the 100-year sediment deposition level.

f. Route E - Tunnel on Approximately the Same Alinement as Route D

Use of a tunnel would minimize the interference with the lessee's operations that would occur with the cut-and-cover conduit route. However, the impact would be the same on the inlet on the north side of the peninsula as the cut-and-cover route. It is estimated that the tunnel route would cost more than the cut-and-cover route even with possible payment to the lessee for interference to his operations if the cut-and-cover route were utilized.

g. Route F - Channel Terminating between Existing Site of Peninsula and Adjacent Island

Route F would closely parallel the existing shoreline and would require surface, as well as subaqueous, excavation. The embankment for the channel would be essentially linear except at the inlet end. It would be constructed with materials excavated for the channel and the pumping plant. A portion of the east side of the peninsula would have to be restricted from public use for boating and swimming and other water-oriented uses. There would also be some interference with the concessionaire's operations during construction. The construction costs are the lowest of the alternatives considered and rejected. The 100-year sediment deposition level was forecast to be slightly above the bottom of the intake.

3. Alternative Pumping Plant and Tunnel Locations and Designs Considered

Three pumping plant locations were considered. The two locations that were rejected were west of the presently planned site. Two designs for the pumping plant, one standard and one low profile, were investigated. The alternatives in the discharge line design were above or below ground. Three tunnel locations were evaluated. The selected tunnel alinement is west of the two other locations. Two bridge designs were considered for Arizona State Highway 95. One was a concrete-beam design and the other a steel design. Two schemes for the cut slopes were evaluated. One was a steep slope scheme (slope 1/2:1) and the other a more gradual slope (1:1).

4. Description of the Present Environment of the Alternatives

The climate, topography, and geology of the area which would be affected by any of the alternative routes would be similar to those described earlier in this statement for the selected plan. The rock types along the lakeshore change from gneiss, a very hard metamorphic rock, to a much softer, less stable sedimentary rock. One of the alternative pumping plant sites would be near the sediment delta of the Bill Williams River and would require the construction of a barrier

dam which would alter the pattern of waterflows and sediment deposition in the upper end of the Bill Williams arm of the lake.

The Buckskin Mountains are a rugged, sparsely vegetated range which trends northeast-southwest along the shore of the Bill Williams arm of Lake Havasu. Several intermittent washes form small alluvial fans at the base of the range. Osborne Wash is on the southeast side of the range where the open canal section of the Granite Reef Aqueduct will receive the water for conveyance to central Arizona.

Native vegetation in this area generally is very sparse and limited to desert species such as cacti, catclaw, cholla, creosote bush, and paloverde, and in some of the washes, mesquite and ironwood. Much of the land along the south and east shores of the Bill Williams arm of Lake Havasu is included in the Havasu National Wildlife Refuge. The refuge contains marsh, delta, and river riparian habitat areas which are used by migratory waterfowl and resident wildlife. A rookery of the great blue heron is found on Heron Island outside the refuge. A small herd of deer uses the area and a small band of desert bighorn sheep inhabits the Buckskin Mountains. Vegetation density increases and changes to a marshy riparian stream type along the Bill Williams River which constitutes the primary wildlife habitat in the area. The lake itself supports a warmwater fishery. Many species of small mammals and birds are found around the lake.

The Colorado River has been significantly altered by the construction of dams like Parker, Davis, and Hoover, and subsequent inundation of areas of desertlands. Recreational and other developments have also changed the natural environment of this area. While most of this human disturbance has been water-oriented along the immediate shoreline, the surrounding mountain and desert areas until recently were largely undisturbed by off-road recreation vehicles. Archeological surveys in this area have not discovered any major sites.

5. Impacts of the Alternatives

Of the several alternative route designs considered for the initial reach of the Granite Reef Aqueduct, as discussed previously under B.1., the first two would have a more significant impact on the Havasu National Wildlife Refuge in that these two routes would involve more work along the Bill Williams River.

This same impact is not present in the latter two alternative routes, which were rejected on engineering grounds and cumulative analysis of each of the components of the feature. The route that was selected is a combination of the most advantageous components from an environmental, engineering, and geologic standpoint.

The selected intake channel design, with its landform embankment and attendant recreational potentialities, will be constructed

from excavated materials available from the pumping plant site and other components of the Havasu complex. The advantages of the selected intake channel design over Alternative F and the other alternatives discussed under B.2., include: (1) decreased construction costs, (2) more adaptability to landform design, (3) potential for incorporation of recreational facilities, (4) availability of spoil materials from other segments of the feature, and (5) enclosure of a smaller surface area of the Bill Williams arm of Lake Havasu. Three disadvantages of the selected design are: (1) minor increase in the quantity of suspended sediment passing through the Havasu Pumping Plant and into the aqueduct system, (2) lack of land-based access to all areas of the intake channel for maintenance purposes, and (3) the possible need for dredging and deposition of sediment deposits encroaching within the intake channel during the life of the project.

The environmental impact of Route A, excluding the effect on the marina, is medium in relation to the other alternatives. Route A would provide for greater than 100-year sediment protection. However, Route A would fail to utilize material from necessary excavation, reduce the available surface acres of water for recreation, create a more extensive loss of aquatic habitat, interfere with the natural continuity of the shoreline and adjacent islands, displace existing concession facilities, and have a greater visual impact on the esthetic value of the overall area. The impacts of the variation of Route A would be similar to those described above. In addition, there would be increased disruption of the shoreline resulting from cove excavation and complete relocation of the marina. This alternative was rejected because of the extensive space required to develop an equivalent marina area.

The impacts of Route B would be similar to those of Route A. Additionally, there would be more significant impact on esthetic values and a greater potential loss of wildlife from drowning in the open intake channel. This route was eliminated because of safety hazards to the public due to the size of the cut required, esthetic considerations, and greater cost.

Route C was eliminated because of environmental impacts similar to those for Route A, plus a need for additional spoil deposit areas, and an increased cost of approximately $5 million.

Route D would entail less environmental impact than Routes A or B since the structure would be underground. However, Route D would have a higher adverse impact than Routes C, E, or F, since it would necessitate a larger area for spoil deposition and would disrupt existing resort concessions. The cost would be greater than Routes A, B, or F.

Route E would have impacts similar to those associated with Route D but would be about three times as costly as Route F.

Route F would be more costly than the selected plan. It would also disrupt extensive shoreline area, and restrict public use of the east side of the peninsula. Route F would diminish the open water area of the lake more than the selected plan. Following extensive evaluation of the environmental, economic, and recreational factors, together with the effects on the existing Havasu Springs Resort, Route F was rejected in favor of the selected landform embankment.

The two pumping plant locations that were rejected involved more extensive cuts into the rock hills than the selected site as well as a cofferdam in Lake Havasu. In addition, both of the respective discharge line locations would be more expensive, have greater visual impacts, and involve more difficult rerouting of Arizona State Highway 95 than the chosen alinement. The standard design for the pumping plant was rejected in favor of the low profile design on the basis of esthetic considerations and the development of more efficient pumps. The below-ground design for the discharge lines was selected because it would present less difficulty in anchoring the lines, less potential interference with wildlife movement, and a lesser visual impact than the above-ground lines. The present tunnel location was chosen on the basis of geologic and economic investigations, and contemplated a lesser environmental impact from construction and operation of this component. The selected concrete beam design for the bridge on Arizona State Highway 95 was chosen for its compatibility with the pumping plant design and surrounding area, and for compliance with the specifications of the Arizona State Highway Department. A steel design was rejected due to its incompatibility with the improved appearance plan for this feature. The steep slope scheme for cuts involved in site preparation was rejected following evaluation of geological factors.

C. Alternative Power Sources [5, 8, 37, 38, 42, 43, 114]

To meet the 285 megawatt pumping load, alternative sources and line routings have been considered.

During the general planning stage of the CAP, several sources of power have been considered for meeting the aqueduct pumping requirement. Early studies and the 1947 Central Arizona Project planning report included a 750-megawatt Bridge Canyon (Hualapai) Powerplant as the primary source of pumping power. The 1963 supplemental report included a 1,500-megawatt powerplant. At that time, provisions for 17,500 kilowatts of installed power at Orme Dam (then Maxwell-McDowell Dam) and turnout locations where powerhead could be recovered were also included.

During the formulation of the Pacific Southwest Water Plan which incorporated the CAP as a unit into the plan for regional water resource development, consideration was given to obtaining power to meet CAP pumping requirements and to assist in repayment by combining the power units at Bridge Canyon and Marble Canyon Dams on the Colorado River. (In January 1964, the Secretary of the Interior submitted the Pacific Southwest Water Plan to the Congress.)

Because of objections to the Bridge Canyon and Marble Canyon Dams for environmental reasons, the Secretary of the Interior in 1966 directed the Bureau of Reclamation to analyze alternative plans to provide for the CAP pumping power requirement. The results of these studies were utilized in formulating a revised development program. This revised program was presented in a report entitled "Summary Report--Central Arizona Project with Federal Prepayment Power Arrangements," dated February 1967. On March 2, 1967, this report was transmitted to the 90th Congress. The main difference in the revised program as outlined in the report was the replacement of the Marble Canyon and Bridge Canyon Dams and their hydroelectric units with a coal-fired thermal power unit. Public Law 90-537 directed the Secretary to find appropriate arrangements for supplying project energy requirements. This direction ultimately resulted in Federal participation in the Navajo powerplant project located near Page, Arizona. Environmental analysis of that project is contained in the Navajo Project Final Environmental Statement, dated February 4, 1972.

With a period of a few years between the start of construction for the Havasu complex and the need for the integrated transmission system for the CAP, the conceptional design routing is subject to modification to best meet the fast-changing energy requirements in southern California and the Southwest power market area. This procedure will allow the project to capitalize on existing facilities and utilize or share facilities required to meet other needs.

The integrated transmission system, which will serve the CAP, will be included in later individual environmental statements.

D. No Construction Alternative of the Proposed Action [132]

A no-action alternative would be no construction of the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel. With no alternative replacement feature, this alternative would preclude construction of the CAP and would not meet the objectives of the CAP as set forth by Congress in Public Law 90-537 and outlined in the overall environmental statement for the CAP. The no construction alternative would have no physical impact upon the feature area.

The Colorado River would remain very similar to the conditions found today and those projected by the Comprehensive Framework Study. As the salinity of the river will not be affected by the project, no difference would be seen without it. The water allocated to the State of Arizona would undoubtedly continue to be used for the most part by the State of California in the absence of CAP or a similar system in Arizona. Flow patterns would be slightly different in the reach of the river between Hoover Dam and Lake Havasu, due to the lack of increased flows for CAP diversion. The Lake Havasu area would not have the minor impacts which will be associated with the Havasu feature as discussed in Chapter III.

If the Havasu feature is not constructed as a part of CAP, central Arizona's water supply would continue to come from local sources. At the present time, water consumption exceeds the safe-yield supply of local sources by approximately 2.1 maf per year. As future consumption increases, overdraft of aquifers would continue, eventually exhausting some basins entirely. Water would have to be obtained from deeper or more distant aquifers or from some aquifers which are not presently used because of poor water quality. This would increase costs of delivery and treatment, raising consumer costs, and decrease the agricultural productivity. Land subsidence would continue in the central service area of Arizona, causing increasing problems for agriculture and possibly threatening several of the small communities in the area.

If the water which the Havasu feature will provide is not made available, those agencies which supply water to users in the central service area of Arizona would probably utilize any and all other sources of water which they could obtain. Some alternative facilities of the CAP would undoubtedly be constructed for the control, storage, and conveyance of intermittent surface runoff waters on the Salt, Verde, Gila, San Pedro, and Santa Cruz Rivers. However, such a fragmented or less than multiple-purpose approach would not be in the best interest of the public, and would waste the opportunity to realize the savings offered through the complementary nature of the several functions of the CAP. Through the sharing of CAP elements such as rights-of-way, carriage losses, and management, efficiencies in the provision of the various services are effected. It would cost some 50 percent more to provide the same services by single-purpose undertakings. In addition, such undertakings would have similar impacts on the environment in the area as those associated with development of major features of the CAP.

It is not possible to predict exactly where the impact of a restricted water supply without CAP would be felt. Tests indicate, however, that even under the most favorable and ideal conditions where reductions are limited to agricultural sectors, the economy would suffer a substantial absolute loss. The realities of the water supply systems, water rights, and legal and institutional arrangements indicate that it is highly unlikely that such a limiting of reductions could be accomplished. Some sharing of the impact by both agriculture and other industries would occur.

Besides the conversion of agricultural lands to urban development, much agricultural land in central Arizona would eventually be abandoned by agricultural production due to lack of water supply and would not be put to any other use. Neither would the State of New Mexico be able to increase its consumption of Gila River waters, as the increased amount of water would not be available for the exchange in Arizona. This would have limiting effects on the economy and other developments in the southwestern portion of New Mexico, and the Indian communities in the central Arizona service area.

Recreational opportunities provided by Colorado River water as a part of the CAP would not materialize. Therefore, the projected deficit in water-based recreation days would not be met or reduced.

E. Alternative Water Sources [31, 43-52, 55, 58, 59, 107-111]

Several sources of water and ways and means of conserving present supplies of water were evaluated and examined for viable alternatives to diversion of Colorado River water. None of these alternatives appear to be feasible, but they could enhance the long-range success of the CAP or serve as a second stage of development. One problem common to all these alternatives is that they would only provide very limited sources of water in relation to the needs. Regardless of the source of water, distribution and storage facilities similar to those of the CAP would still be required to effectively manage the water supplies in central Arizona. The environmental impacts of the facilities needed to accomplish the overall objectives of the CAP would be similar to those associated with the CAP. Additionally, most of the alternatives evaluated would not supply the quantity of water that the Colorado River will provide.

Alternative sources of water, for the CAP were fully evaluated on pages 189 through 195 of the CAP overall environmental statement. Due to the relationship between the function of the Havasu feature as a part of CAP and the availability of water, that material is also presented below.

1. Use of Recycled Water Produced in the Service Area

Water reclamation projects provide great promise for increasing the efficiency of waste water reuse. Research and pilot studies are underway in Phoenix at the "Flushing Meadows Project" and in Tucson at the "Waste Water Reclamation Project," where municipal waste water is being reclaimed for irrigation, recreation, and possibly mining and other industrial uses. Wastes would be treated to an equivalent secondary level after which the treated effluent is applied to the land for removal of additional impurities by infiltration through the soil. Water would be made available by ground-water recharge and is available for unrestricted irrigation and recreation uses. In addition, mining and other industrial uses are being studied. Potential health hazards and other possible adverse environmental consequences resulting from utilizing soil for further impurity removal by filtration have not been fully evaluated. Studies regarding pathogen and/or other bacterial responses and the effects on the soil fertility, percolation rates, and long-term ground-water recharge will require further investigation and analysis before total health and other environmental effects can be predicted in the central service area. In the meantime, recycled sewage water is now being successfully used only for lower priority needs such as greenbelt park irrigation and certain nonfood crops. Reclaimed sewage water is generally not presently considered acceptable for direct domestic water supply.

Future projected water requirements in the CAP service area greatly exceed the quantity of waste water potentially available for reuse. Satisfaction of these water requirements will necessitate the availability of another water supply to augment existing surface and underground sources. Thus, recycling is not a practical or viable alternative, but is a necessary supplement to the CAP water supply and diversion from the Colorado River.

2. Precipitation Management [44-47]

The subject of precipitation management, or weather modification, has been under intensive investigation for about 25 years. Since 1966, the bulk of precipitation management research has been conducted or sponsored by the Bureau of Reclamation. The program is known as "Project Skywater," and is a coordinated multidisciplinary effort with the goal of putting together various systems to manage the amount and distribution of precipitation in an efficient, economic, socially acceptable manner. About 90 percent of Project Skywater activities are conducted through contracts with colleges and universities, private organizations, and State and other Federal agencies. In addition, the National Water Commission is studying the effects of precipitation management experiments.

A number of studies have been conducted in various places in the West, including selected locations in the Colorado River Basin. These include selected sites in Arizona, both in the mountainous regions and in the desert areas. The results of these experiments and studies have not been uniform. Various techniques for seeding clouds were used, with effects that were not completely predictable. Under certain meteorological conditions, cloudseeding led to more precipitation. Under other conditions, cloudseeding led to less precipitation or had no measurable effect. Moreover, the effects of cloudseeding on precipitation are predictable for only a limited number of cloud systems. The meteorological conditions which may influence snowpack increases from cloudseeding of orographic storms over the western mountains have now been reasonably well identified. While recent progress in modification of precipitation from convective storms is promising, the effects of such modification cannot yet be reliably predicted.

Beneficial use of augmented runoff for water supply depends upon its capture. This depends on the timely availability of reservoir storage. As yet, there is very limited information as to the effectiveness of precipitation modification in increasing water supply during sustained or protracted drought periods. Results to date indicate that the potential during such periods may not be great. In areas where substantial extra annual or carryover storage is available the average annual water supply may be increased by seeding during wet periods.

Precipitation management may represent a potential source of new or additional water for a basin by producing runoff from precipitation

that normally would not have fallen on the basin. Probable low operational costs, program flexibility, and the high quality of water produced, make precipitation management a desirable method for increasing the water supply where seeding conditions are suitable. However, within the Colorado River Basin most of the potential for water created would be found in the Upper Basin. In addition, more research is needed to develop a better understanding of the physical mechanisms of precipitation and the statistical effects of cloudseeding operations, and to improve existing seeding techniques. The legal ramifications and environmental consequences also need clarification. A firm annual increase in snowpack may have a direct effect on game and nongame species composition and behavioral patterns, and on vegetation associations. Increased precipitation in the form of rain would need to be scrutinized in respect to similar impacts. Other considerations would be directed to erosion potential, nesting habits of the avifauna, and the character of burrowing animals in the areas affected. Increased precipitation in a given area on a regular basis could increase the biological carrying capacity of the area. Without regularity of precipitation, flora and fauna populations would continue to fluctuate in response to available moisture. All of these considerations are now being studied by Project Skywater. Precipitation management is approaching practical application; but as an alternative for the CAP, and diversion from the Colorado River, it can be considered only a promising supplemental source of additional water.

3. Conservation of Irrigation Water [48]

The long history of the scarcity of water and the increasing costs of pumping water have made the agricultural industry in the lower Colorado region of the Colorado River Basin look critically at water management. Even though the full potential has not yet been realized, much has been accomplished in efficient use of water supplies within the lower Colorado region, especially in the Gila subregion, which in essence comprises the CAP area.

Irrigation facilities and conservation measures that have been installed on the land include about 6,394 miles of irrigation ditch lining, canal lining, and irrigation pipelines that have been installed to reduce seepage losses. More than 146,000 water-control facilities have been installed in the CAP service area, including major storage reservoirs, diversion dams, tailwater recovery facilities, pumping plants, and other water-control structures designed for better water management. In several areas where ground water and surface water are incorporated in the same system, pumps can be regulated to minimize system waste and assist in creating a flexible and reliable operation. This and other advanced water management techniques are being increasingly applied throughout the lower Colorado region and Gila subregion. Expansion of these practices can have a significant beneficial effect, but the resultant water savings will only be a supplement to CAP and therefore cannot be considered an alternative to diversion from the Colorado River.

4. Increased Watershed Runoff [49-52, 78]

Watershed management is directed at the use of land to improve the quantity and quality of water, to reduce erosion and sediment yield, and to maintain a productive watershed. Proper management must consider a number of factors, including past use of the land, ownership patterns, soils, vegetative types, climate, and physiography. Any well-balanced watershed management program must consider the use and development of such resources as timber, forage, and wildlife, and such social values as recreation, esthetics, and population dispersal.

The need for increased watershed yields is greatest in the West. Studies in Arizona and watershed research in Colorado, the intermountain area, the Pacific Northwest, and California, are providing valuable information for land managers. At this time, however, further study is needed before the effects of various watershed management programs can be reliably determined. Certain conclusions can be drawn and basic assumptions can be made from existing research. Generally, larger increases occur when precipitation is low. The possibilities for increasing water yields in the West appear to be most favorable in areas of high elevation and greater precipitation. Research has shown that partial cutting in some types of forests can provide opportunities for increasing water yield through redistribution of the heavy snowfall and reduced evapotranspiration. Replacement of native vegetation with grasses in some areas has yielded inconclusive results.

The Salt River watershed offers a good example of problems associated with watershed management which need to be evaluated. It has been estimated that an additional yield of 145,000 acre-feet of water annually could be obtained by vegetative management on 710,000 acres in the Salt River watershed. Most of this work would involve modifying timber harvesting practices and conversion of chaparral and mountain brush to shallow-rooted grasses and forbs on watershed lands at higher elevations where precipitation is greater. One of the major environmental considerations associated with this alternative is the conversion of a large number of acres of native vegetation at higher elevations to grasses and forbs. Complete conversion of native vegetation to grasses and forbs could not be accomplished without almost total alteration of the associated fauna. The displacement and alteration of existing species may be followed by establishment of species adaptable to a grassland habitat or by creation of empty niches. The impact of such displacement and alteration is not fully known. It would vary from place to place depending on the area being managed.

Water gained by watershed management has the potential of supplying additional water in the Gila River Basin and reducing the requirements for imported water. To be of benefit to New Mexico, this alternative would probably involve a portion of the Gila Wilderness Area. Further studies will be necessary in order to fully

evaluate the contribution this program could have toward increasing water supply and the impact the program would have on all aspects of the environment. Present information indicates that water increases developed from watershed management programs would be supplemental to the importation of water by the CAP and not of sufficient quantity to be considered a suitable alternative to diversion from the Colorado River.

5. Import from Other Basins [107-109, 111]

Transfer of water from areas of surplus, such as Alaska or the Pacific Northwest, has been contemplated but legislative constraints have been imposed prohibiting current study of its potential. P.L. 90-537, Section 201, provides that "...for a period of ten years from the date of this Act, the Secretary shall not undertake reconnaissance studies of any plan for the importation of water into the Colorado River Basin from any other natural river drainage basin lying outside the States of Arizona, California, Colorado, New Mexico, and those portions of Nevada, Utah, and Wyoming which are in the natural drainage basin of the Colorado River." Since these studies have not and cannot be initiated for some time, inter-basin transfer does not appear to be a presently available alternative water source in lieu of diversion of a portion of Arizona's present entitlement to Colorado River water. In addition, the normal lead time from start of planning through an authorization and contracts for inter-basin transfer of water could require from 20 to 30 years or more. Moreover, if water were available in the Colorado River system from inter-basin transfer, some delivery system similar to CAP would have to be constructed if this water were to be used elsewhere within Arizona other than along the Colorado River itself. Environmental impacts from this delivery system would be similar to those of the present CAP. Additional impacts on the environment would be experienced outside the currently anticipated CAP area.

6. Geothermal Sources [55, 58, 59, 110]

Studies of the geothermal resources in Imperial Valley, California, indicate that substantial quantities of high salinity water with a high heat content may be stored in the deep ground-water basin. The area southeast of Yuma, Arizona, is also considered to have high potential for geothermal development. Utilizing the produced steam as an energy source for desalting this water may be an attractive source of new water for the possible augmentation of the Colorado River. If geothermal development is successful, the possibility for development of a relatively nonpolluting source would also exist.

Utilization of desalted geothermal water as a supplement to the Colorado River water would require a transport and storage facility equal to or more elaborate than the one selected for the CAP. The extent of such facilities would be dependent upon the source and point of use for the water. The current state of technology and the insufficient knowledge relating to the quantities of water potentially available preclude geothermal sources as being a feasible or viable alternative to CAP.

The impact that geothermal development would have on environmental values is being considered in connection with geothermal resource investigations being conducted in Imperial Valley, California.

A final environmental statement on the Deep Geothermal Test Well, Geothermal Resource Investigations, Imperial Valley, California, FES 72-9, was filed with CEQ on April 28, 1972. The final statement for the Skid-Mounted Desalting Unit and Injection Well (FES 72-21) was filed with CEQ on July 10, 1972. A brief summary of the environmental impacts of the geothermal investigations is provided below.

About 14-20 acres of desertland will be required for access roads and work areas during drilling and testing of the well. A minor impact on the overall esthetic value of the area will thus occur. The nature of the construction is such that it lends itself to restoration of the terrain's natural conditions at the completion of the work. The behavioral patterns of the few animals in the area might be temporarily altered by the presence of men and machinery. During operation and testing of the well, some noise could be expected during steam blowoff. Noise levels will be controlled by using silencers or other means to prevent injury to workmen. Accidents that could occur during drilling and testing of the well include blowout, leakage or spillage of geothermal brine, and inadvertent venting of quantities of noxious gases to the atmosphere. Stringent precautions will be enforced throughout the various operations to insure against such accidents. Certain amounts of objectionable gases, mostly hydrogen sulfide, might be encountered during investigations. These gases, if present, should be in low concentration and should disperse sufficiently within a short distance so as not to be objectionable. The presence of gases will be periodically monitored during the work. Temporary holding ponds for brines are designed to prevent escape of the brine into the surface- or ground-water systems until disposal is effected.

A more detailed discussion of environmental consequences of geothermal development can be found in the subject environmental statements. The future of geothermal water as the byproduct of electrical energy is dependent upon the success of the geothermal testing. The magnitude of the environmental impacts including subsidence effects of this alternative will be directly proportional to the amount of development that takes place in the future.

7. Desalting of Ocean Water [31, 59, 66]

The desalting of sea water has been considered as one of the alternative sources of water. It is not a feasible alternative to initial diversion of Colorado River water for three reasons: (1) large-scale desalting technology has not been proven, (2) the costs of desalting sea water and transporting it to a point on the Colorado River

where it could be further transported to central Arizona are infinitely greater than the economic costs of diverting Arizona's remaining entitlement in the Colorado River, and (3) the leadtime involved in relation to the need.

For the most part, facilities similar to those proposed for the CAP would be needed to convey and regulate the successive stages of desalinized water from the storage area on the Colorado River to the CAP area. Unless the imported sea water were introduced into Lake Mead where storage capacity is available, an additional regulatory reservoir would be required on the Colorado River or elsewhere.

Environmental impacts resulting from construction of an off-river storage reservoir would probably not adversely affect native fish fauna. Adverse impacts on esthetics, land-dwelling vertebrates and invertebrates, vegetation communities, and recreational resources in open space would be similar to those encountered during construction of a reservoir on a stream. The species affected may be different, but the general impacts would be similar. Water quality improvements would be positive if the desalted water were refined to a better quality than that of the stream or the reservoir where desalted water is introduced.

Because of the developmental nature of desalting technology, a detailed evaluation of the impact that desalting of ocean water and the transportation of the desalted water inland would have on the environment is not included in this statement. Preliminary reviews indicate that impacts similar to those associated with the CAP plan would occur in Arizona. In addition, there would be impacts associated with the desalination plant itself, and the conveyance system needed between the desalination plant and the CAP facilities in Arizona. One of the major problems associated with desalting plants is disposal of the brine which is a byproduct of desalinization. As a part of the conveyance system, pumping plants, aqueducts, siphons, bridges, roads, and transmission lines would be required. Environmental impacts of these structures would be similar to those of the CAP aqueducts.

A detailed study of sea water desalinization will be part of the ongoing Western United States water plan studies for augmentation of the Colorado River. Desalting of ocean water is not considered a feasible alternative to the CAP.

CHAPTER IX

CONSULTATION AND COORDINATION

IX. CONSULTATION AND COORDINATION

A. Consultation and Coordination during the Development of the Proposal and during the Preparation of the Draft Environmental Statement

Throughout the period of preauthorization studies and postauthorization advanced planning studies, there has been reliance upon intradepartmental-coordination procedures with the Bureau of Sport Fisheries and Wildlife, Bureau of Outdoor Recreation, Bureau of Land Management, and National Park Service, to utilize their delegated jurisdiction and environmental expertise. The above bureaus and the Bureau of Reclamation have coordinated their activities with the Arizona Game and Fish Department, Arizona State Parks Board, State Land Department, Arizona Highway Department, and the Arizona Water Commission, in order to obtain environmental information for the draft. Additionally, the Central Arizona Project Environmental Advisory Group participated in review of the draft and provided comments thereon. The Advisory Group was organized specifically for the purpose of dealing with environmental aspects of CAP during preconstruction, construction, and subsequent operational activities of the CAP. The membership of the Advisory Group is representative of a broad cross section of public interests in Arizona, including the Arizona Wildlife Federation, the Arizona League of Women Voters, the Arizona State Reclamation Association, the Central Arizona Water Conservation District, the Advisory Commission on Arizona Environment, the Department of Economic Planning and Development for the State of Arizona, and the Bureau of Reclamation.

B. Coordination during Review of the Draft Environmental Statement

Following the distribution of the draft statement, separate meetings or informal discussions were held to discuss portions of the draft with representatives of the Arizona Game and Fish Department, Arizona Water Commission, and others. Preliminary drafts of material to be used in preparing the final environmental statement were also furnished to the Central Arizona Project Environmental Advisory Group for review and comment.

The Draft Environmental Statement on the Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel was filed with CEQ on March 7, 1972. Notification of availability of the draft was published in the Federal Register on March 14, 1972, and also in news releases available to news media on March 14, 1972. The official review period ended April 28, 1972; however, several letters of comment have been received since that closing date. All letters received by October 20, 1972, have been considered in this final statement.

Copies of the draft statement were distributed to about 97 entities, 77 at the time of initial distribution, and 20 subsequent to the initial distribution. Official letters of comments were received from 36 offices

representing 34 different agencies or organizations. Federal Department or Bureau Offices provided 16 letters of comment with eight of these from Interior Department Bureau Offices. State entities provided 12 letters of comments. Three local agencies commented, as did five private organizations. No comments were received from any of the nine individuals who received copies either in the original distribution or by subsequent request. A complete list identifying the entities submitting comments is included with the Summary Sheet in the front of this statement.

A summarization of the distribution made and the responses received is shown below.

Classification	Initial	Subsequent	Total	Entities Responding
Federal Departments	4	0	4	3
Interior Bureaus	7	0	7	6
Federal Administrations, and Agencies, Commissions	2	0	2	2
Federal Field Offices	0	2	2	5
Indian Communities	0	0	0	0
State Executives	7	0	7	1
State Clearinghouses	7	0	7	3
State Agencies/Commissions	17	1	18	8
Local Agencies	8	0	8	3
Corporations	2	4	6	0
Professional Organizations	3	1	4	1
News Media	1	1	2	0
Labor Organizations	0	1	1	0
Private Organizations	17	0	17	4
Individuals	1	8	9	0
Attorneys	1	2	3	0
TOTAL	77	20	97	36

C. Disposition of Comments Received by Official Letter

Copies of the letters of comment received by the Bureau of Reclamation on the Havasu feature are included in the Appended Material of this final statement. All of the comments received have been carefully considered in the preparation of this statement. Wherever appropriate, additions or modifications have been made in the text material as information has been made available. The expanded factual base has allowed Reclamation to fully respond to the questions raised.

Of the total 36 entities responding on the draft, 21 entities made comments that did not request or require significant additions in this final statement. These entities are listed below in the order of the communication date.

1. Comprehensive Health Planning, Clark County, Nevada.
2. State of Utah, Department of Natural Resources.
3. Museum of New Mexico.
4. Advisory Commission on Arizona Environment.
5. Governor of Arizona.
6. Maricopa County Board of Supervisors, and Flood Control District of Maricopa County.
7. State Planning Office, State of New Mexico.
8. Department of Housing and Urban Development, Federal Housing Administration.
9. Museum of Northern Arizona.
10. Department of Agriculture, Soil Conservation Service, Phoenix, Arizona.
11. Department of the Interior, Bureau of Indian Affairs, Phoenix Area Office.
12. Four Corners Regional Commission.
13. Arizona Consulting Engineers Association.
14. Colorado River Commission of Nevada.
15. Department of the Army, Corps of Engineers, South Pacific Division.
16. State of New Mexico, Department of Game and Fish.

17. Department of Transportation, U. S. Coast Guard.

18. Arizona Highway Department.

19. Department of Agriculture, Office of the Secretary.

20. Department of Health, Education, and Welfare.

21. Land Resources and Ecology Committee, Advisory Commission on Arizona Environment.

Expansion of this final statement has provided the basis for response to the substantive concerns of the other 15 entities which provided comments.

Many questions raised by an individual letter have been answered in this statement by a separate reply. The separate replies to the letters of comment are found in the Appended Material behind the respective individual letters. For ready reference to these letters and replies, refer to pages vii and viii of the Table of Contents in the front of this statement.

D. Unresolved Questions

Every effort was made in this statement to quantify the environmental impacts of the proposed work. There are, however, some unresolved questions which cannot be answered at the present time. These include whether fish screens will be needed at the Havasu Pumping Plant, the net effects of the intake channel embankment on the bass spawning potential in the area, the extent of disturbance to the great blue heron colony, and others as described in Chapter III, section D.

These unquantified amenities are recognized in this statement so that methods and procedures can be effected to better understand and evaluate them.

APPENDIX A OF APPENDED MATERIAL

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

MAY 17 1972

Mr. Ellis L. Armstrong
Commissioner
Bureau of Reclamation
Department of the Interior

Dear Mr. Armstrong:

This is in reply to your letter of March 15, 1972, transmitting for our review and comment a draft environmental statement for the Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico.

The proposal for which this statement is being prepared is apparently a major feature of the Central Arizona Project. This draft indicates that a general draft of an environmental statement has been prepared for the Central Arizona Project. The environmental impact of the total project is not included in this statement. We believe that the environmental impact of the Havasu feature of the project can be assessed adequately only in the context of the impact of the total Central Arizona Project.

Thank you for the opportunity to review this draft statement.

Sincerely,

T. C. BYERLY
Coordinator of Environmental
Quality Activities

Replies on Comments made by the
Department of Agriculture, Washington, D.C.
(Letter of May 17, 1972)

1. Comment: The proposal for which this statement is being prepared is apparently a major feature of the Central Arizona Project. This draft indicates that a general draft of an environmental statement has been prepared for the Central Arizona Project. The environmental impact of the total project is not included in this statement. We believe that the environmental impact of the Havasu feature of the project can be assessed adequately only in the context of the impact of the total Central Arizona Project.

   Reply: The Department of Agriculture was sent a copy of both the September 1971 draft and the overall Final Environmental Statement on the entire Central Arizona Project (FES-72-35). The overall environmental impact of the total project, as assessed in the final statement, was not included in the Havasu complex draft statement. Therefore, the Havasu feature can be assessed adequately only in the context of the impact of the project as a whole, and both final statements are available for this purpose.

INFORMATION COPY FOR 100, 700

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

6029 Federal Building, Phoenix, Arizona 85025

RECEIVED APR 12 1972

Action.....
Action Taken.....(Initials)

Date	Initials	To
4/13		150
4/13		155
File		

April 10, 1972

Mr. E. A. Lundberg
Regional Director
Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

The Draft Environmental Statement, Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, has been reviewed. We find the statement well prepared and all items adequately covered.

We are pleased to note that provisions were made to minimize air and water pollution during construction and mitigating measures were included.

Sincerely,

Cliffton A. Maguire
Acting State Conservationist

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

Mr. Ellis L. Armstrong
Commissioner
Bureau of Reclamation
U.S. Department of the Interior
Washington, D. C. 20240

Dear Mr. Armstrong:

This is in response to your letter of March 15, 1972, wherein you requested comments on the draft environmental impact statement for the Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico.

This Department has reviewed the health aspects of the above project as presented in the documents submitted. This project does not appear to represent a hazard to public health and safety. However, there is no mention in the draft environmental impact statement of the provision of a safe drinking water supply nor of appropriate sanitary facilities. Therefore, we recommend that appropriate health guidelines outlined in the following publication be employed during the development of any new or expanded recreational facilities:

Environmental Health Practice in Recreational Areas
(PHS Publication No. 1195)

The opportunity to review this draft environmental impact statement is appreciated.

Sincerely yours,

Merlin K. DuVal, M.D.
Assistant Secretary for
Health and Scientific Affairs

Replies on Comments made by the
Department of Health, Education, and Welfare
(Letter of May 26, 1972)

Comment: However, there is no mention in the draft environmental impact statement of the provision of a safe drinking-water supply nor of appropriate sanitary facilities. Therefore, we recommend that appropriate health guidelines outlined in the following publication be employed during the development of any new or expanded recreational facilities:

Environmental Health Practice in Recreational Areas
(PHS Publication No. 1195)

Reply: Provision of water supply and sanitary facilities at the Havasu complex for construction personnel will be the responsibility of the contractor and is contained in standard construction specification provisions. Provision of the same type facilities at the Havasu Pumping Plant for operating personnel and visitors will be provided as standard Reclamation policy and in keeping with Executive Order No. 11507, "Prevention, Control, and Abatement of Air and Water Pollution at Federal Facilities," dated February 4, 1970. The development of recreational facilities in the Havasu Intake Channel area will be under the administrative responsibility of the Bureau of Land Management. Reference should also be made to the Replies to Comments by the Arizona Water Sports Council and the Bureau of Land Management included in this Appended Material.

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (WS/83)
400 SEVENTH STREET SW.
WASHINGTON, D.C. 20590
PHONE: (202) 426-2262

2 [illegible] 1972

Honorable Ellis L. Armstrong
Commissioner, Bureau of
Reclamation
U. S. Department of the Interior
Washington, D. C. 20240

Dear Mr. Armstrong:

This is in response to your letter of 15 March 1972 addressed to Mr. Herbert F. DeSimone, Assistant Secretary for Environment and Urban Systems, Department of Transportation, concerning the draft environmental impact statement for the Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico.

The concerned operating administrations and staff of this Department have reviewed the environmental statement and noted in the comments of the Federal Highway Administration is the following:

> "We have reviewed the subject Department of the Interior's report as it concerns highways and highway transportation.
>
> "We note that the project will require the reconstruction of a section of State Route 95 and that the proposed work has been coordinated with the Arizona Highway Department."

This Department has no further comments to offer on this draft statement and it is our determination that the impact of this project upon transportation is fairly minimal and we have no objection to the project.

The opportunity for the Department of Transportation to review and comment on this project is appreciated.

Sincerely,

J. M. Austin

Captain, U.S. Coast Guard
Acting [illegible] of Transp.
Environment and Systems

INFORMATION COPY FOR 700

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL HOUSING ADMINISTRATION
244 West Osborn Road, P. O. Box 13468
Phoenix, Arizona 85002

OFFICE OF THE DIRECTOR

April 5, 1972

RECEIVED APR 10 1972
IN REPLY REFER TO:
Action:
Action Taken (Initials)

Date	Initials	To
4/11	[illegible]	150
4/11	[illegible] C	155
File		

U. S. Department of the Interior
Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Re: Draft Environmental Statement, Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buchin Mtns. Tunnel, C.A.P.

Gentlemen:

Please be advised that this office has reviewed the referenced Draft Environmental Statement dated March 9, 1972, and has no comment.

Sincerely,

MERRITT R. SMITH
Director

INFORMATION COPY FOR LLL 700-1P0

DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION, CORPS OF ENGINEERS
630 Sansome Street, Room 1216
San Francisco, California 94111

REPLY TO
ATTENTION OF:

SPDPD-R

27 April 1972

RECEIVED MAY 3 1972

Action:
Action Taken (Initials)

Date	Initials	To
5/4	[illegible]	150
5-5	[illegible]	700
File		

Mr. E. A. Lundberg
Regional Director
United States Department
of the Interior
Bureau of Reclamation
Regional Office - Region 3
P.O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

This is in response to your letter of 9 March 1972 in which you requested Corps of Engineers review and comments on the draft environmental statement for the Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico. In accordance with our review procedures, this letter shall serve as the consolidated response of the District Engineer, Los Angeles and the Division Engineer, South Pacific.

The proposed plan does not conflict with existing or authorized plans of the Corps of Engineers. If a final environmental statement has been prepared for the entire Central Arizona Project we would appreciate receiving copies in both the Los Angeles District and South Pacific Division offices. Such a comprehensive document would provide a better overall perspective and assist us in the review of the environmental statements for each project segment. This would be particularly desirable since several of our future projects will be affected by CAP and this will require close coordination. We have no comments concerning the environmental statement for this proposed action but appreciate the opportunity to review it.

Sincerely yours,

DAVID N. HUTCHISON
Colonel, CE
Deputy Division Engineer

Replies to Comments made by the
South Pacific Division, Corps of Engineers
(Letter of April 27, 1972)

1. Comment: If a final environmental statement has been prepared for the entire Central Arizona Project, we would appreciate receiving copies in both the Los Angeles District and South Pacific Division offices. Such a comprehensive document would provide a better overall perspective and assist us in the review of the environmental statements for each project segment. This would be particularly desirable since several of our future projects will be affected by CAP and this will require close coordination.

   Reply: A final environmental statement (FES 72-35) has been prepared and copies have been furnished to both the Los Angeles District and the South Pacific Division offices. Continuing coordination is being accomplished with regard to the project features that either have flood control functions or will influence or be influenced by Central Arizona Project features.

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

APR 28 1972

Ellis L. Armstrong, Commissioner
U.S. Department of the Interior
Bureau of Reclamation
Washington, D.C. 20240

Dear Mr. Armstrong:

We are replying to your letter of March 15, 1972 requesting our review and comment on the draft environmental statement for the proposed Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico.

This Agency is concerned about the environmental impact of the Central Arizona Project as a whole and is looking forward to reviewing the final statement when it is available. Since it is our intention to address the broader environmental issues at that time, we are limiting our consideration in this review to the specific project at hand.

We believe, if you consider these comments in revising the text of your statement, it will result in a more complete and meaningful evaluation of the environmental impact of this segment of the Central Arizona Project. We would appreciate receiving a copy of your final statement.

Sincerely,

Paul De Falco, Jr.
Regional Administrator

Enclosure

ENVIRONMENTAL PROTECTION AGENCY
REGION IX

Review and comment on the draft environmental impact statement prepared by the U.S. Bureau of Reclamation on the proposed Havasu Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico.

The statement should discuss the quantity of water to be diverted from the Colorado River as a result of this portion of the Central Arizona Project. This is particularly significant in light of the statement's contention that no deterioration of mainstream flows will result from this action. The Bureau should support this conclusion with additional information, addressing particularly the continuing problem of salinity in the lower Colorado.

The statement should expand its discussion of the possible environmental effects of maintenance activities. The pesticides and herbicides to be used in the intake area should be named. The body of scientific knowledge surrounding the long term impact of these products is being expanded rapidly and traditional uses are being questioned. The Bureau should also consider the possibility of biological controls. In addition, planned tunnel cleaning operations should be detailed including the nature and disposition of cleaned materials.

The statement does not discuss the length of time the bass spawning area will be temporarily disrupted. If possible, construction activities might be scheduled, to interfere as little as possible with spawning periods. The effect of the current created by the intake structure on fish fry should be discussed. The anticipated impact of blasting and increasing noise levels from construction on area residents and wildlife should be clarified.

The alternative of no project should be expanded to discuss its general environmental impact.

Replies to Comments made by the
Environmental Protection Agency, San Francisco
(Letter of April 28, 1972)

1. Comment: The statement should discuss the quantity of water to be diverted from the Colorado River as a result of this portion of the Central Arizona Project.

   Reply: This has been accomplished in Chapter I, section E., Chapter II, section K, and Chapter III, sections C.2.f., g., and h.

2. Comment: The statement should expand its discussion of the possible environmental effects of maintenance activities. The pesticides and herbicides to be used in the intake area should be named. . . .In addition, planned tunnel-cleaning operations should be detailed including the nature and disposition of cleaned materials.

   Reply: Chapter III, sections C.2.a., b., and i. provides this material.

3. Comment: The statement does not discuss the length of time the bass spawning area will be temporarily disrupted.

   Reply: The period of time involved in construction of the dike has been more specifically discussed in Chapter I, section D.1. The dike will occupy an area of about 10 acres out of the total water surface area in Lake Havasu of 20,400 acres. As determined by the 1972 underwater aquatic studies, the bass spawning habitat in the vicinity of the intake channel is of poor quality.

4. Comment: The effect of the current created by the intake structure on fish fry should be discussed.

   Reply: The effect or non-effect of the current created by partial shift in water withdrawal from MWD's Intake Pumping Plant to the Havasu Pumping Plant is a partial basis for the underwater survey and monitoring program initiated in 1972. Based on limited observations, the withdrawal of water at the Havasu Pumping Plant should not be a significant factor upon the fish population of Lake Havasu. This is covered in Chapter III., sections C.1.m. and n.

5. Comment: The anticipated impact of blasting and increasing noise levels from construction on area residents and wildlife should be clarified.

Reply: These items have been expanded and discussed in Chapter III., sections C.1.h., i., m., n., and o., and Chapter IV., section B.1. This temporary impact during construction apparently was not considered an adverse factor of sufficient magnitude to delay development of the mobile-home development, the only private property immediately in the area of the proposed work.

6. Comment: The alternative of no project should be expanded to discuss its general environmental impact.

Reply: The no-project alternative discussion has been expanded in Chapter VIII, section D.

INFORMATION COPY FOR

United States Department of the Interior

BUREAU OF INDIAN AFFAIRS
PHOENIX AREA OFFICE
P.O. Box 7007
Phoenix, Arizona 85011

APR 13

Action:		
Action Taken		(Initials)
Date	Initials	To
4/14		150
4/14		155
April 10, 1972		
File		

IN REPLY REFER TO:
Industrial Development

Memorandum

To: Regional Director, Region 3 - Bureau of Reclamation

From: Area Director, Phoenix Area Office

Subject: Review of Draft Environmental Statement for Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project (3-150, 540)

This office has reviewed subject statement and has no comments on the proposed construction.

Acting Asst. Area Director

IN REPLY REFER TO:

1792.2 (220)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

MAY 9 1972

Memorandum

To: Commissioner, Bureau of Reclamation

From: Assistant Director, Bureau of Land Management

Subject: Review of Draft Environmental Statement for Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona - New Mexico

We offer the following comments and information for your consideration:

I. Description of the Project

Page 2, D. General Description of the Feature. What features and disturbed areas, if any, will be visible from State Highway 95 and Lake Havasu?

II. Description of the Environment

Additional information on volumes to be excavated, e.g., jeep road, aggregate borrow area, etc., and the proposed location, method, volume, and composition of spoil material to be disposed of in each area would help describe the effects of disposal of excavated spoil material.

Will disposal of spoil materials take into consideration the coloration of the existing parent material and will it be possible to retain patterns harmonious with undisturbed areas?

Page 8, D. Fish and Wildlife. The Bill Williams Delta provides habitat for the endangered Yuma Clapper Rail. The California Fish and Game Department indicates the rare Humpback Sucker is also present in Lake Havasu (see its January 1972 publication "At the Crossroads.")

Three Bighorn Sheep lambing grounds have been identified in the vicinity of the project area. One located in the Section 3, T. 10 N., R. 17 W. will be accessible via four-wheel drive vehicles and could be adversely affected by construction crews or other parties visiting the area. Will protective measures be taken?

The statement notes the Great Blue Heron on Heron Island could be affected by construction activities in the vicinity of the intake area. A heron rookery at the south end of Topock Gorge was abandoned in 1970 because of disturbance by humans but relocated within a mile. What is likely to happen here?

Wild horses and burros also frequent this general area.

Page 10, E. Recreation, third paragraph. It is indicated an extensive trailer park is likely to expand during construction of the intake related facilities. Will facilities be sufficient to avoid pollution?

III. Environmental Impacts of the Proposed Action

Page 12, 2. Quality of Water. It is unclear what quantity of water will be pumped from Lake Havasu or what affect the removal of this water will have on salinity below Parker Dam.

3. Herbicide and Pesticides. Page 8, D. Fish and Wildlife, second paragraph, indicates a depressed game fish population resulting from a decreasing amount of basic food exists. Will mechanical or chemical methods to control aquatic needs, etc., in the forebay be in conflict with the needs for food to support gamefish populations?

The statement does not identify the impacts of burial of the two discharge lines or realignment of the maintenance road and the possibilities of erosion associated with either which might occur. Erosion problems associated with disposal of spoil material and a discussion of plans for stabilization or revegetation of disposal areas would be helpful.

The BLM is planning for public land in the vicinity of the project. This effort has compiled extensive information on resources, uses, and opportunities for enhancing wildlife, recreation, and other resource values. This information is available and may aid in preparing plans related to recreation and wildlife, identification of suitable spoil disposal areas, the needs of reclamation, identification of project conflicts, etc.

Replies on Comments by the
Bureau of Land Management, Washington D.C.
(Memorandum of May 9, 1972)

1. Comment: Page 2, section D. General Description of the Feature. What features and disturbed areas, if any, will be visible from State Highway 95 and Lake Havasu?

   Reply: Illustrative drawings and photographs included in this final statement provide graphic descriptions of project features outlined in Chapter I., section D. For additional insight on the visibility of components of the Havasu complex, refer to Chapter II., section B, and Chapter III., sections C.3.a. and b.

2. Comment: Additional information on volumes to be excavated, e.g., jeep road, aggregate borrow area, etc., and the proposed location, method, volume, and composition of spoil material to be disposed of in each area would help describe the effects of disposal of excavated spoil material.

   Reply: Descriptions and data for these specific items are found in Chapter I., sections D.2. and 3., and Chapter III., sections C.1.a., b., and c.

3. Comment: Will disposal of spoil materials take into consideration the coloration of the existing parent material and will it be possible to retain patterns harmonious with undisturbed areas?

   Reply: The coloration of materials used in the intake channel embankment will be taken into account. This is specifically covered in Chapter I., section D.1. This is considered most important as the intake channel will be visible to the public. Disposal material excavated from the outlet portal of the tunnel will be placed in less conspicuous areas. Coloration will be one consideration in selection of final disposal areas and reshaping schemes.

4. Comment: Page 8, section D. Fish and Wildlife. The Bill Williams Delta provides habitat for the endangered Yuma clapper rail. The California Fish and Game Department indicates the rare humpback sucker is also present in Lake Havasu (see its January 1972 publication "At the Crossroads.")

   Reply: The subjects of the Yuma clapper rail, the Bill Williams Delta, and the Bill Williams section of the Havasu National Wildlife Refuge, are specifically discussed in Chapter I., section A., Chapter II., section E.3.b., and Chapter II., section G. In summary, the Yuma clapper

rail is found in the Bill Williams area only above the Highway 95 bridge and is out of the area of the project construction influence. Only 14.8 percent of the Yuma clapper rail in the Havasu Refuge 1972 census was in the Bill Williams portion of the Havasu Refuge.

The presence of the humpback sucker is referred to in Chapter II., section E.2. Additional information is included in the separate reply in this Appended Material to comments made by the Resources Agency of California. The humpback sucker adapted through evolutionary processes to the environment of swift flowing streams that existed in the area of the present Lake Havasu prior to the construction of Hoover, Parker, and Davis Dams. Lake Havasu is not a conducive environment for this species as it is not capable of rapid evolutionary change from stream-type to reservoir-type conditions. Therefore, the humpback sucker is rarely encountered in a mature reservoir environment. They are, however, relatively common in the Upper Colorado River Basin.

5. Comment: Three bighorn sheep lambing grounds have been identified in the vicinity of the project area. One located in Section 3, T. 10 N., R. 17 W. will be accessible via four-wheel-drive vehicles and could be adversely affected by construction crews or other parties visiting the area. Will protective measures be taken?

Reply: Section 3 is outside of the area of the proposed action by Reclamation. Jurisdiction for land use of this section is the responsibility of Bureau of Land Management. The protective measures to be adopted by that Bureau are under consideration.

The estimated population of bighorn sheep in the Buckskin Mountains area has decreased from about 300 in 1948-50 to about 50 in 1972. This decrease has occurred in conjunction with the increases in recreation use of the Colorado River, off-road vehicular use of adjacent lands, poaching, and highway traffic. In spite of good game management practices, the nonobservance of game laws by citizens and the refusal of observers of game law violations to become involved has been an important factor. The recent action of the President in signing Executive Order 11644 - Use of Off-Road Vehicles on the Public Lands - and the future promulgation of regulations will assist the Arizona Game and Fish Department in establishing controls over access to the Buckskin Mountains. From the verbal report of the biologist making a field study in October 1972, the Havasu complex, including the Buckskin Mountains Tunnel, will have no significant incremental effect on the decreasing population trend of the bighorn sheep. The

habitat evaluation portion of the study shows that the area along the tunnel alinement has the lowest value of three habitat sectors mapped. (See Chapter II., Figure 12.)

This same type of comment was also made by the Bureau of Sport Fisheries and Wildlife. The Arizona Game and Fish Department did not submit comments on the draft environmental statement.

6. Comment: The statement notes the great blue heron on Heron Island could be affected by construction activities in the vicinity of the intake area. A heron rookery at the south end of Topock Gorge was abandoned in 1970 because of disturbance by humans but relocated within a mile. What is likely to happen here?

   Reply: This matter is discussed in Chapter III., section C.1.n. It is anticipated that there may be a temporary disturbance of the colony but not abandonment of the island by the blue heron. A more significant effect will be related to future plans for administration and construction of recreational activities and facilities in this area of Lake Havasu. The Bureau of Land Management is assigned the primary responsibility for recreation administration in the area of the project.

7. Comment: Wild horses and burros also frequent this general area.

   Reply: Information from the Arizona Game and Fish Department indicates that wild horses frequent portions of the Colorado River Indian Reservation to the south of the proposed action area but not the proposed action area. The information also indicates that the southern and western limit of burro use is upstream from the Highway 95 bridge and along the north facing slope to an area about 2 miles east of Mineral Wash. The use is generally on and adjacent to the Bill Williams portion of the Havasu National Wildlife Refuge, the adjacent Planet Ranch, and the range to the north of the Bill Williams River.

8. Comment: Page 10, section E. Recreation, third paragraph. It is indicated an extensive trailer park is likely to expand during construction of the intake related facilities. Will facilities be sufficient to avoid pollution?

   Reply: Reference is made to Figure 1 which shows the location of this privately developed mobile-home development. The development expansion is limited by the amount of private

land available. Sanitation and water supply facilities fall under the jurisdiction of Yuma County and the Arizona State Health Department for enforcement of appropriate standards.

9. Comment: "Page 12, 2. Quality of Water. It is unclear what quantity of water will be pumped from Lake Havasu or what affect the removal of this water will have on salinity below Parker Dam."

   Reply: Reference is made to Chapter I., section E., Chapter II., section K., and Chapter III., sections C.2.d., e., f., and h.

10. Comment: 3. Herbicide and Pesticides. Page 8, section D. Fish and Wildlife, second paragraph, indicates a depressed gamefish population resulting from a decreasing amount of basic food exists. Will mechanical or chemical methods to control aquatic weeds, etc., in the forebay be in conflict with the needs for food to support gamefish populations?

    Reply: The control of aquatic weeds by mechanical or chemical methods in the forebay and intake channel is not expected to have an identifiable influence upon the Lake Havasu gamefish population. For a further discussion of this matter, refer to Chapter III., sections C.2.b. and i.

11. Comment: The statement does not identify the impacts of burial of the two discharge lines or realinement of the maintenance road and the possibilities of erosion associated with either which might occur.

    Reply: The return of the discharge line excavation to a natural appearing rocky slope is not expected to have an appreciable impact. (See Chapter III., section C.1.j.) Erosion will also be controlled using standard operating practices. Disposal of spoil material is discussed with stabilization and revegetation in Chapter III., sections C.1.a., c., j., and l.

12. Comment: BLM is planning for public land in the vicinity of the project. This effort has compiled extensive information on resources, uses, and opportunities for enhancing wildlife, recreation, and other resource values. This information is available and may aid in preparing plans related to recreation and wildlife, identification of suitable spoil disposal areas, the needs of reclamation, identification of project conflicts, etc.

Reply: The cooperation and constructive efforts of state and district office personnel of the Bureau of Land Management in making information available and in participating in coordination meetings with the Arizona Game and Fish Department, Arizona State Parks Department, Arizona State Land Department, Arizona Water Commission, Bureau of Sport Fisheries and Wildlife, and National Park Service are appreciated.

OFFICE OF THE DIRECTOR

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
WASHINGTON, D.C. 20240

April 14, 1972

Memorandum

To: Commissioner of Reclamation
Through: Assistant Secretary--Mineral Resources

From: Director, Bureau of Mines

Subject: Draft environmental statement, Havasu Intake Channel, Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico

The draft environmental statement by the Bureau of Reclamation on the proposed Havasu Intake Channel, Pumping Plant and the Buckskin Mountains Tunnel, Central Arizona Project, Arizona and New Mexico, has been reviewed by the Bureau of Mines. The proposed construction includes an intake channel in Lake Havasu, a pumping plant, twin discharge lines to the inlet portal of the Buckskin Mountains Tunnel, and the 36,000-foot-long tunnel itself.

The Bureau of Mines did not make a mineral examination of the site of the proposed construction. The Bureau, in December 1969, made a field reconnaissance examination of part of the area which was proposed for earlier withdrawal for the Havasu pumped-storage power project. This FPC project was to consist of a shorter tunnel at a higher elevation with the upper Buckskin Reservoir on The Mesa. A number of productive mine properties nearby were reported. While mineral deposits could exist beneath the project area in the same older rocks that were mined nearby, the younger rocks near the surface did not show any indications of mineral potential. The 1969 examination indicates that the south portal of the proposed tunnel is in an area where many mining claims have been staked over the years and may contain mineral deposits.

The Buckskin Mountains are formed by Quaternary basalt flows that may conceal dikes, plugs, and sills which intrude Mesozoic sediments and Precambrian granite. The presence of minable ore bodies in similar mineralized ground east, south, and west of the proposed tunnel suggests that mineralization may occur at depth along the route of the tunnel.

The draft environmental statement makes no reference to mineral resources within the area. It is suggested that under Section III, The Environmental

Impact of the Proposed Action, an additional paragraph be added stating that mineral deposits may exist at depth which could be lost in the barrier zone needed to protect the tunnel.

Director

Replies on Comments Made by the
Bureau of Mines, Washington, D.C.
(Memorandum of April 14, 1972)

The Bureau of Mines' first paragraph concisely describes Reclamation's Havasu feature. The Bureau of Mines' second paragraph refers to the Arizona Power Authority pumped storage project (FPC Project No. 2702).

Comment: The draft environmental statement makes no reference to mineral resources within the area.

Reply: In Chapter III, Section C.1.s., the geology of the area and the absence of mineralization found during the geologic drilling and exploration program are presented. The drilling program consisted of total length of about 5,800 feet of core drilling at 22 holes ranging in depth to about 500 feet and to at least 10 feet below the tunnel grade. Although isolated pockets of mineralization may be encountered, there is little indication that such pockets would be of commercial value.

INFORMATION COPY FOR 700

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Intermountain Field Operation Center

BUILDING 20
DENVER FEDERAL CENTER
DENVER, COLORADO 80225

Office of
Chief

RECEIVED APR 10 1972

Action:		
Action Taken (Initials)		
Date	Initials	To
4/11	[illegible]	150
4/11	[illegible]	155
File		

March 6, 1972

Your reference:
3-150
540.

Memorandum

To: E. A. Lundberg, Regional Director, Region 3, Bureau of Reclamation, P. O. Box 427, Boulder City, Nevada 89005

From: Chief, Intermountain Field Operation Center

Subject: Draft Environmental Statement, Havasu Intake Channel and Pumping Plant, and Buckskin Mountains Tunnel, Arizona

The attached review comments, requested by your memorandum of March 9, have been prepared by W. R. Hardwick of our Tucson Field Office. He made an onsite reconnaissance of the area in December 1969 when FPC Project No. 2702 was under consideration.

In view of mineralization in the area, Mr. Hardwick recommends an exploration program, including drilling and sampling, on the alignment of the proposed tunnel. If the Bureau of Reclamation plans any drilling to ascertain ground conditions that will be encountered in driving the tunnel, the two operations might well be combined.

Our field-level comments are submitted to you as a service, but the formal review will be made later in our Washington office. At that time the requested 10 copies presumably will be forwarded to the Council on Environmental Quality.

O. M. Bishop

Attachment

cc: W. M. Monroe, Field Representative, Pacific Southwest Region (w/att)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
Intermountain Field Operation Center

REDONDO TOWER
8 WEST PASEO REDONDO
TUCSON, ARIZONA 85705

April 4, 1972

Memorandum

To: L. F. Heising, Chief Project Coordinator, Intermountain Field Operation Center

From: Mining Engineer, Tucson Mineral Supply Field Office

Subject: Draft Environmental Statement, Havasu Intake Channel and Pumping Plant, and Buckskin Mountains Tunnel, Arizona

The proposed project has been changed from FPC Project No. 2702 as presented in 1969. That proposed a pumped storage reservoir on Buckskin Mesa. The proposed withdrawal area (shown in red on the attached sketch) was bounded on the south by a line through the centers of Sections 16, 17, and 18, T. 10 N., R. 17 W. In the new plan, Buckskin Reservoir has been eliminated, the tunnel through the Buckskin Mountains has been lowered, and the tunnel outlet moved eastward to an outlet reservoir lower on Osborne Wash.

The area that was proposed for withdrawal in 1969 was examined on December 5, 1969. No mineral deposits and no patented claims were on this area. Two mines were operating nearby--the Mineral Hill mine in Section 3, T. 10 N., R. 17 W., and a small leaching operation called the Jim and Bob Mining Company which is in the eastern half of Sec. 4, T. 9 N., R. 17 W. Water for this operation came from a nearby mine. Mining claims in the area as listed by the Bureau of Land Management have been plotted on the sketch as a red checkmark

The original proposed withdrawal area north of the line along the centers of Section 16, 17 and 18, T. 10 N., R. 17 W., and on the mesa formed by Quaternary basalt flows does not contain indications of significant mineral deposits. The area south of this line and in the vicinity of the proposed outlet portal of Buckskin Mountains tunnel and reservoir is in an area where many mining claims have been staked over the years and may contain mineral deposits. In this area Mesozoic sediments and Precambrian granite intruded by dikes, plugs, and sills cover the area. They, in turn, are covered by Quaternary basalt that forms the Buckskin Mountains.

Copy to:
FD Lamb
OM Bishop

In Township 10 N., R. 18 W., just west of the area, there are mines that have been productive. Production records are not complete but some are shown in the following table.

Mine	Date of production	Tons	Copper, percent	Gold, oz. per ton
Grey Eagle	1916-1944	393.54	15.58	0.453
Eagles Nest	1916-1944	238.60	17.11	0.187
Carnation	1916-1944	2045.19	2.23	0.201
Mammon	W.W.I	6000	3-4	Appreciable

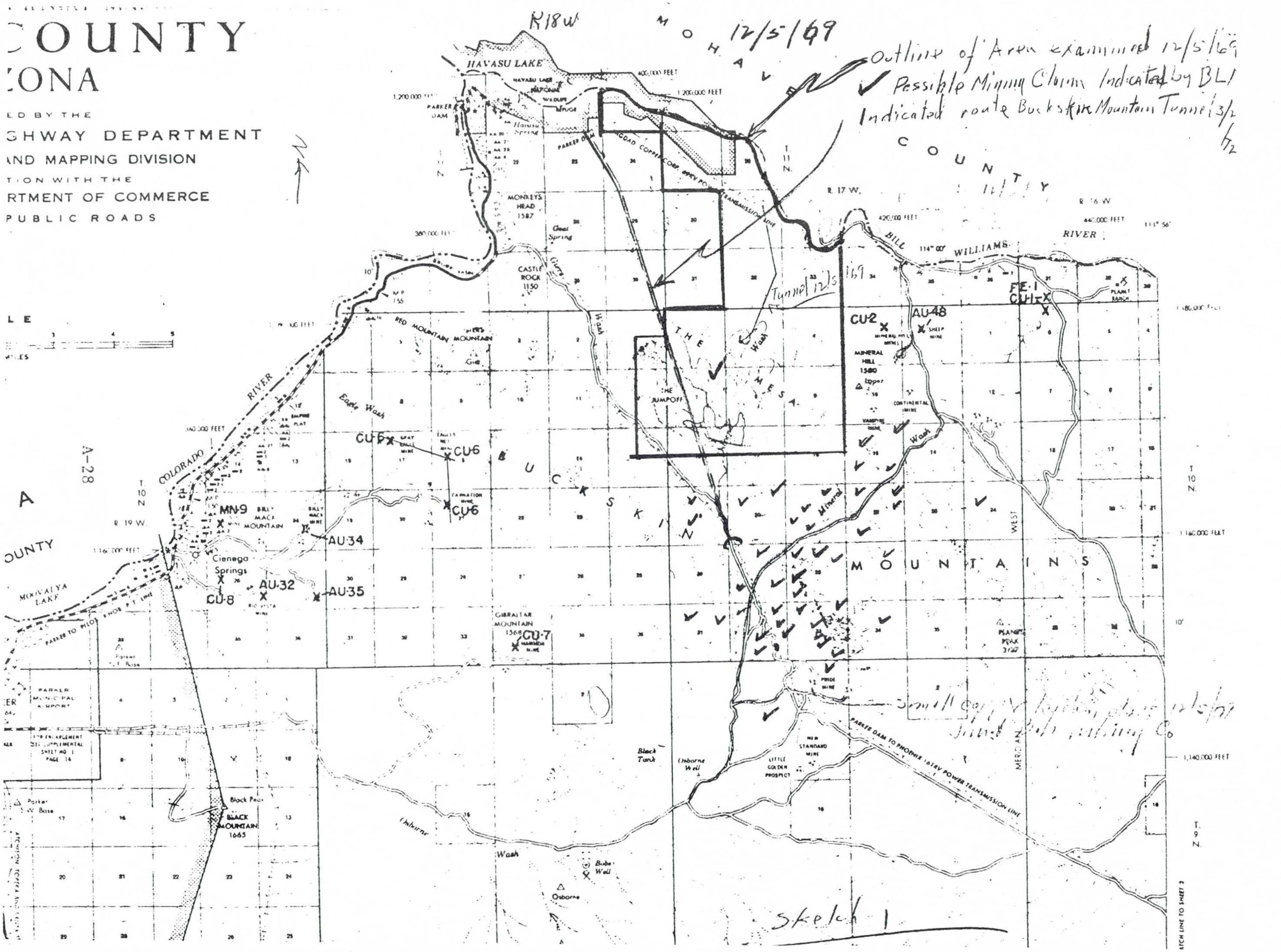
These deposits are veins and replacement type generally in blocks of limestone but sometimes in other sediments.

As minable ore bodies occur nearby in similar mineralized ground, it is suggested that a detailed exploration program including drilling and sampling be completed on the proposed alignment. While this examination would be expensive and time consuming, it will prevent selection of an alignment that may cross an extensive copper deposit and subsequent realignment should defense requirements indicate production from this deposit.

W. R. Hardwick

W. R. Hardwick

Attachment



COUNTY
ZONA
ED BY THE
GHWAY DEPARTMENT
AND MAPPING DIVISION
TION WITH THE
RTMENT OF COMMERCE
PUBLIC ROADS
R18W
MOHAVE COUNTY
12/5/69
Outline of Area examined 12/5/69
✓ Possible Mining Claim Indicated by BLM
Indicated route Buckskin Mountain Tunnel 3/2
HAVASU LAKE
PARKER DAM
MONKEYS HEAD 1587
Goat Spring
CASTLE ROCK 1150
BILL WILLIAMS RIVER
R. 17 W.
R. 16 W.
T. 11 N.
Tunnel 12/5/69
RED MOUNTAIN
THE MESA
THE JUMPOFF
Eagle Wash
CU-2
AU-48
FE-1
CU-1
MINERAL HILL 1580
CU-5
CU-6
BUCKSKIN MOUNTAINS
Mineral Wash
COLORADO RIVER
MN-9
BILLY MACK MOUNTAIN
AU-34
AU-32
AU-35
CU-8
Cienega Springs
MOOVALYA LAKE
R. 19 W.
T. 10 N.
A-28
GIBRALTAR MOUNTAIN 1568
CU-7
PLANET PEAK
PARKER MUNICIPAL AIRPORT
Black Tank
Osborne Well
NEW STANDARD MINE
LITTLE GOLDEN PROSPECT
PARKER DAM TO PHOENIX 161 KV POWER TRANSMISSION LINE
BLACK MOUNTAIN 1665
Osborne Wash
Bube Well
Osborne
T. 9 N.
1,140,000 FEET
1,160,000 FEET
Sketch 1

Replies on Comments by the
Bureau of Mines (Field Offices)
(Memorandum of March 6, 1972 and attachment memorandum
of April 4, 1972, both received April 10, 1972)

Response comments were received from the Bureau of Mines, Intermountain Field Operation Center, Denver, Colorado, and Tucson, Arizona offices. These comments were primarily oriented toward FPC Project No. 2702 with reference to a field examination of that project and suggest an exploration program of drilling and sampling along the tunnel alinement. The final environmental statement discusses the geology and the lack of mineralization encountered during the geologic investigation and core drilling along the tunnel alinement.

Comment: The proposed project has been changed from FPC Project No. 2702 as presented in 1969.

Reply: Project No. 2702 was a pumped storage generation project with a reservoir on the top of The Mesa of the Buckskin Mountains proposed by the Arizona Power Authority. The comments directly applicable to Project No. 2702 have no bearing upon the Havasu Intake Channel, Pumping Plant, and the Buckskin Mountains Tunnel. The comments relating to mineralization along the Buckskin Mountains Tunnel alinement have been discussed in Chapter III, in connection with the subjects of geology, mineralization, and the Reclamation geologic exploration and drilling program. The drill cores have indicated no evidence of mineralization. The possibility of isolated mineralization pockets along the tunnel alinement can be hypothecated, but the actual presence can be reasonably determined only by the excavation of the Buckskin Mountains Tunnel.

United States Department of the Interior

BUREAU OF OUTDOOR RECREATION
WASHINGTON, D.C. 20240

IN REPLY REFER TO:

D6427-LCO

APR 18 1972

/ 30 /

CENTRAL ARIZONA PROJECT

Memorandum

To: Commissioner of Reclamation

From: Assistant Director for Federal Programs

Subject: Review of Draft Environmental Statement for Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico

As requested in your memorandum of March 15, 1972, we have reviewed the subject draft environmental statement.

The project involves the construction of the Havasu Intake Channel, Havasu Pumping Plant, and the Buckskin Mountains tunnel. These facilities will enable water to be pumped from the Colorado River at Lake Havasu to the Central Arizona Project Service area.

This office has not been involved in this project study; nor has an onsite inspection been made of the project area. Based on our review of the draft statement, we conclude that it is adequate from the standpoint of outdoor recreation and esthetics, and have no comment to offer.

Robert L. Eastman

Replies on Comments by the
Bureau of Outdoor Recreation, Washington, D.C.
(Memorandum of April 18, 1972)

Comment: This office has not been involved in this project study; nor has an onsite inspection been made of the project area. Based on our review of the draft statement, we conclude that it is adequate from the standpoint of outdoor recreation and esthetics, and have no comment to offer.

Reply: During the course of studies for the Central Arizona Project, the Bureau of Outdoor Recreation prepared a report in August 1968 on the feasibility of recreational facilities for the Central Arizona Project Aqueduct system (see References Cited No. 29). On the basis of planning at that time, recreational facilities were recommended for a potential reservoir at the Osborne Wash site located at the outlet portal of the Buckskin Mountains Tunnel. Field studies were made by Bureau of Outdoor Recreation personnel in the preparation of the referenced report. Personnel of the Washington Office of the Bureau of Outdoor Recreation did not make an onsite inspection, but the Osborne Wash Reservoir has been dropped from further consideration due to adverse reservoir seepage loss tests, and the advancing technology for automating pumping plant and aqueduct check structure controls.

ADDRESS ONLY THE DIRECTOR,
BUREAU OF SPORT FISHERIES
AND WILDLIFE

CEN

United States Department of the Interior

FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
WASHINGTON, D.C. 20240

MAY 10 [illegible]

Memorandum

To: Commissioner of Reclamation

From: Assistant Director, Bureau of Sport Fisheries and Wildlife

Subject: Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona and New Mexico - Draft Environmental Statement

We have reviewed the subject draft environmental statement as requested in your memorandum of March 15.

The statement is well written and gives adequate consideration to the greater portion of the fish and wildlife resources of the project area. However, we are concerned about the project's effect on the desert bighorn sheep found in the Buckskin Mountains. Increased recreational use has decreased the use of the area by these animals and the additional activity and attendant noise of construction and operation of the project may be the final factor in driving them out of the area and depriving them of much needed habitat.

Page 11, A. Possible Impact of the Proposed Action on the Environment, mention should be made that the desert bighorn is an animal that does not tolerate human disturbance and that the impact of construction activities coupled with disturbances caused by recreational use within the area may cause the sheep to abandon otherwise good quality habitat.

On page 15, VI. The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity, it is stated in the last sentence, 2nd paragraph, that "Construction and operation of the proposed facilities will not have a significant effect on use of the area by bighorn sheep." Again, the increased activity associated with construction and operation of the facilities may drive the sheep from the area.

Willa Klug

Replies on Comments by the
Bureau of Sport Fisheries and Wildlife, Washington D.C.
(Memorandum of May 10, 1972)

Additional data have been developed by the Arizona Game and Fish Department in cooperation with the Arizona Water Commission and the Bureau of Reclamation relative to the bighorn sheep in the Buckskin Mountains. These data are reflected in the replies below:

1. Comment: The statement is well written and gives adequate consideration to the greater portion of the fish and wildlife resources of the project area. However, we are concerned about the project's effect on the desert bighorn sheep found in the Buckskin Mountains. Increased recreational use has decreased the use of the area by these animals and the additional activity and attendant noise of construction and operation of the project may be the final factor in driving them out of the area and depriving them of much needed habitat.

   Reply: The estimated population of bighorn sheep in the Buckskin Mountains area has decreased from about 300 in 1949-50 to about 50 in 1972. This decrease has occurred in conjunction with the increases in recreation use of the Colorado River, off-road vehicular use of adjacent lands, poaching, and highway traffic. In spite of good game management practices, the nonobservance of game laws by citizens and the refusal of observers of game law violations to become involved has been an important factor. The recent action of the President in signing Executive Order 11644 - Use of Off-Road Vehicles on the Public Lands - and the future promulgation of regulations will assist the Arizona Game and Fish Department in establishing controls over access to the Buckskin Mountains. From the verbal report of the biologist making a field study in October 1972, the Havasu complex, including the Buckskin Mountains Tunnel, will have no significant incremental effect on the decreasing population trend of the bighorn sheep. The habitat evaluation portion of the study shows that the area along the tunnel alinement has the lowest value of three habitat sectors mapped. (See Figure 12.)

   The Arizona Game and Fish Department did not submit comments on the draft environmental statement.

2. Comment: Possible Impact of the Proposed Action on the Environment, mention should be made that the desert bighorn is an animal that does not tolerate human disturbance and that the impact of construction activities coupled with disturbances caused by recreational use within the area may cause the sheep to abandon otherwise good quality habitat.

Reply: In view of the above reply, and the fact that the tunnel is underground, no abandonment of quality habitat is likely. Any future decline of sheep population in the absence of the establishment of a roadless area is believed to be attributable to factors other than construction. The habitat would not be abandoned by migration of the sheep from the Buckskin Mountains to some other habitat location, but rather the decline, possibly to the point of extinction of the population, would result from human encroachment for recreation and off-road purposes by unthinking individuals and poachers unconcerned for the bighorn sheep.

3. Comment: In Chapter VI, page 15, The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity, it is stated in the last sentence, 2nd paragraph, that "Construction and operation of the proposed facilities will not have a significant effect on use of the area by bighorn sheep." Again, the increased activity associated with construction and operation of the facilities may drive the sheep from the area.

Reply: In light of the field study, the above replies to comments, and the further coverage of the subject in this final statement, this comment has been considered.

United States Department of the Interior

GEOLOGICAL SURVEY
WASHINGTON, D.C. 20242

OFFICE OF THE DIRECTOR

April 18, 1972

Memorandum

To: Commissioner of Reclamation
Through: ~~Deputy~~ Assistant Secretary--Mineral Resources

From: Acting Director, Geological Survey

Subject: Review of Draft Environmental Statement for Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico

We have reviewed the subject draft environmental statement as requested in your memorandum of March 15.

The project would be located in a region subject to earthquakes causing moderate damage. Neither the geology of the area of the proposed construction or the possible effects of earthquakes on the structures of the project are described in the draft environmental statement. Damage due directly to earthquake motion and damage caused by earthquake-triggered landslides should be considered.

We have no comment on hydrologic aspects of the proposed project.

Director

Replies on Comments Made by the
Geological Survey, Washington, D.C.
(Memorandum of April 18, 1972)

The Geology section of Chapter II, Description of the Environment, has been expanded to include the Modified Mercalli Scale rating used for structural design of facilities.

Comment: Damage due directly to earthquake motion and damage caused by earthquake-triggered landslides should be considered.

Reply: The possibility of damaging earthquake-triggered landslides is reflected in Chapter II, section C., and Chapter III, section C.1.u.

United States Department of the Interior

NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240

IN REPLY REFER TO:
L7427-CC

CENTRAL ARIZONA PROJECT

MAY 18 1972

Memorandum

To: Commissioner, Bureau of Reclamation
Through: Assistant Secretary for Fish and Wildlife and Parks Noted gV

From: Assistant Director, Cooperative Activities

Subject: Review of Draft Environmental Statement for Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico (DES 72-40)

The National Park Service has reviewed the subject statement transmitted with your memorandum of March 15 and our comments follow.

The proposed action will not directly affect any existing or proposed units of the National Park System, nor any sites that are eligible or recommended for registration as National Historic, Natural, or Environmental Education Landmarks.

We are pleased to note that a copy of the statement has been sent to the State Liaison Officer for Historic Preservation for his review. We request that the final statement indicate that the National Register of Historic Places has been consulted and that no properties listed on or proposed for nomination to the Register will be affected by the proposed action, if that is the case.

We are aware that the referenced (p. 10) archeological survey has been superseded by a field survey performed in April of 1972 by the Arizona State Museum. The survey report, now in preparation for delivery prior to May 29, will include maps indicating the areas examined. We recommend that contractual agreements include provision for archeological clearance of any construction associated areas located outside the lands now surveyed. Suggested language for such clearance stipulations was included in the attachment to the February 24 memorandum from our Arizona Archeological Center to the Regional Director, Bureau of Reclamation, Region 3 on the subject of draft material for the final environmental statement, Central Arizona Project. With this material included, the environmental statement for the Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel project will, insofar as archeological resources are concerned, be adequate and will have no adverse effects that will not be mitigated.

Thorbert G. Swem

National Parks Centennial 1872-1972

Replies on Comments made by the
National Park Service, Washington, D.C.
(Memorandum of May 18, 1972)

1. Comment: We are pleased to note that a copy of the statement has been sent to the State Liaison Officer for Historic Preservation for his review. We request that the final statement indicate that the National Register of Historic Places has been consulted and that no properties listed on or proposed for nomination to the Register will be affected by the proposed action, if that is the case.

   Reply: Chapter II., section H, contains a statement on consultation of the National Register of Historic Places and no listed properties or known nominations will be affected.

2. Comment: We are aware that the referenced (p. 10) archeological survey has been superseded by a field survey performed in April of 1972 by the Arizona State Museum. The survey report, now in preparation for delivery prior to May 29, will include maps indicating the areas examined. We recommend that contractual agreements include provision for archeological clearance of any construction associated areas located outside the lands now surveyed. Suggested language for such clearance stipulations was included in the attachment to the February 24 memorandum from our Arizona Archeological Center to the Regional Director, Bureau of Reclamation, Region 3, on the subject of draft material for the final environmental statement, Central Arizona Project. With this material included, the environmental statement for the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel project will insofar as archeological resources are concerned, be adequate and will have no adverse effects that will not be mitigated.

   Reply: Should areas of significant archeological content be disclosed during construction, measures will be undertaken to protect, or salvage, the findings. For the initial contract specifications of the Havasu Pumping Plant Site Preparation and the Havasu Intake Channel Dike, archeological clearance has been essentially completed. For aggregate borrow areas or work and service areas beyond the limits that have been covered by archeological teams, clearance surveys will be made. This matter is covered in Chapter III., section C.1.q, and Chapter VII, section E.

INFORMATION COPY FOR 100, 700

JACK WILLIAMS
GOVERNOR

OFFICE OF THE GOVERNOR
STATE HOUSE
PHOENIX, ARIZONA 85007

IN REPLY
REFER TO:

March 20, 1972

OFFICIAL FILE COPY
RECEIVED MAR 22 1972
Action:
Action Taken.....(Initials)

Date	Initials	To
3/22	JW	150
3/22	JMC	155
Fils		

Mr. E. A. Lundberg
Regional Director
Bureau of Reclamation
Regional Office- Region 3
United States Department of the Interior
PO Box 427
Boulder City, Nevada 89005

Re: 3-150 ....120.01

Dear Mr. Lundberg:

Thank you very much for your letter of March 9 and the copy of the Draft Environmental Statement for the Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico.

Appreciate very much having the opportunity to review this study.

Sincerely,

Jack Williams

Jack Williams

ls

INFORMATION COPY FOR 100, 700

March 17, 1972

Mr. E. A. Lundberg
Regional Director
Bureau of Reclamation
U. S. Department of the Interior
P. O. Box 427
Boulder City, Nevada 89005

Re: 3-150 540.

Dear Mr. Lundberg:

OFFICIAL FILE COPY
RECEIVED MAR 22 1972
Action:
Action Taken (Initials)

Date	Initials	To
3/22	FJM	150
3/22	JFJ	155
File		

206 S. 17 Ave. Phoenix Arizona 85007 261-7322

I have just finished reading the Draft Environmental Statement on the Proposed Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project.

It seems to be well done, and I think it covers everything it needs to.

Speaking as a member of the Central Arizona Project Environmental Advisory Group, I think the statement is o.k.

I will hand the proposal to the Advisory Commission on Arizona Environment Land Resources and Ecology Committee for analyzation.

Yours sincerely,

ADVISORY COMMISSION ON ARIZONA ENVIRONMENT

F. J. MacDonald
Chairman

FJM:jfj

cc: Dennis McCarthy

September 14, 1972

Mr. E. A. Lundberg
Regional Director
Bureau of Reclamation
U. S. Department of the Interior
P. O. Box 427
Boulder City, Nevada 89005

Re: 3-150 540.

Dear Mr. Lundberg:

[illegible] Phoenix Arizona 85007 261/322

This is a follow up to the letter addressed to you by F. J. MacDonald, Chairman of the Advisory Commission on Arizona Environment, relative to the Proposed Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, Central Arizona Project.

Mr. MacDonald advised in his letter of March 17, 1972 that he had handed the proposal to the Advisory Commission on Arizona Environment Land Resources and Ecology Committee for analyzation.

I, as Chairman of the Land Resources and Ecology Committee, wish to state that there is no adverse comment concerning this proposal.

Yours sincerely,

ADVISORY COMMISSION ON ARIZONA ENVIRONMENT

Dennis McCarthy
Committee Chairman

DM:jfj

cc: Clifford A. Pugh
F. J. MacDonald

INFORMATION COPY FOR 166, 266, 466

ARIZONA HIGHWAY DEPARTMENT

Phoenix, Arizona 85007

May 2, 1972

Mr. E. A. Lundberg
Regional Director
Bureau of Reclamation
Regional Office - Region 3
P. O. Box 427
Boulder City, Nevada 89005

Re: Draft Environmental Statement for Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountain Tunnel

Dear Mr. Lundberg:

The referenced Draft Environmental Statement has been reviewed by the Arizona Highway Department and the following comments are offered:

The bridge structure which will be located on State Route 95 across the proposed intake channel (reference paragraph 1, page 4 of Draft) is correctly described in the environmental statement. It is our understanding that the Bureau of Reclamation will be responsible for design and construction of the bridge which will be built to Arizona Highway Department standards and requirements.

The Arizona Highway Department will continue to work with the Bureau of Reclamation to develop final bridge details for total width, loading, bridge rails, etc., and the traffic detour which will be required to accommodate traffic flow around the proposed bridge construction site, including signing, responsibility to public, inspections, closure times, etc.

In consideration of the aforementioned, the Arizona Highway Department concurs with the findings of the Draft Environmental Statement and considers the proposed projects to be significant segments of the overall C.A.P. program which when fully constructed will be a major long-range enhancement to the planned and orderly growth and development of the State of Arizona.

We appreciate the opportunity to review and comment on this Draft Environmental Statement.

Yours very truly,

WM. N. PRICE
State Highway Engineer

A. L. CHADWICK
Chief Deputy State Engineer

ALC/JLS/cm

cc: Mr. David Creighton
Phoenix Office
Bureau of Reclamation

Replies on Comments made by the
Arizona Highway Department
(Letter of May 2, 1972)

The comments and understanding as expressed in the letter of the Arizona Highway Department are correct. Coordination is on a continuing basis to insure that construction affecting Arizona State Highway 95 will not cause more than a minor inconvenience to traffic.

INFORMATION COPY FOR 100, 700 Arch. Hist.

ARIZONA STATE PARKS

1688 WEST ADAMS / 271-4174 / PHOENIX, ARIZONA 85007

DENNIS McCARTHY, DIRECTOR

April 17, 1972

E. A. Lundberg
Regional Director
U.S. Bureau of Reclamation
Regional Office - Region 3
P.O. Box 427
Boulder City, Nevada 89005

Reference: 3-150,540

Dear Director Lundberg:

This is to acknowledge receipt of the Draft Environmental Impact Statement re: Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico. My staff and I have read the Draft Statement and offer the following comments:

1) There are no sites or structures in the proposed project area currently listed on the National Register of Historic Places.

2) We know of no highly significant historical or archaeological sites or structures within the proposed project area. We are gratified to know that a continuing archaeological survey is being conducted in the area, however.

3) Although the Draft Statement makes mention of the intent to protect "special esthetic values, historical or archaeological sites", no mention is made of the need to comply with the National Historic Preservation Act of 1966. The Environmental Policy Act of 1969, which requires written environmental impact statements, also incorporates the earlier Preservation Act of 1966. In this

respect, i.e., failure to mention the need for compliance, the Draft Statement is inadequate and we respectfully call this fact to your attention.

This sums up our remarks relative to the Draft Statement. Again, I thank you for making this information available to my office.

Sincerely,

Dennis McCarthy

DENNIS McCARTHY
State Parks Director
State Liaison Officer,
National Historic
Preservation Act of 1966

DM:RF:ol

Replies on Comments Made by the
Arizona State Parks Board
(Letter of April 17, 1972)

The itemized comments 1) and 2) are additional documentations of statements made in Chapters II, Section H, and III, Section C.1.q., that no significant archeological and historical values will be affected by the Havasu feature.

Comment: 3) Although the Draft Statement makes mention of the intent to protect "special esthetic values, historical, or archaeological sites", no mention is made of the need to comply with the National Historic Preservation Act of 1966. The Environmental Policy Act of 1969, which requires written environmental impact statements, also incorporates the earlier Preservation Act of 1966. In this respect, i.e., failure to mention the need for compliance, the Draft Statement is inadequate and we respectfully call this fact to your attention.

Reply: In the absence of any known historic or archeological sites, the phraseology for need for compliance was not included in the draft. Compliance with the National Historic Preservation Act of 1966 is part of Reclamation policy and is in accord with Executive Order 11593. Archeological studies have been made as discussed in Chapters III and IV. No significant resources were found.

INFORMATION COPY FOR 100, 700, 420

Arizona Water Commission
34 WEST MONROE STREET - 7TH FLOOR
Phoenix, Arizona 85003
TELEPHONE (602) 258-7561

April 26, 1972

Mr. Edward A. Lundberg
Regional Director-Region III
Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

We have reviewed the Draft Environmental Statement, Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico and offer the following comments:

1. The overall impact of the report could be strengthened by providing a more detailed description of project features and the environment. Additional numbers, drawings, and photographs would be helpful.

2. On page 11 it is stated that initially no fish screens will be installed on the pumping plant intake and that a monitoring program will determine if screens are needed. It would seem, based on experience to date at the pumping plant of the Metropolitan Water District of Southern California elsewhere on Lake Havasu and the extensive body of experience and research at other similar installations, that a more definitive determination of the need for fish screens could be made at this time.

3. On page 16 it is stated that the short-term economic impact will be minor in the local area during the construction period. It is our opinion that this is an incorrect evaluation and should be reconsidered. We are aware of information which tends to lead to the opposite conclusion.

We will be pleased to assist you in developing the final environmental statement for the Havasu features.

Sincerely,

Wesley E. Steiner
Executive Director

Replies on Comments made by the
Arizona Water Commission
(Letter of April 26, 1972)

The staff and support of the Arizona Water Commission have provided information and data that might otherwise not have been obtained or included in this final statement.

1. Comment: The overall impact of the report could be strengthened by providing a more detailed description of project features and the environment. Additional numbers, drawings, and photographs would be helpful.

   Reply: The final statement includes additional descriptive and illustrative materials.

2. Comment: It would seem, based on experience to date at the pumping plant of the Metropolitan Water District of Southern California, elsewhere on Lake Havasu, and the extensive body of experience and research at other similar installations, that a more definitive determination of the need for fish screens could be made at this time.

   Reply: The Arizona Game and Fish Department now recommends a monitoring program to determine the ultimate need for fish screens even though initial recommendations by the Bureau of Sport Fisheries and Wildlife, with the cooperation of the Arizona Department, were that no screens would be needed. The expressed hope that experience to date at the intake pumping plant of the MWD on Lake Havasu would allow a more definitive determination is apparently not conclusive. No factual data or recorded observations of fish destruction or fish protein in samples from the discharged water of the intake pumping plant to the Gene Wash Reservoir on MWD's system have been found. An underwater inspection at the intake trashracks provided one negative observation relative to fish being drawn into the pumps. Initial studies for assessment of the need for screens have been completed. Specific reference is found in Chapter III., section C.1.n.

3. Comment: On page 16 it is stated that the short-term economic impact will be minor in the local area during the construction period. It is our opinion that this is an incorrect evaluation and should be reconsidered. We are aware of information which tends to lead to the opposite conclusion.

   Reply: The section on short-term impact has been examined further and the impact is discussed in Chapter III., sections C.1.p. and t. The 9-year construction program is expected to have a

significant impact on the population and economic activity of the Parker and Lake Havasu City communities.

INFORMATION COPY FOR 100, 700

Museum OF NORTHERN ARIZONA

ORIGINAL COPY
RECEIVED APR 7 1972
Action
Action Taken (Initials)

Date	Initials	To
4/10	AM	150
4/10	MC	155
File		

5 April 1972

Mr. E. A. Lundberg
Regional Director
Bureau of Reclamation
Regional Office, Region 3
P. O. Box 427
Boulder City, Nevada 89005

RE: 3-150
540

Dear Mr. Lundberg:

In response to your 9 March 1972 invitation for review and comment on the Draft Environmental Statement, Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico.

I find the document satisfactory in light of the fact that the basic questions concerning Central Arizona Project should be treated in the overall environmental statement. My only reservation is that the rip rap of the landform embankment be done so that it will not be as ugly as every other example of rip rap that I have seen (for example, along the Verde River near Arizona Highway 87).

Sincerely,

Eric G. Walther

Eric G. Walther
Coordinator of Environmental Studies

EGW/jp

FORT VALLEY ROAD · P. O. BOX 1389 · TELEPHONE 774-2433 · FLAGSTAFF, ARIZONA 86001

Replies on Comments by the
Museum of Northern Arizona
(Letter of April 5, 1972)

The commentor expresses a personal reservation concerning the appearance of rock protection on the intake channel embankment as it relates to his visual observation of rock protection at a location remote from the site of the proposed action. Materials native to the Havasu area will be used on the intake channel embankment so that they will blend in with the adjacent peninsulas.

INFORMATION COPY FOR 100, 700

SALT RIVER PROJECT
P.O.BOX 1980
PHOENIX, ARIZONA 85001

May 1, 1972

TELEPHONE 273-5900

RECEIVED MAY 4 1972

Action.....
Action Taken.....(Initials)

Date	Initials	To
5/8	FGS	150
5/8	MC	153
5-11	MC	MC
File		

E. A. Lundberg
Regional Director
Bureau of Reclamation
Regional Office - #3
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

We have reviewed the draft Environmental Statement of the proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico, forwarded with your letter of March 9, 1972.

It is our opinion that this statement adequately covers the proposed facilities and outlines the steps that will be taken to minimize the impact on the environment.

It appears that the biological portion of the Statement starting on Page 7 has been extremely condensed. We would suggest that a list of the plants present be included. Even in our supposedly sparse desert regions, a list of indigenous plants is quite impressive and is often longer than a reviewer might first expect. From such a list of plants, it is possible to construct a list of the probable mammals and birds which inhabit the area.

We appreciate having been given an opportunity to review the Statement and provide constructive comments to this project which is important to the State of Arizona.

Sincerely,

F. G. Scussel, Director
Project Planning

ccg
cc: Council on Envir. Quality (10)

Replies on Comments made by the
Salt River Project
(Letter of May 1, 1972)

Comment: It appears that the biological portion of the Statement starting on Page 7 has been extremely condensed. We would suggest that a list of the plants present be included. Even in our supposedly sparse desert regions, a list of indigenous plants is quite impressive and is often longer than a reviewer might first expect. From such a list of plants, it is possible to construct a list of the probable mammals and birds which inhabit the area.

Reply: A description of the major vegetation is included in Chapter II., section D. A listing of fish, mammals, birds, and amphibians and reptiles was obtained from the Bureau of Sport Fisheries and Wildlife and is included in the Appended Material. This listing was developed by personnel at the Havasu National Wildlife Refuge.

INFORMATION COPY FOR 100, 720

RECEIVED APR 17 1972

Action:

Action Taken (Initials)

Date	Initials	To
		5120 West Via Mallorca
		Tucson, Arizona 85705
4/18		12/[illegible] 1972
4/18		150
		Your Ref: 540/3-150
File		

SIERRA CLUB

FOUNDED IN 1892

Southwest Regional Conservation Committee

Mr E A Lundberg, Regional Director
Region 3, U S Bureau of Reclamation
Post Office Box 427
Boulder City, Nevada 89005

Subject: Comments re draft environmental statement, Havasu Pumping Plant, etc.

Dear Mr Lundberg:

Thank you for the notice issued 9 March 1972 by your office and for the accompanying draft environmental statement on the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, which you have sent us for comment. This letter is a coordinated statement of the Sierra Club position concerning the subject draft environmental statement. Please append these comments to any subsequent drafts and to the final environmental statement.

Please refer to our letter to you of 26 October 1971, containing comments pertaining to the draft environmental statement for the Central Arizona Project as a whole (your ref: 3-150/120.01). In that letter we stated our conclusion that separate environmental statements for all the individual units and features of the CAP should be completed before any of the following: 1) final assessment of the environmental impact of the CAP as a whole; 2) decisions with regard to site selection and design of the several features and units; 3) any request on Congress for appropriations except for studies having to do with site selection and design and environmental impact.

It is clear that the overall environmental impact of the CAP cannot be assessed until specific environmental analyses of all component features and units have been accomplished and decisions made as to their site and design, thus making possible an assessment of the composite or synergistic effect of the sum of the parts which make up the whole. Nor can decisions as to site and design for the components be made discretely, because they are elements of the whole and hence must be coordinated together. Thus the steps should be: 1) environmental analysis of all components; 2) coordinated decisions as to site and design of components; 3) assessment of the environmental impact of the CAP as a whole. Certainly no construction should be started until the entire process of environmental analysis has been completed, nor should any construction funds be asked for from Congress until a complete environmental analysis can be presented concurrently. As already indicated in previous correspondence we also believe that public hearings are a necessary precursor to any construction start on the CAP.

The illogical method of environmental analysis now being used by your office, that is, to try to do an environmental statement for the project as a whole, to be followed at intervals later on by uncoordinated environmental analyses for the individual components, is likely to have any or all of three harmful results, besides being impractical to begin with.

First, the successive completion of studies for the several components

may increasingly invalidate the overall analysis, due to changes in their sites and design from the original concept. An example of such potential is to be seen in the change in the Havasu Intake Channel between the overall statement and the specific draft for the Channel. If the specific environmental studies are to give real treatment to the choice between alternatives, which the draft now under consideration does not, the chances for progressive invalidation of the general statement are much greater.

Second, the discrete study of the several units and features, beginning at the intake end of the total project, resulting in successive final decisions with respect to the site and design of components, will progressively eliminate options as the specific environmental studies proceed from intake to terminus. This is obvious, because if any earlier decision is to remain firm, the later decisions must conform, thus restricting choice.

Third, if construction should be started after completion of a vague overall environmental statement but before completion of the statements for all of the components, a difficult situation could conceivably arise. In one way of looking at this situation, it might be said that because there had been a construction start there was a commitment to complete the entire CAP regardless of the findings with respect to environmental impact of any of the components later studied. We believe that such a position would be in conflict with the National Environmental Policy Act, so another way of looking at the situation would demand that the entire project be brought to a halt. Thus, there is the potential for endless controversy which could be avoided to a considerable degree by a systematic approach to the environmental analysis of the CAP.

Our suspicion, these points being obvious, is that your office must, for unknown reasons, have no intention of actually considering any major alternatives for the several units and features, but plans to hew to the bare sketch of the CAP contained in the authorizing legislation. This sketch has emphatically never been critically examined in public, certainly never under the concepts of the National Environmental Policy Act. The apparent intentions of your office would indicate a policy of decision prior to analysis, under which analysis becomes a means of merely rationalizing pre-existing decisions.

We proceed to comments referring to specific passages of the draft.

Sub-section I.C., "Purpose", page 2: This paragraph does not state the purpose of the Havasu Intake Channel, Havasu Pumping Plant, or Buckskin Mountains Tunnel. Instead it makes some unsupported and controversial statements about the purpose of the Central Arizona Project and its claimed benefits. The purpose of the features mentioned is simply to take water from the Colorado River at Lake Havasu and to start it on its way to points east.

Sub-section I.D., "General Description of the Feature", page 3, second paragraph on page: The change in plans for the Havasu Intake Channel subsequent to issuance of a draft environmental statement for the CAP as a whole is noted. The possible consequences of your illogical approach to the environmental analysis of the CAP are discussed above.

Sub-section I.D., page 3, third paragraph on page: No explanation is giv-

en concerning the choice of a flow capacity of 3,000 cfs for the Havasu Intake Channel. This capacity is an option offered by the authorizing legislation, but explanation is in order to show why it should be accepted. The law requires special payoff arrangements in case this larger capacity is adopted. Will these requirements be met and how? In addition, the greater flow capacity will require an increment of power for pumping to be supplied by the Navajo Project, thus producing a specific environmental effect through requiring increased generating capacity, and thereare very likely to be other environmental impacts due to the increased flow and the increased total withdrawal.

Sub-section I.D., page 4, last paragraph on page: There is no evidence to support the statement made that the proposed pumping plant site was carefully selected from a variety of major alternatives. The later discussion of alternatives in the draft gives no consideration to any possible sites except for minor local variations of the site selected.

Sub-section I.D., page 5, second paragraph on page: It is said that the Havasu Pumping Plant will have a capacity of 3,000 cfs. Here, again, explanation is in order, as well as assessment of any environmental effect ensuing from the increased capacity.

Section II, "DESCRIPTION OF THE ENVIRONMENT", pages 6-10: We are not satisfied with the sketchy treatment of the biota in this ection. A much more comprehensive study, much more thorough in detail, is needed. Impact on the biota cannot be judged on the basis of the information pesented.

Sub-section III.A.,"THE ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION", page 11, second paragraph on page: The justification for not installing fish screens in the pumping plant intake is not at all clear. Apparently the Bureau of Sport Fisheries and Wildlife has advised installation of screens. Why not accept this advice and guard against unnecessary slaughter of fish? The cost of these screens would undoubtedly be relatively small. It is noted that there is no concern for aquatic life other then "game" fish, and thus no consideration of biotic community. It should be remembered that even in an artificial body of water such as Lake Havasu there is the eventual formation of a biotic community, every element of which, both plant and animal, has some function within it. Is there likelihood of damage to elements of the biotic community other than game fish, whether other species of fish or other than fish species?

Sub-section III.A., paragraph 2 on page 12, "Quality of Water": The unsupported assertion is made: "No quality deterioration of the mainstream flows is foreseen as a result of this action." If this statement is true, it very badly needs to be justified. Normally, water withdrawals such as those for the CAP would bring decreased flows to the main stream below the point of withdrawal, and these in turn would be subject to increased salinity due to salt concentration. There is nothing in the flat statement which is quoted to indicate that the effect will be any different in this case. Referring to the discussion of "Streamflow Regimen" and "Quality of Water" on pages 35-38 of the draft environmental statement for the CAP as a whole affords little enlightenment. It appears likely that the CAP withdrawals will indeed cause increased salinity in the Colorado River downstream of the Havasu Intake Channel. This possibility raises a serious question from several points of view, and must receive an answer. In our view

the question is sufficiently serious from several points of view, international, national, and regional, to warrant delay in any planned construction start until the question is fully resolved by expert testimony.

Section V, "ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED", pages 14-15: A very serious such effect would be increased salinity of the Colorado River downstream of the Havasu Intake Channel if such is to be a result of the CAP. This result must be assumed unless the contrary can be shown to be true.

Another adverse effect that should be listed is the result of the location of the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel within the Havasu National Wildlife Refuge. They will certainly detract from the atmosphere of the wildlife refuge, being installations which do not conform to the mission and nature of such an institution. Whether they will affect the biota of the refuge is a point that is quickly glossed over in the draft environmental statement.

Section VI, "THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY": The Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, if built, will set up another drain on the Colorado River, adding to the tendency inherent in its intensive development of reducing the river to a salty trickle. Any benefits from the CAP can be only very short-lived, since there is not sufficient water provided by the flow of the Colorado River to mean anything but a steadily decreasing water supply for the project. Thus the long-term values of the Colorado River will be sacrificed to the short-term expediencies desired by some interests in Arizona.

Section VIII, "ALTERNATIVES TO THE PROPOSED ACTION", pages 16-21: This section is a travesty of what it should be. There is no discussion of real alternatives affecting the Havasu Intake Channel, Havasu Pumping Plant, or Buskskin Mountains Tunnel. There is an unsatisfactory and deficient discussion of minor variations in the location and design of various features, but there is no treatment of basic or major options such as is needed under the National Environmental Policy Act. No consideration is given to any location not on Lake Havasu or within the Havasu National Wildlife Refuge, although there are a number of other possible locations for the intake point of the CAP. No consideration is given the several alternatives available for transporting water from the intake point to Central Arizona, so most of these are automatically ruled out because of the inelasticity caused by the premature, isolated selection of a specific location for the intake. The impression given is one of inflexibility in planning, of discussion to shield decisions which must be protected from exposure to reason.

Thinking of the desirability of removing all these features from the Havasu National Wildlife Refuge, on page 15, in the fifth paragraph on the page, there is the statement that the long-term use of the area has already altered for bighorn sheep. In support of this statement a number of factors are mentioned which appear to indicate poor management of the wildlife refuge by the Bureau of Sport Fisheries and Wildlife. If such be the case, management should be improved and the former use of the area by bighorn sheep restored. Poor management of the refuge should in no way be used as an excuse by the Bureau of Reclamation further to curtail the use of the area by bighorn sheep. We think an alternative location outside the Havasu National Wildlife Refuge should be sought.

Sub-section VIII.C., "No Construction of Authorized Feature", page 21: This paragraph begs the issue that a decision not to build the CAP would be valid. To us, it is the preferred alternative, since no additional water is required in the Central Arizona area which would be served by the project. The water problem in Arizona originates in poor management which it is within the scope of state and local government to improve materially.

It has been conclusively established that the metropolitan areas of Phoenix and Tucson do not require CAP water, that their function in the CAP is only to pay for the project the real beneficiaries of which either cannot or will not pay for it. It has also been shown that the agricultural need for the CAP is not established and is very questionable. The truth of the matter is that the need for the CAP itself has never been established except by appeals to supposedly self-evident truths which collapse under critical examination.

If the withdrawals of water for the CAP will cause salinity to increase downstream in the main stem of the Colorado River, this fact in itself is probably enough to eliminate the Havasu Pumping Plant, etc. If the present decisions with regard to location and design of the Havasu Pumping Plant, etc, are untenable because of their effect on the river, other alternatives should be considered. If none of the alternatives are any more tenable, then it must be concluded that the withdrawal of water from the Colorado River for the CAP is not practicable and the project should be discarded. A decision to this effect would not be difficult to reach, since the CAP has no genuine purpose anyhow.

Sub-section IX.B., "Coordination in the Review of the Draft Environmental Statement", page 22: This sub-section explains the establishment of the Central Arizona Project Environmental Advisory Group, and states that the group has reviewed the subject draft environmental statement and that their comments have been incorporated. Adequate evidence that the review by this group did not produce any especially effective results is to be found in the quality of the draft. It is to be hoped that the Bureau of Reclamation will not feel that consulting this group is in any way a substitute for consulting the public, for it is emphatically not.

We appreciate this opportunity to comment on the subject environmental statement in draft form. We'll be grateful if you will inform us of all developments affecting the CAP. Please send copies of all important documents to both of the undersigned.

Sincerely yours

David Yetman
Secretary
Grand Canyon Chapter
SIERRA CLUB

Henry M Zeller
Vice-Chairman
Southwest Regional
Conservation Committee
SIERRA CLUB

Replies to Comments by the
Sierra Club, Southwest Regional Conservation Committee
(Letter of April 12, 1972)

This letter of comments is essentially a repetition of the comments made by the Sierra Club in its October 26, 1971, letter on the draft environmental statement for the Central Arizona Project. Many of the comments are directed toward procedure and do not raise specific environmental points. The first 1-3/4 pages of the letter raise questions similar to those found in the April 13, 1972, letter of the Native American Rights Fund. Except for a few specific items which are covered later, the following reply involves the first 1-3/4 pages.

1. Reply: In the overall final environmental statement, it states "Initial construction of the CAP is scheduled to begin in 1972 with project completion tentatively scheduled in 1982. In view of the time required to construct the project, individual environmental statements for major features of the project will be prepared during assembly of field design data prior to initiation of construction on the respective components." . . .the individual statements will be distributed for review and comment. This will insure that cumulative environmental aspects will be kept current and any changes that occur in present conditions at the feature sites will be fully considered."

The cumulative effects of the project as a whole have been assessed in the final overall statement. The plan for issuance of subsequent individual statements does not imply fragmentation of the project, but rather an attempt in good faith to be responsive to environmental changes during the 10-year construction period. It is the plan recommended by CEQ for compliance with NEPA regarding large-scale projects such as CAP. 99

In paragraph 5(b) of CEQ's guidelines on implementation of NEPA, it states in part ". . .'major Federal actions significantly affecting the quality of the human environment' is to be construed by agencies with a view to the overall, cumulative impact of the action proposed (and of further actions contemplated)." and again "In considering what constitutes major action significantly affecting the environment, agencies should bear in mind that the effect of many Federal decisions about a project or complex of projects can be individually limited but cumulatively considerable." It must be recognized that individual statements to be prepared, such as this final statement on the Havasu complex, are not intended to negate the cumulative assessment of impacts in the overall statement, but rather to use all practicable means to improve and

coordinate the work using the most current technological advancements and environmental data available. To suggest that no work on any feature of CAP should begin unless and until designs and specifications on every component of CAP are refined to a level required for award of construction contracts is not in keeping with Federal responsibilities, nor required by NEPA. The procedure set forth by Reclamation for continued assessment of environmental conditions during the time frame of construction is in keeping with CEQ guidelines, and is in the best interest of the public.

2. Comment: As already indicated in previous correspondence we also believe that public hearings are a necessary precursor to any construction start on the CAP.

   Reply: Public hearings are an option that may be used by responsible agencies to obtain public input in the development of projects. As stated in the final overall environmental statement, the degree of public opportunity to participate in development of CAP plans together with the response to the draft statement contributed heavily to the decision not to hold further public hearings.

3. Comment: The successive completion of studies for the several components may increasingly invalidate the overall analysis, due to changes in their sites and design from the original concept. An example of such potential is to be seen in the change in the Havasu Intake Channel between the overall statement and the specific draft for the Channel. If the specific environmental studies are to give real treatment to the choice between alternatives, which the draft now under consideration does not, the chances for progressive invalidation of the general statement are much greater.

   Reply: The comment suggests that the analyses in the overall statement will be invalidated by individual feature analyses. An example is cited to show the difference between the initial Havasu feature design and subsequent designs. The example referred to should further strengthen confidence in the procedure for issuance of individual statements because full evaluation of the changes made will show that the net effect was a reduction in overall adverse impacts.

4. Comment: Subsection I.C., "Purpose", page 2: This paragraph does not state the purpose of the Havasu Intake Channel, Havasu Pumping Plant, or Buckskin Mountains Tunnel. Instead it makes some unsupported and controversial

statements about the purpose of the Central Arizona Project and its claimed benefits. The purpose of the features mentioned is simply to take water from the Colorado River at Lake Havasu and to start it on its way to points east.

Reply: This paragraph in Chapter I has been rewritten and expanded. Additions have been made to fully describe how the Havasu feature relates to the CAP as a whole.

5. Comment: Subsection I.D., "General, Description of the Feature", page 3, second paragraph on page: The change in plans for the Havasu Intake Channel subsequent to issuance of a draft environmental statement for the CAP as a whole is noted. The possible consequences of your illogical approach to the environmental analysis of the CAP are discussed above.

Reply: The change as noted has less adverse environmental impact than the initially described concept for excluding sediment from the pumps. This environmentally beneficial change was the result of updated data and recognition of the completion of the Alamo Dam upstream on the Bill Williams River. The last sentence of this comment is covered by the replies above.

6. Comment: Subsection I.D., page 3, third paragraph on page: No explanation is given concerning the choice of a flow capacity of 3,000 cfs for the Havasu Intake Channel. This capacity is an option offered by the authorizing legislation, but explanation is in order to show why it should be accepted.

Reply: The statement has been amplified and discussion of the 3,000-cfs capacity is found in Chapter I., section E.2. The State of Arizona also requested that the Granite Reef Aqueduct be designed to convey 3,000 cfs.

7. Comment: The law requires special payoff arrangements in case this larger capacity is adopted. Will these requirements be met and how?

Reply: The repayment by the State of Arizona will be through contractual arrangements and terms of the repayment contract with the Central Arizona Water Conservation District.

8. Comment: In addition, the greater flow capacity will require an increment of power for pumping to be supplied by the

Navajo Project, thus producing a specific environmental effect through requiring increased generating capacity, and there are very likely to be other environmental impacts due to the increased flow and the increased total withdrawal.

Reply: The contract commitment for power from the Navajo plant was based upon an aqueduct system capacity of 3,000 cfs. No additional increment of power or generating capacity will be required. When less than 3,000 cfs is being pumped, the unused capacity and energy will be available through power coordination arrangements to meet other Pacific Southwest power market area loads. The impacts of flow and water diversion are discussed in Chapters II and III.

9. Comment: Subsection I.D., page 4, last paragraph on page: There is no evidence to support the statement made that the proposed pumping plant site was carefully selected from a variety of major alternatives. The later discussion of alternatives in the draft gives no consideration to any possible sites except for minor local variations of the site selected.

Reply: The alternative discussion is found in Chapter VIII of the draft, pages 16-21. The draft statement discussed alternative locations from Giers Wash south of Parker Dam to Mineral Wash east of the Buckskin Mountains. In this final statement, the Marble Canyon and Bridge Canyon alternatives to the Parker route are also discussed in Chapter VIII.

10. Comment: Subsection I.D., page 5, second paragraph on page: It is said that the Havasu Pumping Plant will have a capacity of 3,000 cfs. Here again, explanation is in order, as well as assessment of any environmental effect ensuing from the increased capacity.

Reply: Refer to "reply" under 6 on the previous page.

11. Comment: Chapter II, "DESCRIPTION OF THE ENVIRONMENT, pages 6-10:

We are not satisfied with the sketchy treatment of the biota in this section. A much more comprehensive study, much more thorough in detail, is needed. Impact on the biota cannot be judged on the basis of the information presented.

Reply: This final statement includes more detail on biota than the draft. The additional detail has also increased the size of the statement.

12. Comment: Subsection III.A., "THE ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION", page 11, second paragraph on page: The justification for not installing fish screens in the pumping plant intake is not at all clear. Apparently, the Bureau of Sport Fisheries and Wildlife has advised installation of screens. Why not accept this advice and guard against unnecessary slaughter of fish? The cost of these screens would undoubtedly be relatively small.

Reply: The direct quote from BSFW's referenced November 21, 1969, letter is "Under the present plan of development, we see no need for fish screens at this time." The reason for misinterpretation of BSFW's position is not clear. In any event, this matter is being fully considered as discussed in Chapter III., section C.1.n.

13. Comment: It is noted that there is no concern for aquatic life other than "game" fish, and thus no consideration of biotic community. It should be remembered that even in an artificial body of water such as Lake Havasu there is the eventual formation of a biotic community, every element of which, both plant and animal, has some function within it. Is there likelihood of damage to elements of the biotic community other than game fish, whether other species of fish or other than fish species?

Reply: There are existing pumping withdrawals and releases from Lake Havasu. There is no evidence that such withdrawals and releases have adversely affected elements of the aquatic biotic community; thus, transfer of water diversion from one point on Lake Havasu to another indicates that there is little likelihood of damage to biotic communities.

14. Comment: Subsection III.A., paragraph 2 on page 12, "Quality of Water": The unsupported assertion is made: "No quality deterioration of the mainstream flows is foreseen as a result of this action." If this statement is true, it very badly needs to be justified. Normally, water withdrawals such as those for the CAP would bring decreased flows to the main stream below the point of withdrawal, and these in turn would be subject to increased salinity due to salt concentration. There is nothing in the flat statement which is quoted to indicate that the effect will be any different in this case. Referring to the discussion of "Streamflow Regimen" and "Quality of Water" on pages 35-38 of the draft environmental statement for the CAP as a whole affords little enlightenment. It appears likely that the CAP withdrawals will indeed cause increased salinity in the Colorado River downstream of the Havasu Intake Channel. This possibility raises a serious question from several

points of view, and must receive an answer. In our view, the question is sufficiently serious from several points of view, international, national, and regional, to warrant delay in any planned construction start until the question is fully resolved by expert testimony.

Reply: The quality and quantity aspects of the diversion of Colorado riverflows from the river and to central Arizona were covered in detail in the overall environmental statement for the CAP (FES-72-35). Those same aspects are also included in this detailed statement on the Havasu feature to indicate the quality and quantity impact of this diversion upon the Colorado River above and below Parker Dam. Refer to Chapter II., section K, and Chapter III., sections C.2.c. and d.

15. Comment: Section V, "ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED, pages 14-15: A very serious such effect would be increased salinity of the Colorado River downstream of the Havasu Intake Channel if such is to be a result of the CAP. This result must be assumed unless the contrary can be shown to be true.

Reply: Refer to the reply in 14 above.

16. Comment: Another adverse effect that should be listed is the result of the location of the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel within the Havasu National Wildlife Refuge. They will certainly detract from the atmosphere of the wildlife refuge, being installations which do not conform to the mission and nature of such an institution. Whether they will affect the biota of the refuge is a point that is quickly glossed over in the draft environmental statement.

Reply: The Havasu National Wildlife Refuge area is discussed and shown on drawings included in this statement. It is also pointed out that this land has pre-existing Reclamation withdrawn status and use of such land for the wildlife refuge is subservient to the primary purpose of the withdrawal.

The existing boundary line of the refuge was shown incorrectly on the drawings in the draft, which may have led to some confusion. Figure 3 in this final statement shows that only the intake channel and one corner of the pumping plant will be within the wildlife refuge. This is considered a minor use in view of the magnitude of the Refuge as a whole. (Refer to Figure 14.) Since the embankment is in the open water of Lake Havasu, no significant effect on the refuge

is anticipated. For additional detail, refer to Chapter I., section A., Chapter II., section G., and Chapter III., section C.1.m.

17. Comment: Section VI, "THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY": The Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, if built, will set up another drain on the Colorado River, adding to the tendency inherent in its intensive development of reducing the river to a salty trickle.

Reply: Refer to the reply in 14 on the previous page.

18. Comment: Any benefits from the CAP can be only very short-lived, since there is not sufficient water provided by the flow of the Colorado River to mean anything but a steadily decreasing water supply for the project. Thus the long-term values of the Colorado River will be sacrificed to the short-term expediencies desired by some interests in Arizona.

Reply: This comment is apparently based on a hydrologic and economic analysis other than that utilized by the Congress in making its decision to authorize the project, and by the Central Arizona Water Conservation District in its negotiation of a repayment contract.

19. Comment: Section VIII, "ALTERNATIVES TO THE PROPOSED ACTION", pages 16-21: This section is a travesty of what it should be. There is no discussion of real alternatives affecting the Havasu Intake Channel, Havasu Pumping Plant, or Buckskin Mountains Tunnel. There is an unsatisfactory and deficient discussion of minor variations in the location and design of various features, but there is no treatment of basic or major options such as is needed under the National Environmental Policy Act. No consideration is given to any location not on Lake Havasu or within the Havasu National Wildlife Refuge, although there are a number of other possible locations for the intake point of the CAP. No consideration is given the several alternatives available for transporting water from the intake point to Central Arizona, so most of these are automatically ruled out because of the inelasticity caused by the premature, isolated selection of a specific location for the intake. The impression given is one of inflexibility in planning, of discussion to shield decisions which must be protected from exposure to reason.

Reply: This comment in a large measure is repetitious of comments responded to earlier regarding alternatives. The alternative coverage in Chapter VIII of this final statement includes additional drawings to illustrate the several alternatives examined in the decision-making process. The conceptual

planning reported in the final overall environmental statement is repeated in Chapter VIII of this statement for the benefit of those who did not examine that statement.

20. Comment: Thinking of the desirability of removing all these features from the Havasu National Wildlife Refuge, on page 15, in the fifth paragraph on the page, there is the statement that the long-term use of the area has already altered for bighorn sheep. In support of this statement a number of factors are mentioned which appear to indicate poor management of the wildlife refuge by the Bureau of Sport Fisheries and Wildlife. If such be the case, management should be improved and the former use of the area by bighorn sheep restored. Poor management of the Refuge should in no way be used as an excuse by the Bureau of Reclamation further to curtail the use of the area by bighorn sheep. We think an alternative location outside the Havasu National Wildlife Refuge should be sought.

Reply: Refer to the replies in this Appended Material to the letters from the Bureau of Land Management and Bureau of Sport Fisheries and Wildlife regarding the declining trend of bighorn sheep in the Havasu area.

Toward the goal of assisting the Arizona Game and Fish Department in attempting to restore or increase the bighorn sheep population in the Buckskin Mountains area, Reclamation at the field level has initiated discussions with the Arizona Game and Fish Department, and the Bureau of Land Management regarding possibilities of closing existing Reclamation powerline access roads in this area. This closure would assist the Department in establishing an official roadless area that would preclude animal disturbance by operation of off-road vehicles. The unfortunate confusion as to the location of the refuge boundary is also apparent in this comment.

21. Comment: Subsection VIII.C., "No Construction of Authorized Feature", page 21: This paragraph begs the issue that a decision not to build the CAP would be valid. To us, it is the preferred alternative, since no additional water is required in the central Arizona area which would be served by the project. The water problem in Arizona originates in poor management which it is within the scope of state and local government to improve materially.

It has been conclusively established that the metropolitan areas of Phoenix and Tucson do not require CAP water, that their function in the CAP is only to pay for the project the real beneficiaries of which either cannot or will not pay for it. It has also been shown that the agricultural

need for the CAP is not established and is very questionable. The truth of the matter is that the need for the CAP itself has never been established except by appeals to supposedly self-evident truths which collapse under critical examination.

Reply: This comment, while only indirectly related to the Havasu feature, questions the wisdom of Congress in authorization of CAP. It further indicates that the Sierra Club has chosen to ignore the extensive and voluminous data presented during congressional hearings in favor of its own findings. During the preauthorization planning for the CAP, the Bureau of Reclamation has been responsive to constructive input by others regardless of the source. During the preconstruction and construction phase, where refinements in project features for the betterment of the overall environment are possible, the Bureau will assume a similar role.

Since the remainder of the Sierra Club's comments on page 5 would require a repetition of material already covered in Items 1 through 21 above, no further comment is provided.

INFORMATION COPY FOR 166-710-401

Arizona Water Sports Council

PRESIDENT:
CLIVE JORDAN

VICE-PRESIDENT:
FRED RUPPERT

SECRETARY-TREASURER:
GEORGE A. HAHN

BOARD OF DIRECTORS:
CLARENCE ROBERTS
DICK BORN
AL FUNK

3121 North Third Avenue
Phoenix, Arizona 85013

May 1, 1972

RECEIVED MAY 3 1972

Action:
Action Taken

Date	Initials	
5-2		150
5-5		166
File		

Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Attention Mr. E. A. Lundberg
Regional Director

Ref: 3-150
540.
Control Number DES 72-40

Gentlemen:

We find no objection to the project, but recommend the following:

1. A public boat ramp capable of handling not less than six launchings or recoveries be constructed on the landward end of the intake channel structures.

2. A parking lot capable of handling 300 to 400 cars with boat trailers be constructed in close proximity to the ramp.

3. Restrooms be provided adjacent to the ramp or parking area.

4. Other facilities serving the boater and public be considered such as safety tips, map of the lake, picnic tables, shaded ramadas, lighting and landscaping of improvements.

Planning for these facilities at the time of construction of the intake channel would be quite simple, and should not add significantly to the project cost. In addition, most of the facilities suggested could be constructed using State (of Arizona) Lake Improvement Funds.

The existing public boat ramp 1/4 mile north of Parker Dam is too steep, in poor repair, inadequate, has poor approaches, lacks adequate parking, and the access road is in poor repair and hazardous.

Very truly yours,

Clive N. Jordan, President
Arizona Water Sports Council

cc (10) Council on Environmental
Quality
Washington, D.C.

The Voice of Arizona Boating Public

Replies on Comments made by the
Arizona Water Sports Council
(Letter of May 1, 1972)

The recommendation and comments of the Council regard facilities that would be enhancement features, possible financing methods for items not contemplated at the time of authorization, and existing recreation facilities. Such enhancement measures are covered in Chapter IV., section D.

1. Comment: We find no objection to the project, but recommend the following:

   a. A public boat ramp capable of handling not less than six launchings or recoveries be constructed on the landward end of the intake channel structures.

   b. A parking lot capable of handling 300 to 400 cars with boat trailers be constructed in close proximity to the ramp.

   c. Restrooms be provided adjacent to the ramp or parking area.

   d. Other facilities serving the boater and public be considered such as safety tips, map of the lake, picnic tables, shaded ramadas, lighting and landscaping of improvements.

   Reply: For item No. b above, the placing of fill for a parking lot could be one potential use of any excess excavated material from the pumping plant site or tunnel inlet portal. The magnitude of the potential parking area would be influenced by the material available and would not be constructed as an additional feature with additional costs attributable to recreation enhancement. Items a, c, and d, are in the area of recreation enhancement not contemplated during the congressional authorization process. These items, while desirable to enhance the recreation capability and control the adverse impact of "de facto" recreation use in unplanned and undeveloped or controlled areas, should be considered for accomplishment by the agency responsible for the administration of recreation on the Reclamation withdrawn lands at Lake Havasu. This agency is the Bureau of Land Management.

2. Comment: Planning for these facilities at the time of construction of the intake channel would be quite simple, and should not add significantly to the project cost. In addition, most of the facilities suggested could be constructed using State (of Arizona) Lake Improvement Funds.

Reply: The planning and construction of recreation facilities that should be located in this area of Lake Havasu need to be coordinated between the Bureau of Reclamation - the construction agency for the Havasu complex of the Central Arizona Project - and the Bureau of Land Management which administers the recreation program on Reclamation withdrawn lands along the Colorado River. This coordination has been initiated to develop a comprehenisve recreation plan for this area. Funding of construction with State of Arizona assistance from Lake Improvement Funds is suggested. Policy decisions regarding such assistance as a commitment of state fund expenditures falls within the purview of the Arizona Outdoor Recreation Coordinating Commission.

3. Comment: The existing public boat ramp, 1/4-mile north of Parker Dam, is too steep, in poor repair, inadequate, has poor approaches, lacks adequate parking, and the access road is in poor repair and hazardous.

Reply: The existing facilities are within the security zone for Parker Dam. The administration of these facilities is under the jurisdiction of the Bureau of Outdoor Recreation. A copy of this letter of comment has been provided to the State Director's Office, and coordination activities have been initiated to develop a comprehensive recreation plan for the area from Parker Dam through the Bill Williams River arm of Lake Havasu. This comprehensive plan may modify the Take-off Point facilities, possibly to day use only and would be more consonant with the security zone.

INFORMATION COPY FOR 700

Flood Control District
of
Maricopa County
3325 WEST DURANGO STREET
PHOENIX, ARIZONA 85009

RECEIVED MAR 27 1972

Action:
Action Taken (Initials)

Date	Initials	To
3/27	AR	150
3/27	-WHC	120
File		

March 24, 1972

Mr. E. A. Lundberg, Regional Director
Regional Office - Region 3
U. S. Dept. of Interior-Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Re: Comments on Draft-Environmental Statement, CAP Project
Control No. DES 72-40 (3-150/540.)

Dear Mr. Lundberg:

Receipt is acknowledged of the Draft-Environmental Statement, Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico, which was forwarded with your letter dated March 9, 1972 to the Maricopa County Flood Control District, Phoenix, Arizona. The same environmental report with accompanying letter notice was forwarded on the same date to the Maricopa County Board of Supervisors, Phoenix, Arizona.

The proposed Central Arizona Project Aqueduct will traverse across Maricopa County to the point where it enters the proposed Orme Dam Reservoir. Another aqueduct will traverse the eastern part of Maricopa County south of the Salt River until it enters Pinal County on its way south toward Tucson, Arizona.

This Draft-Environmental Statement covers an area which is outside of Maricopa County. However, the report has still been studied for the reason a similar environmental impact report will be made covering the aqueduct traversing across Maricopa County. It is our opinion the works planned and as referred to in the Draft-Environmental Statement will have little, or at least minimum, effect upon the environment of the construction area. Some of the visual aesthetics of the construction area will, no doubt, be somewhat altered during the construction period, but, as stated in your report, will be partially restored upon the completion of construction.

Ten (10) copies of these comments have this date been forwarded to the Council on Environmental Quality in Washington, D. C.; Control No. DES 72-40.

The Board of Supervisors approve of the above comments and has requested this office to advise you to consider this communication as a joint answer from the Board of Supervisors of Maricopa County and the Flood Control District of Maricopa County.

Sincerely,

John C. Lowry
Chief Engineer & General Manager

JCL/jm
cc: Bd/Supervisors(1 each)
Council/Env.Qlty,Wash.D.C.(10)

ARIZONA CONSULTING ENGINEERS ASSOCIATION

SUITE 107, 3625 NORTH 16th STREET • PHOENIX, ARIZONA • PHONE: (602) 266-4926
MAILING ADDRESS: POST OFFICE BOX 5337, McDOWELL STATION • PHOENIX, ARIZONA 85010

JAMES O. MARTIN
EXECUTIVE SECRETARY

INFORMATION COPY FOR 100, 700

April 20, 1972

APR 24 1972

Action		
Date	Initials	
4/24	JOM	150
4/24	CJW	153
File		

Mr. E. A. Lundberg, Region #3 Director
Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

Subject: Draft Environmental Statement
Proposed Havasu Intake Channel
Havasu Pumping Plant and Buckskin Mountains Tunnel
DES 72-40
A Feature of the Central Arizona Project

It is our opinion that the referenced document is well and thoroughly prepared. The following comments are of the nit-picking variety and are made in the spirit of constructive comment only.

Page 1, Paragraph A - The intake channel will be formed... landform embankment extending outward from the south shore in a natural appearing nonlinear sinous alinement . . .mile. Photo #P 344-300-12251 and between pages 6 and 7 do not depict such an installation.

Page 10, Third paragraph, first sentence. What islands?

If this office can be of any further service to you, please do not hesitate to call on us.

Sincerely yours,

J. O. Martin

James O. Martin, P.E.
Executive Secretary

cjw
CC: (10 copies)
Council on Environmental Quality
Washington, D. C.

Replies on Comments made by the
Arizona Consulting Engineers Association
(Letter of April 20, 1972)

1. Comment: Page 1, Paragraph A - The intake channel will be formed ... landform embankment extending outward from the south shore in a natural appearing nonlinear sinuous alinement ... mile. Photo #P 344-300-12251 and between pages 6 and 7 do not depict such an installation.

   Reply: The graphic work on the illustration and the written description do not appear to agree. An attempt has been made to make this artist's conception coincide more with the description and the shape shown on map No. 344-314-1114. (See P 344-300-12523.)

2. Comment: Page 10, third paragraph, first sentence. What islands?

   Reply: This sentence has been changed to indicate that the shoreline is the area involved. The islands off from the shoreline include Heron Island which is the major one.

INFORMATION COPY FOR [illegible]

NORMAN B. LIVERMORE, JR.
SECRETARY

RONALD REAGAN
GOVERNOR OF
CALIFORNIA

OFFICE OF THE SECRETARY
RESOURCES BUILDING
1416 NINTH STREET
95814

Department of Conservation
Department of Fish and Game
Department of Harbors and Watercraft
Department of Parks and Recreation
Department of Water Resources

Air Resources Board
Colorado River Board
State Lands Commission
Office of Nuclear Energy
State Reclamation Board
Regional Water Quality Control Boards
State Water Resources Control Board

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

JUN - 8 1972

JUN 12 1972

Date	Initials	To
6/12 11-14	[illegible]	150 700
File		

Honorable E. A. Lundberg
Regional Director
Regional Office, Region 3
Bureau of Reclamation
U. S. Department of the Interior
Post Office Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

The State of California has reviewed the "Draft Environmental Statement, Proposed Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel" dated March 7, 1972, which was submitted to the Office of Intergovernmental Management (State Clearinghouse) within the Lieutenant Governor's Office. The review accomplished by the State fulfills the requirements under Part II of the U. S. Office of Management and Budget Circular A-95 and the National Environmental Policy Act of 1969.

The subject draft Statement was reviewed by the State Departments of Water Resources, Fish and Game, Parks and Recreation, Conservation, Navigation and Ocean Development, Public Health (Community Health Services and Resources Program), and Public Works (Division of Highways); State Water Resources Control Board; and Colorado River Board of California. The State's comments are as follows:

1. We concur in the necessity for monitoring the intake for the purpose of determining requirements for fish screens, particularly since the humpback sucker and bonytail which are designated as rare in California have been reported from these waters. The report should mention these rare species. Also, important game fish species in the immediate vicinity of the proposed intake include striped bass, largemouth bass, black crappie, bluegill and green sunfish as noted in the report.

2. It is doubtful that the proposed embankment will provide any significant fish spawning habitat. Consideration should be given to incorporating large rock in the embankment construction which would provide some fish cover and improve sport fishing.

3. Large numbers of waterfowl use the Bill Williams arm of Lake Havasu during the winter months and feed in the Bill Williams River delta. Care should be taken to insure that these waterfowl are not disturbed by construction and associated operative procedures.

4. Materials harmful to fish life, including siltation materials produced from the construction work, should be excluded from entering the lake waters and should not be placed where they may enter the waters subsequent to completion of construction. All possible precautions should be taken to reduce or confine sedimentation which will result from construction of the proposed embankment.

Thank you for the opportunity to comment on this Statement.

Sincerely yours,

N. B. LIVERMORE, JR.

By _____

Replies on Comments made by
The Resources Agency of California
(Letter of June 8, 1972)

The Resources Agency consolidated the comments of several state agencies through clearinghouse procedures although the comments were submitted after the 45-day review period.

1. Comment: We concur in the necessity for monitoring the intake for the purpose of determining requirements for fish screens, particularly since the humpback sucker and bonytail chub, which are designated as rare in California, have been reported from these waters. The report should mention these rare species.

   Reply: The humpback sucker and bonytail chub are adapted through evolutionary processes to the environment of swift-flowing streams that existed in the area of the present Lake Havasu prior to the construction of Hoover, Parker, and Davis Dams on the Colorado River. Lake Havasu is not a conducive environment for these two species as they are not capable of rapid evolutionary change that would permit them to become adapted to present reservoir conditions. Therefore, an individual of either species is rarely encountered in a mature reservoir environment. Humpback suckers and bonytail chubs are relatively common in the Upper Colorado River Basin. The California Department of Fish and Game classifies the humpback sucker as rare. However, neither the humpback sucker nor the bonytail chub are included on the Federal List of Endangered Species (50 CFR 17, Appendix D). The humpback sucker is included as status undetermined in BSFW's 1968 edition of "Rare and Endangered Fish and Wildlife of the United States." These species are mentioned in Chapter II., section E.2.

2. Comment: It is doubtful that the proposed embankment will provide any significant fish spawning habitat. Consideration should be given to incorporating large rock in the embankment construction which would provide some fish cover and improve sport fishing.

   Reply: The concern and confidence expressed that the inclusion of rock would provide cover and improve fishing would indicate that some significance is attached to the value of large rock for habitat purposes. The size of large rocks selected for wave protection will be considered along with esthetic values.

   As discussed in Chapters III and IV, Reclamation is making investigations of spawning habitat in the area of the intake channel to ascertain the actual effects of the Havasu feature.

3. Comment: Large numbers of waterfowl use the Bill Williams arm of Lake Havasu during the winter months and feed in the Bill Williams River delta. Care should be taken to insure that these waterfowl are not disturbed by construction and associated operative procedures.

   Reply: The use of the Bill Williams arm of Lake Havasu by waterfowl is discussed in Chapter II., section E.3.b. The impact is covered in Chapter III., sections C.l.m. and n. There is no absolute assurance that no individual bird will be disturbed, but the construction and operation activities are not expected to have any significant adverse impact on waterfowl. As a whole, the Bill Williams delta area attracts a relatively small number of migratory waterfowl compared to Lake Havasu.

4. Comments: Materials harmful to fish life, including siltation materials produced from the construction work, should be excluded from entering the lake waters and should not be placed where they may enter the waters subsequent to completion of construction.

   Reply: The projected effect of construction methods and material placement is discussed in Chapter III., section C, and precautionary measures are stated therein. Construction specification provisions and monitoring and inspection procedures will be exercised to ameliorate the incidence of adverse water quality effects.

Native American Rights Fund
1506 Broadway • Boulder, Colorado 80302 • (303) 447-8760

Director
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Deputy Director
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Washington Office
1712 N Street, N.W.
Washington, D.C. 20036
(202) 785-4166

Staff Attorney
L. Graeme Bell III

13 April 1972

Mr. E. A. Lundberg
Bureau of Reclamation
Region 3
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

Thank you for sending me a copy of the draft environmental statement for the proposed Havasu intake channel and related facilities of the Central Arizona Project. As you are aware, the Native American Rights Fund submitted a lengthy set of comments on the draft statement for the entire Central Arizona Project on November 10, 1971. Our objections to the Project were fully set forth in that letter.

We do not believe that it is sound policy to divide a massive project such as the C.A.P. into many small segments for purposes of environmental analysis. The primary environmental problems associated with the C.A.P. revolve around the quality and quantity of Colorado River water and the impetus to growth in the Phoenix-Tucson area. These basic problems are completely avoided when the Project is discussed in segments. For that reason, we wish to go on record as strongly disagreeing with the Bureau of Reclamation's policy of dividing up the environmental analysis of large projects. We believe that this policy is not in keeping with the spirit of paragraph 5(b) of the Council on Environmental Quality's Guidelines for Federal Agencies under the National Environmental Policy Act. Paragraph 5(b) directs federal agencies to assess the "overall cumulative impact of the action proposed (and of further actions contemplated). . . . In considering what constitutes major actions significantly affecting the environment, agencies should bear in mind that the effect of many federal decisions about a project or complex of projects can be individually limited but cumulatively considerable."

Instead of wasting the taxpayers' time and money by preparing meaningless public relations documents, such as the statement for the Havasu intake facilities, the Bureau of Reclamation should be devoting its energies to examining the scores of problems connected with the C.A.P. brought out in our earlier letter.

By choosing not to comment specifically on the Havasu statement, we do not mean to imply that we are waiving any rights to challenge the entire C.A.P. plans on the basis of their non-compliance with the NEPA. Again, thank you for sending us the statement and we hope that we will be retained on your mailing list for further statements.

Yours truly,

Joseph J. Brecher

JJB:fpp

Replies on Comments of the
Native American Rights Fund
(Letter of April 13, 1972)

This letter of comment is somewhat repetitive of the November 10, 1971, letter referred to. It also raises questions similar to those found in the early pages of the Sierra Club's April 12, 1972, letter. Portions of the replies provided on the Sierra Club's April 12, 1972, letter are also repeated below.

1. Comment: We do not believe that it is sound policy to divide a massive project such as the CAP into many small segments for purposes of environmental analysis.

   Reply: In the overall final environmental statement, it states, "Initial construction of the CAP is scheduled to begin in 1972 with project completion tentatively scheduled in 1982. In view of the time required to construct the project, individual environmental statements for major features of the project will be prepared during assembly of field design data prior to initiation of construction on the respective components. . . .The individual statements will be distributed for review and comment. This will insure that cumulative environmental aspects will be kept current and any changes that occur in present conditions at the feature sites will be fully considered."

   The cumulative effects of the project as a whole have been assessed in the final overall statement. The plan for issuance of subsequent individual statements does not imply fragmentation of the project, but rather an attempt in good faith to be responsive to environmental changes during the 10-year construction period. This procedure is considered to be in the best interest of the public, and in keeping with NEPA. Furthermore, it accords with the CEQ recommendations for large-scale projects such as the CAP. 99

2. Comment: The primary environmental problems associated with the CAP revolve around the quality and quantity of Colorado River water and the impetus to growth in the Phoenix-Tucson area.

   Reply: The quality and quantity aspects of the diversion of Colorado River flows from the river and to central Arizona were discussed in detail in the overall environmental statement for the CAP (FES-72-35). Those same aspects are also covered in this detailed statement on the Havasu feature since this feature will accomplish the diversion of water from Lake Havasu and is the feature most closely associated with the CAP's overall effect upon the

Colorado River above and below Parker Dam. Refer to Chapter I., section B, Chapter II., section K, and Chapter III., section C.2. of this statement.

The "impetus to growth in the Phoenix-Tucson area" is assumed to refer to population growth which is also discussed in this statement although to a lesser extent than in the overall final statement. The expected population growth of this portion of the Lower Colorado River Basin is also documented in the Type I Framework Studies published in 1971.

It is expected that population growth will continue in the future, although at a somewhat reduced rate, regardless of whether or not the CAP is constructed. Supplemental water from the Colorado River will probably be used to the greatest extent as replacement water for pumped ground water. Its effect will be to prolong the life of the available ground-water supply rather than to make additional water available for consumptive use.

3. Comment: These basic problems are completely avoided when the Project is discussed in segments. For that reason, we wish to go on record as strongly disagreeing with the Bureau of Reclamation's policy of dividing up the environmental analysis of large projects. We believe that this policy is not in keeping with the spirit of paragraph 5(b) of the Council on Environmental Quality's Guidelines for Federal Agencies under the National Environmental Policy Act.

Reply: Paragraph 5(b) states in part ". . . . 'major Federal actions significantly affecting the quality of the human environment' is to be construed by agencies with a view to the overall, cumulative impact of the action proposed (and of further actions contemplated.)" and again "In considering what constitutes major action significantly affecting the environment, agencies should bear in mind that the effect of many Federal decisions about a project or complex of projects can be individually limited but cumulatively considerable."

As stated in reply No. 1, on the previous page, the overall final statement on the CAP assesses the cumulative impacts of all major features of the project. It must be recognized that individual statements to be prepared, such as this final statement on the Havasu complex, are not intended to negate the cumulative assessment of impacts in the overall statement, but rather to use all practicable means to improve and coordinate the work using the most current technological advancements and environmental data available.

INFORMATION COPY FOR.....

Comprehensive Health Planning

625 SHADOW LANE • P. O. BOX 4426 • LAS VEGAS, NEVADA 89106

Clark County

(702) 385-1291

MAR 13 1972

Date	Initials	
3/13	[illegible]	150
3/13	[illegible]	155
File		

March 10, 1972

Mr. E. A. Lundberg
Regional Director
U. S. Dept. of the Interior
Bureau of Reclamation
Regional Office-Region 3
Post Office Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

Thank you very much for the copy of the Draft Environmental Statement on the Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project.

Because this project is physically outside of the boundaries of the State of Nevada, and particularly Clark County, the Environmental Health Task Force of the Advisory Council of Clark County Comprehensive Health Planning feels that they should not comment on this particular project.

We appreciate being on your list for receiving environmental impact statements and thank you very much for this opportunity to review this particular impact statement.

Very truly yours,

Richard V. Nutley

Richard V. Nutley, Planner

RVN:mh

MIKE O'CALLAGHAN
GOVERNOR

INFORMATION COPY FOR 100, 700
APO

JACK LEHMAN, CHAIRMAN
LAS VEGAS, NEVADA

THEODORE R. LAWSON, VICE CHAIRMAN
LAS VEGAS, NEVADA

DONALD L. PAFF, ADMINISTRATOR
LAS VEGAS, NEVADA

M. WILLIAM DEUTSCH, MEMBER
LAS VEGAS, NEVADA

MRS. MARY KOZLOWSKI, MEMBER
LAS VEGAS, NEVADA

FRANK M. SCOTT, MEMBER
CALIENTE, NEVADA

COLORADO RIVER COMMISSION OF NEVADA

P.O. Box 1748
LAS VEGAS, NEVADA 89101
TELEPHONE 384-5135

Reference: 3-150
540.

APR 26 1972

April 25, 1972

Date	Initials	To
4/27		150
4/27		1.55
File		

Mr. E. A. Lundberg
Regional Director
Region 3
Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

We have reviewed the Draft Environmental Statement for the Proposed Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, elements of the Central Arizona Project. We have no comments to offer except for some suggestions relative to the aesthetics of the pumping plant and spoil from the tunnel and structural excavations. We would suggest to de-emphasize the intrusion of the pumping plant on the natural landscape, the external geometric configuration, color and texture be compatible with the surrounding area. Also, excess excavation should be disposed in nonregular horizontal and vertical configurations so as to minimize the effect on the surrounding area.

We believe the proposed plan for the intake facility is consistent with the functional requirements of the Central Arizona Project and also minimizes the impact on the environment. We would suggest further that the proposed actions to reduce impacts to the environment relating from the construction of the channel, the pumping plant and the tunnel be rigorously enforced during the construction phase.

Very truly yours,

Donald L. Paff

Donald L. Paff
Administrator

cc (10) to: Council on Environmental Quality
722 Jackson Place
Washington, D. C. 20006

Replies on Comments by the
Colorado River Commission of Nevada
(Letter of April 25, 1972)

1. Comment: We have no comments to offer except for some suggestions relative to the aesthetics of the pumping plant and spoil from the tunnel and structural excavations. We would suggest to de-emphasize the intrusion of the pumping plant on the natural landscape, the external geometric configuration, color and texture be compatible with the surrounding area. Also, excess excavation should be disposed in non-regular horizontal and vertical configurations so as to minimize the effect on the surrounding area.

   Reply: More extensive description in Chapter I, section D. has been made with regard to configuration and coloration to show how the esthetic impact will be minimized.

2. Comment: We would suggest further that the proposed actions to reduce impacts to the environment relating from the construction of the channel, the pumping plant and the tunnel be rigorously enforced during the construction phase.

   Reply: Environmental protection provisions are part of Bureau of Reclamation specifications and become part of the terms of the contract for construction of a facility. The Bureau's construction supervisors and field personnel are charged with the responsibility for contract compliance.

INFORMATION COPY FOR 700

FOUR CORNERS REGIONAL COMMISSION
SUITE 238 PETROLEUM PLAZA BUILDING
3535 EAST 30TH STREET
FARMINGTON, NEW MEXICO 87401
AREA CODE 505-327-9626

UTAH | COLORADO

ARIZONA | NEW MEXICO

OFFICE OF THE EXECUTIVE DIRECTOR

April 18, 1972

OFFICIAL FILE COPY
RECEIVED APR 20 1972
Action:
Action Taken (Initials)

Date	Initials	To
4/21	JCM	150
4/21	1112	155
File		

Mr. E. A. Lundberg
Regional Director
Bureau of Reclamation
Regional Office - Region 3
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

Thank you for the opportunity to review the Draft Environmental Statement of the proposed Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel.

We do not have any comments to submit on this statement at this time.

Sincerely,

Allan T. Howe

Allan T. Howe
Executive Director

STATE OF NEW MEXICO

INFORMATION COPY FOR 106-116

STATE PLANNING OFFICE

SANTA FE

OFFICE OF DIRECTOR

April 4, 1972

Mr. E.H. Lundberg, Regional Director
U.S. Department of Interior
Bureau of Reclamation
Regional Office, Region 3
P.O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

With reference to the Draft Environmental Statement of the proposed Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountains Tunnel, the State Planning Office is concerned with the Central Arizona Project only as it affects the necessity of siting Hooker Dam.

The proposed location will be approximately one mile upstream from the site of the Woodrow Ruin Development Project.

As we have stated in previous correspondence, Woodrow Ruin is listed on the National Register of Historic Properties and any potential threat to the integrity of this site will be a violation of Section 106 of the Federal Cultural Properties Act of 1966.

Your consideration of the Woodrow Ruin Site would be appreciated in this regard.

Sincerely,

David W. King

David W. King
State Planning Officer
State Liaison Officer for
Historic Preservation Program

Replies on Comments by the
State Planning Office, State of New Mexico
(Letter of April 4, 1972)

The State of New Mexico makes reference to Hooker Dam and the Woodrow Ruin Development Project. This item was discussed in the Central Arizona Project final overall Environmental Statement FES 72-35, pages 68, 101, 148, and 171, but is not pertinent to the Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel.

INFORMATION COPY FOR ~~150, 700~~

State of New Mexico

GOVERNOR
BRUCE KING

DIRECTOR AND SECRETARY
TO THE COMMISSION
LADD S. GORDON

STATE GAME COMMISSION
FLOYD TODD, CHAIRMAN
CENTRAL
ALVA A. SIMPSON, JR.
SANTA FE
EDWARD MUNOZ
GALLUP
ALBERT J. BLACK
ALBUQUERQUE
ROBERT H. [illegible]

DEPARTMENT OF GAME AND FISH

STATE CAPITOL
SANTA FE
87501

April 28, 1972

RECEIVED MAY 4 1972

Date	Initials	
5/3	[illegible]	150
5/4	[illegible]	150
5/4	[illegible]	700

File

Mr. E. A. Lundberg
U. S. Department of
the Interior
Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

We have reviewed the March, 1972 Draft Environmental Statement on the Proposed Havasu Intake Channel, Havasu Pumping Plant and Buckskin Mountain Tunnel.

As it appears that adequate consideration is being directed to fish and wildlife as presented on pages 8 and 9, we do not have any comments at this time.

Thank you for the opportunity to review and comment on this statement.

Very truly yours,

Ladd S. Gordon

Ladd S. Gordon
Director

INFORMATION COPY FOR... TOC

MUSEUM OF NEW MEXICO, P.O. BOX 2087, SANTA FE, NEW MEXICO 87501

OFFICIAL FILE COPY

RECEIVED MAR 17 1972

Action:
Action Taken (Initials)

Date	Initials	To
3/17	[illegible]	550
3/17	[illegible]	155
File		

March 15, 1972

E. A. Lundberg
Regional Director, Region 3
Bureau of Reclamation
P.O. Box 427
Boulder City, Nevada 89005

Dear Sir:

Ref: DES 72-40

Thank you for sending us a copy of the Draft Environmental Statement covering the proposed Havasu Intake Channel and Pumping Plant, and the Buckskin Mountains Tunnel.

Since this project is geographically remote from our area of responsibility, we have no information or comment to contribute.

Sincerely,

George H Ewing

George H. Ewing
Assoc. Director
Anthropology Division

GHE/mbo

INFORMATION COPY FOR 700

STATE OF UTAH

DEPARTMENT OF NATURAL RESOURCES

STATE CAPITOL BUILDING / SALT LAKE CITY, UTAH 84114

CALVIN L. RAMPTON
GOVERNOR

GORDON E HARMSTON
EXECUTIVE DIRECTOR

March 13, 1972

OFFICIAL FILE COPY

RECEIVED MAR 14 1972

Action

Action Taken (Initials)

Date	Initials	To
3/14	AR	150
3/14	[illegible]	155

File

Mr. E. A. Lundberg, Director
Region 3, Bureau of Reclamation
P. O. Box 427
Boulder City, Nevada 89005

Dear Mr. Lundberg:

Thank you for the opportunity to inspect the Draft Environmental Statement of the Proposed Havasu Intake Channel, Havasu Pumping Plant, and Buckskin Mountains Tunnel, Central Arizona Project, Arizona-New Mexico.

The draft statement has been reviewed by our Environmental Statement Review Committee. The committee will have no comments since it is their opinion that Utah is not directly affected by this phase of the Central Arizona Project.

Sincerely,

Gordon E Harmston

Gordon E. Harmston
Executive Director

GEH:r

APPENDIX B OF APPENDED MATERIAL

Table 1
Fishes That Are Found in the Vicinity
of the Havasu Intake Channel

		Common	Uncommon	Rare
Carp	*Cyprinus carpio*	X		
Bony-tail Chub	*Gila elegans*			X
Humpback Sucker	*Xyrauchen texanus*			X
Mosquitofish	*Gambusia affinis*	X		
Channel Catfish	*Ictalurus punetatus*	X		
Yellow Bullhead	*Ictalurus natalis*		X	
Largemouth Black Bass	*Micropterus salmoides*	X		
Green Sunfish	*Lepomis cyanellus*	X		
Bluegill Sunfish	*Lepomis macrochirus*	X		
Redear Sunfish	*Lepomis microlophus*		X	
Black Crappie	*Pomoxis nigromaeulatus*		X	
Striped Bass	*Morone saxatalis*		X	
Threadfin Shad	*Dorosoma petenense*	X		

Table 2

Amphibians and Reptiles in the Vicinity of the Havasu Intake Channel and Buckskin Mountains Tunnel Area

Turtles		
Sonoran Mud Turtle	Kinosternon sonoriense	2
Yellow Mud Turtle	Kinosternon flavescens	2
Spiny Soft-shelled Turtle	Trionyx spiniferus hartweg	2
Desert Tortoise	Gopherus agassizi	0
Toads		
Couch's Spadefoot Toad	Scaphiopus couchi	0
Colorado River Toad	Bufo alvarius	1
Great Plains Toad	Bufo cognatus	0
Woodhouse's Toad	Bufo woodhousei	1
Southwestern Toad	Bufo microscaphus microscaphus	2
Desert Toad	Bufo punctatus	2
Frogs		
Canyon Tree Frog	Hyla arenicolor	1
Pacific Tree Frog	Hyla regilla	1
Bull Frog	Rana catesbiana	2
Leopard Frog	Rana pipiens	2
Lizards		
Western Banded Gecko	Coleonyx variegatus variegatus	0
Zebra-tailed Lizard	Callisaurus draconoides gabbi	2
Collared Lizard	Crotaphytus collaris baileyi	2
Leopard Lizard	Crotaphytus wislizani wislizeni	2
Desert Iguana	Dipsosaurus dorsalis dorsalis	2
Regal Horned Lizard	Phrynosoma solare	1
Desert Horned Lizard	Phrynosoma platyrhinos	0
Flat-tailed Horned Lizard	Phrynosoma m'calli	1
Chuckawalla	Sauromalus obesus obesus	2
Desert Spiny Lizard	Scaloporus magister magister	2
Yellow Back Spiny Lizard	Scaloporus magister uniformis	2
Colorado Desert Fringe-toed Lizard	Uma notata notata	2
Cowle's Fringe-toed Lizard	Uma notata rufopunctata	1
Long-tailed Brush Lizard	Urosaurus graciosus graciosus	0
Mojave Fringe-toed Lizard	Uma scoparia	2
Tree Lizard	Urosaurus ornatus	2
Side-blotched Lizard	Uta stansburiana stejnegeri	2
Many-lined Skink	Eumeces multivirgatus	1

Key: 1 - Species that uncommonly occurs in area of Bill Williams delta
2 - Definitely recorded from Bill Williams delta
0 - Expected to be found in the area

Western Whiptail	Cnemidophorus tigris tigris	
Desert Night Lizard	Xantusia vigilis vigilis	0
Gila Monster	Heloderma suspectum cinctum	1

Snakes

Western Worm Snake	Leptotyphlops humilis	0
Desert Rosy Boa	Lichanura trivirgata gracia	0
Glossy Snake	Arizona elegans noctivaga	2
Desert Glossy Snake	Arizona elegans eburnata	0
Western Shovel-nosed Snake	Chionactis occipitalis occipitalis	0
Colorado Desert Shovel-nosed Snake	Chionactis occipitalis annulata	0
Spotted Night Snake	Hypsiglena torquata ochrorhyncha	0
Desert Night Snake	Hypsiglena torquata deserticola	0
California King Snake	Lampropeltis getulus california	0
Yuma King Snake	Lampropeltis getulus yumensis	2
Common Whip Snake	Masticophis flagellum piceus	2
Spotted Leaf-nosed Snake	Phyllorhynchus decurtatus perkinsi	0
Sonora Gopher Snake	Pituophis melanoleucus airinis	2
Great Basin Gopher Snake	Pituophis melanoleucus deserticola	2
Long-nosed Snake	Rhinocheilus lecontei lecontei	2
Western Ground Snake	Sonora semiannulata linearis	0
Desert Patch-nosed Snake	Salvadora hexalepis hexalepis	0
Mojave Patch-nosed Snake	Salvadora hexalepis mojavensis	1
Checkered Garter Snake	Thamnophis marcianus	2
Arizona Lyre Snake	Trimorphodon lamda	0
Colorado Desert Sidewinder	Crotalus cerastes laterorepens	0
Mojave Desert Sidewinder	Crotalus cerastes cerastes	0
Mojave Rattlesnake	Crotalus scutulatus scutulatus	2
Western Diamondback Rattlesnake	Crotalus atrox	2
Southwestern Speckled Rattlesnake	Crotalus mitchelli pyrrhus	2

Table 3

Birds That Are Found in the Vicinity of the Havasu Intake Channel and Buckskin **Mountains Tunnel Area**

	Occurrence				Project Impact		
	S	S	F	W	Not Affected	Increase	Decrease
Common Loon	o	r	o	o	X		
Artic Loon		accidental			X		
Horned Grebe		accidental			X		
Eared Grebe	c	o	c	c	X		
Western Grebe	c	o	c	c	X		
*Pied-billed Grebe	u	u	c	c	X		
White Pelican	c	o	c	u	X		
Brown Pelican		accidental			X		
*Double-crested Cormorant	a	c	a	a	X		
*Great Blue Heron	c	c	c	c			X
*Green Heron	u	c	u	r	X		
*Common Egret	c	c	c	c	X		
*Snowy Egret	c	c	c	u	X		
*Black-crowned Night Heron	u	c	c	u	X		
*Least Bittern	u	c	c	u	X		
American Bittern	r		u	u	X		
Wood Ibis		o	u		X		
White-faced Ibis	o		o		X		
Whistling Swan			o	o	X		
Canada Goose	u		c	c	X		
White-fronted Goose	r		o	r	X		
Snow Goose	o		c	c	X		
Blue Goose		accidental			X		
Ross' Goose		accidental			X		
Fulvous Tree Duck		accidental			X		
*Mallard	u	o	c	c	X		
*Gadwall	u	r	c	c	X		
Pintail	c	o	a	u	X		
Green-winged Teal	o	r	c	a	X		
Blue-winged Teal	o	r			X		
Cinnamon Teal	c	o	a	o	X		
European Widgeon		accidental			X		

KEY:

S - March-May
S - June-August
F - September-November
W - December-February

a - abundant
c - common
u - uncommon
o - occasional

Birds That Are Found in the Vicinity of the
Havasu Intake Channel and Buckskin
Mountains Tunnel Area (continued)

	Occurrence				Project Impact		
	S	S	F	W	Not Affected	Increase	Decrease
American Widgeon	u	o	c	c	X		
Shoveler	o	r	c	c	X		
Wood Duck			r	r	X		
Redhead	c	o	c	u	X		
Ring-necked Duck	o		c	u	X		
Canvasback	o		u	u	X		
Lesser Scaup	c	o	c	u	X		
Common Goldeneye	o		o	u	X		
Bufflehead	c		c	c	X		
Oldsquaw		accidental			X		
Ruddy Duck	c	o	a	u	X		
Hooded Merganser				r	X		
Common Merganser	o	o	o	c	X		
Red-breasted Merganser	c	r	c	r	X		
Turkey Vulture	c	c	u	o	X		
Sharp-shinned Hawk	u		u	u	X		
*Cooper's Hawk	u	r	c	u	X		
*Red-tailed Hawk	c	c	c	c	X		
Swainson's Hawk		accidental			X		
*Zone-tailed Hawk		r	r		X		
Rough-legged Hawk		accidental			X		
Ferruginous Hawk		accidental			X		
*Harris' Hawk	o	o	o	o	X		
Golden Eagle				u	X		
Bald Eagle				r	X		
Marsh Hawk	u		c	c	X		
Osprey	c	r	c	o	X		
Prairie Falcon	r	r	r	r	X		
Peregrine Falcon	o	o	o	o	X		
Pigeon Hawk			u	o	X		
Sparrow Hawk	c	u	c	c	X		
*Gambel's Quail	a	a	a	a	X		
Sandhill Crane	o		o		X		
*Clapper Rail	c	c			X		
Virginia Rail	r		u	u	X		
Sora	c		c	c	X		
*Common Gallinule	u	u	u	u	X		
*American Coot	c	c	c	a	X		
Semipalmated Plover	u	o	u		X		
Snowy Plover	u	c	c	r	X		

Birds That Are Found in the Vicinity of the
Havasu Intake Channel and Buckskin
Mountains Tunnel Area (continued)

	Occurrence				Project Impact		
	S	S	F	W	Not Affected	Increase	Decrease
*Killdeer	c	c	c	c	X		
Mountain Plover			r		X		
Black-bellied Plover	o	o	o		X		
Common Snipe	u		u	u	X		
Long-billed Curlew	u	c	u		X		
Whimbrel			r		X		
Spotted Sandpiper	c	u	c	u	X		
Solitary Sandpiper	r	u	u		X		
Willet	u	c			X		
Greater Yellowlegs	u	u	c	o	X		
Lesser Yellowlegs	o	o	o		X		
Pectoral Sandpiper			o		X		
Baird's Sandpiper		u	u		X		
Least Sandpiper	u		c	c	X		
Dunlin	r		o	r	X		
Long-billed Dowitcher	u		c	u	X		
Western Sandpiper	u	c	c		X		
Marbled Godwit	o	c	r		X		
Sanderling	r	r	r		X		
American Avocet	u	c	c	r	X		
Black-necked Stilt	o	c	u		X		
Red Phalarope			r		X		
Wilson's Phalarope	o	u	u		X		
Northern Phalarope	r	c	u		X		
Parasitic Jaeger		accidental			X		
Herring Gull				o	X		
California Gull	c		u		X		
Ring-billed Gull	c	u	c	c	X		
Franklin's Gull			r		X		
Bonaparte's Gull	o		o	r	X		
Sabine's Gull			r		X		
Forster's Tern	u	c	u		X		
Common Tern		u	u		X		
Caspian Tern	o	c	u		X		
Black Tern	o	c	u		X		
*Mourning Dove	c	a	c	u	X		
*White-winged Dove	u	c			X		
Ground Dove		r	r		X		
*Yellow-billed Cuckoo		u			X		
*Roadrunner	c	c	c	c	X		

Birds That Are Found in the Vicinity of the
Havasu Intake Channel and Buckskin
Mountains Tunnel Area (continued)

	Occurrence				Project Impact		
	S	S	F	W	Not Affected	Increase	Decrease
*Barn Owl	u	u	u	u	X		
*Screech Owl	c	c	c	c	X		
*Great Horned Owl	c	c	c	c	X		
Long-eared Owl	r			r	X		
Short-eared Owl	accidental				X		
*Poor-will	c	o	c		X		
*Lesser Nighthawk	c	c	c		X		
Vaux's Swift	u		o		X		
*White-throated Swift	u	u	o	u	X		
*Black-chinned Hummingbird	u	u			X		
*Costa's Hummingbird	c			u	X		
Rufous Hummingbird		o	o		X		
Belted Kingfisher	u		c	c	X		
Red-shafted Flicker	u		c	c	X		
*Gilded Flicker	o	o	o	o	X		
*Gila Woodpecker	c	c	c	c	X		
Acorn Woodpecker	accidental				X		
Lewis' Woodpecker			o	o	X		
Yellow-bellied Sapsucker	o		u	u	X		
Williamson's Sapsucker	accidental				X		
Ladder-backed Woodpecker	c	c	c	c	X		
Tropical Kingbird	accidental				X		
*Western Kingbird	c	c	o		X		
Cassin's Kingbird		r			X		
*Wied's Crested Flycatcher	o	o			X		
*Ash-throated Flycatcher	c	c	o	o	X		
Eastern Phoebe	accidental				X		
Black Phoebe	u	c	c	c	X		
Say's Phoebe	c	u	c	c	X		
Traill's Flycatcher	a	o	c		X		
Hammond's Flycatcher	c		c		X		
Gray Flycatcher	o		o	o	X		
Western Flycatcher	c		c		X		
Western Wood Pewee	c		c		X		
Olive-sided Flycatcher	o		o		X		
*Vermilion Flycatcher	c	c	c	c	X		
Horned Lark			o	o	X		
Violet-green Swallow	c	o	u	o	X		
Tree Swallow	a	u	a	a	X		
Bank Swallow	o	o			X		
*Rough-winged Swallow	c	c	o	o	X		

Birds That Are Found in the Vicinity of the
Havasu Intake Channel and Buckskin
Mountains Tunnel Area (continued)

	Occurrence				Project Impact		
	S	S	F	W	Not Affected	Increase	Decrease
Barn Swallow	c		c		X		
*Cliff Swallow	c	c	o		X		
Purple Martin	r		r		X		
Steller's Jay	r		r	r	X		
Scrub Jay	r		o	o	X		
Common Raven	c	c	c	c	X		
Pinyon Jay		accidental			X		
*Verdin	c	c	c	c	X		
Bushtit		accidental			X		
White-breasted Nuthatch			r	r	X		
Red-breasted Nuthatch			r		X		
Brown Creeper			r	r	X		
House Wren	u		c	c	X		
Bewick's Wren			o	o	X		
*Cactus Wren	o	o	o	o	X		
*Long-billed Marsh Wren	c	c	c	c	X		
*Canyon Wren	o	o	o	o	X		
*Rock Wren	u	o	c	c	X		
*Mockingbird	c	c	c	c	X		
Bendire's Thrasher	o				X		
*Crissal Thrasher	c	c	c	c	X		
Sage Thrasher	u		u	o	X		
Robin	o		u	u	X		
Hermit Thrush	u		u	u	X		
Swainson's Thrush	o		o		X		
Western Bluebird			u	u	X		
Mountain Bluebird			u	u	X		
Townsend's Solitaire	o		o	o	X		
Blue-gray Gnatcatcher	o		o	o	X		
*Black-tailed Gnatcatcher	c	c	c	c	X		
Ruby-crowned Kinglet	c		c	c	X		
Water Pipit	u		c	c	X		
Sprague's Pipit		accidental			X		
Cedar Waxwing	r		o		X		
*Phainopepla	c	c	u	c	X		
*Loggerhead Shrike	c	c	c	c	X		
Starling				u	X		
Hutton's Vireo		accidental			X		
Bell's Vireo	r	r			X		
Gray Vireo		accidental			X		
Yellow-throated Vireo		accidental			X		

Birds That Are Found in the Vicinity of the
Havasu Intake Channel and Buckskin
Mountains Tunnel Area (continued)

	Occurrence				Project Impact		
	S	S	F	W	Not Affected	Increase	Decrease
Solitary Vireo	u		u		X		
Warbling Vireo	c	u	c		X		
Black-and-white Warbler			r	r	X		
Blue-winged Warbler		accidental			X		
Orange-crowned Warbler	c		c	c	X		
Nashville Warbler	u		u		X		
Virginia Warbler		accidental			X		
*Lucy's Warbler	r	r	r		X		
*Yellow Warbler	c	c	c		X		
Magnolia Warbler		accidental			X		
Myrtle Warbler			r	r	X		
Audubon's Warbler	c		c	c	X		
Black-throated Gray Warbler	u		u		X		
Townsend's Warbler	u		u		X		
Black-throated Green Warbler		accidental			X		
Hermit Warbler	u		o		X		
Northern Waterthrush		accidental			X		
MacGillivray's Warbler	c		c		X		
*Yellowthroat	c	c	c	u	X		
*Yellow-breasted Chat	c	c	u		X		
Wilson's Warbler	c		c		X		
American Redstart	r		o		X		
House Sparrow	u	u	u	u	X		
Western Meadowlark	u		c	c	X		
*Yellow-headed Blackbird	c	c	c		X		
*Red-winged Blackbird	c	a	a	c	X		
*Hooded Oriole	o	o			X		
Scott's Oriole		accidental			X		
*Bullock's Oriole	c	c			X		
Rusty Blackbird			r	r	X		
Brewer's Blackbird	u		c	c	X		
*Brown-headed Cowbird	c	c			X		
Western Tanager	c		c		X		
*Summer Tanager	o	o	o		X		
*Cardinal	o	o	o	o	X		
Rose-breasted Grosbeak		accidental			X		
Black-headed Grosbeak	u	o	c		X		
*Blue Grosbeak	o	c	o		X		
Lazuli Bunting	u		u		X		
Varied Bunting		accidental			X		
Dickcissel		accidental			X		

Birds That Are Found in the Vicinity of the
Havasu Intake Channel and Buckskin
Mountains Tunnel Area (continued)

	Occurrence				Project Impact		
	S	S	F	W	Not Affected	Increase	Decrease
Purple Finch			r		X		
*House Finch	c	c	c	c	X		
Pine Siskin	o		u	u	X		
American Goldfinch	o		o	o	X		
*Lesser Goldfinch	u	u	u	u	X		
Lawrence's Goldfinch	r			o	X		
Green-tailed Towhee	u		u	u	X		
Rufous-sided Towhee	o		u	o	X		
*Abert's Towhee	c	c	c	c	X		
Lark Bunting		accidental			X		
Savannah Sparrow	u		c	u	X		
Grasshopper Sparrow		accidental			X		
Vesper Sparrow	u		u		X		
Lark Sparrow	o		o		X		
*Black-throated Sparrow	u	u	u	u	X		
Sage Sparrow			u	u	X		
Slate-colored Junco			o	r	X		
Oregon Junco	o		u	u	X		
Gray-headed Junco			r		X		
Chipping Sparrow	c	o	c	o	X		
Brewer's Sparrow	c		c	o	X		
Black-chinned Sparrow		accidental			X		
White-crowned Sparrow	c		c	c	X		
Golden-crowned Sparrow		accidental			X		
Fox Sparrow	r		r	r	X		
Lincoln's Sparrow	c		c	o	X		
Swamp Sparrow		accidental			X		
*Song Sparrow	c	c	c	c	X		
Chestnut-collared Longspur			r		X		

Table 4

Mammals That Are Found in the Vicinity of the Havasu Intake Channel
and Buckskin Mountains Tunnel Area

		Relative Abundance				Project Impact		
		Abundant	Common	Uncommon	Rare	Not Affected	Increase	Decrease
California Myotis	Myotis californicus		X			X		
Western Pipistrel	Pipistrellus hesperus		X			X		
Pallid Bat	Antrozous pallidus			X		X		
Mexican Freetail Bat	Tadarida mexicana			X		X		
Blacktail Jackrabbit	Lepus californicus		X			X		
Desert Cottontail	Sylvilagus audubonii		X			X		
Yuma Antelope Squirrel	Citellus harrisii		X			X		
Roundtail Ground Squirrel	Citellus tereticaundus		X			X		
Valley Pocket Gopher	Thomomys bottae				X	X		
Desert Pocket Mouse	Perognathus pencillatus		X			X		
Rock Pocket Mouse	Perognathus intermedius		X			X		
Merriam Kangaroo Rat	Dipodomys merriami		X			X		
Desert Kangaroo Rat	Dipodomys deserti		X			X		
Beaver	Castor canadensis			X		X		
Western Harvest Mouse	Reithrodontomys megalotis			X		X		
Canyon Mouse	Peromyscus crinitus			X		X		
Cactus Mouse	Peromyscus eremicus		X			X		
Deer Mouse	Peromyscus maniculatus		X			X		
Hispid Cotton Rat	Sigmodon hispidus			X		X		
Whitethroat Woodrat	Neotoma albigula		X			X		
Desert Woodrat	Neotoma lepida		X			X		
Muskrat	Ondatra zibethicus			X		X		
House Mouse	Mus musculus			X		X		
Porcupine	Erethizon dorsatum				X	X		
Coyote	Canis latrans		X			X		
Kit Fox	Vulpes macrotis			X		X		
Gray Fox	Urocyon cinereoargenteus		X			X		
Ringtail Cat	Bassariscus astutus		X			X		
Raccoon	Procyon lotor		X			X		
Badger	Taxidea taxus			X		X		

Mammals That Are Found in the Vicinity of the Havasu Intake Channel
and Buckskin Mountains Tunnel Area

		Relative Abundance				Project Impact		
		Abundant	Common	Uncommon	Rare	Not Affected	Increase	Decrease
Striped Skunk	Mephitis mephitis		X			X		
River Otter	Lutra canadensis				X	X		
Mountain Lion	Felis concolor				X	X		
Bobcat	Lynx rufus			X		X		
Burro	Equus asinus		X			X		
Feral Horse	Equus caballus			X		X		
Feral Hog	Sus scrofa				X	X		
Mule Deer	Odocoileus hemionus			X		X		
Bighorn Sheep	Ovis canadensis nelsoni			X		X		

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