CENTRAL ARIZONA PROJECT/ SALT RIVER PROJECT INTERCONNECTION FINAL ENVIRONMENTAL ASSESSMENT REPORT

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UNITED STATES BUREAU OF RECLAMATION
DEPARTMENT OF THE INTERIOR

NOVEMBER 1988

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BUREAU OF RECLAMATION
LOWER COLORADO REGION
ARIZONA PROJECTS OFFICE
PHOENIX, ARIZONA

FINDING OF NO SIGNIFICANT IMPACT

CENTRAL ARIZONA PROJECT/SALT RIVER PROJECT INTERCONNECTION

FONSI NO. LC-89-1
Finding of No Significant Impact Number

Recommened: Bruce D. Ellis Date: 1-10-89
Chief, Environmental Division

Concur: Cecil Ouellette Date: 1/18/89
ACTING Regional Environmental Officer

Approved: John D. Brown Date: 1-18-89
ACTING Regional Director

A final Environmental Assessment (EA) for the proposed Central Arizona Project (CAP)/Salt River Project (SRP) Interconnection Facility (Interconnect) has been prepared by SRP. The purpose of the Interconnect is to provide a means of conveying water from the CAP aqueduct to the SRP water distribution system. The Interconnect will allow diversions from the CAP aqueduct at the existing SRP turnout structure near Granite Reef Diversion Dam into SRP's Arizona and South Canals.

The Bureau of Reclamation (Reclamation) is the responsible federal agency for the Interconnect and requested that SRP (the project proponent) prepare the EA to comply with the National Environmental Policy Act. The EA disclosed the environmental consequences of construction and operation of the Interconnect. Reclamation used the EA to determine the need to prepare an environmental impact statement (EIS) or issue a Finding of No Significant Impact (FONSI).

Two alternatives were considered in detail in the final EA:

Alternative 1 (the Proposed Action) - Option A: direct delivery to the Arizona and South Canals or the Salt River bed downstream from Granite Reef Diversion Dam with a river crossing downstream of the diversion dam. Option B: same as Option A except the river crossing would be upstream of the diversion dam. Both options would provide a discharge outlet to the Salt River downstream of the Granite Reef Diversion Dam to provide emergency evacuation of the CAP aqueduct or future delivery of water for groundwater recharge projects. The Interconnect will be constructed as either a pressure pipe system with regulating valves or a combination pressure pipe and open channel system with regulating valves and radial gates. Option A is the preferred and selected option for implementation.

Alternative 2 (No Action) - the Interconnect would not be constructed. No CAP water would be delivered into the SRP canals.

The key environmental issue associated with construction and operation of the Interconnect was the possibility for introduction of undesirable non-native fish from the Colorado River into the Salt and Verde River systems via the Interconnect. This potential impact has been mitigated by: 1) requiring that deliveries of CAP water to the SRP canals will be downstream from Granite Reef Diversion Dam and; 2) constructing electrical fish barriers in the Arizona and South Canals between the Interconnect outlet to the canals and the diversion dam.

Reclamation is committed to the monitoring program described on page 49 of the final EA. The program will be implemented in cooperation with SRP, Fish and Wildlife Service, and Arizona Game and Fish Department. It will specifically monitor the effectiveness of the electrical fish barriers in preventing upstream movement of non-native fish species in the Arizona and South Canals in the canal reaches between the barriers and the spillway gates of Granite Reef Diversion Dam. The intent of this commitment will be to determine if the electrical barriers are effective and identify the need for further investigations if the barriers are demonstrated to be ineffective.

The environmental mitigation commitments contained in Chapter IV of the EA with the additional monitoring commitment will be implemented through incorporation into the contract specifications or required permits for the

project, or carried out by Reclamation and SRP through project administration, and through inclusion in interagency agreements.

Reclamation has determined that the proposed action (Option A), with implementation of the environmental mitigation commitments identified and specified in the final EA, will not significantly affect the quality of the human environment. Therefore an environmental impact statement will not be prepared. This finding is made considering the following factors:

1. All areas of environmental concern and significant issues raised by the public and other agencies were explored and analyzed. The required environmental mitigation commitments in the proposed action were developed in response to the truly significant environmental concerns and issues.

2. Reclamation is committed to implementation of actions to minimize, eliminate, or avoid impacts to threatened and endangered species, particularly bald eagles. The installation of electrical fish barriers, in combination with water velocities and drop in the Arizona and South Canals, will prevent upstream movement of non-native fishes that could be introduced from the CAP aqueduct into the Salt-Verde River systems. The original proposed action was altered to include these mitigation actions.

3. Impacts on public health and safety are mitigated through implementation of safety measures described in the EA.

4. There are no adverse effects on cultural resources. The actions specified on page 50 and 51 of the EA for features 1, 2, and 3 of Site AZ U:6:2 (ASU) will be fully implemented by SRP.

5. Impacts to floodplains affected by this proposed action have been evaluated in accordance with E.O. 11988. No wetlands will be affected. SRP will obtain a 404 permit from the Corps of Engineers prior to construction of the Interconnect.

6. The cumulative effects to the affected environment are mitigated and insignificant. Impacts to wildlife populations and habitat, threatened and endangered species, human safety, vegetation, and water quality have been addressed.

A draft EA was distributed to 48 individuals, groups, and agencies for review and comment. Ten letters of comment were received. Consultation included but was not limited to:

Arizona Game and Fish Department
Fish and Wildlife Service
Arizona State Historic Preservation Office
Salt River Project
Tonto National Forest
Maricopa County Flood Control District

The final EA and public input demonstrate that SRP and Reclamation have taken a hard look at the environmental concerns and significant issues related to construction and operation of the of the Interconnect. The EA evaluated and

disclosed the relevant areas of environmental concern. The proposed action with the required mitigation commitments reduces the environmental impacts to a minimum and insignificant level. Further, the standards of the National Environmental Policy Act regarding consideration of environmental factors in decisionmaking, public involvement, alternative consideration, and maintenance of a productive harmony between man and nature are met in this finding.

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I. PURPOSE AND NEED FOR THE PROJECT

A. BACKGROUND OF THE PROPOSED ACTION

The Salt River Project Agricultural Improvement and Power District (SRP) is a water and power utility supplying water to much of the Phoenix metropolitan area in south central Arizona. The SRP canal system consists of approximately 1,300 miles of canals and laterals that are used for delivering agricultural, municipal and industrial water to eight cities and over 174,000 SRP shareholders in the Salt River Valley.

Implicit in the decision to construct the federal Central Arizona Project (CAP) was the necessity to construct turnouts or interconnection facilities to allow distribution of CAP water to the allottees. While the location and tentative configuration of the Interconnection Facility to serve the Salt River Valley co-users were not known until late 1982, such an interconnection has been included in CAP planning from the beginning. USBR completed construction of the SRP turnout in 1985.

The purpose of the Central Arizona Project/Salt River Project (CAP/SRP) Interconnection Facility is to provide a means of conveying water from the CAP aqueduct to the Salt River Project water distribution system. The Interconnection would allow diversions from the CAP aqueduct either for ultimate delivery to CAP allottees downstream of Granite Reef Diversion Dam or to accommodate CAP water exchanges for allottees upstream.

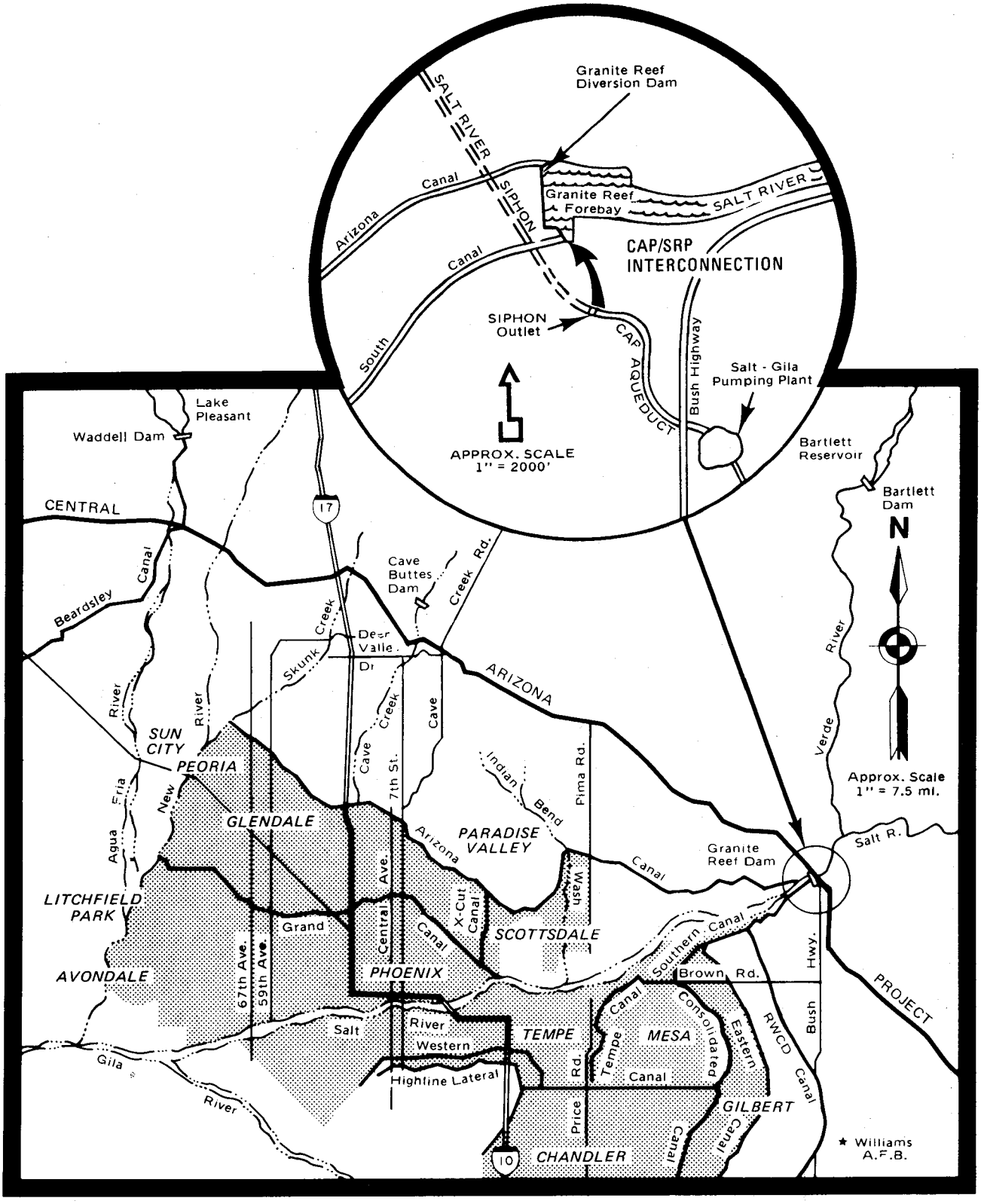
The area chosen for the Interconnection Facility is shown on the Site Location Map, Figure 1. The project study area, as shown in Figure 2, lies between the Salt River and Bush Highway south of the Granite Reef Diversion Dam in Maricopa County, Arizona (T2N, R6E, Sec. 13).

The Interconnection Facility would incorporate electrical fish barriers in the SRP Arizona and South Canals designed to prevent the upstream movement of any aquatic organisms that may be introduced into the SRP canal system with the CAP water. The fish barrier concept was developed in response to state and federal agency concerns about the possible impacts of introducing Colorado River fish species into the lower Salt River from the Granite Reef Dam forebay, which was the originally-conceived delivery point.

As presently conceived, the facility will be designed, constructed, operated and maintained by SRP. Funding will be provided by SRP and other co-users that elect to participate on a pro-rata basis. SRP intends to proceed with design and construction of the facility, with funding being provided by SRP until the allottees are prepared to contribute their shares.

B. PURPOSE OF THE PROPOSAL AND THE ENVIRONMENTAL ASSESSMENT REPORT

CAP water delivered through the Interconnection will be used to supplement existing surface water supplies for continued urban growth, to reduce the user's dependence on groundwater, and to provide CAP water for future groundwater recharge by CAP allottees. CAP water will not be used to

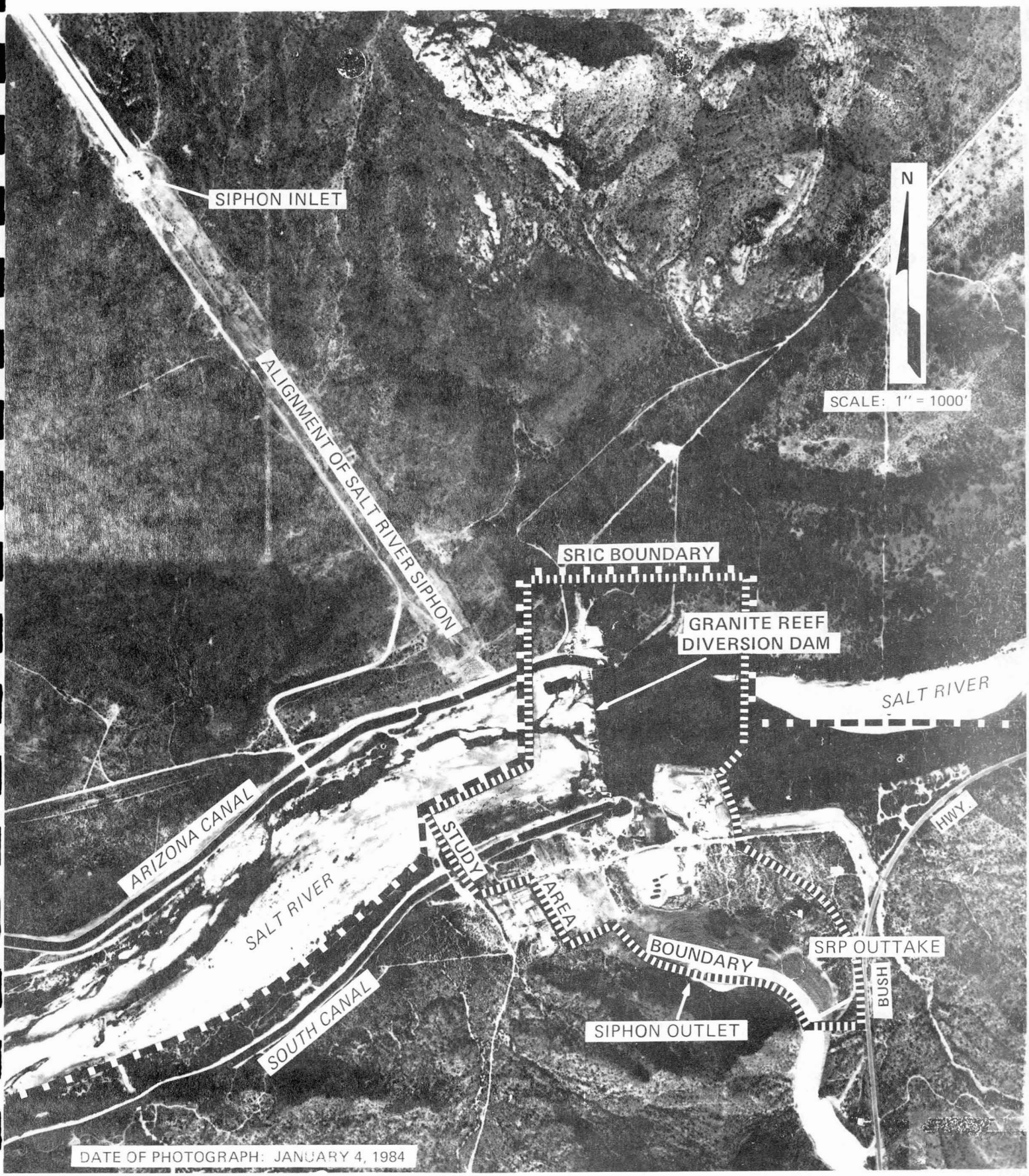


LEGEND

SRP Water Service Area

SITE LOCATION MAP
CAP/SRP INTERCONNECTION

FIGURE 1



PROJECT VICINITY MAP
GRANITE REEF DIVERSION DAM

FIGURE 2

reduce SRP surface water deliveries to Valley cities.

This Environmental Assessment (EA) report has been prepared to disclose and discuss the environmental consequences of the proposed project and it's reasonable alternatives. It also includes environmental mitigation commitments that will minimize the impacts of the proposal.

C. NEED FOR THE ENVIRONMENTAL ASSESSMENT REPORT

This EA report was prepared by SRP for Reclamation, the federal agency responsible for this project. Preparation and submittal of an EA report is required under the National Environmental Policy Act for any project proposed on federal lands, using federal funds or requiring federal approval or permits. The proposed project would be constructed on federal land, would connect to a federal project (CAP) and requires federal approval prior to construction.

D. SCOPE OF THE ENVIRONMENTAL ASSESSMENT REPORT

This EA report provides detailed information on the proposed method for delivering water from the CAP aqueduct to the SRP canal system and the Salt River bed below Granite Reef Dam, as well as an alternative means of delivery of this water. Other alternatives that were evaluated and dropped from further consideration are reviewed in a referenced report. Since the site of the project was established by USBR construction of the SRP outtake from the CAP system no site selection information is included.

E. ISSUES

There are several issues of potential concern that have been identified during review of the project by a number of agencies. The alternatives discussed in Section II.D were developed to deal with these significant issues and the Analysis Criteria that are discussed in Section II. B. These issues are discussed in this section, roughly in order of percieved importance.

1. Impacts on Protected Wildlife Species

Two federally-listed endangered species, the Yuma clapper rail and bald eagle, are known to occur along that portion of the Salt River that includes the present study area (58). One of the primary localities for Yuma Clapper Rails on the Salt River was the now dry cattail stand within the study area (45, 47). There is no known nesting of Yuma clapper rails in the project area (pers. comm. Bruce Palmer, AGFD, Dec. 1987).

Bald eagles nest at several localities on the nearby Verde River (28, 41, 54, 55) and occur in the study area from time to time while in transit or foraging. No known nesting sites for bald eagles are located in the study area, nor has the site been identified as an important foraging area. In the spring of 1987 a bald eagle nest was discovered on Salt River Indian Community lands about 2 1/2 miles upstream of the project location. The nest fledged two young in 1987. (See USFWS letter, dated Dec. 17, 1987, in Appendix E).

A number of species included on the Arizona Game and Fish Commission's wildlife list Threatened Native Wildlife in Arizona (8) are potential users of the Interconnection study area. This list is included in Appendix A.

A major concern is that the proposed action could result in the introduction of Colorado River plant and fish fauna into the Salt-Verde River system. Such introduction could result in longterm impacts to existing native and non-native fishes that are present in Granite Reef Dam forebay and the lower Salt-Verde River system. The latter is especially true if the highly predacious striped bass is introduced and becomes established. It is not inconceivable that direct competition between striped bass and bald eagles for the available fish prey could have a long term negative impact on the eagles.

Recent documentation (50) of a large resident fish population in the Granite Reef Aqueduct, including largemouth bass, striped bass and channel catfish, indicates that several fish species will be transferred from the CAP aqueduct to the SRP canals. It appears that striped bass and white bass could find their way into the lower Salt River if introduced into the Arizona and South Canals without protective measures being taken. Water velocities in the canals would be helpful in washing eggs, larvae and young of these three species downstream, but larger fish may be able to swim against these velocities and pass through the headgates.

In order to eliminate the potential for such transfer of predatory fish species, the proposed project would incorporate electrical fish barriers in the Arizona and South Canals between the Interconnection outlet and the Granite Reef Dam forebay. These barriers are discussed in the Proposed Action section of this report (Section II.D.1.c.).

Delivery of the CAP water to points below the headgates of the Arizona and South Canals and installation and operation of the planned electrical fish barriers upstream of the point of water delivery will prevent introduction of the exotic species into the river system. Backup generators will be provided to maintain the electrical field in case of a power failure, and so will insure that fish will be unable to move upstream from the canals.

So-called "bait-bucket" transfers to the Salt River system remain a possibility, but transfer of a large number of fingerlings rather than a few adults of a given species would probably be required for establishment of a viable population. Transfers on this scale would more likely be the result of a deliberate effort rather than an accidental occurrence (Pers. comm. Joe Janish, AGFD, Dec. 1987).

During periods of high runoff, water is released to the normally dry Salt River bed downstream of Granite Reef Dam. These releases are made both through the spillway gates and over the crest of the dam. During these periods releases of up to 9,000 cfs are made through the six spillway gates. At releases larger than 9,000 cfs the spillway gates are closed and all flows pass over the spillway crest.

The concrete chutes downstream of the spillway gates are approximately 75 feet long and constructed at a 16% slope. At low releases approximately 350 cfs is passed through each gate, with velocities in the chutes of about 23 fps at the gates and 25 fps at the bottom of the chute. At high releases through the spillway gates, approximately 1,500 cfs per gate, the velocities in the chutes will be about 16 fps at the gates and 30 fps at the bottom of the chute.

The Granite Reef Dam crest is at elevation 1310.0. During large releases over the dam crest the downstream tailwater elevations are as shown below:

Q (cfs)	Tailwater Elevation
120,000	1301.4
150,000	1303.5
185,000	1305.6

The water velocities over the dam at flow ranges of 120,000 to 185,000 cfs are approximately 30 to 50 fps on the ogee crest of the dam.

These water velocities, combined with the roughly 4.5 to 8.5 feet of drop at the various flows, will prevent upstream movement of any Colorado River fish species that may be residing in the riverbed downstream of Granite Reef Dam.

2. Impacts on Water Quality

Under existing operational conditions SRP water is of good quality (Table 1). Seasonal and annual quality varies because of hydrologic characteristics of the watersheds as well as traditional storage and release patterns which emphasize the use of Salt River water in the summer and Verde River water in the winter. Total dissolved solids concentration is higher in the summer than it is in the winter (occasionally exceeding secondary drinking water standards) due to the preponderance of Salt River water whereas hardness is higher when Verde River water dominates the supply.

Any amount of Colorado River water placed in the SRP system will result in some change in overall water quality. Generally, as the percentage of CAP water rises, the significance of impacts due to water quality changes rises. Table 2 summarizes the changes expected in several water quality parameters as a result of the blending of CAP and SRP waters. The changes expected in these parameters as a result of blending CAP water with winter and summer blends of SRP water is summarized in Table 3. From the standpoint of overall quality, complete or near-complete replacement of SRP water by CAP water on a periodic basis would represent the greatest change in water quality. However, if the CAP/SRP water blends are held fairly constant on a month-to-month basis, the variations in canal water quality and thus the impacts can be considerably reduced.

During those months when a high percentage of Colorado River water is being conveyed in the canals, municipal water treatment plants may

WATER QUALITY COMPARISON FOR CAP AND SRP WATER WITH PUBLISHED STANDARDS AND CRITERIA (m) (UNITS mg/L)

	DRINKING WATER STANDARDS (a)	CROP IRRIGATION CRITERIA (b)	FRESHWATER AQUATIC LIFE CRITERIA (b)	CAP WATER (c)			SRP WATER		
				MINIMUM	AVERAGE	MAXIMUM	AVG VERDE d	AVG SALT d	AVG FLOW WGT. e
ALKALINITY	–	–	> 20.	98.0	127.4	150.0	162.1	109.0	127.1
AMMONIA	–	–	0.02	–	–	–	0.07	0.07	0.07
ARSENIC	0.05(a)	0.1	–	0.0005	0.0027	0.005	0.0123	0.00275	0.0074
BARIUM	1.0(a)	NNS	–	0.0	0.124	0.500	0.118(f)	0.0975	0.105(g)
BORON	NNS	0.75	–	0.050	0.140	0.400	–	–	0.1(h)
CADMIUM	0.01(a)	0.01	0.0004–0.004	0.0	0.0037	0.013	0.00052	0.00054	0.00053
CALCIUM	200.(j)	–	–	64.0	82.5	100.0	37.7	44.5	42.2
CHLORIDE	250.	–	–	51.0	89.6	140.0	14.5	123.0	86.1
CHROMIUM	0.05(a)	0.1	0.1	0.0	0.006	0.026	0.0048	0.0037	0.0041
COPPER	1.0	0.2	NNS	0.0	0.009	0.037	0.0075	0.0088	0.0084
CYANIDES	–	–	–	0.0	0.0009	0.02	–	–	–
DISSOLVED OXYGEN	MAX	–	≥ 5.0	5.1	8.7	13.0	9.9	8.6	9.04
FLUORIDE	1.4–2.4(a)	2.0	–	0.20	0.36	0.70	0.32	0.32	0.32
HARDNESS	< 170.	–	–	250.0	328.7	380.0	184.9	157.0	166.5
HARDNESS, NONCARBONATE	–	–	–	0	194.9	240	16.6	46.4	36.2
IRON	0.3	NNS	1.0	0.010	0.145	0.550	0.814	0.374	0.524
LEAD (DISSOLVED)	0.05(a)	5.0	NNS	0.0	0.0019	.008	0.0011	0.0018	0.0016
MAGNESIUM	150.	–	–	23.0	29.8	40.0	21.9	11.1	14.8
MANGANESE	0.05	0.2	–	.004	.017	.050	0.075	0.037	0.050
MERCURY	0.002(a)	–	0.00005	0.0	.0001	0.0006	0.00023	0.00019	0.00020
NITRATE (NO_2 + NO_3 AS N)	10.(a)	–	–	0.02	0.16	0.30	0.093	0.05	0.07
PH	6.5–8.5	–	6.5–9.0	7.1	7.96	8.8	8.2	8.0	8.1
PHOSPHORUS (ORTHO) (DISSOLVED)	–	–	–	0.0	.014	0.10	–	–	0.025(h)
POTASSIUM	50.	–	–	3.50	4.92	6.80	2.6	3.3	3.1
SELENIUM	0.01(a)	0.02	NNS	0.0005	.003	.008	0.0005	0.0004	0.00043
SPECIFIC CONDUCTANCE	–	–	–	825.0	1112.8	1720.0	441.4(i)	714.7(i)	621.8(i)
SILVER	0.05(a)	–	NNS	0.0	0.004	0.010	0.00039	0.00033	0.00035
SODIUM	< 500.	MIN	–	69	99.8	120.0	24.8	81.6	62.3
SODIUM ADSORPTION RATIO	–	26.	–	2.0	2.6	3.0	.0.76	2.96	2.2
SULFATE	250.	–	–	200	295.9	380.0	44.9	56.8	52.7
SULFIDES	–	–	–	–	–	–	–	–	–
TOTAL DISSOLVED SOLIDS	500.	500–5000	–	531.0	707.5	848.0	266.0	403.0	356.4
TRIHALOMETHANE FORMATION POTENTIAL (k)	0.1(a)	–	–	0.28	0.34	0.40	–	–	0.39
N/P (l)	–	–	–	–	11.4	–	–	–	2.8
ZINC	5.	5.	NNS	0.0	0.024	0.310	22.1	23.1	22.8

a) Primary Drinking Water standard where footnoted, all other parameter values are secondary guidelines.

b) U.S. Environmental Protection Agency, 1976.

c) National Stream Quality Accounting Network (NASQAN), U.S. Geological survey, 1988; Colorado River Water Quality data collected below Parker Dam, period of record, October 1968 – December 1986. Values recorded as less than X (< x) were computed as one–half X (x/2).

d) National Stream Quality Accounting Network (NASQAN), U.S. Geological Survey, 1988; period of record October 1979 – September 1986. Values recorded as less than X (< x) were computed as one–half X (x/2).

e) Flow weighted average based on NASQAN data, period of record October 1979 – September 1986. Resulting in 34 percent Verde and 66 percent Salt mix at the confluence of the two rivers.

f) NASQAN data, period of record October 1979 to August 1982.

g) Flow weighted average based on NASQAN data, October 1979 to August 1982 resulting in 36 percent Verde and 64 percent Salt mix at the confluence of the two rivers.

h) From NASQAN data December 1950 to September 1979 and USGS Flow records resulting in 43 percent Verde and 57 Salt at the confluence at the two rivers.

i) Values as microseimens per centimeter (us/cm).

j) World Health Organization 1963.

k) Estimated from SRP data and Metropolitan Water District data for Colorado River. SRP analyses conducted for 7 days and extrapolated to potential THM using MWD data.

l) Ratio of inorgnic Nitrate to Ortho – Phosphate.

m) Mixing of SRP and CAP water will occur directly in the canal and range from 0 percent to 100 percent CAP water.

NNS No numerical standard.

WATER QUALITY DATA **TABLE 1**

MVWQD

TABLE 2: WATER QUALITY OF CAP/SRP MIXES, AVERAGE VALUES (mg/L)

CONSTITUENT	100% SRP[a] 0% CAP	75% SRP[a] 25% CAP	50% SRP[a] 50% CAP	25% SRP[a] 75% CAP
ALKALINITY	127.1	127.2	127.3	127.3
CADMIUM	0.00053	0.0013	0.0021	0.0029
CALCIUM	42.2	52.3	62.4	72.4
CHLORIDE	86.1	87.0	87.9	88.7
CHROMIUM	0.0041	0.0046	0.0051	0.0055
COPPER	0.0084	0.0086	0.0087	0.0089
FLUORIDE	0.32	0.33	0.34	0.35
HARDNESS	166.5	207.1	247.6	288.2
NON-CARBONATE HARDNESS	36.2	75.9	115.6	155.2
IRON	0.524	0.429	0.335	0.240
LEAD	0.0016	0.0017	0.0018	0.0018
pH	8.1	8.07	8.03	8.00
SODIUM	62.3	71.7	81.1	90.4
SULFATE	52.7	113.5	174.3	235.1
TOTAL DISSOLVED SOLIDS	356.4	444.2	532.0	619.9

a) CALCULATED USING WATER QUALITY VALUES FROM THE AVERAGE CAP WATER QUALITY COLUMN AND SRP FLOW WEIGHTED AVERAGE COLUMN FROM TABLE 1.

TABLE 3: WATER QUALITY OF CAP/SRP MIXES, SEASONAL AVERAGE VALUES (mg/L)

CONSTITUENT	WINTER SEASON MIXES [a]				SUMMER SEASON MIXES [b]			
	100% SRP 0% CAP [a]	75% SRP 25% CAP [c]	50% SRP 50% CAP [c]	25% SRP 75% CAP [c]	100% SRP 0% CAP [b]	75% SRP 25% CAP [c]	50% SRP 50% CAP [c]	25% SRP 75% CAP [c]
ALKALINITY	151.5	145.5	139.5	133.4	125.2	125.8	126.3	126.9
CADMIUM	0.00052	0.0013	0.0021	0.0029	0.00053	0.0013	0.0021	0.0029
CALCIUM	39.1	50.0	60.8	71.7	42.4	52.4	62.5	72.4
CHLORIDE	36.2	49.6	62.9	76.3	89.9	89.8	89.8	89.7
CHROMIUM	0.0046	0.0050	0.0053	0.0057	0.0040	0.0045	0.0050	0.0055
COPPER	0.0078	0.0081	0.0084	0.0087	0.0084	0.0086	0.0087	0.0089
FLUORIDE	0.32	0.33	0.34	0.35	0.32	0.33	0.34	0.35
HARDNESS	179.3	216.7	254.0	291.4	165.5	206.3	247.1	287.9
NON-CARBONATE HARDNESS	22.6	65.7	108.8	151.8	37.3	76.7	116.1	155.5
IRON	0.726	0.581	0.436	0.290	0.508	0.417	0.327	0.236
LEAD	0.0012	0.0014	0.0016	0.0017	0.0016	0.0017	0.0018	0.0018
pH	8.16	8.11	8.06	8.01	8.06	8.04	8.01	7.99
SODIUM	36.2	52.1	68.0	83.9	64.3	73.2	82.1	90.9
SULFATE	47.3	109.5	171.6	233.8	53.2	113.9	174.6	235.2
TOTAL DISSOLVED SOLIDS	293.4	396.9	500.5	604.0	361.2	447.8	534.4	620.9

a) JANUARY THROUGH APRIL WINTER SEASON. WATER QUALITY VALUES CALCULATED FROM AVERAGE SALT AND AVERAGE VERDE COLUMNS OF TABLE 1 BASED ON AN SRP NORMAL YEAR WINTER MIX OF 20% SALT WATER AND 80% VERDE WATER.

b) MAY THROUGH SEPTEMBER SUMMER SEASON. WATER QUALITY VALUES CALCULATED FROM AVERAGE SALT AND AVERAGE VERDE COLUMNS OF TABLE 1 BASED ON AN SRP NORMAL YEAR SUMMER MIX OF 69% SALT WATER AND 30.5% VERDE WATER.

c) CALCULATED USING AVERAGE CAP WATER QUALITY COLUMN FROM TABLE 1 AND SRP CALCULATED SEASONAL VALUE.

MVTABLE3

have difficulty meeting secondary drinking water standards for total dissolved solids (TDS) and sulphates. However, in recent years the TDS value of Colorado River water has dropped considerably, now approaching 500 mg/L rather than the expected 700 to 800 mg/L range (18). If this trend is more typical than the apparent trend from previous years, the above-mentioned difficulties may never occur.

Thus far, only minor adjustments in municipal water treatment processes have been needed to accommodate the CAP water. Higher nitrogen levels in CAP water coupled with higher water temperatures could lead to increased growth of algae in commingled water. This would reduce the length of time filters could be operated at treatment plants before cleaning, thereby increasing operating costs.

Industrial users are generally less concerned with overall water quality than with water quality fluctuations, which require frequent adjustments in treatment procedures. Under a seasonal increase or decrease in source water proportions, industrial users would have to make more frequent adjustments to their specific treatment processes and thus they could experience increased costs as a result of changes in source water quality.

A doubling of total dissolved solids by a seasonal increase in the proportion of CAP water could impact those agricultural operations which traditionally depend on Verde River water in the winter months. Crops and soils sensitive to salt may require additional water to flush salts beyond the root zone.

Consumers may be noticeably affected when CAP water delivery begins if earlier water quality data are accurate. Water hardness could nearly double with 100% substitution of CAP water, significantly reducing the efficiency of soaps, detergents and cleaners. In contrast, most physiological studies suggest that an increase in hardness is related to a <u>decrease</u> in cardiovascular diseases (40).

Total dissolved solids could increase from 264 mg/l (Verde River water) to as much as 720 mg/l (CAP water). This change, when coupled with a possible increase in algae growth due to the higher temperatures and nitrogen levels of the CAP water, could detrimentally affect water taste. The seasonal changes in taste can result in increased consumer complaints.

Reduction in the life of water heaters, evaporative coolers and water pipes is probable if hardness increases. This would result in annual cost increases to home owners of approximately ten cents per milligram per liter increase in TDS (18). For example, a 200 mg/l increase would cost an additional $20.00 per year per household (18). Of the user groups mentioned, the municipal group will probably be the most adversely affected by any seasonal change in quality.

3. Impacts on Operation of Existing and Planned Water Distribution Systems

Other than as described in the above discussion on the effects of the addition of CAP water to the existing SRP water supply, there are anticipated to be no impacts on any existing or planned water distribution systems.

4. Impacts on Existing and Future Land Uses

As discussed in the section on Recreation, the project site is not maintained or officially available for recreational uses. There is minor recreational use of the area, as well as recreational trail and vehicular river crossings that pass through the site, but these uses will not be impacted, other than possible intermittent disruption during construction. Other than the immediate vicinity of the proposed new facilities, the uses of the site will not be substantially changed.

No actions will be taken that will impede administrative access or access to the Salt River Indian Community lands via this route, although access may be disrupted intermittently during construction.

The forebay is continually dredged by SRP with the dredged materials being stored on a portion of the Interconnection site for use and sale by Aggregate Products Inc., a sand and gravel company that is licensed to process and remove this material. Year around vehicular access through the study area is necessary for operation and maintenance of the dam, canals, dredge, and associated facilities, for sand and gravel trucks and for access to the CAP Salt River siphon right-of-way. These activities are not to be impeded except, possibly, intermittently during construction.

No commercial activities occur on the recreational lands adjacent to the Interconnection site with the exception of a weekend recreational river-rafting enterprise (Desert Voyagers) that uses the Granite Reef Campground as a take-out point during the summer.

The Spook Hill Floodway, adjacent to the project site on the northeast side, is owned and maintained by the Maricopa County Flood Control District. The floodway provides a channel to convey runoff from a drainage area to the southeast of the project site into the Granite Reef Diversion Dam forebay. This facility will not be impacted by the proposed action or alternative.

The Rio Salado Project area extends for 28 miles along the Salt River from 51st Avenue in Phoenix to Granite Reef Dam, which forms the Project's eastern boundary. The Project was planned to transform the river bed into a recreational development featuring parks, waterways, and hiking, biking and horse trails, and to act as a catalyst for residential and commercial development, but it's recent rejection by Maricopa County voters puts the project's future in doubt.

There would be no known conflict between the Interconnection Facility and the Rio Salado Project, should it eventually be developed.

The Interconnection Facility will include an outlet to the Salt River bed below Granite Reef Dam that can accommodate CAP water delivery to a proposed downstream water recharge project.

The project site has approximately 180 feet of head available for use by a future hydrogeneration plant and so the Interconnection Facility will be designed to accommodate the addition of such a plant, should one become feasible. (At the time this EA report was written, August 1988, hydrogeneration was not considered to be feasible.) No disruption of the Interconnection should occur when, and if, the hydrogeneration plant is added.

5. Impacts on Other Water Users

SRP surface water represents the lower cost water available to the cities, and it is safe to assume that the cities will continue to use this source to the maximum extent possible. The cities can be expected to supplement their surface water supplies with other, more expensive, sources, such as groundwater (to the degree permitted by the Groundwater Management Act) and CAP water.

SRP will negotiate an Inter-Governmental Agreement (IGA) with interested parties, and will act as agent for the participants in all aspects of the project. Potential participants include: SRP, City of Phoenix, City of Glendale, City of Scottsdale, City of Tempe, City of Mesa, City of Chandler, City of Peoria, Town of Gilbert and many others that may express an interest. The Interconnection Facility would be used to transport CAP water to the SRP canal system for transportation to CAP allottees and to accommodate exchange of SRP and CAP water for the upstream exchangees.

Discussions are currently taking place between SRP and potential participants in an effort to formulate mutually acceptable downstream transportation, upstream exchange and Interconnection Facility agreements. Concurrent with the formulation and negotiation of the IGA and the end of the Conceptual Design Phase (February 1988), SRP provided potential participants with cost estimates for participation. Based on those conceptual estimates and related cost vs. capacity data, the potential participants are considering their level of participation.

The desired capacity entitlements by all potential IGA participants exceed the Interconnection Facility capacity. IGA negotiations will determine the final participation levels. While negotiations continue, current participation in the Interconnection Facility is as noted in Table 4. Other interested allottees will be represented by SRP funding of the remaining capacity of the facility.

Table 5 identifies the other potential users of the Interconnection Facility for direct delivery of CAP water downstream of Granite Reef

Dam or as a means to accommodate CAP water exchanges with CAP allottees upstream of Granite Reef Dam.

6. Impacts on Cultural Resources

Based on a review of pertinent area historical literature and archaeological site files, and on the results of an intensive archaeological survey of the study area, three unreported features of a previously identified and reported historic archaeological site (AZ U:6:2 ASU), and an historic building and dam were identified (See Appendix B). Site AZ U:6:2 (ASU) is the remains of a work camp occupied during the construction of Granite Reef Dam (1906-1908). This site was investigated by Patricia E. Brown of the Department of Anthropology at Arizona State University in 1976 (16).

TABLE 4. CITY DESIRED CAPACITY REQUIREMENTS (Peak Daily Flows)

	Common Pipe	Arizona Canal	South Canal	River Bottom (Future Recharge)
Chandler	99 cfs	--	99 cfs	49 cfs
Mesa	58 cfs	--	--	124 cfs
Peoria	10 cfs	10 cfs	--	--
Phoenix	221 cfs	75 cfs	150 cfs	426 cfs
Scottsdale	30 cfs	30 cfs	--	70 cfs
Tempe	88 cfs	40 cfs	40 cfs	85 cfs
Gilbert	10 cfs	--	10 cfs	--
Glendale	34 cfs	34 cfs	--	--
Total	550 cfs	189 cfs	299 cfs	754 cfs

Feature 1 (an historic building or structure remnant), and Feature 2 (an historic trash scatter), are located immediately to the east of AZ U:6:2 (ASU), and are considered to be integral and significant elements of this site which has been determined to be potentially eligible for inclusion on the National Register of Historic Places. Feature 3 is a concrete platform, presumably a floor for one of the 1906-1908 buildings.

The historic building, a residence for one of the Granite Reef Dam tenders, is constructed of concrete block masonry and is considered to be potentially eligible for inclusion on the National Register based on criteria a and d of 36 CFR Part 60.4. This building was constructed during the dam construction period. Granite Reef Dam is also considered to be potentially eligible for inclusion on the Register (Appendix B, Page 5).

7. Impacts on Recreation

While the project area is immediately adjacent to the Tonto National Forest Lower Salt River Recreation Area (49), the project site is not officially available for recreational uses. No opportunity exists in this system for recreational development and none is planned.

There will probably be an impact on this campground during the one-year construction period due to heavy equipment noise and dust during daylight hours. After construction has been completed, there should be no increase of noise or other disturbance due to operation and maintenance of the facility. No additional noise should be apparent from the campground at night. While security lighting of the facility will be used at night, provisions will be made to prevent these lights from having an impact on the campground.

TABLE 5. OTHER PARTICIPANTS ESTIMATED CAPACITY REQUIREMENTS

	Peak Daily Flow (Rounded)
Downstream Delivery	
Roosevelt Water Conservation District	100 cfs
Avondale	11 cfs
Gila River Indian Community	283 cfs
Arcadia Water Company	3 cfs
Total	397 cfs
Upstream Exchanges	
Prescott	13 cfs
Payson	4 cfs
E & R Water Company	1 cfs
Globe	6 cfs
Camp Verde Water Company	3 cfs
Cottonwood Water Company	3 cfs
Rio Verde Utility	1 cfs
Camp Verde Indian Community	2 cfs
Fort McDowell Indian Community	8 cfs
Yavapai-Prescott Indian Community	1 cfs
Tonto Apache Indian Community	1 cfs
San Carlos Indian Community	12 cfs
Total	55 cfs
SRP	
Future Exchanges (Drought, emergency, etc.)	Unspecified
Cave Creek	500 cfs
Roosevelt Replacement	17 cfs
SRP/APS Power Allocation	75 cfs
Total	592 cfs
Total	1,045 cfs

The Maricopa County Parks and Recreation Department has a right-of-way for a Sun Circle hiking and riding trail crossing the Salt River bed in the vicinity of Granite Reef Dam. In addition the USBR proposes to construct a hiking and equestrian trail on or adjacent to the CAP aqueduct right-of-way. The proposed Interconnection project will be designed to accommodate these trail crossings and their use should not be impacted except for brief periods during construction.

Existing vegetation will screen any new above-ground construction as viewed from the campground.

There should be no adverse effect on recreational fishing in the SRP canals downstream of the project area. While some fish carried by the Salt River water into the canals may be killed or injured by being carried through the electrical field generated by the fish barrier (which is described in detail in Section II. D. 1. C.), the exposure time is estimated to be only from about 2 to 5 seconds. Most of the fish should survive this exposure. Any loss of Salt River fish should be more than compensated for by the fish that will be delivered to the SRP canals with the CAP water.

8. Impacts on Vegetation

None of the federally listed threatened or endangered plants of Arizona is known to occur anywhere near the study area (58). Moreover, none of the presently proposed threatened or endangered plants of Arizona appears to occur in or near the study area (9, 60).

Species listed as protected by the Arizona Native Plant Law that occur in the study area include mesquite, paloverde, ironwood, perhaps one or more species of Liliaceae and several species of cacti. Nothing in the Arizona Native Plant Law prevents a private owner from removing these species if they are not to be transported from the land or offered for sale and provided the Arizona Commission on Agriculture and Horticulture is given at least thirty days' advance notice of their removal (5).

Since the project is to be constructed adjacent to Granite Reef Dam, it will be built almost entirely in areas that are presently badly disturbed and have marginal wildlife habitat value. There would be some loss of vegetation, primarily mesquite, on both sides of the Salt River between its bed and the South Canal. While construction of the project is expected to disturb a total of approximately 23 acres, including about 14 acres of vegetative cover, the completed project will occupy only about 6 acres. After landscaping and revegetation with native species the result should be about the same area of vegetative cover as before the project.

9. Impacts on Wildlife

Other than possible effects on Special Status Species, as discussed above, there should be no significant impacts on any wildlife. The project area is essentially industrial in nature and continual use has limited the use of the area by wildlife. Refer to the Biotic Resources report (Appendix A) for additional information.

10. Other Concerns

It is estimated that the construction cost for the project will be approximately $4 million. The work is to be done by a contractor and no additional staffing is anticipated, although a few short-term (up to 10 months) jobs could be created. Staffing of the completed

project will be very limited with the positions being filled by existing SRP personnel. While the majority of the necessary equipment and materials will be purchased locally, the total dollar amount will be insignificant compared to the existing economic activity of the Phoenix metropolitan area.

The delivery of CAP water to entities with water allocations in the Phoenix metropolitan area by means of the Interconnection Facility will result in little or no social and/or economic impact. The overall impact of the CAP water delivery would be to maintain the social and economic activities at existing levels and to accommodate the projected trends in population and economic growth (53).

While there may be localized short-term increases in dust and exhaust gasses during construction, there will be no long-term impacts on air quality due to the proposed project.

Significant impacts on the visual quality of the area will be avoided. The project area has been highly disturbed by past flooding, construction projects and industrial uses. The primary above-ground element of the proposed project will be one single-story building approximately 50' by 50' in size. Areas disturbed for constuction work or access roads that will not be used as permanent project facilities will be revegetated and returned to a near-natural condition.

The area is generally quiet, particularly at night when traffic levels on nearby Bush Highway are very low. During the weekday hours some noise is audible from the dredging and sand and gravel operations adjacent to the Granite Reef Dam forebay and from traffic on Bush Highway. On summer weekdays heavy traffic to recreation areas along Bush Highway produces the highest noise levels in the vicinity. Construction noise is expected to be limited to daylight hours and should have no effect on the Granite Reef Campground. The only anticipated noise impacts once construction has been completed would be from water flow through the system when it is in operation.

No impacts are anticipated to transportation, except that there may be brief, intermittent, disruption during construction. Traffic controls on Bush Highway when and if necessary.

Other than occasional temporary disruptions of traffic on Bush Highway during the one-year construction period, there should be no effects on transportation due to the proposed action or alternatives.

II. PROPOSED ACTION AND ALTERNATIVES

A. FORMULATION OF ALTERNATIVES

The site for the CAP/SRP Interconnection was determined by the location of the SRP outtake that was constructed by USBR in 1985. Once the location of the project had been determined, and with a known need to prevent upstream movement of Colorado River fish species, it was necessary to evaluate alternative project designs in order to

identify the best project from economic, operational and environmental points of view.

The alternative screening process is discussed in detail in the ECI engineering report (10). After completion of this process, two delivery options remained. These are as follows:

- Delivery of CAP water to the Granite Reef Dam forebay

- Delivery of CAP water to the Arizona and South Canals and the river bottom below Granite Reef Dam.

The first option, delivery to the forebay, was rejected because of the extreme difficulty in preventing upstream movement of Colorado River fishes.

Due to the necessity to cross the Salt River in order to deliver water to the Arizona Canal, the ECI report included an alternative alignment and configuration study that began with identification of all possible ways to accomplish the proposed action. This study is also detailed in the ECI report (10).

B. ANALYSIS CRITERIA

The primary objective of the Interconnection Project is to deliver water to the SRP system and the Salt River bed safely, economically, reliably and in an environmentally acceptable manner. A secondary objective of the Project is to not preclude future hydrogeneration potential. The general parameters (or constraints) to be met are that the Interconnection Project must:

1. Allow Maximum Flexibility for Water Deliveries.

   The Interconnection Facility should allow delivery of CAP water into the Arizona Canal, South Canal and Salt River bed downstream of Granite Reef Dam.

2. Permit Maximum Water Delivery.

   All facilities should be sized to allow delivery of the maximum probable allocations and designed for staged development.

3. Permit Mixing of Water from Various Sources.

   All facilities should be designed to allow mixing of water from the various sources so that the quality of the water deliveries can be as uniform as possible.

4. Minimize Impact on Existing Facilities.

   The construction and operation of the Interconnection should not adversely affect the safety or operation of Granite Reef Dam outlet works to the Arizona and South Canals or the CAP siphon and aqueduct.

5. Be constructed entirely on Non-Indian Lands.

   Alignment of the facilities, particularly to the Arizona Canal, are restricted to U.S. Bureau of Land Management (USBLM) land and USBLM withdrawn lands.

6. Not Preclude Future Hydrogeneration.

   To maximize potential benefits, the Interconnection Facility should be designed to allow addition of a future hydrogeneration facility with minimum impact on operation of the Interconnection.

7. Prevent Introduction of CAP Fish Upstream of Granite Reef Dam.

   It is environmentally unacceptable to allow fish from the CAP system to enter the Salt River upstream of Granite Reef Dam. The Interconnection Facility shall be designed to eliminate introduction or upstream migration of fish from the Interconnection and/or SRP's canal system into the Salt River system above Granite Reef Dam.

8. Minimize Disruption of SRP Water Deliveries.

   The design and construction of the Interconnection shall minimize disruption of operation of the Arizona and South Canals. During the annual maintenance period (October, November and December) each canal is taken out of service for approximately four weeks. Staged construction may allow dewatering of reservoir for a limited period of time.

9. Withstand Flood Releases Over Granite Reef Dam.

   The Interconnection shall be designed to withstand flood flows over Granite Reef Dam. (The peak flow in 1980 was 180,000 cfs.)

10. Provide for Accurate Flow Control and Regulation.

    The Interconnection Facility shall be designed to regulate the specified range of flows to each delivery point with an accuracy of ±2%.

C. ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER CONSIDERATION

The selection of the alignment and configuration for the CAP/SRP Interconnection Facility for final design and construction required the evaluation of all possible alternatives. The set of possible alternatives was defined by those alternatives which achieve the interconnection objectives without violating any of the general parameters. Objectives and general parameters were identified in the Specification for Consultant Services provided to the engineering consulting firm (ECI), and are listed as "Analysis Criteria" in Section II. B of this report.

The selection process began with an openminded and unrestrained "brainstorming" approach to identifying all possible alternatives, followed by a series of three screening processes where alternatives which do not satisfy the objectives or violate a general parameter are rejected. The brainstorming team was constrained only by the requirement that the proposed ideas had to achieve the objective of delivering water from the CAP system to the SRP system. The method used to achieve the objective was not constrained.

The screening process was designed to reduce the number of alternatives to be analyzed in detail. In the first screening, alternatives were evaluated on the basis of performance of required function and ease of implementation and construction. In the second screening, a listing of advantages and disadvantages provided a comparative evaluation of the alternatives not eliminated in the first screening. In the final screening, the alternatives not previously eliminated were rated and ranked based on weighted evaluation factor criteria.

The overall screening goal was reduction of the number of alternatives to be analyzed in a more rigid and refined evaluation process. The screening process was designed to select alternatives for conceptual design which best achieve the objectives with the least impact on the environment and the existing system.

Assumptions used in selection and screening of alternatives for the Interconnection Facility are as follows:

1. Four alternatives will be selected for conceputal design.

2. The forebay cannot be dewatered for construction.

3. The facility will be designed for 800 cfs.

4. The location and configuration of the segment of the Interconnection which delivers water to the riverbed downstream of Granite Reef Dam will not be a factor in selecting the most feasible alternatives.

5. Electric fish barriers are the most efficient means of preventing upstream fish migration.

6. Fish barriers cannot prevent the movement of fish eggs and larva when placed in the direction of flow.

7. System operation and flow measurement are more difficult and more expensive for a closed pressure system.

8. The system is to be sized for water delivery and not for hydropower.

9. The facility is to be operated by remote control.

10. Inspection and maintenance will be performed on a periodic basis requiring dewatering of all or part of the system independent of existing systems.

11. A closed-pipe system will cost more to modify for future hydropower because the closed system will be sized for water delivery, not for a hydro-generation installation.

The brainstorming session generated a long list of ideas (shown in Table 6 and discussed in the ECI report, Ref. 10). These ideas were used to formulate a number of alternatives which served as the starting point of the screening process.

Functional screening was used to evaluate and reduce the number of alternatives to be scrutinized in the ranking process. The screening process eliminated unreasonable alternatives while allowing further consideration of all reasonable alternatives.

During the screening process, all conceptual alternatives with a river-crossing pipe supported on piers were altered, with the piers being replaced by a suspension bridge. The alternatives with the ability to deliver CAP water to the required three points under good control received a Good rating. Those that had functional problems but still managed to deliver to the three points received a Fair rating. Those that could not deliver to three points received a Poor rating. The alternatives rated as Fair of Poor were not carried forward.

The next level of screening was a comparison of advantages and disadvantages. The advantages and disadvantages of the functionally acceptable alternatives were compared against each other and an effort was made to consider only the differences between the alternatives. The functional screening assured that all alternatives analyzed at this point were flexible and functional.

Table 7 lists the 16 alternatives which were evaluated in the final screening. (Figures 1 to 7 in Appendix D show the generalized layout of the 16 alternatives.) These final alternatives were evaluated as to how well each achieves the specific criteria. The specific criteria are listed in Table 8.

The comparison process included consideration of the impacts of the Interconnection Facility on the environment, including the ability of the facility to prevent the introduction of fish from the CAP system into the Salt River upstream of Granite Reef Diversion Dam. Also included were means to minimize the impacts of: noise and light from operation; construction activities; destruction or damage of existing vegetation; visual appearance of scarring and structures and impact on endangered species in the vicinity.

Appraisal level cost estimates, of major items only, were prepared for all alternatives included in the decision matrix. These costs do not include items such as mobilization, junction structures, instrumentation, fish barriers, site work and all costs for the

Table 6: POSSIBLE IDEAS

1. Total Closed System (Pressure)
2. Total Open System
3. Combination
4. Pipe on Dam
5. Pipe Upstream of Dam
6. Pipe in Dam
7. Pipe Part of Downstream Apron
8. Two Pipe System
9. Diversion Weir Downstream of Granite Reef Dam to Arizona Canal near Interconnection Site
10. Siphon Upstream and Downstream
10a. Gated Control into Closed Chute with Stilling Basin at Foot of Hill
10b. Fish Barrier Upstream of Dam
11. Tap CAP Siphon (U.S.B.R.)
12. Open Flume Across River
13. Pipe with Suspension Bridge
14. Pipe on Bottom of River
15. Delivery to Only South Canal
16. Exchanges
17. Downstream Deliveries (Via Phoenix Treatment Plants) to Arizona Canal
18. Downstream Deliveries (New Structures) Off Interconnection Site to Arizona Canal
19. Trucking
20. Fish Barriers at Turnout
21. Discharge into Forebay
22. Pump Into Arizona Canal From River
23. Discharge Downstream of Measuring Weir
24. Discharge Upstream of Measuring Weir
25. Alignment Above Stockpile Area
26. Siphon from CAP to South Canal

TABLE 7: 16 ALTERNATIVE PROJECT ARRANGEMENTS

Alternative	Description
1.A	Closed pipe to river, closed pipe crossing river upstream elevated on piers.
1.B	Closed pipe to river, pipe crossing river upstream on bottom.
1.C	Closed pipe to river, pipe crossing river upstream buried in bottom.
1.D	Closed pipe to river, closed pipe crossing river downstream on piers.
1.E	Closed pipe to river, pipe crossing river downstream buried in bottom.
3.A(1)	Closed pipe and open canals to river, high pressure pipe crossing river upstream elevated on piers.
3.A(2)	Closed pipe and open canals to river, high pressure pipe crossing river upstream on bottom.
3.A(3)	Closed pipe and open canals to river, pipe crossing river upstream buried in river bottom.
3.B(2)	Closed pipe and open canals to river, low pressure siphon crossing river upstream on bottom.
3.B(3)	Closed pipe and open canals to river, low pressure siphon crossing river upstream buried in bottom.
3.B(4)	Closed pipe and open canals to river, open flume crossing river downstream elevated on piers.
3.B(5)	Closed pipe and open canals to river, low pressure siphon downstream buried in bottom.
3.C(2)	Closed pipe to river, low pressure siphon crossing river upstream on bottom.
3.C(3)	Closed pipe to river, low pressure siphon crossing river upstream buried in bottom.
3.C(4)	Closed pipe to river, open flume crossing river downstream elevated on piers.
3.C(5)	Closed pipe to river, low pressure siphon crossing river downstream buried in bottom.

(Sketches of these alignments are shown in Appendix D.)

TABLE 8: EVALUATION FACTOR CRITERIA

1. Site Constraints
   A. Existing facilities within project vicinity
   B. Future development

2. Design
   A. Ease, economy and efficiency of system's stage development for water deliveries
   B. Ease, economy and efficiency of future expansion for hydrogeneration
   C. Effects of flood control and water supply releases from existing facilities
   D. Energy Dissipation

3. Impact on Existing Features
   A. Access
   B. Operation
   C. Maintenance
   D. Construction

4. Maintainability/Replacement

5. Environmental

6. Geotechnical

7. Operation
   A. Ease/simplicity
   B. Controlability
   C. Reliability
   D. Measurability
   E. Safety (including fish barrier)

8. Construction
   A. Constructability
   B. Construction schedule

9. Costs
   A. Capital costs
   B. Operation, maintenance and replacement costs
   C. Cost to modify for future hydrogeneration
   D. Costs of staged development

Weighting Factor

1	Least Important
2	Moderately Important
3	Highly Important

Rating Factor

1	Very Poor
2	Poor
3	Fair
4	Good
5	Very Good

segment which delivers to the riverbed, which are common to all alternatives. The ranking of alternatives is difficult unless either relative or appraisal cost estimates are prepared. The major cost items which were used to develop the appraisal cost estimates are as follows:

a. Conduit (pressure pipe) which can be either buried in or placed on the riverbed. Costs include earthwork, materials and method of construction.

b. Open channel canal system, including excavation, lining and fencing.

c. Energy dissipation and regulating valves, including excavation, backfill and concrete for associated structures.

d. Diversion structures, including radial gates, excavation, backfill and reinforced concrete for associated structures.

If an alternative violated any of the general parameters, and the constraining aspect could not be removed or modified, it was dropped from further consideration. The alternatives selected were assumed to meet the objectives except for minor variations in achieving direct delivery to the three designated points.

The final matrix screening resulted in selection of five optional alignments and configurations of the proposed action that best meet the specific criteria listed in Table 8. The five best options are:

1E Closed pipe system to all three points of delivery with the Arizona Canal delivery being a buried pipe crossing d/s of the dam.

3B(3) Closed pipe and canal system to all three points of delivery with the Arizona Canal delivery being a buried low pressure siphon u/s of the dam.

3B(4) Closed Pipe and canal system to all three points of delivery with the Arizona Canal delivery being an open flume d/s of the dam.

3B(5) Closed pipe and canal system to all three points of delivery with the delivery to the Arizona Canal, being a buried low pressure siphon d/s of the dam.

3C(5) Closed pipe system to all three delivery points with the delivery to the Arizona Canal being a buried low pressure siphon d/s of the dam.

The alternative review and selection process is discussed in detail in the ECI report (10). The alternatives that were evaluated but dropped from further consideration are:

- CAP water delivery to the Granite Reef Dam forebay

- A pressure system with a high pressure pipe crossing the river upstream of the dam

- An open-channel system or high pressure system with an elevated open flume crossing the river upstream of the dam

- A pressure system or open-channel system with an upstream river crossing that is not buried

- Alternatives 3C(4) and 3C(5) were dropped because of final matrix evaluation

For the purpose of evaluating the environmental impacts of the Interconnection Facility's best five alignment alternatives of the preferred option, it was assumed that alternatives 3-B(3), 3-B(4) and 3-B(5) created the greater impacts to the environment because they were a combination of open channel (canal) and pressure pipe systems. The combination system requires more land for construction and establishes a larger area of permanent structures. Water delivery alternatives that are composed of completely buried pressure pipe [alternatives 1-E and 3-C(5)] require less land for construction and a smaller area for permanent structures.

The five remaining alignment alternatives are technically and economically feasible, satisfy all objectives, meet all criteria and were shown by the screening and evaluation process to be superior to the alternatives that were dropped from consideration.

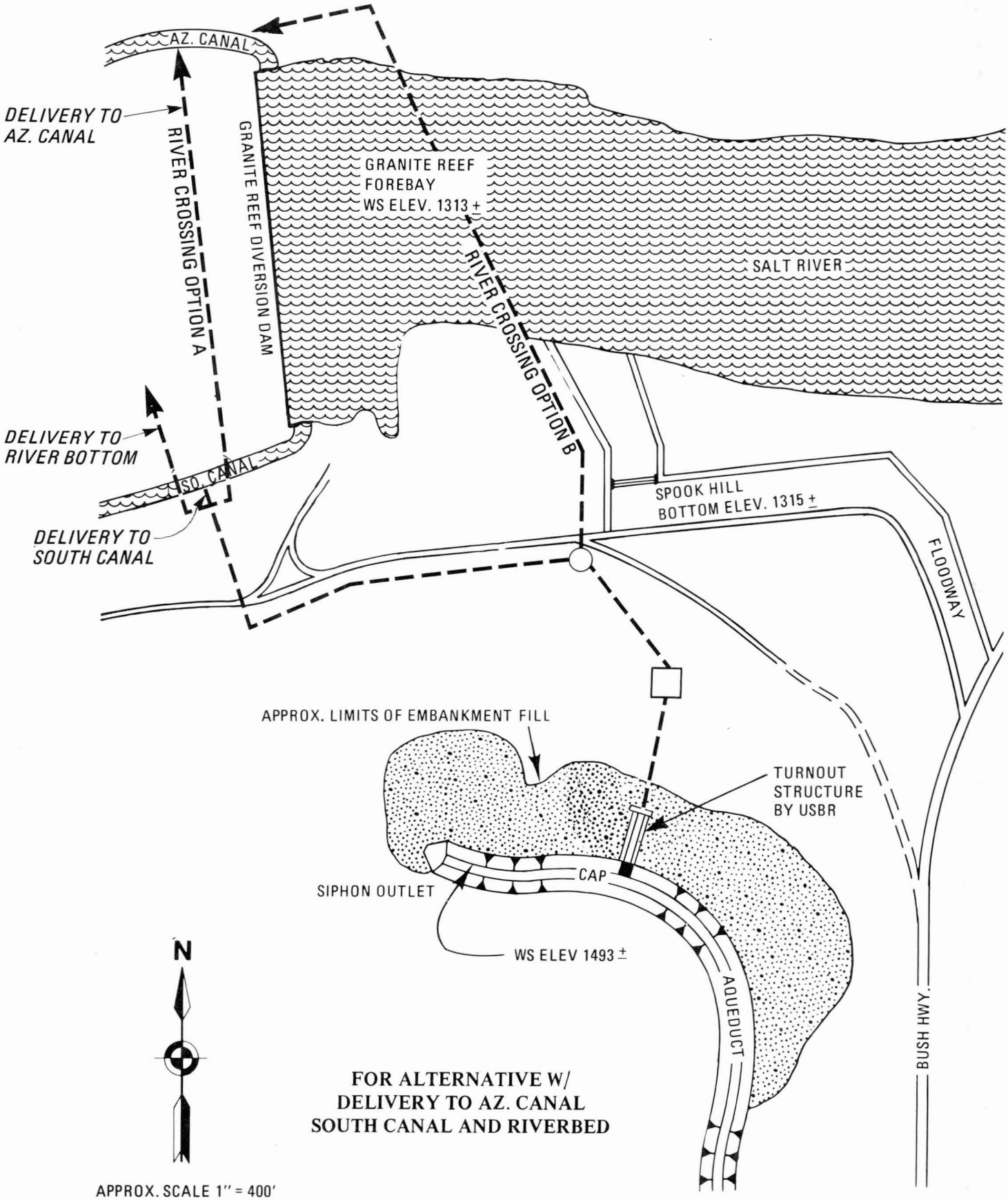
D. ALTERNATIVES CONSIDERED IN DETAIL

1. The Proposed Action - Direct Delivery to the Arizona and South Canals and the Salt River Bed with a River Crossing Downstream of the Dam

The Proposed Action is construction of a CAP/SRP Interconnection Facility from the existing USBR CAP turnout, located south of the Salt River Siphon and west of the Bush Highway, to the Arizona Canal, South Canal and the Salt River bed downstream of the Granite Reef Diversion Dam, with the delivery to the Arizona Canal being located either upstream or downstream of the dam (Figure 3). The U.S. Bureau of Reclamation (USBR) has constructed a turnout structure (referred to as the "SRP Turnout") on the north bank of the CAP aqueduct approximately 600 feet east of the Salt River siphon outlet on the south side of the Salt River in the vicinity of Granite Reef Diversion Dam. The Interconnection Facility will accommodate the SRP turnout's design capacity of from 800 to 1200 cfs.

The tentative alignments of the Proposed Action are shown in Figure 3 and the alternative selection process is detailed in the ECI engineering report (10).

Preliminary facility sizing based on current AMWUA demands, potential non-AMWUA demands, potential upstream exchanges, and SRP interests is shown in Table 9. The sizing also provides a degree of operational flexibility for all users of the Interconnection Facility.



PROPOSED ACTION
CAP/SRP INTERCONNECTION
FIGURE 3

The Interconnection Facility's alternative alignments and configurations will be either entirely a pressure pipe system with regulating valves or a combination pressure pipe and open channel system with both regulating valves and radial gates.

TABLE 9. PRELIMINARY INTERCONNECTION FACILITY SIZING (as of 1/25/88)

Common Pipe	1200 cfs
South Canal Delivery	800 cfs
Arizona Canal Delivery	800 cfs
Salt River Bed (Recharge)	800 cfs

The CAP/SRP Interconnection Facility will include a discharge outlet to the river bed which can be used to supply CAP water or other waters transported via the aqueduct to a future groundwater storage project. The discharge outlet can also be used as an emergency spillway for the CAP/SRP Interconnection Facility or the Granite Reef aqueduct, if necessary. Presently, SRP and interested parties are pursuing a future groundwater storage project downstream of the Granite Reef Diversion Dam, which could utilize CAP allotted water, CAP excess water, SRP excess flood waters and other waters.

The main facilities included in the Interconnection Facility include flow control facilities, water conveyance facilities (canals, pressure pipe, inverted siphon and/or a flume), energy dissipators, fish barriers, flow measuring facilities, remote control and communication facilities, building enclosure, and power and backup power supply.

a. Common Facilities

The "Common Facilities" referred to in this section include all installations that are located on the south side of the river and would be common to all alternatives (conveyance facilities, control room, valves, gates, energy dissipation facilities, etc.).

The conveyance facilities from the CAP Aqueduct to the SRP canals and river bed will include one or more of the following: canals, pressure pipes, inverted siphons and flumes.

Any open canals will be concrete-lined trapezoidal structures with operation and maintenance roads on both sides. Bridges will be used to cross the canal for access to existing facilities at the site. A typical canal size for 800 cfs is bottom width of 7 feet, side slopes 1 to 1, water depth 8.8 feet with 1 to 1.5 feet freeboard. The alternatives with open canal and maintenance roads would require permanent use of more land than would buried conduits. Flow control on the open canals will be provided by radial gates.

Piped high pressure conveyance facilities will be either concrete or steel pipe. The pipe sizes for 1200 cfs capacity will be 54 to 96 inches. All piped high pressure conveyance facilities will be buried. Any high pressure discharge facilities will have high pressure

regulating valves to control the flow of water and dissipate the energy of water. The regulating valves will be either hollow cone valves with spray control or a multiport-sleeve type valve.

Construction of the Interconnection Facility will take approximately 10 months.

It is anticipated that the project will occupy approximately 6 acres, with an additional 17 acres to be used during construction. A total of about 23 acres will be disturbed, including about 14 acres of vegetative cover. It is planned that one single-story building about 50 feet by 50 feet in size will enclose all of the controls and electrical equipment required for operation of the regulating valves, remote flow controls, monitoring equipment and other facilities. All equipment will be remotely-controlled from the SRP facilities in Tempe, with on-site overrides.

No borrow or fill areas will be required. All necessary materials for construction, fill, etc., will be either from on-site or transported to the site from the Phoenix metropolitan area. Construction access will by via the Bush Highway, immediately to the east of the project area, and existing on-site roads will be used for on-site movement. No temporary construction camps will be required due to the proximity to the Phoenix area. Temporary field offices for the contractor and SRP, and temporary water and sewage facilities meeting all applicable laws and regulations and health requirements, will be established on-site.

All electrical power for construction and operation of the Interconnection Facility, including the fish barriers, will be provided by the existing SRP 12 kV power line that serves Granite Reef Dam. In case of a power failure, a backup power supply is to be provided by means of an on-site, propane-fueled, generator that will come on-line automatically in less than one minute when needed.

Regulating valves and, if open-channel options are selected, radial gates will provide flow control and assist in energy dissipation. Additionally, a flow metering system acceptable to the U.S. Bureau of Reclamation will be provided. Flow measurement will provide accurate rates of flow into each delivery point. If required, and funded, by USBR, a flow measurement facility will be installed that will measure the total rate of flow from the CAP turnout.

b. River Crossing

In order to provide for water delivery to the Arizona Canal, on the north side of the Salt River, a river crossing is planned. This connection will be required to provide the necessary operational flexibility, facilitate water exchanges with users to the north of the Salt River, allow scheduling of extended dry-up of the Granite Reef Dam forebay and allow more control over the uniformity of the quality of water delivered on both sides of the river.

The proposed action includes two possible alignments for delivery of CAP water to the Arizona Canal, either upstream or downstream of the Granite Reef Diversion Dam, and considers several configuration options, such as an underground high-pressure system and a combination open channel and high-pressure system with either underground siphons or elevated open flume river crossings.

An elevated flume located downstream of the Diversion Dam is an alternative configuration for delivering CAP water to the Arizona Canal. The base width and depth of the flume would be 20 feet and 6 feet respectively for delivering 800 cfs. The flume would be supported above projected future flood water levels on 10 to 12 reinforced concrete piers that would be tied to bedrock.

Another means of delivery of the CAP water to the Arizona Canal is a downstream buried high-pressure pipe. For a capacity of 800 cfs, the pressure pipe would be 72 inches in diameter and would have an internal pressure of 180 feet of head (78 psi). The length of pipe required would be approximately 1500 feet.

A downstream inverted siphon is another possible configuration (and the Proposed Action) for delivering CAP water to the Arizona Canal. For a capacity of 800 cfs, the inverted siphon will be a 9 to 10 foot diameter concrete pipe. The maximum internal water pressure for the proposed alignment is 50 feet of head (22 psi). The length of pipe required for the inverted siphon would be approximately 1500 feet.

The proposed siphon will be buried with sufficient cover to provide protection from scour during periods of flood flows over the dam.

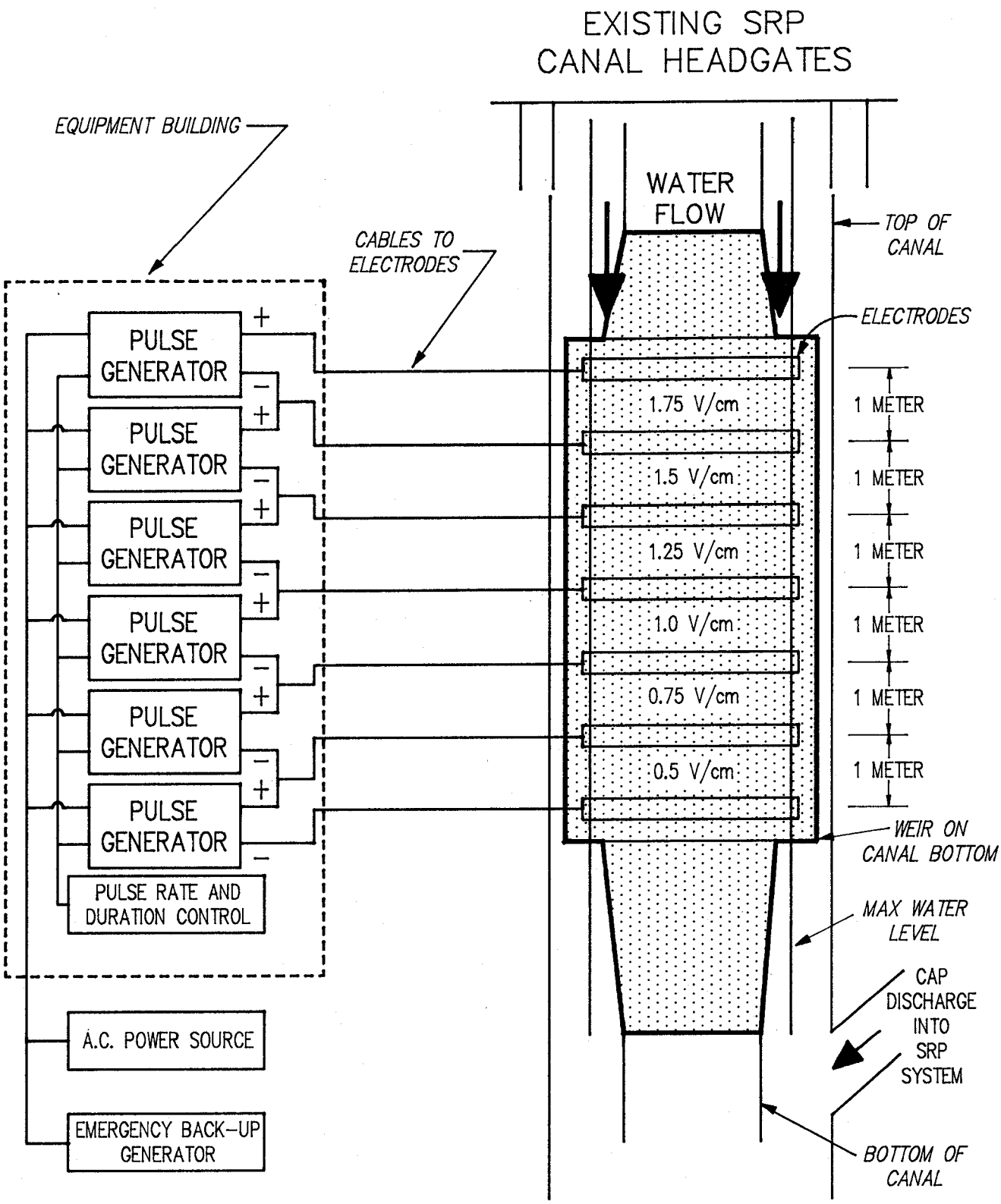
c. Fish Barriers

The SRP canals will be equipped with electric fish barriers below their headgates and upstream of the CAP discharge outlet in order to prevent upstream migration of fish that may be introduced along with the CAP water. This feature will be designed to prevent predacious Colorado River fish from finding their way to the lower Salt and Verde Rivers by way of the CAP and damaging the existing food base that is used by the endangered bald eagles that nest upstream of Granite Reef Dam.

The electric fish barriers will utilize an electric field in the water of the canals, in combination with the canal water velocities, to prevent upstream migration of fish. The electric field in the water immobilizes fish as they try to swim through. Once a fish has been immobilized, the water velocity in the canal will move it back downstream where it will recover.

A general plan and profile view of the proposed electric fish barrier are shown in Figures 4A and 4B.

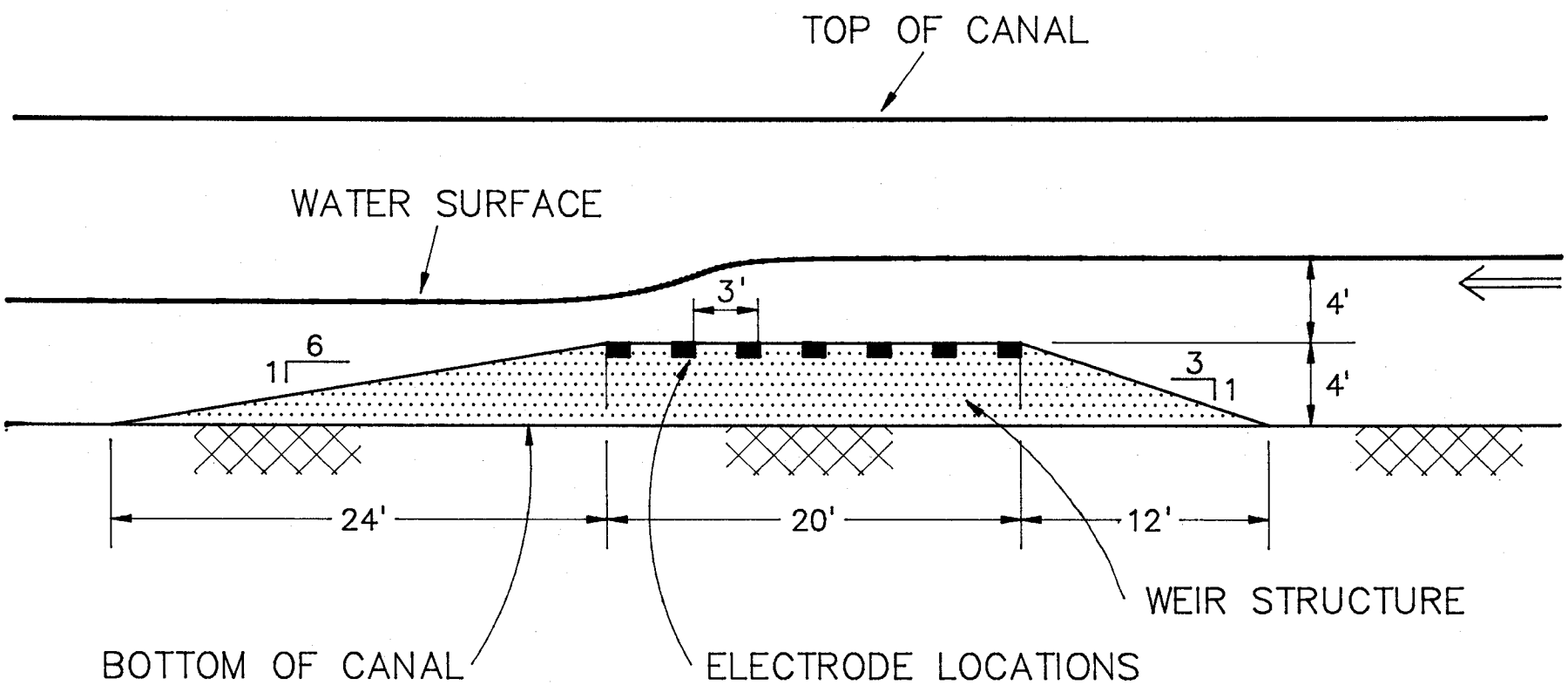
Thirteen fish barrier methods were reviewed for application to the CAP/SRP Interconnection and 10 of these were eliminated as being unacceptable (Appendix C). The existing structures at Granite Reef



ELECTRIC FISH BARRIER – PLAN VIEW

FIGURE 4A

MVEFBPV



ELECTRIC FISH BARRIER – PROFILE VIEW

FIGURE 4B

FISH.DWG

Dam, and/or the water uses downstream, preclude the use of certain barrier methods (i.e. chemicals, odors and baffles). Installation and maintenance costs of some methods strongly suggest that they be avoided as not cost-effective (i.e. baffles, rack bars, screens). Some methods are not positive barriers to upstream movement and, although they may be somewhat effective when used in conjunction with other methods, probably would not assure complete prevention of fish introduction (i.e. bubble curtain, louvers, sounds, odors, lights, chains and rack bars.) The three methods which hold the most promise include sill dams, water velocity and electric curtains.

Sill dams will not be effective as a barrier because a sill dam of sufficient height, approximately 3 feet, cannot be installed in the Arizona and South Canals downstream of the headgates without reducing the existing discharge capacity of the dam. For example, at the design discharge capacity of the South Canal, the difference between the water level in the canal immediately downstream of the dam's headgates and the water level immediately upstream of the dam's headgates is 3 feet. Thus a 3 foot vertical drop structure in the canal would reduce the differences in water levels to zero.

In order to raise the water level in the canal 3 feet, and maintain the existing canal capacity, it would be necessary to raise the water level upstream of the dam approximately 3 feet. This means that the height of the dam structure would need to be increased, which would increase the water level in the reservoir and inundate more land upstream of the dam. The existing hydraulic conditions at the site will not allow installation of a sill dam without extensive modifications to the canal, gate and dam structures at a potentially prohibitive cost.

Water velocity may not be an effective barrier because the existing minimum velocities in the canals and at the canal headgates do not exceed the maximum estimated fish swimming speeds. The average water velocities in the canals are 1 to 5 fps, depending on the flow rates in the canals. The average velocities through the headgate openings is a minimum of 14 fps. The actual velocities through the headgates range from 14 to 19 fps. These high velocities are always maintained, but under certain hydraulic conditions they are maintained only through the gate openings a distance of approximately 2 to 5 feet In view of the maximum estimated fish sprint speeds, the headgate velocity should be an effective barrier for all but the larger fish (approximately 14 inches and longer).

Water velocities below the canal headgates and fish sprint speeds are discussed in Appendix C, and water velocities over the fish barrier weir are discussed in Table 10. The velocities shown in Table 1 of Appendix C are the average velocities that occur under certain water delivery conditions immediately downstream of the headgate openings, in the area of the submerged hydraulic jump.

As shown in Figure 4A, the electric fish barriers will incorporate five major elements: pulse generators, electrodes on the weir structures, electrical cables connecting the pulse generators and

electrodes, emergency backup generators and weirs across the bottom of the canals to hold the electrodes. For each canal, six pulse generators will produce the power for the barriers while the electrodes transmit the electric field to the water.

The six pulse generators will be connected in series. This enables the user to create either of two types of electric fields: a graduated field that increases in strength with distance upstream or a constant-strength field over the entire length of the fish barrier. SRP has selected the graduated field for the proposed barriers. Using six pulse generators in series rather than one large generator builds redundancy into the system. If one or two of the generators fail, the remaining units will provide adequate power to maintain the barrier. Also, the modular design will allow immediate replacement of a faulty pulse generator without disrupting the barrier. Additional pulse generators will be stored on site for emergency use.

TABLE 10. WATER DEPTH VS. VELOCITY OVER WEIR

Discharge (cfs)	Depth (ft)	Velocity (fps)
200	0.9	3.9
400	1.3	5.0
800	2.0	6.5
1200	2.6	7.4
1400	2.8	7.8
1700	3.2	8.3
2000	3.5	8.8
2300	3.8	8.8+

Weir structures (Figure 4B) will be installed in the bottoms of both canals to serve three functions: 1) a platform for installation of the electrodes, which must be flush with the bottom to prevent damage or clogging by debris, 2) to assure a uniform water depth to improve the efficiency of the barrier, and 3) to increase water velocity over the barrier by reducing depth to make upstream movement of fish more difficult. The estimated water depth and velocity across the weir structure are shown in Table 10.

The strength of the electric field maintained within a fish barrier is normally measured in terms of voltage per centimeter (volts/cm). A number of studies (65, 66, 67, 68) have documented the electric field strengths required to effect fish in water, with effective field strengths ranging from 0.1 volts/cm to 1.2 volts/cm. In the proposed type of fish barrier the weakest part of the electric field is at the water surface. For this installation, at maximum depth of water over the weir, the minimum field strength at the surface is estimated to be 1.0 volts/cm, increasing in strength toward the electrodes mounted on the weir, with the field extending for a minimim of 20 feet up the canal (Figure 4B).

Over a period of time the electrodes will be corroded by electrolytic action, thus reducing their effectiveness. The rate at which erosion will occur depends primarily on three variables: the amount of electricity passing into the water, the material of which the

electrodes are made and the electrical conductivity of the water. The electrodes will be designed for a minimum service life of 3 to 5 years, assuming that the conductivity of the water is consistently at the highest levels ever documented. This conservative design should result in considerably longer electrode life. Presently the SRP canals are drained for one month annually for repairs and maintenance. During this time the electrodes will be inspected and replaced as necessary.

Emergency back-up generators will be provided to supply power for any times when the primary power supply for the barriers may be interrupted.

The fish barriers will be monitored both on-site and remotely from the SRP Association Dispatch Center (ADC) located in Tempe, Arizona. ADC is staffed around the clock. Standard and emergency operating procedures for the barriers will be developed prior to their being energized. All appropriate agencies will be consulted during development of the procedures.

Electric curtains are effective as barriers, and, in conjunction with water velocities which now exist in the canal, will be a positive barrier to upstream movement of fish. Installation, operation and maintenance costs of an electrical curtain should be relatively low when compared to effective sill dams or velocity barriers, both of which are not practical at this site (Appendix C).

Access to the vicinity of the fish barriers will be limited due to their being located in the secure area surrounding Granite Reef Dam. However, additional fencing and warning signs will be installed around the barriers to reduce accessibility, thereby minimizing the safety hazards to the public.

2. No Action

No action would mean that no Interconnection Facility would be constructed and no CAP water would be delivered into the SRP canal system. The CAP allocations of some entities desiring to transport water via the SRP canal system could still conceivably be accommodated by a three-party exchange among (1) SRP, (2) a city which constructs a turnout from the CAP aqueduct and at the same time has water customers with rights to SRP water (Glendale, Phoenix, Scottsdale or Mesa), and (3) the party desiring to receive its allocation at a point along the SRP canal system (Arcadia Water Company and numerous others).

For example, Arcadia Water Company might take SRP water directly from the Arizona Canal. SRP would make itself whole by reducing the amount of SRP water available to, for instance, the City of Phoenix. The City of Phoenix would make itself whole by taking Arcadia's CAP allocation at the Union Hills treatment plant on the CAP aqueduct. Such an exchange arrangement would not accommodate the desire of some cities (Phoenix, Glendale and Scottsdale) to deliver a portion of their CAP water via the SRP canal system.

Water deliveries to upstream exchange allottees could be accomplished through a similar three-party exchange. For example, the City of Prescott might divert SRP water from the Verde River and SRP would make itself whole by reducing the amount of SRP water available to, for instance, the City of Phoenix. The City of Phoenix would be made whole by taking Prescott's CAP allocation at the Union Hills treatment plant on the CAP aqueduct.

No action on the proposed project will have no effect on climate, air quality, seismicity, geology and physiography. Some area dominated by native plant communities (e.g. Sonoran Desertscrub and riparian woodlands), and providing habitat requirements to native wildlife species would remain intact under the no action alternative. The aquatic environment would remain as it is. The project would have no impact on wetland vegetation downstream of Granite Reef Dam, there would be less chance of introducing Colorado River species into the Salt/Verde River system and so less potential for impacts on the bald eagles.

Some individual cacti, palo verdes, mesquites and other plants protected by the Arizona Native Plant Law would not be disturbed in the absence of a project. The no action alternative could reduce the potential risks to some special status wildlife in addition to bald eagles. Some individual animals may be spared via the no action alternative by the removal of an increased potential for road kills and construction workers collecting them.

The site is not now and would not become a recreation area, so "No Action" would have no effect on recreation. The three historic features of site AZ U:6:2 (ASU), Granite Reef Dam, and the dam tender's house will not be affected under "No Action" conditions within the immediately foreseeable future.

If the project is not constructed a limited number of short-term construction jobs for building the Interconnection Facility would not become available, and a few long-term jobs would not be created for operation and maintenance of the facility. "No Action" would mean no increased construction traffic on Bush Highway for about a one-year period, no increased noise levels at the site during and after construction and no additional buildings and canals to impact the visual aspects of the site.

If CAP water is not commingled with SRP water, there would be no change in water quality, at least in the short term (i.e., less than 50 years). In the long term (i.e., more than 50 years), groundwater pumping must be reduced in accordance with the Groundwater Management Act to prevent overdrafting of the aquifers. The quality of groundwater in the SRP service area is significantly poorer in terms of TDS than the surface water, therefore, if groundwater pumping is reduced, the water supply should improve in quality.

If Salt River Valley growth follows present patterns, groundwater overdraft would worsen. Conservation and reuse could offset this significantly and extend the time before supplemental supplies must be

developed. Without CAP water, the necessity of conservation and reuse would be greater. No action on an Interconnection might make obtaining CAP water by alternative methods in the future too expensive relative to a reduction in demand obtained through conservation and reuse. This could mean all water would be tightly controlled.

Certain methods of groundwater recharge (e.g. agricultural and urban runoff) would become scarce as municipalities sought to collect this water for other uses. This could result in all recharge coming from municipal and industrial wastewater and gradual deterioration of groundwater quality. Such a scenario could jeopardize groundwater's use as a backup supply in the event of prolonged drought.

Municipal water treatment plants would be able to maintain traditional treatment patterns under the "No Action" alternative. Plants receiving only SRP or CAP water would not be faced with the treatment difficulties and costs that monthly or seasonal mixture could cause. Even without a CAP/SRP Interconnection, the water treatment plants are planning significant changes in their disinfection methods. These changes will be made in order to meet Safe Drinking Water Act requirements and will be made regardless of any commingling of SRP and CAP waters.

Consistent supply quality results in more consumer satisfaction because water taste does not fluctuate. Although SRP supplies vary seasonally, this variation is not as great as the change expected from full mixing with CAP water. Since consumers tend to complain more about a change in quality than about the magnitude of the change, maintaining the SRP supply without mixing with CAP water would probably result in less frequent change and fewer complaints.

Agricultural users would have traditional quality under the "No Action" alternative thereby enabling them to plan water needs, crop species, etc., as they have always done, without fearing that a change in quality detrimental to their crops (doubling or quadrupling if the TDS of CAP water exceeds 1000 mg/L, as some projections indicate) might occur. This may be more important to agricultural interests that use a high percentage of surface water due to their traditional reliance on water with lower TDS. Agricultural users relying on groundwater may actually see reduced TDS levels with CAP water.

3. <u>Alternative Action</u> - Direct Delivery to the Arizona and South Canals and the Salt River Bed with the River Crossing <u>Upstream</u> of the Dam

a. Common Facilities

The common facilities for delivery of the CAP water from the SRP outtake to the point at which the conduits diverge for the river crossing would be the same as for the Proposed Action, as described in Section II.D.1.a.

1. Air Quality

The study area is located in the Sonoran Desert where long hot summers, short mild winters, low annual rainfall, low relative humidity, high evaporation rate and a high percentage of sunny days are characteristic.

The air in the vicinity of the study area is relatively clean, with the major pollutant being dust, primarily from unpaved roads, construction activities, cultivated fields and the use of off-road vehicles (49). It is anticipated that continued expansion of residential and commercial development and increasing recreational use of the Tonto National Forest will result in increased air pollution both from motor vehicles and urban activities (7,49).

No effect on air quality due to the CAP/SRP Interconnection is anticipated. The potential effects of the water allocation on air quality have been covered in the Water Allocations and Water Service Contracting EIS (56). The impacts on air quality due to the Interconnection Facility would be limited to a small temporary increase in dust and vehicular exhaust emissions during construction, a period of about 12 months.

2. Seismicity

The site is in an area of historically low seismicity (56). A 1981 seismotectonic study of the Stewart Mountain Dam vicinity (25), about eight miles from Granite Reef Dam, states that the area is of very low observed seismicity, with no instrumentally detected earthquakes having occurred within 25 km of the dam. A more recent seismotechtonic investigation of the Stewart Mountain Dam vicinity (4) found that the Sugarloaf fault, located about 15 km north of Stewart Mountain Dam (about 35 km northeast of Granite Reef Dam) is the only structure within about 50 km of Stewart Mountain that displays evidence of recurrent Quaternary activity. While this fault should be considered to be a potential seismic source "the potential for surface faulting below Stewart Mountain Dam is judged to be extremely low" (4).

Based on seismic history, Algermissen and Perkins (1) show that the interconnection site is in an area with a 90 % probability of not having ground shaking with horizontal ground acceleration exceeding 0.04G (gravity) in a 50-year period. This probability for maximum horizontal ground acceleration is equivalent to a source earthquake having a return period of 475 years.

Damage to the interconnection facility from an earthquake could result in localized flooding and erosion for a short period of time. Since the area is highly disturbed and is in close proximity to the Salt River, the impacts of damage due to seismic activity would be minimal. As mentioned above, the likelihood of the occurrence of a damaging earthquake is judged to be very low.

3. Geology and Physiography

The project site is located within the Salt River drainage basin adjacent to the Salt River. The water surface elevation of the CAP aqueduct at the SRP turnout is at approximate elevation 1493 and the Granite Reef Dam forebay is at elevation 1313. The entire project site has been previously disturbed by past and present construction activities and high water flows.

The area around the project site is a broad valley covered by alluvial material. The project site is located on rough, broken land with soil consisting primarily of loose gravel and cobblestones. Runoff is rapid and the water erosion hazard is moderate. Because the site has been greatly disturbed by construction, a mixture of soil types on much of the area is likely. Rough, broken land is listed as Class VII soil, which has very severe limitations for agriculture (27).

The grazing potential of the site is limited due to the roughness of the terrain. Other than the sand and gravel mining operation that exists in conjunction with reservoir dredging, there are no known mineral resources in the project area.

While minor grading and land form changes will be required in order to prepare the appropriate slope for installation of the needed facilities and to maintain design flows, the proposed project will not result in significant modification of the existing land form and should have no impact on the geology of the site.

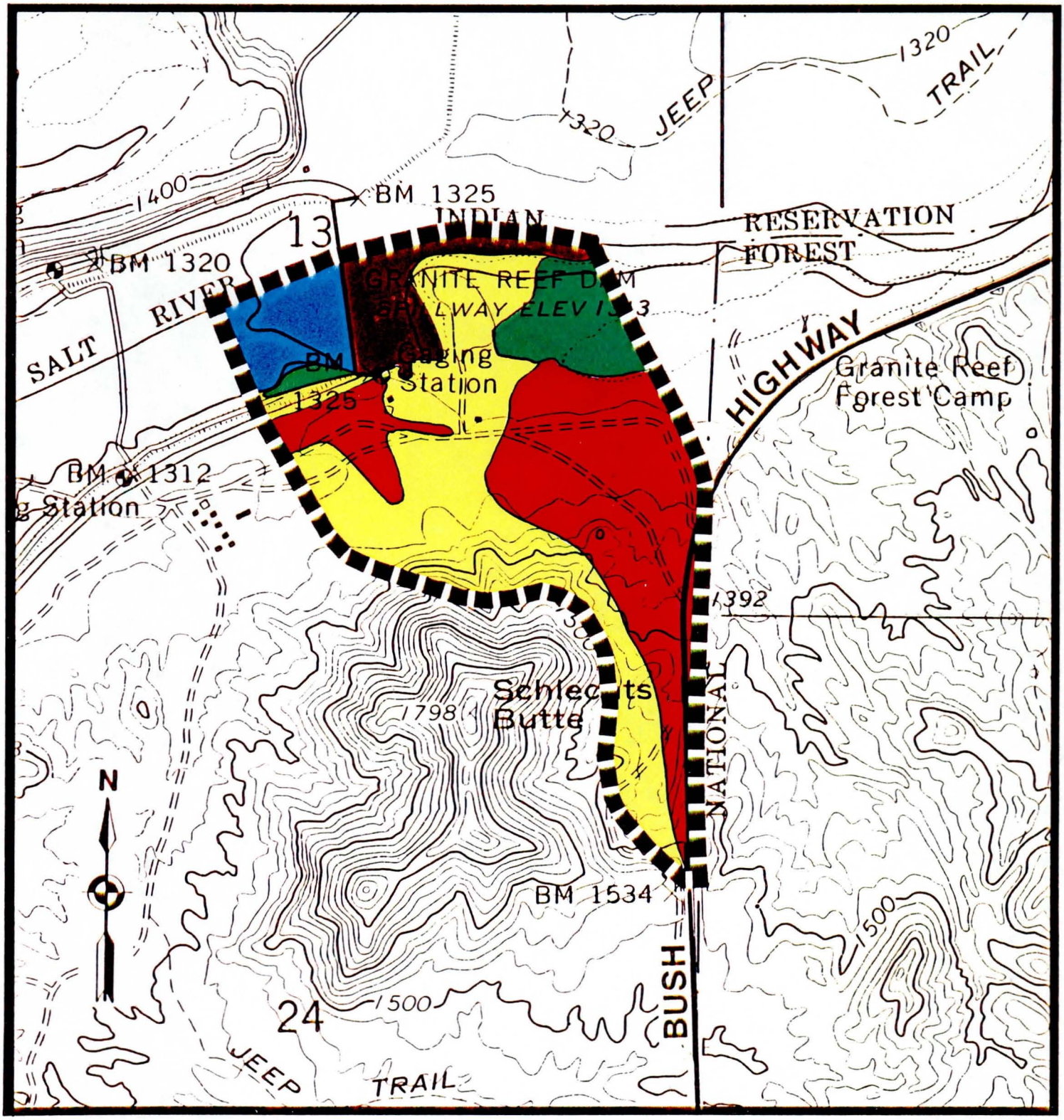
4. Terrestrial Environment

a. Vegetation

The terrestrial environment of the CAP/SRP Interconnection study area is dominated by Sonoran Desertscrub Biotic Communities (13, 14, 32, 48) with limited occurrences of riparian woodlands along the banks of the Salt River, and a largely herbaceous strand (i.e. intermittent stream channel) community occurring in the riverbed below Granite Reef Dam (see Figure 5 in which the strand community is designated as "river bottom"). Appendix A is a biological report on this site.

The majority of the native Sonoran Desert plant community in the study area has been eliminated through industrial use of the site. Most of the level parts of the study area have been cleared at one time and/or are being used as a gravel storage area. Gravel is presently being mined along the banks of the lake formed by Granite Reef Dam and upland portions of the site along the east face of Schlechts Butte have been severely degraded by construction of the CAP canal and siphon. Plant communities on such disturbed areas consist mainly of weedy species that thrive on disturbed soils.

Surface flow due to seepage now occurs in the river channel immediately downstream from Granite Reef Dam throughout much of the year, with flows extending beyond the dam vicinity only during unusual runoff conditions. While the surface



STUDY AREA BOUNDARY

1" = 900' (APPROX.)

APPROXIMATE DISTRIBUTION OF MAJOR BIOTIC FEATURES WITHIN THE CAP/SRP INTERCONNECTION STUDY AREA

- SONORAN DESERTSCRUB COMMUNITIES
- RIPARIAN COMMUNITIES
- RIVER BOTTOM COMMUNITIES
- OPEN WATER
- HIGHLY MODIFIED, DISTURBED SITES WITH LIMITED OCCURRENCE OF NATIVE PLANT/ANIMAL COMMUNITIES

BIOTIC FEATURES
CAP/SRP INTERCONNECTION

FIGURE 5

and subsurface flows are minimal during normal runoff years, they support a copse of willow along each side of the stream channel and an important riparian and marsh habitat in the stream channel below the dam.

Frequent flood flows below the dam scour the riverbed and reduce the ability of riparian vegetation to become well established in the project area. As a result, the few surviving larger woody perennials, such as willows and cottonwoods, are important constituents of the riparian habitat.

In the recent past the area below the dam supported cottonwood, willow and mesquite trees in addition to marshlands (63). These features are no longer present, probably as a result of recent scouring floods coupled with construction of the Granite Reef Siphon of the CAP. Appendix A includes additional information on the project-area vegetation.

Since the project is to be constructed adjacent to Granite Reef Dam it will be built almost entirely in areas that are presently badly disturbed and have marginal wildlife habitat value. No significant or long-lasting impacts to the vegetation of the site are anticipated. Following project completion, recovery of emergent vegetation communities to current levels would take about two to three years (pers. comm. Bruce Palmer, AGFD).

b. Wildlife

Perhaps as many as 250 wildlife species are likely to occur within the study area over the course of a year's time. Bird species comprise the majority of this estimate because of the wide variety of habitats available for use (from open water and associated wetlands to shrub-dominated desertscrub uplands). Of the wildlife habitats present, the riparian woodlands undoubtedly play host to the greatest array of species with paloverde-cactus dominated Sonoran Desert uplands being the next most important (29). Appendix A includes wildlife lists and discussion.

The current ecological condition of the project site, most notably below Granite Reef Dam, is highly disturbed. Heavy disturbance during construction of the CAP Granite Reef Siphon remains evident. In addition to human disturbance, the riverbed and adjacent habitats below the dam have been subjected to scouring during relatively frequent spring flooding over the last several years. Within the study area this scouring removes major portions of the emergent riparian habitat with only a few woody perennials surviving above ground. As a result the existing wildlife value of the project site is marginal.

Construction of the project may result in some short-term disturbance, such as noise, that could prevent some wildlife species from actively using the area as feeding or breeding areas during construction. Bald eagles and ospreys, for example, may not forage at Granite Reef Dam during some construction periods. It appears, however, that these

species do not use the dam vicinity frequently and so the construction impacts on them should be minimal.

5. Aquatic Environment

The aquatic environment within the study area consists of a portion of the lake created by Granite Reef Diversion Dam and several small ponds below the dam created by seepage through and under it.

The ichthyofauna (fishes) of the study area primarily consists of introduced species such as bluegill, bass, catfish and minnows (carp, shiner). According to Grabowski, et al (26), only three of 15 fish species occurring in the Salt River and three of 16 species occurring in the Verde River are native species; the remaining species were introduced for various reasons at some time in the past. A survey conducted by the U.S. Fish and Wildlife Service in 1975 as part of the Orme Reservoir Study on Fish and Wildlife (62) demonstrated that 17 species of fish were represented at the Orme Site (i.e., in the vicinity of Granite Reef Diversion Dam forebay). In all, four native species were found in the survey: roundtail chub, longfin dace, Gila sucker and Gila Mountain sucker.

While not qualifying as aquatic habitat in the usual sense, the CAP canal has become the home of numerous fish that have been pumped from the Colorado River at Lake Havasu. The Bureau of Reclamation, in a 1986 report on the fishes that are living in the Granite Reef Aqueduct (50), found 10 species amounting to several thousand fish. While the vast majority of these fish were threadfin shad, significant numbers of more predacious species, such as largemouth bass, striped bass and channel catfish, have become established in the canal.

CAP water deliveries to downstream allottees will have no effect on flows or aquatic life in the Salt and Verde Rivers. In the case of upstream exchanges, however, the river flows will be reduced in relation to the amount of water diverted upstream. Upstream exchangers will divert SRP water from the rivers and, in turn, SRP will take the exchangers CAP allocations by way of the CAP/SRP Interconnection. The net result will be that the river reaches below the reservoirs will be bypassed, and a reduction in the flow will occur. (USBR is currently conducting instream flow studies that will allow evaluation of the impacts of diversions from the Verde River upstream of Horseshoe Dam.)

Even at the maximum potential annual exchange rate of 29 KAF the upstream exchanges will represent only about 3 to 4% of the SRP annual surface water deliveries of 800 to 900 KAF.

Some exotic fish species and other organisms, such as clams, snails and algae, are likely to be introduced into the SRP canal system with the CAP water, but no impact on SRP water quality or maintenance procedures will result.

6. Special Status Species

The proposed project could have a negative effect on local breeding pairs of the endangered bald eagle if Colorado River fishes, especially striped bass, are introduced into the Salt-Verde system. This is especially true if populations of striped bass become well established and deplete the forage fish prey base upon which bald eagle depend, while growing to too large a size to be utilized as a forage source by the eagles (pers. comm. Robert Mesta, USFWS, Dec. 1987). Consultation with USFWS has been completed under Section 7 of the Endangered Species Act in order to resolve potential conflicts between the proposed project and the bald eagles (see USFWS letter, dated Dec. 17, 1987 in Appendix E).

No significant long term impacts to Yuma clapper rails are anticipated. At present there are no stands of emergent vegetation that are of sufficient size to serve as nesting habitat for this species within the study area (pers. comm. Bruce Palmer, AGFD).

Some individual plants of species listed in the Arizona Native Plant Law will probably be destroyed or damaged as a result of construction of the project. Confining construction activities as much as possible to presently disturbed lands would minimize impacts to plant species listed in the Arizona Native Plant Law.

Some individuals of species listed among the threatened wildlife of Arizona (e.g. snowy egrets, great egrets, and black-crowned night herons) may be disturbed during construction of the project and may avoid foraging in the Granite Reef Dam area in response to construction activities. Some such animals may be accidentally killed by construction workers and equipment going to or coming from the project site. Some animals (e.g. desert tortoises) may be caught and removed from their natural habitats by construction personnel.

7. Recreation

The only designated recreation site in the vicinity of the project area is the Tonto National Forest Granite Reef Campground, located approximately 1/4 mile from the Interconnection site. This small campground contains ten family camping areas and two restroom facilities. It is open year around providing opportunities for camping, fishing and picnicking. It is also used as a tubing take-out point by Desert Voyagers, a commercial river running enterprise. No expansion of this campground is scheduled.

The most heavily used parts of the recreation area are several miles upstream. The Salt River recreation area farther upstream is very heavily used on summer weekends, with up to 10,000 people per day being recorded by Tonto National Forest personnel (49). The most popular activity in the recreation area is river floating, or "tubing", with one trip down the river lasting about four to six hours. Other activities include picnicking, fishing, swimming, diving, water play, sunbathing, camping, bird-watching, target practice and partying (49).

The Maricopa County Parks and Recreation Department has a license for a trail across the study area for a connector from the river crossing downstream of Granite Reef Dam to the Forest Service boundary at Bush Highway. This corridor provides continuous hiking and equestrian trail access from the Sun Circle Trail to the Tonto National Forest trail system. Also the USBR proposes a hiking and equestrian trail along the CAP right-of-way. Both of these trail crossings will be accommodated by a common route through the project area.

During project construction noise and dust will be limited to daylight hours. After construction has been completed noise will be kept to a minimum and security lighting will be designed with the Granite Reef Campground in mind. These steps, in addition to the considerable distance between the two facilities, will minimize impacts on the campground. Noise and light from nearby Bush Highway will be far more noticeable than from the Interconnection Facility. The Sun Circle Trail will be accommodated in the project plan. Recreational impacts due to the proposed action will be minimal.

8. Cultural Resources

Features 1 and 2 will not be adversely affected as a result of the proposed action, while Feature 3 may be removed. Granite Reef Dam and the historic Granite Reef Dam tender's house, built in about 1906-08, will not be affected by this proposed action. Refer to Appendix B for details.

9. Socio-Economic Environment

The site selected for the Interconnection is on U.S. Bureau of Land Management land that is included in a First Form Reclamation Withdrawal under the provisions of the Act of June 17, 1902, and a Water Power Withdrawal effected by the Act of June 20, 1910. These withdrawals give the Bureau of Reclamation and its agent, the Salt River Project, specific rights on the withdrawn lands for reclamation and power purposes. The proposed Interconnection falls within the range of uses intended by the withdrawal. No other proposed use of this land is known at this time.

The availability of CAP water may result in a reduction of groundwater pumping (and associated costs) to municipal, industrial, non-Indian and agricultural entities, with the additional benefit of decreased groundwater overdrafting. Increased retirement of agricultural lands for their grandfathered water rights may also occur. CAP water delivery to Indian tribes could be used to supplement pumped water for irrigation or to promote development of new lands which may result in the creation of new jobs (56).

There should be no adverse social or economic impacts associated with the proposed project. The operation of the Spook Hill flood control facility and Aggregate Products Inc., will not be impacted. No impacts are anticipated on either the Salt River Pima-Maricopa Indian Community or the Rio Salado Project area. (In November 1987 the proposed Rio Salado project was rejected by Maricopa County voters and is not likely to be pursued in the forseeable future.)

10. Transportation

Access to the project area is by way of Bush Highway, a Maricopa County Highway. The site is approximately eight miles north of Mesa, Arizona. The average daily traffic volume (as measured by the State of Arizona in 1976) varies from 960 to 2,100 vehicles per day (49). It has been estimated that there have been as many as 5,500 or more vehicles per day along the lower Salt River on busy Saturdays or Sundays (49).

The Maricopa County Highway Department has no plans for roadway improvements in the study area that would conflict with the project.

The only impacts on transportation due to this project would occur during construction as a result of transportation of equipment and materials on Bush Highway. This would be temporary, lasting no more than one year.

11. Noise

The area is generally quiet, particularly at night when traffic levels on Bush Highway are very low. During the weekday hours some noise is audible from the dredging and sand and gravel operations adjacent to the Granite Reef Dam forebay. On summer weekdays heavy traffic to recreation areas along Bush Highway produces the highest noise levels in the vicinity.

The only anticipated noise impacts once construction has been completed would be from water flow through the system when it is in operation.

12. Scenic/Visual

The visual quality of the study area is in a degraded condition primarily due to the extensive historical, recent and current industrial and construction activities on the site and in the immediate vicinity. Much of the area has had extensive surface scarring. The resultant loss of natural vegetation which could serve as screening has made the areas of exposed rock and fill very noticeable. A small area of natural or near-natural vegetation between the Salt River and the Spook Hill Flood Control dike at the northern edge of the study area is the only substantial area of vegetation that will serve as a screen. This area serves primarily to shield the project area as viewed from the Granite Reef Campground.

Minimal visual impact will occur because the proposed structures will have a lower profile than existing man-made structures and disruption of the landform and vegetation will be minor. Landscaping with native vegetation and screening of security lighting will minimize the visual impacts.

13. Water Quality

For the purposes of this analysis, the existing conditions are defined as the SRP system operating independently of the CAP water deliveries and without commingling, and no transfer of SRP water to the Salt-Gila Aqueduct.

Under existing operational conditions, SRP deliveries are largely comprised of water from three main sources; surface water from the Salt River, the Verde River, and groundwater pumped from SRP wells. SRP operations are designed to optimize each available resource under changing hydrologic conditions. In order to supply the best quality water that is possible, surface water supplies are maximized during those years of above normal runoff. During normal and below normal runoff years, SRP relies on increasing levels of groundwater pumping to meet water demands and maintain the desired storage levels in its reservoirs.

Each of the three water sources is of differing, and variable, water quality. Under normal operations, these sources comprise differing quantities of the total canal volume. These sources all influence the overall quality of the canal water. Therefore, variations in SRP water quality are due in part to variations in SRP water operations as well as variations in the water quality of the source waters themselves. Seasonal and annual variations in the water quality of the Salt and Verde Rivers are a result of the dynamic hydrologic characteristics of the watersheds. Variations in groundwater quality are source-location related.

The Salt River watershed encompasses approximately 6,258 square miles and is controlled by four dams; Theodore Roosevelt, Horse Mesa, Mormon Flat, and Stewart Mountain. The water quality of the Salt River is characterized by a high total dissolved solids (TDS) load. This load is due largely in part to the high concentrations of sodium, chloride, and bicarbonate contributed by several salt springs which contribute much of the Salt River's base flow. During high runoff periods, this base flow is diluted and the TDS concentration of Salt River water is reduced. Tonto Creek, which drains into the Salt River, serves to lower the TDS concentration as well. However, during low flow periods, base flow is prevalent and the river water has a high TDS concentration.

The Verde River watershed encompasses approximately 6,600 square miles and is regulated by two dams; Horseshoe and Bartlett. The characteristic water quality of Verde River water, while lower in sodium, chloride and TDS than Salt River water, is higher in alkalinity, bicarbonate, magnesium, and hardness. Base flow conditions contribute much of these constituents, therefore in high flow periods the concentrations are diluted and in low flow conditions they are maximized.

The SRP groundwater system consists of 248 existing wells. Of these, 91 are located adjacent to canals, 122 are adjacent to laterals, and 25 are connected directly to city water distribution systems. The

majority of SRP wells were constructed prior to 1960 and were originally intended for agricultural water production. Since 1970, SRP has pumped up to a maximum of 400,000 acre feet per year to meet water demands. The wells are located in six subareas of differing water quality within the Salt River basin. The groundwater produced in the Salt River basin is of overall lower quality than the surface water supplied due in part to the increased concentrations of total dissolved solids and nitrates in groundwater. Due to variations in the water quality of each of the groundwater subareas, the influence groundwater has on overall canal water varies by location.

Under existing operational conditions, the overall quality of SRP water is good. Table 1 summarizes SRP water quality for the period of record from October 1979 to September 1986, and emphasizes the differences in water quality between the Salt and the Verde Rivers.

Traditional SRP operations patterns have emphasized the use of Salt River water in the summer, with supplemental groundwater, and the use of Verde River water in the winter. As a result of the water quality characteristics of Salt River water and groundwater, TDS concentrations of SRP delivered water generally reach a maximum in the summer months. During the winter the hardness of SRP delivered water increases due to the utilization of increased quantities of Verde River water.

SRP water contains naturally high levels of dissolved organic matter based on values of trihalomethane (THM) formation potential. Data collected by the SRP Water C&M Laboratory from February 1982 until May 1983 indicate levels near 0.2 mg/L total trihalomethane (TTHM) concentrations as a formation potential in the winter and a level near 0.6 mg/L TTHM during the spring runoff. These values were extrapolated from SRP data using curves developed by Metropolitan Water District in Southern California. In addition, the SRP canals receive periodic influxes of urban runoff, return irrigation water, industrial and other types of water that contribute organic matter to the load and to the THM formation potential faced by municipal treatment plants that receive SRP water.

TTHM concentrations in treated water from existing supplies would exceed Safe Drinking Water Act (SDWA) requirements of 0.1 mg/L TTHM if adjustments were not made in the treatment processes. THMs are produced through the interaction of excess chlorine and dissolved organic matter. With currently employed methods of disinfection, treatment plants must carefully balance their needs to disinfect with the need to prevent the formation of THMs. Alternative disinfection methods, such as ozonization or ultra-violet light, may soon be employed to eliminate the potential for THM formation.

Algae growth potential can be measured by the ratio of nitrates to phosphorus in the water supply. Algae growth potential for SRP water appears to be relatively low due to the low concentrations of nitrogen, one of the essential elements of algae growth. In contrast, phosphorus, another essential element, is present in adequate concentrations, but its full utilization is limited by the low concentration of nitrogen.

This combination helps to keep algae and other aquatic plants from being a major canal maintenance problem. Current canal maintenance consists of the use of hydrothol and mechanical straining upstream of municipal water treatment plants and the addition of acrolein downstream of the treatment plants for the control of aquatic vegetation.

IV. ENVIRONMENTAL MITIGATION COMMITMENTS

Potential impacts resulting from the introduction of Colorado River fishes and other aquatic organisms into the lower Salt and Verde Rivers will be mitigated by the water velocities in the canals and installation of electrical fish barriers in the canals upstream of the Interconnection discharge points. The water velocity in the canals will prevent upstream movement of sedentary organisms and hinder movement of the more active fish species. Water velocity alone would be sufficient to prevent upstream movement of nearly all fish. But electric fish barriers will be used, in combination with the water flow, to assure that fish movement upstream from the canals into the lower Salt River will be prevented. Back-up generators will be installed to insure that the electric fish barriers remain in operation in case of a power failure (See Section II.D.1.c.).

Procedures for monitoring the effectiveness of the fish barriers will be developed in conjunction with the other concerned agencies. The first meeting of a multi-agency "Task Force" established for this purpose was held on August 29, 1988 in order to identify potential monitoring options prior to completion of the barrier design. It is anticipated that this "Task Force" will remain in operation for two or three years after the barriers have gone into operation in order to recommend monitoring procedures and review their effectiveness.

Special provisions would be incorporated into the construction of the upstream inverted siphon alternative to insure a conveyance facility that will not fail. The design of the upstream inverted siphon would provide the following:

1. The pipe and joints will be designed to not crack or break.
2. The operating and shut-off pressure will be very low, maximum internal pressure will never exceed 22 psi.
3. Exposed metal will be corrosion resistant.
4. The pipe will be buried in consolidated materials.
5. The joints will be flexible, restrained and leakproof.
6. There will be provisions for internal inspection.
7. There will be provisions for in-place repairs.

Additional fencing and warning signs will be installed to alert the public to the potential hazard presented by the fish barriers.

The Arizona Commission of Agriculture and Horticulture will be given advance notification of the project construction as required by the Arizona Native Plant Law.

Topsoil removed from the site during construction will be stockpiled on-site for use in landscaping the completed project. Planting of native vegetation will be accomplished whenever feasible for landscaping purposes and for ground cover and to screen structures and disturbed areas.

The construction contractor will be required to provide fire protection and maintain a fire prevention program during construction.

When required for construction access, temporary traffic controls on the Bush Highway will be coordinated with the Maricopa County Highway Department. Construction roads that are no longer needed will either be revegetated or scarified and left in a condition that will facilitate natural revegetation.

General construction specifications will require that the contractor provide measures to reduce the dust resulting from construction operations and properly dispose of all waste oil, filters, etc., from equipment maintenance. Once construction has been completed, all remaining construction materials and debris will be either removed to approved disposal areas or moved to existing storage areas on-site and off-site.

During construction the workers and others associated with the project will be instructed not to kill, injure or attempt to collect any wildlife that may be encountered on the construction site or nearby. When possible, these animals will be removed, unharmed, to safe areas nearby. No one will be allowed to remove wildlife from the site with the intention of taking it home for a pet.

Potential recreational impacts will be mitigated by designation of a route for the already licensed hiking and equestrian access trail from the Maricopa County Parks and Recreation Department's Sun Circle Trail to the trails of the Tonto National Forest, and for the proposed USBR trail adjacent to the CAP aqueduct right-of-way. The Parks and Recreation Department will be asked to participate in identification of this crossing.

Archaeological/Historical Features 1, 2 and 3 of site AZ U:6:2 (ASU) are in the project vicinity. The following data retrieval and reporting procedures will be implemented for these features:

Feature 1: This feature will be avoided, however, a mitigation plan will be prepared for use in case the plans should change and the site will be monitored by a qualified archaeologist during initial ground-disturbing construction activities.

Feature 2: Map, surface collect, and test excavate.

(Feature 3 is not considered to be of sufficient importance to warrant further archaeological investigation. Similar features have been documented and reported by Brown (15)).

The visual and environmental impact of the project on the dam tender's house will be minimized by maintaining the existing fenced buffer around this property.

Any new electrical lines constructed on-site will be designed to minimize risks to raptors.

V. CONSULTATION AND COORDINATION

A. AGENCY SCOPING PROCESS

On August 13, 1982, project scoping letters were sent to 26 federal, state, county and city governmental agencies, three conservation organizations and 24 potential co-users. The letter reviewed the need for the Interconnection Project and it's proposed location. The responses to this letter were included in a draft Environmental Assessment that was distributed as a working document, and the comments raised in the responses were reevaluated in preparation of the project design and this report.

On October 1, 2 and 5, 1987, 47 federal, state, county and city governmental agencies, conservation organizations and potential co-users were sent letters describing the proposed project and requesting comments on it. A list of these agencies and organizations, a copy of the scoping letter and copies of the comments that were received are included in Appendix E.

On November 16, 1987 SRP requested that the USFWS initiate an Endangered Species Act, Section 7, consultation on the endangered bald eagles. A response from USFWS, dated December 17, 1987, is included in Appendix E.

Consultation has been completed on the potential impacts of the project on archaeological/historical resources with the SHPO. U.S. Bureau of Reclamation and U.S. Bureau of Land Management. A copy of a letter from the SHPO documenting the consultation is included herein on Page 69.

B. AGENCY AND ORGANIZATION REVIEW OF DRAFT EA REPORT

In June 1988, copies of this Draft EA Report were sent to all concerned and potentially concerned federal and state agencies, interest groups and interested individuals. Following is a list of those that were provided copies:

Federal Agencies

U.S. Army Corps of Engineers, Arizona Area Office
U.S. Army Corps of Engineers, District Engineer
U.S. Bureau of Land Management, Phoenix District Office
U.S. Fish and Wildlife Service, Ecological Services
U.S. Forest Service, Tonto National Forest, Supervisor

U.S. Forest Service, Tonto National Forest, Mesa Ranger Dist.
U.S. Soil Conservation Service

Arizona State Agencies

Arizona Department of Agriculture and Horticulture
Arizona Department of Environmental Quality
Arizona Department of Game and Fish
Arizona Department of Health Services
Arizona Department of Water Resources
Arizona State Clearinghouse
Arizona State Land Department
Arizona State Parks, Director
Arizona State Parks, Historic Preservation Officer

Local and Tribal Agencies

Camp Verde Yavapai-Apache Indian Community
Fort McDowell Yavapai Tribal Council
Gilbert, Town of
Globe, City of, Mayor
Maricopa County Board of Supervisors
Maricopa County Department of Planning and Development
Maricopa County Highway Department, County Engineer
Maricopa County Parks and Recreation Department
Mesa, City of, City Manager
Payson, Town of, Town Manager
Peoria, City of
Phoenix, City of, Environmental Services
Prescott, City of, City Manager
Salt River Pima-Maricopa Indian Community
San Carlos Apache Tribe
Tempe, City of, City Manager
Tonto Apache Tribal Council
Yavapai-Prescott Indian Community

Others

American Fisheries Society, Arizona-New Mexico Chapter
Arcadia Water Company
Arizona Municipal Water Users Association
Arizona Wildlife Federation
Camp Verde Water Company
Central Arizona Project Association
Central Arizona Water Conservation District
Cottonwood Water Works, Inc.
Maricopa Audubon Society
Maricopa Association of Governments
Maricopa County Flood Control District
Rio Salado Development District
Rio Verde Utilities, Inc.
Sierra Club, Grand Canyon Chapter

C. WRITTEN COMMENTS

Written replies received on the draft EA Report have been reproduced on the following pages. The comments and questions requiring a response have been numbered, with the responses in the following section being numbered accordingly. Replies were received from:

U.S. Army Corps of Engineers
- Los Angeles District, Environmental Resources Branch
- Los Angeles District, Regulatory Branch

U.S. Fish and Wildlife Service
- Ecological Services, Phoenix

U.S. Forest Service
- Tonto National Forest, Phoenix

Arizona State
- Agriculture and Horticulture Department
- Department of Commerce
- Game and Fish Department
- Parks, Historic Preservation Officer

Maricopa County
- Flood Control District
- Highway Department

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2711
LOS ANGELES, CALIFORNIA 90053-2325

June 27, 1988

OFFICIAL FILE COPY - APO
RECEIVED JUL 11 1988

Date	To	Initials
7/12		

REPLY TO
ATTENTION OF:

Office of the Chief
Environmental Resources Branch

Mr. Bruce Eillis
Buerau of Reclamation
Arizona Projects Office
Environmental Division
23636 North 7th Street
P.O. Box 9980
Phoenix, Arizona 85068

Dear Mr. Ellis:

We have reviewed the Draft Environmental Assessment (DEA) for the Salt River Project (SRP)/Central Arizona Project (CAP), as requested in a letter from your office, dated May 31, 1988.

Work in waters of the United States might require a permit under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act. We cannot determine from the submitted information the extent of the Corps' jurisdiction over this project. Please give our Regulatory Branch documentation that clearly describes the area and extent of any proposed work in watercourses and adjacent wetlands to help us make that determination. 1

If the proposed project involves any Federal assistance through funding or permits, compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470f) and implementing regulations, 36 CFR 800, will be required. 2

Flood flows greater that the design 185,000 cubic feet would cause disruptions of undeterminable length in the delivery of CAP water into the SRP canal system. You will need to coordinate your design with SRP personnel to insure minimum disruptions caused by flooding. 3

Thank you for the opportunity to review and comment on this document.

Sincerely,

Ruth Villalobos
for Robert S. Joe
Chief, Planning Division

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2711
LOS ANGELES, CALIFORNIA 90053

REPLY TO
ATTENTION OF:

June 7, 1988

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RECEIVED JUN 10 1988
DATE 6/13/88 BDE

Office of the Chief
Regulatory Branch

Bureau of Reclamation
Arizona Projects Office
ATTN: Bruce Ellis
P.O. Box 9980
Phoenix, Arizona 85068

Gentlemen:

Reference is made to your letter of May 31, 1988 ~~requesting review and~~ comments on the Central Arizona Project/ Salt River Project Interconnection Draft Environmental Assessment Report.

Based on the information furnished in the draft environmental assessment the proposed activity would require a Section 404 permit. The proposed activity may be permitted as an individual permit, however, it would likely qualify for the Corps' nationwide permit at 33 CFR Part 330.5(a)(12). This nationwide permit allows the discharge of material for backfill or bedding for utility lines, including outfall and intake structures, provided there is no change in preconstruction bottom contours. The enclosure, Part 330.5(a)(12), defines the terms of the nationwide permit and Part 330.5(b) lists the conditions that must be satisfied for the work to qualify for a nationwide permit. 4

It would be appropriate to apply for a Section 404 permit at the point in your review process when you have chosen a preferred crossing design and have resolved any potential conflicts with the conditions for a nationwide permit.

The receipt of your letter is appreciated. If you have any questions please contact Robert J. Dummer of my staff at (602) 241-5385.

Sincerely,

Robert L. Koenigs

Robert L. Koenigs
Acting Chief, North Coast Section

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
3616 W. Thomas, Suite 6
Phoenix, Arizona 85019
July 5, 1988

RECEIVED JUL 11 1988

Date	To	Initials
7/11	[illegible]	[illegible]
7/12	[illegible]	[illegible]

MEMORANDUM

TO: Project Manager, Bureau of Reclamation, Arizona Projects Office
Phoenix, Arizona

FROM: Field Supervisor

SUBJECT: Draft Environmental Assessment for Salt River Project/Central Arizona Project Interconnection Facility

The Fish and Wildlife Service (Service) has reviewed the draft Environmental Assessment for the proposed Salt River Project/Central Arizona Project Interconnection Facility. The following comments are provided for your consideration.

Page 32, c. Fish Barriers

The proposed electrical fish barrier is presented as a solution to prevent predacious Colorado River fish from entering the lower Salt and Verde Rivers. However, a complete design is not addressed in the Environmental Assessment and until a design is presented to the Service, we believe that the proposed electrical fish barrier could be ineffective. We recommend that further coordination be carried out with the Arizona Game and Fish Department and the Service to address the following concerns; electrical barrier designs, screens, velocity barrier, and possible drop structures. 5

If we can be of further assistance or if you have any questions, please call Denise Baker or me (Telephone: 602/261-4720). We appreciate the opportunity to comment.

Sam F. Spiller
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico
[Fish and Wildlife Enhancement]
Director, Arizona Game and Fish Department, Phoenix, Arizona

United States Department of Agriculture | Forest Service | Tonto National Forest | 2324 E. McDowell Road
P.O. Box 5348
Phoenix, AZ 85010

Reply To: 1530

Date: July 7, 1988

Subject: Draft EA for Interconnection Facility

To: Mr. Bruce Ellis
Bureau of Reclamation
Environmental Division
P.O. Box 9980
Phoenix, AZ 85068

The Tonto National Forest has reviewed the above subject EA and fully support Option 2, that is the delivery of CAP water below the Granite Reef forebay. We also support use of the electric curtain screen to guard against the introduction of Colorado River fish into the Salt/Verde System.

The EA adequately addressed the issues and environmental impacts. The proposed action appears insignificant. If you have any questions, please contact Delvin Lopez at 225-5200.

Sincerely,

JAMES L. KIMBALL
Forest Supervisor

cc:
Mesa District Ranger

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RECEIVED JUL - 8 1988
Date | To | Initials
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TO:

Director
Agriculture & Horticulture Dept
421 Capitol Annex West
Phoenix, AZ 85007

State Application Identifier (SAI)

JUN 17 1988 State AZ No 88000107

Economic Sec.
Indian Affairs
Transportation
Public Safety
Mineral Res.
Att'y General
Corrections
Civil Rights
Education
Gov's Office for Children
Administration
JLBC
Developmental Disabilities
Game & Fish
Ag. & Hort.

Tourism
Health
AZ Environ. Qtly
Water
Parks
Land
Commerce
Region I, II, III IV, V, VI

Salt River Indian Clearinghou
Navajo Indian Clearinghouse

FROM: Arizona State Clearinghouse
1700 West Washington Street, 4th Floor
Phoenix, Arizona 85007

This project is referred to you for review and comment. Please evaluate as to the following questions. After completion, return THIS FORM AND ONE XEROX COPY to the Clearinghouse no later than 17 WORKING DAYS from the date noted above. Please contact the Clearinghouse at 255-5004 if you need further information or additional time for review.

☐ No comment on this project ☐ Proposal is supported as written ☒ Comments as indicated below

1. Is project consistent with your agency goals and objectives? ☐ Yes ☐ No ☐ Not Relative to this agency

2. Does project contribute to statewide and/or areawide goals and objectives of which you are familiar? ☐ Yes ☐ No

3. Is there overlap or duplication with other state agency or local responsibilities and/or goals and objectives? ☐ Yes ☐ No

4. Will project have an adverse effect on existing programs with your agency or within project impact area? ☐ Yes ☐ No

5. Does project violate any rules or regulations of your agency? ☐ Yes ☐ No

6. Does project adequately address the intended effects on target population? ☐ Yes ☐ No

7. Is project in accord with existing applicable laws, rules or regulations with which you are familiar? ☒ Yes ☐ No

Additional Comments (Use back of sheet, if necessary): No. 8 on page 16 states ARS 3-901-910 requirements of Commission Notice where protected native plants are to be destroyed.

Reviewers Signature [illegible] Date 6-23-88

Title Eastern Regional Director Telephone 255-1373

ROSE MOFFORD
GOVERNOR

ARIZONA DEPARTMENT OF COMMERCE

STATE CAPITOL
1700 WEST WASHINGTON
PHOENIX, ARIZONA 85007
(602) 255-5371

OFFICIAL FILE COPY - APO
RECEIVED JUL 12 1988
LOIS C. YATES
ACTING DIRECTOR

To	Initials
7/12 TOD	
7/13 150	

MEMORANDUM

TO : DOI BOR

FROM : ARIZONA STATE CLEARINGHOUSE

DATE : July 1, 1988

RE : BUREAU OF RECLAMATION
DRAFT EA FOR SALT RV. PRJ./CAP INTERCONNECTION FACILITY
15.999
AZ880617800107

This memorandum is in response to the above project submitted to the Arizona State Clearinghouse for review.

The project has been reviewed pursuant to the Executive Order 12372 by certain Arizona State officials and Regional Councils of Government.

If the Standard Form 424 was submitted with the application, it is attached for your information.

Also attached are comments from the Arizona Department of Agriculture and Horticulture, and the Arizona Game and Fish Department. Please consider these comments to the extent in which they apply to your project.

Attachment

cc: Arizona State Clearinghouse
Applicant

ROSE MOFFORD, *Governor*

Commissioners:
LARRY D. ADAMS, Bullhead City, Chairman
FRANCES W. WERNER, Tucson
THOMAS G. WOODS, JR., Phoenix
PHILLIP W. ASHCROFT, Eagar
GORDON K. WHITING, Klondyke

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TEMPLE A. REYNOLDS

Deputy Director
DUANE L. SHROUFE

ARIZONA GAME & FISH DEPARTMENT

2222 West Greenway Road Phoenix, Arizona 85023 942-3000

July 5, 1988

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Date	To	Initials
7/6	150	[illegible]

Mr. Bruce Ellis
Bureau of Reclamation
Arizona Projects Office
Environmental Division
P. O. Box 9980
Phoenix, Arizona 85068

Dear Mr. Ellis:

Re: Draft Environmental Assessment (EA) for Salt River Project (SRP)/Central Arizona Project (CAP) Interconnection Facility

Our Department has reviewed the above-referenced draft and, in general, we find the document complete and accurate as it pertains to anticipated impacts to wildlife.

We continue to be concerned, however, with the potential for introduction of Colorado River fish fauna into the Salt-Verde River system. While it appears that the combination of water velocities and the electric fish barriers would, under normal operating conditions, prevent upstream movement of fish, we are concerned that the delay before return of electric power after a power failure could still allow for upstream fish migration, especially in light of the sprint speeds displayed in Table I of Appendix C. Also, the draft does not appear to describe provisions for the prevention of fish movement during periods when the barriers must be turned off for repairs and maintenance. We recommend that some type of temporary barrier, such as a small mesh grate, be designed for use during power outages and maintenance. Further, we still believe that a vertical drop structure is preferred, in combination with an electric fish barrier. 6 7 8

Two minor corrections are recommended for clarity. On page 44, 3rd paragraph, 3rd line, the draft document incorrectly infers that "chub" is introduced rather than native. Also, in Table 2 of Appendix A beavers should be shown as occurring in the riparian and aquatic habitats within the study area. 9 10

Thank you for the opportunity to review and comment on this draft EA.

Sincerely,

Robert K. Weaver
Habitat Evaluation Coordinator
Planning and Evaluation Branch

RKW:lkl

cc: Don Turner, Supervisor, Mesa Regional Office
Sam Spiller, Field Supervisor, USFWS, Phoenix ES Office
Arizona State Clearinghouse, AZ 88-80-0107

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June 30, 1988

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Bruce Ellis, Chief
Environmental Planning
DOI Bureau of Reclamation
P.O. Box 9980
Phoenix, AZ 85068

RE: Central Arizona Project (CAP)/Salt River Project (SRP) Interconnection
Draft Environmental Assessment (EA) Report, DOI-BR

Dear Mr. Ellis:

I have reviewed the draft EA for the above project and have the following comments pursuant to 36 CFR Part 800:

1. I note that the EA (Appendices B and E) does not indicate that our office was formally consulted on this undertaking. I also note that Dr. Stone's report (Appendix B) states that 128 acres were surveyed and three features associated with historic site AZ U:6:2 (ASU), a National Register eligible site, may be impacted by the proposed undertaking. I also note that the Granite Reef Dam and the dam tender's house (both of which are potentially eligible for inclusion in the National Register) will not be affected.

2. Based upon the information provided, I concur with Dr. Stone's recommendations that all three features (Features 1, 2 and 3) of AZ U:6:2 (ASU) should be considered as integral parts of the site and each warrants further investigations (i.e. data recovery) prior to their destruction as a result of the proposed construction activities. I also concur with Dr. Stone's recommendation that the Granite Reef Dam and the dam tender's house be avoided and his recommendations that construction activities in the vicinity of AZ U:6:2 (ASU) be monitored by a professional archaeologist to assure that any buried remains are properly evaluated and recorded. In addition, his recommendation that the area outside of the west boundary of the study area be avoided during construction meets with our concurrence.

3. Please submit a formal request for our consultation on a proposed treatment plan that will enable the agency to reach a determination of "no adverse effect" for this undertaking. 11

Your continued cooperation with this office in complying with the historic preservation requirements for Federal undertakings is appreciated. If you have any questions, please do not hesitate to contact me.

Sincerely,

Robert E. Gasser
Archaeologist & Compliance Coordinator

for Shereen Lerner, Ph.D.
State Historic Preservation Officer

cc: Judy Brunson, SRP

CONSERVING AND MANAGING ARIZONA'S HISTORIC PLACES, HISTORICAL SITES, AND RECREATIONAL, SCENIC AND NATURAL AREAS

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of
Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 262-1501

D. L. Sagramoso, P.E., Chief Engineer and General Manager

FLOOD CONTROL DISTRICT of MARICOPA COUNTY 1959

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Mr. Bruce Ellis
Bureau of Reclamation
Arizona Projects Office
Environmental Division
P.O. Box 9980
Phoenix, Arizona 85068

Subject: Draft Environmental Assessment for Salt River Project/Central Arizona Project Interconnection Facility

Dear Mr. Ellis:

The Flood Control District Staff has reviewed the Draft Environmental Assessment dated May 1988. The proposed project does not appear to impact any existing Flood Control District facilities or planned projects.

Our comments in our November 5, 1987, letter concerning compliance with floodplain regulations are still relevant. Thank you for the opportunity to review this assessment and please keep us informed of future progress. 12

Sincerely,

Stanley L. Smith, Jr., P.E.
Deputy Chief Engineer

MARICOPA COUNTY HIGHWAY DEPARTMENT

3325 West Durango Street
Phoenix, Arizona 85009

(602) 233-8600

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June 7, 1988

Bureau of Reclamation
Arizona Projects Office
Environmental Division
P. O. Box 9980
Phoenix, Arizona 85068

Attention Mr. Bruce Ellis

Gentlemen:

RE DRAFT ENVIRONMENTAL ASSESSMENT FOR SRP/CAP INTERCONNECTION FACILITY

We have reviewed the Draft Environmental Assessment submitted by your letter dated May 31, 1988 and have no comments.

Sincerely,

R. C. ESTERBROOKS, P.E.
ASSISTANT COUNTY MANAGER,
PUBLIC WORKS DIRECTOR & COUNTY ENGINEER

Harry R. Keller

Harry R. Keller, P.E.
Assistant County Engineer

WHH:rg

D. RESPONSE TO WRITTEN COMMENTS

Comment No.

1. The Salt River Project has submitted documentation to the Army Corps of Engineers and requested that the Section 404 permit process be initiated. See the copies of the SRP letter and the COE response at the end of this section.

2. Section 106 consultation has been held with the U.S. Bureau of Reclamation, U.S. Bureau of Land Management and Arizona Historic Preservation Officer. A letter documenting this consultation and project compliance with Section 106 is included in the following pages.

3. Flood flows greater than 185,000 cfs are not expected to result in disruption of delivery of CAP water into the SRP canal system. During flood flow releases on the Salt River, the CAP/SRP Interconnection is not expected to be in operation since an ample supply of water would be available from the river. The Salt River Project is in charge of design and construction of the facility.

4. See the response to Comment 1, above.

5. On July 27, 1988, SRP sponsored a consultation meeting on the proposed electrical fish barriers. Those attending included representatives from the U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, U.S. Forest Service, Arizona Game and Fish Department and Smith and Root, Inc., (the designers of the barriers).

   Section D.1.C., a description of the proposed fish barriers, has been expanded to include responses to questions that were asked at the above meeting and to provide more detailed descriptions of the fish barrier and its operation. In addition, the discussion of the reasons for selection of the electric barriers over drop structures in the canals have been expanded.

   While the fish barriers have been laid out conceptually, the design has not been finalized and the standard and emergency operating procedures are under development. SRP will continue consultation with all concerned agencies on the final barrier design and the development of the operating procedures and an appropriate monitoring program.

6. The electric fish barriers are being designed to be 100% effective in preventing upstream movement of fish from the SRP canals and into the Salt River, including emergency events such as a power failure. Water velocities through the canal headgates are sufficient to prevent upstream movement of all but a very few active and determined fish. Nonetheless, the barrier design includes an on-site back-up generator designed to come on-line within seconds of a power failure, thus re-starting the electric fields in the canals.

Emergency operating procedures are being developed to address a major failure of the barrier that cannot be forseen at this time. These procedures will be developed in consultation with the appropriate environmental and water utility agencies. Since the primary bulk delivery of the valley's drinking water is via the Arizona and South Canals, the water needs of the cities as well as environmental issues must be considered.

7. It is planned that the fish barriers will be de-energized during the normally-scheduled Fall annual dryup of the Arizona and South Canals, during which time SRP will inspect the electrodes and perform any needed repairs and maintenance. The fish barriers will not be de-energized until after the canals have been drained. Every precaution will be taken to prevent the movement of any fish into the river upstream.

8. Drop structures were carefully considered by SRP prior to selection of the electric fish barriers as the preferred alternative. While it appears that the existing drop and velocity combination at the headgates will prevent upstream movement of all fish likely to enter the SRP canals with the CAP water, the electric barriers have been added to the proposed design as an insurance measure.

   The only drop structure that is practical at this site already exists. The shallow slope in the canals would not permit construction of a significant new drop structure within several miles downstream. If an increased drop were to be built into the gates it would be necessary to increase the height of Granite Reef Dam, and the water level of the dam's forebay (with resultant permanent flooding of a large additional area), in order to continue water deliveries at the required levels.

   This subject is discussed in more detain in Section II.D.1.c., Fish Barriers, on Page 33.

9. This correction has been made as noted.

10. Beaver has been added to Appendix A, Table 2.

11. The formal archaeology consultation has been completed. Refer to the letter from the State Historic Preservation Officer at the end of this section.

12. The potential need for a flood plain use permit has been added to Section VI. B., "List of Permits Needed", and an application for the permit will be submitted if it is needed.

SALT RIVER PROJECT

POST OFFICE BOX 52025
PHOENIX, ARIZONA
85072-2025
(602) 236-5900

July 1, 1988

File: CSI-01.12
Ref: CSIE-191

The District Engineer
U. S. Army Corps of Engineers
South Pacific District
P. O. Box 2711
Los Angeles, California 90053-2325

Attention: SPLCO-R

Subject: CAP/SRP Interconnection (CSI) Project
ENG Form 4345

Gentlemen:

In accordance with the U. S. Army Corps of Engineers (COE) regulatory program, please find attached ENG Form 4345 and supporting documentation required to initiate the permit application process.

The Salt River Project (SRP) requests COE to identify permit requirements for the CSI Project based on the information submitted and to coordinate the process leading to issuance of the applicable permit(s).

If you should require additional information, please do not hesitate to contact me at (602) 236-5960.

Sincerely,

Terry V. Lambson

Terry V. Lambson
CSI Project Manager

TVL/cae

Attachments

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT
CORPS OF ENGINEERS
P.O. BOX 2711
LOS ANGELES, CALIFORNIA 90053-2325

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SPLCO-R

Terry V. Lambson, CSI Project Manager
Hydro and Project Services
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-2025

CSI- 03.0803.02

Date 7-11-88

Your application dated 7-5-88 was received in our office on

7-7-88 and has been assigned Application No. 88-303-RD

Please refer to this number when requesting further information.

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JUL 15 1988

Chief, Construction-Operations Division
PROJ MGT

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COURTLAND NELSON
DEPUTY DIRECTOR

September 20, 1988

Judy Brunson
Land Management Agent/Archaeology
Public Lands Division
Salt River Project
P.O. Box 52025
Phoenix, AZ 85072-2025

RE: Central Arizona Project (CAP)/Salt River Project (SRP) Interconnection, DOI-BR and SRP

Dear Judy:

Thank you for sending us addtional information about your plans to protect cultural resources within the above project area. I have reviewed your plans and have the following comments pursuant to 36 CFR Part 800 since there is Federal involvement in this project.

1. As you state, site AZ U:6:2 (ASU) has already been determined to be eligible for inclusion in the National Register of Historic Places.

2. We concur with you that since Feature 1 can be avoided, no further work needs to be done with this component of the site. If Feature 1 cannot be avoided, we also concur that excavation of the dry-laid masonry structure is warranted.

3. We understand that Archaeological Research Services has provided you with a set of recommendations for the treatment of Feature 2, a historic trash scatter. This treatment plan will be followed and the feature will be monitored during any construction activities.

4. Feature 3 (a.k.a. Feature 44) has already been studied by Arizona State University as part of the Granite Reef Aqueduct Project and no further work at this component of the site is warranted.

We appreciate you keeping us advised on the status of this project and your continued cooperation with this office in considering the impacts of your projects on historic preservation. If you have any questions, please contact me.

Sincerely,

Robert E. Gasser
Archaeologist & Compliance Coordinator

for Shereen Lerner, Ph.D.
State Historic Preservation Officer

SEP 1988
RECEIVED
S.R.P.
Land Dept.

cc: Bruce Ellis, DOI-BR
Mary Barger, DOI-BLM
Lyle Stone, ARS

VI. RELATIONSHIP TO OTHER PROJECTS AND ACTIONS

A. FEDERAL, STATE, REGIONAL AND LOCAL

The CAP/SRP Interconnection is an integral part of the Federal Central Arizona Project and will tie into the canal system of the Salt River Project. The site is adjacent to a small Tonto National Forest Campground which is not currently scheduled for expansion although some minor additional development may occur. The adjacent county road, Bush Highway, is not scheduled for improvement, and the Bureau of Land Management has no plans for development of the Interconnection site. The Diversion Dam serves as the eastern boundary of the Rio Salado project planning area, which is unlikely to be developed within the forseeable future.

The Interconnection will provide water for a short-term groundwater storage demonstration project in the Salt River bed below the Granite Reef Dam. In the future, the Interconnection may provide water to permanent groundwater storage project downstream of Granite Reef Dam. Environmental documentation of these proposed projects is beyond the scope of this report.

Other than the facilities associated with the Interconnection, no projects are planned or proposed for this site.

B. LIST OF PERMITS NEEDED TO BUILD THE PROJECT

Finding of No Significant Impact, Bureau of Reclamation, U.S. Department of the Interior.

U.S. Army Corps of Engineers Section 404 Dredge and Fill Permit

Maricopa County Construction Permit

Flood Control District of Maricopa County Flood Plain Use Permit (if required)

VII. LIST OF PREPARERS

The CAP/SRP Interconnection Environmental Assessment Report was prepared by an interdisciplinary team of individuals with varied specialties and backgrounds. The following assisted in preparation of this report:

Scott Atkinson, Engineer, Salt River Project
W. E. Davis, Senior Staff Scientist, Salt River Project
G. D. Harris, Senior Staff Scientist, Salt River Project
D. L. Heinert, Water Group Management Staff, Salt River Project
C. J. Kissel, Water Civil Engineering Department, Salt River Project
E. Linwood Smith, Consulting Biologist, Principal of E. L. Smith and Associates, Tucson, Arizona.
Stephanie A. Statler, Project Scientist, SWCA Inc.
Lyle M. Stone, Contract Archaeologist, Principal of Archaeological Research Services, Tempe, Arizona.
T. R. Suriano, Water Quality Department, Salt River Project
Kevin G. Wanttaja, Water Quality Department, Salt River Project

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APPENDICES

APPENDIX A

BIOTIC RESOURCES

BIOTIC RESOURCES OF THE CAP/SRP INTERCONNECTION STUDY AREA

DRAFT FINAL REPORT

Submitted By:

E. Linwood Smith, Ph.D.
E.L. Smith & Associates
Tucson, Arizona

Submitted To:

Salt River Project
Environmental Services Department
Phoenix, Arizona

13 November 1984

INTRODUCTION

The Salt River Project (SRP) and the U.S. Bureau of Reclamation (USBR) propose to construct an interconnection between the Central Arizona Project (CAP) canal and the SRP water delivery system. The proposed interconnection is planned to be built on a site immediately south of Granite Reef Dam on the Salt River. The project will consist of a turnout structure on the CAP aqueduct and pipelines to the Arizona and South Canals.

The SRP is a federal reclamation project under the jurisdiction of the USBR. As such, an environmental assessment of the proposed CAP/SRP Interconnection is required. The assessment is submitted to indicate whether an environmental impact statement is required pursuant to the National Environmental Policy Act of 1969.

The following report, intended to be a portion of a larger Environmental Assessment report being prepared by SRP, deals with the biotic resources (plants and animals) present at the proposed interconnection site. The report was prepared by E. Linwood Smith, Ph.D. of E.L. Smith & Associates of Tucson, Arizona.

METHODS

The information presented in this report was largely gleaned from the existing regional literature on the flora and fauna of Arizona. The brief literature review was augmented by two one-day visits to the site, one in September 1982 and one in October, 1984. During site visits lists of plants and animals seen on-site were and in adjacent areas were recorded. Other information included herein comes from comments made on the original draft of this report which was submitted to SRP in September, 1983.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

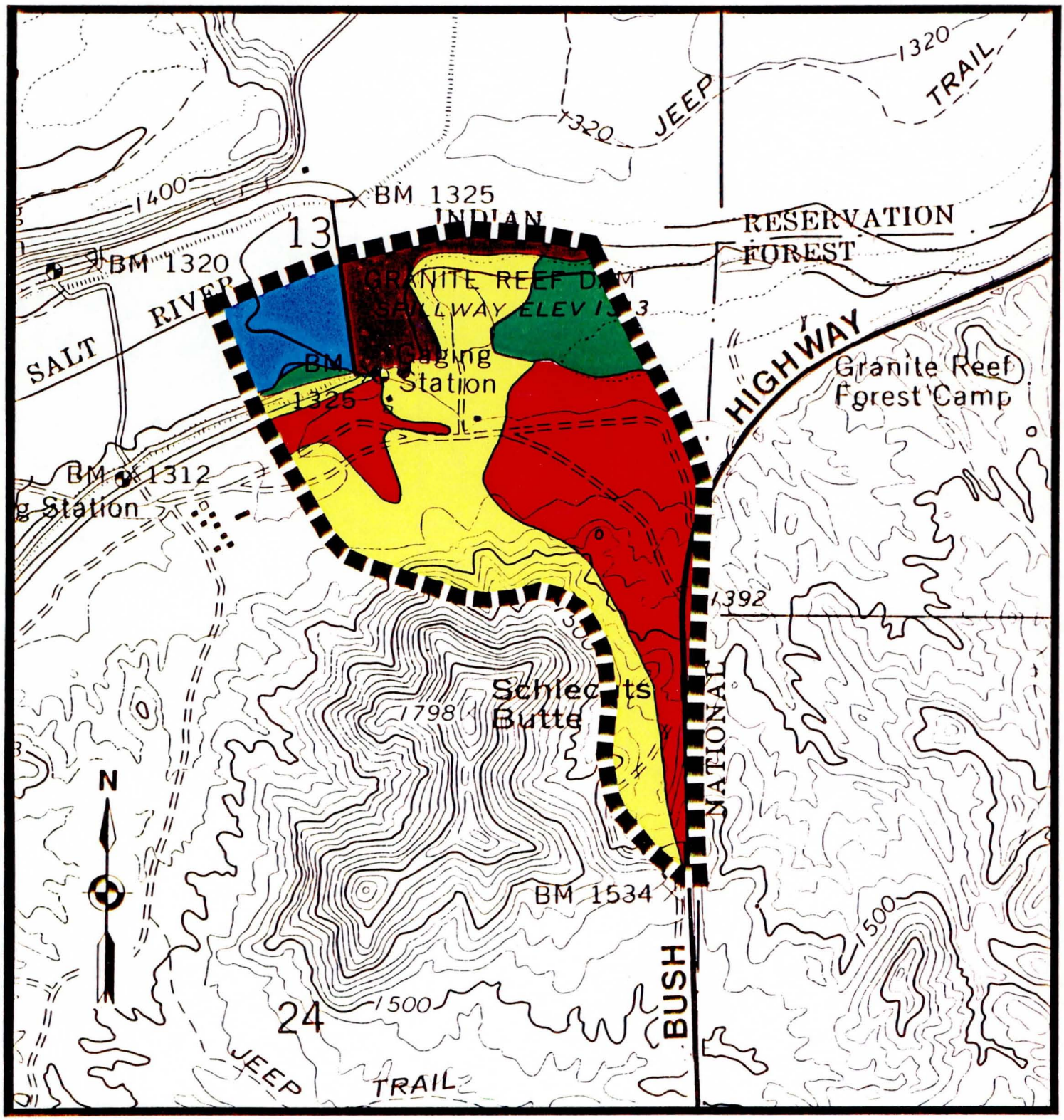
TERRESTRIAL ENVIRONMENT - VEGETATION

The terrestrial environment of the CAP/SRP Interconnection Study Area is dominated by Sonoran Desertscrub Biotic Communities (See Turner and Brown, 1982; Brown and Lowe, 1980; Brown and Lowe, 1974; and Lowe, 1964) with limited presence of riparian woodlands along the banks of the Salt River and a largely herbaceous strand (i.e. intermittant stream channel) community that occupies the largely dry stream channel downstream from Granite Reef Dam (see Figure I in which the strand community is designated "river bottom").

Sonoran Desertscrub plant associations present in the area include one of creosotebush and bursage (Larrea tridentata - Ambrosia deltoidea) and one of mixed paloverde and cactus (Cercidium sp. - Opuntia sp.). Generally, the creosotebush-bursage association dominates the more level areas south and southwest of the Granite Reef Gaging Station while the paloverde-cactus association is found on the rocky soils associated with Schlechts Butte. Table 1 is a listing of plant species observed on relatively undisturbed sites within the study area.

Most native Sonoran Desert plant communities on-site have been removed as a result of industrial use of the site. It appears that all level areas within the study area, except in the Salt River bottom below Granite Reef Dam, have been cleared at one time or another and most are presently being used as a gravel storage area. There is a gravel mining operation in place along the banks of the lake formed by Granite Reef Dam and upland plant communities along the east face of Schlechts Butte have been severely degraded by construction of the CAP canal and siphon. Plant communities on such disturbed sites consist mostly of weedy species that thrive on disturbed soils. Russian thistle, wild buckwheat, desert broom, sand mat, and burro weed are typical members of such communities. Occasional individuals of brittlebush and creosotebush also occur in areas of disturbance, possibly representing initial reinvasion by native species following disturbance.

Riparian habitats present in the study area above Granite Reef Dam are strongly dominated by mesquite and blue paloverde with willow (Salix cf Gooddingii) present at the water's edge. There is also salt cedar present but it is not strongly dominant. Within the boundaries described in Figure I the extent of mesquite/blue paloverde dominated lands consists of approximately 10 acres. Below Granite Reef Dam riparian habitat is represented by a copse of willow along each side of the trickle of water that normally escapes from Granite Reef Dam. There are also cottonwood seedlings and cheesebush present along and near the wet areas below the dam. Further downstream, outside the study area, are large cottonwood, willow, and mesquite trees along the stream.



STUDY AREA BOUNDARY

1" = 900' (APPROX.)

APPROXIMATE DISTRIBUTION OF MAJOR BIOTIC FEATURES WITHIN THE CAP/SRP INTERCONNECTION STUDY AREA

- SONORAN DESERTSCRUB COMMUNITIES
- RIPARIAN COMMUNITIES
- RIVER BOTTOM COMMUNITIES
- OPEN WATER
- HIGHLY MODIFIED, DISTURBED SITES WITH LIMITED OCCURRENCE OF NATIVE PLANT/ANIMAL COMMUNITIES

BIOTIC FEATURES

CAP/SRP INTERCONNECTION

FIGURE 1

TABLE I

A LISTING OF PLANT SPECIES OBSERVED ON RELATIVELY UNDISTURBED SITES WITHIN THE CAP/SRP INTERCONNECTION STUDY AREA

Habitats:

1 = Sonoran Desertscrub
2 = Riparian Woodland
3 = River Bottom below Granite Reef Dam

+ = Species observed in this habitat type
- = Species not observed in this habitat type

Scientific Name	Common Name	Habitats 1	2	3
Ambrosia ambrosioides	canyon ragweed	-	-	+
Ambrosia deltoidea	burro bush	+	-	-
Ambrosia dumosa	white bursage	+	-	-
Baccharis salicifolia	seep willow	-	-	+
Baccharis sarathroides	desert broom	+	+	+
Bebbia juncea	rush bebbia	-	-	+
Calliandra eriophylla	fairy duster	+	-	-
Cercidium floridum	blue paloverde	+	+	-
Cercidium microphyllum	foothill paloverde	+	-	-
Cereus giganteus	saguaro	+	-	-
Cynodon dactylon	bermuda grass	-	+	+
Datura sp.	thorn apple	-	+	+
Echinocereus engelmanni	strawberry hedgehog	+	-	-
Encelia farinosa	brittlebush	+	-	+
Eriogonum sp.	wild buckwheat	+	-	+
Erioneuron pulchellum	desert fluff grass	+	-	-
Euphorbia cf polycarpa	sand mat	+	-	-
Ferocactus acanthodes	barrel cactus	+	-	-
Fouquieria splendens	ocotillo	+	-	-
Gutierrezia sarothrae	snakeweed	+	-	+
Haplopappus sp.	burro weed	+	-	+
Heterotheca subaxillaris	telegraph plant	-	-	+
Hymenoclea salsola	cheesebush	+	-	-
Krameria grayi	white ratany	+	-	-
Larrea tridentata	creosotebush	+	-	-
Mentzelia sp.	stick-leaf	-	-	+
Nicotiana glauca	tree tobacco	-	-	+
Olneya tesota	ironwood	+	-	-
Opuntia acanthocarpa	buckhorn cholla	+	-	-
Opuntia bigelovii	teddy bear cactus	+	-	-
Polanisia trachysperma	clammy weed	-	-	+

TABLE I - concluded

A LISTING OF PLANT SPECIES OBSERVED ON RELATIVELY UNDISTURBED SITES WITHIN THE CAP/SRP INTERCONNECTION STUDY AREA

Scientific Name	Common Name	Habitats 1	2	3
Populus fremonti	fremont cottonwood	-	+	+
Prosopis velutina	velvet mesquite	+	+	-
Salix sp.	willow	-	+	+
Salsola iberica	russian thistle	+	+	+
Stephanomeria pauciflora	wire lettuce	+	-	+
Tamarix pentandra	salt cedar	-	+	+
Tessaria sericea	arrowweed	-	+	-
Xanthium strumarium	common cocklebur	-	-	+

Common and scientific names used in this table generally follow those of Lehr, 1978

That part of the Salt River bed below Granite Reef Dam that is presently dry supports an herbaceous strand-like community of clammy weed, telegraph plant, wild buckwheat, wire lettuce, and canyon ragweed. Shrub-like plants present here include rush bebbia, desert broom and cheesebush. In the recent past, the area below Granite Reef Dam supported cottonwood, willow, and mesquite trees in addition to marshlands (Witzeman, 1977). These features are no longer present, probably as a result of recent scouring floods coupled with construction of the Granite Reef Siphon of the CAP.

TERRESTRIAL ENVIRONMENT - WILDLIFE

A large number, perhaps as high as 250, of wildlife species are likely to occur within the study area over the course of a year's time. Bird species comprise the majoprity of this estimate which is large, reflecting the wide spectrum of wildlife habitats present (i.e. open water and associaed wetlands to shrub dominated desertscrub uplands). The riparian woodlands undoubtedly play host to the largest number of species (see Hubbard, 1977).

Table 2 is a listing of some wildlife species that are most likely to occur in the study area and environs as permanent resident and/or breeding species. It is important to be aware that many species not listed in Table 2, in the interest of brevity, use the study area regularly during periods of spring and fall migration, and during the winter months.

AQUATIC ENVIRONMENT

The aquatic environment within the study area consists of a portion of the lake created by Granite Reef Dam and several small ponds created by seepage from leaks below the dam and along the South Canal. In September, 1982 there were no well developed emergent plant communities within the study area although one fairly large (about one acre) patch of dead and dried cattail (Typha cf domingensis) was present near the eastern edge of the study area at the juncture of riparian and desertscrub communities (See Figure I). This stand of cattail was not noted during the October, 1984 visit to the site. In both 1982 and 1984 there were meager stands of cattail immediately below Granite Reef Dam and between the South Canal and the Salt River.

Some wildlife species that may occur in aquatic habitats are listed in Table 2. As can be seen from the table, the ichthyofauna (fishes) of the study area is composed largely of introduced species of Centrarchids (bass, bluegill, sunfish) minnows (carp, shiner, buffalo), and catfish. According to Grabowski et al (1977), only three of 15 fish species occurring in the Salt River and three of 16 in the Verde River are native species; the remainder having been introduced for various reasons at some time in the past. A survey conducted by the U.S. Fish and Wildlife Service as part of the Orme Reservoir study on fish and Wildlife (1975) demonstrated the presence of 17 fish species at the Orme site (i.e. in the vicinity of the Granite Reef Diversion Dam reservoir. In all, four native species of fish were found; roundtail chub, longfin dace, gila sucker, and gila mountain sucker.

TABLE 2

WILDLIFE SPECIES THAT ARE POTENTIAL PERMANENT RESIDENT AND/OR BREEDING SPECIES WITHIN THE CAP/SRP INTERCONNECTION STUDY AREA

Habitat Types:

1 = Aquatic and associated shorelines, mudflats, and emergent (e.g. cattail) communities.
2 = Riparian woodlands, including mesquite bosques.
3 = Sonoran Desertscrub

Note: River bottom habitats below Granite Reef Dam are not included in this habitat list owing to a general absence of occupation by a distinctive vertebrate assemblage.

* = Introduced (i.e. non-native) species.
+ = Species observed on-site or nearby in September, 1982 or in October, 1984)

Common Name	Scientific Name	Habitats 1	2	3
FISHES				
*Threadfin Shad	Dorosoma pentenense	+	-	-
*Carp	Cyprinus carpio	+	-	-
Roundtail Chub	Gila robusta	+	-	-
Longfin Dace	Agosia chrysogaster	+	-	-
*Red Shiner	Notropis lutrensis	+	-	-
*Bigmouth Buffalo	Ictiobus cyprinellus	+	-	-
Gila Sucker	Catostomus insignus	+	-	-
Gila Mountain Sucker	Pantosteus clarki	+	-	-
*Channel Catfish	Ictalurus punctatus	+	-	-
*Yellow Bullhead	Ictalurus natalus	+	-	-
*Mosquitofish	Gambusia affinis	+	-	-
*Sailfin Molly	Poecilia latipinna	+	-	-
*Largemouth Bass	Micropterus salmoides	+	-	-
*Bluegill	Lepomis macrochirus	+	-	-
*Redear Sunfish	Lepomis microlophus	+	-	-
*Green Sunfish	Lepomis cyanellus	+	-	-
*Black Crappie	Pomoxis nigromaculatus	+	-	-

TABLE 2 - continued

WILDLIFE SPECIES THAT ARE POTENTIAL PERMANENT RESIDENT AND/OR BREEDING SPECIES WITHIN THE THE CAP/SRP INTERCONNECTION STUDY AREA

Common Name	Scientific Name	Habitats 1	2	3
AMPHIBIANS				
Tiger Salamander	Ambystoma tigrinum	+	-	-
Couch's Spadefoot	Scaphiopus couchi	-	+	+
Colorado River Toad	Bufo alvarius	-	+	+
Woodhouse's Toad	Bufo woodhousei	+	-	-
Great Plains Toad	Bufo cognatus	-	+	+
*Bullfrog	Rana catesbiana	+	-	-
Leopard Frog	Rana pipiens			
REPTILES				
*Spiny Softshell	Trionyx spiniferus	+	-	-
Gila Monster	Heloderma suspectum	-	+	+
Banded Gecko	Coleonys variegatus	-	-	+
Collared Lizard	Crotaphytus collaris	-	-	+
Greater Earless Lizard	Cophosaurus texanus	-	-	+
+Zebra-tailed Lizard	Callisaurus draconoides	-	-	+
+Desert Spiny Lizard	Sceloporus magister	-	-	+
+Tree Lizard	Urosaurus ornatus	-	+	+
+Side-blotched Lizard	Uta stansburiana	-	+	+
Regal Horned Lizard	Phrynosoma solare	-	-	+
+Western Whiptail	Cnemidophorus tigris	-	+	+
+Black-necked Garter Snake	Thamnophis cyrtopsis	+	+	-
Coachwhip	Masticophis flagellum	-	+	+
Desert Patch-nosed Snake	Salvadora hexalepis	-	-	+
Ringneck Snake	Diadophis punctatus	-	+	-
Gopher Snake	Pituophis melanoleucus	-	+	+
Glossy Snake	Arizona elegans	-	-	+
Long-nosed Snake	Rhinocheilus lecontei	-	+	+
Common Kingsnake	Lampropeltis getulus	-	+	+

TABLE 2 - continued

WILDLIFE SPECIES THAT ARE POTENTIAL PERMANENT RESIDENT AND/OR BREEDING SPECIES WITHIN THE CAP/SRP INTERCONNECTION STUDY AREA

Common Name	Scientific Name	Habitats 1	2	3
REPTILES - continued				
Lyre Snake	*Trimorphodon biscutatus*	-	-	+
Night Snake	*Hypsiglena torquata*	-	+	+
Coral Snake	*Micruroides euryxanthus*	-	-	+
Western Diamondback Rattlesnake	*Crotalus atrox*	-	-	+
Black-tailed Rattlesnake	*Crotalus molossus*	-	+	+
BIRDS				
+Great Blue Heron	*Ardea herodius*	+	+	-
+Green-backed Heron	*Butorides striatus*	+	+	-
+Black-crowned Night Heron	*Nycticorax nycticorax*	+	+	-
Cinnamon Teal	*Anas cyanoptera*	+	-	-
Ruddy Duck	*Oxyura jamaicensis*	+	-	-
+Turkey Vulture	*Cathartes aura*	-	+	+
Cooper's Hawk	*Accipiter cooperi*	-	+	-
+Red-tailed Hawk	*Buteo jamaicensis*	-	+	+
+Osprey	*Pandion haliaetus*	+	+	-
+American Kestrel	*Falco sparvarius*	-	-	+
+Gambel's Quail	*Callipepla gambelii*	-	+	+
American Coot	*Fulica americana*	+	-	-
+Killdeer	*Charadrius vociferus*	+	-	-
American Avocet	*Recurvirostra americana*	+	-	-
Black-necked Stilt	*Himantopus mexicanus*	+	-	-
+White-winged Dove	*Zenaida asiatica*	-	+	+
+Mourning Dove	*Zenaida macroura*	-	+	+
+Greater Roadrunner	*Geococcyx californianus*	-	+	+
Western Screech Owl	*Otus kennecottii*	-	+	+
Great Horned Owl	*Bubo virginianus*	-	+	+
Elf Owl	*Micrathene whitneyi*	-	+	+
Common Poorwill	*Phalaenoptilus nuttallii*	-	-	+

TABLE 2 - continued

WILDLIFE SPECIES THAT ARE POTENTIAL PERMANENT RESIDENT AND/OR BREEDING SPECIES WITHIN THE CAP/SRP INTERCONNECTION STUDY AREA

Common Name	Scientific Name	Habitats 1	2	3
BIRDS - continued				
Lesser Nighthawk	Chordeiles acutipennis	-	-	+
Black-chinned Hummingbird	Archilochus alexandri	-	+	-
Costa's Hummingbird	Calypte costae	-	-	+
+Northern (Gilded) Flicker	Colaptes auratus	-	+	+
+Gila Woodpecker	Melanerpes uropygialis	-	+	+
+Ladder-backed Woodpecker	Picoides scalaris	-	+	+
Western Kingbird	Tyrannus verticalis	-	+	+
Brown-crested Flycatcher	Myiarchus tyrannulus	-	+	+
Ash-throated Flycatcher	Myiarchus cinerascens	-	+	+
Black Phoebe	Sayornis nigricans	-	+	-
Say's Phoebe	Sayornis saya	-	+	+
Vermilion Flycatcher	Pyrocephalus rubinus	-	+	-
Northern Rough-winged Swallow	Stelgidopteryx serripenis	-	+	+
Cliff Swallow	Hirundo pyrrhonota	-	+	+
+Common Raven	Corvus corax	-	+	+
Verdin	Auriparus flaviceps	-	+	+
+Cactus Wren	Campylorhynchus brunneicapillus	-	+	+
+Rock Wren	Salpinctes obsoletus	-	-	+
+Black-tailed Gnatcatcher	Polioptila melanura	-	+	+
Northern Mockingbird	Mimus polyglottos	-	+	+
+Curve-billed Thrasher	Toxostoma curvirostre	-	+	+
+Crissal Thrasher	Toxostoma dorsale	-	+	-
Phainopepla	Phainopepla nitens	-	+	+
+Loggerhead Shrike	Lanius ludovicianus	-	+	+
*+Starling	Sturnis vulgaris	-	+	+
+Bell's Vireo	Vireo bellii	-	+	-
Yellow Warbler	Dendroica petechia	-	+	-
+Northern Cardinal	Cardinalis cardinalis	-	+	-
+Abert's Towhee	Pipilo aberti	-	+	-
+Black-throated Sparrow	Amphispiza bilineata	-	-	+
Song Sparrow	Melospiza melodia	+	+	-

Table 2 - continued

WILDLIFE SPECIES THAT ARE POTENTIAL PERMANENT RESIDENT AND/OR BREEDING SPECIES WITHIN THE CAP/SRP INTERCONNECTION STUDY AREA

Common Name	Scientific Name	Habitats 1	2	3
BIRDS - concluded				
Red-winged Blackbird	Agelaius phoenicius	+	+	-
Hooded Oriole	Icterus cucullatus	-	+	-
+Great-tailed Grackle	Quiscalus mexicanus	-	+	-
Brown-headed Cowbird	Molothrus ater	-	+	+
+House Finch	Carpodacus mexicanus	-	+	+
+Lesser Goldfinch	Carduelis psaltria	-	+	-
*-House Sparrow	Passer domesticus	-	+	-
MAMMALS				
Desert Shrew	Notiosorex crawfordi	-	+	-
Yuma Myotis	Myotis yumanensis	-	+	+
Cave Myotis	Myotis velifer	-	+	+
California Myotis	Myotis californicus	-	+	+
Western Pipistrelle	Pipistrellus hesperus	-	+	+
Big Brown Bat	Eptesicus fuscus	-	+	+
Hoary Bat	Lasiurus cinereus	-	+	-
Pallid Bat	Antrozous pallidus	-	+	+
Mexican Free-tailed Bat	Taderida brasiliensis	-	+	+
+Black-tailed Jack Rabbit	Lepus californicus	-	+	+
+Desert Cottontail	Sylvilagus auduboni	-	+	+
+Rock Squirrel	Citellus variegatus	-	+	+
+Harris' Antelope Ground Squirrel	Ammospermophilus harrisii	-	+	+
Round-tailed Ground Squirrel	Spermophilus tereticaudus	-	+	+
Valley Pocket Gopher	Thomomys bottae	-	+	-
Arizona Pocket Mouse	Perognathus amplus	-	-	+
Bailey's Pocket Mouse	Perognathus baileyi	-	-	+
Beaver	Castor Canadensis	+	-	-

Table 2 - concluded

WILDLIFE SPECIES THAT ARE POTENTIAL PERMANENT RESIDENTS AND/OR BREEDING SPECIES WITHIN THE CAP/SRP INTERCONNECTIONS STUDY AREA

Common Name	Scientific Name	Habitats 1	2	3
MAMMALS - concluded				
Desert Pocket Mouse	Perognathus penicillatus	-	-	+
Rock Pocket Mouse	Perognathus intermedius	-	-	+
Merriam's Kangaroo Rat	Dipodomys merriami	-	-	+
Southern Grasshopper Mouse	Onychomys torridus	-	+	+
Western Harvest Mouse	Reithrodontomys megalotis	-	+	+
Cactus Mouse	Peromyscus eremicus	-	-	+
Deer Mouse	Peromyscus maniculatus	-	+	+
Hispid Cotton Rat	Sigmodon Hispidus	-	+	-
White-throated Wood Rat	Neotoma albigula	-	+	+
*House Mouse	Mus musculus	-	+	-
Muskrat	Ondatra zibethica	+	-	-
+Coyote	Canis latrans	-	+	+
Gray Fox	Urocyon cinereoargenteus	-	+	+
Ringtail	Bassariscus astutus	-	+	+
+Raccoon	Procyon lotor	+	+	-
Badger	Taxidea taxus	-	+	+
River Otter	Lutra canadensis	+	-	-
Spotted Skunk	Spilogale putorius	+	+	-
Striped Skunk	Mephitis mephitis	+	+	-
Bobcat	Lynx rufus	-	+	+
Mule Deer	Odocoileus hemionus	-	+	+

References consulted:

Cockrum, 1982, 1964, and 1960; Demaree et al, 1972; Lowe, 1964; Miller and Lowe, 1964; Minckley, 1973; Minckley and Deacon, 1968; Monson and Phillips, 1981; Stebbins, 1966.

Avian nomenclature follows that of the American Ornithologist's Union Checklist of North American Birds (1983).

Other fishes found during the 1975 study, which included the collection of over 10,000 fish, are listed in Table 2. Red shiner and mosquitofish were found to be the most numerous species (44 percent of total numbers) while carp, gila sucker and gila mountain sucker (33 percent of total numbers) provided over 84 percent of total biomass. Bass, bluegills, and catfish yielded less than 10 percent of numbers and biomass.

Aquatic habitats in the study area are also used by a large array of waterfowl and shorebirds including such forms as loons, grebes, herons, ducks, cormorants, sandpipers, plovers and others. Many of these birds occur mainly during periods of migration and/or in winter. Table 2 includes a few species of "aquatic" birds that may nest in the study area or nearby environs.

SPECIAL STATUS SPECIES

Plants

None of the federally listed threatened or endangered plants of Arizona is known to occur anywhere near the study area (U.S. Fish and Wildlife Service, 1980). Moreover, none of the presently proposed threatened or endangered plants of Arizona (U.S. Fish and Wildlife Service, 1983) appears to occur in or near the study area (Arizona Natural Heritage Program, Pers. Comm., 1982)

Species listed as protected by the Arizona Native Plant Law that occur in the study area include several species of cacti (see Table 1), mesquite, blue paloverde, foothill paloverde, ironwood, and, perhaps, one or more species of Liliaceae (e.g. Allium sp., Calochortus sp.). Nothing in the Arizona Native Plant Law, however, prevents a private owner from clearing land supporting such species provided such species are not to be transported from the land or offered for sale and further provided that the Arizona Commission on Agriculture and Horticulture is give at least 30 days notice (Ariz. Comm. of Agric. and Hortic., 1978).

Wildlife

Two species of birds on the federal list of endangered species occur in the study area. Both the Yuma clapper rail (Rallus longirostris yumanensis) and the southern bald eagle (Haliaetus l. leucocephalus) are known to occur along that portion of the Salt River that includes the present study area (U.S. Fish and Wildlife Service, 1980). One of the primary for Yuma clapper rails on the Salt River was the presently dry cattail stand within the study area (Todd, 1975; Smith et al, 1978) Bald eagles nest at several localities on the nearby Verde River (Ohmart and Sell, 1980; Haywood and Ohmart, 1982; Witzeman, 1978 and 1979) and probably occur in the study area from time to time while in transit or while foraging. The Stewart Mountain/Blue Point bald eagle pair's normal foraging area includes Granite Reef Dam and the lake behind it but the pair does not normally forage at Granite Reef Dam (Larry Forbis, Tonto N.F., Pers. Comm., 1984). Moreover, the Granite Reef Dam area is considered to be of minimal importance to the Stewart Mountain/Blue Point pair (Larry Forbis, Pers. Comm.,1984)

Several species listed among the "Threatened Native Wildlife of Arizona" (Arizona Game and Fish Commission, 1982). The Arizona Game and Fish Commission wildlife list recognizes the following categories:

Group 1. Animals that are known or suspected to have been extirpated from Arizona but still exist elsehwere.

Group 2. Animals whose continued presence in Arizona is now in jeopardy and extirpation from the state is highly probable if no recovery efforts are made.

Group 3. Animals whose continued presence in Arizona could be in jeopardy in the foreseeable future.

Group 4. Animals for which moderate threat exists to the habitats they occupy.

Among the four groups the present study is concerned with the following:

Group 1. None

Group 2. Fishes - None
Amphibians and Reptiles - None
Birds

Southern Bald Eagle - see previous discussion of this species

Mammals

River Otter (Lutra canadensis) - This species formerly occurred in the Colorado and Gila River Systems. Reports of sightings persisted into the 1970s. A Louisiana subspecies has recently been reintroduced to the Verde River and it is possible that the species could occur in the lower Salt River.

Group 3
Fishes - None
Amphibians and Reptiles

Desert Tortoise (Gopherus agassizii) - Desert tortoises occur mostly in rocky foothill areas and are likely to be present in small numbers in desert habitats along the lower Salt River.

Group 3 - continued

Birds

Osprey (Pandion haliaetus) - Occurs along the Salt River fairly commonly. Nests in northern Arizona.

Peregrine Falcon (Falco peregrinus) - Fewer than 20 nesting pairs in Arizona. This falcon could occur in the study area as a spring/fall transient or, possibly, as a foraging, breeding bird. Species is on the Federal Endangered List.

Common Black Hawk (Buteogallus anthracinus) - This hawk has nested in canyons of the Upper Sonoran Zone in Maricopa County. It is most likely to occur in the present study area as an uncommon migrant.

Northern Beardless Tyrannulet (Camptostoma imberbe) - This species apparently reaches its northern limits of distribution in habitats along the Verde River (Monson and Phillips, 1981). It could occur as an uncommon summer resident in riparian habitats in the study area.

Yuma Clapper Rail - See previous discussion

Group 4

Fishes - None
Amphibians and Reptiles - None
Birds

Great Egret (Casmerodius albus) - This species could occur in the study area as an uncommon transient.

Snowy Egret (Egretta thula) - This egret probably occurs in the study area as a fairly common spring and fall transient.

Black-crowned Night Heron (Nycticorax nycticorax) - an uncommon transient in the study area; one seen near Granite Reef Dam by the author on 15 September 1982.

Group 4 - continued

Birds

Black-bellied Whistling Duck (Dendrocygna autumnalis) - This species is an uncommon summer resident (has nested) and fall transient in Maricopa County. It could occur uncommonly at the lake behind Granite Reef Dam.

Mammals - None

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

TERRESTRIAL ENVIRONMENT

Since the project is to be constructed downstream from Granite Reef Dam, it will be built almost entirely in areas that are presently badly disturbed and have marginal wildlife habitat value. Construction would require digging a trench across the Salt River bed which would damage some incoming riparian habitat (sapling willow trees) along the flowing portion of the river below the dam. There would also be some loss of mesquite on the south side of the Salt River between its bed and the South Canal. Some vegetation would also be removed on the north side of the Salt River.

Construction of the project is not likely to have major impact on any terrestrial wildlife species on or off the site. There will certainly be some disturbance as a result of construction activities, including noise, that may prevent some species from actively using the area during construction. Bald eagles and ospreys, for example, may not be able to forage right at Granite Reef Dam during some construction periods. It appears, however, that at least eagles do not use the area right at Granite Reef Dam with great regularity anyway and one would consider construction impacts to eagles to be very minimal.

AQUATIC ENVIRONMENT

A major concern of the proposed action is the potential for the introduction of Colorado River plant and fish fauna into the Salt-Verde River system. Such introduction could have serious negative impact on native and non-native fishes present in the Salt-Verde system today. The latter is especially true if the highly predacious striped bass is introduced and becomes established. It is not inconceivable that direct competition between striped bass and bald eagles for the available fish prey base could have a long term negative impact on the eagles.

Other than the potential for introducing Colorado River fishes and plants into the Salt-Verde system, the proposed project should have very little effect on the existing aquatic environment.

SPECIAL STATUS SPECIES

The proposed project could have a negative effect on local breeding pairs of the endangered bald eagle if Colorado River fishes, especially striped bass, are introduced into the Salt-Verde system. This is especially true if populations of striped bass became well established and depleted the forage fish prey base upon which bald eagles depend.

Some individual plants of species listed in the Arizona Native Plant Law will probably be destroyed or damaged as a result of construction of the project.

Some individuals of species listed among the threatened wildlife of Arizona may be disturbed during construction of the project (e.g. snowy egrets, great egrets, and black-crowned night herons may avoid foraging in the Granite Reef Dam area in response to construction activities. Some such animals may be accidently killed by construction workers and equipment going to or coming from the project site. Some animlals may be caught and removed from their natural habitats by construction personnel (e.g. desert tortoises).

ENVIRONMENTAL CONSEQUENCES OF NO ACTION

TERRESTRIAL ENVIRONMENT

Some areas dominated by native plant communities and providing habitat for native wildlife would remain intact under the no action alternative.

AQUATIC ENVIRONMENT

The aquatic environment would remain as it is under the no action alternative. There would be no chance of introducing Colorado River biota into the Salt-Verde system under the no action alternative and, therefore, no probability of having a long term negative impact on bald eagles.

SPECIAL STATUS SPECIES

Some individual cacti, paloverdes, mesquites, and other plants protected by the Arizona Native Plant Law would not be disturbed.

The no action alternative could have slight effect on some species of special status wildlife in addition to bald eagles (see above). Some individuals may be spared via the no action alternative by the removal of an increased potential for road kills and construction workers removing animals.

RECOMMENDATIONS

The CAP/SRP Interconnection Project should be engineered in such a way as to preclude the possibility of Colorado River biota (especially fishes) entering the Salt-Verde system. Some kind of barrier(s) should be incorporated into the project that would prevent the eggs, larvae, juveniles, or adults of all species of Colorado River fishes from entering the Salt-Verde. Barriers could be physical, chemical, or electrical.

As a mitigation measure to offset habitat loss resulting from constructon of the the Project, USBR and SRP might consider rewatering the marshy area adjacent to the parking/gravel storage area above Granit Reef Dam. This could be done fairly easily and would provide habitat for a variety of wildlife including the Yuma clapper rail.

Construction workers should be admonished not to remove desert tortoises from their native habitat. They should also be instructed not to kill tortoises or gila monsters.

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APPENDIX B

HISTORIC RESOURCES

AN ARCHAEOLOGICAL EVALUATION OF A SMALL PARCEL OF LAND NEAR GRANITE REEF DAM, MARICOPA COUNTY, ARIZONA

prepared for:

Salt River Project
Phoenix, Arizona

prepared by:

Lyle M. Stone
Archaeological Research Services, Inc.
Tempe, Arizona

September 1982

AN ARCHAEOLOGICAL EVALUATION OF A SMALL PARCEL OF LAND NEAR GRANITE REEF DAM, MARICOPA COUNTY, ARIZONA

Introduction

On August 27, 1982, Lyle M. Stone and James E. Ayres of Archaeological Research Services, Inc. (ARS) performed an archaeological survey of an approximately 128 acre parcel of land on the south side of the Salt River near Granite Reef Dam (Figure 1). This irregularly shaped parcel is located in a portion of the S½ of Section 13, and in the E½ of the NE¼ of Section 24, T2N, R6E, and is bounded on the east in part by Bush Highway, on the north by the center of the Salt River, and on the west and south by the Salt River siphon and Central Arizona Project (CAP) canal. The study area consists of U.S. Department of the Interior, Bureau of Land Management-administered land which has been withdrawn for U.S. Bureau of Reclamation purposes for use by the Salt River Project. Accordingly, this survey was performed under the authority and conditions of U.S. Department of the Interior Antiquities Permit Number 82-AZ-319 issued to ARS on June 30, 1982.

This survey was requested by Salt River Project (SRP) in order to determine if cultural resources[1] were located within the study area which would be affected by the proposed construction and operation of an interconnection between the CAP canal and the SRP water delivery system. The interconnection will include a turnout structure on the CAP canal and a pipeline or lined canal extending between the CAP canal and the Granite Reef Dam forebay and/or South Canal.

Study Methods

Survey procedures consisted of walking across the study area in east-west oriented parallel transects spaced from 40 to 50 ft apart in order to observe surface evidence of cultural resources. In addition, the pertinent archaeological and historical literature, and archaeological site

1. Cultural resources may include prehistoric or historic archaeological sites, historically or architecturally significant structures or buildings.

records on file at ARS, at the Department of Anthropology, Arizona State University, and at the Arizona State Historic Preservation Office were consulted to determine if cultural resources had been previously identified within or immediately adjacent to the study area. Literature and documents sources consulted included the archaeological reports of Grady (1973), Dittert, Fish, and Simonis (1969), Rogge (1977), and Brown (1978), as well as historical maps of the study area (1902-03 U.S. Geological Survey Reclamation Service; 1906 U.S. Geological Survey topographic; 1868 General Land Office).

Study Results

In reviewing the archaeological literature pertaining to this area, it is noted that one site, AZ U:6:2 (ASU), has been previously defined and reported (Rogge 1977; Brown 1978). This historic site, the work camp occupied during the construction of Granite Reef Dam, was initially occupied during the 1906-1908 construction period. This site was archaeologically examined by Brown under the Advisory Council on Historic Preservation's guidelines for "no adverse affect," which assumed "the implementation of a systematic program of data recovery and site documentation" (Brown 1978: 55). Importantly, Brown notes that "portions of the Granite Reef Camp site still remain intact subsequent to the construction of the siphon [a CAP feature]. These areas may still yield useful information. Therefore, it is recommended that any further impact on the site should require additional archaeological evaluation" (Brown 1978: 55).

(Site Descriptions)

As a result of the present survey, three isolated features apparently associated with the dam construction camp site were identified.

- Feature 1

Location: North side of foothills of Schlechts Butte, below CAP canal, and approximately 1350 ft southeast of dam tender's house (Figure 1).

Description: dry laid masonry wall or foundation for a small (approximately 10 by 12 ft) building or structure. Wire nails and two tin cans were noted in association with this feature.

Interpretation: This isolated feature is located at least 200 ft to the east of the construction camp defined by Brown and may have served a specialized function judging from its location, manner of construction into a hillside, and absence of associated domestic trash. The feature appears to be contemporaneous with the construction camp.

- Feature 2

Location: South side of area access road, approximately 1000 ft south-southeast of dam tender's house.

Description: Small scatter of historic trash, approximately 20 ft in diameter. Trash consists of sun-colored, green, and clear glass, earthenware, smooth wire, an enamelware pan, and a fragment of a green glass insulator.

Interpretation: This trash appears to have been derived from the construction camp and would probably date to its period of initial occupation (1906-1908).

- Feature 3

Location: Immediately outside west side (near gate) of fence which encloses the dam tender's house.

Description: Small concrete slab, ca. 4 ft by 12 ft, which appears to have been poured in a form but not to have a finished (smoothed) surface.

Interpretation: Platform for building or structure associated with dam construction camp. This platform was not reported by Brown.

In addition to the three features presumed to be associated with AZ U:6:2 (ASU), Granite Reef Dam and the dam tender's house (for the South Canal) are present. The house is constructed of concrete blocks manufactured on site and was constructed at the time the dam was constructed (1906-1908).

Evaluation and Recommendations

Two of the three features attributed to AZ U:6:2 (ASU) contribute to the overall quality of the site which defines its status as a potential National Register property. Feature 1, the historic building or structure remnant, may reflect a unique style or function of building or structure. This feature was constructed within an excavation into

a hillside (rather than on the flat below), is not associated with a domestic trash scatter, and is located in apparent isolation from the main work camp reported by Brown. Feature 2, an historic trash scatter, is in good condition and appears to be contemporaneous with the work camp. Knowledge of this feature's content would serve to refine Brown's observations pertaining to the nature of the material culture associated with the work camp occupation. The third feature, a concrete slab, is very similar to those fully reported by Brown.

The dam tender's house, due to its association with Granite Reef Dam and with the history of water supply in Central Arizona, as well as its unique architectural representation, would potentially qualify for inclusion on the National Register of Historic Places based on criteria a and d of 36 CFR Part 60.4. Similarly, Granite Reef Dam would potentially qualify for inclusion on the National Register.

Both Features 1 and 2 will be destroyed as a result of project implementation. The dam tender's house and Granite Reef Dam will apparently not be affected. It is therefore recommended that Features 1 and 2 be subjected to additional archaeological investigation as a basis for recovering and reporting their significant data values. Mapping, surface collection, photography, and complete excavation would be appropriate procedures for Feature 1. Feature 2 should be mapped, photographed, surface collected, and test excavated.

In addition to the above the following recommendations should be considered:

(1) The area immediately outside of the west boundary of the study area (and on the flat below Schlechts Butte), is archaeologically sensitive. This area should be avoided during construction.

(2) It is possible that sub-surface historic archaeological remains such as privy pits and trash deposits exist within the study area which would not have been located during Brown's 1978 survey and test excavation of the site. It is therefore recommended that construction activities in the vicinity of AZ U:6:2 (ASU) be monitored by a professional archaeologist to assure that any such buried remains are properly evaluated and recorded.

(3) Salt River Project should assure that Granite Reef Dam and the dam tender's house are not adversely affected by the proposed undertaking.

Summary

Three unreported features of a previously defined historic archaeological site (AZ U:6:2 ASU) were defined during this survey. All of the features are considered to be an integral part of this site and two are of sufficient importance to warrant further investigation (eg., data recovery) prior to their destruction as a result of proposed construction activities.

In addition, both the Granite Reef Dam and a dam tender's house are located within the study area and are considered to be potentially eligible for inclusion on the National Register of Historic Places. It does not appear that these structures will be affected by the proposed undertaking.

On the basis of these findings, it is recommended that archaeological clearance be granted for the proposed undertaking, provided that the recommended data retrieval and site preservation procedures are implemented.

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Archaeological
Research
Services, Inc.

2124 South Mill Avenue
Tempe, Arizona 85282
Phone (602) 966-3508

November 21, 1987

Mr. Glenn D. Harris
Environmental Services Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-2025

Dear Mr. Harris:

Per your request of November 12, 1987, Archaeological Research Services, Inc. (ARS) has undertaken an evaluation of eleven proposed geotechnical test locations in relation to known cultural resource in the general area of the Central Arizona Project/Salt River Project (CAP/SRP) Interconnection Facility Project Site. This project area was previously surveyed and reported by ARS in 1982 (Stone 1982); this previous survey project resulted in the identification and reporting of three cultural resource features (Features 1, 2, and 3), in addition to components of the previously defined and reported site AZ U:6:2(ASU), (Rogge 1977; Brown 1978).

Fieldwork for the current project was accomplished under the conditions and authority of Permit A-19998 issued to ARS on 10/23/84 (renewed 7/30/87) by the Bureau of Land Management, U.S. Department of the Interior. Lyle M. Stone of ARS was accompanied during the course of fieldwork by Mr. Charles J. Kissell of Salt River Project. Geotechnical test pits 1-9 are located on the immediate south side of Granite Reef Dam on the approximate centerline of proposed CAP/SRP Interconnection alternate alignments. Test pits 10 and 11 are located on the immediate north side of Granite Reef Dam (Figures 1 and 2). All test pits will be approximately 8 to 12 ft long by 8 ft+ deep by 2.0 ft wide and excavated by backhoe. A 50 ft diameter area centered on each staked and flagged test pit location was surveyed for the presence of cultural resources. Note that test pits 10 and 11 were not staked, but could be readily located by reference to a map provided by SRP, and by Mr. Kissel.

Test Pits 1-7, 9 No cultural resources were observed at these test pit locations, or along proposed vehicle equipment access routes to these test pits. Clearance is therefore recommended for the excavation of these test pits.

Test Pit 8 A concrete building feature (Feature 44) associated with site AZ U:6:2 (ASU), and previously reported by Brown (1978:24) is located ca 30 ft south of test pit 8. It does not appear that this feature will be disturbed or otherwise adversely affected as a result of the excavation of this test pit. Upon reviewing Brown's report (1978:55), it is our impression that this features has been subjected to cultural resources data recovery procedures. Clearance is recommended for the excavation of this

test pit.

Test Pits 10-11 Although no cultural resources were present at these test pit locations, SRP construction personnel should be advised to exercise caution in moving equipment and personnel in the vicinity of structural features associated with the north abutment/gate complex of Granite Reef Dam. Clearance is recommended for the excavation of these two test pits.

While in the field, ARS had an opportunity to re-locate two cultural resource features (which had been previously dfeined and described by Stone (1982:3-4) in relation to alternate CAP/SRP Interconnection alignments. It should be noted that Features 1 and 2 (see Figure 1) are in locations where they would be adversely affected by the construction of the interconnection facility. As such, we reiterate our recommendations (Stone 1982:5) that these features be subjeected to archaeological data recovery procedures. In addition, upon definition of a final proposed alignment, it is our opinion that features associated with site AZ U:6:2 (ASU) be evaluated in relation to this proposed construction action. This recommendation is based on prior recommendations of both Brown (1978:55 and Stone 1982:5).

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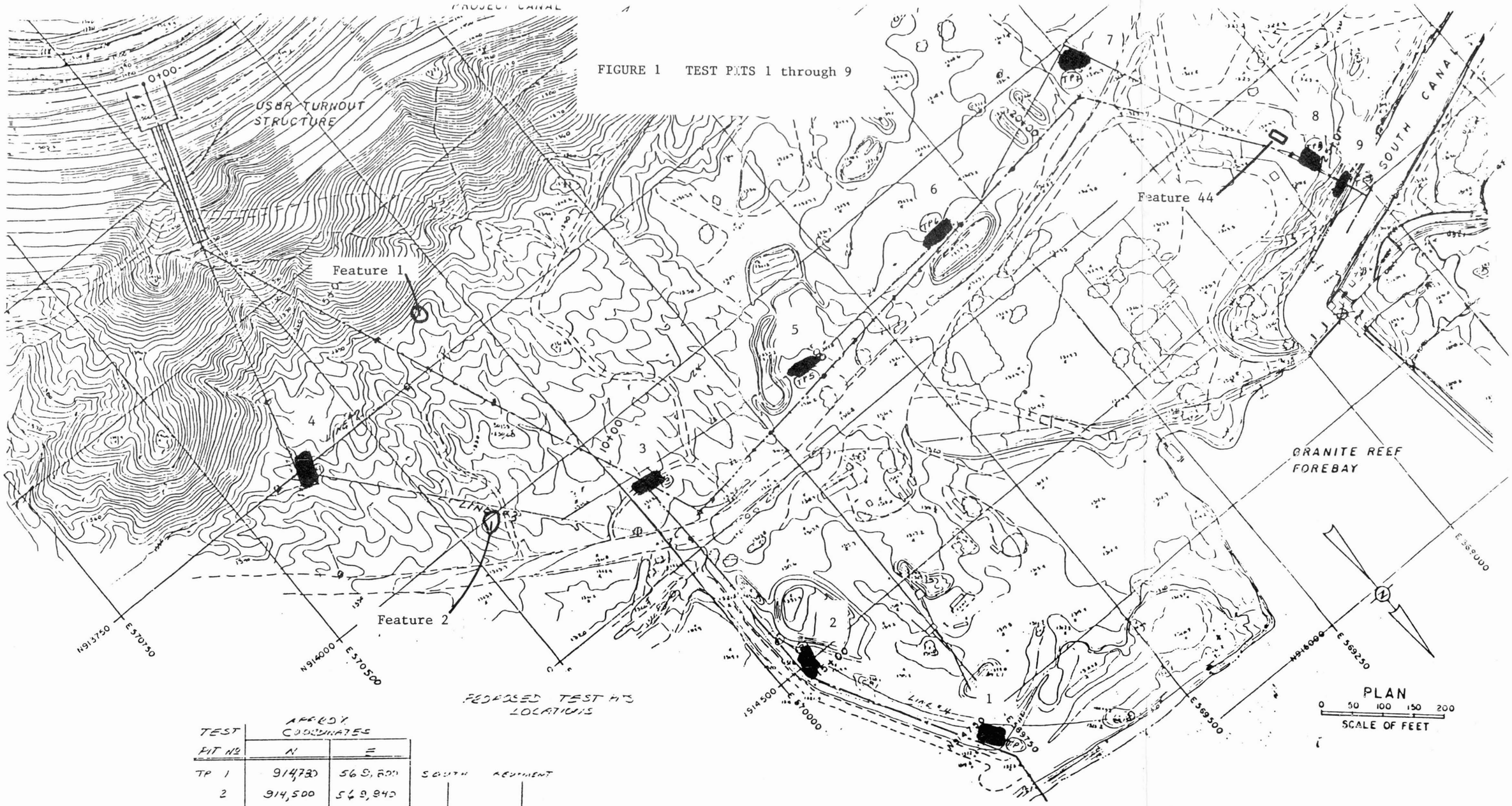
Sincerely,

Lyle M. Stone, Ph.D.
President

FIGURE 1 TEST PITS 1 through 9



PROPOSED TEST PITS LOCATIONS

TEST PIT Nº	ARBOR COORDINATES N	E	
TP 1	914,730	569,800	SOUTH ABUTMENT
2	914,500	569,840	
3	914,110	569,860	
4	913,750	570,350	
5	914,130	569,640	
6	914,110	569,340	
7	914,030	569,000	
8	914,400	568,800	
9	914,460	568,780	
10	915,850	568,920	NORTH ABUTMENT
11	915,750	570,070	" "

LEGEND

—— SEISMIC LINES (Run on 11-7-87)

⊠ PROPOSED TEST PITS

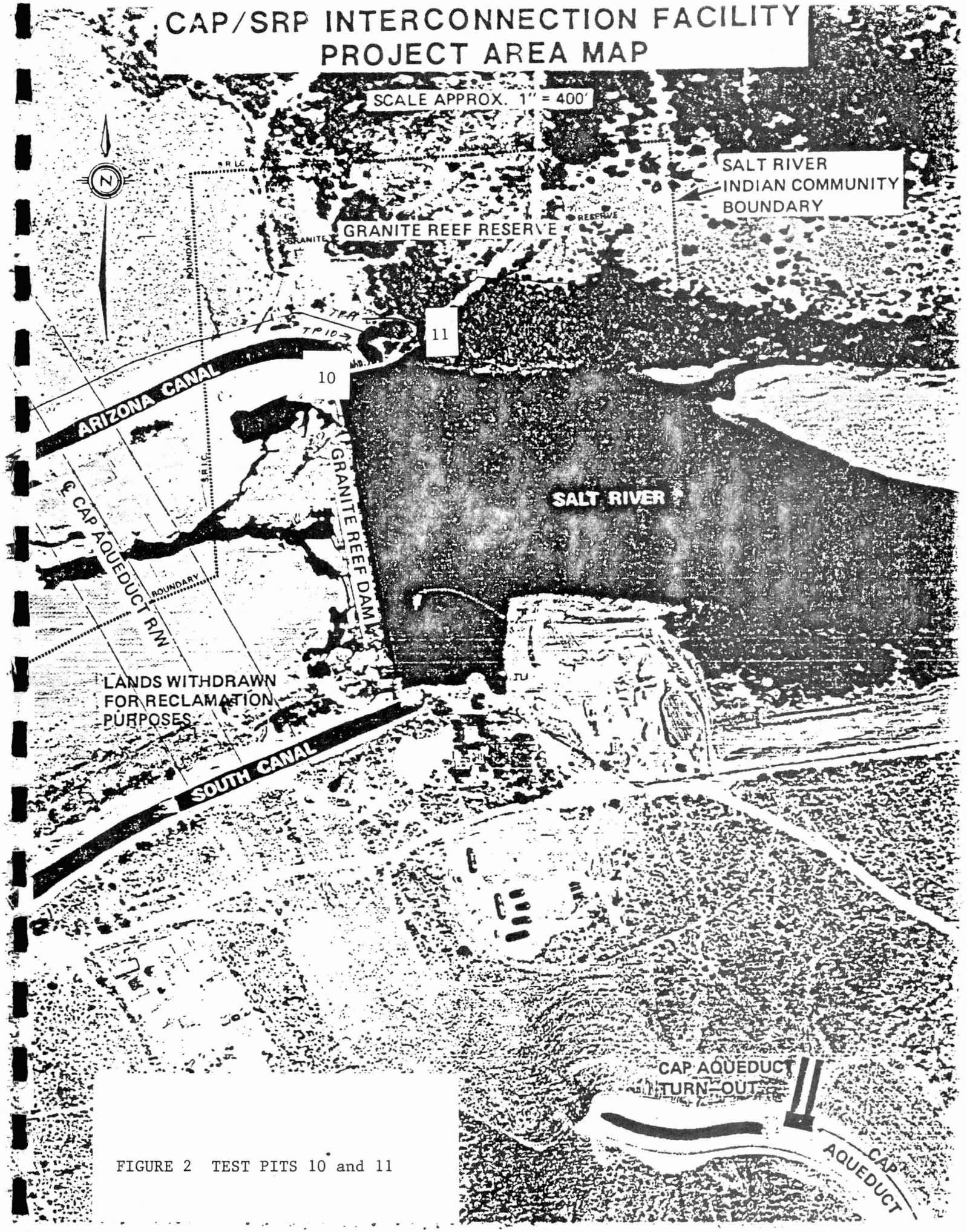


FIGURE 2 TEST PITS 10 and 11

APPENDIX C

FISH BARRIER STUDY

AN INVESTIGATION OF BARRIERS TO INTRODUCTION OF FISH INTO GRANITE REEF DAM FOREBAY FROM AN INTERCONNECTION WITH THE CAP AQUEDUCT

W. E. Davis

Environmental Services Department

July, 1984

EXECUTIVE SUMMARY

Salt River Project management has decided that delivery of Central Arizona Project water directly to the Arizona and South Canals is preferable to a delivery to the Granite Reef Dam Forebay and the associated risk of a jeopardy opinion from the U. S. Fish and Wildlife Service on the issue of new fish introductions. Delivery to the canals will utilize normal waterflows to help carry eggs, larvae and young fish downstream and away from the Forebay; however, juvenile and older fish are able to swim against velocities which occur in the canal and at the headgates and could enter the lower Salt and Verde Rivers. Therefore, a supplementary barrier will be needed.

Thirteen fish barrier methods were reviewed for application at Granite Reef Dam. Of these, the electric curtain appears most cost-effective. However, unknowns exist regarding safe installation of an electric curtain and additional information is needed.

AN INVESTIGATION OF BARRIERS TO INTRODUCTION OF FISH INTO GRANITE REEF DAM FOREBAY FROM AN INTERCONNECTION WITH THE CAP AQUEDUCT

INTRODUCTION

The U. S. Fish and Wildlife Service (USFWS) staff has indicated to SRP staff that any alternative interconnection facility which allows fish to be delivered from the CAP Aqueduct into the Salt and Verde River system will require a consultation as set forth in Section 7 of the Endangered Species Act and most likely will result in a jeopardy opinion. Their concern relates to possible predation by introduced non-native fish species (namely striped bass, white bass and blue Tilapia) on fish used by bald eagles as forage in the river. Under such circumstances, the project may be stopped to prevent possible impact on the endangered bald eagle.

As a result of discussions with the USFWS, SRP management decided that delivery of CAP water directly to the Arizona and South Canals would be preferable to a forebay delivery and the risk of a jeopardy opinion. This scheme would deliver water to the canals downstream of their headgates and would use water velocity from the headgates to carry eggs and young fish downstream, and to help prevent movement of larger fish upstream into Granite Reef Dam Forebay and thence into the Salt and Verde River system.

The purpose of this brief report is to discuss methods by which larger fish introduced to the canals from the CAP could be completely prevented from moving upstream. These methods will include ways of utilizing existing features of the canals (such as water velocity) to the maximum extent practical. It will analyze fish swimming speeds to help place the canal water velocities in perspective and provide a comparison of known fish barrier techniques that have been used to guide or stop fish.

SWIMMING SPEEDS OF FISH

Fish swimming speeds are highly variable between species, but just as important to this investigation, they are highly variable for individual fish. Depending on the situation, a fish may be motionless one moment, then suddenly moving at 20 feet per second the next. The capacity to reach high speeds varies, of course, between species of fish. Of the three species of concern, striped bass would appear to be the strongest swimmers. This conclusion is based on a thorough life history review of each of the three species by the U. S. Bureau of Reclamation (1,2). Therefore, methods which employ flow velocity or jumps as barriers to prevent upstream movement of strong swimmers like striped bass are almost certainly adequate to stop white bass and blue Tilapia as well.

The wide range of swimming speeds for fish is a function of such factors as species, size, water temperature, oxygen levels and a fish's motivation. Predatory fish, like striped bass, succeed in feeding by being able to outswim and capture other fish. On the other hand, prey fish, like bluegill, use man-

euverability, rather than swimming speed, to avoid being eaten. Large fish swim faster than small fish, even though speed measured in terms of body lengths per second is higher for small fish.

Fish swimming speeds are generally grouped into three categories: cruising, sustained and sprint. Cruising speed relates to a speed fish may use for such purposes as migration and is measured in hours. Sustained speed may be used by fish for passage through difficult areas and is measured in minutes. Sprint speed is used for feeding, escape purposes or passing barriers, and is measured in seconds. Each speed requires a different amount of muscular energy; however, sprint speeds for fish cannot be maintained indefinitely because glycogen, the energy source during these sprints, is limited. According to one information source (3) muscles used during sprinting have sufficient glycogen energy to provide a maximum of 140 seconds of swimming under ideal conditions.

Maximum sprint or burst swimming speeds for most fish studied vary with size and the literature shows a range of 8.4 to 24.0 feet per second for fish 7 to 24 inches in length, respectively (3,4,5,6). In one example, 5 percent and 50 percent of the chinook salmon and steelhead studied, respectively, negotiated a flume 85 feet long when the velocities were at 16 feet per second.

Although most swimming speed information is on other fish species, where striped bass have been tested, the results display the same wide range of speeds as other fish (7, 8, 9, 10). Sustained speeds of 4 feet per second for more than 30 minutes have been measured for 12 inch striped bass, whereas 12 feet per second were recorded during sprint testing for the same size fish (11, 12).

FISH BARRIER TECHNOLOGIES

Technologies to control fish movements have been used by man for hundreds, if not thousands, of years, primarily as a means to catch fish for food. In rivers the technology has relied on upstream or downstream fish movements to be successful. In more recent years, the interest in guiding fish migrating upstream in rivers past natural or man-made barriers or into hatcheries for artificial spawning has resulted in more knowledge on fish capabilities and control techniques (13). In addition, the desire to bar upstream movement of undesirable fish into certain waters (14, 15, 16, 17) and the need to prevent the intake of fish into cooling water pumps (7, 8, 11) has provided incentive toward development of more efficient barriers.

In recent months, Salt River Project management decided to deliver Central Arizona Project water from the Colorado River directly into the Arizona and South Canals. Delivery directly to the canals would take advantage of existing water velocities to wash eggs, larvae and young of the Colorado River fish species downstream in the canals and away from the headgates. However, older fish are bigger and stronger and capable of swimming upstream against the currents existing in the canals and some of these fish are capable of passing upstream against the headgate velocities (18)(Table I). Therefore, a barrier to upstream movement of introduced Colorado River fish, in addition to the headgate water velocity, appears to be a necessity.

In the field of artificial barriers or guiding devices, a wide variety of

methods have been used, including bubble curtains, lights, electric curtains, screens, louvers, rack bars, chains, chemicals, sounds, odors, sill dams, water velocities and baffles. Depending on the application, more than one of the methods may be necessary. The reactions of individual fish or groups of fish to barriers is variable. Each method has its own set of advantages and disadvantages which it could bring to a canal installation (Table II).

Bubble Curtains - A perforated pipe is anchored to the bottom of the stream and air is forced through the pipe, creating a curtain of bubbles rising to the surface (Figure 1). Fish moving upstream see the bubbles and may have a fright response, depending on the species. The literature shows variable success between species and within a species depending on time of day, turbidity, season and size (15, 16, 17). The bubble curtain's variable success makes it a poor choice as a barrier.

Lights - In general, light repels fish at high intensities and attracts them at lower intensities. Factors such as turbidity, time of day and fish species may alter the effectiveness of light, although light may enhance the effectiveness of other devices like bubble curtains (13, 19, 20). Lights may be useful for a guidance, but lack effectiveness as a barrier.

Electric Curtain - Electric screens or curtains have proven effective as barriers to upstream migration, but are not successful for guiding downstream fish movements (13, 16, 22, 23, 24, 25). Positive electrodes are suspended from a cable into the water surface while a submerged ground line is anchored to the stream bottom approximately 10 feet downstream (Figure 2). Fish entering the field are immediately immobilized and carried downstream by the stream flow. Protection from electrical shock for operating personnel and the public when the electric curtain is operated must be assured before installation.

Screens - Screens are effective in preventing movement of fish with head measurements larger than the screen mesh size (Figures 3-6); but screens also collect debris and must be cleaned using backwash from a revolving drum principle or traveling cleaners, sprays or trash rakes. They must be protected from damage by heavy objects, usually by the use of guards. Mesh openings must be large enough to pass all water demanded, but small enough to prevent passage of juvenile fish (13, 14, 26). If placed upstream of the interconnection and downstream of the headgates and designed to allow only very small fish to pass, a screen plus the headgate velocity probably would prevent movement to the forebay.

Louvers - These are not used where complete screening is required since they depend on guiding velocities rather than opening size to deter upstream migration (Figure 7)(13). They are not useful as barriers.

Rack Bars - These devices are effective in preventing movement of fish with head measurements larger than the bar spacing. Bars, like screens, collect debris and must be cleaned, usually with trash rakes. Spacing must be large enough to pass all water demanded but small enough to prevent passage of juvenile fish (13). A design following the principle of screens (i.e. head size larger than opening stops movement) may produce an effective barrier for large fish, and smaller fish could be stopped with headgate water velocities.

Chains - This method works in a similar fashion to a bubble curtain, but consists of chains hung by cable from above the water surface. It works as a visual deterrant and therefore has variable success, depending on the species, time of day, turbidity, etc (13). It is not useful as a barrier.

Chemicals - Certain chemicals cause complete rejection of a stream or strong fright reactions, but generally are considered impractical. Application of chemicals to the canals is probably impractical, also, due to the manner of water use downstream.

Sounds - Fright reaction to sound will deter fish from an area, but as with the bubble curtain, the response is highly variable. Sound has been used to engender the fright reaction but by itself it is not a positive barrier to fish movement or it may be ignored if continued over a long period of time (13).

Odors - Fish will avoid odors and certain odors cause sharp reactions. The synergistic effect of temperature, light and odors may cause extended avoidance of certain areas. The introduction of odor-causing chemicals to the canal water is probably impractical due to the manner of water use downstream (6, 13, 20). Although all odor-causing substances are chemicals, some chemicals may be odorless. Thus the distinction between chemicals and odors.

Sill Dams - The sill dam relies on a short dam of one to four feet high at the upstream end of a sloping apron (Figure 8). To ascend the dam, fish have to pass through the relatively shallow high-velocity flow on the apron, then turn upwards and swim over the dam. For salmon, a sill height of three feet kept 100 percent of the fish from passing when the water over the sill was one foot deep. A sill height less than three feet was not 100 percent effective, regardless of water depth over the sill (21). Construction of a sill dam may require extensive modifications to Granite Reef Dam, but if this is feasible, an effective barrier may be possible.

Water Velocity - Upper limits of swimming speeds for fish may be used to design a barrier which uses water velocity to prevent upstream movement. A positive barrier must have minimum water velocities greater than the maximum sprint or darting speed of each fish species of concern (1-13, 20-22). A velocity barrier by itself at Granite Reef Dam may involve extensive modifications of the gates, etc., to be effective (18). The literature and our own calculations indicate that striped bass, white bass and blue Tilapia could negotiate water velocities present in both canals (Table I). The South Canal flows would be easier to negotiate than those in the Arizona Canal, but fish of the size expected to be pumped from Lake Havasu (i.e. up to 12 inches) probably have the ability to swim upstream in both canals if they are motivated to do so.

Baffles - In this method, water falls through right-angle baffles with the apex parallel to the direction of the stream flow (Figure 9, Type II). Water is dispersed through the panel in a thin sheet or film extending along the entire length. This device proved to be fish-proof during tests in the state of New York (27), but its application to the SRP canals may be doubtful due to operating criteria and installation and maintenance costs.

CONCLUSION

It appears from the literature and our own calculations that striped bass, white bass and blue Tilapia could find their way into Granite Reef Dam Forebay if introduced into the Arizona and South Canals under existing operating conditions. Water velocities in the canals would be helpful in washing eggs, larvae and young of these three species downstream, but larger fish could swim against these velocities and pass through the headgates.

Thirteen methods were reviewed for application with the CAP/SRP interconnection and the brief analysis used above suggests that 10 should be eliminated. The existing structures at Granite Reef Dam, as well as water uses downstream, preclude use of certain barrier methods (i.e. chemicals, odors, baffles). Installation and maintenance costs of others strongly suggest they be avoided as not cost-effective (i.e. baffles, rack bars, screens). Some methods are not positive barriers to upstream movements and, although they may be somewhat effective when used in conjunction with other methods, probably would not assure the U. S. Fish and Wildlife Service of complete prevention of fish introduction (i.e. bubble curtain, louvers, sounds, odors, lights, chains, rack bars).

The three methods which hold promise include sill dam, water velocity and electric curtain. Sill dams could be effective if design criteria could be met at the headgates while not disrupting the ability to release sufficient water to meet downstream water orders. Water velocity as a barrier could be effective if existing velocities were increased through dam and/or headgate modifications to assure that minimum velocities exceed maximum fish swimming speeds. Electric curtains are effective as barriers, and, if placed in conjunction with water velocities which now exist at the headgates, should be a positive barrier to upstream movement of fish. Installation, operation and maintenance costs of an electric curtain should be relatively low when compared to sill dams or simple velocity barriers (18, 23).

RECOMMENDATIONS

Each of the three remaining methods are likely to act as a complete barrier to upstream movement of fish. The desirability of their use for this situation should be determined after a hydraulic and engineering examination. Of the three, the electric curtain appears most cost-effective; however, due to significant unknowns regarding safety and installation feasibility, a vendor should be asked to provide additional site-specific information.

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TABLE I

A comparison of fish swimming speeds with flow velocities below Granite Reef Dam to determine if velocities would provide an effective barrier to upstream movement of fish

Fish Size[1] (Inches)	Sprint Speed[2] (Feet/Second)	Minimum Water Velocity[3] (South) (Canal) (Ft./Sec.)	Minimum Water Velocity[3] (Arizona) (Canal) (Ft./Sec.)	Time to Travel 22-Foot Apron[4] At a Water Velocity of 5 FPS (Seconds)	Time to Travel 22-Foot Apron[4] At a Water Velocity of 8.5 FPS (Seconds)
7	8.4	5	8.5[5]	6.47	-
12	13.6	5	8.5	2.56	4.31
24	24.0	5	8.5	1.16	1.42

(1) Maximum sized fish expected to be pumped from Lake Havasu is 12 inches whereas larger sized fish may migrate downstream from Lake Pleasant.

(2) Speed is a function of the number of tail beats (strides) times the length of each stride. For 7-inch fish, the number of strides is estimated at 18 per second while the stride length is estimated to be 0.8 times the length in centimeters or 14.2. For 12-inch fish, the number of strides is estimated to be 17 per second whereas for 24-inch fish, it is estimated to be 15 per second. (Refs. 3, 4, 5)

(3) Velocity at gate and for the next 22 feet downstream when water is at the top of the dam and gates are wide open. (Ref.18)

(4) Substracting water velocity from sprint speed will give the distance traveled in one second by different sized fish. The times needed to travel the entire apron length of high velocity water are tabulated.

(5) Velocity varies between 7 and 10 F.P.S. over the length of the apron. (Ref.18)

TABLE II

COMPARISON OF FISH BARRIER METHODS FOR APPLICATION WITH THE CAP/SRP INTERCONNECTION

BARRIER TYPE	EFFECTIVE VELOCITY			EFFECTIVENESS		MAINTENENCE COST			INSTALLATION COST			INSTALLATION FEASIBILITY FOR CANALS		
	HIGH	MED	LOW	COMPLETE	PARTIAL	HIGH	MED	LOW	HIGH	MED	LOW	GOOD	FAIR	POOR
Bubble Curtain			X		X		X			X		X		
Lights	Unknown				X		X			X		X		
Electric Field	X	X	X	X			X			X		X		
Screens			X	X		X			X			X		
Louvers	X	X			X		X			X		X		
Rack Bars		X	X		X		X		X			X		
Chains		X	X		X			X			X	X		
Chemicals	X	X	X	X			X				X			X
Sounds	Unknown				X		X			X		X		
Odors	Unknown				X		X				X			X
Sill Dam	X			X				X	X					X
Velocity	X			X				X	X					X
Baffles	X	X	X	X			X		X					X

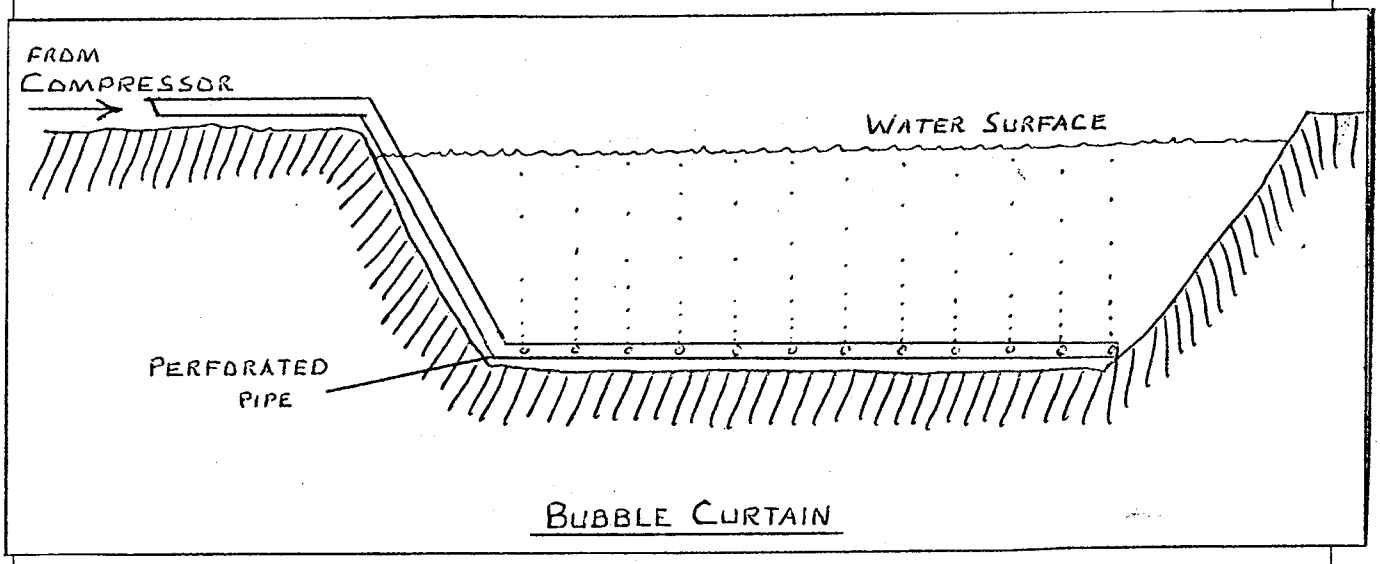
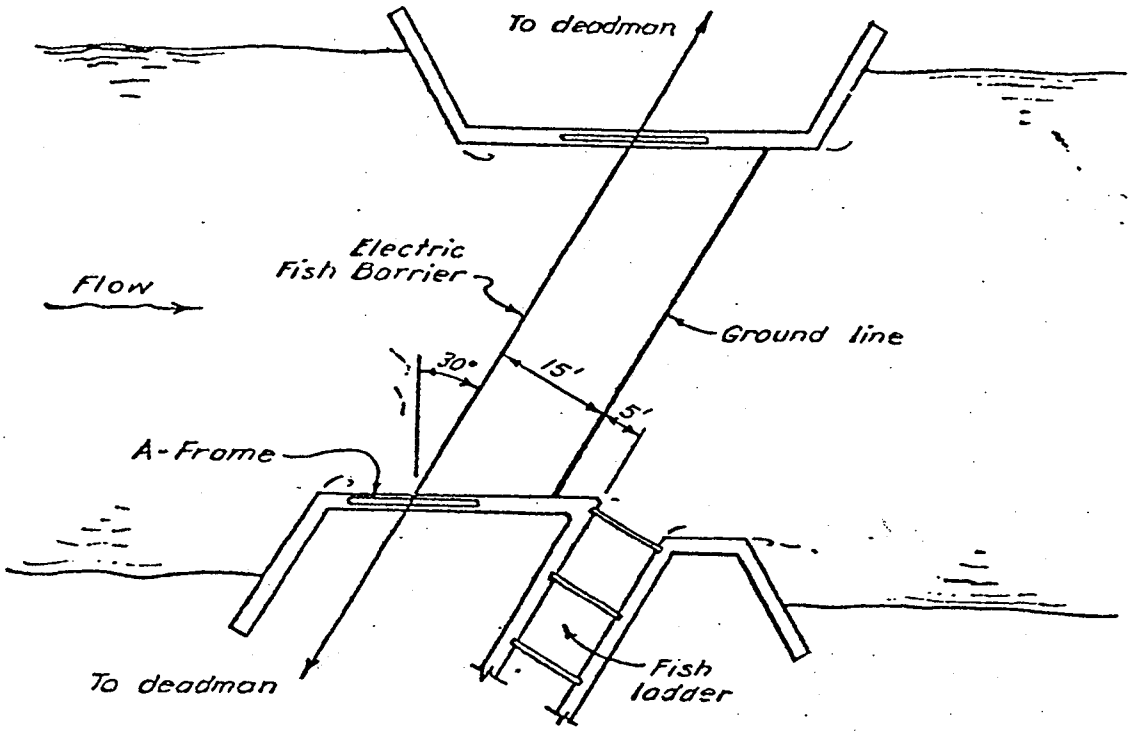
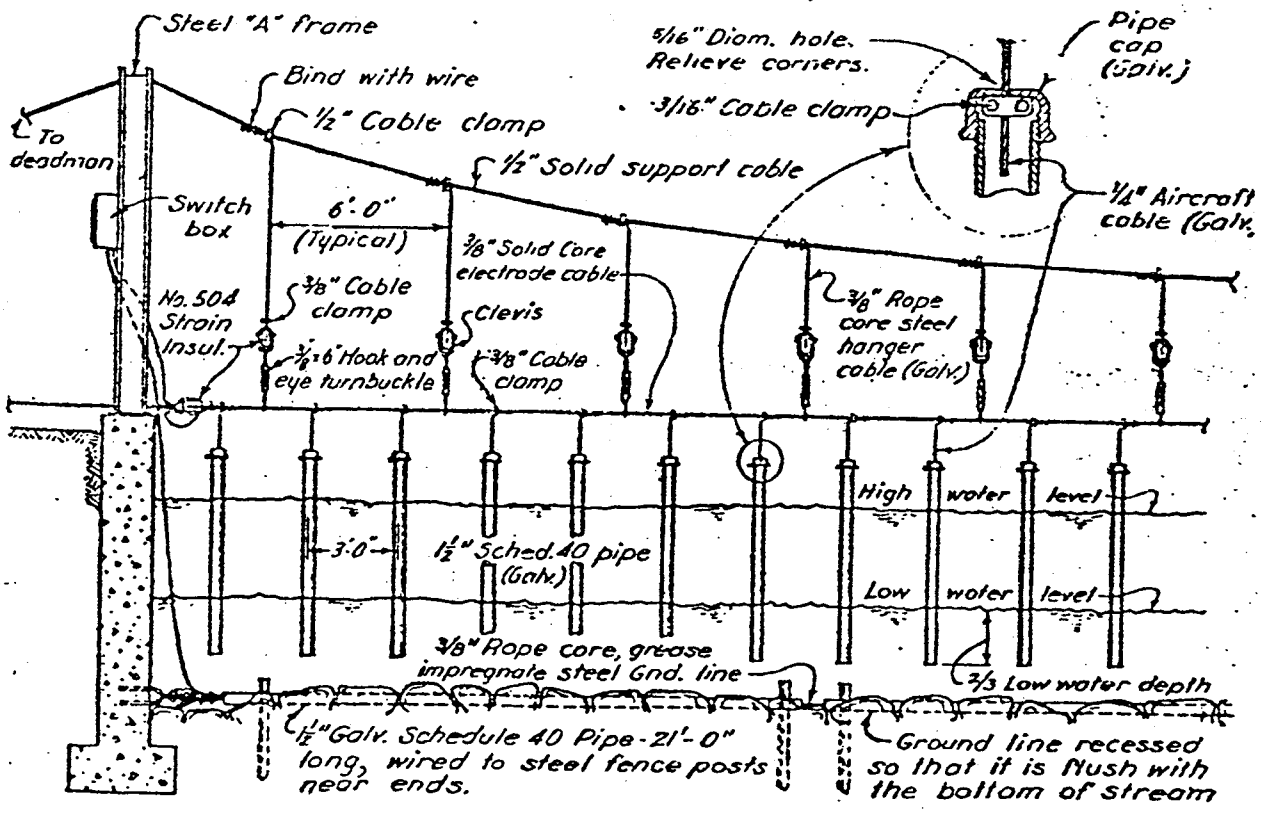

FROM
COMPRESSOR
WATER SURFACE
PERFORATED
PIPE
BUBBLE CURTAIN

FIGURE 1



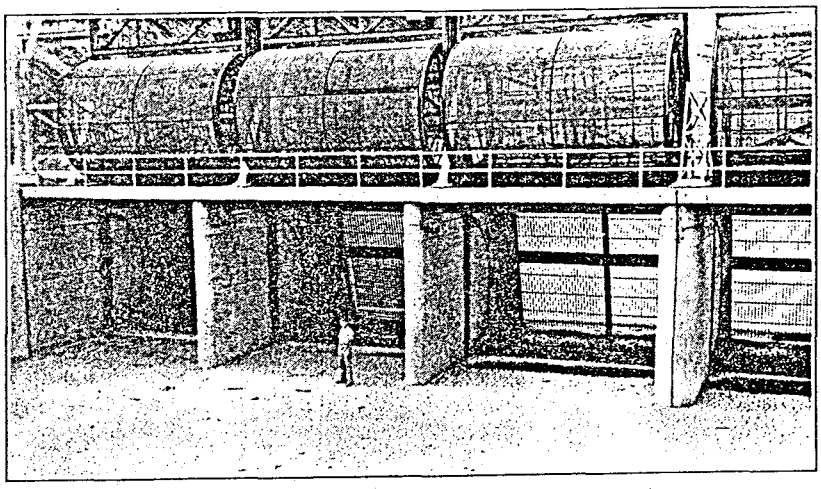
A) PLAN VIEW



B) HALF CROSS SECTION

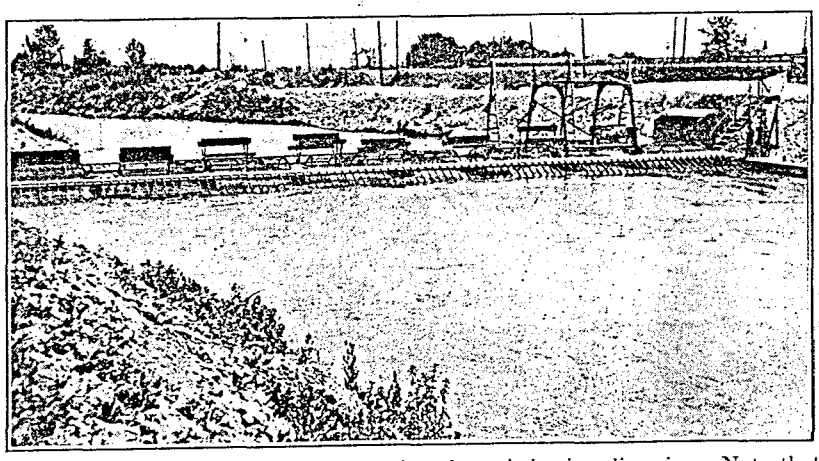
--Specifications of electrical weir. A. Plan view giving general dimensions; B. Detail of electrode and ground line installations.

FIGURE 2



A closeup, looking upstream, of a dry canal with the rotary screens raised for overhauling. These screens are power-operated. (Credit: U. S. Fish and Wildlife Service)

FIGURE 3



A rotary screen installation in a large irrigation diversion. Note that the canal is widened to slow the current as it approaches the screens. (Credit: U. S. Fish and Wildlife Service)

FIGURE 4

42-182 100 SHEETS
NATIONAL

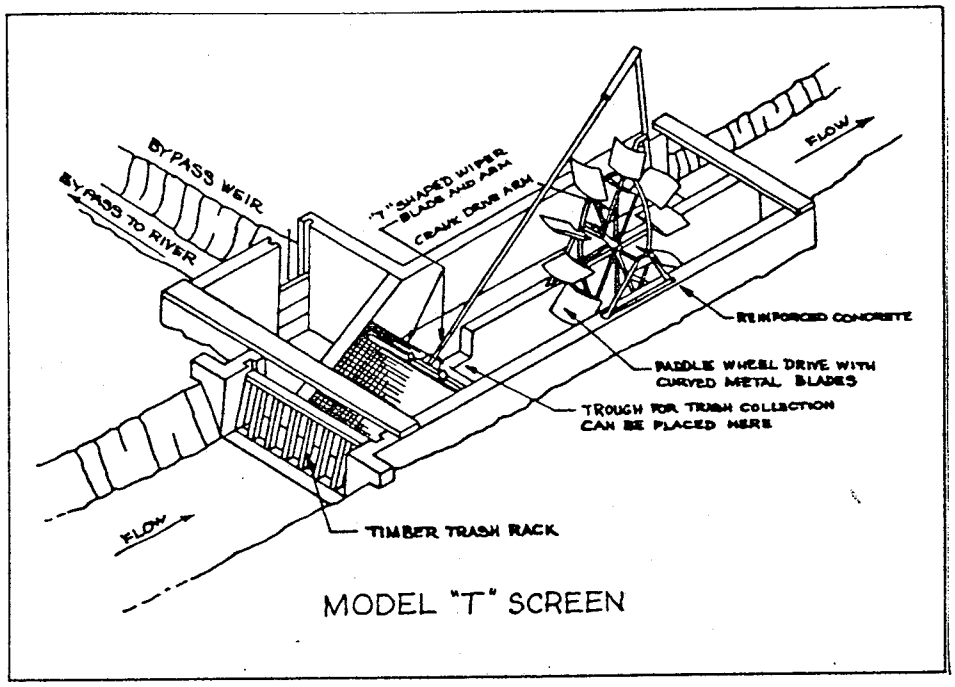


FIGURE 5

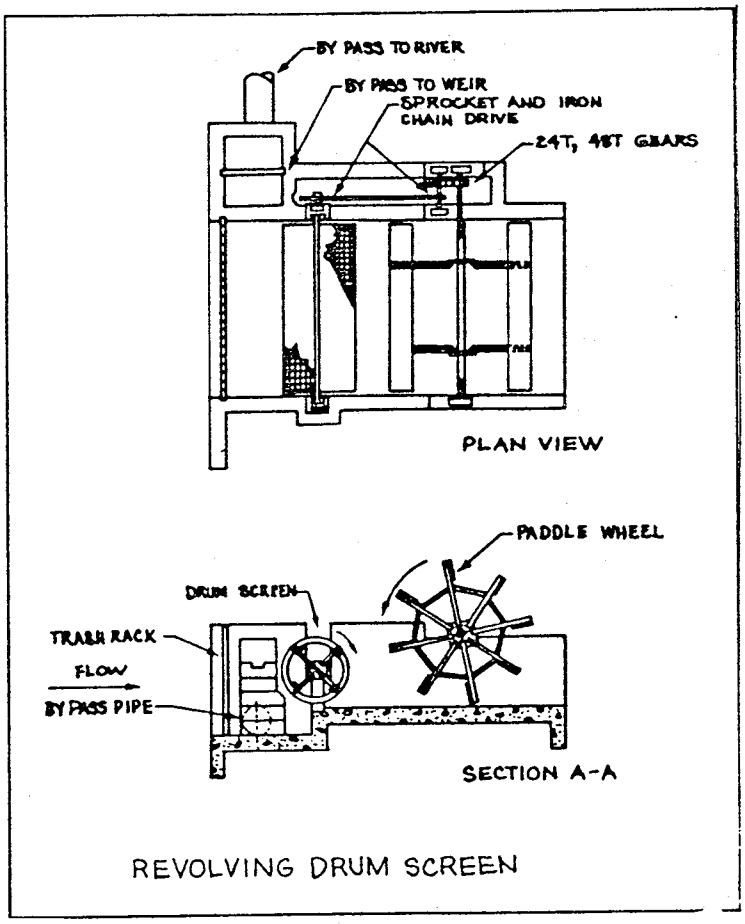


FIGURE 6

42-182 100 SHEETS
NATIONAL

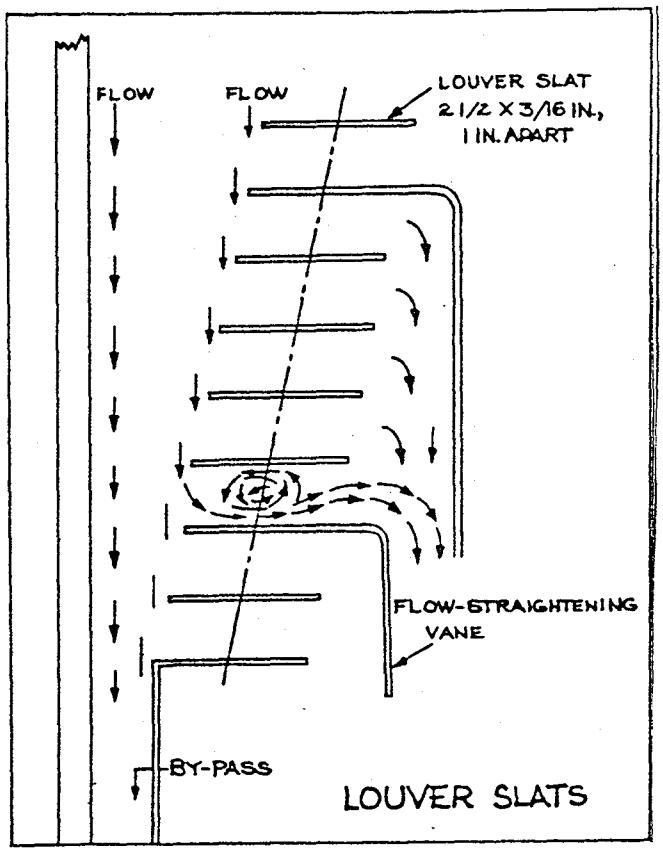
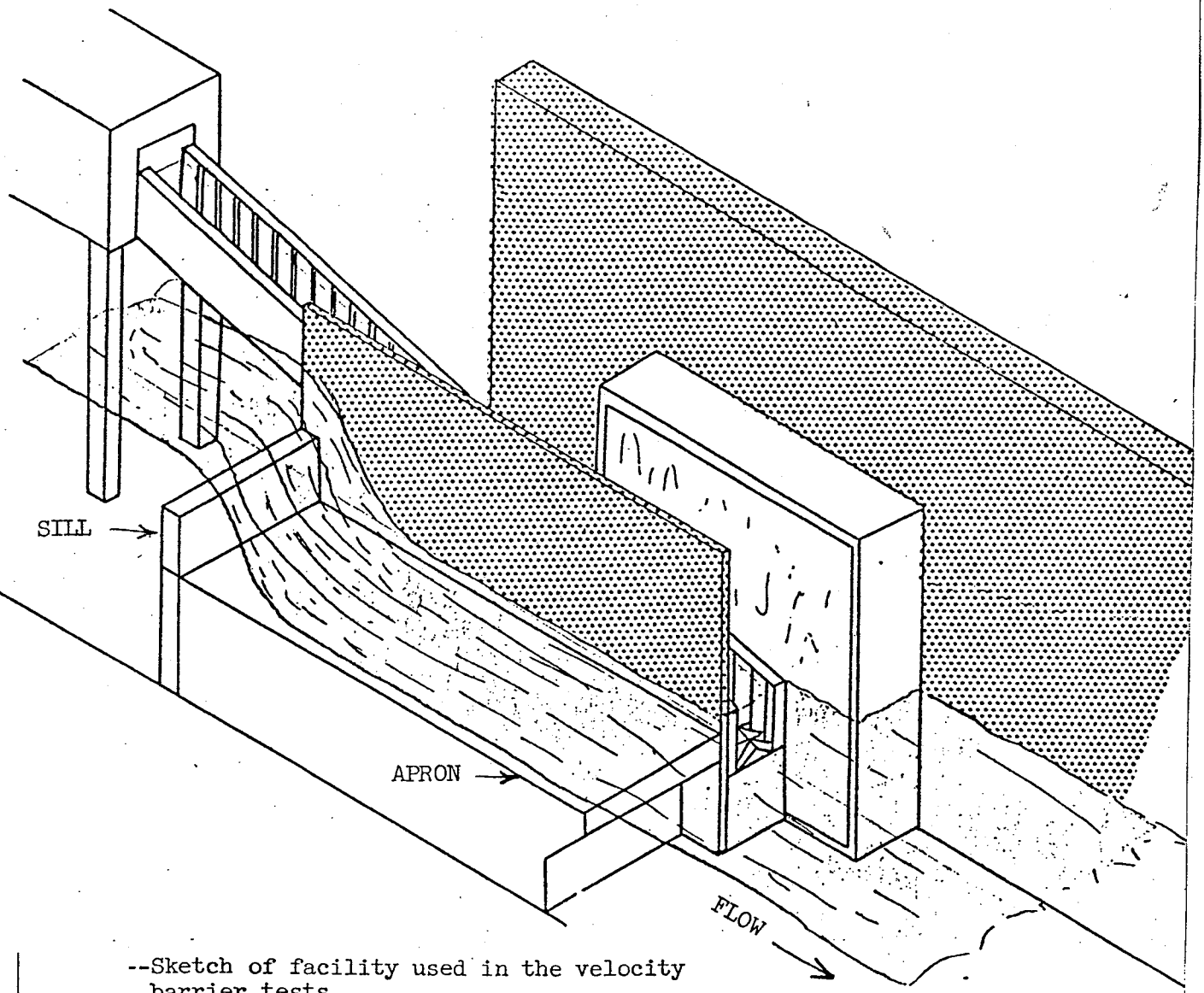


FIGURE 7

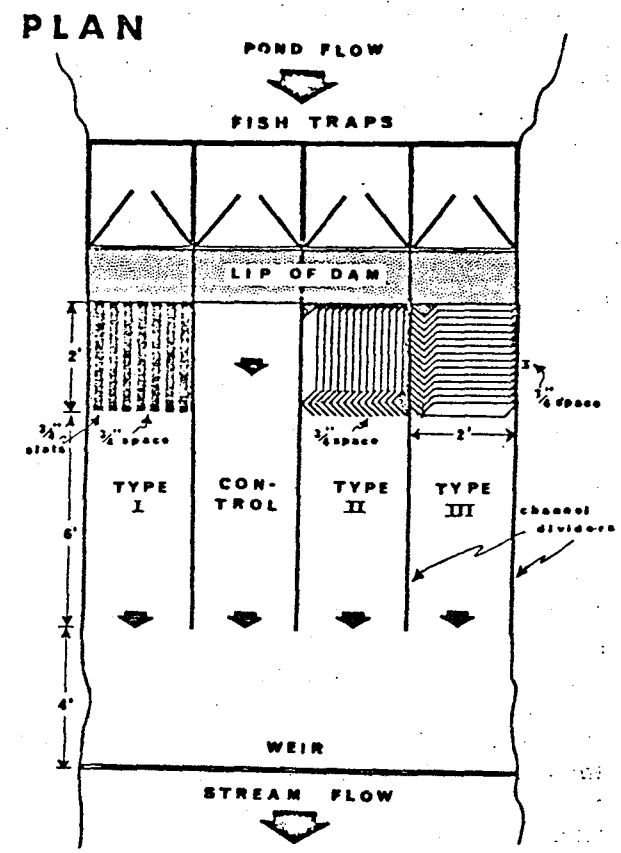
NATIONAL 42-182 100 SHEETS MADE IN U.S.A.

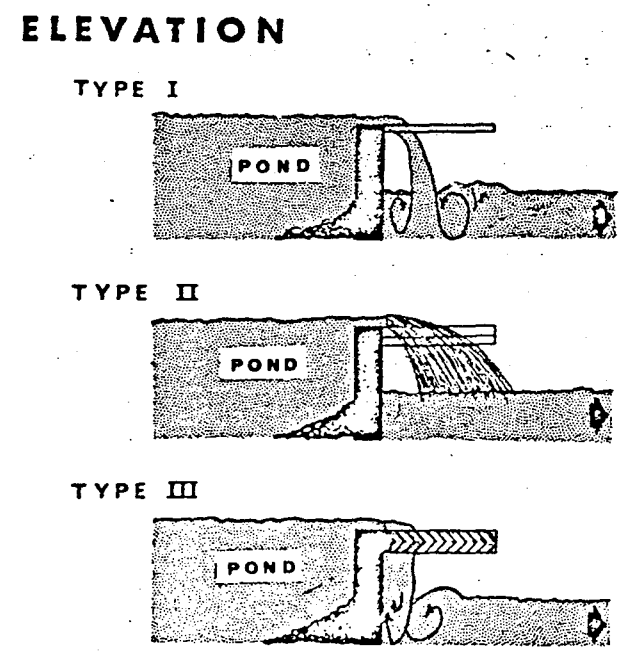


--Sketch of facility used in the velocity barrier tests.

FIGURE 8

42-182 100 SHEETS





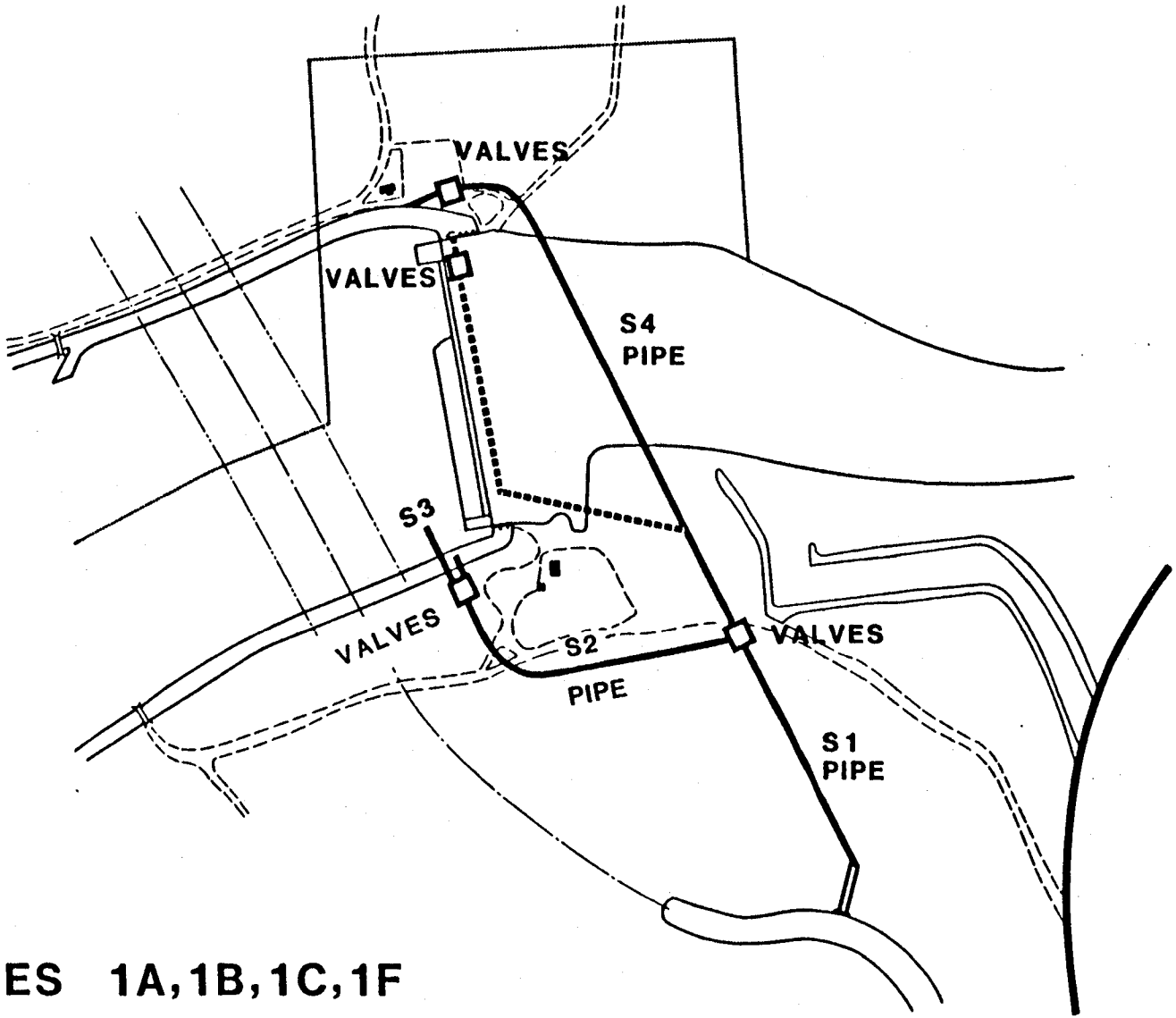
BAFFLE BARRIERS

FIGURE 9

42-182 100 SHEETS
Made in U.S.A.
NATIONAL

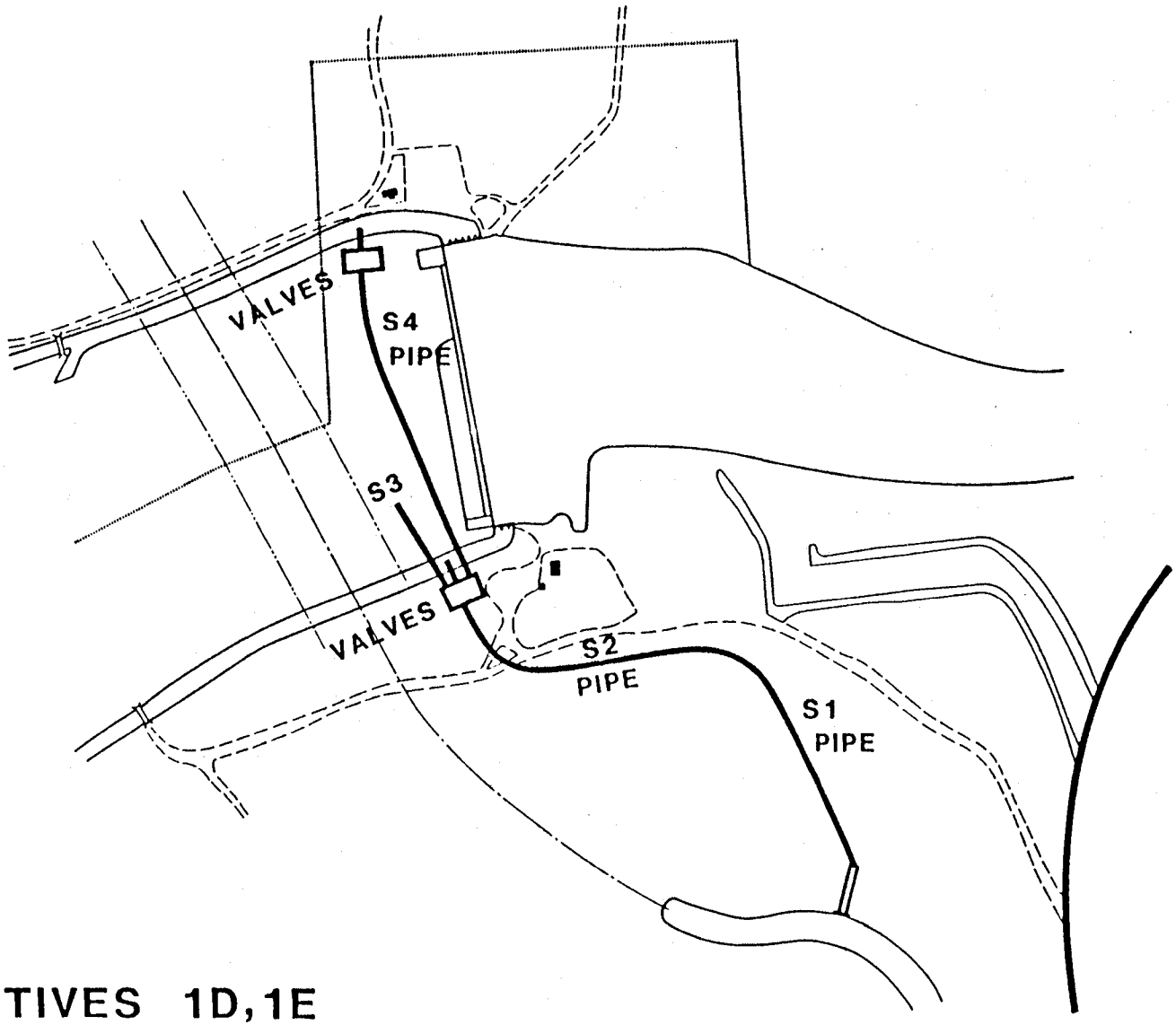
APPENDIX D

ALTERNATIVE PROJECT ALIGNMENTS



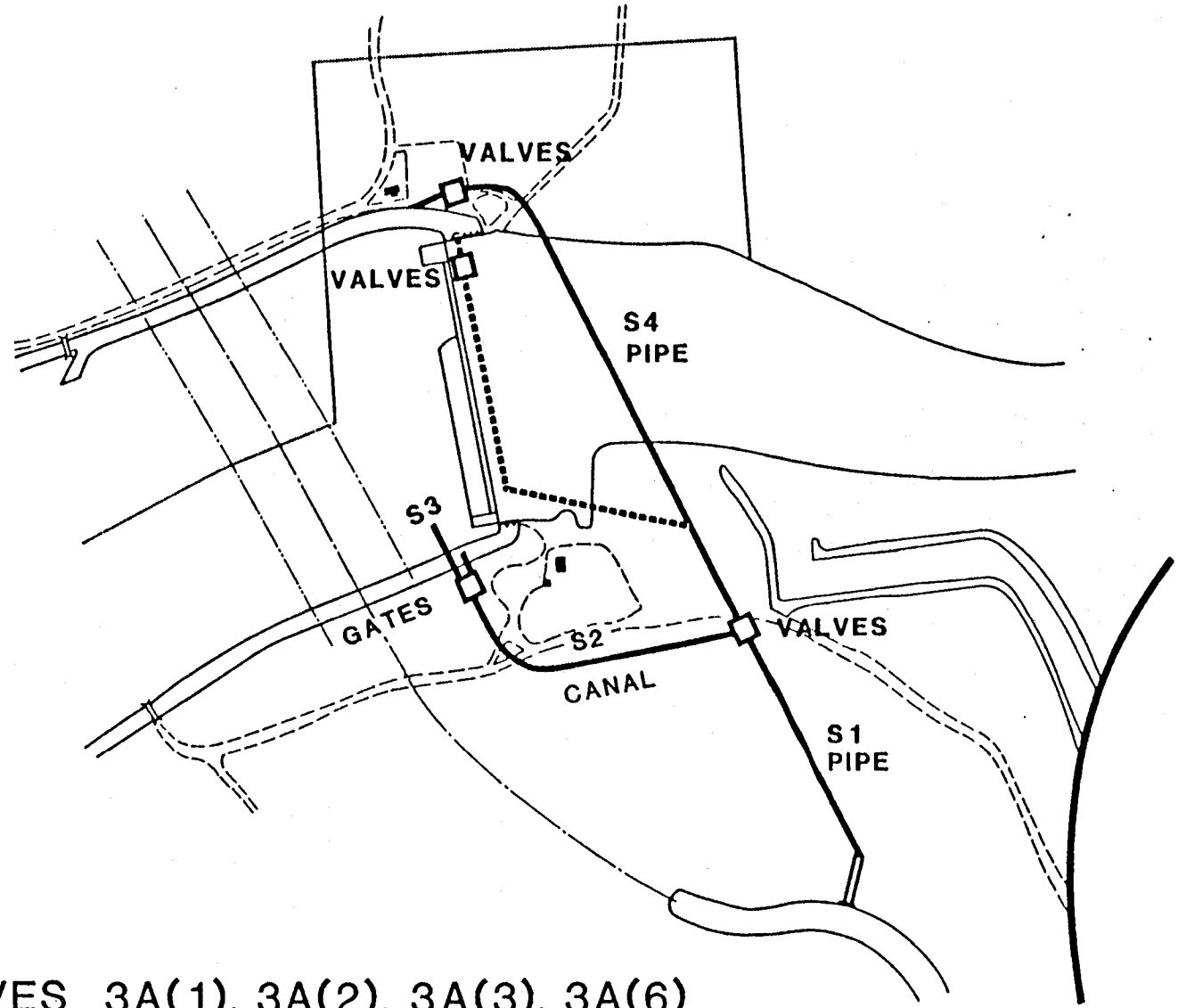
ALTERNATIVES 1A,1B,1C,1F

FIGURE 1



ALTERNATIVES 1D, 1E
3A(4), 3A(5)

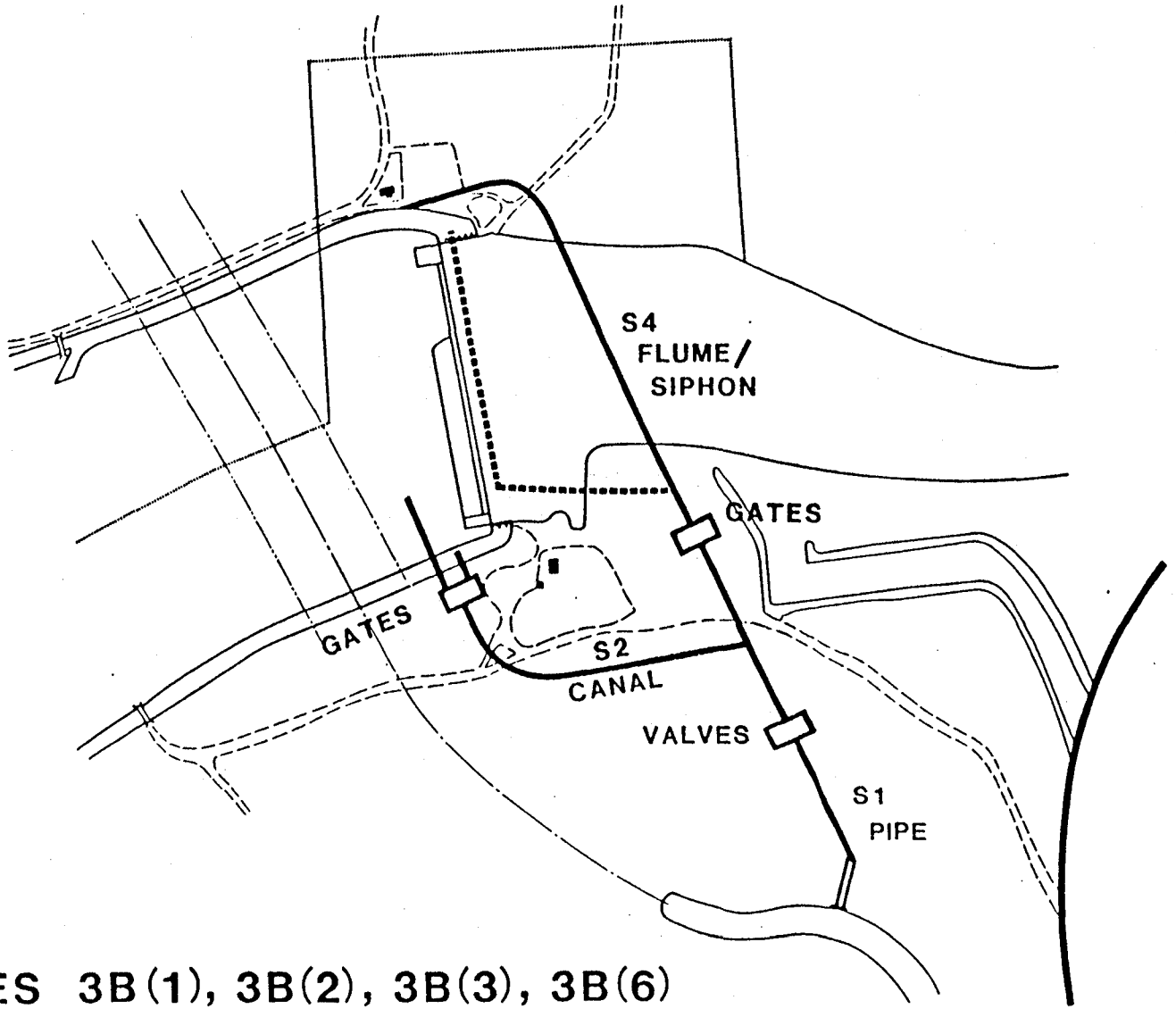
FIGURE 2



ALTERNATIVES 3A(1), 3A(2), 3A(3), 3A(6)

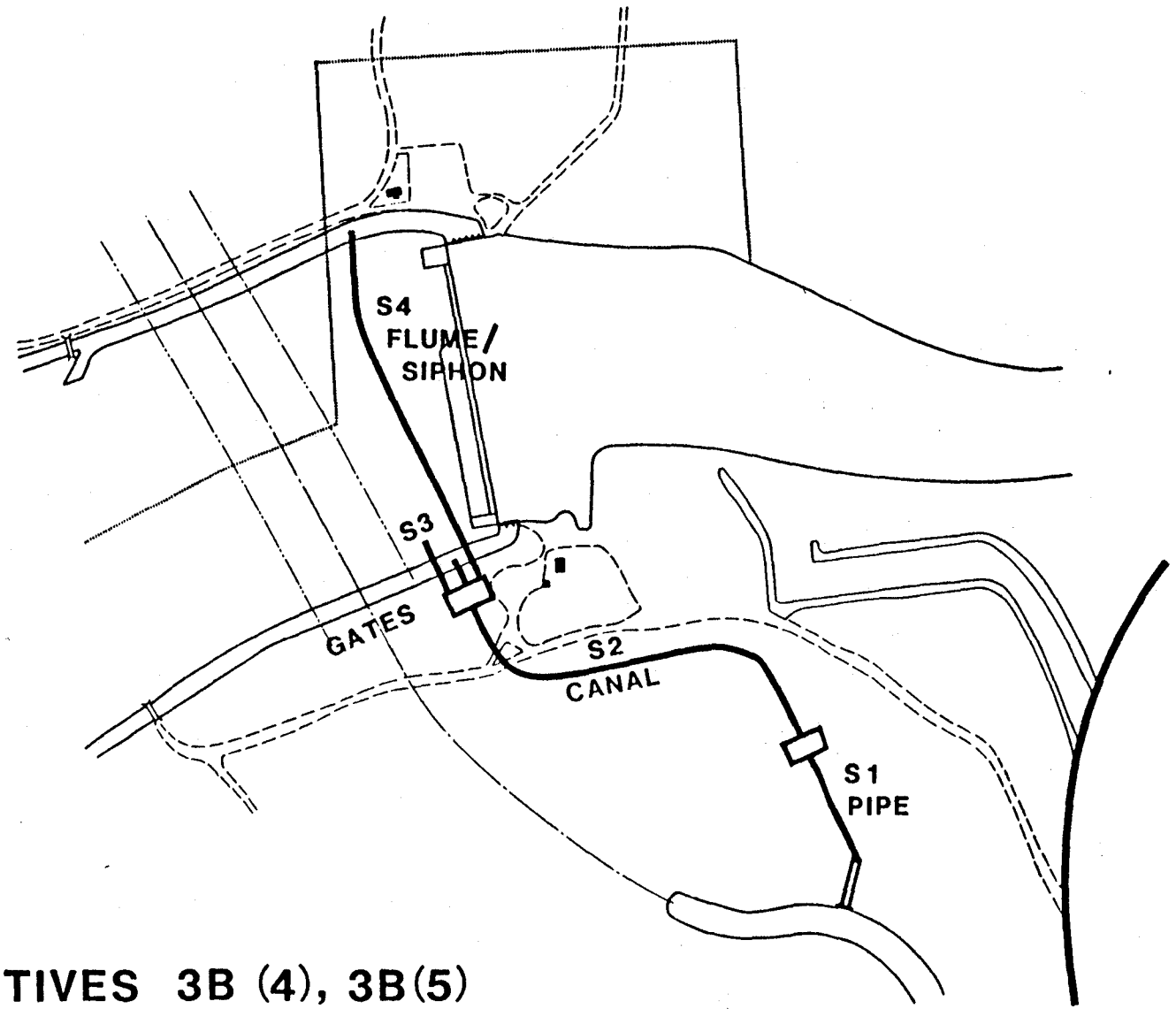
ECI

FIGURE 3



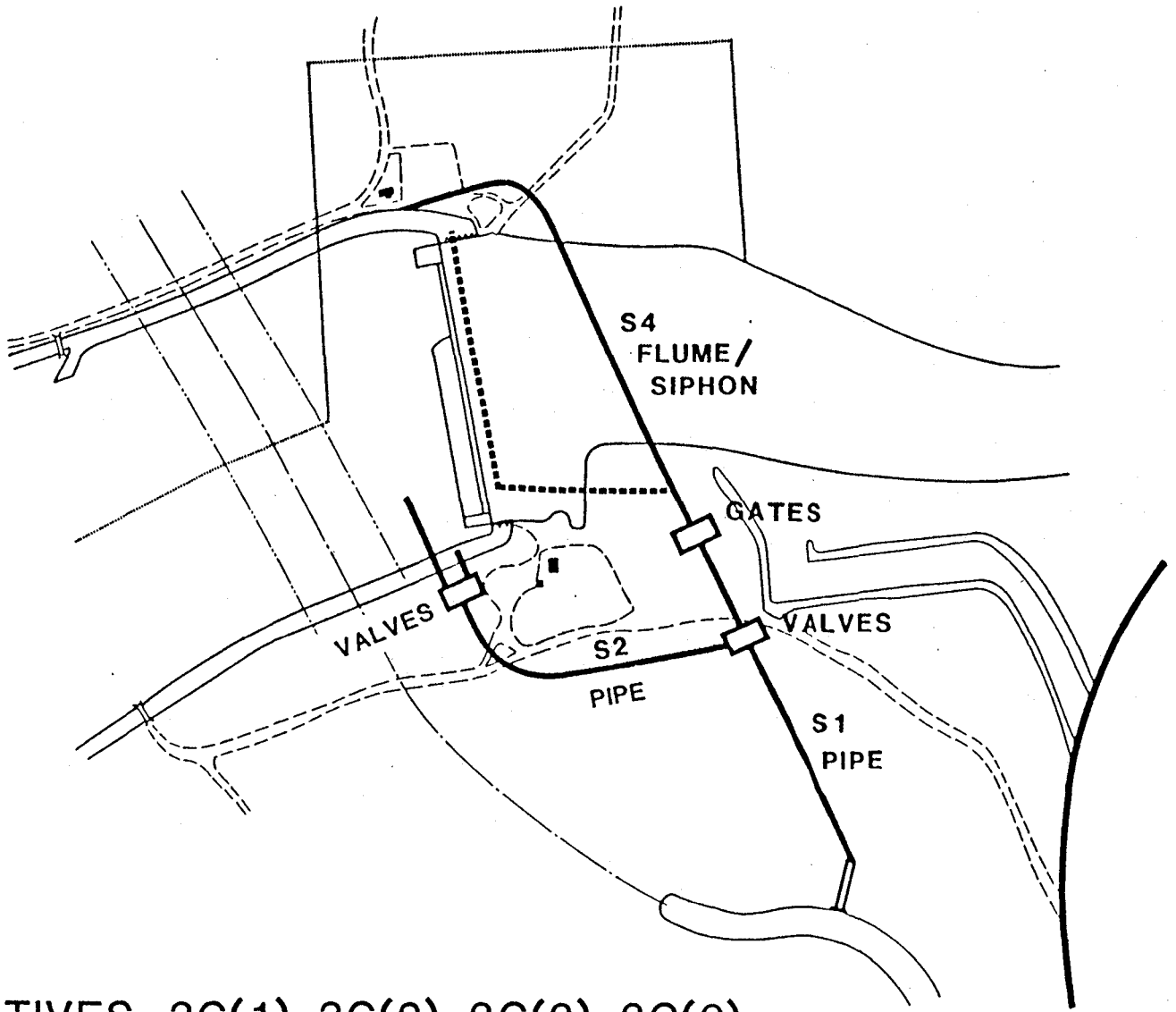
ALTERNATIVES 3B(1), 3B(2), 3B(3), 3B(6)

FIGURE 4



ALTERNATIVES 3B (4), 3B(5)

FIGURE 5



ALTERNATIVES 3C(1), 3C(2), 3C(3), 3C(6)

FIGURE 6

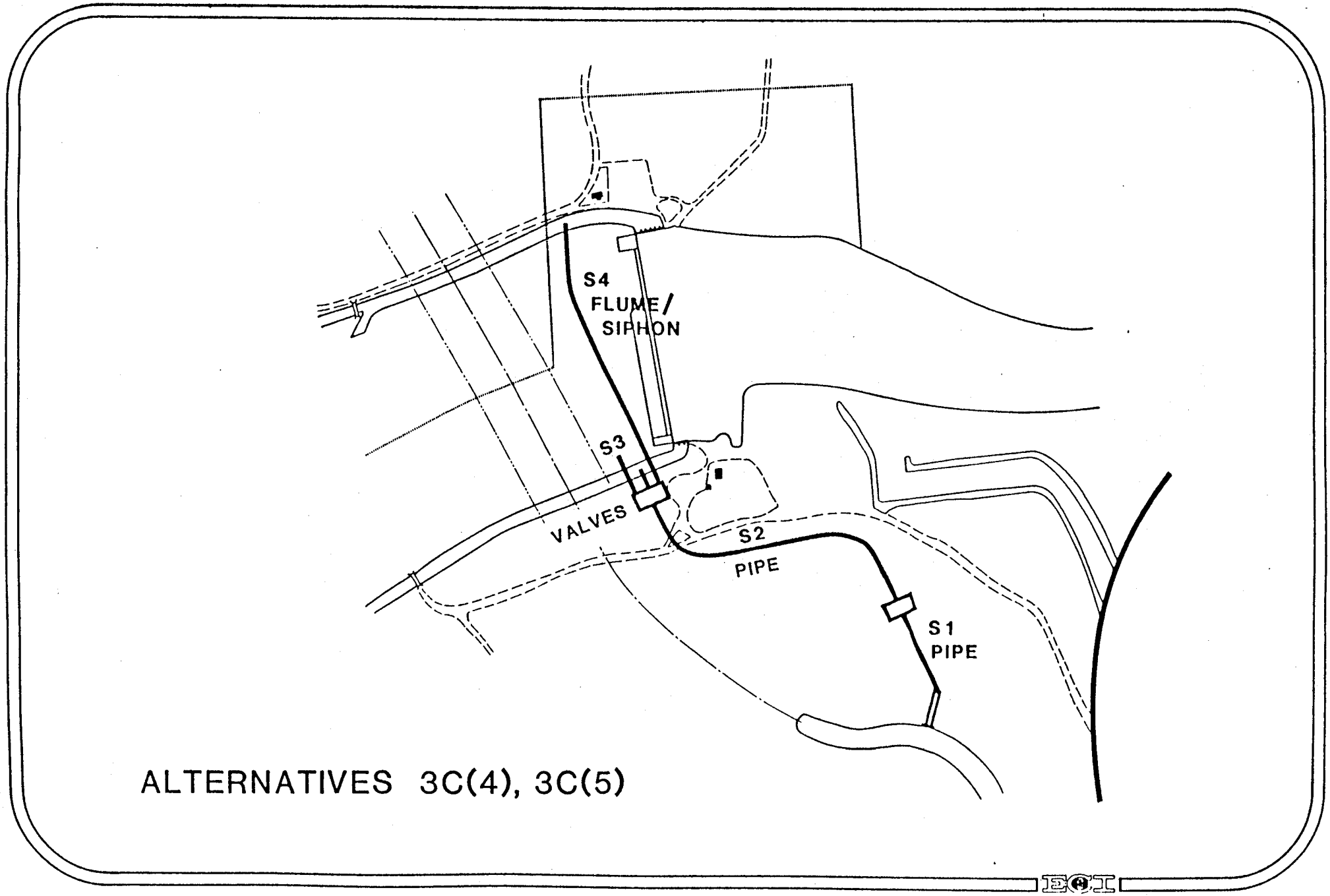

S4
FLUME/
SIPHON
S3
VALVES
S2
PIPE
S1
PIPE
ALTERNATIVES 3C(4), 3C(5)

FIGURE 7

APPENDIX

AGENCY / ORGANIZATION COMMENTS

APPENDIX E: AGENCY/ORGANIZATION COMMENTS

The following is a copy of the agency contact letter that was sent out by SRP on October 1, 2 and 5, 1987, to the list of agencies shown below. On the following pages are copies of the responses of the agencies.

Contact letters describing the proposed project and requesting comments on it were sent to the following agencies and organizations:

U.S. Army Corps of Engineers
- Los Angeles District, Phoenix Office
- Los angeles District, Regulatory Division, Los Angeles

U. S. Department of Agriculture, Tonto National Forest
- Supervisor
- Mesa Ranger District

U.S. Bureau of Land Management, Phoenix District Office
U.S. Bureau of Reclamation, Arizona Projects Office
U.S. Fish and Wildlife Service, Ecological Services, Phoenix
U.S. Soil Conservation Service, Phoenix
Arizona State Agriculture & Horticulture Commission
Arizona Game and Fish Department
Arizona Department of Health Services, Environmental Health Services
Arizona Department of Commerce
Arizona State Parks
- Director
- State Historic Preservation Office

Arizona Department of Water Resources
Arizona State Land Department
Arizona Municipal Water User's Association
Central Arizona Water Conservation District
Maricopa County Board of Supervisors
Maricopa County Department of Planning and Development
Maricopa County Highway Department
Maricopa County Parks and Recreation Department
Maricopa County Flood Control District
Arizona Wildlife Federation
Maricopa Audubon Society
Sierra Club, Grand Canyon Chapter
Town of Gilbert
City of Globe, CAP Project Coordinator
City of Mesa
Town of Payson
City of Peoria
City of Phoenix
- City Manager
- Water Resources Advisor

City of Prescott
City of Tempe
Camp Verde Yavapai-Apache Indian Community
Fort McDowell Mojave-Apache Tribal Council
Salt River Pima-Maricopa Indian Community
San Carlos Apache Tribe
Tonto Apache Tribe
Yavapai-Prescott Indian Tribe

Central Arizona Project Association
Rio Salado Development District
Arcadia Water Company
Camp Verde Water Company
Cottonwood Water Works, Inc.
Rio Verde Utilities, Inc.

SALT RIVER PROJECT

POST OFFICE BOX 52025
PHOENIX, ARIZONA
85072-2025
(602) 236-5900

Dear Mr._____

The Salt River Project (SRP) plans to construct an interconnection between the Central Arizona Project (CAP) canal system and the SRP canal system in the vicinity of the Granite Reef Diversion Dam, Maricopa County, Arizona. In order to be in compliance with the National Environmental Policy Act of 1969, the U. S. Bureau of Reclamation (USBR) has determined that SRP should prepare a draft Environmental Assessment (EA) report for submittal to USBR with a request for a Finding of No Significant Impact (FONSI). This draft EA would then be distributed by the USBR for public and agency comments.

In April, 1983 a draft EA for this project was submitted to the USBR and distributed for review. The comments that were received from several agencies resulted in significant changes in the conceptual design fo the interconnection facility. As a result of these changes, and due to the four years that have elapsed since that draft report was prepared, we decided to rewrite the draft EA and submit it as a completely new document rather than revise the existing draft. Thus, we are again requesting comments on the proposal.

As a result of a detailed siting study, it was determined that the best location for this interconnection facility is south of the Salt River at Granite Reef Dam, between the CAP aqueduct and Bush Highway (T2N, R6E, Sec. 13, see the attached map). This location will allow gravity feed from the CAP aqueduct into the SRP system. Since about 180 feet of hydraulic head exists between the CAP aqueduct and the SRP canals, a small (about 3 mw) hydrogeneration facility may be installed at a later date if future studies prove it to be economically advantageous.

The interconnection facility (see diagram) will transport water from the existing gated turnout structure on the CAP Granite Reef Aqueduct into the Arizona and South Canals just downstream of the Granite Reef Diversion Dam. It will include a combination of underground pressure pipe and lined open channel designed to carry water at up to 800 cubic feet per second.

Conceptually, the facility could consist of a pressure pipe from the CAP turnout structure to a control building at the base of the slope, an open channel from the control building to a diversion structure, an open channel from the diversion structure to the South Canal, an open channel from the diversion structure into the Salt River bed below the dam and a combination open channel and pressure pipe from the diversion structure to the Arizona Canal, passing under the Salt River either above or below the dam. The design of the facility has not been completed and so the above description is subject to change. Possible alternative project layouts are shown on the attached diagrams.

The decision to deliver the water directly into the SRP canals below Granite Reef Diversion Dam, rather than into the reservoir above the dam, was made to prevent the introduction of aquatic organisms from the Colorado River into the Salt and Verde Rivers with the CAP water. Water flow in the canals will prevent upstream movement of sedentary organisms and fish barriers will be installed in the canals to prevent upstream movement of the more active fish species, if any, that might be included in the water deliveries. While the type of fish barrier to be installed has not yet been determined, it appears likely that an electrical barrier will be utilized.

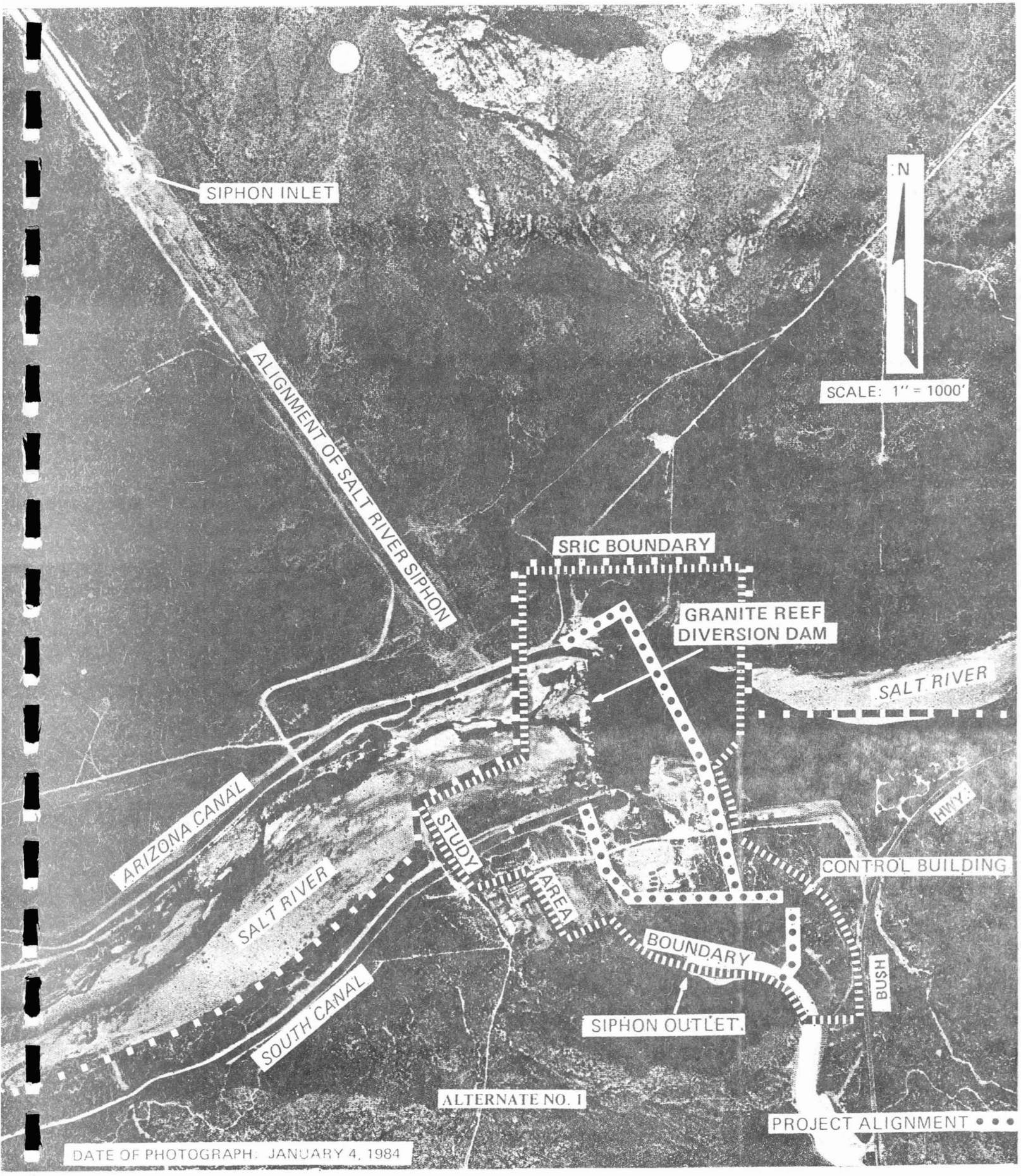
The project site is partially on the CAP right-of-way and partially on Bureau of Land Management land that has been withdrawn for reclamation use by the Salt River Project. The area has been disturbed both by long-term activities at Granite Reef Dam and by the construction of the CAP acqueduct and Salt River siphon. Archaeological and biological field studies have been completed on the project site and vicinity.

The turnout structure from the CAP canal has been built by the USBR within the CAP right-of-way. The water conveyance works from the turnout to the canals will be designed and built by SRP. The hydrogeneration facility, if found to be economically feasible, would be built by SRP at a later date, and is not included in this plan. The diversion into the river bed could be used for emergency dewatering of the facility and as a means of delivering CAP water to a future groundwater recharge project downstream of the dam. The EA will not include the USBR turnout structure (it is in place and was included in the Granite Reef Aqueduct Final Environmental Statement that was prepared by USBR in 1974) or a possible future downstream groundwater recharge facility (it would be a separate project).

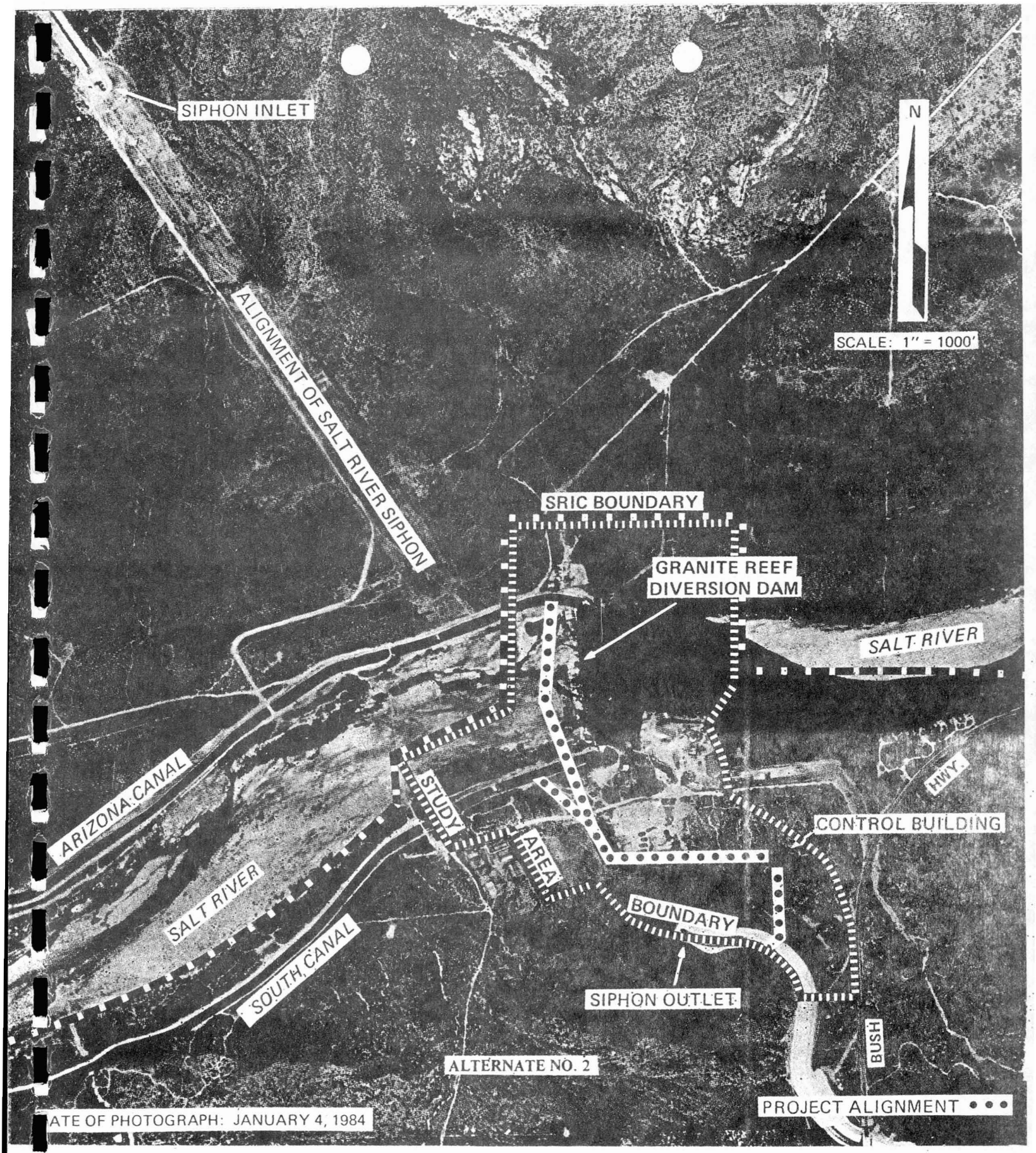
We would appreciate your comments on any potential environmental impacts of this proposed interconnection facility and information on any planned projects or activities in the vicinity that could impact or be impacted by the interconnection facility for inclusion in the Environmental Assessment report. We would appreciate it if you could provide your comments by November 5. If you have any questions on the proposal, please call me at 236-2619.

Glenn D. Harris
Senior Staff Scientist
Environmental Services Department

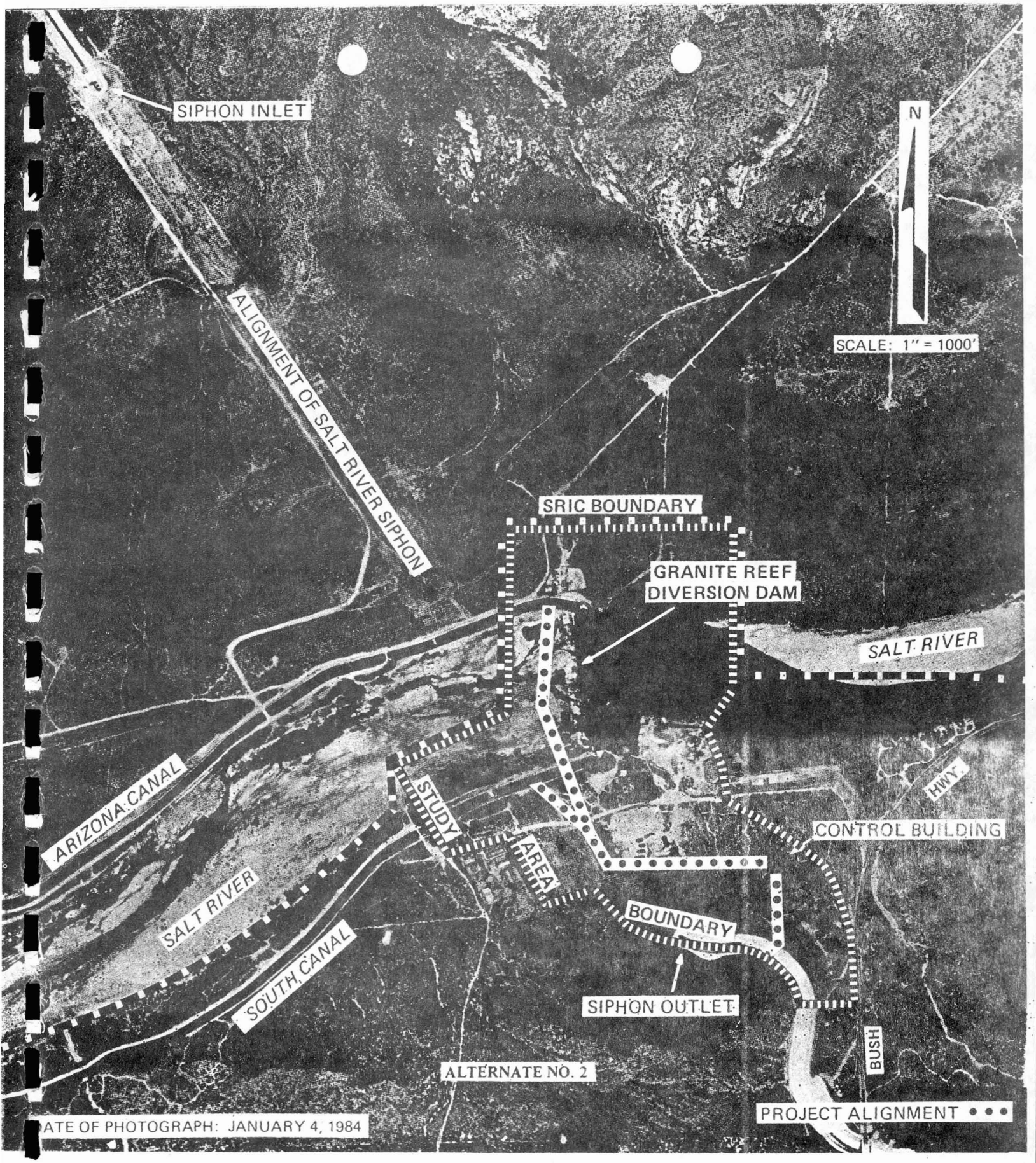
GDH/laf



VICINITY MAP
GRANITE REEF DIVERSION DAM



VICINITY MAP
GRANITE REEF DIVERSION DAM



VICINITY MAP
GRANITE REEF DIVERSION DAM

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2711
LOS ANGELES, CALIFORNIA 90053-2325

19 OCT 1987

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OCT 22 1987
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REPLY TO
ATTENTION OF

Office of the Chief
Regulatory Branch (File No. 30159)

Salt River Project
ATTN: Glenn D. Harris
P.O. Box 52025
Phoenix, Arizona 85072-2025

Gentlemen:

It has come to our attention that you plan to backfill over a pipeline under the Salt River that would connect the Central Arizona Project Canal to the Arizona Canal at Granite Reef Dam, Maricopa County, Arizona. This activity may require a U.S. Army Corps of Engineers permit. A Corps of Engineers permit is required for:

a. Work or structures in or affecting the "navigable waters of the United States"

b. The discharge of dredged or fill material into the "waters of the United States"

c. The transportation of dredged or fill material for the purpose of dumping it into ocean waters; or, any combination of the above.

Enclosed you will find a permit application form and a pamphlet that describes our regulatory program. If you have any questions, please contact Robert J. Dummer, Regulatory Branch, at (213) 894-5606 before 3:00 p.m.

Sincerely,

Richard Harlacher

Richard Harlacher
Acting Chief, South Coast Section

Enclosures

United States Department of the Interior

BUREAU OF RECLAMATION
ARIZONA PROJECTS OFFICE
23636 N. 7TH STREET
P.O. BOX 9980
PHOENIX, ARIZONA 85068

TAKE PRIDE IN AMERICA

IN REPLY REFER TO: 330-150
120.1

NOV 5 1987

NOV 10 1987
ENVIRON. SERV. DEPT.

Mr. Glenn D. Harris
Environmental Services Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072

Dear Mr. Harris:

This letter is in response to your request for comments concerning potential environmental impacts which may result from construction of the proposed interconnection facility between the Central Arizona Project (CAP) canal and the Salt River Project (SRP) canal system in the vicinity of the Granite Reef Diversion Dam.

Reclamation has reviewed your proposed interconnection facility. This facility has been the subject of past discussions between Reclamation and SRP. Those discussions have been constructive in identifying the significant environmental issues related to this project. Our comments focus on the following concerns:

1. What will be the physical and operational relationship between the interconnection facility and future ground-water recharge facilities? We concur that future ground-water recharge facilities will be addressed in a separate environmental analysis and documentation, however, it would be useful to initiate discussion now.

2. What will be the physical and operational relationship between the hydrogeneration facility and the interconnection facility? The hydrogeneration facility can also be analyzed and documented in the future.

3. The fish barriers installed in the canals should be located at the closest feasible location downstream of the Granite Reef Diversion Dam relative to where the interconnect canal enters the canals. This would take advantage of slope and water velocity as additional deterrents to movement of undesirable introduced fish.

4. Right-of-way crossing permits will be required for interconnection facilities that occupy Reclamation-owned lands.

These comments should be considered in conjunction with our previously stated concerns documented in letters dated November 27, 1984 and December 19, 1984 (enclosed).

We appreciate the opportunity to provide comments at this time and will be happy to provide further information as needed. If you have any question regarding our comments, please contact Mr. Daniel Fritz at (602) 870-6776 of our Environmental Division.

Sincerely yours,

Robert J. Towles

Robert J. Towles
Project Manager

Enclosures

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
3616 W. Thomas, Suite 6
Phoenix, Arizona 85019

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NOV 02 1987
ENVIRON. SERV. DEPT.

October 28, 1987

Glenn D. Harris
Senior Staff Scientist
Environmental Services Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-2025

Dear Mr. Harris:

This is in response to your letter dated September 30, 1987, describing the proposed interconnection at Granite Reef Dam (GRD) and requesting Fish and Wildlife Service (Service) comments on its environmental acceptability.

Both alternatives proposed in your letter will deliver Central Arizona Project (CAP) water directly into Salt River Project (SRP) canals and include the construction of electrical fish barriers in the canals to prevent upstream movement of fish.

Our concern with the original design was that it allowed for the introduction of Colorado River ichthyofauna into the Salt and Verde River systems. The change in design will effectively prevent this from happening and therefore, adequately satisfies this concern. Of the two alternatives proposed, we recommend the implementation of alternative No. 2. This alternative which would have an underground pressure pipe alignment below the dam, would keep any escaping fish from entering the Salt and Verde Rivers should the pipe burst.

It has been four years since the interconnect was first proposed. In that time a new bald eagle (Haliaeetus leucocephalus) nest was discovered on the Salt River Indian Community approximately 2 1/2 miles from the GRD in the Buttes area. The nest was active this year and fledged two young. Based on this new information, the Service recommends that you reinitiate Section 7 consultation, as required under the Endangered Species Act.

Thank you for the opportunity to review and comment on the revised proposal. If we can be of any further assistance, please call Robert Mesta or me (Telephone: 602/261-4720).

Sincerely,

Sam F. Spiller

Sam F. Spiller
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico (Fish and Wildlife Enhancement)
Director, Arizona Game and Fish Department, Phoenix, Arizona

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
3616 W. Thomas, Suite 6
Phoenix, Arizona 85019

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DEC 21 1987
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December 17, 1987

Glenn D. Harris
Senior Staff Scientist
Environmental Services Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-2025

Dear Mr. Harris:

This is in response to your letter dated November 16, 1987 requesting that Section 7 consultation be reinitiated, as required under the Endangered Species Act for the proposed Central Arizona Project, Salt River Project Interconnection Project at Granite Reef Dam (GRD), Maricopa County, Arizona.

It has been four years since the original consultation was conducted, since that time a new bald eagle (Haliaeetus leucocephalus) nest was discovered on the Salt River Indian Community approximately 2 1/2 miles from the GRD in the Buttes area. The nest was active this year and fledged two young. This new information should be incorporated into your project evaluation process.

If we may be of any further assistance, please call Robert Mesta or me (Telephone: 602/261-4720).

Sincerely,

Sam F. Spiller
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico (Fish and Wildlife Enhancement)
Director, Arizona Game and Fish Department, Phoenix, Arizona

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
3616 W. Thomas, Suite 6
Phoenix, Arizona 85019

RECEIVED
APR 21 1988
ENVIRON. SERV. DEPT.

April 20, 1988

Glenn D. Harris
Senior Staff Scientist
Environmental Service Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-2025

Dear Mr. Harris:

This is in response to your telephone call of April 19, 1988, requesting information relative to any impacts that construction of the Interconnection Project at Granite Reef might have on the bald eagles breeding on the Salt River, Maricopa-Pima Indian Community.

This pair of eagles is breeding approximately two and one-half miles from the proposed project and would not be impacted by ordinary construction activities associated with the project. However, any blasting should be scheduled to avoid the bald eagle breeding season November 1 to June 30. If this is not possible, any blasting scheduled during this time period will have to be coordinated with and approved by our office.

If we can be of further assistance or if you have any questions, please call Robert Mesta or me (602/261-4720).

Sincerely,

Sam F. Spiller

Sam F. Spiller
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico (Fish and Wildlife Enhancement)
Director, Arizona Game and Fish Department, Phoenix, Arizona

Arizona Commission of
Agriculture and Horticulture
1688 WEST ADAMS • PHOENIX, ARIZONA 85007 • (602) 255-4373

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OCT 20 1987
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FIELD SERVICES

District Offices
Fruit & Vegetable Standardization

Office of the State Chemist
State Agricultural Laboratory

MEMORANDUM

DATE: October 19, 1987

TO: Glenn D. Harris, Senior Staff Scientist
Environmental Services Department
Salt River Project
P. O. Box 52025
Phoenix, AZ 85072-2025

FROM: Ivan J. Shields, Director Ivan J. Shields

SUBJECT: SRP Interconnection Project
CAP and SRP Canal System

In paragraph seven of your letter of October 1, it is stated that biological studies have been completed on the project site.

The Commission would like to remind Salt River Project that, under A.R.S. § 3-901 through 3-910, protected native plants that would be destroyed in the project construction phase would have to be inventoried and an opportunity given to the Commission for salvage. Under this statute, the Arizona Native Plant Law, a thirty day notice is required prior to construction. Any time earlier in notification would allow the Commission to expedite its inventory and salvage program as not to interfere with construction.

Your cooperation in this matter would be greatly appreciated.

EVAN MECHAM, *Governor*

Commissioners:
FRED S. BAKER, Elgin, Chairman
ARRY D. ADAMS, Bullhead City
RANCES W. WERNER, Tucson
HOMAS G. WOODS, JR., Phoenix
PHILLIP W. ASHCROFT, Eagar

Director
EMPLE A. REYNOLDS

Assistant Director
DUANE L. SHROUFE

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ARIZONA GAME & FISH DEPARTMENT

2222 West Greenway Road Phoenix, Arizona 85023 942-3000

November 6, 1987

Mr. Glenn D. Harris
Senior Staff Scientist
Environmental Services Department
Salt River Project
P. O. Box 52025
Phoenix, Arizona 85072-2025

Re: CAP-SRP Interconnection
Granite Reef Diversion Dam

Dear Mr. Harris:

The Arizona Game and Fish Department has reviewed the revised proposal for Salt River Project (SRP) to construct an interconnection between the Central Arizona Project (CAP) canal system and the SRP canal system, in the vicinity of Granite Reef Diversion Dam, and provides the following comments.

At this time the Department is not aware of any planned projects or activities in the vicinity that could potentially impact or be impacted by the interconnection facility.

Regarding the alternative project layouts, the Department definitely favors Alternative 2 over Alternative 1. We continue to be firm in our position that the CAP interconnect with SRP canals must be below the Granite Reef Diversion Dam, to better ensure that Colorado River ichthyofauna are not introduced directly into the lower Salt and Verde River systems.

The inference, in paragraph 2, page 2, of your letter, that water deliveries won't have fish in them is a definite error, based on current knowledge from studies by the Department, the Fish and Wildlife Service, and the Bureau of Reclamation, in western reaches of the CAP.

There is some concern that electrical barriers, by themselves, are not 100 percent effective, particularly when power outages occur. Therefore, we recommend that vertical drop structures be used in combination with the electrical barriers.

The Department, again, accessed its Nongame Data Management System to provide current information on special status species. The bald eagle (Haliaeetus leucocephalus), listed as endangered by the USFWS, has nested near the confluence of the Salt and Verde rivers just upstream from Granite Reef Dam. This nest territory was first "discovered" in 1987. With this discovery, Section 7 consultation with the U. S. Fish and Wildlife Service may now be required. Occurrence records for the endangered Yuma clapper rail (Rallus longirostris yumanensis) include marsh habitats both above and below the dam. This species may not be present in all years, however. The desert tortoise (Gopherus agassizii) and Gila monster (Heloderma suspectum), both USFWS Category 2 species, may be found in habitats surrounding the project site.

If the appropriate barriers are constructed to prevent entry of undesirable species from the CAP canal system into the lower Salt and Verde River system, above Granite Reef Diversion Dam, and that precautions are taken to minimize habitat loss during construction, then the Department has no remaining significant concerns with the project.

Sincerely,

Temple A. Reynolds, Director

Robert K. Weaver
Habitat Evaluation Coordinator
Planning and Evaluation Branch

RKW:lkl

cc: Don Turner, Supervisor, Mesa Regional Office
Bruce Taubert, Chief, Wildlife Management Division
Sam Spiller, Field Supervisor, USFWS, Phoenix ES Office

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

EVAN MECHAM, GOVERNOR
GERALD H. TELETZKE, PH.D., DIRECTOR

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NOV 17 1987
ENVIRON. SERV. DEPT.

November 13, 1987

Mr. Glenn D. Harris
Salt River Project
P. O. Box 52025
Phoenix, AZ 85072

Dear Mr. Harris:

Thank you for the opportunity to have input on the proposed interconnection between the CAP Granite Reef Aqueduct and the Granite Reef Diversion Dam, Maricopa County.

The environmental assessment should contain assurances that during construction, water quality standards will not be violated and that the state policy for construction in water courses will be implemented (copies attached). All applicable permits (e.q. Section 404, Clean Water Act) should also be mentioned in the assessment.

Thank you, again, for the opportunity to comment on this project. Should you have any questions, please call me at 257-2315.

Sincerely,

Susan Monroe

Susan Monroe, Planner

SM:ca

cc: Ed Swanson

ARIZONA STATE PARKS

800 W. WASHINGTON
SUITE 415
PHOENIX, ARIZONA 85007
TELEPHONE 602-255-4174

EVAN MECHAM
GOVERNOR

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M. JEAN HASSELL
STATE LAND COMMISSIONER

KENNETH E. TRAVOUS
EXECUTIVE DIRECTOR

COURTLAND NELSON
DEPUTY DIRECTOR

October 22, 1987

ENVIRON. SERV.

Glenn D. Harris
Senior Staff Scientist
Environmental Services Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072-5900

RE: Interconnection facility between CAP and SRP canal system in the vicinity of the Granite Reef Diversion Dam, SRP and DOI-BR

Dear Mr. Harris:

Thank you for your letter advising us that you plan to issue a new draft Environmental Assessment (EA) for the above project because of extensive modifications to the project since the April 1983 draft EA.

You state that archaeological field studies have already been completed on the project site and vicinity pursuant to 36 CFR Part 800. In the revised EA please summarize the results of those archaeological studies and reference the applicable reports.

We appreciate your continued cooperation with this office in complying with the historic preservation requirements for federally assisted projects. If you have any questions, please contact me.

Sincerely,

Robert E. Gasser
Archaeologist & Compliance Coordinator

for Shereen Lerner, Ph.D.
State Historic Preservation Officer

Arizona Department of Water Resources

99 East Virginia Avenue
Phoenix, Arizona 85004
(602) 255-1553

Evan Mecham, Governor
Alan P. Kleinman, Director

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NOV 18 1987

ENVIRON. SERV. DEPT.

November 13, 1987

Mr. Glenn D. Harris
Environmental Services Department
Salt River Project
Post Office Box 52025
Phoenix, AZ 85072-2025

Dear Mr. Harris:

In response to your letter dated October 1, 1987, requesting the Department comment on any potential environmental impacts of the proposed CAP/SRP interconnection facility and provide information on any planned projects or activities in the vicinity of the facilities. We have no comments at this time. We do however support the proposed interconnection facility and feel that it will add flexibility to the operation of the C.A.P.

We look forward to reviewing the Draft Environmental Assessment when it is available.

Sincerely,

Tim Henley

Tim Henley
Chief, Statewide Planning

EVAN MECHAM
GOVERNOR

Arizona
State Land Department
1624 WEST ADAMS
PHOENIX, ARIZONA 85007

M. J. HASSELL
STATE LAND COMMISSIONER

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November 27, 1987

Mr. Glenn D. Harris
Senior Staff Scientist
Environmental Services Department
Salt River Project
Post Office Box 52025
Phoenix, AZ 85072-2025

Dear Mr. Harris:

The Arizona State Land Department has reviewed your letter of October 1, 1987. We generally agree with your Finding of No Significant Impact (FONSI) for the proposed interlink of the Salt River Project and canal systems; however, as you have requested that we express a preference, the Department recommends Alternative 2.

The Department has investigated a potential land trade in the vicinity of the project. At this time the federal government is dealing with private land owners and the Salt River Indian Tribe on these lands and it appears doubtful that we will acquire land in this area. Approval of the FONSI should not be construed as a waiver of future claims; as issues pertaining to ownership of the Salt River bed have not been settled as of this date.

If you require any assistance, please contact Dale Altshul of our Hydrology Section at 255-3500.

Sincerely,

M. J. Hassell
State Land Commissioner

MJH:DAA:bd

MARICOPA COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT

111 S. 3rd. Avenue, Room 300, Phoenix, Arizona 85003

OCT 26 1987

ENVIRON. SERV. DEPT.

October 16, 1987

Mr. Glenn D. Harris
Environmental Services Department
Salt River Project
P. O. Box 52025
Phoenix, AZ 85072-2025

RE: SRP-CAP INTERCONNECTION PROJECT

Dear Mr. Harris:

Thank you for the opportunity to review the SRP-CAP interconnection near Granite Reef Dam. This department is not aware of any planned projects or environmental conditions in the vicinity of the Granite Reef Dam that would impact or be impacted by the proposed interconnection project.

Sincerely,

DENNIS W. ZWAGERMAN
PRINCIPAL PLANNER
ADVANCE PLANNING

Douglas A. Williams

Douglas A. Williams
Planner II
(602)262-3403

DAW/pac

xc: D. W. Zwagerman

101/58

MARICOPA COUNTY HIGHWAY DEPARTMENT

3325 West Durango Street
Phoenix, Arizona 85009

(602) 233-8600

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October 19, 1987

Salt River Project
P. O. Box 52025
Phoenix, Arizona 85072-2025

Attention Mr. Glenn D. Harris, Senior Staff Scientist
Environmental Services Department

Gentlemen:

RE INTERCONNECTION BETWEEN CAP AND SRP CANAL SYSTEM

In response to your letter dated October 1, 1987, we have no objections to this project. We wish to be kept informed in the event this project impares the existing Bush Highway alignment.

Sincerely,

R. C. ESTERBROOKS, P.E.
ASSISTANT COUNTY MANAGER,
PUBLIC WORKS DIRECTOR & COUNTY ENGINEER

Harry R. Keller

Harry R. Keller, P.E.
Assistant County Engineer

WHH:rg

PARKS AND RECREATION DEPARTMENT
3355 West Durango Street
Phoenix, Arizona 85009

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OCT 16 1987
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MARICOPA COUNTY ARIZONA
(602) 272-8871

October 15, 1987

Mr. Glenn D. Harris, Senior Staff Scientist
Environmental Services Department
Salt River Project
P. O. Box 52025
Phoenix, Arizona 85072-2025

Dear Mr. Harris:

Thanks for the opportunity to comment on the Salt River Project's plans to construct an interconnection between the Central Arizona Project canal system and the Salt River Project canal system. The Parks and Recreation Department does have one area of concern in the general area of the Granite Reef Diversion Dam as it affects the general County trail system and particularly the Sun Circle Trail.

Enclosed is a map of the County Hiking and Riding Trails, and you can note the Sun Circle Trail in the general area of the Granite Reef Diversion Dam. Also, there is a linkage from the Sun Circle Trail into a Forest Service trail across the Bush Highway.

We would appreciate your consideration of our trail system as you are proceeding with your planning program. Please contact Howard Gillmore, Assistant Director/Field Services, 272-8871, if you need additional information or clarification.

Sincerely,

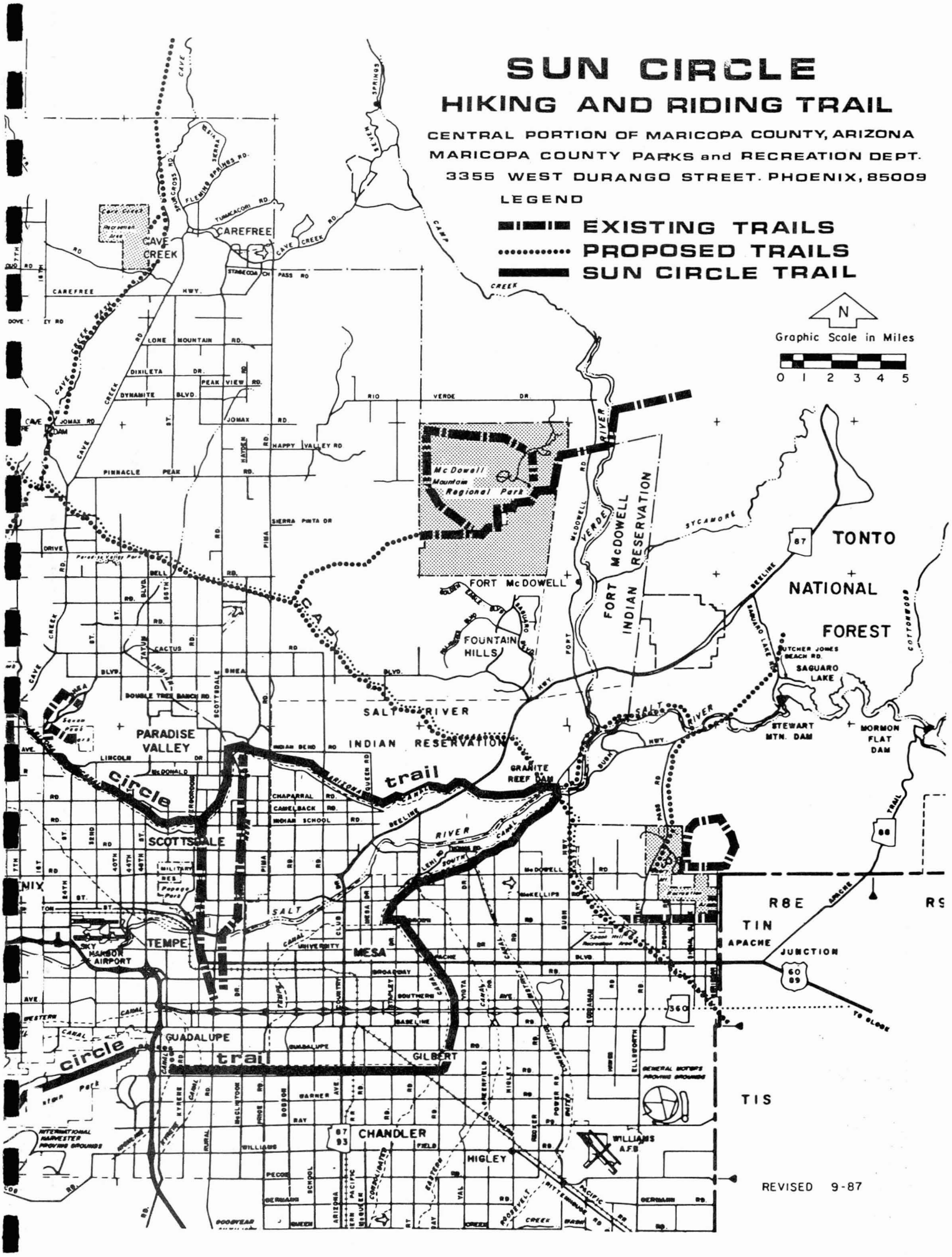
William Richwine

William Richwine
Director

R:t
Enclosure

SUN CIRCLE
HIKING AND RIDING TRAIL

CENTRAL PORTION OF MARICOPA COUNTY, ARIZONA
MARICOPA COUNTY PARKS and RECREATION DEPT.
3355 WEST DURANGO STREET. PHOENIX, 85009



FLOOD CONTROL DISTRICT
of
Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 262-1501

D. E. Sagramoso, P.E., Chief Engineer and General Manager

NOV 06 1987

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BOARD of DIRECTORS
Fred Koory, Jr., Chairman
George L. Campbell
Carole Carpenter
Tom Freestone
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NOV 05 1987

Salt River Project
Environmental Services Department
Glenn D. Harris, Senior Staff Scientist
P. O. Box 52025
Phoenix, Arizona 85072-2025

Re: CAP-SRP Interconnect at Granite Reef

Dear Sir:

The Flood Control District Staff has reviewed your letter of October 1, 1987, and its enclosures. We have no comments with regard to possible environmental impact.

In view of the close proximity to the Spook Hill FRS outlet system, we will appreciate being kept informed of the progress of the project. Further, it appears that a Floodplain Use Permit may be required, as well as compliance with the floodplain regulations.

Thank you for the opportunity to review this proposal.

Sincerely,

Stanley L. Smith
for D. E. Sagramoso, P.E.

CITY OF
MESA

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OCT 02 1987
ENVIRON. SERV. DEPT.

October 28, 1987

Mr. Glenn D. Harris
Senior Staff Scientist
Environmental Services Department
Salt River Project
P.O. Box 52025
Phoenix, Arizona 85072

Re: Environmental Assessment for Interconnection between CAP and the SRP Canal System in the vicinity of Granite Reef Dam, Maricopa County

Dear Mr. Harris:

The City has reviewed several projects in the vicinity and find all consistent with good water resources management practices. It should be noted that the City of Mesa is a participant in the interconnect and the downstream Granite Reef Underground Storage Project (GRUSP).

We agree with the position and request for a Finding of No Significant Impact (FONSI) as this is what we received for Mesa's CAP Water Treatment Plant.

If your office has any further questions please contact Karl Kohlhoff, Water Resources Management Coordinator, at 834-2273.

Yours truly,

CHARLES K. LUSTER
City Manager

CKL:pjm

Office of the City Manager
55 North Center Street ▪ P.O. Box 1466 ▪ Mesa, Arizona 85201-0904 ▪ (602) 834-2011

City of Phoenix
Environmental Services

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OCT 02 1987
ENVIRON. SERV. DEPT.

October 29, 1987

Mr. Glenn D. Harris
Senior Staff Scientist
Environmental Services Office
Salt River Project
Post Office Box 52025
Phoenix, Arizona 85072-2025

Dear Mr. Harris:

The City of Phoenix staff has reviewed your proposed project for the CAP/SRP Interconnection Facility and fully supports the project. As you know, the City intends to participate with the project in the construction and operation of the facility. We are unaware of any adverse environmental impacts which would be caused by either the construction or operation of this project. At the moment the City has no planned projects or activities in the vicinity of the proposed project which would either impact or be impacted by the facility, other than those which are directly related to our intended use of the facility.

If you have any questions, please contact me at 256-3248.

Sincerely,

William L. Chase, Jr.

William L. Chase, Jr.
Water Advisor

WLC/pw:05441

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DEC 07 1987
ENVIRON. SERV. DEPT.

Salt River
PIMA-MARICOPA INDIAN COMMUNITY
ROUTE 1, BOX 216 / SCOTTSDALE, ARIZONA 85256-9722 / PHONE (602) 941-7277

December 2, 1987

IN REPLY REFER TO:

Mr. Glenn D. Harris, Senior Staff Scientist
Environmental Services Department
Salt River Project
P. O. Box 52025
Phoenix, AZ 85072-2025

Dear Mr. Harris:

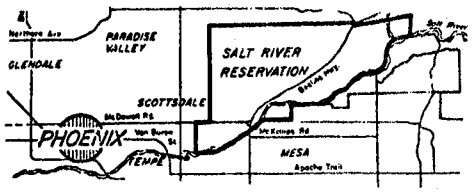
In regards to your letter of October 1, 1987 requesting comments on a proposal to install a delivery system of Central Arizona Project waters from a turnout structure into the Salt River Projects' canals, I have been advised by our staff that:

1. The proposed use is on withdrawn lands located off the reservation.

2. Alternative #1 would impact our access to Bush Highway through the withdrawn lands and may destroy a levee and dike on the north bank east of the dam.

3. Alternative #2 would have the least impact on the environment and wildlife, however. an open channel should be discouraged for safety purposes.

SALT RIVER INDIAN RESERVATION



I am further advised that Mr. Terrance Leonard has been in verbal contact with your offices regarding this matter and future contacts should continue through that office.

Should you have any questions please contact Mr. Leonard at 941-7340.

Sincerely yours,

Gerald Anton, President
Salt River Pima-Maricopa
Indian Community