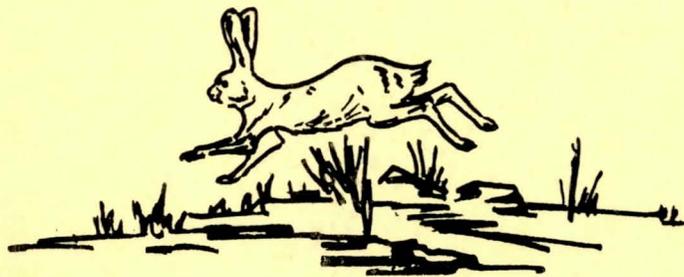


Supplemental Watershed Work Plan No 1

Harquahala Valley Watershed

Maricopa & Yuma Counties Arizona

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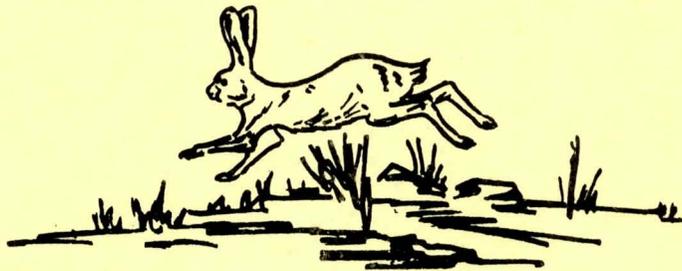
Prepared under the authority of the Watershed Protection & Flood
Prevention Act (Public law 566, 83rd. Congress, 68 Stat. 666)
as amended.

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MARCH, 1977

Prepared under the authority of the Watershed Protection & Flood
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SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NO. 1

and

SUPPLEMENTAL WATERSHED WORK PLAN NO. 1

HARQUAHALA VALLEY WATERSHED

Maricopa and Yuma Counties, Arizona

Prepared under the Authority of the Watershed
Protection and Flood Prevention Act (Public
Law 566, 83d Congress, 68 Stat. 666), as amended.

Prepared by
Flood Control District of Maricopa County
Buckeye-Roosevelt Natural Resource Conservation District
Wickenburg Natural Resource Conservation District

With Assistance by
State of Arizona, Arizona Water Commission
U. S. Department of Agriculture, Soil Conservation Service

March 1977

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SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NO. 1

between the

BUCKEYE-ROOSEVELT NATURAL RESOURCE CONSERVATION DISTRICT
Local Organization

WICKENBURG NATURAL RESOURCE CONSERVATION DISTRICT
Local Organization

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of Arizona

and the

SOIL CONSERVATION SERVICE
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, the Watershed Work Plan Agreement for the Harquahala Valley Watershed, State of Arizona, executed by the Sponsoring Local Organization named therein and the Service, became effective on the 1st day of April 1969; and

Whereas, in order to carry out the Watershed Work Plan for said watershed, it has become necessary to modify said Watershed Work Plan Agreement; and

Whereas, it has been found necessary to modify the structural measures included in the approved work plan and to revise the estimated costs associated with those measures; and

Whereas, the State of Arizona, by legislative action of Senate Bill 1053, dated March 24, 1972, changed the names of the Soil Conservation Districts under its jurisdiction to Natural Resource Conservation Districts; and

Whereas, the Congress in establishing Public Law 91-646 has placed further responsibilities upon the Sponsoring Local Organization and the Service; and

Whereas, a Supplemental Watershed Work Plan dated March 1977, which modifies the Watershed Work Plan for said watershed has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service; which supplemental plan is annexed to and made a part of this agreement:

Now, therefore, the Sponsoring Local Organization and the Service hereby agree upon the following modifications of the terms, conditions and stipulations of said Watershed Work Plan Agreement:

1. Paragraph number 1 is modified to read as follows: The Flood Control District of Maricopa County will acquire, with other than P.L. 566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated cost \$1,231,520.)
2. Paragraph number 4 is modified to read as follows: The total cost of engineering services will be borne by the Service. (Estimated cost \$1,010,950.)
3. Paragraph number 5 is modified to read as follows: The Flood Control District of Maricopa County and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$89,820 and \$685,900 respectively.
4. Paragraph number 12 is modified to read as follows: This is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Flood Control District of Maricopa County before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

5. Paragraph number 13 is modified to read as follows: The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties. An amendment to incorporate changes affecting a specific structural measure may be made by mutual agreement between the Service and the Flood Control District of Maricopa County for the particular structural measure involved.
6. A paragraph number 15 is to be added as follows: The Sponsoring Local Organization assures that comparable

replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation Payments	27.10	72.90	0 <u>1/</u>

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

The Sponsoring Local Organizations and the Service further agree to all other terms, conditions, and stipulations of said Watershed Work Plan Agreement not modified herein.

Buckeye-Roosevelt Natural Resource Conservation District

By John Jones
 Title Chairman
 Address RI Box 199
Buckeye AR 85326
 (Zip Code)
 Date April 5 1977

The signing of this agreement was authorized by a resolution of the governing body of the Buckeye-Roosevelt Natural Resource Conservation District adopted at a meeting held on

April 5, 1977

Secretary Harry W. Porterfield

Date April 5, 1977

Wickenburg Natural Resource Conservation District

By Dral Hunter

Title Chair

Address Box 146 Salome

Date 6-15-77 (Zip Code)

The signing of this agreement was authorized by a resolution of the governing body of the Wickenburg Natural Resource Conservation District adopted at a meeting held on

June 15, 1977

Secretary Donald Beeder

Date 6-15-77

Flood Control District of Maricopa County

By Bob Carlin

Title CHAIRMAN, BOARD OF DIRECTORS

Address 1115, 3rd Avenue Phoenix, Arizona 85003

Date May 23, 1977 (Zip Code)

The signing of this agreement was authorized by a motion of the governing body of the Flood Control District of Maricopa County adopted at a meeting held on

May 23, 1977

Clerk Les Woodall

Date May 23, 1977

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

Thomas G. Korbelaugh
State Conservationist

8-2-77
Date

SUPPLEMENTAL WATERSHED WORK PLAN NO. 1

HARQUAHALA VALLEY WATERSHED

MARICOPA AND YUMA COUNTIES, ARIZONA

BASIS FOR SUPPLEMENTAL PLAN

This work plan supplement is developed to (1) reflect modification of the planned structural measures; (2) include additional environmental features in the design of the planned structures; (3) reflect the name change from Soil Conservation District to Natural Resource Conservation District as provided for by the 1972 Session of the Arizona State Legislature; (4) implement the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970; and (5) recognize the provisions of the National Environmental Policy Act of 1969.

The Harquahala Valley Watershed Work Plan was approved for operations on April 1, 1969. Planned structures have not been constructed because the Flood Control District of Maricopa County has been financially unable to secure necessary land rights. In 1973, interest in implementing the watershed work plan was renewed because of the following developments:

- (1) Passage of State legislation authorizing financial assistance for up to one-half the sponsors' cost in securing land rights.
- (2) A four-times increase in the tax rate of the Flood Control District of Maricopa County which provides increased funds to meet sponsors' costs.
- (3) Passage of State legislation authorizing donation of State Trust Lands for flood control projects to the extent that other State Trust Lands are benefitted. The constitutionality of this act has been questioned, however, the issue has not yet advanced to litigation. Because of the uncertainty of the outcome, cost estimates presented in this supplement assume that State lands will not be donated. Sponsors' costs for State lands may be reduced from those shown if the outcome of the case varies from this assumption.
- (4) Construction of Interstate 10 through the watershed resulting in change of flood flow patterns and causing location conflicts with two of the work plan structures.
- (5) Authorization of the Central Arizona Project and scheduled construction through the watershed of the

Granite Reef Aqueduct which also requires flood protection.

- (6) The ongoing construction of an upstream floodwater retarding structure by the U.S. Bureau of Reclamation to protect Reach 5a of the Granite Reef Aqueduct. The structure would control 140 square miles of upstream drainage area within the watershed.
- (7) The proposal for an intensive structural irrigation water distribution system in Harquahala Valley to distribute water from the Granite Reef Aqueduct.

The works of improvement in the work plan are modified by this supplement to reflect the above developments and present desires of the sponsors.

WORKS OF IMPROVEMENT TO BE INSTALLED

Structural Measures

Changes have been made in structural alignments, locations, and types of structures. (See Project Map - Revised for the proposed new structural program.) Several of the work plan structures have been renamed to facilitate a clearer understanding of the modifications. The modified structural program consists of two floodwater retarding structures (Saddleback F.R.S. and Harquahala F.R.S.); one floodway (Harquahala Floodway); one combination floodway and diversion (Saddleback Diversion); and one levee (Centennial Levee). All structural measures are for flood protection. Environmental features have been added to all of the structures.

The modifications of the structures as provided for in this supplemental work plan will result in protection of facilities not included in the original work plan formulation. However, the change in scope is not significant (see EXPLANATION OF INSTALLATION COSTS). Explanation of the changes and description of the modified structural program are described below:

- (1) The work plan structures, Little Horn Diversions, have been deleted. These structures were located at a point where flow braiding occurs on an alluvial fan. The structures were needed to insure positive and predictable division of flow to downstream dams. This requirement is no longer needed because of the modification to the proposed downstream structures.
- (2) The work plan structures, Burnt Mountain Floodwater Retarding Structure and Burnt Well Diversion have been combined into one structure and renamed Harquahala Floodwater Retarding Structure. (See Project Map,

Table 3, and Plates No. 2 and 2a.) The alignment of the dam has been moved $1\frac{1}{2}$ to $2\frac{1}{2}$ miles upstream to be above the authorized Granite Reef Aqueduct. Reasons for the modification reflect the sponsors' desire to avoid the visual impairment to the natural desert setting that would result from constructing the work plan structures immediately above Interstate 10, and to minimize the compounding adverse environmental impacts that would result from dual construction of the work plan structures with proposed flood protection works for the aqueduct.

Harquahala F.R.S. extends from Burnt Mountain to Buckeye-Salome Road. The structure will be an earth-fill dam, 11.5 miles in length with a maximum height of 43 feet and average height of 25 feet. Fill material will be obtained from excavation of the Granite Reef Aqueduct. The dam is assigned a hazard "b" classification from the standpoint of downstream hazard in the event of sudden breaching, however, the dam is being designed to meet criteria substantially above the minimum to provide an added safety factor. The structure will provide floodwater protection up to and including the 100-year flood from a drainage area of 102.3 square miles. Total storage capacity will be 10,911 acre-feet, 10,497 acre-feet for floodwater storage, and 414 acre-feet for a 50-year accumulation of sediment. There will be no storage of water in the sediment pool except in section 22, T3N, R9W, where storage pond will be located at a low point along the alignment and at other locations where small washes are intercepted and not completely drained. Total storage is 242 acre-feet. Future sediment deposition will fill these depressions and reduce this storage capability.

An emergency spillway will be located near Burnt Mountain. The emergency spillway will be a straight inlet rectangular concrete chute, 100 feet in width, outletting into the Granite Reef Aqueduct. The spillway will discharge into the aqueduct for floods exceeding the 100-year event. Maximum discharge will be 9,650 cfs.

Floodwaters will be released through the principal spillway, a 4 foot by 4 foot concrete box culvert, with a maximum capacity of 485 cfs. The 10-day 100-year flood would be released in about 9.08 days. Releases will be conveyed by Harquahala Floodway through Saddleback F.R.S. and Saddleback Diversion into Centennial Wash.

Harquahala F.R.S. is a very long structure (11.5 miles). Two 24-inch diameter gated drain outlets will be spaced along the dam alignment. These will serve as emergency drains in the extreme unlikely event that a debris

plug should separate parts of the reservoir from the spillways.

Construction of the dam will require right-of-way on 2,274 acres of land of which 854 acres are in private ownership and 1,340 acres are public lands administered by the U.S. Bureau of Land Management and 80 acres are State trust. All of the land required is unimproved rangeland. The only other land rights item required is for one ramp road crossing over the embankment.

- (3) The work plan structure, Saddleback Diversion, has been divided into two units. The 32,936 foot length north of Courthouse Road has been converted into a floodwater retarding structure and renamed Saddleback F.R.S. (See Project Map, Table 3, and Plate No. 1.) The diversion reach south of Courthouse Road remains essentially the same as shown in the work plan except 24-hour duration storms were used to design the structure instead of 1-hour durations as used in the work plan.

The modifications north of Courthouse Road were necessitated because no crossings were provided for the diversion when Interstate 10 was constructed. The alignment has been rotated downstream pivoting from Courthouse Road a varying distance ranging up to 1½ miles at the north end so that floodwater releases from the upstream Harquahala F.R.S. can be routed through the structure.

Saddleback F.R.S. will be an earthfill dam 5.27 miles in length with a maximum height of 22 feet and average height of 11 feet. Fill material will be obtained from borrow areas within the flood pool. The dam is a class "a" hazard from the standpoint of downstream hazard in the event of sudden breaching but is being designed as a class "b" hazard to provide an added safety factor. The structure will provide floodwater protection up to and including the 100-year flood from a drainage area of 29.6 square miles. Total storage capacity will be 4,247 acre-feet, 4,127 acre-feet for floodwater storage and 120 acre-feet for a 50-year accumulation of sediment. Floodwaters will release from a 10 foot by 4 foot concrete box culvert with a maximum capacity of 800 cfs. The 10-day 100-year flood will be released in about 8.5 days. Two gated and two ungated vegetative maintenance conduits will be strategically located to maintain a continued water supply for downstream pseudoriparian vegetation. Design details and locations are shown on Plate 1.

Construction of the dam will require right-of-way on

1,266.2 acres of land; 515 acres are in private ownership, 281 acres are State Trust Lands administered by the Arizona State Land Department, 464 acres are public lands administered by the U.S. Bureau of Land Management, 5 acres are State land within the Interstate 10 right-of-way administered by the Arizona Department of Transportation, and 1.2 acres are under the jurisdiction of Maricopa County. All of the land required is unimproved desert except 85 acres of previously irrigated land located in the south $\frac{1}{2}$ section 17, T2N, R8W. Other land right items include a ramp for the Buckeye-Salome Road crossing, raising and repaving of a 440 foot length of Courthouse Road, lowering of an underground telephone cable, and raising of a power pole.

Saddleback Diversion begins at the principal spillway outlet of Saddleback F.R.S. and releases into a natural wash about 1.4 miles above its confluence with Centennial Wash. (See Project Map, Table 3a, and Plate No. 4.) The diversion will carry the maximum outflow from the Saddleback F.R.S. plus the 50-year flood event from the diversion drainage area of 8.65 square miles. The diversion will be a compacted earth embankment varying in height from 5 feet to 7 feet and an excavated channel of 3 feet average depth varying in bottom width from 35 feet to 232 feet. The diversion will cross Courthouse Road through four 10 foot by 5 foot concrete box culverts.

Construction of the diversion will require right-of-way on 177.3 acres of land; 19 acres are in private ownership, 42 acres are State Trust Lands, 116 acres are public lands (U.S. Bureau of Land Management), and 0.3 acres are under the jurisdiction of Maricopa County. The right-of-way requires 158.0 acres of unimproved rangeland and 19.0 acres of an inactive subdivision. Other land rights items include a concrete box culvert crossing at Courthouse Road and the relocation of one power pole.

- (4) The work plan structure, Burnt Mountain Floodway, was located to convey floodwater releases from Burnt Mountain F.R.S. southward into Big Horn F.R.S. No Interstate 10 crossing was provided for this floodway when the highway was built, therefore, the floodway has been relocated to match an existing box culvert and renamed Harquahala Floodway. (See Project Map, Table 3a, and Plate No. 3.)

Harquahala Floodway will convey floodwater releases from Harquahala F.R.S. into Saddleback F.R.S. Total length is 3.43 miles. The floodway consists of four reaches. Reach 1 is an excavated earth channel 1,028 feet in length from the Harquahala F.R.S. outlet into

a natural wash. Channel bottom width is 18 feet; maximum depth of cut is 14.5 feet. Reach 2 is the existing wash upstream of Interstate 10. Length of Reach 2 is 9,800 feet. Reach 3 is located at the natural wash crossing of Interstate 10 and consists of three 10 foot by 5 foot concrete box culverts. Reach 4 is a rock riprap channel extending 7,090 feet from Interstate 10 to Saddleback F.R.S. with a channel bottom width of 35 feet and average depth of cut of about 4.6 feet. The channel of Reach 4 is designed for a maximum discharge of 1,265 cfs resulting from 485 cfs as the maximum outflow from Harquahala F.R.S. and 780 cfs as the 50-year flood event from the uncontrolled drainage area contributing to the floodway.

Construction of the floodway will require right-of-way for construction purposes on 17.5 acres of land. Of this total, 5.8 acres are in private ownership and 11.7 acres are public lands administered by the U.S. Bureau of Land Management. An additional 55.5 acres of land between the structure and Interstate 10 may also be required due to severance. Flowage easement will be required on 26 acres of public land for the natural wash upstream of Interstate 10. All of the land required is unimproved rangeland.

- (5) The work plan structures Big Horn Floodwater Retarding Structure, Big Horn Floodway, and Centennial Levee have all been combined into a single unit designated as Centennial Levee. (See Project Map, Table 3a, and Plate No. 5.) The levee consists of two reaches. Reach 1 is essentially a combination of Big Horn F.R.S. and Big Horn Floodway. These structures have been converted from a dam and floodway into a diversion type structure. This change was possible due to upstream control by Harquahala F.R.S. and the proposed U.S. Bureau of Reclamation Tiger Wash Detention Basin. The alignment has been moved $1\frac{1}{2}$ miles upstream to be above a proposed irrigation water distribution main canal. Reach 2 is the same as the work plan structure extended 2.1 miles to join with Reach 1.

Centennial Levee will control the 100-year flood event. Maximum design capacity is 7,540 cfs for Reach 1 and 26,400 cfs for Reach 2. The levee will be a compacted earth embankment varying in height from 2.5 feet to 9.5 feet. Embankment materials will come from borrow areas and/or a channel upstream from Reach 1.

Construction will require land rights acquisition on 6,655 acres of Centennial Wash floodplain which includes 5,276 acres in private ownership (585 acres

of presently irrigated cropland and 4,691 acres of unimproved rangeland or idle cropland), 1,278 acres of State Trust Land, and 101 acres of public land administered by the U.S. Bureau of Land Management. Of the total land, only about 200 acres are required for actual levee construction and borrow. A total of 6,307 acres reflects land rights acquisition for the 100-year frequency flood delineation on Centennial Wash. On Centennial Wash the sponsors will obtain land rights by flowage easements or fee simple title for the 100-year frequency event where significant changes in flooding occur to properties as a result of the project measure. All land rights needed for actual structural placement will be obtained by fee simple title. The majority of these lands are already in the Centennial Wash floodplain and subject to floodwater damage under present flow conditions. The Flood Control District of Maricopa County is anticipating official floodplain delineations prior to project construction. These will serve as a basis for the before-project (existing) condition. The amount of land purchased by fee simple title will vary, depending upon the outcome of individual negotiations with affected landowners. Flowage easement would not preclude all future productive uses of these lands. The cost of obtaining land rights on Centennial Wash (Centennial Levee Reach 2) is estimated at \$664,480.

Saddleback F.R.S. will cross Courthouse Road and Buckeye-Salome Road; Harquahala F.R.S. will cross one unimproved road; and Centennial Levee will cross Courthouse Road. Suitable road crossings will be provided for all four roads. Before installing the structures, written permission to flood the roads will be obtained.

Both Saddleback F.R.S. and Harquahala F.R.S. are designed to have storage areas. This concept will be used because of the acute shortage of surface water in the watershed. These areas should provide a valuable source of water for livestock and wildlife and promote vegetative growth. Water rights will be required. Centennial Levee may also have storage areas depending from where the borrow is taken.

All structure embankment slopes will be treated to reduce rilling and the adverse visual departure from the surrounding natural setting. Several methods of such treatment have been utilized on other structures with varying results. Studies are underway to determine the best method. The U.S. Bureau of Reclamation has established vegetative test plots on the Paradise Valley Detention Dike. The Soil Conservation Service has also established vegetation plantings on the Buckeye and

Guadalupe Structures and their Plant Materials Center is conducting an intensive planting and evaluation program.

The actual concepts to be used for the structures in the Harquahala Valley Watershed will be determined in final design. The above mentioned studies should provide a valuable base for their determinations. It is currently contemplated that the surface of all embankments, borrow areas, and disturbed areas will be scarified and left in a rough scraggy condition and seeded to several different vegetative species. Establishment of indigenous tree species will be accelerated, however, this will not be done on embankments. Seeded and treated areas will be fenced during the planned establishment period for protection from livestock, wildlife, and off-road vehicles. Corridors will be left for free movement of livestock and wildlife.

There are no known significant historical, archaeological or cultural values that will be affected by the installation of the project. The National Park Service and the State Historical Preservation Officer will be notified if any previously unidentified evidence of cultural values are discovered during detailed investigations or construction. The procedures in Public Law 93-291 will be followed. Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archaeological and historical resources.

EXPLANATION OF INSTALLATION COSTS

A summary of the total project installation cost is shown in Table 1 - Revised. The estimated structural cost distribution is shown in Table 2 - Revised.

The work plan total project installation costs were estimated to be \$6,844,110 (1964 prices). The structures as presented in the work plan could not feasibly be constructed today in the location and manner as originally presented. The costs for two required crossings of Interstate 10 alone would be prohibitive. An alternative was developed in which the work plan structures were modified to eliminate the Interstate 10 crossings and reflect current design standards. This alternative will be referred to as the "updated work plan."

The updated work plan would provide the least costly alternative to the original beneficiaries at the same level of protection as in the work plan. This plan is described in detail in the Final Environmental Impact Statement, Harquahala Valley Watershed, March 1977, as Alternate C - Alternative of Installing the Approved 1967 Plan with Revisions. This plan would retain Little Horn Diversions, Big Horn Floodway, Big Horn F.R.S., and Centennial Levee essentially as presented in the work plan. Burnt Mountain F.R.S. and Burnt Well Diversion

would be combined into one structure, with the dam extended on the east to abut Burnt Mountain and allow a rock emergency spillway. Burnt Mountain Floodway would be moved 4 miles eastward for alignment with existing Interstate 10 box culverts. This would also eliminate an expensive crossing at Buckeye-Salome Road. Saddleback Diversion would be split into two units, a dam north of Courthouse Road and a diversion south of the road.

A comparison of this alternate, adjusted to a 1975 price base with full recognition of environmental factors, with the new system proposed in the supplement is shown below:

	<u>Updated Work Plan</u>	<u>Supplemental Plan</u>	<u>Difference</u>
Construction Cost	7,238,390	6,858,960	379,430
Structural Installation Cost	10,540,530	9,877,150	663,380
Total Project Cost	12,476,530	11,813,150	663,380

Several other alternative systems of interrelated flood prevention measures were investigated. The system selected and proposed in this supplemental plan provides the greatest economic efficiency and least adverse environmental impact.

Structural Cost Distribution

Certain costs shown in Table 2 - Revised, of this supplement are displayed differently than in Table 2 of the work plan. Costs previously displayed as Installation Services and as Administration of Contracts are now shown in the Categories of Engineering Services and Project Administration.

Construction Costs

The construction costs shown on Table 2 - Revised are based on data from the most recent contract data for flood prevention projects in Arizona. Contingency factors range from 15 to 22 percent of the engineer's estimate.

Approximately \$537,540, or 7.8 percent of the construction cost, is for environmental factors not considered in the work plan. It reflects design, construction, and landscaping requirements exceeding those needed for a purely structural functioning. This includes costs for seeding, tree plantings, vegetation maintenance conduits, shaping and blending of borrow areas, and increased structural requirements required because of non-draining storage areas.

Engineering Services

Engineering services costs are estimated to be \$1,101,950,

all of which will be from P.L. 566 funds. Costs include the direct cost of engineers and other technicians for surveys, investigations, design, and preparation of plans and specifications for structural measures. It also includes those engineering costs required for vegetative work and other environmental factors. It does not include the cost of similar services for land rights or for project administration.

Project Administration

The P.L. 566 costs for project administration include the cost for government representatives, necessary inspection services during construction to insure that structural measures are installed in accordance with plans and specifications, and administrative costs related to the project. Project administration costs borne by other funds include review of engineering plans, contract administration, relocation advisory assistance services, and other administrative costs of the sponsors associated with the project. It also includes fees paid to the State of Arizona for supervision and control of construction of the dams. Costs for P.L. 566 funds are estimated at 10 percent of the construction cost. Costs for other funds are estimated at 1 percent of construction cost plus Arizona State dam filing fees. The local sponsors are responsible for providing the entire cost of relocation assistance advisory services if the need for relocation payments develops before the construction of the project. The cost of other administrative duties associated with relocation payments will be borne by the party that incurs the costs.

Land Rights

Land rights costs include all expenses related to acquiring lands, easements, leases, rights-of-way, and providing for utility relocation, all new and changes of existing roads, bridges or culverts, fence relocations, and removal of existing improvements. Land rights costs for the new structural formulation as presented in this supplement are estimated at \$1,231,520 (1975 price base). Estimates of right-of-way costs are based on land values as reflected on Maricopa County Assessor tax records and appraisals by the U.S. Bureau of Reclamation for land in the area. Costs for individual land right items are shown in the footnotes on Table 2.

Relocation Payments

Relocation payments include the expenditures from P.L. 566 and other funds associated with the requirements of the Uniform Relocation Assistance Act and Real Property Acquisition Policies Act of 1970 (P.L. 91-646). Relocation payments are applicable to a displaced person, business, and farm operation. The amount includes moving and related expenses for a displaced

person, business, or farm operation as well as financial assistance for replacement housing for a displaced person who qualifies and whose dwelling is acquired because of the project.

Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared 72.90 percent by the Soil Conservation Service and 27.10 percent by the Flood Control District of Maricopa County.

Water Rights

It is anticipated that payments for water rights will not be needed, therefore, no costs are included for this purpose. If water rights are required, any payments will be borne from other funds.

EFFECTS OF WORKS OF IMPROVEMENT

Project effects are described in detail in the document Final Environmental Impact Statement, Harquahala Valley Watershed, March 1977. Summary of the effects from Section V of the Environmental Impact Statement shows:

Floodwater, sediment and erosion damages will be reduced on existing agricultural and other improvements in Harquahala Valley, Arizona.

1. Conservation land treatment will decrease sheet erosion from .08 tons/acre/year to .06 tons/acre/year on 13,000 acres of irrigated cropland.
2. Structural measures will decrease the area inundated by the 100-year flood from 16,000 acres to 6,850 acres.
3. Structural measures will decrease the 100-year peak discharge from the Harquahala Valley Watershed into Centennial Wash from 38,200 cfs to 6,000 cfs and reduce the 50-year peak from 28,600 cfs to 5,200 cfs.
4. Structural measures will decrease the sediment delivered by the watershed to Centennial Wash from 30,000 tons/year to 10,000 tons/year.

The project will provide protection to a proposed irrigation distribution system, a 10.5 mile reach of the proposed Granite Reef Aqueduct and reduce damages to a 9 mile length of Interstate 10. The project will improve the quality of surface water runoff, create approximately 550 acre-feet of surface water storage, improve yield potential to downstream

impoundments, contribute about 350 acre-feet per year to the groundwater basin, create new vegetation for wildlife use and retain approximately 9,060 acres as open space.

About 10,472 acres of land supporting mostly desert shrub vegetation will be needed for land easements and right-of-way. Vegetation will be removed and wildlife lost from about 780 acres of land needed for construction. The aesthetic values of the immediate area will be altered during and following construction. The project structures will limit accessibility to some sectors of the watershed. The effects as described in the work plan apply also to the new system. A 100-year frequency storm from the drainage areas controlled by Harquahala F.R.S., Saddleback F.R.S., Saddleback Diversion, and Reach 1 of Centennial Levee would inundate 16,000 acres under present conditions. This would be reduced 57 percent to 6,850 acres by the proposed structural measures. The August 26, 1964, flood occurred from a storm over the drainage areas controlled by the above mentioned structures and inundated 8,400 cultivated acres. An event of this magnitude can be expected to occur once in seven years. The project would reduce flooding from this event by 4,400 cultivated acres.

The proposed structural measures would reduce the 100-year peak flows from Harquahala Valley Watershed into Centennial Wash by 84.3 percent from 38,200 cfs to 6,000 cfs.

PROJECT BENEFITS

Average annual flood damage reduction benefits are shown in Table 5 - Revised. Total project benefits, including secondary benefits, are shown in Table 6 - Revised.

Unevaluated and unclaimed benefits include protection for 10½ miles of the Granite Reef Aqueduct, protection for 9.0 miles of Interstate 10, protection for 14.5 miles of a proposed irrigation water distribution system main canals, a reduction in the recurring erosion of the paved Gin Road roadbed, and protection for a \$5,595,000 proposed irrigation water distribution system for Harquahala Valley.

COMPARISON OF BENEFITS AND COSTS

Comparison of benefits and costs for structural measures are shown on Table 6 - Revised.

The ratio of average annual benefits including secondary benefits, to average annual costs is 1.16:1.0. Without secondary benefits, the ratio is 1.01:1.0.

PROJECT INSTALLATION

Responsibilities for installation of project measures are as listed in the work plan. A five year installation period is planned. Construction of the structural measures will be completed within the first four years. Land treatment measures will be applied throughout the five year period. The structures will be planned and installed as follows:

First Year

Work will be started to acquire the necessary land, easements, and rights-of-way for all structures. Final engineering surveys, geologic investigations, and design will be completed for Saddleback Diversion and Saddleback F.R.S.

Second Year

Saddleback Diversion and Saddleback F.R.S. will be constructed after lands, easements, and rights-of-way have been acquired. Final engineering surveys, geologic investigations, and design will be completed for Harquahala Floodway and Harquahala F.R.S.

Third Year

Harquahala Floodway and Harquahala F.R.S. will be constructed after lands, easements, and rights-of-way have been acquired. Final engineering surveys, geologic investigations and design will be completed for Centennial Levee.

Fourth Year

Centennial Levee will be constructed after lands, easements, and rights-of-way have been acquired.

Fifth Year

The application of land treatment measures will be completed.

FINANCING PROJECT INSTALLATION

Financing of the project will be accomplished as described in the work plan. The Flood Control District of Maricopa County will act as the contracting agent for construction of the structural measures. Installation of all structural measures will be by competitive bidding. The Flood Control District of Maricopa County, at a later date, may request the Soil Conservation Service to administer some contracts.

Prior to entering into agreements that obligate funds of the Soil Conservation Service, the Flood Control District of Maricopa County will have a financial management system for control, accountability, and disclosure of P.L. 566 funds received, and for control and accountability for property and other assets purchased with P.L. 566 funds. Program income earned during the grant period will be reported on the District's request for advance or reimbursement from the Service.

PROVISIONS FOR OPERATION AND MAINTENANCE

The Flood Control District of Maricopa County will be responsible for operation and maintenance of all structural measures. The total annual operation and maintenance cost is estimated at \$27,400. A separate operation and maintenance plan will be prepared for each structural measure in accordance with the Soil Conservation Service Operation and Maintenance Handbook. A specific agreement will be entered into between the sponsors and the Soil Conservation Service prior to the signing of a land rights or project agreement. The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with P.L. 566 financial assistance.

In past instances the Flood Control District has entered into special agreements with other entities for the performance of operation and maintenance on specific structures.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST - REVISED
HARQUAHALA VALLEY WATERSHED, ARIZONA

Installation Cost	Unit	Number	Non-Federal Land		Total
			P.L. 566 Funds SCS ^{2/}	Other Funds SCS ^{2/}	
<u>LAND TREATMENT</u>					
Cropland ^{3/}	ac.	13,000		1,837,860	1,837,860
Technical Assistance			56,100	42,040	98,140
TOTAL LAND TREATMENT			56,100	1,879,900	1,936,000
<u>STRUCTURAL MEASURES</u>					
<u>Construction</u>					
Floodwater Retarding Structures	no.	2	5,746,150		5,746,150
Channel Work ^{4/} (N)	mi.	7.77	148,910		148,910
(M)	mi.	.04			
(O)	mi.	9.72	963,900		963,900
Subtotal - Construction			6,858,960		6,858,960
<u>Engineering Services</u>			1,010,950		1,010,950
<u>Project Administration</u>					
Construction Inspection			411,540	17,970	429,510
Other			274,360	71,850	346,210
Subtotal - Administration			685,900	89,820	775,720
<u>Other Costs - Land Rights</u>				1,231,520	1,231,520
TOTAL STRUCTURAL MEASURES			8,555,810	1,321,340	9,877,150
TOTAL PROJECT			8,611,910	3,201,240	11,813,150

- 1/ Price base: Land Treatment 1965 Prices, Structural Measures 1975 Prices.
2/ Federal agency responsible for assisting in installation of works of improvement.
3/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.
4/ Type of channel before project: (N) - an unmodified, well defined natural channel stream; (M) - manmade ditch or previously modified channel; (O) - none or practically no defined channel.

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TABLE 2

ESTIMATED STRUCTURAL COST DISTRIBUTION - REVISED

Harquahala Valley Watershed, Arizona

(Dollars) ^{1/}

Structure	Installation Costs P.L. 566 Funds			Installation Costs Other Funds		Total Installation Cost
	Construction	Engineering	Total PL 566	Land Rights	Total Other	
Floodwater Retarding						
Harquahala FRS	5,040,970	705,740	5,746,710	205,030 ^{4/}	205,030	5,951,740
Saddleback FRS	705,180	105,780	810,960	231,010 ^{5/}	231,010	1,041,970
Subtotal	5,746,150	811,520	6,557,670	436,040	436,040	6,993,710
Diversions & Channel Work						
Saddleback Div. (O) ^{2/}	459,800	82,760	542,560	77,890 ^{6/}	77,890	620,450
Harquahala Floodway						
Reach 1 (N)	3,680	550	4,230	20	20	4,250
Reach 2 (N)	10,640	1,600	12,240	150	150	12,390
Reach 3 (M)	-	-	-	-	-	-
Reach 4 (O)	264,330	39,650	303,980	4,970	4,970	308,950
Centennial Levee						
Reach 1 (O)	239,770	47,950	287,720	47,970	47,970	335,690
Reach 2 (N)	134,590	26,920	161,510	664,480	664,480	825,990
Subtotal	1,112,810	199,430	1,312,240	795,480	795,480	2,107,720
Subtotal	6,858,960	1,010,950	7,869,910	1,231,520	1,231,520	9,101,430
Project Administration			685,900		89,820 ^{3/}	775,720
TOTAL	6,858,960	1,010,950	8,555,810	1,231,520	1,321,340	<u>9,877,150</u>

^{1/} Price base 1974^{2/} Type of channel before project: (N) - an unmodified, well defined natural channel or stream; (O) - none or practically no defined channel; (M) - manmade ditch or previously modified channel.^{3/} Includes \$21,230 for Arizona State Dam Filing Fees.^{4/} Includes \$530 for one road crossing and \$204,500 in land easements and right-of-way costs.^{5/} Includes \$7,880 for Buckeye-Salome Road crossing, \$8,160 for Courthouse Road crossing, \$1,150 to relocate AT&T cable, \$1,150 to raise one power pole, and \$212,670 in land easements and right-of-way costs.^{6/} Includes \$45,320 for Courthouse Road crossing, \$1,120 to relocate one power pole, and \$31,450 in land easements and right-of-way costs.

TABLE 3

STRUCTURAL DATA - REVISED

FLOODWATER RETARDING STRUCTURES

Harquahala Valley Watershed, Arizona

Item	Unit	Harquahala FRS	Saddleback FRS	Total
Class of Structure		b.	a	
Drainage Area (Total)	Sq.Mi.	102.3	29.6	131.9
Average Curve Number (1-day AMC II)		86	89	
Elevation Top of Dam	M.S.L.	1419	1194.2	
Elevation Crest Emergency Spillway	M.S.L.	1409	1190.5 ^{3/}	
Elevation Crest Principal Spillway	M.S.L.	1392.8	1179.0	
Maximum Height of Dam	Ft.	43.0	22.0	
Volume of Fill	Cu.Yd.	4,530,558	584,051	5,114,609
Length	Mi.	11.5	5.27	16.77
Maximum Bottom Width	Ft.	234	133 ^{2/}	
Top Width	Ft.	14	11	
Upstream Slope Z:1		3	3	
Downstream Slope Z:1		2	2	
Total Capacity ^{1/}	AF	10,911	4,247	15,157.5
Sediment (50 yr.)	AF	414	120 ^{2/}	534
Retarding	AF	10,497	4,127	14,624
Surface Area				
Sediment Pool	Ac.	77	89 ^{7/}	166
Retarding Pool ^{1/}	Ac.	1304	879	2,183
Principal Spillway Design				
Rainfall Volume (Areal, 1-day)	In.	3.87	3.98	
Rainfall Volume (Areal, 10-day)	In.	5.99	6.08	
Runoff Volume (10-day)	In.	2.61	3.22	
Capacity	C.F.S.	485	800	
Frequency Operation-Emergency Spillway	%	1.0	8 ^{8/}	
Dimensions of Conduit	Ft.	4x4x370	10x4x85	
Tailwater Elevation	M.S.L.	1360	1178	
Type of Outlet		S.A.F.	P.W.D.	
Drawdown Time	Days	9.08	8.5	
Emergency Spillway Design				
Rainfall Volume (ESH, areal)	In.	3.49	3.81	
Runoff Volume (ESH)	In.	2.24	2.71	
Storm Duration	Hours	6	6	
Type		Concrete Chute	8 ^{8/}	
Bottom Width	Ft.	100		
Velocity of Flow (Ve)	F.P.S.	2.18		
Slope of Exit Channel	Ft./Ft.	.02		
Maximum Reservoir Water Surface Elevation	M.S.L.	1409.9	1190.5 ^{3/}	
Side Slopes Z:1		0		
Maximum Outflow from ESH Routing	C.F.S.	400	801 ^{6/}	
Freeboard Design				
Rainfall Volume (FH, Areal)	In.	7.35	6.55	
Runoff Volume (FH)	In.	5.91	5.38	
Storm Duration	Hours	6	6	
Maximum Reservoir Water Surface Elevation	M.S.L.	1418.8	1194.2 ^{4/}	
Maximum Outflow from FH Routing	C.F.S.	9650	914 ^{6/}	
Capacity Equivalents				
Sediment Volume	In.	.0759	.0761	
Retarding Volume	In.	1.93	2.62	

^{1/} At crest of emergency spillway.

^{2/} Includes berm width.

^{3/} Elevation shown is that attained by routing of emergency spillway hydrograph.

^{4/} Elevation shown is that attained by routing of freeboard hydrograph.

^{5/} This includes 80 AF in Basin #1, 21 AF in Basin #2, and 19 AF in area between basins.

^{6/} Outflow through principal spillway.

^{7/} Includes 55 ac. of nondraining areas.

^{8/} No separate emergency spillway. The principal spillway is dual-purpose, serving also as the emergency spillway.

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TABLE 3A - Revised

STRUCTURE DATA FOR DIVERSIONS, LEVEES, AND FLOODWAYS

Reach	Beginning Station	Drainage Area (Sq. Mi.)	Capacity (cfs)		Channel Dimensions		Side Slopes ¹ / _z ² / _d	"n" Value		Velocities (fps)		Type of Work ⁵ / ₁	Before Project ³ / ₋₄		
			Req'd	Design	Bottom			Flow (ft)	Aged	As Built	Aged			As Built	
					Width (ft)	Slope (ft/ft)									
Saddleback Diversion - 4.64 mi.															
1	8+20	0	800	810	35	.0017	4.5	2	2	.035	.035	4.09	4.09 ⁶ / ₁	I-R	O-E
2	13+36	.30	800	810	50	.000797	4.0	5	3	.035	.035	2.83	2.83	"	"
3	13+64		800	857	56	.000797	"	"	"	"	.03	.025	2.53	3.11	I-E
4	16+60	.86	1040	1663	56	.003	"	"	"	"	"	4.90	6.03	"	"
5	23+20		1499	1499	60	"	"	"	"	"	"	"	4.96	6.07	"
6	44+00	1.94	1499	1762	66	"	"	"	"	"	"	5.05	6.12	"	"
7	51+90		1499	1912	72	"	"	"	"	"	"	"	5.12	6.16	"
8	59+80	3.27	1499	2064	80	"	"	"	"	"	"	5.21	6.21	"	"
9	66+70		1499	2267	90	"	"	"	"	"	"	"	5.31	6.26	"
10	75+60	5.58	2197	2524	110	"	"	"	"	"	"	5.48	6.34	"	"
11	83+50		2197	3042	132	"	"	"	"	"	"	"	5.63	6.40	"
12	94+25	8.21	3029	3619	145	"	"	"	"	"	"	5.70	6.43	"	"
13	105+00		3029	3963	160	"	"	"	"	"	"	"	5.78	6.46	"
14	115+34	8.65	3029	4361	184	"	"	"	"	"	"	5.88	6.50	"	"
15	125+68		4230	5000	196	"	"	"	"	"	"	"	5.92	6.51	"
16	136+00	8.21	4230	5322	208	"	"	"	"	"	"	5.96	6.53	"	"
17	153+00		4230	5644	220	"	"	"	"	"	"	"	6.00	6.54	"
18	170+00	8.65	4230	5966	232	"	"	"	"	"	"	6.03	6.55	"	"
19	187+00		5467	6289	"	"	"	"	"	"	"	"	"	"	"
20	204+00	8.65	5467	"	"	"	"	"	"	"	"	"	"	"	"
21	227+00		5467	"	"	"	"	"	"	"	"	"	"	"	"
22	250+00	8.65	5467	"	"	"	"	"	"	"	"	"	"	"	"
	253+00		5610	(Natural Channel Outlet)											
Harquahala Floodway - 3.43 mi.															
1	11+72	0	485	500	18	.000215	6.80	3	3	.03	.025	1.59	1.91	I-E	N-E
2	22+00	.96	485	500	(Natural channel)										N-E
3	120+00		1265	1265	(I-10 crossing, 3 - 10' x 5' C.B.C.)										M(1964)-E
4	122+10	.98	1265	1265	35	.0090	3.61	2	2	.035	.035	7.02	7.02	I-R	O-E
	177+00		1265	1265	35	.0045	4.38	2	2	.035	.035	5.59	5.59	I-E	N-E
	185+00	8.65	1265	1265	35	0.0	4.38	2	2	.035	.035	5.59	4.49	I-E	N-E
	193+00		1265	(Natural Channel Outlet)											
Centennial Levee - 9.45 mi.															
1	41+00	0	0	7540						.035		0		I-E	O-E
	70+00	2.44	854	"						"		.63		"	"
	95+00	6.08	1979	"						"		.88		"	"
	120+00	10.18	3562	"						"		1.21		"	"
	160+00	14.91	5218	"						"		1.24		"	"
	180+00	15.57	5450	"						"		1.24		"	"
	200+00	16.24	5683	"						"		1.21		"	"
2	238+00	20.99	7539	"						"		1.50		II-E	N-E
	300+00	652-	26390	26400						.035		3.56		"	"
	331+00	"	"	"						"		2.82		"	"
	361+50	"	"	"						.045		3.50		"	"
	388+50	"	"	"						"		3.12		"	"
	416+00	"	"	"						"		3.61		"	"
	442+50	"	"	"						"		3.34		"	"
	469+00	"	"	"						"		3.22		"	"
	498+00	"	"	"						"		3.47		"	"
	525+00	"	"	"						"		3.48		"	"
End Levee	540+00	652	"	"						"		3.66		"	"

- 1/ Cross sectional area below hydraulic grade line, (Ft.²).
- 2/ Wetted perimeter below hydraulic grade line, (Ft.).
- 3/ N - An unmodified, well defined natural channel or stream.
M() - Manmade ditch or previously modified channel (approximate date of original major construction).
O - None or practically no defined channel.
- 4/ Pr - Perennial - flows at all times except during extreme drought.
I - Intermittent - continuous flow through some seasons of the year but little or no flow through other seasons.
E - Ephemeral - flows only during periods of surface run-off, otherwise dry.
S - Ponded water with no noticeable flow - caused by lack of outlet or high groundwater table.
- 5/ I - Establishment of new channel including necessary stabilization measures.
II - Enlargement or realignment of existing channel or stream.
III - Clearing out natural or manmade channel (includes bar removal and major clearing and snagging operation).
IV - Clearing and removal of loose debris within channel section.
V - Stabilization as primary purpose (by continuous treatment or localized problem areas - present capacity adequate).
E - Earth channel.
R - Rock riprap channel.

6/ 10YR-24HR storm depth = 3.0' (low flow channel).

TABLE 4

ANNUAL COST - REVISED

Harquahala Valley Watershed, Arizona

(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost	Total
Floodwater Retarding Structures, Diversions, Floodways and Levees	370,700	27,400	398,100
Project Administration	31,600	--	31,600
Total	402,300	27,400	429,700

1/ Price base 19752/ 50 years at 3 $\frac{1}{2}$ % Interest

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TABLE 5 - REVISED

ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE
REDUCTION BENEFITS

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
<u>Floodwater</u>			
Crop and Pasture	295,200	107,000	188,200
Other Agriculture	102,100	38,300	63,800
Non-Agricultural	<u>26,200</u>	<u>9,400</u>	<u>16,800</u>
Subtotal	423,500	154,700	268,800
<u>Sediment</u>			
Crop and Pasture	166,100	60,200	105,900
Other Agriculture	68,100	25,500	42,600
Non-Agricultural	<u>5,700</u>	<u>2,100</u>	<u>3,600</u>
Subtotal	239,900	87,800	152,100
<u>Erosion</u>			
Floodplain Scour	5,700	0	5,700
<u>Indirect</u>	68,500	24,800	43,700
TOTAL	737,600	267,300	470,300

1/ Price Base: Current Normalized Prices (February 1974)

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TABLE 6

COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES - REVISED

HARQUAHALA WATERSHED, ARIZONA

Dollars ^{1/}

Evaluation Unit	<u>AVERAGE ANNUAL BENEFITS</u>			Average Annual Cost	Benefit Cost Ratio
	Flood Prevention Damage Reduction	Secondary	Total		
Floodwater Retarding Structures, Diversions Floodways and Levees	433,900 ^{2/}	63,600	497,500 ^{3/}	398,100	
Project Administration				31,600	
TOTAL	433,900	63,600	497,500	429,700	1.16:1.0

^{1/} Price Base-Benefits: Current Normalized Prices (February 1974)

Costs: 1975 Prices

^{2/} In addition it is estimated that land treatment measures will provide flood damage reduction benefits of \$36,400.

^{3/} Does not include unevaluated benefits accruing to the Granite Reef Aqueduct, Interstate 10, Gin Road, or to the proposed irrigation water distribution system main canals, laterals, or associated improvements.

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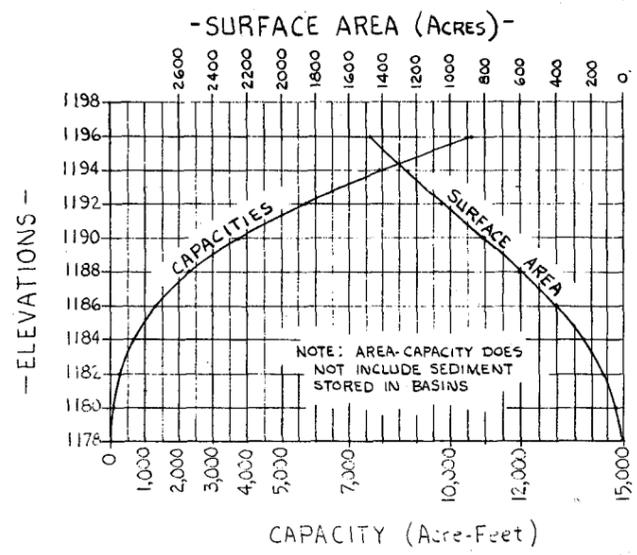
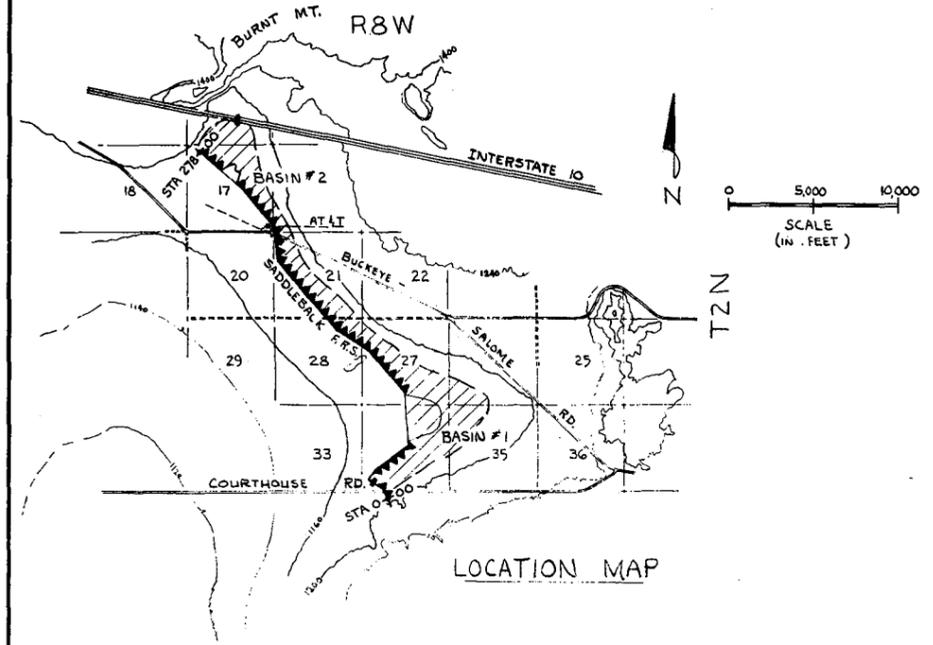
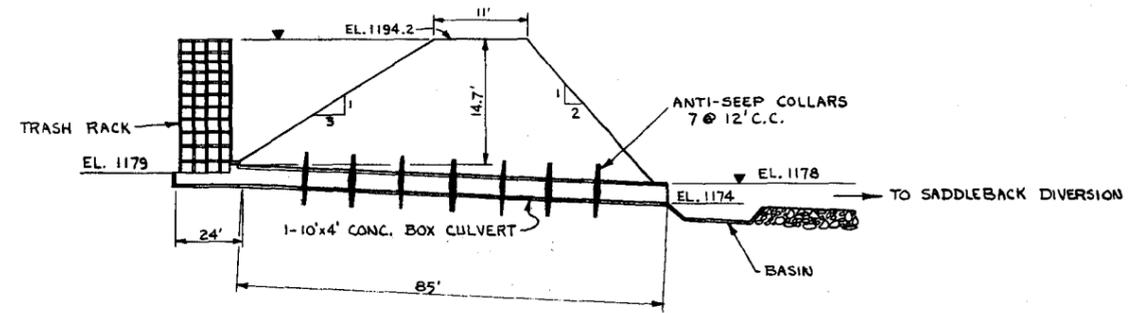
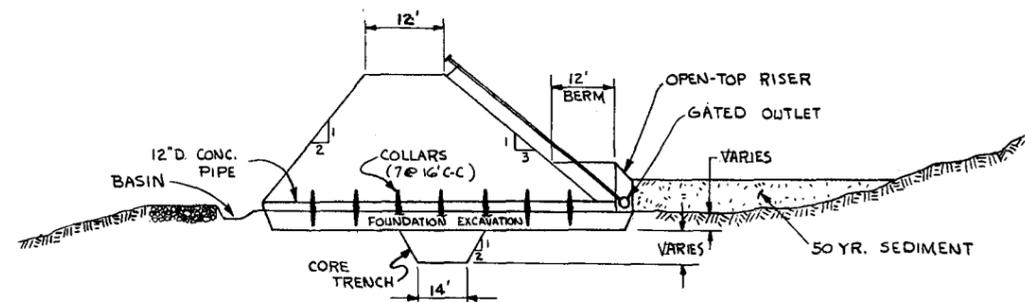
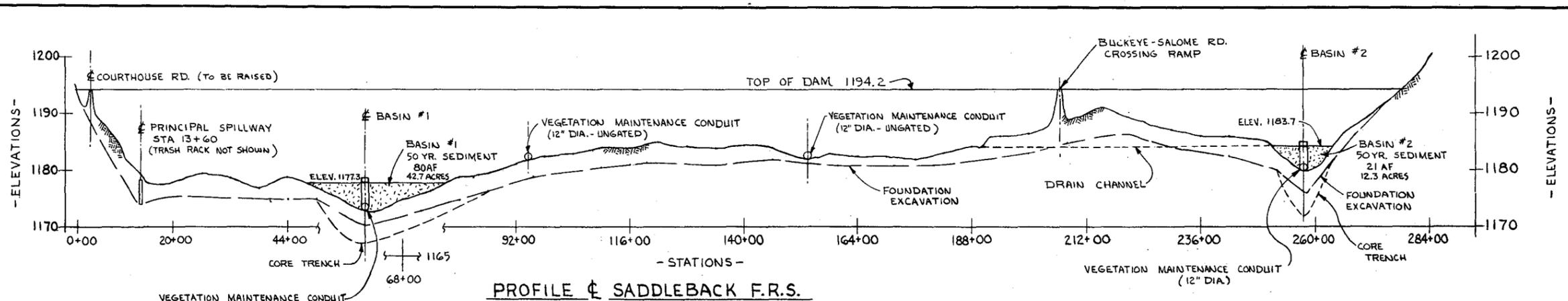
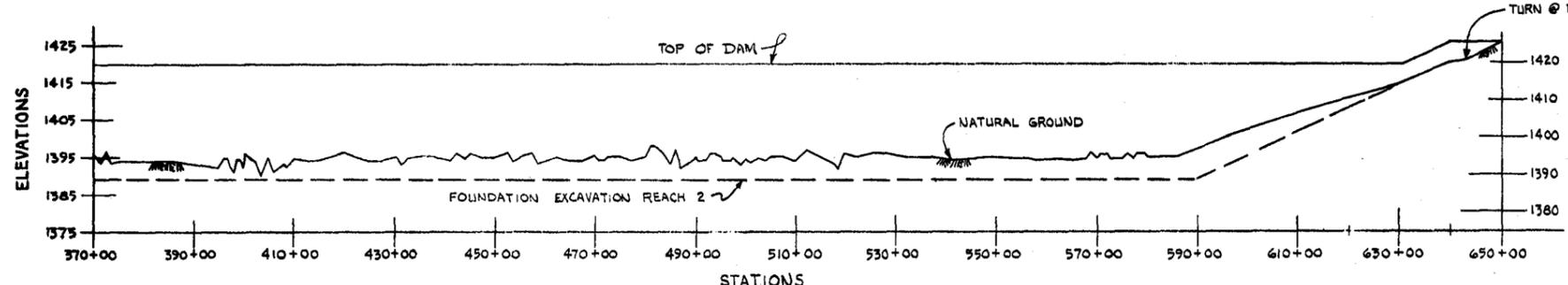
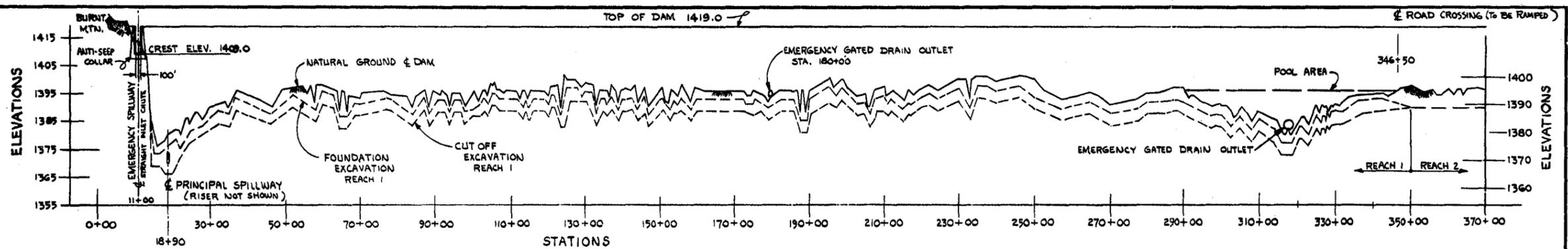
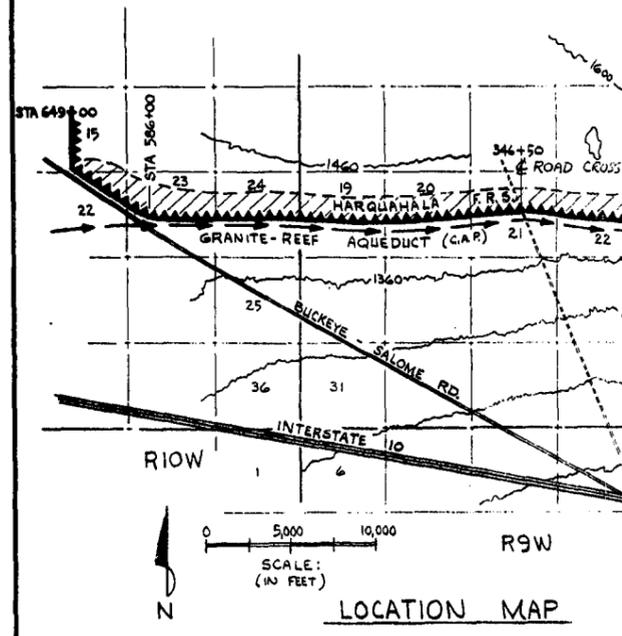
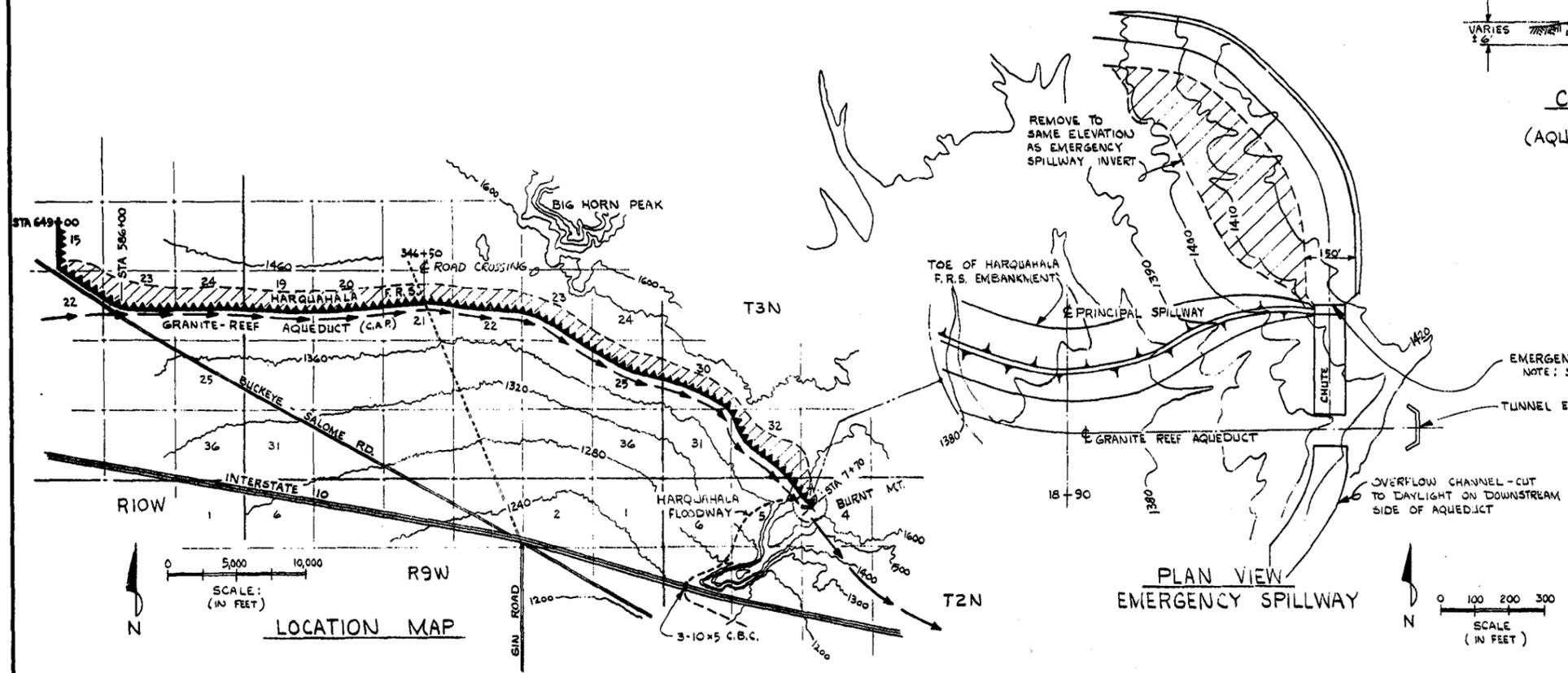
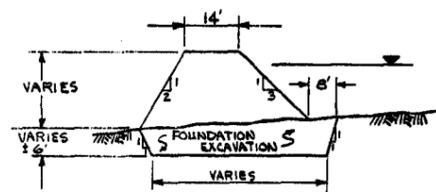


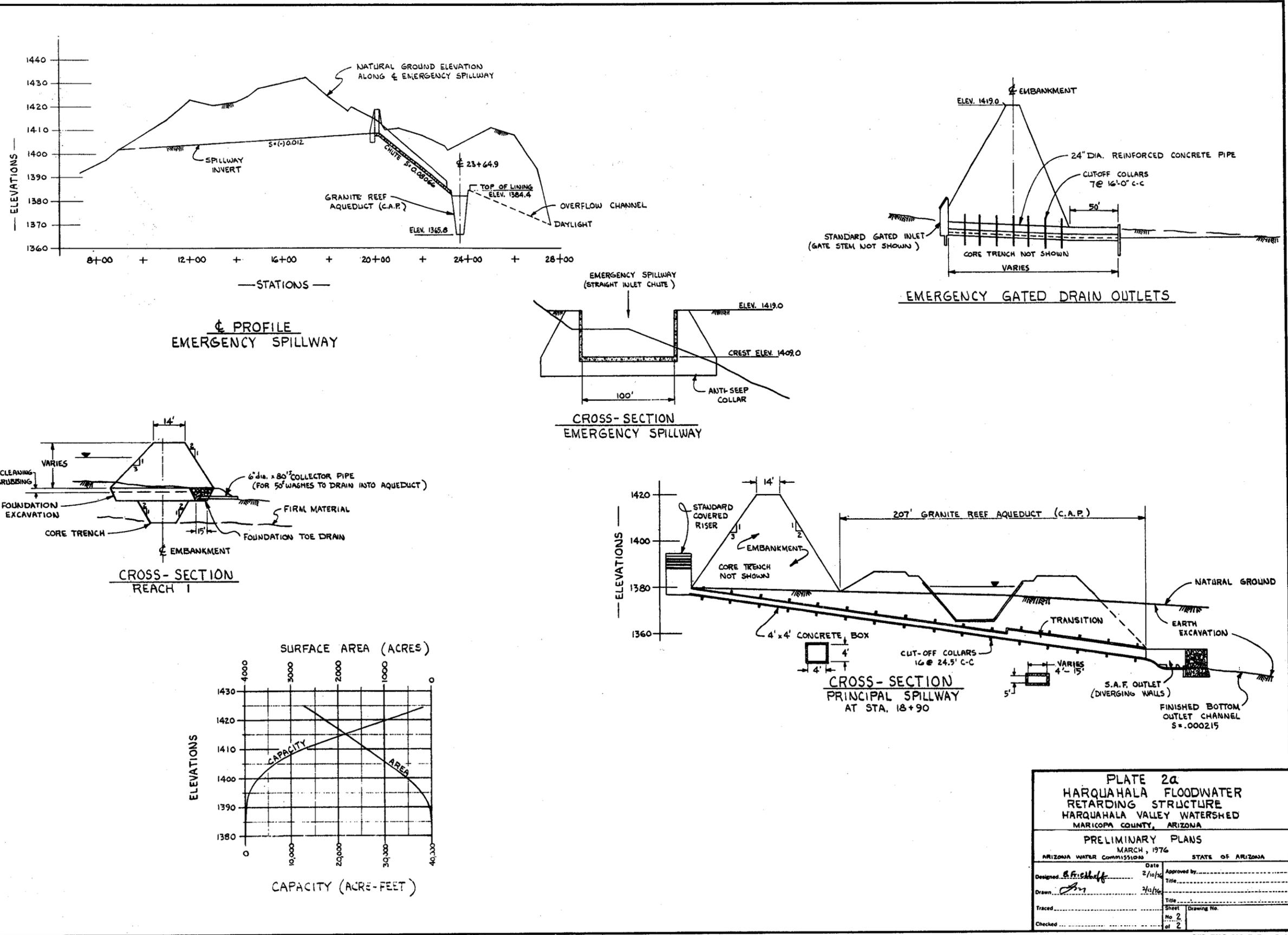
PLATE 1			
SADDLEBACK FLOODWATER RETARDING STRUCTURE			
HARQUAHALA VALLEY WATERSHED			
<small>MARICOPA COUNTY ARIZONA</small>			
PRELIMINARY PLANS			
<small>MARCH, 1976</small>			
<small>ARIZONA WATER COMMISSION</small>		<small>STATE OF ARIZONA</small>	
Designed by BJF	Date 2/10/76	Approved by _____	
Drawn by [Signature]	Date 2/12/76	Title _____	
Traced by _____	Sheet No. _____	Drawing No. _____	
Checked by _____	of _____		



PROFILE OF HARQUAHALA F.R.S.



<p>PLATE 2 HARQUAHALA FLOODWATER RETARDING STRUCTURE HARQUAHALA VALLEY, WATERSHED MARICOPA COUNTY, ARIZONA PRELIMINARY PLANS MARCH, 1976</p>	
<p>ARIZONA WATER COMMISSIONS</p>	<p>STATE OF ARIZONA</p>
<p>Designed: <i>[Signature]</i> Date: 2/10/76</p>	<p>Approved by: _____ Title: _____</p>
<p>Drawn: <i>[Signature]</i> Date: 2/12/76</p>	<p>Title: _____</p>
<p>Traced: _____</p>	<p>Sheet No. 1 Drawing No. _____</p>
<p>Checked: _____</p>	<p>of 2</p>



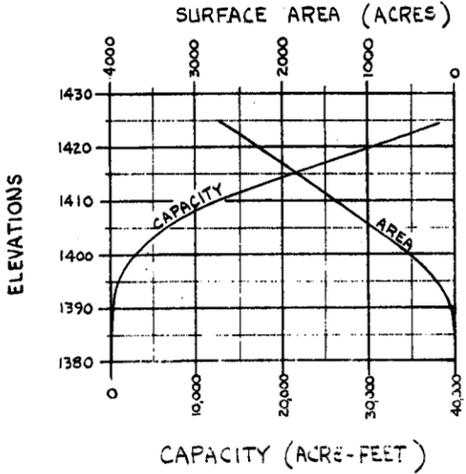
PROFILE
EMERGENCY SPILLWAY

EMERGENCY GATED DRAIN OUTLETS

CROSS-SECTION
EMERGENCY SPILLWAY

CROSS-SECTION
REACH 1

CROSS-SECTION
PRINCIPAL SPILLWAY
AT STA. 18+90



<p>PLATE 2a HARQUAHALA FLOODWATER RETARDING STRUCTURE HARQUAHALA VALLEY WATERSHED MARICOPA COUNTY, ARIZONA</p>			
<p>PRELIMINARY PLANS MARCH, 1976</p>			
ARIZONA WATER COMMISSION		STATE OF ARIZONA	
Designed <i>G.F. Schuff</i>	Date 2/10/76	Approved by	
Drawn <i>J.M.</i>	2/12/76	Title	
Traced		Sheet	No. 2
Checked		of	2

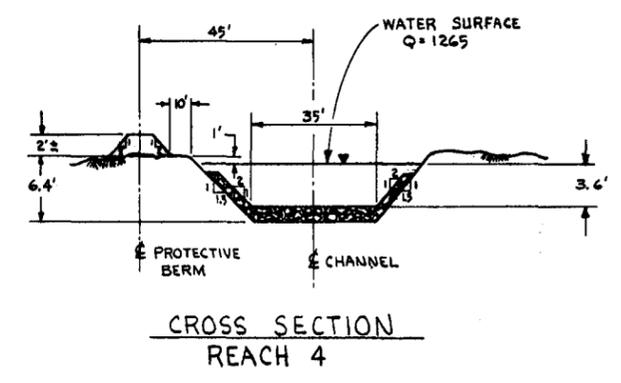
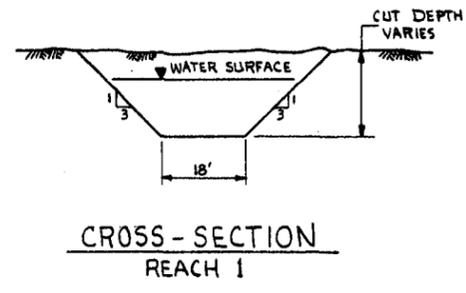
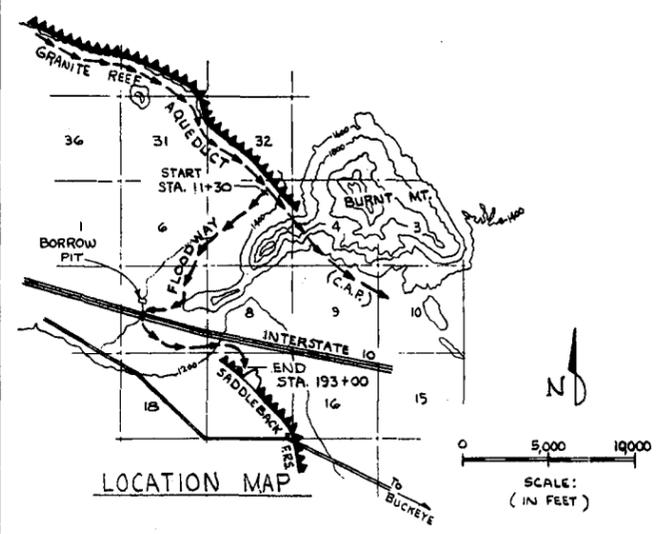
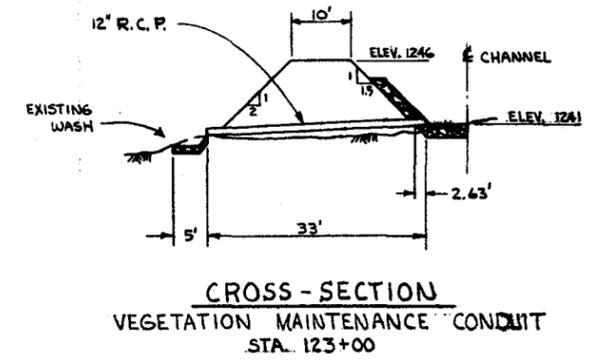
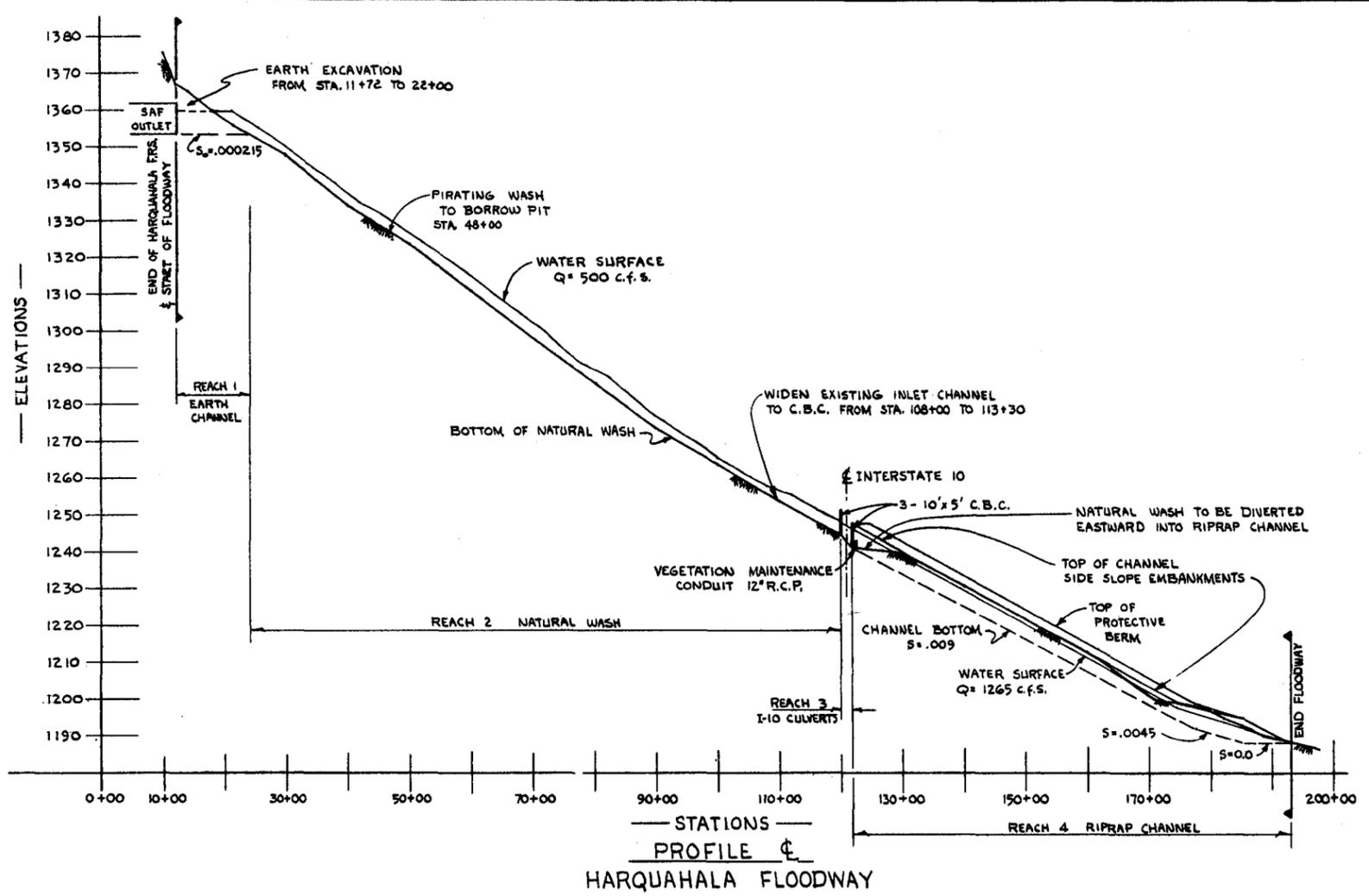
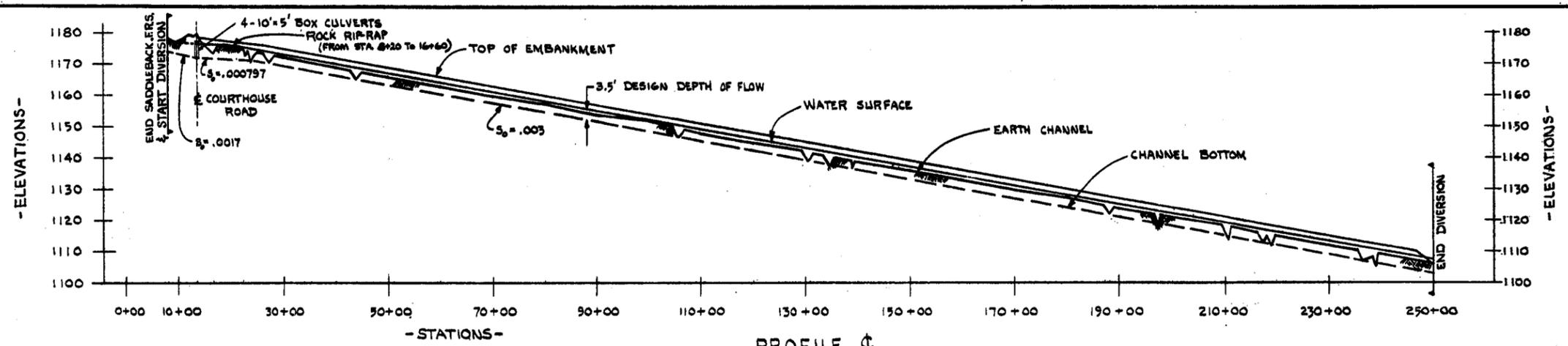


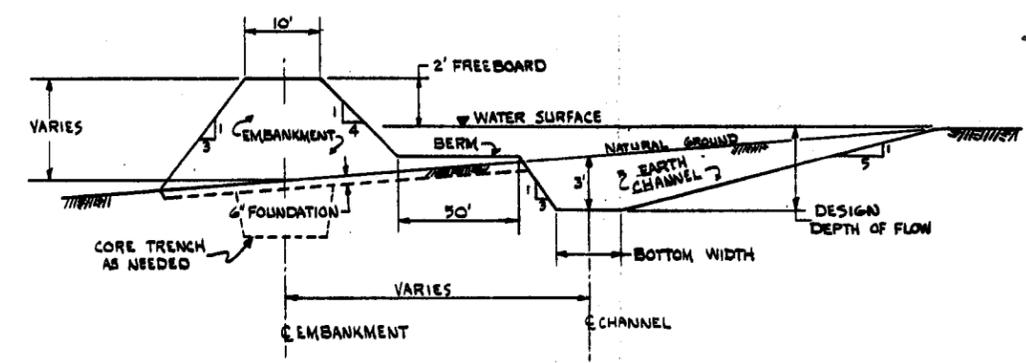
PLATE 3 HARQUAHALA FLOODWAY HARQUAHALA VALLEY WATERSHED MARICOPA COUNTY, ARIZONA			
PRELIMINARY PLANS MARCH, 1976			
ARIZONA WATER COMMISSION		STATE OF ARIZONA	
Designed: <i>B. Fendhoff</i>	Date: <i>2/10/76</i>	Approved by: _____	
Drawn: <i>Jan. M... ..</i>	Date: <i>2/12/76</i>	Title: _____	
Traced: _____	Sheet No.: _____	Drawing No.: _____	
Checked: _____	of _____		



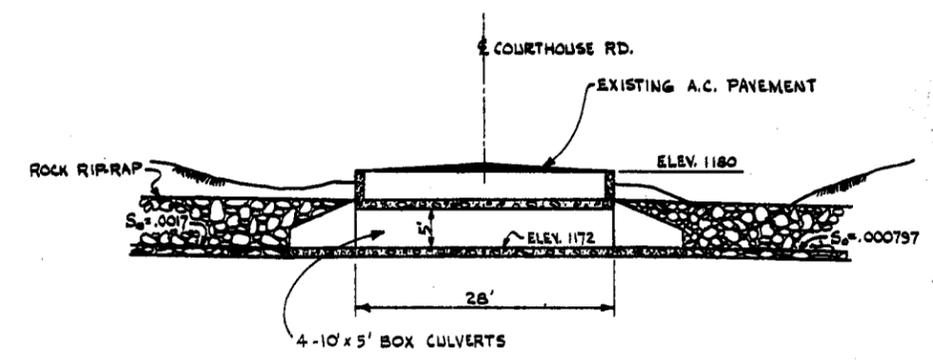
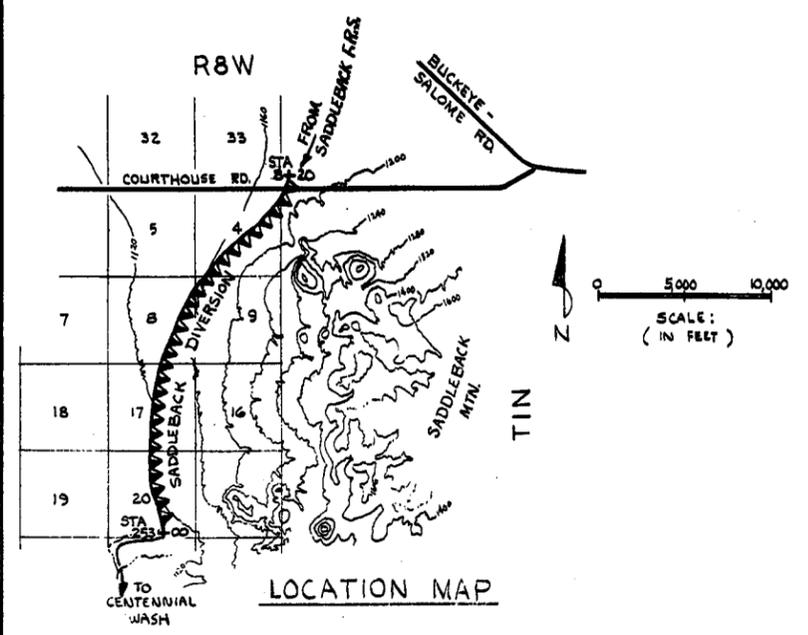
PROFILE ϕ
SADDLEBACK DIVERSION

CHANNEL DESCRIPTION

REACH	BEGINNING STATION	DRAINAGE AREA (SQ. MILES)	BOTTOM WIDTH (FT.)	DESIGN CAPACITY (C.F.S.)
1	8+20		35	810
2	13+36		4-10x5 C.B.C.	810
3	13+64		50	810
4	16+60	.302	56	857
5	23+20		56	1663
6	44+00	.861	56	1663
7	51+30		60	1762
8	59+80		66	1912
9	66+70		72	2064
10	75+60		80	2267
11	83+50	1.94	90	2524
12	94+25		110	3042
13	105+00	3.27	132	3619
14	115+34		147	3963
15	125+68	5.58	160	4361
16	136+00		184	5000
17	153+00		196	5322
18	170+00		208	5644
19	187+00		220	5966
20	204+00	8.21	232	6289
21	227+00		232	6289
22	250+00		232	6289
OUTLET	253+00	8.65	NATURAL CHANNEL	6289



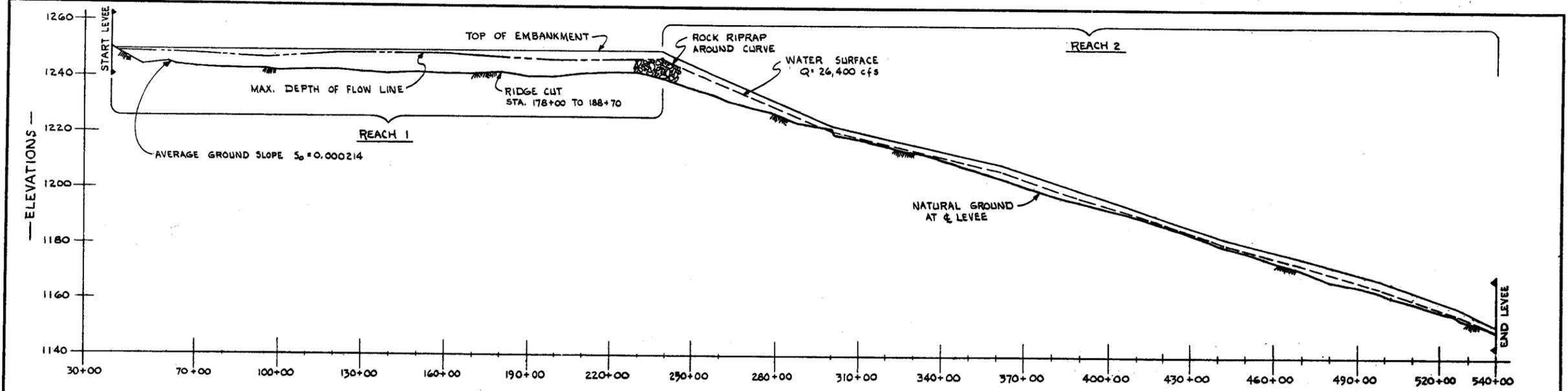
CROSS-SECTION
CHANNEL & EMBANKMENT



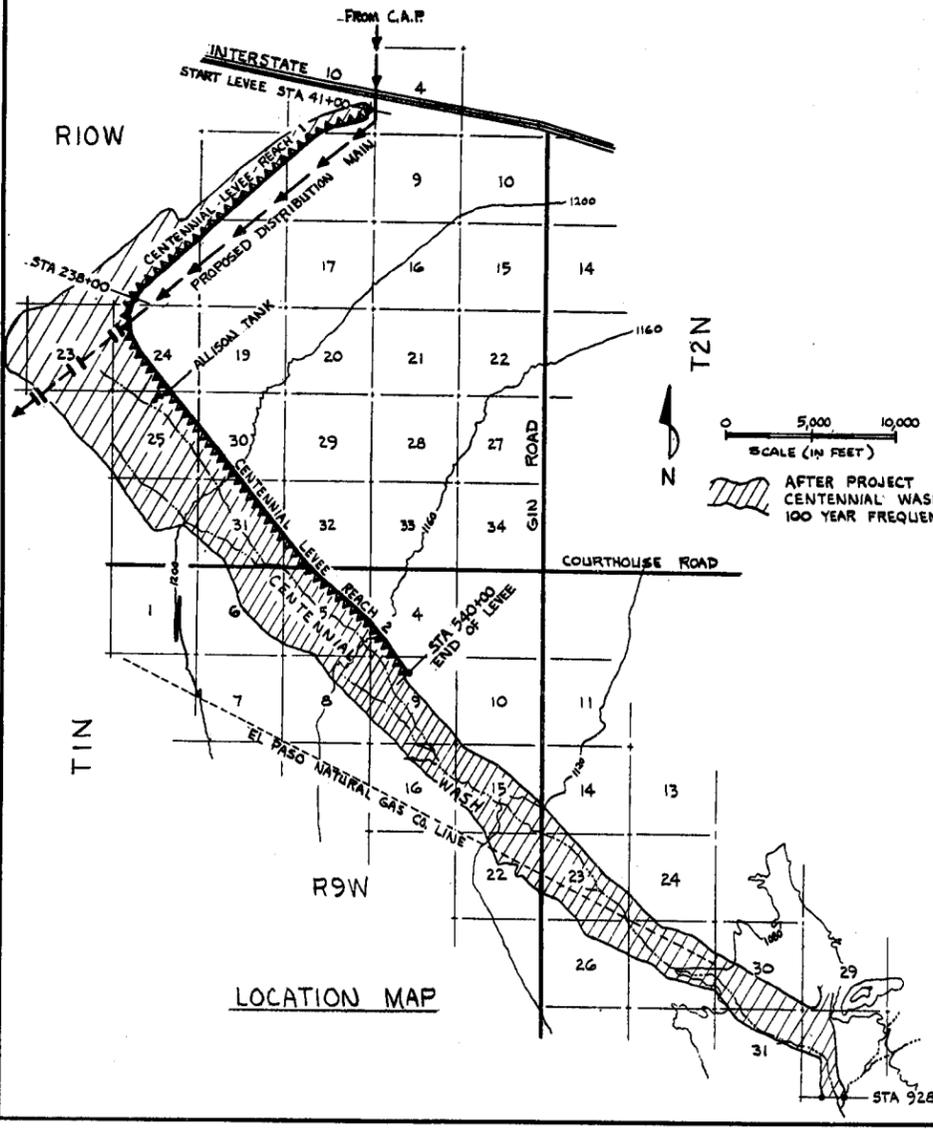
CROSS-SECTION
COURTHOUSE ROAD

PLATE 4
SADDLEBACK DIVERSION
MARQUAHALA VALLEY WATERSHED
MARICOPA & YUMA COUNTIES, ARIZONA
PRELIMINARY PLANS
MARCH, 1976
ARIZONA WATER COMMISSION STATE OF ARIZONA

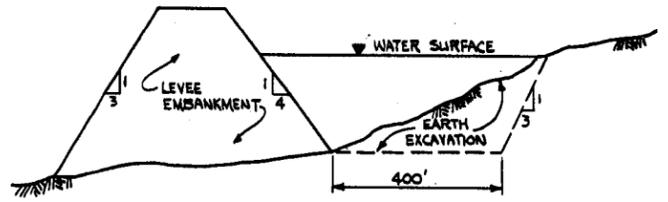
Designed by: <i>RJE</i>	Date: 2/10/76	Approved by:
Drawn: <i>LM</i>	Date: 2/18/76	Title:
Traced:	Sheet:	Drawing No.:
Checked:	No.:	of:



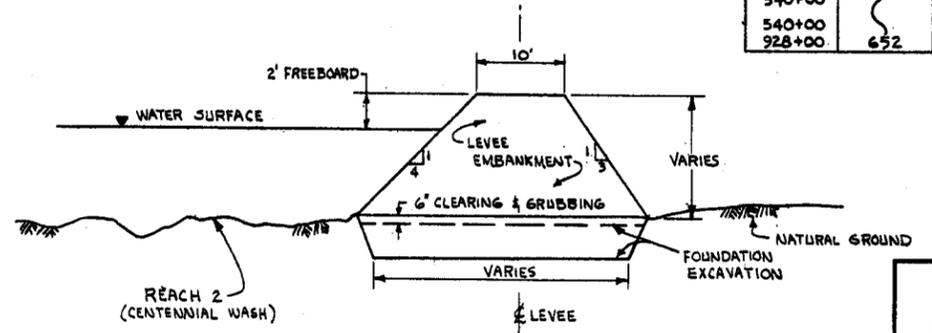
STATIONS
PROFILE $\frac{1}{2}$
CENTENNIAL LEVEE



LOCATION MAP



CROSS-SECTION
RIDGE CUT
(STATION 178+00 TO 188+70)



CROSS-SECTION
LEVEE EMBANKMENT
(TYPICAL)

LEVEE DESCRIPTION

STATION	D. A. (sq. miles)	REQUIRED CAPACITY (cfs)	VELOCITY (f.p.s.)	NATURAL GRADE (ft. sec.)
REACH 1				
41+00	0	0	0	.000214
70+00	2.44	854	1.28	}
95+00	6.08	1979	.88	
120+00	10.18	3562	1.21	
160+00	14.91	5218	1.24	
180+00	15.57	5450	1.24	
200+00	16.24	5683	1.21	
238+00	20.99	7539	1.50	
REACH 2				
238+00	652	26,400		.000214
300+00			3.56	.0039
331+00			2.82	.0021
361+50			3.50	.0025
388+50			3.12	.0028
416+00			3.61	.0034
448+50			3.34	.0031
469+00			3.22	.0026
498+00			3.47	.0031
525+00			3.48	.0034
540+00			3.66	.0032
928+00				NATURAL WASH

PLATE 5
CENTENNIAL LEVEE
HARQUAHALA VALLEY WATERSHED
MARICOPA COUNTY, ARIZONA

PRELIMINARY PLANS
MARCH, 1976
ARIZONA WATER COMMISSION STATE OF ARIZONA

Designed by B. Frisvold Date 2/10/76 Approved by _____
 Drawn by L. M. ... Date 2/10/76 Title _____
 Traced _____ Title _____
 Checked _____ No. _____ Drawing No. _____

PROJECT MAP Harquahala Valley Watershed

Maricopa & Yuma Counties, Arizona

