White Tanks Dam No.1

Engineering Report

390-11-12-15 1983

1/20/47

WHITE TANKS DIVERSION DAM #1

DETAILED ENGINEERING REPORT

The White Tanks Diversion Dam #1, sponsored by the Agua Fria Soil Conservation District, is located near the base of the White Tanks mountains in Sections 4, 8, and 9, T. 2N, R. 2W, S.R.B. & M., about seven miles west of Litchfield Park, Maricopa County, Arizona.

In order to arrive at the correct solution of the flood control problem in this area, it was necessary to carry out extensive and detailed investigations of the entire watershed prior to the actual design. Mr. Fletcher Short, engineering specialist from Albuquerque, New Mexico was in charge of this phase of the work. Drainage areas, main waterways, and existing controls were determined and located from aerial photographs of the affected area.

The total drainage area to be controlled was determined to be 245 square miles, of which 195 square miles originated in the Wickenburg mountains and could be controlled by a dam across the Trilby Wash. 29 square miles originating in the White Tanks mountains to be controlled by a dam across a small local wash; and 21 square miles originating in the White Tanks mountains to be controlled by a dam across a small local wash.

Since all streams in the area are of intermittent flow, it was necessary to estimate the expected runoff. This was carried out by J. H. Dorrah of the Regional office. The estimate was based on a rainfall intensity of 1.4 inches over a period of 24 hours, or an anticipated total runoff of 19,500 acre feet.

After further investigation of the dam sites proper, it was decided to make the reservoir capacity of Dam #1, 8,000 feet, Dam #2, 2,500 acre feet and Dam #3, 9,000 acre feet. These three reservoirs will be connected by controlled waterways by which excess water in Reservoir #3 can be diverted into Reservoirs #1 and #2. Adequate spillway capacity is being provided at all three sites.

Soils investigations are being conducted by Rey S. Decker of the Regional office for determining depth of cut off trench, location of borrow pits, selection of materials, degree of capaction, etc.

His report will be made a part of this report, and the results of the tests will be incorporated in the construction of the job.

Final location of Dam #1, and the reservoir capacity were determined from a topographic map of the site made under the direction of Mr. Fletcher Short while he was conducting the preliminary investigations. The location called for an earthfill dyke 10,560 feet long and 40 feet high at the maximum section. In studying the loading for an outlet conduit under this height of fill, the experiments carried out at the University of Iowa on "External Loads on Closed Conduits," proved to be most helpful. A resume of this method may be found in Hardesty's "Handbook of Culvert and Drainge Practice," pages 18 to 29, inclusive. Figure 18, on page 28 in the handbook, gives values of the coefficient C_c in the formula for load per unit of length - $W_c = C_c W B_c^2$. In our loading determinations, incomplete ditch conditions were assumed.

Capacity for the outlet structure was governed by the capacity of the main canal of the Beardsley Project, into which the outlet will discharge, and was found to be 200 c.f.s. A reinforced concrete culvert with 3.5'x3.5' opening, controlled by a vertical lift sluice gate, gives the required capacity at the average operating head.

Our design is based on the method of analysis and design given in Section II of the "Concrete Culverts and Conduits" bulletin issued by the Portland Cement Association. Table IV, page 31, which gives coefficients for moment, thrust and shear at critical sections, was used in our computations.

The spillway is designed for a 200 foot base width and a discharge capacity of 781 c.f.s. at a depth of one foot. Since Dam #1 has a much larger reservoir capacity than is required for the drainage area, this spillway capacity is more than adequate. An emergency spillway may be constructed at a later date if deemed necessary when designs of the other two dams are complete.

Detailed design of this job was made by me in the Regional office. All original computations are on file in the Regional office, copies of which should be attached to and made a part of this report.

Mr. W. W. Lane, secretary of the Board of Supervisors for the Agua Fria Soil Conservation District and a prominent engineer in the west, has accepted the plans for the project and will be in charge of the job during construction. He has agreed that the District will furnish a survey party and inspector for the job, and only periodic inspection and laboratory control will be required of S. C. S. personnel. It is expected that work will begin on the job in the very near future.

Respectfully submitted

James F. Ellis, Jr.
Engineering Specialist

AGUA FRIA SOIL CONSERVATION DISTRICT

PHOENIX, ARIZONA

PLANS and SPECIFICATIONS

FOR

CONSTRUCTION OF THE

WHITE TANKS DETENTION DAM NO. 1

I N D E X

SECTION I

GENERAL PROVISIONS

SECTION TWO

SPECIAL PROVISIONS

8. Timber for Bridge

9. Permanent Equipment

10. Spillway Channel

11. Irrigation Ditch on Berm

12. Finishing and Cleanup Work

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Whenever in these specifications or any document or instrument where these specifications govern, the following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

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The Agua Fria Soil Conservation District, or its duly authorized representative.

b. ENGINEER

Mr. W. W. Lane, Chairman of the Board of Supervisors of the Agua Fria Soil Conservation District, or his duly authorized representative.

c. PLANS

The official plans which are shown on Sheets No. 1 to 4, entitled: White Tanks Diversion Dam #1, and any supplemental drawings approved by the Engineer.

d. SPECIFICATIONS

The directions, provisions, and requirements contained herein as supplemental by such special provisions as may be necessary, pertaining to the method and manner of performing the work, or to the quantities and qualities of materials furnished. Special provisions or specific clauses setting forth conditions or requirements peculiar to the project under consideration, and covering work or materials involved in the proposal but not satisfactorily covered by the general provisions.

2. AUTHORITY OF ENGINEER:

The Engineer shall decide all questions which may arise as to the quality or acceptability of materials and work performed and as to the manner of performance; all questions which may arise as to the interpretation of the plans and specifications.

No deviation shall be made from any plan or drawing after the same has been

approved by the Engineer, except by his direction. He shall have authority to cause defective work to be remedied, or removed and replaced. Deviations from the approved plans, working drawings and specifications as may be required by the exigencies of construction, will in all cases be determined by the Engineer and authorized in writing.

3. PLANS

The approved plans may be supplemented by such working drawings to be furnished by the District or the Engineer as are necessary to adequately control the work. All authorized alterations affecting the requirements and information given on the approved plans shall be in writing. Should it appear that the work to be done or any of the matters relative thereto are not sufficiently detailed or explained in the plans or specifications, the Company shall apply to the Engineer for such further explanations as may be necessary and shall conform to the same. In the event of any discrepancy between any drawing and the figures written thereon, the figures will be taken as correct.

4. SUPERINTENDENCE

Whenever the contractor is not present on any part of the work where it may be desired to give direction, orders will be given by the Engineer in writing, and shall be received and obeyed by the superintendant or foreman who may have charge of the particular work in reference to which the orders are given.

5. INSPECTION

The Engineer shall at all times have access to the work during its construction, and shall be furnished with every reasonable facility for ascertaining that the stock and materials used and employed, and the workmanship and methods of construction, are in accordance with the requirements and intentions of these specifications.

6. ACCIDENT PREVENTION AND SAFETY REGULATIONS

The District shall at all times exercise reasonable precautions for the safety of employees on the work and shall comply with all applicable provisions of Federal and State safety laws and construction codes.

7. BENCH MARKS AND SURVEY STAKES

The work to be done will be staked out by the Engineer. Bench marks and survey stakes shall be preserved as far as possible, but in case of their destruction or removal they will be replaced by the Engineer.

8. LOCATION

The site of the proposed work is located in Section 4, 8 and 9, T 2N, R 2W, S.R.B. & M., which is about 20 miles west of Phoenix, Arizona.

SECTION TWO

SPECIAL PROVISIONS

1. CLEARING

The area to be occupied by the dam, the surfaces of borrow pits, spillway, and structure sites shall be cleared of all trees, stumps, roots, brush and rubbish; such materials as are combustible may be burned or otherwise disposed of in a satisfactory manner. All burning shall be so thorough that the materials are reduced to ashes. No logs, branches or charred pieces shall be permitted to remain.

2. STRIPPING FOR EMBANKMENT

The entire area of the dam shall be stripped or excavated to a sufficient depth to remove all materials not suitable for the foundation. The unsuitable materials to be removed shall include all rubbish, vegetable matter of every kind, roots, and all other perishable or objectionable materials which might interfere with bond to foundation or with the proper compacting of the materials in the embankment. The stripped material may be placed along the downstream toe for support.

3. PREPARATION OF FOUNDATION:

After all necessary stripping and excavation have been completed, the foundation area shall be lightly plowed or scarified lengthwise to the dam and then moistened in order to provide proper contact between the foundations and the embankment, and to assure the surface materials of the foundation to be as compact and well bonded with the first layer of the fill as is specified for the subsequent layers of the fill.

4. BONDING TRENCH

A bonding or cut-off trench with side slopes of approximately 1:1 and a bottom width of not less than 10 feet, shall be excavated beneath the center line of the dam the full length thereof. The depth of the cut-off trench shall be determined by the engineer in charge and depending upon soil conditions encountered. The minimum depth however, at maximum section of dam shall be 6 feet. The minimum depths may progressively decrease in ratio to height of dam at any station to a minimum of 3 feet at the ends of the dam.

5. BORROW PITS

All materials required for the construction of the dam embankment shall be taken from the borrow pits. These borrow pits shall be located where a soils survey and laboratory tests indicate the best material is to be found but they shall be at a reasonable distance of haul from the dam. Should any borrow pits be located adjacent to the dam, a berm of not less than 100 feet shall be left between the toe of the dam and the upper edge of the borrow pit, with provisions for a side slope not steeper than 5 to 1 to a the bottom of the borrow pit. In order to avoid erosion and the formation of channels, borrow pits shall be discontinuous and separated by undisturbed sections of earth about 30 feet long measured at ground surface. No individual

borrow pit shall be more than 300 feet in its longest dimension.

6. PLACING OF EMBANKMENT

The earth-fill, including the fill in the cut-off or bonding trench under the dam, shall consist of a mixture of the clay, sand and gravel available from borrow pits in the vicinity of the work. Uniform graduation of material shall be accomplished insofar as practicable during the operation of excavation and loading at borrow pits.

No earth-fill material shall be placed in the dam structure until the foundation has been suitably prepared; such preparation of foundation to be kept well ahead of filling operations at all times. The distribution and gradation of materials throughout the earth-fill shall be such that the embankment will be free from pockets, streaks, or layers of material differing materially in texture or gradation from the surrounding material. Successive loads of material shall be so dumped on the embankment as to produce the best practicable distribution of the material to the end that the cut off trench and the upstream two-thirds of the dam, shall be constructed of the most impervious materials, such as clay loam, or a mixture of clay and sand and the downstream one-third of more pervious material, such as a smaller amount of clay and a greater amount of sand and gravel. No stones having maximum dimensions of more than 4 inches shall be placed in the embankment. The fill material shall be placed in the embankment and cut-off trench in continuous horizontal layers not more than 6 inches thick after rolling. Fill material may be dumped in windrows and spread by blades or road patrols. Sheep-foot rollers shall be used for compacting the earth fill. The fill material shall be rolled until it attains a uniform density satisfactory to the Engineer. The material in each layer while being compacted by rolling shall contain within practicable limits, the optimum amount of water for compacting purposes, and this optimum water content shall be uniformly distributed throughout the layer. Harrowing or other working of the material may be required to produce the required uniformity of water content.

All portions of test-pit and cut-off trench excavation within the area to be covered by the embankment shall be filled with the more impervious material as specified for the upstream two thirds of the embankment and compacted in the same manner. Earth fill in test pits and portions of the earth fill about the outlet conduit and other structural works, which cannot be properly compacted by the use of rolling equipment shall be thoroughly compacted by hand tools, or by the use of mechanical tampers. The degree of compaction for such portions of the earth fill shall be equivalent to or greater than that obtained by moistening and rolling, as specified for other portions of the earth fill. No puddling shall be permitted in any part of the fill, or around the outlet conduit. The upper 12 inches of the crest of the dam embankment shall be constructed of selected gravelly material or selected fine-rock material, and the crest be finished with a rounded crown 6 inches high at center.

7. CONCRETE

Concrete shall be composed of cement, sand, gravel or broken rock, and water, all well mixed and brought to the proper consistency. The exact proportions will be such as to produce a concrete having suitable workability, density, impermeability and a compressive strength of 2800 lbs. per square inch at 28 days, without the use of an excessive amount of cement. In general, it is contemplated that 1 part, by volume, of cement shall be used with 2 parts, by volume, of sand, and 3-1/2 parts, by volume, of gravel having a maximum size of 2 inches. The water cement rationshall not exceed 7-1/2 U. S. gallons of water to a sack of cement weighing 94 pounds.

a. COMPOSITION:

Cement: Cement shall comply with the Government specifications for Portland Cement.

Water: The water shall be clean and free from objectionable quantities of silt, organic matter, alkali, salts and other impurities.

Sand: Sand for concrete may be obtained from natural deposits or may be made by crushing suitable rock. The sand particles shall be hard, dense, durable, uncoated, non-organic rock fragments, well graded from coarse to fine, all fragments shall pass a 1/4 inch square or a 5/16 inch round opening. The sand must be free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam, mica or other deleterious substances.

Gravel: Gravel or broken rock for concrete must be hard dense, durable, sound uncoated rock fragments free from injurious amounts of soft friable, thin, elongated, or laminated pieces, alkali, organic, or other deleterious matter. The gravel shall all pass through a screen having 2-inch square or 2-1/4 inch round openings and shall be retained on a screen having 1/4-inch square or 5/16-inch round openings. It shall be well graded from the maximum to the minimum sizes.

Reinforcing Steel:
Deformed steel bars of intermediate grade and with a safe working tensile strength of 18,000 pounds per square inch, shall be placed in the concrete wherever shown on the drawings or otherwise prescribed. The steel shall be so secured in position that it will not be displaced during the depositing of the concrete. The reinforcement, at the time the concrete is placed, shall be free from rust scale or other coating that is injurious or will destroy or reduce the bond. All bars shall be bent cold.

b. PREPARATION OF PLACE OF DEPOSIT:

Before placing the concrete, all debris and water shall be removed from the places to be occupied by the concrete, forms shall be thoroughly wetted or oiled and the reinforcing thoroughly cleaned of everything that will reduce the bond.

c. MIXING OF CONCRETE:

The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturer and mixing shall be continued for at least 1-1/2 minutes after all materials are in the mixer.

Ready mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the "Standard Specifications for Ready Mixed Concrete," (A.S.T.M. Serial Designation: C94-38).

d. CONVEYING:

Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of the materials.

e. DEPOSITING:

Concrete shall be deposited in approximately horizontal layers, as nearly as practicable in its final position to avoid segregation, due to rehandling or flowing. No concrete that has partially set or been contaminated by foreign material shall be deposited on the work, nor shall retempered concrete be used. When concreting is once started, it shall be carried on as a continuous operation until the placing of the panel or section is completed. The top surface shall be generally level. When construction joints are necessary, they shall be made in accordance with the design as shown on drawing No. Supplemental #4 All concrete shall be thoroughly compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement and into the corners of the forms.

f. CURING: Concrete shall be maintained in a moist condition for at least 5 days after placement, or for longer periods as directed by the Engineer.

g. FORMS: Forms shall conform to the shape, lines and dimensions of the members as called for on the plans. They shall be of sufficient strength and rigidity and properly braced to hold the concrete and to withstand the necessary pressure, ramming and vibration without deflection from the prescribed lines. Wooden forms to be used more than once shall be maintained in serviceable condition and thoroughly cleaned before being reused. Forms shall be removed in such a manner as to insure the complete safety of the structure. In no case shall the forms be removed until the members have acquired sufficient strength to support safely their weight and the load thereon.

h. FINISHING: The surface finish of all formed concrete shall be left as formed. No cement coating or plastering to cover defective finish shall be allowed. Honey combing shall be brought flush with the sur-

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face and finished by means of rubbing in a 1:2 cement mortar with a wooden trowel, after first thoroughly wetting the original surface. Honeycombing of concrete shall not exceed 1 percent of the formed surface.

8. TIMBER FOR BRIDGE

The timber for the bridge from the dam to gate tower shall be of a good grade of pine or Douglas fir which will meet the approval of the Engineer with respect to strength, weight, freedom from decay, and other defects which would affect its permanence, after construction the bridge shall be treated with at least 2 coats of a good preservative paint.

9. PERMANENT EQUIPMENT

The outlet gate shall be the Hardesty Model 50-10, bronze, mounted, equipped with a Model J-12:1 pedestal lift, or equal, as shown on Sheet 4 of 4. The outlet gate, trashrack, pedestal lift and bridge shall be built into the dam in a workmanlike manner, as shown on the plans or according to directions by the Engineer. Any changes or adjustments required shall be made to secure satisfactory operation. All exposed metal surfaces shall be given two coats of field paint as directed by the Engineer. Vent pipe to be 4" galvanized iron pipe.

10. SPILLWAY CHANNEL

The spillway channel shall be constructed according to lines and grades shown on sheet 1 of 4. Riprap on side slopes of the spillway channel shall be placed as directed by the Engineer.

11. IRRIGATION DITCH ON BERM

A lined irrigation ditch will be constructed on a berm along the downstream face of the dam extending from Sta. 25 + 40 to Sta. 89 + 00. Lining to be concrete or gunite.

12. FINISHING AND CLEANUP WORK:

The job and all parts thereof shall be finished in a neat and workmanlike manner. The site of work and construction space in the vicinity shall be cleared of all rubbish, discarded construction material and the like, and the premises left in a safe and orderly condition.

AGUA FRIA SOIL CONSERVATION DISTRICT

PHOENIX, ARIZONA

PLANS and SPECIFICATIONS

FOR

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WHITE TANKS DETENTION DAM NO. 1

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b. PREPARATION OF PLACE OF DEPOSIT:

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The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturer and mixing shall be continued for at least 1-1/2 minutes after all materials are in the mixer.

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f. CURING: Concrete shall be maintained in a moist condition for at least 5 days after placement, or for longer periods as directed by the Engineer.

g. FORMS: Forms shall conform to the shape, lines and dimensions of the members as called for on the plans. They shall be of sufficient strength and rigidity and properly braced to hold the concrete and to withstand the necessary pressure, ramming and vibration without deflection from the prescribed lines. Wooden forms to be used more than once shall be maintained in serviceable condition and thoroughly cleaned before being reused. Forms shall be removed in such a manner as to insure the complete safety of the structure. In no case shall the forms be removed until the members have acquired sufficient strength to support safely their weight and the load thereon.

h. FINISHING: The surface finish of all formed concrete shall be left as formed. No cement coating or plastering to cover defective finish shall be allowed. Honey combing shall be brought flush with the sur-

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face and finished by means of rubbing in a 1:2 cement mortar with a wooden trowel, after first thoroughly wetting the original surface. Honeycombing of concrete shall not exceed 1 percent of the formed surface.

8. TIMBER FOR BRIDGE

The timber for the bridge from the dam to gate tower shall be of a good grade of pine or Douglas fir which will meet the approval of the Engineer with respect to strength, weight, freedom from decay, and other defects which would affect its permanence, after construction the bridge shall be treated with at least 2 coats of a good preservative paint.

9. PERMANENT EQUIPMENT

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10. SPILLWAY CHANNEL

The spillway channel shall be constructed according to lines and grades shown on sheet 1 of 4. Riprap on side slopes of the spillway channel shall be placed as directed by the Engineer.

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FOR

CONSTRUCTION OF THE

WHITE TANKS DETENTION DAM NO. 1

I N D E X

SECTION I

GENERAL PROVISIONS

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SPECIAL PROVISIONS

Specifications for the Construction of the White Tanks Detention Dam No. 1, and Appurtenant Structures for the Agua Fria Soil Conservation District.

SECTION I

GENERAL PROVISIONS

1. DEFINITION OF TERMS:

Whenever in these specifications or any document or instrument where these specifications govern, the following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

a. DISTRICT

The Agua Fria Soil Conservation District, or its duly authorized representative.

b. ENGINEER

Mr. W. W. Lane, Chairman of the Board of Supervisors of the Agua Fria Soil Conservation District, or his duly authorized representative.

c. PLANS

The official plans which are shown on Sheets No. 1 to 4, entitled: White Tanks Diversion Dam #1, and any supplemental drawings approved by the Engineer.

d. SPECIFICATIONS

The directions, provisions, and requirements contained herein as supplemental by such special provisions as may be necessary, pertaining to the method and manner of performing the work, or to the quantities and qualities of materials furnished. Special provisions or specific clauses setting forth conditions or requirements peculiar to the project under consideration, and covering work or materials involved in the proposal but not satisfactorily covered by the general provisions.

2. AUTHORITY OF ENGINEER:

The Engineer shall decide all questions which may arise as to the quality or acceptability of materials and work performed and as to the manner of performance; all questions which may arise as to the interpretation of the plans and specifications.

No deviation shall be made from any plan or drawing after the same has been

approved by the Engineer, except by his direction. He shall have authority to cause defective work to be remedied, or removed and replaced. Deviations from the approved plans, working drawings and specifications as may be required by the exigencies of construction, will in all cases be determined by the Engineer and authorized in writing.

3. PLANS

The approved plans may be supplemented by such working drawings to be furnished by the District or the Engineer as are necessary to adequately control the work. All authorized alterations affecting the requirements and information given on the approved plans shall be in writing. Should it appear that the work to be done or any of the matters relative thereto are not sufficiently detailed or explained in the plans or specifications, the Company shall apply to the Engineer for such further explanations as may be necessary and shall conform to the same. In the event of any discrepancy between any drawing and the figures written thereon, the figures will be taken as correct.

4. SUPERINTENDENCE

Whenever the contractor is not present on any part of the work where it may be desired to give direction, orders will be given by the Engineer in writing, and shall be received and obeyed by the superintendant or foreman who may have charge of the particular work in reference to which the orders are given.

5. INSPECTION

The Engineer shall at all times have access to the work during its construction, and shall be furnished with every reasonable facility for ascertaining that the stock and materials used and employed, and the workmanship and methods of construction, are in accordance with the requirements and intentions of these specifications.

6. ACCIDENT PREVENTION AND SAFETY REGULATIONS

The District shall at all times exercise reasonable precautions for the safety of employees on the work and shall comply with all applicable provisions of Federal and State safety laws and construction codes.

7. BENCH MARKS AND SURVEY STAKES

The work to be done will be staked out by the Engineer. Bench marks and survey stakes shall be preserved as far as possible, but in case of their destruction or removal they will be replaced by the Engineer.

8. LOCATION

The site of the proposed work is located in Section 4, 8 and 9, T 2N, R 2W, S.R.B. & M., which is about 20 miles west of Phoenix, Arizona.

SECTION TWO

SPECIAL PROVISIONS

1. CLEARING

The area to be occupied by the dam, the surfaces of borrow pits, spillway, and structure sites shall be cleared of all trees, stumps, roots, brush and rubbish; such materials as are combustible may be burned or otherwise disposed of in a satisfactory manner. All burning shall be so thorough that the materials are reduced to ashes. No logs, branches or charred pieces shall be permitted to remain.

2. STRIPPING FOR EMBANKMENT

The entire area of the dam shall be stripped or excavated to a sufficient depth to remove all materials not suitable for the foundation. The unsuitable materials to be removed shall include all rubbish, vegetable matter of every kind, roots, and all other perishable or objectionable materials which might interfere with bond to foundation or with the proper compacting of the materials in the embankment. The stripped material may be placed along the downstream toe for support.

3. PREPARATION OF FOUNDATION:

After all necessary stripping and excavation have been completed, the foundation area shall be lightly plowed or scarified lengthwise to the dam and then moistened in order to provide proper contact between the foundations and the embankment, and to assure the surface materials of the foundation to be as compact and well bonded with the first layer of the fill as is specified for the subsequent layers of the fill.

4. BONDING TRENCH

A bonding or cut-off trench with side slopes of approximately 1:1 and a bottom width of not less than 10 feet, shall be excavated beneath the center line of the dam the full length thereof. The depth of the cut-off trench shall be determined by the engineer in charge and depending upon soil conditions encountered. The minimum depth however, at maximum section of dam shall be 6 feet. The minimum depths may progressively decrease in ratio to height of dam at any station to a minimum of 3 feet at the ends of the dam.

5. BORROW PITS

All materials required for the construction of the dam embankment shall be taken from the borrow pits. These borrow pits shall be located where a soils survey and laboratory tests indicate the best material is to be found but they shall be at a reasonable distance of haul from the dam. Should any borrow pits be located adjacent to the dam, a berm of not less than 100 feet shall be left between the toe of the dam and the upper edge of the borrow pit, with provisions for a side slope not steeper than 5 to 1 to a the bottom of the borrow pit. In order to avoid erosion and the formation of channels, borrow pits shall be discontinuous and separated by undisturbed sections of earth about 30 feet long measured at ground surface. No individual

borrow pit shall be more than 500 feet in its longest dimension.

6. PLACING OF EMBANKMENT

The earth-fill, including the fill in the cut-off or bonding trench under the dam, shall consist of a mixture of the clay, sand and gravel available from borrow pits in the vicinity of the work. Uniform graduation of material shall be accomplished insofar as practicable during the operation of excavation and loading at borrow pits.

No earth-fill material shall be placed in the dam structure until the foundation has been suitably prepared; such preparation of foundation to be kept well ahead of filling operations at all times. The distribution and gradation of materials throughout the earth-fill shall be such that the embankment will be free from pockets, streaks, or layers of material differing materially in texture or gradation from the surrounding material. Successive loads of material shall be so dumped on the embankment as to produce the best practicable distribution of the material to the end that the cut off trench and the upstream two-thirds of the dam, shall be constructed of the most impervious materials, such as clay loam, or a mixture of clay and sand and the downstream one-third of more pervious material, such as a smaller amount of clay and a greater amount of sand and gravel. No stones having maximum dimensions of more than 4 inches shall be placed in the embankment. The fill material shall be placed in the embankment and cut-off trench in continuous horizontal layers not more than 6 inches thick after rolling. Fill material may be dumped in windrows and spread by blades or road patrols. Sheep-foot rollers shall be used for compacting the earth fill. The fill material shall be rolled until it attains a uniform density satisfactory to the Engineer. The material in each layer while being compacted by rolling shall contain within practicable limits, the optimum amount of water for compacting purposes, and this optimum water content shall be uniformly distributed throughout the layer. Harrowing or other working of the material may be required to produce the required uniformity of water content.

All portions of test-pit and cut-off trench excavation within the area to be covered by the embankment shall be filled with the more impervious material as specified for the upstream two thirds of the embankment and compacted in the same manner. Earth fill in test pits and portions of the earth fill about the outlet conduit and other structural works, which cannot be properly compacted by the use of rolling equipment shall be thoroughly compacted by hand tools, or by the use of mechanical tampers. The degree of compaction for such portions of the earth fill shall be equivalent to or greater than that obtained by moistening and rolling, as specified for other portions of the earth fill. No puddling shall be permitted in any part of the fill, or around the outlet conduit. The upper 12 inches of the crest of the dam embankment shall be constructed of selected gravelly material or selected fine-rock material, and the crest be finished with a rounded crown 6 inches high at center.

7. CONCRETE

Concrete shall be composed of cement, sand, gravel or broken rock, and water, all well mixed and brought to the proper consistency. The exact proportions will be such as to produce a concrete having suitable workability, density, impermeability and a compressive strength of 2800 lbs. per square inch at 28 days, without the use of an excessive amount of cement. In general, it is contemplated that 1 part, by volume, of cement shall be used with 2 parts, by volume, of sand, and 3-1/2 parts, by volume, of gravel having a maximum size of 2 inches. The water cement rationshall not exceed 7-1/2 U. S. gallons of water to a sack of cement weighing 94 pounds.

a. COMPOSITION:

Cement: Cement shall comply with the Government specifications for Portland Cement.

Water: The water shall be clean and free from objectionable quantities of silt, organic matter, alkali, salts and other impurities.

Sand: Sand for concrete may be obtained from natural deposits or may be made by crushing suitable rock. The sand particles shall be hard, dense, durable, uncoated, non-organic rock fragments, well graded from coarse to fine, all fragments shall pass a 1/4 inch square or a 5/16 inch round opening. The sand must be free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam, mica or other deleterious substances.

Gravel: Gravel or broken rock for concrete must be hard dense, durable, sound uncoated rock fragments free from injurious amounts of soft friable, thin, elongated, or laminated pieces, alkali, organic, or other deleterious matter. The gravel shall all pass through a screen having 2-inch square or 2-1/4 inch round openings and shall be retained on a screen having 1/4-inch square or 5/16-inch round openings. It shall be well graded from the maximum to the minimum sizes.

Reinforcing Steel:
Deformed steel bars of intermediate grade and with a mfe working tensile strength of 18,000 pounds per square inch, shall be placed in the concrete wherever shown on the drawings or otherwise prescribed. The steel shall be so secured in position that it will not be displaced during the depositing of the concrete. The reinforcement, at the time the concrete is placed, shall be free from rust scale or other coating that is injurious or will destroy or reduce the bond. All bars shall be bent cold.

b. PREPARATION OF PLACE OF DEPOSIT:

Before placing the concrete, all debris and water shall be removed from the places to be occupied by the concrete, forms shall be thoroughly wetted or oiled and the reinforcing thoroughly cleaned of everything that will reduce the bond.

c. MIXING OF CONCRETE:

The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturer and mixing shall be continued for at least 1-1/2 minutes after all materials are in the mixer.

Ready mixed concrete shall be mixed and delivered in accordance with the requirements set forth in the "Standard Specifications for Ready Mixed Concrete," (A.S.T.M. Serial Designation: C94-58).

d. CONVEYING:

Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of the materials.

e. DEPOSITING:

Concrete shall be deposited in approximately horizontal layers, as nearly as practicable in its final position to avoid segregation, due to rehandling or flowing. No concrete that has partially set or been contaminated by foreign material shall be deposited on the work, nor shall retempered concrete be used. When concreting is once started, it shall be carried on as a continuous operation until the placing of the panel or section is completed. The top surface shall be generally level. When construction joints are necessary, they shall be made in accordance with the design as shown on drawing No. Supplemental #1 All concrete shall be thoroughly compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement and into the corners of the forms.

f. CURING: Concrete shall be maintained in a moist condition for at least 5 days after placement, or for longer periods as directed by the Engineer.

g. FORMS: Forms shall conform to the shape, lines and dimensions of the members as called for on the plans. They shall be of sufficient strength and rigidity and properly braced to hold the concrete and to withstand the necessary pressure, ramming and vibration without deflection from the prescribed lines. Wooden forms to be used more than once shall be maintained in serviceable condition and thoroughly cleaned before being reused. Forms shall be removed in such a manner as to insure the complete safety of the structure. In no case shall the forms be removed until the members have acquired sufficient strength to support safely their weight and the load thereon.

h. FINISHING: The surface finish of all formed concrete shall be left as formed. No cement coating or plastering to cover defective finish shall be allowed. Honey combing shall be brought flush with the sur-

h. Cont'd

face and finished by means of rubbing in a 1:2 cement mortar with a wooden trowel, after first thoroughly wetting the original surface. Honeycombing of concrete shall not exceed 1 percent of the formed surface.

8. TIMBER FOR BRIDGE

The timber for the bridge from the dam to gate tower shall be of a good grade of pine or Douglas fir which will meet the approval of the Engineer with respect to strength, weight, freedom from decay, and other defects which would affect its permanence, after construction the bridge shall be treated with at least 2 coats of a good preservative paint.

9. PERMANENT EQUIPMENT

The outlet gate shall be the Hardesty Model 50-10, bronze, mounted, equipped with a Model J-12:1 pedestal lift, or equal, as shown on Sheet 4 of 4. The outlet gate, trashrack, pedestal lift and bridge shall be built into the dam in a workmanlike manner, as shown on the plans or according to directions by the Engineer. Any changes or adjustments required shall be made to secure satisfactory operation. All exposed metal surfaces shall be given two coats of field paint as directed by the Engineer. Vent pipe to be 4" galvanized iron pipe.

10. SPILLWAY CHANNEL

The spillway channel shall be constructed according to lines and grades shown on sheet 1 of 4. Riprap on side slopes of the spillway channel shall be placed as directed by the Engineer.

11. IRRIGATION DITCH ON BERM

A lined irrigation ditch will be constructed on a berm along the downstream face of the dam extending from Sta. 23 + 40 to Sta. 89 + 00. Lining to be concrete or gunite.

12. FINISHING AND CLEANUP WORK:

The job and all parts thereof shall be finished in a neat and workmanlike manner. The site of work and construction space in the vicinity shall be cleared of all rubbish, discarded construction material and the like, and the premises left in a safe and orderly condition.

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT
NUMBER ONE

LOG OF WELL 3-36

Starting Date:	January 20, 1939
Completion Date:	March 6, 1939
Water Level:	192' 9"
Perforated:	211' to 586' 10 Holes per 12"

0 - 9	Caliche
9 - 35	Sand & gravel
35 - 50	Clay & caliche
50 - 90	Sand & clay
90 - 170	Clay & caliche
170 - 180	Sand & clay & gravel
180 - 270	Sandy clay & caliche
270 - 280	Sand & clay
280 - 420	Clay & caliche
420 - 430	Sand & gravel 1" dia.
430 - 530	Clay & caliche
530 - 538	Sand and gravel & caliche
538 - 540	Sand & gravel 1"
540 - 550	Cemented gravel
550 - 604	Clay & caliche

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL A-19

Starting date:	March 6, 1939
Completion date:	March 31, 1939
Water Level:	204
Perforated:	214' to 574' - 10 Holes per 12"

0 - 10	Clay
10 - 60	Hard packed sand and gravel
60 - 86	Sand, gravel & clay
86 - 100	Sand & Gravel
100 - 117	Hard Packed sand & gravel
117 - 197	Clay
197 - 200	Hard shell of cement
200 - 205	Clay
205 - 212	Clay
212 - 233	Clay with sand and gravel
233 - 275	Clay
275 - 280	Sand, clay & little gravel
280 - 284	Hard cement shell
284 - 328	Clay
328 - 367	Tight Clay & Gravel
367 - 412	Clay
412 - 453	Tight clay & gravel, streaks of cement
453 - 518	Clay
518 - 530	Tight clay & gravel
530 - 545	Clay
545 - 574	Clay, sand & gravel
574 - 580	Clay
580 - 588	Clay & sandstone
588 - 590	Hard clay

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL A - 21

Starting date:	October 26, 1938
Completion date:	January 19, 1939
Water level:	169' 6"
Perforated:	176' to 486' - 10 Holes per 12"
Driller:	Roscoe Moss Company

0 - 5	Surface soil
5 - 12	Cemented gravel & caliche
12 - 50	Sand & gravel
50 - 100	Caliche & sandstone
100 - 123	Clay, caliche & sand
123 - 150	Caliche-cemented sand & rocks
150 - 190	Sticky clay-caliche
190 - 195	Quick sand
195 - 220	Clay
220 - 230	Cemented gravel & clay
230 - 270	Clay, sand & gravel
270 - 285	Cemented sand & gravel
285 - 345	Caliche & clay
345 - 502	Caliche & sandstone

MARICOPA RESERVOIR AND POWER COMPANY

LOG OF WELL 5-10

Starting Date:	June 6, 1938
Completion date:	August 12, 1938
Water Surface:	226 Ft.
Perforated:	226 to 564 Ft.
Driller:	Scott Coburn

0 - 6	Soil
6 - 8	Caliche
8 - 16	Clay & sand
16 - 21	Sand
21 - 27	Sand & Caliche
27 - 34	Clay & Caliche
34 - 40	Clay & sand
40 - 51	Loose gravel
51 - 54	Gravel & sand tight
54 - 105	Loose Gravel & sand
105 - 106	Compact sand
106 - 114-	Loose gravel
114 - 115	Compact sand & gravel
115 - 140	Sand & gravel
140 - 142	Decomposed granite
142 - 144	Fine sand
144 - 150	Compact sand
150 - 155	Sand and granite mixed
155 - 175	Hard compact sand
175 - 178	Hard caliche
178 - 182	Hard sand
182 - 190	Loose sand
190 - 202	Hard compact sand
202 - 222	Sand and gravel loose but dry
222 - 226	Hard caliche
226 - 234	Fine sand - First water
234 - 238	Caliche
238 - 248	Hard sand dry
248 - 252	Caliche
252 - 260	Hard sand
260 - 270	Clay and hard sand
270 - 281	Hard sand
281 - 290	Hard sand
290 - 292	Fine sand
292 - 300	Cemented sand
300 - 304	Cement and clay
304 - 306	Hard sand rock
306 - 316	Hard sand and clay
316 - 321	Sand and clay
321 - 322	Hard shell sand rock
322 - 328	Hard sand
328 - 334	Hard yellow sand
334 - 350	Sand and clay

Maricopa Reservoir & Power Co.
Log of Well 5-10
Sheet #2

350 - 354	Hard shell sand rock
354 - 358	Sand and Clay
358 - 365	Hard sticky clay
365 - 380	Clay and sand
380 - 388	Hard sand rock
388 - 421	Sand and clay mixed
421 - 430	Hard sand and clay
430 - 433	Sticky clay
433 - 439	Sand and clay mixed
439 - 442	Hard clay and sand
442 - 444	Sandy
444 - 447	Hard lime rock
447 - 461	Sand and clay
461 - 470	Compact sand
470 - 473	Hard Lime rock
473 - 476	Hard sand
476 - 478	Soap stone
478 - 482	Compact sand
482 - 486	Hard shell sand rock
486 - 492	Compact sand
492 - 501	Sand and Clay
501 - 516	Compact sand
516 - 522	Sand and clay
522 - 528	Hard sand rock
528 - 531	Soft sand
531 - 534	Hard shell Lime rock
534 - 540	Clay and sand
540 - 549	Compact sand
549 - 556	Sand and clay
556 - 564	Sandy clay
564 - 570	Hard sand stone
570 - 573	Hard sand and gravel
573 - 578	Hard compact sand
578 - 583	Sand and clay (soft)
583 - 586	Hard shell

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL 13-21

Starting date:	December 23, 1938
Completion date:	January 17, 1939
Water Level:	165 Ft.
Perforated:	178 to 488 - 10 Holes per 12"
Driller:	Roscoe Moss Company (B. Hatherley)

0 - 1½	Clay
1½ - 7½	Caliche
7½ - 82	Clay and caliche
82 - 120	Sandy clay
120 - 123	Caliche
123 - 145	Sandy clay
145 - 170	Clay and caliche
170 - 172	Sandy clay
172 - 176	Sandy gravel and clay
176 - 182	Clay
182 - 188	Sandy clay
188 - 260	Sandy clay and streaks caliche
260 - 318	Sticky clay and streaks caliche
318 - 360	Clay
360 - 374	Hard clay and small streaks caliche
374 - 504	Clay and hard streaks

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL M.C.-746

Starting Date:	October 17, 1938
Completion Date:	November 28, 1938
Water Level:	180
Perforated:	182 to 484 - 10 Holes per 12"
Driller:	Roscoe Moss Company

0 - 12	Hard red clay
12 - 18	Caliche
18 - 30	Sandy red clay
30 - 35	Caliche
35 - 53	Brown clay
53 - 56	Gravel & clay
56 - 118	Sandy brown clay
118 - 136	Clay & caliche
136 - 140	Gravel & caliche
140 - 154	Caliche
154 - 183	Brown sandy clay
183 - 198	Gravel & caliche
198 - 249	Sandy brown clay
249 - 260	Caliche & gravel
260 - 270	Hard brown clay
270 - 280	Cemented gravel to 3"
280 - 295	Brown clay-gravel to 2"
295 - 303	Cemented gravel to 2"
303 - 322	Hard cemented sand, gravel to 2"
322 - 324	Sandy brown clay
324 - 364	Conglomerate
364 - 400	Sandy brown clay, cemented streaks
400 - 500	Conglomerate

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL M.C.-844

Starting Date:	October 20, 1938
Completion Date:	November 25, 1938
Water Level:	190' 9"
Perforated:	512-194 10 Holes per 12"
Driller:	Roscoe Moss Company

0 - 3	Clay
3 - 5	Hard pan
5 - 13	Clay
13 - 14	Sand & gravel
14 - 31	Clay
31 - 62	Tight sand & gravel partly cemented
62 - 66	Clay
66 - 104	Sandy clay
104 - 114	Tightly packed sand & gravel
114 - 128	Sandy clay
128 - 133	Clay, sand & gravel
133 - 175	Sandy clay
175 - 182	Clay, little sand & gravel mixed
182 - 202	Clay & little sand
202 - 215	Sandy clay
215 - 220	Sand & small gravel & clay
220 - 270	Clay
270 - 280	Sand & gravel & little clay
280 - 285	Clay & caliche
285 - 295	Clay
295 - 298	Clay & caliche
298 - 344	Hard clay
344 - 360	Sandy clay
360 - 380	Hard clay
380 - 387	Conglomerate
387 - 391	Hard clay
391 - 409	Clay & gravel
409 - 422	Hard clay
422 - 450	Clay, sand & gravel
450 - 482	Sticky clay
482 - 525	Clay & little sand & gravel

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL MC-895

Starting Date:	October 24, 1938
Completion Date:	November 30, 1938
Water Level:	140
Perforated:	150' to 484' - 10 holes per 12"
Driller:	Roscoe Moss Company

0 - 10	Sandy clay
10 - 26	Clay and gravel
26 - 32	Caliche
32 - 50	Gravel to 10"
50 - 62	Sandy clay
62 - 76	Sandy clay % gravel
76 - 84	Caliche
84 - 94	Sandy clay
94 - 106	Soft cemented sand
106 - 155	Hard clay & gravel
155 - 223	Hard caliche clay
223 - 227	Soft sandy clay
227 - 260	Hard caliche clay
260 - 308	Soft sticky clay
308 - 316	Clay & gravel
316 - 346	Sandy clay
346 - 370	Hard clay
370 - 398	Cemented sand & gravel
398 - 402	Caliche
402 - 404	Fine sand, tight
404 - 408	Cemented sand & gravel
408 - 410	Hard sandy clay
410 - 430	Cemented sand & gravel
430 - 439	Concrete
439 - 444	Hard caliche clay
444 - 450	Hard sandy clay
450 - 458	Caliche clay
458 - 464	Sand-gravel in clay
464 - 472	Cemented sand
472 - 490	Gravel in hard clay
490 - 500	Cemented sand & gravel

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL MC-938

Starting Date:	April 1, 1939
Completion Date:	April 25, 1939
Water Level:	208
Perforated:	206 to 236 - 10 Holes per 12"
Driller:	Roscoe Moss Company

0 - 10	Clay and caliche
10 - 22	Sand gravel & little clay
22 - 30	Sandy clay
30 - 77	Clay & little sand & gravel mixed
77 - 93	Clay and caliche
93 - 100	Clay caliche & sand streaks
100 - 120	Caliche
120 - 142	Clay and caliche
142 - 150	Packed sand & gravel
150 - 175	Packed sand & gravel
175 - 180	Clay sand & gravel
180 - 252	Sandy clay and little gravel
252 - 265	Sticky Clay
265 - 326	Clay and caliche
326 - 332	Sticky clay
332 - 404	Clay
404 - 408	Caliche
408 - 480	Clay
480 - 500	Sandy clay
500 - 506	Clay
506 - 550	Clay and caliche

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL NO. 2-26

Starting Date:	August 22, 1939
Completion Date:	October 14, 1939
Depth:	550 feet
Perforated:	204' to 534', 10 Holes per 12"
Driller:	Roscoe Moss Company

0 - 8	Clay, caliche and some gravel
8 - 45	Brown clay, caliche
45 - 60	Sandy brown clay with some gravel
60 - 75	Tight gravel
75 - 93	Brown clay
93 - 105	Tight gravel
105 - 155	Brown clay, caliche
155 - 167	Packed sand
167 - 188	Brown clay, caliche
188 - 194	Clay, some gravel
194 - 249	Brown clay
249 - 251	Sandy brown clay, some gravel
251 - 424	Brown clay
424 - 430	Caliche, cement
430 - 519	Brown clay
519 - 550	Brown clay with streaks of cement

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL M.C. 1057

Starting Date:	November 29, 1938
Completion Date:	December 22, 1938
Water Level:	202.75
Perforated:	220 to 484 - 10 Holes per 12"
Driller:	Roscoe Moss Company

0 - 3	Sandy Brown Clay
3 - 6	Sand, Gravel to 1"
6 - 13	Sandy red clay
13 - 46	Sandy Brown clay
46 - 81	Sandy brown clay - cemented streaks
81 - 90	Caliche
90 - 129	Brown clay
129 - 145	Brown clay and caliche
145 - 168	Brown clay
168 - 172	Sand and Gravel
172 - 463	Brown clay
463 - 465	Gravel and clay
465 - 500	Brown clay

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION
DISTRICT NUMBER ONE

LOG OF WELL - 3-26

Starting Date: October 23, 1937
Completion Date: February 5, 1938

0 - 3	Surface Soil
3 - 20	Hard Caliche
20 - 32	Coarse Sand
32 - 41	Cemented Fine Sand
41 - 65	Boulders & Gravel
65 - 110	Cemented Sand
110 - 131	Boulders and Gravel
131 - 184	Sand and Gravel
184 - 205	Hard Brown Sand (Water Cut)
205 - 207	Good Gravel (Water Cut)
207 - 362	Brown Sandy Clay
362 - 367	Gray Sandstone
367 - 407	Sandy Lime Rock
407 - 418	Hard Lime Clay
418 - 458	Brown Sandy Clay
458 - 467	Cemented Sand
467 - 540	Brown Sandy Formation
540 - 580	Gray clay mixed with rock
580 - 595	Good sand and Gravel
595 - 600	Brown clay and Rock
600 - 615	Gray lime rock
615 - 622	Sandstone
622 - 625	Coarse Gray Sand
625 - 675	Brown Sand
675 - 685	Cemented Fine Sand
685 - 707	Brown Sand
707 - 710	White clay and rocks
710 - 735	Hard Brown Sand
735 - 745	Brown Sandy Clay
745 - 755	Find sand
755 - 760	Hard Sand and gravel
760 - 823	Brown sandy clay
823 - 825	Lime rock
825 - 830	Sand and small rocks
830 - 833	Lime rock
833 - 847	Sand and gravel
847 - 857	Brown clay and sand

11/15/46

PRELIMINARY ENGINEERING REPORT

WHITE TANKS DAM ~~#3~~ I

The White Tanks Dam ~~#3~~ I, sponsored by the Maricopa County Water Conservation District, is located near the base of the White Tanks mountains about seven miles west of Litchfield Park, Arizona.

Drainage from the White Tanks mountains and from a part of Trilby Wash is concentrated along the main canal of the sponsor's system, overflowing it at times and spreading over the adjacent farm lands, causing considerable damage to both the canal and the land.

Preliminary surveys and investigations have been made of the entire area to determine the feasibility of a series of dams and channels needed for complete control of the watershed runoff. It has been determined that three dams with a total storage capacity of approximately 20,000 acre feet will be adequate for this control. The location, size and capacity of Dam ~~#3~~ have been based on estimates of runoff from its watershed, augmented by runoff diverted from the two other dams to be constructed sometime in the future.

Since all streams in this area are of intermittent flow, runoff was estimated on a rainfall intensity of 1.4 inches over a period of 24 Hrs hours, (Determination by J. H. Dorrah.) or an expected total runoff of 19,500 Acre feet.

Soils investigations are now being conducted by Rey S. Decker for determining depth of cutoff trench, location of borrow pits, selection of materials, etc. The results of his tests will be incorporated in the final plans of the job.

The Caterpillar Equipment Company has established headquarters for a proving ground near the site of Dam #3, and have tentatively agreed to do considerable earth moving on this job as an experimental measure in testing out new designs under actual on-the-job conditions. In view of this, our recommendation is that an earth fill dam be constructed, 10,560 feet long by 40 feet high, the reservoir having a capacity of 7,800 acre feet. This will supply storage for much of the runoff to be diverted by the other two dams (#1 & 2) to be built in the future. The spillway will be 150 feet wide with a capacity of 550 cfs. The outlet structure will consist of a reinforced concrete culvert 3.5 x 3.5 opening, controlled by a vertical lift sluice gate. The nominal capacity of the outlet will be 200 cfs.

All labor, equipment and materials for the outlet structure will be furnished by the sponsor, as well as a survey party for layout and inspection work. A periodic inspection by S.C.S. technicians is all that will be required after plans and specifications have been completed.

390-11-13-15 D.

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Room 6029 Federal Building, Phoenix, Arizona 85025

SUBJECT: WS - Engineering - Powerline Channel, White Tanks Project

DATE: October 12, 1971

TO:

Marion E. Strong
State Conservationist

On October 12 I discussed the powerline channel situation briefly with Mr. Lee Ohsiek, Flood Control Engineer with the Maricopa County Flood Control District.

Mr. Ohsiek advised that they have graded the access roads paralleling the concrete lined channel to improve surface drainage and prevent surface runoff from overflowing the channel banks.

Mr. Ohsiek also advised that he would request us to accompany him on a field inspection of the channel damage as soon as the water has ceased to run in the channels.

We agreed to meet Mr. Brand of the Caterpillar Proving Grounds for an on-site review on October 19 of the changes in drainage patterns that have occurred on the watershed of the White Tanks Pilot Watershed Project.

J. J. Turner
State Conservation Engineer

cc: J. Hickerson
WPP
Design Section
P. Tilker

10-13

18

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE River Basin-Watershed Planning Staff

Suite 326, Arizona Title Bldg., 111 West Monroe St.
Phoenix, Arizona 85003

SUBJECT: WS - PL 566 - White Tanks Dam No. 4 DATE: December 14, 1970

TO: J. J. Turner

WHITE TANKS FLOOD REPORT

1. In the summer of 1954 two flood control structures, identified as White Tanks No. 3 and No. 4, were built by the Soil Conservation Service in cooperation with the County of Maricopa and the Municipal Water Conservation District No. 1.

2. The project was known as the White Tanks Erosion Control Project and SCS participation was under the Pilot Watershed Program.

3. It is reported that 4.5" of precipitation were recorded in a guage near the intersection of Jack Rabbit Road (195th Avenue) and West Indian School Road. According to the Salt Lake City R.F.C. map, dated October 20, 1970, the total area was in the 4" rainfall area. The 100-year, 24-hour storm for this area is 4.0 inches.

4. The rain is reported to have started about midafternoon on Saturday, September 5, 1970. The maximum intensity is believed to have occurred between 6:00 and 8:00 p.m. It was reported that water started flowing across Jack Rabbit Road in the vicinity of Thomas Road about 7:00 p.m. and ceased to flow across the road about 9:00 p.m.

5. The elevation of the high point of the watershed is 3671'. The spillways of Structure No. 4 are at elevation 1050' with the top of the structure at 1056'. The elevation at the rain gauge is approximately 1165'.

6. Structure No. 4 was designed to impound 1036 acre-feet from a drainage area of 10.3 square miles.

7. Since 1954 developments north and west of Indian School Road and Tuthill road have caused four square miles of watershed originally designed to flow into Structure No. 3 and an additional 1.8 square miles of watershed to flow into Structure No. 4 along Tuthill Road. Additional land developments between Jack Rabbit Road and Tuthill Road plus improvements of Jack Rabbit Road divert still another 2.7 square miles of watershed into the east end of Structure No. 4 along Jack Rabbit Road.

8. Thus at the time of the storm there was a total of 18.9 square miles of watershed contributing to Structure No. 4. This is 8.6 square miles more than the structure was designed to handle.

9. It should be noted that deposition of coarse sands in the west channel of Jack Rabbit Road limit the flow of water diverted into Structure No. 4. Excess flood waters flowing south along Jack Rabbit Road overflowed the pavement in the vicinity of Thomas and McDowell Roads causing damage to an unknown number of homes in the subdivisions east of Jack Rabbit Road.

10. High water marks indicate that Structure #4 filled and the 160' wide west emergency earth spillway flowed for a short period at a depth averaging about 0.8 ft. The approximate maximum discharge from the spillway was 250 cfs. There was no erosion in the channel except for a small 1' deep headcut at the extreme south end where it emptied into a flood channel along the north side of an auxiliary Air Force Landing Field. The flood channel appeared to have been carrying ten to twenty times the spillway flow.

11. Flow through the 175' wide north emergency earth spillway averaged about 1.6' in depth. The approximate maximum discharge was 650 cfs. Surveys after the flood indicate that the crest of this spillway is now about 0.4' below the elevation it was at the time of completion. It is believed that most of the lowering of the earth spillway crest resulted from wind erosion and from use of the cleared spillway crest area as a driveway for vehicles and as a practice ground for horsemen and motorcyclists during the 16 years since its construction. The high water marks indicate that the water surface was 0.4' higher at the Jack Rabbit Road spillway than at the Tuthill Road (west) spillway. This could have been the result of wave action or a west wind across the one mile reach of the reservoir. Erosion in this spillway from this storm was negligible. Flood water through the spillway crossed unimproved desert for one-half mile before co-mingling with water flowing from the north and west.

12. The two gated principal spillways remained closed during the storm. Had they been open they would have had little effect upon the reservoir hydrograph because of the intense short period of runoff. The reservoir was emptied through seepage into the reservoir area.

13. Structure No. 3, with a capacity of 2655 acre-feet and a design watershed area of 24.1 square miles, received an inflow of approximately 350 acre-feet. The rainfall on this watershed was from 3 inches to 4 inches according to the Salt Lake City R.F.C. Preliminary Storm Total Map. As mentioned in paragraph 7, four square miles of this watershed have

been diverted into the watershed of Structure No. 4. These four square miles are located in the area where the rainfall was 4 inches or more and where the storm was quite intense.

14. Based on current SCS criteria for a Class C Structure this storm was equal to the design storm for the principal spillway hydrograph. Because of the extra drainage area there was some flow through the emergency spillways.

15. Based on a Class C Structure Classification and a drainage area of 10.3 square miles an emergency spillway hydrograph was routed through the existing Structure No. 4. This routing showed that the earth spillways would have a discharge of 8300 cfs. with the water surface at elevation 1054.2 and a velocity of 7.0 ft/sec in the west spillway and 7.6 ft/sec in the north spillway.

16. A Freeboard Hydrograph based on 10.3 square miles was routed through the existing Structure #4 and it was found to overtop the existing structure while the inflow was still increasing. If it is desired to keep the same size spillway in width at the present location it will be necessary to raise the dam approximately 5 feet to handle the freeboard storm. The existing structure has a maximum storage capacity of 2,000 acre feet, while to handle the freeboard storm it would be necessary to store around 3,200 acre feet, when the spillways are flowing 29,000 cfs.

17. Since the original drainage area cannot be handled by the existing Structure No. 4, it is recommended that consideration be given to correct the overloading of Structure No. 4 by combinations of the following alternatives:

    A. Redesign the roadway fills and channels in Sections 18 and 13 so as to permit the four square mile area in parts of Sections 2, 3, 10, 11, 12, 13 and 14 so the area will drain into structure No. 3 as originally planned. (See map attached.)

    B. Construct one or more small retarding structure north of Indian School Road to control runoff from all or parts of Sections 13, 14, 17, 18, 19 and 20. (Structure No. 4 was not designed to receive runoff from this area but since 1954 the runoff has been directed into Structure No. 4).

    C. Enlarge Structure No. 4 to enable it to safely handle runoff from the original drainage area plus the drainage from Section 29 and 32 that was not originally planned to be handled by Structure No. 4.

This enlargement can be done by widening the existing spillway so the dam will not be overtopped or by raising the dam to prevent the overtopping or a combination of the two.

(1) The existing spillways will discharge 12,000 cfs. with a velocity of approximately 8.5 fps. If the existing spillway is retained and the problem is connected by raising the dam it may be necessary to protect the spillways from erosion by lining with concrete or some other type of protection.

D. If it is desired to control the entire 18.9 sq. mi. drainage area with Structure #4 and the spillways are kept at their present location and elevation, it will be necessary to raise the top of the dam to elevation 1063. At this elevation the storage will be approximately 4,000 ac. ft. with the spillways discharging 55,000 cfs. The above numbers reflect the routing of a Class "C" freeboard storm through the structure.

The Emergency Hydrograph routed through the structure for the 18.9 sq. mi. drainage shows the spillways would need to handle 16,000 cfs with the upstream water surface at elevation 1056.0. The velocity in the west spillway would be 9.1 fps and the velocity in the north spillway would be 9.7 fps.

E. If it is not feasible to increase the size of the existing Structure No. 4, additional flood control structures should be built upstream from Structure No. 4. One possible location would be in the S.E. corner of Section No. 23. Another possible location would be in Section No. 25.

F. The existing principal spillway pipes are not being used as designed. The downstream outlet channels for these pipes have never been constructed.

Conclusions:

It is apparent that structure No. 4 as it exists today is not a safe structure according to our criteria for a Class "C; Structure. Since the original 10.3 square mile drainage area cannot be safely handled by the structure, the extra drainage area diverted into the structure can be controlled before it gets to Structure No. 4 or the structure can be enlarged to handle it.

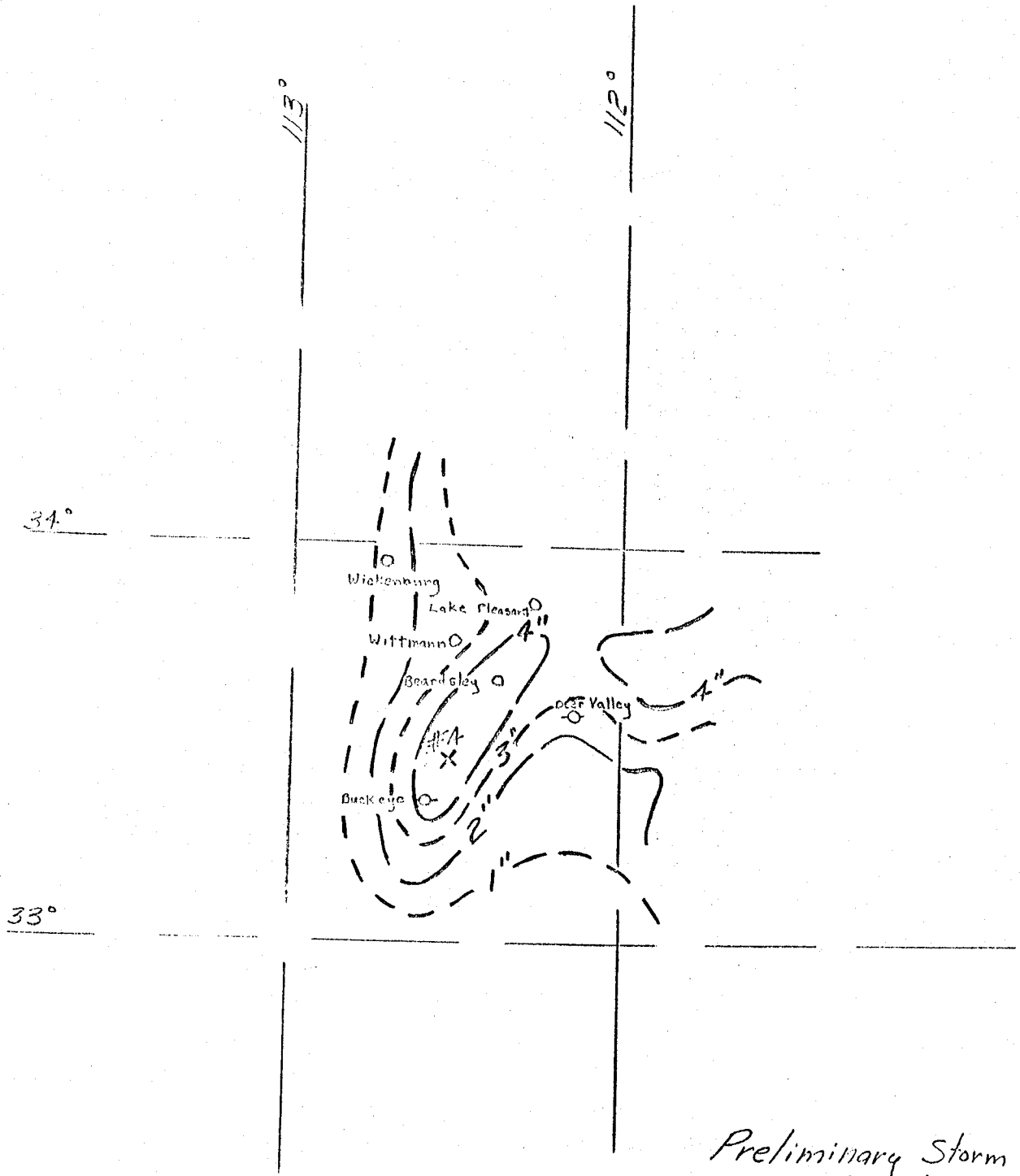
James M. Malone
Hydraulic Engineer

Robert M. Bertels
Engineering Specialist

Attachments

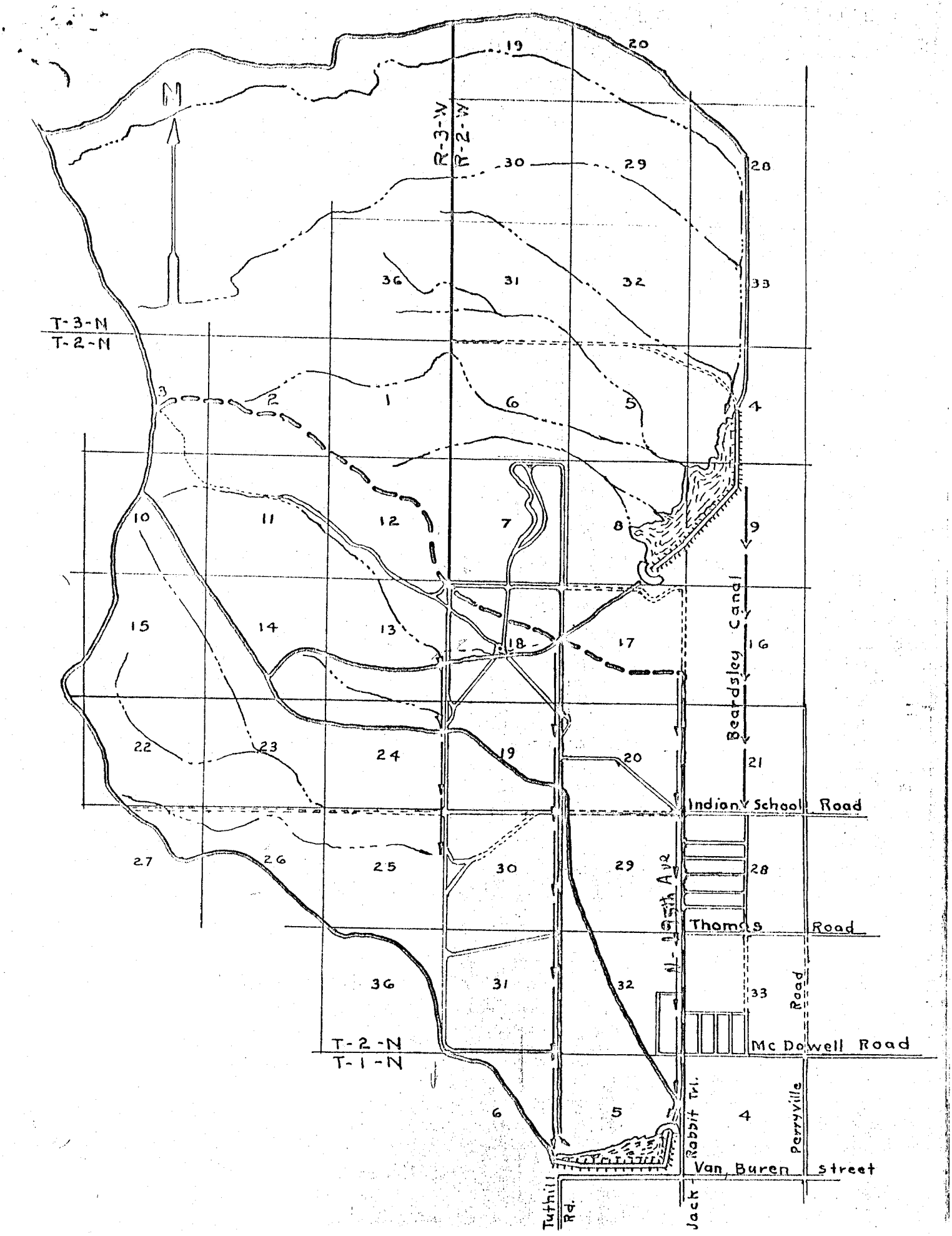
cc: R. E. Rallison - Portland
G. Watt
C. Maguire

JMM/RMB:mh



Preliminary Storm Total
Sept. 5&6, 1970
Salt Lake City R.F.C.
10/20/70

Traced 12/10/70
R.M. Bartels


N
R-3-W
R-2-W
T-3-N
T-2-N
T-2-N
T-1-N
Beardsley Canal
Indian School Road
Thomas Road
McDowell Road
Van Buren street
N. 95th Ave
Tuthill Rd.
Jack Rabbit Trl.
Perryville Road

390-11-13-19

Engineering & Watershed Planning Unit, ERSC, Portland, Oregon

ERS - Hydrology - PMP for Buckeye and White Tanks Project, Arizona

December 16, 1970

C. L. Drayna, Director, Engineering Division
SCS, Washington, D. C.

We have received a request from the Arizona state conservationist to provide estimates of probable maximum precipitation for use in designing emergency spillways for two project areas west of Phoenix. All structures on both projects are class (c) from a hazard standpoint (location maps are attached).

The White Tanks project was constructed as a pilot project during the mid-fifties and has much smaller spillway capacities than present day criteria require. One structure in this project had substantial flow through the emergency spillway this past September and at present the safety of this structure and others in the system are being evaluated.

The Buckeye project is approaching the final design stage. The work plan was prepared some years ago using criteria that are substantially lower than present day criteria. The structures will be designed using the most current values of PMP. Because of recent refinements in estimating PMP, we wondered if an updated estimate might be significantly different than values published in Weather Bureau Technical Paper 38-A which have generally proven to be on the high side. Although the White Tank mountains are not a major barrier, they still effect considerable influence on precipitation frequency and amount. Please note that the White Tank project is adjacent to the Buckeye project, but on the opposite side of the mountains.

We are hopeful that the special studies branch of the Weather Bureau can provide us with an updated estimate of PMP or an indication of little expected change within a comparatively short period of time. We understand that many of the relationships developed in making the revised TP-40 maps are applicable to the methods used for estimating PMP so less time is required since this study has been completed.

Arizona would like an indication of whether this area merits further study by January 15 and if it does, we would like an estimate of PMP for 6 and 24 hours together with areal correction factors for areas ranging from 10 to 75 square miles by February 1.

Please advise what you can do in this matter.

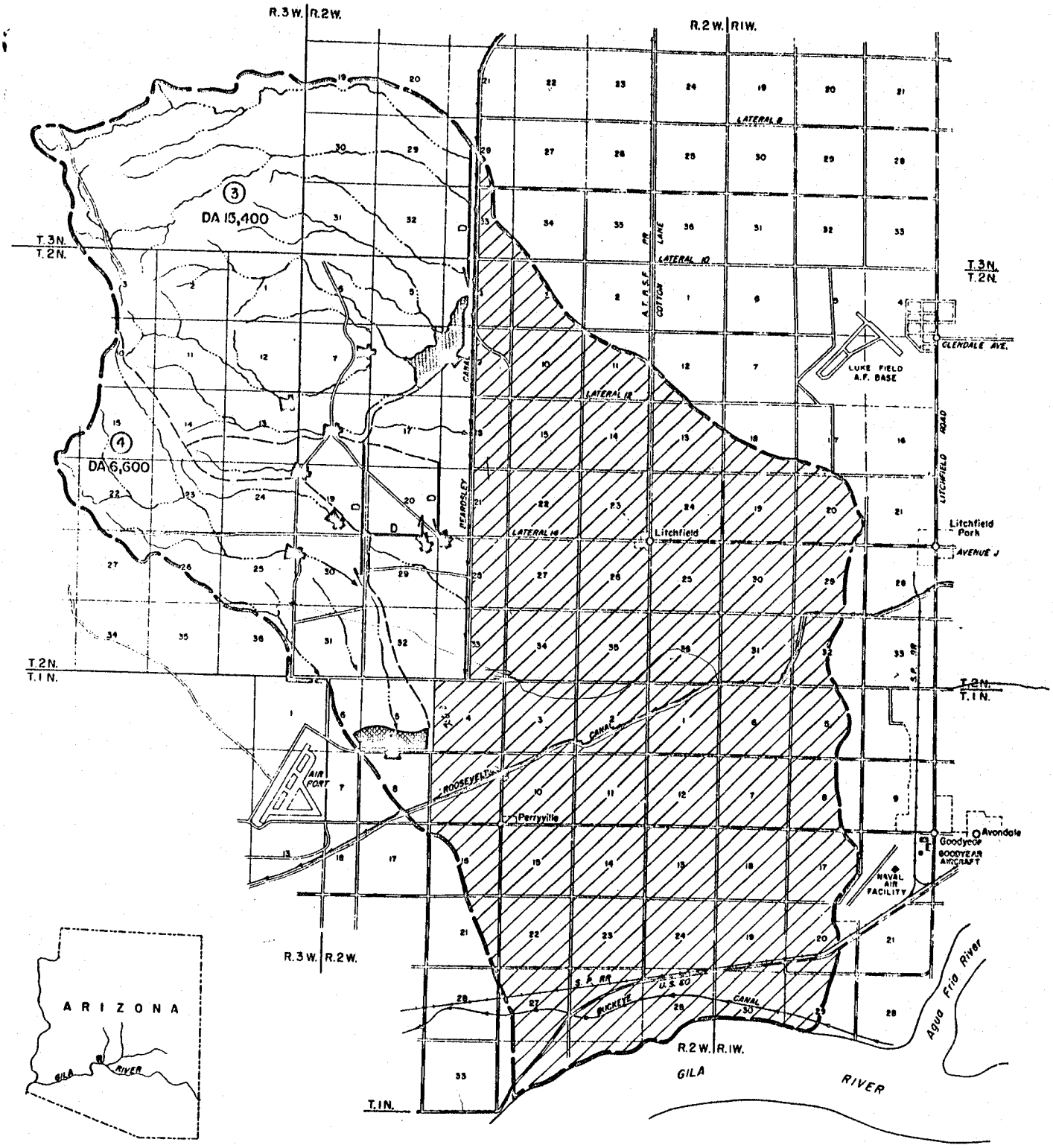
E. J. Cera
Head, PMP Unit

Attachments

cc:
K. H. Kent, Washington, D. C.
George Watt, Phoenix
J. J. Turner, Phoenix
James Malone, Phoenix

WORK PLAN
WHITE TANKS WATERSHED
ARIZONA

Tanner Copy.



PREPARED BY
SOIL CONSERVATION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE
APRIL, 1954

M-514

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency	1954, SCS	1954, SCS	1956, C of E
Length	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height	30 ft.	20 ft.	38 ft.
Spillway Size	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F.	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff	2.1	1.9	1.6
Crest Width	10'	10'	12'
Side slope	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets	3 pipes	2 pipes	1 box
Size of outlets	48",48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets	- - - -	- - - -	4400 cfs.
Evacuation time	80 hrs.	118 hrs.	- - - -
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.	.3	.3	.25
	[1] $56,500±	[2] $29,400±	
Total cost of Project		$395,145.00	$2,180,000.00
Private Contributions		196,057.00	180,000.00
Public Contributions		199,088.00	2,000,000.00
Annual O & M cost(Non-Federal)		3,750.00	17,000.00
Estimated annual cost of project (50 yr. amortization)		20,860.00	115,000.00
Estimated annual benefits (50 yr. amortization)		35,220.00	200,000.00

Benefit - cost ratio 1.7 to 1

WORK PLAN

WHITE TANK WATERSHED PROTECTION PROJECT
Agua Fria River Watershed
Maricopa County, Arizona

Participating Agencies

Agua Fria Soil Conservation District
Maricopa County Municipal Water Conservation District
Soil Conservation Service, USDA

Hank Raymond, Mgr. Flood Cty
Project advised in Feb. 1963
that cost of maintaining the 9.4 mile
Main Channel & 3.5 mile of channel
averaged $306 per mile of dam for years
1960-61 & 62.
Maintenance on White Tank
structures 3 & 4 averaged 295/mile
for same period.
JJT
2-12-63

Prepared by
Soil Conservation Service
United States Department of Agriculture
April 1954

CONTENTS

WORK PLAN
WHITE TANK WATERSHED PROTECTION PROJECT
AGUA FRIA RIVER WATERSHED
MARICOPA COUNTY, ARIZONA.

INTRODUCTION

Authority - The Federal participation outlined in this work plan is expected to be performed under the authority of the Soil Conservation Act of 1935 (Public Law No. 46 74th Congress) and other authorities of the national programs of concerned agencies.

Purpose and Scope of the Plan - The purpose of this plan is to state specifically the practices and measures required and feasible and how they will be carried out to achieve the maximum practicable reduction of erosion, floodwater and sediment damages. Application of this mutually developed plan will provide protection and improvement of land and water resources which it has been agreed can be undertaken at this time with the combined facilities of local interests, State and Federal agencies. Upon completion and continued maintenance of the measures set forth in this plan, agricultural production will be sustained at a level corresponding to the capability of the land, and the welfare of the landowners and operators, the community, and State and the Nation will be promoted thereby. The area in the subwatershed is entirely in Maricopa County and contains 59,136 acres, or 92.4 square miles.

SUMMARY OF PLAN

This plan is a combination of land treatment practices and measures used for the conservation of water and watershed lands which contribute directly to flood prevention, and of measures primarily for flood prevention. The works of improvement as listed in combined Tables 1 and 2 are planned to be completed entirely during calendar year 1954, at an estimated total cost of $417,375, said cost to be shared $218,287, by the non-Federal interests and $199,088 by the Federal Government. These estimates include the current costs of local interests and Federal agencies under the going national programs pertaining to the objectives of this plan.

The Agua Fria Soil Conservation District hereafter referred to as the "District" will assume overall responsibility for future operation and maintenance of this project. This District has arranged with the Maricopa County Municipal Water Conservation District #1 (Locally known and hereinafter referred to as the Beardsley Project) an irrigation district organized under laws of Arizona to assume specific responsibility for overall periodic inspection of the measures primarily for flood prevention and for maintenance of the floodwater retarding structures and directly associated measures at an estimated annual cost of $3,750.

Comparison of Benefit and Cost - When the works of improvement are applied and operating at full effectiveness, the ratio of the estimated average annual benefit ($35,350) to the estimated average annual value of the cost $20,860 is 1.7 to 1 based on current price levels for costs and long term prices for benefits.

DESCRIPTION OF THE WATERSHED PROTECTION PROJECT AREA

The White Tank Mountains generally form the western edge of the Agua Fria River Watershed near its confluence with the Gila River. Drainage from the eastern face of the White Tank Mountains is divided between Trilby Wash on the north, tributary to the Agua Fria River, and an intermittent stream locally known as Avondale Wash, tributary to the Gila River on the south. It is this southern portion of the White Tank Mountain drainage area that comprises the subwatershed area covered by this plan. The watershed has a gross area of 59,136 acres, of which 25,024 acres are mountain and foothill slopes comprising the drainage area and flood source. The remaining 34,112 acres are intensively irrigated land lying on a broad, gently sloping alluvial fan and terrace which have an average slope to the southeast of about 0.4 percent. Channels are very poorly defined or even non-existent through the cultivated areas, making the construction of floodways through the farmland to the Gila River impractical.

Following the disastrous floods of 1951, the Agua Fria Soil Conservation District with the technical assistance of the Soil Conservation Service prepared plans designed to reduce the damages caused by flash runoffs from the White Tank - Trilby Wash watersheds. Construction of a series of four primary detention structures numbered (1) to (4) respectively were planned, near the mouths of Trilby and Avondale Washes. Damage to military and national defense installations in the area, however, led to the initiation by the Corps of Engineers of plans for the protection of these installations from water originating in the Trilby Wash drainage. These plans of the Corps of Engineers also protect the irrigated lands from floods from Trilby Wash so no further

consideration was given by the Soil Conservation Service for structures (1) and (2) of their original plan.

The Avondale Wash watershed has no protection and therefore active interest in watershed protection has been maintained in this area. The necessity for structures 3 and 4 remains, if adequate protection to farm lands is to be obtained. Since the numerical designation has become recognized through usage, it has been retained throughout this report. Costs of original planning on these four structures have been prorated and those applying to structures 3 and 4 are charged as a portion of the engineering costs incident to this plan.

The soils of the area comprise recent alluvial soils along the Gila River, the moderately developed fan soils of the intermediate slopes and the shallow soil materials and rocks in the White Tank Mountains. The soils of the intermediate slopes, including the bulk of the cultivated lands, are moderately deep, deep or very deep, calcareous, moderately developed fan soils. They are derived principally from granites and schists.

Soils derived from these parent materials compact badly as a rule and as a result water penetrates slowly and they are highly susceptible to erosion. The organic matter content is low but the general fertility level is good with the possible exception of nitrogen.

The soils of the area have been classified according to their permanent limitations and hazards into five capability classes. The non-arable lands fall into classes VI, VII and VIII, whereas the cultivated lands fall into classes I and II. See Map 2. Irrigation is required for successful crop production. Water for irrigation is available and exceptionally high crop yields are obtained.

Class I lands are productive farm lands with very few or no permanent hazards or limitations. These lands are subject to a moderate overflow hazard at the present time. The proposed program will greatly reduce this hazard. Class II lands have a few recognized limitations and under the conservation farming being practiced in this area safe and continuing production is assured. The limitation which places these lands in Class II is the greater slope which creates an erosion hazard. Land leveling and adjustment of length of irrigation runs keep erosion at a minimum. Class II lands are also subject to a moderate overflow hazard which will be greatly reduced by this project works. Good land management, including the use of fertilizers and crop rotations to improve soil structure, is essential to keep the soils of both classes I and II productive.

Class VI lands consist of desert bottom intermingled with rolling desert plain. The soils are medium textured and subject to gullying when the vegetative cover is depleted. The dominant climax vegetation is sacaton and big galleta. Class VI lands have moderate rates of runoff.

Class VII lands consist of medium textured soils of varying depth with plane to slightly rolling topography. The climax vegetation is mixed desert grass and shrub. Class VII lands have high rates of runoff

The upper portion of the watershed is mapped as desert mountains and includes capability classes VII and VIII. These lands consist of bare rock or rough, stony, mostly shallow soils. Vegetation consists of desert shrubs such as encelia, bursage, cactus cholla, lycium, mariola and grasses such as bush muhly, tobosa, Arizona Cotton grass and black grama. Runoff rates are very high. Infiltration rates for

classes VI, VII and VIII vary from .10 inches per hour on the less permeable shallow soils to .60 inches per hour for the desert bottoms. Sediment production rates are relatively low in this area.

The elevation of the watershed varies from about 950 feet above sea level at its confluence with the Gila River to 3,500 feet at the crest of the White Tank Mountains. Mean temperatures range from 50 degrees Fahrenheit in winter to 91 degrees in summer, with recorded extreme temperatures ranging from a low of 17 degrees to a high of 117 degrees. The average date of the last killing frost is March 3 and that of the first killing frost is November 22, or a normal frost free period of 264 days. The mean annual precipitation is 8.04 inches, which generally occurs in two well defined rainy seasons. The winter rainy season usually extends through December, January and February, while the summer season includes July and August and early September. During the summer flood season the damage potential is very high due to the fact that crops, especially cotton which is the staple crop in the area, are very susceptible to damage. In contrast, during the winter flood season the value of crops is much lower. Most of the cotton has been harvested at this time and the growing crops consist of alfalfa, small grain and a small acreage of winter vegetables. Offsetting the lower crop values during the winter rainy season, to some extent, is the higher damage that land sustains due to the fact that it is not so well protected. Other direct flood damages are not usually affected by the season in which the flood occurs.

The range land in the upper, mountainous part of this watershed has sparse vegetation of the desert grassland type. Forage production is low and generally grazing occurs only after periods of unusually high precipitation. Because of the low precipitation, difficulty of

access, and scarce watering facilities, grazing use has not significar ly affected the vegetative cover in the upper portion of this watershed.

The cultivated land is highly productive under irrigation and is intensively farmed with cotton being the principal cash crop. Alfalfa barley and various varieties of sorghums are the principal feed crops. Some winter vegetables are grown on the less calcareous soils. Double cropping is practiced to some extent, but not to the degree found in the Salt River Valley to the east. Farm units vary from small family-size farms of forty to eighty acres to large commercial farms covering several thousand acres. The value of crop production in the watershed is estimated at seven million dollars annually.

The White Tank Watershed includes parts of three soil conservation districts, the Agua Fria, Roosevelt and Buckeye. Because of the nature of the enabling legislation prior to an amendment adopted by the legislature in 1954 soil conservation districts in Arizona are limited to areas used primarily for crop production. The non-arable flood producing portion of the watershed is, therefore, not included within the boundaries of any district. The Agua Fria Soil Conservation district sponsored this project as major structures and principal damage areas are in this district.

Approximately 53 percent of the land in the watershed is privately owned. Ownership of the remainder is about equally divided between the State of Arizona and the Federal Government. The Federal land is all included in Arizona Grazing District Number 3 and is administered by the Bureau of Land Management. Most of the high runoff producing portion of the watershed is publicly owned, whereas the flood plain is

privately owned. See map 3.

The watershed is adequately served by a network of county roads aggregating 62 miles. U. S. Highway No. 80 crosses the lower portion of the flood plain for a distance of four miles. Drainage ways are poorly defined or non-existent in the flood plain, so destruction of bridges does not constitute an important part of highway damage. The Southern Pacific railroad crosses the lower portion of the flood plain, generally paralleling U. S. Highway No. 80. In addition, the Santa Fe Railway has a branch line from Ennis extending about 2½ miles into the flood plain from the north. Portions of the supply canals of the Beardsley, Roosevelt, Goodyear and Buckeye Irrigation Districts lie within the flood plain. All are subject to damage by floods. Many miles of farm laterals serve the farm land in the watershed.

There are no incorporated towns within the watershed. Phoenix, within 20 miles of the watershed, is the trade center for this part of Arizona. The small unincorporated villages of Liberty and Perryville are in the lower end of the watershed. Cotton gins are located at various places throughout the farming area. The Caterpillar Tractor Company has a proving ground for testing various types of earth moving equipment near the central part of the watershed.

FLOOD AND EROSION PROBLEMS AND DAMAGES

Storm runoff from the White Tank Mountains and intervening foothill areas strike the Beardsley Canal at the western edge of the flood plain. Siphons have been installed along this canal at natural drainageways so that floodwater may pass over without damage. However, past experience has shown that these siphons are inadequate both as to capacity or number

to handle anything but small flows. Occasionally even small flows damage the canal because aggradation causes shifts in the channels above the canal and floodwater may strike a section of the canal where there is no siphon. After the water passes over the Beardsley Canal it tends to spread out because of the flat terrain and absence of defined channels. This sheet flow is, however, modified by roads and irrigation ditches which tend to concentrate the water until sufficient volume is attained to cause it to break over into adjoining fields. Improved roads have eroded in some cases to depths of 3 to 4 feet. Ponding usually occurs in the lower ends of flooded fields until water over-tops and breaches the irrigation lateral that has caused the ponding. Other obstructions such as railroad grades or flood dikes may shift the area of overflow but seldom reduce it. Attempts to control floodwater, once it has crossed the Beardsley Canal, have not been successful. Farm property incurs the greatest damage of any type of property within the flood plain. Crop yields are reduced by scouring of soil from the plant roots, ponding and scalding due to high temperatures. Irrigation furrows and field laterals may be so badly damaged late in the irrigation season that it is not possible to make the final irrigation needed to develop a profitable yield. In many cases where land damage is severe the land cannot be cultivated until it has been releveled. Growing alfalfa usually is not seriously damaged, but hay that has been cut is a complete loss. Land damage is greatest where water concentrates and flows with considerable velocity as it does below breaks in irrigation laterals, road fills, or other obstructions and where there is no protective cover from growing crops or crop stubble.

Farm irrigation systems are damaged by even relatively small floods. Earthen ditches generally require rebuilding after a flood, and the case of ditches formed above the ground surface considerable dirt has to be hauled in to build a new ditch. Concrete lined ditches generally withstand small floods, but scouring of the soil away from the lining causes structural failures that are expensive to repair. Occasionally pump motors are fouled by sediment and have to be repaired before they can be used. In a few cases, irrigation wells have caved in and have been abandoned. Farm improvements are frequently damaged, though not seriously because water does not attain great depths. Farm machinery is damaged if the water reached sufficient depth to deposit mud on moving parts. Stored crops and supplies sustain damages. The lower tiers of stacked baled hay that are flooded usually rot and this also requires the rebuilding of the stack.

Flood flows from the upper watershed first strike the Beardsley Canal with sufficient force to breach it in many places. Larger floods also damage other canals. Siphons and unloaders to spill floodwater that gets into canals have been installed, but these measures have been of only minor benefit. The floods of 1951 breached canals in many places and tore out many sections of canal lining, ruined two irrigation wells and washed out training dikes. In some places the canal embankments have been washed out so many times that it is becoming increasingly difficult to secure earth within reasonable distances to patch them. The Beardsley District has been forced to defer replacing some canal lining until the flood hazard is reduced except where the canal gradient is so steep that lining is necessary to prevent damaging erosion. As a result, water losses from seepage have increased. County roads are

very susceptible to damage by floodwater. This is due primarily to two reasons: first, road beds have eroded below ground level and now serve as channelways, and second, the location of irrigation laterals on the downstream side of east and west roads provide a natural barrier to prevent water from draining off the road. As a result, most roads are sub-standard and until such time as the flood hazard is reduced, permanent road improvements are not practicable.

Railroads in the flood plain experience some damage in each flood. The principal damage is loss of ballast where floodwaters over-top the roadbed. Occasionally, the roadbed is washed out and requires major repair work before trains can again move over the line.

Damage to power and telephone lines is usually limited to undermining a few poles, thereby necessitating resetting or straightening. The cost associated with this type of damage in this area is comparatively small.

The true value of property subject to damage in the flood plain is estimated at $23,900,000, distributed as follows (1951 prices):

Agricultural	$22,110,000.00
Irrigation Works	1,320,000.00
Transportation Facilities . . .	370,000.00
Rural Non-Farm	100,000.00

Flood records of the past 25 years indicate that damaging floods occur once in two years on the average. Analysis of high intensity storms and examination of past flood records show that fully 85 percent of the floods can be expected during the summer months when crops are most susceptible to damage. The most damaging recent flood year was 1951 when floods in January, July and two in August occurred. The flood of August 28, 1951, caused direct damage of more than $200,000.

The total primary direct floodwater damage is estimated to averag $28,220 annually, of which 47 percent is crop damage. About 23 percent is irrigation system damage including farm laterals, 15 percent is land damage and the remainder consists of damage to transportation facilities and farm improvements. None of this floodwater damage occurs in the area which will be inundated by proposed detention structures. These figures are based on all floods up to and including those of 100-year frequency. In addition, there are important indirect primary damages such as the reduction in crop yields arising from interruption of irrigation schedules, travel interruptions or detouring costs, losses of income to cotton gins and reduction of income to cotton workers. The estimated annual value of these indirect primary damages is $7,000. See Table 4.

Erosion Damage - Soil erosion, exclusive of flood plain scour, is a factor only on the upper desert portion of the watershed. In this part of the watershed sheet erosion has progressed to the point where the soil surface consists principally of desert pavement. Gully erosion is confined chiefly to the rough mountainous part of the watershed and the alluvial outwash at the base of the mountains. Because of watershed characteristics, it is not considered feasible to apply a program designed primarily to reduce the present rate of erosion. There is little likelihood that the present rate of erosion will change under existing use and management practices. Erosion damage of watershed land has not been evaluated for the reason that erosion has not seriously impaired the productivity of these lands, and it is apparent that a program which would significantly reduce the rate of erosion is not practical.

Sedimentation Damage - Deposition of sediment has caused considerable channel changes above works that have been installed to protect irrigation canals. As a result, each successive flow may strike canals or other property at unprotected places. Sediment deposition on farm land makes more frequent leveling necessary to maintain the precise grade of irrigated land. Both of these types of sediment damage are closely associated with floodwater damage and have been evaluated as floodwater damage. None of the sediment from this watershed reaches irrigation reservoirs.

EXISTING OR PROPOSED WATER MANAGEMENT PROJECTS

Efforts to control high runoff in the White Tank-Trilby Wash watersheds date back at least to 1939. At that time efforts were made by local interested groups to establish a soil erosion demonstration project. In 1945 the Agua Fria Soil Conservation District was organized for the express purpose of unifying flood control efforts. At various times plans to alleviate the flood problem have been prepared, but inability to finance delayed construction. For practical purposes work being done by local interests is continuous. Some structures have been completed recently and others are being built concurrently with work being done by the Federal Government (See combined Table 1 and 2 attached).

Measures Primarily for Flood Prevention - Engineering and hydrologic studies show that the most effective method of controlling surface runoff from the watershed of Avondale Wash above the Beardsley Canal is by the construction of two retarding structures and 11 miles of diversions. The diversions will divert runoff from small subwatersheds into retarding structures numbers 3 and 4, located in the larger drainage channels. Eight small stabilizing and sediment control structures

in the upper watershed will provide sediment storage and desilting basins and thereby lengthen the effective life of the retarding structures. The total cost of these measures is shown in combined Table 1 and 2 attached. The location of these structures is shown on map 2. These measures are located on nonarable land.

For design purposes, the area-depth-duration relationship for storm rainfall was developed from a number of high intensity storms which have occurred in central and southern Arizona. For reservoir design a storm of four-inch center was used. This is estimated to have a recurrence interval of more than 100 years. Retarding structure Number 3 will discharge into the Beardsley Canal. Retarding Structure Number 4 will discharge into existing waterways at a safe rate. Maximum evacuation time for the detention reservoirs will not exceed five days. The spillway design storm selected was one of six-inch rainfall center. The frequency of such a storm is estimated to substantially exceed the 100-year expectancy. Reservoir and spillway designs are based on the occurrence of design storms centered over each watershed so that the maximum runoff would occur at the structure. Because adequate detention storage is developed at each structure paved emergency spillways are unnecessary. Sediment capacity has been provided in the design of the retarding structures for 50 years of sedimentation without encroachment on the effective detention capacity.

Measures for Conservation of Water and Watershed Lands Which Contribute Directly to Flood Prevention - Sixty-four hundred acres of private and state range land are being retired permanently from grazing. The lands retired from grazing include those areas immediately above he retarding structures and any improvement in cover will reduce reservoir sedimentation.

Measures for Evaluating the Effects of the Program - The hydrologic, economic and other effects of this watershed program will be measured in the future. A plan for the installations and procedures required to evaluate these results is now being developed in cooperation with other interested fact-finding agencies. This plan will be distributed later as a supplement to this work plan.

Effect of These Measures on Damages and Benefits - The measures described above will prevent damage from all floods of the size used in the damage evaluation series. Hence, the floodwater damage reduction benefit is equal to the average annual damage under present conditions or $35,220 in Table 4.

Approximately 79 percent of the flood damage reduction benefit is credited to the two retarding structures and 18 percent is credited to the diversions. The remainder is credited to the stabilization and sediment control structures and the range improvement program. The flood prevention benefit is distributed by measures in Table 5.

It is not believed that any significant land use changes will occur from the measures described above. An examination of land use in the flood plain indicates that the presence of a flood hazard is not a primary determinant of land use. This conclusion is confirmed by local people. Hence, no land enhancement benefit is expected to accrue from these measures.

Range forage production on the watershed is extremely limited. Hence, the conservation benefit is insignificant and only $130.00 per year is credited to range improvement in Table 5. As previously mentioned, about one-third of the total watershed above the structures has been retired from grazing use. The remaining area consisting of steep rocky desert mountains is under adequate management by the Bureau of Land

Management. The program is not expected to improve ground or surface water supply significantly and no water conservation benefit is credited to it.

Comparison of Costs and Benefits - The ratio of the average annual benefit from measures primarily for flood prevention ($35,100) to the average annual cost of the measures ($20,730) is 1.7 to 1. The ratio of the average annual benefit ($250) from the range improvement measure to the average annual cost ($130) is about 1.9 to 1. The ratio of total average annual benefits ($35,350) to total average annual value of costs ($20,860) is 1.7 to 1. See Table 5.

ACCOMPLISHING THE PLAN

The sponsoring agency, the Agua Fria Soil Conservation District, and the Soil Conservation Service have mutually agreed to the sharing of costs set forth in combined Table 1 and 2. Specifically, the Soil Conservation District (or the Beardsley Irrigation District or others in behalf of the Agua Fria Soil Conservation District) will:

1. Acquire all lands, easements and rights of way needed for the floodwater retarding structures. This has been done.
2. Purchase and install all outlet pipes in the retarding structures together with gates and appurtenant works. The pipe and gates have been ordered.
3. Clear, strip and excavate the sites for the retarding structures. This has been done.
4. Excavate 300 feet of the spillway on Structure Number 3. Arrangements for accomplishing this are now being negotiated.
5. Arrange to complete the installation of all stabilization and sediment control structures and diversions by December 31, 1954.

6. Provide for periodic inspection of the measures to insure that they are maintained in a satisfactory manner.

7. Bring about the retirement from grazing use of 6,400 acres (about one-third) of watershed above the Structures 3 and 4.

The above items of local contribution are valued at $218,287.

The sponsoring agency has sufficient funds or commitments to meet its obligations within the specified time.

The Soil Conservation Service will:

1. Contract for the earth work for Structures 3 and 4, except for Item 4 above.

2. Design Structures 3 and 4 with appurtenances and will provide engineering supervision and inspection during construction.

3. Transfer to the Agua Fria District the sum of $14,000 to help defray costs of the Districts' portion of the work.

The above items of Federal contribution, plus Program evaluation and development of the work plan are valued at $199,088.

PROVISIONS FOR MAINTENANCE

Executed agreements provide for adequate future maintenance by assuring that periodic inspections, at least annually, will be made by a responsible local agency with representatives of the Soil Conservation Service, annual levies will be made for maintenance purposes and repairs will be made promptly when needed.

COMBINED TABLE 1 & TABLE 2 *

ESTIMATED INSTALLATION COST ** - TOTAL NEEDED PROGRAM

MEASURES	UNIT	NO. TO BE APPLIED	ESTIMATED TOTAL COSTS		
			Federal	Private ***	Total
A-Measures Primarily for Flood Protection					
Floodwater Retarding Structures	No.	2	192,088	119,664	311,752
Stabilization and Sediment Control Measures					
Diversion Dykes & Ditches	Mile	11		77,805	77,805
Debris & Desilting Basins	No.	8		18,068	18,068
SUB TOTAL			192,088	215,537	407,625
B-Measures					
Range Improvement	Ac.	6400		2,750	2,750
TOTAL A & B MEASURES			192,088	218,287	410,375
Facilitating Measures					
SCS					
Program Evaluation			2,000		2,000
Work Plan Development			5,000		5,000
TOTAL SOIL CONSERVATION SERVICE			7,000		7,000
GRAND TOTAL			199,088	218,287	417,375

* For practical purposes, the work being done by local interests is a continuous job. Some items have been completed recently and others are now being constructed concurrently with the work being done by the Federal Government. For convenience, all parts of the program are shown in combined Table 1 and 2.

** All items to be installed during calendar year 1954.

*** It is impractical to distinguish between contributions from Maricopa County and the Beardsley project, which are loc units of government, and from strictly private sources. Hence, no separate column has been shown for Non-Federal Gov't costs and these items are included in Private costs.

TABLE 3

ANNUAL COSTS

MEASURES	AMORTIZATION OF INSTALLATION COSTS			OPERATION AND MAINTENANCE			OTHER ECONOMIC COSTS	GRAND TOTAL
	FEDERAL	PRIVATE	TOTAL	FEDERAL	PRIVATE	TOTAL		
A MEASURES	(1)	(2)						
Floodwater Retarding Structures	$6,950	$5,570	$12,520	--	$2,950	$2,950	--	$15,470
Stabilization and Sediment Control Measures								
Debris & Desilting Basins	--	840	840	--	150	150	--	990
Diversion Dikes & Ditches	--	3,620	3,620	--	650	650	--	4,270
SUB TOTAL	$6,950	$10,030	$16,980	--	$3,750	$3,750	--	$20,730
B MEASURES								
Range Improvement	--	$ 130	$ 130	--	--	--	--	$ 130
TOTAL A & B	$6,950	$10,160	$17,110	--	$3,750	$3,750	--	$20,860

(1) Amortization factor .035258 (50 yrs. @ 2⅝% interest).
(2) Amortization factor .04655 (50 yrs. @ 4% interest).

TABLE 4

SUMMARY OF AVERAGE ANNUAL MONETARY FLOODWATER AND SEDIMENT DAMAGE AND FLOOD PREVENTION BENEFIT FROM THE PLAN
(LONG TERM PRICES)

DAMAGES	AVERAGE ANNUAL DAMAGE			AVERAGE ANNUAL BENEFIT		
	PRESENT CONDITION	B-MEASURES ONLY	A and B MEASURES	B-MEASURES ONLY	A-MEASURES ONLY	TOTAL FLOOD BENEFIT FROM A & B MEASURES
	DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
FLOODWATER & SEDIMENT DAMAGE						
CROP	$13,260	$13,140	0	$ 120	$13,140	$13,260
LAND	4,380	4,380	0	0	4,380	4,380
IMPROVEMENTS	1,310	1,310	0	0	1,310	1,310
TRANSPORTATION FACILITIES	2,790	2,790	0	0	2,790	2,790
DITCH SYSTEMS	6,480	6,480	0	0	6,480	6,480
POWER & PHONE ETC.	--	--	--	--	--	--
INDIRECT DAMAGE	7,000	7,000	0	0	7,000	7,000
TOTAL DAMAGE	$35,220	$35,100	0	XXX	XXXXX	XXXXX
BENEFIT FROM REDUCTION OF DAMAGE	XXXXX	XXXXX	XXXXX	$ 120	$35,100	$35,220
BENEFIT FROM MORE INTENSIVE USE OF FLOOD PLAIN	XXXXX	XXXXX	XXXXX	0	0	0
TOTAL FLOOD PREVENTION BENEFIT	XX	XXXXX	XXXXX	$ 120	$35,100	$35,220

TABLE 5

DISTRIBUTION OF COSTS AND BENEFITS BY MEASURES AND GROUPS OF MEASURES

ITEM	TOTAL COST	AVERAGE ANNUAL COST	FLOODWATER & SEDIMENT BENEFIT	MORE INTENSIVE USE OF LAND	CONSERVATION BENEFIT	TOTAL	BENEFIT COST RATIO
A MEASURES							
Floodwater Retarding Structures	$316,752	$15,470	$27,970	-	-	$27,970	1.8 to 1
Stabilization and Sediment Control Measures							
Debris & Desilting Basins	18,068	990	990	-	-	990	1.0 to 1
Diversion Dikes & Ditches	77,805	4,270	6,140			6,140	1.4 to 1
TOTAL A MEASURES	$412,625	$20,730	$35,100			$35,100	1.7 to 1
B MEASURES							
Range Improvement	2,750	130	120		$130	250	1.9 to 1
TOTAL	$415,375/1	$20,860	$35,220		$130	$35,350	1.7 to 1

/1 Does not include the cost of program evaluation ($2,000).

TABLE 6

FLOODWATER RETARDING STRUCTURE DATA

SITE NO.	DRAINAGE AREA SQ. MI.	STORAGE CAPACITY: SEDIMENT POOL	STORAGE CAPACITY: DETENTION POOL	STORAGE CAPACITY: TOTAL	SURFACE AREA: SEDIMENT POOL	SURFACE AREA: DETENTION POOL	SURFACE AREA: TOTAL	SURFACE AREA: TOP OF SED. POOL	SURFACE AREA: TOP OF DET. POOL	SURFACE AREA: MAXIMUM HT. OF DAM	FLOOD PLAIN AREA INUNDATED: UNDER SED. POOL	FLOOD PLAIN AREA INUNDATED: UNDER DET. POOL	FLOOD PLAIN AREA INUNDATED: TOTAL	VOL. OF FILL	DRAW DOWN RATE	TYPE OF SPILLWAY	EST. TOTAL COST
		AC.FT.	AC.FT.	AC.FT.	INCHES OF RUNOFF			ACRES		FEET	ACRES			C.Y.	CFS		
3*	24.1	193	2,462	2,655	.14	1.92	2.06	30	384	30	---	---	---	375,000	375	Earth	$229,50
4*	10.3	72	964	1,036	.13	1.76	1.89	14	221	20	---	---	---	175,000	100	Earth	$124,15
																	353,65

Sediment Storage based on 50 Year estimated accumulation (including structures on Drainage Area).

*Note discussion of numerical designations in narrative portion of report.

TABLE 7

SUMMARY OF PROGRAM DATA

ITEM	UNIT	QUANTITY
YEARS TO COMPLETE PROGRAM	YEAR	1
TOTAL INSTALLATION COST		
FEDERAL	DOLLARS	199,088
NON-FEDERAL	DOLLARS	218,287
ANNUAL O & M COST		
FEDERAL	DOLLARS	---
NON-FEDERAL	DOLLARS	3,750
ANNUAL BENEFITS	DOLLARS	35,350
FLOODWATER RETARDING STRUCTURES	EACH	2
AREA INUNDATED BY STRUCTURES		
FLOODPLAIN	ACRES	0
UPLAND	ACRES	605
WATERSHED AREA ABOVE STRUCTURES	ACRES	22,000
REDUCTION IN FLOODWATER AND SEDIMENT DAMAGE		
A MEASURES	PERCENT	99.7
B MEASURES	PERCENT	0.3
REDUCTION OF EROSION DAMAGE		
A MEASURES	PERCENT	---
B MEASURES	PERCENT	---
OTHER BENEFITS		
A MEASURES	DOLLARS	---
B MEASURES	DOLLARS	130

TABLE 8

SUMMARY OF PHYSICAL DATA

ITEM	UNIT	QUANTITY WITHOUT PROGRAM	QUANTITY WITH PROGRAM
WATERSHED AREA	SQ. MI.	92.4	92.4
WATERSHED AREA	ACRES	59,136	59,136
AREA OF CROPLAND	ACRES	34,112	34,112
AREA OF GRASSLAND	ACRES	25,024	25,024
AREA OF WOODLAND	ACRES	---	---
FLOODPLAIN SUBJECT TO DAMAGE BY DESIGNATED STORM	ACRES	4,800	0
ANNUAL RATE OF EROSION (FLOOD PRODUCING PORTION)			
SHEET	TONS/YR)	33,900	31,900
GULLY	TONS/YR)		
STREAMBANK	TONS/YR)		
SCOUR	TONS/YR)		
AREA DAMAGED ANNUALLY BY:			
SEDIMENT	ACRES)	660	0
FLOODPLAIN SCOUR	ACRES)		
SWAMPING	ACRES	---	---
STREAMBANK EROSION	ACRES	---	---
SHEET EROSION	ACRES	Not determined	
SEDIMENT PRODUCTION (FLOOD PRODUCING PORTION)	TONS/AC/YR	.77	1/
SEDIMENT ACCUMULATION IN RESERVOIRS	AC/FT/YR	---	---
FREQUENCY OF FLOODING	EVENTS/YR	.3	0
AVERAGE ANNUAL RAINFALL	INCHES	8	8
AVERAGE ANNUAL RUNOFF	INCHES	.3	.3

1/ Amount depends on trap efficiency of retarding structures. No basis for accurate estimate at this time.

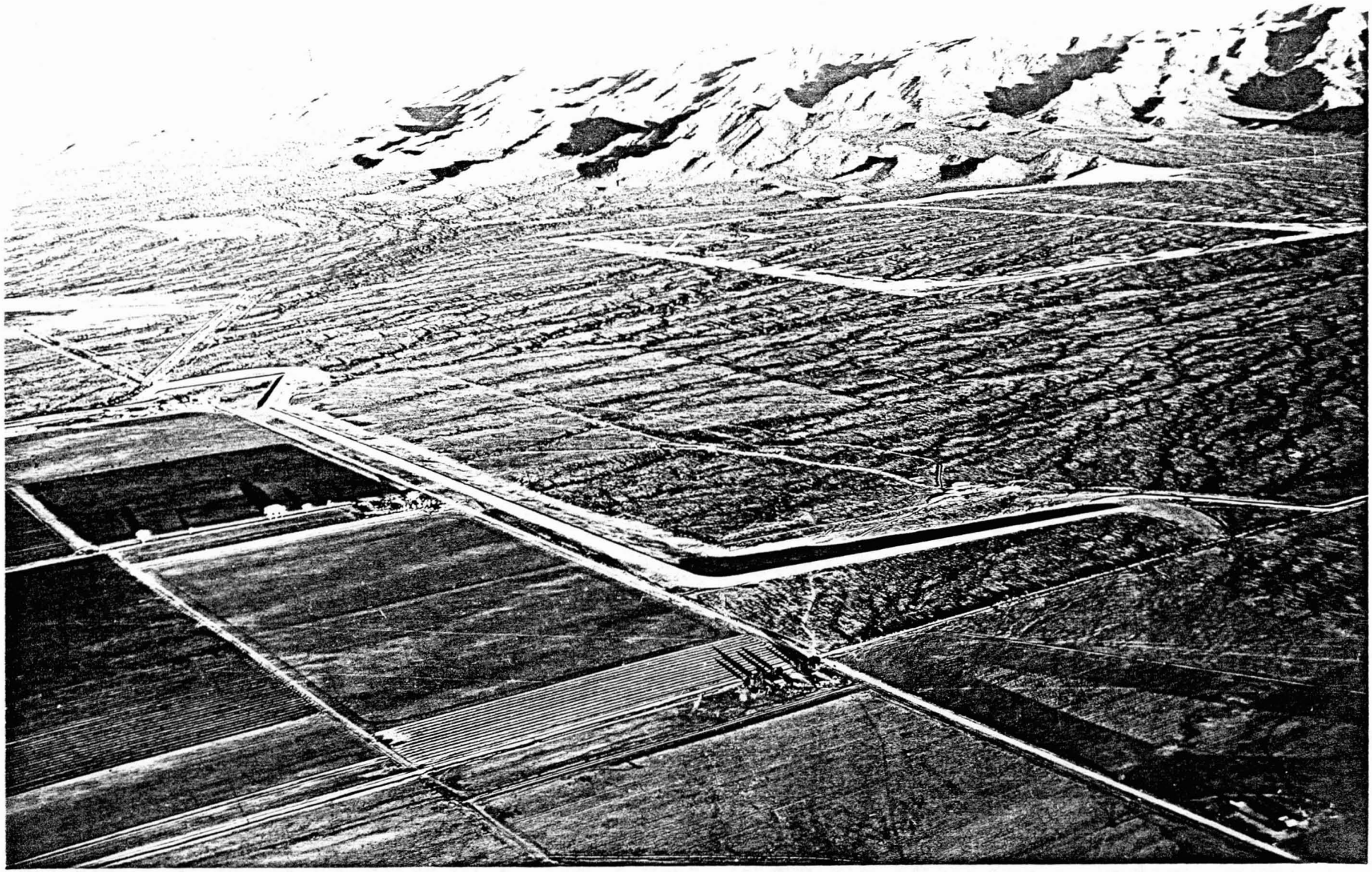
Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

	Structure No. 3	Structure No. 4	McMicken Dam
Cooperating Federal Agency	1954, SCS	1954, SCS	1956, C of E
Length	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height	30 ft.	20 ft.	38 ft.
Spillway Size	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F.	2655 AF	1036 AF	19,000 AF
Reservoir Capacity in inches of runoff	2.1	1.9	1.6
Crest Width	10'	10'	12'
Side slope	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets	3 pipes	2 pipes	1 box
Size of outlets	48", 48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets	- - - -	- - - -	4400 cfs.
Evacuation time	80 hrs.	118 hrs.	- - - -
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.	.3	.3	.25
Total cost of Project	$395,145.00		$2,180,000.00
Private Contributions	196,057.00		180,000.00
Public Contributions	199,088.00		2,000,000.00
Annual O & M cost (Non-Federal)	3,750.00		17,000.00
Estimated annual cost of project (50 yr. amortization)	20,860.00		115,000.00
Estimated annual benefits (50 yr. amortization)	35,220.00		200,000.00

Benefit - cost ratio 1.7 to 1

- Maintenance costs 1960-61-62   ave. $795/mi./yr.   ave $306/mi/yr. dike



Az-5302

White Tanks Project. View facing northwest with White Tank mountain in background. Structure No. 4 above protected farm lands in foreground with diversion dykes in center and right center.

Photographed by Edward D. Neville on March 2, 1955.

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UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
Region 6

Date February 27, 1953
Watershed #4

Page 1
(Sheet 1 of 2)

JOB PROPOSAL

Preliminary
Detailed Report

Class of Job R

1. Name of project White Tanks Erosion Control Project

2. Location: (a) State Arizona (b) County Maricopa (c) Nearest town Litchfield Park
(d) S.C.D. Agua Fria (e) Watershed Trilby Wash & White Tank Mts.

3. Sponsoring organization data: (a) Name Agua Fria SCD & MCMWCD No. 1
(b) Is sponsor - (1) Individual_____ (2) Informally organized group_____ (3) Mutual company_____
(4) Irrigation or drainage district X (5) Private corporation_____
(c) If corporation, is it: (1) Profit_____ or (2) Non-profit X in objective?

4. Type and purpose of project_____
(irrigation, drainage, stream bank protection,
Flood Control
flood control, watershed treatment, etc.)

istory of project (water supply, work of other agencies, failures, present financial status, how ell have project works been maintained, etc.)

The Maricopa County Municipal Water Conservation District No. 1 and other property owners along the easterly side of the White Tanks Mountains and below Trilby Wash are subject to losses and severe damage because of floods originating along the east slope of the White Tank Mountains and in the Trilby Wash watershed. Such damage has consisted in the main of soil erosion, crop loss, severe damage to roads, railroads, public utilities, and other items. Present farming methods tend to aggravate the situation by removal or changes, and occasionally complete obliteration of principal shallow drainageways.

6. Character and description of work required (be specific):

Four detention dams are designed to furnish adequate protection from major floods from U. S. Highway 60-70-89 to the Roosevelt Irrigation District Canal - a distance of approximately 18.5 miles. Controled outlets will be provided to drain off detained water into existing canals and laterals. The system of four dams will give adequate protection to the farmland east of the main Beardsley Canal and to a portion of farmland in the Roosevelt Irrigation District. It is planned to let contracts for the earthwork only and the MCMWCD No. 1 will do the remaining miscellaneous work.

AGR-SCS-ALBUQUERQUE, N. MEX. M-204-3 FEBRUARY 1953

7. (a) State cooperator's interest in the project and method of financing and willingness to undertake construction on the basis of the accompanying estimate (be specific):

Interest on the part of the Agua Fria SCD, the MWCD No. 1, Goodyear Farms, Public Utilities, Santa Fe Railroad and key land owners is active. Water right filings have already been made with the State Land Commissioner. Funds for construction of the project will be raised by subscription by the land owners, Public Utilities, Santa Fe Railroad and Maricopa County.

(b) Does this proposal represent the formally expressed wishes of the majority of the group or stockholders, or of the board of directors? State which Majority of group.

8. Does cooperator agree to follow plans and specifications? Yes

9. (a) Have specific maintenance requirements been discussed with sponsors? Yes

(b) In your opinion, will the sponsors provide adequate maintenance? Yes

(c) Has a maintenance schedule been set up in the agreement? Yes

10. Estimated benefits and justification:

(a) Land directly benefited by proposed project 71,000 Acres

(b) Average cost per acre directly benefited (costs from 13-a) $ 15.51

(c) Discuss benefits, including benefits to other interests (State, Federal, County, Public Utilities, Private, etc.)

The Santa Fe Railroad, State and County roads, Luke Air Force Base, Litchfield Naval Air Facility, Town of Goodyear, farms, wells, irrigation systems, etc., and protection of crops - all will benefit extensively.

(d) Possible adverse effects of project - danger to life or property

No adverse effects are contemplated. The structures are designed with adequate storage capacities to detain maximum improbable floods. With the provisions that are planned in operating the completed project the possibility of adverse effects is remote.

11. Wh

Class	I	II	III	IV	Other
(a) Potential Land Use Capability (acres)	42600	21400	7000	0	0
(b) Present condition (acres)	42600	21400	3500	3500	0
(c) After treatment (acres)	42600	21400	7000	0	0

(If proposed work does not affect land use, omit 11.)

12. (a) How much land served by this project is now under agreement with the S.C.D.?

60,384 acres

) What effect will assistance given on this job have on conservation on lands served by the project? What measures are proposed to secure conservation? Effect will be to make major and other conservation work being done more permanent because of the removal of flood damage danger. No measures are needed to secure conservation, but continued support of the SCD by the people will serve to secure additional conservation.

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Job Proposal
(Sheet 2 of 2)

Name of Project White Tank Erosion Control Project

13. Estimated quantities and costs.

(a) Construction costs.

Item	Unit	Quantity	Unit Cost	Total Cost
Structure No. 3				
Clearing & Grubbing	Ac.	63	15.00	$ 945.00
Stripping & Excavation	C.Yd.	50,831	0.15	7,624.65
Embankment - Compacted	C.Yd.	363,109	0.40	145,343.60
Reinforced Concrete	C.Yd.	28	65.00	1,820.00
Reinforced Gunite	Sq.Ft.	5,220	.35	1,827.00
C.M.P.	Lin.Ft.	321.5		5,980.00
Gates		3		2,050.00
Labor for Structures		3	500.00	1,500.00
				$167,090.25
Structure No. 4				
Clearing & Grubbing	Ac.	36	15.00	$ 540.00
Stripping & Excavating	C.Yd.	28,518	.15	4,277.70
Embankment - Compacted	C.Yd.	170,290	0.40	68,116.00
Reinforced Concrete	C.Yd.	9	65.00	585.00
Reinforced Gunite	Sq.Ft.	1,380	0.35	483.00
C.M.P.	Lin.Ft.	189.5		2,512.00
Gates	2			889.00
Labor for Structures	2		400.00	800.00
				$ 78,202.00
				245,292.25

(Do not include technical costs in above estimate)

Total construction costs (a) $_____

(b) SCS technical costs $_____

(c) Sponsor's or owner's technical costs $_____

(d) Total cost (items a + b + c) $_____

14. Will O. and M. costs be increased or reduced, and how much? $_____

15. (a) Discussion of labor, equipment and material needs and arrangements

(b) How will job be constructed - force account, contract, or otherwise?

(a) When will work start?_____ (b) When will job be completed?_____

17. Surveys and plans.

(a)

Type	Percentage Complete	Estimated Additional Man Hours to Complete
(1) Investigations	_____	_____
(2) Surveys	_____	_____
(3) Detailed plans and specifications	_____	_____
(4) Other	_____	_____

(b) How much technical assistance will sponsor supply?

(c) Will Service technical assistance outside of Work Group be required, including regional office? (Specify)

18. Legal information

(a) Water rights: Are water rights, direct diversion and/or storage, already established for use of water as planned for this project?_____
If not, is water user proceeding to acquire the required water right in accordance with State regulations?_____

(b) Easements and rights-of-way: Are any required?_____
Have they been acquired?_____ or is sponsor proceeding to acquire them?_____

Technical Engineering Approval:

By_____

_____
Date

_____
(County, City, Irrigation Co., etc. Date

Has Zone Conservationist seen and approved this job?_____

_____
(Soil Conservation District Rep.) Date

_____
(Soil Conservation Service Rep.) Date

_____
Date

(Supplemental sheets may be used if required; identify with proper number of the item enlarged upon.

17. Surveys and plans:

(a)

Type	Percentage Complete	Estimated Additional Man Hours to Complete
(1) Investigations	100	
(2) Surveys	100	
(3) Detailed plans and specifications	95	100
(4) Other	100	

(b) How much technical assistance will sponsor supply?

Rodmen, chairmen
Engineer for preparation of specifications
Part time draftsman

(c) Will Service technical assistance outside of Work Group be required, including regional office? (Specify)

18. Legal information

(a) Water rights: Are water rights, direct diversion and/or storage, already established for use of water as planned for this project?_____

If not, is water user proceeding to acquire the required water right in accordance with State regulations? Yes

(b) Easements and rights-of-way: Are any required? Yes

Have they been acquired?_____ or is sponsor proceeding to acquire them? Yes

Technical Engineering Approval:

By_____

_____
Date

Has Zone Conservationist seen and approved this job? Yes

_____
Date

L. Rodmon — (County, City, Irrigation Co., etc.) — Date 2-27-53

L. Rodmon — (Soil Conservation District Rep.) — Date 2-27-53

Lucien G. Reed — (Soil Conservation Service Rep.) — Date 2-27-53

(Supplemental sheets may be used if required; identify with proper number of the item enlarged upon.

Form R6-226
(. 3/1/50)
... Proposal
(Sheet 2 of 2)

Name of Project White Tanks Erosion Control Project

13. Estimated quantities and costs:

(a) Construction costs.

Structure No. 1 Item	Unit	Quantity	Unit Cost	Total Cost
Clearing & Grubbing	Acre	264	15.00	$ 3,960.00
Stripping & Excavation	C.Yd.	216,256	0.15	32,438.40
Embankment - Compacted	C.Yd.	1,221,094	0.40	448,437.60
Reinforced Concrete	C.Yd.	290	65.00	18,850.00
Reinforced Gunite	Sq.Ft.	6,000	.35	2,100.00
C.M.P.	Lin.Ft.	790		31,174.00
Control Gates	6			8,577.00
Labor for Structures	6		600.00	3,600.00
				$589,137.00
Structure No. 2				
Clearing & Grubbing	Acre	138	15.00	$ 2,070.00
Stripping & Excavation	C.Yd.	114,845	0.15	17,227.00
Embankment - Compacted	C.Yd.	549,720	0.40	219,888.00
Reinforced Concrete	C.Yd.	150	65.00	9,750.00
Reinforced Gunite	Sq.Ft.	7,000	0.35	2,450.00
C.M.P.	Lin.Ft.	460		10,138.00
Control Gates	5			3,839.00
Labor for Structures	5		400.00	2,000.00
				$267,362.00

(Do not include technical costs in above estimate)

	Total construction costs (a)	$ 1,101,799.95
(b)	SCS technical costs	$ 10,528.05
(c)	Sponsor's or owner's technical costs	$ 9,581.85
(d)	Total cost (items a + b + c)	$ 1,121,909.85

14. Will O. and M. costs be increased or reduced, and how much? $ 235,900 Annually

Reduced to practically zero, except for small storms below and east of the proposed dams.

15. (a) Discussion of labor, equipment and material needs and arrangements

(b) How will job be constructed - force account, contract, or otherwise?

Contracts for earthwork, MCMWCD No. 1 to do miscellaneous work.

(a) When will work start? 1953 (b) When will job be completed? 1958

390-11-11

W H I T E T A N K S

WATERSHED PROTECTION PROJECT

Agua Fria Soil Conservation District

Maricopa County

A R I Z O N A

STRUCTURES NUMBERS 3 & 4

OUTLET WORKS "K" - "L" - "M" - "N" - "O"

INSTALLATION SPECIFICATIONS

SPECIFICATIONS FOR THE INSTALLATION OF OUTLET STRUCTURES "K", "L", "M", "N", & "O", IN STRUCTURES 3 & 4 OF THE WHITE TANKS EROSION CONTROL PROJECT.

OUTLET STRUCTURES

The outlet structures which are part of Structures Nos. 3 and 4 shall be constructed as shown on the Plans and conform to lines, grades and dimensions as shown and in accordance with the Plans and Specifications for all items constitute the complete structure.

The items which comprise the complete structures are: installation of the discharge pipes with steel anti-seep rings, construction of the reinforced concrete inlet and outlet boxes, concrete steel anchors, reinforced concrete base for the lift mechanism, and installation of the control gate, gate stem, vent pipe, lift mechanism and trash rack. All miscellaneous items stated above will be performed by the District.

(a) Materials: The materials used shall be those stated above or described herein.

(b) Construction Methods:

(1) Excavation: Excavation of the trenches for the outlet pipes shall be made by the Contractor as specified under the Item #2. Excavation; Invitation No. Reg. 6-3202, "Schedules, Specifications and General Conditions for the Construction of Earth Filled Dikes known as White Tanks Structures Numbers 3 and 4". The Contractor will be required to construct the fill at the outlet pipes to a minimum of 12 inches above the top of the anti-seep rings. The trenches will then be excavated by machine methods according to the lines and grades established by the Engineer. Fine grading and necessary hand excavating and trimming shall be done by District forces.

(2) Backfill of Outlet Pipe Trenches: Backfilling of the outlet pipe trenches shall be done with select materials approved by the Engineer. Backfill shall be placed along side the pipe in layers not to exceed six (6) inches in depth before compaction. If necessary to bring moisture content up to optimum, water shall be added to the backfill material. Special care shall be taken to thoroughly compact the fill under the haunches; by mechanical or hand tamping devices. Extreme care shall be exercised to prevent damage to the pipe and anti-seep rings. Heavy equipment will not be permitted to cross or run over any portion of the outlet pipes and rings until a minimum of twelve (12) inches of backfill after compaction has been placed above the top of the anti-seep rings.

(3) Foundations: Foundations shall be thoroughly compacted before any material is placed thereon.

(4) Forms: Forms shall be of wood or metal and so constructed as to have mortar tight joints. All forms shall be set and maintained true to lines and grades and dimensions as designated on the plans until the concrete has hardened sufficiently to permit safe removal.

No wooden spreaders shall be left in the concrete. All sawdust, shavings, chips and other deleterious materials shall be removed from the forms before concrete is placed therein.

Form ties of suitable design and construction may consist of steel wire of proper gage. Ties of special design may be used but are not a requirement of this project.

(5) Construction Operations: Structures are of relatively small size and shall each be poured in continuous operation. Headwalls, sidewalls and wingwalls shall be cast full depth and working faces shall be kept horizontal. The top surfaces of walls shall be carried up to specified grade, tamped, troweled, and finished with a sidewalk edger. Aprons will be floated and troweled to a smooth finish. All top surfaces of walls and all exposed surfaces of aprons shall be protected from the direct rays of the sun while the concrete is setting.

(6) Construction Joints: No construction joints other than those specified or shown on the Plans will be allowed except by permission of the Engineer. All construction joints shall be keyed and bonded as approved by the Engineer.

(7) Removal of Forms: A minimum of 36 hours will be required to elapse after the last pour in the section before forms will be removed. The Engineer may extend this time because of weather conditions or other conditions that may retard the setting of the concrete. No forms shall be removed without the approval of the Engineer.

Care shall be exercised in removing forms so as not to deface or injure the structure. Supports shall be removed in such a manner as to permit the concrete to uniformly and gradually take the stresses due to its own weight.

Holes and porous spots in the concrete surfaces shall be filled in a manner satisfactory to the Engineer. Bolts, wires, etc., used to hold forms shall be cut off and covered in a neat workmanlike manner and the surface finished as stipulated in "Portland Cement Concrete."

PORTLAND CEMENT CONCRETE

Portland cement concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, and water, so proportioned and mixed as to produce a plastic workable mixture in accordance with all requirements of this section and suitable to specific conditions of placement.

(a) Materials: All materials shall be delivered, stored and handled by the District in a manner as to prevent inclusion of foreign materials and the damage of materials by water or breakage. Packaged materials shall be delivered in original packages until ready for use. Packages or materials showing evidence of water or other damage shall be rejected. All materials shall be of the respective qualities and quantities specified herein.

(1) Cement: All cement shall be of a reputable brand and shall conform to the specifications and test for Portland Cement. A.S.T.M. Specifications (Serial Designation C 150-47) Type II. High early strength cement, if used, shall conform to A.S.T.M. Specifications (Serial Designation C 150-47) Type III.

Cement shall not contain more than 6% of tricalcium aluminate. Each sack shall contain not less than ninety-four (94) pounds (net) of cement and such sack shall be deemed to have a volume of one (1) cubic feet. No resacked cement and no lumpy or partially set cement shall be used.

Class "A" concrete shall be a mixture as specified above, in which the cement in the finished product shall be not less than six (6) sacks, 564 pounds, to secure a minimum compressive strength of 2,500 pounds at twenty-eight (28) days.

(2) Aggregates: All aggregates shall conform to Standard Specifications for Material and Tests for Portland Cement A.S.T.M. Designation C 33-46 and D 75-39T and subsequent amendments thereto.

(a) Fine Aggregate: Fine aggregate for concrete or mortar shall consist of clean, coarse, sharp silica sand, uncoated and free from lumps of clay, soft or flaky particles, loam, caliche, ice or frost, and injurious amounts of organic matter. The total quantity of deleterious substances shall not exceed three percent (3%) by weight. Sand shall meet the following requirements for grading:

Passing	No. 4	sieve	95-100%
"	16	"	45-80%
"	50	"	10-22%
"	100	"	2-8%
"	200	"	0-4%

(b) Coarse Aggregate: Coarse aggregate shall consist of clean, hard, durable particles of crushed stone or gravel graded in size, free from organic or other deleterious matter, and shall contain no flat or elongated particles. Coarse aggregate shall be graded from coarse to fine and shall conform to the following limiting percentage by weight:

Passing	1-1/2"	sieve	95-100%
"	1"	"	88-100%
"	3/4"	"	35-70%

Passing	1/2"	sieve	25-60%
"	3/8"	"	10-30%
"	No. 4	"	0-5%

The use of unscreened aggregate or crusher run stone will not be permitted.

(3) Admixtures: At the option of the District admixtures may be used to prevent segregation and improve workability. The Engineer shall then specify the proportion and type of admixture to be used.

(4) Water: The water used for concrete shall be free from injurious amounts of oil, acid, alkali, clay, vegetable matter, silt, soluble salts or other harmful matter.

(b) Construction Methods:

(1) Proportioning. Concrete shall be proportioned to secure the strength as hereinbefore specified. It shall be permissible for the District to use the volume method providing that measuring boxes of known capacity are used to measure each size of aggregate.

To obtain the previously specified Class "A" concrete, the following proportions shall be used:

One	(1)	part cement
Two	(2)	parts fine aggregate
Four	(4)	parts coarse aggregate
Seven	(7)	gallons of water maximum per 94 pound sack of cement.

The specified water proportion shall include the total amount of water to be used which will include free water that is in the aggregates, and will not be a measure solely of the amount of water to be added to the mixer.

No change in the source, character or grading of the materials shall be made without due notice to the Engineer and no work shall proceed using such changed or new materials until the Engineer has duly determined and designated a mix based on the new or altered materials.

The several ingredients shall be measured separately before being mixed and uniform proportions of materials in each batch shall be accurate to within .5%.

(2) Mixing: All concrete shall be mixed in a batch mixer of approved type, except when small quantities do not justify a batch mixer.

No concrete shall be mixed when the atmospheric temperature is below 40 degrees F., and such precautions as may be deemed necessary by the Engineer shall be used to protect the work during such time as the temperature is below 40 degrees F. No material containing ice or frost shall be used regardless of the temperature of the air at the time. Aggregate in

such condition shall be heated until the material is in a satisfactory condition for use.

Concrete which has partially set or which is not in place in the form within 30 minutes after being mixed shall not be used. Retempering will not be permitted.

(a) Machine Mixing: Mixing equipment shall be of the mechanically operated type and shall be equipped with a device for accurately measuring the amount of water entering the concrete. The mixer drum shall revolve at a speed of not less than fourteen (14) and not more than twenty (20) revolutions per minute.

Concrete shall be mixed in batches requiring a minimum of one (1) full sack of cement. Concrete shall be mixed for a period of not less than one and one-half minutes after all materials, including water, have been placed in the mixer.

The volume of material mixed in each batch shall at no time exceed the manufacturer's guaranteed capacity, and the entire contents of the drum shall be discharged before any materials are placed therein for the succeeding batch.

The capacity of the mixer shall be of such that any monolithic unit of concrete may be placed and finished in one continuous operation.

The use of mixed-in-transit concrete shall be at the option of the District providing that all requirements of this Specification are complied with. The mixing of concrete in transit mixing equipment shall conform to requirements which will be designated by the Engineer.

(b) Hand Mixing: Hand mixing may be employed by permission of the Engineer in cases of emergency or when small quantities do not justify a mechanical mixer. Should this method of mixing be employed, the Engineer shall establish the conditions and requirements underwhich it will take place.

(3) Consistency: The total amount of mixing water used shall in no case exceed seven (7) gallons per ninety-four (94) pound sack of cement. The amount of water used shall be the minimum consistent with the required workability.

The slump shall not exceed 4 inches on the basis of slump tests as described by the A.S.T.M. in "Slump Test for Consistency of Portland Cement Concrete" Serial Designation C 143-39.

(4) Placing Concrete: No concrete shall be placed until the depth and character of the foundation, the adequacy of the forms, and the placing of the steel have been approved by the Engineer.

Concrete shall be placed in the forms, immediately after the mixing, in horizontal layers not exceeding twelve (12) inches in depth. It shall be so deposited that the aggregates are not separated. Dropping the concrete any considerable distance, depositing large quantities at any point, and running or working it along the forms, or any other practice tending to cause segregation of the ingredients, will not be allowed. Care shall be taken to fill every part of the forms, to work the coarser aggregate back from the face, and to force the concrete under and around the reinforcement without displacing it. Mass concrete shall be deposited in continuous horizontal layers, and whenever practicable all concrete shall be deposited continuously for each monolithic section of the work. Concrete shall be deposited as nearly as possible in its final position to avoid segregation by rehandling.

All concrete in structures shall be compacted by means of approved pneumatic, mechanical, or electric vibrators, the frequency of which shall be subject to approval by the Engineer. The vibrators shall be placed in the concrete and shall not be attached to the forms or the reinforcing steel. In no case shall they be allowed to vibrate against the forms. The vibration shall be sufficiently intense to cause the concrete to flow or settle readily into place and to visibly affect the concrete over a radius of at least eighteen (18) inches. Vibration shall be supplemented by forking or spading by hand tools adjacent to the forms on exposed faces in order to secure smooth dense surfaces. The concrete shall be thoroughly compacted around reinforcements, pipes, or other shapes built into the work. On the surfaces of the structures, and on all exposed surfaces and slabs, the concrete shall be thoroughly spaded or floated to bring rich mortar to the face. The District shall provide sufficient apparatus to insure uninterrupted and continuous vibration of the concrete.

Special care shall be taken to place the concrete solidly against the forms so as to leave no voids. Precaution shall be taken to make all concrete solid, compact, water-tight, and smooth. If for any reason the surfaces have voids or are in any way defective, such concrete shall be cut out and properly grouted if so directed by the Engineer. The mortar being well forced into the imperfect concrete and finished off in a neat workmanlike manner.

All reinforcement shall be placed and properly secured in its correct position before any concrete is placed in the forms. In addition, the forms shall have been inspected and approved by the Engineer and loose form ties at construction joints have been retightened, all dowels, bucks, sleeves, hangers, pipes, bolts, wires, and any other fixtures required to be embedded therein have been placed and anchored, and the forms shall have been cleaned and oiled as specified. Concrete shall not be placed at any time except under the direct supervision of the Engineer.

(5) Curing Concrete: Unless otherwise specified by the Engineer, and as soon as the forms have been removed, all exposed surfaces of concrete shall be cured by either applying a ready-mixed membrane curing compound, or by sprinkling the concrete with water and protecting the

surfaces with moistened sacks or moist earth. Should the District choose to use the membrane curing method, the compound and method of application shall be subject to approval by the Engineer.

The curing of concrete shall be continued for a period of at least seven (7) days after placing, if normal Portland cement is used, or for three (3) days if high early strength cement is used.

(6) Finishing Concrete: Immediately after the removal of forms, all fins and irregular projections shall be struck flush from all exposed exterior and interior concrete surfaces. All holes, porous spots, honeycomb, rock pockets, or other imperfections in the surface shall be cleaned out and carefully filled with a mortar of the same sand-cement content and consistency as the concrete.

After the completion of the pointing, as specified, the surfaces and slabs shall be thoroughly floated with a wooden float.

(c) Measurement: Since the District will do the necessary work, it will not be necessary to measure the structures for payment.

(d) Basis for Payment: No basis for payment is hereby specified, as the work will be performed entirely by the District.

REINFORCING STEEL

The District shall furnish and place all steel reinforcement of the quality, type and size designated in accordance with these Specifications and as shown on the Plans.

(a) Material: Steel for reinforcing bars to be embedded in concrete shall be corrugated or deformed bars of the size shown on the Plans. Bars shall be rolled from open hearth steel billets (not re-rolled material), and shall conform to the requirements of the "Standard Specifications for Billet-Steel Bars for Concrete Reinforcements," Serial Designation A 15-39 A.S.T.M. Bars shall be of the grade therein specified as intermediate grade. Bars shall be free from defects and kinks and from bends not shown on the Plans.

All bars shall be of new stock, free from rust, scale, mill-scale, or excessive rust when placed in the work. A thin coating of red rust resulting from short exposure will not be considered objectionable, but any bars having rust scale, mill scale, or a thick rust coat shall be thoroughly cleaned or shall be rejected and removed from the premises upon the order of the Engineer.

(b) Placing: The District shall supply all necessary wiring, supports, and labor to put the reinforcement in place, fasten it securely and keep it in place while concrete is being poured. Concrete spacing chairs and other accessories conforming to A.C.I. Standards may be used to hold the bars in position at the option of the District, but such items are not a stipulation of these specifications. The District shall place the bars

indicated on the Plans and said bars shall be cut and bent, as required and properly wired together. All bending shall be accurately done as shown on the Plans and by methods and appliances approved by the Engineer. Adjoining bars and splices shall overlap at least thirty-six (36) diameters unless otherwise specified. The use of pebbles or wooden blocks for blocking will not be permitted. Precast concrete blocking or bar chairs shall be used in slabs, and other places where applicable.

The placing and fastening of reinforcements in each section of the work shall be approved by the Engineer before any concrete is deposited in the section.

GUNITE

Outlets "K", "L" and "M" of Structure No. 3 and "N" and "O" of Structure No. 4 require Gunite for portions of the outlet transitions and for the ditch linings. All such work, including the necessary earth work, shall be done by the District.

(a) Earth Work: All specifications hereinbefore listed for stripping, excavation and compacted or rolled earth fill, etc., shall apply in all cases. For the ditches and fills shall be placed and compacted before the sections are shaped. All hand trimming and fine grading, cutting of ditch sections, etc., shall be done to lines and grades established by the Engineer. Before any Gunite is placed, the earth fills or sections shall be thoroughly moistened by sprinkling.

(b) Aggregates: Fine aggregate shall consist of clean hard durable sand, well graded from fine to coarse, with no particles larger than 3/8 inch. It shall be free from organic matter and shall not contain more than 5% by weight passing the No. 200 sieve. The sand used shall contain not less than 3% and not more than 6% of moisture.

(c) Reinforcement: Mesh wire reinforcement shall be placed as shown on the Plans. All items hereinbefore specified under Portland Cement Concrete and Reinforcing Steel shall apply to this work. Gunite shall be cured in the same manner as specified for Portland Cement Concrete, and the same precautions shall apply for protection from freezing.

390-11-13-14

Condensed Summary

WHITE TANK PROJECT
ARIZONA

Constructed, Spring 1954

	Structure No. 3	Structure No. 4
Capacity	2655 ac.ft.	1036 ac.ft.
Length	7700 ft.	6800 ft.
Drainage Area	24.1 sq.mi.	10.3 sq.mi.
Max. Fill Height	30 ft.	20 ft.
Spillway Size	1100' x 3'	2 @ 165' x 3'
Spillway Capacity	16150 cfs.	4400 cfs.
Capacity in inches of runoff	2.06	1.89
Crest width	10'	10'
Side Slope	2½:1 & 2:1	2:1 & 2:1
No. of outlet pipes	3	2
Size of outlet pipes	48", 48" & 24"	30" & 36"
Evacuation time	80 hrs.	118 hrs.
Sediment production: 0.3 A.F. per Sq.Mi. per yr. est.		
Total embankment	351,481 c.y.	171,728 c.y.
Cost emb.	.272 c.y.	.212 c.y.
Cost Rolling	.02 c.y.	.02 c.y.
Cost Sprinkling	.02 c.y.	.02 c.y.

Total structural excavation - 1455 c.y. @ .30

Site preparation - total cost $900.00
Clearing & Stripping - " " $950.00

Estimated total cost of project	$417,375.00
Estimated private contributions	218,287.00
Estimated public "	199,088.00
Annual O & M Cost (non-federal)	3,750.00
Estimated annual cost of project (50 yr. amortization)	20,860.00
Estimated annual benefits (same basis)	35,220.00

Benefit - cost ratio 1.7 to 1

Spillway Flood design Frequency: 6" tropical summer type storm (.005 Probability)

Reservoir Flood design Frequency: 4" tropical summer type storm (.01 Probability)

cost of 4 is 171,728 of 417,375 = 523,269

[illegible]
2,648.99
150.95
1,10[illegible].95
5.07
6[illegible]
75.60
15.07
1[illegible],793.00
287.90
1,379.5[illegible]
50.45
185,590.36

Refer: Ref. [illegible] Sec 461(2)(b)2.

Rec'd from [illegible] 10/15/62.

SCS-113 Verification of [illegible] of outstanding [illegible] and G/L [illegible]

G/L #347	295,100.9[illegible]
#343	1,466,614.88
Total	1,761,605.75
SCS-98	1,265,570.46
	310,244.95
	1,576,215.30

SCS 347	1,761,605.75
98	1,576,215.39
9/30/62 difference see above	185,[illegible]

T.F. Disbursements G/L and 98's 9/30/62

[illegible signature]

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

~~Washington, D. C. 20250~~ Arizona State Office, Phoenix, Arizona

SUBJECT: WATERSHEDS - White Tanks Project - Report on Flood of September 5, 1970

DATE: November 12, 1970

TO: M. E. Strong, State Conservationist
SCS, Phoenix, Arizona

1. In the summer of 1954 two flood control structures, identified as White Tanks No. 3 and No. 4, were built by the Soil Conservation Service in cooperation with the County of Maricopa, the Municipal Water Conservation District No. 1, and the Agua Fria-New River Soil Conservation District.

2. The project was known as the White Tanks Erosion Control Project and SCS participation was under the Pilot Watershed Program.

3. It is reported that 4.5" of precipitation were recorded in a gauge near the intersection of Jackrabbit Road (195th Avenue) and West Indian School Road. (See attached map.) This is believed to have been near the center of maximum rainfall with somewhat lesser intensity near the summit of the White Tanks Mountains about five miles to the west.

4. The rain is reported to have started about midafternoon on Saturday, September 5, 1970. The maximum intensity is believed to have occurred between 6:00 and 8:00 p.m. It was reported that water started flowing across Jackrabbit Road in the vicinity of Thomas Road about 7:00 p.m. and ceased to flow across the road about 9:00 p.m.

5. The elevation of the high point of the watershed is 3671'. The spillways of Structure No. 4 are at elevation 1050' with the top of the structure at 1056'. The elevation of the rain gauge is approximately 1165'.

6. Structure No. 4 was designed to impound 1036 acre-feet from a drainage area of 10.3 square miles.

7. Since 1954 developments north of Indian School Road and west of Tuthill Road have caused four square miles of watershed originally designed to flow into Structure No. 3, and an additional 1.8 square miles of watershed to flow into Structure No. 4 along Tuthill Road. Additional land developments between Jackrabbit Road and Tuthill Road plus improvement of Jackrabbit Road divert still another 2.7 square miles of watershed into the north end of Structure No. 4 along Jackrabbit Road.

8. Thus at the time of the storm there was a total of 18.8 square miles of watershed contributing to Structure No. 4. This is 8.5 square miles more than the 10.3 square miles for which the structure was designed.

9. It should be noted that chronic deposition of coarse sands in the borrow channel on the west side of Jackrabbit Road limits the flow of water diverted into Structure No. 4. Excess flood waters flowing south along Jackrabbit Road overflowed the pavement in the vicinity of Thomas and McDowell Roads causing damage to an unknown number of homes in the subdivisions east of Jackrabbit Road.

10. High water marks indicate that the Structure No. 4 filled and the 165' wide Tuthill Road (west) emergency earth spillway flowed for a short period at a depth averaging about 0.8'. There was no erosion in the channel except for a small 1' deep headcut at the extreme south end where it emptied into a flood channel along the north side of an auxiliary Air Force landing field that appeared to have been carrying 10 to 20 times the spillway flow.

11. Flow through the Jackrabbit Road (north) emergency earth spillway, also 165' wide, averaged about 1.6' in depth. Surveys after the flood indicate that the crest of this spillway is now about 0.4' below the elevation at the time of completion. It is believed that most of the lowering of the earth spillway crest resulted from wind erosion and from use of the cleared spillway crest area as a driveway for vehicles and as a practice ground for horsemen and motorcyclists during the 16 years since its construction. The high water marks indicate that the water surface was 0.4' higher at the Jackrabbit Road spillway than at the Tuthill Road (west) spillway. This could have been the result of wave action or a west wind across the one-mile reach of the reservoir. Erosion in this spillway from this storm was negligible. Floodwater through the spillway crossed unimproved desert for one-half mile before co-mingling with larger onslaughts of water flowing from the north and west.

12. The two principal spillways equipped with gates remained closed during the storm. Had they been open they would have had little effect upon the reservoir hydrograph because of the intense short-period of runoff. The reservoir was emptied in a matter of a few days through seepage into the ground.

13. Structure No. 3 with a capacity of 2655 acre-feet and a designed watershed area of 24.1 square miles, received an inflow of approximately 350 acre-feet. The rainfall was less intense on this watershed than on the watershed of Structure No. 4 and as mentioned in paragraph seven above. As mentioned above, four square miles of this watershed has been diverted into the watershed of Structure No. 4. Runoff from this four-square mile area was quite heavy.

It is recommended that consideration be given to correcting the overloading of Structure No. 4 by combinations of the following alternatives:

A. Redesign the roadway fills and channels in Sections 18 and 13 so as to permit the four-square-mile area in parts of Sections 2, 3, 10, 11, 12, 13, and 14 to drain into Structure No. 3 as originally planned. (See map attached.)

B. Construct one or more small retarding structures north of Indian School Road to control runoff from all or parts of Sections 13, 14, 17, 18, 19, and 20. (Structure No. 4 was not designed to receive runoff from this area but since 1954 the runoff has been directed into Structure No. 4.)

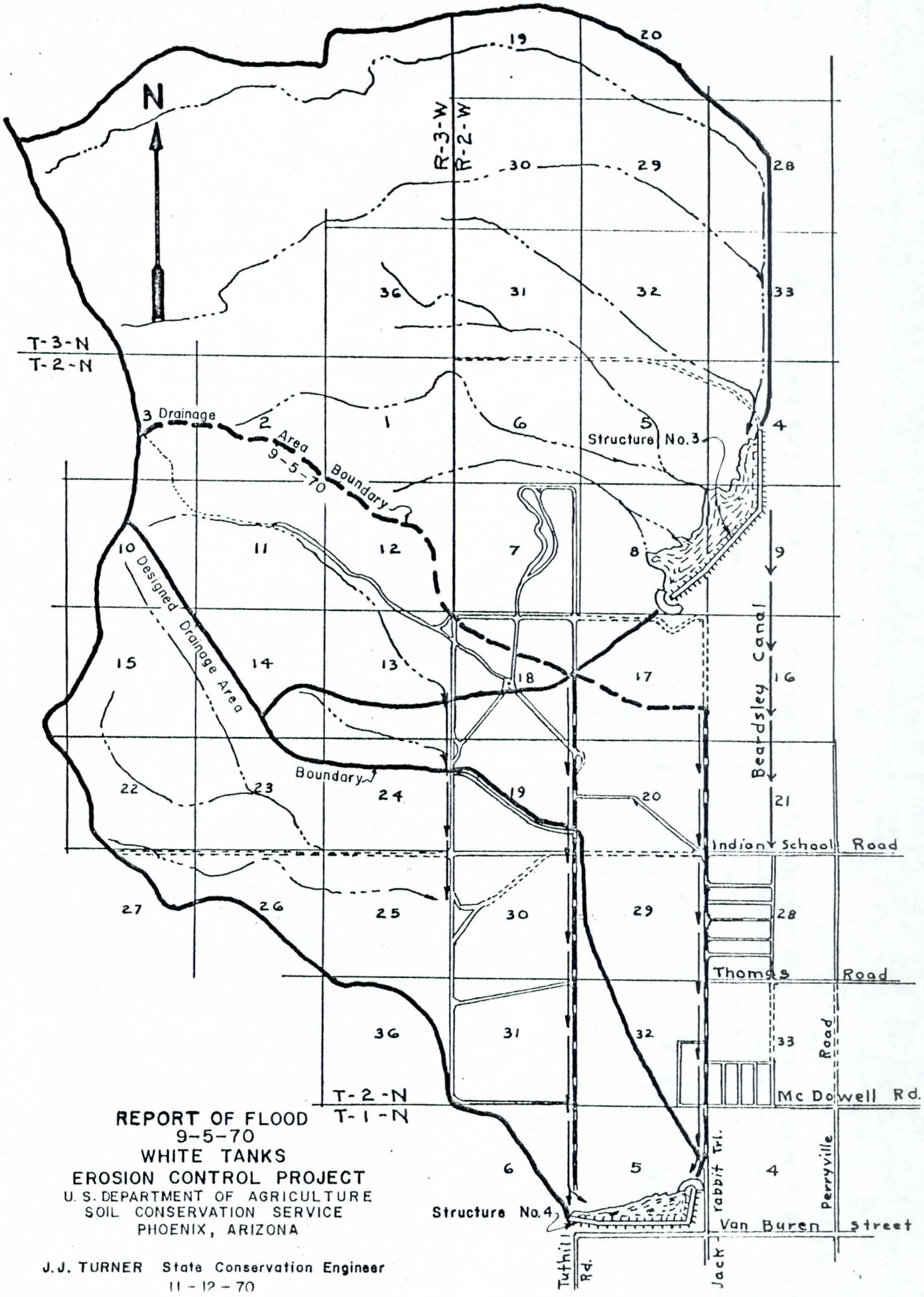
C. Enlarge Structure No. 4 to enable it to safely accommodate runoff from Section 29 and that part of Section 32 that was not originally designed to contribute to Structure No. 4.

D. If it is not practical to materially increase the capacity of Structure No. 4 additional structures should be built upstream, possibly in Sections 23 and 25.

J. J. Turner
State Conservation Engineer

Attachment

cc to:
E. J. Core, Head, E&WP Unit, SCS, Portland, Oregon
Kenneth E. Grant, Administrator, SCS, Washington, D. C.



REPORT OF FLOOD
9-5-70
WHITE TANKS
EROSION CONTROL PROJECT
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PHOENIX, ARIZONA

J.J. TURNER State Conservation Engineer
11 - 12 - 70

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Arizona State Office, Phoenix, Arizona

SUBJECT: ENG - Trip Report - White Tanks Project

DATE: December 17, 1969

TO: M. D. Bardick, State Conservationist
SCS, Phoenix, Arizona

On December 12, 1969 I accompanied District Conservationist Arnold Nowotny and Inspector General Auditors Nils Dahlstrand and Duane Maddox on a tour of the White Tanks Pilot Watershed Project.

The following deficiencies were noted that should be corrected:

1. The principal spillway gate valve at the west end of structure #4 is partially covered with rocks and dirt. The same is true of the outlet gate at the southeast corner of the structure.

2. A trash dump situation in the reservoir at the north end of the structure should be eradicated. It is unsightly, unsanitary, could cause principal spillway stoppages and causes one to wonder if the people benefitting really appreciate the project.

3. The valve stem is bent on the south principal spillway gate of structure #3 and is inoperative. The current position of the gate is about 15% open.

4. The center and north gates of structure #3 are relatively clean.

5. All gates should be cleaned up, tested for proper opening and closing, and repaired or serviced as needed.

Upon returning to Phoenix I made courtesy calls to Mr. Lee Ohsiek, Assistant Chief Engineer of the Flood Control District of Maricopa County, and Dick Yancy, engineer for the Beardsley Project. I learned from them that the Flood Control District inspected the project twice a year, that the county had a maintenance agreement with the Beardsley Project, that both were aware of the need for maintenance and a part of the items noted in their last inspection had been taken care of. Dick Yancy further agreed to try to perform the outlet gate maintenance before the end of January 1970.

J. J. Turner
State Conservation Engineer

cc Geo. Stone, Asst. State Conservationist- Watersheds
Arnold Nowotny, DC, Phoenix

CN
F0

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE Room 3008 Federal Bldg., Phoenix, AZ 85025

SUBJECT: WS - Williams-Chandler WPP
Rittenhouse FRS Embankment Repair

DATE: May 10, 1978

TO: R. M. Davis, Administrator
SCS, Washington, D.C.

We have kept you informed on the progress of studies made on the embankment cracking problems in Arizona. The study team has recently issued their final report. We understand the Engineering Division has received copies. In keeping with the recommendations of the interim and final reports, we are proceeding with designs for repair. At present, our plans are to include the following structures in the repair program: Rittenhouse, Vineyard Road, Magma, Buckeye and White Tanks. As each design project is completed ready for a construction contract, we will request funds for the necessary repair work. The further investigation work recommended to determine extent of cracking to define where repair work is needed will also be part of our future requests for funds.

Glen - the cost estimate sheet which was opened a while ago did indicate White Tanks was a pilot project. Rodney has the sheet and gave it to Joe. Behind the curve & now in action

We have prepared construction drawings and specifications for the installation of a filter drain in the Rittenhouse FRS, Williams-Chandler WPP. The plans have been reviewed and approved by the WTSC. Two copies are attached.

We feel it is urgent to begin the recommended repair work as soon as possible to avoid further risks in damages and/or loss of life that may occur should failure result from storms during the up-coming summer thunderstorm activity. As you know, this has always been a source of concern to us.

We request funds for the installation of the repair work for the Rittenhouse FRS as follows:

Construction	$320,000
Engineering Services	$16,000

The funds for engineering services are requested to allow a contract for A&E services for inspection of the installation. At present, our personnel assignments and workload will not allow changes to inspect the work to be undertaken. A copy of the report is attached.

Thomas G. Rockenbaugh
State Conservationist

Attachments (2)

cc: Kenneth L Williams, Director - WTSC
Stanley Hobson, Head, Engineering Staff, WTSC
Joe Knisley, AC, Tucson, Arizona Area Office

John 6/30

file

United States Department of Agriculture
Soil Conservation Service
3008 Federal Bldg.
230 N. First Ave.
Phoenix, AZ 85025

Subject: ENG - Dam Safety Analysis - White Tanks #4 Date: November 17, 1983

To: W. Wayne Killgore, ASTC(WR) NRK
Phoenix, AZ

File Code: 210-28

I have reviewed the "Probable Maximum Flood Study, White Tanks #4," prepared by the Flood Control District of Maricopa County (FCDMC) and attached to letter dated September 28, 1983. In their analysis, they used the Corps of Engineers' HEC-1 computer program to develop and route the probable maximum flood through the structure's reservoir. They also included in their analysis a study showing the effect of I-10 on flood flow peaks and volumes.

In general, I agree with the assumptions and parameters used in their analysis. I checked the rainfall and curve numbers used and they appear to be reasonable. I am not familiar with the HEC-1 program, as such, so I do not know exactly how the data is used in the program. For instance, it appears that the same rainfall amount was used for the 6-, 12-, 24-, and 72-hour storms. The amount calculated was for the 6-hour storm. This will need to be discussed with them, since I may be misinterpreting the input and output of the program.

There is some difference in the total drainage area used in the county's analysis (14.33 sq. mi.) as compared to that used in the work plan (10.31 sq. mi.). However, based on existing conditions, the 14.33 square miles appears to be correct.

As stated above, I generally agree with the assumptions used in the analysis in order to test the dam by maximizing the amount of flow entering the structure. (For instance, assuming that the Caterpillar Proving Ground Levee will not fail although it is overtopped.) This assumption is fine in order to test the structure under the most severe conditions, but since it was determined that the floodwater retarding structure would overtop and was assumed to fail under these conditions, I think it also would be logical to assume that the Caterpillar levee would fail if overtopped. If this is the case, an analysis needs to be made to determine the effect of a break in the Caterpillar levee. It might be possible that sufficient water would be diverted out of the watershed by I-10, that the structure would be safe from a maximum probable storm, i.e., the dam would not be overtopped. At least I believe this analysis needs to be made before funds are expended to raise the top of dam elevation or other corrective measures are performed.

I suggest that a meeting be scheduled with the Flood Control District in order to discuss their present analysis and determine the procedures to be used in analyzing the effect of a breach in the Caterpillar levee.

Should you have questions concerning this review, please call.

Harry C. Millsaps
Hydraulic Engineer - WRPS

cc:
Ralph Arrington, SCE, Phoenix, AZ

File-

, P.O. Box 2890

Washington, D.C. 20013

MAY 25 1979

40-13-7-5 Arizona Dam Cracking

ENG-7-5 Reports - Deficiency Reports-Summaries

Thomas G. Rockenbaugh, State Conservationist
SCS, Phoenix, Arizona

We have reviewed the Report of the Crack Study Team, April 27, 1978, regarding the dams in Arizona. In addition, we have reviewed the final design report, drawings, and specifications on the drainage measures planned for the Rittenhouse Floodwater Retarding Structure. We think the team's report adequately outlines the scope of the problem and necessary design considerations. The drain designed, if installed as intended (adjustments made where necessary for crack depth), should provide a permanent answer to the existing concern regarding the safe performance of the Rittenhouse structure as affected by cracking. Below are some comments for your future reference:

1. The study team has identified several items which need to be recognized in current planning, design, and construction to assure safe performance of earth dams built in a hot, arid climate. Also included are items involving monitoring during the operation phase which require consideration in O&M plans and agreements. We are sure you will be taking whatever steps are necessary to see that the planning, design, and operation needs are provided as identified in the report.

2. While the report identifies that the existing cracking phenomenon is due principally to desiccation, we are very concerned about the potential for cracking due to regional subsidence. For this reason, we think the methods outlined on pages 9 and 10 of the report should all be used.

3. The design concepts to control cracking as described in the report are all feasible. As mentioned, some control of vegetation, especially deep rooted, will be necessary. The use of earth placed dry of optimum moisture and even at higher than normal densities will greatly reduce cracking. However, a nonyielding foundation is then more necessary to eliminate cracking by other means. The enclosure of a central core in a moisture barrier will also work. As pointed out, there are a few problems related to construction that may not make it the most practical. One caution is that the moisture barrier must extend into the foundation sufficiently to prevent moisture migration laterally and then outward to the atmosphere.

We think the study team has done a good job. You made a good selection and they were up to the assignment. Everyone involved is to be commended for their efforts. We will be looking forward to the detail investigation and remedial measures to be developed on the remaining dams exhibiting significant cracking.

Neil F. Bogner
Director
Engineering Division

cc: K. L Williams, Director, TSC, SCS, Portland, Oregon
J. W. Mitchell, Director, Watersheds Division, SCS, Washington Office

USDA:SCS:ENG:DCRalston:X72629:dcn:5/23/78:Card #1666

Repairs 12 or 13?

State of Arizona

DEPARTMENT OF WATER RESOURCES

99 E. Virginia Avenue, Phoenix, Arizona 85004

BRUCE BABBITT, Governor
WESLEY E. STEINER, Director

November 3, 1981

Mr. William D. Mathews
Chief Engineer and General Manager
Maricopa County Flood Control District
3335 West Durango Street
Phoenix, Arizona 85009

Subject: Phase I Inspection Reports
White Tanks Retarding Dam No. 3 (7-28)
White Tanks Retarding Dam No. 4 (7-29)

Dear Mr. Mathews:

Enclosed are copies of the Phase I Inspection Reports on White Tanks Retarding Dam No. 3 and White Tanks Retarding Dam No. 4, including copies of the Corps of Engineer's September 14, 1981 letter approving the reports. These reports were prepared by the Arizona Department of Water Resources in accordance with a contract between the Department and the U.S. Army Corps of Engineers through authority vested by Public Law 92-367, the National Program of Inspection of non-federal dams. The reports, representing an independent appraisal of those features affecting the safety of the dams, have been prepared in accordance with the Federal Guidelines for Safety Inspection of Dams, and the findings reflect the criteria in those Guidelines. We apologize for the delay in transmitting the reports to you.

The reports conclude that both White Tanks Retarding Dam No. 3 and White Tanks Retarding Dam No. 4 are in a non-emergency unsafe condition due to the inadequate capacity of the emergency spillways and cracking identified along 40 percent and 90 percent of the lengths of the structures, respectively. They recommend that the owner begin implementation of Phase II Studies to:

(a) Expand the hydrologic studies on the dams, which will facilitate preparation of plans for enlargement of the spillway capacity and,

(b) Evaluate the geotechnical conditions responsible for the embankment cracking and recommend remedial construction.

In addition, the reports recommend specific maintenance items to be performed by the owner.

We are aware that the Flood Control District and the Soil Conservation Service have made studies of cracking in earth dams in the Maricopa County area, and that, based on the recommendations of those studies, the SCS has prepared designs for remedial construction to White Tanks Dam No. 3 and White Tanks Dam No. 4, which construction is now underway. These designs have been approved by the Department of Water Resources and Safety of Dams engineers will inspect the construction as it progresses.

We wish to meet and discuss further the other areas of concern identified in the reports and explore avenues to be used to eliminate these concerns. We will appreciate an early reply following your review of the reports in order to schedule a meeting for discussion purposes and possible future scheduling in relation to work at other dams owned by the Maricopa County Flood Control District.

We will continue to rely upon your support and cooperation in assuring the restoration and maintenance of these dams for continuing safety.

Sincerely,

WESLEY E. STEINER,
Director

DAN ROGER LAWRENCE, P.E.,
Acting Chief
Division of Safety of Dams

Enclosures

cc: Mr. Ralph Arrington
Soil Conservation Service

Condensed Summary

WHITE TANK AND TRILBY WASH PROJECTS
ARIZONA

full copy

	Structure No.3	Structure No.4	McMicken Dam
Cooperating Federal Agency	1954, SCS	1954, SCS	1956, C of E
Length	1.5 Mi.	1.3 Mi.	9.3 Mi.
Drainage Area	24 sq. mi.	10 sq. mi.	223 sq. mi.
Max. Fill height	30 ft.	20 ft.	38 ft.
Spillway Size	800 ft.	2 @ 165 ft.	2,000 ft.
Spillway Capacity	11,750 cfs.	4400 cfs.	60,000 cfs.
Reservoir Capacity in A.F.	2655 AF	1036 AF	19,000 AF
Embankment	351,481 cy	171,728 cy	
Reservoir Capacity in inches of runoff	2.1	1.9	1.6
Crest Width	10'	10'	12'
Side slope	2½:1 & 2:1	2:1 & 2:1	2½:1 & 2:1
No. of outlets	3 pipes	2 pipes	1 box
Size of outlets	48",48" & 24"	30" & 36"	11' x 20'
Max. Discharge through outlets	- - - -	- - - -	4400 cfs.
Evacuation time	80 hrs.	118 hrs.	- - - -
Sediment Production: Ac.Ft.Per sq.mi.per yr.est.	.3	.3	.25
Total cost of Project		$395,145.00	$2,180,000.00
Private Contributions		196,057.00	180,000.00
Public Contributions		199,088.00	2,000,000.00
Annual O & M cost(Non-Federal)		3,750.00	17,000.00
Estimated annual cost of project (50 yr. amortization)		20,860.00	115,000.00
Estimated annual benefits (50 yr. amortization)		35,220.00	200,000.00

Benefit - cost ratio 1.7 to 1

Copy 3-31-82

United States Department of Agriculture

Soil Conservation Service

West Technical Service Center
511 NW Broadway, Room 510
Portland, Oregon 97209

File
210-13

Subject: ENG - Design - Repair of White Tanks No. 3 Structure, White Tanks W.P.P., Arizona

Date: June 3, 1981

To: Thomas G. Rockenbaugh, State Conservationist, SCS, Phoenix, Arizona

Attached are the signed cover sheets for White Tanks, Sites No. 3 and 4, indicating WTSC coapproval. Concurrence in repair for Site No. 4 was given in our memo of May 18, 1981. Approval for Site No. 3 is given subject to our comments below and as shown on the attached copy of red-lined drawings and specifications.

The dam will be temporarily breached while repairs are made. A flood occurring at that time may cause considerable damage. As with the repairs made at Graveyard Wash Dam, the following precautions are advised:

1. The construction schedule should provide that the critical period, during which the structure is breached, be kept to a minimum.

2. The critical repair should be made in a season when the probability of floods is least.

3. All approving authorities and sponsors should be made aware of the conditions and possible consequences.

The geologic investigation trip report of February 23, 1981, included in the design report, suggests that variability in foundation materials may have contributed to the cracking problems in the vicinity of station 58+00. We assume that foundation excavation in this area will be closely observed during construction.

Use of a two-element vertical drain is recommended where the embankment is being reconstructed. This will protect against a piping failure initiated by future settlement or dessication cracking. The coarse element will bridge larger crack sizes and will conduct a larger volume of seepage from cracks to the embankment drain outlet. Drain materials already specified can be used. We suggest a two-foot wide section of "embankment drain" material for the filter and a two-foot wide section of "coarse aggregate drain" material for the coarse element. (See red-lined drawings for details.)

Jack C. Stevenson

JACK C. STEVENSON
Acting Head, Engineering Staff

Separate Cover

cc: Ralph M. Arrington, State Conservation Engineer, SCS, Phoenix, Arizona
Donald E. Wallin, Head, Design Section, ENG, WTSC, SCS, Portland, Oregon

United States Department of Agriculture

Soil Conservation Service

West Technical Service Center
511 N.W. Broadway, Room 510
Portland, Oregon 97209

Subject: ENG - Design - Repair of White Tanks No. 4 Structure, White Tanks W.P.P., Arizona

Date: May 18, 1981

To: Thomas G. Rockenbaugh, State Conservationist, SCS, Phoenix, Arizona

We have reviewed the final design report for the above project per your request of April 29, 1981. We recommend limiting the maximum drop of the drain fill in placement to 30 inches. This was discussed with John Sullivan in our telephone conversation of May 13, 1981. Other minor comments are as red-lined on the attached drawings and specifications. Please forward the original cover sheet for coapproval signature.

JACK C. STEVENSON
Acting Head, Engineering Staff

Attachment

cc:
Ralph M. Arrington, State Conservation Engineer, SCS, Phoenix, Arizona
Donald E. Wallin, Head, Design Section, Engineering Staff, WTSC, SCS, Portland, Oregon

40-13 Copy sent to Paul 7/3/79 CMS

United States Department of Agriculture | Soil Conservation Service

West Technical Service Center
511 NW Broadway, Rm. 510
Portland, Oregon 97209

SUBJECT: EN - Arizona Dams - Crack Location
A&E Investigation Reports

DATE: June 20, 1979 ~~CMS~~ sent to Ralph

TO: Ralph Arrington, State Conservation Engineer
SCS, Phoenix, Arizona

The reports prepared by Fugro, Inc. of their findings and recommendations for the Buckeye #1, White Tanks #3 and #4, Magma and Vineyard Road Dams, have been reviewed with much interest. The reports are well prepared. Data is presented in a logical, easy-to-use manner.

Analysis of their data verifies that repair work is necessary at all five structures. With the possible exceptions of White Tanks #3, it appears sufficient investigations have been made to obtain data to determine the extent and magnitude of needed repairs.

In the recommendations section of the reports, the consultant refers to proposed drain-filled trenches as cutoffs. Such terminology is not consistent with earth dam nomenclature where cutoff normally signifies an impervious barrier. We suggest that the terminology in the reports be changed.

Buckeye #1 (Buckeye Watershed)

Alternate "a" is an interesting concept and upon further study may prove to be a viable solution. You may want to have your designers check it out.

Alternate "b" is favored by our staff to repair this structure. If you select this alternate, it is suggested that in preparing the designs, you insure that:

1. The drain trenches extend well into uncracked areas at each end.

2. Detail the outlets similar to those installed at the Rittenhouse Dam.

3. Apply any lessons learned at Rittenhouse to improving the design concept and specifications.

4. Install repair measures in questionable areas as well as demonstrated distress areas.

White Tanks #3 (White Tanks Watershed)

The pattern of cracking at this site departs significantly from the pattern at the other sites. We are particularly concerned about the deep crack at station 58+05. It is recommended that the original geology and other investigations data be studied to see if this crack may be explained by discontinuities in the foundation. It may be necessary to do more investigations to better define the cause of this deep crack. Seismic study may be helpful. Borings to check foundation conditions may be required.

We believe it necessary to know more about the cause of this crack before a design of corrective measures is completed.

White Tanks #4

Alternate "a" presents a real possibility to solve the potential problems at this site. It is suggested that this possibility be fully evaluated in selecting repair measures.

From the standpoint of evaluating the overall condition of the dam, alternate "b" provides the opportunity to observe and log all the cracks.

Vineyard Road Dam (Apache Junction Gilbert Watershed)

The data collected show this structure to be badly in need of repair. We do not look at alternate "e" as a viable solution. It appears that alternate "a" is the best choice for long-term correction of the problem. The suggestions enumerated for the Buckeye #1 repair should be considered in the design of repair measures for the Vineyard Road Dam.

Magma Dam (Magma Watershed)

Data collected indicate this structure has serious problems. The extent can better be evaluated after completion of the Fugro investigations of earth crack potential and the USGS bedrock profile study that is planned.

STANLEY N. HOBSON
Head, Engineering Staff

cc:
Thomas G. Rockenbaugh, State Conservationist, SCS, Phoenix, Arizona

ATTACHMENT TO
ALLOWANCE LETTER
DATED 12/28/81
Signed by Norm Berg

SPECIFIC GUIDANCE AND INSTRUCTIONS

ARIZONA

Conservation Operations Technical Assistance

All targeted funds were withdrawn as per your request.

Resource Appraisal and Program Development

Allowance includes $2,000 to complete work on the sediment yields from irrigated cropland study.

Plant Material Centers

Your allowance includes $25,000 for replacement of a combine. If for any reason you need to reconsider the purchase of this equipment, please contact the Director, Ecological Sciences.

River Basins

A list of budgeted activities for Basin and Area Planning is enclosed.

Watershed Planning

Your allowance includes $360,000 for support of the multi-State planning staff.

Watershed Operations

Your allowance includes financial assistance funds for contracting Signal Butte Floodway repair, White Tanks 3 and 4 repair, and RWCD Reach 2. If White Tanks repairs were made in FY 1981, any excess funds will be applied to repair of the Fredonia structure when approved.

omit

White Tanks Pilot

Fredonia - 566

ATTACHMENT TO
ALLOWANCE LETTER
DATED 8/12/81
Signed by Norm Berg

SPECIFIC GUIDANCE AND INSTRUCTIONS

ARIZONA

Conservation Operations Technical Assistance

Total targeted funds for FY 1982 are $50,000 ($30,000 in FY 1982 base plus $20,000 new funds) for Salinity Control. Update targeted plan of operations accordingly and continue to report accomplishments to this targeted activity per instructions dated March 17, 1981. Advise the Director, Conservation Planning and Application of major changes in the targeted activity. Promptly report any need for additional targeted funds and/or release excess funds that cannot be used effectively. Targeted funds may only be used to accelerate technical assistance within designated targeted areas.

Resource Appraisal and Program Development

Allowance includes $1,300 to complete work on the sediment yields from irrigated cropland study.

Plant Material Centers

Your allowance includes $25,000 for replacement of a combine. If for any reason you need to reconsider the purchase of this equipment, please contact the Director, Ecological Sciences.

River Basins

A list of budgeted activities for Basin and Area Planning is enclosed.

Watershed Planning

Your allowance includes $230,000 for support of the multi-State planning staff.

Watershed Operations

Your allowance includes financial asistance funds for contracting White Tanks 3 and 4 repair and RWCD Reach 2. If White Tanks repairs are made in FY 1981, any excess funds will be applied to repair of the Fredonia structure when approved.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WATERSHED PROTECTION PROJECTS (PL-566)
CUMULATIVE OBLIGATIONS BY AGENCY THROUGH SEPTEMBER 30, 1981
(APPROPRIATED FUNDS ONLY)

PROJECTS BY STATE	PROJECT NO.	*******DEPARTMENT OF AGRICULTURE******* SCS	FS	FmHA/ERS	******DEPARTMEN OF INTERIOR****** BIA	BLM	USGS	CUMULATIVE TOTAL
ARIZONA								
FRYE CREEK-STOCKTON WASH	2002	3,333,724	118,460	6,012			5.887	3.464.083 ✓
MAGMA	2003	1,246,684		2,392			1.428	1.230.504 ✓
FLORENCE AREA	2004	1,056,663		1,813			1.191	1.059.670 ✓
BUCKHORN-MESA	2005	6,411,996	31,472	9,341			47	6.482.856 ✓
APACHE JUNCTION-GILBERT	2006	1,766,037		2,765			1.701	1.770.503 ✓
WILLIAMS-CHANDLER	2007	6,831,664		6,454			1.237	6.839.355
BUCKEYE	2008	5,644,402		6,083			106	5.650.592
VANAR WASH	2009	835,940		1,449			686	848.066
HARQUAHALA VALLEY	2010	19,521,981		14,791			2	19.536.774
FREDONIA	2011	1,445,127		1,772			48	1.446.947
GUADALUPE	2012	585,795		633				586.428
PERILLA MOUNTAIN	2013	4,869		4				4.873
WICKENBURG	2014	1,263,496		1,312				1.264.808
WHITE TANK (PILOT REPAIR)	2015	332,536		226				332.762
SUBTOTAL		50,360,914	149,932	55,042			12.333	50.578.221
PROJECT EVALUATION	0050	5,004		7				5.011
TOTAL		50,365,918	149,932	55,049			12.333	50.583.232

Arrington
(Copy of letter made for RI)

United States Department of Agriculture

Soil Conservation Service

West Technical Service Center
511 NW Broadway, Room 510
Portland, Oregon 97209

Subject: ENG - Design - Repair of White Tanks No. 3 Structure, White Tanks W.P.P., Arizona

Date: June 3, 1981

To: Thomas G. Rockenbaugh, State Conservationist, SCS, Phoenix, Arizona

Attached are the signed cover sheets for White Tanks, Sites No. 3 and 4, indicating WTSC coapproval. Concurrence in repair for Site No. 4 was given in our memo of May 18, 1981. Approval for Site No. 3 is given subject to our comments below and as shown on the attached copy of red-lined drawings and specifications.

The dam will be temporarily breached while repairs are made. A flood occurring at that time may cause considerable damage. As with the repairs made at Graveyard Wash Dam, the following precautions are advised:

1. The construction schedule should provide that the critical period, during which the structure is breached, be kept to a minimum.

2. The critical repair should be made in a season when the probability of floods is least.

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JACK C. STEVENSON
Acting Head, Engineering Staff

Separate Cover

cc: Ralph M. Arrington, State Conservation Engineer, SCS, Phoenix, Arizona
Donald E. Wallin, Head, Design Section, ENG, WTSC, SCS, Portland, Oregon

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE P.O. Box 2890

Washington, D. C. ~~XXXX~~ 20013

Copy made for record

SUBJECT: ENG-7-5 Reports - Deficiency Reports Summaries DATE: August 15, 1977

John & Ralph 1/5/78

Please review upon

today

TO: Thomas G. Rockenbaugh, State Conservationist
SCS, Phoenix, Arizona

We have received the several reports describing the cracking of dams in Arizona you have forwarded. This includes the one by Engineers Testing Laboratories, Inc. along with their followup letter of discussion on three items. The Interim Report dated July 21, 1977, by the SCS study team has also been reviewed.

Based upon our review of the reports, we wish to pass on to you the following comments.

1. We concur in the need to further investigate the cracking on the five dams listed on page 11 of the Interim Report, Buckeye #1, White Tanks, Vineyard Road, Magma and Florence.

2. We concur in the need to take immediate action on treatment of cracks on the Rittenhouse Dam.

3. We recommend that repairs made be done in a manner which will be permanent in nature. This is in line with first of three alternatives listed on page 12 of the Interim Report.

We are hopeful that upon completion of all the investigations, it will verify that the cracking is limited to desication causes. We are greatly concerned about any cracking which may be a result of general subsidence, which in the Phoenix area is related to groundwater withdrawal. This is discussed in the Interim Report on pages 6 and 7. It is imperative that we avoid any construction of dams with any degree of hazard in areas subject to cracking related to this phenomena. The policy on this is clearly established in Engineering Memorandum-60.

If you have any questions on these comments, please let us know.

ACTING Paul E. Nylander

NEIL F. BOGNER
Director
Engineering Division

P. E. Nylander

cc:
K. L Williams, Director, TSC, SCS, Portland, Oregon
R. M. Matthews, Head, Design Section, EWP Unit, TSC, SCS, Portland, Oregon

Orig. to Arizona 7-25

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
West Technical Service Center, 511 N.W. Broadway, Rm. 510, Portland, OR 97209

SUBJECT ENG - Embankment Cracking - Study Team Report DATE: July 22, 1977

TO: Thomas G. Rockenbaugh, State Conservationist
SCS, Phoenix, Arizona

Enclosed are four copies of the study teams' interim report. You will note that these reports lack Smith's and Stearn's signature. I have sent them signature sheets that will be sent to you. When you receive them, please place them in the reports in place of page 17.

Further committee action will be needed as the recommended studies are made. When the studies are complete, we will issue our final report.

If you have any questions, contact any of the committee as the need arises.

One of the copies of the report is for your transmittal to the Washington Office.

Jack Stevenson
Construction Engineer

4 Attachments

Cracking of Dams in Arizona
Interim Report of SCS Study Team
July 21, 1977

Introduction

Neil Bogner, Director, Engineering Division, Paul Tilker, Head, E&WP Unit, and Thomas Rockenbaugh, State Conservationist, Phoenix, appointed a team to study the magnitude and severity of cracking in PL-566 dams in the Phoenix, Arizona, vicinity. The team members are:

Ed Stearns, State Geologist, SCS, Davis, California

Ray Smith, State Design Engineer, SCS, Bozeman, Montana

Jack Stevenson, Construction Engineer/Acting Soil Eng., WTSC

Scope of Study

The team met at the Phoenix SCS State Office on June 22, 1977, discussed the scope of the problem and developed an operational outline. The problem and anticipated activities were discussed with John Peterson, ASTC, and Ralph Arrington, State Conservation Engineer, Ralph showed a series of slides that typified the crack problem and investigations made to date. The team and Mr. Arrington then met with representatives from Maricopa County Flood Control District (MCFCD), Arizona State Water Commission, U.S. Bureau of Reclamation and Engineering Testing Laboratories (ETL). ETL personnel presented a draft copy of observations and inspections made in investigating the problem at the Powerline, Vineyard Road, and Rittenhouse dams.

Mr. Arrington then took the team to inspect the following dams:

Buckeye #1
White Tanks
McMicken (C of E)
Rittenhouse
Vineyard Road
Magma
Florence

A detailed examination of the available predesign investigation, design, and construction records for the Rittenhouse dam was made.

The team discussed the design and construction of the dams with Paul Monville, State Design Engineer, William Anderson, ASCE, and Don Riddle, Chief Inspector.

Our preliminary findings and observations were discussed with Mr. Rockenbaugh.

A second meeting was held with Mr. Arrington, MCFCD, ETL, and Arizona Water Commission personnel. Our observations and concerns were discussed with the group.

Summary of Findings

Some degree of cracking was observed at each site visited. With the exception of the Rittenhouse dam, the crack development has not advanced to the crisis state. In general, the cracks are relatively shallow and do not completely cross through the embankments. The surficial expression of the cracks indicates that the principal cause is desiccation. Transverse cracking as well as longitudinal cracking occurs on most of the structures. Detailed description of the cracking is included in the ETL report (dated July 1, 1977) and shown on the photographs in Appendix #1.

One crack was traced to a depth of 10 feet on the Rittenhouse dam. This crack did not go clear across the dam. This crack and several others took significant volumes of water without the water appearing anywhere at the ground surface. This would indicate either deep cracking or an interconnected network of open cracks that exist inside the structure. It is the study team's conclusion that the Rittenhouse structure should be repaired as soon as practicable to eliminate the potential of a catastrophic failure

during the coming flood season. Such an occurrence would probably require runoff from a storm of somewhat greater magnitude than a 25-year frequency runoff.

A major longitudinal crack was observed in the upstream face of the Florence Structure. This crack is a few hundred feet long and was apparently caused by softening of the upstream foundation from wetting. Due to the weight of the fill, consolidation occurred and the fill cracked. This crack appears to be well on the way to healing itself. Healing apparently occurs as soil particles are washed into the crack by surface waters.

Two crack zones that had the appearance of being associated with foundation compression were noted on the Buckeye #1 dam. These crack zones are discussed in more detail below.

Onsite Observations

1. Buckeye #1

The cracking observed was generally limited to 3 or 4 zones. One area has been investigated by MCFCD personnel. The cracks were found to be less than 20 inches in depth. In two locations the transverse cracks were oriented roughly with an upstream and downstream expression of a natural drainage way. Slight depression of the dam top was noted in these areas, indicating some subsidence may have occurred that could be a partial cause of the cracking. Desiccation appears to be a major cause of cracking in the other areas inspected. To date none of the cracking has progressed sufficiently to present a threat to the structure. The dam is constructed of soils derived from granite and

contains much coarse sand and gravel sized particles. In most areas soil conditions are such that mechanical self healing should occur.

2. White Tanks

This structure is in a pilot watershed and was constructed in 1954. Until recent years its surface was dragged with a heavy anchor chain or crawler tractor tracks at least once yearly. The dam is constructed of silty sands with gravel derived from granites. A fine pattern of narrow (less than 1/8 inch wide) desiccation cracks were noted across the top of the structure. Probing indicates, in general, the cracks are shallow (a foot or less deep). The faces of the dams are covered with a 3 or 4 inch thick dust mulch which appears to have controlled desiccation.

3. Rittenhouse and Vineyard Road Dams

Our observation confirmed the description included in ETL's report of July 1, 1977. Several of the cracks are shown and described on the photographs in Appendix 1.

4. Magma

The Magma dam was constructed in the early 1960's. Cracks have been reported on this dam many times. At the time of our inspection many of the cracks appear to have healed. In lower sections of the dam near the emergency spillway three zones of cracking were noted. One crack crossed the top of the dam from the upstream face into the downstream face. It crosses diagonally. It was reported that no dragging or other maintenance work has been done since 1968.

With the possible exception of the diagonal crack described above, the cracks observed appeared to be a result of desiccation. Our probing indicated the cracks are likely shallow, less than 2 feet or so in depth.

5. Florence

This structure was constructed in the mid-1960's. Three cracks or crack zones were noted. One longitudinal crack along the toe is described in the Summary of Findings section above.

One zone with a 50 or 60 foot long longitudinal crack was noted, it had diagonal cracks at each end trending toward the downstream face. This crack could be associated with downward movement of a part of the downstream toe of the dam. Near the road ramp onto the dam a transverse crack completely crosses the top of the fill. This crack is 2 inches+ wide at the top. Material has caved into the cracks. Our probing indicates it is in excess of two feet deep.

General Geology and Soils

The embankments are all located on broad gently sloping alluvial fans. The dams are all several miles long and consequently cross many small dry streams. Many times the streams are barely discernable except for an increase in vegetation along their course. The sites are all several miles from the mountains that are the ultimate source of the sediment making up the fans. Since the dams are quite far from the mountains, most of the fan material is fine-grained. Much of it is granitic reflecting the composition of the parent material. The soils are mostly low plastic silty sands (SM), sandy silts (ML), and silty clays (CL). There are some

soils that are more clayey, as at Magma, and some that are gravelly, as in sections of Florence dam, but these are less frequent than the SM's and ML's commonly seen.

Geologic reports on Rittenhouse and Vineyard show that firm cemented gravel and siltstone were present over nearly all the foundation area in these dams. Construction records show that the cutoff trench was taken to these firm materials and that about 2 to 3 feet of the looser material overlying it was taken out and recompacted. After talking to Don Riddle, the chief inspector, we concluded that about all that was practical to do to these foundations, was done. Some local settlement has occurred, as at Florence, but it is minor. The local settlement problem, it seems, was recognized early and was considered in the design.

Possible Effects of Regional Subsidence

In the Phoenix area, ground water pumpage has caused widespread land subsidence. The subsidence is as much as 7 feet or more in isolated areas. Data has been gathered by the USGS and consists of releveled monuments and monitoring water levels in wells. The data is shown on a map titled "Land subsidence and earth fissures in alluvial deposits in the Phoenix Area, Arizona." Map I-845-H, published in 1974. The maps shows four large areas of subsidence:

1. Between McMicken Dam and Sun City
2. Mesa area and south
3. Santa Cruz Flats south of Coolidge
4. Maricopa and Stanfield area

Our dams could be affected by the first two areas. The Buckeye and White Tanks dams are on the south edge of subsidence area 1 near McMicken dam. Powerline, Vineyard, Rittenhouse, Magma, and Spook Hill are on the east side of area 2 near Mesa.

Two things happen in a subsiding basin: the ground settles more or less uniformly over a wide area; and fissures or cracks open up on the edges of the subsiding basin, as they are doing in the Phoenix area. Should our dams be in a subsiding area, the dam itself could conceivable become lower than the emergency spillway. A storm would then over-top and possibly cause the dam to wash out. Differential settlement could also cause cracking of the fill, but we believe the cracks we saw were caused by desiccation. It seems to us that cracks due to differential settlement would be more random; those we saw nearly always had a consistent pattern. That is they were roughly parallel and were normal to the centerline. The longitudinal cracks may be related either to desiccation or to local foundation consolidation. We think they are more likely due to local foundation settlement.

If our dams are in an area where the valley alluvium cracks for a mile or more the consequences are likely to be more serious. The dam would likely be rendered unserviceable. Predicting if and where such cracks will appear is next to impossible. The one thing we can do, of course, is not build any new dams on or adjacent to such areas. The cracked areas are known and located on maps, so they can be avoided.

Past Design Philosophy

The first PL-566 dams planned and constructed in Arizona were near Safford in the Fry-Stockton project. The great potential for desiccation cracking in the desert environment was recognized as was the tendency for many desert soils to collapse when loaded and wetted. The Fry-Stockton dam designs included removal of part of the collapse prone material from the foundation and facing the entire surface of the structures with gravel. This design was thought to provide protection for both potential problems. The dams in this watershed were more or less conventional in that they were only a few hundred feet long and tied to well defined abutments. No problems with cracking have been reported for any of these dams.

The next structure constructed was the Magma dam. This structure is several miles long. In the investigations phase, project people made studies to determine if collapse prone materials occurred along the foundation and to find a source of gravel to face the dam. The only source of coarse material located nearby was a basalt hill. It was determined that if the dam was to be faced with crushed basalt to control cracking, the cost would exceed the benefits. Alternative methods of controlling desiccation were studies. The Service's experience on the White Tanks pilot Watershed project indicated that cracking could be kept within tolerable limits by working the dam surface at periodic intervals to maintain surface materials in a loose condition, in effect maintaining a dust mulch breaking the capillary rise of water to the surface. It was decided that the same treatment would insure that the Magma Dam would properly function for its design life if so maintained.

Consequently, it was designed and constructed with earth surfaces, little maintenance has been done.

On each project since then, attempts have been made to locate coarse material to face the structures. In no case has enought material been found to cover the entire surface. In all dams constructed the available coarse material has been used to cover as much of the dam as practicable. It has been anticipated that maintaining a dust mulch on the rest of the surface would be done by the owners. The necessary work on the surfaces of the dam has not been done and significant cracking has occurred.

In recent years, environmental concerns have required that desert vegetation be established on the faces of the dams. This prohibits working the surfaces and seriously retards the tendency to use gravel facing on the dams. The vegetation also speeds the desiccation process.

To date, little change in design has been made to protect against desiccation cracking. An exception to this is the Spookhill dam. It is designed with a permanent irrigation system to maintain vegetation. This should also maintain the moisture level in the fill and prevent desiccation cracking. Also the top of this dam is to be surfaced with gravel.

Construction Practices

All of the dam foundations have been wetted to the depth determined needed by the geologist to reach competent foundation materials. Much of the soft foundation materials are removed and recompacted into the fill. The long structures have been constructed in segments of about 1,000 feet

for better control of the moisture in both the fill and the borrow. In general, embankment materials have been used as they come from borrow areas with a minimum of sorting or routing. The fill densities in general, approach 100 percent of ASTM D-698 maximum density. Generally fill has been placed at optimum to 1 percent wet of optimum. Some of the low density collapse prone materials have been left in the downstream section of the foundation. This could have resulted in differential settlement causing longitudinal cracking.

Recommended Further Investigations

We know from past studies on the cracking problem and from our own observations that some of the dams are cracked worse than others. We also see what appears to be a self-healing process occurring on some of the older dams. By critically examining the cracks in trenches the seriousness of the cracks as well as those that have been healing by themselves can be evaluated. We also want to verify our feelings that White Tanks has not cracked as badly as the others. Since this structure was the only one of the seven we saw that had been periodically maintained by dragging, we believe it is important to see how effective the maintenance had been.

Trenching with a backhoe is about the best way to examine the cracks. The trenches can be dug as deep as the cracks are likely to go (10 feet ±) and the pits are big enough to work in so the cracks can be dug out with a hand pick or knife and examined more closely. Those cracks that appear to be self-healed should be examined especially close to see if they are

truly healed or merely bridged over by larger grains. Trenches should be dug in the following dams:

Buckeye #1	Magma
White Tanks	Florence
Vineyard Road	

The investigation will serve two purposes:

1. Evaluate the effect of maintenance as at White Tanks and the effect of no maintenance as at the others.

2. Help pinpoint the dams that corrective work needs to be done in the future similar to that being proposed for Rittenhouse.

We also think that it would be good to have state office staff technical people examining the cracks. These people could be the design engineer and geologist for example. It is important that information obtained be documented with both photographs and sketches. The work should be done this year, probably sometime in the fall, as schedules allow. After the work is done and data assembled, decisions can be made on necessary corrective measures for the other dams.

Recommendations for Repair

The Dam Cracking Committee concluded, on the basis of the present data, that only the Rittenhouse dam may need emergency treatment. Investigation of the other dams did not reveal open cracking to a depth that would pose a hazard to the structures from a 1 percent chance flood. If such cracks have occurred it appears they have partially or completely healed by developing a filter face and filling. Further investigation will be needed for verification.

Short-Term Emergency Repairs

The committee recommends that emergency repair be considered on the Rittenhouse dam. Areas needing repair can best be identified by Engineering Testing Laboratory, the consulting engineering firm on the basis of their field investigations. All areas having surface evidence of deep cracking may need emergency repairs.

Basic criteria for emergency repairs is to prevent structure failure by erosion or piping along existing cracks through the embankment. The criteria can be met with either a filter or an impervious core.

Three alternative short-term solutions were considered:

1. A graded sand and gravel filter installed in a backhoe trench parallel to the centerline. Attachment A.
2. A reworked narrow (3 feet) earth core. Attachment B.
3. A narrow soil cement core, Attachment C.

Description of Alternatives

1. Design and install a vertical graded sand and gravel filter immediately downstream from the centerline to a depth of at least 3 feet below any cracks encountered. This filter should be 2 or more feet in thickness. Filter material will need to be a clean (washed) sand and gravel compacted by a boom-mounted compactor on a backhoe.

Periodic outlets will be required for drainage to prevent entrapment of water and the build up of hydrostatic pressures.

Care will be required during construction to assure the full depth of cracking is correctly determined and to assure the filter material is not contaminated with fines by sloughing of the trench sidewalls. Shoring protection will be required during inspection for cracks. It would be desirable to have an SCS professional engineer oversee the work. Work should be limited to short reaches to prevent further desiccation cracking of the trench sidewalls.

This alternative will have a fairly high first cost since the filter material will likely have to be imported. It is a long-term positive solution to the cracking problem independent of the cause of the cracking. Future longitudinal extentions can be made without damage to prior work. Should deepening of the filter be required at some later date, much of the previously installed filter could be salvaged.

2. A compacted earth core would provide temporary short-term protection by providing an impervious zone to break the continuity of the cracks. It should have a width of 3 to 4 feet and extend to a depth of at least 3 feet below any cracks encountered.

The top of the dam could be dished and sprinkled so the excavated material could be recompacted back in the trench. Otherwise the excavated material could be wasted and fill material obtained from borrow areas adjacent to the dam.

Care will be required during construction to assure the full depth of cracking is correctly determined. Trench sidewalls will need to be sloped or shored for protection during inspection for cracks and during the backfilling would be required, its recommended that an SCS professional engineer oversee the work and make the crack depth determination. Work should be limited to short reaches to prevent further desiccation cracking of the trench sidewalls or across the trench bottom.

Potentially only a short-lived solution can be provided by this alternative. Desiccation of the core will cause it to crack in the future unless measures are taken to prevent drying. Even then extentions of existing cracks progress into the core from air circulation within the cracks. The core will also be susceptible to cracking from any foundation consolidation or general ground subsidence should these be a partial cause of the present problem or occur in the future.

This alternative would probably have the least first cost since materials are readily available at the site. Considering the potential short life, it can only be considered as a stopgap measure with a long-term solution required to be installed at a later date or as part of a system solution.

3. A soil cement core parallel to the centerline would provide both short- and long-term solution to prevent a piping failure along the existing cracks. A narrow vertical backhoe trench could be backfilled with compacted soil cement. The earth and cement could be mixed on the

dam, deposited in the trench and compacted with a boom-mounted compactor. If they were mixed in the trench and compacted by hand-operated compactors, shoring would be required.

Although a soil cement core may crack, it's erosion rate from water movement will be very slow. It will provide protection against rapid failure and cracks can be repaired by patching the upstream face.

Care will be required during construction to assure the full depth of cracking is correctly determined. Trench sidewalls will need to be shored during inspection for cracks. It is recommended that a professional SCS engineer oversee the work. Work should be limited to short reaches to prevent desiccation cracks from forming in the trench sidewall and across the trench bottom.

This alternative will be fairly expensive. Use of local materials would help decrease costs.

The soil cement core will be susceptible to cracking from any foundation consolidation or general ground subsidence should these be a partial cause of the present problem or occur in the future.

Although a soil cement core could be readily lengthened, it would be very difficult to deepen in the future.

Conclusions

The committee has concluded that the cracking observed is related to desiccation. Most places desiccation is the principal cause of cracks.

Where foundation consolidation is suspect as the principal cause, desiccation has seriously aggravated the problem.

The committee further concludes that only Rittenhouse dam may need emergency repair at this time. It appears the cracks in the other dams have either not developed to a point to be an immediate hazard or have developed and healed.

A sand and gravel filter will be the best solution to the immediate problem.

No long-term solution can be offered at this time. A long-term solution will be dependent upon the results of the investigation to determine the extent of self healing.

No recommendations for changes in design concepts or criteria will be offered at this time. These also will be dependent upon the results of the investigation to determine the extent of cracking and self healing on the Magma and Florence Dams.

Recommendations

The committee recommends that repair work by alternate 1 (sand and gravel filter) be installed in the critical portions of Rittenhouse dam as soon as practicable. Critical areas should be determined by the

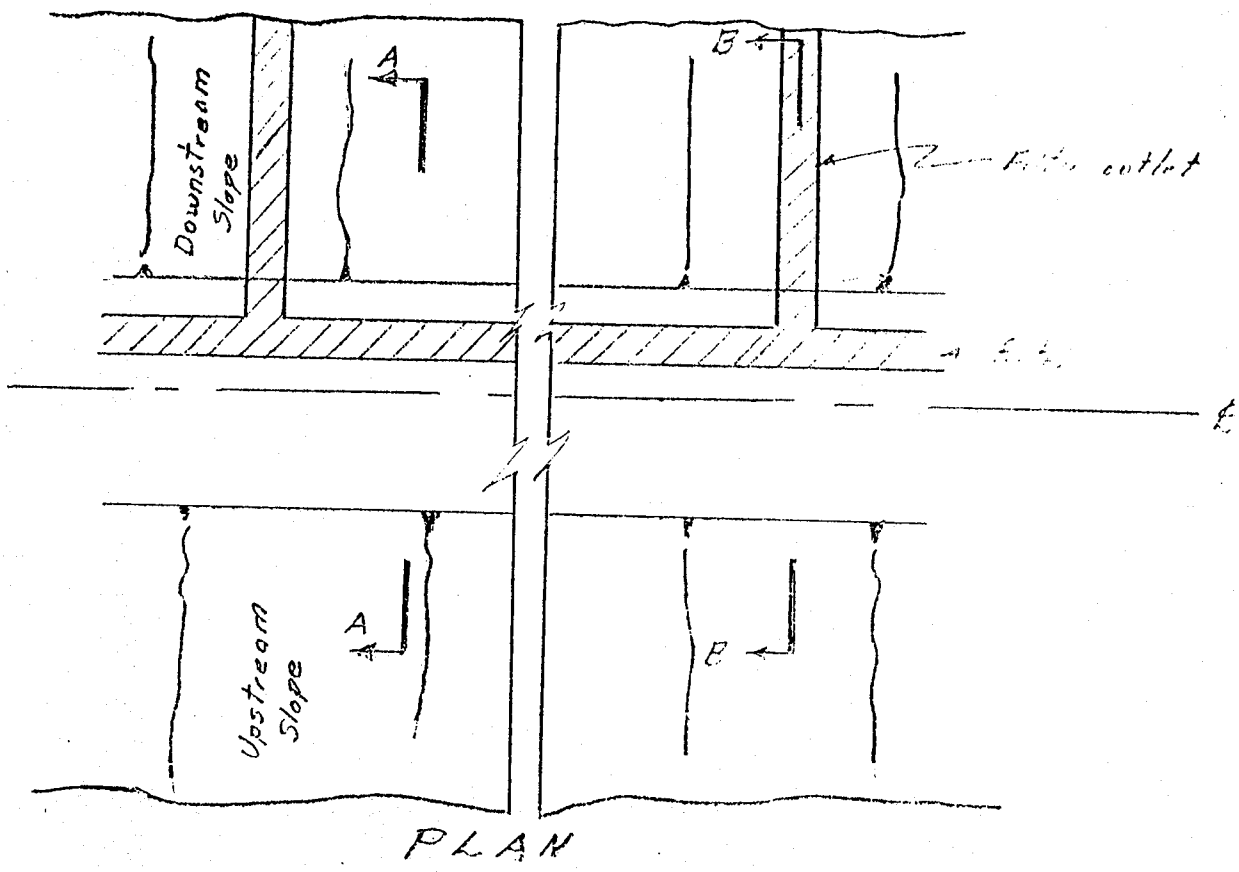
Consultant Engineer based on the results of his detailed investigations and visual observation.

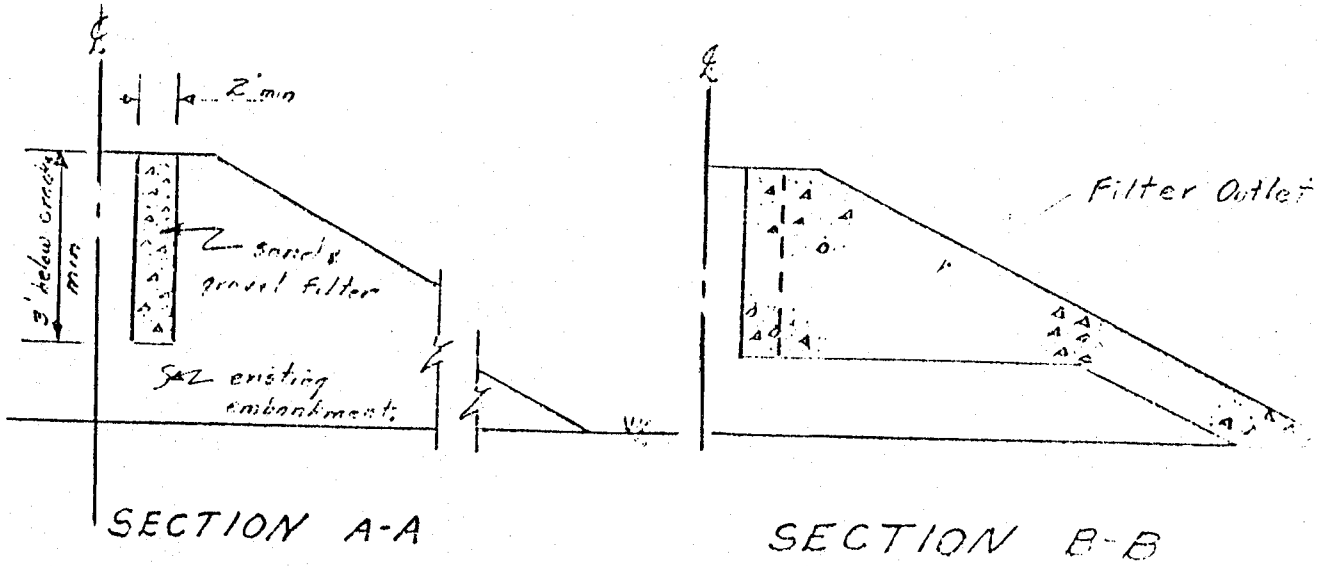
Ray Smith

Jack Stevenson

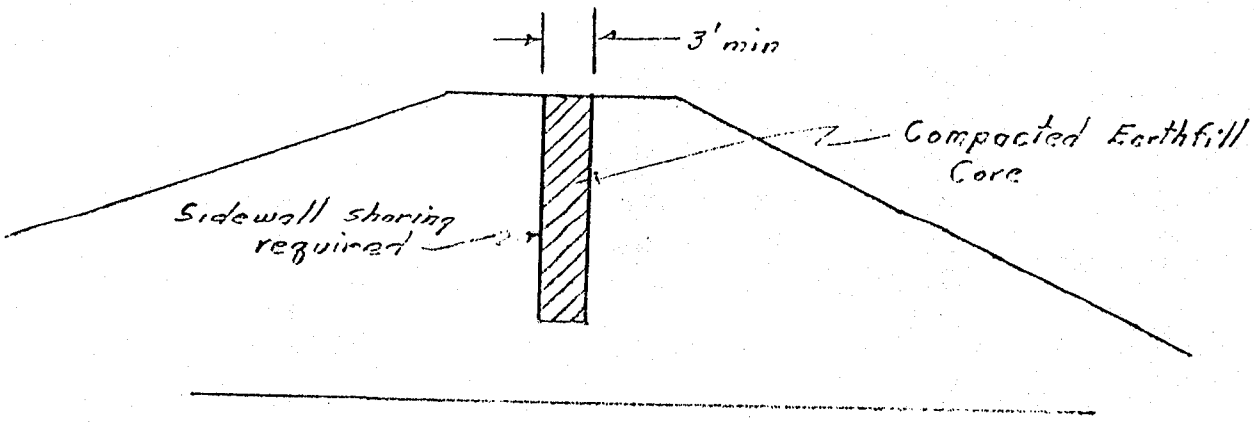
Ed Stearns

Attachment A

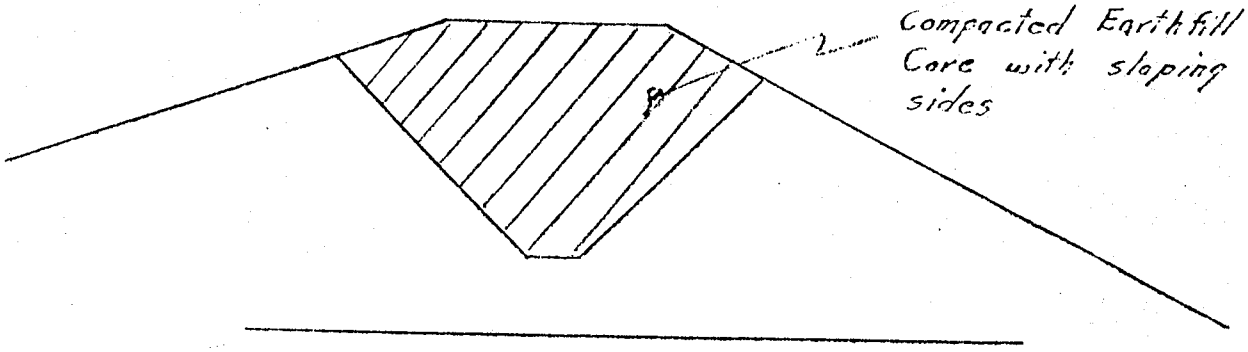




Attachment B

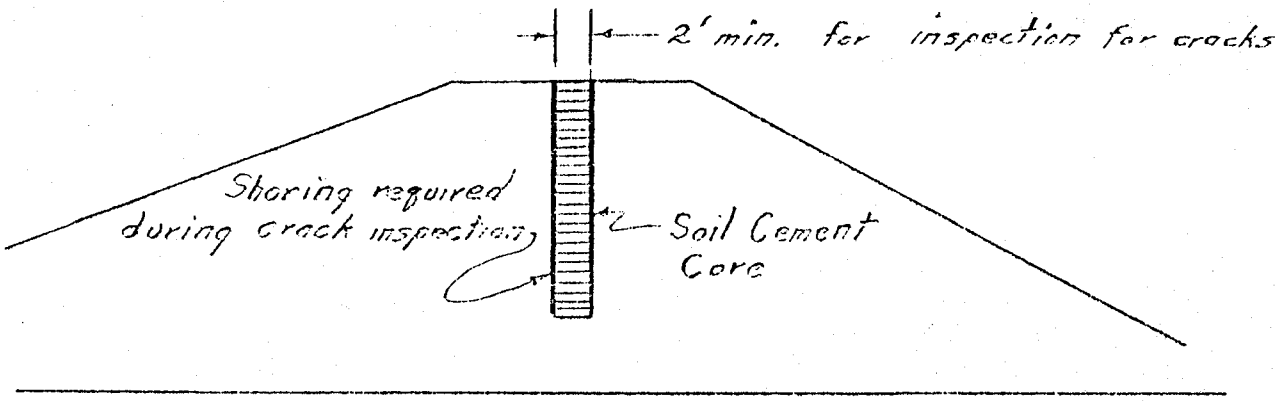


STRUCTURE CROSS-SECTION



STRUCTURE CROSS-SECTION

Attachment C



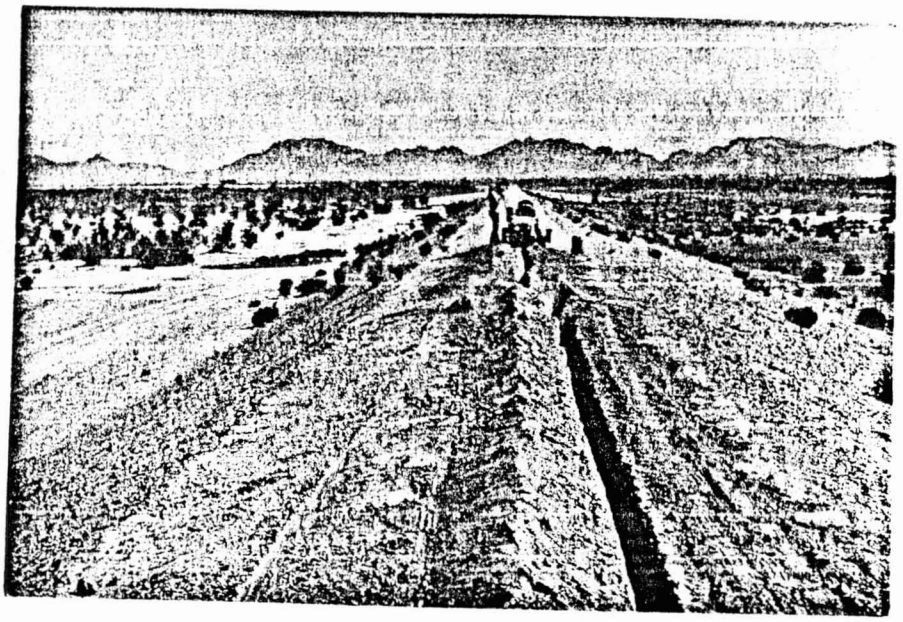
STRUCTURE CROSS-SECTION

Consultant Engineer based on the results of his detailed investigations and visual observation.

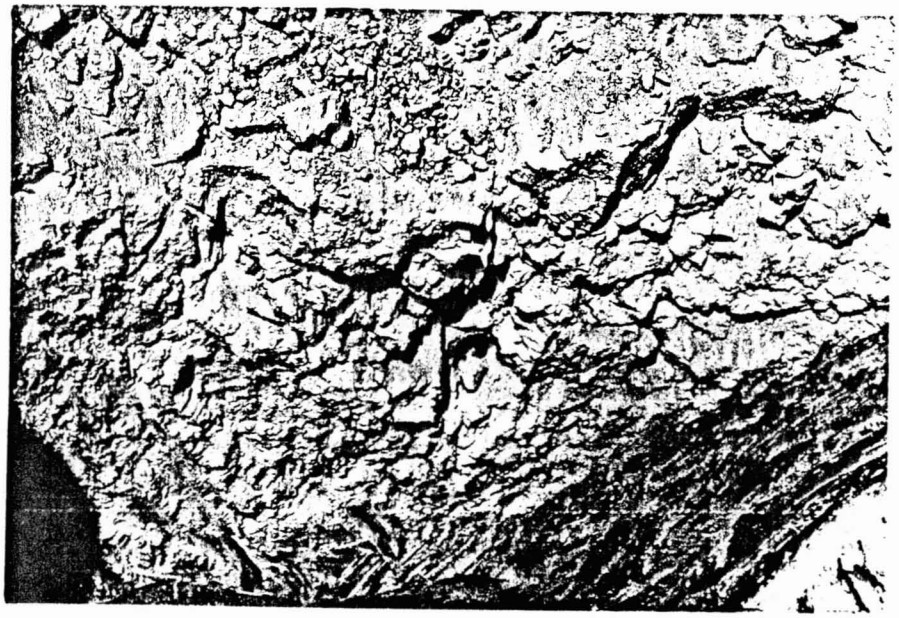
Ray Smith

Jack Stevenson

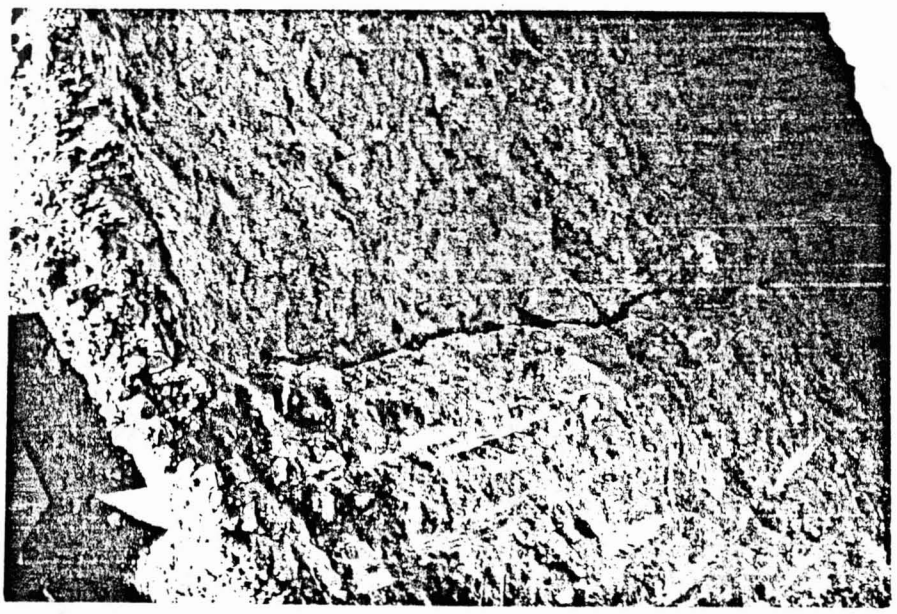
Ed Stearns



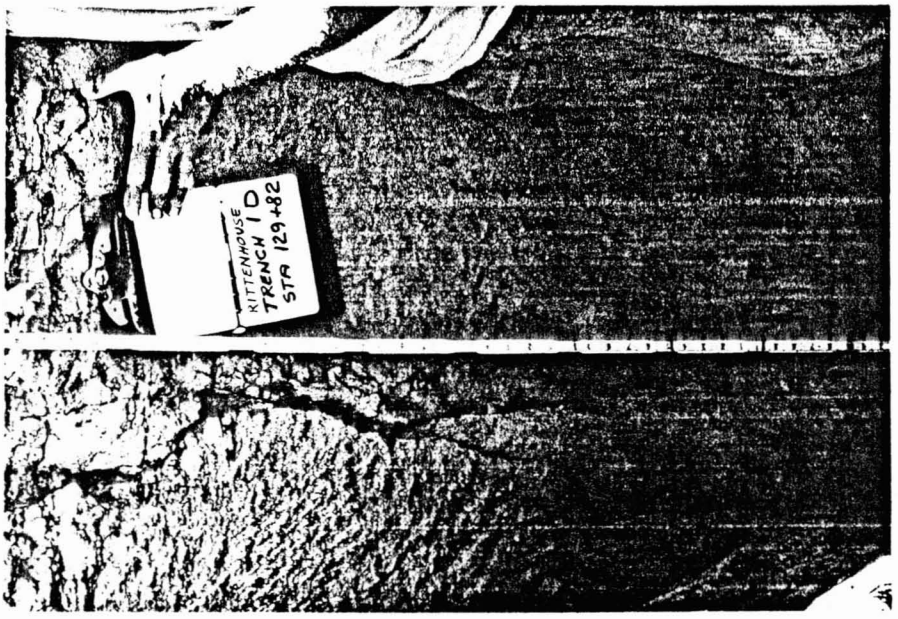
1. Trenching Operation - Vineyard Road dam near Station 200+00. 36" depth, 6" width, date 6/6/77.



2. Backhoe Pit (V-3-A) - Vineyard Road dam Station 111+08 - Cracked dry layer over firm moist soil.

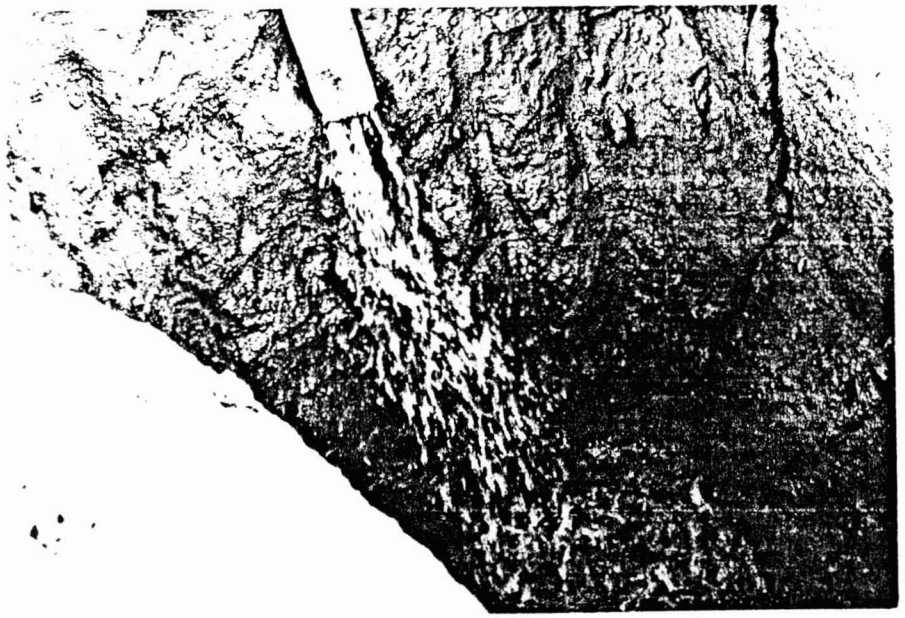


3. Backhoe Pit - Rittenhouse dam Station 183+82 (R-D-2)
   Transverse Crack 6' ±

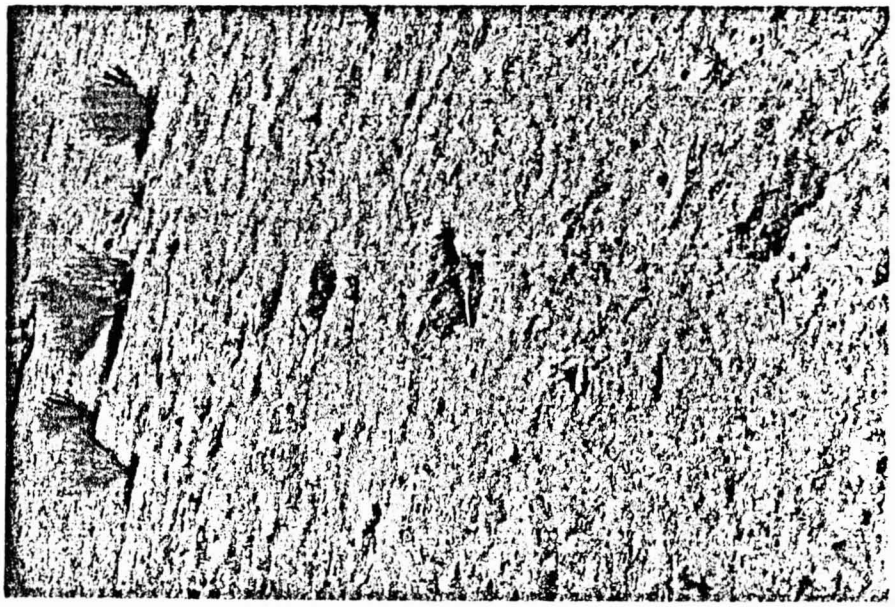


4. Backhoe Pit - Rittenhouse dam Station 129+82 - (R-I-D)
   Transverse Crack opened to 4 1/2 feet.

5. Rittenhouse dam Station 129+82 (R-I-D) - Transverse Crack opened to 5' and 400 gallon of water poured into crack. Evidence of deeper crack. Later excavated to 10' depth.

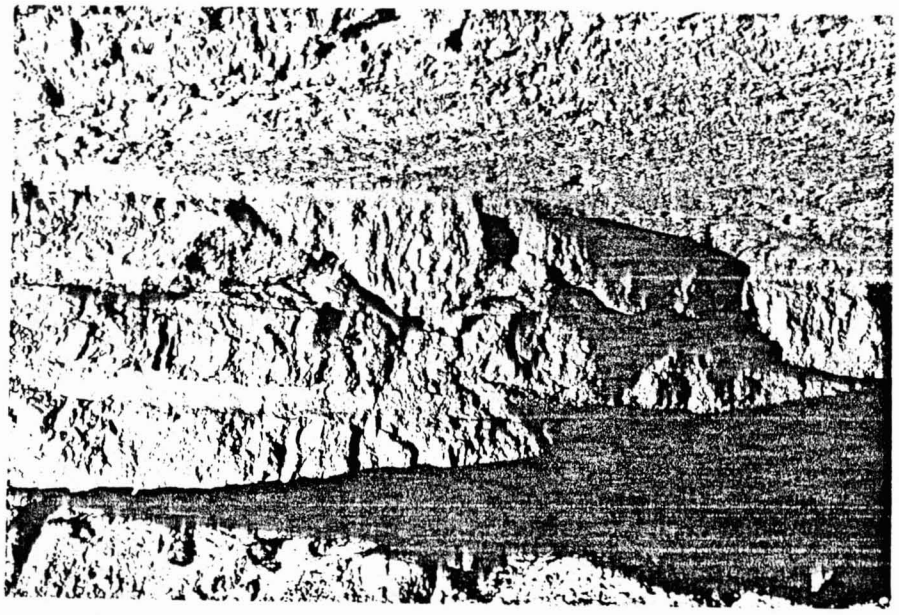


6. Rittenhouse dam Station 129+82 (R-I-D) - Transverse Crack opened to 10 feet level - Water entered into crack. Evidence of 6" diameter x 30" long cavity. Crack is not continuous thru embankment at depth - D.S. 7' U.S. 3'

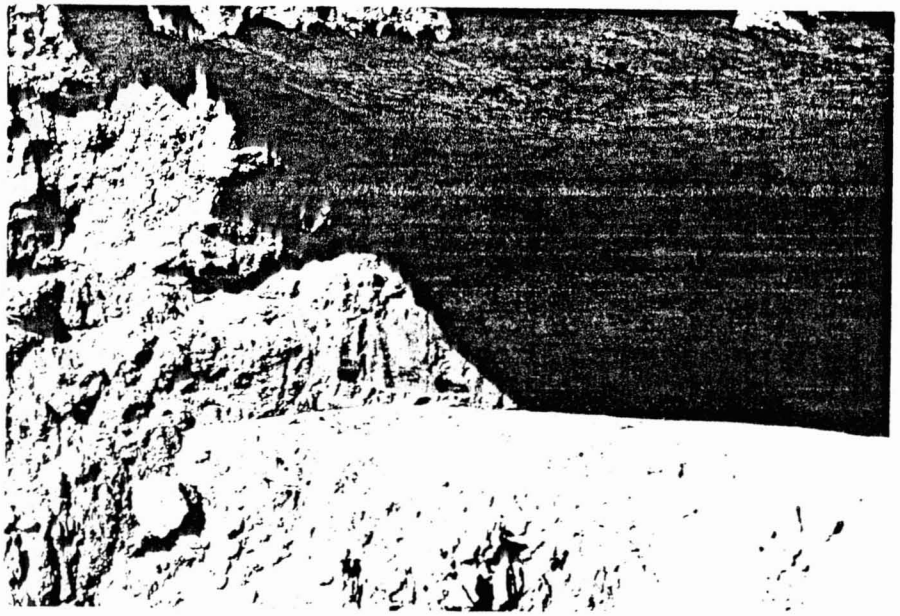


7. Longitudinal Crack - Station 133+56 to Station 135+07 Vineyard Road dam upstream slope (near Schrapnel area).

8. Longitudinal Crack Vineyard dam Station 111+45 - (V-3-B) ℄ crest at dam.



9. Rittenhouse dam - Longitudinal Crack Station 158+04 depth 6'0" - (R-3-B)



10. Rittenhouse dam Station 185+82 (R-2-B) - Wide longitudinal crack - 7"0" depth.

11. Rittenhouse dam longitudinal and transverse cracks Station 158+04 - (R-3-B).

FLOOD CONTROL DISTRICT of Maricopa County

3325 West Durango Street • Phoenix, Arizona 85009 • Telephone (602) 262-3630/262-3639

November 4, 1975

Leo please file w/ White Tanks pilot us - or the we no longer have to a file [illegible] much. [illegible]

United States Department of Agriculture
Soil Conservation Service
3556 West Buckeye Road
Phoenix, Arizona 85009

ATTENTION: Mr. Terence E. Taylor

Dear Mr. Taylor:

We acknowledge receipt of your letter dated September 30, 1975, regarding Operations and Maintenance agreements between Soil Conservation Service and the Flood Control District of Maricopa County.

It is assumed the structures on the White Tanks Watershed you are concerned with are the White Tanks retarding structures #3 and #4.

A review of Operation and Maintenance agreement records in this office indicate that he last agreement entered into relative to these structures was one for Operations and Maintenance, dated November 28, 1966, between the Flood Control District of Maricopa County and the Maricopa County Municipal Water Conservation District No. 1. This agreement provided for the Maricopa County Municipal Water Conservation District No. 1 to do maintenance work on the structures and to be reimbursed for this work by the Flood Control District. This agreement was terminated by mutual consent of both parties on June 30, 1975. Thus, the Flood Control District of Maricopa County is now responsible for the Operation and Maintenance of the above structures.

The agreement referred to above is the only agreement of record involving the Flood Control District of Maricopa County and there appears to be no provision in the agreement for Operation and Maintenance reports to the Soil Conservation Service. There appears to be no record of a formal Operations and Maintenance agreement or official legal transfer of responsibility of these structures from the Soil Conservation Service to the Flood Control District.

In view of the fact that District and Soil Conservation Service personnel are meeting this week to discuss Operations and Maintenance procedures, any further discussion of this matter could be continued at this time.

Sincerely,

Herbert P. Donald, P.E.
Chief Engineer and General Manager

PD/WAA/ly

DETAILED ENGINEERING REPORT

White Tanks Erosion Control Project

The history of the White Tanks Erosion Control Project is so well known to all personnel, both in the State and Regional Offices, that a brief summary should suffice for the engineering narrative.

The White Tanks area includes the Trilby Wash Watershed and the east watershed of the White Tanks Mountains in Maricopa County, Arizona. Runoff from the storms originating in the upper watershed has caused extensive damage to irrigated lands, highways, railroads, armed forces installations and other public and private property. Interest has been active for many years in the construction of some type of works to alleviate this damage, but until the severe floods of 1951 the various groups concerned could never agree on a comprehensive plan.

The Agua Fria Soil Conservation District, which includes all of the irrigated lands in the White Tanks area, was organized in 1945. Commencing in 1946, at the request of the Agua Fria Soil Conservation District, Service technicians began work on the development of a plan for the protection of the farm land and irrigation facilities. In 1947 the design of one detention structure was completed and submitted to the Agua Fria Soil Conservation District, but no construction was undertaken because of financing difficulties.

Severe damage resulted from a storm in January, 1951, and agitation for protection became active. Additional storms during July and August of 1951 emphasized the necessity for immediate construction of adequate protection works. A base line was established from a point about one-half mile northwest of the Beardsley Canal, and permanent points were set approximately every 500 feet. All pertinent items in the structures as designed are referred to the permanent points previously mentioned. Topographic mapping of a strip approximately 4,000 feet in width and 18½ miles in length was started during August, 1951, and completed late in December. After a thorough study of the base map and considerable field reconnaissance, it was decided that a system of four detention dams with controlled outlets or "bleeders" could adequately control runoff. The structures have been located so that the flow from the watershed will run directly into the reservoirs. This provides for a minimum use of training dikes and channels and decreases the maintenance problem considerably.

Structures Numbers 1 and 2 have been designed to function as a unit. A large outlet has been provided to discharge stored water from Number 1 to Number 2, in order to utilize the maximum capacity of the main canal and all laterals in evacuating both reservoirs in a minimum length of time. Because of the interdependence of these two structures, they should be constructed as a unit. The outlets or "bleeders" will be sliding headgates and specially treated corrugated metal pipe. They will discharge stored water directly into the main Beardsley Canal for

distribution into the laterals and wasteways. In case of large storms and increased runoff, additional "bleeders" will discharge small quantities over the present concrete siphons and into established channels.

No structures are to be built between laterals 8½ and 10½. The Irrigation District has agreed to strengthen a dike presently located just west of the Beardsley Canal, and in this manner train runoff into Structure Number 3. The present overshot at Lateral 10½ will consequently be blocked.

Structure Number 4 is located at the extreme southern end of the project and is the smallest of the series. After thorough field reconnaissance, it was decided that with minor modifications in the presently existing structures on the Caterpillar proving grounds that they could easily be incorporated into the overall plan. It was on this basis that the design for Structure Number 4 was made.

Agreement exists between the Irrigation District and the Agua Fria Soil Conservation District for the operation and maintenance of the structures after they have been completed. Necessary water distribution plans will be made and personnel will be trained in the operation of the control gates. Both the Agua Fria Soil Conservation District and the Irrigation District have given assurances that the reservoirs will always be evacuated in the shortest possible time and that water will never be stored for irrigation purposes.

George Sohm

George Sohm
Engineering Specialist
February 27, 1953

6029 Federal Building, Phoenix, Arizona 85025

Jan. 4, 1972

Colonel John C. Lowry
Chief Engineer and General Manager
Flood Control District of Maricopa County
3325 West Durango
Phoenix, Arizona 85009

Dear Colonel Lowry:

Attached for your file are the following operation and maintenance agreements for the White Tanks Pilot Watershed Project:

1. Agreement - Between Agua Fria Soil Conservation District and the Soil Conservation Service - dated November 30, 1953. (See Item 2, page 1 and the first paragraph of page 3 covering O & M).

2. Agreement - Amendment No. 2 dated October 15, 1957 - change in spillway design and costs.

3. Letter - from Robert V. Boyle to K. B. McMicken dated January 28, 1955 advising Service acceptance and outlining O & M responsibilities.

4. Letter - H. S. Raymond to Robert Boyle dated August 31, 1959 confirming O & M responsibilities of Agua Fria SCD.

5. Cooperative agreement - Agua Fria SCD and Maricopa County Water Conservation Dist. No. 1 (Beardsly Project) dated December 3, 1953 giving O & M responsibilities to Beardsly Project.

6. Agreement - Flood Control District of Maricopa County and Maricopa County Municipal Water District No. 1 dated Nov. 28, 1966. Outlines O & M responsibilities of FCDMC for White Tanks structures and provides for the irrigation district to perform this work for a certain fee (See Item 2, page 2).

Sincerely,

Cliffton A. Maguire
Asst. State Conservationist (Acting)

Attachments/6

CAMaguire:as

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE Room 6029 Federal Bldg., Phoenix, AZ 85025

JECT: MGT - Program Inspection
October 4-7, 1971

DATE: December 16, 1971

TO:

Chris Williams, DC
SCS, Phoenix

Attached for your use and file are the following operation and maintenance agreements for the White Tanks Pilot Watershed Project:

1. Agreement - Between Agua Fria Soil Conservation District and the Soil Conservation Service - dated November 30, 1953. (See Item 2, page 1 and the first paragraph of page 3 covering O & M).

2. Agreement - Amendment No. 2 dated October 15, 1957 - change in spillway design and costs.

3. Letter - from Robert V. Boyle to K. B. McMicken dated January 28, 1955 advising Service acceptance and outlining O & M responsibilities.

4. Letter - H. S. Raymond to Robert Boyle dated August 31, 1959 confirming O & M responsibilities of Agua Fria SCD.

5. Cooperative agreement - Agua Fria SCD and Maricopa County Water Conservation Dist. No. 1 (Beardsly Project) dated December 3, 1953 giving O & M responsibilities to Beardsly Project.

6. Agreement - Flood Control District of Maricopa County and Maricopa County Municipal Water District No. 1 dated November 28, 1966. Outlines O & M responsibilities of FCDMC for White Tanks structures and provides for the irrigation district to perform this work for a certain fee (See Item 2, page 2).

This transmittal completes agreed-to item 18 of the program inspection report.

Ralph M. Quing Acting

J. J. Turner
State Conservation Engineer

cc: D. Swenson w/o attachment
G. Welsh w/ attachment

Gerry - We are attaching a copy for your transmittal to the FCDMC to assure they have these documents in their office.

AGUA FRIA SOIL CONSERVATION DISTRICT

P. O. BOX 578, WE 5-9251
PEORIA • ARIZONA

August 31, 1959

Mr. Robert V. Boyle, State Conservationist
Soil Conservation Service
106 East Roosevelt
Phoenix, Arizona

Dear Bob,

By action taken by the Board of Supervisors on August 24, 1959, the Agua Fria Soil Conservation District assumed, as a matter of record, full responsibility for the operation and maintenance of the White Tanks Project. The District has, however, actually operated and maintained the project since its completion in 1954.

Sincerely yours,

H. S. Raymond, Secretary
AGUA FRIA SOIL CONSERVATION DISTRICT

HSR/po

203 Main Post Office Bldg.
Phoenix, Arizona

January 28, 1955

Subject: White Tanks Watershed Protection Project.

Mr. K. B. McMicken, Chairman
Board of Supervisors
Agua Fria Soil Conservation District
Box 25
Litchfield Park, Arizona

Dear Mr. McMicken:

Our records indicate that the U.S. Department of Agriculture represented by the Regional Director of the Soil Conservation Service entered into an agreement, dated November 30, 1953, with the Agua Fria Soil Conservation District.

Among other things, the agreement provided that your District would assume responsibility for operation and proper maintenance of the completed work. Subsequent to the signing of the above-mentioned agreement, the responsibilities of the Regional Director have been assigned to the State Conservationist, Arizona. The Service has fulfilled its obligations under paragraph B (1), (2), (3) of the agreement and we assume therefore that your District is prepared to assume full responsibility for operation and maintenance of the White Tanks project. We submit that the Service's responsibilities have been discharged except for our willingness to consult and advise with you regarding maintenance problems if you desire this.

Please be assured of our extreme appreciation of the manner in which your District and the Maricopa Municipal Water Conservation District #1 have cooperated in the prosecution of this undertaking. The physical progress of the project and the personal relationships connected with it have been most satisfactory and harmonious.

Very truly yours,

Robt. V. Boyle
State Conservationist

cc: D. A. Williams
J. G. Bamesberger
L. A. Hill

KKTXXXXXXWX
JJTurner:wb

State Arizona

Watershed White Tanks

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

AMENDMENT NO. 2 TO AGREEMENT FOR
CONSTRUCTION OF WORKS OF IMPROVEMENT

THIS AMENDED AGREEMENT, made this 15th day of October, 1957, by and between the Agua Fria Soil Conservation District, hereinafter called the Sponsoring Local Organization, and the Soil Conservation Service of the United States Department of Agriculture, hereinafter called the Service,

WITNESSETH THAT:

WHEREAS, under the authority of Public Law 156, 83rd Congress, 1st Session, an agreement for the construction of White Tanks Project retarding structures No. 3 and No. 4 was entered into on the 30th day of November, 1953 and

WHEREAS, the spillway of Structure No. 3, as constructed in 1954, more than satisfies the Service standards for this type of structure as set forth in Engineering Memorandum No. 3 Revised July 16, 1956,

NOW THEREFORE, the Sponsoring Local Organization and the Service do hereby agree to amend the original agreement as follows:

A. The design for the aforementioned spillway is changed from 1100 feet wide as shown on Sheet 17 of the design drawings dated October, 1952 to 800 feet in width as constructed in 1954.

B. Paragraph A(3)(g) of the original agreement is hereby deleted.

C. These changes will decrease the estimated cost in the following amounts:

To the Sponsoring Local Organization	$22,230.00
To the Service	No change

D. All other terms and conditions of the original agreement as amended remain in full force and effect.

U. S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service

By Robt. D. Boyle

Title State Conservationist

AQUA FRIA SOIL CONSERVATION DISTRICT

By [signature]

Title Chairman

A G R E E M E N T

THIS AGREEMENT, made and entered into this 30th day of November, 1953, by and between Agua Fria Soil Conservation District, State of Arizona, hereinafter called the DISTRICT and the Soil Conservation Service, Region 6, of the Department of Agriculture, hereinafter called the SERVICE.

OBJECT - The object of this agreement is to coordinate the activities and efficient use of the resources of the two parties in carrying out and maintaining watershed protection needed on watershed lands, and the installation of such measures in the District as are needed and practicable for the reduction of flood water and sediment damages, such as waterflow-retarding dams, channel improvements, streambank stabilization, major gully control, and related measures.

Specifically this agreement covers the construction of White Tanks Project retarding structures No. 3 and No. 4 as planned by the Soil Conservation Service, along with any appurtenances that may be required. All located about 8 miles west of Goodyear, Arizona, immediately above the main canal of the Maricopa Municipal Water Conservation District No. 1 (Beardsley).

AUTHORITY - Public Law 156, 83rd. Congress, 1st. Session, approved July 28, 1953.

W I T N E S S E T H

A. The District, for and in consideration of the benefits to be derived in the carrying out of this agreement and to accomplish the object herein set forth, does hereby represent, promise and agree as follows:

(1) The District represents that past non-federal contributions, including engineering, securing rights-of-way and easements, and other costs associated with retarding structures No. 3 and No. 4, have a value of $145,046.00 (See attached itemization of expenditures).

(2) To arrange for such easements for rights-of-way as may be required by the parties to facilitate, perform and maintain the watershed protection measures set forth herein, record in the county where the land is situated and furnish evidence to the Service that the foregoing has been accomplished.

(3) To contribute future measures as listed below:

(a) Approximately 50% of required engineering services.

(b) Necessary labor and equipment for clearing and stripping site for structure No. 4

(c) Water required for performance of the work.

(d) Necessary labor, materials and equipment for constructing two-diversion dykes.

(e) Necessary labor, materials and equipment for excavating and sealing a channel.

(f) Furnish and install 511 linear feet of corrugated metal pipe and gates for structures No. 3 & 4 together with appurtenances.

(g) Necessary labor and equipment for completion of spillway excavation. Structure #3.

(h) Completion and/or modification of existing dykes on caterpillar proving ground to insure their functioning as planned with relation to completed project.

It is estimated that cost of the above contributions will amount to $80,412.00 (See attached itemization of estimated costs).

(4) The contributions listed under 3 above shall be timed and performed so as to coordinate with the construction program of the Service's contribution, in order that a minimum of friction and delay will be caused.

B. The Service, in consideration of the representations, promises, and agreements made on the part of the District herein set forth, agrees as follows:

(1) To furnish approximately 50% of required engineering services for surveys, designs and specifications for the construction of two earth filled dams. Structures No. 3 and No. 4.

(2) To circulate invitations for bids and award a contract to the lowest qualified bidder for furnishing necessary materials, equipment and labor, and performing the proposed construction work, except as otherwise provided herein.

(3) To supervise, inspect and make final acceptance of the completed work.

It is estimated that the contribution to be made on the part of the Service as described above will amount to approximately $219,074.00.

IT IS FURTHER UNDERSTOOD AND AGREED

That contributions of the District toward completion of the watershed protection project, both past and future shall equal or exceed Federal Watershed protection funds expended on the project. On the basis of the estimates included in this agreement, the value of the District's contributions, past and future, amounts to $225,458.00. The estimated cost of project work to be financed with Federal watershed protection funds is $219,074.00.

That the District will assume responsibility for operation and proper maintenance of the completed work.

That the responsibility of the Service under this agreement shall terminate upon completion and acceptance of the work as provided under Paragraph B(1)(2)(3), and all interests in ownership and operation shall at that time be relinquished.

That the Service will, upon request from the District, furnish technical assistance to the extent available to aid in inspection and to advise local interests with respect to maintenance needed.

That the District will hold and save the United States Government free from all claims for damages that may arise from construction or operation of the work installed under this agreement.

That determinations will be made jointly by the District and the Service that proposed structures are in conformity with State laws, before construction is started.

No Member of or Delegate to Congress or Resident Commissioner shall be admitted to any share or part of this agreement or to any benefit that may arise therefrom unless it be made with a corporation for its general benefit.

IN WITNESS WHEREOF, the parties hereto have hereunder subscribed their names as of the date first above written.

U. S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service

By Cyril Luker

Title Regional Director
January 11, 1954

AGUA FRIA SOIL CONSERVATION DISTRICT

By /s/ K. B. McMicken

Title Chairman, Agua Fria Soil Conservat
District

The signing of this agreement on behalf of the Agua Fria Soil Conservation District Governing Body adopted at a meeting held on 30th day of November, 1953.

/s/ H. S. Raymond
Secretary, District Governing Board

COOPERATIVE AGREEMENT
AGUA FRIA SOIL CONSERVATION DISTRICT

STATE OF ARIZONA

THIS AGREEMENT is entered into by the AGUA FRIA Soil Conservation District, hereafter referred to as the "District" and MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NUMBER ONE, locally known and hereafter referred to as the Beardsley Project
(Name of company, enterprise, municipality or other legally organized group)

THIS AGREEMENT is for the purpose of setting forth an understanding of how the two parties will install certain prescribed watershed structures or measures within the boundaries of the District.

THE DISTRICT AGREES TO:

1. Furnish technical assistance and supervision for surveys, designs, and construction as required to the extent that these services are available to the District at the time they are scheduled to be furnished.
2. Arrange for funds to be provided by the Soil Conservation Service to install the structures and measures in addition to that supplied by the Beardsley Project and others.
3. Will alow credit to the Beardsley Project for contributions supplied by them, such as easements, labor, materials or installations as agreed upon and set forth in the attached plan.
4. Provide assistance to make inspections by qualified people of all structures and measures installed under this agreement to determine maintenance needs and a schedule for the conduct of maintenance.

THE BEARDSLEY PROJECT AGREES TO:

1. Obtain easements and right of ways for the construction, operation, and maintenance structures and measures installed under this agreement and to pay its proportionate share of the costs of such easements and right of ways as provided for in the attached plans.

2. To provide labor, materials or installations as provided for in the attached plan.

3. Operate and maintain the structures and measures as provided in the attached plan.

4. Hold and save the District free from all claims that may arise from the costs of construction and operation of the work.

IT IS MUTUALLY AGREED THAT:

1. Each party to this Agreement will encourage the adoption and maintenance of conservation measures on the watershed above the works installed under this Agreement.

2. This Agreement will take effect on the date of the last signature to it and will remain in effect for the period of the normal life of the structures or measures installed under this Agreement.

APPROVED:

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NUMBER ONE

By Albert T. Sitty	(Name)	President (Title)	12-2-53 (Date)
By [signature]	(Name)	Leader (Title)	12-2-53 (Date)

AGUA FRIA SOIL CONSERVATION DISTRICT

By [signature]	(Supervisor)	CHAIRMAN (Title)	12/3/53 (Date)
By [signature]	(Supervisor)	SECRETARY (Title)	12/3/53 (Date)

(Seal)

Gerald Welsh File

AGREEMENT

THIS AGREEMENT made and entered into at Phoenix, Arizona, on this, the 23rd day of November, 1966, by and between the FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, ARIZONA, a Flood Control District organized under and pursuant to the laws of the State of Arizona, hereinafter designated "Flood Control District", and the MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NO. 1 an Irrigation Distfict organized under and pursuant to the laws of the State of Arizona, hereinafter designated "Irrigation District".

W I T N E S S E T H :

THAT, WHEREAS, Flood Control District has the responsibility of operating and maintaining certain flood control works, consisting in the main of McMicken Dam and outlet channel, S.C.S. Dams No. 3 and No. 4, and interconnecting dikes and channels and related and adjoining flood control works, all located within the County of Maricopa, State of Arizona, and desires that said flood control works be maintained in proper working condition, and operated in a good and workmanlike manner; and

WHEREAS, Irrigation District has available and is able forthwith to secure the necessary labor, materials, equipment and supervisory personnel necessary and required for the proper maintenance and operation of said flood control works.

NOW, THEREFORE, for and in consideration of the mutual covenants and agreements hereinafter set forth and contained on the part of the parties hereto to be by them respectively kept and performed, said parties hereto agree as follows:

1. That the Irrigation District shall, for the period beginning as of the 1st day of July, 1966, and ending on the 30th day of June, 1967, and from year to year thereafter, in a good and workmanlike manner, keep, maintain and operate said flood control works in a proper condition and manner and

in accordance with instructions and procedures given by the Flood Control District, provided, however, that the Irrigation District shall not be required to do or perform any work in relation to keeping, maintaining and operating said flood control works in a proper condition and manner, the cost of which shall be in excess of the amount which the Flood Control District shall therefor have obligated itself to pay to the Irrigation District for such work.

2. That for the period beginning as of the 1st day of July, 1966, and ending on the 30th day of June, 1967, the Flood Control District shall pay to the Irrigation District a sum not in excess of FOUR THOUSAND ($4,000.00) DOLLARS for keeping, maintaining and operating said flood control works in a proper condition and manner.

3. That the Flood Control District shall, prior to the 1st day of June of each and every year beginning on the 1st day of June, 1967, estimate the amount that the Flood Control District shall provide for keeping, maintaining and operating said flood control works in a proper condition and manner during the period of each year, respectively, beginning on said 1st day of June, 1967. The Irrigation District shall not, during any such period, be required to do and perform any work upon said flood control works, the cost of which shall be in excess of said estimated amount, nor shall it perform any work upon or in relation to the maintenance and operation of said flood control works not previously authorized in writing by the Flood Control District. That in the event that the Irrigation District shall, at any time, by notice in writing given to the Flood Control District, advise the Flood Control District that the cost of doing the work done or to be done and performed by the Irrigation District during the period then in effect will be in excess of the amount estimated by the Flood Control District to cover the cost of such work, then and in such event the Flood Control District shall forthwith give notice in writing to the Irrigation District of its approval for the performance of the work to be done, the cost

of which will be in excess of said estimated amount for such work, and in the further event that such notice shall not be received by the Irrigation District within fifteen (15) days from and after the giving of said notice by the Irrigation District to the Flood Control District, then and in such events the Irrigation District shall have no further obligation to do and perform any further or additional work in relation to the maintenance and operation of said works, the cost of which will be in excess of the amount estimated by the Flood Control District to cover the cost of such work.

4. That the Irrigation District shall, from time to time, as it shall determine, present to the Flood Control District a detailed and itemized statement, with supporting invoices, of the cost of the work performed by the Irrigation District in relation to the maintenance and operation of said flood control works, including among other things, that part of the Irrigation District's general administrative and over-head expenses which are attributable to the maintenance and operation of said flood control works, provided, however, that in no event shall the amount of the Irrigation District's general administrative and over-head expenses exceed twenty per cent (20%) of the total cost to the Irrigation District of performing said work of maintaining and operating said flood control works, and notwithstanding anything herein to the contrary, any and all withholding, social security and other taxes and expenses of any and all employees engaged in the performance of the work of maintaining and operating said flood control works shall be the sole and exclusive responsibility of and shall be paid by the Irrigation District.

5. That the parties hereto recognize and agree that from time to time as a result of accidental, natural or other causes, and through no fault of the parties hereto, or either of them, there may be unusual damage to said flood control works requiring repairs and maintenance thereto exceeding normal repairs and maintenance, and in the event of any such eventuality the parties hereto shall determine and

agree upon the amount of the additional costs and expenses to be incurred as the result of such extraordinary causes, and in the event that the parties hereto shall agree upon the amount of said additional costs and expenses resulting from such extraordinary causes, then and in such event the Irrigation District shall proceed to do and perform the additional work made necessary by such extraordinary causes, and upon the completion thereof the Flood Control District shall pay to the Irrigation District the cost to the Irrigation District of performing such work, together with that part of the Irrigation District's general administrative and over-head expenses which are attributable to the performance of such extraordinary work.

6. That this Agreement shall be automatically renewed from year to year from and after the 1st day of July, 1967, unless the Flood Control District or the Irrigation District shall serve notice in writing, upon the other of them within thirty (30) days prior to the end of the period then in effect of its desire to terminate this Agreement at the end of said period, and upon the giving of such notice this Agreement shall terminate and end on the 30th day of June following the date on which such notice was given.

IN WITNESS WHEREOF, the parties hereto have caused their respective names to be hereto subscribed and their respective corporate seals to be hereto affixed on this, the 8th day of December, 1966.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, ARIZONA

By _____

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NO. 1

By _____

STATE OF ARIZONA)
) ss.
County of Maricopa)

On this, the 8th day of December, 1966, before me, the undersigned Notary Public, personally appeared _____, who acknowledged

himself to be the Chairman of the FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, ARIZONA, a Flood Control District organized under and pursuant to the laws of the State of Arizona, and that he, as such officer, being duly authorized so to do, executed the foregoing instrument for the purpose therein contained by signing the name of the Flood Control District by himself as such officer.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

Notary Public

My commission expires:

STATE OF ARIZONA)
) ss.
County of Maricopa)

On this, the 9th day of December, 1966, before me, the undersigned Notary Public, personally appeared Floyd O. Allen, who acknowledged himself to be the Secretary-Manager of the MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NO. 1, an Irrigation District organized under and pursuant to the laws of the State of Arizona, and that he, as such officer, being duly authorized so to do, executed the foregoing instrument for the purposes therein contained by signing the name of the Irrigation District by himself as such officer.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

Notary Public

My commission expires:

July 28, 1968

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE Room 6029 Federal Bldg., Phoenix, AZ 85025

SUBJECT: WS - White Tanks Pilot Project

DATE: October 22, 1971

TO: M. E. Strong
State Conservationist

On Tuesday, October 19 I accompanied Mr. Lee Ohsiek, Flood Control Engineer for the Maricopa County Flood Control District; Mr. Charles Brandt, Manager; and Mr. McDonald of the Caterpillar Proving Grounds; on a tour of the surface drainage on their grounds.

It was agreed that I would record my understandings of what transpired on the trip and send copies to Mr. Ohsiek who would feel free to supplement or amend the report according to his understandings.

Inspection verified the drainage pattern of the September 5, 1970 storm as shown on the map that accompanied Mr. Turner's report to SCS State Conservationist M. E. Strong dated November 20, 1970 except as follows:

1. Drainage from the wash in Section 13 was not diverted southward into Section 24 as shown, but continued to flow to the east into the small pond in the center of Section 18.

2. After entering the pond in Section 18, some of the water spilled to the south and entered Structure #4. The roadway forming the east embankment of the pond was breached and some water continued eastward to the east line of Section 18; thence, northward toward Structure #3.

Since the September, 1970 storm, the pond in Section 18 has been modified so that now there is a spillway from the pond that diverts water into a man-made caliche pit in the southwest 1/4 of Section 18.

Mr. Brandt indicated that as time permits he will have his engineers make a topographic map of the caliche pit to determine its capacity.

It will be helpful if the topographic maps will include the pond and its embankments as well as the area for several hundred feet north of the pond. This is suggested because if the spillway will not pass the design storm or the caliche pit will not contain the design storm, consideration should be given to modifying the pond to insure that any excess water be directed northward toward Structure #3 and insure against any water overflowing into Structure #4.

There was some discussion regarding replacement of the existing road spillway at the SE corner of Section 31 with pipe to reduce the peak of the flows entering Structure #4. This appeared questionable because the major portion of the drainage area above Structure #4 passes this point.

An extra copy of this report is being sent to the Maricopa County Flood Control District, for transmittal to Mr. Brandt.

J. J. Turner
State Conservation Engineer

cc: C. Williams
Lee Ohsiek, MCFCD (2)

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

6029 Federal Bldg., 230 N. 1st Ave., Phoenix, Arizona 85025

SUBJECT: Watershed - White Tanks Wash

DATE: July 20, 1971

TO: Gerald B. Welsh
Asst. State Conservationist-RB/WS

As follow up to your request as to the disposition of the O&M agreement and notification of sponsors and the Caterpillar people concerning the contributing watershed to Str # 4 the following is submitted:

1. O&M agreement dated 28 November 1966 for White Tank Str # 3 and 4.

2. Copy of Turner's letter indicating discussion with Caterpillar Manager, L. A. Jones, of their main office on the flood report and the watershed boundary conditions - with notice that they should work through Col. Lowry.

3. I talked with Leo Ohsiek, MCFCD. He will call the local Caterpillar office and discuss the watershed boundary problem with them again, and see what action, if any, they might have taken. He will advise later.

Ralph M. Arrington
Asst. State Conservation Engineer

Attachment

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Arizona State Office, 6029 Federal Building, Phoenix, Arizona 85025

SUBJECT: ENG - White Tanks Watershed Project - Caterpillar Proving Ground

DATE April 14, 1971

TO: M. E. Strong, State Conservationist
SCS, Phoenix, Arizona

On the morning of April 13, 1971 SCS District Conservationist Chris Williams and I conferred with Mr. L. A. Jones, Civil Engineer, Caterpillar Tractor Company, Peoria, Illinois, relative to a plan of conservation operations on their 13-1/2 square mile tract of land which is their testing facility west of Litchfield Park.

In the course of the discussion a copy of my report of the September 5, 1970 flood, dated November 12, 1970, was handed to Mr. Jones.

As a result of the discussions it was understood that the company would request formal assistance from SCS through the Agua Fria-New River Soil Conservation District and that any long-range plan must of necessity include provision for handling surface waters.

Mr. Jones understands that flood control aspects must be planned with the Flood Control District of Maricopa County and we gave him Col. Lowry's name and address.

They are hopeful that the ultimate plan can include development of surface water that may be put to beneficial use in connection with their testing operations. We agreed that there were possibilities for this and explained the procedure for acquiring rights to store surface water for beneficial use in Arizona.

It is anticipated that at some future date Mr. Jones will return to make a more thorough study of the matter and arrange for on-site discussions with local agencies.

J. J. Turner
State Conservation Engineer

cc Chris P. Williams, DC, Phoenix, Arizona
Col. John C. Lowry, Gen. Mgr. and Chief Engr.
Flood Control District of Maricopa County
3325 W. Durango St., Phoenix, Arizona 85009

JJT:csw

AGREEMENT

THIS AGREEMENT made and entered into at Phoenix, Arizona, on this, the 21st day of September, 1966, by and between the FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, ARIZONA, a Flood Control District organized under and pursuant to the laws of the State of Arizona, hereinafter designated "Flood Control District", and the MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NO. 1 an Irrigation District organized under and pursuant to the laws of the State of Arizona, hereinafter designated "Irrigation District".

W I T N E S S E T H :

THAT, WHEREAS, Flood Control District has the responsibility of operating and maintaining certain flood control works, consisting in the main of McMicken Dam and outlet channel, S.C.S. Dams No. 3 and No. 4, and interconnecting dikes and channels and related and adjoining flood control works, all located within the County of Maricopa, State of Arizona, and desires that said flood control works be maintained in proper working condition, and operated in a good and workmanlike manner; and

WHEREAS, Irrigation District has available and is able forthwith to secure the necessary labor, materials, equipment and supervisory personnel necessary and required for the proper maintenance and operation of said flood control works.

NOW, THEREFORE, for and in consideration of the mutual covenants and agreements hereinafter set forth and contained on the part of the parties hereto to be by them respectively kept and performed, said parties hereto agree as follows:

1. That the Irrigation District shall, for the period beginning as of the 1st day of July, 1966, and ending on the 30th day of June, 1967, and from year to year thereafter, in a good and workmanlike manner, keep, maintain and operate said flood control works in a proper condition and manner and

in accordance with instructions and procedures given by the Flood Control District, provided, however, that the Irrigation District shall not be required to do or perform any work in addition to keeping, maintaining and operating said flood control works in a proper condition and manner, the cost of which shall be in excess of the amount which the Flood Control District shall therefor have obligated itself to pay to the Irrigation District for such work.

2. That for the period beginning as of the 1st day of July, 1966, and ending on the 30th day of June, 1967, the Flood Control District shall pay to the Irrigation District a sum not in excess of FOUR THOUSAND ($4,000.00) DOLLARS for keeping, maintaining and operating said flood control works in proper condition and manner.

3. That the Flood Control District shall, prior to the 1st day of June of each and every year beginning on the 1st day of June, 1967, estimate the amount that the Flood Control District shall provide for keeping, maintaining and operating said flood control works in a proper condition and manner during the period of each year, respectively, beginning on said 1st day of June, 1967. The Irrigation District shall not, during any such time, be required to do and perform any work upon said flood control works, the cost of which shall be in excess of said estimated amount, nor shall it perform any work upon or in relation to the maintenance and operation of said flood control works not previously authorized in writing by the Flood Control District. That in the event that the Irrigation District shall, at any time, by notice in writing given to the Flood Control District, advise the Flood Control District that the cost of doing the work done or to be done and performed by the Irrigation District during the period then in effect will be in excess of the amount estimated by the Flood Control District to cover the cost of such work, then and in such event the Flood Control District shall forthwith give notice in writing to the Irrigation District of its approval for the performance of the work to be done, the cost

of which will be in excess of said estimated amount for such work, and in the further event that such notice shall not be received by the Irrigation District within fifteen (15) days from and after the giving of said notice by the Irrigation District to the Flood Control District, then and in such events the Irrigation District shall have no further obligation to do and perform any further or additional work in relation to the maintenance and operation of said works, the cost of which will be in excess of the amount estimated by the Flood Control District to cover the cost of such work.

4. That the Irrigation District shall, from time to time, as it shall determine, present to the Flood Control District a detailed and itemized statement, with supporting invoices, of the cost of the work performed by the Irrigation District in relation to the maintenance and operation of said flood control works, including among other things, that part of the Irrigation District's general administrative and overhead expenses which are attributable to the maintenance and operation of said flood control works, provided, however, that in no event shall the amount of the Irrigation District's general administrative and overhead expenses exceed twenty per cent (20%) of the total cost to the Irrigation District of performing said work of maintaining and operating said flood control works, and notwithstanding anything herein to the contrary, any and all withholding, social security and other taxes and expenses of any and all employees engaged in the performance of the work of maintaining and operating said flood control works shall be the sole and exclusive responsibility of and shall be paid by the Irrigation District.

5. That the parties hereto recognize and agree that from time to time as a result of accidental, natural or other causes, and through no fault of the parties hereto, or either of them, there may be unusual damage to said flood control works requiring repairs and maintenance thereto exceeding normal repairs and maintenance, and in the event of any such eventuality the parties hereto shall determine and

agree upon the amount of the additional costs and expenses to be incurred as the result of such extraordinary causes, and in the event that the parties hereto shall agree upon the amount of said additional costs and expenses resulting from such extraordinary causes, then and in such event the Irrigation District shall proceed to do and perform the additional work made necessary by such extraordinary causes, and upon the completion thereof the Flood Control District shall pay to the Irrigation District the cost to the Irrigation District of performing such work, together with that part of the Irrigation District's general administrative and over-head expenses which are attributable to the performance of such extraordinary work.

6. That this Agreement shall be automatically renewed from year to year from and after the 1st day of July, 1967, unless the Flood Control District or the Irrigation District shall serve notice in writing, upon the other of them within thirty (30) days prior to the end of the period then in effect of its desire to terminate this Agreement at the end of said period, and upon the giving of such notice this Agreement shall terminate and end on the 30th day of June following the date on which such notice was given.

IN WITNESS WHEREOF, the parties hereto have caused their respective names to be hereto subscribed and their respective corporate seals to be hereto affixed on this, the [illegible] day of [illegible], 1966.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, ARIZONA

By [illegible]

MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NO. 1

By [illegible]

STATE OF ARIZONA)
) ss.
County of Maricopa)

On this, the [illegible] day of [illegible], 1966, before me, the undersigned Notary Public, personally appeared [illegible], who acknowledged

himself to be the _____ of the FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, ARIZONA, a Flood Control District organized under and pursuant to the laws of the State of Arizona, and that he, as such officer, being duly authorized so to do, executed the foregoing instrument for the purpose therein contained by signing the name of the Flood Control District by himself as such officer.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

_____
Notary Public

My commission expires:

_____

STATE OF ARIZONA)
) ss.
County of Maricopa)

On this, the 9th day of December, 1966, before me, the undersigned Notary Public, personally appeared Floyd O. Allen, who acknowledged himself to be the Secretary & Manager of the MARICOPA COUNTY MUNICIPAL WATER CONSERVATION DISTRICT NO. 1, an Irrigation District organized under and pursuant to the laws of the State of Arizona, and that he, as such officer, being duly authorized so to do, executed the foregoing instrument for the purposes therein contained by signing the name of the Irrigation District by himself as such officer.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

_____
Notary Public

My commission expires:

July 28, 1968

W-pecos

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Room 6029 Federal Building, Phoenix, Arizona 85025

SUBJECT: WS - Engineering - Powerline Channel, White Tanks Project

DATE: October 12, 1971

TO:

Marion E. Strong
State Conservationist

On October 12 I discussed the powerline channel situation briefly with Mr. Lee Ohsiek, Flood Control Engineer with the Maricopa County Flood Control District.

Mr. Ohsiek advised that they have graded the access roads paralleling the concrete lined channel to improve surface drainage and prevent surface runoff from overflowing the channel banks.

Mr. Ohsiek also advised that he would request us to accompany him on a field inspection of the channel damage as soon as the water has ceased to run in the channels.

We agreed to meet Mr. Brand of the Caterpillar Proving Grounds for an on-site review on October 19 of the changes in drainage patterns that have occurred on the watershed of the White Tanks Pilot Watershed Project.

J. J. Turner
State Conservation Engineer

cc: J. Hickerson
WPP
Design Section
P. Tilker

D. A. Dobkins, Soil Conservationist,
Program Services Staff, SCS, Phoenix

March 23, 1961

Lucien A. Hill, Area Conservationist,
Area 2, SCS, Phoenix, Arizona

WATERSHED PROTECTION - Information White Tanks (Pilot) Watershed

Contacts in the area revealed very little tangible benefits from the Pilot Project alone. Yet, coupled with the control measures on Trilby Wash (McMicken Dam), considerable benefits can be enumerated.

H. S. Raymond contributed the following information:

> Military and related developments adjacent to Luke Air Force Base amount to some one hundred and twelve millions of dollars. The Semi-Automatic Ground Control System of the Phoenix Air Defense Sector is practically complete. This installation alone will run in excess of 100 mil.
>
> The Capehart housing project of 1000 homes for base personnel has been completed for another 12 million dollars.
>
> The Maricopa County Water Conservation District (Beardsly Project) has lined 20 odd miles of distribution systems, which was previously unfeasible because of frequent flooding. Subsequent reduction in seepage losses from the canals has resulted in a 20% savings to the Irrigation District.

Flood protection has made it possible for the Maricopa County Highway Dept. to undertake numerous road improvements. The surfacing of Sarival Road is a typical example.

In addition to stepped-up interest in the installation of conservation measures, such as land leveling, ditch lining and irrigation pipelines on farm lands, considerable interest in sub-division activities have become evident.

Progress in housing developments has materialized to the extent that the Agua Fria Water Company has been franchised to serve the growing needs for domestic water.

All of the foregoing accomplishments have been directly or indirectly attributed to controlling of floods from Trilby Wash and the east slope of the White Tank Mountains.

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

MAR 13 1961

Lloyd

TO : L. A. Hill, Area Conservationist, SCS, Phoenix, Arizona

DATE: March 13, 1961

FROM : D. A. Dobkins, Soil Conservationist, Program Services Staff, SCS, P. O. Box 929, Phoenix 1, Arizona

SUBJECT: WATERSHED PROTECTION - Information White Tank (Pilot) Watershed

Attached is a Thermo-Fax copy of a letter from Herb Boddy.

You will note that he wants some information about benefits other than water benefits of the White Tank Watershed Project (Pilot).

We suggest that you may want to make some contacts with local leaders to get the information requested.

We would like to have your reply by March 27 so that we can answer Mr. Boddy's request.

D A Dobkins

Attachment

cc: Herb Boddy - Berkeley

3/17/61

will you please make a few contacts in your area and see if "white tanks" apply or need qualifying. Not due Date 3/27/61

Lloyd

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

TO : Robert V. Boyle, State Conservationist, SCS, Phoenix, Arizona

DATE: March 7, 1961

FROM : Herb Boddy, Information Specialist, Information Unit (Western), SCS, Berkeley, California

SUBJECT: Information - Watershed Benefits

Washington has asked us to pin down and report examples of watershed projects which have attracted new industry, made possible expansion of existing industries or accounted for other notable benefits -- besides water.

Art thought that, perhaps, the White Tanks Pilot Watershed Project might have produced benefits along this line.

Has this project made lands safe for old or new industries? Also, was expansion of nearby military installations made possible by flood prevention features of the work plan?

We would need to be as specific as possible with available information, naming the enterprise, number of employees affected by the change and pin-pointing benefits. The example should be a short one.

Do you think White Tanks would qualify?

cc: D. Harper Simms

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ARIZONA STATE OFFICE
PHOENIX

JUN -1 1956

May 28, 1956

TO : Don A. Williams, Administrator, SCS, Washington, D. C.

FROM : Robt. V. Boyle, State Conservationist, SCS, Arizona

SUBJECT: WATERSHED PROTECTION (Pilot)

On May 28, 1956, Area Conservationist Lucien Hill and District Supervisor H. S. Raymond, accompanied by the Conservation Engineer and the Soil Conservationist on the State Program Staff, jointly inspected the White Tanks Pilot Watershed Project and arrived at the following conclusions:

1. The original work plan provided for installation of all measures during the calendar year 1954. All measures were completed on schedule excepting the last 1/3 of the emergency spillway for Dike #3. The Agua Fria Soil Conservation District arranged with the Maricopa County Municipal Water Conservation District No. 1 who, in turn, arranged with a cooperating organization to perform this actual excavating job. All parties were sincere but it developed that State legislation was needed to adequately establish legal responsibility for the work done. The needed legislation was passed at the last session of the State Legislature and will become effective on July 14, 1956.

   (a) The Maricopa County Municipal Water Conservation District has assured the Agua Fria Soil Conservation District that the work will be completed by December 31, 1956.

   Although the additional spillway excavation involves over 100,000 cubic yards of earth, it does not materially effect the project objectives because the retarding basin, as constructed, provides retarding capacity for a 100-year frequency storm and the already completed portion of the emergency spillway will bypass the run off from another 100-year frequency storm occurring when the retarding basin is full.

(b) The education and information program is adequate and the "B" measure program is complete.

(c) Land, easements, and rights-of-way problems have been solved.

(d) Local commitments and facilities are such that the completion of the work as outlined above seems assured.

(e) During the past two years the small amount of maintenance that has been needed has been provided in a most excellent manner.

2. There appears to be no need for either increasing or decreasing present Project Fund Ceiling.

3. It is not recommended that the scope of the project be expanded. The sponsors, however, have embarked upon a program of similarly treating an additional area of some 4 or 5 square miles adjacent to the original project. This additional work is being performed entirely at local expense.

4. This project is fulfilling the demonstration objectives and people in the flood plain are confident that they are receiving adequate flood protection.

The extension of the installation period to December 31, 1956, will have no material bearing on the period of evaluation.

CC: Lucien A. Hill (2)
(1 for H.S. Raymond)

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Lucien A. Hill, Area II Conservationist, SCS - Phoenix, Arizona

DATE: April 25, 1956

FROM : J. J. Turner, State Conservation Engineer, SCS - Phoenix, Arizona

SUBJECT: WATERSHED PROTECTION (PILOT)

APR 25 1956

Confirming our conversation of this morning, I am attaching a copy of the Administrator's Memorandum of April 9, 1956, calling for an inspection of Watershed Protection (Pilot) projects.

If the suggested dates of May 14, 28, 29, 31, and June 1, are not satisfactory for this inspection, please suggest additional dates and we will make an effort to meet them.

J. J. Turner

Attachments: 3 copies of Administrator's Memo.

Answered 5/10/56 Lut

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
Washington 25, D. C.
May 18, 1956

ANNOUNCEMENT OF WATER-RESOURCES REPORTS RELEASED FOR PUBLIC INSPECTION

The Geological Survey announces that the following reports on water resources in the various sections of the country are being released in open file. Copies of all these reports are available for consultation in the room indicated, General Services Building, Washington 25, D. C. Some of them also are available for consultation at other places as listed.

1. Application of aquifer-test methods to ground-water studies in Marengo County, Ala., by D. B. Knowles. Abstract only. (For publication in Alabama Academy of Science Journal.)

   Geological Survey, Building 6, Smith Woods, University of Alabama, University, Ala.
   Room 1242-G, GSA Bldg.

2. Land-surface collapse in an area underlain by limestone, by G. W. Swindel, Jr. Abstract only. (For publication in Alabama Academy of Science Journal.)

   Geological Survey, Building 6, Smith Woods, University of Alabama, University, Ala.
   Room 1242-G, GSA Bldg.

3. Geology and ground-water resources of Drew County, Ark., by F. E. Onellion. 81 p., 10 figs. (For publication as Arkansas Geological and Conservation Commission Water Resources Circular No. 4.)

   Geological Survey, Room 208, Porbeck Building, 515 East Second Street, Little Rock, Ark.
   Arkansas Resources and Development Commission, Division of Geology, Little Rock, Ark.
   Room 1242-G, GSA Bldg.

4. Ground-water use in Idaho, by E. G. Crosthwaite. 7 p.

   Geological Survey, 209 Fidelity Building, 720 Idaho Street, Boise, Idaho
   Room 1242-G, GSA Bldg.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WASHINGTON 25, D. C.

April 9, 1956

Lult

To: State Conservationists, SCS

From: D. A. Williams, Administrator, SCS

Subject: Watershed Protection (Pilot)

As we approach the end of the third year of operations on the Watershed Protection (Pilot) projects, it is evident that an adequate inspection of each project is needed to determine whether it fulfills the objectives for which this program was established. We have reached the point where definite facts and recommendations are required to guide forthcoming decisions on:

1. Need for extending the project installation period.
2. Increasing or decreasing the present project fund ceiling.
3. Expanding or curtailing the scope of the project.
4. Discontinuing the project if it appears unlikely to fulfill the objective of a suitable demonstration of watershed protection and flood prevention.

Some of the States have recently made inspections and others have scheduled early inspections of the pilot watersheds. Where inspections have not been made within the past six months they should be scheduled before June 15. If the last inspections did not provide sufficient information to permit conclusive recommendations on the above points, a new one should be made.

If you have any doubts concerning recommendations that should be made on the above points, we will be glad to arrange for participation in an inspection by the Engineering and Watershed Planning Unit and a Washington-Field Plant Technologist, or a Washington resident staff member if you consider this especially important.

We are attaching for your guidance in making your recommendations an outline of some of the pertinent factors that should be considered in the watershed inspections. Your report and recommendations to me should contain a brief discussion of the pros and cons of each item with respect to how it influences your recommendations. If the item is not pertinent, please indicate this fact.

D. A. Williams

Attachment

STC -
EWP -
PT -
WD -

Completed May 28
Williams, Hilt
Turner & Raymond

OUTLINE FOR INSPECTION OF WATERSHED PROTECTION (PILOT) PROJECTS

A. Need for Extending the Project Installation Period

Will all of the measures that have a material effect on the project objectives be installed by 1958? If not, by what date? Give consideration to the following:

1. How does the actual rate of installation of measures compare with the schedule (Table 1)?

2. Is the education and information program of the local organization adequate to provide the needed understanding and incentive to sufficiently accelerate the "B" measure program to complete it by 1958 - if not, to what extent?

3. Will land, easements, and rights-of-way be available when needed?

4. Will it be necessary to delay installation of structural works of improvement until the required "B" measures are installed above the structures?

5. Are there adequate personnel and facilities available to keep surveys, designs, specifications and contracts on schedule?

6. Will local commitments such as; money, services, materials and operation and maintenance be available as scheduled? If not, what changes are needed in the scheduled rate of installation to conform with the local organizations ability to meet their obligations?

B. Increasing or Decreasing the present Project Fund Ceiling.

If an <u>increase</u> is proposed, consider the following:

1. What is the approximate difference between the estimated and actual cost for installation of major works of improvement so far constructed or contracted for?

2. Are the expenditures of the local people also exceeding the estimates?

3. Will an increase in technical assistance for "B" measures actually accelerate the establishment of conservation practices?

4. To what extent is the increase in project cost due (1) to expanding the scope of the project in order to provide a better demonstration of watershed protection and flood prevention (2) to change in design standards (3) to increasing bids and general construction cost level?

Is a <u>decrease</u> warranted? If so, give consideration to the following:

1. Can items requiring substantial Federal expenditures be eliminated from the approved project without impairing its demonstrational value?

File with other watershed material —

Lott

SCS
Arizona State Office
223 New Post Office Building
Phoenix, Arizona

March 8, 1955

To: Area Conservationists Freeman, Hill, Surface, Swanson

From: Robt. V. Boyle, State Conservationist

Subject: Memorandum, Watershed Planning No. 5 (Washington)

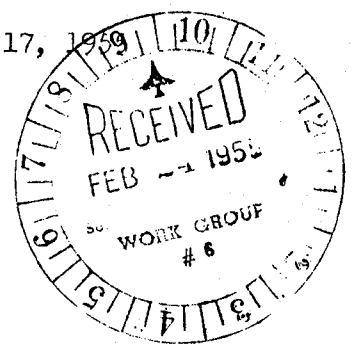
We requested Washington to send enough copies of the attached memorandum - Watershed Planning Memorandum No. 5, re: Evaluation Studies - Pilot Watershed Protection Program, to send each of you a copy. Please file it with the other material we have sent you in the past on the Watershed Protection and Flood Prevention Program.

Robt V. Boyle

Lucien Hill - this complies with your pencilled note to Mr. Dobkins.
W.B.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Washington 25, D. C.

February 17, 1955



To: State Conservationists, SCS

From: D. A. Williams, Administrator

Subject: Watershed Protection (Pilot), Table 1 of Work Plan

Recent correspondence from the field indicates that some States are planning to revise Table 1's for the Pilot Watershed Protection Projects this fiscal year, to provide a basis for the fiscal year 1957 agency estimate. Such a revision will not be necessary since it is our intention to use the Table 1's of the final work plans for this purpose. Therefore it is essential, that all final work plans for the Pilot Watersheds be submitted by April 1, 1955.

It is expected that the next annual revision of the Table 1's for the Pilot Watersheds will be required sometime after the current fiscal year has passed and firm figures are available for obligations incurred in the fiscal year 1955. The exact date on which the next annual revision of the Table 1's for the Pilot Watersheds will be requested has not been determined, however it will be in advance of the preparation of the fiscal year 1958 agency estimate.

Clarence Young
Acting

STC-5
EL.P-5
WD-1
FS-5

United States Department of Agriculture

Soil Conservation Service

Room 3008 Federal Building
230 North First Avenue
Phoenix, Arizona 85025

September 26, 1983

Dan Sagramoso
Chief Engineer and General Manager
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85025

Dear Dan:

The attached report by my staff recommending that we not seed the White Tanks structures at this time, but rather to wait and moniter the progress of existing plants over the next two years. I feel this to be a good recommendation. Please let me know if you or your staff are of a differing opinion, otherwise we will continue with the monitoring program.

Sincerely,

Acting For

Verne M. Bathurst
State Conservationist

cc: Johnny Weaver, Acting ASTC (WR)
Smity Covey, D.C., Phoenix
Joe Knisley, AC, Area II

SCS-INF-74 Rev. 9-69

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

INFORMATIONAL ACTIVITIES

Name of paper White Mtn Ind.

Where published Show Low

Date of issue Aug 23, 1983

Sent by Al Neu

S. C. D. LCRP-RC&D

Stationed at Holbrook

CLASSIFICATION:

For Information Only

- Weekly column ☐
- Story (SCS) ☐
- (Other) ☐
- Feature (SCS) ☐
- (Other) ☐
- Editorial ☐
- Advertisement ☐
- Cons. picture ☐

Apache Co. water survey issued

In the 4,100-square-mile area of southern Apache County, about 30,000 acre-feet of water was used in 1975, according to a report prepared by the U.S. Geological Survey, Department of the Interior, in cooperation with the Arizona Department of Water Resources and released recently.

Water use is expected to increase nearly 100 percent by the mid-1980's owing to projected demands for public, irrigation, and industrial supplies. Ground water will be used to meet the future demands because most of the surface water is allocated to local and downstream users.

Groundwater is present in places in most of the geologic formations that underlie the area. The most widespread source of ground water is the Coconino aquifer, which probably underlies the entire area. In 1975 the aquifer furnished about 7,700 acre-feet of water to pumping and flowing wells, and in general, no appreciable decline in water levels has taken place.

In the southwestern and west-central parts, the water contains moderate concentrations of disolved solids; in the southeastern and east-central parts, the water generally contains large concentrations of disolved solids.

In the southern part of the area, ground water is obtained mainly from the Springerville and White Mountains aquifers and the basaltic rocks that overlie the Coconino aquifer. In the northern part, the Bidahochi aquifer and alluvium overlie the Coconino aquafier and yeild water to wells.

The report "Gohydrology and water use in southern Apache County, Arizona," was prepared by Larry J. Mann, U.S. Geological Survey, and E. A. Nemecek, Arizona Department of Water Resources.

Copies are available for distribution or inspection at the Arizona Department of Water Resources, 99 East Virginia, Phoenix, Ariz., and at U.S. Geological Survey offices in: Room 5-A Federal Building, 301 West Congress Street, Tucson; Suite 1880 Valley Center, Phoenis; 2255 North Gemini Drive, Building 3, Flagstaff; 1940 South Third Avenue, Yuma; and Room 5312 National Center, 12201 Sunrise Valley Drive, Reston, Va.

Weaver - RBWRS
Info only
File - White Tanks WS

3008 Federal Building, Phoenix, Arizona 85025

April 18, 1977

Mr. Jack A. Leavitt
Deputy Engineer
Flood Control District
of Maricopa County
3335 W. Durango St.
Phoenix, Arizona 85009

Dear Jack:

I was disturbed last Friday when, in my visit to your office, you brought up the subject of McMiken Dam and the cracking problem. When you mentioned that two White Tanks SCS structures (structures #1 and #2) had been constructed and later incorporated into McMiken Dam by the Corps, the pieces just did not seem to fit. You were also quoted in an article that appeared in the Phoenix newspapers, as saying two SCS structures overflowed in 1951 creating quite a problem for Luke Air Force Base and the surrounding area. I thought it necessary to check our records, to find out what really happened and in what sequence. Here is the sequence as best I could determine:

1948 - SCS was asked to prepare a work plan on the White Tanks watershed.

July, August 1951 - Serious flooding occurred to Luke AFB and vicinity.

Early 1952 - Corps of Engineers funded to study Trilby Wash.

Early 1952 - SCD and irrigation district pooled funds to build an "interim" flood control structure.

Late summer 1952 - Interim flood control structure constructed (4 miles long, 23' high, containing 500,000 c.y. earth). SCS provided technical assistance.

May 1954 - White Tanks watershed structures #3 and #4 constructed. (Structures #1 and #2 were never planned.)

July 1956 - McMiken Dam completed by the Corps. It incorporated the interim flood control structure built by the SCD and the irrigation district in 1952.

4/20

I am enclosing copies of plans and other documents that support this sequence of events. Thought you might like them for your files. It seems to me that:

1. White Tanks watershed structures #1 and #2 were never seriously planned and were not constructed.

2. No structure on which the SCS provided technical assistance "overflowed" in 1951 inundating Luke AFB runways.

3. The structure that was constructed with SCS assistance was completed in late 1952, after the disastrous 1951 flood.

I would appreciate it if the erroneous newspaper article could be corrected if that opportunity ever presents itself. I have had a few people ask me about the facts, and suspect the article raised suspicions in the minds of many others.

Sincerely,

John W. Peterson
Asst. State Conservationist

Attachments

cc:
Thomas G. Rockenbaugh
Herbert P. Donald

JWPETERSON:bb