SUNRIDGE CANYON DAM

STRUCTURE NO. 7

FOUNTAIN HILLS

GENERAL DATA

Section	Title
1.	Hydrology and Hydraulic Calculations
2.	Specifications
3.	Subsurface Investigation Data
4.	Density Determinations
5.	Tests on Concrete Cylinders
6.	License of Approval
7.	Computer Calculations for Hydrology & Hydraulic (formerly in a second volume)
8.	Photos
9.	As-Built Plans

HYDROLOGY AND HYDRAULIC

CALCULATIONS

TRICO INTERNATIONAL INC.
CIVIL ENGINEERING & LAND PLANNING
TEMPE, ARIZONA

	BY	DATE
CAL'D.		
CHK'D.		
JOB NO.		
SHEET	OF	

FOUNTAIN HILLS, ARIZONA

STRUCTURE NO. 7 | REFERENCE

RETARDATION STRUCTURE

NO. 7

FOUNTAIN HILLS, ARIZONA

HYDROLOGY & HYDRAULIC

CALCULATIONS

TRICO INTERNATIONAL INC.
CIVIL ENGINEERING & LAND PLANNING
TEMPE, ARIZONA

	BY	DATE
CAL'D.	HIGG	
CHK'D.		
JOB NO.		
SHEET 1 OF		

FOUNTAIN HILLS, ARIZONA

RETARDATION STRUCTURE NO 7

REFERENCE

METHOD OF ANALYSIS

1. USE SOIL CONSERVATION SERVICE COMPUTER PROGRAM TR-20 "PROJECT FORMULATION" FOR STREAM FLOW ROUTING AND TO ESTABLISH INVERT OF EMERG. SPILLWAY, SIZE OF PRINCIPAL SPILLWAY PIPE, CAP. OF EMERGENCY SPILLWAY, TOP OF DAM ELEV. AND FREEBOARD

2. GENERAL CRITERIA - STORMS FOR CLASS "B" DAM

THE FOLLOWING STORMS ARE TO BE USED AS THE BASIS OF DESIGN OF THE DAM

STORM "A" - 100YR / 24 HR PRECIP. = 4.2"

STORM "B" - 100YR / 6 HR PRECIP = 3.2"

U.S. WEATHER BUREAU PRECIPITATION MAPS FOR ARIZONA DATED 1970 (ATTACHED)

STORM "C" - 100YR/6HR + 0.12 (PMP - 100YR/6HR)

@ PMP = 19"

= 3.2 + 0.12 (19.0 - 3.2) = 5.10"

PER SCS DESIGN CRITERIA FOR EARTHFILL DAMS (ATTACHED)

STORM "D" - 100YR/6HR + 0.4 (PMP - 100 YR/6HR)

= 3.2 + 0.4 (19.0 - 3.2) = 9.52"

PMP PER U.S. WEATHER BUREAU

or other design storm D = PMP = 19"

3. GENERAL CRITERIA - BASIS OF DESIGN

1. POOL BEHIND DAM MUST HAVE SUFFICIENT STORAGE TO CONTAIN RUNOFF FROM STORM "A" OR STORM "B" (WHICHEVER IS GREATER) WITH DISCHARGE FROM PRINCIPAL SPILLWAY BUT NO DISCHARGE FROM EMERG. SPILLWAY.

2. TOP OF DAM SET TO CONTAIN POOL GENERATED BY STORM "D" WITH BOTH PRINCIPAL & EMERG. SPILLWAYS WORKING.

3. FREEBOARD (POOL ELEV. TO TOP OF DAM) BASED UPON STORM "C" FREEBOARD TO BE AT LEAST 1.0 FT.

BASED UPON GENERAL CRITERIA OF SCS FOR EARTH DAMS (ATTACHED)

TRICO INTERNATIONAL INC.
CIVIL ENGINEERING & LAND PLANNING
TEMPE, ARIZONA

	BY	DATE
CAL'D.	HIGH	
CHK'D.		
JOB NO.		
SHEET 2 OF		

FOUNTAIN HILLS ARIZONA

STRUCTURE NO. 7

REFERENCE

VOLUME OF STORAGE POND

ELEV.	Δ V (AC-FT)	Σ V (AC-FT)
1884	0.0	0.0
1886	2.8	2.8
1900	3.6	6.4
1904	5.2	11.6
1908	7.0	18.6
1912	10.0	28.6
1916	13.2	41.8
1920	20.0	61.8
1926	46.2	108.0
1927	20.1	128.1
1928	20.1	148.2
1930	25.5	173.7
1932	30.0	203.7
1934	29.9	233.6

agrees with page 002 of printout

PRINCIPAL SPILLWAY DISCHARGE CHARACTERISTICS

USE ONE 48" ϕ PIPE (RCP)

$Q = 0.162 \cdot A \cdot \sqrt{2gH}$

$A = \frac{\pi D^2}{4} = \frac{\pi \times 4^2}{4} = 12.57$ SQFT

$G = 32.2$

H IS MEASURED FROM WATER SURFACE TO ℄ OF 48" PIPE

KING'S HANDBOOK OF HYDRAULICS PG. 3-5 4TH EDITION

$\frac{12.57}{1.62} = 7.79$

ELEV	H	Q
1884	0.0	0.0
1886	10.0	198.0
1900	14.0	233.0
1904	18.0	260.0
1908	22.0	283.0
1912	26.0	319.0
1916	30.0	343.0
1920	34.0	360.0
1926	40.0	395.0
1927	41.0	400.0
1928	42.0	405.0
1930	44.0	415.0
1932	46.0	424.0
1934	48.0	433.0

agrees w/ printout

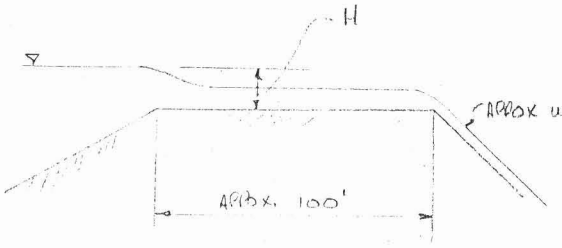
TRICO INTERNATIONAL INC.
CIVIL ENGINEERING & LAND PLANNING
TEMPE, ARIZONA

	BY	DATE
CAL'D.	HIGG	
CHK'D.		
JOB NO.		
SHEET 3 OF		

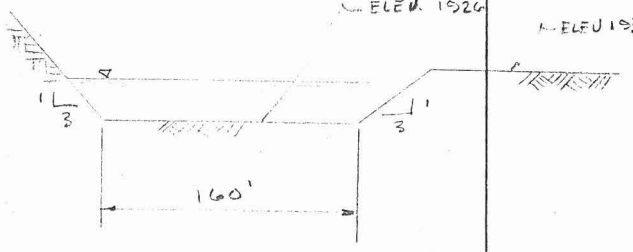
FOUNTAIN HILLS, ARIZONA

STRUCTURE NO 7

REFERENCE



SPILLWAY PROFILE



SPILLWAY SECTION

$Q = C L H^{3/2}$ $C = 2.62$

KING'S HANDBOOK OF HYDRAULICS PG 5-4 & 5-12 4TH EDITION

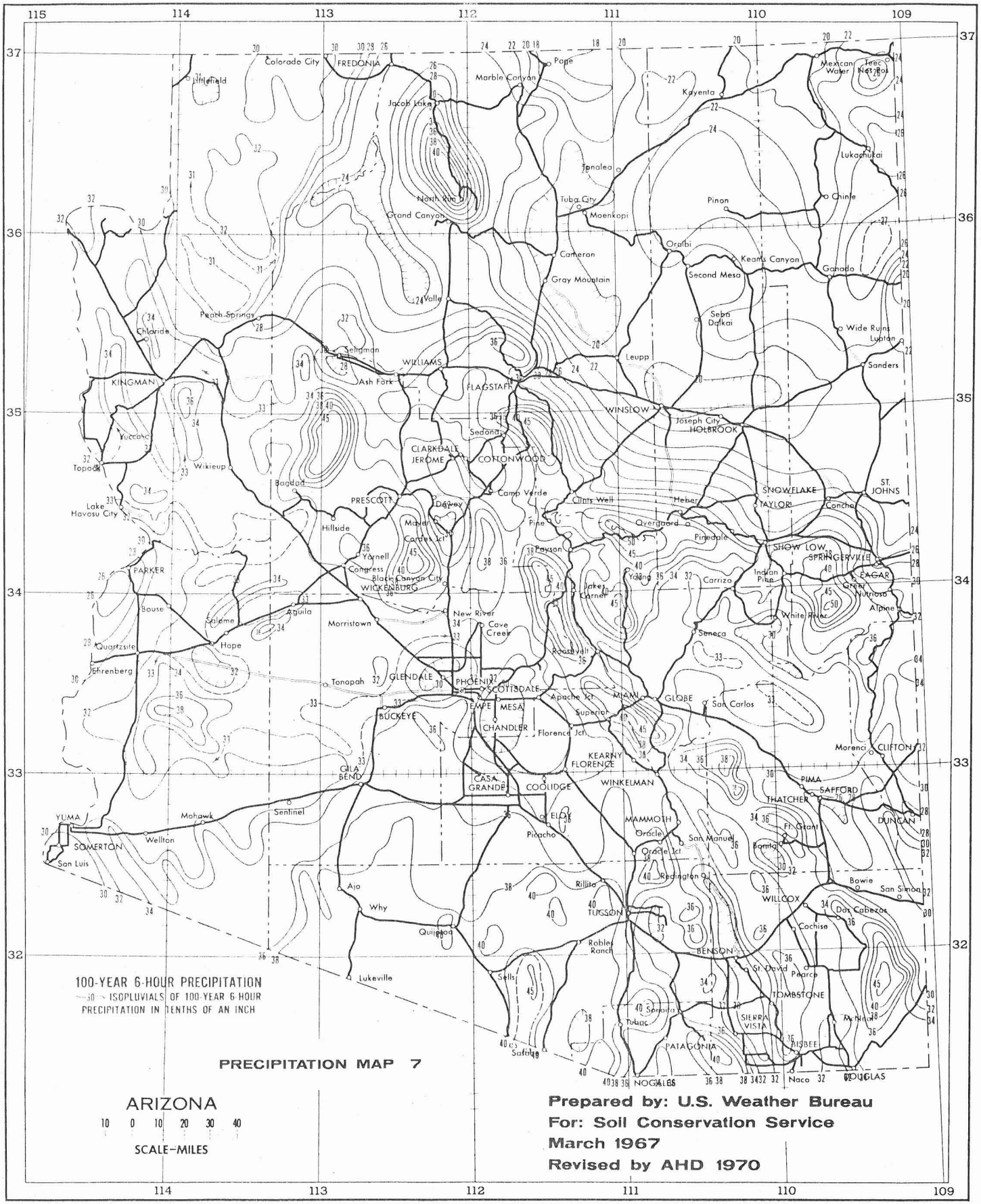
ELEV	H	L	$Q_{EMERG.}$	$Q_{APPROX.}$	Q_{TOTAL}
1926	0.0	160	0	395	395
1927	1.0	163	429	400	829
1928	2.0	166	1235	405	1640
1930	4.0	172	3618	415	4033
1932	6.0	178	6882	424	7306
1934	8.0	184	10951 / 10950	433	11384

Approx U printed

100yr peak Q (548) does not stay below el of Emerg spillway

100 yr peak 1926.35

Emerg spill 1926.00



100-YEAR 6-HOUR PRECIPITATION

30 — ISOPLUVIALS OF 100-YEAR 6-HOUR PRECIPITATION IN TENTHS OF AN INCH

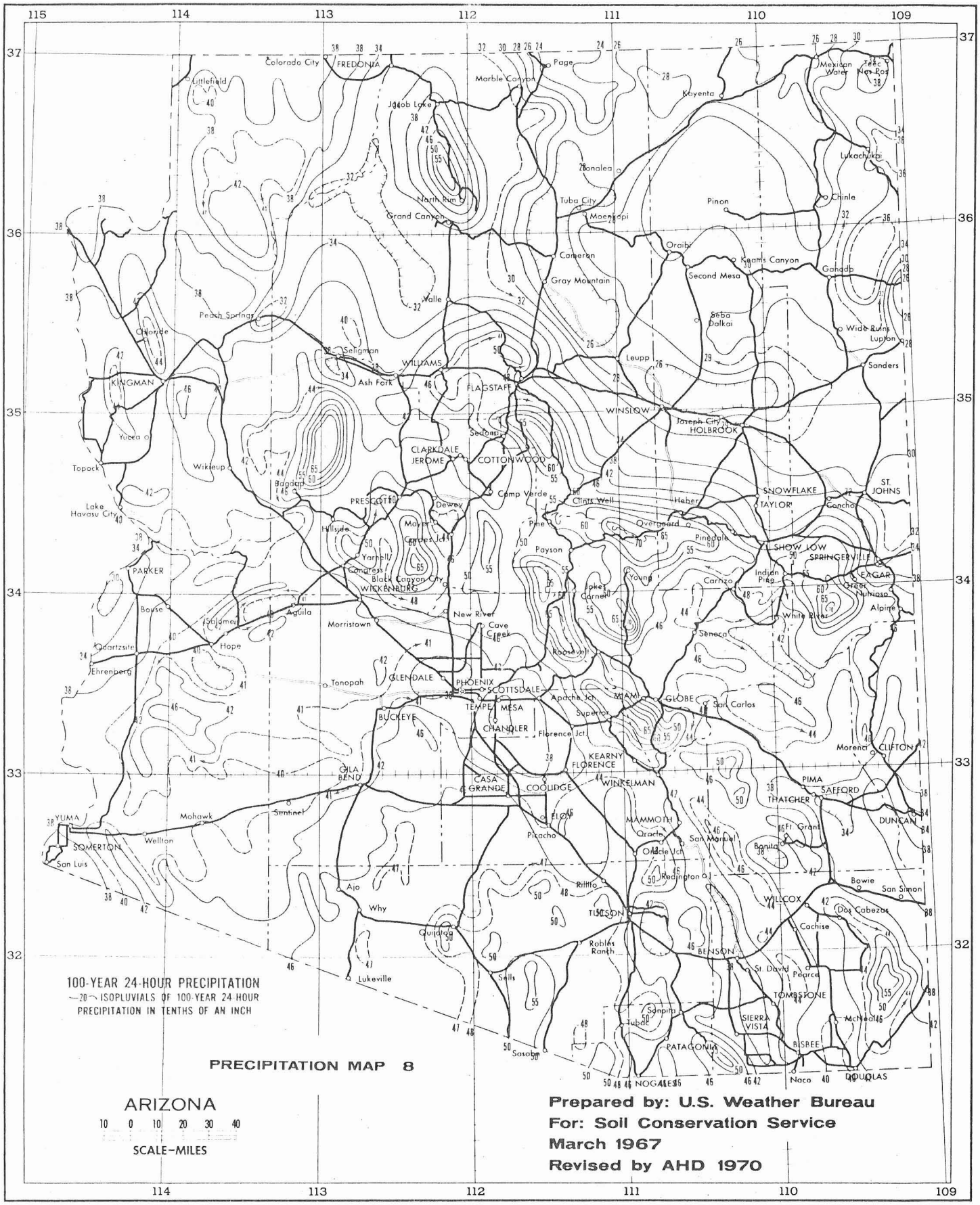
PRECIPITATION MAP 7

ARIZONA

10 0 10 20 30 40

SCALE—MILES

Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970



100-YEAR 24-HOUR PRECIPITATION

—20— ISOPLUVIALS OF 100-YEAR 24-HOUR PRECIPITATION IN TENTHS OF AN INCH

PRECIPITATION MAP 8

ARIZONA

10 0 10 20 30 40

SCALE—MILES

Prepared by: U.S. Weather Bureau
For: Soil Conservation Service
March 1967
Revised by AHD 1970

SUBJECT	CRITERIA	REFERENCES	PROCEDURE
Structure Classification	Class (a) structures located in rural or agricultural areas where failure may damage farm buildings, agricultural lands, or township or county roads. Class (b) structures located in predominantly rural or agricultural areas where failure may damage isolated homes, main highways, or minor railroads or cause interruption of use or service of relatively important public utilities. Class (c) structures located where failure may cause loss of life, serious damage to home, industrial or commercial buildings, or important public utilities.	Section B, SCS Engineering Memo 27 (Rev.) 3/19/65, Earth Dams. Hydrology of Spillway Design Small Structures - Limited Data, by H. O. Ogrosky, May 1964, ASCE Journal Hydraulics Division.	Footnotes 1/ Structures involving industrial of municipal water will use criteria equivalent to that for class (b) or (c) depending on site conditions. Criteria approaching that for class (b) will be used when the storage involves water for agricultural use or recreation. 2/ P_{100} = 100 year precipitation. 3/ PMP = probable maximum precipitation. 4/ Equations can be used for any storm duration. 5/ Chapter references are found in National Engr. Handbook, Section 4, Part I, SCS.
Sediment Storage	For all structure classifications - evaluation life of structure, usually 100 yrs.	Section D, SCS Engr. Memo 27, (Rev.), 3/19/65 and Supplement 3, 5/18/67.	SCS Technical Release 12, Procedure Sediment Storage Requirements for Reservoirs, January 1968.

Principal Spillway Design Hydrographs

Allowable Frequency of Use of Emergency Spillway

Struct. Class	Maximum Use - years No structures upstream		Maximum Use - years Existing or Proposed Struc. Upstream	
	Earth	Vegetated	Earth	Vegetated
a	50	25	100	50
b	100	50	100	50
c	100	100	100	100

Section F, SCS Engr. Memo 27 (Rev.), 3/19/65.
R. E. Rallison's Memo, 10/6/66, a procedure for adjusting the channel loss factor in Chapter 21.
R. E. Rallison's Memo, 1/7/69, a technique for estimating the 10 day precipitation volume.

Any one of the following procedures is suitable as a basis for design of principal spillway capacity and retarding storage:

1. Method described in Chapter 21. 5/
2. Regionalization and transposition of volume-duration-probability data.
3. Local streamflow data.

Auxiliary Spillway Design Hydrographs

Minimum Precipitation Amounts by Structure Class

Class	Purpose	No Structure upstream	Maximum Use - years Existing or Proposed Str. Upstream
a	single or multiple 1/	6 hr. P_{100} 2/ ES-1020, Sheet 1	6 hr P_{100} + .12(PMP-P_{100}) 3/ ES-1020 Sheet 2 (not less than criteria for upper structure.
b	single or multiple	6 hr P_{100}+.12(PMP-P_{100}) 4/ ES-1020, Sheet 2	Same as without structure but not less than criteria for upper structures.
c	single or multiple	6 hr P_{100}+.26(PMP-P_{100}) ES-1020, Sheet 4	Same as without structure.

Sections C and F, SCS Engr. Memo 27 (Rev.) 3/19/65, Earth Dams.

Chapter 21 (Design Hydrographs) 5/

Hydrology of Spillway Design Small Structures - Limited Data, By H. O. Ogrosky, May 1964. ASCE Journal Hyd. Div.

Advisory ENG-65, 12/5/69, Design Criteria for Larger Dams.

Select storm precipitation values from appropriate references. When only 100-year and PMP values are available, compute other values by equation. For areas east of 105th Meridian, use USWB-HMR-33 for durations longer than 6 hrs.

Ore., Wash., Idaho	USWB - HMR-43
Ariz., Utah, Colo.	100 yr-6 hr from revised TP-40 maps. 6 hr PMP from Sheet 5 of ES-1020
Nevada	ES-1020 Sheets 1-5
New Mexico	100 yr-6 hr from revised TP-40 maps. 6 hr PMP from Sheet 5 of ES-1020 "Upper Rio Grande Study" 6 and 24 hr PMP
California	ES-1020 and HMR 36
Hawaii	ES-1021
Alaska	ES-1022

Emergency Spillway Design Hydrographs

Class	Purpose	No Structure upstream	Maximum Use - years Existing or Proposed Str. Upstream
a	single or multiple	6 hr P_{100}+.12(PMP-P_{100}) ES-1020, Sheet 2	6 hr P_{100} + .4(PMP-P_{100}) ES-1020, Sheet 3 (not less than criteria for upper structure)
b	single or multiple	6 hr P_{100}+.40 (PMP-P_{100}) ES-1020, Sheet 3	Same as without structure but not less than criteria for upper structure.
c	single or multiple	6 hr. PMP ES-1020, Sheet 5	Same as without structure.

SPECIFICATIONS

McCULLOCH PROPERTIES, INC.

FOUNTAIN HILLS, ARIZONA

SPECIFICATIONS

FOR

RETARDATION STRUCTURE NO. 7

TRICO OF ARIZONA

Fountain Hills, Arizona

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

SECTION I - CONSTRUCTION MATERIALS

1.01 PORTLAND CEMENT CONCRETE

1.01.1 General:

Concrete consisting of Portland Cement, concrete aggregate, sand and water will be designated by a symbol consisting of a number, a letter, and a number. The first number will be the number of sacks of cement per cubic yard, the letter the grading of the aggregate, and the last number the compressive strength at 28 days. A sack of cement shall be defined as 94 pounds.

1.01.1.1 Concrete Classes

Structural Concrete shall be 6.0-B-3000 and bedding concrete shall be 5.0-B-2000, concrete cemented riprap shall be 5.0-C-2000. Compressive strength test shall be performed in accordance with ASTM C-39.

1.01.2 Portland Cement:

All cement to be used or furnished shall be Type II, Portland Cement, conforming to ASTM C-150. The Contractor shall furnish a certificate of compliance signed by the manufacturer identifying the cement and stating that the cement delivered conforms with ASTM C-150. The cost of furnishing certified cement shall be considered as included in the Contract Bid Price.

Cement shall be stored in such a manner as to permit ready access for the purpose of inspection and sampling, and suitably protected against contamination or moisture. Should any cement delivered show evidence of contamination, or be otherwise unsuitable, the Engineer may require that it be removed from the site.

All Portland Cement used in concrete for any individual structure shall be of the same brand and type unless otherwise approved by the Engineer.

Low alkali cement shall conform to the requirements for Portland Cement as specified in ASTM C-150; and, in addition, shall contain not more than 0.60 percent by weight of total alkali calculated at sodium oxide, including all sodium oxide plus 0.658 of all potassium oxide.

1.01.3 Aggregates:

Aggregates shall be sand and concrete aggregates conforming to the requirements prescribed in Subsection 200-1 of Standard Specifications for Public Works Construction, 1970 Edition, and shall be approved by the Engineer prior to use. They shall meet the grading requirements of this subsection.

Methods of handling materials resulting in segregation, degradation or the combining of materials which results in any stockpile failing to meet specifications, shall not be permitted.

Aggregates which are found to have a silica-released to alkali-reduced ratio greater than one, when tested in accordance with ASTM C-289 may be used only with approval by the Engineer and provided low-alkali cement is used. No additional allowance will be made for the use of low-alkali cement.

1.01.4 Combined Aggregate Gradings:

The combined aggregates shall conform to the gradings specified in the following table:

COMBINED GRADINGS FOR PORTLAND CEMENT CONCRETE

PERCENTAGE PASSING SIEVES

Sieve Size	Grading A	Grading B	Grading C	Grading D	Grading E
2"	100	100			
1-1/2"	95-100	95-100	100		
1"	64- 80	80-100	95-100		
3/4"	55- 71	64- 80	75- 91	100	100
3/8"	37- 53	40- 52	48- 66	92-100	90-100
#4	32- 42	35- 45	39- 51	42- 60	60- 80
#8	25- 35	28- 38	31- 41	33- 47	50- 70
#16	18- 28	21- 31	22- 32	22- 38	33- 53
#30	10- 18	10- 20	12- 22	17- 25	19- 35
#50	3- 9	3- 9	3- 9	6- 12	5- 15
#100	0- 3	0- 3	0- 3	1- 5	2- 6
#200	0- 2	0- 2	0- 2	0- 2	0- 2

1.01.5 Water:

Water used for concrete shall be clear and free from oil, vegetable matter and other deleterious substance. Water shall not contain an amount of impurities that will cause a change in the time of setting of Portland Cement of more than 25% nor a reduction in the compressive strength of mortar at fourteen (14)

days of more than 5% compared to results obtained with distilled water.

In conventionally reinforced concrete work, water shall not contain more than 1,000 ppm of chloride calculated as Cl, nor more than 1,000 ppm of sulfates calculated as SO.

In non-reinforced concrete work, water shall not contain more than 2,000 ppm of chloride calculated as Cl, nor more than 1,500 ppm of sulfates calculated as SO_4.

1.01.6 Admixtures:

No admixture of any type shall be used unless authorized by the Engineer. When an admixture is permitted it shall be measured accurately into each batch or load in liquid form by a mechanical dispensing device and method approved by the Engineer.

When an air-entraining agent is used it will be limited to the extent that the amount of entrained air by volume shall not exceed 6%, and the mix shall be redesigned to adjust to yield.

1.01.6.1 Accelerator:

Use of $CaCl_2$ (Calcium Chloride) will not be permitted.

1.01.7 Mixing:

Machine mixing will be required in all cases other than in which it would obviously prove to be impractical, in which event hand mixing will be permitted.

Mixing shall be commenced as soon as possible after the cement is placed in contact with the aggregates, but in no event shall the intervening period exceed 30 minutes.

All concrete mixers shall be of such design and construction and so operated to provide a thoroughly and properly mixed concrete in which the ingredients are uniformly distributed.

1.01.8 Concrete Consistency:

The amount of water added at the mixer shall be regulated to take into account the free water in the aggregates. Free water is defined as the total water minus the water absorbed by the aggregate in a saturated surface-dry condition.

The amount of water used in the mixture shall not exceed the minimum amount necessary to permit practical placement and

consolidation of the concrete, and unless otherwise authorized by the Engineer shall be that required to produce concrete with a slump within the range shown as nominal in the following table:

Type of Work	NOMINAL SLUMP (inches)	MAXIMUM SLUMP (inches)
Non-reinforced Concrete	0-3	4
Reinforced Concrete Structures		
Heavy Sections	0-3	5
Thin Sections	0-4	6

The concrete used in the work shall not have a slump greater than that shown as maximum above, nor a free water content greater than 312 pounds per cubic yard of concrete.

When adverse or difficult conditions affect the placement of concrete, the Engineer may authorize a greater slump to be used, both the water and cement are increased.

Water shall be added at a ratio not to exceed 30 pounds per sack of added cement per cubic yard of concrete, and such additional water and cement shall be at the Contractor's expense.

The consistency of concrete shall be determined in accordance with ASTM C-143.

If slump tests of individual samples taken at approximately the 1/4 and 3/4 points of the discharge differ by more than two inches (2"), the mixer will not be acceptable for further use until the condition is corrected.

1.01.9 Transit Mixers:

The type, capacity, and manner of operation of the mixing and transporting equipment for ready-mix concrete shall conform to the current "Standards for Operation of Truck Mixers and Agitators of the National Ready-Mixed Concrete Association" and the "Truck Mixer and Agitators Standards of the Truck Mixer Manufacturers Bureau". Transit mix concrete trucks shall be equipped with an automatic device for recording the number of revolutions of the drum during the mixing period. Each mixer and agitator shall have attached thereto in a prominent place, a metal plate, or plates, installed by the manufacturer on which is plainly marked the capacity of the drum in terms of the volume of mixed concrete and the speed of rotation for the agitating and mixing speeds of the mixing drum or blades.

Each mixer shall have an identification number painted on the

truck in such a location that it can be easily read from the batching platform.

The total volume of materials introduced into the mixer shall not exceed the manufacturer's guaranteed mixing capacity. If the concrete so mixed does not meet the uniformity requirements of this subsection, the amount of materials charged into the mixer shall be reduced.

The drum of the mixer shall be completely emptied of any previously mixed load. The proper proportions of aggregate, cement, and water for each load of concrete shall be placed in the mixer and shall be mixed therein for not less than 70 nor mor than 100 revolutions of the drum or blades at the speed designated by the manufacturer of the equipment as mixing speed. Additional revolutions of the drum shall be at the speed designated by the manufacturer of the equipment as agitating speed. The revolving of the drum shall be continuous until the concrete is completely emptied from the drum.

When concrete is being placed for concrete structures, all wash water shall be emptied from the mixer before any portion of the succeeding load is placed therein. For all other work, the mixer shall be empty or may carry 10 gallons of water in the drum. Adequate control of ready-mixed concrete will normally require the additional water to be added and mixed into the batch at the point of discharge. Water so added shall be mixed into the load for a minimum mixing time of three (3) minutes. Water shall not be added to the load during transit.

The total elapsed time between the addition of water at the batch plant and discharging the completed mix shall not exceed 90 minutes. Under conditions contributing to quick setting, the total elapse time permitted may be reduced by the Engineer.

The Engineer shall be provided with a legible certified weighmaster's certificate which shall contain the following information:

Name of Vendor
Name of Contractor
Number of Cubic Yards in the Load
Actual Weights of Cement and of each Size of Aggregate
Amount of Water Added at the Plant
Amount of Water in the Aggregate
Brand and Type of Cement
Brand and Amount of Admixture
Time and Date of Batching

Space shall be provided on the certificate so that amount of water added on the job may be indicated.

1.01.10 Hand Mixing:

Hand-mixing concrete shall be mixed on a water-tight platform, or in a mortar box in batches not to exceed 1/3 cubic yards each.

The aggregates shall first be spread in a uniform layer over which the required quantity of cement shall be evenly distributed. The entire batch shall be turned with shovels until the ingredients are thoroughly blended before adding the water. After adding the proper amount of water, the batch shall again be turned with shovels until a uniform consistency is obtained. Methods of hand mixing which allow the loss of mixing water shall not be permitted.

1.02 CURING COMPOUND (FOR Concrete)

1.02.1 General:

The curing compound shall meet the requirements of ASTM Designation C-309.

Unless otherwise specified the compound shall be Type 2.

1.03 STEEL REINFORCEMENT FOR CONCRETE

1.03.1 General:

Reinforcing steel shall be either Grade 40 or Grade 60 billet steel conforming to ASTM A-615. Varying grades shall not be used interchangingly in structures.

Steel bending processes shall conform to the requirement of ACI-318.

Bending or straightening shall be accomplished so that the steel will not be damaged. Kinked bars shall not be used.

1.03.2 Tie Wires:

The wires shall be cold-drawn black annealed wire and shall have a tensile strength of not less than 40,000 pounds per square inch.

1.04 CEMENT MORTAR SEAL FOR JOINTS IN CONCRETE PIPE

1.04.1 General:

Cement mortar shall be Class C mortar, 1 part cement to 2 parts sand. The quantity of water to be used in the preparation of mortar shall be required to produce a mixture sufficiently workable for the purpose intended.

Mortar shall be used as soon as possible after mixing and shall show no visible signs of setting prior to use. Retempering of mortar will not be permitted.

1.04.2 Cement:

Cement shall conform to the requirements of Subsection 3.01.2 of these specifications.

1.04.3 Sand:

Sand shall conform to the requirements of Subsection 3.01.3.

In proportioning the sand it shall be measured loose (without shaking or compacting) in measuring boxes or other suitable containers of known capacity.

1.04.4 Water:

Water shall conform to the requirements of Subsection 3.01.5 of these specifications.

1.04.5 Admixtures:

No admixture shall be used in mortar unless otherwise specified or approved by the Engineer.

1.05 REINFORCED CONCRETE PIPE

1.05.1 General:

The reinforced concrete pipe to be used for the principal spillway conduit shall be designed to withstand external loads due to the dam embankment and internal loads due to hydrostatic pressure of 25 pounds per square inch and shall conform to requirements of ASTM-C-361. The Contractor shall submit manufacturer's design calculations to the Engineer for approval.

1.05.2 Steel Reinforcement:

The steel reinforcement shall conform to the requirements of the specifications cited in Section 3.04 for the specified type of pipe.

1.05.3 Joints:

The pipe joints shall be of the bell and spigot type and shall incorporate a positive groove in the spigot to contain the gasket. The groove shall be so proportioned as to prevent the displacement of the gasket by the action of either internal or external pressures.

1.05.4 Gaskets:

The cross-sectional diameter of the gaskets shall conform to the pipe manufacturer's recommendation for the type and size of the pipe furnished.

1.05.5 Marking:

All pipe sections shall be marked by the manufacturer with the manufacturer's name and trademark, the date of manufacture, the nominal size, design head, and design external load.

1.06 ROCK FOR CEMENTED RIP-RAP CONSTRUCTION

1.06.1 General Requirements:

Native rock shall be used in the construction of permanent works. The rock size gradation shall be 18" maximum dimensions for the larger rocks and 1" minimum dimensions for the least gradation. Individual rock fragments shall be angular, sound, durable, hard, resistant to abrasion and free from laminations, weak cleavages, and undesirable weathering, leaching, exfoliation, and slaking tendencies. It shall be of such character that it will not disintegrate from the action of air, water, or the conditions to be met in handling and placing. All material shall be clean and free from delerious impurities, including alkali, earth, clay, refuse, and undesirable coatings.

SECTION II - CONSTRUCTION METHODS

2.01 CLEARING AND GRUBBING

2.01.1 General:

This work shall consist of removing all natural and artificial objectionable material from the construction area as delineated on the plans, material sites and areas through which channels are to be constructed. Clearing and grubbing shall be performed in advance of grading operations and in accordance with the requirements herein specified.

2.01.2 Marking:

The limits of the areas to be cleared and grubbed will be marked by means of stakes, flags, tree markings, or other suitable methods. Trees and cactus to be left standing and uninjured will be designated by special markings placed on the trunks at a height of about six feet (6') above the ground surface.

2.01.3 Removal:

All trees and cactus not marked for preservation and all snags, logs, brush, stumps, shrubs, and rubbish shall be removed from the within limits of the marked areas. Unless otherwise specified, all stumps, roots, and root clusters having a diameter of one inch (1") or larger shall be grubbed out to a depth of at least two feet (2') below subgrade elevation for concrete structures and one foot (1') below the natural ground surface at embankment sites and other designated areas. Trees and plants that are not to be removed shall be fully protected from injury by the Contractor at his expense.

2.01.4 Disposal:

All material removed shall be disposed of outside of the construction area by burying or burning. The Contractor shall, at his expense, obtain all necessary county permits for burning and observe all county regulations pertaining to burning. Burning shall be done at such times and in such manner as to prevent the fire from spreading to areas adjoining the construction area. In case burning precedes construction operations, the piles may be placed in the most convenient location on the site. Otherwise, the piles shall be placed in the most convenient location at the side of the site and beyond slope lines where they may be burned without damage to

the surrounding area. No accumulation of flammable material shall remain on or adjacent to the construction site. The adjacent areas shall be left with a neat appearance.

2.02 EARTHWORK, EXCAVATION

2.02.1 General:

Earthwork for debris, dams, and basins shall include stripping, excavation, fill, backfill, grading, and disposal of excavated material.

2.02.2 Stripping:

The Contractor shall strip all top soil and unsuitable material to a minimum of two feet (2') in depth in (1) areas of embankments from toe of slope to toe of slope and, (2), in graded channel areas from top of slope to top of slope, as delineated on the plans.

The material obtained from stripping operations shall be disposed of away from the site unless tests conducted by a soils laboratory conclude the material is suitable for embankment fill. Suitable material shall be stockpiled at a location designated by the Engineer for use as future embankment.

Soil loosened below the stripping depth of two feet (2') shall be compacted. Soil removed below stripping depth, unless otherwise directed by the Engineer, shall be replaced and compacted to subgrade. All such filling and compacting shall be at the Contractor's expense unless otherwise directed by the Engineer.

2.02.3 Cut-Off Trench Excavation:

The Contractor shall excavate a minimum of two feet (2') in depth into cemented granular soils or to solid rock within the limits of the cut-off trench as delineated on the plans as Zone I of embankment. Cut-off trench depth shall be increased to 2'-6" minimum below bottom of principal spillway pipe within area of pipe trench.

The final depths and extent of the cut-off trench will be determined in the field by the Engineer.

2.02.4 Basin Excavation:

Materials obtained from the basin excavation shall be used for compacted embankment fills. The Engineer will designate the exact limits of basin excavation and the depths thereof in order to obtain material suitable for use in the compacted fills. Rocks over twelve inches (12") in greatest dimension will not be permitted in compacted fills and shall be stock-piled for use in grouted Rip-Rap.

2.03 EARTHWORK, FILL AND EMBANKMENT

2.03.1 General:

Earthwork - Fill and embankment shall include all earth fills necessary for construction of the project.

2.03.2 Project Control and Testing:

The Engineer shall act as the Owner's representative during construction, shall perform necessary observation and tests to verify compliance with specifications and shall approve all items specified. Test procedures shall be those outlined in the 1971 Book of Standards of the American Society of Testing and Materials.

2.03.2.1 Testable Embankment:

All embankment materials in Zone I (Core) and those materials in Zone II (Shell) for which accurate field density tests can

be performed shall be placed in horizontal lifts and compacted to a minimum of 95% of maximum density. A minimum of 5 field density tests shall be performed for each lift. Fifty percent of the field density tests shall be at or above 97% of maximum density.

For purposes of acceptance, the in-place density shall be defined as that determined in accordance with ASTM D1556, "Density of Soil in Place by Sand-Cone Method". Appropriate "Rock Correction" shall be made to account for the fraction of soil retained on the No. 4 sieve. During compaction the moisture content of the fill shall be maintained within 2% of the optimum moisture content as determined in accordance with ASTM D1557, Method D.

2.03.2.2 Non-Testable Embankment:

Compaction of coarse embankment materials in Zone II (Shell) which cannot be accurately tested by field density tests shall be controlled on a minimum rolling basis as follows:

A. Lifts shall be placed so their thickness, when compacted, does not exceed twelve inches (12").
B. Compaction shall be accomplished by a specified number of passes of equipment approved by the Soil Engineer. The following types of pneumatic rollers will be satisfactory:

Roller Type	Roller Rating	Wheel Load	Tire Inflation Pressure
A	45 Ton Min.	11 Ton Min.	140 PSI Min.
B	45 Ton Min.	5-1/2 Ton Min.	90 PSI Min.

Each lift shall be compacted with a minimum of three (3) passes of roller A or five (5) passes with Roller B. Other types of rollers can be evaluated as to suitability and required compactive effort established for those which are acceptable by the Engineer.

C. During compaction, the moisture content of the -3/4 fraction of the fill shall be maintained within 2% of the optimum moisture content as determined in accordance with ASTM D1557, Method D.

2.03.3 No fill or embankment shall be placed until the required excavation and preparation of the underlying foundation is completed, inspected, and accepted by the Engineer.

Before placing the materials for the compacted fills, the subgrade therefor shall be moistened, compacted and scarified in accordance with the requirements hereinafter set forth for subsequent layers of fill. Compaction Test shall be taken on the subgrade at the location designated by the Engineer. Areas not having a minimum density of 95% shall be removed to a depth specified by the Engineer and disposed of away from the construction area. The area shall then be rescarified, compacted, and tested.

2.03.4 Materials:

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of materials within the various fills shall be subject to approval by the Engineer.

Fill materials shall contain no sod, brush, roots, or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed from the materials prior to compaction of the fill and stockpiled for use as Rip-Rap.

2.03.4.1 Zone I (Core of Dam):

Embankment shall be selected excavated or borrow material with gradations as follows:

Passing 6 inch square opening -	100%
Passing No. 4 Sieve -	60-100%
Passing No. 200 Sieve -	15-35%
Plasticity Index -	5-25%

2.03.4.2 Zone II (Shell of Dam):

Embankment shall be selected excavated or borrow material with gradations as follows:

Passing 12 inch square opening -	100%
Passing 1/4 inch Sieve -	25-75%
Passing No. 200 Sieve -	0-12%
Plasticity Indes -	5% Maximum

2.03.5 Placement of Embankment:

The Engineer may determine the locations at which each load of fill shall be placed in order to obtain the best possible blending of materials, fill shall be so constructed that the distribution of materials throughout each specified zone will be essentially homogeneous and free from lenses, pockets, streaks, or layers of material differing substantially in

texture or gradation from the surrounding material in the zone and shall be placed in approximately horizontal layers extending the entire length and width of the embankment. Unless otherwise specified, the elevation of the embankment surface shall be increased at approximately the same rate at all points regardless of the number of zones or types of material being placed. Each layer shall be sufficiently scarified after compaction to provide a bond with the succeeding layer. The top surface of each layer shall have sufficient crown to provide adequate drainage for water at all times during the construction period.

Before rolling or tamping, sufficient water shall be evenly applied to each layer of loose material so as to provide proper moisture content for satisfactory compaction to the specified relative density. The material shall be disc harrowed, or otherwise similarly worked, as the water is applied. The moisture content at the time of compaction shall be subject to the approval of the Engineer. In case any layer of the fill shall prove to be too wet to permit the attainment of the specified relative compaction the compacting work shall be delayed until the material has dried sufficiently to permit the attainment of said relative compaction.

After each layer has been spread, worked, and properly moistened, it shall be compacted by approved tamping, sheepsfoot rollers, pneumatic tire roller, mechanically operated hand tampers, or other mechanical means acceptable to the Engineer, to such extent as will produce the specified relative compaction.

Zone I (Core) of the embankement shall be placed in lifts not exceeding six inches (6") and Zone II (Shell) shall be placed in layers not exceeding twelve inches (12"). With authorization from the Engineer, where the Contractor clearly demonstrates that he can attain the required relative density with the type of equipment being used, a greater lift may be permitted.

2.03.5.1 Structure Fill:

Materials placed on the fill by dumping in piles or wind-rows shall be spread uniformly to not more than the specified thickness prior to compaction. Adjacent to structures fill shall be placed in a manner adequate to prevent damage to the structure and to allow the structure to gradually and uniformly assume the backfill loads. Backfill shall be placed in layers not thicker than four inches (4") and shall be

compacted by means of hand tamping, manually directed power tampers, or plate vibrators. Heavy equipment, except Vibrating Rollers, shall not be operated within two feet (2') of any structure. Vibrating Rollers shall not be operated within five feet (5') of any structure. The height of the backfill shall be increased at approximately the same rate on all sides of the structure during placement. No structural backfill shall be placed prior to inspection and approval of the structure by the Engineer.

Compacted fill which is to become subgrade for concrete cradles, spillways, or other hydraulic structures, shall be overfilled, sufficiently as to permit the trimming thereof to an even and firm subgrade for the concrete to be placed thereon. No direct payment will be made for such overfill. Any costs involved therefor shall be included in the price bid for the compacted fill.

On hillsides the existing ground shall be benched as the fill is brought up in layers and the material cut shall be incorporated into the fill. Areas which are inaccessible to heavy equipment shall be compacted manually.

The passage of heavy equipment will not be allowed over cradled precast conduits prior to seven (7) days after placement of the concrete cradle and until the backfill has been placed above the top surface of the pipe to a height of two feet (2').

Compaction of fill adjacent to structures may begin ten (10) days after placement of concrete.

203.5.2 Removal and Replacement of Defective Fill:

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements, or removed and replaced with acceptable fill.

203.6 Fill and Backfill of Channels:

Material for fill and backfill of channels shall be the same as embankment fill for Zone I described in Section 202.4.1 of these specifications and shall be placed in lifts not exceeding eight inches (8") in depth. Each lift shall be compacted in the aforedescribed manner to a minimum of 95% relative density.

Grading of unlined channels shall conform to the following tolerances:

A vertical tolerance of zero above and three inches (3") below the specified grade will be allowed for grading the channel bottom and the channel side slopes in both cut and fill.

Regardless of the construction tolerances specified, the excavation and grading shall be performed so that the finished surfaces are in uniform planes with no abrupt breaks in the surface.

The construction tolerances specified herein for grading are solely for purposes of field control.

203.7 Slope Treatment:

After completion of embankment the side slopes of the dam shall be graded and compacted to a uniform surface. Should the Contractor maintain uniform surfaces during the embankment process and with the approval of the Engineer additional grading and compaction may not be required.

2.04 CEMENTED RIP-RAP:

2.04.1 General:

Cemented Rip-Rap for bank protection shall consist of native rock rip-rap covered with Class 5.-C-2000 concrete constructed in accordance with these specifications and drawings at the designated locations and at other locations as may be directed by the Engineer. Sub-grade and forming shall be inspected and approved prior to any placement of cemented rip-rap.

2.04.2 Materials:

2.04.2.1 Rock for Cemented Rip-Rap:

The rock used in the construction of rip-rap shall conform to the requirements of Material Specifications 1.07 of these specifications. The Contractor shall provide the Engineer free access to the rock source for the purpose of obtaining samples of rock for testing and approving.

2.04.2.2 Concrete for Cemented Rip-Rap:

The concrete used in cemented rip-rap shall conform to the requirements of Material Specifications 1.01 of these specifications.

204.3 Placement of Rip-Rap Rock:

The rock shall be placed by equipment on the surfaces and to the depths specified. The rip-rap shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the rip-rap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. The smaller rocks shall not be grouped as a substitute for larger rock. Flat slab rock shall be laid on edge.

Rip-Rap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to the permanent work.

2.04.4 Placement of Rip-Rap Concrete:

2.04.4.1 Placement of Concrete:

Concrete for rip-rap shall be conveyed, deposited, and consolidated by any method which will preclude the segregation or loss of ingredients. Chutes used in conveying concrete shall be sloped to permit concrete of the consistency required to flow without segregation. Where necessary to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet. The Contractor shall obtain the Engineer's approval for the method of concrete placement prior to start of work.

2.04.4.2 Preparation of Cemented Rip-Rap Base:

Earth surfaces to which cemented rip-rap is to be applied shall be neatly trimmed to line and grade and shall be free of all loose material.

No high subgrade will be permitted. Excavation made below subgrade shall be backfilled with compacted fill or, at the Contractor's opinion, with cemented rip-rap.

Rock surfaces shall be examined and all loose material removed therefrom. The surfaces shall be thoroughly cleaned of all dust, dirt, mortar, grease, or other deleterious substances and then washed with water.

All surfaces shall be wetted with water before application of concrete. Concrete shall not be applied to surfaces on which free water exists.

2.04.3 Curing:

The cemented rip-rap shall be cured by a pigmented sealing compound method.

Curing shall commence as soon as free water leaves the surface face of the concrete but not later than 3 hours following the depositing of the concrete upon the rock. The entire surface shall be covered with Type 2 pigmented curing compound conforming to the requirements of Subsection 1.03 of these specifications.

The curing compound shall be delivered to the work ready-mixed. At the time of use the curing compound shall be thoroughly mixed with the pigment uniformly dispersed throughout the mixture.

The curing compound shall be applied to the entire cemented rip-rap surface by spraying at the rate of one (1) gallon per 200 square feet of pavement surface.

Spraying equipment shall be of the fully atomizing type, equipment with a tank agitator of an approved type which provides for continual agitation of the compound during application. The use of non-agitating type hand pumped garden sprayers will not be permitted except for small and inaccessible areas as may be permitted by the Engineer.

Care shall be taken to provide adequate coverage with the compound at edges, corners, and rough concrete surfaces, and to protect the seal against damage during the curing period. Should the seal be broken or damaged from any cause within 72 hours after application those portions shall be immediately repaired with additional curing compound.

2.05 Concrete Construction:

2.05.1 General:

Concrete structures shall be constructed in conformity with the plans and Special Provisions. Concrete for use in work constructed under this Section shall conform to the requirements of Subsection 1.01 hereof.

Safe and suitable ladders shall be provided to permit access to all portions of the work.

2.05.2 Subgrade for Concrete Structures:

Earth subgrade upon which concrete is placed shall be firm and

free from water. Ground water shall be kept below subgrade until the concrete has set. When the subgrade is in dry earth, it shall be thoroughly dampened with water to insure that no moisture will be absorbed from the fresh concrete.

When the concrete is to be deposited on rock, the rock shall be fully uncovered, cleaned, and its surface shall be removed to a depth sufficient to expose sound rock. Bedrock shall be roughly leveled-off or cut to approximately horizontal and vertical steps. Seams in the rock shall be grouted under pressure or otherwise treated as the Engineer may direct.

2.05.3 Forms:

Forms shall be of suitable material and of a type, size, shape, quality, and strength to insure construction as desired. The forms shall be true to line and grade, mortar tight, and sufficiently rigid to resist deflection during placing of the concrete. The responsibility for their adequacy shall rest with the Contractor. All dirt, chips, sawdust, nails, and other foreign matter shall be completely removed from forms before any concrete is deposited therein. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes that would deface the finished surface. Forms previously used shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being re-used. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly treated with an approved releasing agent which will leave no objectionable film on the surface of the forms that can be absorbed by the concrete. Care shall be exercised that no releasing agent is deposited on previously placed concrete.

Forms for all surfaces that will not be completely enclosed or hidden below the permanent surface of the ground shall be made of surfaced lumber or material which will provide a surface at least equal to surfaced lumber or plywood. Any lumber or material which becomes badly checked or warped, prior to placing concrete, shall not be used.

Form clamps or bolts, approved by the Engineer, shall be used to fasten forms. The use of twisted wire loop ties to hold forms in position will not be permitted, nor shall wooden spreaders be used. Clamps or bolts shall be of sufficient strength and number to prevent spreading of the forms. They shall be of such type that they can be entirely removed or cut back one inch (1") below the finished surface of the concrete.

2.05.4 Removal of Forms:

The periods of time for form removal set forth herein are permissive only and subject to the Contractor assuming all risks that may be involved. The time periods are minimum with no allowance therein for external loads. At time of low temperatures, or other adverse conditions, the Engineer may require the forms to be kept in place for longer periods of time.

The time period is predicated on the use of concrete to which no admixtures have been added for the purpose of obtaining a high early strength, and upon the use of the same type of cement throughout the structure.

Outside forms and inside wall forms may be removed after a period of sixteen (16) hours.

2.05.5 Placing Reinforcement:

Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position in accordance with Concrete Reinforcing Steel Institute "Recommended Practice for Placing Reinforcing Bars", and by using concrete or metal chairs, spacers, metal hangers, supporting wires and other approved devices of sufficient strength to resist crushing under full load. Metal chairs which extend to the surface of the concrete shall not be used.

Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted. Before placing in the forms, all reinforcing steel shall be cleaned thoroughly of mortar, oil, dirt, loose mill scale, loose or thick rust, and coatings of any character that would destroy or reduce the bond. No concrete shall be deposited until the placing of the reinforcing steel has been inspected and approved by the Engineer.

2.05.5.1 Splicing Reinforcement:

Splices of bars shall be made only where shown on the plans or as approved by the Engineer. Where bars are spliced, they shall be lapped at least thirty (30) diameters, unless otherwise shown on the plans.

Splicing shall be accomplished by placing the bars in contact with each other and wiring them together.

Welding of reinforcing steel will not be permitted unless specifically authorized by the Engineer.

2.05.5.2 Bending Reinforcement:

Bends and hooks in bars shall be made in the manner prescribed in the "Manual of Standard Practice" of the American Concrete Institute.

Bars shall not be bent or straightened in a manner which will injure the material. Bars with kinks or unspecified bends shall not be used.

2.05.6 Placing Concrete (General):

Concrete shall be conveyed, deposited and consolidated by any method which will preclude the segregation or loss of ingredients.

Chutes used in conveying concrete shall be sloped to permit concrete of the consistency required to flow without segregation.

2.05.6.1 Depositing:

To avoid segregation, concrete shall be deposited as near to its final position as is practicable. The use of vibrators for extensive shifting of the mass of concrete will not be permitted. Concrete that has partially hardened, has been retempered, or is contaminated by foreign materials shall not be deposited in the structure.

Concrete shall be placed in horizontal layers insofar as practical. Placing shall start at the low point and proceed upgrade unless otherwise permitted by the Engineer. Concrete shall be placed in a continuous operation between construction joints and shall be terminated with square ends and level tops.

2.05.6.2 Consolidating:

Concrete shall be thoroughly consolidated in a manner that will encase the reinforcement and inserts, fill the forms, and produce a surface or even texture free of rock pockets and excessive voids.

Concrete shall be consolidated by means of high frequency internal vibrators of a type, size and number approved by the Engineer. The location, manner, and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar

and coarse aggregate, and without causing water or cement paste to flush to the surface. Internal vibrators shall not be held against the forms or reinforcing steel.

The number of vibrators employed shall be sufficient to consolidate the concrete within fifteen (15) minutes after it has been deposited in the forms. At least two (2) vibrators in good operating condition shall be available at the site of the structure in which more than twenty-five (25) cubic yards of concrete is to be placed.

2.05.6.3 Placing Concrete Under Adverse Weather Conditions:

Concrete for structures or slabs shall not be placed on frozen ground nor shall it be mixed or placed while the atmospheric temperature is below 35 degrees F., unless adequate means are employed to heat the aggregate and water, satisfactory provisions have been made for protecting the work, and with the written permission of the Engineer and only after such precautionary measures have been taken as he may direct.

Concrete shall be effectively protected from freezing or frost for a period of five (5) days after placing.

Concrete for structures shall not be mixed or placed while the atmospheric temperature is above 115 degrees F., unless adequate means are employed to cool the aggregate and water and satisfactory provisions have been made for protecting the work. In any case, the temperature of the concrete as placed shall not exceed 90 degrees F.

Concrete placement shall be stopped when rainfall is sufficient to cause damage to the work.

2.05.7 Surface Finishes:

The classes of surface finish described herein shall be applied to various parts of concrete structures as specified.

2.05.7.1 Ordinary Surface Finish:

Immediately after the forms have been removed, all exterior form bolts shall be removed to a depth of at least one inch (1") below the surface of the concrete and the resulting holes or depressions cleaned and filled with mortar. Mortar shall consist of one (1) part by volume of cement to two (2) parts of sand. Mortar shall be mixed approximately 45 minutes in advance of use. Care shall be exercised to obtain a perfect bond with the concrete. All fins caused by form joints and other projections shall be removed and all pockets cleaned and filled. Mortar for filling pockets shall be treated as specified for bolt holes.

On surfaces which are to be buried underground the removal of

2.06 INSTALLATION OF REINFORCED CONCRETE PIPE (Principal Spillway)

2.06.1 Trench Excavation:

2.06.1. General:

Excavation shall include the removal of all water and materials of any nature which interfere with the construction work.

Excavation for conduits shall be by open trench. Contractor shall not commence trenching operations until embankment fill is placed to minimum height of one foot (1') above the design grade of the top of the conduit.

Excavation for appurtenant structures such as seepage structures shall be deemed to be in the category of trench excavation.

2.06.1.2 Maximum and Minimum Width of Trench:

The minimum and maximum width of trench permitted shall be as indicated on the Plans The side slopes necessary to maintain the stability of excavated surfaces may not necessarily coincide with the limits specified on the Plans for trench excavation. Such work shall be wxcavated, in a manner as to safeguard the work and workmen and to provide the ground adjacent to the excavation will not slide or settle.

2.06.1.3 Over Excavation of Trench:

Excavation in earth below the design grade of the trench due to Contractor's error shall be backfilled with select material as designated by the Engineer and mechanically compacted to 95% optimum density prior to installation of the conduit.

Excavation in rock below design grade of trench due to rock excavation shall be backfilled with concrete bedding after installation of conduit.

2.06.1.4 Access to Trenches:

Safe and suitable ladders which project two feet (2') above the top of the trench shall be provided. One (1) ladder shall be provided for each one hundred fee (100') of open trench, or fraction thereof; and be so located that workmen in the trench need not move more than fifty feet (50') to a ladder.

2.06.2 Backfill:

Backfill shall be considered as starting at the top of concrete bedding. All material below this point shall be considered as bedding.

The Contractor shall proceed as soon as possible with backfilling operations. Care shall be exercised so that the conduit will not be damaged or displaced. The backfill above the concrete bedding shall not be placed until at least forty (40) hours after the placement of concrete bedding.

Rocks larger than six inches (6") in any dimension will not be permitted in backfill of the pipe. Where rocks are included in the backfill they shall be mixed with suitable excavated materials so as to eliminate voids.

After the placing of backfill has been started the Contractor shall proceed as soon as practicable with densification.

2.06.2.1 Densification Methods:

Backfill shall be mechanically compacted by means of tamping with manually directed mechanical equipment. The equipment shall be of a size and type approved by the Engineer. Impact-type pavement breakers (stompers) will not be permitted.

Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, or improvements installed under the Contract. The Contractor shall make his own determination in this regard.

Material for mechanical compacted backfill shall be placed in lift which, prior to compaction, shall not exceed the depth of four inches (4").

Mechanically compacted backfill shall be placed in horizontal layers of such depths (not exceeding those specified above) compatible to the material being placed and the type of equipment being used. Each layer shall be evenly spread, moistened (or dried, if necessary), and then tamped until the specified 95% relative compaction has been attained.

Water densification of backfill will not be permitted.

2.06.3 Laying Reinforced Concrete Pipe:

2.06.3.1 Bedding Material:

Bedding shall be Class 5.0-B-2000 concrete, the top of the concrete as shown on the Plans shall be considered as the top of the bedding.

If soft, spongy, unstable, or similar other material is encountered upon which the bedding material is to be placed, this unsuitable material shall be removed to a depth ordered by the Engineer and replaced with bedding material.

2.06.3.1.1 Placing Bedding Material:

Bedding material shall first be placed so that the pipe is supported for the full length of the barrel with full bearing on the bottom segment of the pipe equal to a minimum of 0.4 of the outside diameter of the barrel. Then the remainder of the bedding shall be placed in accordance with Section 2.05.6 of these Specifications.

2.06.3.2 Pipe Laying:

Pipe shall be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be subject to rejection. Any corrective work shall be approved by the Engineer.

2.06.3.3 Field Jointing of Gasket Type Joints for Reinforced Concrete Pipe:

(1) The ends of the pipe shall be so formed that when the pipes are laid together and joined they shall make a continuous and uniform line of pipe with a smooth and regular surface.

(2) The work shall be scheduled so that the bell end of the pipe faces in the direction of laying. Prior to placing the spigot into the bell of the pipe previously laid, the spigot groove, the gasket and the bell shall be thoroughly cleaned. Then the spigot groove, the gasket and the first two inches (2") of the bell shall be lubricated with a soft vegetable soap compound. The gasket, after lubrication, shall be uniformly stretched when placing it in the spigot groove so that the gasket is distributed evenly around the circumference. After the joint is assembled a

thin metal feeler gauge shall be inserted between the bell and the spigot and the position of the gasket checked around the complete circumference of the pipe. If the gasket is not in the proper position the pipe shall be withdrawn, the gasket checked to see that it is not cut or damaged, the pipe relaid, and the gasket again checked.

(3) Before placement of the bedding the exterior annular space between the ends of the pipe sections shall be cleaned and filled with Class "C" Mortar.

2.06.4 Pressure Testing:

Pressure testing of the completed conduit will not be required.

2.07 DEBRIS BARRIER:

2.07.1 General:

The Contractor shall install wooden poles for the purpose of debris barriers at locations delineated on the Plans.

2.07.2 Wood Poles:

Poles shall be hard, dense timber of sufficient length to allow for a minimum of four foot (4') bury and maintain the required height above ground as shown on the Plans. All poles shall be a minimum of eight inches (8") in diameter and shall be treated with creosote. The minimum amount of preservative to be retained in the wood shall be 12 lbs. per cubic foot to minimum depth of 3/4 inch.

Sawed surfaces shall be painted with creosote as directed by the Engineer.

With approval of the Engineer the Contractor may use surplus utility poles as debris barriers.

2.07.3 Installing Wood Poles:

Poles shall be set in pre-drilled holes at as near vertical positions as possible and backfilled with a cement grout. Poles shall be held in a vertical position for a period of twenty-four (24) hours to allow grout to set up.

2.07.4 Damaged Poles:

Poles moved or otherwise damaged by construction operations after installation shall be removed and replaced at the Contractor's expense.

fins and form marks will not be required. Ordinary surface finish shall be considered as a final finish for exposed surfaces.

2.05.8 Curing:

As soon after the completion of the specified finishing operation as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surface shall either be sprinkled with water, covered with plastic sheet, or covered with earth, sand, or burlap, sprayed with Type 1 curing compound conforming with subsection 1.01.1.

Concrete that is water cured must be kept continuously wet for at least ten (10) days after being placed. The method of water curing shall be subject to approval by the Engineer.

When an impervious membrane (curing compound) is used it shall be applied under pressure through a spray nozzle in such manner and quantity as to entirely cover and seal all exposed surfaces of the concrete with a uniform film. The membrane shall not be applied to any surface until all of the finishing operations have been completed, such surfaces being kept damp until the membrane is applied. All surfaces on which a bond is required, such as construction joints, reinforcing steel, and the like, shall be adequately covered and protected before starting the application of the curing compound in order to prevent any of the compound from being deposited thereon, and any such surface with which the compound may have come in contact shall immediately thereafter be cleaned. Care shall be exercised to prevent any damage to the membrane seal during the curing period. Should the seal be damaged before the expiration of ten (10) days after the placing of the concrete additional impervious membrane shall be immediately applied over the damaged area.

Should any forms be removed sooner than ten (10) days after the placing of the concrete, the surface so exposed shall either be immediately sprayed with a coating of the curing compound or kept continuously wet by the use of burlap or other suitable means until such conrete has cured for at least ten (10) days.

When tops of walls are cured by the curing compound method the side forms, except for metal forms, must be kept continuously wet for at least ten (10) days following the placing of the concrete.

2.08 CLEANUP AND RESTORATION:

2.08.1 General:

Throughout all phases of construction including suspension of work and until final acceptance of the project the Contractor shall keep the worksite clean and free from rubbish and debris. Prior to the acceptance of the work, the Contractor shall remove all excess construction materials and appurtenances and perform general grading operations as directed by the Engineer to restore the construction site to an aesthetically pleasing condition.

SUBSURFACE

INVESTIGATION

DATA

FOUNDATION AND MATERIALS INVESTIGATION REPORT

STRUCTURE No. 7

PROPOSED RETENTION BASIN PROGRAM FOR 1971

FOUNTAIN HILLS, ARIZONA

JOB No. E70-180

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS
PHOENIX • FLAGSTAFF • EL PASO

SERGENT, HAUSKINS & BECKWITH CONSULTING SOIL AND FOUNDATION ENGINEERS

B. DWAINE SERGENT, P.E. • JOHN B. HAUSKINS, P.E. • GEORGE H. BECKWITH, P.E. • DALE V. BEDENKOP, P.E.

FEBRUARY 8, 1971

TRICO INTERNATIONAL INC.
8718 EAST McDOWELL ROAD
SCOTTSDALE, ARIZONA 85257

JOB NO. E70-180

ATTENTION: MR. LARRY WETSTEIN

RE: STRUCTURE NO. 7
PROPOSED RETENTION BASIN
PROGRAM FOR 1971
FOUNTAIN HILLS, ARIZONA

GENTLEMEN,

OUR FOUNDATION AND MATERIALS INVESTIGATION REPORT FOR THE REFERENCED PROJECT IS HEREWITH SUBMITTED. THE REPORT INCLUDES THE RESULTS OF TEST DRILLING AND LABORATORY ANALYSIS ALONG WITH OUR CONCLUSIONS AND RECOMMENDATIONS.

SHOULD ANY QUESTIONS ARISE CONCERNING THIS REPORT, WE WOULD BE PLEASED TO DISCUSS THEM WITH YOU.

RESPECTFULLY SUBMITTED,
SERGENT, HAUSKINS & BECKWITH ENGINEERS

BY Robert D. Booth
ROBERT D. BOOTH, E.

REVIEWED BY George H. Beckwith
GEORGE H. BECKWITH, P. E.

Registered Professional Engineer (Civil) CERTIFICATE NO. 5633 GEORGE HENRY BECKWITH Date Signed 2-8-71 ARIZONA, U.S.A.

COPIES: ADDRESSEE (3)

PHOENIX, ARIZONA
3940 WEST CLARENDON
(602) 272-6848

FLAGSTAFF, ARIZONA
2029 NORTH 4TH STREET
(602) 774-4433

EL PASO, TEXAS
201 NORTH CLARK ROAD
(915) 772-3088

TABLE OF CONTENTS

JOB NO. E70-180

INTRODUCTION

THIS REPORT PRESENTS THE RESULTS OF A FOUNDATION AND MATERIALS INVESTIGATION MADE BY THIS FIRM FOR THE PROPOSED FLOOD CONTROL DAM, STRUCTURE NO. 7, RETENTION BASIN PROGRAM FOR 1971, FOUNTAIN HILLS, ARIZONA. THE OBJECT OF THE INVESTIGATION WAS TO DETERMINE THE PHYSICAL PROPERTIES OF THE SOILS AND ROCK UNDERLYING THE SITE TO PROVIDE RECOMMENDATIONS FOR DESIGN OF THE DAM EMBANKMENT AND SPILLWAY.

PROPOSED CONSTRUCTION

THE PROPOSED DAM WILL BE APPROXIMATELY 385 FEET IN LENGTH WITH A MAXIMUM HEIGHT OF 48 FEET. THE WIDTH AT THE TOP OF THE DAM WILL BE 10 FEET AND APPROXIMATELY 36,000 CUBIC YARDS OF EMBANKMENT WILL BE INVOLVED. THE SPILLWAY ELEVATION WILL BE 1930.5 OR 3.5 FEET BELOW THE TOP OF THE PROPOSED EMBANKMENT. THE PROPOSED STRUCTURE WILL BE USED FOR FLOOD CONTROL PURPOSES ONLY. THE DESIGN IS BASED UPON THE TOTAL TIME REQUIRED FOR FILLING AND DRAINING BEING LESS THAN 2 DAYS.

INVESTIGATION

FIVE EXPLORATORY BORINGS WERE DRILLED TO DEPTHS OF BETWEEN 8 AND 41 FEET BELOW EXISTING GRADE. STANDARD PENETRATION TESTING AND UNDISTURBED SAMPLING WERE PERFORMED AT SELECTED INTERVALS IN SOME OF THE BORINGS. GENERALLY, $6\frac{1}{2}$ INCH HOLLOW STEM AUGER WAS USED TO ADVANCE THE BORINGS TO A DEPTH IN WHICH REFUSAL ON SOLID ROCK OR LARGER COBBLES OR BOULDERS WAS ENCOUNTERED. TRICONE GEAR BITS OR NX DIAMOND CORING WERE UTILIZED IN ADVANCING THE BORINGS BEYOND THESE DEPTHS. INFORMATION ON

THE PERMEABILITY OF THE SOILS AND ROCK INVOLVED WAS OBTAINED BY FILLING THE BOREHOLES WITH WATER AND TAKING PERIODIC OBSERVATIONS OF WATER SURFACE ELEVATION. THE RESULTS OF THE EXPLORATORY DRILLING ARE PRESENTED IN APPENDIX A WHICH INCLUDES A BRIEF DESCRIPTION OF DRILLING AND SAMPLING EQUIPMENT AND PROCEDURES, A SITE PLAN SHOWING BORING LOCATIONS AND LOGS OF THE TEST BORINGS.

IN ADDITION TO THE 5 EXPLORATORY BORINGS, 6 TEST PITS WERE EXCAVATED WITH A WARNER & SWASEY HOPTO SERIES 200 TRUCK MOUNTED BACKHOE IN THE RESERVOIR AREA TO LOCATE BORROW FOR THE DAM EMBANKMENT. EACH TEST PIT WAS CAREFULLY EXAMINED, VISUALLY CLASSIFIED AND LOGGED. WHEREVER APPLICABLE, LARGE BULK SAMPLES WERE OBTAINED FOR LABORATORY ANALYSIS. THE LOGS OF THE TEST PITS ALSO ARE PRESENTED IN APPENDIX A. THEIR LOCATIONS ARE NOTED ON THE SITE PLAN.

GRAIN-SIZE ANALYSIS, ATTERBERG LIMITS, PERMEABILITY AND MOISTURE-DENSITY RELATIONSHIP TESTS WERE PERFORMED ON SELECTED SAMPLES OF THE BORROW AND EMBANKMENT FOUNDATION SOILS. THE RESULTS OF THESE TESTS ARE PRESENTED IN APPENDIX B.

SITE CONDITIONS & GEOLOGIC PROFILE

THE SITE IS COVERED BY A LIGHT TO MODERATE GROWTH OF BRUSH, CACTI AND SMALL TREES. THE AXIS OF THE PROPOSED DAM CROSSES A RELATIVELY STEEP-SIDED CANYON. THE SOUTHERN SLOPE OF THE CANYON IS RATHER UNIFORM IN GRADE WHEREAS THE NORTHERN SLOPE IS MORE VARIABLE HAVING SLOPES TO NEAR VERTICAL NEAR THE NORTHERN ABUTMENT.

THE GEOLOGIC PROFILE, AS INDICATED BY OUR TEST BORINGS, VARIES SOMEWHAT ACROSS THE SITE BUT GENERALLY CAN BE DESCRIBED AS FOLLOWS:

1. WITH EXCEPTION OF THE NORTH SLOPE, A SOFT TO MODERATELY FIRM SURFACE LAYER OF SILTY AND CLAYEY SANDS WITH CONSIDERABLE GRAVEL AND COBBLES ARE PRESENT ACROSS THE EMBANKMENT AREA. THESE SOILS EXTENDED TO DEPTHS OF BETWEEN 1 AND 5 FEET BELOW EXISTING GRADE. THEY ARE GENERALLY UNCEMENTED AND ARE EITHER ALLUVIAL FAN DEPOSITS OR RECENT CHANNEL ALLUVIUM.

2. IN THE CHANNEL AND SOUTH SLOPE, THE SURFACE LAYER IS UNDERLAIN BY ALLUVIAL FAN DEPOSITS CONSISTING OF SILTY AND CLAYEY SANDS AND GRAVELS WITH VARYING AMOUNTS OF COBBLES. THESE SOILS ARE MODERATELY TO STRONGLY LIME CEMENTED AND ARE VERY FIRM TO HARD.

3. BEDROCK AT THE SITE CONSISTS OF SYENITE, A COARSE GRAINED IGNEOUS ROCK. GENERALLY, THE SYENITE IS SLIGHTLY TO MODERATELY FRACTURED AND SLIGHTLY WEATHERED. SYENITE IS PRESENT AT OR NEAR THE SURFACE IN THE SPILLWAY AREA AND NORTH SLOPE AND WAS ENCOUNTERED AT 12 FEET IN BORING 3 IN THE CHANNEL. IT WAS ENCOUNTERED AT 28 FEET IN BORING 1 AT THE SOUTH ABUTMENT AND WAS NOT ENCOUNTERED IN BORING 2.

THE GEOLOGIC PROFILE ALONG THE DAM AXIS IS PRESENTED IN APPENDIX C.

NO FREE GROUND WATER WAS ENCOUNTERED IN THE TEST BORINGS AND SOIL MOISTURE CONTENTS WERE GENERALLY VERY LOW.

DISCUSSION & RECOMMENDATIONS

GENERAL

BECAUSE THE PROPOSED DAM IS FOR FLOOD CONTROL PURPOSES AND WILL NOT RETAIN WATER FOR EXTENDED PERIODS OF TIME, NORMAL SEEPAGE CONSIDERATIONS WILL NOT BE APPLICABLE TO THE PROJECT. EXTENSION OF THE CORE TRENCH TO SLIGHTLY PENETRATE VERY FIRM CEMENTED SOILS OR ROCK IS RECOMMENDED. WITH THIS TREATMENT, EMBANKMENT SETTLEMENTS WILL BE VERY SLIGHT. THIS WILL PREVENT THE POSSIBILITY OF EMBANKMENT CRACKING AND SUBSEQUENT PIPING DURING ISOLATED WATER RETENTION PERIODS DUE TO EXCESSIVE MOVEMENTS OF THE FILL.

CLASSIFICATION BY THE SYSTEM DEVELOPED BY SHERARD, ET AL* INDICATES THAT BOTH THE EMBANKMENT FOUNDATION SOILS AND THOSE IN PROSPECTIVE BORROW AREAS HAVE A COMPARATIVELY HIGH RESISTANCE TO PIPING. WATER LOSS IN THE BOREHOLES INDICATES THAT BOTH THE ROCK AND CEMENTED SOILS ARE LOW IN PERMEABILITY. THE USE OF SOILS WITH RELATIVELY HIGH RESISTANCE TO PIPING AND LOW PERMEABILITY IS RECOMMENDED FOR THE CENTER PORTION OF THE EMBANKMENT. ALSO, SINCE THE EMBANKMENT SOILS WILL BE SUBJECT TO PERIODIC WETTING AND DRYING, THE USE OF GRANULAR SOILS IN THE SHELL TO PREVENT SHRINKAGE CRACKING IS RECOMMENDED. THE RECOMMENDED DETAILS WILL PRECLUDE PIPING THROUGH THE DAM FOUNDATION AND EMBANKMENT AND ENABLE ECONOMICAL CONSTRUCTION WITH MATERIALS AVAILABLE IN THE IMMEDIATE VICINITY OF THE DAM.

---

* SHERARD, J.L., WOODWARD, R.J., GIZIENSKI, S.F. & CLEVENGER, W.A., "EARTH AND EARTH-ROCK DAMS", JOHN WILEY & SONS, 1963, PAGE 129.

EMBANKMENT DETAILS

A ZONED EMBANKMENT IS RECOMMENDED. RECOMMENDED DETAILS FOR THE EMBANKMENT ARE ILLUSTRATED ON A DRAWING PRESENTED IN APPENDIX C. MATERIALS RECOMMENDATIONS ARE DISCUSSED IN THE FOLLOWING SECTION OF THIS REPORT.

THE CORE TRENCH SHOULD BE A MINIMUM OF 10 FEET IN WIDTH AT THE BOTTOM AND PENETRATE THE CEMENTED SOILS OR WEATHERED SURFACE OF THE SYENITE AT LEAST 2 FEET. IT APPEARS THAT THE TRENCH CAN BE EXCAVATED THROUGHOUT BY RIPPING.

BASED ON AN ANGLE OF INTERNAL FRICTION OF 38° FOR THE SHELL (ZONE II), THE FACTOR OF SAFETY WAS CALCULATED AT ABOUT 2.1 FOR $2\frac{1}{2}$:1 SLOPES, 1.6 FOR 2:1 SLOPES AND 1.2 FOR $1\frac{1}{2}$:1 SLOPES. NO SEEPAGE FORCES DURING DRAWDOWN WERE CONSIDERED IN THIS ANALYSIS. BECAUSE SLIGHT SEEPAGE FORCES MAY BE INVOLVED NEAR THE FACE OF THE SHELL DURING THE VERY RAPID DRAWDOWN, 2:1 FILL SLOPES ARE RECOMMENDED.

EMBANKMENT MATERIALS & CONSTRUCTION

RECOMMENDATIONS FOR QUALITY AND REQUIRED DEGREE OF COMPACTION FOR EMBANKMENT MATERIALS ARE INCORPORATED INTO THE "GUIDE SPECIFICATIONS FOR EARTHWORK" PRESENTED IN APPENDIX C.

REQUIREMENTS FOR ZONE II ARE DESIGNED TO ELIMINATE MATERIALS HIGHLY SENSITIVE TO PIPING, CRACKING OR THE DEVELOPMENT OF HIGH SEEPAGE FORCES DURING DRAWDOWN. IN PRACTICE, VIRTUALLY ALL SOILS FROM THE RESERVOIR, CORE TRENCH EXCAVATION AND

SPILLWAY EXCAVATION WILL MEET THESE REQUIREMENTS. APPROXIMATELY 15,000 CUBIC YARDS OF ZONE II MATERIAL (IN TERMS OF VOLUME IN PLACE) CAN BE OBTAINED WITHIN THE RESERVOIR WITHOUT RIPPING. AN ADDITIONAL 7,500 CUBIC YARDS CAN BE OBTAINED IMMEDIATELY DOWNSTREAM.

IN ORDER TO ACHIEVE PROPER PERMEABILITY CHARACTERISTICS, REQUIREMENTS FOR ZONE I MATERIAL ARE SOMEWHAT MORE STRINGENT. A LIMITED AMOUNT OF MATERIALS MEETING THESE REQUIREMENTS ARE AVAILABLE WITHIN THE RESERVOIR. THUS, IT WILL BE NECESSARY TO BORROW ZONE I MATERIAL FROM CLAYEY SAND DEPOSITS ON THE ADJACENT SLOPES OR RIDGES TO THE SOUTH.

COARSER ROCK-FILL FROM THE SPILLWAY EXCAVATION SHOULD BE SELECTIVELY PLACED ON THE SLOPES AS RIPRAP.

OUTLET PIPE

IT IS UNDERSTOOD THAT A REINFORCED CONCRETE OUTLET PIPE IS BEING CONSIDERED. CONCRETE CRADLE-TYPE BEDDING BEARING ON THE CEMENTED SOILS IS RECOMMENDED. IN ORDER TO MINIMIZE THE THICKNESS OF THE CRADLE, IT IS RECOMMENDED THAT ITS BASE BE BENCHED INTO THE SOUTH SLOPE IN THE MANNER SHOWN ON THE GEOLOGIC PROFILE IN APPENDIX C. THE BASE OF THE CRADLE SHOULD EXTEND TO AT LEAST 2 FEET BELOW THE CONTACT OF THE NATIVE SOILS.

WITH THE BEDDING RECOMMENDED ABOVE, SETTLEMENT OF ½ INCH AT THE CENTER OF THE PIPE IS RECOMMENDED FOR STRUCTURAL ANALYSIS BY SOIL CONSERVATION SERVICE PROCEDURES. BY EXCAVATING TO THE

CEMENTED SOILS FOR 5 FEET ON EACH SIDE OF THE PIPE THROUGHOUT ITS LENGTH AND RECOMPACTION, IT CAN BE ASSURED THAT EXTERNAL PRESSURES ON THE PIPE WILL NOT BE SIGNIFICANTLY HIGHER THAN THE WEIGHT OF THE OVERBURDEN.

SEEPAGE COLLARS SHOULD BE PROVIDED.

SPILLWAY

BORING 5 INDICATED RELATIVE SOUND ROCK THAT IS HIGHLY RESISTANT TO EROSION. FROM EXPOSURE, IT APPEARS THAT AN UNLINED SPILLWAY IN SYENITE CAN BE USED AT ANY POINT BETWEEN THE NORTH END OF THE DAM AND TENTATIVE SPILLWAY LOCATION (BORING 5). BLASTING WILL BE NECESSARY FOR MUCH OF THE SPILLWAY EXCAVATION. CUT SLOPES OF $\frac{1}{2}$:1 ARE RECOMMENDED.

APPENDIX A

TEST DRILLING EQUIPMENT & PROCEDURES

DRILLING EQUIPMENT TRUCK MOUNTED CME-55 DRILL RIGS POWERED WITH 4 OR 6 CYLINDER FORD INDUSTRIAL ENGINES ARE USED IN ADVANCING TEST BORINGS. THE 4 CYLINDER AND 6 CYLINDER ENGINES ARE CAPABLE OF DELIVERING ABOUT 4350 AND 6500 FT. LBS. TORQUE TO THE DRILL SPINDLE, RESPECTIVELY. THE SPINDLE IS ADVANCED WITH TWIN HYDRAULIC RAMS CAPABLE OF EXERTING 12,000 POUNDS DOWNWARD FORCE. DRILLING THROUGH SOIL OR SOFTER ROCK IS PERFORMED WITH $6\frac{1}{2}$" O.D. $3\frac{1}{4}$" I.D. HOLLOW STEM AUGER OR $4\frac{1}{2}$" CONTINUOUS FLIGHT AUGER. CARBIDE INSERT TEETH ARE NORMALLY USED ON THE AUGER BITS SO THEY CAN OFTEN PENETRATE ROCK OR VERY STRONGLY CEMENTED SOILS WHICH REQUIRE BLASTING OR VERY HEAVY EQUIPMENT FOR EXCAVATION. WHERE REFUSAL IS EXPERIENCED IN AUGER DRILLING, THE HOLES ARE SOMETIMES ADVANCED WITH TRICONE GEAR BITS AND NW RODS USING WATER OR AIR AS A DRILLING FLUID.

SAMPLING PROCEDURES DYNAMICALLY DRIVEN TUBE SAMPLES ARE USUALLY OBTAINED AT SELECTED INTERVALS IN THE BORINGS BY THE ASTM D1586 PROCEDURE. TWO INCH O.D. 1-3/8" I.D. SAMPLERS ARE USED IN MANY CASES TO OBTAIN THE STANDARD PENETRATION RESISTANCE. "UNDISTURBED" SAMPLES OF FIRMER SOILS ARE OFTEN OBTAINED WITH 3" O.D. SAMPLERS LINED WITH 2.42" I.D. BRASS RINGS. DRIVING ENERGY IS GENERALLY RECORDED AS THE NUMBER OF BLOWS OF A 140 POUND 30 INCH FREE FALL DROP HAMMER REQUIRED TO ADVANCE THE SAMPLERS IN 6 INCH INCREMENTS. HOWEVER, IN STRATIFIED SOILS DRIVING RESISTANCE SOMETIMES IS RECORDED IN 2 OR 3 INCH INCREMENTS SO THAT SOIL CHANGES AND THE PRESENCE OF SCATTERED GRAVEL OR CEMENTED LAYERS CAN BE READILY DETECTED AND REALISTIC PENETRATION VALUES OBTAINED FOR CONSIDERATION IN DESIGN. THESE VALUES ARE EXPRESSED IN BLOWS PER FOOT ON THE LOGS. "UNDISTURBED" SAMPLING OF SOFTER SOILS IS SOMETIMES PERFORMED WITH THIN WALLED SHELBY TUBES (ASTM D1587). WHERE SAMPLES OF ROCK ARE REQUIRED, THEY ARE OBTAINED BY NX DIAMOND CORE DRILLING (ASTM D2113). THE TUBE SAMPLES ARE LABELED AND PLACED IN WATERTIGHT CONTAINERS TO MAINTAIN FIELD MOISTURE CONTENTS FOR TESTING. WHEN NECESSARY FOR TESTING, LARGER BULK SAMPLES ARE TAKEN FROM AUGER CUTTINGS.

CONTINUOUS PENETRATION TESTS CONTINUOUS PENETRATION TESTS ARE PERFORMED BY DRIVING A 2" O.D. BLUNT NOSED PENETROMETER ADJACENT TO OR IN THE BOTTOM OF BORINGS. THE PENETROMETER IS ATTACHED TO 1-5/8" O.D. DRILL RODS TO PROVIDE CLEARANCE AND MINIMIZE SIDE FRICTION SO THAT PENETRATION VALUES ARE AS NEARLY AS POSSIBLE A MEASURE OF END RESISTANCE. PENETRATION VALUES ARE RECORDED AS THE NUMBER OF BLOWS OF A 140 POUND 30 INCH FREE FALL DROP HAMMER REQUIRED TO ADVANCE THE PENETROMETER IN ONE FOOT INCREMENTS OR LESS.

BORING RECORDS DRILLING OPERATIONS ARE DIRECTED BY OUR FIELD ENGINEER OR GEOLOGIST WHO EXAMINES SOIL RECOVERY AND PREPARES BORING LOGS. SOILS ARE VISUALLY CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487) WITH APPROPRIATE GROUP SYMBOLS BEING SHOWN ON THE LOGS.

TERMINOLOGY FOR THE DESCRIPTION OF ROCK

General Property	Descriptive Term	Visual or Physical Properties
WEATHERING	VERY WEATHERED	Abundant fractures coated with oxides, carbonates, sulphates, mud, etc., thorough discoloration, rock disintegration, mineral decomposition
	MODERATELY WEATHERED	Some fracture coating, moderate or localized discoloration, little to no affect on cementation, slight mineral decomposition
	SLIGHTLY WEATHERED	A few stained fractures, slight discoloration, little to no affect on cementation, no mineral decomposition
	FRESH	Unaffected by weathering agents, no appreciable change with depth

FRACTURING	INTENSELY FRACTURED	less than 1" spacing
	VERY FRACTURED	1" to 6" spacing
	MODERATELY FRACTURED	6" to 12" spacing
	SLIGHTLY FRACTURED	12" to 36" spacing
	SOLID	36" spacing or greater
STRATIFICATION	THINLY LAMINATED	less than 1/10"
	LAMINATED	1/10" to 1/2"
	VERY THINLY BEDDED	1/2" to 2"
	THINLY BEDDED	2" to 2 feet
	THICKLY BEDDED	more than 2 feet

HARDNESS	SOFT	Can be dug by hand and crushed by fingers
	MODERATELY HARD	Friable, can be gouged deeply with knife and will crumble readily under light hammer blows
	HARD	Knife scratch leaves dust trace, will withstand a few hammer blows before breaking
	VERY HARD	Scratched with knife with difficulty, difficult to break with hammer blows

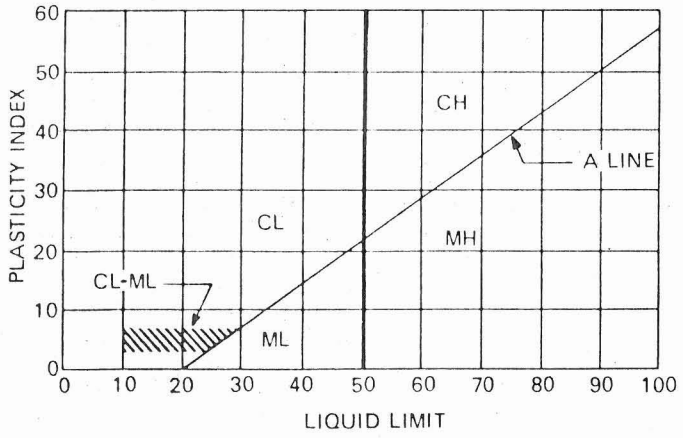
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corp of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 seive)			SW	Well graded sands, gravelly sands.
					SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (Limits plot below "A" line & hatched zone on plasticity chart)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)			ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CLAYS (Limits plot above "A" line & hatched zone on plasticity chart)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

NOTE: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

PLASTICITY CHART



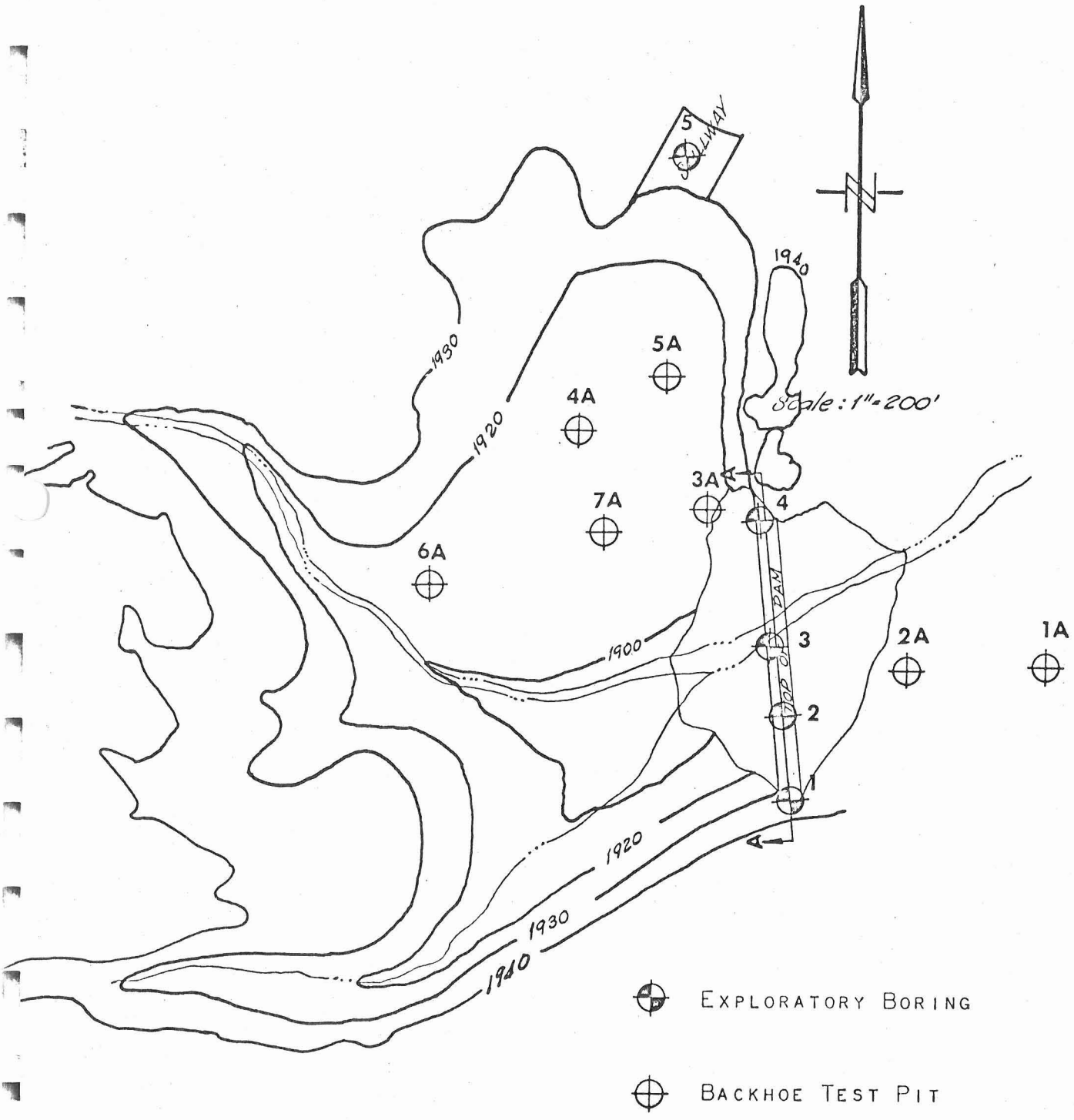
DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to ¾ in.
Fine gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

SITE PLAN

SHOWING LOCATIONS OF TEST BORINGS

STRUCTURE NUMBER 7
FOUNTAIN HILLS, ARIZONA
JOB NO. E70-180



EXPLORATORY BORING

BACKHOE TEST PIT

REFERENCE DRAWING: "TOPOGRAPHIC MAP, FOUNTAIN HILLS, ARIZONA - STRUCTURE NUMBER 7" BY TRICO INTERNATIONAL INC.

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
PHOENIX • FLAGSTAFF • EL PASO

PROJECT FOUNTAIN HILLS-STRUCTURE NUMBER 7

JOB NO. E70-180 DATE 12-22-70

LOG OF TEST BORING NO. 1

RIG TYPE CME-55

BORING TYPE 6½" HOLLOW STEM AUGER, TRICONE

SURFACE ELEV. 1934+ GEAR BIT & NX DIAMOND CORE

DATUM TRICO INTERNATIONAL TOPO

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			G					SC		CLAYEY SAND, CONSIDERABLE GRAVEL & COBBLES, FAIRLY WELL GRADED, LOW TO MEDIUM PLASTICITY, REDDISH-BROWN
5			U		100/4½"				VERY HARD	CLAYEY SAND, SOME GRAVEL & COBBLES, FAIRLY WELL GRADED, SLIGHTLY TO MODERATELY LIME CEMENTED, MEDIUM PLASTICITY, GRAYISH-BROWN
								SC		
10			U		100/2½" (NO RECOVERY)					
15			A						VERY HARD	SAND, SOME CLAY, SMALL AMOUNT OF FINE GRAVEL, WELL GRADED, STRONGLY CEMENTED, LOW PLASTICITY TO NONPLASTIC, GRAYISH-BROWN
			U		100/1" (NO RECOVERY)					
20			U		100/1"					
								SW		
25			U		100/1½"					
30			HOLLOW STEM AUGER REFUSED @ 28'; BEGAN TRICONE GEAR BIT							SYENITE, GENERALLY COARSE, MODERATELY TO SLIGHTLY WEATHERED, MODERATELY FRACTURED, HARD, LIGHT GRAY WITH DARK MOTTLING
			BEGAN CORING @ 31'							
35			NX						100% WATER RETURN 0% CORE RECOVERY	
40			NX						100% WATER RETURN 90% CORE RECOVERY	
										STOPPED CORING AT 41'
45										

GROUND WATER

DEPTH	HOUR	DATE
	NONE	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS PHOENIX TUCSON EL PASO

PROJECT FOUNTAIN HILLS-STRUCTURE NUMBER 7

JOB NO. E70-180 DATE 12-23-70

LOG OF TEST BORING NO. 2

RIG TYPE CME-55

BORING TYPE 6½" HOLLOW STEM AUGER, TRICONE

SURFACE ELEV. 1907+ GEAR BIT & NX DIAMONI

DATUM TRICO INTERNATIONAL TOPO CORE

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			S		14			SC	MOIST MODERATELY FIRM	CLAYEY SAND, CONSIDERABLE GRAVEL & COBBLES, FAIRLY WELL GRADED, LOW TO MEDIUM PLASTICITY, REDDISH-BROWN
5			S		50/4½"					
			HOLLOW STEM AUGER REFUSED @ 5'; BEGAN TRICONE GEAR BIT						VERY HARD	CLAYEY SAND, SOME GRAVEL & COBBLES, FAIRLY WELL GRADED, SLIGHTLY TO MODERATELY LIME CEMENTED, MEDIUM PLASTICITY, GRAYISH-BROWN
10										
15								SC		
			BEGAN CORING @ 17'						100% WATER RETURN 0% CORE RECOVERY	
20			NX							
25										STOPPED CORING AT 25'

GROUND WATER

DEPTH	HOUR	DATE
	NONE	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS

PHOENIX · FLAGSTAFF · EL PASO

PROJECT FOUNTAIN HILLS-STRUCTURE NUMBER 7

JOB NO. E70-180 DATE 12-30-70

LOG OF TEST BORING NO. 3

RIG TYPE CME-55

BORING TYPE TRICONE GEAR BIT & NX DIAMOND CORE

SURFACE ELEV. 1886± DATUM TRICO INTERNATIONAL TOPO

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								GW		SAND, GRAVEL & COBBLES, GENERALLY WELL GRADED, FEW COBBLES TO 30", SUBROUNDED, LOW PLASTICITY TO NONPLASTIC, TAN
5				NX					BEGAN CORING @ 5'	
				NX				GW	90% WATER RETURN 40% CORE RECOVERY	SAND, GRAVEL, COBBLES & BOULDERS TO 3'±, SUBROUNDED, MODERATELY CEMENTED, LOW PLASTICITY TO NONPLASTIC, TAN
10				NX					90% WATER RETURN 50% CORE RECOVERY	
15				NX					85% WATER RETURN 95% CORE RECOVERY	SYENITE, GENERALLY COARSE, MODERATELY TO SLIGHTLY WEATHERED, MODERATELY FRACTURED, HARD, LIGHT GRAY WITH DARK MOTTLING
20				NX					80% WATER RETURN 95% CORE RECOVERY	
25										STOPPED CORING AT 26'
30										

GROUND WATER

DEPTH	HOUR	DATE
	NONE	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT FOUNTAIN HILLS-STRUCTURE NUMBER 7

JOB NO. E70-180 DATE 12-24 & 12-28-70

LOG OF TEST BORING NO. 4

RIG TYPE CME-55

BORING TYPE NX DIAMOND CORE

SURFACE ELEV. 1920+

DATUM TRICO INTERNATIONAL TOPO

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			NX						100% WATER RETURN 100% CORE RECOVERY	SYENITE, GENERALLY MEDIUM TO COARSE GRAINED, GENERALLY SLIGHTLY WEATHERED, MODERATELY TO SLIGHTLY FRACTURED, HARD, LIGHT GRAY WITH DARK MOTTLING
5			NX						100% WATER RETURN 100% CORE RECOVERY	
										NOTE: MODERATELY TO HIGHLY WEATHERED FROM 12' TO 14½'
10			NX						100% WATER RETURN 70% CORE RECOVERY	
15			NX						100% WATER RETURN 95% CORE RECOVERY	
20										
			NX						100% WATER RETURN 100% CORE RECOVERY	
25			NX						100% WATER RETURN 100% CORE RECOVERY	
30										STOPPED CORING AT 30'

GROUND WATER

DEPTH	HOUR	DATE
	NONE	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

SERGENT, HAUSKINS & BECKWITH

PROJECT FOUNTAIN HILLS-STRUCTURE NUMBER 7

JOB NO. E70-180 DATE 12-28-70

LOG OF TEST BORING NO. 5

RIG TYPE CME-55

BORING TYPE NX DIAMOND CORE & TRICONE

SURFACE ELEV. 1932+ GEAR BIT

DATUM TRICO INTERNATIONAL TOPO

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0										SYENITE, GENERALLY COARSE GRAINED, MODERATELY TO HIGHLY WEATHERED, MODERATELY TO VERY FRACTURED, HARD TO SOFT, LIGHT GRAY WITH REDDISH MOTTLING
5				NX					100% WATER RETURN 100% CORE RECOVERY	
				NX						
10										STOPPED CORING AT 8'

GROUND WATER

DEPTH	HOUR	DATE

SAMPLE TYPE

A – Auger cuttings. B – Block sample

SERGENT, HAUSKINS & BECKWITH

FOUNTAIN HILLS-STRUCTURE NUMBER 7
FOUNTAIN HILLS, ARIZONA
JOB NO. E70-180

BORROW

HOLE NO.	DEPTH	DESCRIPTION	
1A	0-2'	CLAYEY SAND, SOME GRAVEL, OCCASIONAL COBBLES, SUBANGULAR, MEDIUM PLASTICITY, REDDISH-BROWN	S
	2'-11'	SILTY SAND, SOME GRAVEL & COBBLES, SUBANGULAR, LOW PLASTICITY, TAN	S
		(DUG WITH BACKHOE)	
2A	0-5'	CLAYEY SAND & GRAVEL, SOME COBBLES, SUBANGULAR, LOW PLASTICITY, REDDISH-BROWN	S
	5'-9'	SAND, GRAVEL & COBBLES, SUBANGULAR, SOME SILT, MODERATE CEMENTATION, NONPLASTIC, LIGHT BROWN	S
		(DUG WITH BACKHOE)	
3A	0-5'	SAND, CONSIDERABLE COBBLES TO 12", SOME SILT, NONPLASTIC, REDDISH-BROWN	S
	5'-8'	SAND, SOME GRAVEL, OCCASIONAL COBBLES, SOME SILT, NONPLASTIC, LIGHT BROWN	S
		(DUG WITH BACKHOE) (BACKHOE REFUSED AT 8')	
4A	0-1'	SANDY CLAY, SOME GRAVEL, OCCASIONAL COBBLES, SUBANGULAR, LOW PLASTICITY, REDDISH-BROWN	S
	1'-10'	SILTY SAND, SOME GRAVEL, FEW COBBLES, SLIGHT LIME CEMENTATION, LOW PLASTICITY, TAN	S
		(DUG WITH BACKHOE)	
5A	0-4'	SILTY SAND, CONSIDERABLE GRAVEL & COBBLES TO 4", SUBANGULAR, SLIGHT CEMENTATION, LOW PLASTICITY, REDDISH-BROWN	S
		(DUG WITH BACKHOE) (BACKHOE REFUSED AT 4')	

FOUNTAIN HILLS-STRUCTURE NUMBER 7
FOUNTAIN HILLS, ARIZONA
JOB NO. E70-180

BORROW

HOLE NO.	DEPTH	DESCRIPTION	
6A	0-3'	SILTY SAND, CONSIDERABLE GRAVEL, SOME COBBLES, NONPLASTIC, BROWN	S
	3'-6'	SAND, SOME GRAVEL, OCCASIONAL COBBLES, SLIGHT TO MODERATE CEMENTATION, NONPLASTIC, BROWN	S
	6'-9'	SAND, GRAVEL & COBBLES, GENERALLY WELL GRADED, SUBANGULAR, NONPLASTIC, BROWN	S
		(DUG WITH BACKHOE)	
7A	0-7'	SILTY SAND & GRAVEL, SOME COBBLES, STRATIFIED, SUBANGULAR, NONPLASTIC, BROWN	S
		(DUG WITH DOZER)	

APPENDIX B

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

REPORT ON LABORATORY TESTS

DATE _____

PROJECT Fountain Hills-Structure Number 7 JOB NO. E70-180

LOCATION Fountain Hills, Arizona LAB NO. 2599-1

CLIENT Trico International Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

SOURCE OF SAMPLE Structure No. 7 - Reservoir Area

MATERIAL _____ SAMPLED BY _____

SUBMITTED BY _____ REQUESTED BY _____

TESTED Permeability - ASTM D2434-68 DATE RECEIVED _____

TEST RESULTS

Sample	Rate of Permeability
Composite - Hole #5A, 1'-10'; #6A, 0-4'	352 feet/year

PHOENIX, ARIZONA
3944 WEST CLARENDON
(602) 264-4377

FLAGSTAFF, ARIZONA
2029 NORTH 4TH STREET
(602) 774-4433

EL PASO, TEXAS
201 NORTH CLARK ROAD
(915) 772-3088

TABULATION OF TEST RESULTS

Job No. E70-180 Date

Client:

Project FOUNTAIN HILLS-STRUCTURE NUMBER 7

FOUNTAIN HILLS, ARIZONA

Material BORROW

Source

HOLE NO.	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS — ACCUM. % PASSING												LAB. NO.
						200	100	40	16	10	4	¼	⅜	¾	1	1½	2	
1A	SEE SITE PLAN	0-2'	GC	28	11	28	32	37	45	51	57	65	72	82	86	89	96	2586-4
1A	SEE SITE PLAN	2'-11'	SW-SC	22	2	10	13	20	33	45	69	76	81	88	89	91	92	2586-5
2A	SEE SITE PLAN	0-5'	GW-GC	23	3	10	12	17	28	37	54	62	70	82	88	96	100	2586-6
2A	SEE SITE PLAN	5'-9'	GW-GM		NP	9	12	17	24	28	39	43	47	54	58	61	73	2586-7
3A	SEE SITE PLAN	0-5'	SW-SM		NP	12	14	19	31	44	61	66	71	77	80	86	89	2586-10
3A	SEE SITE PLAN	5'-8'	GW-GM		NP	9	11	15	21	27	34	37	41	49	55	58	66	2586-11
4A	SEE SITE PLAN	0-1'	SM	31	2	32	35	40	47	53	66	77	89	97	99	100		2586-12
4A	SEE SITE PLAN	1'-10'	SM-SC	24	5	46	54	62	69	75	90	93	95	97	98	98	99	2586-13
5A	SEE SITE PLAN	0-4'	GM-GC	23	4	29	31	34	43	50	59	61	63	72	78	84	89	2586-14
6A	SEE SITE PLAN	0-3'	SM		NP	19	23	31	45	54	71	76	80	88	91	94	98	2586-15
6A	SEE SITE PLAN	3'-6'	SW-SM		NP	7	10	15	26	36	59	68	75	84	88	91	96	2586-16
6A	SEE SITE PLAN	6'-9'	GW-GM		NP	7	9	13	21	26	37	43	49	64	72	78	85	2586-17
7A	SEE SITE PLAN	0-7'	GW-GM		NP	9	11	15	25	35	50	55	59	64	67	70	73	2586-18
4A* 8A*	SEE SITE PLAN	5'-8' 0-7'	SM	21	1	23	26	33	46	55	67	71	75	79	81	84	87	
5A* 6A*	SEE SITE PLAN	1'-10' 0-4'	SM		NP	31	37	44	54	60	72	76	80	86	89	96	96	

*COMPOSITE SAMPLE

TABULATION TEST RESULTS

Job No. E70-180 Date

Client:

Project FOUNTAIN HILLS-STRUCTURE NUMBER 7

FOUNTAIN HILLS, ARIZONA

Material EMBANKMENT FOUNDATION

Source

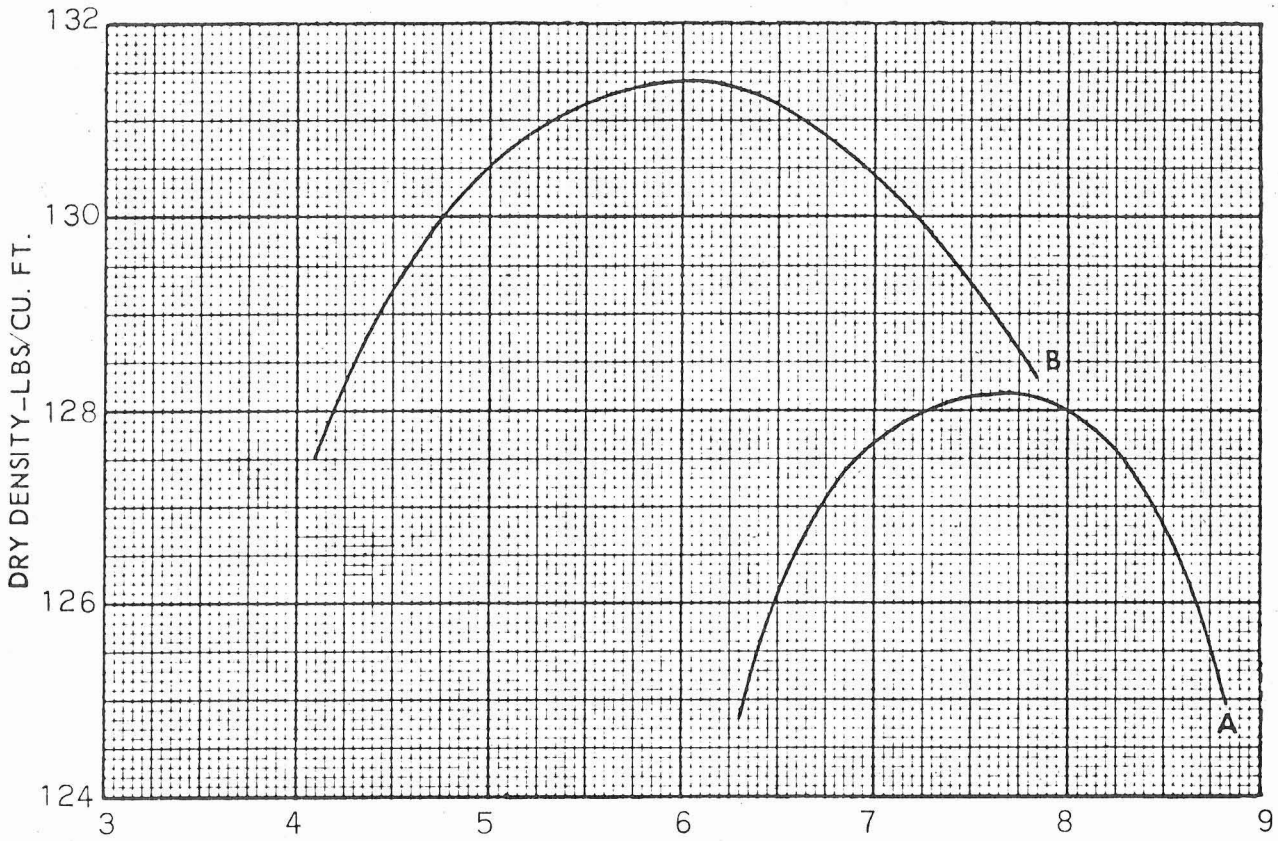
HOLE NO.	LOCATION	DEPTH	UNIFIED CLASS.	LL	PI	SIEVE ANALYSIS — ACCUM. % PASSING												3"	6"
						200	100	40	16	10	4	1/4	3/8	3/4	1	1 1/2	2		
3	SEE SITE PLAN	0-1'			NP	3	4	8	21	29	47	56	64	73	77	81	83	91	100
3	SEE SITE PLAN	1'-3'			NP	9	11	17	29	38	59	62	65	70	73	78	84	93	100

B-3

SERGENT, HAUSKINS & BECKWITH

SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT FOUNTAIN HILLS-STRUCTURE NUMBER 7 **JOB NO.** E70-180



CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
A	COMPOSITE SAMPLE #8A @ 0-7'; #4A @ 5'-8'	7.6	128.1	ASTM D698-66T	D	2599-1
B	COMPOSITE SAMPLE #5A @ 1'-10';#6A @ 0-4'	6.1	131.4	ASTM D698-66T	D	2599-2

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHO T99-61 and ASTM D 698-66T (Standard Proctor)

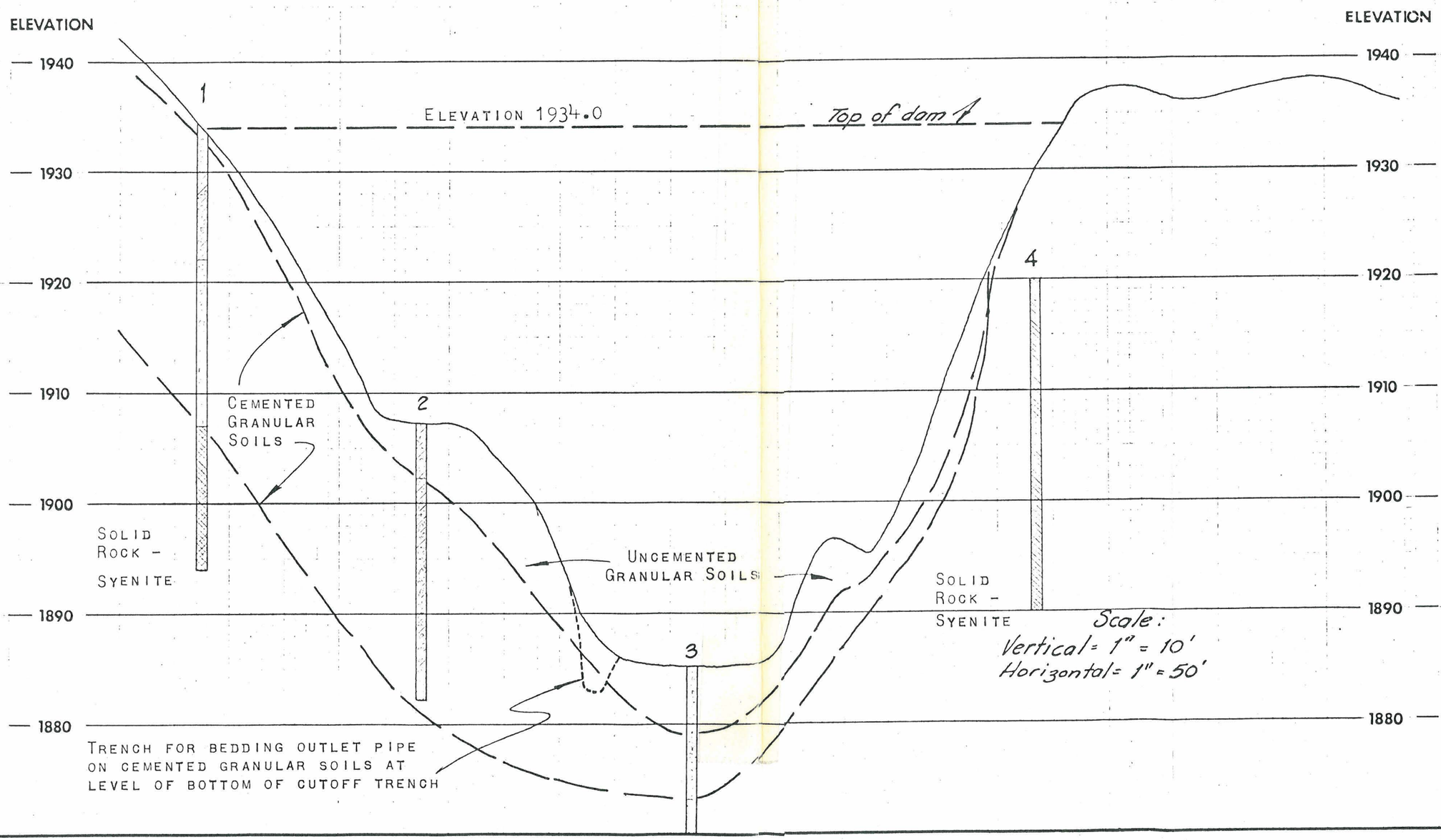
METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4''	4.58''	3	25	5.5 LBS.	12''	12,375
B	-#4	6''	4.58''	3	56	5.5 LBS.	12''	12,317
C	-3/4	4''	4.58''	3	25	5.5 LBS.	12''	12,375
D	-3/4	6''	4.58''	3	56	5.5 LBS.	12''	12,317

AASHO T180-61 and ASTM 1557-66T (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4''	4.58''	5	25	10.0 LBS.	18''	56,250
B	-#4	6''	4.58''	5	56	10.0 LBS.	18''	55,986
C	-3/4	4''	4.58''	5	25	10.0 LBS.	18''	56,250
D	-3/4	6''	4.58''	5	56	10.0 LBS.	18''	55,986

APPENDIX C

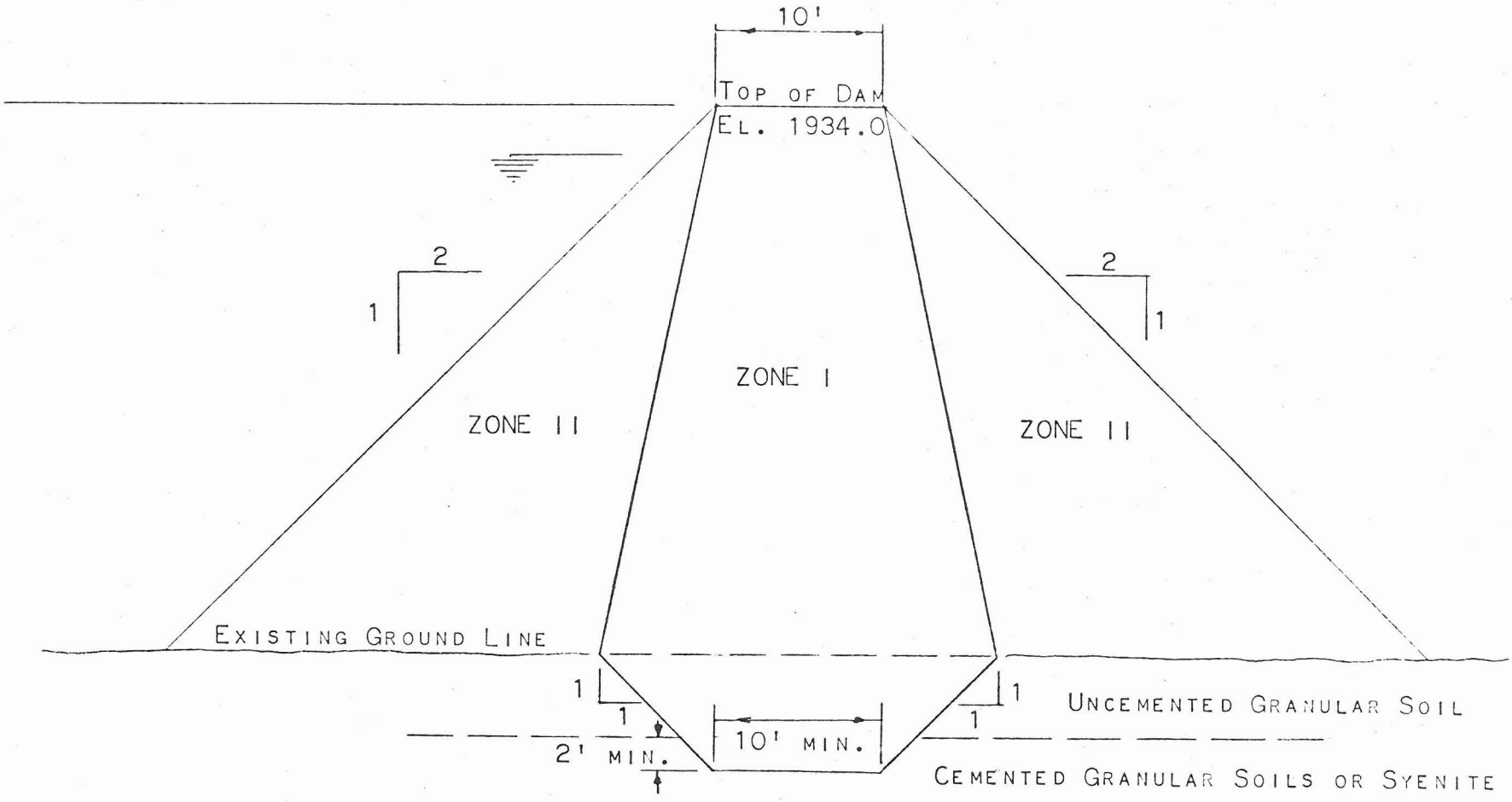
Geologic Profile
Structure #7
Fountain Hills, Arizona
SECTION A-A



C-1

RECOMMENDED EMBANKMENT DETAILS

STRUCTURE NUMBER 7
FOUNTAIN HILLS, ARIZONA
JOB NO. E70-180



SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
PHOENIX • FLAGSTAFF • EL PASO

GUIDE SPECIFICATIONS FOR EARTHWORK

SECTION I - GENERAL

THE ENGINEER SHALL ACT AS THE OWNER'S REPRESENTATIVE DURING CONSTRUCTION, SHALL PERFORM NECESSARY OBSERVATIONS AND TESTS TO VERIFY COMPLIANCE WITH SPECIFICATIONS AND SHALL APPROVE ALL ITEMS SPECIFIED.

SECTION II - CLEARING

(A) DESCRIPTION

CLEARING SHALL CONSIST OF REMOVING ALL TREES, STUMPS, BRUSH, CACTI, ROOTS, RUBBISH, DEBRIS AND OTHER OBJECTIONABLE MATTER FROM ALL AREAS TO RECEIVE EMBANKMENT IN THE RESERVOIR AREA AND THE BORROW AREAS AS DESIGNATED BY THE ENGINEER.

(B) DISPOSAL OF MATERIALS

MATERIALS FROM CLEARING OPERATIONS SHALL BE DISPOSED OF AS DIRECTED BY THE ENGINEER.

SECTION III - EXCAVATION

(A) DESCRIPTION

EXCAVATION SHALL CONSIST OF EXCAVATING ALL MATERIALS FROM THE CORE TRENCH, SPILLWAY AND OUTLET PIPE FOUNDATION TO THE LINES AND GRADES SHOWN ON THE PLANS OR DESIGNATED BY THE ENGINEER,

AND TRANSPORTING AND PLACING SAID MATERIALS IN STOCKPILE OR EMBANKMENT AREAS.

(B) Construction Details

THE EXCAVATED SOILS SHALL BE INCORPORATED INTO DESIGNATED ZONES OF THE EMBANKMENT. EXCAVATED MATERIALS SHALL EITHER BE PLACED DIRECTLY IN EMBANKMENT ZONES OR INITIALLY PLACED IN DESIGNATED STOCKPILE AREAS. THE ENGINEER MAY REQUIRE EXCAVATION OF SOFTER MORE COMPRESSIBLE SOILS IN THE CORE TRENCH AND OUTLET PIPE FOUNDATION BEYOND THE LINES AND GRADES SHOWN ON THE PLANS TO SUCH AN ELEVATION WHERE FIRM CEMENTED SOIL IS EXPOSED THROUGHOUT.

SECTION IV - EMBANKMENT

(A) Description

EMBANKMENT SHALL CONSIST OF THE FOLLOWING ITEMS:

1. ROLLING AND WATERING OF ALL FILL AS HEREAFTER SPECIFIED.
2. EXCAVATION OF NECESSARY MATERIALS FROM DESIGNATED BORROW AREAS, AND TRANSPORT TO AND PLACEMENT OF SAID MATERIALS IN APPROPRIATE EMBANKMENT SECTIONS.
3. EXCAVATION OF NECESSARY MATERIALS FROM TEMPORARY STOCKPILE AREAS AND TRANSPORT TO AND PLACEMENT OF SAID MATERIALS IN DESIGNATED EMBANKMENT SECTIONS.

(B) PLACEMENT AND COMPACTION OF FILL

ALL FILL MATERIALS SHALL BE PLACED IN CONTINUOUS HORIZONTAL LIFTS, BROUGHT TO APPROXIMATELY THE OPTIMUM MOISTURE CONTENT AND PROPERLY COMPACTED. THE ROLLED SURFACES OF ALL LAYERS OF EARTH FILL SHALL BE SO CONSTRUCTED AS TO PROVIDE A FIRM BOND WITH THE OVERLYING LAYER AND PREVENT DEVELOPMENT OF A STRATIFIED STRUCTURE.

THE DIFFERENCE IN ELEVATION BETWEEN ADJACENT ZONES OF COMPACTED FILL MATERIALS SHALL NOT EXCEED 4 FEET AT ANY TIME DURING EMBANKMENT CONSTRUCTION.

(C) REQUIRED DEGREE OF COMPACTION

1. MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT OF SOILS IN WHICH ACCURATE FIELD DENSITY TESTS CAN BE PERFORMED SHALL BE DETERMINED IN ACCORDANCE WITH ASTM D698-66T.

2. ALL EMBANKMENT MATERIALS IN ZONE I AND THOSE MATERIALS IN ZONE II CONTAINING MORE THAN 50 PERCENT PASSING THE NO. 4 SIEVE SHALL BE PLACED IN HORIZONTAL LIFTS AND COMPACTED TO A MINIMUM OF 95 PERCENT OF MAXIMUM DENSITY.

3. FOR PURPOSES OF ACCEPTANCE THE IN-PLACE DENSITY SHALL BE DEFINED AS THAT DETERMINED IN ACCORDANCE WITH ASTM D1556-64,

"DENSITY OF SOIL IN PLACE BY SAND-CONE METHOD". APPROPRIATE "ROCK CORRECTION" SHALL BE MADE TO ACCOUNT FOR THE FRACTION OF SOIL RETAINED ON THE NO. 4 SIEVE.

4. COMPACTION OF EMBANKMENT MATERIALS IN ZONE II WITH 50 PERCENT OR LESS PASSING THE NO. 4 SIEVE SHALL BE CONTROLLED ON A MINIMUM ROLLING BASIS AS FOLLOWS:

   A. LIFTS SHALL BE PLACED SO THEIR THICKNESS, WHEN COMPACTED, DOES NOT EXCEED 12 INCHES.

   B. COMPACTION SHALL BE ACCOMPLISHED BY A SPECIFIED NUMBER OF PASSES OF EQUIPMENT APPROVED BY THE SOILS ENGINEER. THE FOLLOWING TYPES OF PNEUMATIC ROLLERS WILL BE SATISFACTORY:

ROLLER TYPE	ROLLER RATING	WHEEL LOAD	TIRE INFLATION PRESSURE
A	45 TON MIN.	11 TON MIN.	140 PSI MIN.
B	45 TON MIN.	$5\frac{1}{2}$ TON MIN.	90 PSI MIN.

EACH LIFT SHALL BE COMPACTED WITH A MINIMUM OF 3 PASSES OF ROLLER A OR 5 PASSES WITH ROLLER B. OTHER TYPES OF ROLLERS CAN BE EVALUATED AS TO SUITABILITY AND REQUIRED COMPACTIVE EFFORT ESTABLISHED FOR THOSE WHICH ARE ACCEPTABLE BY THE ENGINEER.

   C. DURING COMPACTION THE MOISTURE CONTENT OF THE $-\frac{3}{4}$ FRACTION OF THE FILL SHALL BE MAINTAINED WITHIN 2 PERCENT OF THE OPTIMUM MOISTURE CONTENT AS DETERMINED IN ACCORDANCE WITH ASTM D698-66T, METHOD D.

(D) DESIGNATED EMBANKMENT MATERIALS

1. EMBANKMENT FILL MATERIALS SHALL COME FROM EXCAVATIONS FOR THE CORE TRENCH, SPILLWAY AND OUTLET PIPE AND FROM BORROW AREAS DESIGNATED BY THE ENGINEER. EMBANKMENT FILL MATERIALS SHOULD BE FREE OF VEGETATION AND DEBRIS AND OTHERWISE MEET THE FOLLOWING REQUIREMENTS:

(A) FILL IN ZONE I

PASSING 3 INCH SIEVE	- 100 PERCENT
PASSING NO. 4 SIEVE	- 60-100 PERCENT
PASSING NO. 200 SIEVE	- 15-35 PERCENT
PLASTICITY INDEX	- 5-25

(B) FILL IN ZONE II

PASSING 12 INCH SQUARE OPENING	- 100 PERCENT
PASSING NO. 200 SIEVE	- 0-20 PERCENT
PLASTICITY INDEX	- 5 MAXIMUM

SECTION V - CONCRETE

(A) DESCRIPTION

PORTLAND CEMENT CONCRETE SHALL CONSIST OF A MIXTURE OF CEMENT, FINE AGGREGATE, COARSE AGGREGATE, WATER, AN AIR-ENTRAINING ADMIXTURE, AND A WATER REDUCING ADMIXTURE.

(B) MATERIALS

1. THE CEMENT USED SHALL CONFORM TO THE

REQUIREMENTS FOR PORTLAND CEMENT AASHO M 85, TYPE II. THE CEMENT SHALL NOT CONTAIN MORE THAN 0.60 PERCENT TOTAL ALKALI. THE WORD "ALKALI" AS USED IN THESE SPECIFICATIONS SHALL BE TAKEN AS THE SUM OF SODIUM OXIDE (Na_2O) AND POTASSIUM OXIDE (K_2O) CALCULATED AS SODIUM OXIDE. THE DETERMINATION FOR TOTAL ALKALI SHALL BE MADE IN ACCORDANCE WITH ASTM C 114.

2. WATER FOR USE WITH CEMENT IN CONCRETE SHALL BE FREE FROM INJURIOUS AMOUNTS OF OIL, ACID, ALKALI, CLAY, VEGETABLE MATTER, SILT, SOLUBLE SALTS OR OTHER HARMFUL MATTER. WATER SHALL CONFORM TO AASHO T 26.

3. THE FINE AGGREGATE USED SHALL BE A NATURAL SAND OR OTHER APPROVED INERT MATERIAL WITH SIMILAR CHARACTERISTICS, COMPOSED OF CLEAN, HARD, STRONG, DURABLE, UNCOATED PARTICLES, FREE FROM LUMPS OF CLAY, SOFT OR FLAKY PARTICLES, LOAM, CALICHE, ICE, FROST OR ORGANIC MATTER. THE GRADING SHALL MEET THE FOLLOWING REQUIREMENTS:

PASSING NO. 4 SIEVE - 95-100%
PASSING NO. 16 SIEVE - 45-80%
PASSING NO. 50 SIEVE - 10-30%
PASSING NO. 100 SIEVE - 2-10%
PASSING NO. 200 SIEVE - 0-4%

FINE AGGREGATE SHALL HAVE A TOTAL LOSS NO GREATER THAN 10 PERCENT BY WEIGHT WHEN SUBJECTED TO 5 CYCLES OF THE SODIUM SULFATE SOUNDNESS TEST USING AASHO T 104.

4. THE COARSE AGGREGATE SHALL CONSIST OF CRUSHED STONE, GRAVEL OR OTHER APPROVED INERT MATERIAL OF SIMILAR CHARACTERISTICS HAVING HARD, STRONG, DURABLE, UNCOATED PIECES FREE FROM DELETERIOUS SUBSTANCES. IT SHALL CONFORM TO THE FOLLOWING GRADING REQUIREMENTS:

PASSING 1" SIEVE	- 100%
PASSING $\frac{3}{4}$" SIEVE	- 90-100%
PASSING 3/8" SIEVE	- 20-55%
PASSING NO. 4 SIEVE	- 0-10%
PASSING NO. 8 SIEVE	- 0-5%

IN ADDITION, THE PERCENTAGE OF COARSE AGGREGATE SHALL BE FROM 50% TO 60% OF THE TOTAL AGGREGATE BY WEIGHT.

5. AIR-ENTRAINING ADMIXTURES SHALL CONFORM TO THE REQUIREMENTS OF AASHO M 154 FOR 7 AND 28 DAY COMPRESSIVE AND FLEXURAL STRENGTH AND RESISTANCE TO FREEZING AND THAWING.

(c) <u>COMPOSITION OF MIX</u>

THE CONCRETE SHALL CONTAIN NO LESS THAN $5\frac{1}{2}$ BAGS OF CEMENT PER CUBIC YARD AND HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI. THE CONSISTENCY SLUMP RANGE SHALL BE 2 TO 5 INCHES.

IN ADDITION, THE CONCRETE SHALL CONTAIN NO LESS THAN 3 PERCENT OR MORE THAN 5 PERCENT ENTRAINED AIR AS DETERMINED BY AASHO T 152. THE WATER REDUCING ADMIXTURE SHALL CONFORM TO THE REQUIREMENTS OF MASTER BUILDERS POZZOLITH OR APPROVED EQUIVALENT, IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

(D) COLD WEATHER CONCRETING

EXCEPT BY SPECIFIC WRITTEN AUTHORIZATION FROM THE ENGINEER, CONCRETING OPERATIONS SHALL NOT BE CONTINUED WHEN A DESCENDING AIR TEMPERATURE IN THE SHADE AND AWAY FROM ARTIFICIAL HEAT FALLS BELOW 40 DEGREES F, NOR SHALL OPERATIONS BE RESUMED UNTIL AN ASCENDING AIR TEMPERATURE IN THE SHADE AND AWAY FROM ARTIFICIAL HEAT REACHES 35 DEGREES F.

WHEN CONCRETE IS BEING PLACED DURING COLD WEATHER AND THE AIR TEMPERATURE MAY BE EXPECTED TO DROP BELOW 35 DEGREES F, THE AIR TEMPERATURE SURROUNDING THE CONCRETE SHALL BE MAINTAINED AT A TEMPERATURE OF FROM 60 DEGREES F TO 90 DEGREES F FOR AT LEAST 72 HOURS AND AT A TEMPERATURE OF NOT LESS THAN 40 DEGREES F FOR A PERIOD OF NOT LESS THAN 7 DAYS.

(E) VIBRATING CONCRETE

ALL CONCRETE SHALL BE COMPACTED BY MEANS OF APPROVED PNEUMATIC OR ELECTRIC VIBRATORS TOGETHER WITH ANY OTHER COMPACTION EQUIPMENT NECESSARY TO PERFORM THE WORK AS SPECIFIED

HEREIN. THE MINIMUM FREQUENCY OF THE VIBRATORS SHALL BE 4500 CYCLES PER MINUTE. THE VIBRATORS SHALL BE PLACED IN THE CONCRETE AND SHALL NOT BE ATTACHED TO THE FORMS OR THE REINFORCING STEEL, NOR SHALL THEY BE ALLOWED TO VIBRATE AGAINST THEM.

(F) CURING OF CONCRETE

CAREFUL ATTENTION SHALL BE GIVEN BY THE CONTRACTOR TO THE PROPER CURING OF ALL CONCRETE. THE CURING OF CONCRETE SHALL BE ACCOMPLISHED BY WATER OR MEMBRANE CURING AND SHALL BE CONTINUED FOR A PERIOD OF AT LEAST 7 DAYS AFTER PLACING.

ALL SURFACES NOT COVERED BY FORMS SHALL BE PROTECTED FROM THE SUN AND KEPT WET TO THE TOUCH FOR THE ENTIRE WATER CURING PERIOD.

IMPERVIOUS MEMBRANE CURING SHALL CONSIST OF A CLEAR CURING COMPOUND APPLIED UNIFORMLY IN ONE OR MORE APPLICATIONS TOTALING NOT LESS THAN ONE GALLON TO EACH 150 SQUARE FEET. THE LIQUID MEMBRANE SHALL CONFORM TO THE REQUIREMENTS OF AASHO M 148.

DENSITY

DETERMINATIONS

SERGENT, HAUSKINS & BECKWITH CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAINE SERGENT, P.E. JOHN B. HAUSKINS, P.E. GEORGE H. BECKWITH, P.E.

DALE V. BEDENKOP, P.E. ROBERT D. BOOTH, P.E. BRUCE J. LEISER, P.E.

MAY 26, 1972

TRICO INTERNATIONAL, INC.
8718 EAST MCDOWELL ROAD
SCOTTSDALE, ARIZONA 85257

JOB NO. E72-42

ATTENTION: MR. ROGER TULK

RE: STRUCTURE NO. 7
RETENTION BASIN PROGRAM
FOUNTAIN HILLS, ARIZONA

GENTLEMEN,

SUBMITTED HEREWITH ARE THE RESULTS OF SIEVE ANALYSIS AND MOISTURE DENSITY RELATIONSHIPS PERFORMED IN OUR LABORATORY FOR THE PROPOSED BORROW SOURCES NECESSARY TO CONSTRUCT THE ABOVE REFERENCED PROJECT.

RESPECTFULLY SUBMITTED,
SERGENT, HAUSKINS & BECKWITH ENGINEERS

BY _____
DALE S. PARKER

COPIES: ADDRESSEE (3)

REPLY TO: 3940 W. CLARENDON, PHOENIX, ARIZONA 85019

PHOENIX (602) 272-6819 FLAGSTAFF (602) 774-4433 EL PASO (915) 772-3088 ALBUQUERQUE (505) 344-9940

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

REPORT OF SOIL TESTS

DATE 5-15-72

PROJECT STRUCTURE No. 7 JOB NO. E72-42

LOCATION FOUNTAIN HILLS, ARIZONA

CLIENT TRICO INTERNATIONAL, INC. ADDRESS 8718 EAST McDOWELL ROAD SCOTTSDALE, ARIZONA 85257

SAMPLED BY SHB/GDS SUBMITTED BY SHB/GDS

REQUESTED BY: JOE CHOPRA/TRICO DATE RECEIVED 4-27-72

0-4'
SOURCE N OF STREAM BED, W OF DAM
MATERIAL ZONE II BORROW
LAB NO. 72-42-1

MECHANICAL ANALYSIS

SIEVE SIZE	% RETAINED (INDIV.)	% PASSING (CUMUL)	
4''			
3''		100	
2''			
1-1/2''			
1''		87	
3/4''		84	
1/2''		80	
3/8''		77	
1/4''		72	
# 4		66	
# 8		48	
# 10		44	
# 16		29	
# 30			
# 40		19	
# 50			
# 100		12	
# 200		9	

LIQUID LIMIT 22 PLASTIC LIMIT 18

PLASTICITY INDEX 4

SOIL CLASSIFICATION: AASHO

UNIFIED

OTHER

4'-8'
SOURCE N OF STREAM BED, W OF DAM
MATERIAL ZONE II BORROW
LAB NO. 72-42-2

MECHANICAL ANALYSIS

SIEVE SIZE	% RETAINED (INDIV.)	% PASSING (CUMUL)	
4''			
3''		100	
2''			
1-1/2''			
1''		87	
3/4''		83	
1/2''		77	
3/8''		73	
1/4''		66	
# 4		59	
# 8		41	
# 10		36	
# 16		25	
# 30			
# 40		11	
# 50			
# 100		6	
# 200		4	

LIQUID LIMIT 20 PLASTIC LIMIT 19

PLASTICITY INDEX 1

SOIL CLASSIFICATION: AASHO

UNIFIED

OTHER

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

REPORT OF SOIL TESTS

DATE 5-15-72

PROJECT STRUCTURE No. 7 JOB NO. E72-42

LOCATION FOUNTAIN HILLS, ARIZONA

CLIENT TRICO INTERNATIONAL, INC. ADDRESS 8718 EAST McDOWELL ROAD SCOTTSDALE, ARIZONA 85257

SAMPLED BY SHB/GDS SUBMITTED BY SHB/GDS

REQUESTED BY: JOE CHOPRA/TRICO DATE RECEIVED 4-27-72

SOURCE 0-4' S OF STREAM BED & APPROX. 600' W OF DAM

MATERIAL RED BORROW FOR ZONE I

LAB NO. 72-42-3

MECHANICAL ANALYSIS

SIEVE SIZE	% RETAINED (INDIV.)	% PASSING (CUMUL)	
4''			
3''		100	
2''			
1-1/2''			
1''		96	
3/4''		93	
1/2''		89	
3/8''		86	
1/4''		78	
# 4		68	
# 8		47	
# 10		43	
# 16		28	
# 30			
# 40		18	
# 50			
# 100		13	
# 200		12	

LIQUID LIMIT 31 PLASTIC LIMIT 15

PLASTICITY INDEX 16

SOIL CLASSIFICATION: AASHO

UNIFIED

OTHER

SOURCE 0-4' S OF STREAM BED & APPROX. 900' W OF DAM

MATERIAL RED BORROW FOR ZONE I

LAB NO. 72-42-4

MECHANICAL ANALYSIS

SIEVE SIZE	% RETAINED (INDIV.)	% PASSING (CUMUL)	
4''			
3''		100	
2''			
1-1/2''			
1''		91	
3/4''		88	
1/2''		84	
3/8''		82	
1/4''		73	
# 4		66	
# 8		52	
# 10		47	
# 16		39	
# 30			
# 40		27	
# 50			
# 100		21	
# 200		18	

LIQUID LIMIT 34 PLASTIC LIMIT 16

PLASTICITY INDEX 18

SOIL CLASSIFICATION: AASHO

UNIFIED

OTHER

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

REPORT OF SOIL TESTS

DATE 5-15-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

SAMPLED BY SHB/GDS SUBMITTED BY SHB/GDS

REQUESTED BY: Joe Chopra/Trico DATE RECEIVED 4-27-72 & 5-4-72

SOURCE 0-4' S of Stream Bed & Approx. 1200' W of Dam

MATERIAL Red Borrow for Zone I

LAB NO. 72-42-5

MECHANICAL ANALYSIS

SIEVE SIZE	% RETAINED (INDIV.)	% PASSING (CUMUL)	
4''			
3''		100	
2''			
1-1/2''			
1''		94	
3/4''		91	
1/2''		86	
3/8''		82	
1/4''		73	
# 4		63	
# 8		44	
# 10		40	
# 16		28	
# 30			
# 40		21	
# 50			
# 100		17	
# 200		15	

LIQUID LIMIT 35 PLASTIC LIMIT 16

PLASTICITY INDEX 19

SOIL CLASSIFICATION: AASHO

UNIFIED

OTHER

SOURCE 0.6 mi. W of Dam in Stream Bed

MATERIAL Native

LAB NO. 72-42-7

MECHANICAL ANALYSIS

SIEVE SIZE	% RETAINED (INDIV.)	% PASSING (CUMUL)	
4''			
3''		100	
2''			
1-1/2''			
1''		95	
3/4''		93	
1/2''		91	
3/8''		89	
1/4''		85	
# 4		80	
# 8		60	
# 10		55	
# 16		35	
# 30			
# 40		19	
# 50			
# 100		10	
# 200		6	

LIQUID LIMIT PLASTIC LIMIT

PLASTICITY INDEX Nonplastic

SOIL CLASSIFICATION: AASHO

UNIFIED

OTHER

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

REPORT OF SOIL TESTS

DATE 5-15-72

PROJECT STRUCTURE No. 7 JOB NO. E72-42

LOCATION FOUNTAIN HILLS, ARIZONA

CLIENT TRICO INTERNATIONAL, INC. ADDRESS 8718 EAST McDOWELL ROAD SCOTTSDALE, ARIZONA 85257

SAMPLED BY SHB/GDS SUBMITTED BY SHB/GDS

REQUESTED BY: JOE CHOPRA/TRICO DATE RECEIVED 5-4-72

SOURCE 0.5 MI. N OF DAM IN STREAM BED

MATERIAL NATIVE

LAB NO. 72-42-8

MECHANICAL ANALYSIS

SIEVE SIZE	% RETAINED (INDIV.)	% PASSING (CUMUL)	
4''			
3''			
2''			
1-1/2''			
1''		88	
3/4''		84	
1/2''		80	
3/8''		77	
1/4''		72	
# 4		67	
# 8		49	
# 10		45	
# 16		29	
# 30			
# 40		16	
# 50			
# 100		8	
# 200		5	

LIQUID LIMIT _____ PLASTIC LIMIT _____

PLASTICITY INDEX NONPLASTIC

SOIL CLASSIFICATION: AASHO _____

UNIFIED _____

OTHER _____

SOURCE 0.4 MI. N OF DAM IN STREAM BED

MATERIAL NATIVE

LAB NO. 72-42-9

MECHANICAL ANALYSIS

SIEVE SIZE	% RETAINED (INDIV.)	% PASSING (CUMUL)	
4''			
3''			
2''			
1-1/2''			
1''		81	
3/4''		78	
1/2''		74	
3/8''		72	
1/4''		68	
# 4		63	
# 8		50	
# 10		46	
# 16		31	
# 30			
# 40		18	
# 50			
# 100		9	
# 200		6	

LIQUID LIMIT _____ PLASTIC LIMIT _____

PLASTICITY INDEX NONPLASTIC

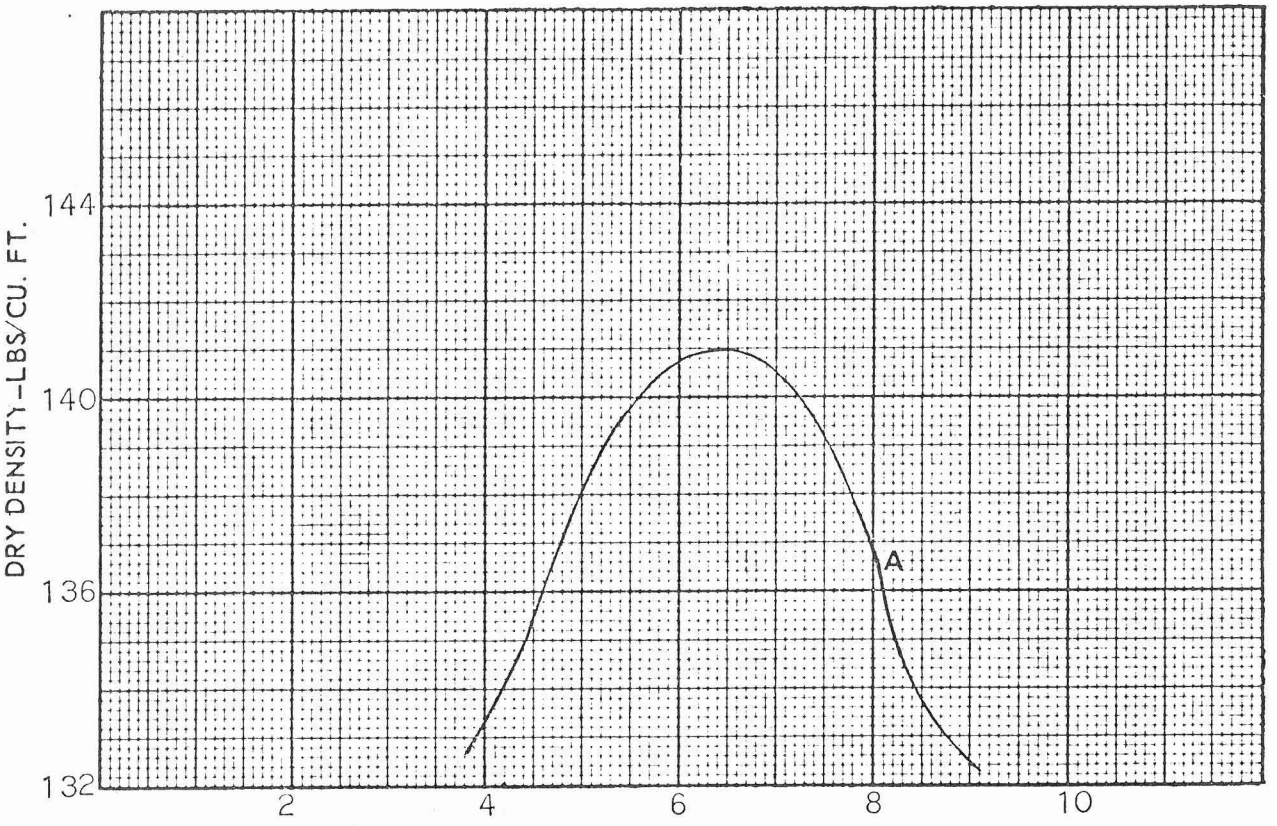
SOIL CLASSIFICATION: AASHO _____

UNIFIED _____

OTHER _____

SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT STRUCTURE No. 7 **JOB NO.** E72-42



MOISTURE CONTENT – % DRY WEIGHT

CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
A	W OF DAM, S OF STREAM BED - ZONE I BORROW	6.4	141.0	ASTM D1557-66T	C	72-42-6
	COMBINED SAMPLES 3, 4 & 5					

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHO T99-61 and ASTM D 698-66T (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHO T180-61 and ASTM 1557-66T (Modified Proctor)

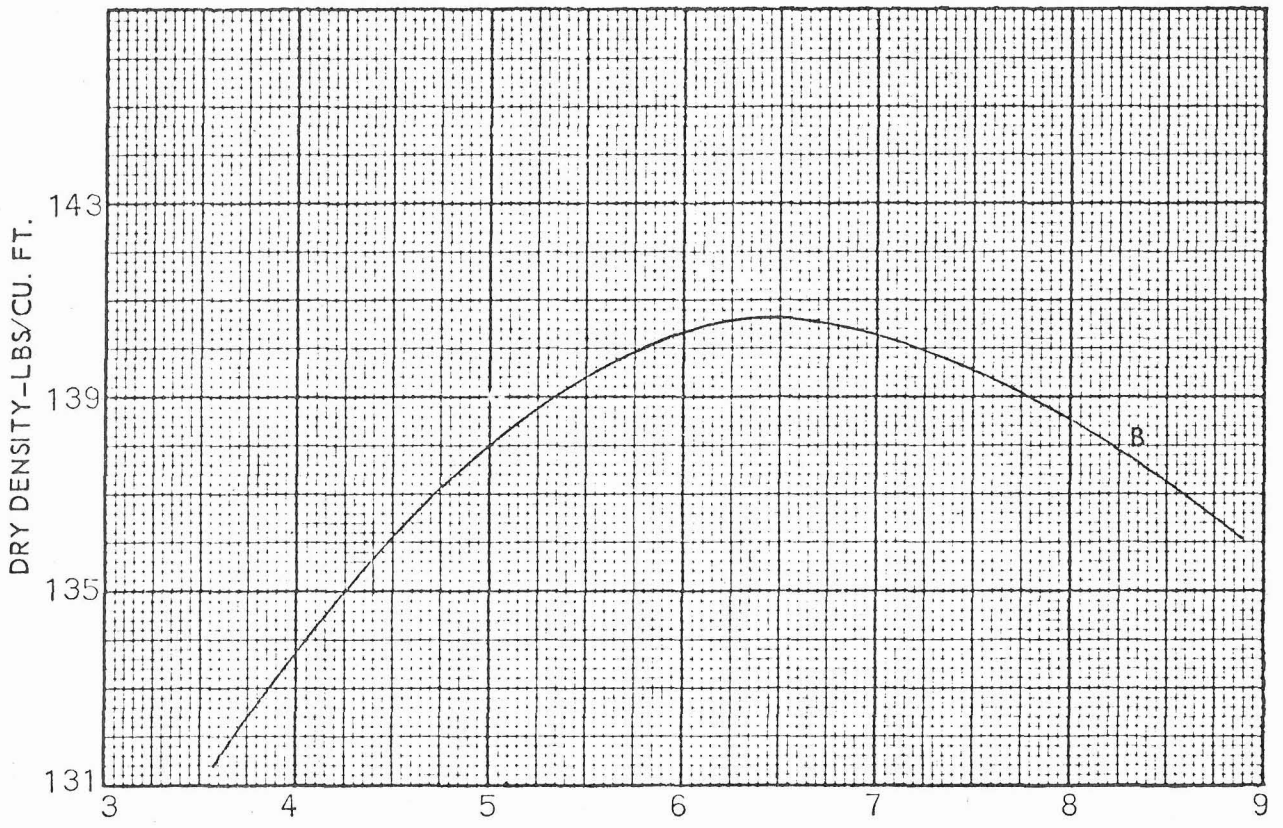
METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS

SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT STRUCTURE No. 7 **JOB NO.** E72-42



MOISTURE CONTENT – % DRY WEIGHT

CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
B	W OF DAM, N OF STREAM BED - ZONE II BORROW	6.4	140.7	ASTM D1557-66T	C	72-42-1

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHO T99-61 and ASTM D 698-66T (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHO T180-61 and ASTM 1557-66T (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS

SERGENT, HAUSKINS & BECKWITH CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAINE SERGENT, P.E. JOHN B. HAUSKINS, P.E. GEORGE H. BECKWITH, P.E.

DALE V. BEDENKOP, P.E. ROBERT D. BOOTH, P.E. BRUCE J. LEISER, P.E.

JUNE 13, 1972

McCULLOCH PROPERTIES, INC.
c/o TRICO INTERNATIONAL, INC.
8718 EAST McDOWELL ROAD
SCOTTSDALE, ARIZONA 85257

JOB No. E72-42

ATTENTION: MR. ROGER TULK

RE: STRUCTURE No. 7
RETENTION BASIN PROGRAM
FOUNTAIN HILLS, ARIZONA

GENTLEMEN,

SUBMITTED HEREWITH ARE THE RESULTS OF FIELD DENSITY TESTS PERFORMED AT THE ABOVE REFERENCED PROJECT FROM MAY 17, 1972 THROUGH MAY 30, 1972. ALSO ATTACHED IS A MOISTURE DENSITY RELATIONSHIP CURVE PERFORMED IN OUR LABORATORY.

RESPECTFULLY SUBMITTED,
SERGENT, HAUSKINS & BECKWITH ENGINEERS

BY _____
DALE S. PARKER

COPIES: ADDRESSEE (3)
ARIZONA WATER COMMISSION
ATTN: MR. JOSEPH D. WALTERS (1)

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 6-9-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF * TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
5-17-72	1	59'-	Sta. 1+50 on ℄ of core				
		60'		6.0	136.8	97.0	A
5-17-72	2	56'-	Sta. 1+50 3' R of ℄ of core				
		57'		5.5	134.6	95.5	A
5-17-72	3	53'-	Sta. 1+50 4' L of ℄ of core				
		54'		6.9	135.8	96.3	A
5-18-72	4	50'-	Sta. 2+00 on ℄ of core				
		51'		6.0	137.7	97.7	A
5-18-72	5	49½'-	Sta. 2+00 6' R of ℄ of core				
		50'		5.7	136.7	97.0	A
5-18-72	6	47'-	Sta. 2+50 5' L of ℄ of core				
		47½'		5.5	135.5	96.1	A
5-19-72	7	46½'-	Sta. 2+50 2' R of ℄ of core				
		47'		6.0	135.8	96.3	A
5-19-72	8	46'-	Sta. 1+50 on ℄ of core				
		46½'		6.0	137.7	97.7	A
5-19-72	9	44'-	Sta. 2+00 3' R of ℄				
		44½'		5.8	138.9	98.5	A
5-24-72	10	46½'-	Sta. 2+00 46' L of ℄				
		47'		6.6	131.4	97.7	C

*Below Grade

4/10

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 6-9-72

PROJECT STRUCTURE No. 7 JOB NO. E72-42

LOCATION FOUNTAIN HILLS, ARIZONA

CLIENT TRICO INTERNATIONAL, INC. ADDRESS 8718 EAST McDOWELL ROAD SCOTTSDALE, ARIZONA 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL NATIVE

DATE OF TEST	TEST NO.	DEPTH OF * TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
5-24-72	11	48'-	STA. 2+25 21' R OF ℄				
		48½'		5.6	127.8	95.0	C
5-24-72	12	46½'-	STA. 2+00 18' L OF ℄				
		47'		6.2	131.8	98.0	C
5-24-72	13	46½'-	STA. 2+00 40' R OF ℄				
		47'		6.0	130.7	97.1	C
5-24-72	14	45'-	STA. 2+00 ON ℄ OF CORE				
		45½'		4.8	137.8	97.7	A
5-24-72	15	45'-	STA. 1+75 40' L OF ℄				
		45½'		6.0	132.1	98.2	C
5-25-72	16	43½'-	STA. 2+25 20' L OF ℄				
		44'		6.5	132.9	98.8	C
5-25-72	17	43½'-	STA. 2+00 ON ℄ OF CORE				
		44'		6.4	137.7	97.6	A
5-25-72	18	44'-	STA. 2+50 40' R OF ℄				
		44½'		5.8	136.1	101.2	C
5-25-72	19	43½'-	STA. 2+00 20' R OF ℄				
		44'		6.3	133.6	99.3	C
5-25-72	20	43½'-	STA. 1+50 3' R OF ℄ OF CORE				
		44'		6.5	138.0	97.9	A

*BELOW GRADE

1/10

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 6-9-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF * TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
5-25-72	21	43½'-	Sta. 2+50 4' L of ℄ of core				
		44'		6.0	139.6	99.0	A
5-26-72	22	42½'-	Sta. 2+50 40' R of ℄				
		43'		5.9	133.1	99.0	C
5-26-72	23	43'-	Sta. 2+25 20' R of ℄				
		43½'		7.0	133.2	99.0	C
5-26-72	24	42½'-	Sta. 2+25 25' L of ℄				
		43'		6.4	131.6	97.8	C
5-26-72	25	39'-	Sta. 3+00 on ℄ of core				
		39½'		6.0	139.2	98.7	A
5-26-72	26	39½'-	Sta. 1+50 on ℄ of core				
		40'		5.7	136.7	97.0	A
5-26-72	27	41'-	Sta. 3+00 30' L of ℄				
		41½'		7.0	131.8	98.0	C
5-26-72	28	38'-	Sta. 2+00 40' R of ℄				
		38½'		6.5	131.5	97.7	C
5-30-72	29	39'-	Sta. 1+50 on ℄ of core				
		39½'		6.0	140.6	99.7	A
5-30-72	30	40'-	Sta. 2+50 4' R of ℄				
		40½'		5.6	133.5	95.0	A

*Below Grade

1/10

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 6-9-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

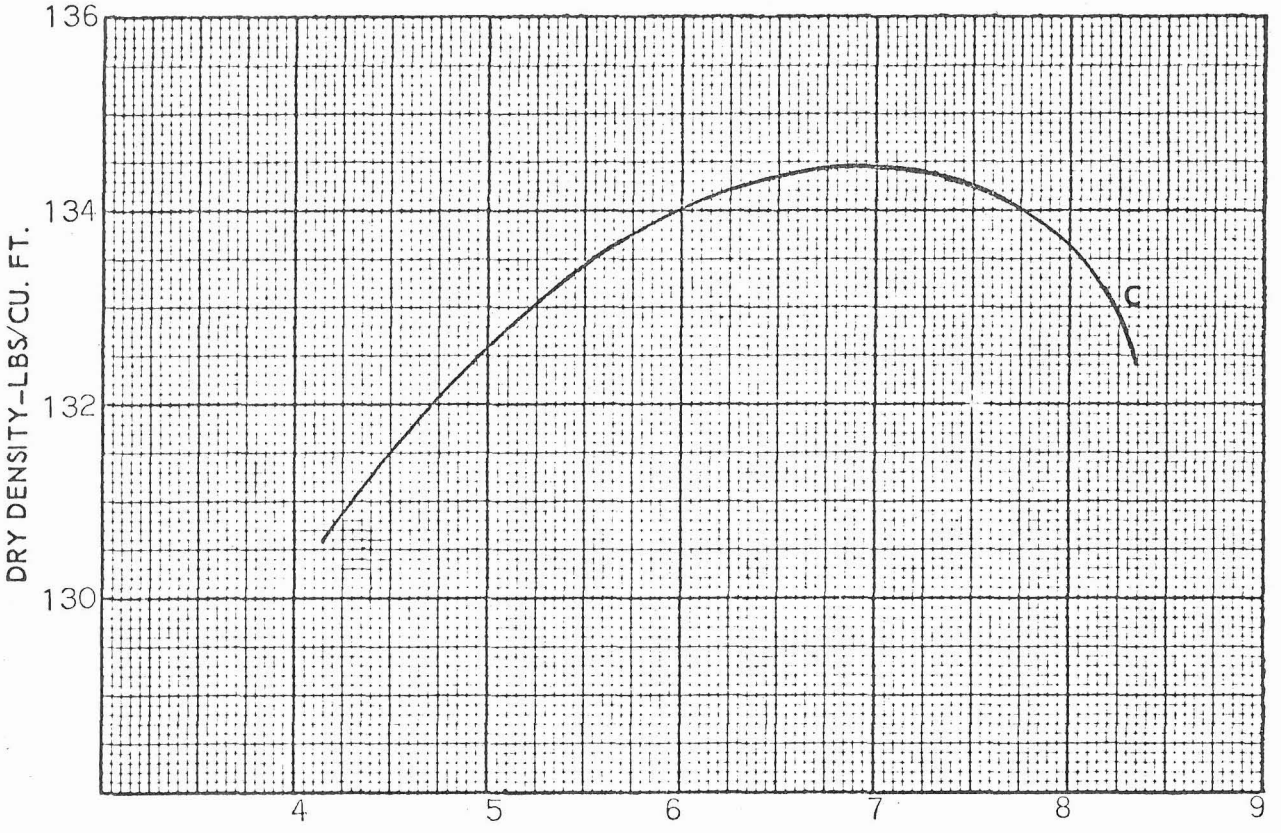
DATE OF TEST	TEST NO.	DEPTH OF *TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
5-30-72	31	40'-	Sta. 2+50 20' L of ℄				
		40½'		6.0	132.5	98.5	C
5-30-72	32	39½'-	Sta. 2+00 40' L of ℄				
		40'		6.2	131.0	97.4	C
5-30-72	33	40½'-	Sta. 2+75 33' R of ℄				
		41'		7.0	129.5	96.3	C
5-30-72	34	40½'-	Sta. 2+00 49' R of ℄				
		41'		6.8	132.0	98.2	C

*Below Grade

16

SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT STRUCTURE No. 7 **JOB NO.** E72-42



MOISTURE CONTENT – % DRY WEIGHT

CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
C	COMPOSITE OF 3 SAMPLES N OF DAM IN STREAM BED	7.0	134.5	ASTM D1557-66T	C	72-42-10

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHO T99-61 and ASTM D 698-66T (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHO T180-61 and ASTM 1557-66T (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

SERGENT, HAUSKINS & BECKWITH

SERGENT, HAUSKINS & BECKWITH CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAINE SERGENT, P.E. JOHN B. HAUSKINS, P.E. GEORGE H. BECKWITH, P.E.

DALE V. BEDENKOP, P.E. ROBERT D. BOOTH, P.E. BRUCE J. LEISER, P.E.

JULY 20, 1972

McCULLOCH PROPERTIES, INC.
c/o TRICO INTERNATIONAL, INC.
8718 EAST McDOWELL ROAD
SCOTTSDALE, ARIZONA 85257

JOB NO. E72-42

ATTENTION: MR. ROGER TULK

RE: STRUCTURE NO. 7
RETENTION BASIN PROGRAM
FOUNTAIN HILLS, ARIZONA

GENTLEMEN,

SUBMITTED HEREWITH ARE THE RESULTS OF FIELD DENSITY TESTS PERFORMED AT THE ABOVE REFERENCED PROJECT FROM JUNE 19, 1972 THROUGH JUNE 30, 1972. ALSO ATTACHED IS A MOISTURE DENSITY RELATIONSHIP CURVE PERFORMED IN OUR LABORATORY.

RESPECTFULLY SUBMITTED,
SERGENT, HAUSKINS & BECKWITH ENGINEERS

BY _____
DALE S. PARKER

COPIES: ADDRESSEE (3)
ARIZONA WATER COMMISSION
ATTN: MR. JOSEPH D. WALTERS (1)

REPLY TO: 3940 W. CLARENDON, PHOENIX, ARIZONA 85019

PHOENIX (602) 272-6848 FLAGSTAFF (602) 774-4433 EL PASO (915) 772-3088 ALBUQUERQUE (505) 344-9940

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 7-19-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
6-19-72	35	1'-	Sta. 2+50 30' R of ℄				
		1½'		7.0	131.8	98.0	C
6-19-72	36	2'-	Sta. 2+50 on ℄ of core				
		2½'		5.6	136.0	97.7	G
6-19-72	37	3'-	Sta. 2+50 20' L of ℄				
		3½'		6.5	132.4	98.4	C
6-28-72	38	46'-	Sta. 2+00 on ℄ of core				
		46½'		6.2	133.7	96.0	G
6-28-72	39	46½'-	Sta. 2+50 35' R of ℄				
		47'		7.5	132.2	98.3	C
6-28-72	40	46'-	Sta. 2+75 35' L of ℄				
		46½'		6.1	132.1	98.2	C
6-29-72	41	45'-	Sta. 2+50 on ℄ of core				
		45½'		5.0	133.1	95.6	G
6-29-72	42	44'-	Sta. 2+60 40' L of ℄				
		44½'		7.5	132.7	98.7	C
6-29-72	43	44'-	Sta. 3+00 45' R of ℄				
		44½'		7.5	134.1	99.7	C
6-30-72	44	43'-	Sta. 1+75 on ℄ of core				
		43½'		6.5	138.1	99.2	G

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 7-19-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

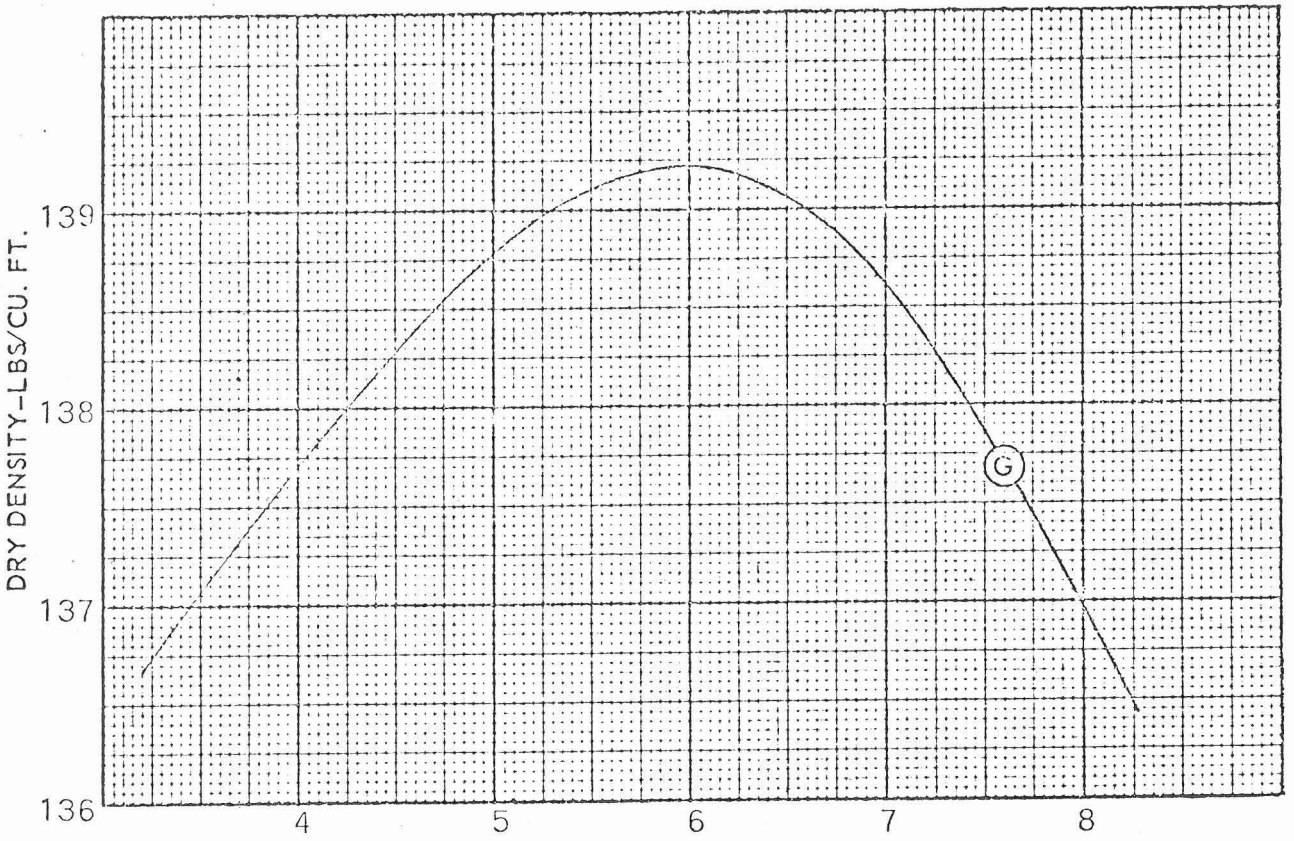
MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
6-30-72	45	43'-	Sta. 2+50 25' L of ℄				
		43½'		6.4	135.9	101.0	C
6-30-72	46	43'-	Sta. 3+00 45' R of ℄				
		43½'		5.9	133.7	99.4	C

6/2

SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Structure No. 4 JOB NO. E72-41



CURVE	SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS./CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
G	Borrow Pit West of Dam 2'-5'	6.0	139.2	ASTM D1557	C	72-41-10

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA

AASHO T99-61 and ASTM D 698-66T (Standard Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS/CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
B	-#4	6"	4.58"	3	56	5.5 LBS.	12"	12,317
C	-3/4	4"	4.58"	3	25	5.5 LBS.	12"	12,375
D	-3/4	6"	4.58"	3	56	5.5 LBS.	12"	12,317

AASHO T180-61 and ASTM 1557-66T (Modified Proctor)

METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
B	-#4	6"	4.58"	5	56	10.0 LBS.	18"	55,986
C	-3/4	4"	4.58"	5	25	10.0 LBS.	18"	56,250
D	-3/4	6"	4.58"	5	56	10.0 LBS.	18"	55,986

SERGENT, HAUSKINS & BECKWITH

CONSULTING SOIL AND FOUNDATION ENGINEERS

SERGENT, HAUSKINS & BECKWITH CONSULTING SOIL AND FOUNDATION ENGINEERS

APPLIED SOIL MECHANICS • ENGINEERING GEOLOGY • MATERIALS ENGINEERING

B. DWAINE SERGENT, P.E. JOHN B. HAUSKINS, P.E. GEORGE H. BECKWITH, P.E.

DALE V. BEDENKOP, P.E. ROBERT D. BOOTH, P.E. BRUCE J. LEISER, P.E.

AUGUST 8, 1972

MCCULLOCH PROPERTIES, INC.
C/O TRICO INTERNATIONAL, INC.
8718 EAST MCDOWELL ROAD
SCOTTSDALE, ARIZONA 85257

JOB NO. E72-42

ATTENTION: MR. ROGER TULK

RE: STRUCTURE NO. 7
RETENTION BASIN PROGRAM
FOUNTAIN HILLS, ARIZONA

GENTLEMEN,

SUBMITTED HEREWITH ARE THE RESULTS OF FIELD DENSITY TESTS PERFORMED AT THE ABOVE REFERENCED PROJECT FROM JULY 5, 1972 THROUGH AUGUST 1, 1972.

IF THERE ARE ANY QUESTIONS REGARDING THESE TESTS, PLEASE DO NOT HESITATE TO CALL.

RESPECTFULLY SUBMITTED,
SERGENT, HAUSKINS & BECKWITH ENGINEERS

BY Peter L. Burt
PETER L. BURT

COPIES: ADDRESSEE (3)
ARIZONA WATER COMMISSION
ATTN: MR. JOSEPH D. WALTERS (1)

REPLY TO: 3940 W. CLARENDON, PHOENIX, ARIZONA 85019

PHOENIX (602) 272-6848 FLAGSTAFF (602) 774-4433 EL PASO (915) 772-3088 ALBUQUERQUE (505) 344-9940

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-5-72	47	37' -	Sta 2+00 on ℄ of core				
		37½'		6.5	137.5	98.0	G
7-5-72	48	37' -	Sta 2+50 25' L of ℄				
		37½'		6.6	133.2	99.1	C
7-5-72	49	37' -	Sta 3+00 60' R of ℄				
		37½'		6.4	134.8	100.1	C
7-6-72	50	31' -	Sta 3+00 65' L of ℄				
		31½'		7.1	133.9	99.5	C
7-6-72	51	33½' -	Sta 2+00 on ℄ of core				
		34'		7.6	133.8	96.1	G
7-6-72	52	35½' -	Sta 2+00 70' R of ℄				
		36'		6.2	130.2	96.9	C
7-7-72	53	30' -	Sta 3+00 40' L of ℄				
		30½'		6.9	131.4	97.7	C
7-7-72	54	32' -	Sta 3+00 on ℄ of core				
		32½'		7.0	135.6	97.4	G
7-7-72	55	34' -	Sta 2+25 30' R of ℄				
		34½'		7.7	129.5	96.3	C
7-10-72	56	31' -	Sta 3+00 on ℄ of core				
		31½'		5.8	136.5	97.0	G

3/10

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS./CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-10-72	57	33' -	Sta 2+00 40' R of ℄				
		33½'		5.6	132.1	98.2	C
7-10-72	58	31' -	Sta 3+75 22' L of ℄				
		31½'		5.9	130.2	96.9	C
7-11-72	59	30' -	Sta 2+00 33' R of ℄				
		30½'		5.8	139.0	103.2	C
7-11-72	60	30' -	Sta 3+25 on ℄ of core				
		30½'		7.0	134.2	96.4	G
7-11-72	61	30' -	Sta 2+50 20' L of ℄				
		30½'		6.4	135.7	100.8	C
7-12-72	62	29' -	Sta 1+50 on ℄ of core				
		29½'		5.8	137.2	98.5	G
7-12-72	63	29' -	Sta 2+50 20' R of ℄				
		29½'		7.2	135.6	100.8	C
7-12-72	64	29' -	Sta 3+25 15' L of ℄				
		29½'		7.6	136.1	101.3	C
7-12-72	65	28' -	Sta 2+00 on ℄ of core				
		28½'		6.5	139.5	100.1	G
7-12-72	66	28' -	Sta 3+00 18' R of ℄				
		28½'		7.2	135.4	100.7	C

2/10

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-12-72	67	28' -	Sta 3+50 20' L of ℄				
		28½'		7.5	136.8	101.5	C
7-13-72	68	27' -	Sta 2+25 20' R of ℄				
		27½'		5.9	136.3	100.6	C
7-13-72	69	27' -	Sta 2+15 on ℄ of core				
		27½'		6.5	138.1	99.3	G
7-13-72	70	27' -	Sta 3+30 30' L of ℄				
		27½'		8.0	130.5	97.2	C
7-13-72	71	26' -	Sta 2+00 40' R of ℄				
		26½'		5.8	128.2	95.3	C
7-13-72	72	26' -	Sta 2+50 on ℄ of core				
		26½'		5.8	138.3	99.4	G
7-13-72	73	26' -	Sta 3+00 46' L of ℄				
		26½'		6.4	134.1	99.6	C
7-14-72	74	25' -	Sta 3+00 on ℄ of core				
		25½'		7.8	135.5	97.4	G
7-14-72	75	25' -	Sta 1+75 30' R of ℄				
		25½'		5.9	135.1	100.6	C
7-14-72	76	25' -	Sta 2+75 30' L of ℄				
		25½'		6.8	135.8	101.0	C

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-14-72	77	24' -	Sta 3+75 on ℄ of core				
		24½'		7.0	138.2	99.3	G
7-14-72	78	24' -	Sta 3+50 21' R of ℄				
		24½'		6.1	135.8	100.8	C
7-14-72	79	24' -	Sta 2+50 28' L of ℄				
		24½'		8.0	135.5	100.7	C
7-17-72	80	23' -	Sta 1+50 on ℄ of core				
		23½'		6.3	138.8	99.6	G
7-17-72	81	23' -	Sta 2+50 30' R of ℄				
		23½'		6.5	136.7	101.6	C
7-17-72	82	23' -	Sta 3+50 30' L of ℄				
		23½'		7.6	133.6	99.3	C
7-18-72	83	22' -	Sta 3+00 3' R of ℄				
		22½'		6.6	137.2	98.5	G
7-18-72	84	22' -	Sta 2+00 20' R of ℄				
		22½'		6.2	133.7	99.5	C
7-18-72	85	22' -	Sta 2+50 26' L of ℄				
		22½'		7.0	132.5	98.6	C
7-18-72	86	21' -	Sta 2+25 on ℄ of core				
		21½'		6.4	136.5	98.0	G

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-18-72	87	21' -	Sta 2+50 28' L of ℄				
		21½'		6.6	136.5	101.5	C
7-18-72	88	21' -	Sta 3+75 30' R of ℄				
		21½'		7.0	133.6	99.4	C
7-19-72	89	20' -	Sta 2+50 on ℄ of core				
		20½'		6.7	137.5	98.8	G
7-19-72	90	20' -	Sta 2+00 18' R of ℄				
		20½'		5.9	133.0	99.0	C
7-19-72	91	19' -	Sta 3+75 20' L of ℄				
		19½'		7.8	133.4	99.3	C
7-19-72	92	19' -	Sta 3+75 on ℄ of core				
		19½'		6.6	136.1	97.8	G
7-19-72	93	19' -	Sta 2+00 15' R of ℄				
		19½'		6.3	136.8	101.6	C
7-20-72	94	18' -	Sta 1+50 20' R of ℄				
		18½'		7.4	132.8	98.9	C
7-20-72	95	18' -	Sta 2+50 on ℄ of core				
		18½'		6.0	138.2	99.3	G
7-20-72	96	18' -	Sta 3+50 20' L of ℄				
		18½'		6.4	133.0	98.9	C

8/0

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-20-72	97	17' -	Sta 1+00 12' R of ℄				
		17½'		7.3	135.5	100.8	C
7-20-72	98	17' -	Sta 2+00 on ℄ of core				
		17½'		5.6	137.2	98.4	G
7-20-72	99	17' -	Sta 3+00 16' L of ℄				
		17½'		7.5	136.5	101.5	C
7-21-72	100	16' -	Sta 2+50 on ℄ of core				
		16½'		6.9	136.8	98.3	G
7-21-72	101	16' -	Sta 1+00 15' L of ℄				
		16½'		7.3	132.2	98.3	C
7-21-72	102	16' -	Sta 3+00 18' R of ℄				
		16½'		6.6	133.4	99.2	C
7-24-72	103	15' -	Sta 1+00 on ℄ of core				
		15½'		6.8	137.2	98.6	G
7-24-72	104	15' -	Sta 2+00 15' R of ℄				
		15½'		7.7	134.8	100.2	C
7-24-72	105	15' -	Sta 3+00 20' L of ℄				
		15½'		7.2	137.3	102.8	C
7-24-72	106	14' -	Sta 2+00 on ℄ of core				
		14½'		6.6	137.6	98.9	G

0/10

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-24-72	107	14' -	Sta 2+00 20' R of ℄				
		14½'		6.0	135.2	100.5	C
7-24-72	108	14' -	Sta 3+00 28' L of ℄				
		14½'		8.2	134.4	99.9	C
7-24-72	109	13' -	Sta 1+25 15' R of ℄				
		13½'		6.3	135.7	100.9	C
7-24-72	110	13' -	Sta 2+25 on ℄ of core				
		13½'		7.0	137.4	98.7	G
7-24-72	111	13' -	Sta 3+50 15' L of ℄				
		13½'		7.9	131.8	98.0	C
7-25-72	112	12' -	Sta 1+75 14' R of ℄				
		12½'		8.0	137.1	101.9	C
7-25-72	113	12' -	Sta 2+50 on ℄ of core				
		12½'		6.6	137.7	98.9	G
7-25-72	114	12' -	Sta 3+50 20' L of ℄				
		12½'		6.8	134.9	100.3	C
7-25-72	115	11' -	Sta 3+75 20' R of ℄				
		11½'		8.1	132.5	98.5	C
7-26-72	116	11' -	Sta 3+00 on ℄ of core				
		11½'		7.2	136.4	97.9	G

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS./CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-26-72	117	11' -	Sta 2+50 20' L of ℄				
		11½'		7.4	132.4	98.4	C
7-26-72	118	10' -	Sta 2+50 30' R of ℄				
		10½'		7.9	135.9	101.1	C
7-26-72	119	10' -	Sta 2+75 on ℄ of core				
		10½'		7.0	135.3	97.1	G
7-26-72	120	10' -	Sta 3+50 24' L of ℄				
		10½'		5.9	135.4	100.7	C
7-27-72	121	9' -	Sta 3+00 on ℄ of core				
		9½'		6.6	135.1	97.0	G
7-27-72	122	9' -	Sta 3+25 20' R of ℄				
		9½'		8.2	133.6	99.3	C
7-27-72	123	8' -	Sta 2+00 15' L of ℄				
		8½'		5.7	135.3	100.6	C
7-27-72	124	8' -	Sta 1+50 on ℄ of core				
		8½'		7.3	136.3	97.9	G
7-27-72	125	7' -	Sta 3+00 10' R of ℄				
		7½'		5.7	134.7	100.1	C
7-28-72	126	7' -	Sta 1+00 on ℄ of core				
		7½'		7.3	134.9	96.9	G

1/10

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT STRUCTURE No. 7 JOB NO. E72-42

LOCATION FOUNTAIN HILLS, ARIZONA

CLIENT TRICO INTERNATIONAL, INC. ADDRESS 8718 EAST McDOWELL ROAD SCOTTSDALE, ARIZONA 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL NATIVE

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
7-28-72	127	6' -	STA 2+50 12' L OF ℄				
		6½'		7.4	131.7	97.9	C
7-28-72	128	6' -	STA 3+00 ON ℄ OF CORE				
		6½'		6.8	137.1	98.5	G
7-28-72	129	5' -	STA 1+75 12' R OF ℄				
		5½'		8.2	132.4	99.1	C
7-28-72	130	5' -	STA 2+75 13' L OF ℄				
		5½'		7.3	132.7	98.7	C
7-31-72	131	4' -	STA 1+50 5' R OF ℄				
		4½'		7.0	134.0	96.3	G
7-31-72	132	4' -	STA 3+50 12' L OF ℄				
		4½'		6.4	136.2	97.7	G
7-31-72	133	3' -	STA 2+00 10' R OF ℄				
		3½'		7.2	134.8	96.9	G
7-31-72	134	3' -	STA 3+00 ON ℄ OF CORE				
		3½'		7.0	136.0	97.7	G
8-1-72	135	2' -	STA 0+75 3' R OF ℄				
		2½'		7.1	134.0	96.4	G
8-1-72	136	2' -	STA 2+25 4' L OF ℄				
		2½'		6.5	135.5	97.2	G

SERGENT, HAUSKINS & BECKWITH
CONSULTING SOIL AND FOUNDATION ENGINEERS
MATERIALS TESTING ENGINEERS

ENGINEERING ANALYSIS • PHYSICAL TESTING • QUALITY CONTROL • FIELD EXPLORATION

FIELD DENSITY TEST DATA

DATE 8-8-72

PROJECT Structure No. 7 JOB NO. E72-42

LOCATION Fountain Hills, Arizona

CLIENT Trico International, Inc. ADDRESS 8718 East McDowell Road Scottsdale, Arizona 85257

ARCHITECT/ENGINEER CONTRACTOR

REQUESTED BY PERFORMED BY SHB/GDS

MATERIAL Native

DATE OF TEST	TEST NO.	DEPTH OF TEST	LOCATION	MOISTURE CONTENT % DRY WT.	DRY DENSITY LBS/CU.FT.	% MAX DRY DENSITY	CURVE NO.
8-1-72	137	1'-	Sta 3+00 on ℄ of core				
		1½'		7.3	133.5	96.0	G
8-1-72	138	1'-	Sta 1+00 on ℄ of core				
		1½'		7.0	136.5	97.4	G

TESTS

ON

CONCRETE CYLINDERS

F 72-42

ATL Testing Laboratories

A Division of R & D Engineering Associates, Inc.

817 West Madison • Phoenix, Arizona 85007 • Telephone 254-6181

For: Sergent, Hauskins & Beckwith
3940 West Clarendon
Phoenix, Arizona 85019

Date: July 12, 1972
June 21, 1972

Received:	6-15-72	Project:	Fountain Hills
Submitted by:	Same, G.D. Swindle	Address of Project:	
Contractor:	Trico International	Source of Sample:	Structure #7 Outle Pipe Cradle
Sub. Contractor:	Anderson		
~~Ready Mix~~:		Mix:	2500 psi
Concrete Co.:	Union Rock & Matls.	Admix:	---
Truck No.:	392	Batch Size:	10 cu. yds.
Ticket No.:	02-09904	Water Added:	15 gallons
Time in Mixer:		Time Sampled:	10:30 AM

REPORT OF CONCRETE CYLINDER TESTS

Lab. No.	Ident. No.	Slump (In.)	Date Made	Date Tested	Age (Days)	lbs./sq. in.
868	Set 36	3½	6-14-72	6-21-72	7	2210
869	Set 36	3½	6-14-72	7-12-72	28	3290
870					Hold	

Respectfully submitted,

ATL TESTING LABORATORIES

Richard H. Nelson

Richard H. Nelson

LICENSE OF APPROVAL

State of Arizona
DEPARTMENT OF WATER RESOURCES
Division of Safety of Dams

LICENSE OF APPROVAL

Pursuant to Chapter 3, Title 45-Waters, of the Arizona Revised Statutes, the DIRECTOR, Department of Water Resources authorizes the use of: FOUNTAIN HILLS FRS #7 *Dam and Reservoir, Application Number* 07.32 *Located in Sec.* 16-17 *, Tp.* 3N *, R.* 6E *, G. & S.R.B. & M.* Maricopa *County, State of Arizona to impound water in accordance with and subject to the following terms and conditions:*

(1) Use shall be only as a flood retarding structure, limited to temporary storage during periods of flood and for such additional time as may be required to completely evacuate the flood waters through the outlet conduit, (2) The owner shall take reasonable action toward removal of the deficiencies present at the dam in a timely manner.

This license of approval supersedes every previous consent for use issued by the State of Arizona relative to said dam and reservoir.

Witness my hand and seal of the Arizona Department of Water Resources

6th *day of* December *, 19* 84 *.*

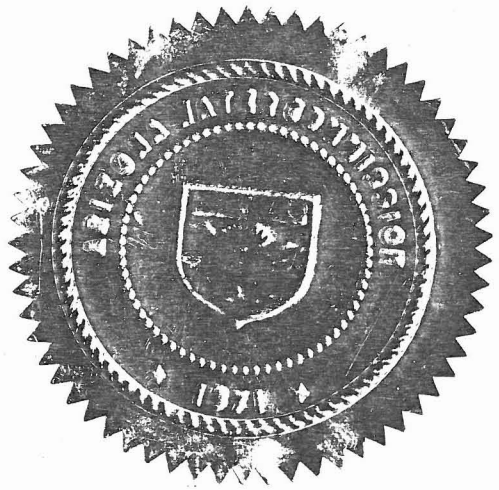
Wesley E. Steiner

WESLEY E. STEINER
DIRECTOR

State of Arizona
OFFICE OF THE STATE WATER ENGINEER
Supervision of Safety of Dams

License of Approval

Pursuant to Chapter 3, Title 45 (Waters), of the Arizona Revised Statutes, the STATE WATER ENGINEER has found that the FOUNTAIN HILLS DAM #7 *Dam and Reservoir, State Application Number* 7-32, *located in Sec.* 16-17, *Tp.* 3N, *R.* 6E, *G. & S. R. B & M,* Maricopa *County, State of Arizona, are safe to impound water; and the use of said dam and reservoir to impound water in accordance with and subject to the following terms and conditions is hereby authorized:* Use shall be only as a flood retarding structure, limited to temporary storage during periods of flood and for such additional time as may be required to completely evacuate the flood waters through the principal spillway



This license of approval supersedes every previous consent for use issued by the State of Arizona relative to said dam and reservoir.

Witness my hand and the seal of the Arizona Water Commission of the State of Arizona this

15th *day of* May, 1973.

WESLEY E. STEINER,
STATE WATER ENGINEER

Benson G. Scott

By Chief, Supervision of Safety of Dams

VOLUME II

COMPUTER CALCULATIONS

FOR

HYDROLOGY & HYDRAULIC

STRUCTURE NO. 7

HYDROLOGY PROGRAM FOR IBM 1130 - DATED JULY, 1971

FOUNTAIN HILLS STRUCTURE NUMBER 7 TR-20 ROUTING.

EXECUTIVE CONTROL CARD OPERATION LIST

FOUNTAIN HILLS STRUCTURE NUMBER 7

C TABLE VELOCITY INCREMENT = 0.200

8	0.0000	0.0800	0.1600	0.2500	0.3200
8	0.3700	0.4100	0.4500	0.4900	0.5100
8	0.5400	0.5700	0.5900	0.6100	0.6300
8	0.6500	0.6600	0.6700	0.6900	0.7000
8	0.7100	0.7200	0.7300	0.7400	0.7500
8	0.7600	0.7700	0.7700	0.7800	0.7900
8	0.7900	0.8000	0.8100	0.8100	0.8200
8	0.8200	0.8300	0.8300	0.8400	0.8400
8	0.8400	0.8500	0.8500	0.8600	0.8600
8	0.8600	0.8600	0.8700	0.8700	0.8700
8	0.8800	0.8800	0.8800	0.8900	0.8900
8	0.8900	0.8900	0.8900	0.8900	0.9000
8	0.9000	0.9000	0.9000	0.9000	0.9100
8	0.9100	0.9100	0.9100	0.9100	0.9100
8	0.9200	0.9200	0.9200	0.9200	0.9200
8	0.9200	0.9200	0.9200	0.9300	0.9300
9 ENDTBL					

CROSS SECTION NO. 41 DRAINAGE AREA = 1.00

	ELEVATION	DISCHARGE	END AREA
8	2215.0004	0.0000	0.0000
8	2216.0004	604.0001	43.0000
8	2217.0004	1972.0002	92.0000
8	2219.0004	6656.0009	208.0000
9 ENDTBL			

CROSS SECTION NO. 42 DRAINAGE AREA = 1.00

	ELEVATION	DISCHARGE	END AREA
8	2315.0004	0.0000	0.0000
8	2316.0004	1278.0002	73.0000
8	2317.0004	4119.0009	152.0000
8	2319.0004	13507.0019	328.0000
9 ENDTBL			

CROSS SECTION NO. 43 DRAINAGE AREA = 1.00

	ELEVATION	DISCHARGE	END AREA
8	2215.0004	0.0000	0.0000
8	2216.0004	640.0001	73.0000
8	2217.0004	2063.0004	152.0000
8	2219.0004	6766.0009	328.0000
9 ENDTBL			

CROSS SECTION NO. 44 DRAINAGE AREA = 1.00

	ELEVATION	DISCHARGE	END AREA

SYSILA/3 REPORT

8	2215.0004	0.0000	0.0000
8	2216.0004	913.0001	103.0000
8	2217.0004	2922.0004	212.0000
8	2219.0004	9473.0019	448.0000
9 ENDTBL			

CROSS SECTION NO. 45 DRAINAGE AREA = 1.00

	ELEVATION	DISCHARGE	END AREA
8	2030.0002	0.0000	0.0000
8	2031.0002	1322.0002	103.0000
8	2032.0002	4233.0009	212.0000
8	2034.0002	13722.0019	448.0000
9 ENDTBL			

CROSS SECTION NO. 46 DRAINAGE AREA = 1.00

	ELEVATION	DISCHARGE	END AREA
8	2030.0002	0.0000	0.0000
8	2031.0002	435.0000	43.0000
8	2032.0002	1419.0002	92.0000
8	2034.0002	4786.0009	208.0000
9 ENDTBL			

CROSS SECTION NO. 47 DRAINAGE AREA = 1.00

	ELEVATION	DISCHARGE	END AREA
8	2030.0002	0.0000	0.0000
8	2031.0002	1322.0002	103.0000
8	2032.0002	4233.0009	212.0000
8	2034.0002	13722.0019	448.0000
9 ENDTBL			

CROSS SECTION NO. 48 DRAINAGE AREA = 1.00

	ELEVATION	DISCHARGE	END AREA
8	1884.0002	0.0000	0.0000
8	1885.0002	1025.0002	103.0000
8	1886.0002	3280.0004	212.0000
8	1888.0002	10638.0019	448.0000
9 ENDTBL			

STRUCTURE NO. 7

	ELEVATION	DISCHARGE	STORAGE
8	1884.0002	0.0000	0.0000
8	1896.0002	198.0000	2.7999
8	1900.0002	233.0000	6.3999
8	1904.0002	265.0000	11.5999
8	1908.0002	293.0000	18.5999
8	1912.0002	319.0000	28.5999
8	1916.0002	343.0000	41.7999
8	1920.0002	365.0000	61.7999
8	1926.0002	395.0000	108.0000
8	1927.0002	829.0001	128.0999
8	1928.0002	1640.0002	148.1999
8	1930.0002	4033.0004	173.6999

used in design

SYSTEM/3 REPORT

```
 8                        1932.0002   7306.0009    203.6999
 8                        1934.0002  11384.0019    233.5999
 9 ENDTBL

DIMENSIONLESS HYDROGRAPH - DELTA T =  0.02

 8              0.0000      0.0150      0.0750      0.1600      0.2800
 8              0.4300      0.6000      0.7700      0.8900      0.9700
 8              1.0000      0.9800      0.9200      0.8400      0.7500
 8              0.6600      0.5650      0.4900      0.4200      0.3650
 8              0.3200      0.2790      0.2400      0.2100      0.1800
 8              0.1550      0.1300      0.1130      0.0980      0.0860
 8              0.0750      0.0650      0.0560      0.0470      0.0410
 8              0.0350      0.0300      0.0260      0.0220      0.0190
 8              0.0170      0.0150      0.0130      0.0110      0.0090
 8              0.0070      0.0050      0.0030      0.0020      0.0010
 8              0.0000      0.0000      0.0000      0.0000      0.0000
 9 ENDTBL

RAINFALL TABLE NO. 1      TIME INCREMENT =  0.50

 8              0.0000      0.0050      0.0110      0.0160      0.0220
 8              0.0280      0.0350      0.0410      0.0480      0.0560
 8              0.0630      0.0710      0.0800      0.0890      0.0980
 8              0.1090      0.1200      0.1330      0.1470      0.1630
 8              0.1810      0.2040      0.2350      0.2830      0.6630
 8              0.7350      0.7720      0.7990      0.8200      0.8380
 8              0.8540      0.8680      0.8800      0.8910      0.9020
 8              0.9120      0.9210      0.9290      0.9370      0.9450
 8              0.9520      0.9590      0.9650      0.9720      0.9780
 8              0.9840      0.9890      0.9950      1.0000      1.0000
 9 ENDTBL

RAINFALL TABLE NO. 2      TIME INCREMENT =  0.02

 8              0.0000      0.0100      0.0200      0.0200      0.0300
 8              0.0400      0.0500      0.0600      0.0700      0.0800
 8              0.1000      0.1100      0.1300      0.1400      0.1700
 8              0.1900      0.2200      0.2300      0.3800      0.4400
 8              0.5200      0.6000      0.6300      0.6600      0.6800
 8              0.7000      0.7200      0.7400      0.7600      0.7700
 8              0.7900      0.8000      0.8200      0.8300      0.8400
 8              0.8500      0.8700      0.8800      0.8900      0.9000
 8              0.9100      0.9200      0.9300      0.9400      0.9500
 8              0.9567      0.9633      0.9700      0.9800      0.9900
 8              1.0000      1.0000      1.0000      1.0000      1.0000
 9 ENDTBL
```

SYSFILA/3 REPORT

STANDARD CONTROL INSTRUCTIONS

SUBRTN	XSECTN	STRCT	HYDROGRAPHS IN1	IN2	OUT	DATA NO. 1	DATA NO. 2	DATA NO. 3	OUTPUT OPTIONS PK	H	E	V	PH	SM
RUNOFF	41	0	0	0	4	0.130	90.000	0.170	1	0	0	0	0	1
RUNOFF	42	0	0	0	1	0.560	90.000	0.200	1	0	0	0	0	1
REACH	43	0	1	0	2	2300.000	0.000	0.000	0	0	0	0	0	0
RUNOFF	43	0	0	0	1	0.240	90.000	0.150	1	0	0	0	0	0
ADDHYD	43	0	1	2	3	0.000	0.000	0.000	1	0	0	1	0	1
ADDHYD	44	0	3	4	1	0.000	0.000	0.000	1	0	0	1	0	1
REACH	45	0	1	0	2	3800.000	0.000	0.000	0	0	0	0	0	0
RUNOFF	45	0	0	0	1	0.250	90.000	0.230	1	0	0	0	0	0
ADDHYD	45	0	1	2	3	0.000	0.000	0.000	1	0	0	1	0	1
RUNOFF	46	0	0	0	1	0.200	90.000	0.230	1	0	0	0	0	0
ADDHYD	47	0	1	3	2	0.000	0.000	0.000	1	0	0	1	0	1
REACH	48	0	2	0	1	5000.000	0.000	0.000	0	0	0	0	0	0
RUNOFF	48	0	0	0	2	0.290	90.000	0.330	1	0	0	0	0	0
ADDHYD	48	0	1	2	3	0.000	0.000	0.000	1	0	0	1	0	1
RESVOR	0	7	3	0	4	1884.000	0.000	0.000	1	1	1	1	0	1
ENDATA														

END OF LISTING

SYSTEM/3 REPORT

EXECUTIVE CONTROL CARD OPERATION INCREM, MAIN TIME INCREMENT= 0.15
EXECUTIVE CONTROL CARD OPERATION COMPUT, FROM XSECTN/STRUCT 41/ 0 TO XSECTN/STRUCT 0/ 7
STARTING TIME= 0.00 RAIN DEPTH= 3.20 RAIN DURATION= 6.00 RAIN TABLE NO.= 2 SOIL CONDITION= 2
ALTERNATE NO.= 1 STORM NO.= 1

SUBROUTINE RUNOFF CROSS SECTION 41
AREA= 0.13 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.17
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.29	161.029	(RUNOFF)
2.50	147.080	(RUNOFF)
3.22	40.458	(RUNOFF)
3.88	34.173	(RUNOFF)
4.36	32.902	(RUNOFF)
5.17	21.138	(RUNOFF)
5.93	21.973	(RUNOFF)

HYDROGRAPH, TZERO= 1.04 DELTA T= 0.15 DRAINAGE AREA= 0.13

TIME											
1.04	DISCHG	0.00	2.28	4.27	8.65	11.53	20.05	27.26	36.83	153.32	129.73
2.55	DISCHG	143.08	80.46	56.06	41.67	39.79	39.81	34.58	31.70	27.02	34.07
4.05	DISCHG	23.29	20.87	32.80	24.72	21.19	20.68	20.67	20.71	20.75	17.62
5.55	DISCHG	14.35	14.76	19.69	20.71	7.84	1.07	0.09	0.00		

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1343 CFS-HRS= 179.06 ACRE-FT= 14.79

SUBROUTINE RUNOFF CROSS SECTION 42
AREA= 0.56 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.20
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.30	657.937	(RUNOFF)
2.50	621.164	(RUNOFF)
3.87	143.841	(RUNOFF)
4.37	132.821	(RUNOFF)
5.17	90.607	(RUNOFF)
5.94	92.208	(RUNOFF)

HYDROGRAPH, TZERO= 1.04 DELTA T= 0.15 DRAINAGE AREA= 0.56

TIME											
1.04	DISCHG	0.00	7.75	17.63	34.48	44.79	83.56	110.89	142.01	619.63	551.18
2.55	DISCHG	609.19	387.72	260.27	188.46	172.88	171.61	155.84	132.66	122.95	143.18
4.05	DISCHG	105.43	91.46	131.97	111.68	93.19	89.70	89.06	89.22	89.39	79.25
5.55	DISCHG	63.53	62.98	82.19	88.63	44.18	8.46	1.37	0.06	0.00	

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1424 CFS-HRS= 774.27 ACRE-FT= 63.98

SUBROUTINE REACH CROSS SECTION 43

SYSTEM/3 REPORT

LENGTH= 2300.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 8.767 AVERAGE ROUTING COEFF= 0.8375 NUMBER OF ROUTINGS= 0.40

SUBROUTINE RUNOFF CROSS SECTION 43
AREA= 0.24 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.15
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.29	301.111	(RUNOFF)
2.49	274.387	(RUNOFF)
3.22	74.990	(RUNOFF)
3.88	63.902	(RUNOFF)
4.35	63.657	(RUNOFF)
5.17	39.177	(RUNOFF)
5.93	41.396	(RUNOFF)

HYDROGRAPH, TZERO= 1.04 DELTA T= 0.15 DRAINAGE AREA= 0.24

TIME											
1.04	DISCHG	0.00	4.96	8.04	16.79	23.32	37.35	52.28	76.10	287.79	241.88
2.55	DISCHG	265.37	137.46	98.15	75.12	73.23	73.55	61.10	60.69	47.70	63.77
4.05	DISCHG	41.42	38.08	63.56	43.80	38.67	38.11	38.18	38.26	38.33	31.31
5.55	DISCHG	26.09	27.56	37.03	38.47	11.12	1.11	0.02	0.00		

SUBROUTINE ADDHYD CROSS SECTION 43
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.49	869.085	2216.16
3.88	198.840	2215.31
4.38	180.216	2215.28
5.17	129.164	2215.20
5.95	126.877	2215.19

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1668 CFS-HRS= 1118.74 ACRE-FT= 92.45

SUBROUTINE ADDHYD CROSS SECTION 44
INPUT HYDROGRAPHS= 3,4 OUTPUT HYDROGRAPH= 1

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.49	1016.073	2216.05
3.88	233.022	2215.25
4.38	212.971	2215.23
5.17	150.312	2215.16
5.95	148.736	2215.16

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1623 CFS-HRS= 1297.81 ACRE-FT= 107.25

SUBROUTINE REACH CROSS SECTION 45
LENGTH= 3800.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 12.834 AVERAGE ROUTING COEFF= 0.8830 NUMBER OF ROUTINGS= 0.48

SYSTEM 2 REPORT

SUBROUTINE RUNOFF CROSS SECTION 45
AREA= 0.25 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.23
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.32	271.757	(RUNOFF)
2.51	272.740	(RUNOFF)
3.86	62.629	(RUNOFF)
4.39	56.079	(RUNOFF)
5.17	40.300	(RUNOFF)
5.95	39.953	(RUNOFF)

HYDROGRAPH, TZERO= 1.04 DELTA T= 0.15 DRAINAGE AREA= 0.25

TIME											
1.04	DISCHG	0.00	2.75	7.37	14.13	18.52	35.55	46.54	59.64	249.94	244.47
2.55	DISCHG	269.09	189.30	125.15	89.01	78.63	76.81	71.29	58.99	57.24	62.19
4.05	DISCHG	49.42	41.69	55.30	51.94	42.62	40.38	39.87	39.82	39.89	36.48
5.55	DISCHG	29.24	28.03	35.59	39.00	23.75	5.94	1.32	0.21	0.00	

SUBROUTINE ADDHYD CROSS SECTION 45
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.52	1242.384	2030.93
3.84	281.567	2030.21
4.46	252.437	2030.19
5.17	189.539	2030.14
5.97	177.206	2030.13

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1807 CFS-HRS= 1660.69 ACRE-FT= 137.24

SUBROUTINE RUNOFF CROSS SECTION 46
AREA= 0.20 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.23
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.32	217.413	(RUNOFF)
2.51	218.188	(RUNOFF)
3.86	50.098	(RUNOFF)
4.39	44.861	(RUNOFF)
5.17	32.235	(RUNOFF)
5.95	31.959	(RUNOFF)

HYDROGRAPH, TZERO= 1.04 DELTA T= 0.15 DRAINAGE AREA= 0.20

TIME											
1.04	DISCHG	0.00	2.20	5.89	11.30	14.82	28.44	37.23	47.71	199.95	195.57
2.55	DISCHG	215.27	151.44	100.12	71.21	62.91	61.45	57.03	47.19	45.79	49.75
4.05	DISCHG	39.54	33.35	44.24	41.55	34.09	32.30	31.89	31.85	31.91	29.18
5.55	DISCHG	23.39	22.42	28.47	31.20	19.00	4.75	1.05	0.17	0.00	

SYSTEM/3 REPORT

SUBROUTINE ADDHYD CROSS SECTION 47
INPUT HYDROGRAPHS= 1,3 OUTPUT HYDROGRAPH= 2

DUE TO STORAGE OVERFLOW, THE SUM OF HYDROGRAPHS 1 AND 3 WAS TRUNCATED HERE TO 100 VALUES.

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.52	1460.295	2031.04
3.85	331.610	2030.25
4.45	295.267	2030.22
5.17	221.807	2030.16
5.97	208.925	2030.15

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1767 CFS-HRS= 1938.59 ACRE-FT= 160.20

SUBROUTINE REACH CROSS SECTION 48
LENGTH= 5000.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 10.733 AVERAGE ROUTING COEFF= 0.8632 NUMBER OF ROUTINGS= 0.74

SUBROUTINE RUNOFF CROSS SECTION 48
AREA= 0.29 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.33
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.54	293.254	(RUNOFF)
4.48	63.063	(RUNOFF)
5.98	43.103	(RUNOFF)

SUBROUTINE ADDHYD CROSS SECTION 48
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.62	1679.205	1885.29
4.53	348.121	1884.33
6.07	233.299	1884.22

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1929 CFS-HRS= 2363.46 ACRE-FT= 195.31

SUBROUTINE RESVOR STRUCTURE 7
SURFACE ELEVATION= 1884.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
4.04	377.957	1922.59

TIME		HYDROGRAPH, TZERO= 1.04				DELTA T= 0.15			DRAINAGE AREA= 1.66		
1.04	DISCHG	0.00	1.27	8.26	24.98	51.86	90.66	146.33	201.85	233.82	280.66
1.04	ELEV	1884.00	1884.07	1884.50	1885.51	1887.14	1889.49	1892.86	1896.44	1900.10	1906.23
2.55	DISCHG	321.42	347.67	362.85	369.67	373.02	374.91	376.17	377.07	377.60	377.84
2.55	ELEV	1912.40	1916.85	1919.61	1920.93	1921.60	1921.98	1922.23	1922.41	1922.52	1922.56
4.05	DISCHG	377.94	377.82	377.43	377.06	376.77	376.29	375.57	374.74	373.88	373.00
4.05	ELEV	1922.58	1922.56	1922.48	1922.41	1922.35	1922.25	1922.11	1921.94	1921.77	1921.60

SYSTEM/8 REPORT

5.55	DISCHG	372.01	370.80	369.48	368.25	367.14	365.74	362.79	358.47	353.79	349.04
5.55	ELEV	1921.40	1921.16	1920.89	1920.65	1920.42	1920.14	1919.59	1918.81	1917.96	1917.09
7.05	DISCHG	344.32	337.50	329.97	322.62	313.92	303.96	294.32	280.77	267.19	248.69
7.05	ELEV	1916.24	1915.08	1913.82	1912.60	1911.21	1909.68	1908.20	1906.25	1904.31	1901.96
8.55	DISCHG	229.00	202.97	100.97	39.43	15.39	6.01	2.34	0.91	0.35	0.13
8.55	ELEV	1899.54	1896.56	1890.11	1886.38	1884.93	1884.36	1884.14	1884.05	1884.02	1884.00
10.05	DISCHG	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10.05	ELEV	1884.00	1884.00	1884.00	1884.00	1884.00	1884.00	1884.00	1884.00	1884.00	

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1913 CFS-HRS= 2361.80 ACRE-FT= 195.17

ENDCMP 1

SYSTEM/3 REPORT

EXECUTIVE CONTROL CARD OPERATION INCREM, MAIN TIME INCREMENT= 0.25
EXECUTIVE CONTROL CARD OPERATION COMPUT, FROM XSECTN/STRUCT 41/ 0 TO XSECTN/STRUCT 0/ 7
STARTING TIME= 0.00 RAIN DEPTH= 4.20 RAIN DURATION= 1.00 RAIN TABLE NO.= 1 SOIL CONDITION= 2
ALTERNATE NO.= 1 STORM NO.= 2

SUBROUTINE RUNOFF CROSS SECTION 41
AREA= 0.13 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.17
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.92	246.813	(RUNOFF)
16.87	7.465	(RUNOFF)
19.37	5.472	(RUNOFF)
20.37	4.800	(RUNOFF)
21.40	4.784	(RUNOFF)
22.37	4.137	(RUNOFF)
23.40	4.119	(RUNOFF)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1654 CFS-HRS= 265.57 ACRE-FT= 21.94

SUBROUTINE RUNOFF CROSS SECTION 42
AREA= 0.56 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.20
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.93	1036.847	(RUNOFF)
16.87	32.086	(RUNOFF)
19.37	23.549	(RUNOFF)
20.37	20.667	(RUNOFF)
21.41	20.552	(RUNOFF)
23.41	17.651	(RUNOFF)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1654 CFS-HRS= 1144.00 ACRE-FT= 94.54

SUBROUTINE REACH CROSS SECTION 43
LENGTH= 2300.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 10.238 AVERAGE ROUTING COEFF= 0.8576 NUMBER OF ROUTINGS= 0.21

SUBROUTINE RUNOFF CROSS SECTION 43
AREA= 0.24 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.15
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.91	463.845	(RUNOFF)
16.87	13.785	(RUNOFF)
19.37	10.107	(RUNOFF)
20.37	8.871	(RUNOFF)
21.39	8.862	(RUNOFF)
22.37	7.650	(RUNOFF)

SYSTEM/3 REPORT

23.39 7.629 (RUNOFF)

HYDROGRAPH, TZERO= 5.25 DELTA T= 0.25 DRAINAGE AREA= 0.24

TIME											
5.25	DISCHG	0.00	1.17	1.61	1.94	2.24	2.53	2.80	3.06	4.04	4.44
7.75	DISCHG	4.78	5.10	6.36	6.82	7.74	8.19	9.76	10.31	12.05	12.66
10.25	DISCHG	16.67	17.63	24.44	25.94	41.17	44.19	377.68	440.95	109.67	86.96
12.75	DISCHG	47.64	45.05	33.74	33.03	26.21	25.77	22.36	22.14	19.86	19.72
15.25	DISCHG	17.43	17.29	14.99	14.84	13.69	13.62	13.63	13.64	12.48	12.41
17.75	DISCHG	11.25	11.18	10.02	9.94	9.95	9.95	9.96	9.96	8.80	8.72
20.25	DISCHG	8.72	8.73	7.56	7.48	8.65	8.74	7.57	7.49	7.49	7.50
22.75	DISCHG	6.33	6.25	7.42	7.50	6.33	6.25	0.40	0.00		

SUBROUTINE ADDHYD CROSS SECTION 43
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.95	1420.601	2216.54
16.87	45.817	2215.07
19.37	33.579	2215.05
21.43	29.129	2215.04
23.43	25.032	2215.03

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1623 CFS-HRS= 1632.73 ACRE-FT= 134.92

SUBROUTINE ADDHYD CROSS SECTION 44
INPUT HYDROGRAPHS= 3,4 OUTPUT HYDROGRAPH= 1

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.95	1665.687	2216.37
16.87	53.314	2215.05
19.37	39.068	2215.04
21.43	33.935	2215.03
23.43	29.155	2215.03

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1628 CFS-HRS= 1898.30 ACRE-FT= 156.87

SUBROUTINE REACH CROSS SECTION 45
LENGTH= 3800.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 13.550 AVERAGE ROUTING COEFF= 0.8885 NUMBER OF ROUTINGS= 0.27

SUBROUTINE RUNOFF CROSS SECTION 45
AREA= 0.25 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.23
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.95	448.595	(RUNOFF)
16.87	14.321	(RUNOFF)
19.37	10.511	(RUNOFF)
21.43	9.129	(RUNOFF)
23.43	7.838	(RUNOFF)

SYSTEM/3 REPORT

SUBROUTINE ADDHYD CROSS SECTION 45
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.98	1962.148	2031.21
19.37	49.441	2030.03
21.47	42.576	2030.03
23.47	36.493	2030.02

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1539 CFS-HRS= 2401.81 ACRE-FT= 198.48

SUBROUTINE RUNOFF CROSS SECTION 46
AREA= 0.20 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.23
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.95	358.766	(RUNOFF)
16.87	11.458	(RUNOFF)
19.37	8.408	(RUNOFF)
21.43	7.298	(RUNOFF)
23.43	6.270	(RUNOFF)

SUBROUTINE ADDHYD CROSS SECTION 47
INPUT HYDROGRAPHS= 1,3 OUTPUT HYDROGRAPH= 2

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
11.98	2319.133	2031.34
19.37	57.859	2030.04
21.46	49.869	2030.03
23.46	42.800	2030.03

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1538 CFS-HRS= 2808.83 ACRE-FT= 232.12

SUBROUTINE REACH CROSS SECTION 48
LENGTH= 5000.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 12.304 AVERAGE ROUTING COEFF= 0.8786 NUMBER OF ROUTINGS= 0.39

SUBROUTINE RUNOFF CROSS SECTION 48
AREA= 0.29 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.33
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.01	468.578	(RUNOFF)
19.37	12.130	(RUNOFF)
21.49	10.417	(RUNOFF)
23.49	8.930	(RUNOFF)

SUBROUTINE ADDHYD CROSS SECTION 48
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS

SYSTEM/3 REPORT

12.05	2485.602	1885.64
19.37	69.725	1884.06
21.53	59.286	1884.05
23.53	50.761	1884.04

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1453 CFS-HRS= 3390.00 ACRE-FT= 280.14

SUBROUTINE RESVOR STRUCTURE 7
SURFACE ELEVATION= 1884.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.83	548.024	1926.35
21.69	58.149	1887.52
23.69	49.550	1887.00

HYDROGRAPH, TZERO= 4.75 DELTA T= 0.25 DRAINAGE AREA= 1.66

TIME											
4.75	DISCHG	0.00	0.17	0.70	2.46	5.52	8.84	11.88	14.41	16.56	18.54
4.75	ELEV	1884.00	1884.01	1884.04	1884.14	1884.33	1884.53	1884.72	1884.87	1885.00	1885.12
7.25	DISCHG	21.30	25.21	28.98	31.91	35.51	40.47	45.76	50.76	56.37	63.01
7.25	ELEV	1885.29	1885.52	1885.75	1885.93	1886.15	1886.45	1886.77	1887.07	1887.41	1887.81
9.75	DISCHG	70.41	78.28	89.15	103.82	123.81	149.09	187.32	207.30	277.16	348.11
9.75	ELEV	1888.26	1888.74	1889.40	1890.29	1891.50	1893.03	1895.35	1897.06	1905.73	1916.92
12.25	DISCHG	379.86	394.90	538.42	511.50	445.18	394.45	392.24	389.69	386.89	383.92
12.25	ELEV	1922.97	1925.98	1926.33	1926.26	1926.11	1925.89	1925.44	1924.93	1924.37	1923.78
14.75	DISCHG	380.85	377.70	374.47	371.18	367.81	363.96	358.10	352.26	346.50	339.47
14.75	ELEV	1923.17	1922.54	1921.89	1921.23	1920.56	1919.81	1918.74	1917.68	1916.63	1915.41
17.25	DISCHG	330.39	321.52	310.23	298.25	283.41	266.69	244.05	217.99	164.94	84.20
17.25	ELEV	1913.89	1912.42	1910.65	1908.80	1906.63	1904.24	1901.38	1898.28	1893.99	1889.10
19.75	DISCHG	70.20	65.04	62.14	61.06	59.36	56.10	54.93	57.12	58.05	55.84
19.75	ELEV	1888.25	1887.94	1887.76	1887.70	1887.59	1887.40	1887.32	1887.46	1887.51	1887.38
22.25	DISCHG	53.48	52.49	50.79	47.52	46.34	48.54	49.47	47.22	37.62	20.40
22.25	ELEV	1887.24	1887.18	1887.07	1886.88	1886.80	1886.94	1886.99	1886.86	1886.28	1885.23
24.75	DISCHG	6.97	1.64	0.30	0.04	0.00	0.00	0.00	0.00		
24.75	ELEV	1884.42	1884.09	1884.01	1884.00	1884.00	1884.00	1884.00	1884.00		

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 3.1345 CFS-HRS= 3378.35 ACRE-FT= 279.18

ENDCMP 1

4.2'
100 yr

SYSTEM/3 REPORT

```
EXECUTIVE CONTROL CARD            OPERATION  INCREM,     MAIN TIME INCREMENT=  0.15
EXECUTIVE CONTROL CARD            OPERATION  COMPUT,     FROM XSECTN/STRUCT  41/  0     TO XSECTN/STRUCT   0/  7
       STARTING TIME=  0.00     RAIN DEPTH=  5.10     RAIN DURATION=  6.00     RAIN TABLE NO.= 2     SOIL CONDITION= 2
       ALTERNATE NO.= 1         STORM NO.= 3

SUBROUTINE RUNOFF    CROSS SECTION  41
          AREA=   0.13     INPUT RUNOFF CURVE=  90.0     TIME OF CONCENTRATION=  0.17
          COMPUTED CURVE NO. =   90.0

******************** WARNING MAIN TIME INCREMENT CHECK ********************

          PEAK TIMES                PEAK DISCHARGES              PEAK ELEVATIONS
              2.29                      308.065                    (RUNOFF)
              2.49                      263.039                    (RUNOFF)
              3.88                       57.700                    (RUNOFF)
              4.36                       55.268                    (RUNOFF)
              5.17                       35.289                    (RUNOFF)
              5.93                       36.540                    (RUNOFF)

   TIME                          HYDROGRAPH, TZERO=   0.75      DELTA T= 0.15      DRAINAGE AREA=   0.13
   0.75   DISCHG       0.00      3.05      6.25     14.45     16.95     26.68     31.17     48.97     61.54     77.64
   2.25   DISCHG     296.44    238.19    253.76    140.44     96.86     71.57     68.06     67.85     58.78     53.74
   3.75   DISCHG      45.71     57.52     39.25     35.12     55.12     41.49     35.52     34.62     34.58     34.61
   5.25   DISCHG      34.64     29.38     23.91     24.59     32.76     34.43     13.03      1.78      0.16      0.00

          TOTAL WATER, IN INCHES ON DRAINAGE AREA=   3.9059      CFS-HRS=     327.70      ACRE-FT=     27.08

SUBROUTINE RUNOFF    CROSS SECTION  42
          AREA=   0.56     INPUT RUNOFF CURVE=  90.0     TIME OF CONCENTRATION=  0.20
          COMPUTED CURVE NO. =   90.0

          PEAK TIMES                PEAK DISCHARGES              PEAK ELEVATIONS
              2.29                     1265.858                    (RUNOFF)
              2.49                     1116.937                    (RUNOFF)
              3.87                      242.942                    (RUNOFF)
              4.37                      223.120                    (RUNOFF)
              5.17                      151.310                    (RUNOFF)
              5.94                      153.353                    (RUNOFF)

          TOTAL WATER, IN INCHES ON DRAINAGE AREA=   4.1028      CFS-HRS=    1482.79      ACRE-FT=    122.53

SUBROUTINE REACH     CROSS SECTION  43
          LENGTH=   2300.00     INPUT COEFFICIENT=  0.0000     INPUT ROUTINGS=  0.00

          AVERAGE WATER VELOCITY=  10.634      AVERAGE ROUTING COEFF= 0.8621      NUMBER OF ROUTINGS=  0.34

SUBROUTINE RUNOFF    CROSS SECTION  43
          AREA=   0.24     INPUT RUNOFF CURVE=  90.0     TIME OF CONCENTRATION=  0.15
          COMPUTED CURVE NO. =   90.0

******************** WARNING MAIN TIME INCREMENT CHECK ********************

          PEAK TIMES                PEAK DISCHARGES              PEAK ELEVATIONS
```

SYSTEM/3 REPORT

2.29	573.007	(RUNOFF)
2.49	488.892	(RUNOFF)
3.22	127.963	(RUNOFF)
3.88	107.847	(RUNOFF)
4.35	106.920	(RUNOFF)
5.17	65.417	(RUNOFF)
5.93	68.862	(RUNOFF)

TIME HYDROGRAPH, TZERO= 0.75 DELTA T= 0.15 DRAINAGE AREA= 0.24

0.75	DISCHG	0.00	6.25	12.19	29.43	30.86	50.93	62.25	90.44	117.24	159.58
2.25	DISCHG	553.34	441.62	468.97	239.42	169.36	128.93	125.20	125.31	103.81	102.86
3.75	DISCHG	80.68	107.62	69.79	64.09	106.78	73.49	64.79	63.78	63.85	63.91
5.25	DISCHG	63.96	52.21	43.48	45.89	61.62	63.98	18.49	1.85	0.04	0.00

SUBROUTINE ADDHYD CROSS SECTION 43
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.47	1588.325	2216.66
3.88	338.317	2215.52
4.38	307.146	2215.47
5.17	215.898	2215.33
5.95	212.945	2215.33

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 4.0567 CFS-HRS= 2094.50 ACRE-FT= 173.08

SUBROUTINE ADDHYD CROSS SECTION 44
INPUT HYDROGRAPHS= 3,4 OUTPUT HYDROGRAPH= 1

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.48	1850.827	2216.46
3.88	395.987	2215.43
4.37	362.301	2215.39
5.17	251.242	2215.27
5.94	249.400	2215.27

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 4.0637 CFS-HRS= 2439.03 ACRE-FT= 201.56

SUBROUTINE REACH CROSS SECTION 45
LENGTH= 3800.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 14.269 AVERAGE ROUTING COEFF= 0.8935 NUMBER OF ROUTINGS= 0.44

SUBROUTINE RUNOFF CROSS SECTION 45
AREA= 0.25 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.23
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.31	524.209	(RUNOFF)
2.49	493.252	(RUNOFF)
3.86	105.808	(RUNOFF)

SYSTEM/3 REPORT

4.39	94.224	(RUNOFF)
5.17	67.299	(RUNOFF)
5.95	66.450	(RUNOFF)

HYDROGRAPH, TZERO= 0.75 DELTA T= 0.15 DRAINAGE AREA= 0.25

TIME											
0.75	DISCHG	0.00	4.22	10.06	21.48	32.21	46.02	52.14	88.95	107.34	128.28
2.25	DISCHG	490.35	456.08	482.50	333.11	217.33	153.37	134.72	131.08	121.28	100.10
3.75	DISCHG	96.91	105.05	83.35	70.21	92.96	87.20	71.45	67.62	66.70	66.54
5.25	DISCHG	66.60	60.86	48.74	46.69	59.24	64.88	39.49	9.88	2.20	0.36
6.75	DISCHG	0.00									

SUBROUTINE ADDHYD CROSS SECTION 45
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.49	2296.470	2031.33
3.85	478.230	2030.36
4.44	425.362	2030.32
5.17	316.927	2030.23
5.97	298.343	2030.22

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 4.0295 CFS-HRS= 3068.65 ACRE-FT= 253.59

SUBROUTINE RUNOFF CROSS SECTION 46
AREA= 0.20 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.23
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.31	419.386	(RUNOFF)
2.49	394.611	(RUNOFF)
3.86	84.653	(RUNOFF)
4.39	75.391	(RUNOFF)
5.17	53.851	(RUNOFF)
5.95	53.167	(RUNOFF)

HYDROGRAPH, TZERO= 0.75 DELTA T= 0.15 DRAINAGE AREA= 0.20

TIME											
0.75	DISCHG	0.00	3.37	8.04	17.18	25.77	36.81	41.71	71.16	85.87	102.62
2.25	DISCHG	392.28	364.86	386.00	266.48	173.86	122.69	107.78	104.86	97.02	80.08
3.75	DISCHG	77.53	84.04	66.68	56.17	74.37	69.76	57.16	54.09	53.36	53.23
5.25	DISCHG	53.28	48.69	38.99	37.35	47.39	51.90	31.59	7.90	1.76	0.29
6.75	DISCHG	0.00									

SUBROUTINE ADDHYD CROSS SECTION 47
INPUT HYDROGRAPHS= 1,3 OUTPUT HYDROGRAPH= 2

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.49	2690.836	2031.47
3.86	562.885	2030.42
4.43	497.708	2030.37
5.17	370.846	2030.28
5.97	351.298	2030.26

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 4.0378 CFS-HRS= 3596.12 ACRE-FT= 297.18

SYSTEM/3 REPORT

SUBROUTINE REACH CROSS SECTION 48
LENGTH= 5000.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 13.494 AVERAGE ROUTING COEFF= 0.8881 NUMBER OF ROUTINGS= 0.60

SUBROUTINE RUNOFF CROSS SECTION 48
AREA= 0.29 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.33
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.51	538.375	(RUNOFF)
4.48	105.967	(RUNOFF)
5.98	71.725	(RUNOFF)

SUBROUTINE ADDHYD CROSS SECTION 48
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.56	3119.424	1885.92
4.51	590.595	1884.57
6.02	394.285	1884.38

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 4.0097 CFS-HRS= 4321.61 ACRE-FT= 357.13

SUBROUTINE RESVOR STRUCTURE 7
SURFACE ELEVATION= 1884.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
3.06	1365.634	1927.66

HYDROGRAPH, TZERO= 0.60 DELTA T= 0.15 DRAINAGE AREA= 1.66

TIME											
0.60	DISCHG	0.00	0.04	2.94	15.05	42.82	90.01	152.03	202.44	220.91	246.03
0.60	ELEV	1884.00	1884.00	1884.17	1884.91	1886.59	1889.45	1893.21	1896.50	1898.61	1901.62
2.10	DISCHG	272.78	308.32	348.98	376.13	459.20	1024.61	1335.65	1309.16	1185.47	1068.09
2.10	ELEV	1905.11	1910.35	1917.08	1922.22	1926.14	1927.24	1927.62	1927.59	1927.43	1927.29
3.60	DISCHG	967.53	874.54	810.28	773.66	732.75	688.64	658.98	638.35	610.45	577.71
3.60	ELEV	1927.17	1927.05	1926.95	1926.87	1926.77	1926.67	1926.60	1926.56	1926.49	1926.42
5.10	DISCHG	547.92	523.83	503.72	481.25	452.74	426.07	412.40	405.24	394.48	392.56
5.10	ELEV	1926.35	1926.29	1926.25	1926.19	1926.13	1926.07	1926.04	1926.02	1925.89	1925.51
6.60	DISCHG	389.85	386.84	383.76	380.69	377.63	374.61	371.60	368.62	365.67	361.18
6.60	ELEV	1924.97	1924.36	1923.75	1923.13	1922.52	1921.92	1921.32	1920.72	1920.13	1919.30
8.10	DISCHG	356.29	351.46	346.70	341.37	333.76	326.32	319.05	308.95	299.15	287.91
8.10	ELEV	1918.41	1917.53	1916.67	1915.72	1914.46	1913.22	1912.00	1910.45	1908.94	1907.27
9.60	DISCHG	273.97	258.50	239.50	215.84	162.10	63.30	24.72	9.65	3.77	1.47
9.60	ELEV	1905.28	1903.18	1900.81	1898.03	1893.82	1887.83	1885.49	1884.58	1884.22	1884.08

SYSTEM/3 REPORT

5.1

11.10	DISCHG	0.57	0.22	0.08	0.03	0.01	0.00	0.00	0.00	0.00	0.00
11.10	ELEV	1884.03	1884.01	1884.00	1884.00	1884.00	1884.00	1884.00	1884.00	1884.00	1884.00
12.60	DISCHG	0.00									
12.60	ELEV	1884.00									

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 4.0155 CFS-HRS= 4327.80 ACRE-FT= 357.64

ENDCMP 1

SYSTEM/3 REPORT

EXECUTIVE CONTROL CARD OPERATION COMPUT. FROM XSECTN/STRUCT 41/ 0 TO XSECTN/STRUCT 0/ 7
STARTING TIME= 0.00 RAIN DEPTH= 9.52 RAIN DURATION= 6.00 RAIN TABLE NO.= 2 SOIL CONDITION= 2
ALTERNATE NO.= 1 STORM NO.= 4

SUBROUTINE RUNOFF CROSS SECTION 41
AREA= 0.13 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.17
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.28	651.863	(RUNOFF)
2.48	529.158	(RUNOFF)
3.88	111.395	(RUNOFF)
4.36	106.378	(RUNOFF)
5.17	67.659	(RUNOFF)
5.93	69.901	(RUNOFF)

HYDROGRAPH, TZERO= 0.44 DELTA T= 0.15 DRAINAGE AREA= 0.13

TIME											
0.44	DISCHG	0.00	6.12	15.94	24.26	30.80	54.41	55.50	78.04	84.52	124.19
1.95	DISCHG	147.49	176.72	631.60	488.01	506.80	277.30	189.90	139.75	132.52	131.80
3.45	DISCHG	113.96	104.03	88.37	111.04	75.69	67.67	106.09	79.78	68.24	66.47
4.95	DISCHG	66.35	66.37	66.39	56.29	45.79	47.06	62.68	65.84	24.92	3.41
6.45	DISCHG	0.31	0.00								

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 8.1663 CFS-HRS= 685.13 ACRE-FT= 56.61

SUBROUTINE RUNOFF CROSS SECTION 42
AREA= 0.56 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.20
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.29	2690.755	(RUNOFF)
2.48	2257.291	(RUNOFF)
3.87	469.139	(RUNOFF)
4.37	429.514	(RUNOFF)
5.17	290.086	(RUNOFF)
5.94	293.168	(RUNOFF)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 8.1979 CFS-HRS= 2962.80 ACRE-FT= 244.84

SUBROUTINE REACH CROSS SECTION 43
LENGTH= 2300.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 13.676 AVERAGE ROUTING COEFF= 0.8894 NUMBER OF ROUTINGS= 0.27

SUBROUTINE RUNOFF CROSS SECTION 43
AREA= 0.24 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.15
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS

SYSTEM/3 REPORT

1.25	112.429	(RUNOFF)
2.28	1207.385	(RUNOFF)
2.48	980.536	(RUNOFF)
3.88	208.192	(RUNOFF)
4.35	205.760	(RUNOFF)
5.17	125.381	(RUNOFF)
5.93	131.658	(RUNOFF)

HYDROGRAPH, TZERO= 0.44 DELTA T= 0.15 DRAINAGE AREA= 0.24

TIME											
0.44	DISCHG	0.00	13.02	31.39	46.42	58.12	108.80	99.75	147.63	167.48	228.04
1.95	DISCHG	279.56	361.70	1173.88	900.90	934.07	472.00	331.73	251.63	243.72	243.36
3.45	DISCHG	201.23	199.06	155.94	207.72	134.58	123.47	205.49	141.31	124.49	122.46
4.95	DISCHG	122.50	122.55	122.58	100.01	83.25	87.83	117.89	122.32	35.35	3.55
6.45	DISCHG	0.08	0.00								

SUBROUTINE ADDHYD CROSS SECTION 43
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.31	3474.157	2217.60
3.88	658.291	2216.01
4.37	600.114	2215.93
5.17	414.343	2215.64
5.94	411.002	2215.64

HYDROGRAPH, TZERO= 0.44 DELTA T= 0.15 DRAINAGE AREA= 0.79

TIME											
0.44	DISCHG	0.00	28.36	82.01	134.83	177.93	296.60	335.15	449.30	502.07	703.34
1.95	DISCHG	867.29	1032.91	3232.82	3137.60	3091.61	2049.33	1345.64	955.55	836.24	814.30
3.45	DISCHG	730.45	656.58	567.63	656.58	511.93	433.12	596.13	520.22	441.54	414.21
4.95	DISCHG	409.09	408.46	408.58	362.39	300.12	289.23	362.63	398.54	215.20	62.20
6.45	DISCHG	10.82	1.37	0.05	0.00	0.00					

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 8.2579 CFS-HRS= 4263.52 ACRE-FT= 352.33

SUBROUTINE ADDHYD CROSS SECTION 44
INPUT HYDROGRAPHS= 3,4 OUTPUT HYDROGRAPH= 1

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.31	4116.430	2217.36
3.88	769.724	2215.84
4.37	706.296	2215.77
5.17	481.937	2215.52
5.94	480.722	2215.52

HYDROGRAPH, TZERO= 0.44 DELTA T= 0.15 DRAINAGE AREA= 0.92

TIME											
0.44	DISCHG	0.00	34.49	97.96	159.09	208.73	351.01	390.65	527.34	586.59	827.54
1.95	DISCHG	1014.79	1209.64	3864.42	3625.61	3598.41	2326.64	1535.55	1095.31	968.76	946.11
3.45	DISCHG	844.42	760.61	656.00	767.63	587.63	500.79	702.22	600.01	509.79	480.69
4.95	DISCHG	475.45	474.84	474.98	418.68	345.91	336.29	425.31	464.39	240.12	65.61
6.45	DISCHG	11.13	1.37	0.05	0.00	0.00					

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 8.2450 CFS-HRS= 4948.65 ACRE-FT= 408.95

SYSTEM/3 REPORT

SUBROUTINE REACH CROSS SECTION 45
LENGTH= 3800.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 18.579 AVERAGE ROUTING COEFF= 0.9161 NUMBER OF ROUTINGS= 0.34

SUBROUTINE RUNOFF CROSS SECTION 45
AREA= 0.25 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.23
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.30	1117.402	(RUNOFF)
2.48	1001.810	(RUNOFF)
3.86	204.429	(RUNOFF)
4.39	181.345	(RUNOFF)
5.17	129.036	(RUNOFF)
5.95	127.115	(RUNOFF)

TIME HYDROGRAPH, TZERO= 0.44 DELTA T= 0.15 DRAINAGE AREA= 0.25

0.44	DISCHG	0.00	7.65	24.80	41.36	54.95	85.87	109.62	138.46	144.95	229.44
1.95	DISCHG	261.45	296.68	1056.88	946.15	971.67	661.65	427.61	300.11	262.62	254.84
3.45	DISCHG	235.30	193.88	187.44	202.87	160.80	135.33	178.97	167.74	137.34	129.87
4.95	DISCHG	128.01	127.63	127.68	116.60	93.35	89.38	113.35	124.07	75.51	18.89
6.45	DISCHG	4.20	0.69	0.00							

SUBROUTINE ADDHYD CROSS SECTION 45
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.46	4710.762	2032.10
3.86	935.039	2030.70
4.41	826.135	2030.62
5.96	581.178	2030.43

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 8.3156 CFS-HRS= 6332.65 ACRE-FT= 523.33

SUBROUTINE RUNOFF CROSS SECTION 46
AREA= 0.20 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.23
COMPUTED CURVE NO. = 90.0

********** WARNING MAIN TIME INCREMENT CHECK **********

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.30	893.948	(RUNOFF)
2.48	801.444	(RUNOFF)
3.86	163.527	(RUNOFF)
4.39	145.101	(RUNOFF)
5.17	103.240	(RUNOFF)
5.95	101.684	(RUNOFF)

TIME HYDROGRAPH, TZERO= 0.44 DELTA T= 0.15 DRAINAGE AREA= 0.20

0.44	DISCHG	0.00	6.12	19.84	33.09	43.96	68.70	87.70	110.77	115.96	183.55
1.95	DISCHG	209.16	237.34	845.50	756.92	777.33	529.32	342.09	240.09	210.10	203.87
3.45	DISCHG	188.24	155.11	149.95	162.30	128.64	108.26	143.17	134.19	109.87	103.90
4.95	DISCHG	102.41	102.11	102.14	93.28	74.68	71.50	90.68	99.26	60.40	15.11
6.45	DISCHG	3.36	0.55	0.00							

SUBROUTINE ADDHYD CROSS SECTION 47
INPUT HYDROGRAPHS= 1,3 OUTPUT HYDROGRAPH= 2

DUE TO STORAGE OVERFLOW, THE SUM OF HYDROGRAPHS 1 AND 3 WAS TRUNCATED HERE TO 100 VALUES.

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.46	5462.726	2032.25
3.86	1098.682	2030.83
4.41	971.066	2030.73
5.96	682.677	2030.51

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 8.3047 CFS-HRS= 7396.26 ACRE-FT= 611.22

SUBROUTINE REACH CROSS SECTION 48
LENGTH= 5000.00 INPUT COEFFICIENT= 0.0000 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 18.483 AVERAGE ROUTING COEFF= 0.9157 NUMBER OF ROUTINGS= 0.45

SUBROUTINE RUNOFF CROSS SECTION 48
AREA= 0.29 INPUT RUNOFF CURVE= 90.0 TIME OF CONCENTRATION= 0.33
COMPUTED CURVE NO. = 90.0

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.49	1108.938	(RUNOFF)
4.48	203.950	(RUNOFF)
5.98	137.187	(RUNOFF)

SUBROUTINE ADDHYD CROSS SECTION 48
INPUT HYDROGRAPHS= 1,2 OUTPUT HYDROGRAPH= 3

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.50	6517.783	1886.88
4.49	1148.207	1885.05
5.99	775.393	1884.75

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 8.3707 CFS-HRS= 9021.76 ACRE-FT= 745.55

SUBROUTINE RESVOR STRUCTURE 7
SURFACE ELEVATION= 1884.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
2.69	5841.017	1931.10

upgrade w/design 9.52"

TIME		HYDROGRAPH, TZERO= 0.44			DELTA T= 0.15			DRAINAGE AREA= 1.66			
0.44	DISCHG	0.00	7.28	40.73	109.54	198.31	219.30	248.16	276.48	300.91	323.77
0.44	ELEV	1884.00	1884.44	1886.46	1890.63	1896.03	1898.43	1901.89	1905.64	1909.21	1912.79

SYSTEM/3 REPORT

1.95	DISCHG	345.88	364.49	386.20	1584.40	5129.33	5837.60	4922.11	3604.76	2641.74	2074.30
1.95	ELEV	1916.52	1919.90	1924.24	1927.93	1930.67	1931.10	1930.54	1929.64	1928.83	1928.36
3.45	DISCHG	1800.73	1627.44	1530.87	1439.39	1365.69	1268.51	1177.34	1147.19	1123.94	1062.85
3.45	ELEV	1928.13	1927.98	1927.86	1927.75	1927.66	1927.54	1927.42	1927.39	1927.36	1927.28
4.95	DISCHG	993.58	940.68	906.13	877.70	832.03	792.23	758.78	750.71	744.19	688.96
4.95	ELEV	1927.20	1927.13	1927.09	1927.06	1927.00	1926.91	1926.83	1926.81	1926.80	1926.67
6.45	DISCHG	581.24	461.01	393.68	390.55	387.42	384.31	381.23	378.17	375.14	372.13
6.45	ELEV	1926.42	1926.15	1925.73	1925.11	1924.48	1923.86	1923.24	1922.63	1922.02	1921.42
7.95	DISCHG	369.15	366.19	362.05	357.15	352.31	347.54	342.73	335.09	327.62	320.32
7.95	ELEV	1920.83	1920.23	1919.46	1918.57	1917.69	1916.82	1915.95	1914.68	1913.43	1912.22
9.45	DISCHG	310.72	300.86	290.44	276.39	261.99	242.73	220.47	184.11	71.90	28.07
9.45	ELEV	1910.72	1909.21	1907.63	1905.62	1903.62	1901.21	1898.56	1895.15	1888.35	1885.70
10.95	DISCHG	10.96	4.28	1.67	0.65	0.25	0.09	0.03	0.01	0.00	0.00
10.95	ELEV	1884.66	1884.25	1884.10	1884.03	1884.01	1884.00	1884.00	1884.00	1884.00	1884.00
12.45	DISCHG	0.00	0.00	0.00	0.00	0.00					
12.45	ELEV	1884.00	1884.00	1884.00	1884.00	1884.00					

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 8.3489 CFS-HRS= 8998.25 ACRE-FT= 743.61

ENDCMP 1

SYSTEM/3 REPORT

SUMMARY TABLE 1

	ALT	STORM	ID	DA SQ-MI.	RAIN TBLE	AMC	DELTA-T HRS.	TZERO HRS.	PRECIP IN.	PRECIP DURATION	PEAK-Q CFS	PEAK-TIME	PEAK-ELEV	RUNOFF IN.	CSM
*	1	1	41X	0.13	2	2	0.15	0.00	3.20	6.00	161.02	2.29	0.00	2.13	1238.68
*	1	1	42X	0.56	2	2	0.15	0.00	3.20	6.00	657.93	2.30	0.00	2.14	1174.88
*	1	1	43X	0.79	2	2	0.15	0.00	3.20	6.00	869.08	2.49	2216.16	2.16	1086.35
*	1	1	44X	0.92	2	2	0.15	0.00	3.20	6.00	1016.07	2.49	2216.05	2.16	1092.55
*	1	1	45X	1.18	2	2	0.15	0.00	3.20	6.00	1242.38	2.52	2030.93	2.18	1052.86
*	1	1	47X	1.37	2	2	0.15	0.00	3.20	6.00	1460.29	2.52	2031.04	2.17	1058.18
*	1	1	48X	1.66	2	2	0.15	0.00	3.20	6.00	1679.20	2.62	1885.29	2.19	1005.51
*	1	1	7S	1.66	2	2	0.15	0.00	3.20	6.00	377.95	4.04	1922.59	2.19	226.32
*	1	2	41X	0.13	1	2	0.25	0.00	4.20	24.50	246.81	11.92	0.00	3.16	1898.56
*	1	2	42X	0.56	1	2	0.25	0.00	4.20	24.50	1036.84	11.93	0.00	3.16	1851.51
*	1	2	43X	0.79	1	2	0.25	0.00	4.20	24.50	1420.60	11.95	2216.54	3.16	1775.75
*	1	2	44X	0.92	1	2	0.25	0.00	4.20	24.50	1665.68	11.95	2216.37	3.16	1791.06
*	1	2	45X	1.18	1	2	0.25	0.00	4.20	24.50	1962.14	11.98	2031.21	3.15	1662.83
*	1	2	47X	1.37	1	2	0.25	0.00	4.20	24.50	2319.13	11.98	2031.34	3.15	1680.53
*	1	2	48X	1.66	1	2	0.25	0.00	4.20	24.50	2485.60	12.05	1885.64	3.14	1488.38
*	1	2	7S	1.66	1	2	0.25	0.00	4.20	24.50	548.02	12.83	1926.35	3.13	328.15
*	1	3	41X	0.13	2	2	0.15	0.00	5.10	6.00	308.06	2.29	0.00	3.90	2369.73
*	1	3	42X	0.56	2	2	0.15	0.00	5.10	6.00	1265.85	2.29	0.00	4.10	2260.46
*	1	3	43X	0.79	2	2	0.15	0.00	5.10	6.00	1588.32	2.47	2216.66	4.05	1985.40
*	1	3	44X	0.92	2	2	0.15	0.00	5.10	6.00	1850.82	2.48	2216.46	4.06	1990.13
*	1	3	45X	1.18	2	2	0.15	0.00	5.10	6.00	2296.47	2.49	2031.33	4.02	1946.16
*	1	3	47X	1.37	2	2	0.15	0.00	5.10	6.00	2690.83	2.49	2031.47	4.03	1949.88
*	1	3	48X	1.66	2	2	0.15	0.00	5.10	6.00	3119.42	2.56	1885.92	4.00	1867.91
*	1	3	7S	1.66	2	2	0.15	0.00	5.10	6.00	1365.63	3.06	1927.66	4.01	817.74
*	1	4	41X	0.13	2	2	0.15	0.00	9.52	6.00	651.86	2.28	0.00	8.16	5014.33
*	1	4	42X	0.56	2	2	0.15	0.00	9.52	6.00	2690.75	2.29	0.00	8.19	4804.92
*	1	4	43X	0.79	2	2	0.15	0.00	9.52	6.00	3474.15	2.31	2217.60	8.25	4342.69
*	1	4	44X	0.92	2	2	0.15	0.00	9.52	6.00	4116.43	2.31	2217.36	8.24	4426.26
*	1	4	45X	1.18	2	2	0.15	0.00	9.52	6.00	4710.76	2.46	2032.10	8.31	3992.17
*	1	4	47X	1.37	2	2	0.15	0.00	9.52	6.00	5462.72	2.46	2032.25	8.30	3958.49
*	1	4	48X	1.66	2	2	0.15	0.00	9.52	6.00	6517.78	2.50	1886.88	8.37	3902.86
*	1	4	7S	1.66	2	2	0.15	0.00	9.52	6.00	5841.01	2.69	1931.10	8.34	3497.61

'X' OR 'S' FOLLOWING THE ID REPRESENTS CROSS-SECTION OR STRUCTURE, RESPECTIVELY.

SYSTEM/8 REPORT

FOUNTAIN HILLS 4/10/75
DAM #7
CREST OF SPILLWAY
LOOKING FROM LEFT
END OF DAM

945

FOUNTAIN HILLS 4/10/75
DAM #7
CREST OF SPILLWAY
LOOKING FROM LEFT
END OF DAM

945

FOUNTAIN HILLS 4/10/75
DAM #7
LOOKING ACROSS DAM
TO RIGHT ABUTMENT

945

FOUNTAIN HILLS 4/10/75

DAM #7

LOOKING ACROSS DAM

TO RT. ABUTMENT

945

FOUNTAIN HILLS 4/10/75

DAM #7

CREST OF SPILLWAY

LOOKING FROM LEFT

END OF DAM

945

FOUNTAIN HILLS 4/10/75

DAM #7

CREST OF SPILLWAY

LOOKING FROM LEFT

END OF DAM

945

7

Frame 17

7

Frame 18

AN ORIGINAL POLAROID® LAND PHOTOGRAPH

SUBJECT FOUNTAIN HILLS DATE 3/13/75

NAME DAM #7

ADDRESS LOOKING NW FROM DAM TO POINT WHERE SADDLE DIKE WAS PLANNED

For your convenience when ordering copies, indicate the number of copies desired in the appropriate box for the size(s) you select. You can get quality work by Polaroid Copy Service through your dealer or by mail.

REGULAR SIZE COPIES

WALLET SIZE COPIES

5 x 7 ENLARGEMENTS

8 x 10 ENLARGEMENTS

35mm SLIDES

P558B-1 4/72 Printed in U.S.A.

AN ORIGINAL POLAROID® LAND PHOTOGRAPH

SUBJECT FOUNTAIN HILLS DATE 3/13/75

NAME DAM #7

ADDRESS BERM ON LEFT SIDE OF EMERGENCY SPILLWAY, LOOKING DOWN GRADE

For your convenience when ordering copies, indicate the number of copies desired in the appropriate box for the size(s) you select. You can get quality work by Polaroid Copy Service through your dealer or by mail.

REGULAR SIZE COPIES

WALLET SIZE COPIES

5 x 7 ENLARGEMENTS

8 x 10 ENLARGEMENTS

35mm SLIDES

P558B-1 4/72 Printed in U.S.A.

Structure No. 7.

Trash Rack. Wooden post were braced for some reason. Bracing damaged.

Reservoir drains good.

Structure No. 7.

Spillway - on left abutment. No sill or grout. No slope protection. Alinement of spillway level. This spillway appears to of material that will erode badly during heavy flows.


tructure #7
MADE IN U.S.A.
Embankment
Looking upstream
L


Structure #7
MADE IN U.S.A.
Spillway
4/75
17


STRUCTURE #7
MADE IN U.S.A.
4/75
Spillway

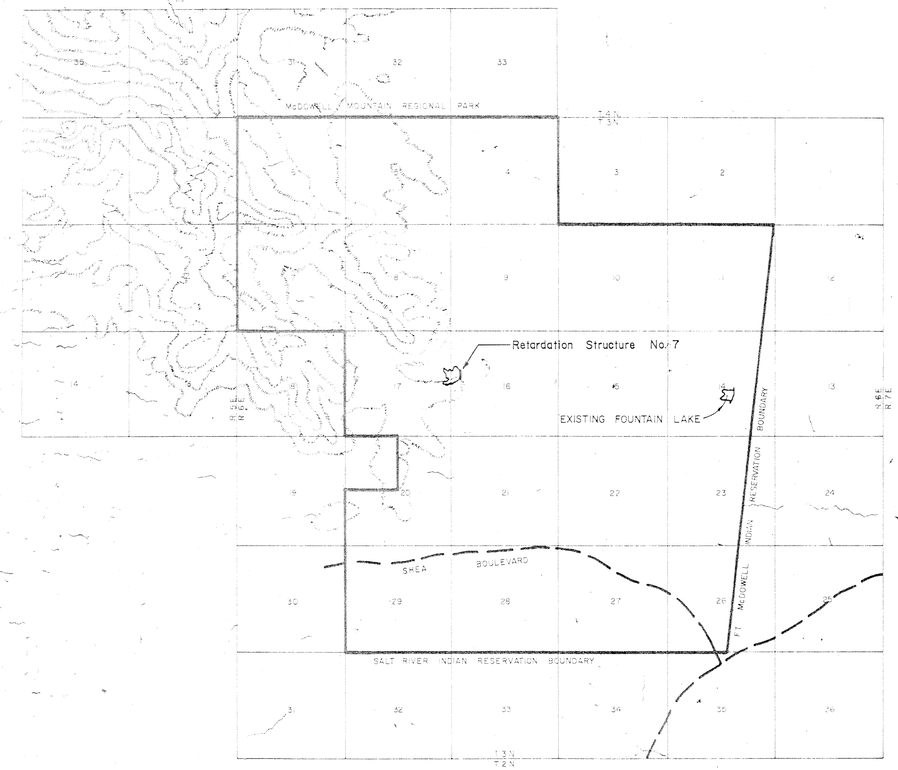

Structure #7
MADE IN U.S.A.
Spillway
4/75
9


6
Fountain Hills
Structure #7
5-78
looking west
MADE IN U.S.A.

FOUNTAIN HILLS

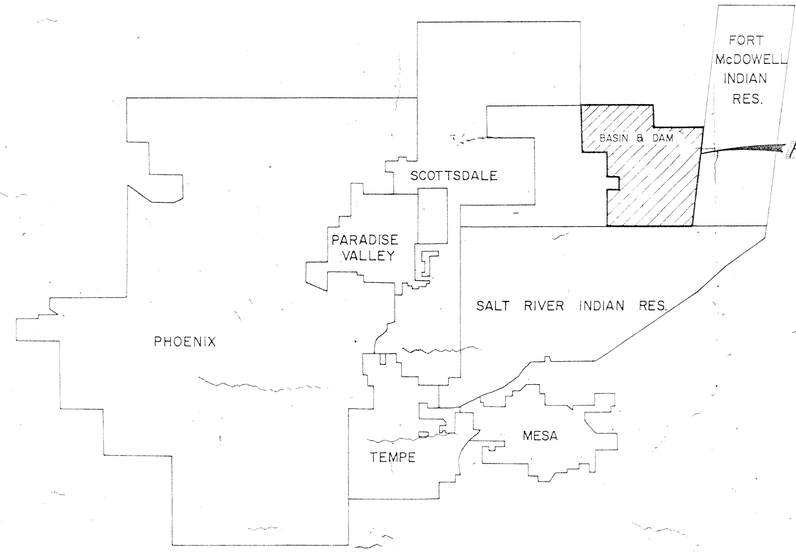
MARICOPA COUNTY, ARIZONA

STORM WATER RETARDATION BASIN NO. 7



VICINITY MAP

NO SCALE



PHOENIX - SCOTTSDALE AREA

NO SCALE

INDEX TO DRAWINGS

SHEET	TITLE
1	VICINITY MAP
2	DRAINAGE BASIN AND DAM LOCATION MAP
3	SITE PLAN & GRADING PLAN
4	PLAN AND PROFILE OF DAM
5	PRINCIPAL AND EMERGENCY SPILLWAY DETAILS
6	EMERGENCY SPILLWAY CROSS SECTIONS
7	INLET STRUCTURE DETAILS
8	OUTLET STRUCTURE DETAILS
9	DAM CORE BORINGS

GENERAL NOTES

1. THE DAM CONSTRUCTION WILL BE FIELD INSPECTED BY CONSULTING SOIL AND FOUNDATION ENGINEERS.
2. THE DAM CONSTRUCTION TO BE IN ACCORDANCE WITH THE FOUNDATION AND MATERIALS INVESTIGATION REPORT (STRUCTURE N° 7) BY SERGENT, HAUSKINS, AND BECKWITH.

DESIGN CRITERIA

1. CREST ELEVATION IS BASED ON 100 YEAR STORM.
2. EMERGENCY & FREEBOARD DESIGN BASED ON 6 HOUR P.M.P.
3. PRINCIPAL SPILLWAY DESIGN BASED ON A 10 DAY DRAW DOWN PERIOD.
4. FLOOD WATER DAM'S FUNCTION IS TO RETARD RUNOFF.

PRIVATE ENGINEER'S NOTICE TO CONTRACTOR

THE EXISTENCE & LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE, THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS.
THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITY LINES SHOWN, AND ANY OTHER LINES NOT OF RECORD OR NOT SHOWN ON THESE PLANS.

GURDON FREUDENTHAL REGISTERED CIVIL ENGINEER No. 3476

AS BUILT

DATE	BY	REVISION & REMARKS

TRICO INTERNATIONAL, INC.

CIVIL ENGINEERING

VICINITY MAP STRUCTURE NUMBER 7

File No. 71 MPIF P-4-15

7-32

SHEET 1 OF 9 SHEETS

CITY OF SCOTTSDALE CORPORATE LIMITS

SCOTTSDALE

McDOWELL MOUNTAIN REGIONAL PARK

McDOWELL MTS

DRAINAGE AREA (1.62 Sq. Mi.)

BASIN LIMIT (100yr. design storm)

RETARDATION STRUCTURE NO.7

INFLOW Q_{100} = 3184 c.f.s.

OUTFLOW Q_{100} = 305 c.f.s.

18 HOLE GOLF COURSE

CLUB HOUSE

Access Road to McDowell Mountain Regional Park

SCALE 1" = 1000'

0 500' 1000' 2000' 3000' 4000'

Fountain Hills Blvd.

Palisades Blvd.

Saguaro Blvd.

AS BUILT

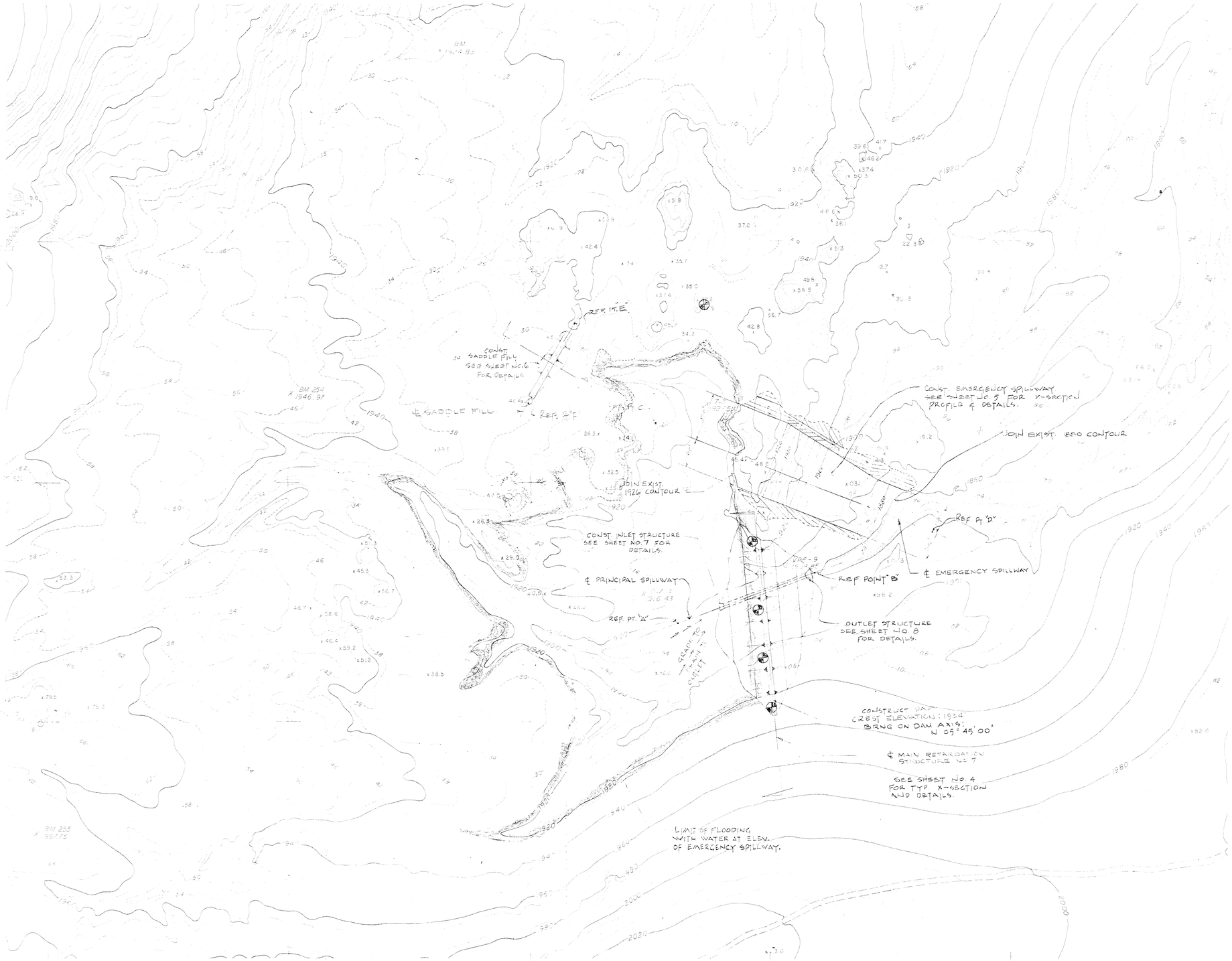
ES P HS JH TP

T 4 N

R 5 E R 6 E

McCULLOCH PROPERTIES, INC.	
FILE NO. 71 MPIF P-4-15	TRICO INTERNATIONAL INC. CIVIL ENGINEERING SCOTTSDALE, ARIZONA
SHEET NO. 2	
DRAWN BY H.C.	DRAINAGE BASIN AND DAM LOCATION MAP
SCALE 1" = 1000'	SHEET 2 OF 9
DATE	NO. / DATE / BY / REVISIONS & REMARKS
APPROVED	1. 2. 3. 4. 5. 6. 7.
CHECKED	
F.B. REF.	

7-82



SCALE - 1" = 100'

COORDINATES		
REF. PT.	N	E
A	29,200.39	20,309.09
B	29,316.00	20,540.00
C	29,661.00	20,243.00
D	29,201.00	20,637.00
E	29,669.00	20,041.00
F	29,832.00	19,496.00

DENOTES LOCATION OF SOIL BORING. SEE SHEET NO. 8 FOR LOGS OF BORINGS.

AS BUILT

RETARDATION STRUCTURE #7 - FOUNTAIN HILLS

FILE NO.

TRICO INTERNATIONAL INC.
CIVIL ENGINEERING
SCOTTSDALE, ARIZONA

SHEET NO. 3

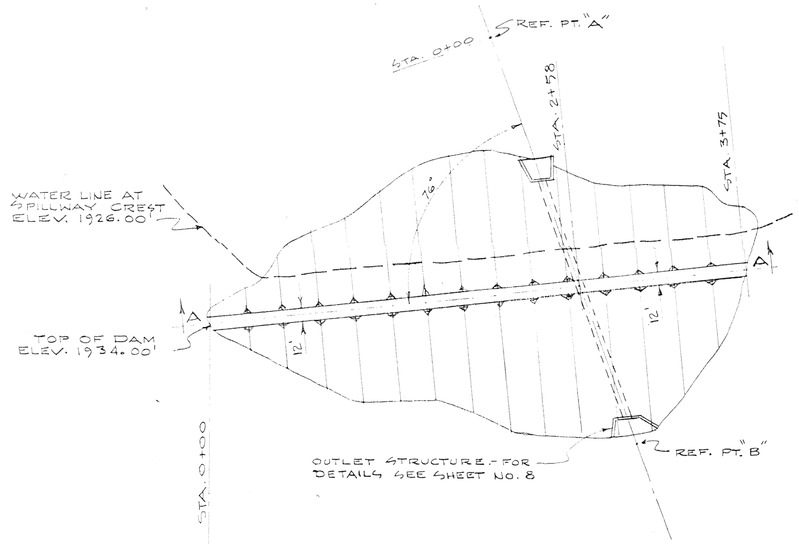
DRAWN BY R.S.T.M.
SCALE 1" = 100'
DATE
APPROVED
CHECKED
F.B. REF.

SITE PLAN & GRADING PLAN

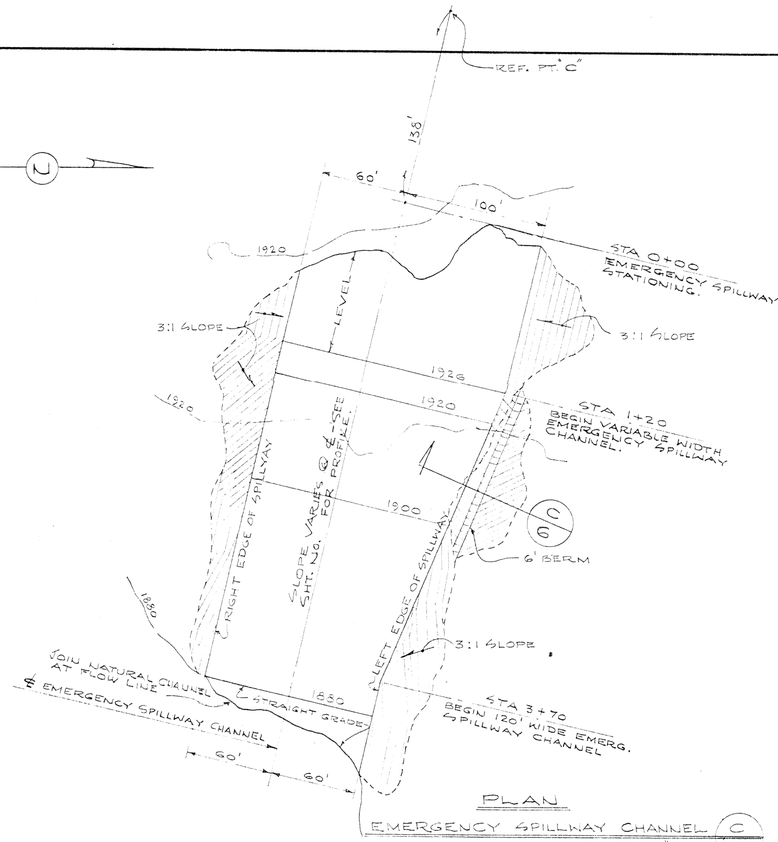
SHEET 3 OF 9

NO.	DATE	BY	REVISIONS & REMARKS
1.	6/11/76	R.M.	ADDED STRUCTURE
2.			
3.			
4.			
5.			
6.			
7.			

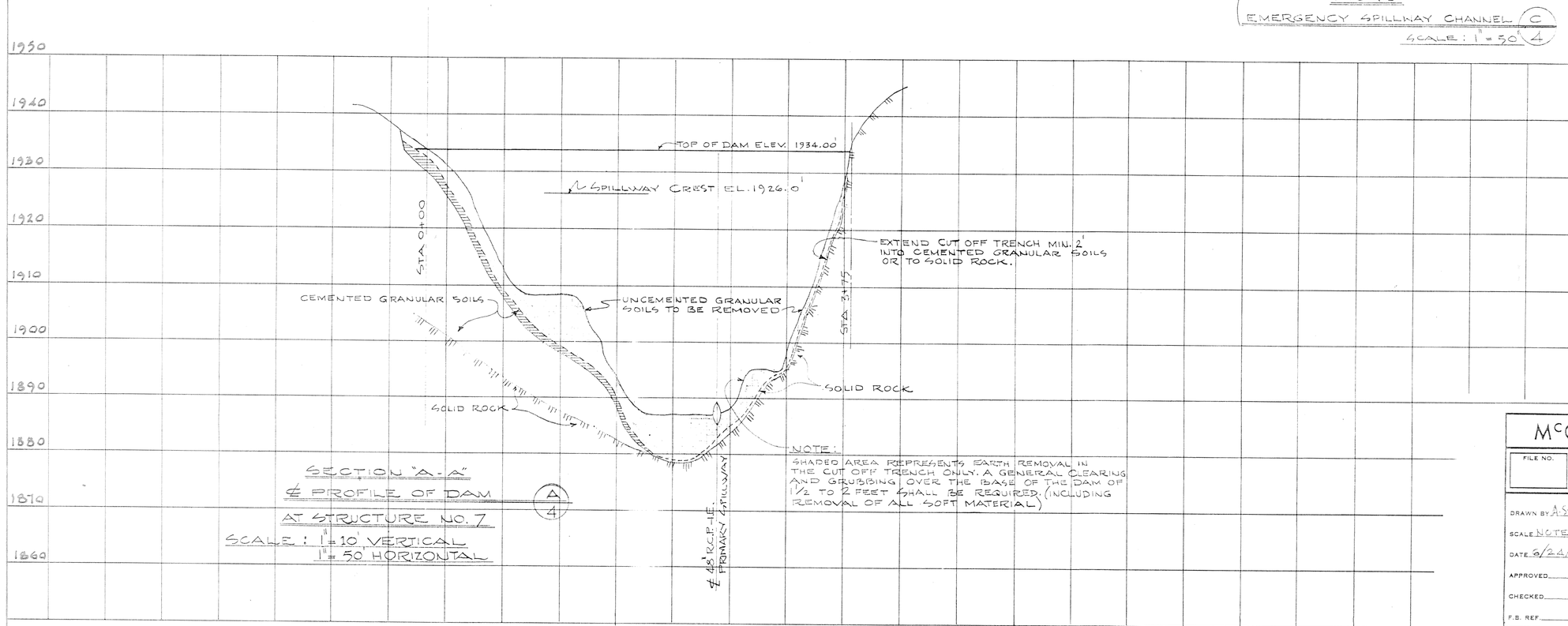
A-32



PLAN
RETARDATION STRUCTURE NO.7
SCALE: 1" = 50'
B / 4



PLAN
EMERGENCY SPILLWAY CHANNEL
SCALE: 1" = 50'
C / 4



SECTION "A-A"
℄ PROFILE OF DAM
AT STRUCTURE NO. 7
SCALE: 1" = 10' VERTICAL
1" = 50' HORIZONTAL
A / 4

AS BUILT

McCULLOCH PROPERTIES, INC.

FILE NO.

TRICO INTERNATIONAL INC.
CIVIL ENGINEERING
SCOTTSDALE, ARIZONA

SHEET NO. 4

RETARDATION STRUCTURE NO.7
℄ PLAN AND PROFILE OF DAM

SHEET 4 OF 9

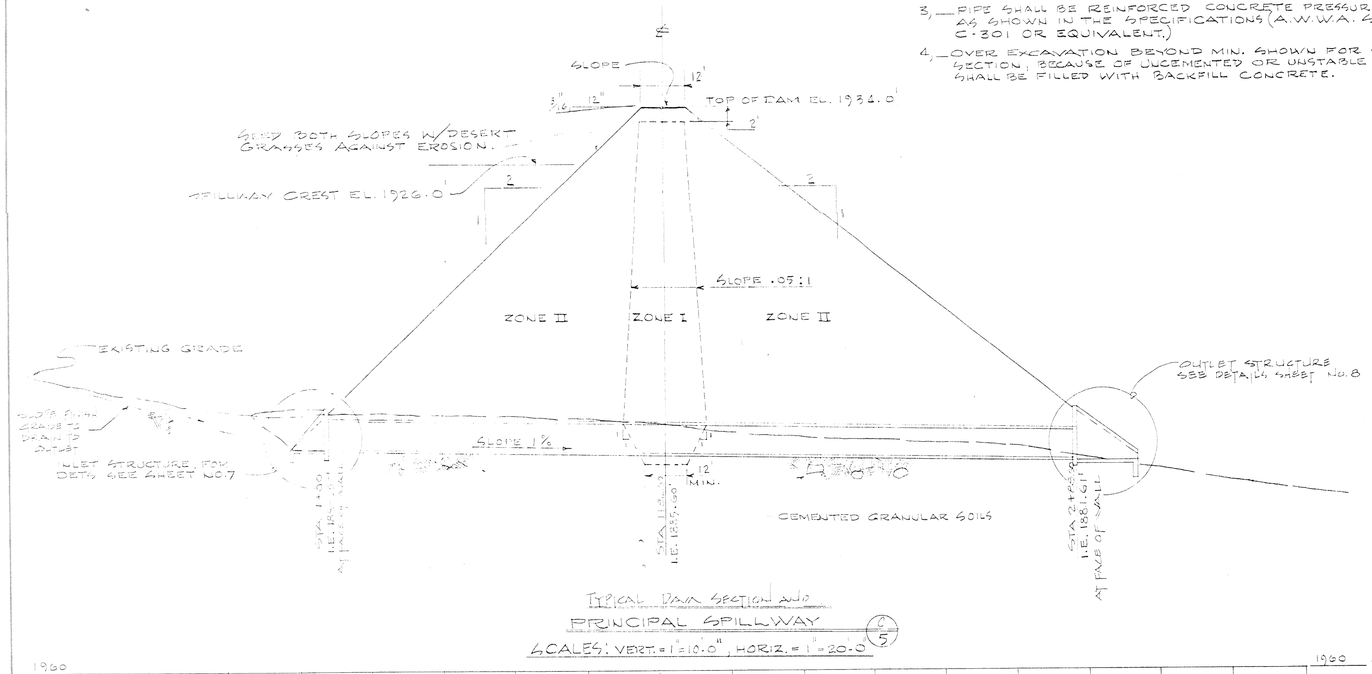
DRAWN BY A.S.T.M.
SCALE NOTED
DATE 6/24/72
APPROVED
CHECKED
F.B. REF.

NO.	DATE	BY	REVISIONS & REMARKS
1.	7/6/71	T.N.	REV. SPILLWAY LOCATION
2.	6/24/72	T.N.	REDRAWN
3.			
4.			
5.			
6.			
7.			

8-32

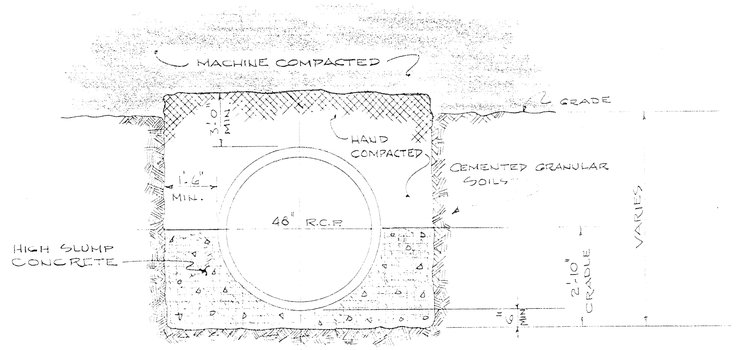
NOTES:

1. ZONE I - SOIL WITH HIGH RESISTANCE TO PIPING & LOW PERMEABILITY AS DETERMINED BY THE CONSULTING SOIL & FOUNDATION ENGINEER.
2. ZONE 2 - GRANULAR SOIL
3. PIPE SHALL BE REINFORCED CONCRETE PRESSURE PIPE AS SHOWN IN THE SPECIFICATIONS (A.W.W.A. STAND: C-301 OR EQUIVALENT.)
4. OVER EXCAVATION BEYOND MIN. SHOWN FOR CRADLE SECTION; BECAUSE OF UNCEMENTED OR UNSTABLE SOILS, SHALL BE FILLED WITH BACKFILL CONCRETE.



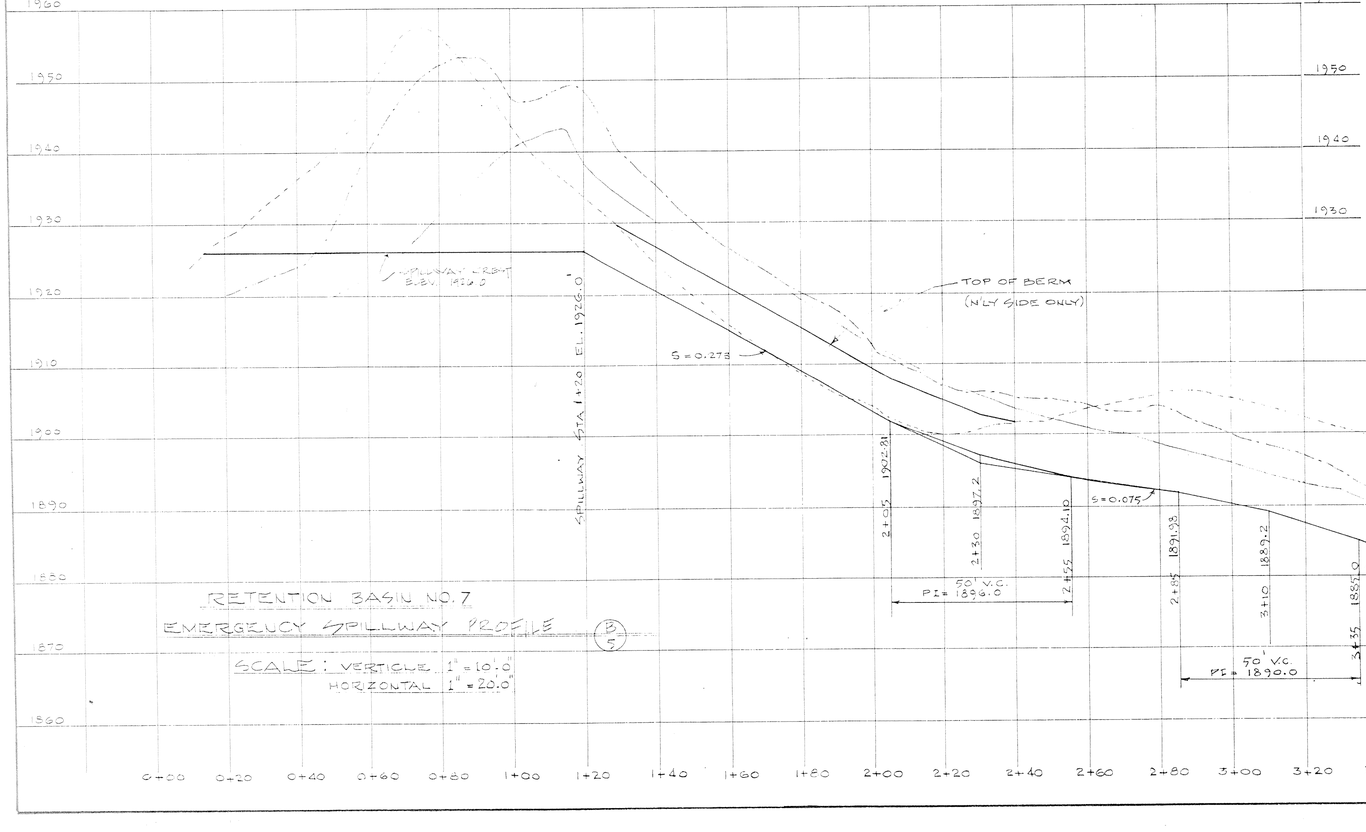
TYPICAL DAM SECTION AND PRINCIPAL SPILLWAY (C/5)

SCALES: VERT. = 1" = 10.0', HORIZ. = 1" = 20.0'



CRADLE IN CUT AREA (A/5)

SCALE: 1/2" = 1'-0"



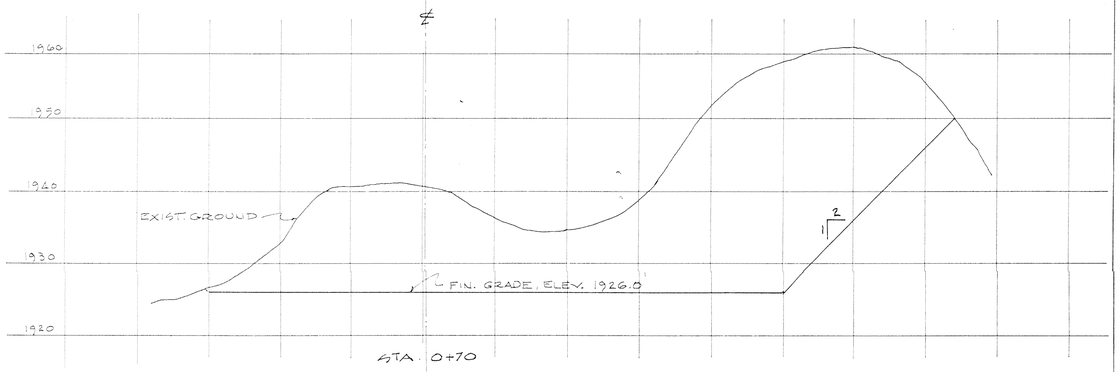
RETENTION BASIN NO. 7

EMERGENCY SPILLWAY PROFILE (B/5)

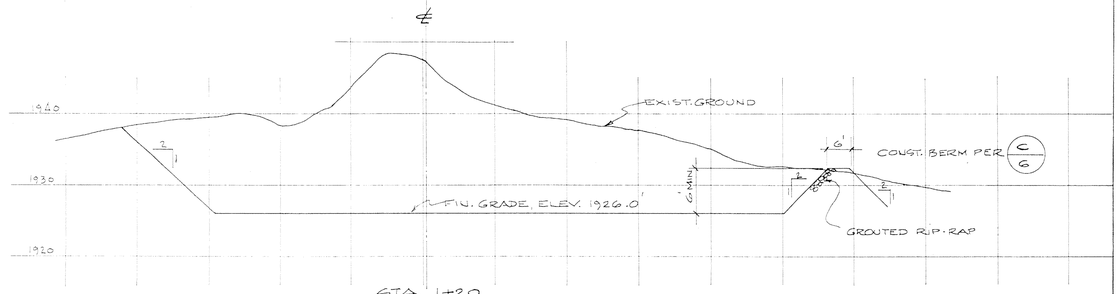
SCALE: VERTICLE 1" = 10.0'
HORIZONTAL 1" = 20.0'

AS BUILT

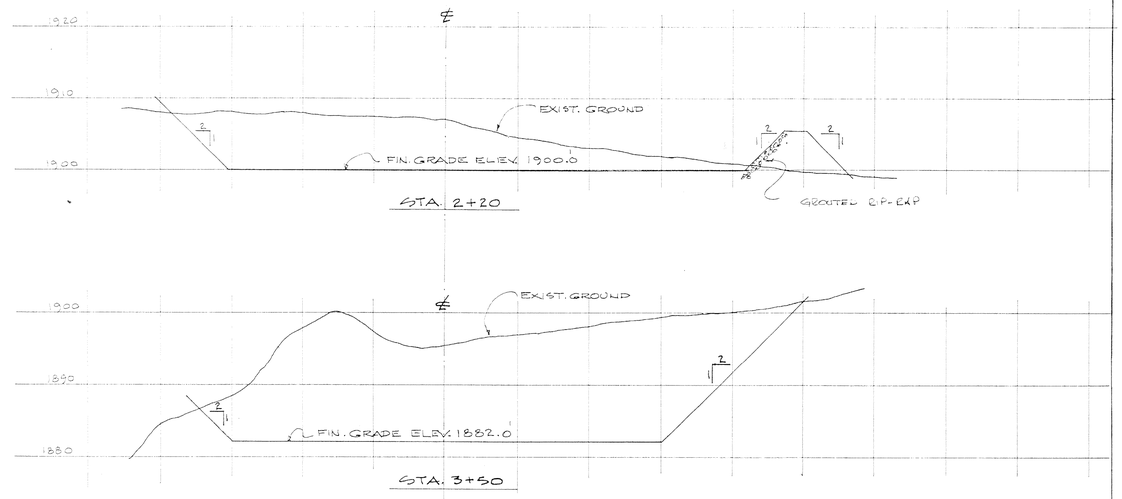
McCULLOCH PROPERTIES, INC.				
FILE NO.	TRICO INTERNATIONAL INC. CIVIL ENGINEERING SCOTTSDALE, ARIZONA			SHEET NO. 5
DRAWN BY A.G.M.	PRINCIPAL & EMERGENCY SPILLWAY PROFILE			SHEET 5 OF 9
SCALE NOTED	NO.	DATE	BY	REVISIONS & REMARKS
DATE 5/26/71	1.	10/12	A.G.M.	REDRAWN
APPROVED	2.			
CHECKED	3.			
F.B. REF.	4.			
	5.			
	6.			
	7.			



STA. 0+70



STA. 1+20

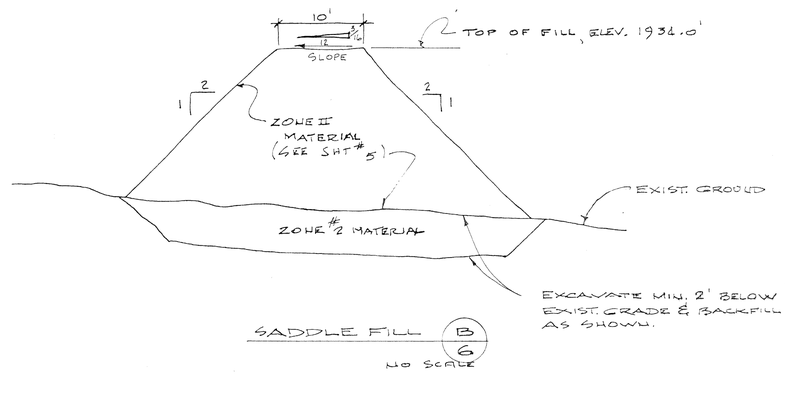


STA. 2+20

STA. 3+50

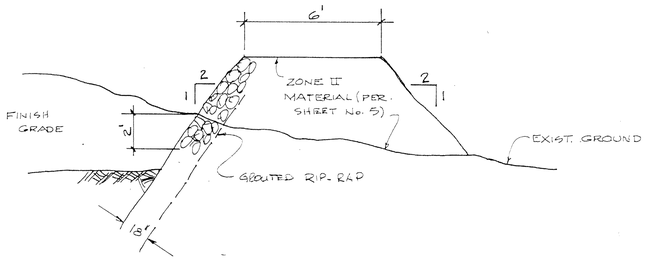
TYPICAL CROSS-SECTIONS
EMERGENCY SPILLWAY
△ 6

SCALES:
HORIZ.: 1" = 20'
VERT.: 1" = 10'



SADDLE FILL B/6

NO SCALE



EMERGENCY SPILLWAY BERM C/6

NO SCALE

AS BUILT

RETARDATION STRUCTURE No. 7, FOUNTAIN HILLS

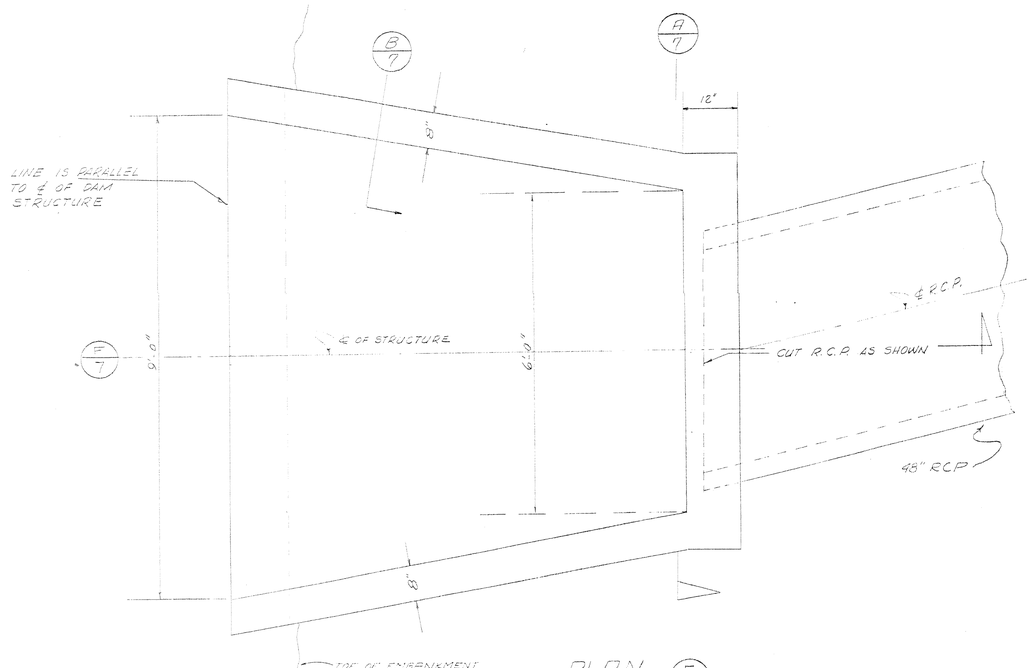
FILE NO.	TRICO INTERNATIONAL INC. CIVIL ENGINEERING SCOTTSDALE, ARIZONA	SHEET NO. 6

DRAWN BY: C.H.L.
SCALE
DATE
APPROVED
CHECKED
F.B. REF.

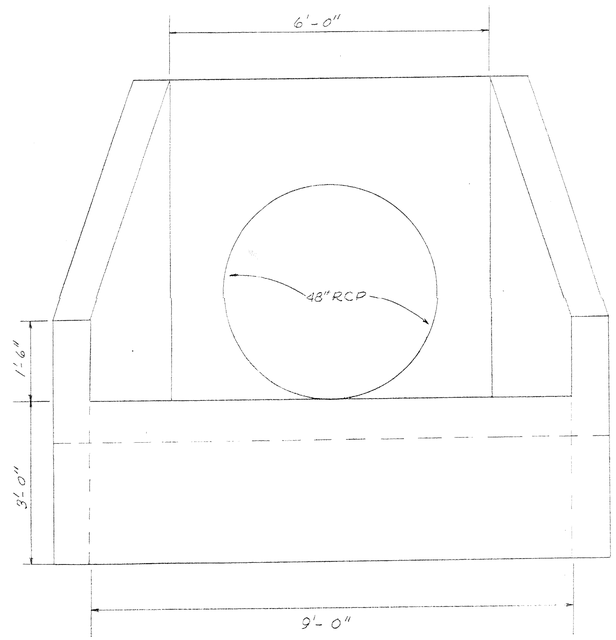
EMERGENCY SPILLWAY - CROSS SECTS
SHEET 8 OF 9

NO.	DATE	BY	REVISIONS & REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			

7-32

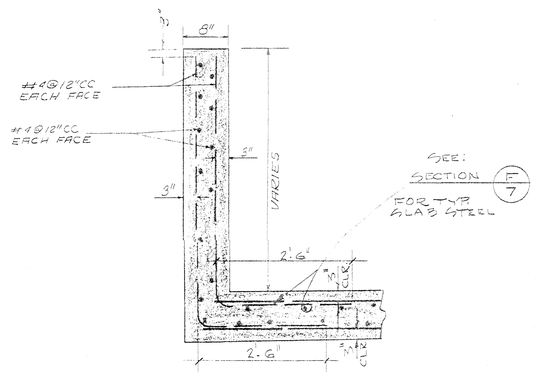


PLAN E/7
SCALE 3/4"=1'

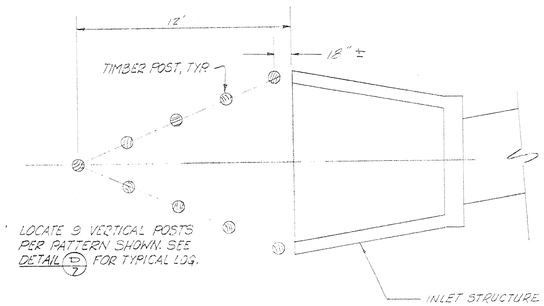


FRONT VIEW
SCALE 3/4"=1'

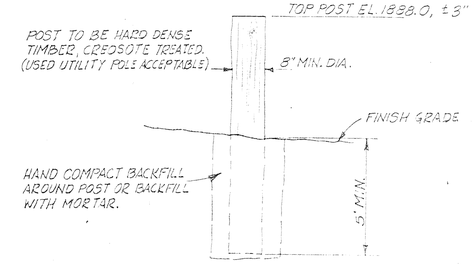
NOTE: CLEARANCES SHOWN ARE MEASURED TO ℄ OF REINFORCING BAR.



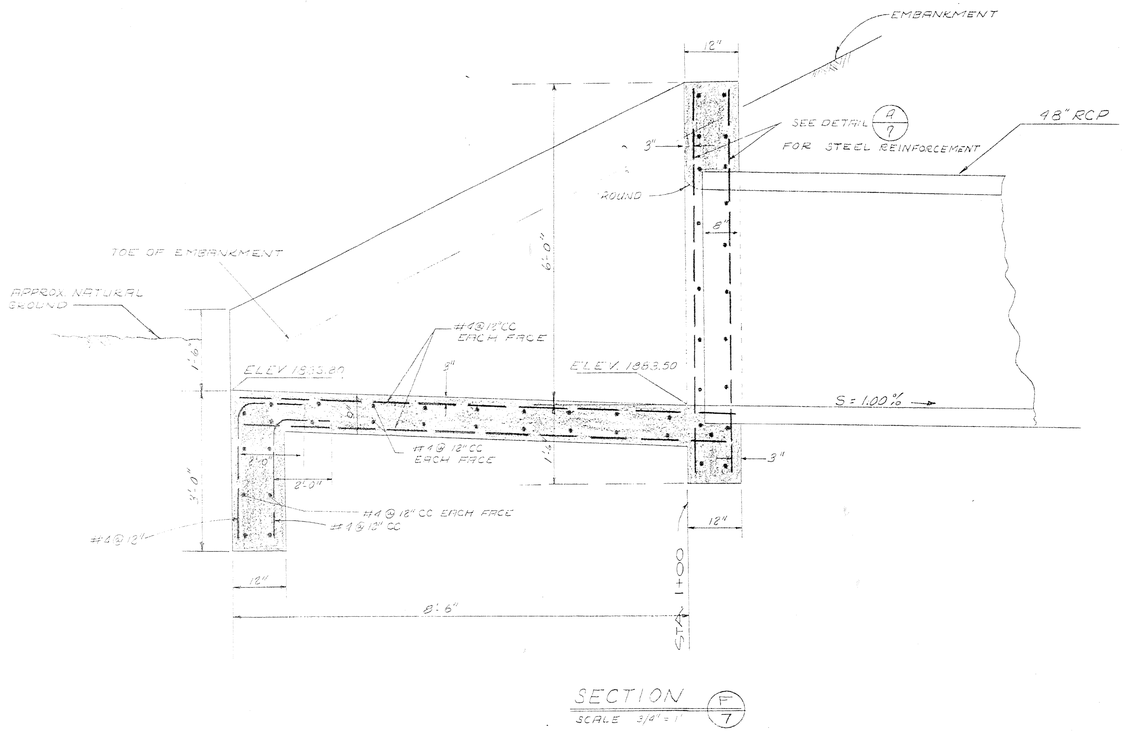
SECTION B/7
SCALE 3/4"=1'



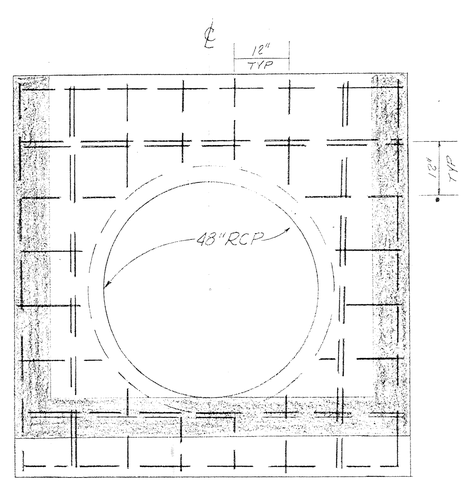
PLAN OF TRASH BARRIER C/7
SCALE: 1/4"=1'-0"



TYPICAL POST DETAIL D/7
SCALE: NONE



SECTION F/7
SCALE 3/4"=1'



HEADWALL DETAIL A/7
SCALE 3/4"=1'

NOTES:
1. HAIL BARS SHOWN IN THIS DETAIL ARE No 4 BARS.
2. USE DOUBLE BARS WHERE SHOWN.
3. REINFORCING STEEL PATTERN IS FOR EACH FACE OF HEADWALL.
4. REINFORCEMENT IN SIDEWALLS AND FLOOR HAVE NOT BEEN SHOWN IN THIS DETAIL. SEE SECTION E/7 FOR WALL AND FLOOR STEEL.

McCULLOCH PROPERTIES, INC.

FILE NO.

TRICO INTERNATIONAL INC.
CIVIL ENGINEERING
SCOTTSDALE, ARIZONA

SHEET NO. 7

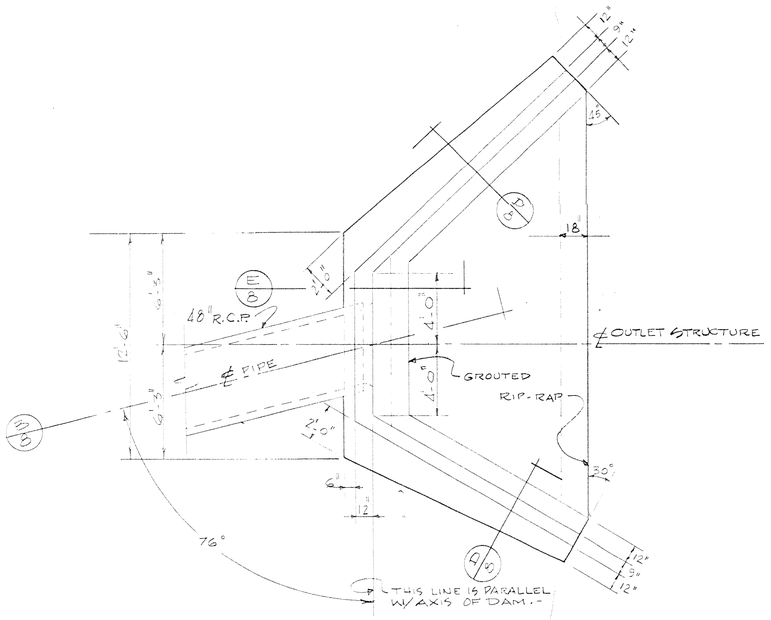
INLET STRUCTURE DETAILS
RETARDATION STRUCTURE NO.7

SHEET 7 OF 9

DRAWN BY D.K.
SCALE AS SHOWN
DATE JULY '72
APPROVED
CHECKED
F.B. REF.

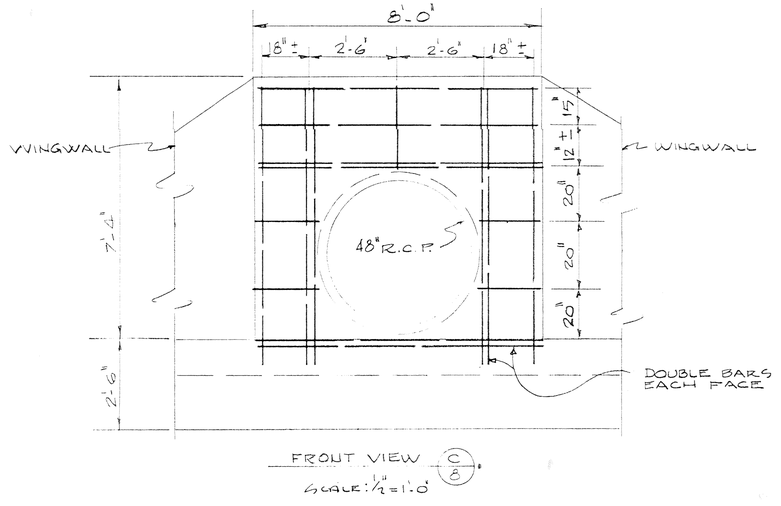
NO.	DATE	BY	REVISIONS & REMARKS
1.			AS BUILT
2.			
3.			
4.			
5.			
6.			
7.			

7-22



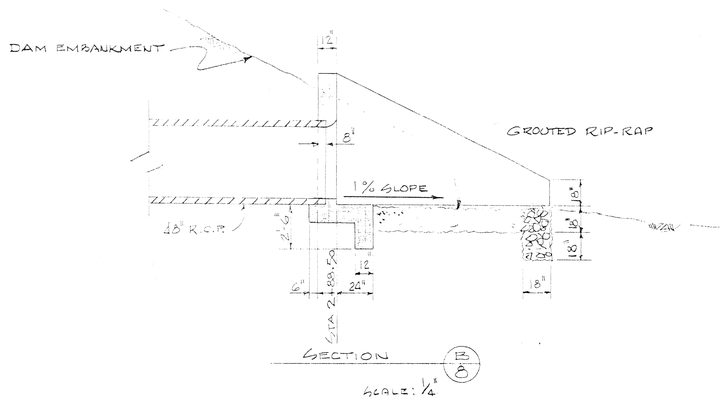
PLAN (A/8)

SCALE: 1/4"



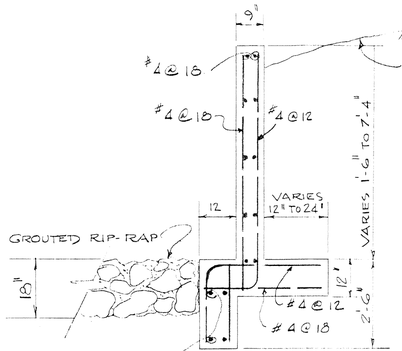
FRONT VIEW (C/8)

SCALE: 1/2" = 1'-0"



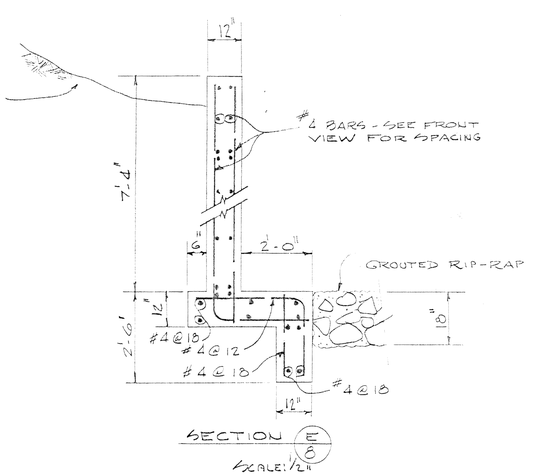
SECTION (B/8)

SCALE: 1/4"



SECTION (D/8)

SCALE 1/2"



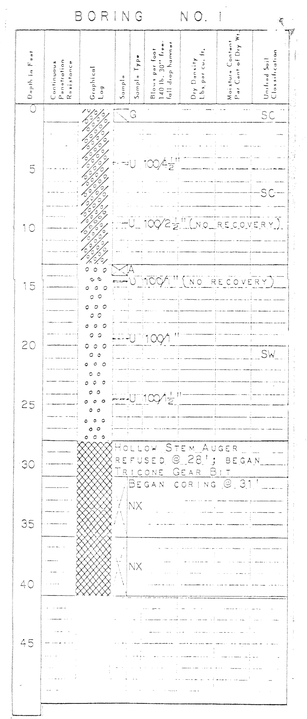
SECTION (E/8)

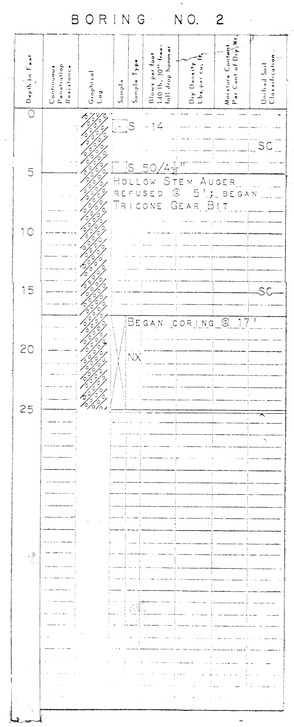
SCALE: 1/2"

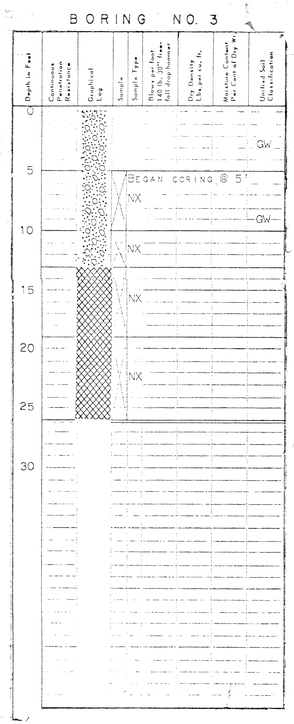
AS BUILT

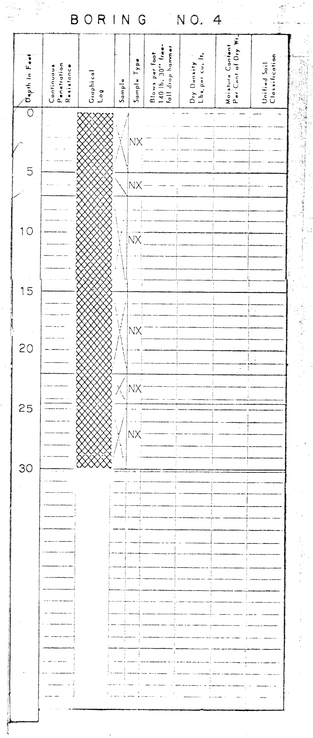
FILE NO.	TRICO INTERNATIONAL INC. CIVIL ENGINEERING SCOTTSDALE, ARIZONA	SHEET NO. 8
DRAWN BY C. H.	RETARDATION STRUCTURE NO. 7 OUTLET STRUCTURE DETAILS	SHEET 8 OF 9
SCALE NOTED	NO. DATE BY REVISIONS & REMARKS	
DATE 7-27-72	1. 2. 3. 4. 5. 6. 7.	
APPROVED		
CHECKED		
F.B. REF.		

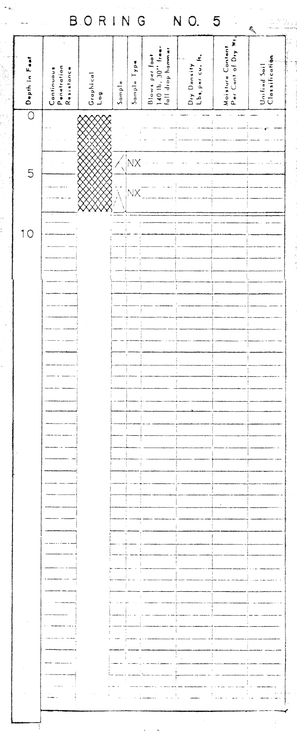
19 of 29

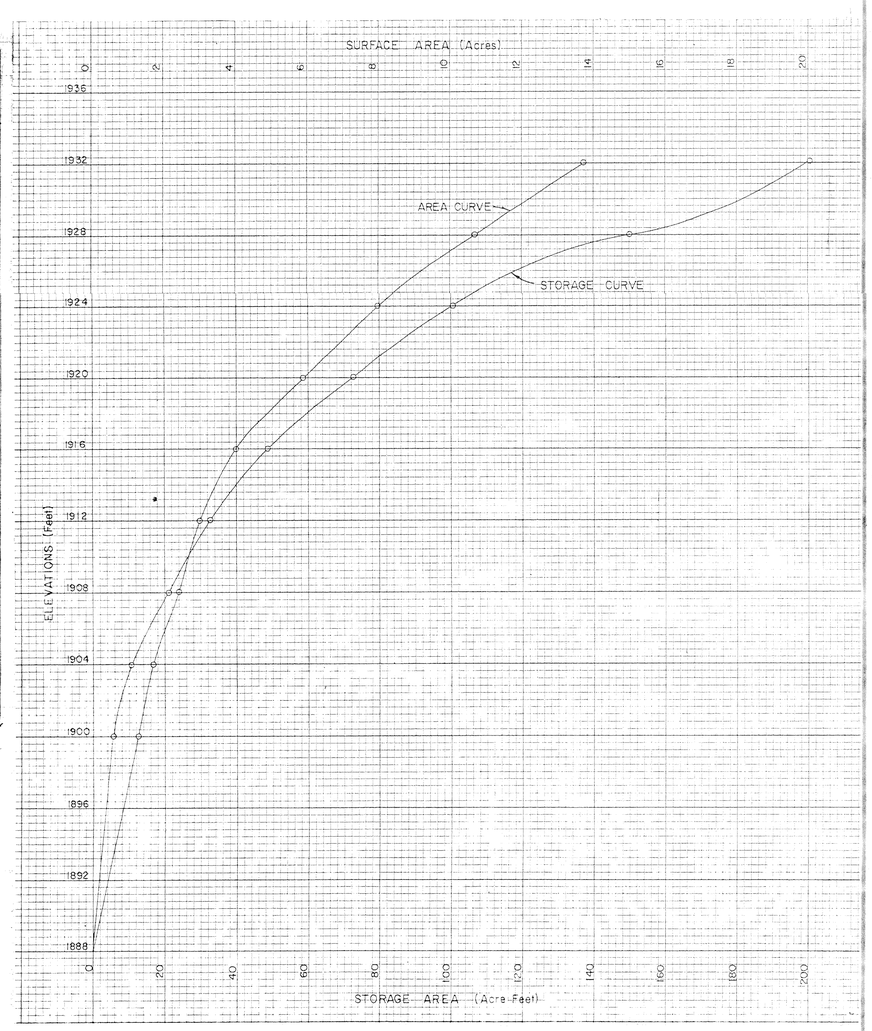












LOGS OF TEST BORINGS

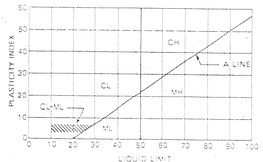
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corps of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 50% passes No. 200 sieve)	GRAVELS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)		GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
				GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)		SW	Well graded sands, gravelly sands.
				SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
		SANDS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (Liquid limit plots below "A" line & hatched zone on plasticity chart)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)		ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)		MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CLAYS (Liquid limit plots above "A" line & hatched zone on plasticity chart)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)		CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

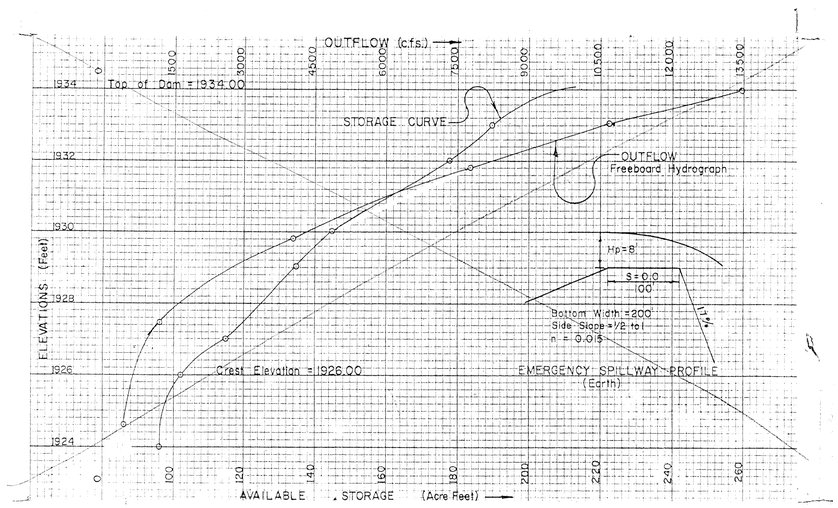
NOTE: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to ¾ in.
Fine gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve



SPILLWAY RATING CURVE

See supplemental data in report text

STAGE CAPACITY CURVE

NOTE

FOR MORE COMPLETE DETAILS OF TEST BORINGS SEE FOUNDATION AND MATERIAL INVESTIGATION REPORT BY SERGENT, HAUSKINS & BECKWITH DATED FEB. 8, 1971

AS BUILT

McCULLOCH PROPERTIES, INC.

FILE NO. 71-MPIF-P.4-15

TRICO INTERNATIONAL INC.
CIVIL ENGINEERING
SCOTTSDALE, ARIZONA

SHEET NO. 9

DRAWN BY H.C.
SCALE NONE
DATE
APPROVED
CHECKED
F.B. REF.

DAM CORE BORINGS

SHEET 9 OF 9

NO.	DATE	BY	REVISIONS & REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			

Pen No. 7

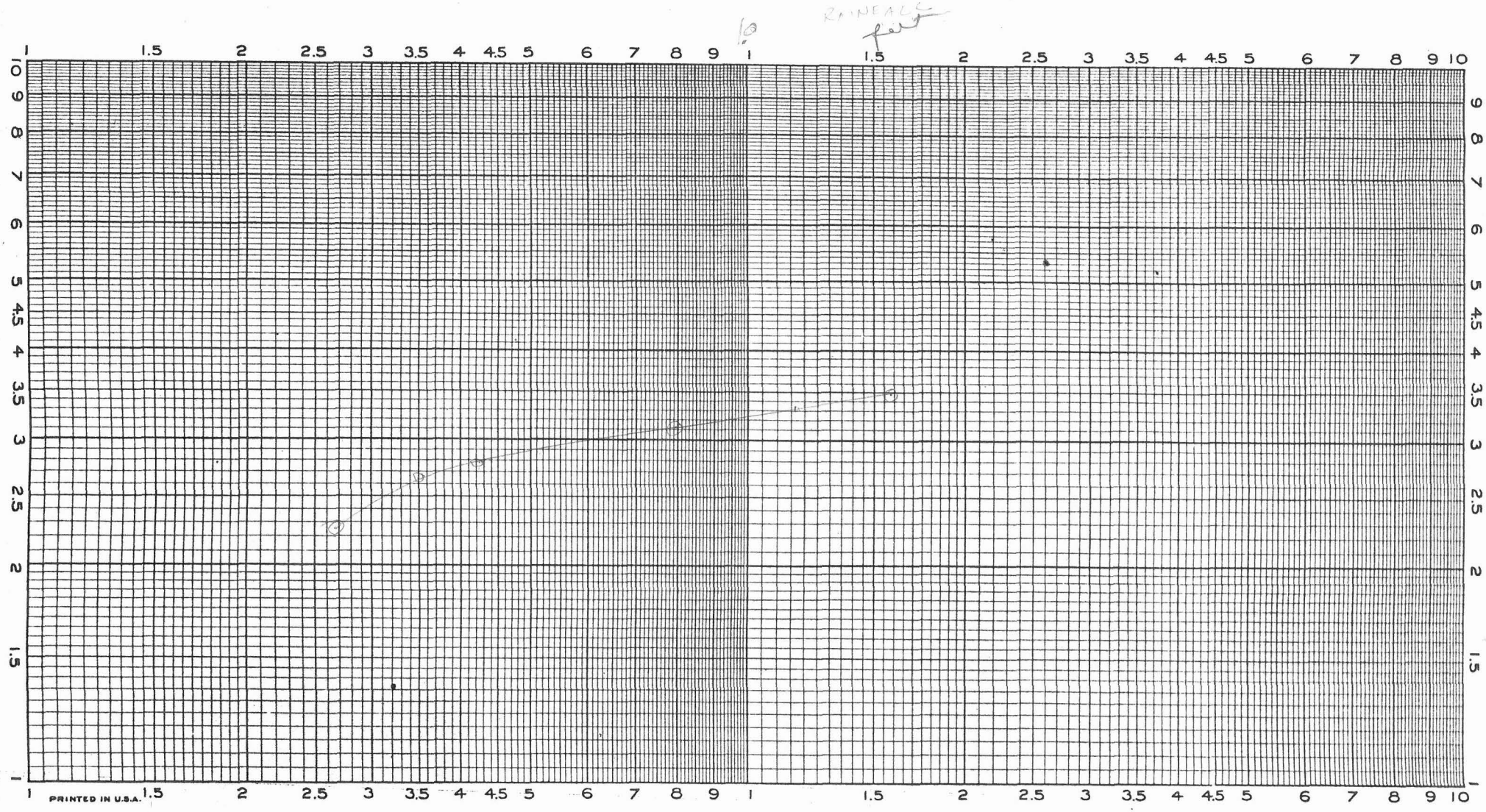
Rainfall	Qp	El.
3.2"	378	1922.6
4.2	548	1926.35
5.1	1366	1927.7
9.52	~~548~~ 5841	1931.1
19	13,269	1934.9

Log plot
El vs rainfall

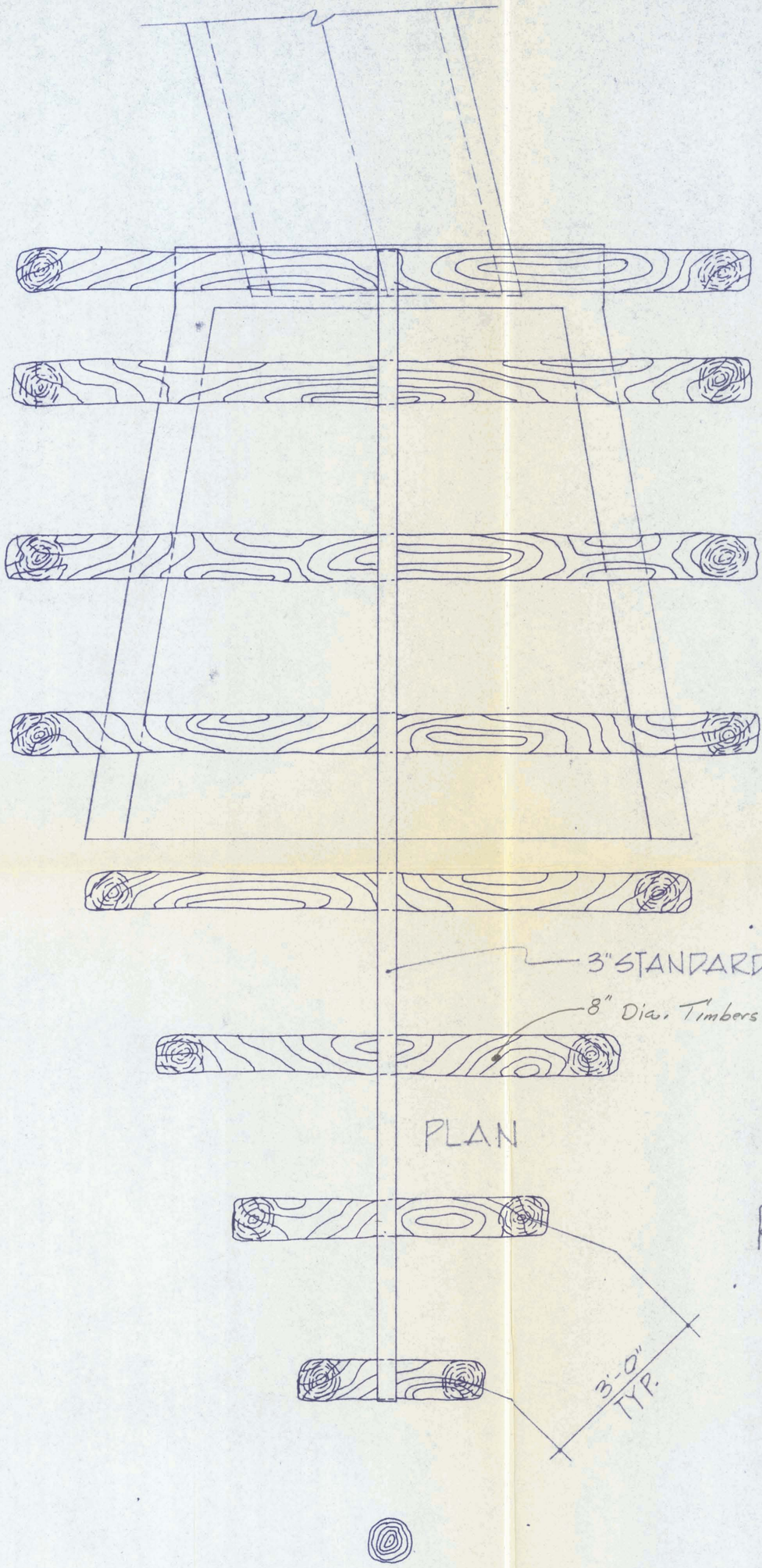
14" = 1933.2

7" = 1930.5

NO. 551 LOGARITHMIC 2X1.5 INCH CYCLES THE FREDERICK POST CO., CHICAGO, ILL.



Dam #7



REVISED TRASH RACK
FOR STRUCTURE № 7
SCALE: 1" = 2'

Dam # 7 Design Data

Calc. 1 On 3 of the 5 dams, storm D was PMP = 19". This one has storm D equal to 100 yr plus a function of PMP. Why the difference? Why not use the same storm for all the dams?

Calc. 2-3 Data checked, and agree with printout.

Hydrographs

4.2" storm (A)

			Calc	Sheet 4, plans
Hydro	peak Q	~~378~~ 548	spillway crest	
	peak El.	~~1923.59~~ 1926.35	1926.0	1926.0

9.52" storm (D)

			Calc	Sheet 5 plans
Hydro	peak Q	5841	dam crest	
	peak El.	1931.10	1934	1934.0

19" storm *

Hydro	peak Q	13,269	Sheet 5 plans
	peak El	1934.9	1934.0

Specs Require 95% min density, at least 1/2 must be 97% or better

Field Tests Emb 21 of 138 tests showed less than 97% density; this is 15%. None were below 95%.

Core. test cyl. 3290 lb. — ok.

* On hydrograph printout (p. 0097) for Dam #4

Dam #7 Plans

4. Dam and emerg. spillway crests agree with design data

6. A berm on the north side of the emergency spillway (6 ± Ligh) may be hazardous. How thick is grouted riprap (18")? What condition? What compaction (assume same as dam)? What velocities on spillway here? (Looks like slope of ~~.275~~ .273 will produce high velocities.

looks sturdy - may need riprap eventually. If failed - would go at this time.

Say $d = 8'$	4.0	$5'$ ~~2.3~~ 2.9	$2'$ (1.58)

flow around bend in dike range (1-2 fps)

$n = .03$

$V = \frac{1.486}{.03} \times 8^{2/3} \times .273^{1/2}$

$49.5 \times$ ~~4~~

$V =$	100 f/sec	75 f/sec	41 f/sec

Can this dike stand such velocities? Examine in the field.

7. Trash rack posts have top 1.5' below top of intake headwall, and are only 0.5' above the top of the 48" pipe. They will probably be ineffective to stop clogging for any appreciable flow! Will require frequent maintenance (cleaning).

Dam #7 Plans (cont'd)

7. All hrs are +4 min. ok

8 The storage and outflow curves plotted do not agree with the printout and design data. Inasmuch as the ~~plotted~~ design and printout data were used in the hydrographic analysis, and not the plotted curves, there is no adverse effect. However, these curves should not be used in any future analysis.

Dam #7 General

a. The D storm for this dam is not the PMP which was used for 3 of the other dams. Why? A modified storm was used. However, hydrology for dam #4 included this dam (7), and a PMP analysis was ~~derived~~ made.

The dam crest (1934.0) is 2.9' higher than the peak elev. (1931.1) for the modified D storm. But it is 0.9 lower than the peak elev. (1934.9) for the PMP storm. It may possibly be that after the dam was designed and a crest selected, it was found that the selected elevation was lower than the peak crest elev. for the PMP storm; therefore a lesser storm was chosen for design basis for the dam.

(See over)

There is another complication, however. A saddle dike is required NW of the dam, and its top is the same as the dam crest (1934.0). If the max storm overtops the dam it will also overtop the ~~dam~~ dike and unexpected flooding into another area will occur.

How serious is this problem?

See comments on Dam #36 General

I could not find the saddle
like? If it was not
hard, why not? what is
beyond?

Energ. spillway. Very
friable cementation. Quite broad.
Review beyond with AWC

AWC says area was such hard rock that
excav was stopped.

4/10 Energ. spillway. Very large boulders (many)
in spillway with hard but cemented, and
soft granular, mtls between. Erosion
possible but large rock will form ^ fracture
~~to~~ before serious erosion occurs.