

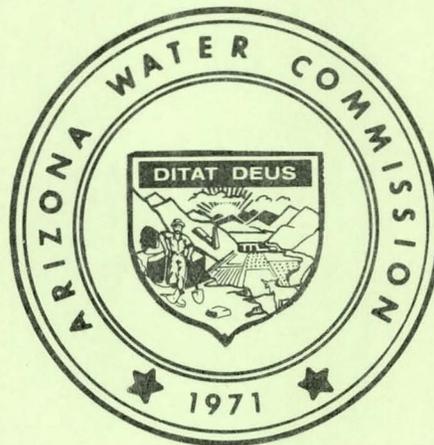
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Name of Dam: Sunny Cove Flood Retarding-Az. Dam No.(7-48)
County and State: Maricopa, Arizona
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PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

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STATE OF ARIZONA



OFFICE OF THE STATE WATER ENGINEER

Prepared by: Arizona Water Commission
Supervision of Dam Safety
Phoenix, Arizona
For: Los Angeles District Corps of Engineers
Date: January 1979

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PHASE I REPORT

National Dam Safety Program

Name of Dam: Sunnycove Dam (7-48)

State Located: Arizona

County Located: Maricopa

Stream: Sunnycove Wash

Date of Inspection: June 5, 1978

This small flood retarding dam is in excellent condition. It is conservatively designed, adequately maintained and under jurisdiction of the State's Division of Safety of Dams. There is no need for further investigation, but the Commission should obtain missing records not presently in their files. The aspect of downstream damage from spillway operation should be investigated.

Submitted by,


Benson G. Scott, P.E.

Arizona Water Commission
Chief, Supervision of Dam Safety
Arizona Registration No. 8169

Sunnycove Retarding Dam (7-48)

Phase I Inspection

Introduction: The purpose of this report is to evaluate the safety of a nonfederal dam in accordance with the National Dam Inspection Act, Public Law 92-367.

Since 1971, all nonfederal dams in Arizona 25 feet or more in height or storing more than 50 acre-feet of water have been under jurisdiction of the State Water Engineer for the protection of life and property from the consequences of a failure or malfunction of a dam. Experienced professional engineers of the Arizona Water Commission carry out the program for safety of dams by review and approval of designs for new dams or major repair to existing dams, supervision of construction for all new dams and for repair to existing dams, and surveillance of existing dams by periodic inspection and evaluation.

Sunnycove Retarding Dam was designed and constructed and has been operated under the regulatory control of the Commission as documented in this report. Attached as part of the report are photographs, drawings and data sheets.

1. Location. Sunnycove Dam and Reservoir are located in the southeast quarter of Section 11, Township 7N, Range 5W, G & SR B&M. The dam is across Sunnycove Wash, a tributary to the Hassayampa River, approximately one mile southwest of the center of the town of Wickenburg, Arizona.
2. Description. The earthfill dam has a crest length of 714 ft., a crest width of 14 ft., upstream slope of 3:1 and downstream slope of 2:1 and has a maximum height of 48½ ft. The unlined spillway is excavated through a saddle adjacent to the left abutment of the dam. The ungated outlet works consist of a multilevel, reinforced concrete tower at the upstream toe of the dam and a 30-inch reinforced concrete pipe conduit constructed through the dam at the base of the left abutment. The dam is a flood retarding structure to protect the community of Wickenburg. It will never have a permanent storage pool.
3. Hazard Potential. With its capacity of 218 acre-feet and height to spillway crest of 40 feet the structure qualifies as a small-to-intermediate sized dam. Its location on a small wash which drains down through the community of Wickenburg calls for a hazard potential of high. Within less than one-half mile of the toe of the dam there are a number of homes located almost in the bottom of the wash. Significant discharge from the emergency spillway or failure of the dam embankment would cause severe property damage and in the latter case heavy loss of life.
4. Project Documentation. An application to construct the Sunnycove Flood Control Dam was filed on June 25, 1975 by the Maricopa County Flood Control District, owner of the dam. The dam was designed and constructed by the United States Soil Conservation Service under the authority of Public Law 566 for the District. Submitted with the application document were the necessary support documents for the

independent review by the Commission staff. Included were plans, specifications, and design reports.

5. Geology. Based upon their site inspections an engineer and an engineering geologist from the Commission staff concurred with the owner's engineer in site suitability. Briefly, the geologic setting is defined as being within the Sonoran Desert section of the Basin and Range Physiographic Province. Bedrock at the site consists of Tertiary fanglomerate which is generally moderately to well-cemented. This material is massive. No faulting was identified. Basalt overlies the fanglomerate southwest of the damsite. Other alluvial deposits of Quaternary age are present on many hilltops. Recent alluvial deposits are present to shallow depths in the stream channel. Fanglomerate bedrock is exposed in both abutments of the dam. Foundation conditions in the dam and spillway as well as potential borrow sources were examined by both test pits and test holes.

6. Seismicity. There are no known active faults in the immediate vicinity of the damsites and there have been no recorded earthquakes in the immediate vicinity during the recorded seismic history of Arizona. However, 17 earthquakes have occurred in historic time within a radius of 100 miles of the sites. The largest of these was a 5.1 magnitude event that occurred in 1976 in Chino Valley about 55 miles northeast of the damsites; this resulted in an intensity of IV on the Modified Mercalli Scale (MM) at Wickenburg. The closest historic earthquakes occurred about 35 miles east at New River in 1974 with magnitudes of 2.5 and 3.0, and also about 35 miles northwest in 1967 with a magnitude of 3.8.

Based on present knowledge of the geology and seismic history of the area, the damsites could experience an expected maximum probable intensity of VI-VII MM. A seismic coefficient of 0.1g is considered conservative for stability analysis.

7. Foundation Conditions. The massive fanglomerate underlies the entire dam and was judged adequate for the foundation after removal of the overlying alluvial material primarily in the streambed section.

8. Foundation Treatment. The foundation was stripped of all alluvial material beneath the entire dam. A keyway for the central impervious core was excavated to firm fanglomerate to depths generally ranging from one to three feet. The minimum width was 12 feet. Abrupt changes or projections or other undesirable irregularities in the foundation, including abutments were eliminated prior to fill placement. A shelf was cut into the fanglomerate along the base of the left abutment for the outlet conduit. Other than removal of loose material, no additional foundation treatment was required.

9. Embankment. The dam is a zoned-earthfill dam with a central vertical chimney drain and blanket drain for outfall purposes. With the exception of the chimney drain (Zone 2) other embankment material was to be obtained from locally designated borrow areas and required excavation. Examination of the stability analysis conducted by the engineer revealed no reason to question the structural safety of the dam. The Zone 1 core utilized clayey sands, sandy clays or sandy

silts available in the designated borrow area. Fine content of the chimney drain was limited to less than 5 percent. The shell zones (Zone 3) consist of gravelly sands or sandy gravels from the designated borrow and required excavation. The Zone 4 transition was similar to Zone 3 except that it contained more fines. Requiring an internal drain on a flood retarding dam was believed necessary because of the limited fines content in the core zone, its lack of clay sizes and of course the high downstream risk. Compaction was to minimum 95 percent of standard AASHO at optimum moisture.

10. Outlet Works. The 30-inch reinforced concrete pipe conduit is founded on firm fanglomerate material along the base of the left abutment at streambed level. It is bedded in a concrete cradle to the springing line for its entire length. Five antiseep cutoff collars spaced at 16 feet on centers are located through the transition and core zones. Flow into the pipe is controlled by a reinforced concrete intake tower with the screened intake port at approximately stream level and an uncontrolled drop inlet at the top of the tower, approximately at spillway crest level. Discharge through the conduit enters a manhole at the downstream toe of the dam from whence flow is conveyed via a pipeline to an outfall in the Hassayampa River, approximately 1½ miles away. There is a provision for overflow from the manhole into the natural stream channel below the dam when discharge exceeds outfall line capacity.

The reinforced, concrete steel cylinder pipe is adequate to resist the design load. The foundation is nonyielding. Hydraulically the outlet work is designed to empty in 10 days the flood control pool accumulated during a 100-year storm. Under normal operating conditions the outlet conduit will not flow full as it is controlled by an 18-inch slide gate on the intake tower until a flood greater than the 100-year storm occurs.

11. Spillway Design. The spillway, a 100-ft. wide unlined and uncontrolled channel through a narrow ridge 200 feet to the left of the left abutment of the dam, conveys flood water to a discharge point several hundred feet below the downstream toe of the dam. The firm, in place fanglomerate material is adequate to resist any serious erosion from the infrequent spills that might occur. Additional spillway data is provided on data sheets elsewhere in this report.

According to Corps of Engineers classification criteria, Sunnycove Dam is a small structure with a high downstream hazard. The recommended spillway design flood for this classification ranges from ½ the Probable Maximum Flood (PMF) to the PMF.

A local, six hour Probable Maximum Storm was developed for the watershed using procedures outlined in HMR-49, "Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages", dated September 1977, prepared by the National Oceanic and Atmospheric Administration. This storm was routed through the structure using the Soil Conservation Service watershed modeling program "TR-20". The routing was performed with an initial water surface at spillway crest elevation. The spillway is capable of passing 100% of the PMF with 0.7 feet of residual freeboard.

12. Specifications. The specifications governing construction of the dam were developed from standard Soil Conservation Service specifications with the addition of the special sections to cover those features pertinent to this dam. Commission review concerned itself with foundation preparation, embankment placement, embankment moisture condition, embankment density, control of drain fill, installation of filter drain pipe, structural backfill, and control over concrete. With the exception of a few minor points the construction specifications were satisfactory to the Commission.

13. Construction History. The application for construction was approved by the State Water Engineer on September 5, 1975, but the contract for construction was not awarded until March 22, 1976. The first foundation inspection by Water Commission engineers was on May 13, 1976, at which time foundation preparation was well along. Contrary to their normal method of operation, the Soil Conservation Service contracted with a private engineering firm for all quality control and construction supervision for the project. Engineers Testing Laboratories of Phoenix performed this service. Construction of the dam was by M. M. Sundt Construction Company. Quality control was in accordance with the specifications but records of tests are not available in Commission files. There were no unusual problems associated with construction and all work was completed and accepted on September 15, 1976.

14. Data on File. The following data is on file with the Commission:

1. As-built plans
2. Construction specifications
3. Preliminary design report
4. Geologic investigation report
5. Inspection reports with photographs by Commission engineers covering construction of the project.
6. Inspection reports with photographs by Commission engineers since completion of the project.

Items 1 through 4 are also in the permanent records of the Soil Conservation Service.

15. Instrumentation. There is no instrumentation on this project.

16. Surveillance.

A. Inspections: The dam is inspected annually by Commission engineers. The dam was inspected in October 1976, April 1977 and June 1978. At the time of the most recent inspection engineers from the Commission inspected the dam with representatives of the Maricopa County Flood Control District, owner of the dam. There was evidence of about 20 feet of impoundment from recent floods in March 1978. At that time there was flow through the outlet works but none through the spillway. There was no evidence of seepage through the embankment or the foundation during or after this period of moderate storage. The crest and slopes of the embankment appeared to be in good condition with no visible signs of cracks or settlement. There are no surveillance monuments installed on this dam. There is moderate vegetation growth on the slopes but erosion gullies are developing along the slopes. They are not detrimental but

represent future maintenance work.

According to the Flood Control District, the gate mechanism was recently serviced and is believed to be in operable condition. The concrete of the intake structure on the outlet appeared to be in good condition. There is some silt accumulation around the base of the intake structure but not enough to affect operation of the low-level intake. The spillway has not operated yet and appeared virtually unchanged from its as-constructed condition. The Maricopa County Flood Control District is able to adequately perform all operation and maintenance required for the various flood control facilities including this dam that they own.

B. Future Activity: The Commission will continue to inspect this structure at yearly intervals and also after periods of heavy inflow. Utilization as a flood retarding structure permits little possibility of any long-term water retention and buildup of a seepage condition within the dam embankment. There is little likelihood that the under drain system will ever operate. It is conceivable that a small amount of water could be impounded for a longer period of time than the operational 10-day drawdown. However, to do this the low-level, 18-inch gate would have to be closed, contrary to Flood Control District operating procedures. It will probably be necessary after a number of years to remove silt buildup from around the low-level intake and also to repair erosion gullies as they become more prominent. Should the spillway ever discharge it will do substantial damage to downstream property located along the wash and, in some cases, in the wash.

17. Appraisal of the Project.

A. Conclusions: The proposed project is in satisfactory condition with no problems other than some routine maintenance to correct erosion of the embankment surface. There is no evidence of any problem that will affect the safety of the dam. The structure has been designed and constructed in accordance with practices acceptable within the profession. The dam is capable of operating under the most severe condition up to and including a flood from the probable maximum precipitation. Operation and maintenance is above normal. There is no need for any further investigation beyond this Phase I report.

B. Recommendations: Construction quality control records presently not in the Commission files should be acquired for completion of the record. The present operational surveillance plan should be continued. Because the dam is unattended and because discharge from the emergency spillway could cause damage downstream, it might be well for the Flood Control District to consider the installation of a warning system to alert local emergency services people in time of extreme floods.

STATE OF ARIZONA
ARIZONA WATER COMMISSION
Supervision of Dam Safety

DATE:

- - Informational Summary Sheet - -

Name of Dam Sunnycove Flood Retarding Dam No. 7-48

Type of Dam Earthfill Use Flood Control Located in Maricopa County

Located on Sunnycove Wash (stream), A Tributary to Hassayampa River

SW $\frac{1}{4}$ Sec. 11 Twp. 7N Range 5W, G & SR B&M

The attached location map is a portion of the Wickenburg USGS

7 $\frac{1}{2}$ or) Quadrangle.

The following additional maps may be helpful _____

Special access problems? Yes ___ No X If Yes see comments on attached map.

DAM:

Height 40 feet U/S Slope 3:1 D/S Slope 2:1

Crest Elev. 2178.5 Crest Width 14 feet Crest Length 714 feet

SPILLWAY:

Crest Elev. 2170 Type Unlined, broadcrested Capacity 6300 cfs

Freeboard 8.5 Width 100 feet Side Slopes 2:1

Flashboards? No If yes, Height n/a

Controlled? No If yes, Describe n/a

OUTLET:

Type, size, capacity: cut and cover, 30" R/C cylinder pipe;

Controls Perforated trash guard permits discharge through 18" slide gate at base of intake tower. Drop inlet structure above El 2169.5. Gate controlled by stem and wheel on dam crest.

(over)

RESERVOIR:

Cap. @ Spwy Crest 218 AF Normal Capacity Empty
Drainage Area 1.35 MI² Normal W.S. Elev. n/a

DOWNSTREAM HAZARD:

Nearest D/S City Wickenburg Distance Less than 1 mi. Elev. 2100 feet
Population 3,200 Damage would
probably be limited to areas along wash, affecting about 1/10 the
population.

CONSTRUCTION:

Application Approved 9-5-75 Construction Completed 9-15-76
License Issued 2-22-77
Subsequent Alterations None

RESTRICTIONS: No permanent storage permitted.

COMMENTS:

STATE OF ARIZONA
ARIZONA WATER COMMISSION
Supervision of Dam Safety

DATE:

- - Informational Summary Sheet - -

Name of Dam Sunnycove Flood Retarding Dam No. 7-48

Located SW $\frac{1}{4}$ Sec. 11 Twp. 7N Range 5W, G & SR B&M

OWNER

ENGINEER

Name Maricopa County Flood Control District Name Herbert P. Donald, Chief Eng.

Address 3325 W. Durango St. Address Maricopa Co. F.C.D.

Phoenix, Arizona 85009 Same

Phone 262-1501 Phone _____

Emergency 273-1411

OTHER

IN EMERGENCY CONTACT:

Name Jack Leavitt, Operations Chief, Maricopa Co. F.C.D.

Address 3325 W. Durango St. Nearest Communication to Dam

Phoenix, AZ 85009

Phone 262-1501 (Emergency 273-1411)

LAW ENFORCEMENT

Maricopa County Sheriff Local Police _____

Address 102 W. Madison Ave. Address _____

Phoenix

Phone 258-6941 Phone _____

STATE OF ARIZONA
ARIZONA WATER COMMISSION
SUPERVISION OF DAM SAFETY

FLOOD ESTIMATE AND SPILLWAY ANALYSIS

Name of Dam Sunnycove Type of Dam Earthfill Dam No. 7-48
County Maricopa Hydrologic Class Size - Small*/Hazard = High
Located on Sunnycove Wash Tributary to Hassayampa River
SW $\frac{1}{4}$ Sec. 11 Twp. 7 N Range 5 W G & SR B & M
USGS Quadrangle Wickenburg, AZ (7 $\frac{1}{2}$), 15' (Circle One)

I. DRAINAGE BASIN

1. Drainage Area - Sq. Mi. 1.35
2. Channel Reach Length, Ft. _____
3. Maximum Elevation _____
4. Minimum Elevation 2130
5. Avrg. Watershed slope, % _____
6. Cover Density, % _____
7. Cover Type, _____
8. Soil Group _____
9. Runoff Curve Number 86
10. Impaired? no

II. DAM AND RESERVOIR

1. Reservoir Area @S/W. Ac. 18
2. Res. Cap. to S/W A.F. 219
3. Surcharge Storage-A.F. 168
4. S/W Crest Elev. 2170.
5. Dam Crest Elev. 2178.5
6. Total Freeboard Ft. 8.5
7. Max. Storage Level _____
8. Gated or Ungated Ungated
9. Max. S/W Q, -cfs 8250

*According to Corps of Engineers criteria.

Sketch of Spillway Attached, as per As-Constructed
SCS Drawings Date _____

Remarks, Special Conditions, Etc. _____

Calculated by W. C. Jenkins Date 12-78

Checked by _____ Date _____

FLOOD HYDROLOGY

Name of Dam Sunnycove

No. 7-48

	SCS	HMR-49		
	PMF*	PMF**		
1. Flood Type				
2. Storm Precip-In.	14.9	14.9		
3. Precip, Dur. - Hr.	6.0	6.0		
4. Peak Intensity - In/Hr.		11.3		
5. Time of Concentration - Hr.	1.1	1.1		
6. Peak Inflow - cfs	5168	7709		
7. Peak Inflow - csm	3828	5710		
8. Runoff - A.F.	943	942		
9. Runoff - In.	13.1	13.1		
10. Runoff Coeff.	86	86		
11. Routed?	yes	yes		
12. Peak Outflow - cfs	4858	7188		
13. Peak Outflow - csm	3598	5324		
14. Max. Water Surface Elev.	2176.1	2177.8		
15. Residual Freeboard	2.4	0.7		
16. Diverted Inflow, cfs	-	-		
17. Check Adopted Flood				

Remarks:

Initial reservoir water surface at spillway crest, outlet presumed plugged.

* Precipitation time distribution per SCS 6-hour storm.

**Precipitation time distribution per HMR-49 thunderstorm criteria.

Sunnycove Dam



Photo 1 (October 22, 1976) - Outlet intake structure, upstream slope of dam and reservoir area.

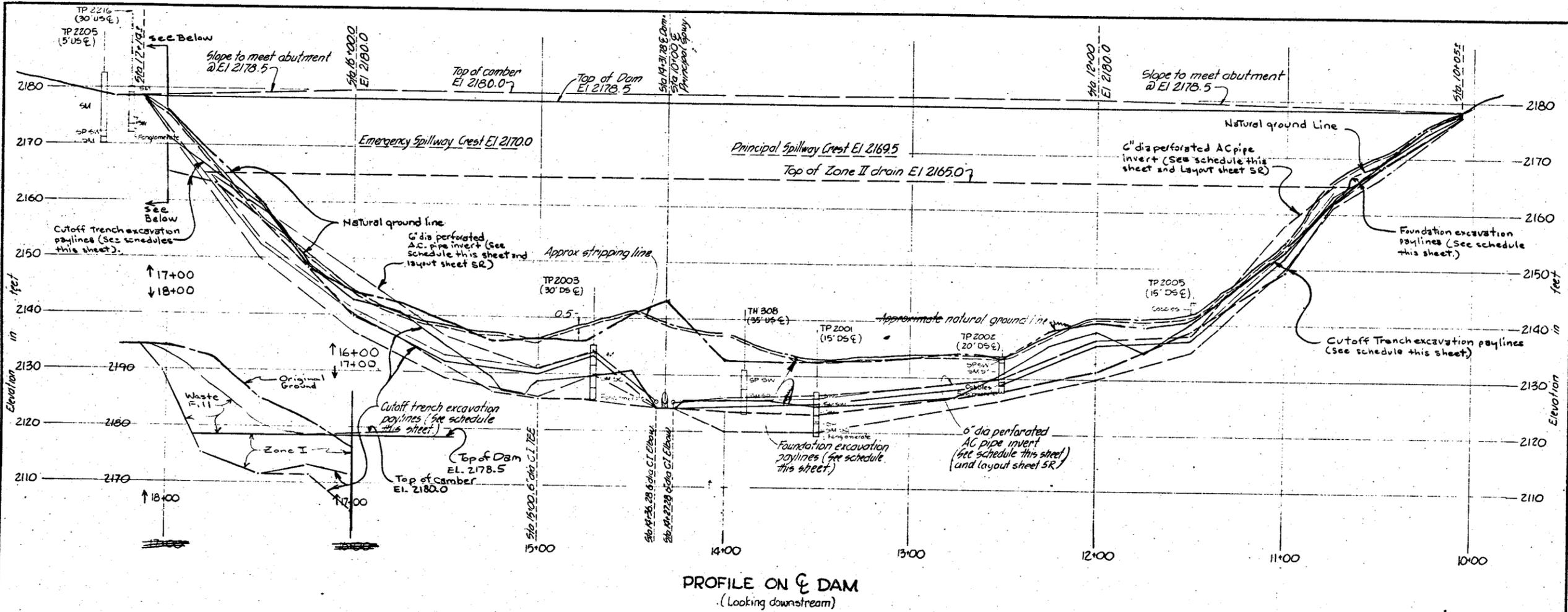


Photo 2 (August 19, 1976) - Emergency spillway. Looking downstream.

Sunnycove Dam



Photo 3 (October 22, 1976) - Downstream slope.



PROFILE ON E DAM
(Looking downstream)

SCHEDULES

STATION	ELEVATION	
10+05 ±	2177.5	2177.7
10+50	2168.0	2168.9
10+75	2163.0	2162.1
11+00	2152.0	2153.1
11+50	2137.0	2139.8
12+00	2136.0	2138.5
12+50	2129.0	2131.1
13+50	2125.0	2124.7
14+27.28	2124.1	
14+36.28	2124.1	
14+70.50	2133.0	2130.6
15+00	2130.0	2127.9
15+50	2132.0	2134.9
16+00	2140.0	2140.0
16+50	2153.0	2159.7
17+00	2174.0	2171.4
17+14 ±	2177.5	2172.4

Elevations at E Dam Excavated surface in cross sections shall be to firm conglomerate except from Sta. 13+50 to Sta. 14+50 where foundation excavation shall be uniformly sloped to the foundation excavation lines required for Principal Spillway. See Profile on E Principal Spillway sheet 4R.

STATION	ELEVATION	
10+05 ±	2177.5	2177.4
10+50	2166.0	2168.0
10+75	2161.0	
11+00	2150.0	2149.4
11+50	2135.0	2139.0
12+00	2130.0	2131.5
12+50	2126.0	2127.7
13+50	2120.0	2123.3
14+00	2120.0	2123.5
14+27.28	2124.1	
14+36.28	2124.1	
14+70.50	2130.0	2124.5
15+00	2126.0	2125.5
15+50	2129.0	2131.0
16+00	2137.0	2139.9
16+50	2150.0	2157.0
17+00	2172.0	2165.1
17+14 ±	2177.5	2171.3

Elevation at 70' upstream from E of Dam.

STATION	ELEVATION
17+50	2171.3
17+80	2175.2
18+01	2189.7
18+17	2195.0

All Elevations and Stations are approximate and may be adjusted by Engineer.

STATION	ELEVATION	REMARKS
10+75	2164.0 ^{2165.0}	Plug beginning end with mortar or AC cap.
11+00	2153.0 ^{2158.0}	Grade change
11+50	2138.0	Grade change
12+00	2137.0	Grade change
12+50	2130.0	Grade change
13+00	2128.0	Grade change
13+50	2126.0 ^{2122.0}	Grade change
14+27.28	2125.1	CI Elbow to 6" dia non-perforated AC outlet pipe.
14+36.28	2125.1	CI Elbow to 6" dia non-perforated AC outlet pipe.
14+70	2132.0	Grade change. Plug beginning ends with mortar or two AC caps.
15+00	2131.0	CI Tee to 6" dia non-perforated AC outlet pipe.
15+50	2133.0 ^{2136.5}	Grade change
16+00	2141.0 ^{2147.5}	Grade change
16+50	2154.0 ^{2158.5}	Grade change
16+75	2164 ±	Plug beginning end with mortar or AC cap.

Elevation at 70' Downstream from E of Dam.

Notes:

- Unified soil descriptions are based on field identifications except where an asterisk is shown the classification has been based on laboratory analysis.
- Complete field logs, laboratory test data and geologic report are available for review in the project office.
- For locations of test pits and test holes see sheet 2R.
- Test pit or test hole location D5 = Downstream from E Dam and U5 = Upstream from E Dam.

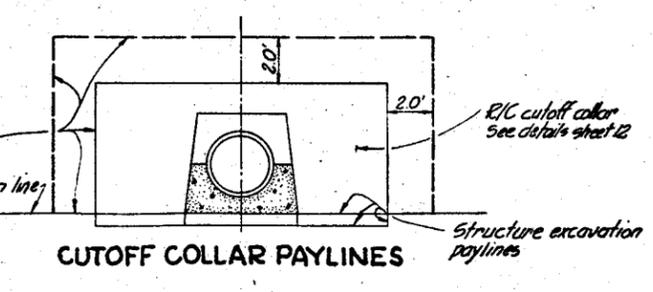
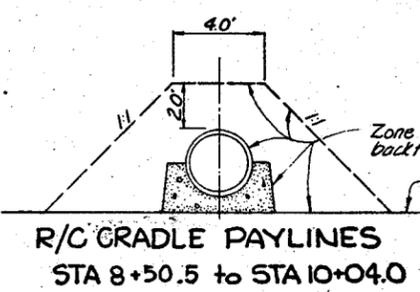
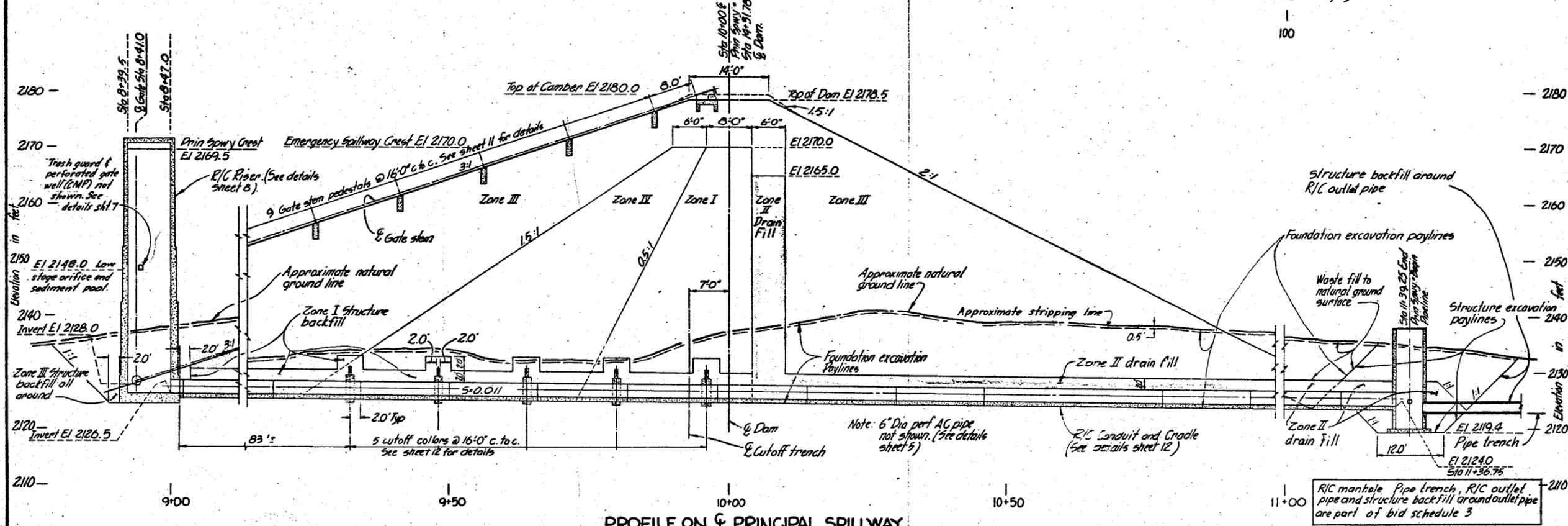
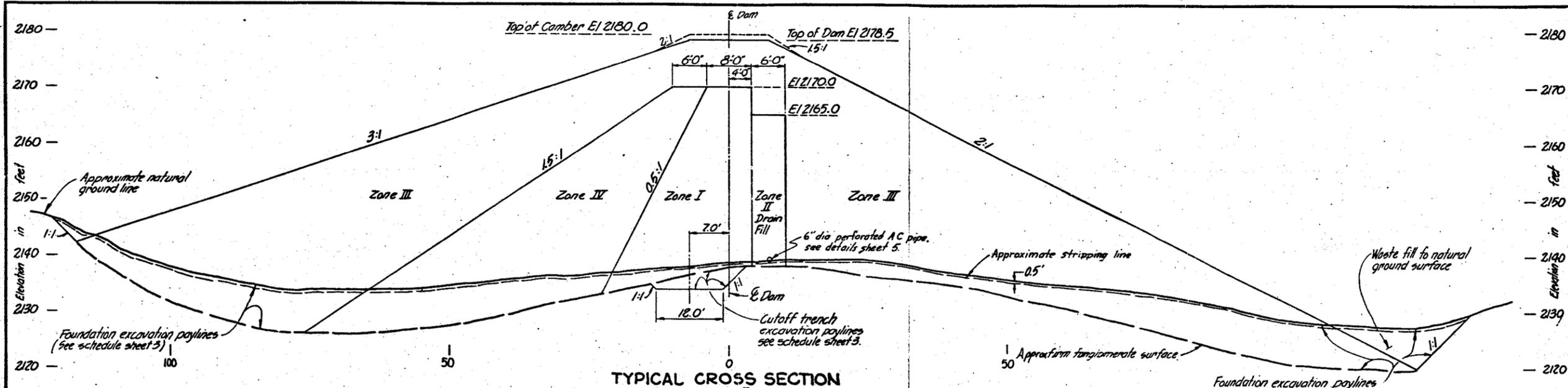
AS BUILT
CONSTRUCTION COMPLETED
9/15/76

Don Wakefield

PROFILE ON E DAM AND EXCAVATION SCHEDULES
SUNNYCOVE F.R.S.
WICKENBURG, W.P.D.
MARICOPA COUNTY, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed Greg Cunningham	Date 3-75	Approved by	Date
Drawn Jack Long	Date 4-75	Title	
Traced		Checked	
		Sheet 3 of 18	Drawing No. 7E-23090



PROFILE ON E PRINCIPAL SPILLWAY AND TYPICAL CROSS SECTION OF DAM			
SUNNYCOVE F.R.S			
WICKENBURG W.P.P.			
MARICOPA COUNTY, ARIZONA			
U. S. DEPARTMENT OF AGRICULTURE			
SOIL CONSERVATION SERVICE			
Designed: Greg Cunningham	Date: 9-75	Approved by: _____	Title: _____
Drawn: Jack Land	Date: 9-75	Checked: _____	Title: _____
Traced: _____	Sheet No: 4	Drawing No: 7-E-23090	
Checked: _____	of 18		