CONCRETE BOX CULVERT ON SIGNAL BUTTE FLOODWAY AT ELLSWORTH ROAD

Final Copy

STRUCTURAL CALCULATIONS

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

FOR

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DIBBLE AND ASSOCIATES
CONSULTING ENGINEERS
PHOENIX, ARIZONA

NOVEMBER 23, 1979

9/24/79
KMO

DESIGN CRITERIA:

I. DESIGN STRESSES

$f'_c = 4000$ PSI

$f_c = 0.4 f'_c = 1600$ PSI

$f_s = 20{,}000$ PSI

$n = 8$

$v = 0.03 f'_c = 120$ PSI

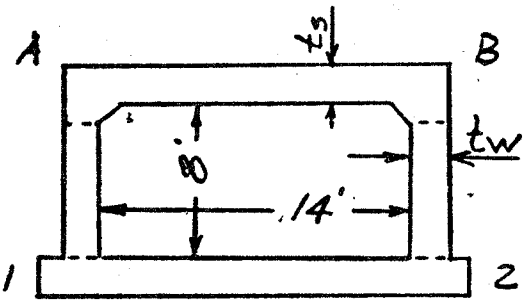
$K = 272$

$k = 0.390$

$j = 0.870$

II. BOX CULVERT

1 - 14' x 8' x 164' CBC



$t_s = 14"$ ASSUMED

$t_w = 12"$ ASSUMED

III. LOADING

SOIL TYPE SM (UNIFIED) $W_e = 130$ PCF

$K_A = 0.64$ (REF.: SCS ENGINEER DESIGN STANDARDS, FAR WEST STATES, FIG. 2.11 & FIG. 2.12, NON-YIELDING WALL, "AT REST" FOR LEVEL BACKFILL, $\phi = 27°$)

FILL = 2'

2' SURCHARGE FOR LATERAL LOADS

LIVE LOAD (LL) = H20

IMPACT LOAD (I) = 30% OF LL

9/24/79
K.H.O.

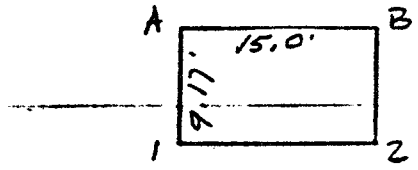
ANALYSIS

USE "WORKING STRENGTH" DESIGN

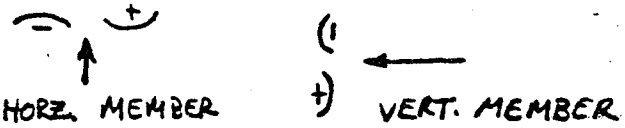
SOLVE BY MOMENT DISTRIBUTION

ANALYSIS LENGTH = L = 14' + t_w = 15'-0" c. to c.

ANALYSIS HEIGHT = H = 8' + t_s = 9'-2" = 9.17'



USE BEAM (CURVATURE) SIGN CONV.



ANALYZE AS A RIGID FRAME. THERE IS NO SIDESWAY — LENGTH OF BOX IS MUCH GREATER THAN THE WIDTH.

STIFFNESS FACTORS

$$K_{AB} = K_{12} = C\frac{EI}{L} - \frac{bt^3}{12} \longrightarrow \frac{t_s^3}{L_{AB}} = \frac{14^3}{15} = 183$$

$$K_{A1} = K_{B2} = C\frac{EI}{L} \longrightarrow \frac{t_w^3}{L_{A1}} = \frac{12^3}{9.17} = 189$$

NOTE: MEMBER A1 IS SYMMETRICALLY LOADED AT ALL TIMES, THEREFORE IF K_{A1} IS MULTIPLIED BY 1/2 THERE WILL BE NO CARRY-OVER FROM A TO 1 OR B TO 2.

DISTRIBUTION FACTORS

JOINT A.: $D_{A1} = K_{A1} \times 1/2 = 189 \times \frac{1}{2} = 94.5 = 0.34$

$D_{AB} = \quad = 183 = 0.66$

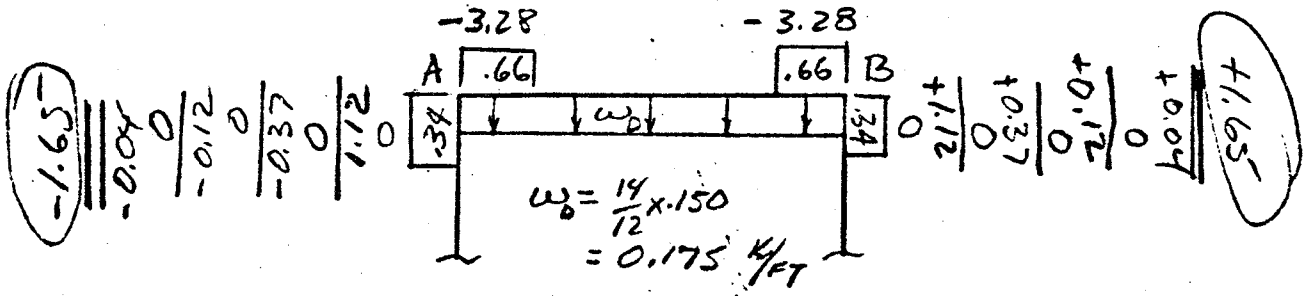
$277.5 \quad 1.00$

9/24/79
K.M.O.

DEAD LOAD (DECK)

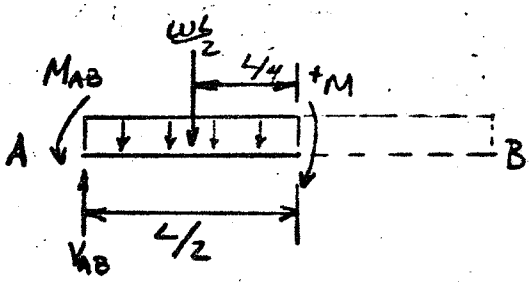
-1.65
+0.08
-0.12
+0.24
-0.36
+0.71
-1.08
+2.16
-3.28

-1.65
+0.08
-0.12
+0.24
-0.36
+0.71
-1.08
+2.16
-3.28



$$M^F_{AB} = M^F_{BA} = \frac{\omega_0 L^2}{12} = \frac{.175(15.0)^2}{12} = 3.28 \text{ FT-K}$$

$$V_{AB} = V_{BA} = \frac{\omega_0 L}{2} = \frac{.175(15)}{2} = 1.31 \text{ K}$$



$$+M_{@CENTER} = \left(V \times \frac{L}{2}\right) - \left(\omega \times \frac{L}{2} \times \frac{L}{4}\right) - M_{AB}$$

$$= \left(1.31 \times \frac{15}{2}\right) - \left(.175 \times \frac{15}{2} \times \frac{15}{4}\right) - 1.65$$

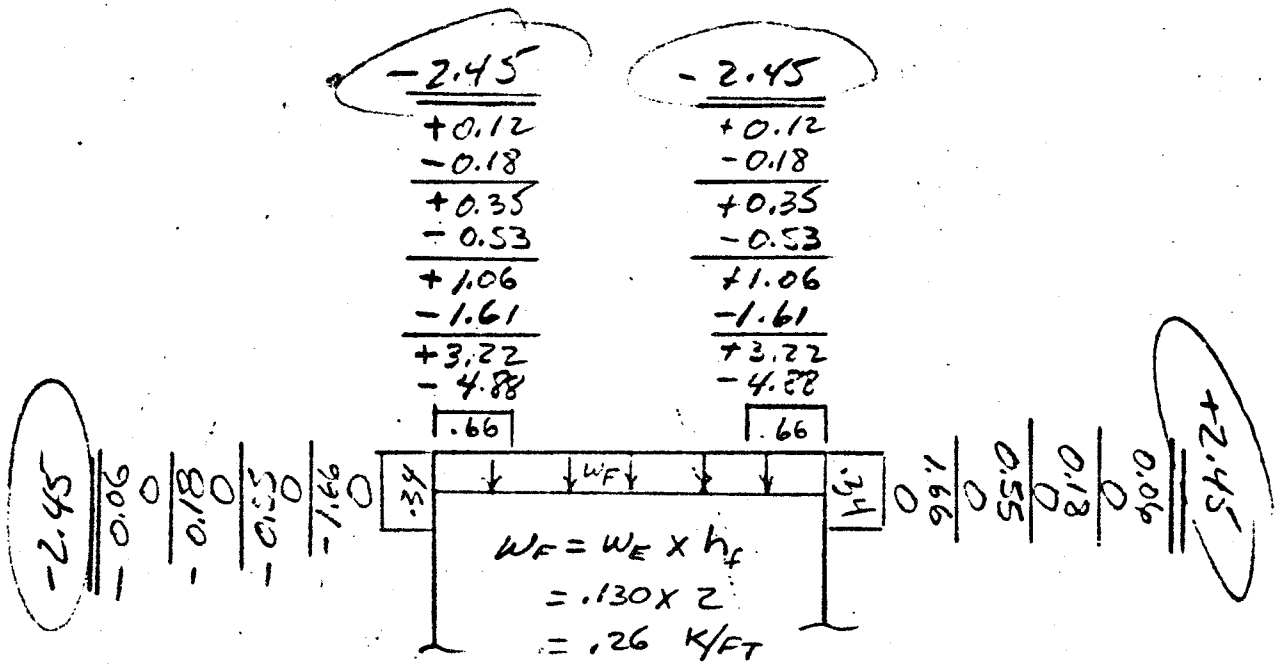
$$= 7.83 - 4.92 - 1.65$$

$$= 3.25 \text{ FT-K}$$

$$V_{A1} = \frac{M_{A1}}{H} = \frac{1.65}{7.17} = 0.18 \text{ K} \leftarrow$$

9/25/79
KMD

DEAD LOAD (FILL)



$$M^F_{AB} = M^F_{BA} = w_F \times \frac{L^2}{12} = .26 \times \frac{(15)^2}{12} = 4.88 \text{ FT-K}$$

$$V_{AB} = V_{BA} = w_F \frac{L}{2} = .26\left(\frac{15}{2}\right) = 1.95^{K}$$

$$+M = 1.95\left(\frac{15}{2}\right) - (.26)\frac{(15)^2}{8} - M_{AB}$$

$$= 14.63 - 7.31 - 2.45$$

$$= 4.86 \text{ FT-K}$$

$$V_{A1} = \frac{2.45}{9.17} = 0.27^{K}$$

9/25/79
KMO

LIVE LOAD

H20 LOADING

$P_{LL} = 16^k$

I = 30% of LL. → $P_{LL} + I = 16 + 0.3(16)$

$= 16 + 4.80 = 20.8^k$

WHEEL LOAD DISTRIBUTION

(1) REINFORCEMENT PERPENDICULAR TO TRAFFIC

$$M = \left(\frac{S+2}{32}\right)P = \frac{PS}{4E} \rightarrow E = \frac{8S}{S+2}$$ S = CLEAR SPAN

$$E = \frac{8(14)}{14+2} = 7.00$$

(2) REINFORCEMENT PARALLEL TO TRAFFIC

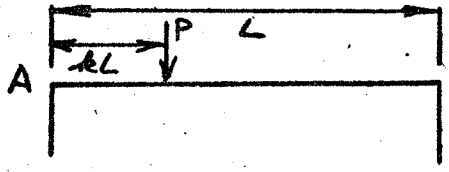
$E = 4 + 0.06S = 4 + 0.06(14) = 4.84$ ✓

∴ USE MINIMUM E

LIVE LOAD PER FOOT OF LENGTH

$$LL = \frac{P_{LL} + I}{E} = \frac{20.8^k}{4.84} = 4.30^k$$

FIXED END MOMENT COEFFICIENTS



$M^F_{AB} = C_{AB} \cdot P \cdot L$

$M^F_{BA} = C_{BA} \cdot P \cdot L$

$C_{AB} = k(1-k)^2$ $\qquad C_{BA} = k^2(1-k)$

k	C_{AB}	C_{BA}
0.25	0.141	0.047
0.30	0.147	0.063
→ 0.35	0.148	0.080
0.40	0.144	0.096
0.45	0.136	0.111
→ 0.50	0.125	0.125

NOTE: BY INSPECTION
MAX NEG. M @ $k = 0.35$
MAX POS. M @ $k = 0.50$

9/25/79
KMO

LL @ 0.35 L $k = 0.35$

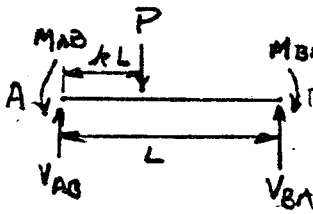
$M^F_{AB} = (0.148)(4.30)(15) = 9.55^{FT-K}$

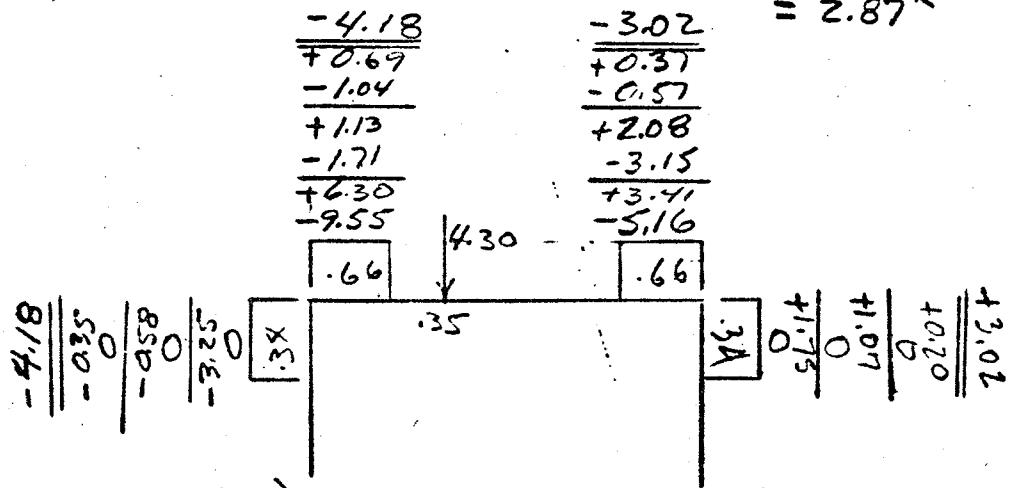
$M^F_{BA} = (0.080)(4.30)(15) = 5.16^{FT-K}$

$V_{AB} \rightarrow \Sigma M_B = 0 = V_{AB} L + M_{BA} - M_{AB} - P(1-k)L$

$V_{AB} = P(1-k) + \left(\frac{M_{BA} - M_{AB}}{L}\right) = 4.30(.65) + \left(\frac{1.16}{15}\right)$

$= 2.87^K$





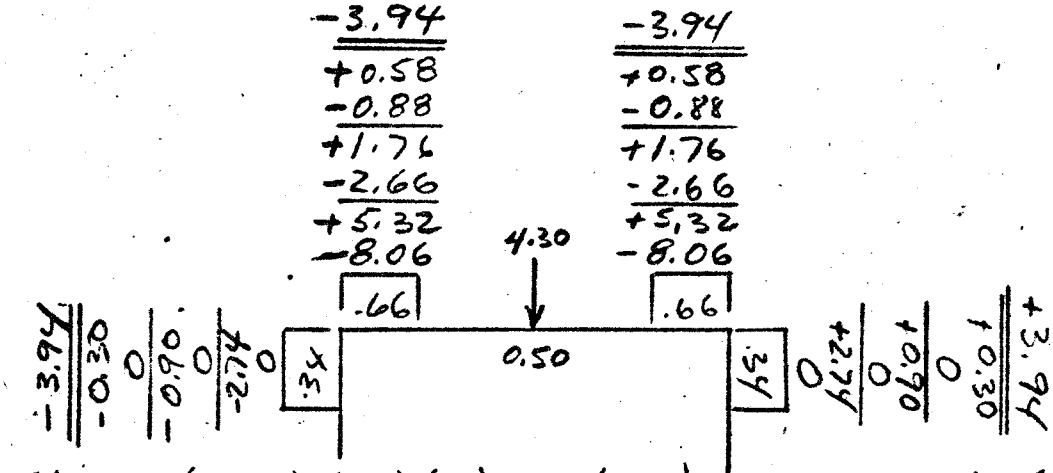
$M_{.35} = V_{AB}(kL) - M_{AB} = (2.80)(.35)(15) - 4.18 = 10.52^{FT-K}$

$V_{A1} = \frac{M_{A1}}{H} = \frac{4.18}{9.17} = 0.46^K$

LL@ .50L $k = 0.50$

$M^F_{AB} = (0.125)(4.30)(15) = 8.06 = M^F_{BA}$

$V_{AB} = 4.30(.50) + 0 = 2.15^K$



$M_{.50} = (2.15)(.50)(15) - (3.94) = 12.19^{FT-K}$

$V_{A1} = \frac{3.94}{9.17} = 0.43^K$

9/25/79
KMO

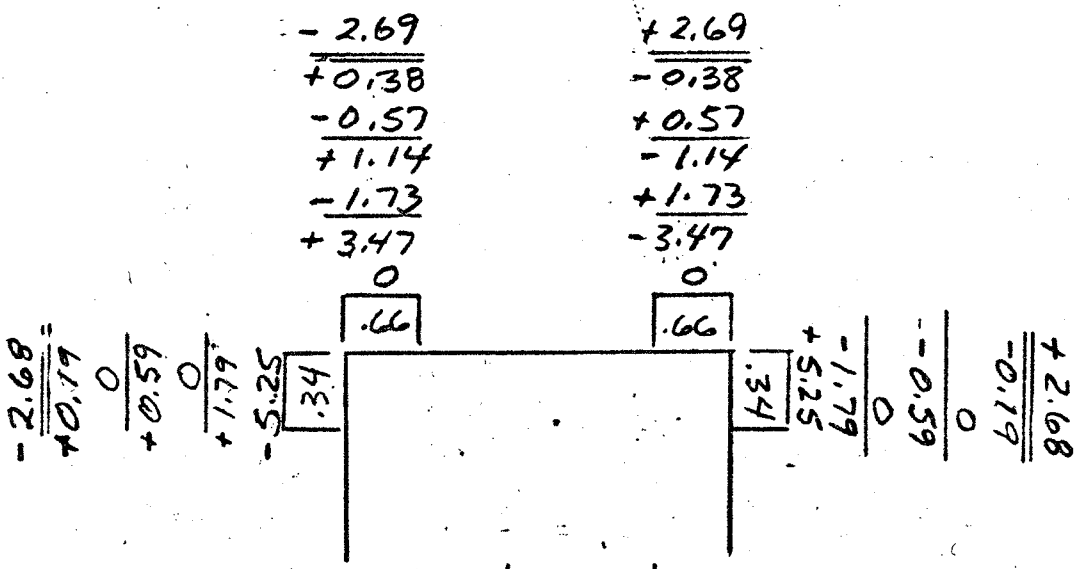
EARTH PRESSURE

FILL	2.0'
DECK	1.0'
2' SURCHARGE	2.0'
½ HEIGHT	4.0'
$h =$	9.0'

$W = K_A(WE)\,h = (.64)(.130)(9.0)$
$= (0.083)(9.0) = 0.749\ K/FT$

$$-M^F_{A1} = M^F_{1A} = \frac{WH^2}{12} = \frac{(.749)(9.17^2)}{12} = 5.25\ FT\text{-}K$$

$$V_{A1} = V_{1A} = \frac{WH}{2} = \frac{(.749)(9.17)}{2} = 3.43\ K$$



$$+M_{A1} = \left(V_{A1} \times \frac{H}{2}\right) - \left(\frac{WH}{2} \times \frac{H}{4}\right) - M_{A1}$$

$$= 3.43\left(\frac{9}{2}\right) - (.749)\left(\frac{9.17^2}{8}\right) - 2.69$$

$$= 15.44 - 7.87 - 2.69 = 4.87\ K\text{-}FT$$

$$V_{AB} = \frac{M_{AB}}{L} = \frac{2.69}{15.0} = 0.18^K$$

$5.25 \times .64 = 3.5$

7.9
3.5
4.4

9/25/79
KHD

CONCRETE DESIGN

I. TOP SLAB & BOTTOM SLAB (BY SYMMETRY)

POSITIVE MOMENT:		MAX. SHEAR	
$M_{DL(DECK)}$	= 3.25	$V_{DL(DECK)}$	= 1.31
$M_{DL(FILL)}$	= 4.86	$V_{DL(FILL)}$	= 1.95
M_{LL+I}	= 12.19	V_{LL+I}	= 4.30
	20.30 FT-K		7.56

d CALCULATION

$$d = \sqrt{\frac{M}{Kb}} = \sqrt{\frac{20.3..}{.272(1.0)}}$$

$$= \sqrt{74.63} = 8.64 \text{ in}$$

$$d = \frac{V}{vjb} = \frac{7.56}{.120(.870)(12)}$$

$$= 6.03 \text{ in}$$

USE $d = 9.0''$

$t_s = 12.0''$

$$d = 12.0\left[\frac{14}{16}\right]^{\frac{1}{2}}\left[\frac{2500}{4000}\right]^{\frac{1}{2}} = 8.87 \text{ in}$$

$$A_s = \frac{M}{f_s jd} = \frac{20.3\ (12)}{20^k(.870)(9.0)} = 1.56\ \square''$$

$$A_s = 1.33 \times \frac{12.0}{9.0} \times \left[\frac{14}{16}\right] = 1.55 \text{ in}^2$$

USE #8 @ 6"

$A_s = 1.57\ \square''$ POSITIVE STEEL

$\Sigma o = 6.28''$

CHECK

$$\rho = \frac{A_s}{bd} = \frac{1.57}{(12)(9)} = 0.0145 \rightarrow k = 0.379\ \ j = 0.874$$

$$f_s = \frac{M}{A_s jd} = \frac{20.3..^k(12)}{(1.57)(.874)(9)} = 19.73^k < 20^k$$

$$f_c = \frac{f_s k}{n(1-k)} = \frac{19.73^k(.379)}{8\ (1-.379)} = 1.505 KSI < 1.600 KSI$$

$$v = \frac{V}{bjd} = \frac{7.56\ (1000)}{12(.874)(9)} = .80 PSI < 120 PSI$$

DISTRIBUTION STEEL (TOP & BOTTOM SLAB)

$A_{S\,DIST.} = (A_{S\,MOMENT})\left(\frac{1}{\sqrt{S}}\right) = 1.56\left(\frac{1}{\sqrt{15}}\right) = 0.40\ in^2$

USE #5@9" $A_S = 0.41\ in^2$ $E_o = 2.62$ in

(Ref. AASHTO BRIDGE SPECIFICATION 1.3.2(e).)

TEMPERATURE STEEL

TOP SLAB (b = 12") (t = 12")

$\rho_t = 0.002$ (EXPOSED FACE)

$A_S = \rho_t (t)(b) = 0.002(12)(12) = 0.29\ in^2$

USE DISTR. STEEL #5@9" $A_S = 0.41\ in^2$

$\rho_t = 0.001$ (UNEXPOSED FACE)

$A_S = \frac{0.29}{2} = 0.14\ in^2$

USE #4@16" $A_S = 0.15\ in^2$

BOTTOM SLAB (b = 12") (t = 13")

$\rho_t = 0.002$ (EXPOSED FACE)

$A_S = 0.002(12)(13) = 0.31\ in^2$

USE DISTR. STEEL #5@9" $A_S = 0.41\ in^2$

$\rho_t = 0.001$ (UNEXPOSED FACE)

$A_S = \frac{0.31}{2} = 0.15\ in^2$

USE #4@16" $A_S = 0.15\ in^2$

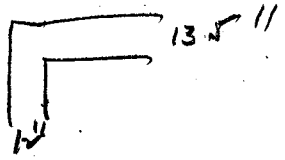
9/25/79
KMD

II. SIDEWALLS

NEGATIVE SECTION

	M_{AI}	V_{AI}	V_{AB}
DL(D)	-1.65	.18	1.31
DL(F)	-2.45	.27	1.95
LL+I	-4.18	.46	4.30
EP	-2.69	3.43	0.18
@ BOT. OF SLAB	-10.97	4.34	7.74

Sfd



$K_{AI} = \frac{1^3}{14} \times \frac{1}{2} = .036 = .29$

$K_{AB} = \frac{11^3}{16} = \frac{.087}{.123} = .71$

d for M_{AI} $\rightarrow$ $d = \sqrt{\frac{M}{Kb}} = \sqrt{\frac{10.97}{.272(1)}} = 6.35"$

d for V_{AI} $\rightarrow$ $d = \frac{V}{vjb} = \frac{4.34}{(.120)(.870)(12)} = 3.46"$ ▷ R_D

$d = 10.5 \times \frac{1.34}{.29} \times \left[\frac{2500}{4000}\right]^{\frac{1}{2}} \left[1 - \frac{8+2}{14\times4}\right] = 8.1"$ ← Δ_M

USE $d_{min} = 8.5"$ $t_w = 11.0"$

$A_s = \frac{M}{f_s j d} = \frac{10.97(12)}{20^k(.870)(8.5)} = 0.89\ \square"$

$A_s = .80 \times \frac{10.5}{8.5} + \frac{.34}{.29}\left[1 - \frac{8\times2}{14\times4}\right] = .83$

USE #6 @ 6" $A_s = .88\ \square"$ $\Sigma_o = 4.71"$

USE AS CORNER BARS

CHECK BOND — TOP SLAB

ALLOWABLE $\mu = 0.06 f'c = 240$ PSI

$\mu = \frac{V_{AB}}{\Sigma_o j d_{AB}} = \frac{7.74(1000)}{4.71(.870)(9)} = 210 < 240$

EMBED TOP BEND $0.25\ell = .25(15) = 3.75'$
USE 4.0'

LAP SIDE BEND 20 DIAMETERS MINIMUM.

9/25/79
K.M.O.

II. SIDEWALLS (CONT'D)

CENTER OF SPAN MOMENT

$d = 8.5$ $^{+}M_{A1} = 4.87$ FT-K (FROM SHEET 8)

$$A_s = \frac{^{+}M}{f_s j d} = \frac{4.87\,(12)}{20^{K}(.870)(8.5)} = 0.40\ \square''$$

USE #5 @ 9" $A_s = 0.41\ \square''$ $\varepsilon_0 = 2.62''$

TEMPERATURE STEEL

SIDEWALLS $(b = 12'')(t_s = 11'')$

$P_t = 0.002$ (EXPOSED FACE)

$A_s = 0.002\,(12)(11) = 0.26\ \square''$

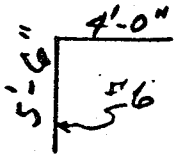
USE # 4 @ 8" $A_s = 0.29\ \square''$

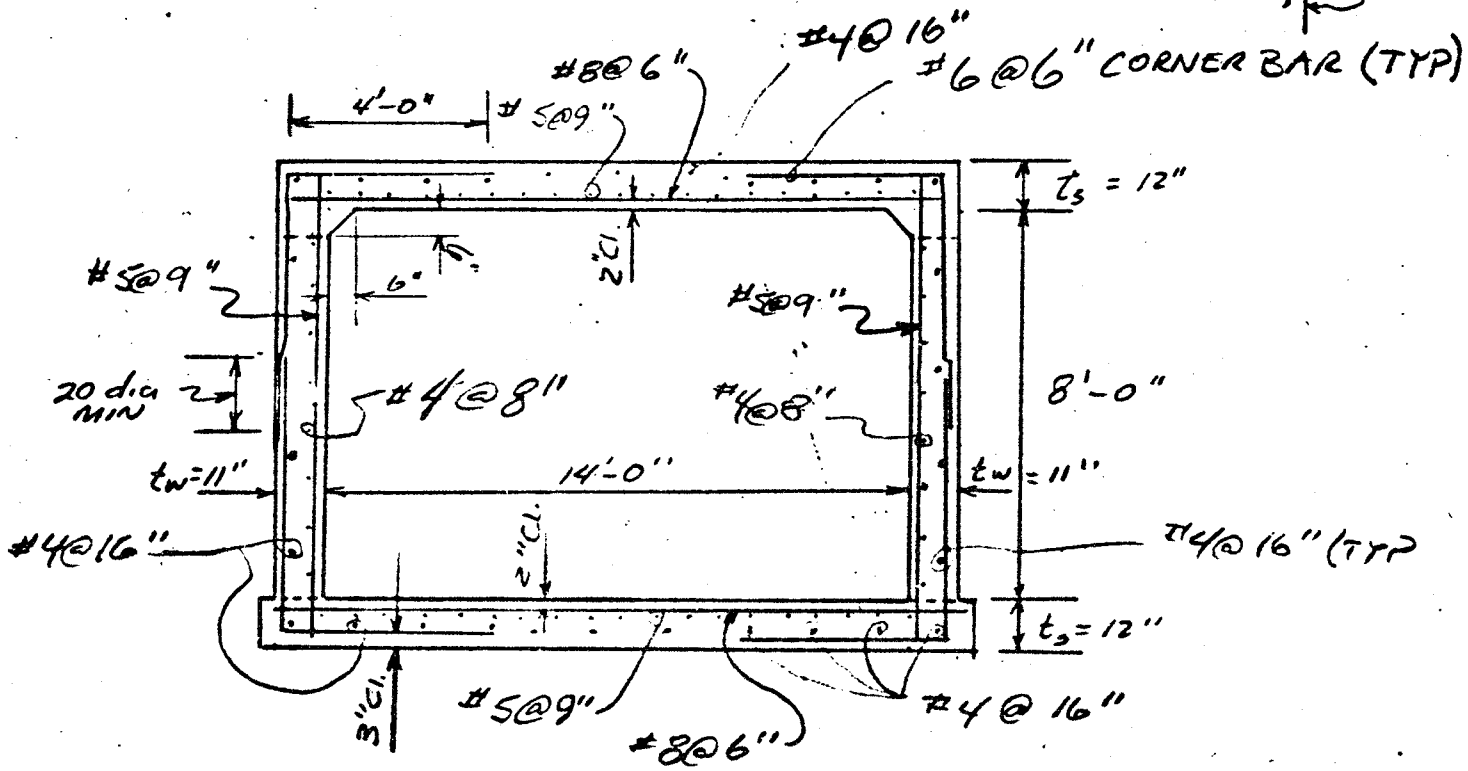
$P_t = 0.01$ (UNEXPOSED FACE)

$A_s = \frac{0.26}{2} = 0.13\ \square''$

USE # 4 @ 16" $A_s = 0.15\ \square''$

9/25/79
KMD





ALL STEEL SHALL HAVE 2" MIN. COVER EXCEPT AS NOTED

Final Copy

CONSTRUCTION SPECIAL PROVISIONS AND LIST OF MARICOPA ASSOCIATION OF GOVERNMENTS STANDARD SPECIFICATIONS

CONCRETE BOX CULVERTS ON SIGNAL BUTTE FLOODWAY AT CRISMON ROAD AND ELLSWORTH ROAD

DIBBLE AND ASSOCIATES
CONSULTING ENGINEERS
PHOENIX, ARIZONA

November 27, 1979

FLOOD CONTROL DISTRICT
OF
MARICOPA COUNTY

APPLICABLE
MARICOPA ASSOCIATION OF GOVERNMENTS
STANDARD SPECIFICATIONS

CONCRETE BOX CULVERTS
ON SIGNAL BUTTE FLOODWAY
AT CRISMON ROAD AND ELLSWORTH ROAD

MAG STANDARD SPECIFICATIONS

Part 100 General Conditions

No. 206 Structure Excavation and Backfill
No. 211 Fill Construction
No. 215 Earthwork for Open Channels
No. 225 Watering

No. 301 Subgrade Preparation
No. 310 Untreated Base
No. 321 Asphalt Concrete Pavement
No. 336 Pavement Matching and Surfacing Replacement
No. 350 Removal of Existing Improvements

No. 401 Traffic Control
No. 405 Monuments
No. 415 Flexible Metal Guardrail
No. 420 Chain Link Fences

No. 505 Concrete Structures
No. 525 Pneumatically Placed Mortar

No. 601 Trench Excavation, Backfilling and Compaction

No. 701 Rock, Gravel, and Sand
No. 702 Base Materials
No. 710 Asphalt Concrete
No. 711 Paving Asphalt
No. 712 Liquid Asphalt
No. 713 Emulsified Asphalts
No. 725 Portland Cement Concrete
No. 726 Concrete Curing Materials
No. 727 Steel Reinforcement
No. 729 Expansion Joint Filler
No. 771 Galvanizing
No. 772 Chain Link
No. 778 Lumber
No. 779 Wood Preservatives
No. 792 Dust Palliative

CONSTRUCTION SPECIAL PROVISIONS

CONCRETE BOX CULVERTS
ON SIGNAL BUTTE FLOODWAY
AT CRISMON ROAD AND ELLSWORTH ROAD

LOCATION OF WORK: This project is the construction of concrete box culverts at two different locations in Eastern Maricopa County as follows:

1. Crismon Road approximately 1400 feet north of Brown Road.

2. At the intersection of Ellsworth Road and Brown Road.

PROPOSED WORK: The proposed work consists of excavation, concrete box culverts, backfill, and other miscellaneous items of work required for the completion of the project.

SPECIFICATIONS: The work embraced herein and as shown on the plans for the construction of this project shall be done in accordance with the Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction dated July 1, 1974 and the applicable Supplements thereto together with the Maricopa County Highway Department Supplement to the Uniform Standard Specifications and the Construction Special Provisions contained herein.

PREVAILING WAGE SCALE: All labor employed on the work shall be paid for at rates not less than the prevailing rates of wages certified by the Industrial Commission of Arizona for public works contracts in excess of $1,000. A list of prevailing wage rates is on file in the office of the Maricopa County Highway Department and with the Clerk of the Board of Supervisors, and may be inspected at any time during regular working hours, or it may be secured from the office of the Industrial Commission of Arizona.

CONTRACT TIME: The Contractor shall complete all work on the project within One Hundred Twenty (120) calendar days after the date of notice to proceed.

PROGRESS SCHEDULE: The Contractor shall submit his proposed work progress schedule to the Engineer for approval before starting the work.

ITEM COMMENTS: The herein contained Construction Special Provisions supplement the Uniform Standard Specifications and the Maricopa County Highway Department Supplement to the Uniform Standard Specifications, however, in case of conflict, these Special Provisions supersede the Uniform Standard Specifications and the Maricopa County Supplement.

ADDENDA: Addenda issued during the time of bidding shall be attached to and made a part of the contract drawings.

SECTION 105.6 - COOPERATION WITH UTILITIES: The Contractor shall comply with the requirements of the ARS 40-360.21 through 40-360.20 in notification to the interested utility owners prior to the start of construction and shall ascertain the approximate locations of the various underground utilities shown on the plans, and as may be brought to his attention. The exact location of these underground utilities shall be determined by excavations made by the Contractor prior to any trenching operations.

When the Contractor's operations result in damage to any utility, the location of which has been brought to his attention, he shall assume full responsibility for such damage.

The following phone numbers as indicated should put the Contractor in contact with the proper personnel:

Salt River Project.....Blue Stakes.....263-1100

Mountain Bell Telephone Company.....Blue Stakes.....263-1100

Arizona Public Service.....Blue Stakes.....263-1100

City of Mesa.....834-2248

SECTION 109 - MEASUREMENT AND PAYMENT: The work under this project shall be measured and paid for as a lump sum price for each culvert location. The lump sum price bid shall be compensation in full for furnishing all labor, materials, equipment and appurtenances necessary to complete the work in a satisfactory manner as shown on the plans and as required in these specifications.

SECTION 206 - STRUCTURE EXCAVATION AND BACKFILL: The work under this item shall consist of clearing, excavation, backfill, grading and disposal of excess material and shall conform to Section 206 of the Uniform Standard Specifications and Maricopa County Highway Department supplement thereto, except as modified herein.

All compaction shall be Type I, as specified in Table 601-2. Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 215 - EARTHWORK FOR OPEN CHANNELS: The work under this item shall fully conform to Section 215 of the Uniform Standard Specifications except that payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 225 - WATERING: The work under this item shall fully comply with Section 225 of the Uniform Standard Specifications.

SECTION 301 - SUBGRADE PREPARATION: The work under this item shall consist of shaping the roadway subgrades to the grades and cross section for the pavement replacement as shown on the plans and in accordance with Section 301 of the Uniform Standard Specifications and Maricopa County Highway Department Supplement to the Uniform Standard Specifications. Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 310 - UNTREATED BASE: The work under this item shall consist of furnishing and placing select material and aggregate base material in accordance with the following specifications:

Select Material and Aggregate Base shall conform to the requirements of Section 702 of the Uniform Standard Specifications. Select Material and Aggregate Base shall be crushed in accordance with Section 702.2.

Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 321 - ASPHALT CONCRETE PAVEMENT: The work under this item shall consist of furnishing and placing a plant mixed asphalt concrete road surfacing material to the compacted thickness shown on the plans for the pavement replacement.

The bituminous material to be used shall be AR-4000 Paving Asphalt and shall fully comply with Section 711 of the Uniform Standard Specifications.

The mineral aggregate shall meet the grading requirements within the range of the specified tolerances for Mix Designation C-3/4 in accordance with Section 710 of the Uniform Standard Specifications.

Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 321.4 - BITUMINOUS TACK COAT: The work under this item shall fully comply with Section 321.4 of the Uniform Standard Specifications. The tack coat will be used where asphalt concrete is place directly on top of the box culvert deck.

The tack coat shall be grade SS-1h (diluted) and shall fully comply with Section 321 and 713 of the Uniform Standard Specifications. Tack coat shall be applied at the rate of 0.05 gallon per square yard.

Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 336 - PAVEMENT MATCHING AND SURFACING REPLACEMENT: Work under this item shall conform to Section 336 of the Uniform Standard Specifications.

Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 350 - REMOVAL OF EXISTING IMPROVEMENTS: The work under this item shall consist of the removal and disposal of any obstacle to construction whether shown on the plans or not, unless specifically called out on the plans to be removed or relocated by other agencies and shall be accomplished in accordance with Section 350 of the Uniform Standard Specifications.

Arrangements for disposal of all waste material shall be the responsibility of the Contractor.

Payment for this item will be included in the contract lump sum price bid for the concrete box culverts.

SECTION 401 - TRAFFIC CONTROL: Traffic control shall conform to the applicable paragraphs of Section 401 of the MAG Uniform Standard Specifications dated July 1, 1974, amendments and the County Supplements thereto and these special provisions.

Road closures are authorized for construction of the two box culverts. However, only one site may be closed at a time. Once a road is closed, the work shall proceed until all work, which would necessitate a road closure at that site, has been completed and road re-opened. The road at the second site may then be closed and the work completed.

For the Brown Road and Ellsworth Road project, the Contractor shall provide road

closure and detour signing at the intersections of; Ellsworth Road and University Road, Ellsworth Road and Mckellips Road, Power Road and Brown Road, Crismon Road and Brown Road as well as at all four inbound legs at the construction site.

For the Crismon Road project, the contractor shall provide road closure signing and detour signing at the intersections of Mckellips Road and Ellsworth Road, Brown Road and Crismon Road as well as at the inbound legs at the construction site.

All construction and detour advance warning signs shall be placed on channels 1500, 1000 and 500 feet prior to the construction zone. Contractor shall notify local police, fire and schools of closure date and duration of closure. All unneeded traffic control signs disturbed by construction shall be removed and stored by the contractor for pick up by the County. Stop signs, stop ahead and street name signs shall be maintained during construction.

All necessary signs and barricades shall remain three working days beyond acceptance of the project by the County.

Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 405 - MONUMENTS: The work under this section shall consist of furnishing and installing survey monuments of the types as shown on the plans.

All work shall conform to Section 405 of the Uniform Standard Specifications and Maricopa County Highway Department Standard C-101, Type A.

Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 415 - FLEXIBLE METAL GUARDRAIL: The guardrail shall be constructed where shown on the plans and as detailed in the Arizona Department of Transportation (A.D.O.T.) Standard No's. C-10.01, C-10.12, C-10.13.

The materials for construction shall conform to the requirements of Section 415 of the Uniform Standard Specifications, except as modified herein:

All metal surfaces shall be galvanized in accordance with the requirements of ASTM A 525. The weight of the coating (total for both sides) shall be the weight specified for Coating Class 2.50.

Painting will not be required on treated timber posts and blocks.

Payment shall be included in the lump sum price bid for the concrete box culverts.

SECTION 505 - CONCRETE STRUCTURES: The concrete box culverts and apron shall conform to the requirements of Section 505 - Uniform Standard Specifications (MAG) except as modified herein:

A. The culvert materials at Crismon Road shall meet the following specifications:

1. Class A concrete, f'c = 3000 PSI per MAG Specifications Section 725.
2. The dimension detailing shall conform to A.D.O.T. Standard Drawings CM-1, CB-3 (Table I) and CWL-2, Type A, except as modified on the plans.
3. Reinforcing steel, curing compound and expansion joint filler shall conform to Sections 726, 727, and 729 of the MAG Specifications.

B. The culvert materials at the intersection of Ellsworth Road and Brown Road shall meet the following specifications:

1. Class AA concrete, f'c = 4000 PSI per MAG Specifications Section 725.
2. The dimension detailing shall conform to the details on the plans.
3. Reinforcing steel, curing compound and expansion joint filler shall conform to Sections 726, 727, and 729 of the MAG Specifications.

Measurement shall be for each culvert in place, including all labor, materials, equipment, excavation, backfill, compaction, guardrail, pavement replacement, monuments, traffic control watering, and miscellaneous removals and other work to complete the culvert installation as detailed on the plans.

Payment for all work under these items shall be for the job, lump sum, per culvert at each location.

SECTION 525 - PNEUMATICALLY PLACED MORTAR: All work under this item shall conform to Section 525 of the Uniform Standard Specifications except as modified herein:

Payment shall be included in the lump sum price bid for the concrete box culverts.

GENERAL COMMENTS: The County reserves the right to adjust design grades or the location of drainage structures prior to construction, if it should become necessary in the opinion of the Engineer, without additional cost to Maricopa County.

The cost of all work required under this contract as shown on the plans for which there are no specific items shown on the Bidding Schedule, shall be included in the prices bid for related items.

An attempt has been made to determine the location of all underground utilities and design the location and elevation of culverts and structures so as not to interfere with existing utilities, however, it shall be the Contractor's responsibility to cooperate with the pertinent utility companies so that any obstructing utility installation may be adjusted.

Any facility or work which may be performed for the accommodation of any utility (except as noted on the plans) shall be paid for by the utility owner. The Contractor shall make all arrangements that may be necessary for the construction and any financial agreement shall be solely between the contractor and the utility owner.

ENGINEERING REPORT

SIGNAL BUTTE FLOODWAY

BUCKHORN-MESA WATERSHED

SEPTEMBER 19, 1985

United States Department of Agriculture

Soil Conservation Service

USDA, Soil Conservation Service
201 E. Indianola, Suite 200
Phoenix, Arizona 85012

April 1, 1986

Dan Sagramoso
Chief Engineer and General Manager
Flood Control District of Maricopa County
3335 W. Durango Street
Phoenix, Arizona 85009

Dear Dan:

We are submitting for your information and use a copy of the engineering report prepared as a result of ponding of waters and land rights considerations on the Signal Butte Floodway, Buckhorn-Mesa WPP.

We request that you contact Wayne Killgore, of my staff, to set up a meeting for resolving the issues and to discuss the needs for this project.

Don R. Phillips Acting For

Verne M. Bathurst
State Conservationist

Enclosure

cc: Wayne Killgore, Asst. State Conservationist (WR)

Nick H

The Soil Conservation Service is an agency of the United States Department of Agriculture

50 Soil and Water Conservation

☆ U.S. Government Printing Office: 1983—420-939/1578

AZ

United States Department of Agriculture

Soil Conservation Service

West National Technical Center
511 N. W. Broadway, Room 547
Portland, Oregon 97209-3489

Subject: ENG - Engineering Report - Signal Butte Floodway, Buckhorn Mesa Watershed, Arizona

Date: February 6, 1986

To: Ralph M. Arrington, State Conservation Engineer, SCS, Phoenix, Arizona

File Code:

We have reviewed the subject engineering report and find it technically acceptable. Should the repair follow the procedure recommended in alternative 2.c., the precaution noted in Paul Monville's letter of this date will need to be considered.

Several editorial comments are noted below. These should be corrected prior to final distribution of the report.

Page 3. - Item C.15. references, Attach. "A". This attachment as well as others need to be identified.

Page 6. - Add the word "during" between "inlets" and "the storms" in the first sentence of item 5 at top of page.

We suggest deleting the first sentence under item B. and renumbering the sub-item accordingly.

Item A.1., first sentence, delete "at this time."

C. E. Stearns acting

DONALD E. WALLIN
Acting Head, Engineering Staff

cc:
Verne Bathurst, State Conservationist, SCS, Phoenix, Arizona
Paul J. Monville, Civil Engineer, WNTC

Corrections have been made on the report.

United States Department of Agriculture
Soil Conservation Service
West National Technical Center
511 N. W. Broadway, Room 547
Portland, Oregon 97209-3489

Subject: ENG - Engineering Report - Signal Butte Floodway, Buckhorn Mesa WPP, Arizona

Date: February 6, 1986

To: Ralph M. Arrington, State Conservation Engineer, SCS, Phoenix, Arizona

File Code:

I have reviewed the report and concur in the findings and the conclusions presented. However, Alternative 2.c. of the recommendations suggest that lowering the inverts of the side inlets to the same elevation as the lowest point of the washes would result in a stable channel. Care should be taken, if this alternative is followed, to assure that stability of the side channel will be achieved and that headcutting upstream of the inlet will not occur. The side inlet design should be researched to determine the considerations that the designers had given to the side channel stability in setting the inlet crest elevations.

Paul Monville

PAUL J. MONVILLE
Civil Engineer

cc:
Donald E. Wallin, Acting Head, Engineering Staff, WNTC
Verne Bathurst, State Conservationist, SCS, Phoenix, Arizona

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PHOENIX, ARIZONA
SEPTEMBER 19, 1985

ABSTRACT OF ENGINEERING REPORT

General Description of Problem: Ponding of flood water occurs outside of flood channel on land not covered by land-rights.

Locations: Signal Butte Floodway of Buckhorn Mesa Watershed, Maricopa County, Arizona.

Type of Facility: Earth channel

Job Class: Class VII (NEH 501)

Date of Installation: 1983 and 1984

Within a reach of 8,000 of earthen channel, 15 side inlets were designed and constructed. These inlets were at locations of existing water courses (washes), however, the invert elevations of some of these inlets were above the natural ground elevations by 1 to 5 feet.

At some of the inlets, the ponded water extends outside of the existing rights -of-way limits.

The area where ponding occurs, were designed as sediment traps and were to be cleaned under the provisions of the O&M Agreement.

The project was planned, designed, and was build as planned. There were no major changes in the works of improvement to be installed from the planned phase to the "as-built" phase.

The project has functioned twice since being installed. The Sponsors are not pleased with the performance of the side inlets and wish a design change in lieu of obtaining the necessary land-rights. The Sponsor wish that the design be changed to allow the sediment from the side-inlet to enter the floodway and that no ponding to occur outside of existing right of way.

In viewing the project in retrospect, the Service in Arizona should exercise greater care and concern in the use of Land-Right Work Maps. The committee does not view the need to revise any existing policy or criteria.

Problem Category: Land Rights

Site Name: Buckhorn

Practice Standard: 404

State: Arizona

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
PHOENIX, ARIZONA
SEPTEMBER 19, 1985

ENGINEERING INVESTIGATION REPORT

PROJECT: Buckhorn Mesa Watershed

LOCATION: Phoenix, Arizona, Maricopa and Pinal Counties

SITE NO.: Signal Butte Floodway (Sta. 10+00 to 90+00)

APPROPRIATION: PL-566 (08)

Authority: The State Conservationist, Verne M. Bathurst appointed an investigating committee for the purpose to study the side inlets. The letter of appointment was dated August 2, 1985.

Committee: The following personnel were appointed to serve on the committee:

Harold Honeyfield, Assistant State Conservation Engineer, Davis, California, to act as Chairman

Frank Wilimek, Assistant State Administrative Officer, Phoenix, Arizona, Member

THE PROBLEMS

The Signal Butte Floodway Channel includes 8000 feet of earthen channel to convey water from the principal spillway of a floodwater retarding structure and to collect overland flow upstream of the channel and to convey the flow into the channel at 15 locations along the 1.5 miles of length.

These 15 side inlets were located at points of existing washes (water courses); however, the inlet inverts were above the lowest elevations of the washes; thereby creating a sediment trap and/or pond of water. Some of these ponds extend outside of existing rights-of-way limits. The sponsors had been advised by SCS to obtain additional flowage rights-of-way, and they commenced to acquire these rights. The data provided to the sponsors was grossly in error. When the error was discovered, the sponsors terminated their efforts to acquire necessary landrights.

This project has been constructed without adequate land rights; and now the performance of the constructed project is being questioned.

INVESTIGATION

A. The committee met during the week of September 16-20, 1985.

1. On September 16, the committee interviewed:

   a. Verne M.Bathurst, State Conservationist
   b. Ralph M. Arrington, State Conservation Engineer
   c. Donald E. Paulus, Design Engineer
   d. Tom S. Jayo, Project Engineer

2. On September 17, a field trip was made to the sites.

3. On September 18, the following personnel were interviewed at the Maricopa Flood Control District (FCD) Office:

   a. Stan Smith, Deputy Chief Engineer
   b. Earl Kirby, Deputy Chief Construction & Operation
   c. Dick McNamara, Property Acq. Manager
   d. Dave Johnson, Chief Hydrologist
   e. Cora Fernandez, Project Engineer
   f. R.W. Shobe, Project Engineer

4. On September 18 and 19, an in-depth review was made of the engineering files, the contract documents, and the correspondence file.

5. On September 18, a storm occurred over the project site. The storm was of sufficient intensity to produce runoff that caused the washes to flow and thus created ponds upstream of some of the side inlets.

6. On September 19, the committee conducted an exist conference with Wayne Killgore, ASTC(WR), and the State Conservation Engineer.

B. The following documents were made available to the committee:

1. Buckhorn Mesa Watershed - Work Plan, January 1963.

2. Buckhorn Mesa Watershed - Supplemental Work Plan, June 1976.

3. Buckhorn Mesa EIS, June 1976.

4. Preliminary Design Report, by Lou Burton, September 13, 1978.

5. Final Design Report, by Arnold Kallestad, December 1980.

6. Construction Drawings, dated March 1983.

7. Land-Rights Work Map only sheet 1 of the 18 sheets; dated March 1978.

8. FCD's Land-Rights Map; prepared by A&E firm,Dibble, dated 11-2-79.

9. SCS, As-Built "red-line" drawings.

C. A chronological listing of events:

	Event	Date
1.	Land-Rights Work Map prepared by SCS	3/78
2.	Preliminary design, plan & profile of channel	5/78
3.	FCD prepared Land-Rights Map (work done by A&E) (no flowage easements)	11/2/79
4.	Final design report (see attached)	12/80
5.	SCS informed FCD about additional flowage rights by letter and attachments	1/9/82
6.	FCD said they were proceeding with flowage rts. acquisition	4/6/82
7.	FCD signed form SCS-AS-78	4/25/83
8.	FCD signed O&M Agreement	5/23/83
9.	FCD signed construction drawings, as "approved"	5/25/83
10.	STC & SCE approve Land-Rights Map (#3 above, not SCS Land-Rights Work Maps)	6/23/83
11.	Construction commenced	11/9/83
12.	A storm occurred, producing significant runoff causing all washes to flow	7/14/84
13.	Construction completed	9/14/84
14.	Project released to FCD for O&M	
15.	See attachment "A" FCD's memo listing their summary of events	

D. Interviews of Personnel:

1. Ralph Arrington, SCE. Outlined the history of the project, made film available, introduced personnel who were involved, and provided assistance as was needed.

   He presented the nature of the problem and some alternatives being studied that may solve the problem.

2. Tom Jayo, P.E. and G.R., Tom stated that the project was constructed as set forth on the construction drawings.

   It was his understanding that the low areas upstream of the inlets were "designed sediment traps" and were not to be filled.

   There was a need to construct a V-ditch adjacent to the R/W fence to drain low areas to the location of side inlets.

3. Don Paulus, D.E. Provided the committee with the design files and assisted the committee in locating key information. He had made a study of the flow pattern and acreage covered by flood water for each inlet after the July storm.

4. Stan Smith, FCD

   a. The Sponsors were not pleased with the performance of the side inlets, in that large areas of land are flooded upstream of the inlets during and after storm events, and that areas of undrained water will cause health concerns.

b. The rights-of-way requirements as needed were revised three (3) times by SCS and thus FCD has terminated the acquisition of additional flowage land-rights until final decisions are made.

E. Summary of Facts

1. The Land-Rights Work Maps prepared on 3/78 could not be located, except for sheet 1 which did not reflect the signature of the STC, as per par. 501.42 (390-V NWSH).

   a. Sheet 2 thru 19 were located by the FCD on September 19, however, no additional flowage limits were shown on these maps.

2. The Final Design Report, December 1980, states:

   a. "Because of land-rights considerations an effort was made in the final design to keep the alignment and layout within the proposed rights-of-way. It does appear however, that additional flowage easements may be needed at the locations of the side inlets to the earth channel".

   b. "Sediment traps installed at the side inlets to the earth channel will remove all of the bedload carried by the overland flow".

   c. "Cleaning the sediment traps will be a maintenance item for the Flood Control District".

3. The 1-9-82 notification to the FCD for additional flowage easements required were grossly in error as the area shown was for land below elevation 1693.5. Please note that the invert elevation for the side inlet, are at elevation 1697. With approximately 1.0 depth of flow, the high water line for the inlets is at elevation 1698. The top of the dike is at elevation 1699 to 1700.

4. The sponsor, FCD, was aware of the design concepts of the needed sediment traps upstream of the side inlets and so concurred in the signing of the construction drawings.

5. Construction of the project was allowed to commence without adequate land rights. This was acknowledged by SCS and FCD.

6. The FCD has terminated all additional land acquisition until the problems associated with side inlets can be resolved.

7. The floodway channel was designed to collect sediment in traps upstream of inlets, and for maintenance to remove sediment from the traps. The system was constructed as designed, and the system has functioned as designed.

8. The sponsors, FCD, are not NOT pleased with the project because the performance proves that additional flowage rights-of-way are required, and ponding creates a health concern.

9. Hydraulic computations for the final water surface profile elevations for the designed channel could not be located.

10. The sponsors now state that they would prefer to remove sediment from inside the channel even though the flood channel was not designed for this method of maintenance. The question of ramps to enter for maintenance has been discussed.

11. The existing O&M plan states:

"Sedimentation"

"Inspect the floodway annually and after significant flows to determine sediment accumulations from side drainage and remove sediment to designed grade".

12. The O&M section as written in the Work Plan Supplement states, "The perservation, maintenance, and replacement costs is estimated to be $44,800 annually for outlets and floodways.

13. On September 18, 1985, there was a storm event that covered the area of the site. The storm created sufficient runoff that caused flows in the washes. Some of the runoff was ponded in low area outside of the R/W and some flows were great enough to flow through the side inlets and into the floodway. At some of these inlets there were sediment deposits in the floodway channel.

14. Costs:

    a. The costs fo land-rights as shown in the Work Plan Supplement was estimated to be $668,400 for Signal Butte Floodway which includes $384,000 for rights-of-way, $262,000 to relocate roads, $2,200 for relocation of telephone lines, and $18,000 for legal fees and surveys.

    b. The costs for construction as shown in the Work Plan Supplement was estimated to be $4,002,300; with no contribution from other funds.

    c. The actual cost of construction as shown on form SCS-ENG-547 is $2,434,807.06, of which $34,460.93 was local costs for land-right encumbrances.

EVALAUTION

A. Evaluation of Basic Data

1. The Land-Rights Work Maps as proposed by SCS in March of 1978, did not reflect the need for any easements over adjacent land for the purpose of flooding, empoundment or flowage.

2. SCS provided the Sponsor with incorrect data on January 9, 1982, as to the land coverage required for easements. This caused the Sponsor to commence with condemnation proceedings in court that later needed to be changed, and caused them embarrassment.

3. It appears that the content of the design report was never reviewed in depth with the Sponsor. If so, the need for additional land-rights would have surfaced in sufficient detail to discover the erroneous data given on January 9, 1982.

4. SCS awarded a construction contract without sufficient land-rights. SCS did not do an adequate job of checking and reviewing land-rights documents.

5. The performance of the floodway channel and the side inlets during the storms provided the basis to re-think the design assumptions and the maintenance requirements.

B. **Summary of Possible Causes**

a. SCS provided the Sponsors with incorrect data.
b. The Sponsor chose to terminate the purchase of land-rights.
c. SCS did not provide an adequate check or review of land-rights before awarding of the contract.

CONCLUSIONS

A. **The Conclusions of the Study Are:**

1. There is no engineering deficiency. The project was designed as planned, the design was concurred in by the Sponsor; the project was constructed as designed.

2. The plan, the designs, and the construction all provided that sediment traps were to be upstream of the inlets and that the Sponsors were to remove the sediment from the traps.

3. The Sponsors are requesting a design change and a modification to the constructed work in order to reduce their obligations to obtain the necessary land-rights. Should a modification be considered, then the need for additional ramps must be discussed.

4. The committee believes shortcomings have been committed by both the sponsor and SCS.

RECOMMENDATIONS

A. **The Following Alternatives May be Considered**

1. Alternative 1: Obtain land-rights; this alternative would be for the Sponsors to obtain the needed land-rights for the existing system: The estimated acres and costs are:

9.25 ac	@	$10,500 =	$97,125
7.81 ac	@	$1,575 =	$12,300
17.06 ac	Total	=	$109,425

The 9.25 acres @ $10,500 is for land that would be permanently damaged or used for ponding of water and/or sediment.

The 9.25 acres @ $10,500 is for land that would be permanently damaged or used for ponding of water and/or sediment.

The 7.81 acres @ $1,575 is for land not used nor disturbed, it is only needed to "block-out" legal land descriptions.

2. Alternative 2: A design change; this alternative would require the construction of features that would drain the ponded water into the floodway. There may be several design layouts that would provide a solution, such as:

   a. Construct a channel along the R/W fence and collect the flood water and drain to a selected location for discharging into the floodway.

   b. Construction pipe drop inlets at the washes that require draining.

   c. Modify the present side inlets, by lowering the inverts to the same elevations as the lowest points of the washes.

   However, any design layout must assure that the new inlets do not become outlets during high flows of the floodway, and that the new channel hydraulics account for reduced capacity due to sediment deposition.

3. Alternative 3: Combination of Alternative 1 and 2; of the 15 side inlets, 6 are satisfactory, 6 sites can be reworked by placing "fill" upstream of the inlet to the invert elevation; and 3 sites needed both fill and flowage rights.

   a. This would require temporary construction easements at 9 sites; and temporary flowage rights at 11 sites, and flooding (temporary impoundment) rights at 3 sites.

   b. This alternative would require a construction change at 3 sites, to provide for drainage of ponded water.

   c. This would require new water surface profiles to provide for bulking of water due to sediment.

B. The O&M Plan should be re-written so that each party has a clear understanding of performance and maintenance.

Harold R. Honeyfield

Harold R. Honeyfield, Chairman

Frank Wilimek

SIDE - INLET DATA

STA	AS-BUILT	S/I # NO.	S/I Q C.F.S.	L W FT.	S/I INV. ELEV.	S/I W.S. ELEV.	ELEV. WASH	TOP OF DIKE-RT ELEV.	Q_{100} C.F.S.	W.S. Q_{100} ELEV.
10+10	---	---	--	--	----	-----	--	1698	160	93.6
12+60	12+45	1	17	5	1696	1697.1	95	1698	177	93.6
16+40	16+35	2	36	10	1696	1697.1	93	1698	213	93.5
20+40	20+19	3	107	30	1696	1697.1	95	1699	320	93.5
25+90	25+62	4	50	30	1696	1696.66	94	1699	370	93.5
33+40	33+24	5	70	25	1697	1697.93	96	1700	440	93.3
37+80	37+20	6	70	25	1697	1697.93	96	1700	510	93.3
41+90	41+85	7	17	15	1696	1696.36	94	1700	527	93.2
44+20	44+74	8	17	10*	1697	1697.67	97	1700	544	93.2
49+20	49+14	9	16	10	1697	1697.64	98	1700	560	93.0
53+10	53+18	10	25	25	1697	1697.47	97	1700	585	93.0
60+70	60+89	11	12	20	1697	1697.33	96	1700	597	92.8
66+80	66+59	12	23	20	1696	1696.52	94	1700	620	92.7
73+60	73+56	13	319	50	1697	1696.6	97	1700	939	92.6
82+10	82+09	14	98	15	1695	1696.6	94	1698	1037	92.4
87+60	87+70	15	98	15	1695	1696.6	95	1698	1135	92.2
90+00	----	--	--	--	----	-----	--	1698	1135	92.1

* Construction Mod. changed 10' to 25'

S/I # = side inlet number as shown on drawing
S/I Q= flow into side inlet
LW = length of weir of side inlet
S/~~I INV~~. = elevation of side inlet
S/I W.W. = elevation of water surface in side inlet
Q_{100} = 100-yr. flow in floodway channel
W.S. Q_{100} = Water surface profile elevation of Q in floodway channel

MEMO TO: D. E. Sagramoso
Stanley L. Smith, Jr.

VIA: Nick Karan
Ed Opstein

FROM: Cora Fernandez

SUBJECT: Signal Butte Floodway

The following is a summary of events that led to the present situation at Signal Butte Floodway:

1. The Watershed Work Plan was approved and signed by the Board of Directors of the Flood Control District in a Resolution dated February 25, 1963.

   The Work Plan included the alignment of the floodway which runs along the Salt River transmission lines. The alignment was not feasible because it traverses all private parcels diagonally which would result in a greater amount of severance damages.

2. February 11, 1976 - The Work Plan alignment was too costly so the District requested SCS to investigate other alternate alignments.

3. 1977-1978 - During 1977 and the first half of 1978, SCS performed various investigations, field trips and technical studies. The alternate which seemed the most viable was Alternate No. 3. This alignment is north of Brown Road and runs parallel to it to a point where the channel heads to a northwesterly direction, then changes to a southwesterly course to connect with Spook Hill Dam.

4. March 1, 1978 - The SCS sent a letter to the District stating they had completed their study of the alternatives. They concluded that Alternative 3 was the most economical alignment. SCS then proceeded with the design of that alternative.

5. April 1978 - The District had Dibble & Associates survey the right-of-way based on the new work plan furnished by SCS.

6. June 4, 1979 - The Board of Directors authorized the District to start right-of-way acquisitions.

7. February 29, 1980 - Dibble & Associates started topographic surveys to locate upstream washes for use in the design of side inlets and vegetative outlets. The results of the survey were submitted to SCS.

8. August 21, 1980 - The District received from SCS plans and profiles of five vegetative outlets that would not operate within the right-of-way unless an outlet channel were constructed outside the right-of-way to connect with existing washes. Additional survey and construction easement were provided by the District.

9. January 22, 1982 - SCS advised the District that flood easements were needed upstream of the channel. The area to be acquired was red-lined in the preliminary plans.

   According to SCS, the side inlets were designed to prevent high velocities and subsequent erosion of the rock riprap protection on the upstream side. As a result, the backwater would extend beyond the current right-of-way limits at some locations.

10. April 6, 1982 - The District notified SCS they were proceeding with the acquisition of the flood easements defined by SCS.

11. January 15, 1984 - SCS informed the District in a letter dated January 11, 1984 that construction staking operations revealed the need for additional rights-of-way (1.77 acres) to collect offsite flows and direct them to a major channel inlet.

12. Construction of the project started in October, 1983. During that period, problems with the inlet became physically apparent. Additional solutions were offered to SCS.

13. July 17-18, 1984 - Local flooding occurred in some areas in Eastern Maricopa County as a result of runoff from an intense rainstorm in the area. Widespread ponding developed around the inlets and extended beyond the flowage easements acquired by the District at the earth channel section. This was due to the fact that the inverts of the side inlets were built higher than the inverts of existing washes. The water has to build up to the invert of the inlet in order to drain into the floodway.

14. August 3, 1984 - SCS and District personnel made a field trip to the project to look at the ponding problem. SCS agreed to analyze the District's concerns and look for solutions.

15. April 2, 1985 - The District received a letter from SCS dated 04/01/85, and a report of the results of their analysis. The options were:
    a. Lowering the ponded side inlets.
    b. Install outlet pipes to drain standing water.

    A cost comparison was included. Both options require additional flowage easements.

16. April 24, 1985 - A meeting was held between the personnel of SCS and the District to discuss the problem. The options proposed were not acceptable to the District. Both parties have agreed to give the matter further consideration.

Cora G. Fernandez

EXHIBITS

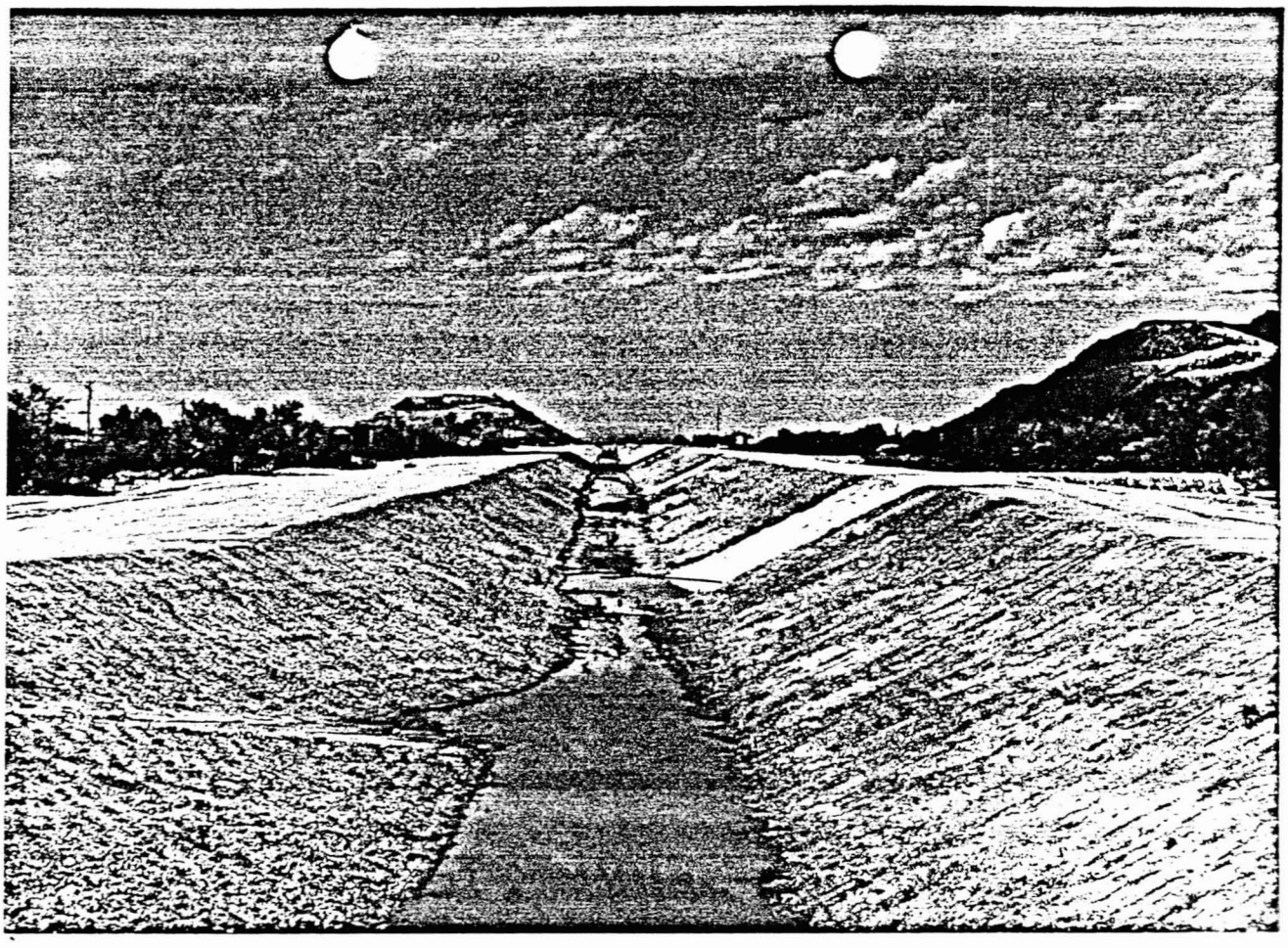


Photo Number No. 1 - View of Channel

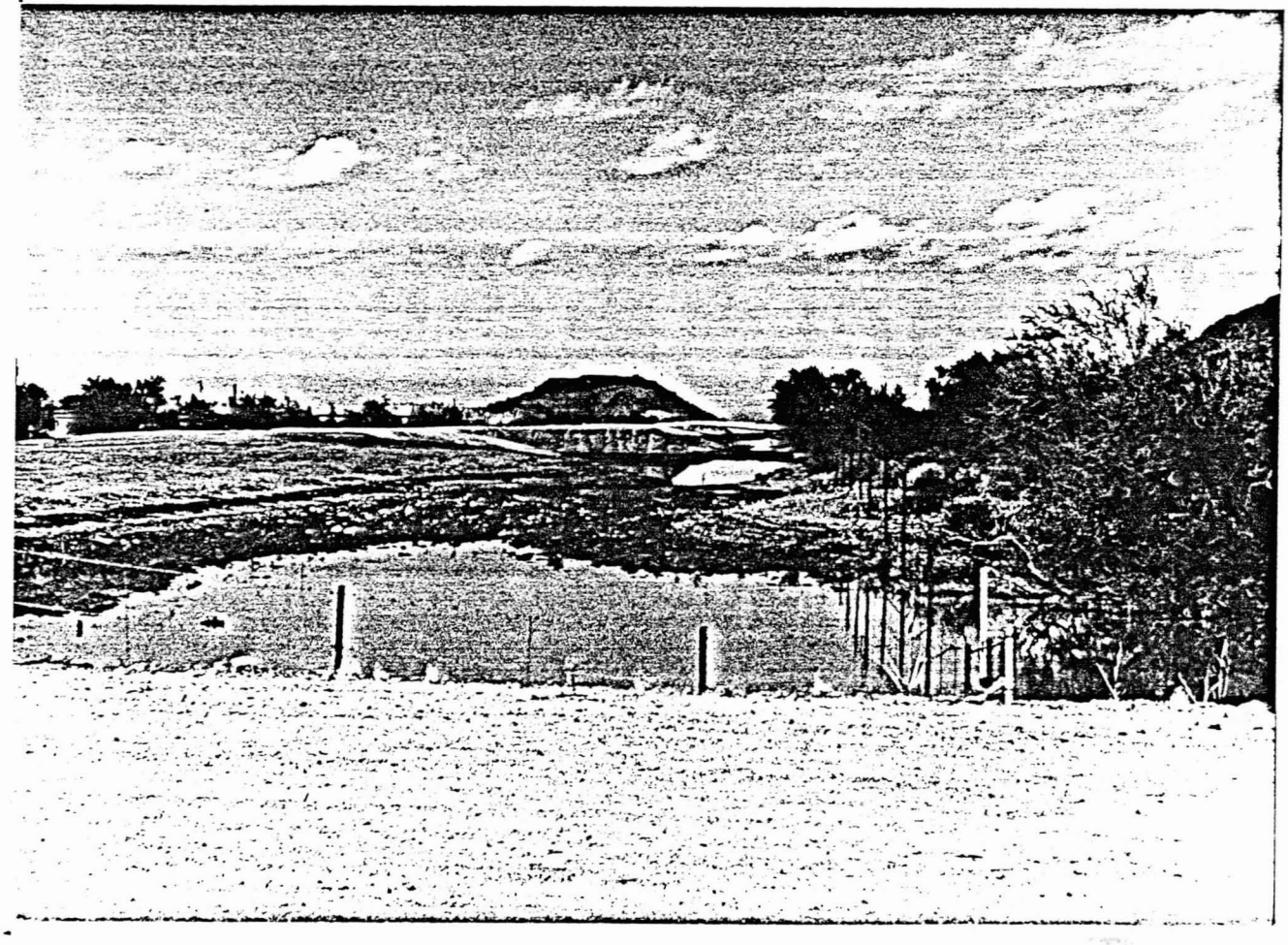


Photo Number No. 2 - Upstream of Inlet

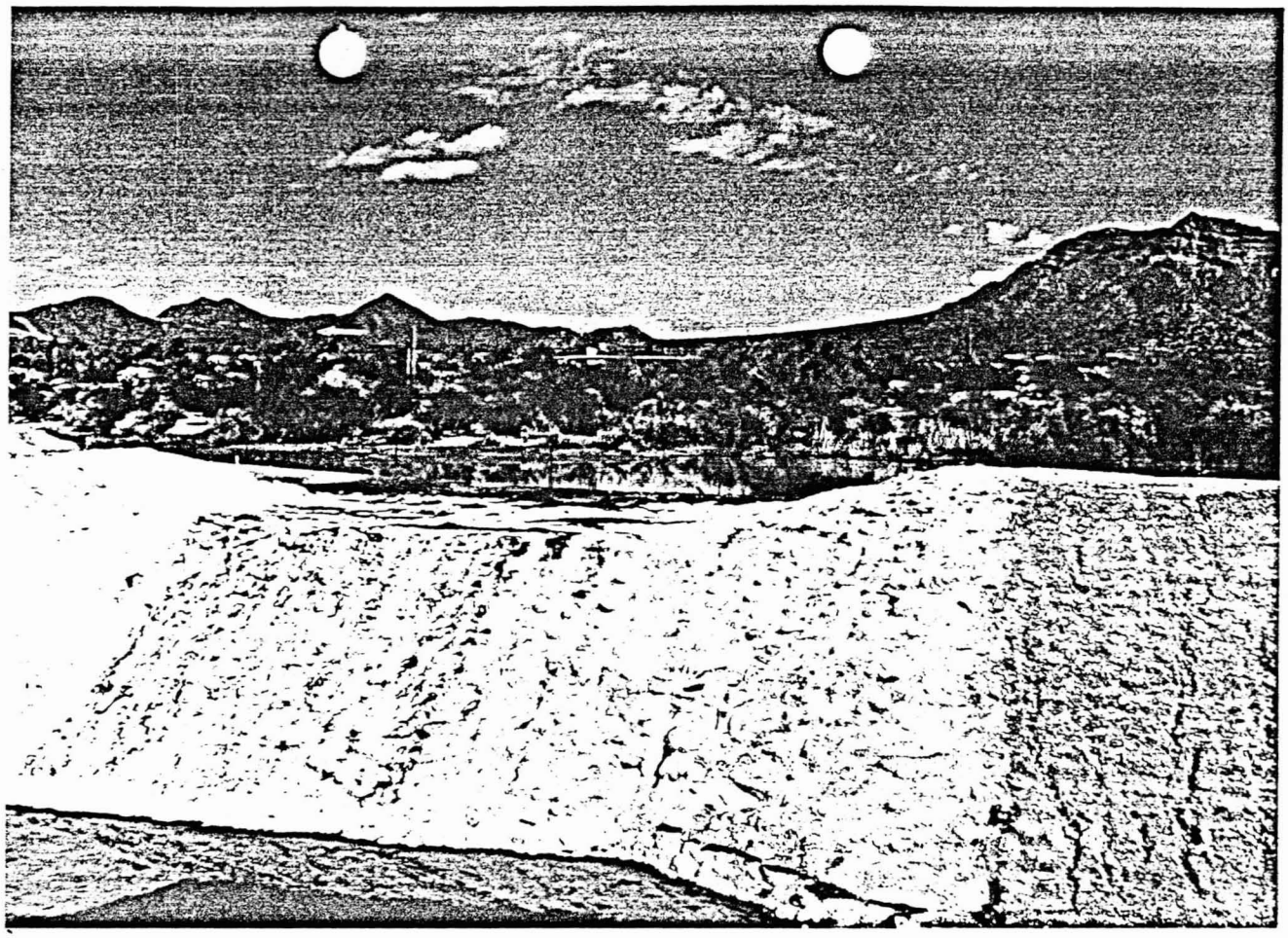


Photo Number 3 - Grouted Rock Side-inlet

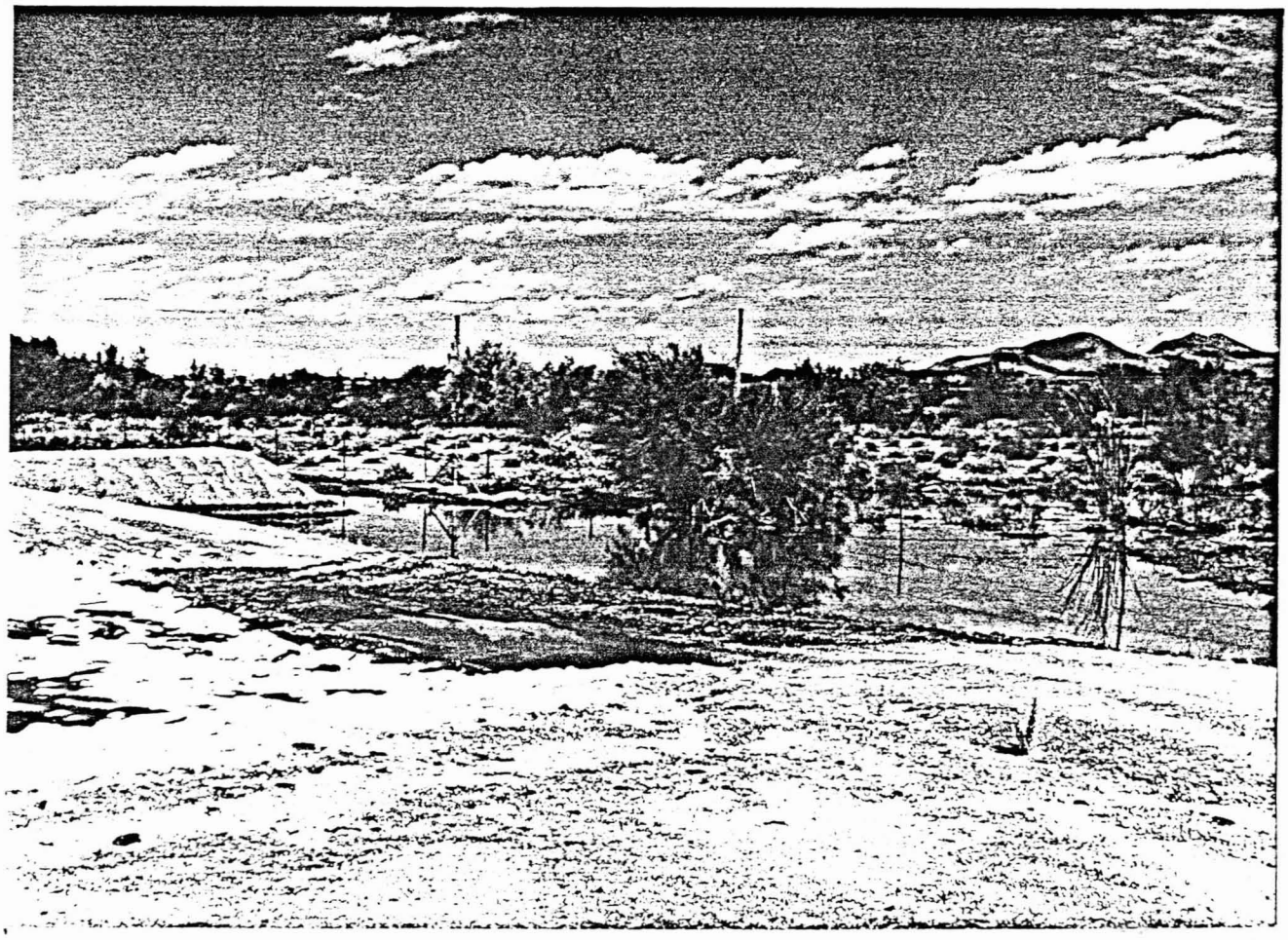


Photo Number 4 - Sediment trap

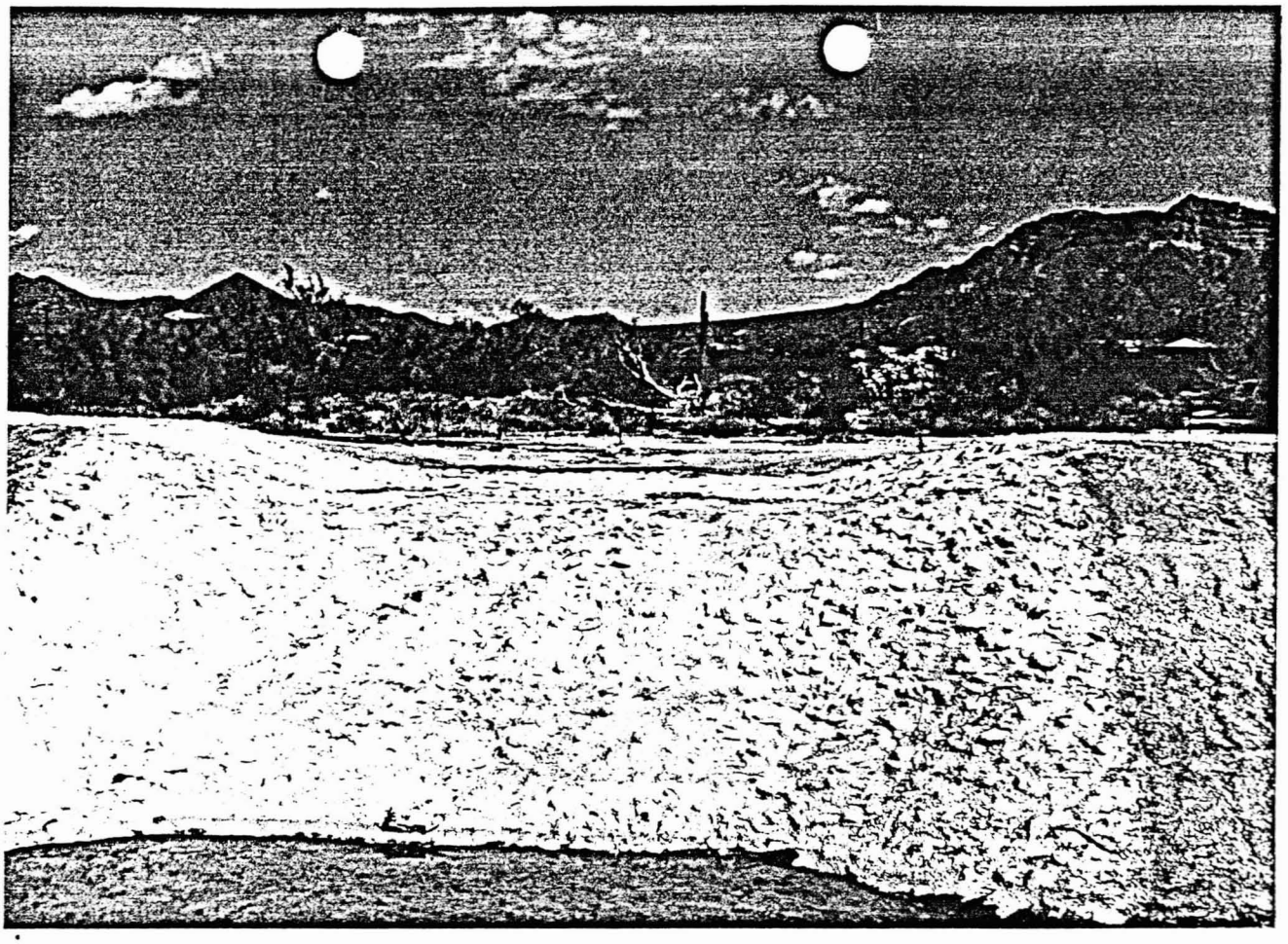


Photo Number 5 - Sideinlet - sediment full

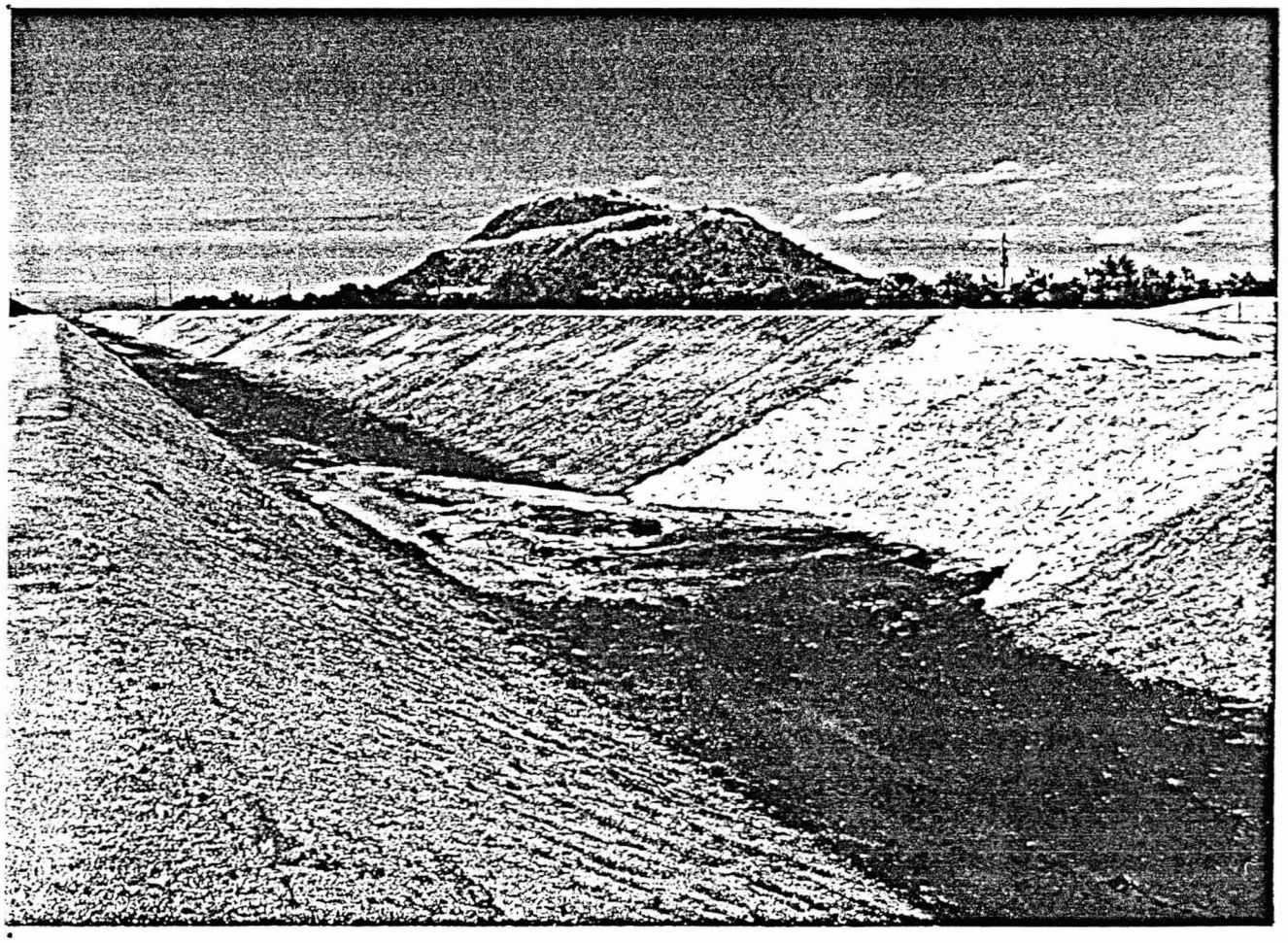


Photo Number 6 - Sediment in Channel