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Phoenix, AZ 85009

*Rubber Dam Background Information
for
Rio Salado*

Information Compiled from Various Sources

1994

City of Tempe

Community Development Dept.
 Long Range Planning Division
 115 E. 5th Street, Suite 2
 Tempe, AZ 85281
 (602) 350-8587
 (602) 350-8872 FAX

FLOOD CONTROL DISTRICT RECEIVED	
JUL 11 '94	
CHENG	P & PM
DEP	HYDRO
ADMIN	LMGT
FINANCE	FILE
C & O	RESPT 7/11
2 ENGR	
REMARKS	

Letter of Transmittal

To: DICK PERREAULT

Date: JULY 7, 1994

Re: FUSEGATE DAM - RIO SALADO

We are sending you the following:

- Rio Salado Info
- Downtown Info

- Application
- HYDRO PLUS INFO.

These are transmitted as checked below:

- As Requested
- For Your Use

- For your Comments
- _____

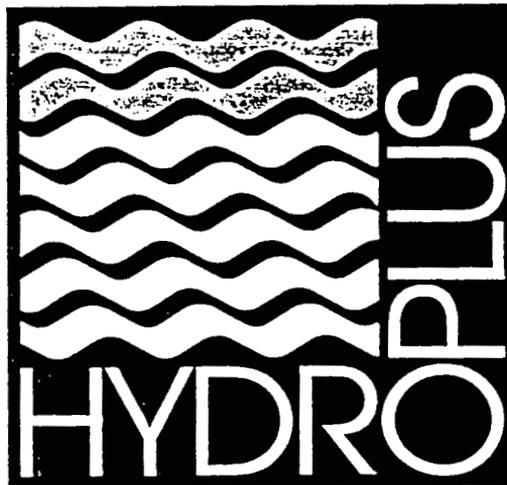
Remarks: I FINALLY FOUND SOME INFO ON THIS SYSTEM.

Signed: GARY MEYER

RIO SALADO

FUSEGATES TECHNICAL
AND
BUDGET PROPOSAL

CITY OF TEMPE



SEPTEMBER 1993



RIO SALADO PROJECT

The focal point of the Rio Salado project is a 200 acre recreational lake "Town Lake" located downtown Tempe, Arizona.

This lake will be created by constructing two dams on the Salt River channel; the main "downstream " dam will be located approximately 1,500 feet west of Mill Avenue, the "upstream" dam will be located near the confluence of Indian Bend Wash and the Salt River.

As currently proposed by the City of Tempe and its engineers, the project includes a 16 foot high inflatable rubber dam for the downstream dam and a 6 foot high air inflatable rubber dam at the upstream end of the lake.

In the following document, Hydroplus, Inc. proposes as an alternate solution to install Hydroplus fusegates system instead of rubber dams.

1. THE HYDROPLUS FUSEGATE SYSTEM

a- Description

The fusegates consists of an alignment of elements standing on the sill, which may first be lowered if maximum spillway capacity is to be increased and each element simply held in place by gravity forces.

Each elements consists of three parts bound together :

- * The top section : "bucket" or "parapet wall" type which may present a labyrinth configuration or discharging moderate floods under small head.
- * The well, connected to the bottom chamber which begins to fill at a precise predetermined reservoir level which could be different for each fusegate.
- * The bottom chamber : a hollow base set over the sill where pressure will develop when headwater reaches a pre-determined level.

Drain holes are provided at the downstream face of the chamber to avoid any uplift before the reservoir has reached the level of the top of the well.

Some simplified gate elements can be envisaged but always based on the same principle.

The fusegates are made of steel, concrete, or a combination of both.

b- Operation

The units act as a dam, an overspill or a fusegate, depending on reservoir level :

- * When headwater level is lower than or level with the top of the fusegate, it acts as an upward extension of the dam. It is designed to be amply stable under these conditions and retain stability despite any wilful or accidental damage that might occur. Its stability is analogous to that of a well-drained gravity dam.
- * When a small to moderate flood occurs, the elements acts as a weir, with the water spilling over the length of the labyrinth (around three times the sill length).



* Lastly, the fusegate rotates and tilts over during exceptionally large floods when the headwater reaches a pre-determined level and admits water through the well thus creating uplift pressure in the base chamber. The accuracy of operation is of an order of a few centimetres. This design confers a large stability margin before the pre-set level is reached and enables an individual elements to be activated without affecting its neighbours not yet subjected to uplift. Once the flood has receded, the collapsed unit is simply re-set on the sill or replaced with a new one if it has been damaged.

The setting of the wells can be chosen so that no element will overturn for floods of less than 20 to 50 years return period. Since such floods often occur when the reservoir is partially full, it is likely that only two or three elements will overturn over a period of about a century. This return period may be only 200 years for fusegates chosen only for increasing spillway capacity.

The relatively lightweight units used on small dams should not sustain much damage when they overturn and could generally be recovered just downstream of the dam and sometimes re-utilized with minimum reworking. The elements are carried away by the current when velocity is higher than about 10 ft./s.

Even in the infrequent case when a large number of elements have tilted, the replacement can be completed quickly , after the flood has receded.

The extra water stored by fusegates might be lost once or twice per century if an element has tilted but:

.This would usually happen in the middle of the rainy season and it would often be possible to make up the loss before the end of the season.

.The sill could be set at two different levels with proper gate heights adjusted on each segment to minimize drawdown of the reservoir.

The fusegate system considerably aerates the nappe, not only during moderate floods but also for most of major floods.

c- Maintenance

No supervision or maintenance is necessary except that, after a flood, floating debris that may have jammed against the fusegates or accumulated upstream should be removed. Under normal operating conditions, it is advisable to perform routine inspection to verify that drain holes have not been blocked. For protection against corrosion, extra steel thickness is built into the design, but anti-corrosion coating is usually foreseen.

**RIO SALADO PROJECT - DOWNSTREAM DAM
PRELIMINARY FUSEGATES PROPOSAL**

1. PARAMETERS USED FOR CALCULATIONS :

- Normal water level at..... : El. 1148
 - Maximum water level at..... : El. 1158
 - Design flood (100 years flood)..... : 215,000 cfs
 - Canal Elevation at fusegate location..... : El 1132 est.
 - Canal width at fusegate location..... : 880 L.F est.
- Channel*

2. PROPOSED FUSEGATES SYSTEM :

To accommodate the design flood while maintaining the Maximum Water Level at/or below El. 1158, Hydroplus, Inc. proposes to install on the downstream dam :

- 40 fusegates of 14.76 Ft. High x 22.15 Ft. wide

3. DOWNSTREAM SPILLWAY CHARACTERISTICS :

- Type.....: Fusegate
- Length of spillway equipped with fusegates.....: 886.00 Ft.
- Fusegate bucket El.....: El. 1148
- Elevation of spillway.....: El. 1133.24
- Maximum reservoir level.....: El. 1158

**DOWNSTREAM DAM
PRELIMINARY FUSEGATES PROPOSAL**

4. FUSEGATES CHARACTERISTICS : (See sketch # 1)

- Fusegate height.....: 14.76 Ft.
 - Width of fusegate.....: 22.15 Ft.
 - Type of fusegate.....: Wide Low Head (WLH)
 - Fusegate bucket El.....: El. 1148
 - Fusegate bottom El.....: El. 1133.24
 - Number of fusegates.....: 40
- + 9' = El. 1157 = 136,000 cfs.
 + 6.5' = El. 1154.5 = 90,000 cfs.
 + 3.2' = El. 1151.2 = 41,000 cfs.

5. FUSEGATES OPERATION :

A complete and detailed fusegate hydraulic operation could not be done with the present available information; however our preliminary fusegates design shows :

- The maximum flood discharged before any fusegate tilting should be equal to 136,000 cfs; at that time the lake water level should be at El. 1157.
- The return period for such a flood (136,000 cfs) should be in the range of 30 years.
- For the 100 years flood (215,000 cfs) only 15 fusegates would have tilted.

For the downstream dam, the following information would be required :

- The maximum water level on the downstream side of the dam
- Channel sections at the downstream dam location
- Manning Strickler coefficient to be considered for the channel.

**RIO SALADO PROJECT - UPSTREAM DAM
PRELIMINARY FUSEGATES PROPOSAL**

1. PARAMETERS USED FOR CALCULATIONS :

- Normal water level at..... : El. 1148
- Maximum water level at..... : El. 1162
- Design flood (100 years flood)..... : 215,000 cfs
- Canal El. at fusegate location..... : El. 1141
- Canal width at fusegate location..... : 850 L.F.

2. PROPOSED FUSEGATES SYSTEM :

As a preliminary design, to accommodate the design flood while maintaining the Maximum Water Level at/or below El. 1162, Hydroplus, Inc. proposes to install on the upstream dam:

- 100 concrete fusegates of 6 Ft. High x 16.40 Ft. wide

3. UPSTREAM SPILLWAY CHARACTERISTICS :

- Length of spillway equipped with fusegates: 1640 Ft.
- Fusegate El.....: El. 1148
- Elevation of spillway.....: El. 1141
- Maximum reservoir level.....: El. 1162

**UPSTREAM DAM
PRELIMINARY FUSEGATES PROPOSAL**

4. FUSEGATES CHARACTERISTICS : (See sketch # 2)

- Fusegate height..... : 6 Ft.
- Width of fusegate..... : 16.40 Ft.
- Fusegate bucket El..... : El 1148
- Fusegate bottom El..... : El.1142
- Number of fusegates..... : 100

5. FUSEGATES OPERATION :

Further details would be required to determine exactly the return period of each fusegate tilting; however our preliminary fusegates design shows :

- The maximum flood discharged before any fusegate tilting should be equal to 200,000cfs; at that time the lake water level should be at El.1160

For the upstream dam, the following information would be required :

- The maximum water level on the upstream side of the dam
- Channel sections at the upstream dam location
- Manning Strickler coefficient to be considered for the channel.

**RIO SALADO PROJECT - TOWN LAKE
BUDGET PRICE ESTIMATE**

1. SCOPE OF WORK

In accordance with the quantities and method, Hydroplus, Inc. will supply all labor, equipment, materials, supervision and quality control to perform the following :

- Fusegate design
- Design of spillways sill for fusegate's installation
- Fusegates fabrication (done by a local fabricator)
- Fusegates installation

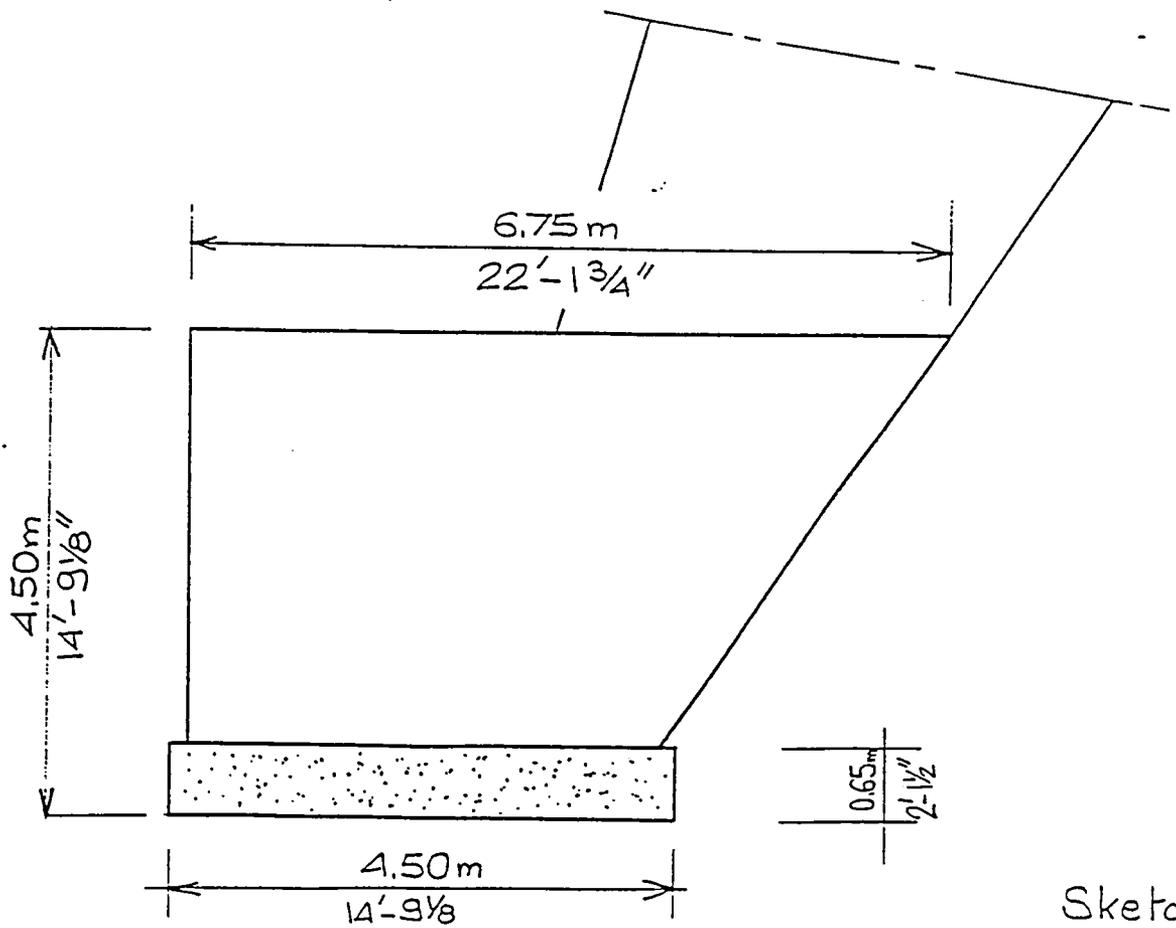
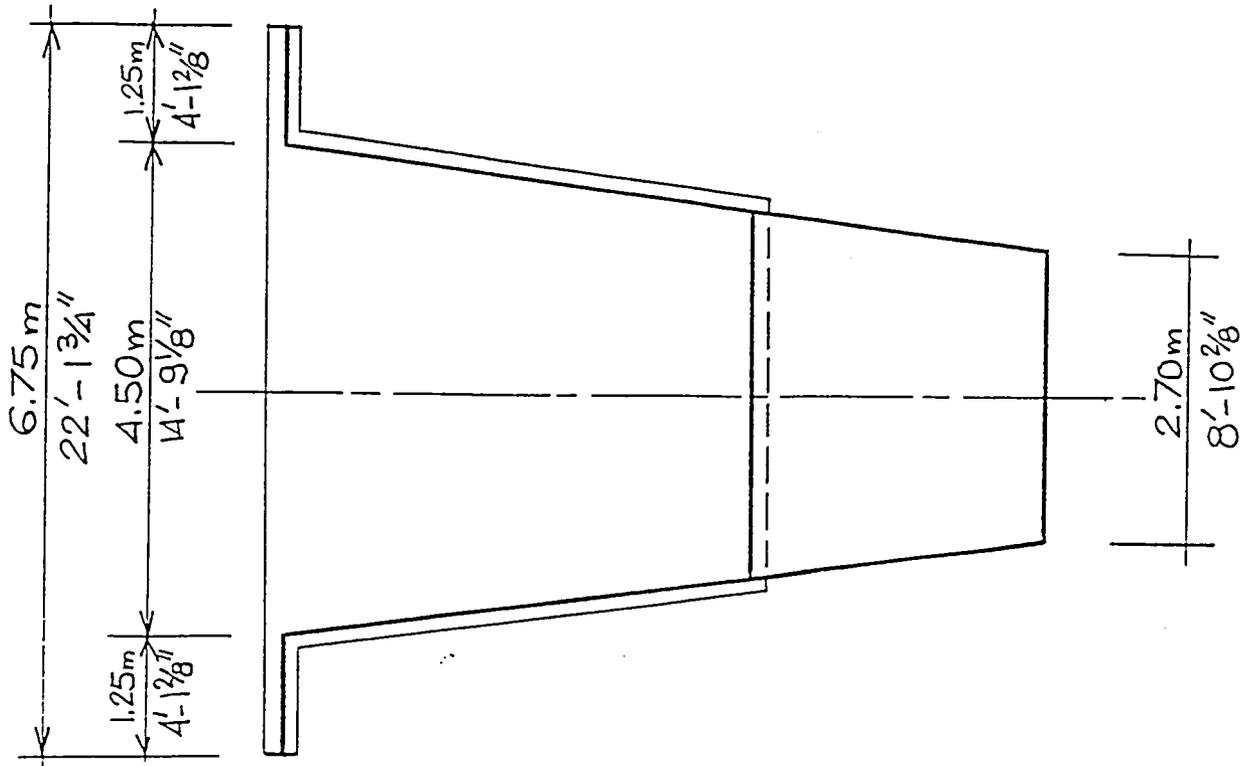
2. EXCLUSION

The following items are excluded from this proposal :

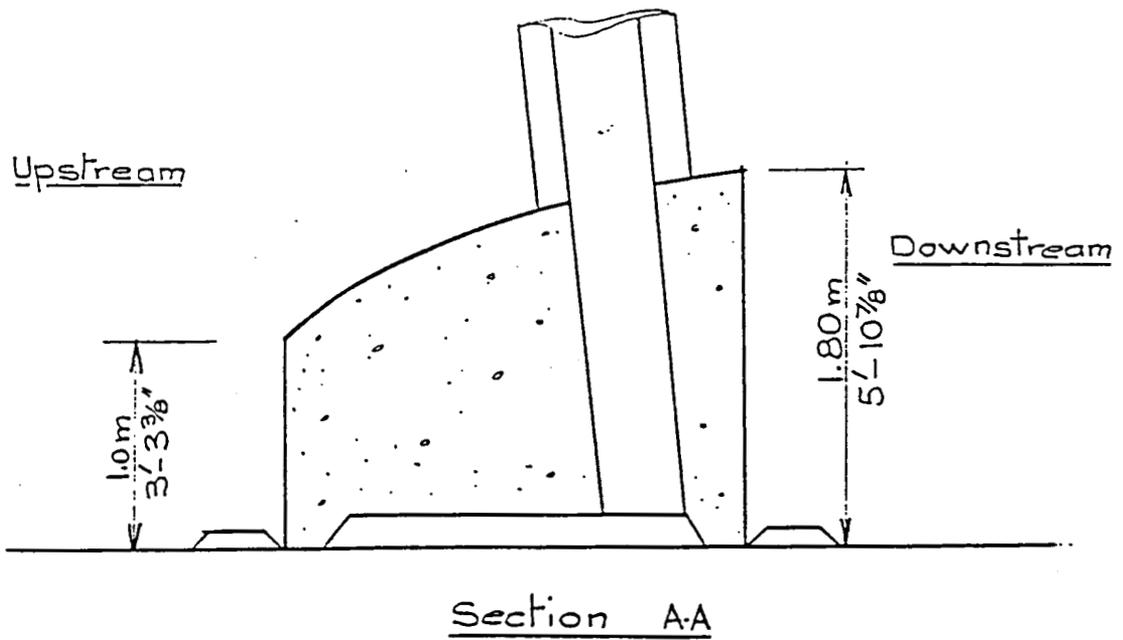
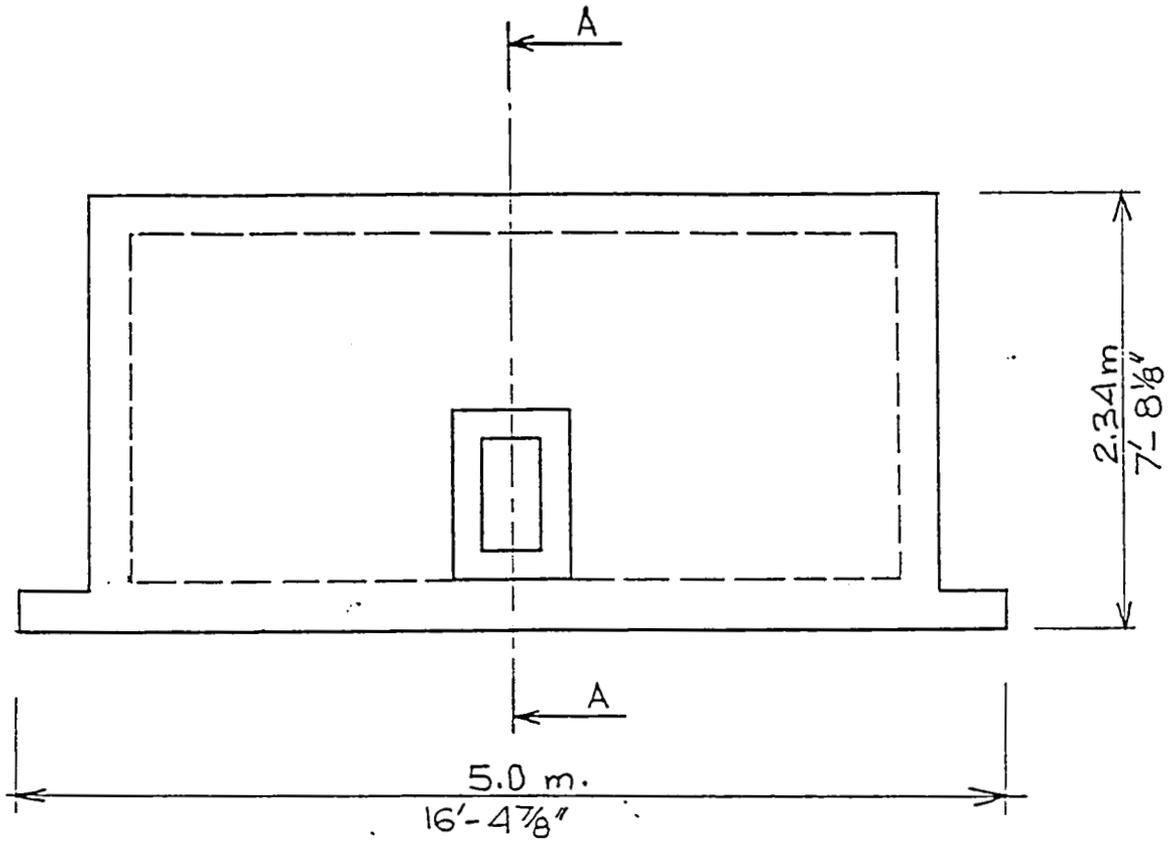
- All permits and authorization
- Access to work areas
- Spillways modifications (excavation and construction)
- All indemnities, liabilities and insurance costs
- Federal, State and local taxes
- Bond

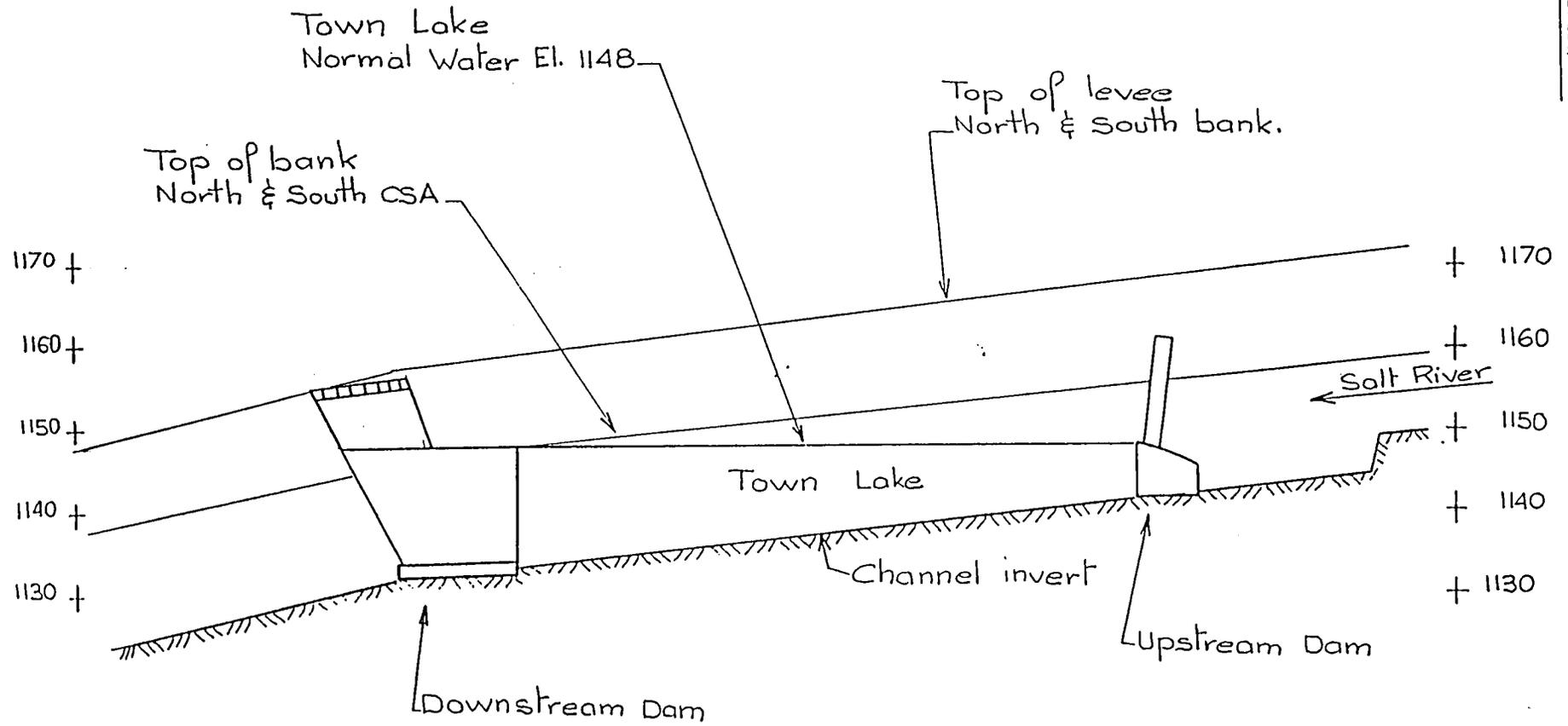
3. PRICING

Based on the present market conditions, Hydroplus, Inc. will perform the above scope of work for a budget price of \$4 to \$6 Million.



Sketch #1





Longitudinal Section

HYDROPLUS, INC.
Rio Salado Project-Town Lake Fusegates Design.
9-21-92

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

INTEROFFICE MEMORANDUM

SUBJECT: RUBBER DAMS

FILE: LS 1.5.1

TO: JOHN RODRIGUEZ
NICK KARAN
DAVE JOHNSON
BOB PAYETTE
STAN SMITH
/ DAN SAGRAMOSO

FROM: RICHARD G. PERREAULT

DATE: 21 FEB. 1990

(PLEASE RETURN TO RGP)

1. ON 8FEB1990, I ACCOMPANIED REPRESENTATIVES FROM THE CITY OF TEMPE TO LOS ANGELES TO HEAR A PRESENTATION BY THE BRIDGESTONE RUBBER CO. AND VISIT SOME OF THEIR RUBBER DAMS THAT HAVE BEEN INSTALLED ON THE SAN GABRIEL RIVER. PETER WOODS FROM THE LOS ANGELES COUNTY PUBLIC WORKS DEPT. WAS OUR GUIDE ON THE RIVER.

2. TEMPE IS THINKING ABOUT INSTALLING THE RUBBER DAMS (13'X 800'+/-) IN THE SALT RIVER CHANNEL WEST OF THE RAILROAD BRIDGE ON GRADE CONTROL STRUCTURE #4. THIS WILL CREATE A "LAKE" FROM MILL AVE. EASTWARD THROUGH RURAL ROAD. THIS IS STILL IN THE CONCEPTUAL STAGE, BUT THEY APPEAR TO BE SERIOUS ABOUT IT. I'D BE HAPPY TO ANSWER ANY QUESTIONS THAT I CAN ABOUT THE DAMS OR TEMPE'S PLAN.

PROPOSED ITINERARYBRIDGESTONE RUBBER DAM JOBSITE VISIT

Date: Thursday, February 8, 1990

Location: San Gabriel River
Los Angeles Dept. of Public Works
Whittier Headworks (see map)

Attendees: • Steve Nelsen - City of Tempe - Planning Division
• 4 Guests - City of Tempe - Planning Division
• 2 Guests - City of Tempe - Flood Control
• Peter Wood - Supervision Hydrograph - LADPW
• Roger Busch - Bridgestone - Los Angeles

Itinerary

8:00 a.m. - 9:30 a.m. - Rubber Dam presentation and open discussion.
Holiday Inn, Crowne Plaza (Los Almos Rm., 2nd
Flr), 5985 W. Century Blvd, L.A.
(4 Blocks East of Airport).

9:30 a.m. - 10:15 a.m. - Travel by car and van to rubber dam jobsite at
Whittier Headworks.

10:15 a.m. - 11:00 a.m.- Tour Headworks rubber dam facility and compare
water filled and air filled rubber dams.

11:00 a.m. - 12:30 p.m.- Visit new Bridgestone Rubber Dam installation at
Washington Blvd. and operate system.

1:30 p.m. - Lunch (Bridgestone's Guests)

2:30 p.m. - Return to Airport

BRIDGESTONE

BRIDGESTONE (U.S.A.), INC.
IRP DIVISION
P.O. Box 6147
Huntington Beach, CA 92615-6147
Phone: (714) 962-1666
Rapifax: (714) 968-3441

RAPIFAX TRANSMITTAL
(602) 350-8872

DATE: 2/7/90

TO: CITY OF TEMPE
COMMUNITY DEV. - PLANNING DIV.
115 EAST 5TH ST
TEMPE, ARIZONA 85281

FAX NO: 020785

ATTN: STEVE NIERSEN

Number of pages attached: 2

IF ALL PAGES ARE NOT RECEIVED SATISFACTORILY, PLEASE CONTACT US AT THE ABOVE TELEPHONE OR RAPIFAX NUMBER AS SOON AS POSSIBLE.

Comments: PLEASE FIND ATTACHED THE PROPOSED
ITINERARY FOR YOUR TRIP TO LA.
UNLESS I HEAR FROM YOU TODAY, I
WILL EXPECT TO SEE YOU AT THE HOLIDAY
INN (NEAR THE AIRPORT) AROUND 7:30-8AM
THURSDAY. PLEASE COME DIRECTLY TO THE
LOS ALAMOS RM. THE HOTEL PH #(213) 642-7500

THANKED
R.A. Bunch



LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT

**MAJOR FACILITIES
CONTROL AND CONSERVATION
OF FLOOD WATERS**

1979

LEGEND

- CHANNEL
- RESERVOIR
- DEBRIS BASIN
- LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
- COMPLETED
- UNITED STATES CORPS OF ENGINEERS PROGRAM COMPLETED
- UNITED STATES DEPARTMENT OF AGRICULTURE PROGRAM
- UPSTREAM FLOOD CONTROL AND CONSERVATION WORK HAS BEEN AUTHORIZED WITHIN THE LOS ANGELES RIVER WATER SHED BOUNDARIES MARKED THIS

APPROXIMATE SCALE IN MILES

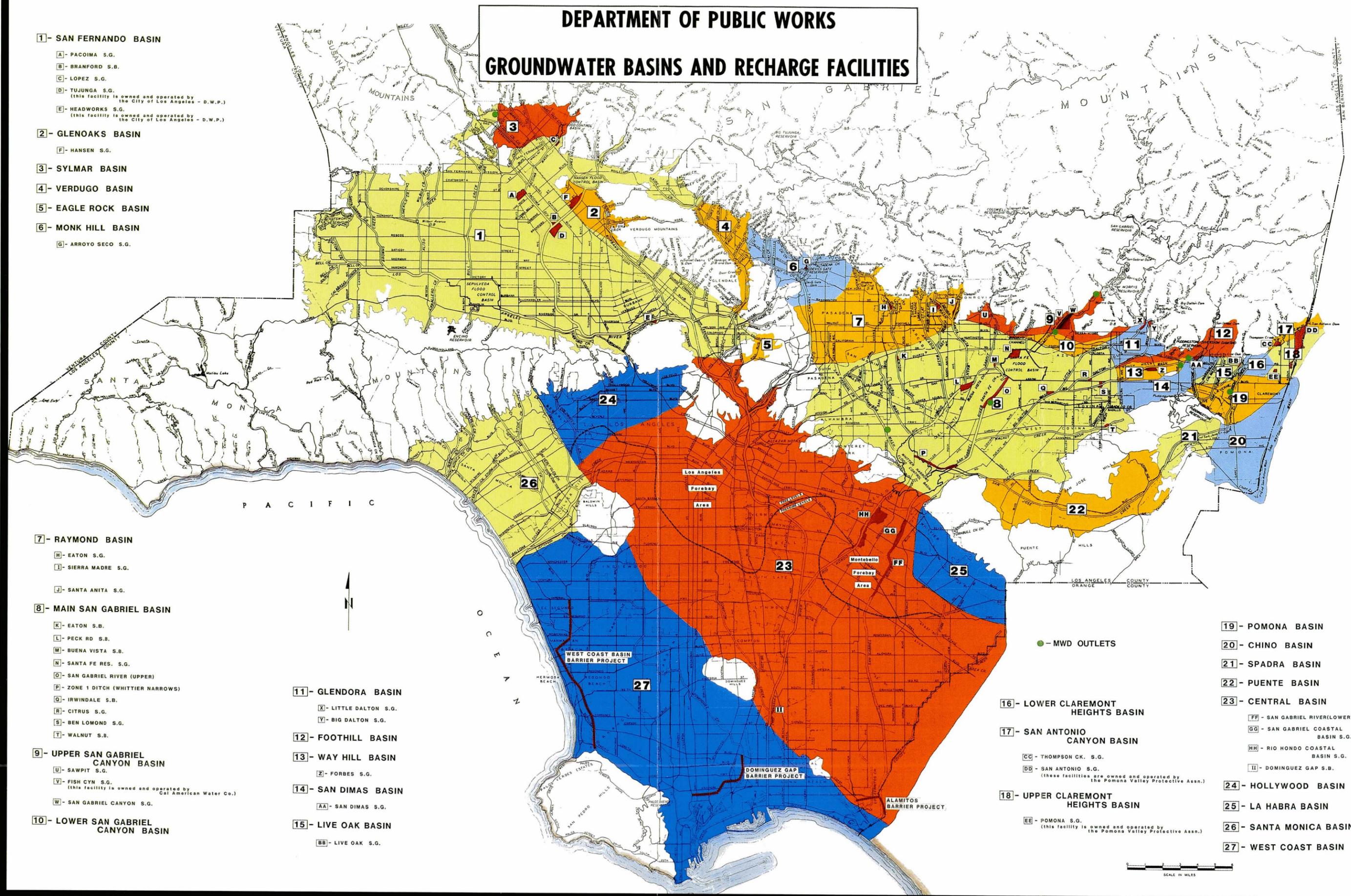
DEPARTMENT OF PUBLIC WORKS

GROUNDWATER BASINS AND RECHARGE FACILITIES

- 1- SAN FERNANDO BASIN**
 - A- PACOIMA S.G.
 - B- BRANFORD S.B.
 - C- LOPEZ S.G.
 - D- TUJUNGA S.G.
(this facility is owned and operated by the City of Los Angeles - D.W.P.)
 - E- HEADWORKS S.G.
(this facility is owned and operated by the City of Los Angeles - D.W.P.)
 - 2- GLENOAKS BASIN**
 - F- HANSEN S.G.
 - 3- SYLMAR BASIN**
 - 4- VERDUGO BASIN**
 - 5- EAGLE ROCK BASIN**
 - 6- MONK HILL BASIN**
 - G- ARROYO SECO S.G.
-
- 7- RAYMOND BASIN**
 - H- EATON S.G.
 - I- SIERRA MADRE S.G.
 - J- SANTA ANITA S.G.
 - 8- MAIN SAN GABRIEL BASIN**
 - K- EATON S.B.
 - L- PECK RD S.B.
 - M- BUENA VISTA S.B.
 - N- SANTA FE RES. S.G.
 - O- SAN GABRIEL RIVER (UPPER)
 - P- ZONE 1 DITCH (WHITTIER NARROWS)
 - Q- IRWINDALE S.B.
 - R- CITRUS S.G.
 - S- BEN LOMOND S.G.
 - T- WALNUT S.B.
 - 9- UPPER SAN GABRIEL CANYON BASIN**
 - U- SAWPIT S.G.
 - V- FISH CYN S.G.
(this facility is owned and operated by Cal American Water Co.)
 - W- SAN GABRIEL CANYON S.G.
 - 10- LOWER SAN GABRIEL CANYON BASIN**

- 11- GLENDORA BASIN**
 - X- LITTLE DALTON S.G.
 - Y- BIG DALTON S.G.
- 12- FOOTHILL BASIN**
- 13- WAY HILL BASIN**
 - Z- FORBES S.G.
- 14- SAN DIMAS BASIN**
 - AA- SAN DIMAS S.G.
- 15- LIVE OAK BASIN**
 - BB- LIVE OAK S.G.

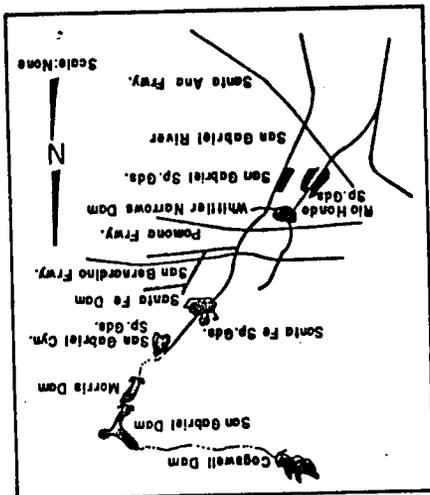
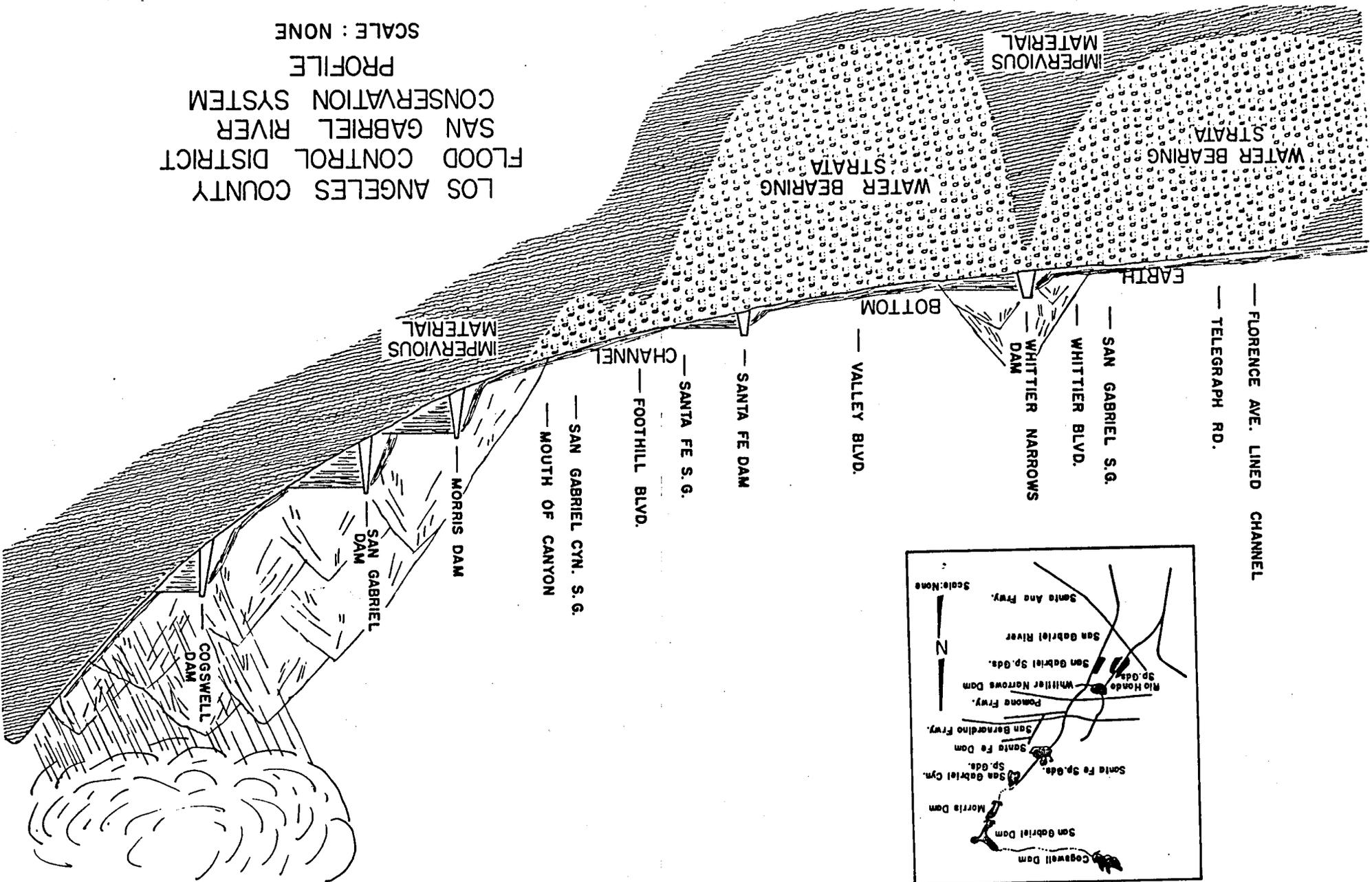
- 16- LOWER CLAREMONT HEIGHTS BASIN**
- 17- SAN ANTONIO CANYON BASIN**
 - CC- THOMPSON CK. S.G.
 - DD- SAN ANTONIO S.G.
(these facilities are owned and operated by the Pomona Valley Protective Assn.)
- 18- UPPER CLAREMONT HEIGHTS BASIN**
 - EE- POMONA S.G.
(this facility is owned and operated by the Pomona Valley Protective Assn.)
- 19- POMONA BASIN**
- 20- CHINO BASIN**
- 21- SPADRA BASIN**
- 22- PUENTE BASIN**
- 23- CENTRAL BASIN**
 - FF- SAN GABRIEL RIVER (LOWER)
 - GG- SAN GABRIEL COASTAL BASIN S.G.
 - HH- RIO HONDO COASTAL BASIN S.G.
 - II- DOMINGUEZ GAP S.B.
- 24- HOLLYWOOD BASIN**
- 25- LA HABRA BASIN**
- 26- SANTA MONICA BASIN**
- 27- WEST COAST BASIN**

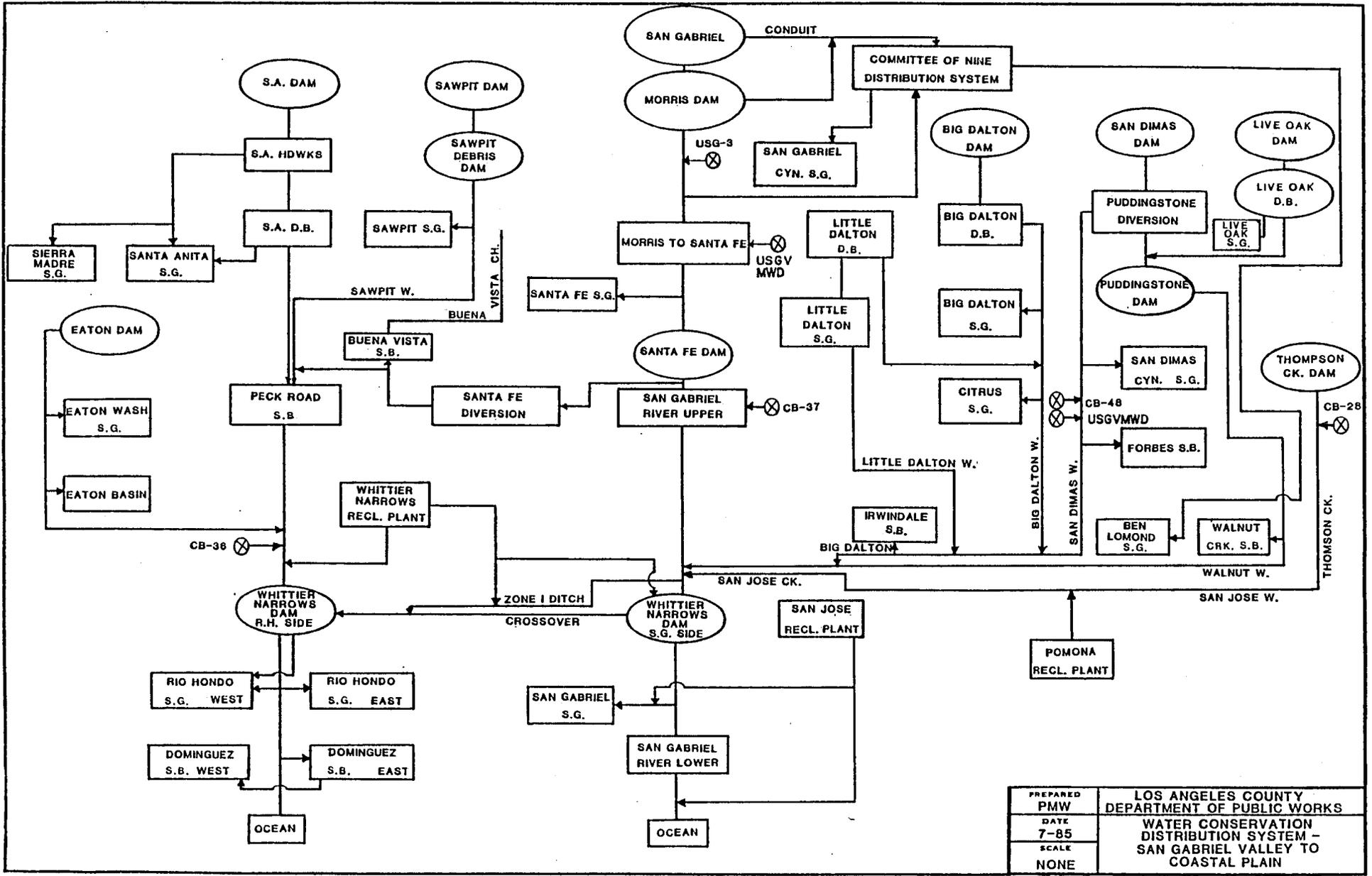


● - MWD OUTLETS

SCALE IN MILES

LOS ANGELES COUNTY
 FLOOD CONTROL DISTRICT
 SAN GABRIEL RIVER
 CONSERVATION SYSTEM
 PROFILE
 SCALE : NONE





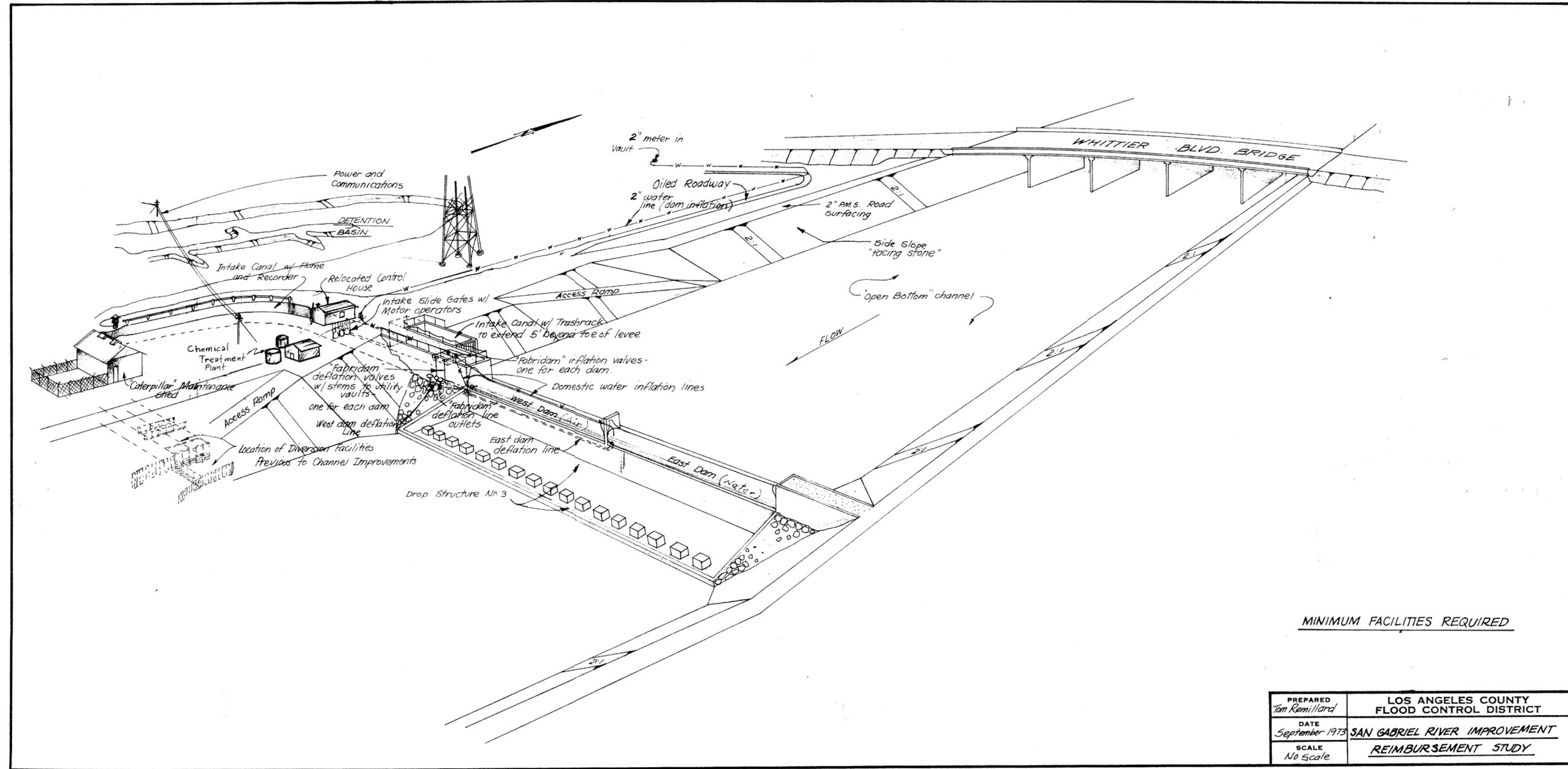
PREPARED PMW	LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS WATER CONSERVATION DISTRIBUTION SYSTEM - SAN GABRIEL VALLEY TO COASTAL PLAIN
DATE 7-85	
SCALE NONE	



SAN GABRIEL COASTAL BASIN SPREADING GROUNDS
RUBBER DAM DIVERSION

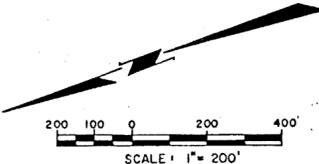
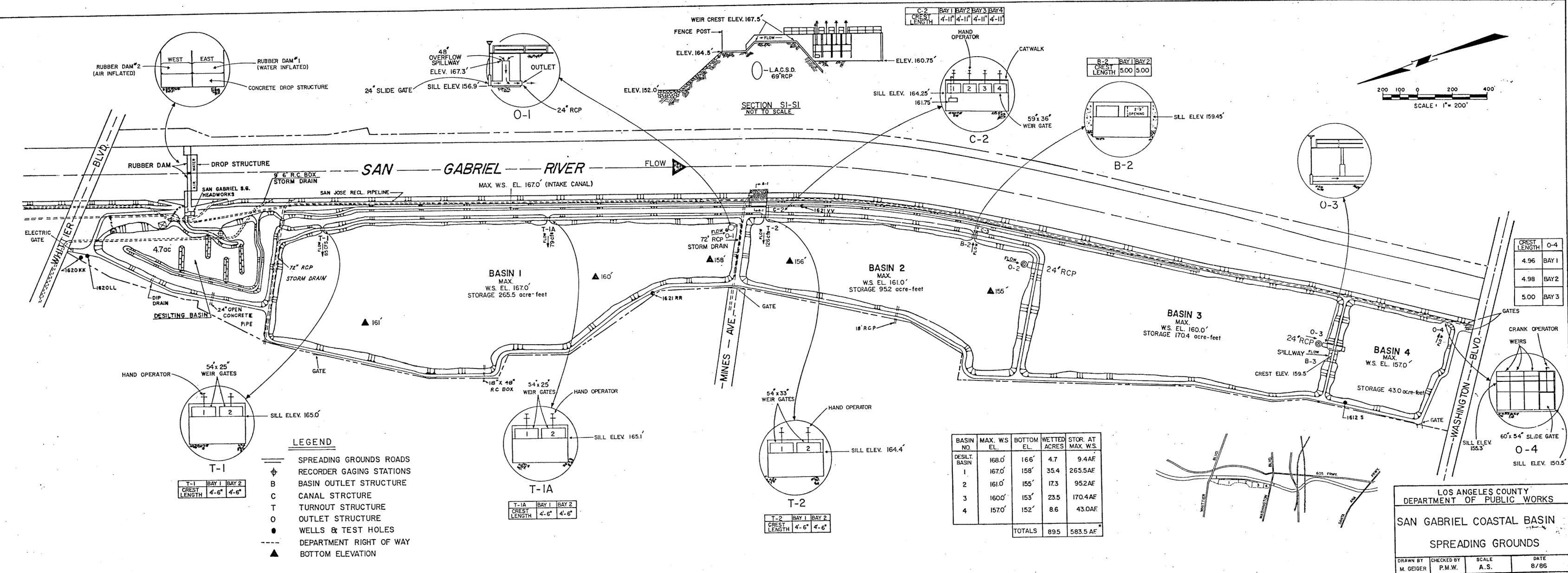


San Gabriel River Spreading Facility
Check levees
Looking Upstream



MINIMUM FACILITIES REQUIRED

PREPARED Tom Kemillard	LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
DATE September 1973	SAN GABRIEL RIVER IMPROVEMENT
SCALE No Scale	REIMBURSEMENT STUDY



LEGEND

- ⊕ SPREADING GROUNDS ROADS
- ⊕ RECORDER GAGING STATIONS
- B BASIN OUTLET STRUCTURE
- C CANAL STRUCTURE
- T TURNOUT STRUCTURE
- O OUTLET STRUCTURE
- WELLS & TEST HOLES
- DEPARTMENT RIGHT OF WAY
- ▲ BOTTOM ELEVATION

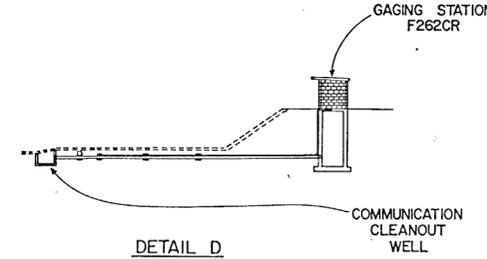
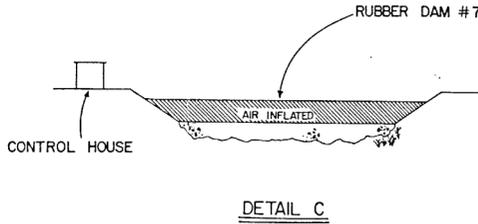
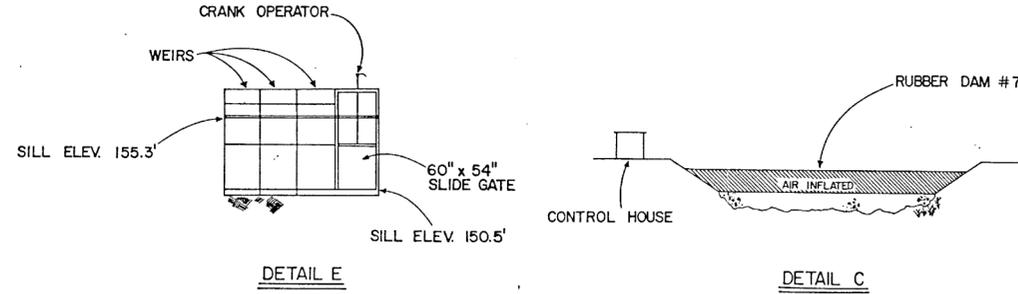
BASIN NO.	MAX. WS. EL.	BOTTOM EL.	WETTED ACRES	STOR. AT MAX. WS.
DESILT. BASIN	168.0'	166'	4.7	9.4AF
1	167.0'	158'	35.4	265.5AF
2	161.0'	155'	17.3	95.2AF
3	160.0'	153'	23.5	170.4AF
4	157.0'	152'	8.6	43.0AF
TOTALS			89.5	583.5 AF

CREST LENGTH	O-4
4.96	BAY 1
4.98	BAY 2
5.00	BAY 3

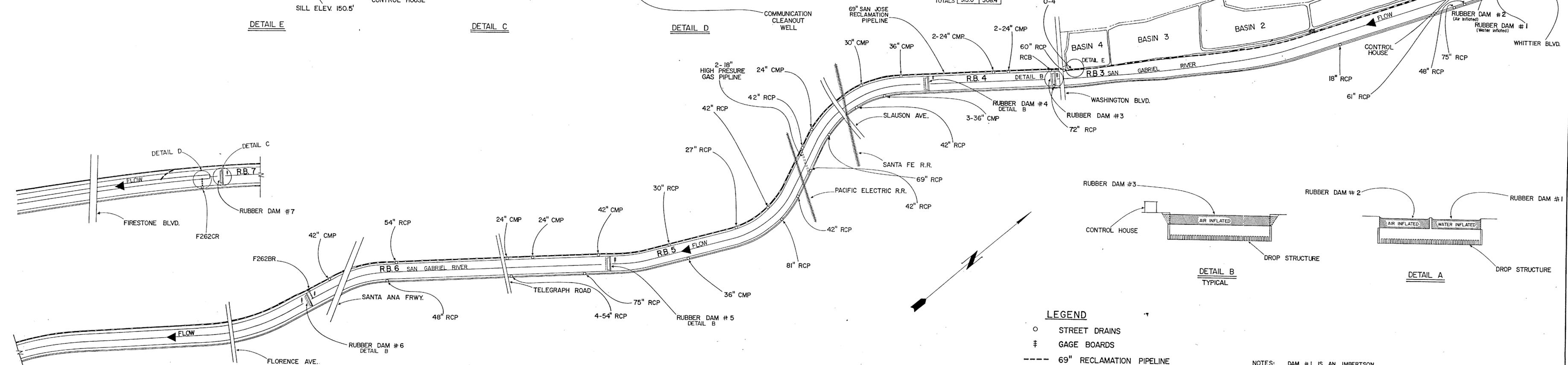
CREST LENGTH	O-4
4.96	BAY 1
4.98	BAY 2
5.00	BAY 3

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS
SAN GABRIEL COASTAL BASIN
SPREADING GROUNDS

DRAWN BY: M. GEIGER
CHECKED BY: P.M.W.
SCALE: A.S.
DATE: 8/86



R.D. NO.	LENGTH OF DAM	SILL ELEV.	MAX. WS. ELEV.	MAX. HT. OF DAM	STOR.	AREA	CORNERS (NO.)
1	99	165.0	173.0	172.0	150.0	194	3
2	99	165.0	173.0	172.0	150.0	194	3
3	223.0	148.73	156.73	155.73	272.5	46.5	4
4	225.33	141.48	148.48	147.48	72.8	13.0	5
5	226.17	127.84	134.84	133.84	156.4	39.4	6
6	227.0	114.45	121.45	120.45	139.1	30.2	7
7	304.0	102.4	109.4	108.4	122.2	29.3	NO D.S.
TOTALS					913.0	308.4	



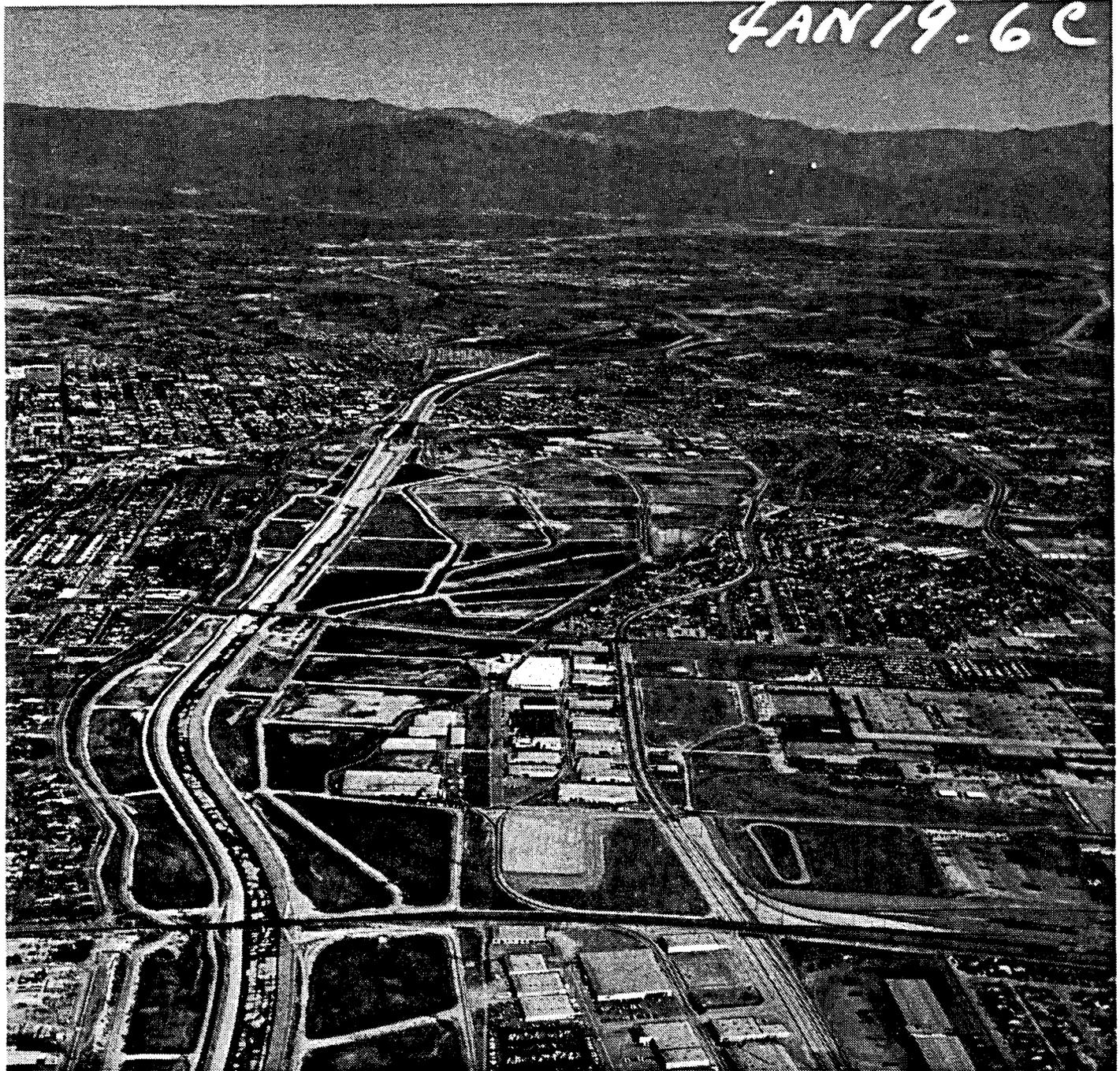
LEGEND

- STREET DRAINS
- ⊞ GAGE BOARDS
- 69" RECLAMATION PIPELINE

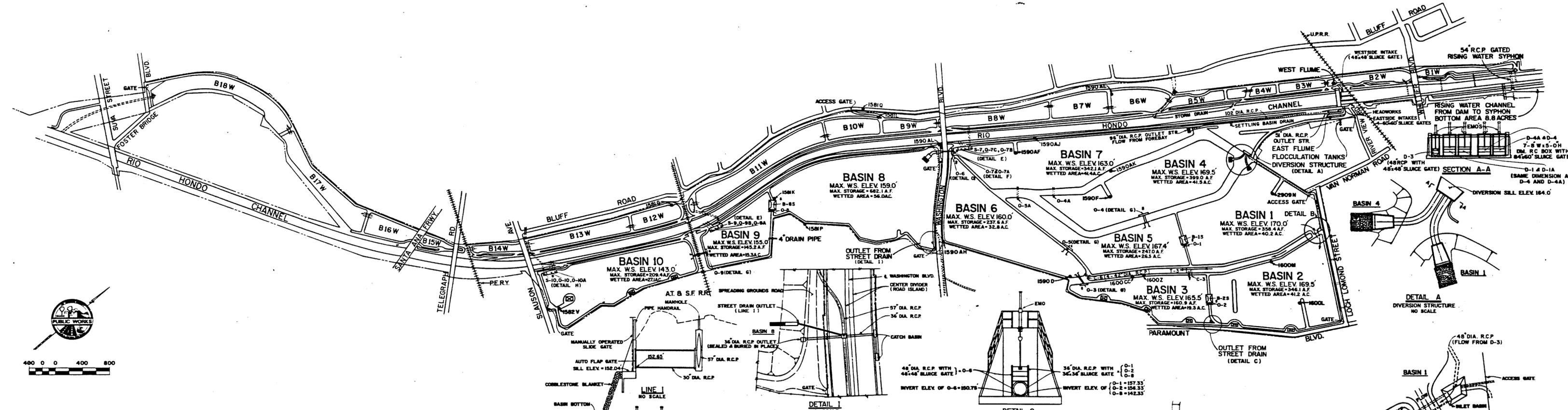
NOTES: DAM #1 IS AN IMBERTSON
DAMS #2 THRU #7 ARE BRIDGESTONES

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS
SAN GABRIEL RIVER
RUBBER DAMS
DRAWN BY MG CHECKED: PMW SCALE: N.S.

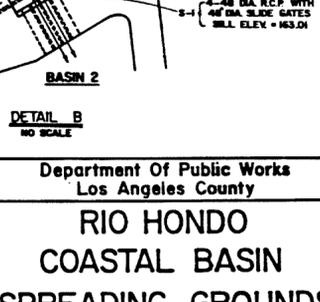
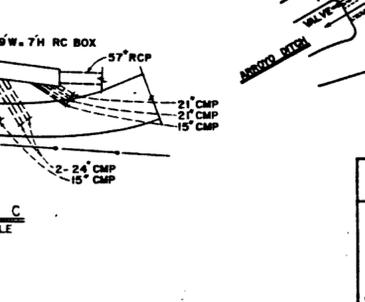
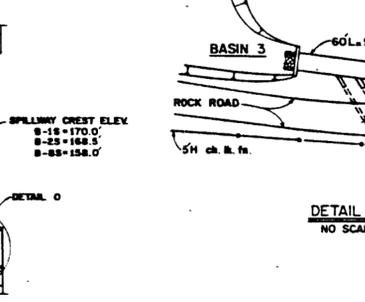
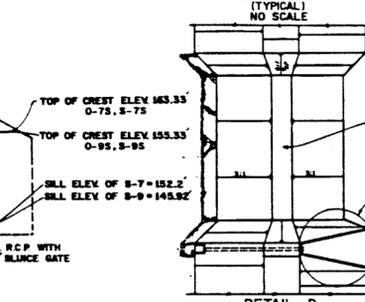
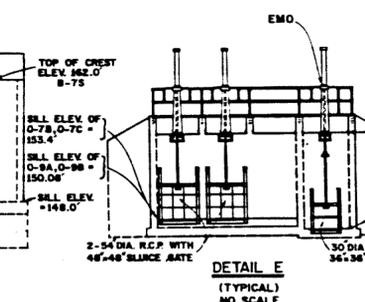
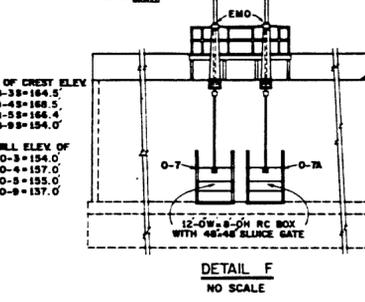
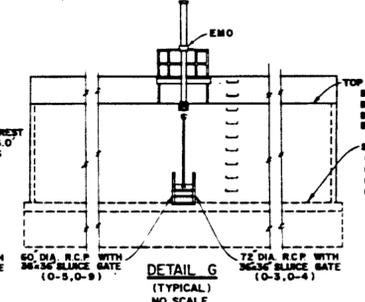
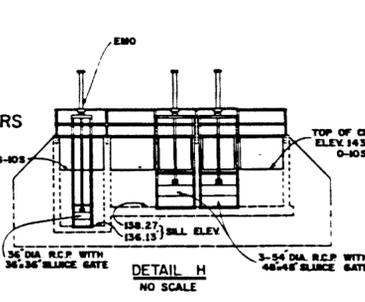
4AN19.6C



Rio Hondo Spreading Grounds
Looking Upstream



- LEGEND**
- DISTRICT RIGHT OF WAY
 - SPREADING GROUNDS ROADS
 - WELLS
 - ⊕ FLOW RECORDER
 - ⊠ SOUTHERN CALIFORNIA EDISON TOWERS
 - ⊡ BASIN SPILLWAY STRUCTURE
 - C CANAL STRUCTURE
 - D KEY DIVERSION STRUCTURE
 - O OUTLET STRUCTURE
 - S SYPHON STRUCTURE
 - T TURNOUT STRUCTURE
 - EMO ELECTRIC MOTOR OPERATOR
 - ‡ GAGE BOARD STAFF



Department Of Public Works
Los Angeles County

RIO HONDO COASTAL BASIN SPREADING GROUNDS

DRAWN BY SOO T. KHOO	CHECKED BY PETE M. WOOD	SCALE AS SHOWN	DATE 12/88
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