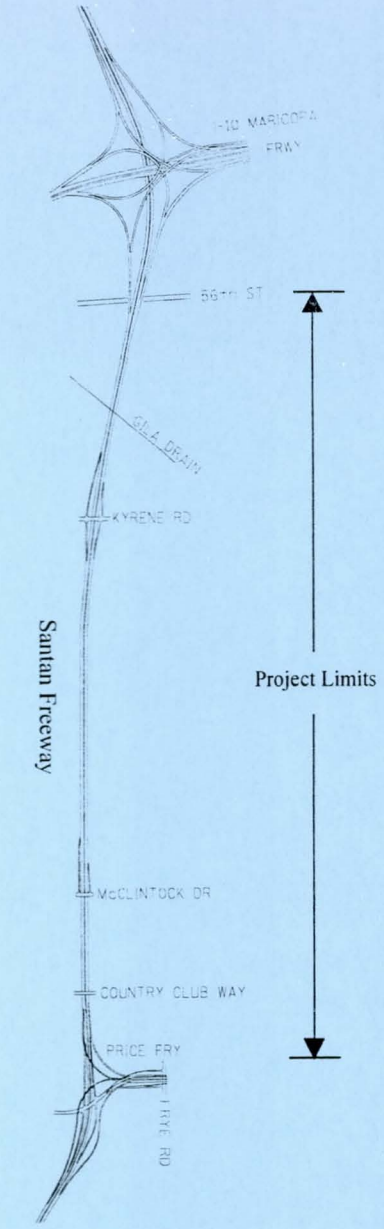
~~FINAL~~
DRAFT

DRAINAGE REPORT

SOUTHEAST VALLEY REGIONAL DRAINAGE SYSTEM
Phase 3
Santan Collector Channel

ADOT Contract 95-53
RAM 600-7-503
TRACS NO. H4314 03C
Contract No. FCD 99-05
PCN 4900133



Prepared for:
Arizona Department of Transportation
And
Flood Control District of Maricopa County

Prepared by:

DMJM
Daniel, Mann, Johnson, & Mendenhall

2777 East Camelback Rd., Suite 200
Phoenix, AZ 85016

August 1999

Registered Professional Engineer (Civil)
CERTIFICATE NO. 24999
JEFFREY R. MINCH
DATE SIGNED 8-11-99
ARIZONA, U.S.A.

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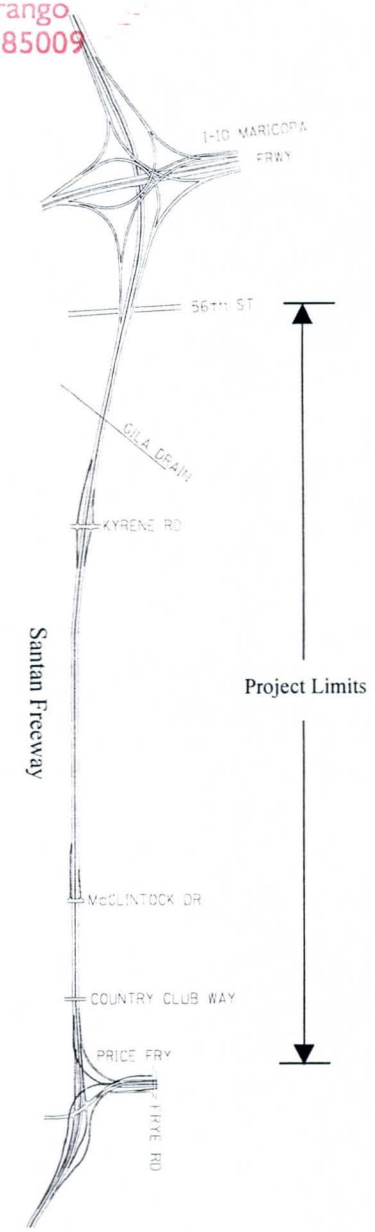

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I. INTRODUCTION

A. Introduction and Purpose

The Santan Collector Channel project is jointly funded by the Arizona Department of Transportation (ADOT) and the Flood Control District of Maricopa County (FCDMC). The project is commonly referred to as the Southeast Valley Regional Drainage System (SEVRDS). The Santan Collector Channel parallels and protects the Santan Freeway east of Interstate 10 (I-10). The project also provides a drainage system outlet for the Price Freeway at the Santan Freeway alignment.

The project is being designed and constructed in three phases. The first phase of construction mass graded the Santan Channel detention basin complex, commonly referred to as Basin B. The detention basin complex includes a large detention basin, an equalization basin and two water quality basins. The second phase, currently under construction, consists of the Outfall Channel from Basin B to the Gila Floodway along the west side of I-10, and some piping facilities for the water quality basins.

Phase three (3) will be designed and constructed in two stages, The first stage of Phase 3 includes the design and construction of the east and west collector channels along the north side of the future Santan Freeway east of 56th Street. Phase 3 also includes the connection of the collector channels to the Basin B complex and the Outfall Channel (Phase 2). The second stage of Phase 3 is the construction of the west collector channel along the north side of the I-10/SR202L System Traffic Interchange (TI) from approximately 54th Street to east of 56th Street. The delay in design and construction of the second stage of Phase 3 is related to the schedule of the I-10/SR202L system TI construction.

The Kyrene South Stormwater Pump Station is also an integral part of the SEVRDS system. The pump station will be constructed concurrently with Phase 3. The pump station's primary role is to evacuate the Santan Freeway sump at Kyrene Road. The station will also dewater Basin B and circulate stormwater in the Basin B complex for the treatment of the "first flush" from the contributing watershed.

In support of the Final (95%) Design Submittal for Phase 3, this report summarizes the hydrologic and hydraulic analyses performed for the on-site and off-site drainage systems.

The Phase 3 design was prepared in accordance with previously approved and current ADOT, FHWA, and FCDMC design criteria. The drainage design also

conforms to the requirements of the Final Environmental Assessment Update for the Santan Freeway, from 56th Street to the Price Freeway. The entire system is designed to be compatible with future ADOT, FCDMC, and City of Chandler (COC) local drainage improvements. When constructed, the SEVRDS drainage system will provide a drainage outlet for the Price and Santan Freeways and flood control benefits for East Valley communities and unincorporated areas.

B. Project Location

The Santan Channel Project, Phase 3 is located in Maricopa County, Arizona, within Sections 33, 34, 35 and 36 of Township 1 South, Range 4 East of the Gila and Salt River Baseline & Meridian. A project vicinity map is provided as Figure 1. A project location map is provided as Figure 2.

C. Description of Improvements

1. Existing Conditions

Phase 3 of the Santan Collector Channel is bounded on the west by approximately 56th Street; on the south by the future Santan Freeway and Gila River Indian Community (GRIC); and on the east by the future Price Freeway/Santan Freeway System TI.

The City of Chandler owns the property immediately north of the project between 56th Street and the Salt River Project (SRP) Gila Drain. This site is planned to be a future wastewater reclamation facility. The Chandler School District owns the property between the Gila Drain and Kyrene Road. Plans for this property include a school, library, pool and other city facilities. Residential properties border the north side of the right-of-way between Kyrene Road and McClintock Drive. Stellar Airpark is located along the north right-of-way from McClintock Drive west to approximately the eighth section line. East of McClintock Drive to Country Club Way, the Hearthstone subdivision bounds the north right-of-way. The north right-of-way, between Country Club Way and the Price Freeway, is active agricultural property, planned for a future regional shopping center.

The contributing watershed is largely developed with interspersed agricultural land uses. No major storm drains exist adjacent to the proposed project.

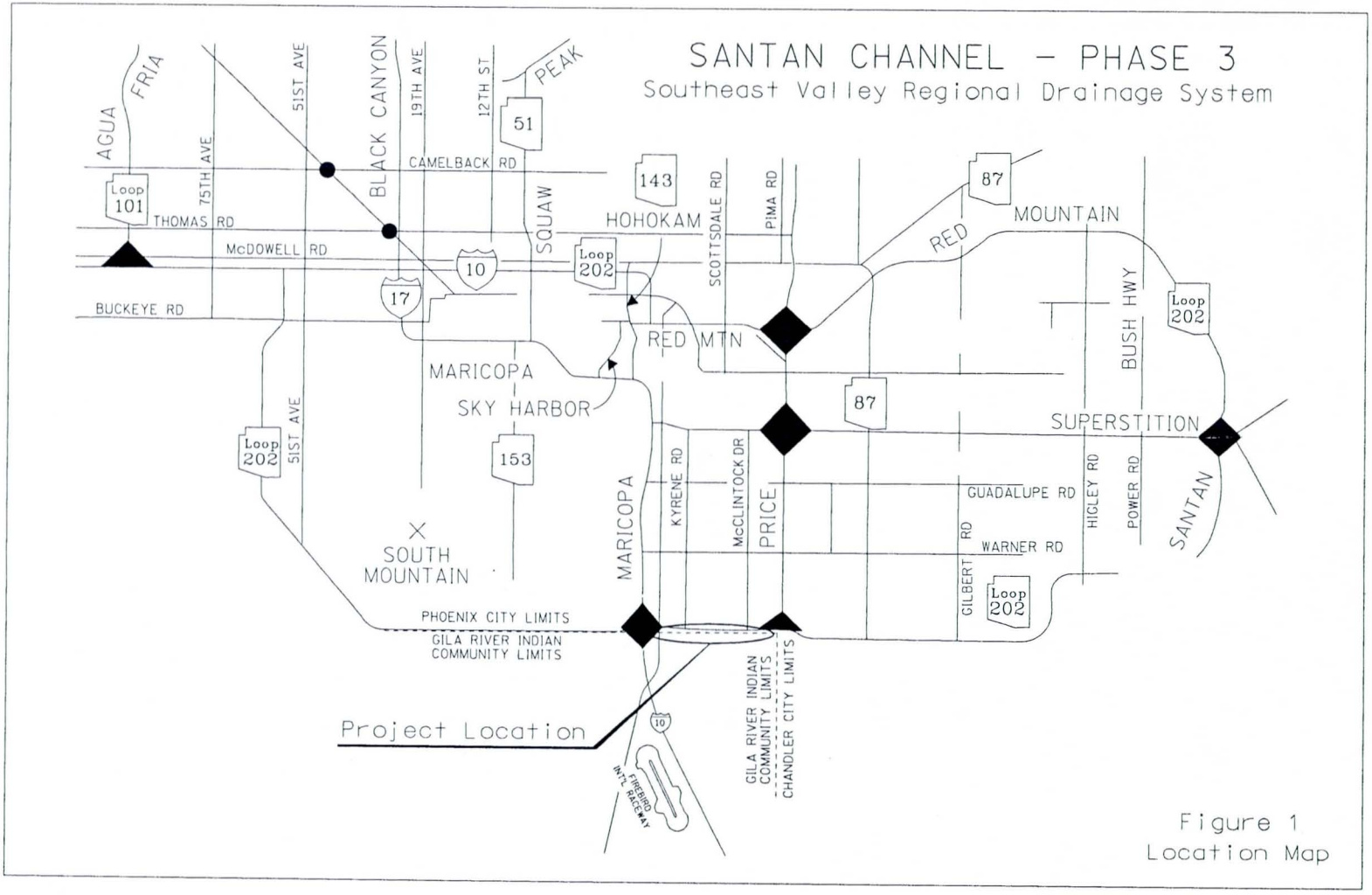

Figure 1
Location Map

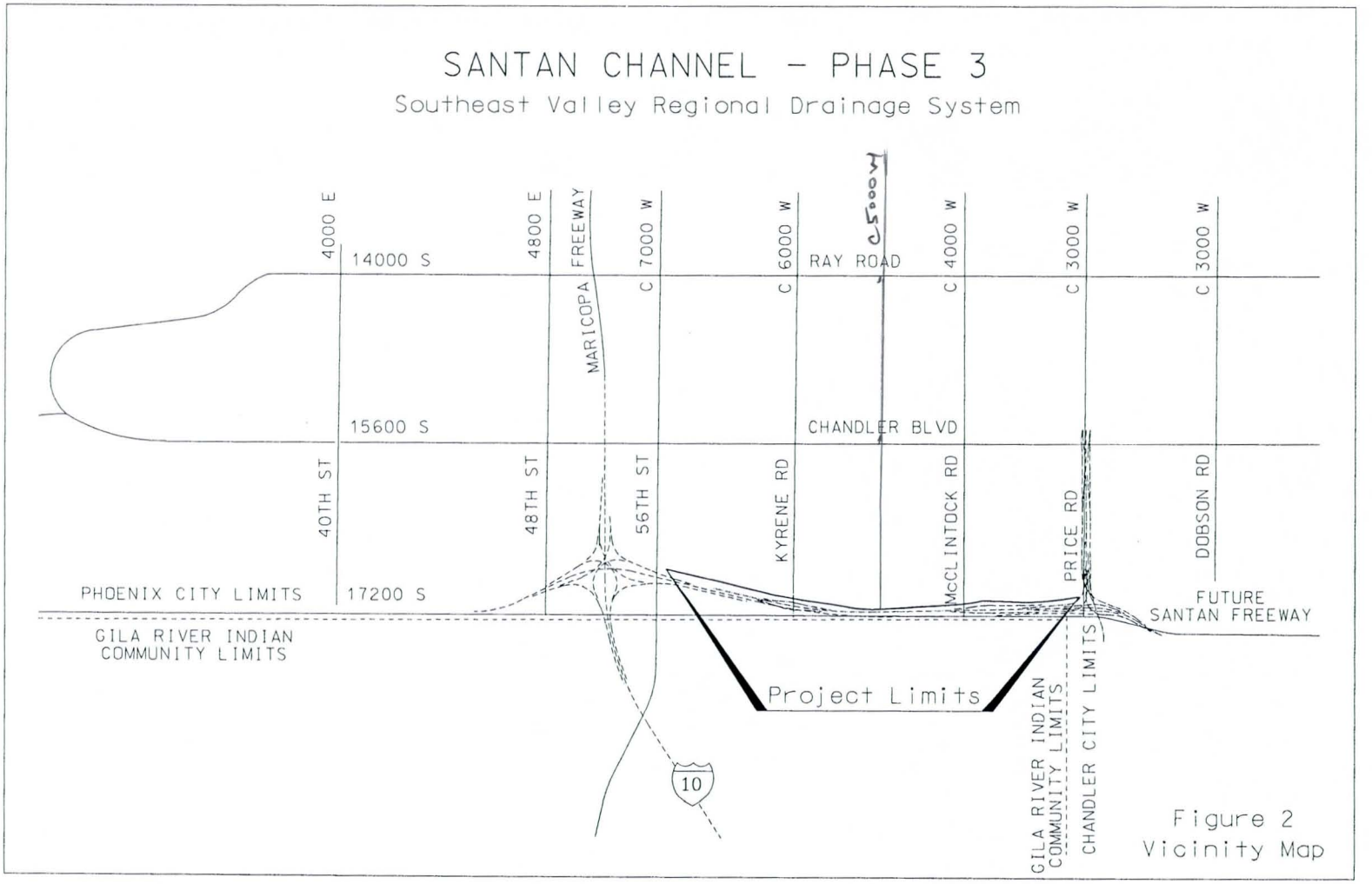

Figure 2
Vicinity Map

2. Principal Project Features

Two collector channels comprise the conveyance system for Phase 3 of the Santan Collector Channel. The west collector channel begins east of 56th Street and flows east to the box culvert siphon under the Gila Drain. The west collector channel ends at the inlet to the box culvert crossing under the future Santan Freeway.

The east collector channel begins at the Price Freeway and serves as the outfall for the piped outlet from Basin G on the Price Freeway. The east end of the channel will also serve as the outlet for the siphon under the future Price/Santan System TI. Stormwater will be conveyed west through a concrete lined channel to a 2600-foot long box culvert under the future westbound connector road between Country Club Way and McClintock Drive. The box culvert will discharge to a rectangular channel which will intercept off-site flow and provide a discharge facility for a future stormwater pump station sited at the northeast corner of McClintock Drive and the Santan Freeway. The rectangular channel flows into a box culvert under McClintock Drive. The remainder of the east channel upstream of the Santan Freeway box culvert crossing is open channel with the exception of the box culvert under Kyrene Road.

Stormwater is conveyed under the Santan Freeway through a multi-cell box culvert to the forebay channel and Basin B complex. Initial flows are directed to the equalization basin for treatment. Larger flows are conveyed into Basin B and/or the Outfall Channel depending on the magnitude of the stormwater flows. Phase 3 will construct the Santan Freeway culvert, forebay channel, overflow weir to Basin B, Outfall Channel siphon, and a portion of the Outfall Channel to connect to the Phase 2 project. A portion of the Kyrene South Stormwater Pump Station discharge line will be constructed with this project to avoid conflicts between contractors and minimize the cost of construction at the Gila Drain.

Numerous utilities will be relocated with the Phase 3 project including parallel water and sewer lines. A 12-Mgd sanitary sewer lift station will also be constructed at the northeast corner of Kyrene Road and the Santan Freeway.

3. Future Roadway Improvements

The I-10/SR202L System TI is currently under final design. Design of the Santan Freeway and Price/Santan System TI will also begin in August 1999. These freeway design projects will include east and westbound connector roads between McClintock Drive and Country Club Way.

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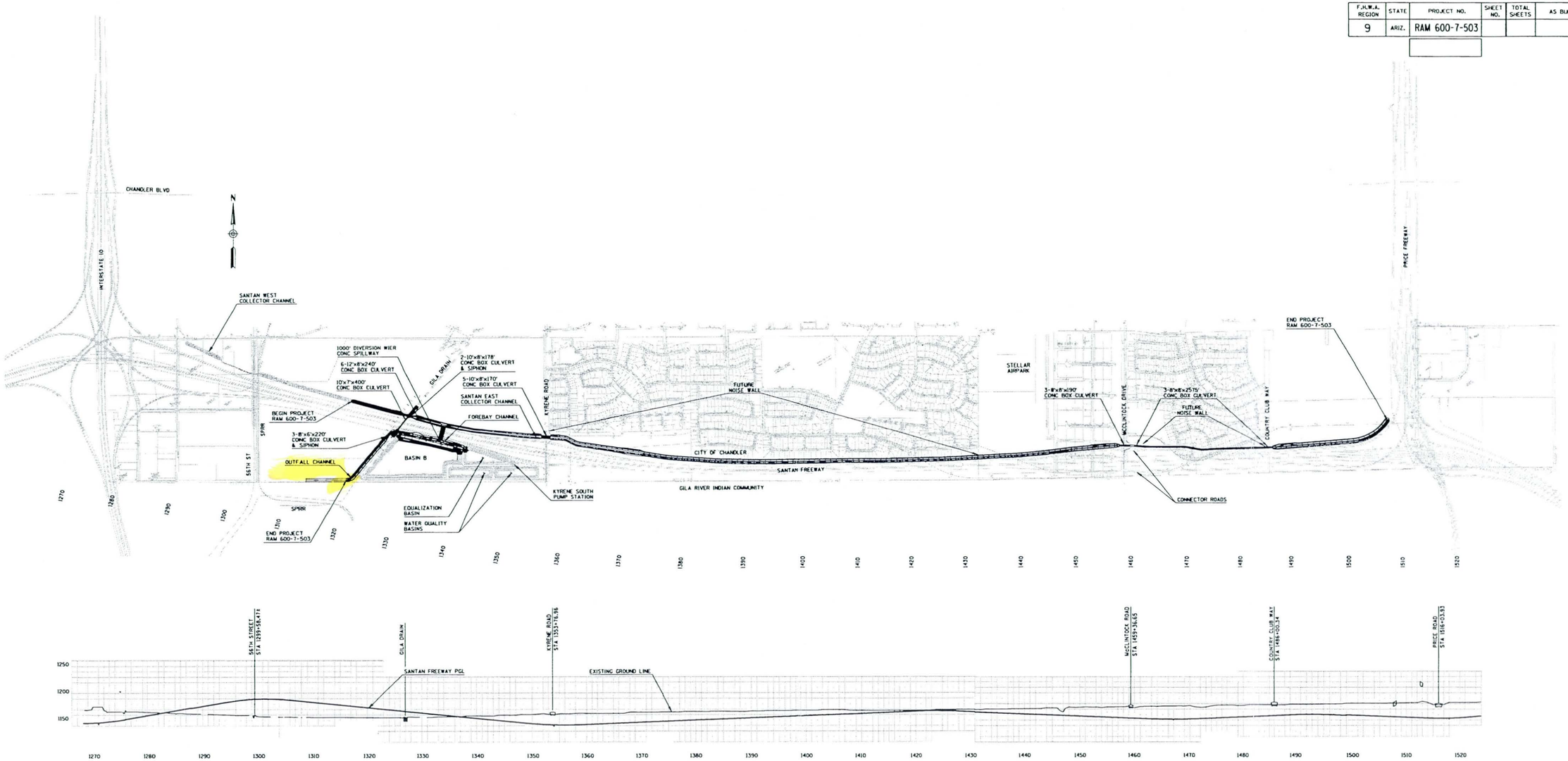

SANTAN FREEWAY PROFILE

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRM	8/99

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FIGURE 3

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ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

TRACS NO. H4314 03D | 600-7-503 | ___ OF ___

SURVEY	TINSHEET PLANS	REVISIONS	LOCATION	DATE

CONSTRUCTION DISPLAY ON

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D. Drainage Plans

The Pre-Final (95% Submittal) drainage plans for the Phase 3 of the Santan Collector Channel are provided in Appendix A. A complete set of Pre-Final construction drawings and specifications are provided under separate cover which include: removal plans, utility relocations, sanitary sewer lift station, structural details, traffic detours, paving plans, and soil borings.

II. COORDINATION

Several agencies are participants in the Santan Channel (SEVRDS) project. Key stakeholders include ADOT, FCDMC, the Gila River Indian Community (GRIC), City of Chandler (COC), City of Phoenix (COP) and SRP. The Santan Channel project will discharge stormwater to the Gila Floodway, which requires a stormwater discharge permit from the GRIC. The permitting process is currently being led by ADOT with technical assistance from DMJM. On-going issues, which could impact the design features of the project, are listed below:

1. Water quality of the stormwater runoff is of primary concern to the GRIC. DMJM developed a drainage design concept that addresses both water quality and quantity issues, as defined in the Design memorandum for the SEVRDS Water Management (1996). ADOT continues to advance this plan with the GRIC to obtain the stormwater discharge permit. The text of the agreement is included in Appendix B.

2. The water quality permit requires the treatment of the "first flush" stormwater originating from watershed. The equalization basin and associated facilities are designed to collect and retain the "first flush" stormwater. The water quality basins will treat the "first flush" prior to discharge to the Outfall Channel. Details of the water quality treatment system are provided with the design of the Kyrene South Stormwater Pump Station.

3. The COP and the FCDMC have advanced the design and construction of the 48th Street Detention Basin originally called Basin 15, on the west side of I-10. Design of the 48th Street Detention Basin is at the 90% submittal stage at the time of this report. Coordination is required with the 48th Street Detention Basin design since the discharge from Basin B will limit the discharge from the 48th Street Detention Basin to the Santan Outfall Channel.

4. The Gila Drain is a SRP irrigation return flow (tailwater) channel that parallels the west side of the Basin B complex and ultimately discharges to the Gila River. The Gila Drain is covered in an early 1900's agreement between the GRIC and SRP. Recent conversations with SRP indicate a revised water rights agreement is near completion between SRP and the GRIC at the federal congressional level. Once the water rights agreement is completed between the GRIC and SRP, the GRIC will likely approach ADOT to allow a diversion of the Gila Drain to the Santan Outfall Channel.

III. OFF-SITE HYDROLOGY

A. Previous Studies

The Santan Freeway off-site hydrologic analysis was originally developed by HDR Engineering, Inc. as part of the Management Consultant contract with ADOT for the Price Freeway and the Santan Freeway from Dobson Road to I-10. References for the original hydrologic analyses are provided at the end of this report. The HEC-1 model for the contributing watershed was originally developed in 1989 and modified in 1992. It is the current hydrologic model of record for the drainage design of the Santan Freeway and Channel project. A history of the application of this model is provided below:

1. The original HEC-1 model was developed in 1989 for the Price Freeway from the Western Canal to the Price/Santan System TI and the Santan Freeway from Dobson Road to I-10.

2. In 1989 a study was performed to review the possibility of using the Gila Drain as an outlet for the Price/Santan freeway drainage system. Based on this plan, ADOT entered into an agreement with the GRIC in 1991 to discharge the Price and Santan freeway stormwater into the Gila Floodway.

3. In the mid-90's, the FCDMC identified the Santan Channel system as the SEVRDS and began to provide technical, administrative, and financial support to the project. An additional report was prepared to explore alternative channel routings to the Gila Floodway. This report resulted in the current alignment of the Phase 2 Santan Outfall Channel, except that the alignment along Pecos Road is north of the GRIC boundary.

4. In 1996, DMJM and Wood/Patel & Associates, Inc. (WPA) advanced the design concept to the 30% design stage. Modifications to the concept included the development of an equalization basin to allow treatment of "first flush" stormwater from the contributing watershed.

5. In 1995, the 1992 HEC-1 model was used to design some of the Price Freeway components of the SEVRDS/Santan Channel system including Basin G at Galveston Road. The outlet pipe from this basin will discharge to the Santan Channel. The model was also used to design the off-site drainage system for the Price Freeway north of Basin G to the Carriage Lane Outfall at the Western Canal.

For the final design of the Santan Channel Phase 3 project, the HEC-1 model was separated into two HEC-1 models to accurately represent the Basin B

hydrologic and hydraulic routings. The first HEC-1 model is identical to the model outlined above to define the contributing watershed design hydrographs. The hydrographs were then routed through the Basin B complex using a spreadsheet based on rating tables for the hydrologic and hydraulic controls within the basin complex. The second model routes the outflow from the Basin B complex to the Gila Floodway through the Phase 2 Santan Outfall Channel.

B. Watershed Description

The contributing watershed is located in eastern Maricopa County between the Salt and Gila Rivers. The historical drainage pattern is toward the Gila Drain. Surface runoff ultimately concentrates near the I-10/Maricopa Road Traffic Interchange. West of I-10 the Gila Floodway, a natural wash nearly 12 miles long, conveys floodwater westerly to the Gila River.

The SEVRDS/Santan Channel Project drainage area contributing to this portion of the Santan Freeway drainage system is approximately 36 square miles. The area is bounded on the west by I-10, on the east by the Union Pacific Railroad, on the north by the Western Canal and on the south by the Santan Freeway. The 1989 model schematic included with this report shows the general routing details. The 1992 routing schematic provided with this report shows the modifications that directed off-site and on-site flows from Basin G southward and westward to the Gila Drain.

A majority of the watershed is urbanized. However, substantial tracts of agricultural land use are present within the watershed. Due to agricultural land leveling and the development of street networks, the drainage area has lost a majority of its natural drainage corridors. Consequently, stormwater runoff exceeding the retention requirements generally flows southwesterly in the major streets until a barrier is reached such as an irrigation canal or railroad embankment. The original structure of the model incorporates the impact of barriers and other factors in determining routing paths and concentration points as illustrated in the hydrologic model schematics.

C. First Flush Hydrologic Analyses

The volume of "first flush" required to design the water quality basins, or the initial runoff from the watershed carrying non-point-source pollutants was defined during the initial design (30% submittal) of the Phase 3 project. The initial design team could not identify an official regulatory definition of the "first flush" volume. The selected definition of the "first flush" volume was the first one-quarter inch of runoff generated by the effective watershed. The effective watershed is defined as the area that directly contributes to a point of interest (i.e., developments with detention/retention, areas behind canal and railroad embankments, areas behind

depressed freeways, bermed agricultural fields, etc. were eliminated). Once the effective area was identified, the following formula was utilized to determine the first flush volume:

$$V = (0.25/12)*A$$

Where: V = "first flush" volume
A = area in acres of effective watershed

The contributing area from undeveloped land directly contributing to the water quality basin was estimated to be 1.85 square miles, resulting in a first flush volume of approximately 25 acre-feet.

It should be noted that as the contributing watershed continues to develop, the "first flush" volume will decrease due to city retention requirements for new development. A majority of the long-term first flush volume will consist of the flows from the Santan Freeway on-site drainage system and major streets within the Cities of Chandler and Tempe.

Changes to the Initial (30%) Santan Channel design concept resulted in a revised distribution of the "first flush" storage volume provided in the Basin B complex. In order to meet other system design criteria, specifically interceptor channel freeboard, the "first flush" volume provided by the system was redistributed to provide approximately 26 acre-feet including the storage volume available in the equalization basin, forebay channel, Santan Freeway box culvert and collector channel drop inlet.

D. Basin Complex Hydrologic/Hydraulic Analyses

The design concept for the Basin B complex is illustrated in Figure 4. Figure 4 identifies all the elements to be constructed with the Phase 3 project. Phase 1 mass graded the detention basins and Phase 2 constructs the Outfall Channel up to the basin complex and some of the basin piping facilities. Figure 4 is an updated plan from the concept presented during the final design of Phases 1 and 2.

The major change from the concept presented in the other two phases is the elimination of the Gila Drain Siphon under the Santan Freeway and channels. SRP indicated that the design of a siphon for the Gila Drain would cost approximately 1.7 million dollars plus annual maintenance costs. This was unacceptable to ADOT. DMJM developed an alternative concept to siphon the Santan Channel and Outfall Channel under the Gila Drain at a much lower capitol cost. ADOT directed that the design proceed to siphon the channels under the Gila Drain.

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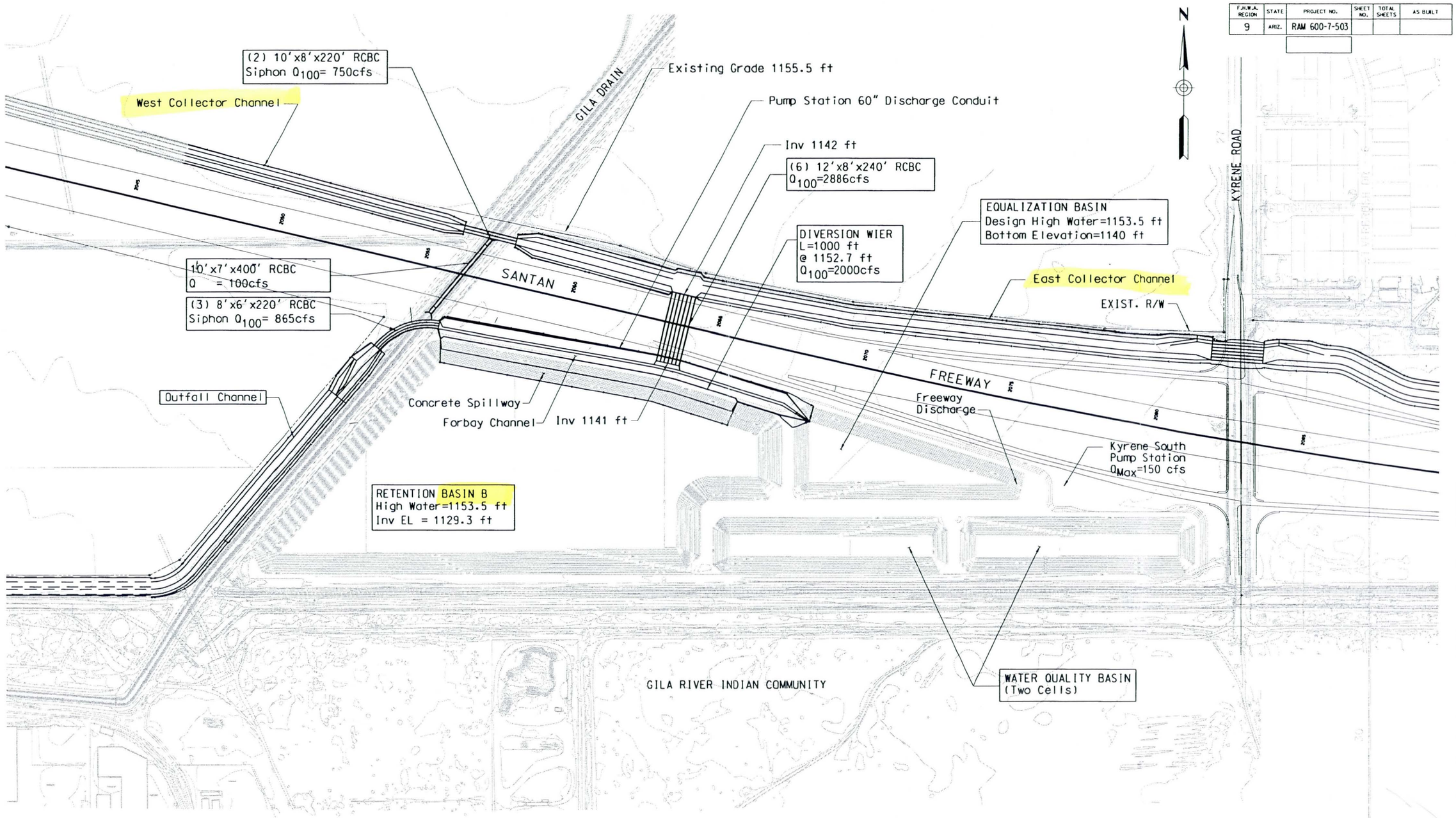

LEGEND
PHASE 3 FACILITIES
PHASES 1 & 2 FACILITIES

	NAME	DATE
DESIGN		8/99
DRAWN	CPG	8/99
CHECKED		8/99

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FIGURE 4

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1. Phase 3 Basin B Facilities

Figure 4 illustrates most of the facilities in the Basin B complex. The primary facilities constructed with Phase 3 include the following:

a) The (6) 12'x8' cell Santan Freeway reinforced concrete box culvert was moved east from the location shown in previous phases to reduce the fill height and resulting construction cost. The size was also modified to a standard ADOT box culvert dimension.

b) The Equalization Basin box culvert was eliminated from the original design concept.

c) The 1000-foot long Basin B inflow diversion weir is designed to clip the peak discharge of the inflow hydrograph.

d) The (3) 8'x6' cell reinforced box culvert siphon outfall was added under the Gila Drain. Hand calculations were performed to define the outflow rating from Basin B. The supporting calculations are provided in Appendix C. Flows in excess of 890 cfs are diverted over the diversion weir into Basin B.

e) The forebay channel will be constructed as part of Phase 3 to distribute flows within the Basin B complex.

f) A portion of the Kyrene Pump Station 60-inch RCP discharge conduit will be constructed with Phase 3. Incorporating a portion of this pipe in Phase 3 will permit coordinated construction for the Santan Freeway box culvert and the Gila Drain.

g) The 10'x7' Gila Drain box culvert under the future Santan Freeway will be constructed with Phase 3 due to the complexities of temporarily rerouting the Gila Drain in the future.

2. Basin B Flow Routing

Flows from the Santan Collector Channels are directed to the equalization basin until the capacity of approximately 26 acre-feet is reached, at which time additional flows are directed to bypass the basin complex to the outfall channel. Additional flows will continue to bypass the basin until the overflow weir level is reached, where the flow will split between the Outfall Channel and the Basin B diversion weir. Once the Basin B complex is filled, flows will bypass the complex to the Outfall Channel.

The runoff volume contained in the equalization basin can be retained as long as required to settle solids from the "first flush" flows. These flows are then circulated through the water quality cells to remove pollutants prior to discharge to the Outfall Channel. Flows from the treatment cells are then discharged to Basin B through gated 24-inch discharge pipes. The gates are primarily used to control the water levels in the treatment cells.

Treated flows will be discharged to the Kyrene South Pump Station through a 54-inch Basin B evacuation pipe. Two low-flow submersible pumps in the pump station will evacuate the treated flows to the Outfall Channel. Treated flows that are captured in Basin B can also be recycled to the equalization basin for further treatment if necessary.

The Kyrene South Pump Station will evacuate excess stormwater detained in Basin B. The pump station is sized to evacuate Basin B in approximately 36 hours. The 60-inch pipe will be gated at the outlet.

Supporting calculations for the routing of the inflow hydrograph to the Basin B complex are provided in Appendix C.

E. Results

HEC-1 computer model output for the final design is provided in Appendix C. Key off-site peak discharges along the collector channels and outfall channel are summarized in Tables 1 and 2. Computer disks containing input and output files for the hydrologic analyses are provided in the back pocket of selected copies of this report.

Appendix C also includes a detailed hydrologic analysis for the off-site contributing area to the Hearthstone box culvert between McClintock Drive and Country Club Way. This analysis was used to size the inlet pipe connections to the box culvert from the Hearthstone subdivision. The final inlet design for these pipes will be coordinated with the freeway design and the location and foundation for the future sound walls.

Table 1. 100-Year Peak Discharges for the Santan Freeway and Santan Collector Channel Project

Location	Concentration Point	Q_{100} (cfs)
Price/Santan TI	Cinter	938
McClintock Drive	CMCIN	1332
Rural Road Alignment	COMB1	1338
Kyrene Road	COMBB	2221
56th Street	OUTLC	719
Downstream of Gila Drain	WCHAN	750
Basin B Inflow	INBB	2886

Table 2. 100-Year Outfall Channel Peak Discharges for the Santan Freeway and I-10/SR202L System T.I.

Location	Concentration Point	Q_{100} (cfs)
Basin B Outflow	BASINB	865
56th Street at Pecos Road	CGILAE	970
West of I-10 at Pecos Road	CGILAW	1150
I-10 at the Gila Floodway	RI10W	1105

IV. ON-SITE DRAINAGE

A. General Discussion

The on-site drainage for the segment of the SR202L Freeway (Santan) adjacent to SEVRDS consists of two major drainage systems as shown in Appendix D of this report.

- An on-site drainage system for the depressed section of the Santan Freeway from Station 2065+50 to Station 2153+21 is designed for the run-off generated by the 50-year storm for the ultimate project including a pump station for the sag condition at Kyrene Road. The pump station at Basin B is designed to dewater the freeway and Basin B.

- An on-site drainage system for the depressed section of the Santan Freeway from Station 2153+21 to the crest in the freeway profile east of McClintock Drive. It is designed for the run-off generated by the 50-year storm for the ultimate project including a pump station for the sag condition at McClintock Drive. This pump station will discharge into the Santan Collector Channel.

B. Design Criteria

The on-site hydrology will be analyzed in English units. The procedures found in the ADOT Highway Drainage Design Manual, Hydrology, (HDDM) December 1994 will be used. The Rational Method is used to develop the 50-year peak runoff for the depressed portion and the 10-year peak runoff for the elevated portion based on a site-specific Intensity-Duration Frequency (I-D-F) Graph. The Rational Equation is:

$$Q = C\,i\,A$$

Where Q = the peak discharge in cfs.

C = runoff coefficient

i = the average rainfall intensity, in inches/hour (in/hr) for the selected rainfall return period

A = the contributing drainage area in acres

The freeway will be designed using retaining walls and maximum allowable side slopes to reduce right of way requirements. Side slopes will be plated with

decomposed granite and for the interim conditions, medians left unpaved. However, in anticipation of future additional lanes, roadway drainage analysis assumes that the medians are paved and slope in the same direction as the adjoining traveled way.

The following values of "C" are used with a 10-year 1-hour rainfall depth of 1.57 inches and with a 50-year 1-hour rainfall depth of 2.24 inches:

- Paved Surfaces - 0.95
- Highway slopes - 0.70

The rainfall intensity is estimated based upon the time of concentration at the point being analyzed. A site-specific I-D-F Graph, developed from the procedures in the HDDM, is used to estimate the average rainfall intensity. The initial time of concentration is calculated from Equation 2-2 of the HDDM as follows:

$$T_c = 11.4\ L^{0.5}\ K_b^{0.52}\ S^{-0.31}\ I^{-0.38}$$

Where T_c = time of concentration in hours

L = the length of the longest flow path in miles

K_b = the watershed resistance coefficient from Table 2-1, HDDM

S = the slope of the longest flow path in ft/mile

I = the average rainfall intensity in in/hr, the same i as Equation 2-1, HDDM

The minimum T_c, and therefore the minimum rainfall duration, is ten (10) minutes.

Drainage areas, which include shoulders, median and side slopes, are determined by a thorough examination of the roadway plan and profile.

The following drainage design criteria will be applied to the on-site hydrology design and are found in Chapter 600, HIGHWAY DRAINAGE DESIGN (ENGLISH UNIT EQUIVALENCIES) of the ADOT Roadway Design Guidelines (RDG), May 1996:

- Storm Drain Design Storm Frequency is 50 years for the depressed roadway.

- For the 50 year storm, the allowable spread (ponding width) shall not exceed the width of the roadway gutter, shoulder, parking lane and/or distress lane plus the adjacent lane (for roadways with more than one lane) or 22 feet.

- Desirable "self cleaning" velocity is 3 feet per sec (fps) flowing full. The absolute minimum velocity flowing full is 2 fps.

The following pipe design criteria will be used on this project and is found in the ADOT Pipe Selection Guidelines and Procedures dated February 1, 1996 with March 21, 1996 Revisions.

- Pipe roughness values of 0.012 shall be used for all pipes except for non-reinforced cast-in-place concrete pipe (NRCIPCP) which has a pipe roughness value of 0.014.

C. Main Storm Drain

HYDRAIN (Version 6.0) was used to confirm the location and size of the on-site drainage facilities that will impact the SEVRDS system when the Santan Freeway is constructed. The new horizontal and vertical geometrics developed for the Stage II (30% design) at Kyrene Road for the East Half of the I-10/SR202L Traffic Interchange was used to confirm the size, location and elevation of the pipe connecting to the Kyrene Road/Basin B pump station. The existing General Plan horizontal and vertical geometry at McClintock Drive was used to locate and size the pipe connecting the main storm drain to the pump station located east of McClintock Drive on the north side of the east collector channel. Supporting calculations are found in Appendix D.

The following procedures and assumptions were used in the analysis:

- Drainage area lengths (see Appendix D) were limited to the desirable distance between manholes.

  Pipes under 33 inches in diameter - 330 feet
  Pipes 36 and 39 inches in diameter - 440 feet
  Pipes from 42 to 69 inches in diameter - 660 feet
  Pipes 72 inches in diameter and larger - 1200 feet

- Drainage area limits were based on the proposed locations of retaining walls and proposed profiles of the entrance and exit ramps.

- All areas were calculated in acres.

- The proposed mainline profile grade at each manhole station was calculated.
- The analysis assumes no by-pass from one drainage area to another.
- The pavement drainage areas include potential future lanes.

V. CHANNEL HYDRAULIC ANALYSES

A. General Discussion

The purpose of the Santan Collector Channel drainage system is to protect the depressed Santan Freeway from stormwater runoff generated by the contributing watersheds and provide an outfall for the Price Freeway Basin G. The contributing stormwater will be intercepted and conveyed along the north side of the freeway and discharged to the Basin B complex. Figure 3 schematically illustrates the major features of the off-site drainage system to protect the Santan Freeway.

B. Design Criteria

The design criterion summarized below was applied to the off-site channel design. Most of the criteria outlined below is found in the ADOT "Roadway Design Guidelines" (RDG), May 1996.

Cross-Section:

Side Slopes (maximum):

Concrete lined channels - 2:1 (H:V).

Bottom Width:

Concrete lined channels - 8' minimum.

Cross-Slope:

2% cross-slope to one side with a 1' maximum drop across the total channel bottom width. The channel profile grade line is defined as the low edge of the channel bottom.

Profile:

Smooth paved channels (Concrete lined) - preferred minimum grade of 0.10%.

Alignment:

Horizontal and vertical channel control is independent of the Santan Freeway alignment and generally parallels the north side of the right-of-way.

Transitions:

Vertical wall transitions are designed for transitions into and out of box culverts between trapezoidal channel sections per Section 608.3 of the RDG.

Hydraulic Analysis:

Flow Regime:

All channels are designed to convey flows in the sub-critical flow regime with Froude numbers less than 0.86.

Manning's "n" value:

The final hydraulic analysis used Manning's "n" values of 0.016 for concrete lined channels, 0.013 for box culverts. Curved box culvert "n" values were increased to 0.016 per design recommendations by the U.S. Army Corps of Engineers.

Energy Loss Coefficients:

Vertical wall transition at culverts:
Expansion - 0.40
Contraction - 0.20

Standard ADOT box culvert inlet and outlet wing walls
Expansion - 0.50
Contraction - 0.30

Gradual channel section transitions:
Expansion - 0.30
Contraction - 0.10

Flow Depth:

Channel flow depth is limited to preclude saturation of the roadway pavement structural section for the 100-year frequency design storm for depressed freeway sections.

Freeboard:

Water surface elevation below natural ground: Minimum 1'

The channel lining heights were varied in half-foot increments to facilitate construction of trapezoidal sections constructed by channel pavers.

Maintenance Access:

One continuous 12' wide maintenance access road is included for the north side of the collector channels.

Ten-foot wide maintenance access ramps are provided upstream and downstream of hydraulic structure transitions on the high side of the channel invert. Two double direction ramps are included in the design west of McClintock Drive and east of Country Club Way.

Channel Lining:

The concrete channel lining is six inches thick for the majority of the project length. The concrete channel lining was increased to eight inches at locations subjected higher stresses such as channel segments with steep gradients. Cutoff walls or anchor slaps are included at breaks in the channel profile of more than 0.9 percent. Anchor slap details are included in the plan submittal. DMJM has also reviewed the depth of the cutoff walls at the outlet to the equalization basin.

C. Hydraulic Analyses

Hydraulic models were developed for the channels using the U.S. Army Corps of Engineers HEC-RAS Computer program (Version 2.2). Summary outputs for the models are provided in Appendix E. The Santan Freeway multi-barreled culvert crossing was modeled using the culvert routine in HEC-RAS. The downstream boundary condition was defined as the peak stage in the Basin B complex corresponding to the peak discharge.

The relationship between the HEC-RAS cross-section numbers and the construction centerline stationing and profiles are provided in Appendix E. Computer disks containing input and output files for the hydraulic analyses are provided in the back pocket of selected copies of this report.

Appendix E includes the original HEC-RAS model for the Phase 2 project downstream of the Basin B complex. It should be noted that the outfall channel could convey 1000 cfs without exceeding the height of the lined channel. It is not recommended that the proposed industrial/commercial developments east of I-10, north of the Pecos Road alignment, south of the Santan Freeway, and west of the Gila Drain be directly connected to the Santan Outfall Channel.

Also included in Appendix E are calculations from the preliminary submittal in support of the SRP bypass channels at the Gila Drain, Kyrene Road lateral, and McClintock Drive lateral. Revisions will be made to these calculations to conform to SRP design criteria upon resolution of datum discrepancies.

In support of the final design, riprap and spillway design calculations are provided at the end of Appendix E. Some engineering judgement was used to size the riprap considering the unusual tailwater conditions that will be experienced in Basin B during a major flood event. It is recommended that ADOT maintenance inspect the spillway for structural integrity following every major flood event.

VI. REFERENCES

Arizona Department of Transportation, "Highway Drainage Design Manual, Volume 1 - Hydrology," March 1993.

Arizona Department of Transportation, Roadway Engineering Group "Roadway Design Guidelines," May 1996.

Arizona Department of Transportation, Intermodal Transportation Division, "Pipe Selection Guidelines and Procedures", February 1, 1996, with March 21, 1996 revisions.

Chow, Ven Te, Ph.D., Open Channel Hydraulics, McGraw-Hill Book Company, New York-Toronto-London, 1959.

DMJM, "Santan Drainage Channel, 56th Street – Price Road, Gila Drain Floodway to Basin B," September 1996.

HDR Engineering, Inc., "Hydrology Study, Price Expressway," December 1989.

HDR Engineering, Inc., "Gila Drain Alternative Concept Drainage Report," February 1993.

HDR Engineering, Inc., "Gila Drain Floodway Master Plan Report," February 1993.

HDR Engineering, Inc., "Final Drainage Report, Santan Channel Project, Southeast Valley Regional Drainage System, Phase 1 - Basin Grading, Phase 2 – Outfall Channel and Basin Piping," May 1998.

U. S. Army Corps of Engineers, "HEC-1 Flood Hydrograph Package User's Manual," Hydrologic Engineering Center, September 1990.

U. S. Army Corps of Engineers, HEC-RAS Computer Program, Version 2.2.

U. S. Army Corps of Engineers, "Hydraulic Design of Flood Control Channels," EM 1110-2-1601, July 1991.

U.S. Department of Transportation, Federal Highway Administration, "Hydraulic Design of Highway Culverts," Hydraulic Design Series No. 5, September 1985.

Wood, Patel & Associates, Inc., "Initial Drainage Report, Santan Freeway, 56th Street to Price Road and Gila Drain Floodway to Basin B," September 12, 1996.

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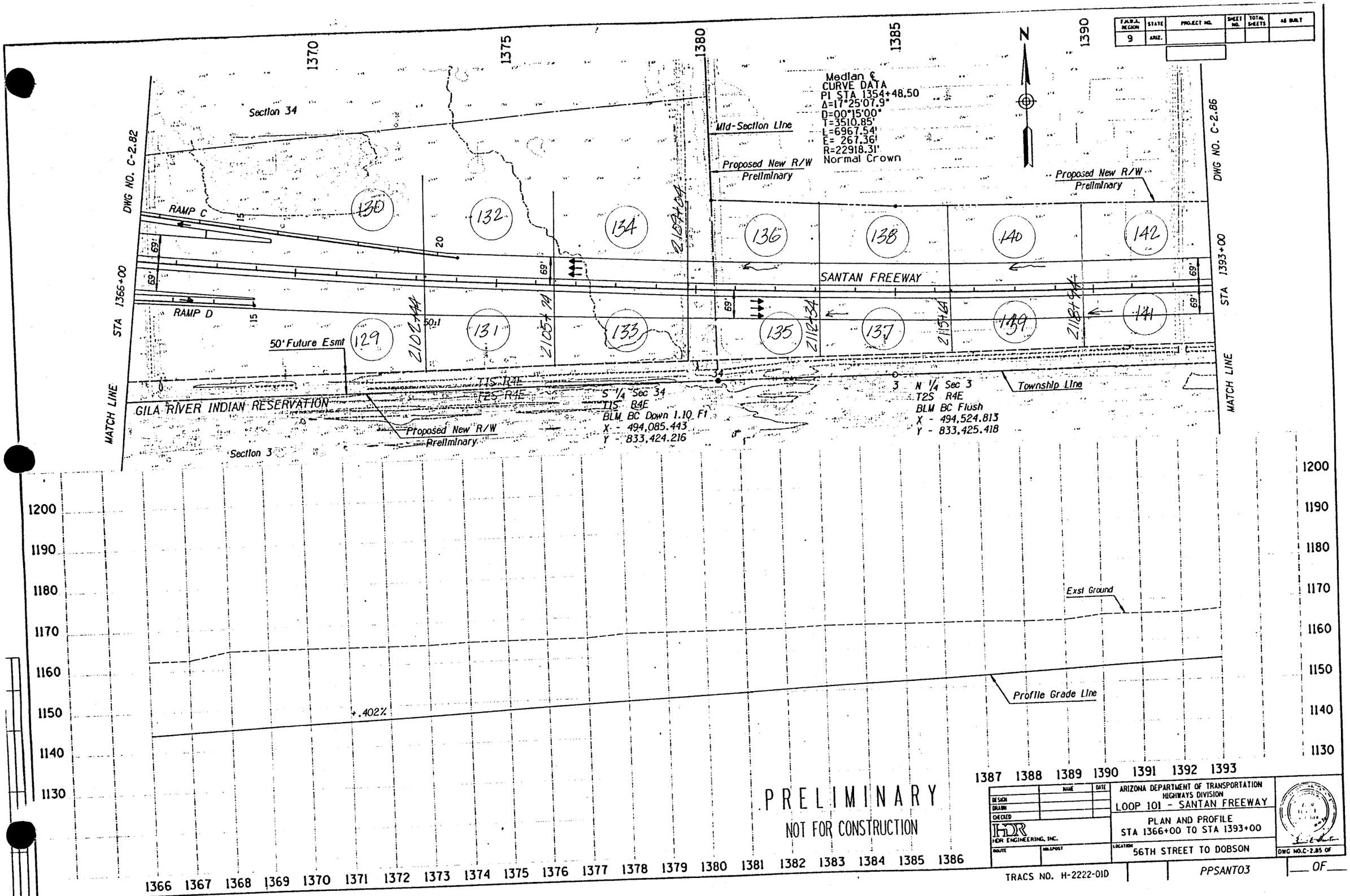

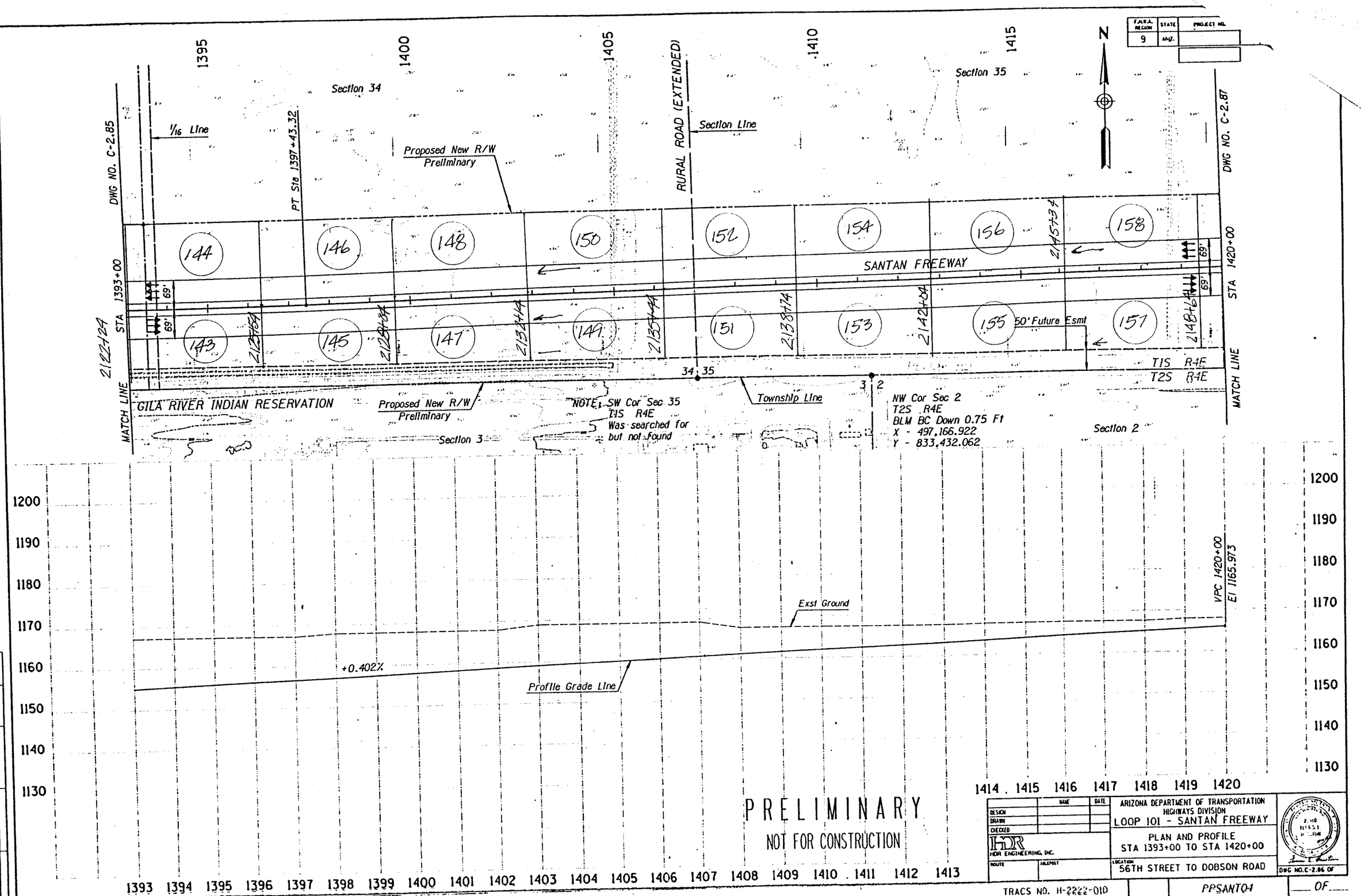
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N
1395
1400
1405
1410
1415
Section 34
Section 35
1/16 Line
PT Sta 1397+43.32
Proposed New R/W
Preliminary
RURAL ROAD (EXTENDED)
Section Line
DWG NO. C-2.85
DWG NO. C-2.87
STA 1393+00
STA 1420+00
MATCH LINE
144
146
148
150
152
154
156
158
143
145
147
149
151
153
155
157
69'
50' Future Esmt
SANTAN FREEWAY
T1S R4E
T2S R4E
34 35
3 2
GILA RIVER INDIAN RESERVATION
Proposed New R/W
Preliminary
NOTE: SW Cor Sec 35
T1S R4E
Was searched for
but not found
Township Line
NW Cor Sec 2
T2S R4E
BLM BC Down 0.75 Ft
X - 497,166.922
Y - 833,432.062
Section 3
Section 2
VPC 1420+00
El 1165.973
Exst Ground
+0.402%
Profile Grade Line
1200
1190
1180
1170
1160
1150
1140
1130
1393 1394 1395 1396 1397 1398 1399 1400 1401 1402 1403 1404 1405 1406 1407 1408 1409 1410 1411 1412 1413
1414 1415 1416 1417 1418 1419 1420
PRELIMINARY
NOT FOR CONSTRUCTION
DESIGN
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NAME
DATE
HDR ENGINEERING, INC.
ROUTE
MILEPOST
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
LOOP 101 - SANTAN FREEWAY
PLAN AND PROFILE
STA 1393+00 TO STA 1420+00
LOCATION
56TH STREET TO DOBSON ROAD
DWG NO. C-2.86 OF
TRACS NO. H-2222-01D
PPSANT01
OF

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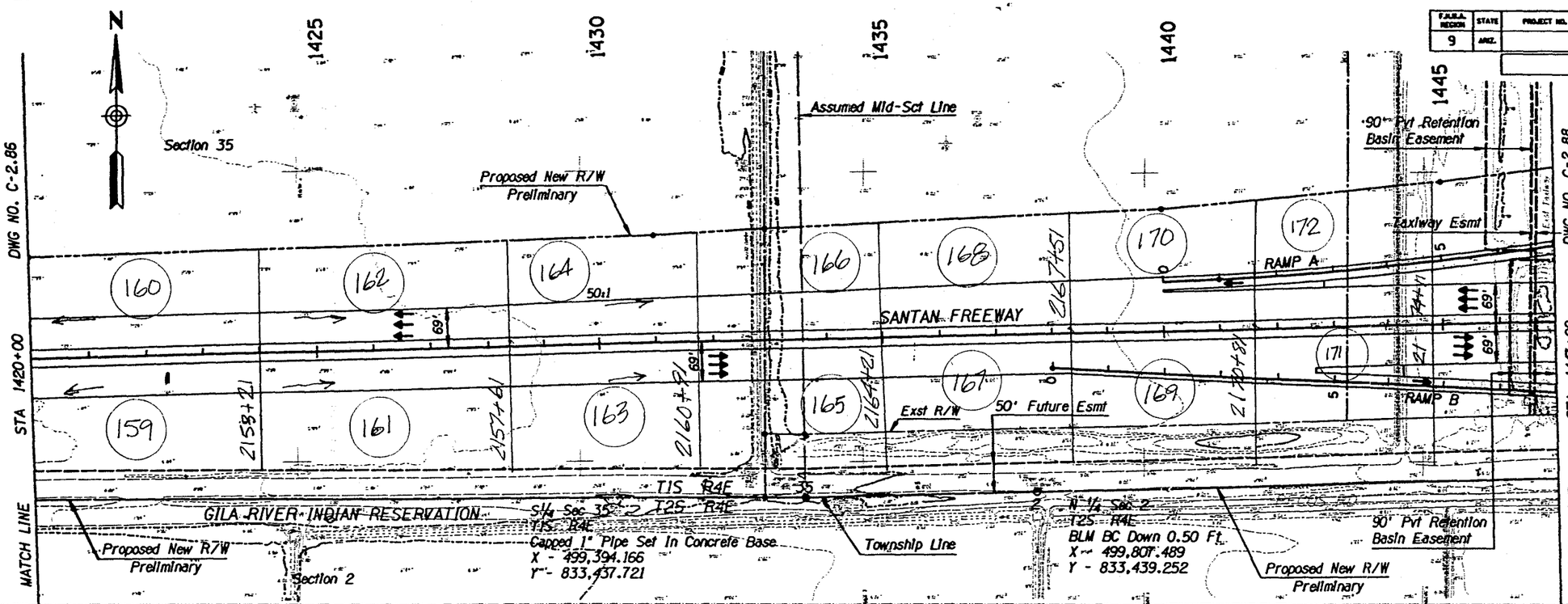

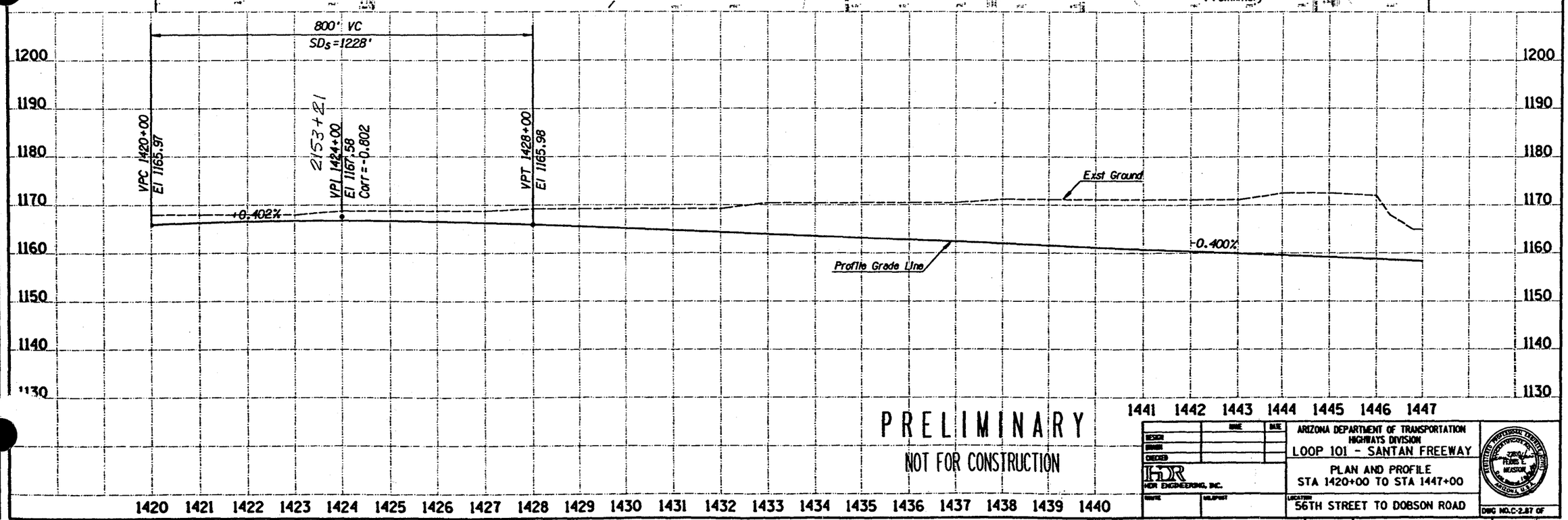

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HDR ENGINEERING, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

LOOP 101 - SANTAN FREEWAY

PLAN AND PROFILE
STA 1420+00 TO STA 1447+00

LOCATION: 56TH STREET TO DOBSON ROAD

DWG NO. C-2.87 OF

TRACS NO. H-2222-01D | PPSANT05 | OF

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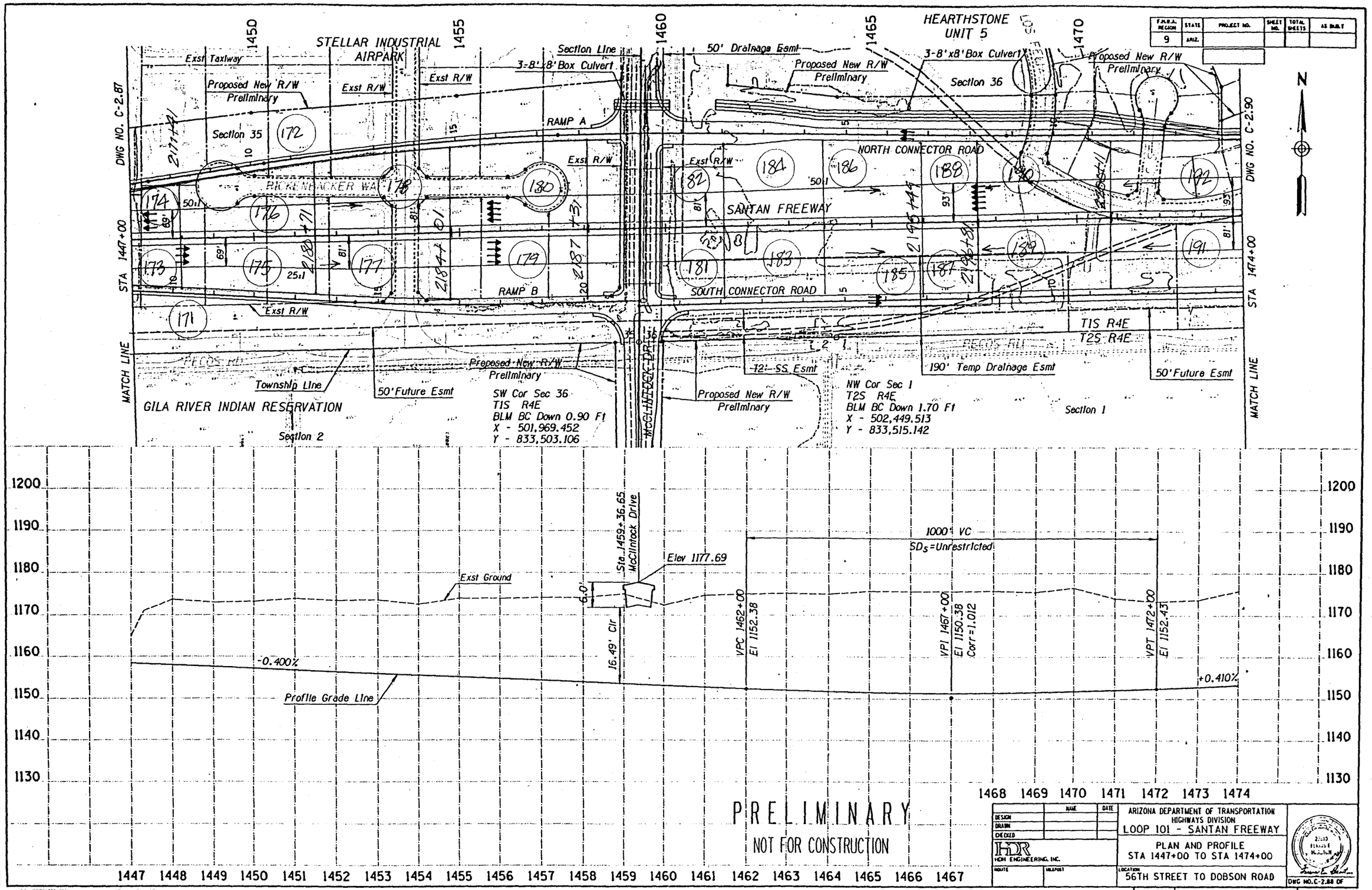

PRELIMINARY
NOT FOR CONSTRUCTION

	NAME	DATE
DESIGN		
DRAWN		
CHECKED		

HDR ENGINEERING, INC.

ROUTE | MILEPOST

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
LOOP 101 - SANTAN FREEWAY

PLAN AND PROFILE
STA 1447+00 TO STA 1474+00

LOCATION: 56TH STREET TO DOBSON ROAD

DWG NO. C-2.88 OF

TRACS NO. H-2222-01D | PPSANT06 | ___ OF ___

*****OGM-SPECIFICATION***** VIEW NAME: PLOT
*****SYSTIME*****

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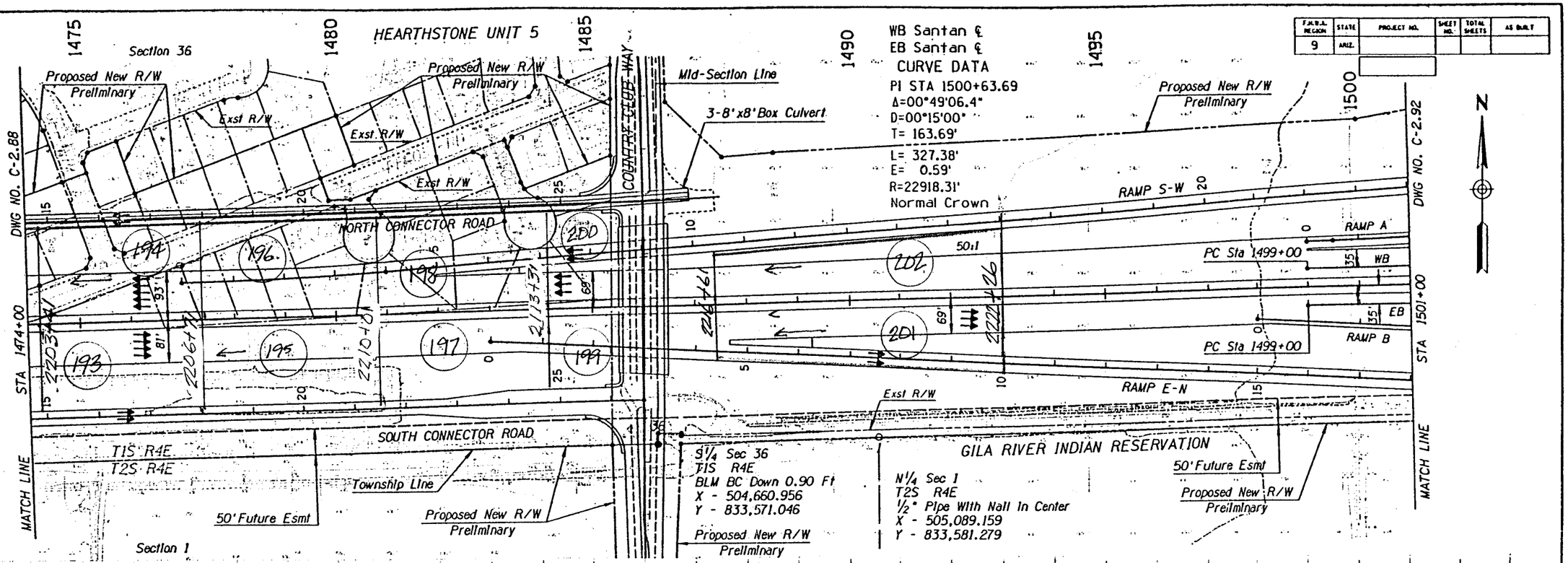
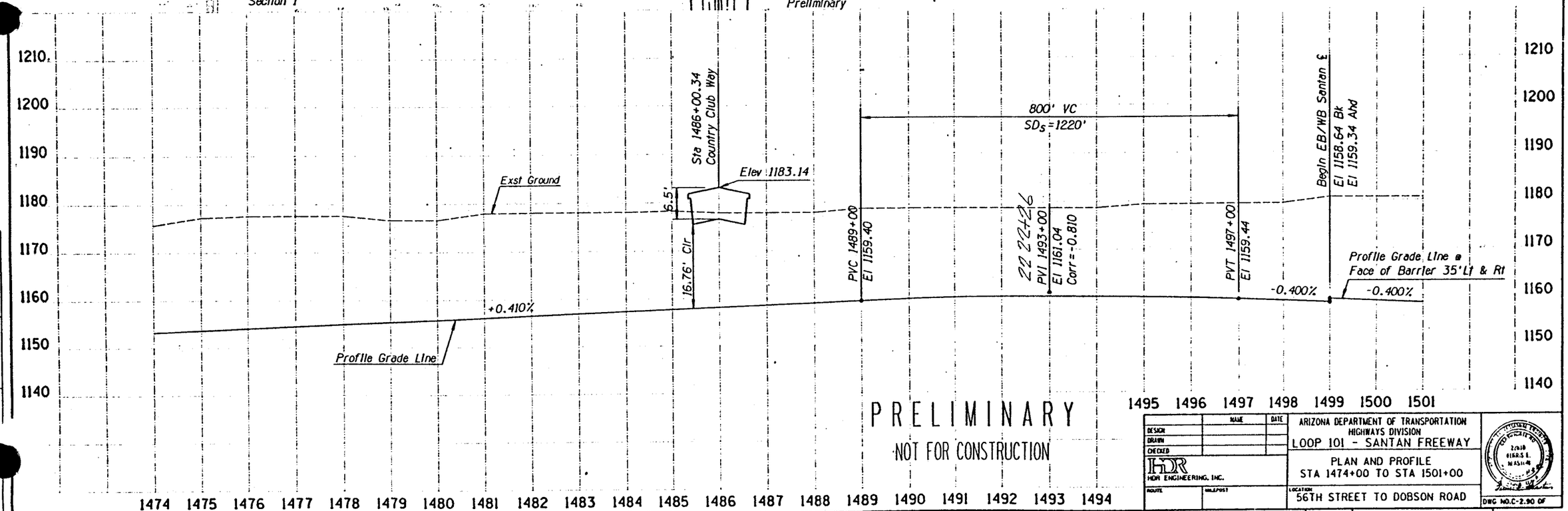
9	ARIZ.				





PRELIMINARY

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	NAME	DATE
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HDR ENGINEERING, INC.

ROUTE | MILEPOST

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
LOOP 101 - SANTAN FREEWAY

PLAN AND PROFILE
STA 1474+00 TO STA 1501+00

LOCATION
56TH STREET TO DOBSON ROAD

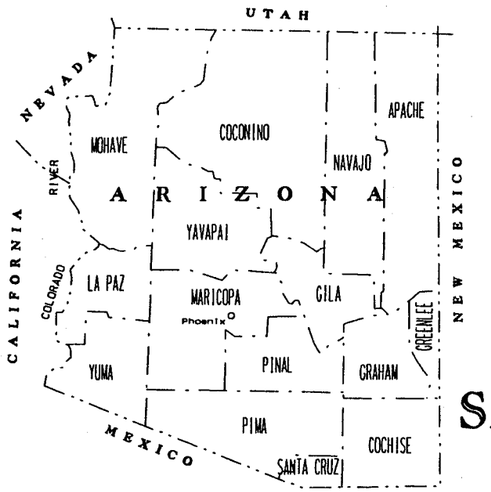
DWG NO. C-2.90 OF

TRACS NO. H-2222-01D | PPSANT07 | OF

*****DGN-SPECIFICATION***** VIEW NAME: PLOT
*****SYSTIME*****

APPENDIX A

Pre-Final (95%) DRAINAGE PLANS



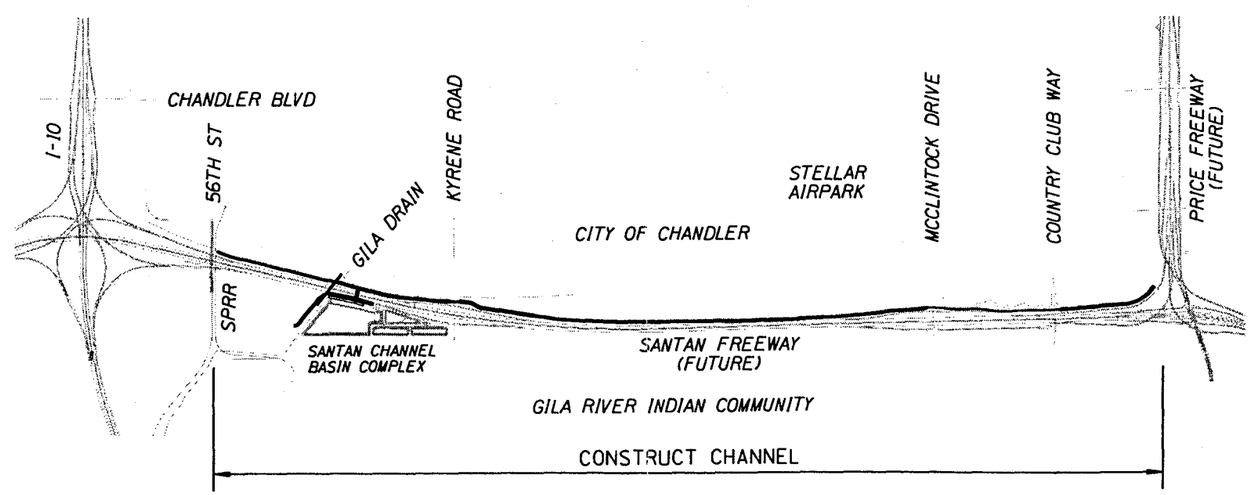
STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PHASE 3
SANTAN COLLECTOR CHANNEL PROJECT

SOUTHEAST VALLEY REGIONAL DRAINAGE SYSTEM (SEVRDS)
CONTRACT NO. FCD 99-05
PCN 4900133

ADOT PROJECT 600-7-503
TRACS H4314 03C



STAGE IV DESIGN SUBMITTAL
95% COMPLETE
AUGUST 6, 1999

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
APPROVED: THOMAS G. SCHMITT
STATE ENGINEER

APPROVED DATE

ASSISTANT STATE ENGINEER

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ISSUED FOR PUBLIC BIDDING BY:

CHIEF ENGINEER AND GENERAL MANAGER DATE

FULTON BROCK - CHAIRMAN

DISTRICT 1	FULTON BROCK
DISTRICT 2	DON T. STAPLEY
DISTRICT 3	ANDY KUNASEK
DISTRICT 4	JAN BREWER
DISTRICT 5	MARY ROSE GARRIDO WILCOX

SANTAN FREEWAY (SR202L)
56TH STREET - PRICE ROAD

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			

INDEX OF SHEETS

SHEET NO.	DWG. NO.	SHEET TITLE
		GENERAL
1		Cover/Face Sheet
2	G-1.01	Index of Drawings
3	G-1.02	Design Data Sheet - General Notes, Earthwork Quantities
4-6	G-1.03 - G-1.05	Typical Sections
7-8	G-2.01 - G-2.02	New Box Culvert Summary Sheets
9-11	G-2.03 - G-2.05	New Pipe Summary Sheets
12-26	G-3.01 - G-3.15	Drainage Details
27-37	G-4.01 - G-4.11	Soil Boring
		CIVIL
38-40	C-1.01 - C-1.13	Removal Plans
41	C-2.01	Benchmark and Control Point Plan
42-49	C-2.02 - C-2.09	Geometric Layout and Data
		DRAINAGE PLAN AND PROFILE
50-70	D-1.01 - D-1.21	West, East & Forebay Channel Plan and Profile
71	D-1.22	Basin G Outfall Pipe Plan and Profile
72-73	D-1.23 - D-1.24	Kyrene Pump Station Discharge Line - Plan and Profile
	D-1.25	Pipe Profiles
		STRUCTURAL PLANS
74-78	S-1.01 - S-1.05	Culvert Detail Sheets
79-83	S-2.01 - S-2.05	Hearthstone Culvert and Rectangular Channel Detail Sheets
84-101	S-3.01 - S-3.18	Structural Details

SHEET NO.	DWG. NO.	SHEET TITLE
		TRAFFIC PLANS
102	T-1.01	Notes and Details
103-104	T-1.02 - T-1.03	Kyrene Road Traffic Control
105-106	T-1.04 - T-1.05	Kyrene Detour Plan & Profile
107	T-1.06	79th Street Hammerhead
		UTILITIES
108-121	U-1.01 - U-1.14	City Of Chandler Sewer Relocations
122-134	U-2.01 - U-2.13	Sewer Lift Station
135-150	U-3.01 - U-3.15	City Of Chandler Water Relocations
		IRRIGATION
* 151-155	IR-1 - IR-5	SRP Lateral Reconstruction
156-157	IR-6 - IR-7	Gila Drain Box Culvert Structural Detail Sheets
158-159	IR-8 - IR-9	Gila Drain Inlet/Outlet Channel
160	IR-10	Gila Drain 36" Bypass Pipe Profile
* 161-163	IR-11 - IR-13	Gila Drain Details

* Not Provided With This Submittal

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRM	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

DESIGN SHEET

ROUTE 202L — LOCATION: SANTAN CHANNEL - PHASE III

PRELIMINARY 95% Review NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. G- 1.01

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			

GENERAL NOTES

For R/W Information not shown, see Right-of-Way projects No. 600-7-701 and 600-1-728.

The horizontal location and elevation of existing utilities will not be shown on plans unless verified through potholing or field survey methods. The Contractor shall verify the exact horizontal location and depth of each underground facility.
The average project elevation is 1160.00'.

All construction shall be completed in accordance with the Maricopa Association of Governments (MAG) "Uniform Standard Specifications for Public Works Construction", 1998 Edition inclusive of the latest revisions and amendments, these Design Plans, and the Special Provisions.

The Maricopa Association of Governments "Uniform Standard Details for Public Works Construction", with the latest revisions and amendments are the Standard Drawings for this project, are an integral part of the Contract, and these Design Plans.

Where noted, references shall also be made to the "Arizona Department of Transportation Standard Specifications for Road and Bridge Construction", 1990 Edition inclusive of the latest revisions.

Geotechnical Reports were prepared by AGRA Earth & Environ mental. Copies of these reports can be reviewed and purchased at the Flood Control District of Maricopa County.

The Contractor will be responsible for ensuring that all necessary permits have been obtained prior to construction. Dust shall be controlled in accordance with Federal, State, and local laws, ordinances and regulations. The Contractor shall obtain a permit from the Maricopa County Air Pollution Officer prior to start of construction.

All construction signing, barricading and traffic delineation shall conform to the MAG Standard Specifications and to the "Manual of Uniform Traffic Control Devices - 1984" and any of their latest revisions.

Clearing and Grubbing shall include the removal of all trash and debris within project work area. The removal of trees will not be measured or paid for separately, but considered as part of the clearing and grubbing work.

The Contractor shall take all precautionary measures necessary to protect existing improvements from damage; and all such improvements or structures damaged by the Contractor's operations shall be repaired or reconstructed satisfactory to the Engineer at the expense of the Contractor.

In the event that a discrepancy is encountered on these plans or within the Special Provisions, the Contractor shall notify the Engineer immediately for advisement and prior to any construction activity.

All quantities shown hereon and in the Bid Schedule are estimates and are included for comparison of bids only. The Contractor shall satisfy himself as to the accuracy and completeness of all quantities.

Stations shown on the profile are along the construction centerline. Earthwork cross-sections are stationed along the construction line and are drawn perpendicular or radial to the construction control line. Cross-sections are provided as an aid in evaluating earthwork quantities only and should not be used for staking centerline control or grades.

LEGEND

- ●2 Soil Boring Location & Number (Text Location Varies)
- —X—X— Existing Fence
- -o—o—o- New Chain Link Fence
- —C— Cut Line
- —F— Fill Line (Toe of Slope)
- —·-·-· Existing Right of Way (R/W)
- —··—·· New Right of Way (R/W)
- — — New Temporary Construction Easement (TCE)
- ≡IR≡ ≡IR≡ Existing Irrigation Ditch
- ≡IR≡ New Irrigation Ditch
- —G— Existing Gas Line
- —S— City of Chandler Sanitary Sewer/Forcemain
- —W— City of Chandler Water
- —SD— Storm Drain
- —P— Underground SRP Power
- —T— US West Telephone
- —TV— Underground Cable T.V.
- —OP— Overhead PRP Power
- —IR— Underground SRVWUA Irrigation
- —G— Southwest Gas
- —AT— Abandoned Telephone
- ℄ Section Line
- R/W Right-of-way
- ℙ Property Line
- N.T.S. Not To Scale
- FL Flow Line
- Pt. Point
- C.Y. Cubic Yard
- Cst Construction
- STA Station
- U/G Underground
- VCP Vitrified Clay Pipe
- RCP Reinforced Concrete Pipe
- CCP Concrete Cylinder Pipe
- ACP Asbestos Cement Pipe

BASIS OF DESIGN

Q_{DESIGN} = 100-Year Flood

DESIGN FREEBOARD = 1 FOOT (Non-Levee Condition)

LENGTH OF PROJECT

West Channel = 1738.82'
East Channel = 17466.77'
Foreway Channel = 2618.79'
Gila Drain Channel = 724'
Total = 22,548.38' = 4.27 miles

ABBREVIATIONS

AGENCY:

1. ADOT = Arizona Department of Transportation
2. COC = City of Chandler
3. FCD or FCDMC = Flood Control District of Maricopa County
4. GRIC = Gila River Indian Community
5. MAG = Maricopa Association of Governments
6. SRP = Salt River Project

UTILITIES:

APS = Arizona Public Service
EPNG = El Paso Natural Gas Company
SRPPD = Salt River Project Power Distribution
SRPPT = Salt River Project Power Transmission
SWG = Southwest Gas Corporation
USW = U.S. West Communications

MIDPOINT OF PROJECT

Central Zone
State Plane Coordinates

X = 699,170
Y = 833,970

EARTHWORK QUANTITIES

Channel Excavation (Net)	345,000 CY
Structural Excavation (Net)	36,000 CY
Waste	396,000 CY

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRM	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

DESIGN SHEET

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY 95% Review
NOT FOR CONSTRUCTION OR RECORDING
DWG. NO. G- 1.02

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SURV.	FINISHED PLANS	REVISIONS	LOCATION	DATE

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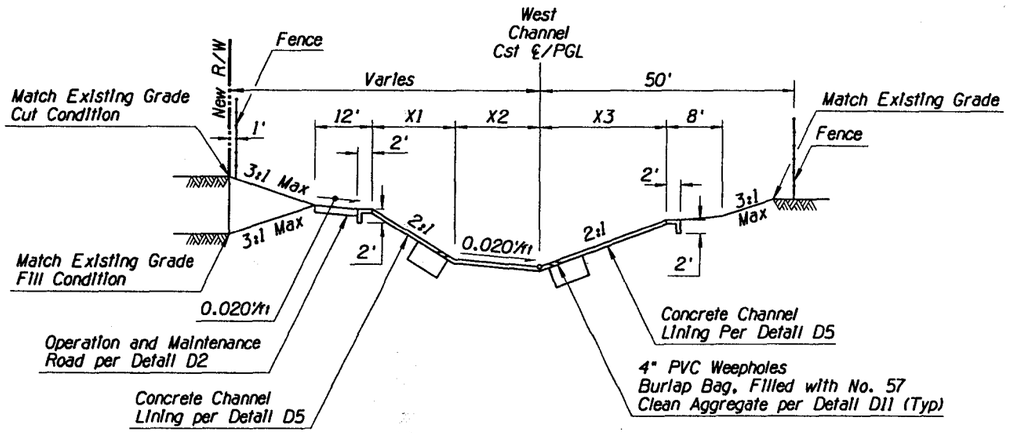
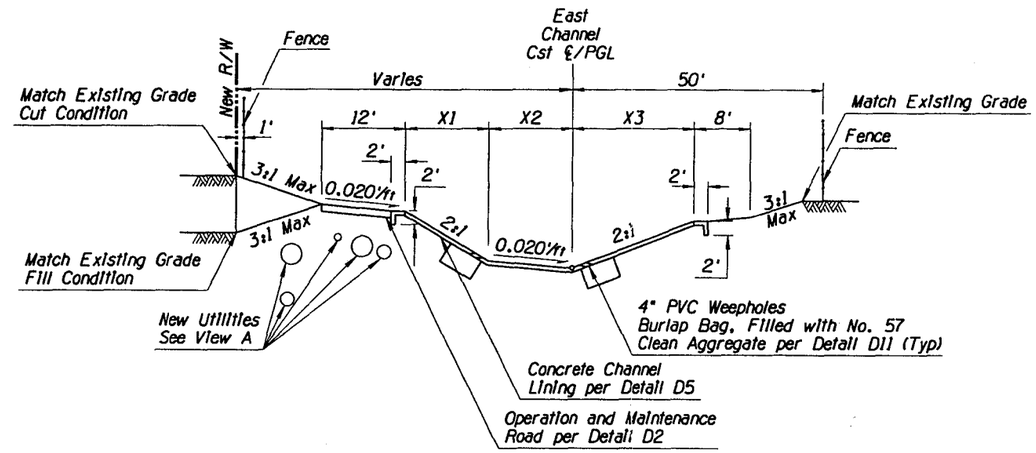


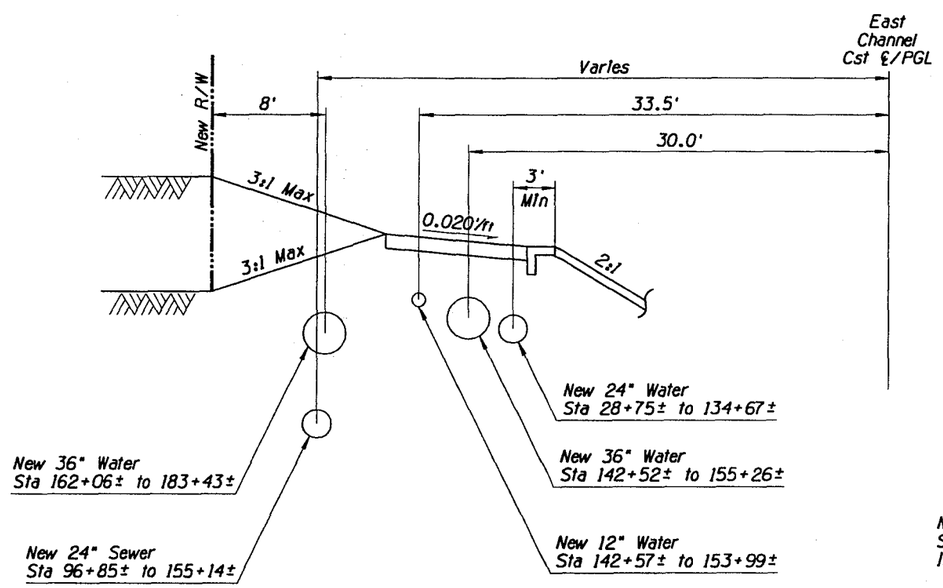
TYPICAL WEST CHANNEL SECTION

Station			X1,(ft)	X2,(ft)	X3,(ft)
Sta	44+95.00	to 52+65.49	16.52	9.00	16.88
Sta	58+35.33	to 61+76.23	17.96	26.00	19.00



TYPICAL EAST CHANNEL SECTION

Station			X1,(ft)	X2,(ft)	X3,(ft)
Sta	10+62.44	to 16+40.00	14.96	26.0	16.00
Sta	16+40.00	to 19+00.00	16.00	26.0	16.00
Sta	19+00.00	to 22+07.81	17.00	26.0	16.00
Sta	22+07.81	to 27+41.77	18.00	26.0	18.0
Sta	31+69.39	to 41+10.00	21.00	26.0	18.0
Sta	41+10.00	to 46+40.82	23.00	26.0	18.0
Sta	46+40.82	to 47+42.36	23.00	26.0 to 12.0	18.0
Sta	47+42.36	to 62+00.00	23.00	12.0	18.0
Sta	62+00.00	to 68+60.00	25.00	12.0	18.0
Sta	68+60.00	to 74+00.00	28.00	12.0	18.0
Sta	74+00.00	to 78+00.00	27.00	12.0	18.0
Sta	78+00.00	to 80+40.00	25.00	12.0	18.0
Sta	80+40.00	to 122+80.00	22.0	12.0	18.0
Sta	122+80.00	to 126+00.00	23.00	12.0	18.0
Sta	126+00.00	to 128+50.00	23.00	12.0	22.0
Sta	132+40.00	to 133+35.03	23.00	12.0	22.0
Sta	167+40.21	to 168+00.00	26.00	12.0	20.0
Sta	168+00.00	to 178+00.00	28.00	12.0	19.0
Sta	178+00.00	to 184+67.70	28.00	12.0	18.0



VIEW A

NOTE:
Stations with Different Width Values
Indicates Steps in Channel Lining Height.

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRM	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

WEST AND EAST CHANNEL
TYPICAL SECTIONS

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING
DWG. NO. G- 1.03

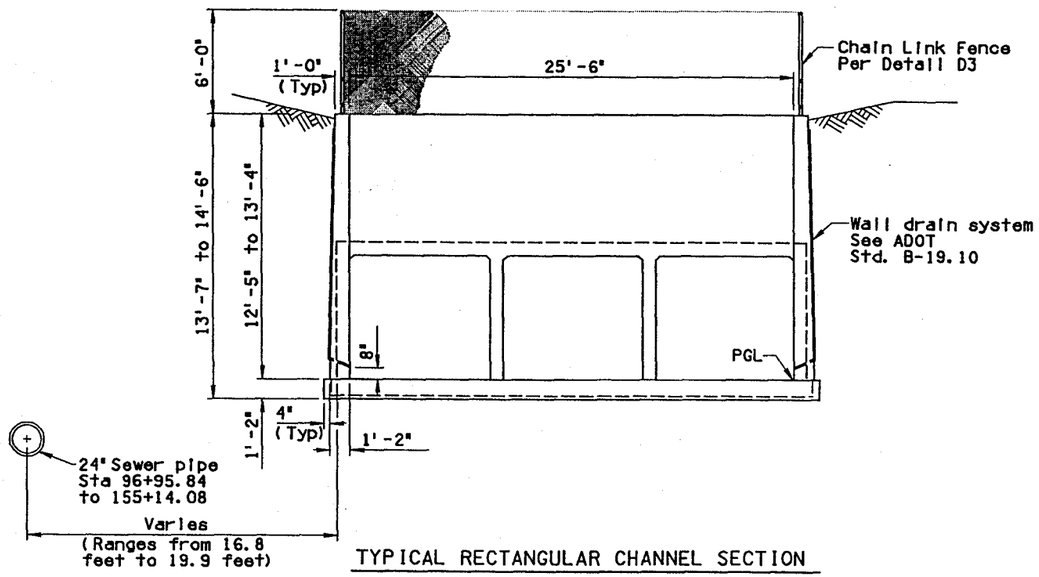
TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

j:\sanc\prod\gen\scgty02.dgn VIEW NAME:
05 AUG 1999

j:/sanc/prod/gen/scgty02.dgn Aug. 05, 1999 06:50:05 DMJM Arizona,Inc.

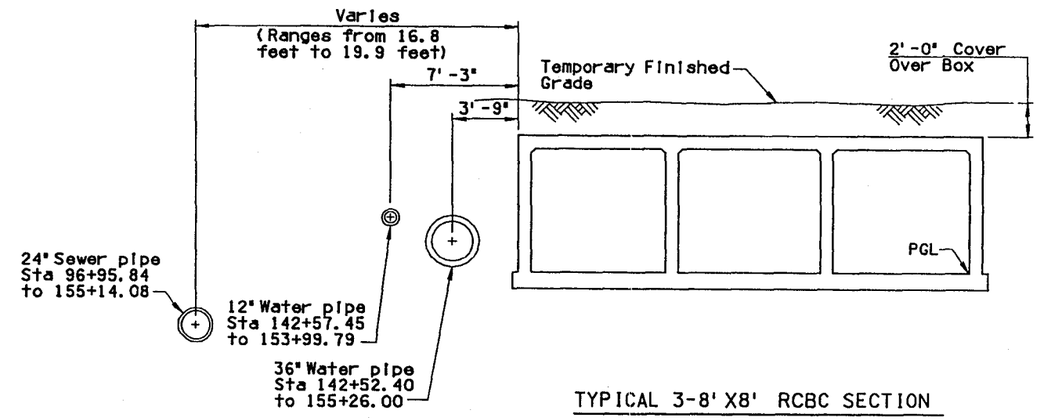
CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



TYPICAL RECTANGULAR CHANNEL SECTION

Sta 135+93.47 to 136+75.69



TYPICAL 3-8' X8' RCBC SECTION

Sta 136+75.69 to 162+52.37
(Hearthstone RCBC)

	NAME	DATE
DESIGN	S. SENAPATHI	8/4/99
DRAWN	J. FAHLUL	8/4/99
CHECKED	F. ALAGHI	8/4/99

PREMIER

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

EAST CHANNEL TYPICAL SECTIONS

ROUTE 202L

LOCATION SANTAN CHANNEL-PHASE III

PRELIMINARY
95%
Review
NOT FOR
CONSTRUCTION
OR RECORDING

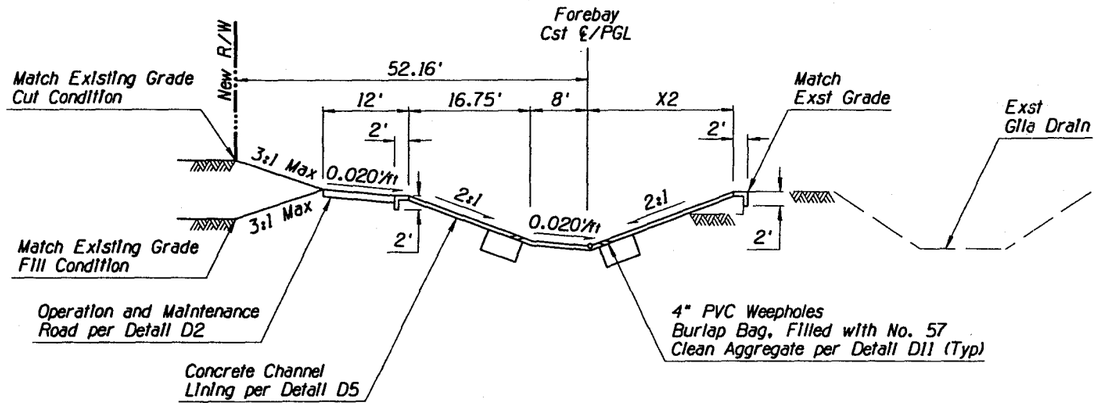
Dwg No. G-1.04

TRACS NO. H 4314 03D | 600-7-503 | ___ OF ___

SUPERSEDES	FINISHED PLANS	REVISIONS	LOCATION	DATE

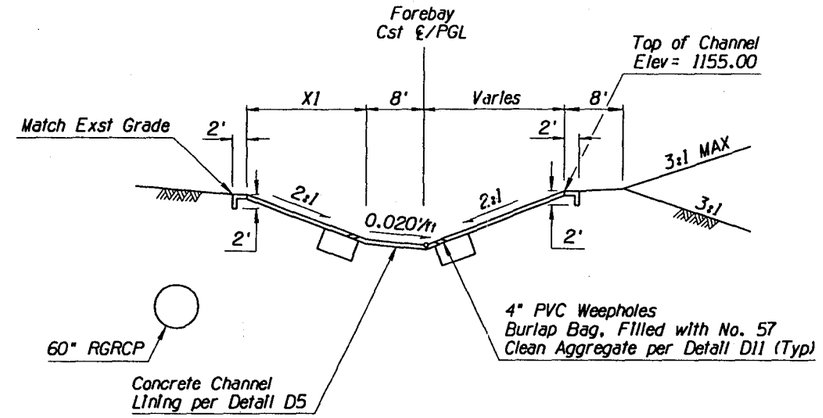
s:\9503.9\cadd\1_4boxdtls.dgn
Plotted By: JMC 04 AUG 99 21:30:02

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



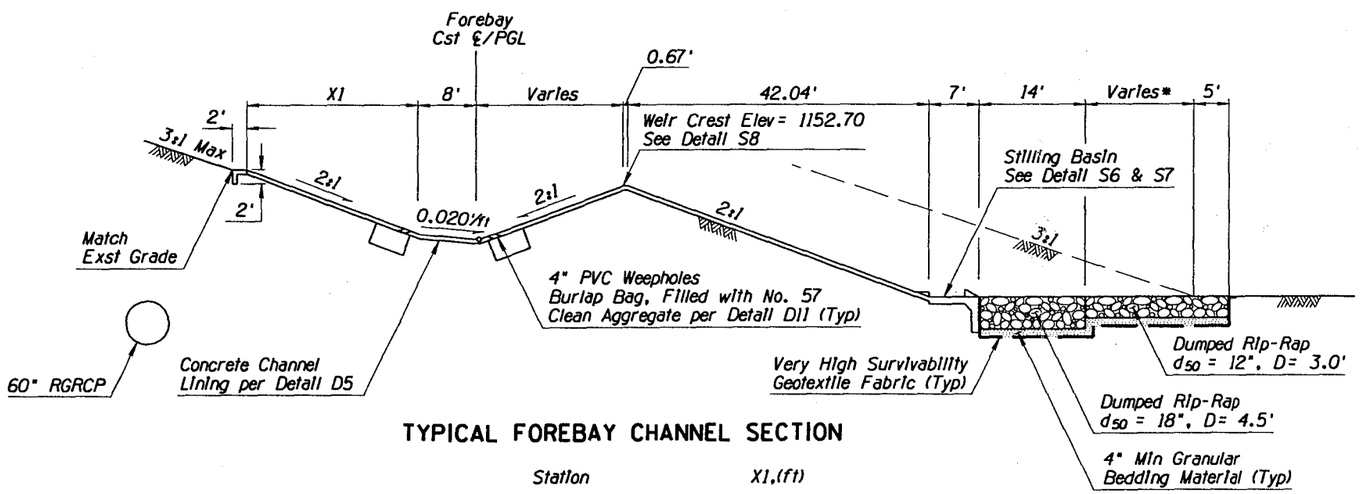
TYPICAL FOREBAY CHANNEL SECTION

	Station		X2,(ft)
Sta	8+46.20 to	9+25.00	17.00
Sta	9+25.00 to	9+40.00	Varies
Sta	9+40.00 to	18+12.16	23.20



TYPICAL FOREBAY CHANNEL SECTION

	Station		X1,(ft)
Sta	22+07.80 to	22+40.00	27.48
Sta	32+40.00 to	34+25.00	32.20



TYPICAL FOREBAY CHANNEL SECTION

	Station		X1,(ft)
Sta	22+40.00 to	29+99.17	27.48
Sta	24+19.17 to	32+40.00	32.20

* Varies 19.38' at West Wall to 25.0' at East Wall

NOTE:
Stations with Different Width Values
Indicates Steps in Channel Lining Height.

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPC	8/99
CHECKED	JRM	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

FOREBAY CHANNEL
TYPICAL SECTIONS

ROUTE 202L
LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING
DWG. NO. G- 1.05

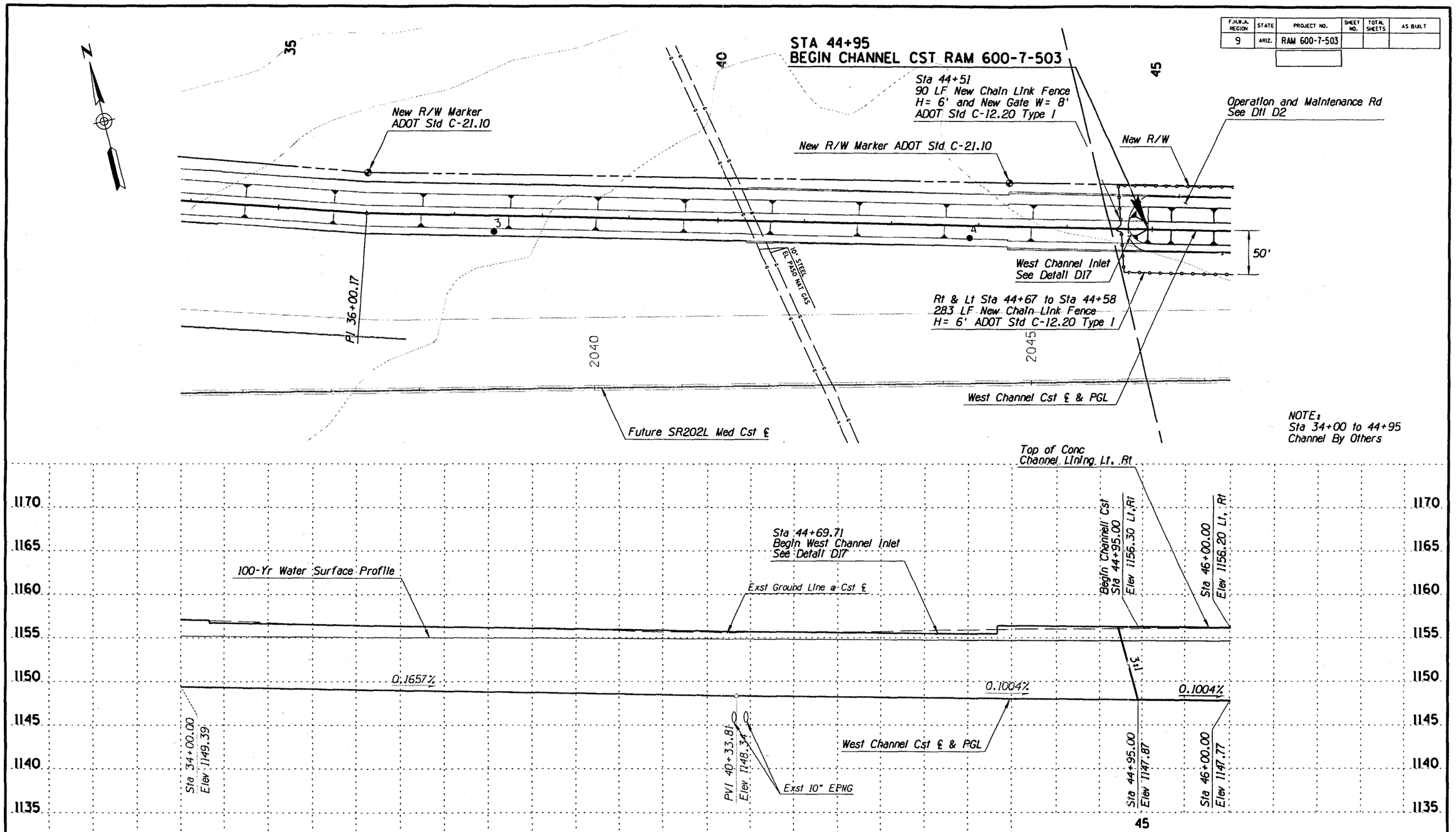
SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

j:\senc\prod\gen\scgty03.dgn
04 AUG 1999
VIEW NAME:

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

senc/prod/gen/scgty03.dgn Aug. 04, 1999 15:02:58 DMJM Arizona, Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

WEST CHANNEL
PLAN AND PROFILE
STA 34+00 to 46+00

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III | DWG. NO. D- 1.01

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

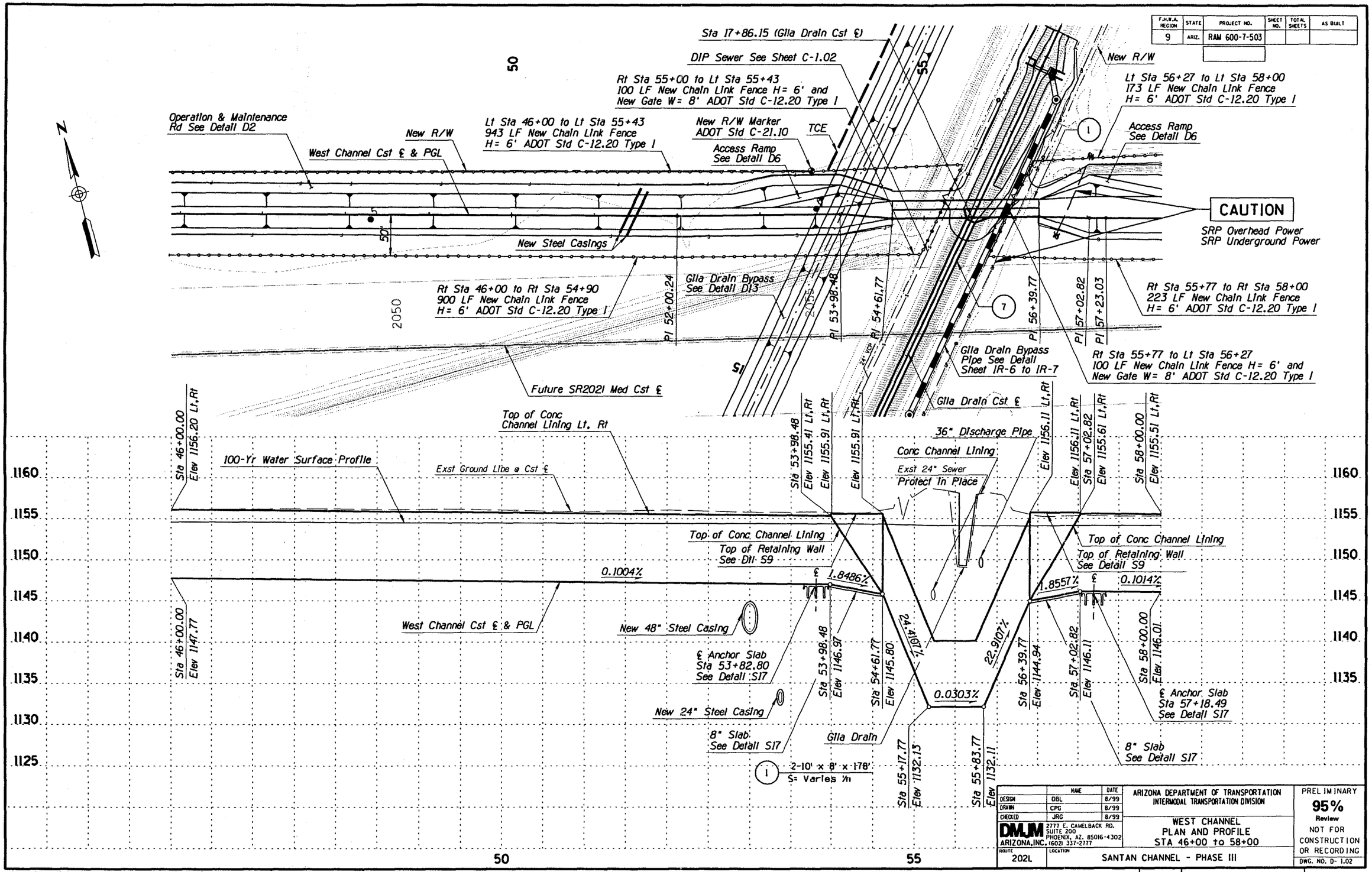
SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

CONSTRUCTION DISPLAY ON

j:\sanc\prod\drn\scdpp3.dgn VIEW NAME:
04 AUG 1999

j:/sanc/prod/drn/scdpp3.dgn Aug. 04, 1999 15:19:29 DMJM Arizona,Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

WEST CHANNEL
PLAN AND PROFILE
STA 46+00 to 58+00

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.02

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

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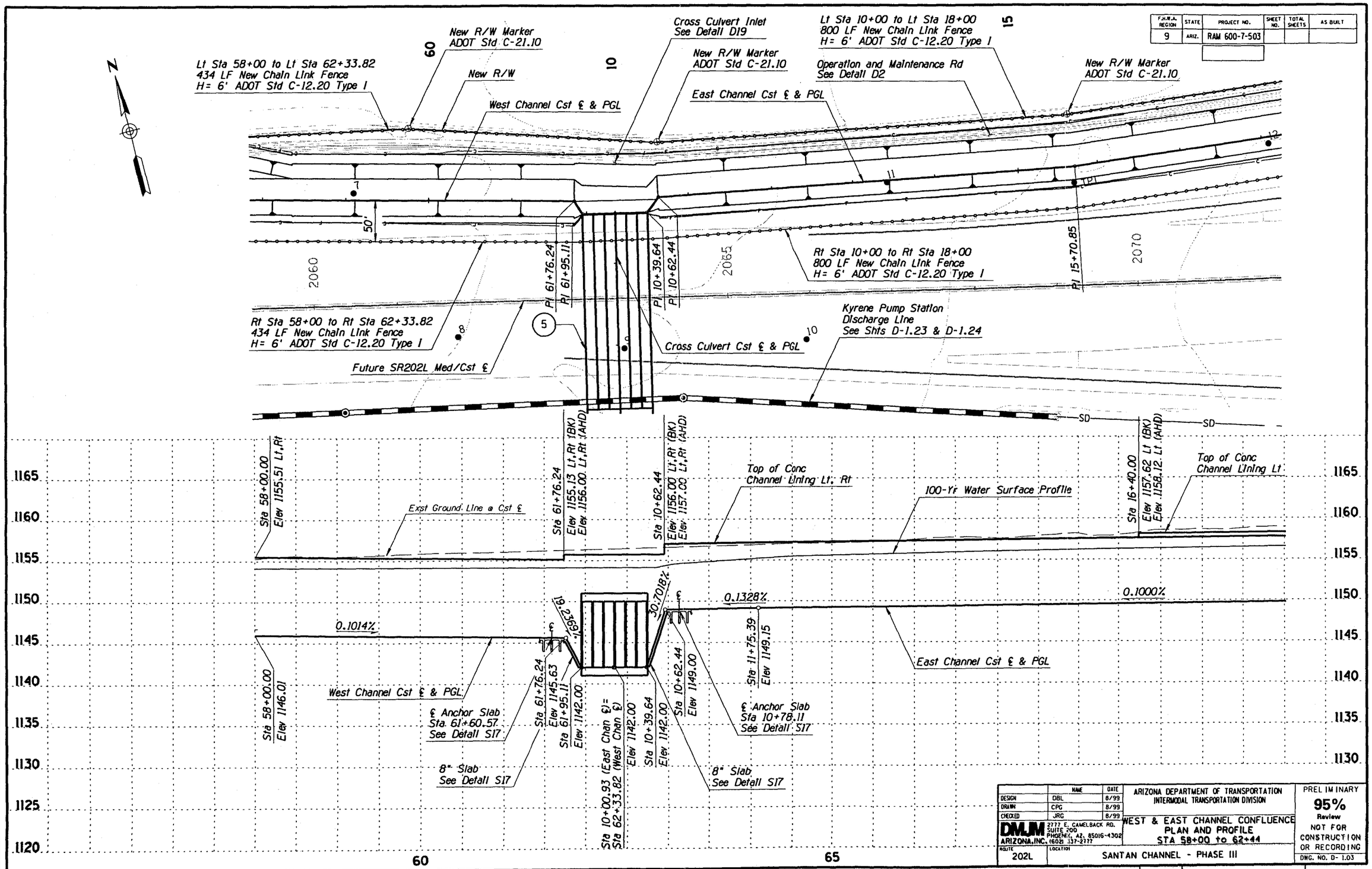
04 AUG 1999

j:/sanc/prod/drn/scdpp4.dgn Aug. 04, 1999 16:01:35 DMJM Arizona, Inc.

CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

WEST & EAST CHANNEL CONFLUENCE
PLAN AND PROFILE
STA 58+00 to 62+44

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.03

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SURV.	FINISHED PLANS	REVISIONS	LOCATION	DATE

CONSTRUCTION DISPLAY ON

jt\sanc\prod\drn\scdpp5.dgn VIEW NAME:
04 AUG 1999

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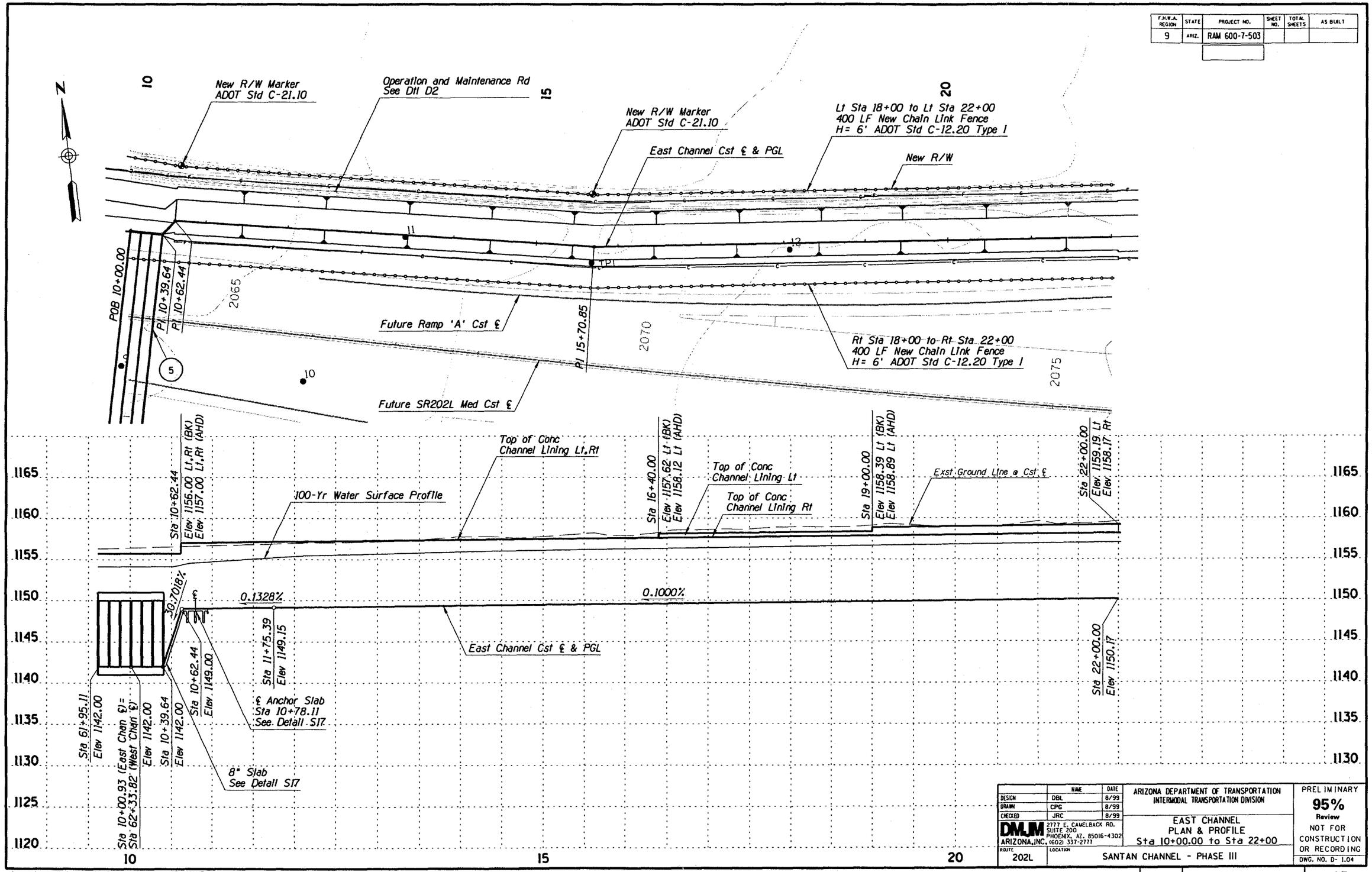
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRC	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN & PROFILE
Sta 10+00.00 to Sta 22+00

ROUTE 202L LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING
DWG. NO. D- 1.04

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

CONSTRUCTION DISPLAY ON

SURV | FINISHED PLANS | REVISIONS | LOCATION | DATE

j:\sanc\prod\drn\scdpp6.dgn VIEW NAME:
03 AUG 99

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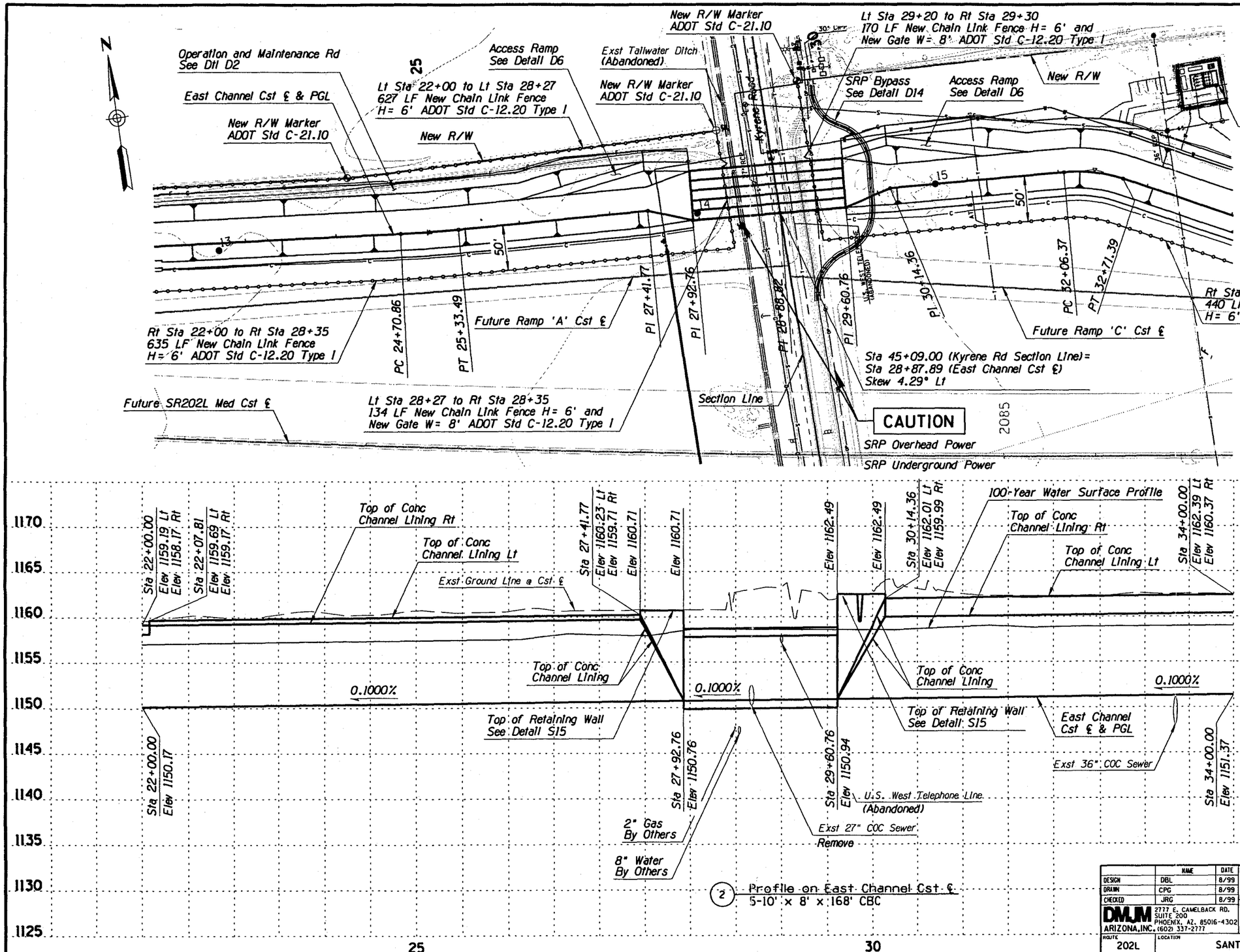
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



(2) Profile on East Channel Cst ℄
5-10' x 8' x 168' CBC

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 22+00 to 34+00

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR
CONSTRUCTION
OR RECORDING

DWG. NO. D- 1.05

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

DATE	LOCATION	REVISIONS	FINISHED PLANS	SURVEY

CONSTRUCTION DISPLAY ON

j:\sanc\prod\drn\scdpp7.dgn
05 AUG 1999
VIEW NAME:

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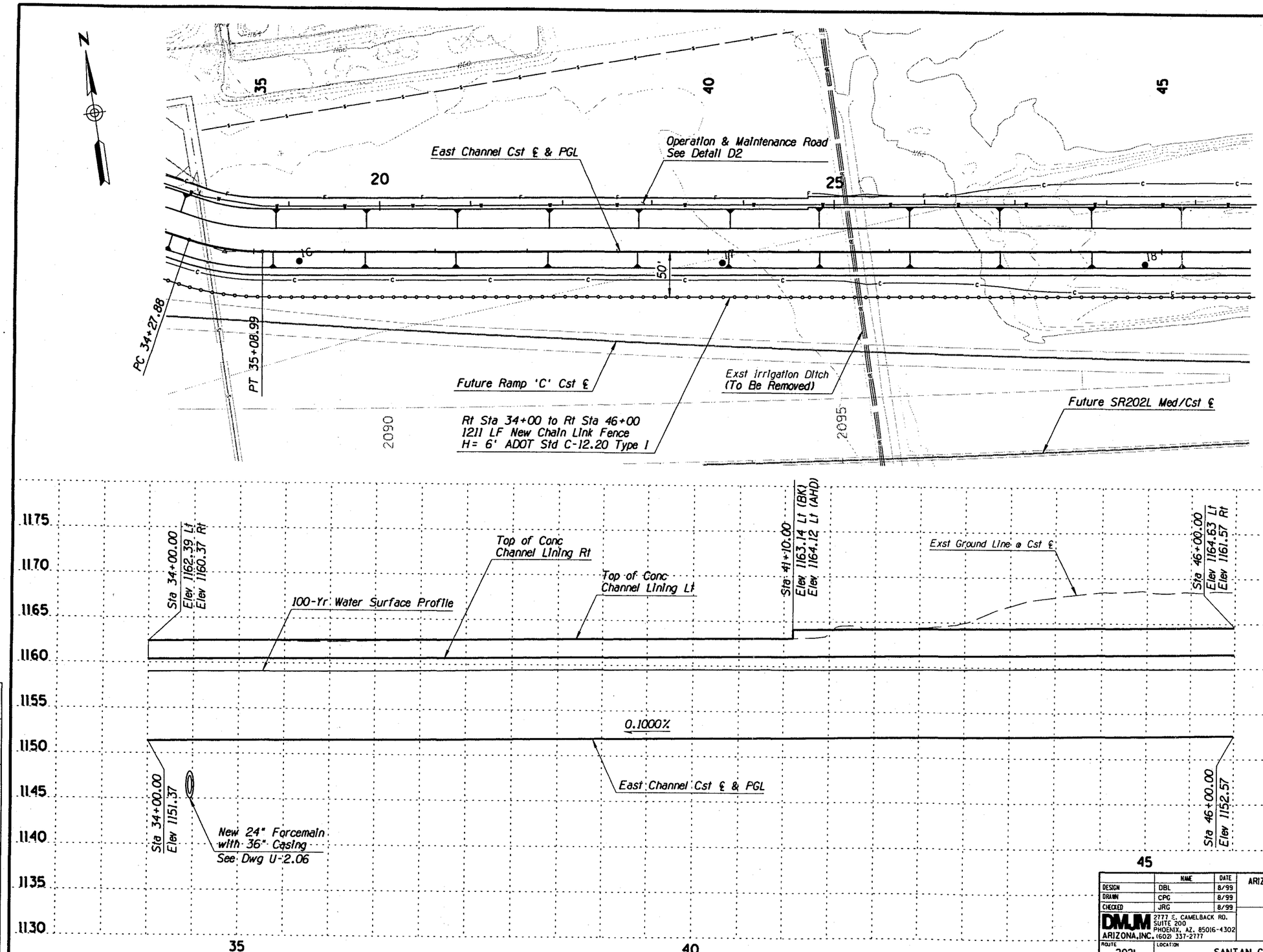
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.13

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 34+00 to 46+00

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.06

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

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05 AUG 1999

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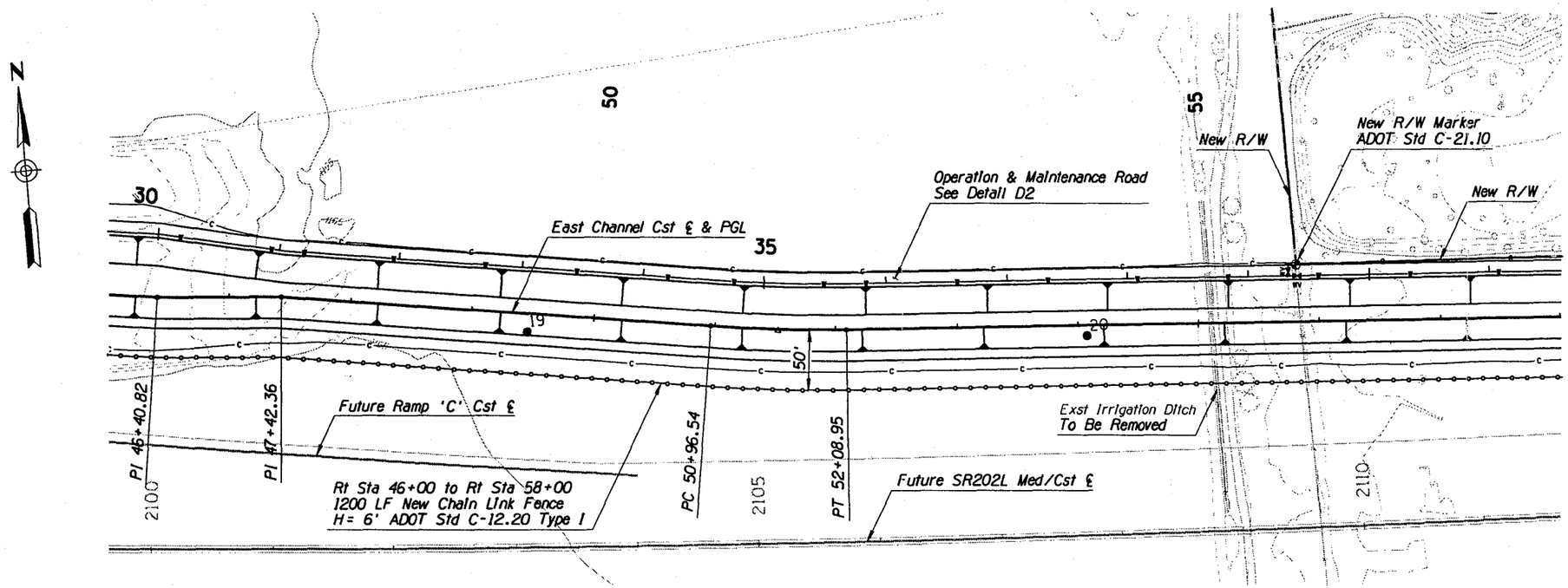
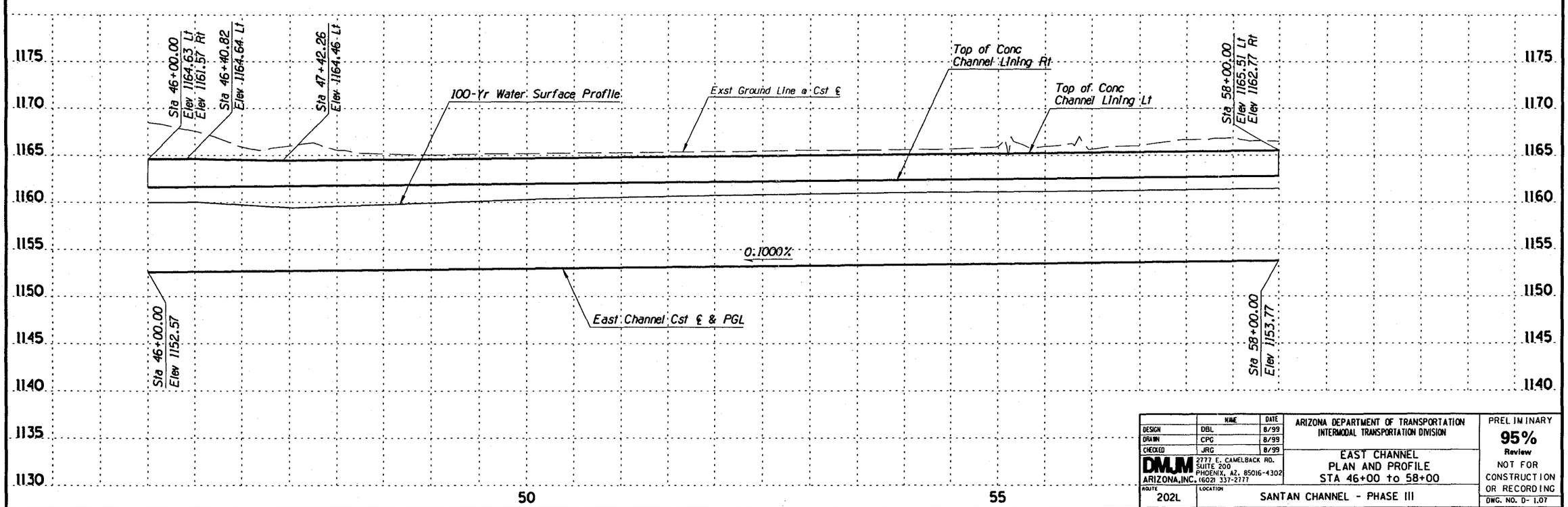
CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			





	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 46+00 to 58+00

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.07

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SUR	FINISHED PLANS	REVISIONS	LOCATION	DATE

CONSTRUCTION DISPLAY ON

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04 AUG 1999
VIEW NAME:

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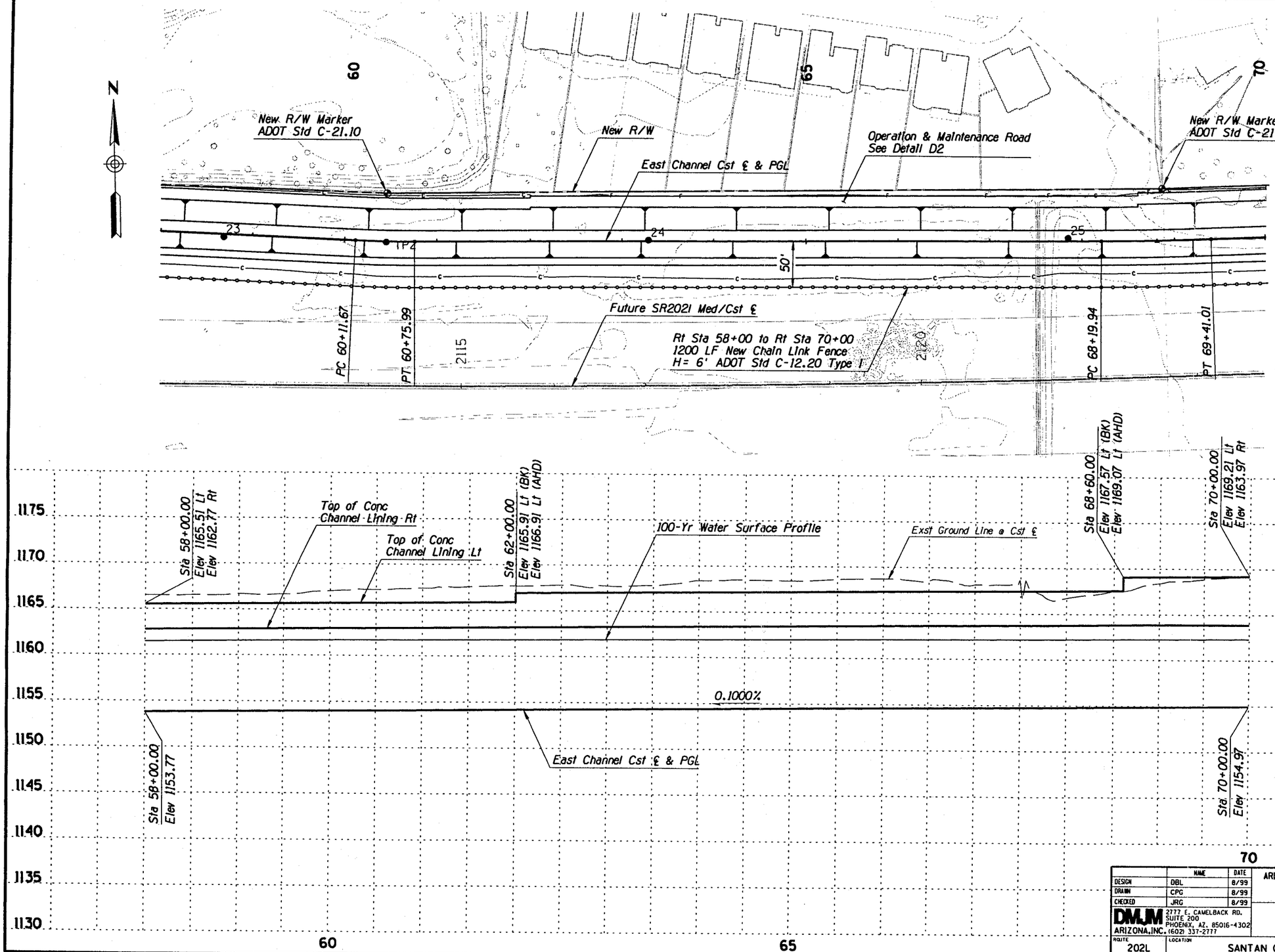
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC.
2777 E. CAMELBACK RD.
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 58+00 to 70+00

ROUTE 202L
LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR
CONSTRUCTION
OR RECORDING

DWG. NO. D- 1.08

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SURVEY | TRIMMED PLANS | REVISIONS | LOCATION | DATE

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04 AUG 1999

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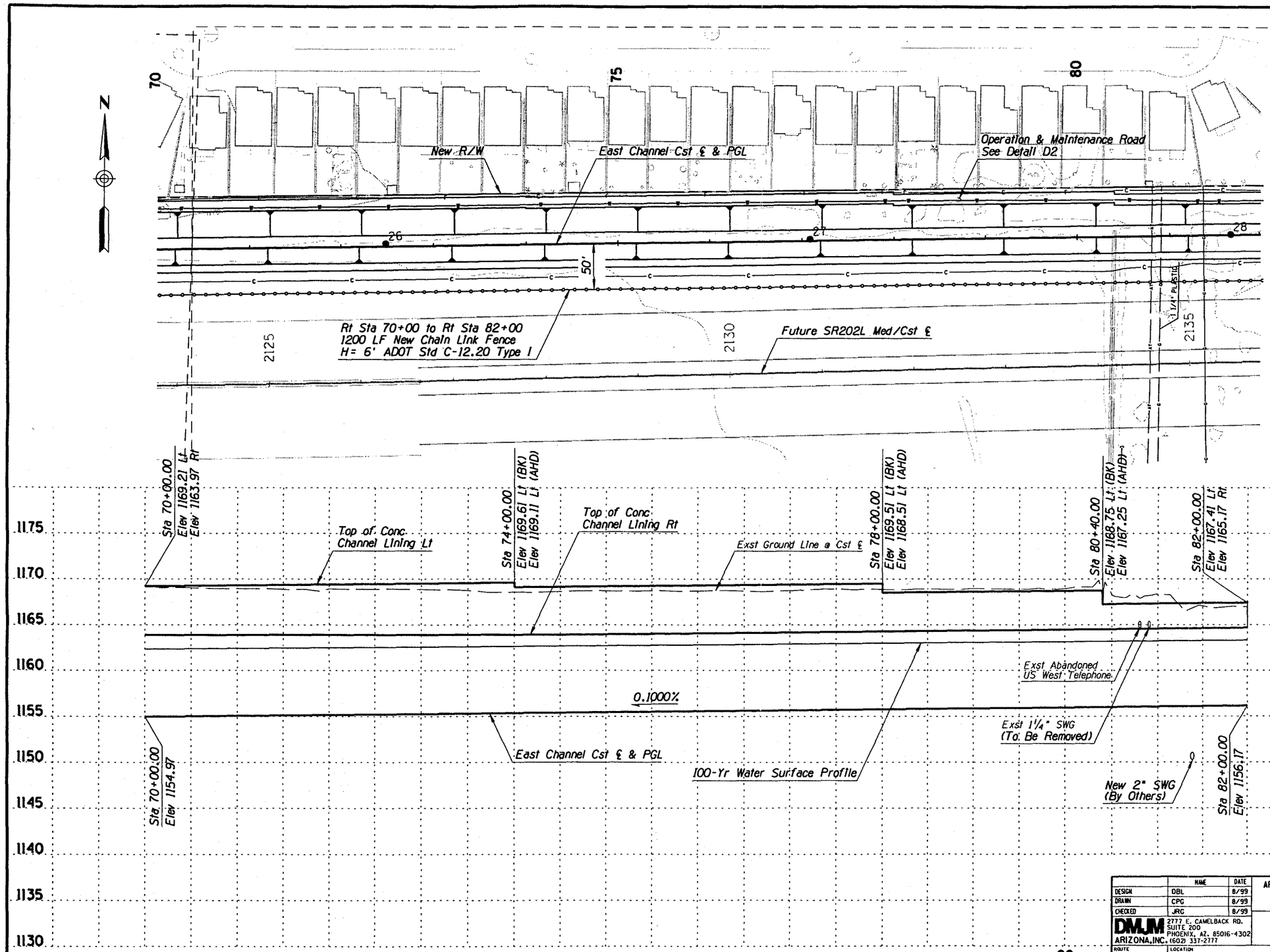
CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



NOTE:
For Removals See Removal Sheets C-1.01 to C-1.13

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 70+00 to 82+00

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.09

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

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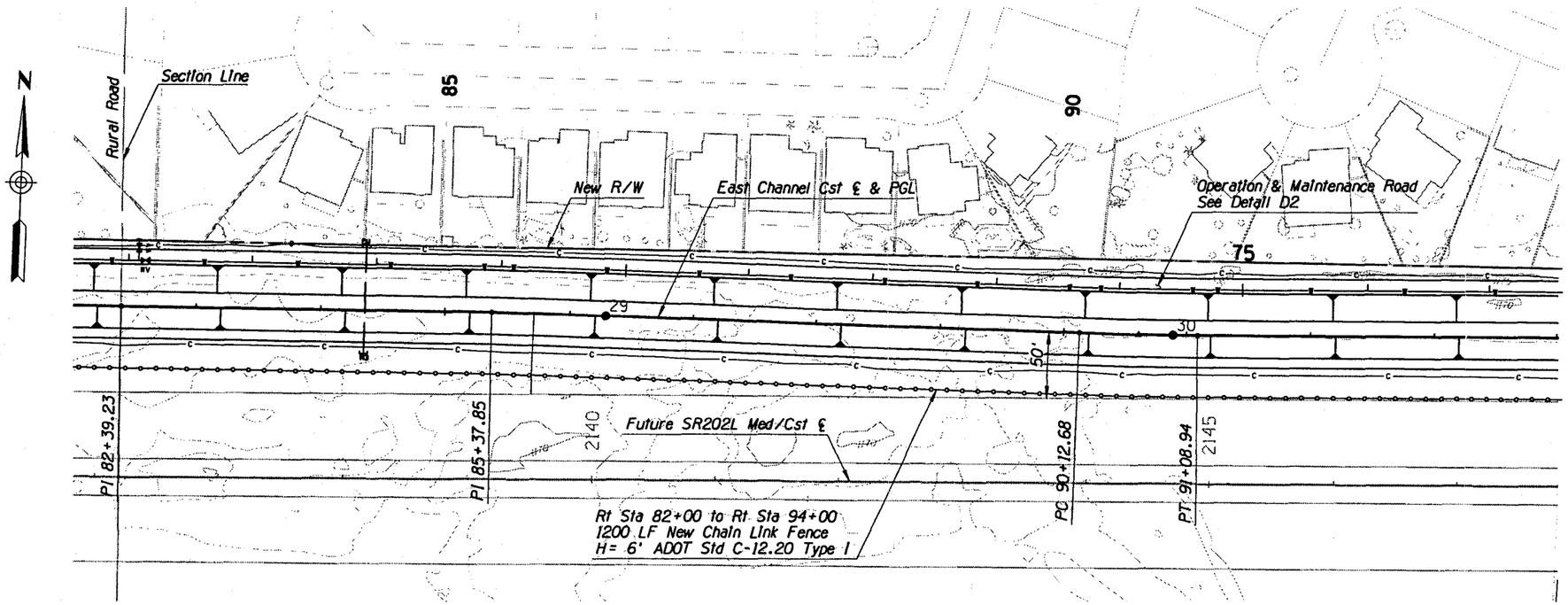
05 AUG 1999
VIEW NAME:

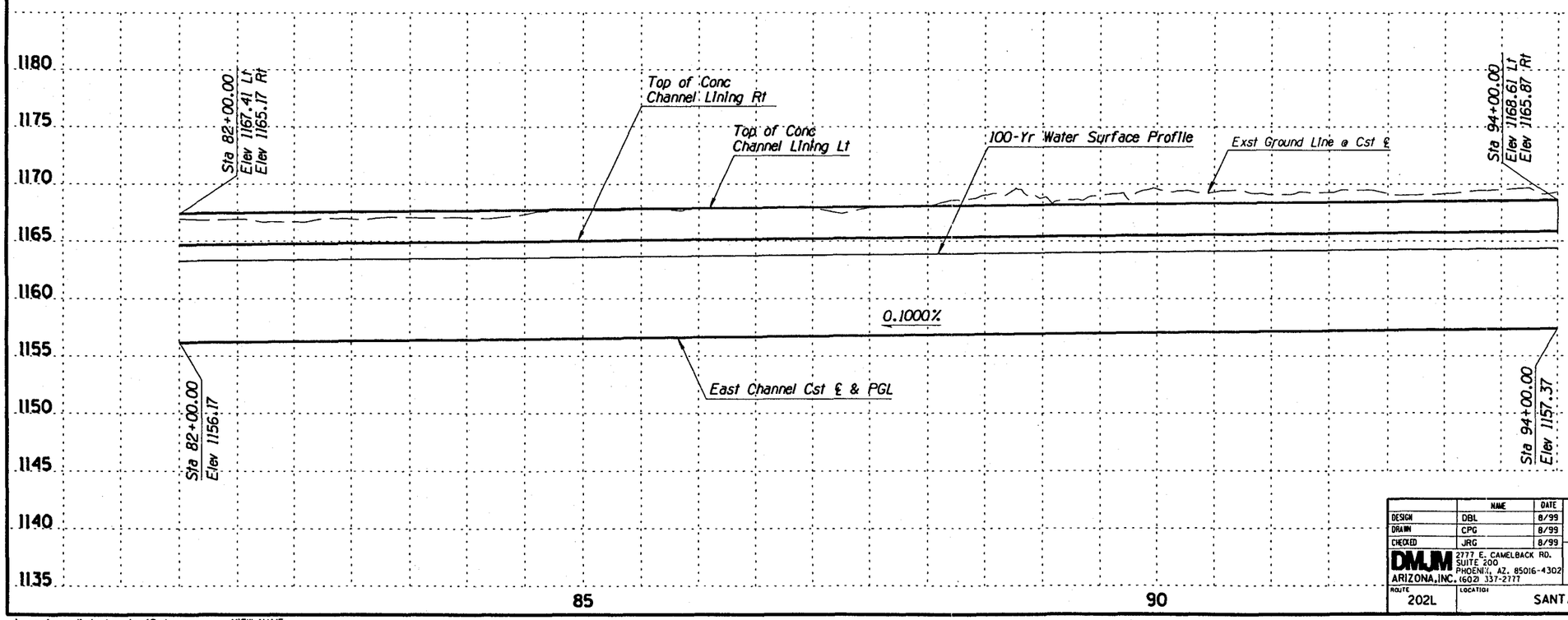
j:/sanc/prod/drn/scdpp11.dgn Aug. 05, 1999 11:22:11 DMJM Arizona,Inc.

CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.13



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 82+00 to 94+00

ROUTE 202L
LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.10

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

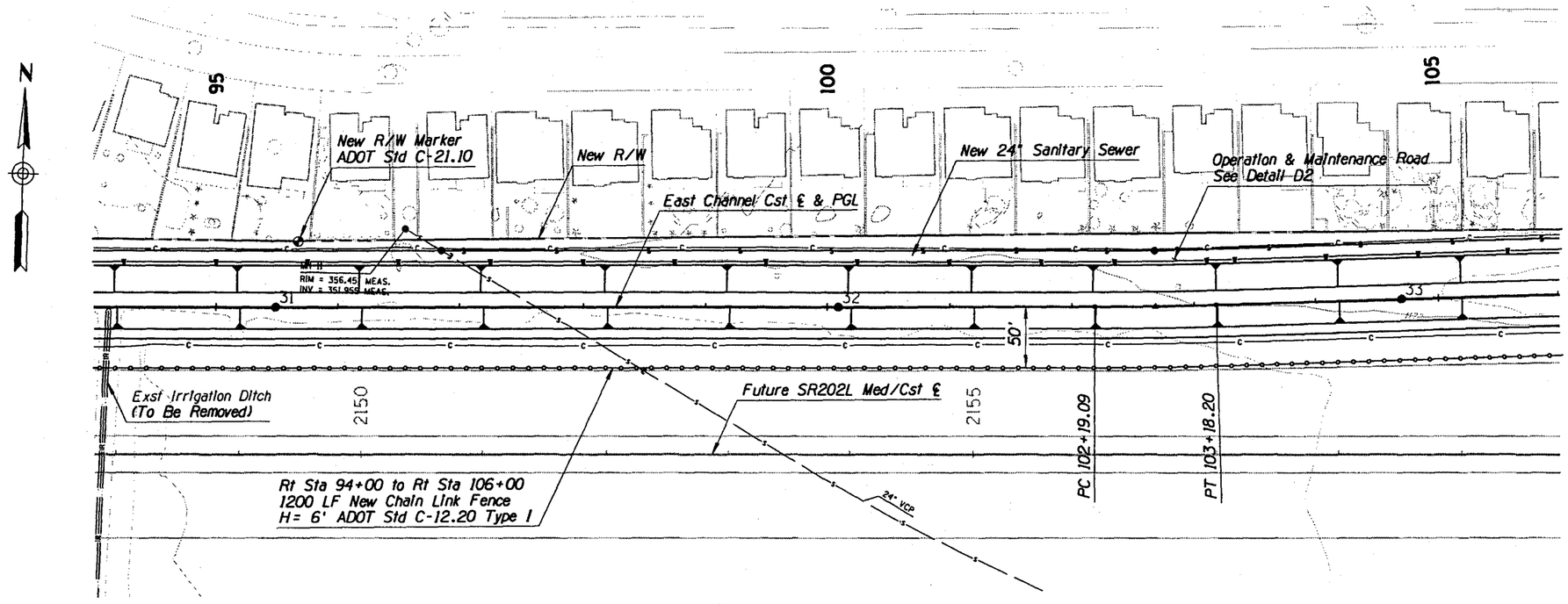
j:\sanc\prod\drn\scdpp12.dgn
02 AUG 1999
VIEW NAME:

j:/sanc/prod/drn/scdpp12.dgn Aug. 02, 1999 15:14:09 DMJM Arizona,Inc.

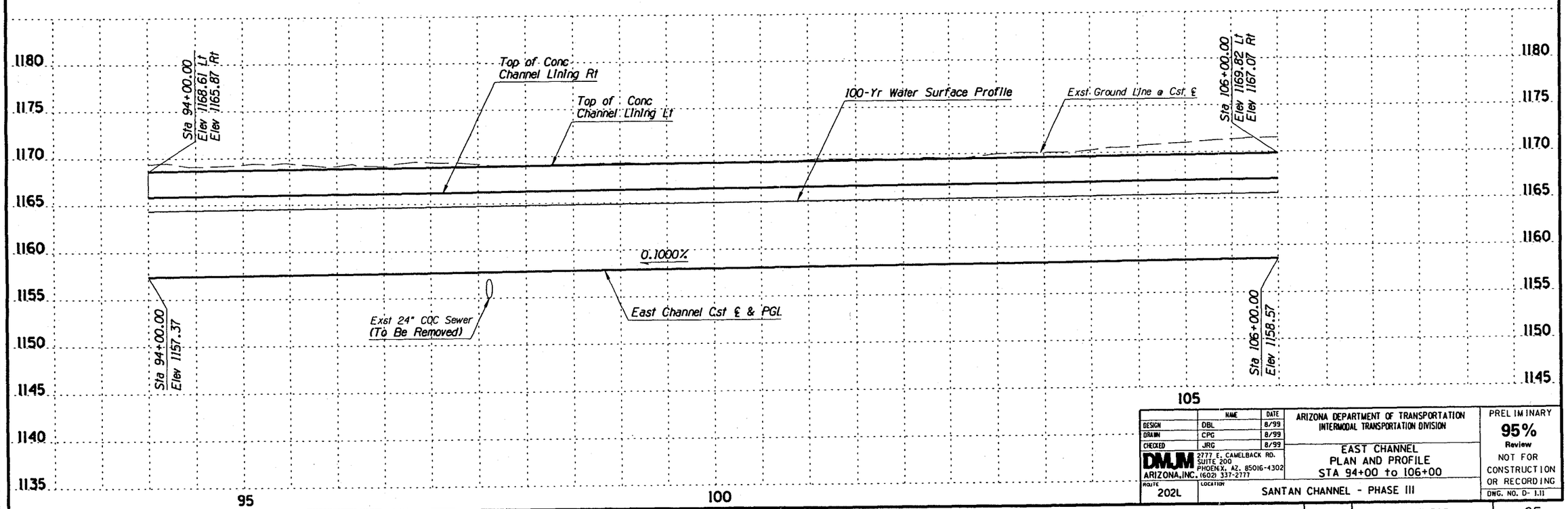
CONSTRUCTION DISPLAY ON

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.13.
For Utility Relocation See Utility Sheets.



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 94+00 to 106+00

ROUTE 202L
LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING
DWG. NO. D- 1.11

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

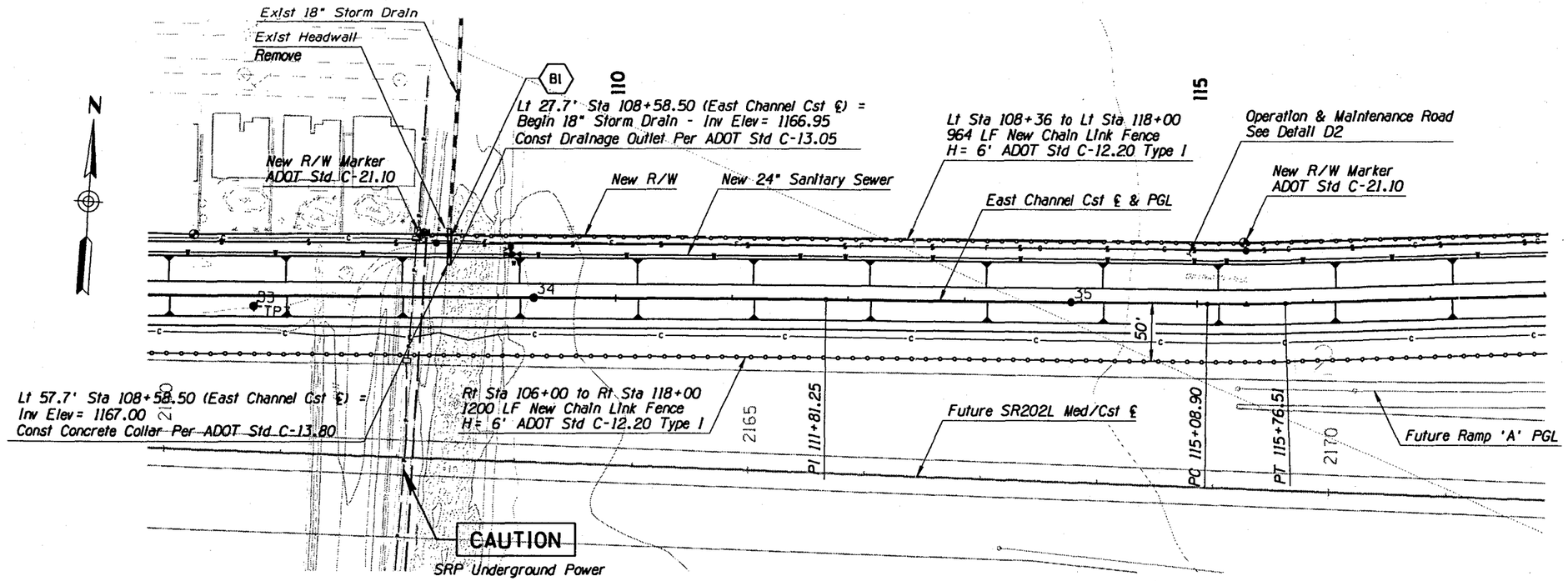
CONSTRUCTION DISPLAY ON

SURV | FINISHED PLANS | REVISIONS | LOCATION | DATE

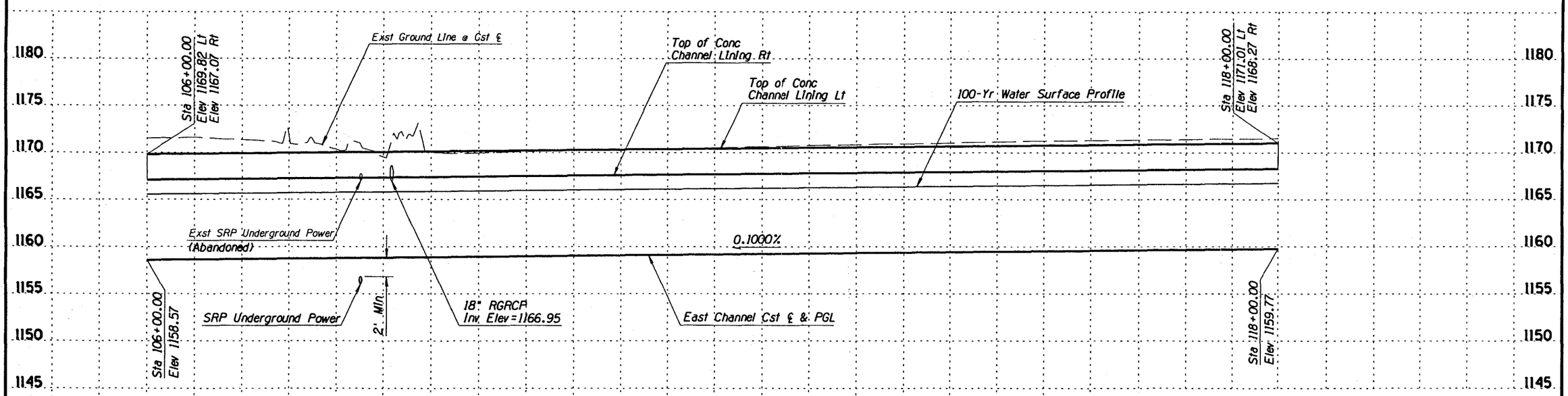
j:\sanc\prod\drn\scdpp13.dgn VIEW NAME:
05 AUG 1999

j:/sanc/prod/drn/scdpp13.dgn Aug. 05, 1999 11:22:35 DMJM Arizona, Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.13.
For Utility Relocations See Utility Sheets.



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 106+00 to 118+00

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.12

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

j:\sanc\prod\drn\scdpp14.dgn VIEW NAME:
05 AUG 1999

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

CONSTRUCTION DISPLAY ON

j:/sanc/prod/drn/scdpp14.dgn Aug. 05, 1999 11:23:02 DMJM Arizona,Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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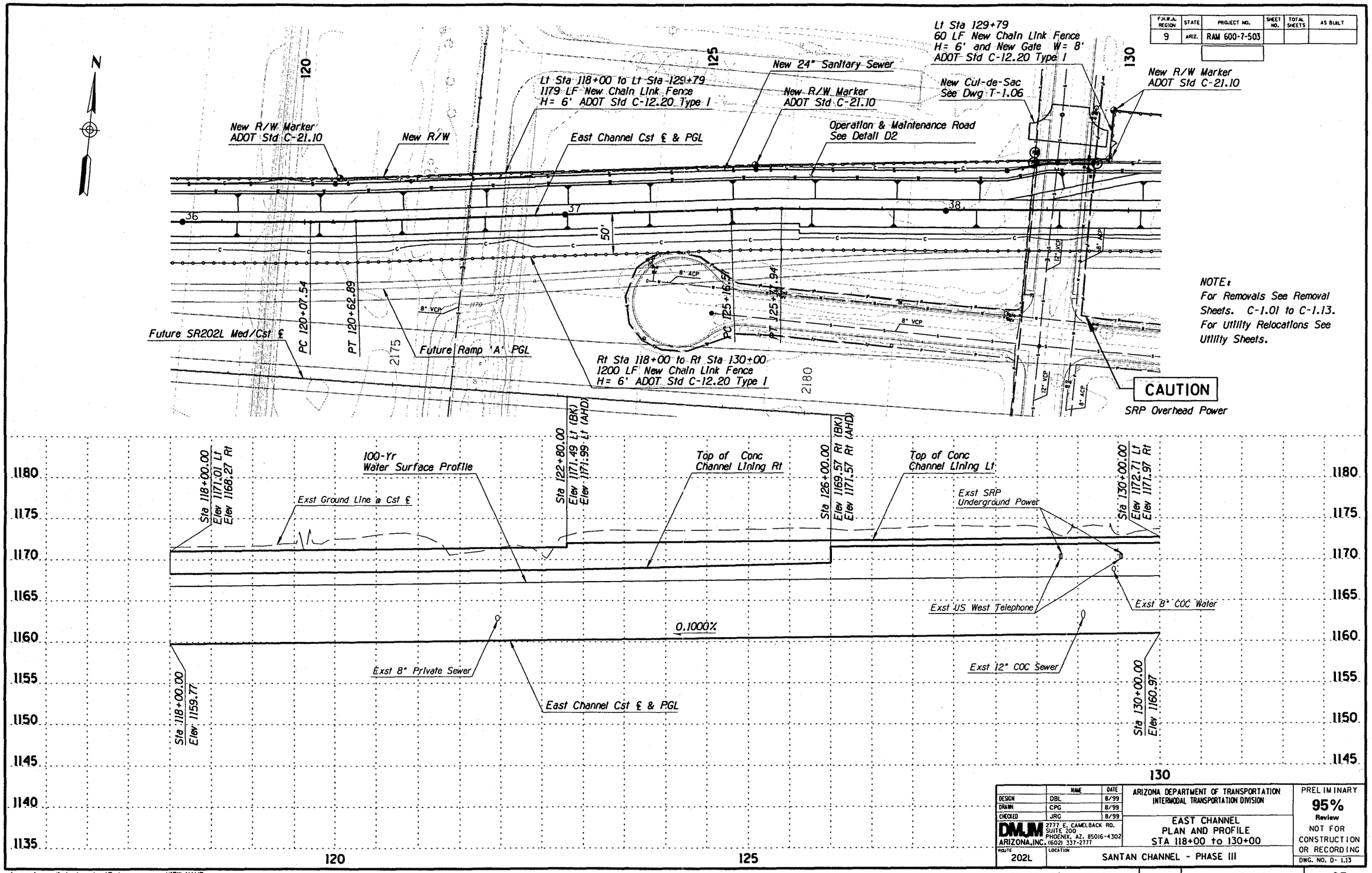


	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 118+00 to 130+00

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.13

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

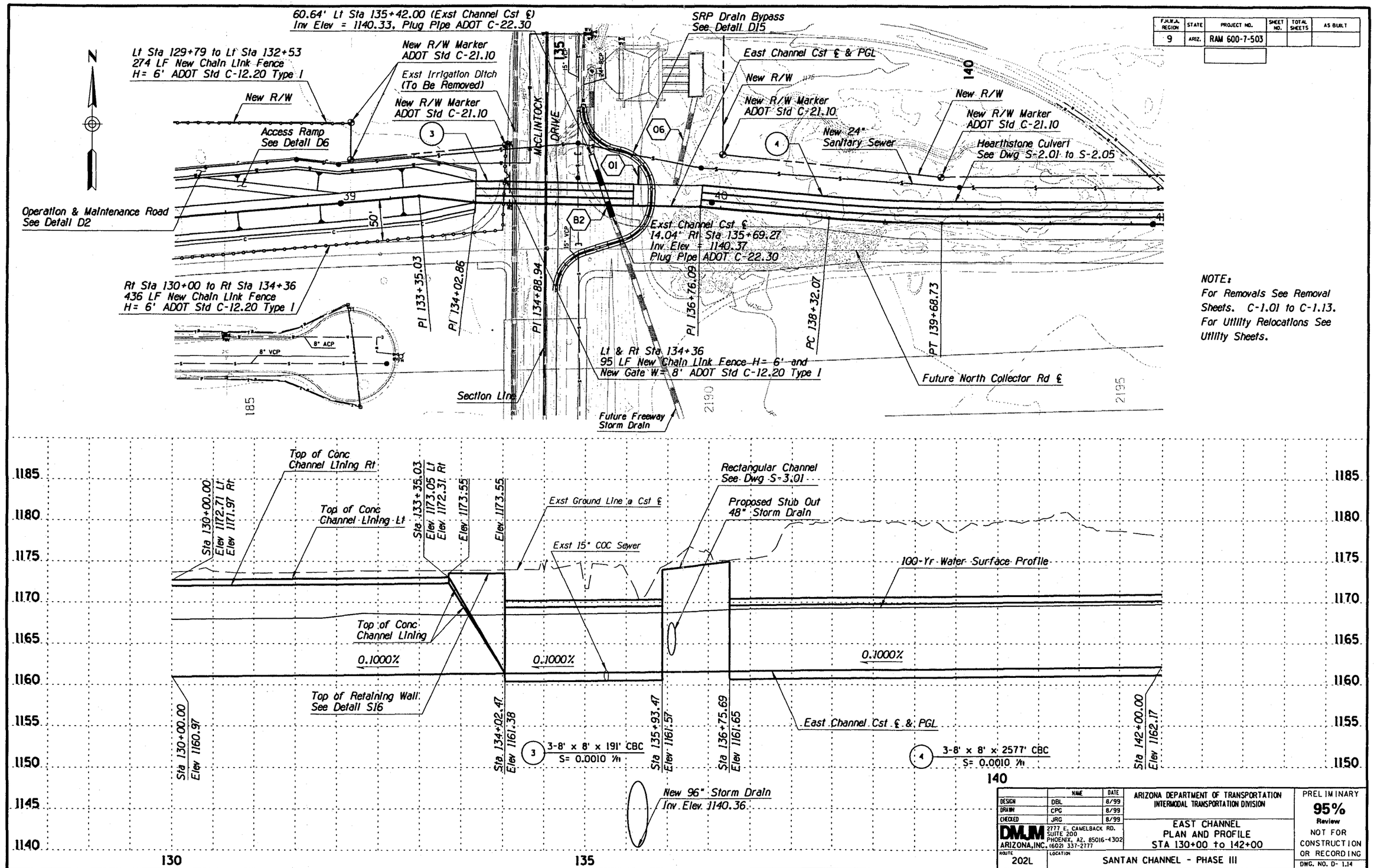
DATE	LOCATION	REVISIONS	FINISHED PLANS	SURVEY

j:\sanc\prod\drn\scdpp15.dgn
05 AUG 1999
VIEW NAME:

j:/sanc/prod/drn/scdpp15.dgn Aug. 05, 1999 11:23:48 DMJM Arizona,Inc.

CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.13.
For Utility Relocations See Utility Sheets.

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 130+00 to 142+00

ROUTE 202L LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.14

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

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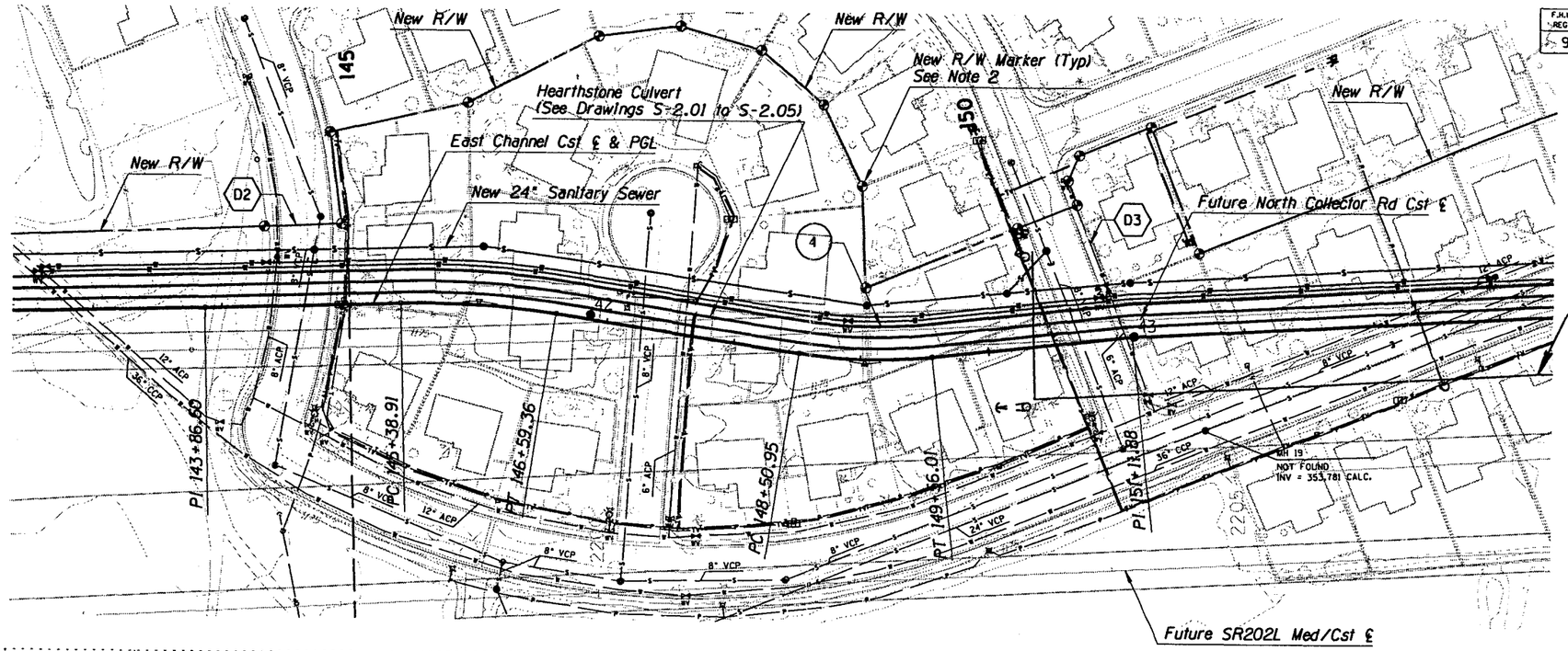
05 AUG 1999
VIEW NAME:

j:/sanc/prod/drn/scdpp16.dgn Aug. 05, 1999 11:24:14 DMJM Arizona,Inc.

CONSTRUCTION DISPLAY ON

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			

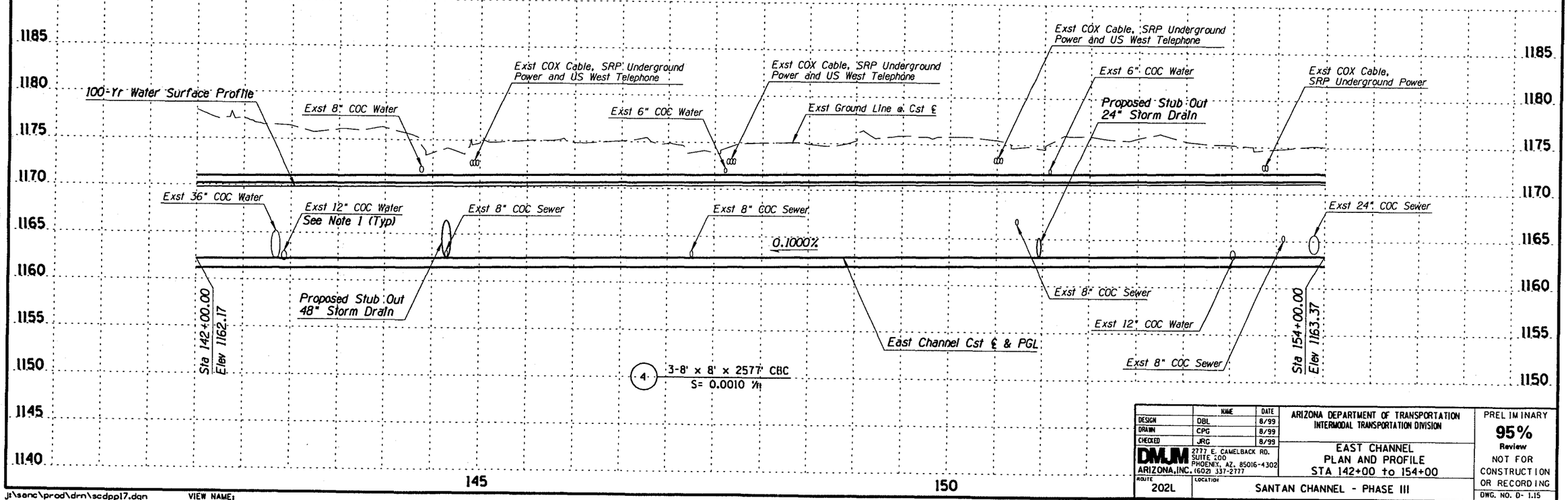


CAUTION

SRP Overhead Power

NOTE:

1. For Removals See Removal Sheets C-1.01 to C-1.13. For Utility Relocations See Utility Sheets.
2. Install 16 ea New R/W Markers per ADOT Std C-21.10.



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
STA 142+00 to 154+00

ROUTE 202L
LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.15

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

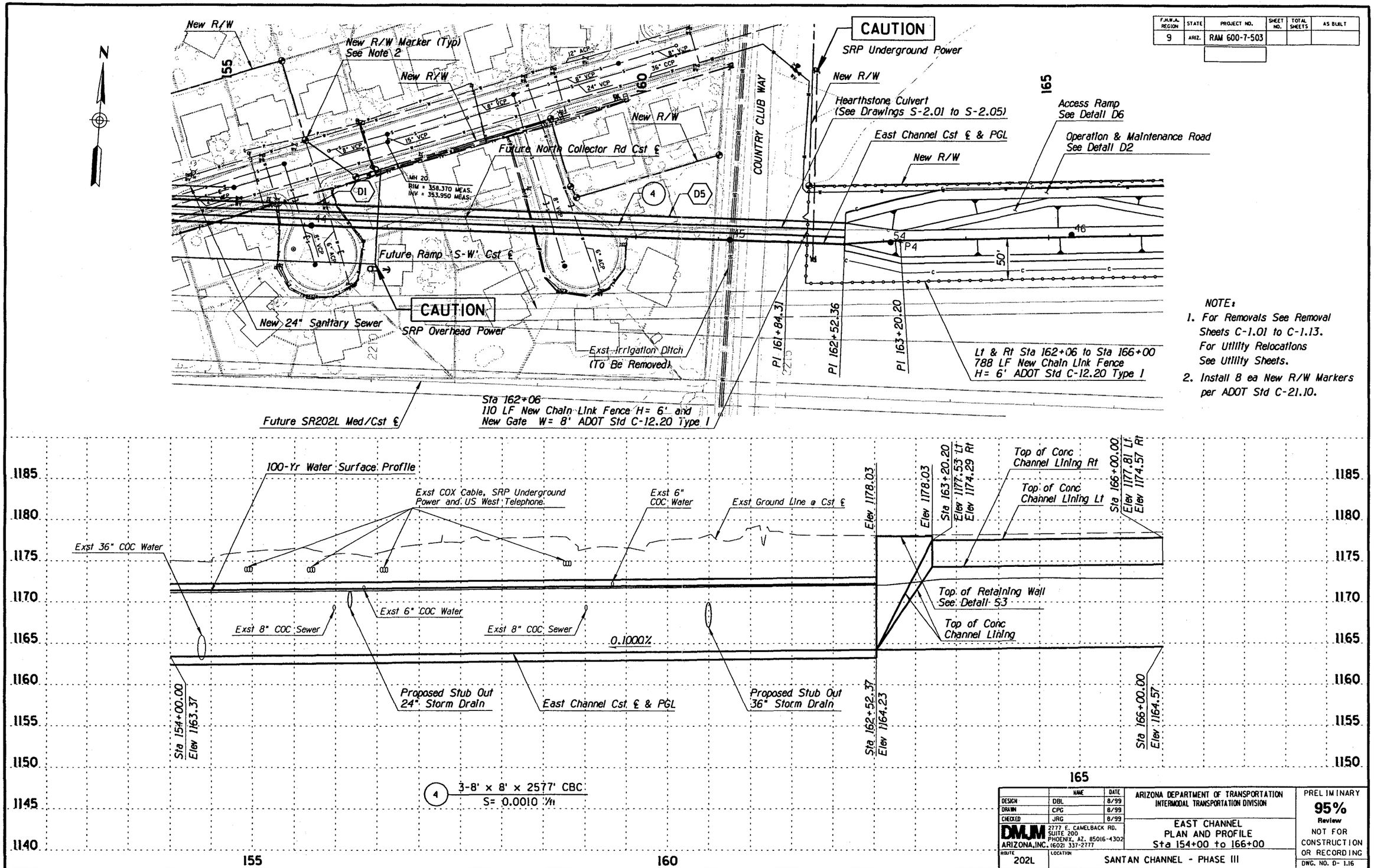
SURVEY | FINISHED PLANS | REVISIONS | LOCATION | DATE

CONSTRUCTION DISPLAY ON

j:\sanc\prod\drn\scdpp17.dgn VIEW NAME:
05 AUG 1999

j:/sanc/prod/drn/scdpp17.dgn Aug. 05, 1999 12:41:07 DMJM Arizona,Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
Sta 154+00 to 166+00

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.16

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

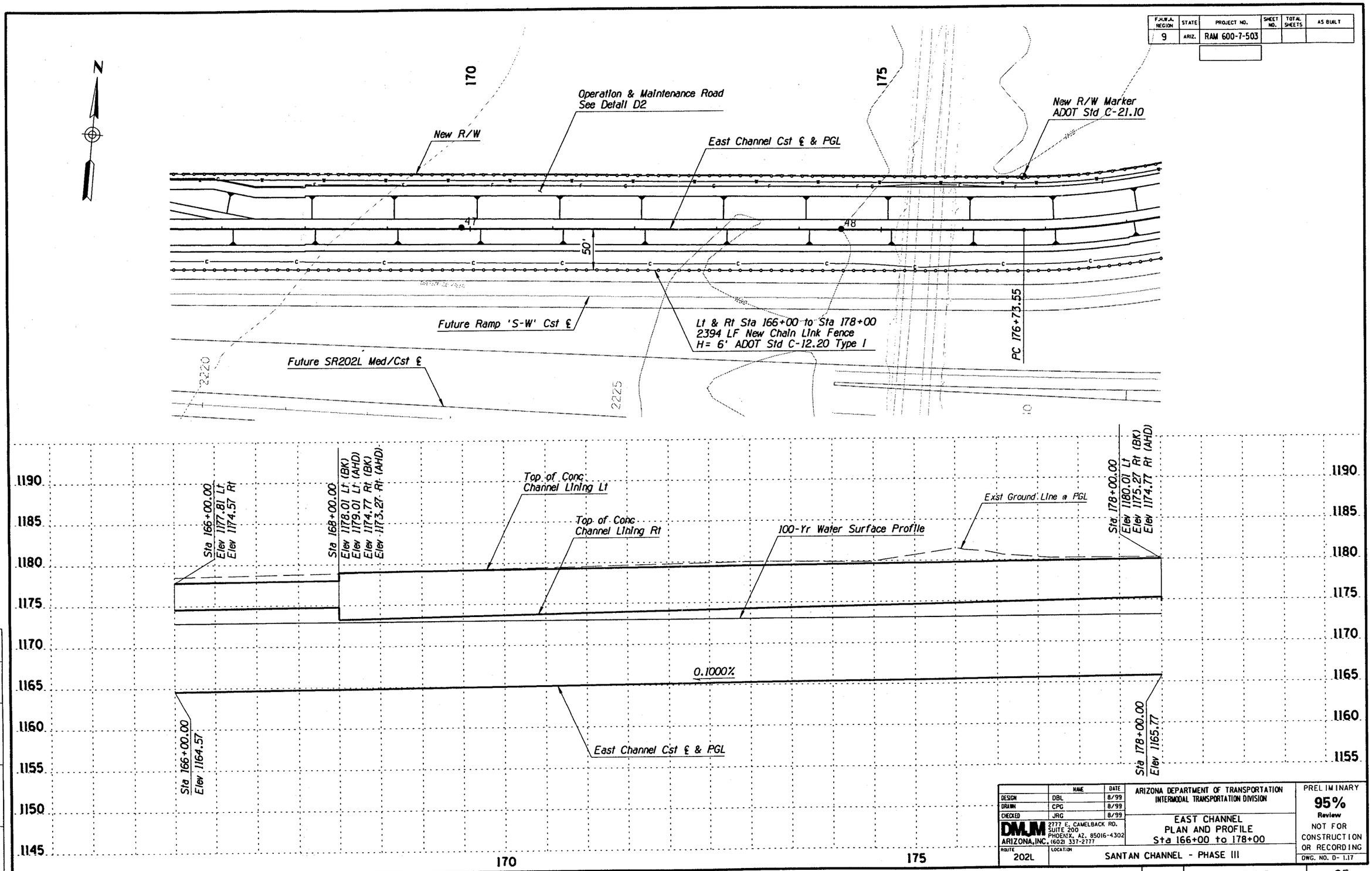
CONSTRUCTION DISPLAY ON

SURV	FINISHED PLANS	REVISIONS	LOCATION	DATE

j:\sanc\prod\drn\scdpp18.dgn
05 AUG 1999
VIEW NAME:

j:/sanc/prod/drn/scdpp18.dgn Aug. 05, 1999 12:48:52 DMJM Arizona,Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
Sta 166+00 to 178+00

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING
DWG. NO. D- 1.17

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

j:\sanc\prod\drn\scdpp19.dgn VIEW NAME:
05 AUG 1999

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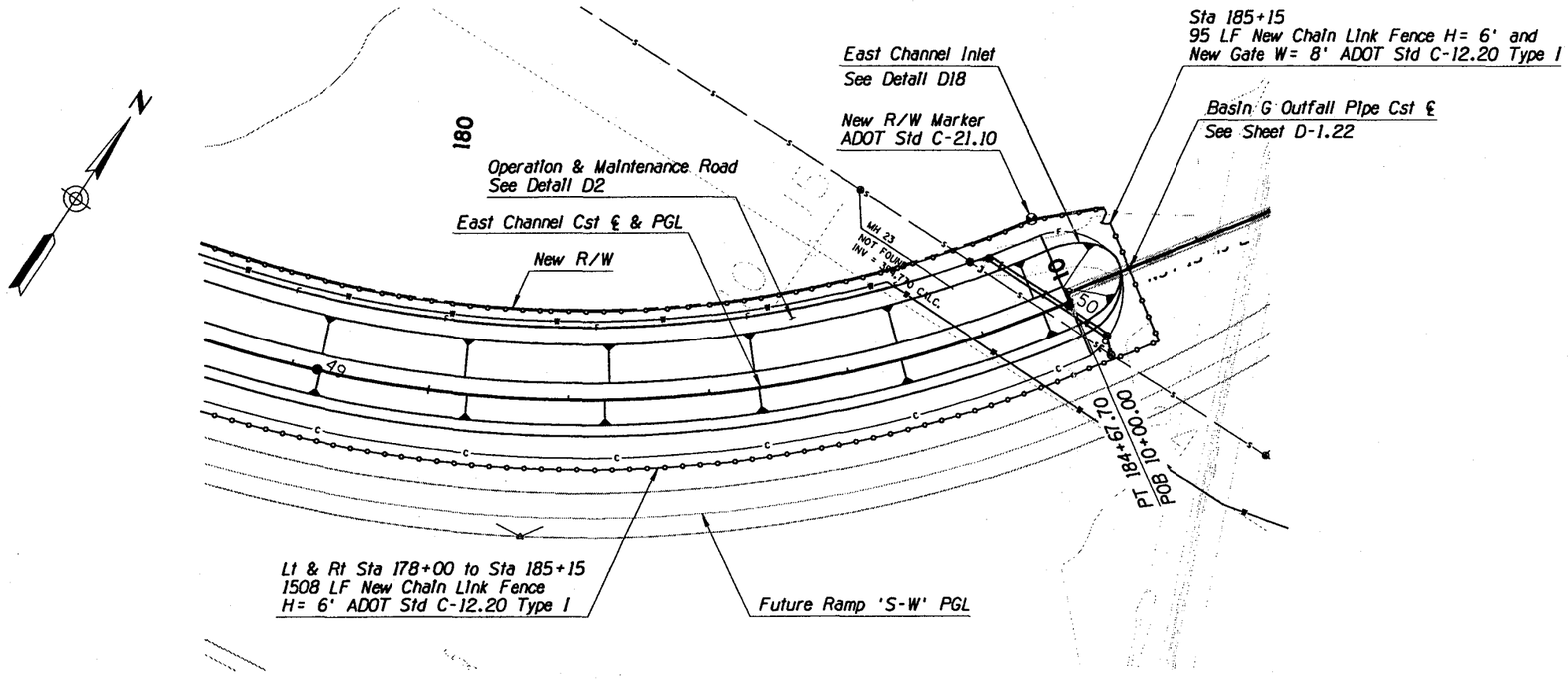
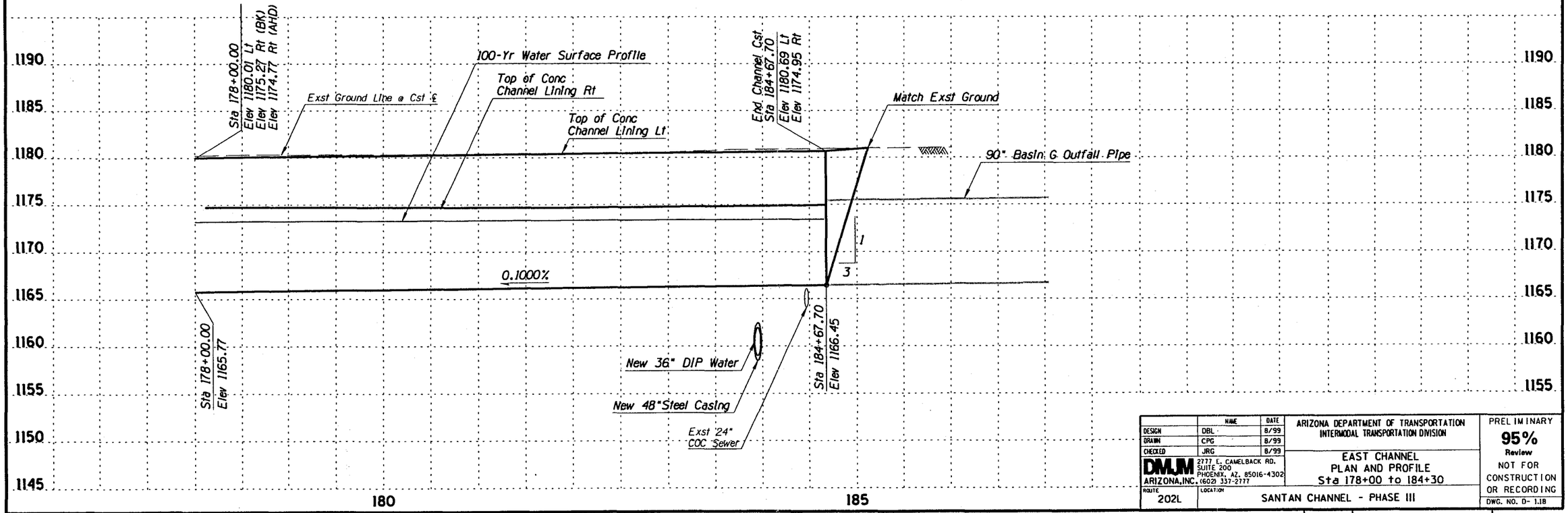
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



NOTE:
For Removals See Removal Sheets C-1.01 to C-1.13.
For Utility Relocations See Utility Sheets.



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

EAST CHANNEL
PLAN AND PROFILE
Sta 178+00 to 184+30

ROUTE: 202L
LOCATION: SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.18

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

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05 AUG 1999
VIEW NAME:

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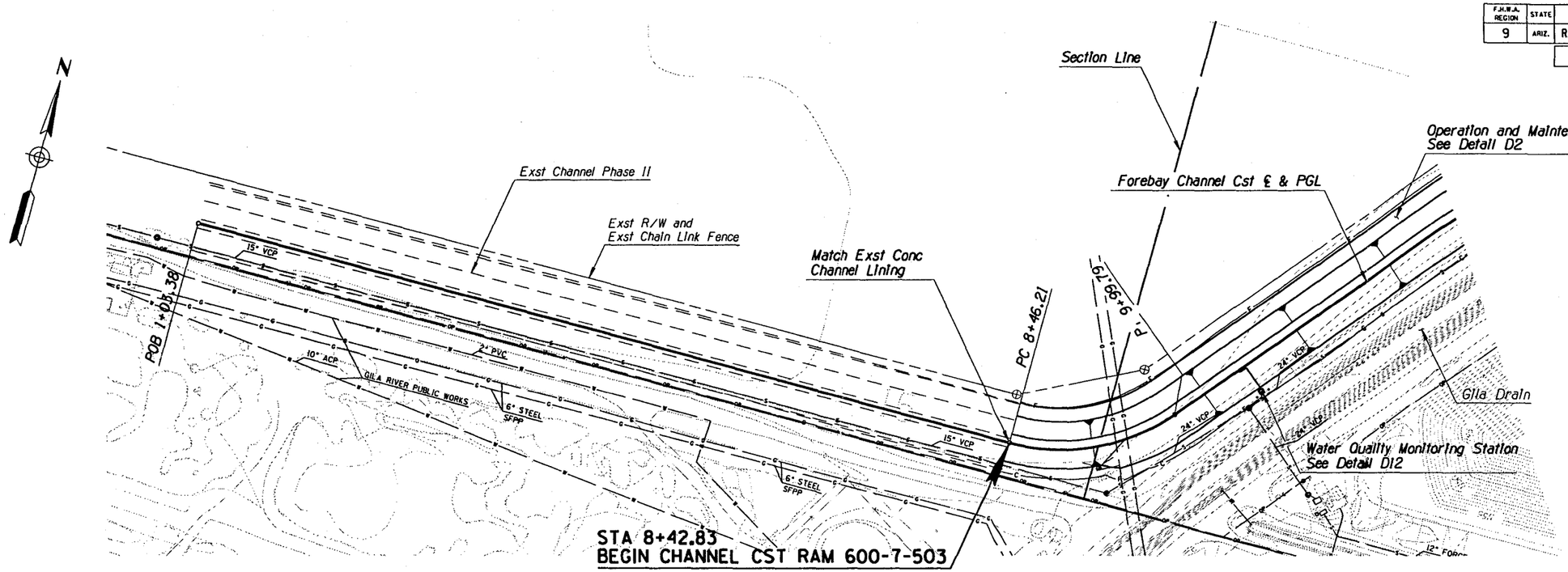
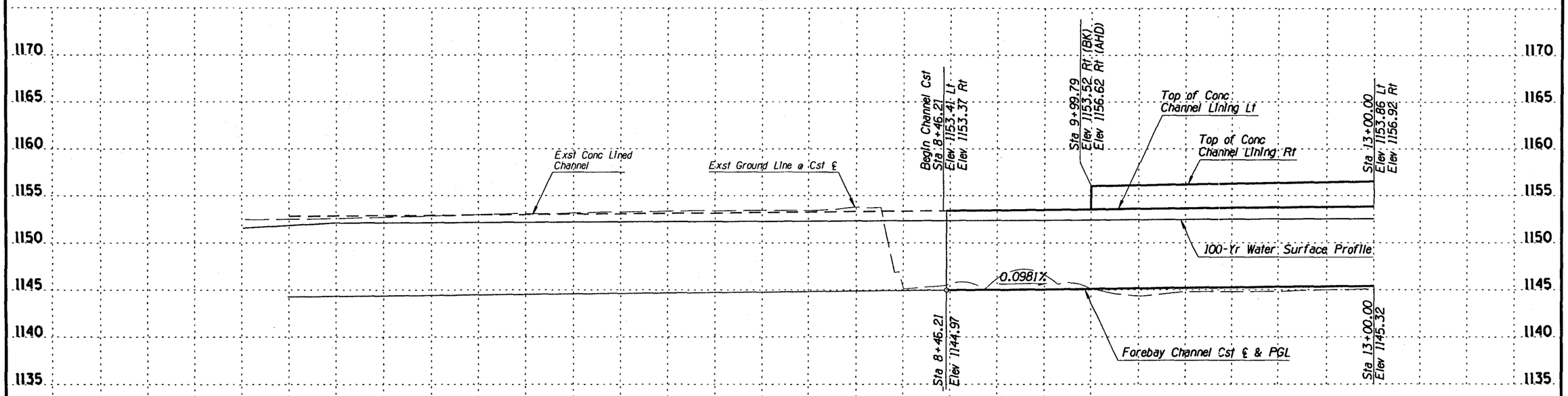
CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			





		NAME	DATE
DESIGN		DBL	8/99
DRAWN		CPG	8/99
CHECKED		JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

FOREBAY CHANNEL
PLAN & PROFILE
Sta 1+00 to Sta 13+00

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.19

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

SURVEY | FINISHED PLANS | REVISIONS | LOCATION | DATE

j:\sanc\prod\drn\scdpp23.dgn VIEW NAME:
04 AUG 1999

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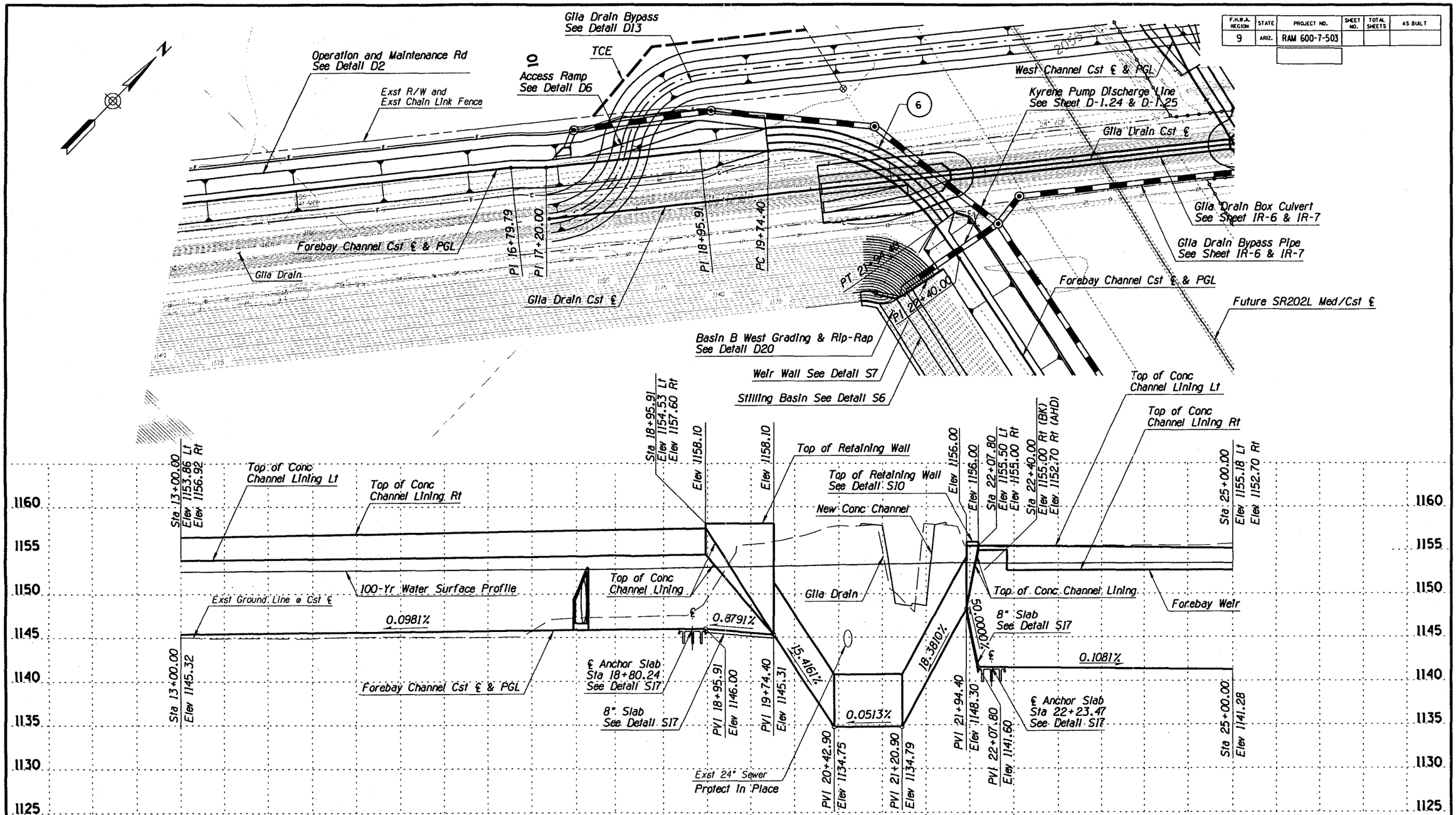
CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

FOREBAY CHANNEL
PLAN & PROFILE
Sta 13+00 to Sta 25+00

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

ROUTE 202L | LOCATION SANTAN CHANNEL - PHASE III | DWG. NO. D- 1.20

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

DATE | LOCATION | REVISIONS | FINISHED PLANS | SURVEY

CONSTRUCTION DISPLAY ON

j:\sanc\prod\drn\scdpp21.dgn VIEW NAME:
05 AUG 1999

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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
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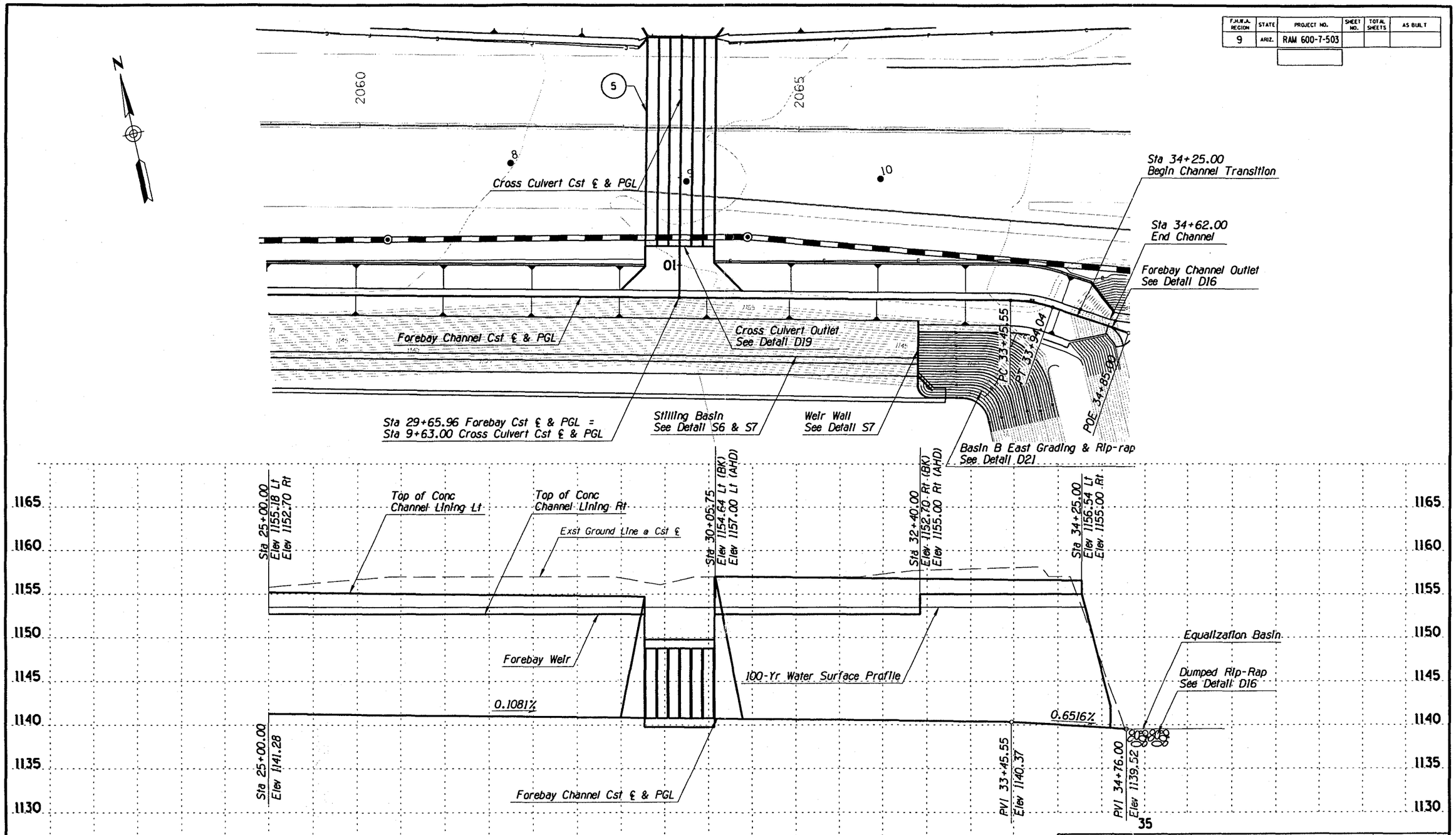

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

FOREBAY CHANNEL
PLAN & PROFILE
Sta 25+00 to Sta 34+76

ROUTE 202L LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.21

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY

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05 AUG 1999

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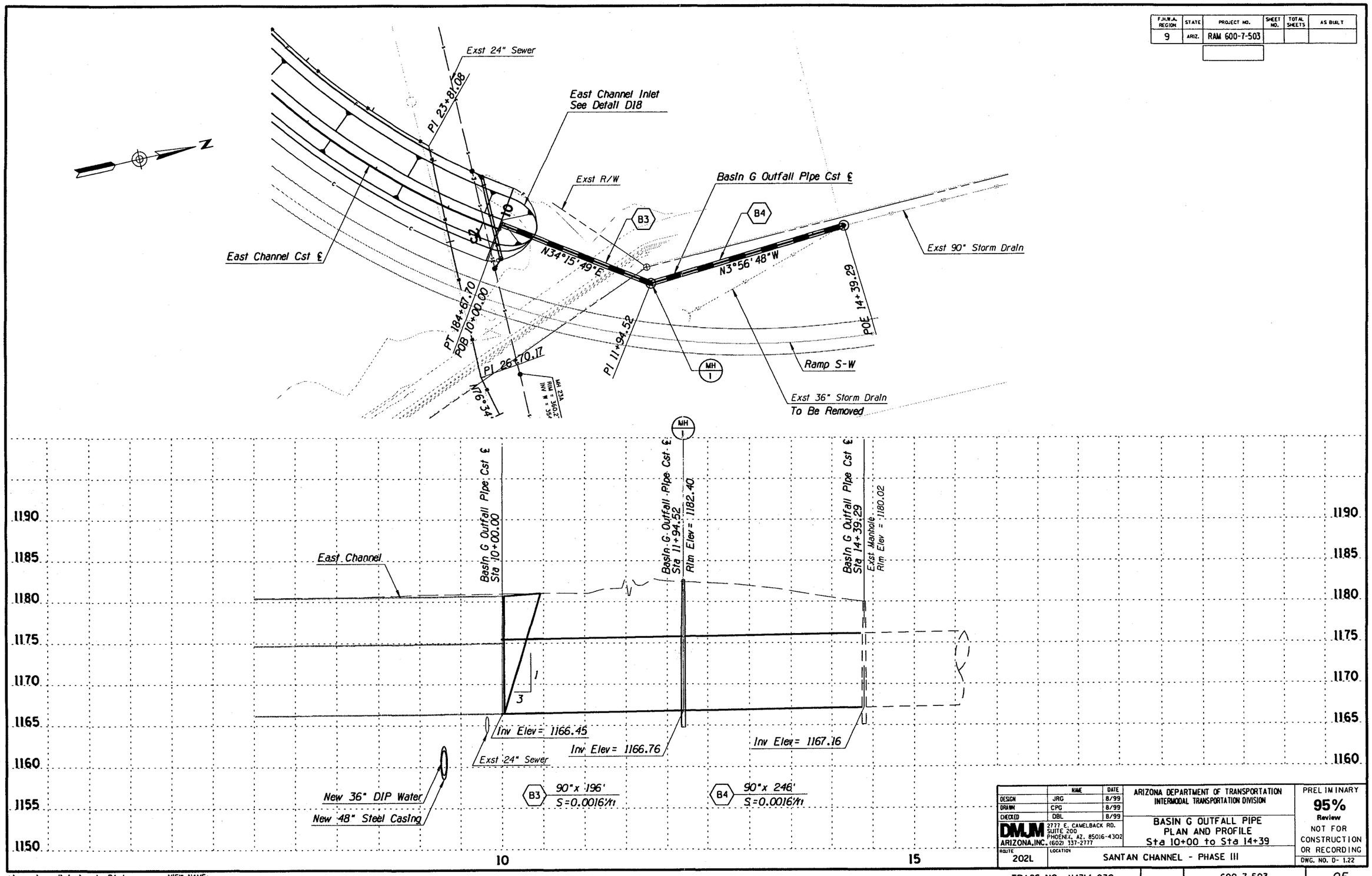
CONSTRUCTION DISPLAY ON

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	JRG	8/99
DRAWN	CPG	8/99
CHECKED	DBL	8/99

DMJM ARIZONA, INC.
2777 E. CAMELBACK RD.
SUITE 200
PHOENIX, AZ. 85016-4302
(602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

BASIN G OUTFALL PIPE
PLAN AND PROFILE
Sta 10+00 to Sta 14+39

ROUTE 202L
LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR
CONSTRUCTION
OR RECORDING
DWG. NO. D- 1.22

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

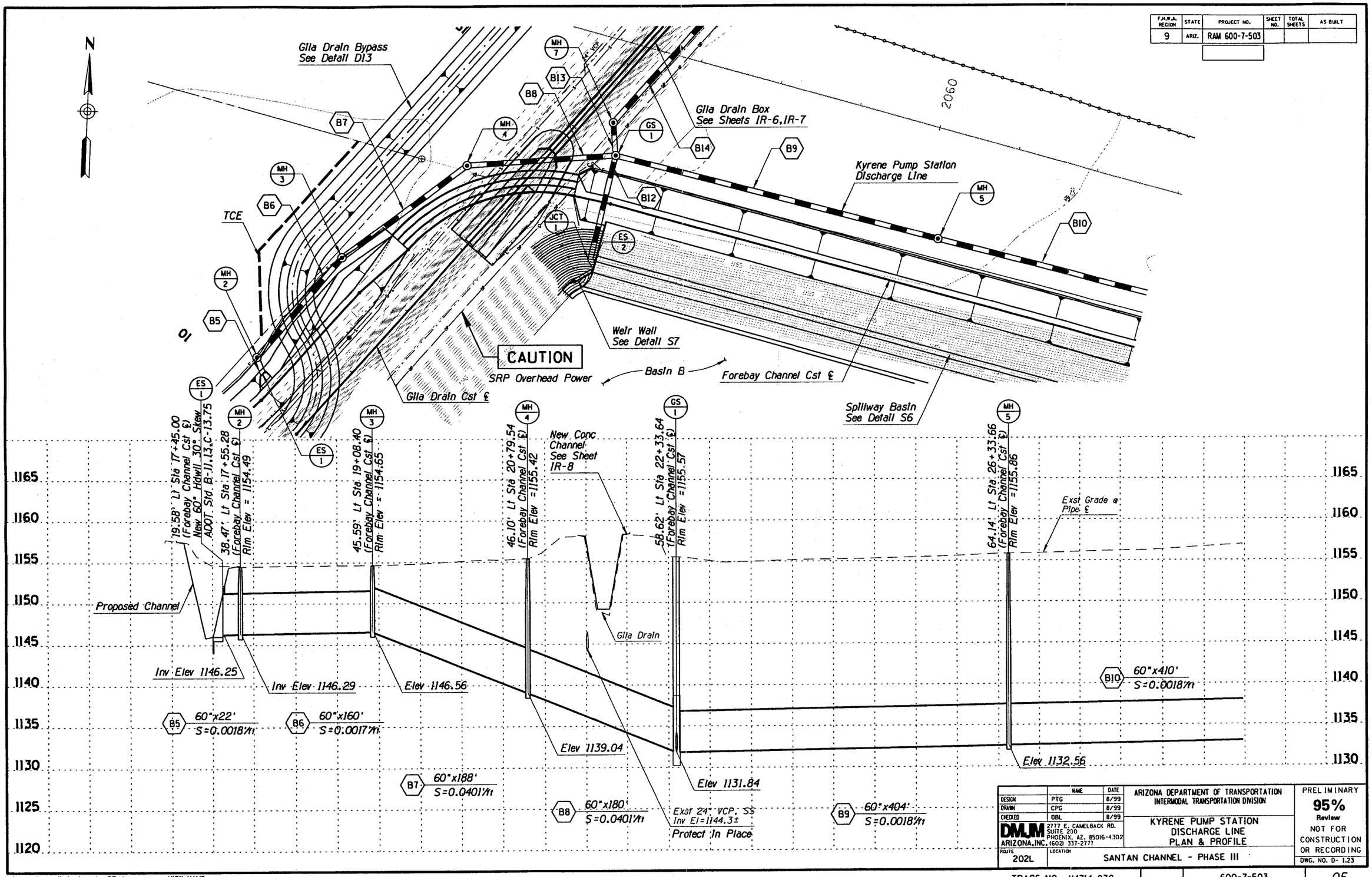
DATE	LOCATION	REVISIONS	FINISHED PLANS	SURVEY

CONSTRUCTION DISPLAY ON

j:\sanc\prod\drn\scdpp24.dgn VIEW NAME:
04 AUG 1999

j:/sanc/prod/drn/scdpp24.dgn Aug. 04, 1999 16:34:21 DMJM Arizona,Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	PTG	8/99
DRAWN	CPG	8/99
CHECKED	DBL	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

KYRENE PUMP STATION
DISCHARGE LINE
PLAN & PROFILE

ROUTE 202L

LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.23

TRACS NO. H4314 03C

600-7-503

___ OF ___

CONSTRUCTION DISPLAY ON

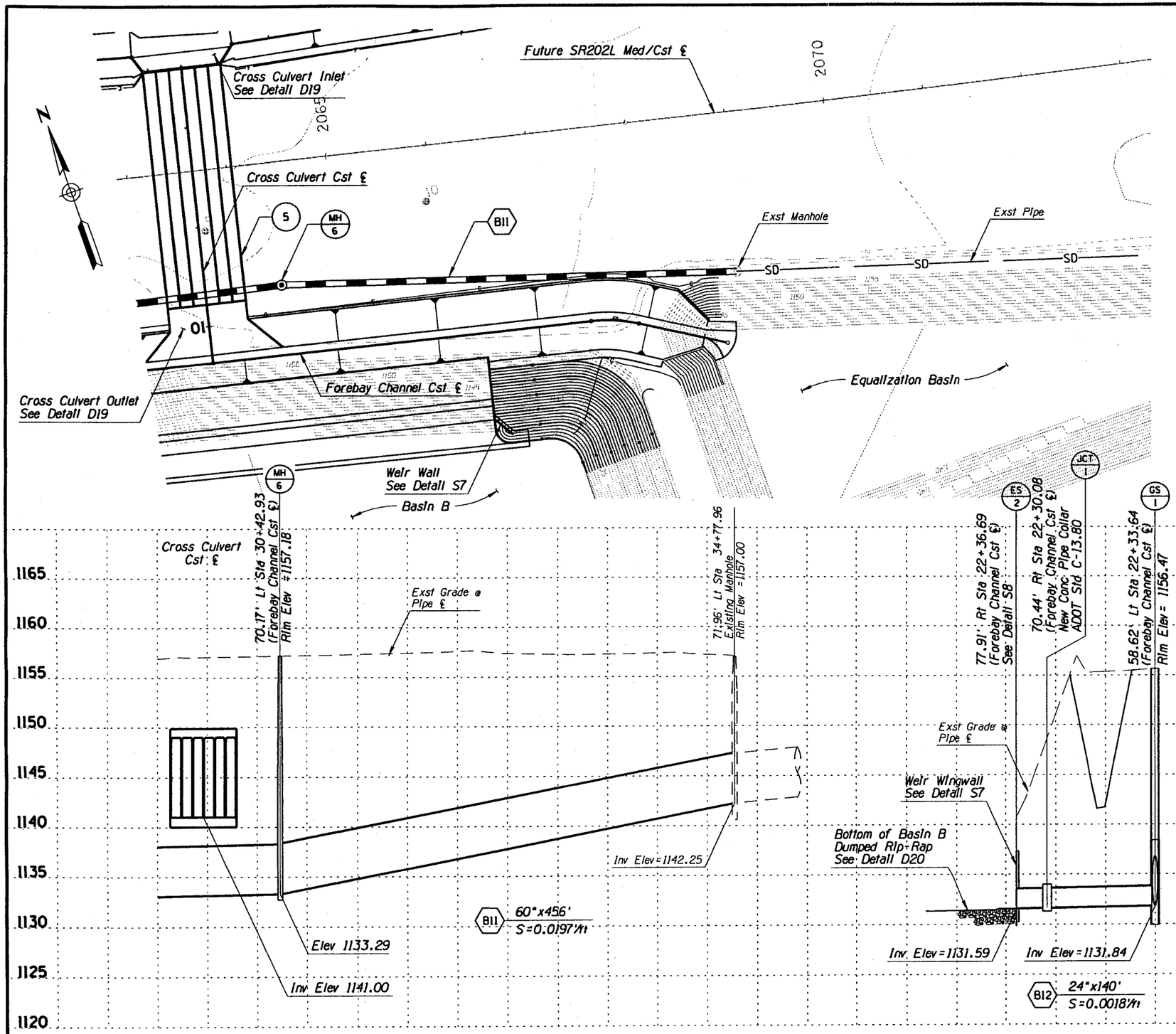
FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY

j:\sanc\prod\drn\scdpp25.dgn
05 AUG 1999

VIEW NAME:

sanc/prod/drn/scdpp25.dgn Aug. 05, 1999 10:19:30 DMJM Arizona, Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	PTG	8/99
DRAWN	CPG	8/99
CHECKED	DBL	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

KYRENE PUMP STATION
DISCHARGE LINE
PLAN & PROFILE

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. D- 1.24

TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

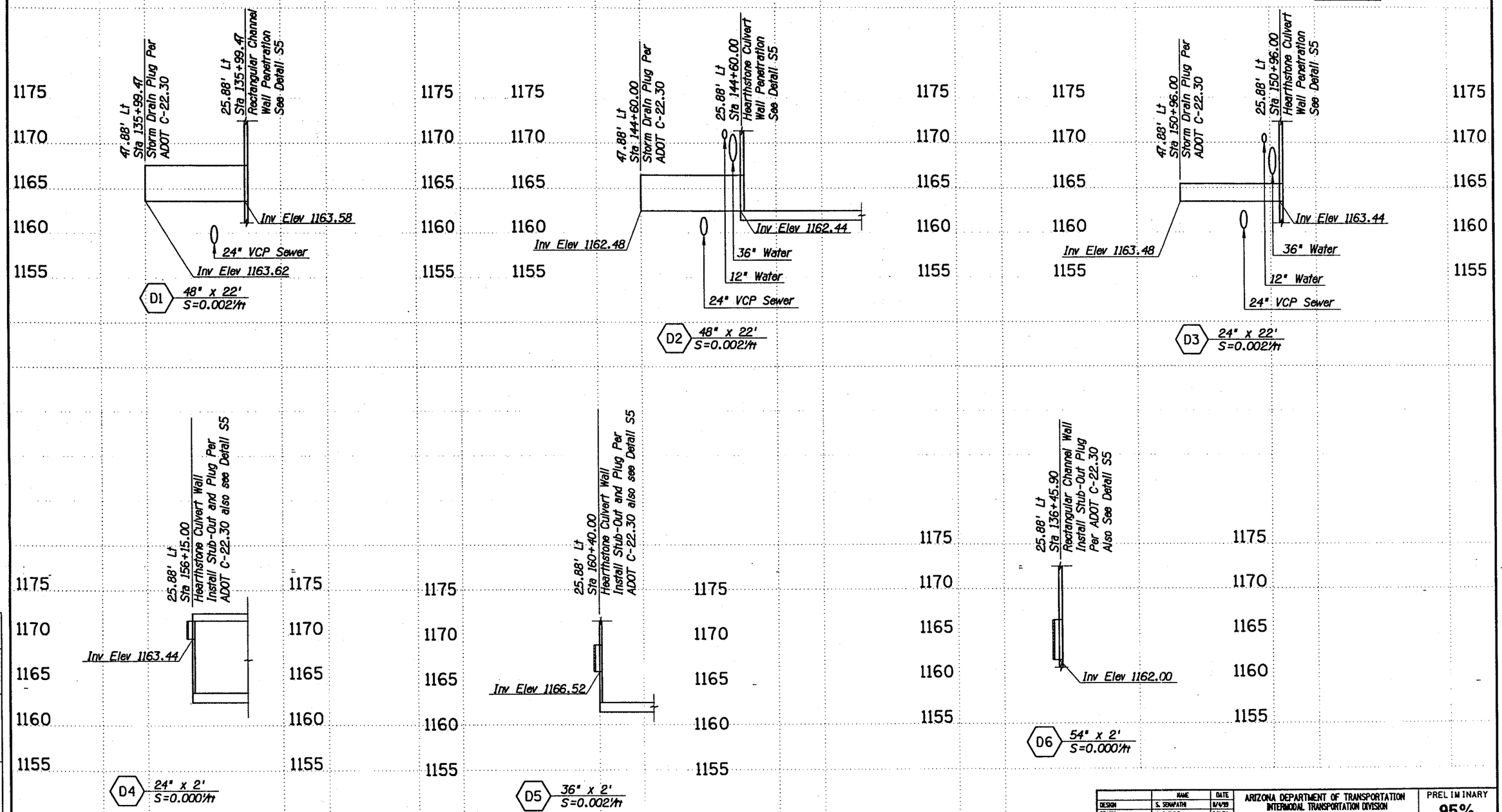
SURV	FINISHED PLANS	REVISIONS	LOCATION	DATE

CONSTRUCTION DISPLAY ON

j:\sanc\prod\drn\scdpp26.dgn VIEW NAME:
04 AUG 1999

j:/sanc/prod/drn/scdpp26.dgn Aug. 04, 1999 14:42:16 DMJM Arizona, Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	S. SOWAPATH	8/4/99
DRAWN	J. CHILILE	8/4/99
CHECKED	F. JALAGH	8/4/99

PREMIER

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STORM DRAIN PROFILES

ROUTE 202L

LOCATION SANTAN CHANNEL-PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

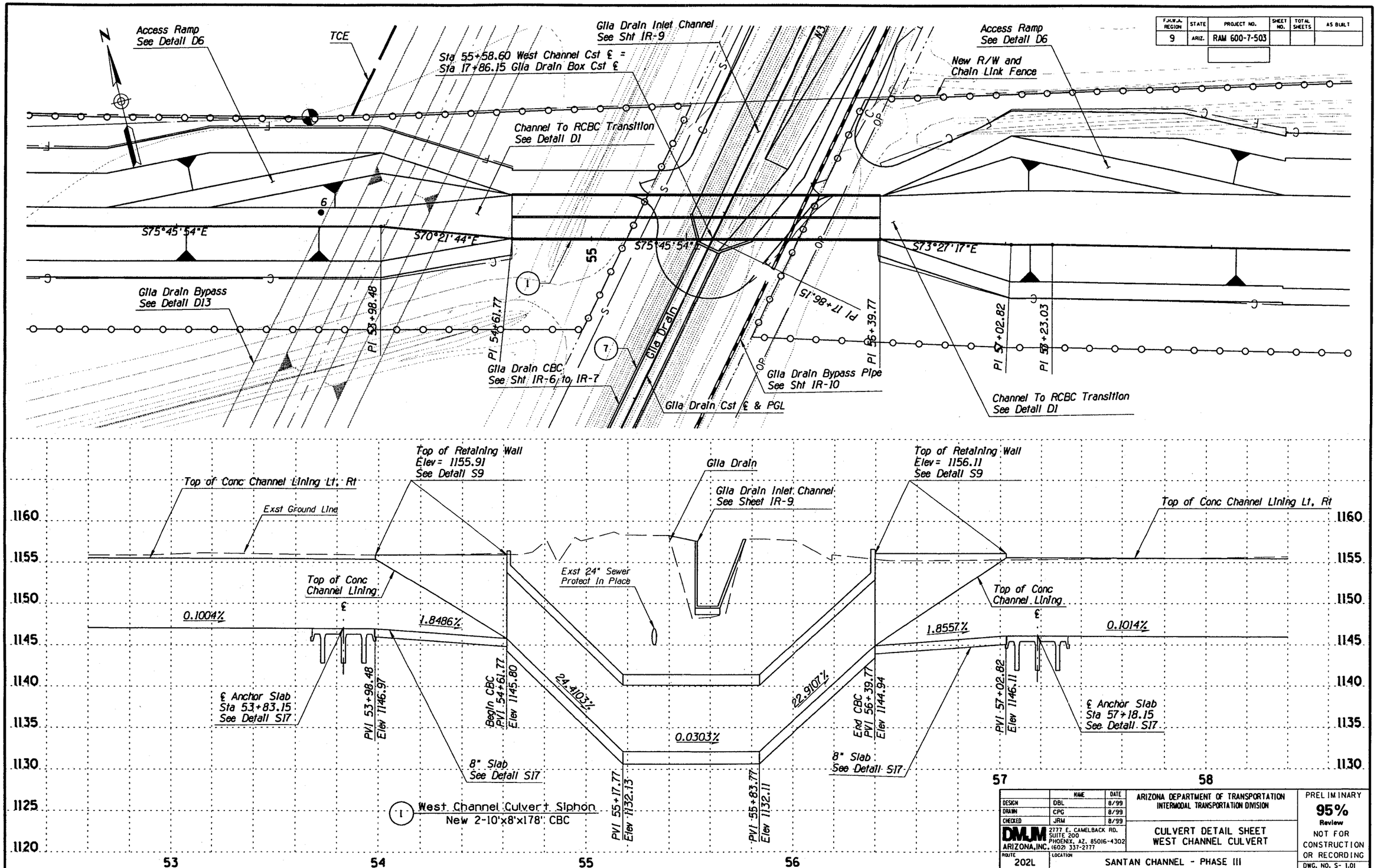
Dwg No. D-L.25

TRACS NO. H 4314 03D | 600-7-503 | ___ OF ___

DATE | LOCATION | REVISIONS | FINISHED PLANS | SURVEY FILE

s:\9503.9\cadd\profile_1.dgn
Plotted By: MGR 04 AUG 99 15:56:07

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRM	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

CULVERT DETAIL SHEET
WEST CHANNEL CULVERT

ROUTE 202L

LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. S- 1.01

TRACS NO. H4314 03C

600-7-503

___ OF ___

CONSTRUCTION DISPLAY ON

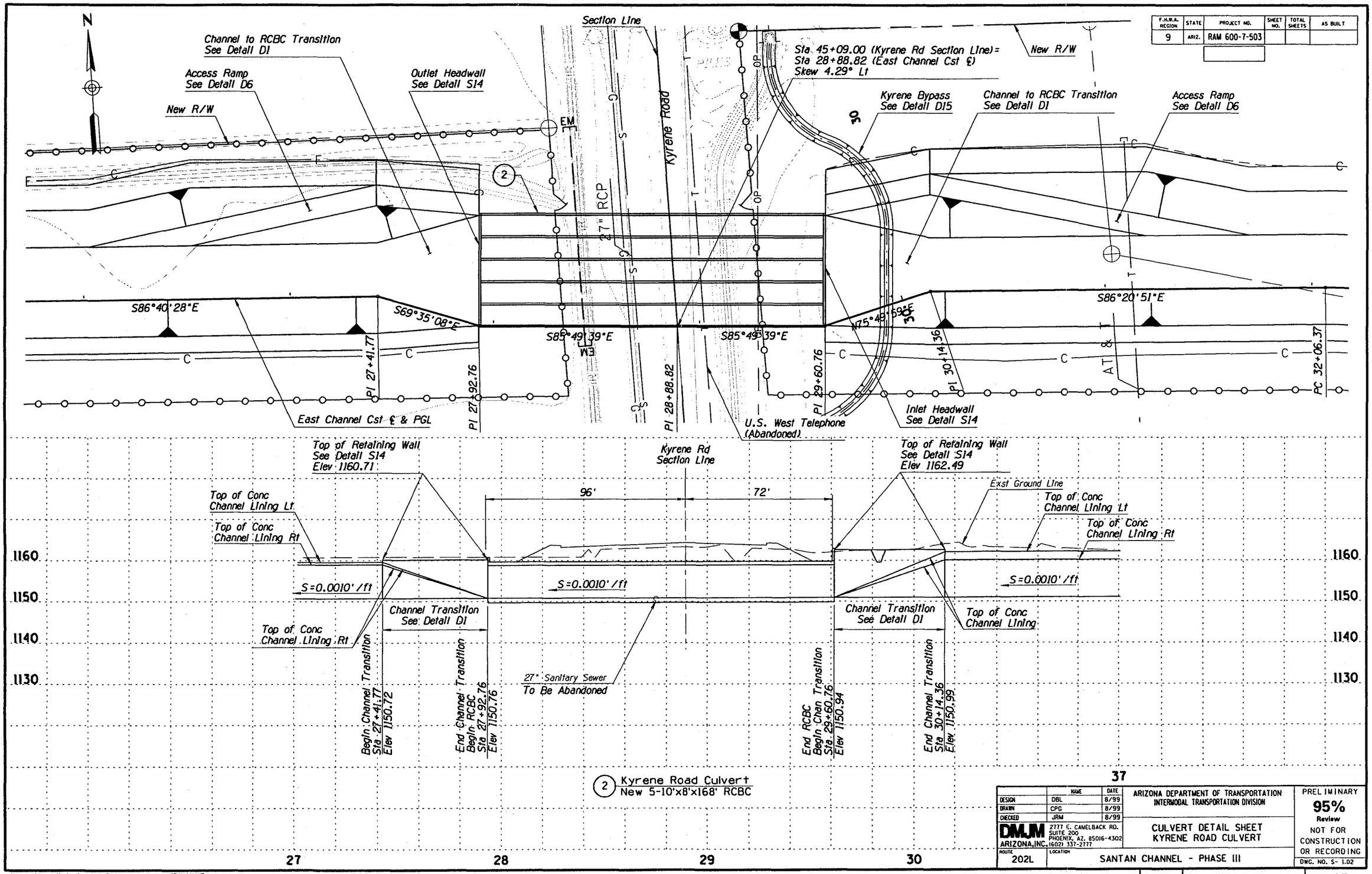
DATE	LOCATION	REVISIONS	FINISHED PLANS	SURVEY

jt\sanc\prod\drn\scddt6.dgn
05 AUG 1999

VIEW NAME:

j:/sanc/prod/drn/scddt6.dgn Aug. 05, 1999 10:56:05 DMJM Arizona, Inc.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RAM 600-7-503			



(2) Kyrene Road Culvert
New 5-10'x8'x168' RCBC

37

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRM	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

CULVERT DETAIL SHEET
KYRENE ROAD CULVERT

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. S- 1.02

TRACS NO. H4314 03D — 600-7-503 — ___ OF ___

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

CONSTRUCTION DISPLAY ON

j:\sanc\prod\drn\scddt2.dgn VIEW NAME:
04 AUG 1999

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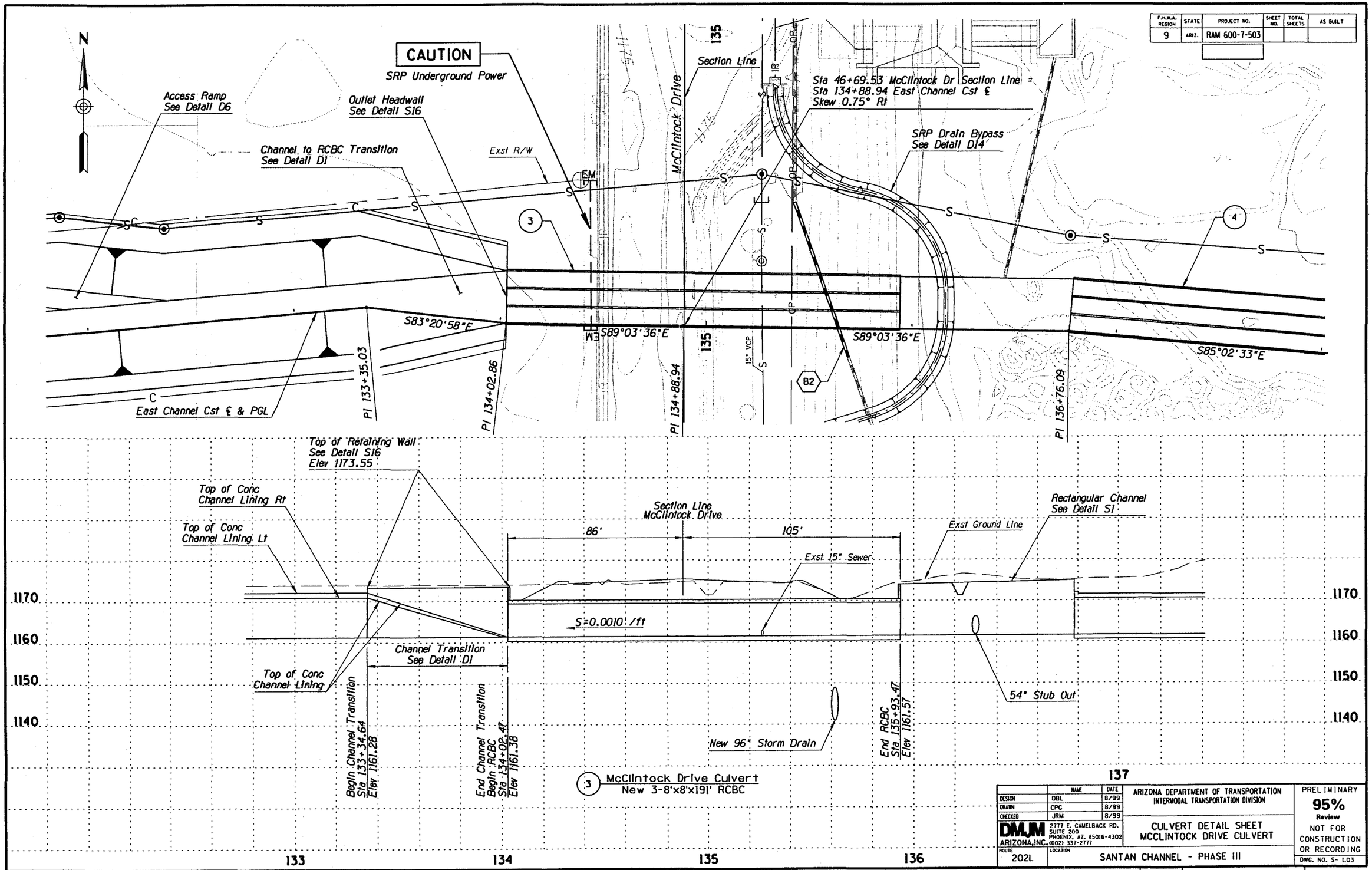

3 McClintock Drive Culvert
New 3-8'x8'x191' RCBC

	NAME	DATE
DESIGN	DBL	8/99
DRAWN	CPG	8/99
CHECKED	JRM	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

CULVERT DETAIL SHEET
MCCLINTOCK DRIVE CULVERT

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. S- 1.03

TRACS NO. H4314 03D | 600-7-503 | ___ OF ___

FINISHED PLANS | REVISIONS | LOCATION | DATE | SURVEY

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04 AUG 1999

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CONSTRUCTION DISPLAY ON

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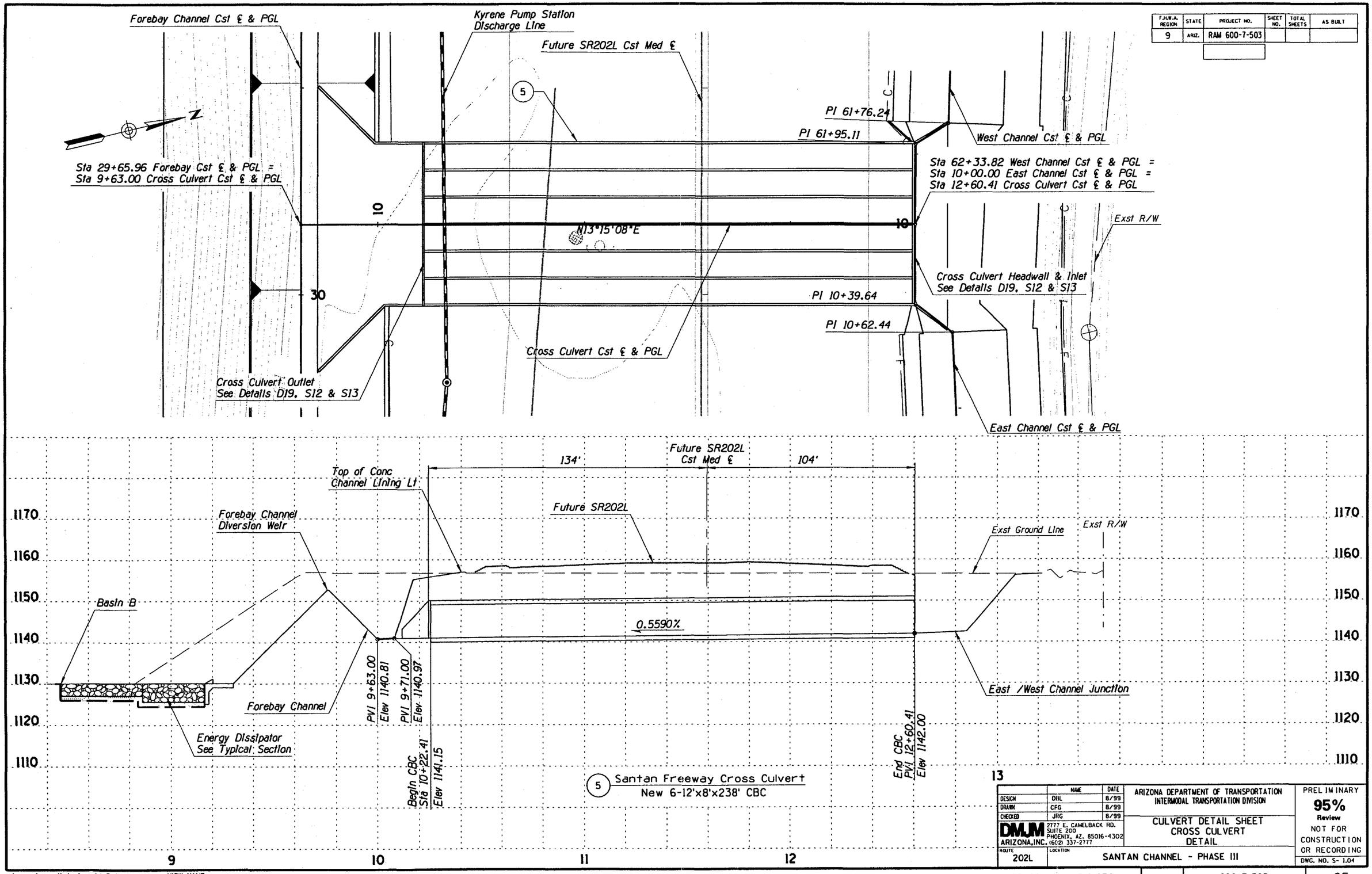

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DRAWN	CFG	8/99
CHECKED	JRG	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

CULVERT DETAIL SHEET
CROSS CULVERT
DETAIL

ROUTE 202L — LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. S- 1.04

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

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03 AUG 1999
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TRACS NO. H4314 03C | 600-7-503 | ___ OF ___

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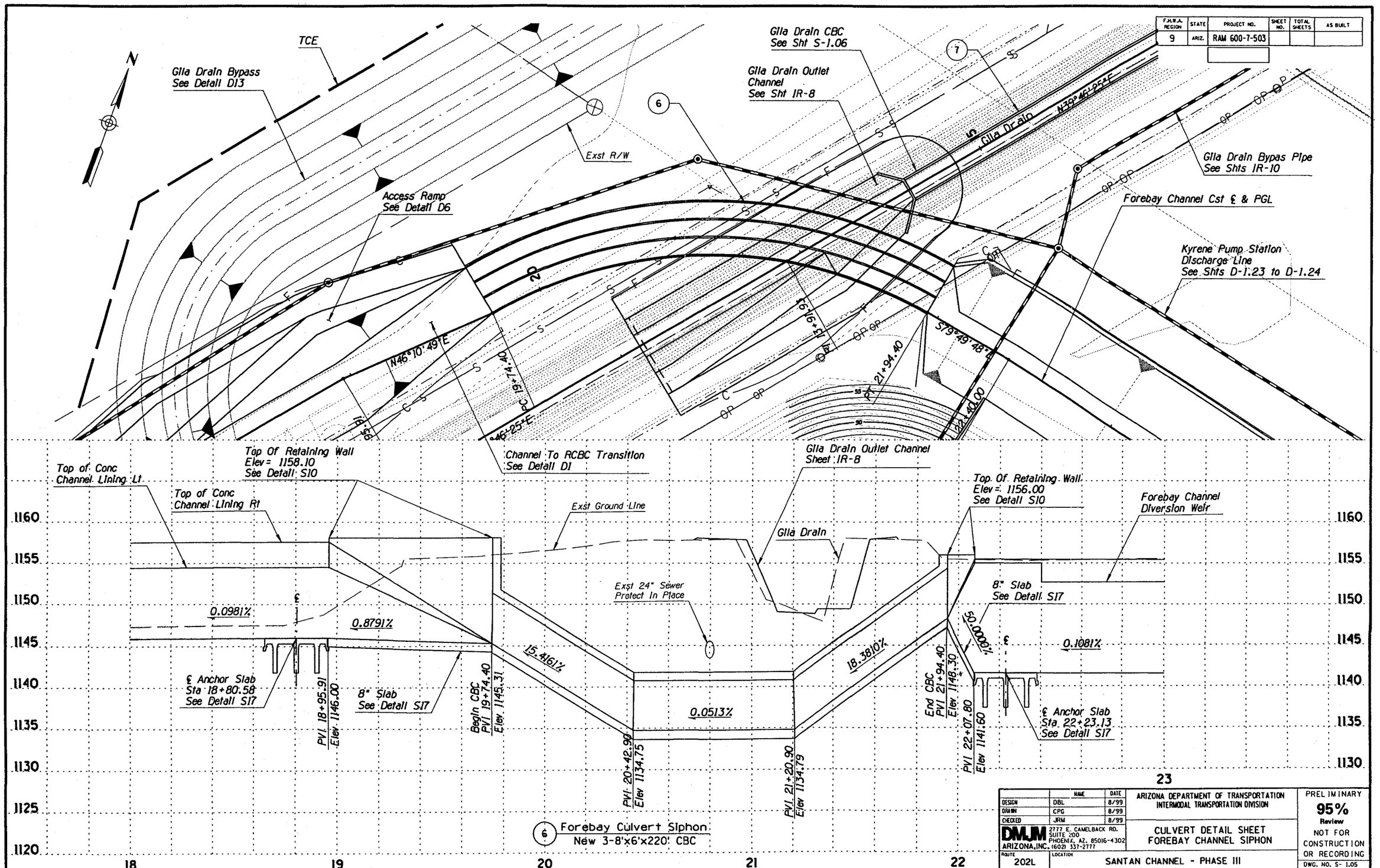

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CHECKED	JRM	8/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

CULVERT DETAIL SHEET
FOREBAY CHANNEL SIPHON

ROUTE 202L

LOCATION SANTAN CHANNEL - PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. S- 1.05

TRACS NO. H4314 03C

600-7-503

___ OF ___

CONSTRUCTION DISPLAY ON

DATE | LOCATION | REVISIONS | FINISHED PLANS | SURVEY

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04 AUG 1999

VIEW NAME:

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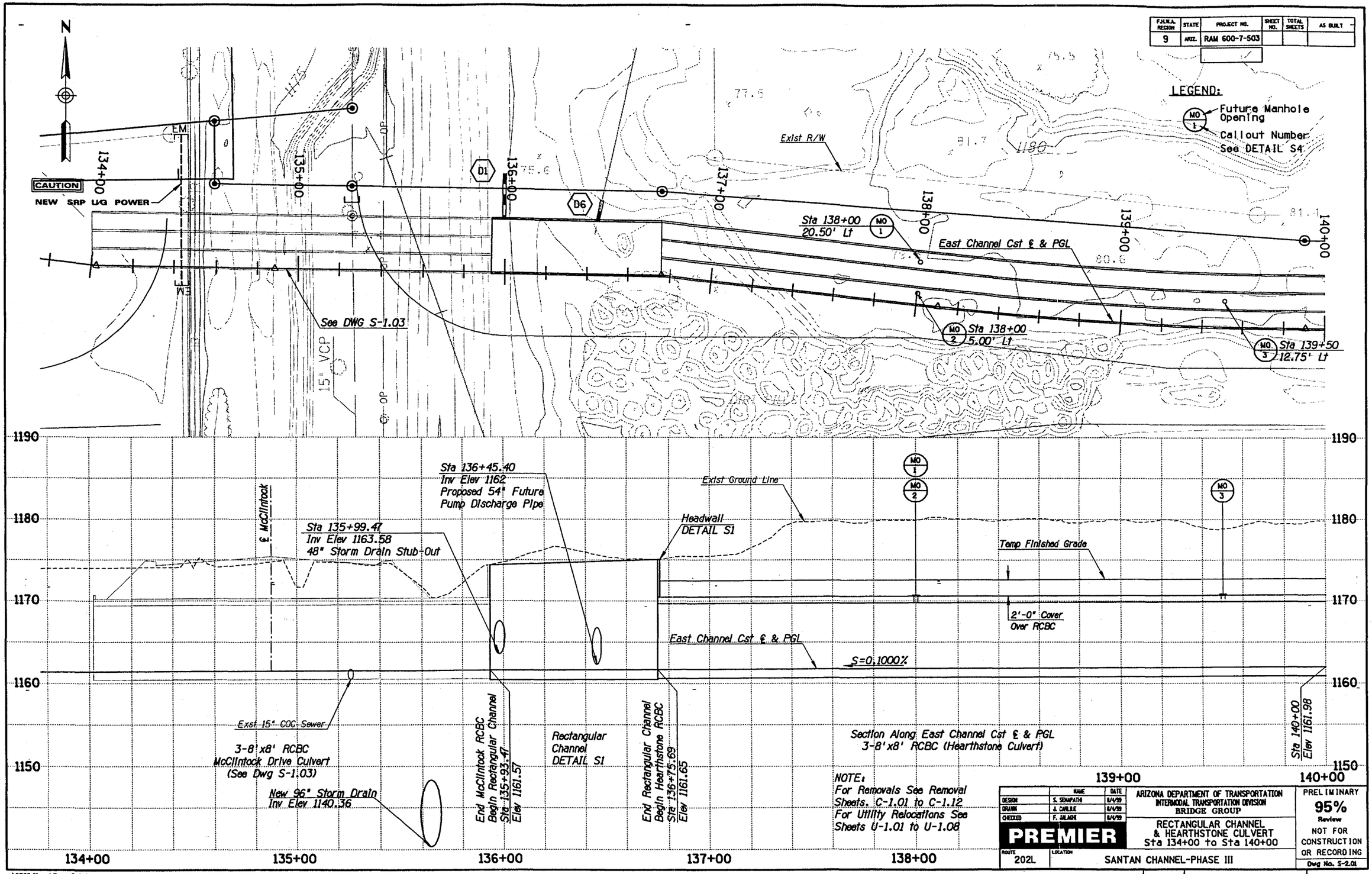

NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.12
For Utility Relocations See Sheets U-1.01 to U-1.08

	NAME	DATE
DESIGN	S. SENAPATHI	8/4/99
DRAWN	J. CARLILE	8/4/99
CHECKED	F. JALAGH	8/4/99

PREMIER

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

RECTANGULAR CHANNEL
& HEARTHSTONE CULVERT
Sta 134+00 to Sta 140+00

ROUTE 202L — LOCATION SANTAN CHANNEL-PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

Dwg No. S-2.01

TRACS NO. H 4314 03D | 600-7-503 | ___ OF ___

DESIGNED	FINAL PLANS	REVISIONS	LOCATION	DATE

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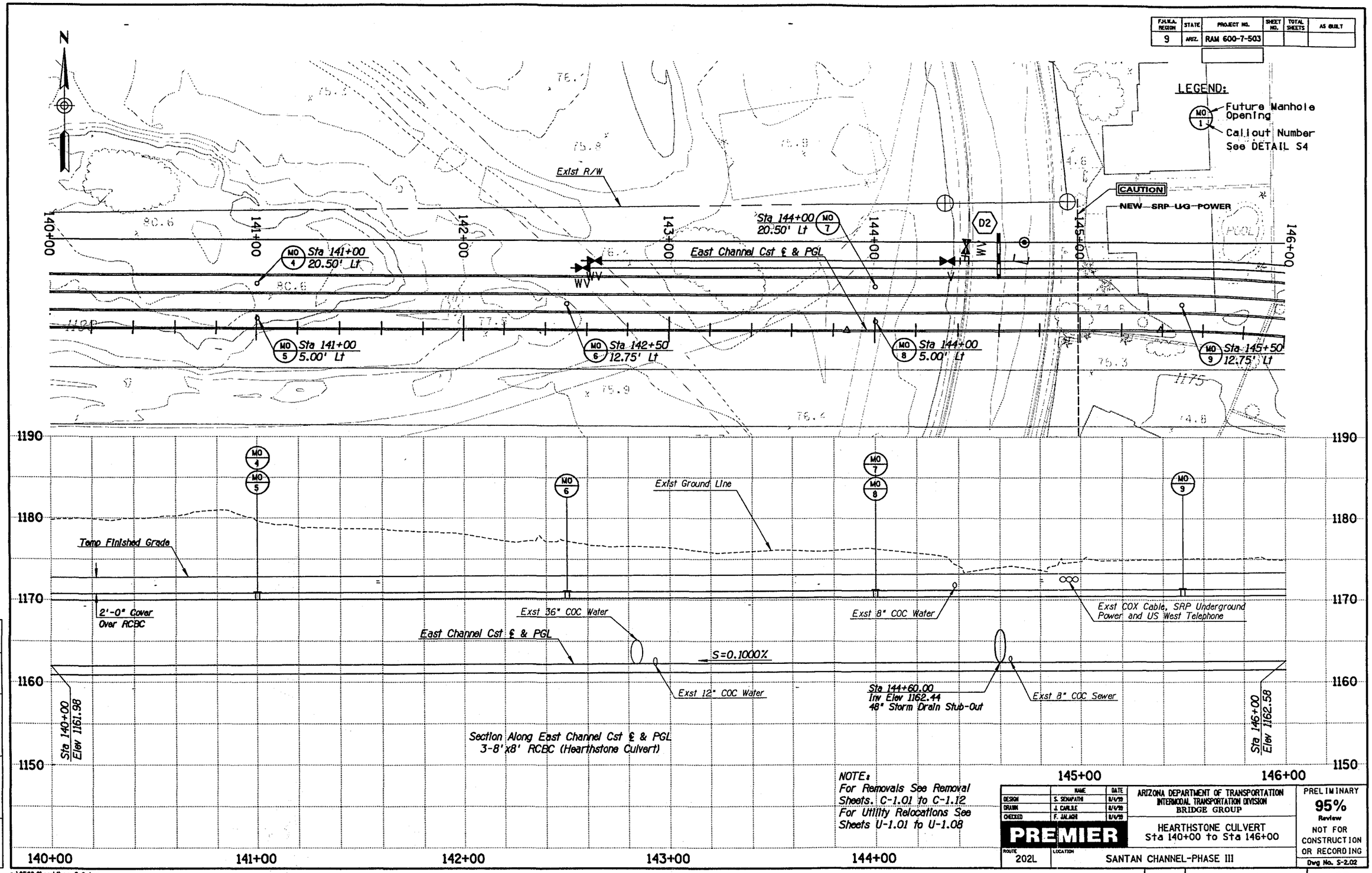

NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.12
For Utility Relocations See Sheets U-1.01 to U-1.08

	NAME	DATE
DESIGN	S. SENAPATHI	8/4/99
DRAWN	J. CARLILE	8/4/99
CHECKED	F. JALAGHI	8/4/99

PREMIER

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

HEARTHSTONE CULVERT
Sta 140+00 to Sta 146+00

ROUTE 202L
LOCATION SANTAN CHANNEL-PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

Dwg No. S-2.02

TRACS NO. H 4314 03D | 600-7-503 | ___ OF ___

DATE	LOCATION	REVISIONS	FINISHED PLANS	SUBMITTED

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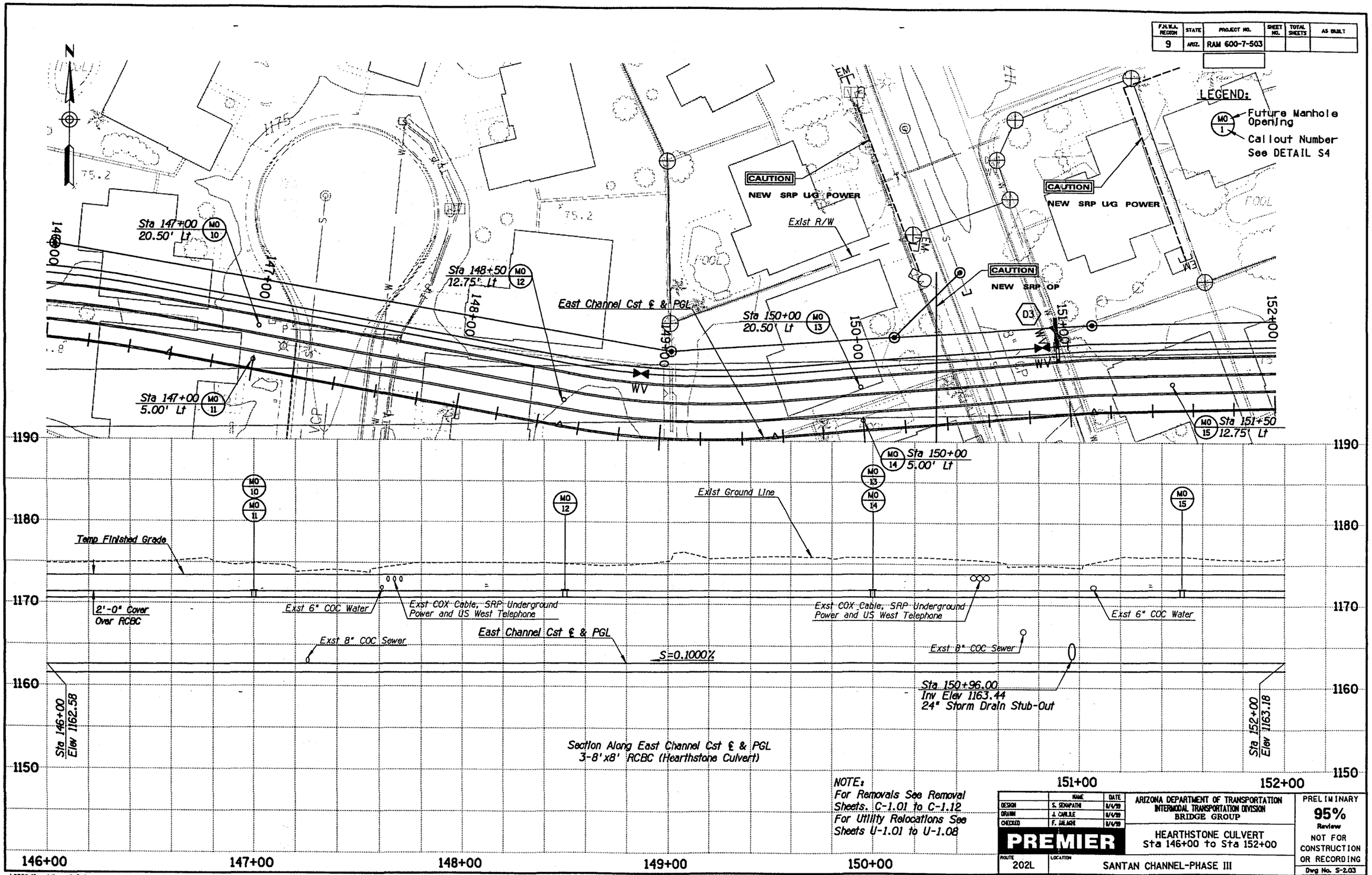

NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.12
For Utility Relocations See Sheets U-1.01 to U-1.08

	NAME	DATE
DESIGN	S. SENAPATHI	8/4/99
DRAWN	J. CARLILE	8/4/99
CHECKED	F. JALAGHE	8/4/99

PREMIER

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

HEARTHSTONE CULVERT
Sta 146+00 to Sta 152+00

ROUTE 202L
LOCATION SANTAN CHANNEL-PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING
Dwg No. S-2.03

TRACS NO. H 4314 03D | 600-7-503 | ___ OF ___

DATE | LOCATION | REVISIONS | FINISHED PLANS

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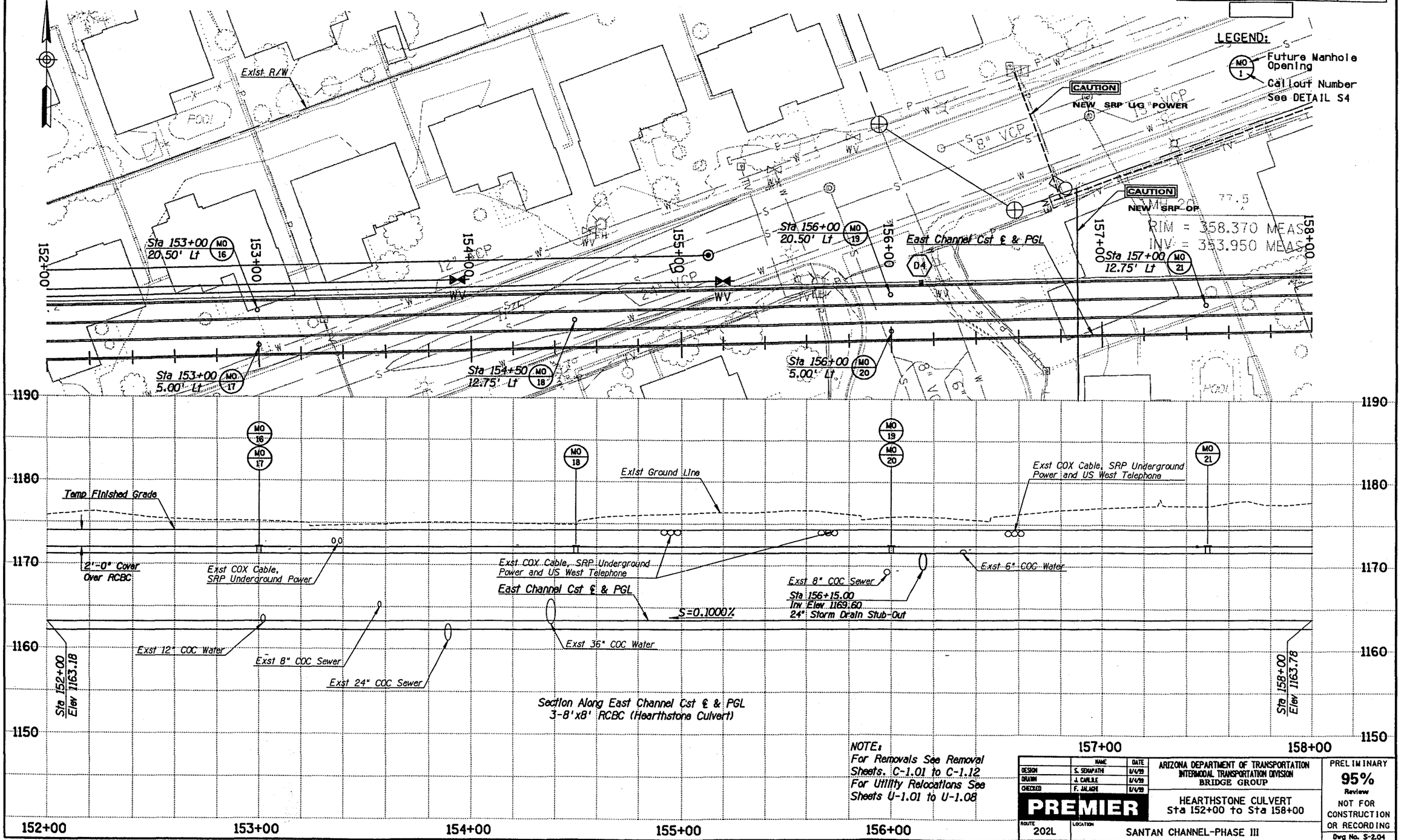

NOTE:
For Removals See Removal Sheets. C-1.01 to C-1.12
For Utility Relocations See Sheets U-1.01 to U-1.08

	NAME	DATE
DESIGN	S. SEMPATH	8/4/99
DRAWN	J. CARLILE	8/4/99
CHECKED	F. JALAGH	8/4/99

PREMIER

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

HEARTHSTONE CULVERT
Sta 152+00 to Sta 158+00

ROUTE 202L | LOCATION SANTAN CHANNEL-PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING
Dwg No. S-2.04

TRACS NO. H 4314 03D | 600-7-503 | ___ OF ___

DATE	LOCATION	REVISIONS	FINISHED PLANS	NO.

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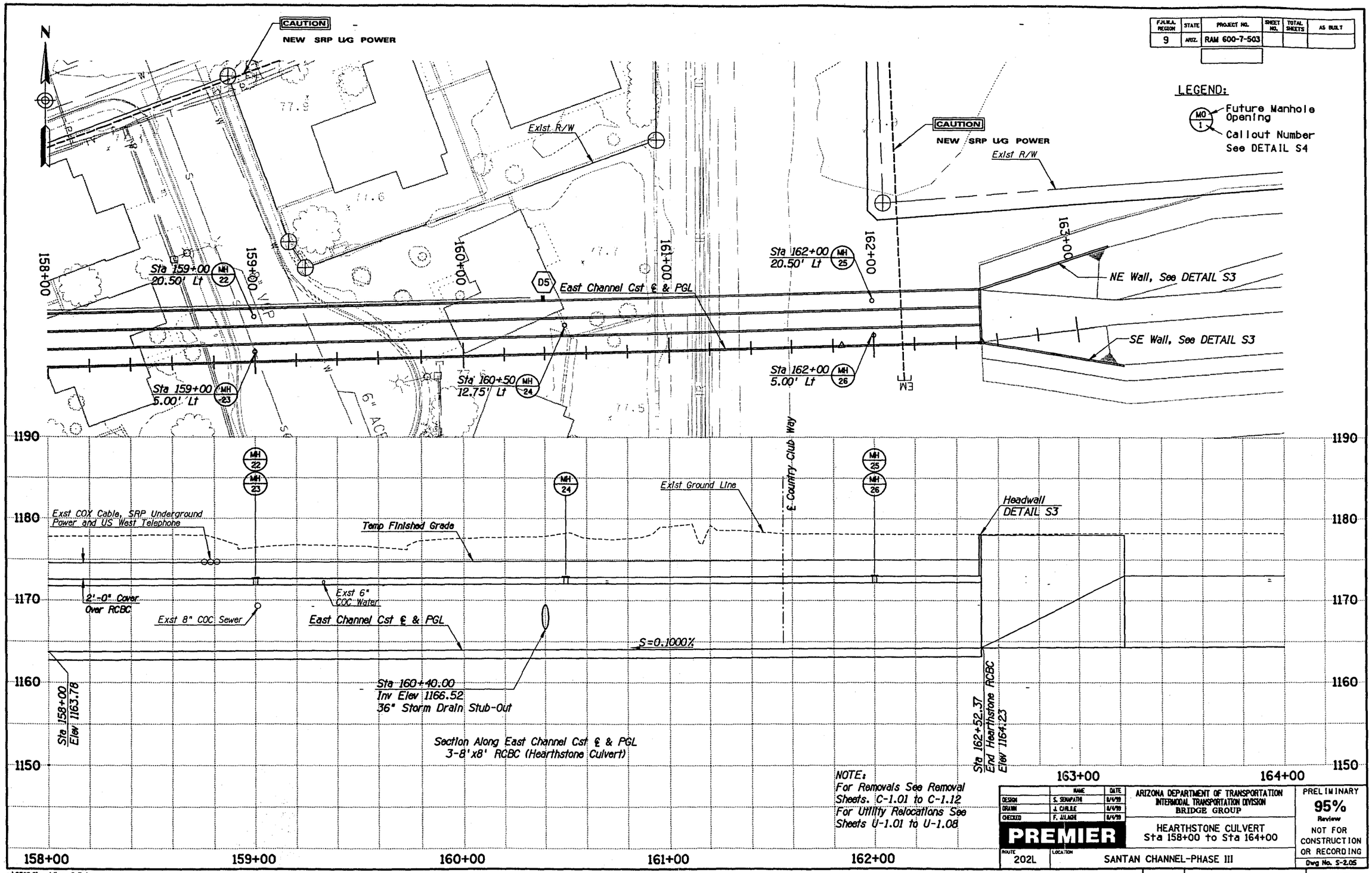

	NAME	DATE
DESIGN	S. SENAPATHI	8/4/99
DRAWN	J. CARLILE	8/4/99
CHECKED	F. JULAGIE	8/4/99

PREMIER

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

HEARTHSTONE CULVERT
Sta 158+00 to Sta 164+00

ROUTE 202L
LOCATION SANTAN CHANNEL-PHASE III

PRELIMINARY
95%
Review
NOT FOR CONSTRUCTION OR RECORDING

Dwg No. S-2.05

TRACS NO. H 4314 03D | 600-7-503 | ___ OF ___

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APPENDIX B

WATER QUALITY PROTECTION PERMIT – GILA FLOODWAY

2885
200.18,
500.54, 200.3, 600

GILA RIVER INDIAN COMMUNITY

SACATON, AZ 85247

Executive Office of the
Governor and Lt. Governor
315 West Casa Blanca Road
Post Office Box 97

(520) 562-6000
Fax: (520) 562-6010

ADOT GEN. CONS.
TM EW BW TO JG DP SO RL JM MS
FILE 1
TM

March 6, 1998

Steve Jimenez
Assistant State Engineer
Valley Project Management Group, Mail Drop 614E
Arizona Department of Transportation
205 South Seventeenth Avenue
Phoenix, AZ 85007-3213

Re: **Southeast Valley Regional Drainage System (SEVRDS) and Gila Floodway Permit**

Dear Mr. Jimenez:

In order to implement the existing 1991 agreement between the Gila River Indian Community (GRIC) and ADOT the GRIC Department of Environmental Quality has initiated a permit development process for the SEVRDS project as described in our April 25, 1997 letter to Dick Perreault of the Maricopa County Flood Control District. Based on the latest information, we believe this process now would best function in two steps: a Conditional Permit issued within the next few months to allow construction of an outfall channel coincident with the Pima-Maricopa Irrigation Project (P-MIP) crossing of the I-10 Freeway and a Final Permit issued after a more comprehensive review of the ultimate project. Although we prefer to issue a single permit after the necessary information is gathered, we recognize the need to keep the P-MIP and Freeway projects on schedule. Also, the Conditional Permit will further define the relationship between ADOT and the Community in anticipation of issuing a Final Permit for discharge of stormwater to the Gila Floodway. As you know, the Tribal Council will make the final decision on permit issuance.

The attached Final Scope of Work (SOW) has been revised according to agreements reached at our meeting on December 31, 1997. The specific agreements and the location in the SOW of those changes are as follows:

ADOT is only responsible for the quality of water discharged from SEVRDS to the Gila Floodway. ADOT is not responsible for the quality of water from any other source discharged to the Floodway (Page 2, Paragraph 4).

The point-of-compliance for the SEVRDS outfall will be determined by agreement between ADOT and Gila River Indian Community (GRIC); this point-of-compliance will be above all other discharges to the Gila Floodway (Page 2, Paragraph 4).

ADOT will provide funds for well installation and monitoring near the wetlands/detention basins, and GRIC will be responsible for having wells installed and samples collected (Page 2, Paragraph 5).

The location of groundwater monitor wells at the wetlands/detention basins will be determined by scientific and technical considerations. All parties must agree on locations before wells are installed (Page 2, Paragraph 5; Page 9, Task 6).

The purpose of groundwater monitoring, conducted as part of the permit development process, is to provide a baseline characterization of current groundwater quality (Page 2, Paragraph 5; Page 6, Bullet 4; Page 9, Task 6.0).

Historical aquifer contamination or contamination caused by activities unrelated to SEVRDS are not the responsibility of Arizona Department of Transportation (ADOT) (Page 2; Paragraph 5; Page 6, Bullet 4).

The SOW will only refer to the use of action levels; not Maximum Contaminant Levels or MCLs (No reference to MCLs in the document; action levels referred to on Page 3).

In the event that the Final Permit is not complete when stormwater discharges to the Gila Floodway become necessary, the Conditional Permit will allow for discharge to the Floodway if ADOT and GRIC agree that construction is complete and that the wetland best management practice is fully operational (Page 4, Paragraph 4).

Other Final SOW changes of note include: (1) changes agreed to and noted in GRIC's December 3rd response to ADOT's comments to the original SOW were incorporated; (2) GRIC added some language to emphasize that GRIC views this agreement as a document developed to implement an agreement between two governments; it was not developed to meet a state, tribe or federal regulatory requirement (see top of Page 4); and (3) the cost estimate was modified to reflect the cost for installing and monitoring two groundwater wells near the wetlands/detention basins.

Work on the Conditional Permit can commence once the following items are received from ADOT 1) receipt of the necessary technical information for the permit; 2) the permit application fee; and 3) ADOT agreement to work toward development of a Final Permit. Detail of these three items follows.

1. Complete Technical Information on the SEVRDS Project

Additional information is needed to prepare the Permits and ensure their accuracy. This information includes, but may not be limited to, the following:

1. Design Memorandum for SEVRDS Storm Water Management (dated September 1996)
2. Current plan for design and construction of SEVRDS as described in a June 12,

1997 SEVRDS project meeting or updated as appropriate [e.g., 30% and 60% design memoranda, wetlands designs report (Karpiscak, University of Arizona)].

3. Additional information on water quality which may assist us in preparing a Final Permit such as:

- Update of anticipated values, if any, for quantity and quality of constituents entering the Santan Channel from the SEVRDS' detention and wetland treatment system.
- Update of anticipated values, if any, for stormwater quantity and quality expected to flow to SEVRDS' detention and wetland treatment system; and
- Update on anticipated flow from SEVRDS system to the Gila Floodway.

2. Fees to complete preparation of permits

The GRIC DEQ requires a Permit Application Fee from ADOT for the Conditional and Final Permits. Attached is a Scope of Work and Cost Estimate for both permits.

3. ADOT agreement to work toward development of a Final Permit

GRIC needs a letter of commitment from ADOT which is signed by the State Engineer. The letter should express that ADOT is committed to work with GRIC and its contractor, EcoPlan Associates, on development of the Final Permit in a timely manner.

The Final Permit will supersede the Conditional Permit. We anticipate issuing the Final Permit within two years of issuing the Conditional Permit. The Final Permit will be more comprehensive than the Conditional Permit and is intended to protect surface and ground water quality and water uses on GRIC lands.

We expect to complete the technical work and deliver to the Natural Resources Committee (NRC) for discussion and approval a draft Memorandum of Agreement (MOA) containing a Conditional Permit within 16 weeks after all requirements are met. The NRC may approve, revise or remand the draft Conditional Permit back to staff; however, if they approve the draft permit, it would then go to the Tribal Council for discussion and approval.

In the event that the Final Permit is not complete when stormwater discharges to the Gila Floodway become necessary, the Conditional Permit will allow for discharge to the Floodway if ADOT and GRIC agree that construction is complete and that the wetland best management practice is fully operational.

In addition to developing the permits, there is a need to maintain an ongoing working relationship among all responsible parties to provide a forum for addressing questions and implementing solutions to identified problems. Areas of interest include determining 1) the local

relationship between percolating surface water in the Floodway or wetlands and shallow and regional aquifer quality, 2) the source of possible contaminants in stormwater and other drainage waters, and 3) the dynamics of contaminants after they enter the Floodway.

Your assistance in expediting submittal of the above items would be appreciated. We look forward to working closely with you and your staff to complete the permits. If you have questions regarding these items, please contact Glenn Stark at 520-562-3203.

Sincerely,

Mary V. Thomas 3-24-98

Mary V. Thomas
Governor - Gila River Indian Community

cc: Pat Mariella, Director of Environmental Quality

Attachments

2886
200.18,
500.5.4,
200.2.600

TM
TM PW SW TO JG KF SO BL JM MS
ADOT GEN. CONS.
BR
FILE 1

FINAL

SCOPE OF WORK

and

COST ESTIMATE

to develop

CONDITIONAL AND FINAL WATER QUALITY PROTECTION PERMITS FOR THE ARIZONA DEPARTMENT OF TRANSPORTATION

by the

GILA RIVER INDIAN COMMUNITY

Permitting Assumptions and Expectations

In preparing a water quality permit for stormwater, GRIC is making seven principal assumptions:

1. Source water consists of stormwater, and although its quality may vary, this stormwater is not expected to contain industrial or municipal wastes;

2. SEVRDS wetlands/detention basins are adequate to remove stormwater pollutant concentrations to levels which will not exceed levels necessary to protect surface water uses of the Gila Floodway or aquifers beneath GRIC lands. These wetlands/detention basins, therefore, constitute a Best Management Practice (BMP) for the treatment of this stormwater;

3. Monitoring for pollutants (e.g., stormwater inflow, SEVRDS' point of compliance which accounts for both the wetlands discharge and balance of storm, aquifers near wetlands, etc.) will be adequate to track water quality trends, identify problems and verify assumptions 1 and 2. If deemed necessary, to the extent practicable monitoring will occur during preparation of the conditional and final permit. Monitoring will continue upon completion of the final permit;

4. ADOT will pay for the surface water point of compliance sampling station and all monitoring costs associated with either the conditional or final permit. The point of compliance sampling station will be located downstream of all SEVRDS basins but upstream of all other potential discharges to the SEVRDS outfall channel at a point determined by agreement between ADOT and GRIC. ADOT is only responsible for the quality of water discharged by SEVRDS; ADOT is not responsible for any other discharges to the Gila Floodway;

5. ADOT will provide funds for installation and monitoring of groundwater wells near the wetlands/detention basins. GRIC will be responsible for installing wells and collecting groundwater samples. The location of wells will be determined by scientific and technical considerations; ADOT and GRIC must agree on selected locations before wells are installed. GRIC recognizes that ADOT is not responsible for the quality of groundwater as it exists prior to construction of SEVRDS. The purpose of these wells is to provide baseline data to characterize current water quality in the aquifer underlying the wetlands/detention basins. The need for continued monitoring of these wells upon completion of the final permit will be determined on the basis of the quality of stormwater, i.e., if it appears to pose a risk to aquifer water quality;

6. The Gila Floodway is protected by the following designated uses: Aquatic & Wildlife ephemeral (acute only), Partial Body Contact, and Agricultural Livestock Watering. These designated uses are defined the same as those in Arizona's surface water quality standards adopted April 24, 1996. The quality of water entering the Floodway at all times should meet

the numeric and narrative water quality criteria required to protect those designated uses. These criteria are also the same as those found in Arizona's 1996-adopted surface water quality standards: and

7. Compliance with the water quality standards will be an element of the final permit. We anticipate using a reasonable approach where we consider the frequency with which the exceedance occurs. We are considering if more than half of the observations over any consecutive two-year period exceed a standard at the point of compliance, then the discharge is considered out of compliance with the permit.

Although regulation of stormwater is treated as a point source program under the Clean Water Act, in practice pollutants in stormwater typically arise from nonpoint or diffuse sources that can vary depending on intensity, frequency and location of storm events. This variability contrasts with industrial or municipal point source discharges that vary little in quality. For this reason, stormwater is treated in various communities by implementation of best management practices, including such simple activities as street sweeping, litter control, elimination of illegal discharges, public education, and retention and detention basins.

The SEVRDS project relies on stormwater BMP's applied by municipal governments (i.e., Chandler, FCD and ADOT) and the wetlands to minimize the oppportunity for pollutants to be present in stormwater discharges. The use of wetlands is an innovative approach to mitigating the effects of stormwater pollutants on receiving waters. The numeric and narrative standards that apply to the Gila Floodway to protect surface water and groundwater will act as action levels to evaluate compliance with permit conditions. If the discharge does not comply with a water quality standard as defined in Assumption #7 above, the following stepwise process will be initiated by ADOT to identify additional best management practices that must be implemented to bring stormwater into compliance with standards:

Identify source(s) of pollutants;
Identify additional best management practice(s) required to reduce pollutants in stormwater; and
Develop a schedule for implementation of additional best management practice(s).

Permitting Background

The Memorandum of Agreement, JPA 90-138, between the Arizona Department of Transportation (ADOT) and Gila River Indian Community (GRIC) provides a basis for development of permits for discharge of stormwater to the Gila Floodway. The permits are being developed as an agreement between two governmental entities and not for the purposes of complying with any tribal, state or federal statutory requirement.

The permit process is intended to provide Gila River Indian Community (GRIC) water users with a measure of protection of their surface water and aquifer supplies against pollutants introduced from the Southeast Valley Regional Drainage System (SEVRDS). Protection is expected to be accomplished by issuing two permits: a Conditional and a Final. Although the GRIC Department of Environmental Quality (DEQ) will prepare the permits, ultimate authority to issue permits lies with the Tribal Council. Work on the Conditional Permit can commence once any necessary resolutions regarding the proposed Scope of Work are approved by the GRIC Tribal Council and the following items are received from ADOT 1) receipt of the necessary technical information for the permit; 2) the permit application fee; and 3) ADOT agreement to work toward development of a Final Permit.

Permit adoption formalizes the need to: 1) set up an ongoing monitoring program; 2) determine effectiveness of the SEVRDS basins as a BMP; and 3) determine the risk to GRIC's sole source aquifer used for drinking purposes. A Conditional Permit will provide the vehicle for GRIC and SEVRDS participants to resolve questions regarding standards and performance and set up a monitoring program for implementation under the Final Permit.

The strategy behind two permits is pragmatic: a Conditional Permit will be issued to ADOT because: 1) the Conditional Permit will allow GRIC to confirm the accuracy of information from ADOT on the projected quality and quantity of water to be discharged to the Floodway before preparing the Final Permit; 2) the timing of various construction projects in the area is critical; and 3) there is a need to provide ADOT with a commitment from GRIC to issue a permit for discharge so ADOT may proceed with expending funds on construction of the Santan Channel. Under the Conditional Permit, discharges from the SEVRDS outfall to the Gila Floodway will be allowed once all parties agree that construction has been appropriately completed and the wetland is fully operational.

A Final Permit replacing the Conditional Permit will be issued to ADOT after all the required information has been compiled, the data have undergone a thorough technical review and a comprehensive public-involvement process has been completed. We anticipate that the development of the Final Permit will require 24 months. It will require BMPs designed to reduce stormwater pollution to the maximum extent practicable, and an ongoing monitoring program to characterize the quality of runoff to evaluate compliance with the conditions of the final permit.

The permits will reflect Community member values as well as scientific understanding of necessary water quality control measures. In this regard, the permits will utilize the latest available information on constituents of concern and the water quality criteria necessary to protect designated uses. These criteria are periodically updated to reflect new scientific information. Similarly, treatment or preventive measures (e.g. BMPs) effective in the control of pollutants may also be updated as new technologies become available, e.g., through the development of new stormwater BMPs by the Environmental Protection Agency. A Final Permit to discharge to the Gila Floodway will be issued for five years. The application to renew this permit will take into account updated or newly developed BMPs as well as any changes to water quality criteria used to protect Gila Floodway designated uses.

In addition to developing the permits, there is a need to establish an ongoing working relationship among all responsible parties to provide a forum for addressing questions and implementing solutions to identified problems. Areas of interest include determining 1) the local relationship between percolating surface water in the Floodway or wetlands and shallow and regional aquifer quality, 2) the source of possible contaminants in stormwater and other drainage waters, and 3) the dynamics of contaminants after they enter the Floodway. DEQ will work with all responsible parties to gain assurance that GRIC aquifers, which are used for drinking purposes, are not at risk from discharges of stormwater.

Elements of Water Quality Permits

Conditional Permit

The Conditional Permit to ADOT for discharge of stormwater to the Gila Floodway will contain requirements for ADOT to gather monitoring data to support the Final Permit including data to confirm the appropriateness of the designated uses applied to the Floodway and numeric and narrative water quality criteria required to protect those uses. As a minimum, this Conditional Permit will contain the following elements:

- Monitoring of stormwater expected to enter the wetlands/detention basins to the greatest extent possible before the Final Permit is completed;
- Estimates of quantities and qualities of water to be released to the Gila Floodway based on projected inflow qualities and wetlands/detention basin treatment capabilities;
- Determination of the relationship between stormwater discharges to the wetlands/ detention basins and the Gila Floodway and shallow and regional aquifers to determine if there is any risk to the quality of aquifer water used as a drinking water source;
- Development of a sampling and monitoring plan to provide the means to track the water quality of SEVRDS' discharges when they occur and determine the effect of these stormwater discharges on attainment of water quality standards. The sample plan will include installation of groundwater wells to characterize current aquifer water quality at the wetlands/detention basins. Also, monitoring data will provide the basis for evaluating changes in groundwater quality that may occur in the future that are not resulting from ADOT's activities, e.g., changes in regional land use; and
- Reporting plan development to include the type, frequency, and content of reports.

Once GRIC (DEQ, Law Office) and EcoPlan Associates develop a draft Conditional Permit, it will be presented to the Natural Resources Committee (NRC) for approval. Following NRC approval, the Conditional Permit requires approval from the Tribal Council. If policy makers approve the proposed permit without changes, these two steps will take at least two months. In addition, the vehicle for Conditional permit adoption will be a Memorandum of Agreement (MOA) patterned after other state and federal stormwater permits. Preparation and refinement of the MOA will involve legal review and comment as well as stakeholder coordination.

Final Permit

The Final Permit to ADOT for discharge of stormwater to the Gila Floodway will contain as a minimum the following elements:

- The water quality standards that must be met at the point of compliance for discharge to the Gila Floodway. Standards in the Final Permit are expected to be those for protection of ephemeral surface water designated uses, i.e., Partial Body Contact (PBC) Aquatic and Wildlife (ephemeral) (A&We) and Agricultural Livestock Watering (AgL)] and water quality criteria (i.e., numeric and narrative) required to protect those uses (for example, those adopted by Arizona DEQ, April 24, 1996; EPA approval currently pending).
- Water quality monitoring requirements for the life of the permit, including location(s) and frequency of monitoring and constituents of concern;
- Reporting requirements, including the type, frequency and content; and
- The basis for what constitutes non-compliance with a water quality standard and expectations of ADOT in the event non-compliance occurs.

The review process for the Final Permit is similar to the Conditional Permit. Both the NRC and Tribal Council must approve the permit. The vehicle for Final Permit adoption will again be a MOA that is subject to legal review and comment and stakeholder coordination. GRIC anticipates that the time between Conditional Permit and Final Permit adoption will be approximately 24 months (based on the flow chart developed by GRIC DEQ).

TASKS

Preparation of Conditional Permit

1.0 Develop interim aquifer and surface water sampling and monitoring requirements and key dates for implementation of activities.

1.1 Develop monitoring requirements and key dates for implementation

1.1.1 Determine parameters to be sampled
1.1.2 Determine frequency and location of sampling
1.1.3 Determine key dates
1.1.4 Initiate sampling

2.0 Develop reporting requirements including dates of completion.

3.0 Provide for review of Conditional Permit

3.1 Discuss draft Conditional Permit with stakeholders

3.1.1 Meet with necessary GRIC departments (DEQ, Law)
3.1.2 Meet with key Tribal members (e.g., council members, allottees) to gain sense of interest/concern
3.1.3 Meet with local, county, state, etc. agencies with stake in the permit

3.2 Discuss Conditional Permit and process with NRC

3.2.1 Distribute permitting concept for NRC review and discuss
3.2.2 Prepare and distribute draft permit and MOA for NRC review and comment
3.2.2 Obtain concurrence from NRC

3.3 Discuss Conditional permit and process with district members

3.3.1 Meet with Districts 4 and 6 members to explain permitting concept
3.3.2 Meet with Districts 4 and 6 members to explain draft permit and receive ideas

3.4 Discuss NRC-approved draft Conditional Permit and MOA with Tribal Council

3.4.1 Distribute permitting concept for Council review and discuss
3.4.2 Obtain adoption of Conditional Permit and MOA from Council

Preparation of Final Permit

4.0 Compile all Gila Floodway-related technical information on the SEVRDS

- 4.1 Review wetlands/detention basin and channel design with design engineers
- 4.2 Review 30% and 60% Design Memoranda and Wetlands Design Report for understanding of project
- 4.3 Review soil type, permeability, etc. and aquifer depth
- 4.4 Confirm SEVRDS design represents the BMP for stormwater

5.0 Develop water quality monitoring in accordance with the monitoring program set forth in the Conditional Permit

- 5.1 Determine parameters to be checked
- 5.2 Determine frequency and location of sampling, including point of compliance
- 5.3 Determine representative storm events
- 5.4 Determine sample collection procedures
- 5.5 Develop an understanding of aquifers in vicinity including depth, movement and direction
- 5.6 Determine likely disposition of released constituents from floodway and wetlands/detention basins
- 5.7 Determine performance level of wetlands by comparing the quality of inflow and outflow
- 5.8 Set date for collection and reporting of monitoring data

6.0 Develop well field monitoring to characterize baseline water quality of aquifer underlying the wetlands/detention basins

- 6.1 Determine status of existing well sampling results for quality
- 6.2 Determine locations for installation of monitoring wells
- 6.3 Install new monitoring well(s) for wetlands/detention basins
- 6.4 Implement monitoring and reporting on aquifer conditions

7.0 Validate assumptions used in development of Final Permit based on data generated under Conditional Permit

- 7.1 Confirm appropriateness of designated uses (A&We, PBC, AgL) applied to Gila Floodway
- 7.2 Confirm appropriateness of numeric water quality criteria used to protect designated uses
- 7.3 Confirm appropriateness of narrative water quality criteria used to protect surface

water and groundwater associated with Gila Floodway

8.0 Develop contingency plan to address permit compliance issues that could occur following implementation of the Final Permit

8.1 Work with stakeholders to develop process and reasonable schedule for addressing and correcting compliance problems.

8.2 Develop strategy for working with stakeholders to modify permit conditions in the event that the project design/operation needs to be changed, e.g., operation of the wetlands/detention basin needs to be modified, a significant change in source water to the Gila Floodway occurs, or the uses of the Gila Floodway change because of the operation of the Santan Channel.

9.0 Provide for review of Final Permit

9.1 Discuss draft permit with stakeholders

9.1.1 Meet with interested GRIC departments

9.1.2 Meet with key Tribal members (e.g., council members, allottees) to gain sense of interest/concern

9.1.3 Meet with local, county, state, etc. agencies with stake in the permit

9.2 Discuss permit and process with NRC

9.2.1 Distribute permitting concept for NRC review and discuss

9.2.2 Prepare and distribute draft permit and MOA for NRC review and comment

9.2.3 Obtain concurrence from NRC

9.3 Discuss permit and process with district members

9.3.1 Meet with Districts 4 and 6 members to explain permitting concept

9.3.2 Meet with District 6 members to explain draft Permit and receive ideas

9.4 Discuss NRC-approved draft permit and MOA with Tribal Council

9.4.1 Distribute permitting concept for Council review and discuss

9.4.2 Obtain adoption of permit and MOA from Council

Project Schedule

Task		Number of Months From Beginning of Process (1–20)	Total Hours
		Conditional Permit	
1.0	Monitoring goals and dates	XX	40
2.0	Reporting goals and dates	XX	20
3.0	Provide for review of Conditional Permit		200
	3.1 Stakeholders	XXX	
	3.2 NRC	XX	
	3.3 District Members	XX	
	3.4 Tribal Council	X	
		Final Permit	
4.0	Technical information	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	120
5.0	Monitoring program	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	160
6.0	Well field monitoring	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	230/100*
7.0	Validate assumptions	XXXXXXXXXXXXX	200
8.0	Contingency plan	XXXXXXXXXXXXX	80
9.0	Review of Final Permit		210
	9.1 Stakeholders	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	
	9.2 NRC	XXXXXX	
	9.3 District Members	XXXXXX	
	9.4 Tribal Council	XXXX	

* - 100 hours for GRIC installation of wells and collection of groundwater samples

Cost Estimate – EcoPlan Associates, Inc.

Task Number	Description	Hours
Preparation of Conditional Permit		
1.0	Establish monitoring goals and dates	40
1.1	Develop monitoring requirements and key dates for implementation	
2.0	Establish reporting goals and dates	20
3.0	Provide for review of Conditional Permit	200
3.1	Discuss draft with stakeholders	
3.2	Discuss draft and gain approval from NRC	
3.3	Discuss with district members	
3.4	Discuss and gain approval from Council	
Preparation of Final Permit		
4.0	Compile all technical information	120
4.1	Review SEVRDS design information	
4.2	Review design memoranda	
4.3	Review soils and aquifer information	
4.4	Confirm if SEVRDS is a BMP	
5.0	Develop monitoring program	160
5.1	Determine parameters	
5.2	Determine frequency and location	
5.3	Determine representative storm events	
5.4	Determine sample collection procedures	
5.5	Develop understanding of aquifers	
5.6	Determine likely disposition of constituents	
5.7	Determine performance of wetlands	
5.8	Determine date for initiating monitoring	
6.0	Develop well field monitoring	230
6.1	Determine existing well results	
6.2	Determine locations for installation of monitoring wells	
6.3	Install new monitoring wells	
6.4	Implement monitoring of aquifers	

7.0	Validate assumptions used in development of Final Permit	200
	7.1 Designated uses	
	7.2 Numeric water quality criteria	
	7.3 Narrative water quality criteria	
8.0	Develop contingency plan	80
	8.1 Develop compliance process and schedule	
	8.2 Develop strategy for modifying permit	
9.0	Provide for review of Final Permit	210
	9.1 Discuss with stakeholders	
	9.2 Discuss permit with NRC	
	9.3 Discuss permit with district members	
	9.4 Discuss gain/approval from Council	
	Total Hours	**1260**

Assuming an average rate for all EcoPlan staff and subconsultants of $80/hour, this produces a total professional fee of $100,800. If we also assume an expense rate of 15% of professional fees (e.g.. travel, copying, communications, etc.), this adds $15,120. The total for EcoPlan Associates is $115,920.

Cost Estimate – Gila River Indian Community

Well Installation and Monitoring

Two monitor wells installed each to 100 feet below grade at $50/foot		$10,000
Sample each of the two wells for range of contaminants (e.g., metals, bacteria, VOCs, semi-VOCs, herbicides and pesticides) to determine baseline conditions at $5,750 per sample. Cost includes one QA/QC duplicate sample		$11,500
60 hours of consultant time to install wells at $80 per hour	$ 4,800	
40 hours of consultant time to sample wells at $80 per hour	$ 3,200	
Subtotal		$29,500

GRIC Administration Expenses

13% of professional fees paid to EcoPlan Associates (13% of 100,800)	$13,000.
13% of professional fees paid for well installation/monitoring (13% of $8000)	$ 1,000
Subtotal	$14,000
Total	$43,500

Budget Summary

EcoPlan Associates professional fees and expenses	$115,920
GRIC Expenses	43,500
Total Cost	$159,420

APPENDIX C

OFF-SITE HYDROLOGY

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   09MAY99  TIME  12:20:32  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        FN: SEVRDS3A.DAT  May 1999        ADAPTED FROM SVRD05~2.DAT  (HDR 5/98)
  2           ID        This model has one revision from the previous model. The previous model
  3           ID        is separated into two models for the routing of the Basin B complex.
  4           ID        The outflow hydrograph from the Basin B routing is the inflow for the
  5           ID        SEVRDS3B.DAT model downstream of the basin complex to the Gila Floodway.
  6           ID        ***********************************************************************
  7           ID        FN: SVRD05~2.DAT  May 1998        ADAPTED FROM SEVRDS.DAT (HDR 4/97)
  8           ID        This model has two revisions from the previous model.
  9           ID        1. Revised BASIN B and Outlet Channel routings to accomodate P-MIP
 10           ID           project overflows from the Gila Drain as described below.
 11           ID        2. Revised Basin 15 from detention to retention so that flows will not
 12           ID           bypassed to the SEVRDS Channel during the event. See more below.
 13           ID        ***********************************************************************
 14           ID        HISTORY THIS MODEL:   This model is a modification of ALT2c.DAT
 15           ID        developed by HDR for the Alternative Study for SEVRDS by HDR in
 16           ID        June 1995. SMF48TH.DAT(PRICE5) on the West side of I-10 was included.
 17           ID        GILA1B.DAT(Gila Drain Floodway Model) was also included in this model.
 18           ID        ALT2c was a composite of HEC1 models from Price GEC Gila Drain Alternati
 19           ID        Drainage Report,HDR,Feb 1993(Price/Santan/Gila Drain GILADRY.DAT model),
 20           ID        South Mountain Freeway Concept Drainage Report, HDR, Feb 1993,(Segment V
 21           ID        PRICE5.DAT model modified to SMF48th.DAT described below), and Gila
 22           ID        Drain Floodway Master Plan Report, Feb 1993(GILA1B.DAT model).  The
 23           ID        original model was developed for the Price Freeway drainage system as
 24           ID        reported in "Hydrology Study: Price Expressway", ADOT Contract 88-24,
 25           ID        Dec. 1989.  The model criteria is provided in that report.  The basic
 26           ID        model has not changed since 1989. The model continues to be the model
 27           ID        record because the model was used to design the upper part of the
 28           ID        SEVRDS/Santan Channel system on Price Freeway for the Galveston to Frye
 29           ID        Interim Project which included construction of Basin G and the outlet to
 30           ID        the Santan Channel.
 31           ID        ***********************************************************************
 32           ID        BASIN B DESIGN. Basin B was configured as a bypass basin in 1993. With
 33           ID        the formation of SEVRDS, the Basin was reconfigured as a multi-celled
 34           ID        basin with first flush containment cell, a treatment cell and a large
 35           ID        retention cell to capture flows above 800 cfs.("Initial Drainage Report
 36           ID        Santan Freeway:56th St to Price Rd and Gila Drain Floodway to Basin B,"
 37           ID        Wood Patel & Assoc., Sept. 12, 1996.)
 38           ID        HDR prepared a detailed design of the Basin B complex in Feb. 1997.
 39           ID        The size of Basin B was increased from 385(9/96) to 450 af to limit bypa
 40           ID        flows to 900 cfs. This operation maximized the available storage on-site
 41           ID        and required moving the outlet channel to the west side of the Gila
 42           ID        Drain.  This most recent model further optimized storage on site in
 43           ID        in Basin B to limit bypass flows to 800 cfs to allow Gila Drain
 44           ID        flows of up to 150 cfs to enter the outfall channel at the GRIC boundary
 45           ID
 46           ID        Basin B site has three basins: 1.First flush equalization/sedimentation
 47           ID        basin stores first 39 ac-ft of inflow into system.  2. A two-celled Watr
 48           ID        Quality Basin treats the first-flush post-event. This basin is not
 49           ID        included in the model. 3. An off-line retention basin, Basin B, has a
 50           ID        capacity of 450 ac-ft.  Operation: The first flush is conveyed in the
 51           ID        Forebay Channel to Eq. Basin. Additional flow up to 804 cfs is bypassed
 52           ID        thru 3-10x4 control RCB to Outfall Chan.  At about 600 cfs, flow begins
 53           ID        to spill over Basin B weir.  At 100-yr peak of 2895 cfs, 804 cfs is
 54           ID        discharging to RCB and 2091 cfs is overflowing 1000' weir into Basin B
 55           ID        ***********************************************************************
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  56          ID        SMF48th.DAT Model of the area west of I-10 was significantly
  57          ID        changed in Feb. 1996 for the 48th St. ID study for Phoenix, including
  58          ID        the reconfiguration of Basin 15 as a retention basin as mentioned above.
  59          ID        A future connection of the 48th St.-Basin 15 to SEVRDS would be a pipe
  60          ID        to dewater Basin 15 post-event.  Basin 15 will not increase design
  61          ID        discharge of the SEVRDS Channel during the event.
  62          ID        ************************************************************************
  63          ID
  64          ID
  65          ID        INITIAL ABSTRACTION USED TO REPRESENT DEVELOPMENT RETENTION PROVIDED
  66          ID        100 YEAR - 24 HOUR STORM
  67          ID        DMJM - PHOENIX
  68          ID        FILENAME: SEVRDS3A.DAT
  69          IT      5                    1000
  70          IO      5
  71          IN     12                     310
              *DIAGRAM

  72          KK    bash
  73          KM        OFFSITE INFLOW INTO BASIN H AT PRICE AND PECOS INTERCHANGE FROM E
  74          BA    6.76
  75          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  76          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  77          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  78          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
  79          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.01    0.04    0.10
  80          QI    0.39    0.64    0.98    1.43    2.00    2.72    3.65    4.88    6.57
  81          QI   17.35   40.17   84.15  157.71  255.02  413.77  498.78  738.94  766.73
  82          QI  651.16  578.19  513.98  461.77  419.16  385.17  357.03  332.76  310.86
  83          QI  273.04  257.39  243.47  230.94  219.41  208.60  198.28  188.77  180.16
  84          QI  266.57  267.73  269.41  275.07  284.98  292.73  296.44  298.71  300.62
  85          QI  305.48  308.84  312.78  317.34  322.46  327.76  332.81  337.94  343.13
  86          QI  352.29  356.32  360.03  363.42  366.42  368.99  371.12  372.80  374.07
  87          QI  375.45  375.48  374.63  372.22  368.09  362.92  357.28  351.35  345.22
  88          QI  333.55  328.09  322.75  317.35  311.81  306.05  300.07  293.86  287.41
  89          QI  273.87  266.79  259.39  251.92  244.89  238.17  231.52  225.00  218.58
  90          QI  206.10  200.05  194.15  188.41  182.85  177.47  172.30  167.36  162.81
  91          QI  156.68  155.31  154.12  152.82  151.49  150.11  148.70  147.25  145.78
  92          QI  142.82  141.38  139.94  138.43  136.93  135.42  133.94  132.46  131.00
  93          QI  128.13  126.72  125.34  123.98  122.65  121.34  120.07  118.96  118.33
  94          QI  118.07  118.01  117.94  117.88  117.82  117.76  117.70  117.64  117.57
  95          QI  117.44  117.38  117.32  117.25  117.19  117.12  117.05  116.99  116.92
  96          QI  116.79  116.72  116.65  116.58  116.51  116.44  116.37  116.30  116.23
  97          QI  116.09  116.02  115.95  115.88  115.81  115.74  115.67  115.60  115.53
  98          QI  115.38  115.31  115.24  115.17  115.09  114.99  114.83  114.61  114.38
  99          QI  113.91  113.68  113.45  113.22  112.99   57.77   57.54   57.32   57.09
 100          QI   56.65   56.43   56.21   55.99   55.77   55.56   55.34   55.12   54.91
 101          QI   54.49   54.28   54.07   53.86   53.65   53.44   53.24   53.03   52.83
 102          QI   52.43   52.23   52.03   51.83   51.63   51.43   51.24   51.04   50.85
 103          QI   50.45   50.24   50.02   49.79   49.55   49.31   49.06   48.80   48.54
 104          QI   48.00   47.72   47.44   47.16   46.88   46.59   46.30   46.01   45.73
              *
 105          IN     12                     310
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 106          KK  CHNDLR
 107          KM        Pumped outflow from Chandler Basins (Galveston, Arrowhead and Denv
 108          BA   0.001
 109          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 110          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 111          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 112          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 113          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 114          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 115          QI    0.00    0.00    0.00    0.00    0.00   100.0   100.0   100.0   100.0
 116          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.
 117          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 118          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 119          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 120          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 121          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 122          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 123          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 124          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 125          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 126          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 127          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 128          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 129          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 130          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 131          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 132          QI   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0   100.0
 133          QI   100.0   100.0   100.0   100.0   100.0    0.00    0.00    0.00    0.00
 134          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 135          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 136          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 137          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 138          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 139          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
              *

 140          KK  cchand
 141          KM        Combine flow from regional basins with offsite flows at old basin
 142          HC       2
              *
 143          IN       5                        300

 144          KK  interchange inflow
 145          KM        ONSITE DRAINAGE/STORAGE ANALYSIS -50 YEAR 24 HOUR STORM
 146          KM        USE OUTFLOW HYDROGRAPH FROM THE PRICE/SANTAN INTERCHANGE
 147          BA    0.16
 148          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 149          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 150          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 151          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 152          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 153          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 154          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 155          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 156          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 157          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 158          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 159          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 160          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 161          QI    0.00    0.00    0.00    0.00    0.00    0.00   40.00   40.00   40.00     0.
 162          QI    0.00    0.00    0.00   40.00  120.00  120.00  200.00  200.00  200.00   200.
 163          QI  200.00  200.00  200.00  200.00  200.00  200.00    0.00    0.00    0.00     0.
 164          QI    0.00    0.00   40.00   40.00   40.00    0.00    0.00    0.00    0.00     0.
 165          QI    0.00    0.00    0.00    0.00   40.00   40.00   40.00    0.00    0.00     0.
 166          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 167          QI   40.00   40.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 168          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 169          QI    0.00   40.00   40.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 170          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 171          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 172          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 173          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 174          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 175          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 176          QI    0.00    0.00    0.00   40.00   40.00    0.00    0.00    0.00    0.00     0.
 177          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
              *

 178          KK   addTI
 179          KM        Combine onsite p.s. outflow to offsite runoff from east
 180          HC       2
 181          IN      12                     310

 182          KK    basg
 183          KM        INFLOW INTO PRICE BASIN G FROM EAST
 184          BA    4.37
 185          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 186          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 187          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 188          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 189          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00     0.
 190          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.01    0.04    0.17     0.
 191          QI    4.27   23.63   65.05  129.91  189.65  223.82  228.38  209.70  175.27   397.
 192          QI  954.28  905.32  843.40  750.42  650.70  561.76  486.59  424.50  372.86   329.
 193          QI  293.55  262.86  236.31  213.14  192.75  174.77  159.23  145.96  134.73   125.
 194          QI  116.85  109.70  103.63   98.58   94.39   90.95   88.07   85.64   83.62    82.
 195          QI   80.98   80.17   79.47   78.77   78.01   77.18   76.25   75.24   74.12    72.
 196          QI   71.75   70.55   69.36   68.18   67.03   65.90   64.80   63.73   62.69    61.
 197          QI   60.70   59.62   58.31   56.55   54.32   51.67   48.71   45.61   42.47    39.
 198          QI   35.68   32.14   28.66   25.32   22.21   19.38   16.87   14.65   12.72    11.
 199          QI    9.58    8.32    7.25    6.33    5.55    4.90    4.32    3.81    3.37     2.
 200          QI    2.60    2.32    2.07    1.85    1.66    1.48    1.33    1.20    1.08     0.
 201          QI    0.88    0.80    0.72    0.65    0.59    0.54    0.49    0.45    0.41     0.
 202          QI    0.34    0.31    0.28    0.26    0.24    0.22    0.20    0.19    0.17     0.
 203          QI    0.14    0.13    0.12    0.11    0.11    0.10    0.09    0.08    0.08     0.
 204          QI    0.07    0.06    0.06    0.05    0.05    0.05    0.04    0.04    0.04     0.
 205          QI    0.03    0.03    0.03    0.03    0.02    0.02    0.02    0.02    0.02     0.
 206          QI    0.02    0.02    0.01    0.01    0.01    0.01    0.01    0.01    0.01     0.
 207          QI    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01    0.01     0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 208          QI    0.01    0.01    0.01    0.00    0.00    0.00    0.00    0.00    0.00    0.
 209          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 210          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 211          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 212          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 213          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 214          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
 215          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              *

 216          KK   rbasg
 217          KM        ROUTE OFFSITE FLOW INTO FROM EAST OF REGIONAL BASIN G
 218          KM        72 INCH GRAVITY LINE OUTFLOW TO Price/Pecos TI down WFR
 219          RS       1    ELEV     0.0
 220          SV     0.0    19.1    75.2    98.2   161.2
 221          SE    1174    1176    1179    1180    1183
 222          SQ     0.0      45     155     180     245
              *
              *

 223          KK  rtbasg  90-inch to 96-inch basin G drain
 224          RK    6301  .00060    .012            circ     7.5
              *

 225          KK  cinterchange
 226          KM        COMBINE ONSITE and offsite FLOWS TO TI and from Basin G.
 227          KM        Combined discharge to outfall to Santan collector channel to west.
 228          HC       2

 229          KK  MCSWL2
 230          KM        CHANDLER - AGRICULTURAL (PART SECTION 36)
 231          KM        COMPUTE RUNOFF HYDROGRAPH FOR AGRICULTURAL AREA
 232          PH       1   18.38    0.71    1.39    2.44    2.66    2.81    3.11    3.33    3.70
 233          BA  0.1550
 234          LS     1.5      83
 235          UD    0.88

 236          KK   cbash
 237          KM        COMBINE BASIN H OUTFLOW WITH LOCAL DRAINAGE AREA
 238          HC       2

 239          KK     RT1
 240          KM        ROUTE MCSWL2 HYDROGRAPH TO MCSWL3 CONFLUENCE
 241          RK    1600  .00200   0.016            TRAP     0.0    25.0

 242          KK  MCSWL3
 243          KM        CHANDLER - AGRICULTURAL  (PART SECTION 36)
 244          KM        COMPUTE RUNOFF HYDROGRAPH FOR AGRICULTURAL AREA
 245          BA  0.1700
 246          LS     1.5      83
 247          UD    0.91
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 248          KK   COMB1
 249          KM        COMBINE MCSWL3 - AT HALF-MILE POINT OF SECTION 36
 250          KM        THIS COMBINE FOR INFO. ONLY, SHOULD BE XX CFS AT THIS POINT
 251          HC       2

 252          KK  SECT25
 253          KM       CHANDLER
 254          KM       COMPUTE RUNOFF FOR SECTION 25
 255          PH       1   18.38    0.71    1.39    2.44    2.66    2.81    3.11    3.33    3.70
 256          BA    1.00
 257          LS    1.81      84
 258          UD    0.91

 259          KK     RT1
 260          KM       ROUTE SECTION 25 HYDROGRAPH TO OUTLET-A(OLD) - SW CORNER SECT. 36
 261          RK    4400  0.0011   0.016            TRAP     0.0    25.0

 262          KK  SECT36
 263          KM       CHANDLER
 264          KM       COMPUTE RUNOFF HYDROGRAPH FOR remainder of SECTION 36
 265          KM       This area reduced 0.32 to account for areas MCSLW2 and MCSLW3, areas
 266          KM       calculated separately in original analysis - now included in flow logic.
 267          BA    0.51
 268          LS    1.95      84
 269          UD    0.94

 270          KK  SECT36
 271          KM       COMBINE RT1 - SECT36 HYDROGRAPHS TO GIVE HYDROGRAPH AT SW COR SECT. 36
 272          HC       3
 273          IN       5                    300

 274          KK  mcclintock
 275          KM        ONSITE DRAINAGE/STORAGE ANALYSIS 50 YEAR 24 HOUR STORM
 276          KM        USE PUMP STATION 'OUTFLOW' HYDROGRAPH FROM MCCLIN4.DAT ONSITE FILE
 277          KM        PUMP STATION DESIGN Q IS 200 CFS.
 278          BA    0.11
 279          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 280          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 281          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 282          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 283          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 284          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 285          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 286          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 287          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 288          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 289          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 290          QI    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00
 291          QI    0.00    0.00    0.00    0.00    0.00    0.00   40.00    0.00    0.00    0.00
 292          QI    0.00    0.00    0.00    0.00   40.00    0.00    0.00    0.00    0.00    0.00
 293          QI   40.00   40.00    0.00  120.00    0.00  200.00  200.00  200.00  200.00  200.00
 294          QI  200.00  200.00    0.00    0.00  120.00    0.00    0.00    0.00   40.00    0.00
 295          QI    0.00    0.00   40.00    0.00    0.00    0.00    0.00   40.00    0.00    0.00
 296          QI    0.00    0.00   40.00    0.00    0.00    0.00    0.00    0.00    0.00   40.00
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 297          QI     0.00     0.00     0.00     0.00     0.00    40.00     0.00     0.00     0.00     0.00
 298          QI     0.00     0.00     0.00    40.00     0.00     0.00     0.00     0.00     0.00     0.00
 299          QI     0.00     0.00    40.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 300          QI     0.00     0.00    40.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 301          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 302          QI    40.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 303          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 304          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 305          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00    40.00     0.00
 306          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 307          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00
 308          QI     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00     0.00

 309          KK    cmcln
 310          HC        2

 311          KK   RT2536
 312          KM        ROUTE TO MID-SECTION POINT OF SECT. 35
 313          RK    2600    .008    .016            TRAP     9.5       2

 314          KK   RUSWL1
 315          KM        CHANDLER - COMMERCIAL (PART SECTION 35)
 316          KM        COMPUTE RUNOFF HYDROGRAPH FOR COMMERCIAL AREA
 317          BA   0.2145
 318          LS     3.0      92
 319          UD    0.45

 320          KK     RT1
 321          KM        ROUTE RUSWL1 HYDROGRAPH TO RUSWL3 CONFLUENCE
 322          RK    1200  .00330   0.016            TRAP     0.0    25.0

 323          KK   RUSWL2
 324          KM        CHANDLER - RESIDENTIAL - 0.16 (OLD) PART SECTION 35
 325          KM        COMPUTE RUNOFF HYDROGRAPH FOR RESIDENTIAL AREA
 326          BA   0.0933
 327          LS     2.9      84
 328          UD    0.51

 329          KK     RT2
 330          KM        ROUTE RUSWL2 HYDROGRAPH TO RUSWL3 CONFLUENCE
 331          RK    1800  .00330   0.016            TRAP     0.0    25.0

 332          KK   RUSWL3
 333          KM        CHANDLER - AGRICULTURAL  (PART SECTION 35)
 334          KM        COMPUTE RUNOFF HYDROGRAPH FOR AGRICULTURAL AREA
 335          BA   0.0990
 336          LS     1.5      83
 337          UD    0.57

 338          KK    COMB1
 339          HC        4
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 340          KK     RT3
 341          KM        ROUTE COMB1 HYDROGRAPH TO SW COR. SECT. 35 (PLUS 1000 FT. WEST)
 342          RK    3600  .00800   0.016            TRAP     9.5     2.0

 343          KK  RUSWL4
 344          KM        CHANDLER - RESIDENTIAL - 0.16 (PART SECTION 34 AND 35)
 345          KM        COMPUTE RUNOFF HYDROGRAPH FOR RESIDENTIAL AREA
 346          BA   .1638
 347          LS    2.90      84
 348          UD    0.48

 349          KK  RUSWL5
 350          KM        CHANDLER - OPEN FIELD  (PART SECTION 34 AND 35)
 351          KM        COMPUTE RUNOFF HYDROGRAPH FOR OPEN FIELD
 352          BA  0.0890
 353          LS    1.00      83
 354          UD    0.39

 355          KK     RT4
 356          KM        ROUTE RUSWL5 HYDROGRAPH TO OUTLET
 357          RK    1000  .00330   0.016            TRAP     0.0    25.0

 358          KK  RUSWL6
 359          KM        CHANDLER - RESIDENTIAL - 0.16  (PART SECTION 34 AND 35)
 360          KM        COMPUTE RUNOFF HYDROGRAPH FOR RESIDENTIAL AREA
 361          BA  0.1464
 362          LS     2.9      84
 363          UD    0.34

 364          KK   COMB2
 365          HC       3

 366          KK     RT5
 367          KM        ROUTE COMB2 HYDROGRAPH TO OUTLET
 368          RK    1400  .00330   0.016            TRAP     0.0    25.0

 369          KK  RUSWL7
 370          KM        CHANDLER - RESIDENTIAL - 0.16  (PART SECTION 34 AND 35)
 371          KM        COMPUTE RUNOFF HYDROGRAPH FOR RESIDENTIAL AREA
 372          BA   .1281
 373          LS    2.90      84
 374          UD    0.34

 375          KK  RUSWL8
 376          KM        CHANDLER - PARK/SCHOOL (PART SECTION 34 AND 35)
 377          KM        COMPUTE RUNOFF HYDROGRAPH FOR PARK/SCHOOL
 378          BA  0.0628
 379          LS       0      64
 380          UD    0.22
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 381          KK  RUSWL9
 382          KM        CHANDLER - AGRICULTURAL  (PART SECTION 34 AND 35)
 383          KM        COMPUTE RUNOFF HYDROGRAPH FOR AGRICULTURAL AREA
 384          BA  0.0961
 385          LS     1.5      83
 386          UD    0.23

 387          KK    SW34
 388          HC       5

 389          KK    RT35
 390          KM        ROUTE TO BOTTOM OF SECTION 34
 391          RK    4000   .0013    .016            TRAP      10     2.0

 392          KK   SECT9
 393          KM       TEMPE (TO OLD OUTLET B)
 394          KM       COMPUTE RUNOFF FOR SECTION 9
 395          BA    0.33
 396          LS    1.94      83
 397          UD    0.44

 398          KK  SECT10   OUTLET 3
 399          KM       TEMPE
 400          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 10 - OUTLET 3
 401          BA    0.03
 402          LS    1.50      83
 403          UD    0.92

 404          KK  SECT10   OUTLET 2
 405          KM       TEMPE
 406          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 10 - OUTLET 2
 407          BA    0.19
 408          LS    2.25      88
 409          UD    0.53

 410          KK     RT1
 411          KM       ROUTE SECTION 10 OUTLET 2 HYDROGRAPH TO KYRENE/ELLIOT INTERSECTION
 412          RK    2100  0.0010   0.016            TRAP     0.0    25.0

 413          KK   COMB1
 414          KM       COMBINE SECT9 * SECT10-3 * RT1 TO GIVE HYDROGRAPH AT KYRENE/ELLIOT
 415          HC       3

 416          KK     RT2
 417          KM       ROUTE COMB1 HYDROGRAPH TO KYRENE/WARNER INTERSECTION
 418          RK    5280  0.0004   0.016            TRAP     0.0    25.0

 419          KK  SECT16   OUTLET 1
 420          KM       TEMPE
 421          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 16 - OUTLET 1
 422          BA    0.14
 423          LS    1.54      83
 424          UD    0.41
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 425          KK  SECT15   OUTLET 2
 426          KM       TEMPE
 427          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 15 - OUTLET 2
 428          BA    0.31
 429          LS    1.45      83
 430          UD    0.98

 431          KK   COMB2
 432          KM       COMBINE RT2 * SECT16-1 * SECT15-2 TO GIVE HYDROGRAPH AT KYRENE/WARNER
 433          HC       3

 434          KK     RT3
 435          KM       ROUTE COMB2 HYDROGRAPH TO KYRENE/RAY INTERSECTION
 436          RK    5280  0.0020   0.016            TRAP     0.0    25.0

 437          KK  SECT21   OUTLET 1
 438          KM       TEMPE
 439          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 21 - OUTLET 1
 440          BA    0.42
 441          LS    1.41      83
 442          UD    0.61

 443          KK  SECT22   OUTLET 1
 444          KM       TEMPE
 445          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 22 - OUTLET 1
 446          BA    0.82
 447          LS    2.26      83
 448          UD    0.38

 449          KK   COMB3
 450          KM       COMBINE RT3 * SECT21-1 * SECT22-1 TO GIVE HYDROGRAPH AT KYRENE/RAY
 451          HC       3

 452          KK     RT4
 453          KM       ROUTE COMB3 HYDROGRAPH TO KYRENE/CHANDLER INTERSECTION
 454          RK    5280  0.0019   0.016            TRAP     0.0    25.0

 455          KK  SECT12
 456          KM       TEMPE
 457          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 12
 458          BA    0.50
 459          LS    3.00      83
 460          UD    0.58

 461          KK     RT5
 462          KM       ROUTE SECT12 HYDROGRAPH TO SECT11 CONFLUENCE
 463          RK    2600  0.0006   0.016            TRAP     0.0    25.0

 464          KK  SECT11
 465          KM       TEMPE
 466          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 11
 467          BA    0.51
 468          LS    2.41      86
 469          UD    0.71
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

470           KK   COMB4
471           KM       COMBINE SECT12 * SECT11 HYDROGRAPHS
472           HC       2

473           KK     RT6
474           KM       ROUTE COMB4 HYDROGRAPH TO RURAL/ELLIOT INTERSECTION
475           RK    2600  0.0006   0.016            TRAP     0.0    25.0

476           KK  SECT10   OUTLET 1
477           KM       TEMPE
478           KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 10 - OUTLET 1
479           BA    0.50
480           LS    2.41      84
481           UD    0.36

482           KK   COMB5
483           KM       COMBINE SECT10-1 * RT6 HYDROGRAPHS
484           HC       2

485           KK     RT7
486           KM       ROUTE COMB5 HYDROGRAPH TO RURAL/WARNER INTERSECTION
487           RK    5280  0.0006   0.016            TRAP     0.0    25.0

488           KK  SECT13
489           KM       TEMPE
490           KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 13
491           BA    1.00
492           LS    2.72      88
493           UD    0.32

494           KK     RT8
495           KM       ROUTE SECT13 HYDROGRAPH TO RURAL/WARNER INTERSECTION
496           RK    5280  0.0009   0.016            TRAP     0.0    25.0

497           KK  SECT14
498           KM       TEMPE
499           KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 14
500           BA    1.00
501           LS    2.83    75.7
502           UD    0.75

503           KK  SECT15   OUTLET 1
504           KM       TEMPE
505           KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 15 - OUTLET 1
506           BA    0.69
507           LS    2.18      81
508           UD    0.82

509           KK   COMB6
510           KM       COMBINE RT7 * RT8 * SECT14 * SECT15-1 TO GIVE HYDROGRAPH AT
511           KM       RURAL/CHANDLER INTERSECTION
512           HC       4
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  513         KK     RT9
  514         KM       ROUTE COMB6 HYDROGRAPH TO RURAL/CHANDLER INTERSECTION
  515         RK    5280  0.0006   0.016            TRAP     0.0    25.0

  516         KK  SECT24
  517         KM       TEMPE
  518         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 24
  519         BA    1.00
  520         LS    2.77      83
  521         UD    0.60

  522         KK    RT10
  523         KM       ROUTE SECT24 HYDROGRAPH TO SECT23 CONFLUENCE
  524         RK    5280  0.0011   0.016            TRAP     0.0    25.0

  525         KK  SECT23
  526         KM       TEMPE
  527         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 23
  528         BA    1.00
  529         LS    2.97      83
  530         UD    0.78

  531         KK  SECT22   OUTLET 2
  532         KM       TEMPE
  533         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 22 - OUTLET 2
  534         BA    0.13
  535         LS    1.45      83
  536         UD    0.33

  537         KK   COMB7
  538         KM       COMBINE RT9 * RT10 * SECT22-2 * SECT23 TO GIVE HYDROGRAPH AT
  539         KM       RURAL/RAY INTERSECTION
  540         HC       4

  541         KK    RT11
  542         KM       ROUTE COMB7 HYDROGRAPH TO RURAL/CHANDLER INTERSECTION
  543         RK    5280  0.0009   0.016            TRAP     0.0    25.0

  544         KK  SECT26
  545         KM       CHANDLER
  546         KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 26
  547         BA    1.00
  548         LS    1.82      85
  549         UD    0.96

  550         KK   COMB8
  551         KM       COMBINE RT11 * SECT26
  552         HC       2
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 553          KK    RT12
 554          KM       ROUTE COMB8 HYDROGRAPH TO KYRENE/CHANDLER INTERSECTION
 555          RK    5280  0.0009   0.016            TRAP     0.0    25.0

 556          KK  SECT28   OUTLET 1
 557          KM       CHANDLER
 558          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 28 - OUTLET 1
 559          BA    0.69
 560          LS    2.51      85
 561          UD    0.35

 562          KK  SECT27
 563          KM       CHANDLER
 564          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 27
 565          BA    1.00
 566          LS    2.18      88
 567          UD    1.38

 568          KK   COMB9
 569          KM       COMBINE SECT27 * RT13 * RT12 * RT4 TO GIVE HYDROGRAPH AT
 570          KM       KYRENE/CHANDLER INTERSECTION
 571          HC       4

 572          KK    RT13
 573          KM       ROUTE COMB9 HYDROGRAPH TO KYRENE/SOUTHWEST LOOP INTERSECTION
 574          RK    4000  0.0006   0.016            TRAP     0.0    25.0

 575          KK  SECT34
 576          KM       CHANDLER
 577          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 34
 578          BA    0.67
 579          LS    2.04      83
 580          UD    1.05

 581          KK   COMBB
 582          KM        COMBINE HYDROGRAPHS AT SW CORNER SECTION 34 (INCL. 35,36,25)
 583          HC       3

 584          KK  SECT33   OUTLET 2
 585          KM       CHANDLER
 586          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 33 - OUTLET 2
 587          BA    0.26
 588          LS    1.53      86
 589          UD    0.54
              *
              * IN     5                    300
              * ***************************************************************************
              *        Note: Kyrene Pump Station removed from routing.  Pump Station pumps
              *        directly to Equalization Basin.
              * ***************************************************************************
              * KKkyrene
              * KM      ONSITE DRAINAGE/STORAGE ANALYSIS 50 YEAR 24 HOUR STORM
              * KM      USE PUMP STATION 'INFLOW' HYDROGRAPH FROM KYRENE2.DAT ONSITE FILE
              * KM      PUMP STATION DESIGN Q IS 200 CFS.
              * BA  0.11
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
              * QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
```

```
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00     1.0     1.0     1
* QI  1.00    1.00    1.00    1.00    1.00    1.00    2.00    2.00    2.00    2.
* QI  2.00    3.00    3.00    3.00    4.00    4.00    4.00    5.00    5.00    6.
* QI  9.00   14.00   22.00   34.00   54.00   94.00  159.00  209.00  216.00  188.
* QI150.00  116.00   88.00   65.00   47.00   35.00   26.00   20.00   17.00   14.
* QI 12.00   11.00   11.00   10.00    9.00    9.00    8.00    8.00    8.00    7.
* QI  7.00    7.00    6.00    6.00    6.00    6.00    6.00    5.00    5.00    5.
* QI  5.00    5.00    5.00    5.00    4.00    4.00    4.00    4.00    4.00    4.
* QI  3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.
* QI  3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.00    3.00    2.
* QI  2.00    2.00    2.00    2.00    2.00    2.00    2.00    2.00    2.00    2.
* QI  2.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.
* QI  1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.
* QI  1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.
* QI  1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.
* QI  1.00    1.00    1.00    1.00    1.00    1.00    1.00    1.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
* QI  0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.
*
* KK ckyre
* HC     2
*
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 590          KK   COMBB
 591          KM        COMBINE HYDROGRAPHS AT BASIN B FROM AREAS TO THE EAST
 592          HC       2

 593          KK  SECT16   OUTLET 3
 594          KM       TEMPE
 595          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 16 - OUTLET 3
 596          BA    0.23
 597          LS    3.00      88
 598          UD    0.39

 599          KK     RT1
 600          KM       ROUTE SECTION 16 OUTLET 3 HYDROGRAPH TO 56TH/RAY INTERSECTION
 601          RK    5280  0.0010   0.016            TRAP     0.0    25.0

 602          KK  SECT20
 603          KM       TEMPE
 604          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 20
 605          BA    0.29
 606          LS    1.10      83
 607          UD    0.28

 608          KK   COMB1
 609          KM       COMBINE SECT10 * RT1 TO GIVE HYDROGRAPH AT 56TH/RAY INTERSECTION
 610          HC       2

 611          KK     RT2
 612          KM       ROUTE COMB1 HYDROGRAPH TO 56TH/CHANDLER INTERSECTION
 613          RK    5280  0.0010   0.016            TRAP     0.0    25.0

 614          KK  SECT29
 615          KM       CHANDLER
 616          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 29
 617          BA    0.50
 618          LS    2.12      85
 619          UD    0.62

 620          KK   COMB2
 621          KM       COMBINE SECT29 * RT2 TO GIVE HYDROGRAPH AT 56TH/CHANDLER INTERSECTION
 622          HC       2

 623          KK     RT3
 624          KM       ROUTE COMB2 HYDROGRAPH TO OUTLET-C AT 56TH/SOUTHWEST LOOP INTERSECTION
 625          RK    3600  0.0010   0.016            TRAP     0.0    25.0

 626          KK  SECT16   OUTLET 2
 627          KM       TEMPE
 628          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 16 - OUTLET 2
 629          BA    0.50
 630          LS    1.52      83
 631          UD    0.54
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 632          KK     RT4
 633          KM       ROUTE SECT16 - OUTLET 2 HYDROGRAPH TO RAY/SO.PAC RR INTERSECTION
 634          RK    5400  0.0010   0.016            TRAP     0.0    25.0

 635          KK  SECT21   OUTLET 2
 636          KM       TEMPE
 637          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 21 - OUTLET 2
 638          BA    0.59
 639          LS    1.60      83
 640          UD    0.60

 641          KK   COMB3
 642          KM       COMBINE SECT21-2 * RT4 * HYDROGRAPHS AT RAY/SO.PAC. RR INTERSECTION
 643          HC       2

 644          KK     RT5
 645          KM       ROUTE COMB3 HYDROGRAPH TO CHANDLER/SO.PAC. RR INTERSECTION
 646          RK    5500  0.0010   0.016            TRAP     0.0    25.0

 647          KK  SECT28   OUTLET 2
 648          KM       CHANDLER
 649          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 28 - OUTLET 2
 650          BA    0.30
 651          LS    1.97      85
 652          UD    0.58

 653          KK   COMB4
 654          KM       COMBINE SECT28-2 * RT5 HYDROGRAPHS AT CHANDLER/SO.PAC. RR INTERSECTION
 655          HC       2

 656          KK     RT6
 657          KM       ROUTE COMB4 HYDROGRAPH TO SOUTHWEST LOOP/SO.PAC. RR INTERSECTION
 658          RK    3700  0.0010   0.016            TRAP     0.0    25.0

 659          KK  SECT32
 660          KM       CHANDLER
 661          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 32
 662          BA    0.33
 663          LS    1.50      83
 664          UD    0.60

 665          KK  OUTLTC
 666          KM       COMBINE RT6 * SECT32 * RT3 TO GIVE HYDOGRAPH AT OUTLET-C AT
 667          KM       SOUTHWEST LOOP/SO.PAC. RR INTERSECTION
 668          HC       3

 669          KK  SECT33   OUTLET 1
 670          KM       CHANDLER
 671          KM       COMPUTE RUNOFF HYDROGRAPH FOR SECTION 33 - OUTLET 1
 672          BA    0.53
 673          LS    2.22      82
 674          UD    0.18
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

675           KK   WCHAN
676           KM       COMBINE SECT33-1 AND OLD OUTLET C AREA
677           HC       2
              *
              *
              *

678           KK    INBB
679           KM       COMBINE ALL HYDROGRAPHS INFLOW TO BASIN B FOREBAY
680           HC       2
              * ******************************************************************************
              *       HYDROLOGIC ROUTING OF BASIN B PERFORMED USING SPREADSHEET.
              *       SEE DRAINGE REPORT FOR SANTAN CHANNEL PHASE 3.
              * ******************************************************************************
681           ZZ
```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

 NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  72        bash
              .
              .
 106          .       CHNDLR
              .            .
              .            .
 140      cchand............
              .
              .
 144          .       interc
              .            .
              .            .
 178       addTI............
              .
              .
 182          .         basg
              .            V
              .            V
 216          .        rbasg
              .            V
              .            V
 223          .       rtbasg
              .            .
              .            .
 225      cinter............
              .
              .
 229          .       MCSWL2
              .            .
              .            .
 236       cbash............
              V
              V
 239         RT1
              .
              .
 242          .       MCSWL3
              .            .
              .            .
 248       COMB1............
              .
              .
 252          .       SECT25
              .            V
              .            V
 259          .          RT1
              .            .
              .            .
 262          .            .      SECT36
              .            .           .
              .            .           .
 270      SECT36........................
              .
              .
 274          .       mcclin
              .            .
              .            .
 309       cmcln............
              V
```

```
                V
311        RT2536
                .
                .
314             .      RUSWL1
                .          V
                .          V
320             .        RT1
                .          .
                .          .
323             .          .      RUSWL2
                .          .          V
                .          .          V
329             .          .        RT2
                .          .          .
                .          .          .
332             .          .          .      RUSWL3
                .          .          .          .
                .          .          .          .
338        COMB1.................................
                V
                V
340         RT3
                .
                .
343             .      RUSWL4
                .          .
                .          .
349             .          .      RUSWL5
                .          .          V
                .          .          V
355             .          .        RT4
                .          .          .
                .          .          .
358             .          .          .      RUSWL6
                .          .          .          .
                .          .          .          .
364             .       COMB2......................
                .          V
                .          V
366             .        RT5
                .          .
                .          .
369             .          .      RUSWL7
                .          .          .
                .          .          .
375             .          .          .      RUSWL8
                .          .          .          .
                .          .          .          .
381             .          .          .          .      RUSWL9
                .          .          .          .          .
                .          .          .          .          .
387        SW34.............................................
                V
                V
389        RT35
                .
                .
392             .       SECT9
                .          .
                .          .
398             .          .      SECT10
                .          .          .
                .          .          .
404             .          .          .      SECT10
                .          .          .          V
```

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                 .         .         .         V
410              .         .         .       RT1
                 .         .         .         .
                 .         .         .         .
413              .     COMB1.......................
                 .       V
                 .       V
416              .      RT2
                 .       .
                 .       .
419              .       .     SECT16
                 .       .         .
                 .       .         .
425              .       .         .     SECT15
                 .       .         .         .
                 .       .         .         .
431              .     COMB2.......................
                 .       V
                 .       V
434              .      RT3
                 .       .
                 .       .
437              .       .     SECT21
                 .       .         .
                 .       .         .
443              .       .         .     SECT22
                 .       .         .         .
                 .       .         .         .
449              .     COMB3.......................
                 .       V
                 .       V
452              .      RT4
                 .       .
                 .       .
455              .       .     SECT12
                 .       .         V
                 .       .         V
461              .       .        RT5
                 .       .         .
                 .       .         .
464              .       .         .     SECT11
                 .       .         .         .
                 .       .         .         .
470              .       .      COMB4............
                 .       .         V
                 .       .         V
473              .       .        RT6
                 .       .         .
                 .       .         .
476              .       .         .     SECT10
                 .       .         .         .
                 .       .         .         .
482              .       .      COMB5............
                 .       .         V
                 .       .         V
485              .       .        RT7
                 .       .         .
                 .       .         .
488              .       .         .     SECT13
                 .       .         .         V
                 .       .         .         V
494              .       .         .       RT8
                 .       .         .         .
                 .       .         .         .
497              .       .         .         .     SECT14
                 .       .         .         .         .
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                .         .         .         .         .
503             .         .         .         .         .     SECT15
                .         .         .         .         .         .
                .         .         .         .         .         .
509             .         .      COMB6.................................
                .         .         V
                .         .         V
513             .         .        RT9
                .         .         .
                .         .         .
516             .         .         .     SECT24
                .         .         .         V
                .         .         .         V
522             .         .         .       RT10
                .         .         .         .
                .         .         .         .
525             .         .         .         .     SECT23
                .         .         .         .         .
                .         .         .         .         .
531             .         .         .         .         .     SECT22
                .         .         .         .         .         .
                .         .         .         .         .         .
537             .         .      COMB7.................................
                .         .         V
                .         .         V
541             .         .       RT11
                .         .         .
                .         .         .
544             .         .         .     SECT26
                .         .         .         .
                .         .         .         .
550             .         .      COMB8............
                .         .         V
                .         .         V
553             .         .       RT12
                .         .         .
                .         .         .
556             .         .         .     SECT28
                .         .         .         .
                .         .         .         .
562             .         .         .         .     SECT27
                .         .         .         .         .
                .         .         .         .         .
568             .      COMB9.................................
                .         V
                .         V
572             .       RT13
                .         .
                .         .
575             .         .     SECT34
                .         .         .
                .         .         .
581          COMBB......................
                .
                .
584             .     SECT33
                .         .
                .         .
590          COMBB............
                .
                .
593             .     SECT16
                .         V
                .         V
599             .       RT1
                .         .
```

```
                .          .
602             .          .      SECT20
                .          .          .
                .          .          .
608             .      COMB1............
                .          V
                .          V
611             .        RT2
                .          .
                .          .
614             .          .      SECT29
                .          .          .
                .          .          .
620             .      COMB2............
                .          V
                .          V
623             .        RT3
                .          .
                .          .
626             .          .      SECT16
                .          .          V
                .          .          V
632             .          .        RT4
                .          .          .
                .          .          .
635             .          .          .      SECT21
                .          .          .          .
                .          .          .          .
641             .          .      COMB3............
                .          .          V
                .          .          V
644             .          .        RT5
                .          .          .
                .          .          .
647             .          .          .      SECT28
                .          .          .          .
                .          .          .          .
653             .          .      COMB4............
                .          .          V
                .          .          V
656             .          .        RT6
                .          .          .
                .          .          .
659             .          .          .      SECT32
                .          .          .          .
                .          .          .          .
665             .      OUTLTC........................
                .          .
                .          .
669             .          .      SECT33
                .          .          .
                .          .          .
675             .      WCHAN............
                .          .
                .          .
678         INBB............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
* RUN DATE   09MAY99  TIME  12:20:32   *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

FN: SEVRDS3A.DAT May 1999 ADAPTED FROM SVRD05~2.DAT (HDR 5/98)
This model has one revision from the previous model. The previous model is separated into two models for the routing of the Basin B complex. The outflow hydrograph from the Basin B routing is the inflow for the SEVRDS3B.DAT model downstream of the basin complex to the Gila Floodway.
****
FN: SVRD05~2.DAT May 1998 ADAPTED FROM SEVRDS.DAT (HDR 4/97)
This model has two revisions from the previous model.

1. Revised BASIN B and Outlet Channel routings to accomodate P-MIP project overflows from the Gila Drain as described below.
2. Revised Basin 15 from detention to retention so that flows will not bypassed to the SEVRDS Channel during the event. See more below.

****
HISTORY THIS MODEL: This model is a modification of ALT2c.DAT developed by HDR for the Alternative Study for SEVRDS by HDR in June 1995. SMF48TH.DAT(PRICE5) on the West side of I-10 was included. GILA1B.DAT(Gila Drain Floodway Model) was also included in this model. ALT2c was a composite of HEC1 models from Price GEC Gila Drain Alternati Drainage Report,HDR,Feb 1993(Price/Santan/Gila Drain GILADRY.DAT model), South Mountain Freeway Concept Drainage Report, HDR, Feb 1993,(Segment V PRICE5.DAT model modified to SMF48th.DAT described below), and Gila Drain Floodway Master Plan Report, Feb 1993(GILA1B.DAT model). The original model was developed for the Price Freeway drainage system as reported in "Hydrology Study: Price Expressway", ADOT Contract 88-24, Dec. 1989. The model criteria is provided in that report. The basic model has not changed since 1989. The model continues to be the model record because the model was used to design the upper part of the SEVRDS/Santan Channel system on Price Freeway for the Galveston to Frye Interim Project which included construction of Basin G and the outlet to the Santan Channel.
****
BASIN B DESIGN. Basin B was configured as a bypass basin in 1993. With the formation of SEVRDS, the Basin was reconfigured as a multi-celled basin with first flush containment cell, a treatment cell and a large retention cell to capture flows above 800 cfs.("Initial Drainage Report Santan Freeway:56th St to Price Rd and Gila Drain Floodway to Basin B," Wood Patel & Assoc., Sept. 12, 1996.)
HDR prepared a detailed design of the Basin B complex in Feb. 1997. The size of Basin B was increased from 385(9/96) to 450 af to limit bypa flows to 900 cfs. This operation maximized the available storage on-site and required moving the outlet channel to the west side of the Gila Drain. This most recent model further optimized storage on site in in Basin B to limit bypass flows to 800 cfs to allow Gila Drain flows of up to 150 cfs to enter the outfall channel at the GRIC boundary

Basin B site has three basins: 1.First flush equalization/sedimentation basin stores first 39 ac-ft of inflow into system. 2. A two-celled Watr Quality Basin treats the first-flush post-event. This basin is not included in the model. 3. An off-line retention basin, Basin B, has a capacity of 450 ac-ft. Operation: The first flush is conveyed in the Forebay Channel to Eq. Basin. Additional flow up to 804 cfs is bypassed thru 3-10x4 control RCB to Outfall Chan. At about 600 cfs, flow begins

to spill over Basin B weir. At 100-yr peak of 2895 cfs, 804 cfs is discharging to RCB and 2091 cfs is overflowing 1000' weir into Basin B
****
SMF48th.DAT Model of the area west of I-10 was significantly changed in Feb. 1996 for the 48th St. ID study for Phoenix, including the reconfiguration of Basin 15 as a retention basin as mentioned above. A future connection of the 48th St.-Basin 15 to SEVRDS would be a pipe to dewater Basin 15 post-event. Basin 15 will not increase design discharge of the SEVRDS Channel during the event.
****

INITIAL ABSTRACTION USED TO REPRESENT DEVELOPMENT RETENTION PROVIDED
100 YEAR - 24 HOUR STORM
DMJM - PHOENIX
FILENAME: SEVRDS3A.DAT

```
70 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                    NMIN          5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1   0  STARTING DATE
                   ITIME       0000  STARTING TIME
                      NQ       1000  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE      4   0  ENDING DATE
                 NDTIME       1115  ENDING TIME
                 ICENT          19  CENTURY MARK

            COMPUTATION INTERVAL     .08 HOURS
                 TOTAL TIME BASE   83.25 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	bash	764.	13.58	327.	255.	126.	6.76		
HYDROGRAPH AT	CHNDLR	100.	13.00	90.	90.	45.	.00		
2 COMBINED AT	cchand	864.	13.58	417.	344.	171.	6.76		
HYDROGRAPH AT	interc	200.	12.17	38.	10.	3.	.16		
2 COMBINED AT	addTI	904.	13.58	428.	350.	174.	6.92		
HYDROGRAPH AT	basg	954.	14.00	337.	109.	36.	4.37		
ROUTED TO	rbasg	190.	16.83	180.	105.	36.	4.37	1180.46	16.83
ROUTED TO	rtbasg	190.	16.92	180.	105.	36.	4.37		
2 COMBINED AT	cinter	938.	13.58	569.	454.	211.	11.29		
HYDROGRAPH AT	MCSWL2	48.	13.17	15.	4.	1.	.16		
2 COMBINED AT	cbash	975.	13.58	581.	459.	212.	11.45		
ROUTED TO	RT1	969.	13.58	581.	458.	212.	11.45		
HYDROGRAPH AT	MCSWL3	52.	13.17	17.	5.	2.	.17		
2 COMBINED AT	COMB1	1011.	13.58	595.	463.	214.	11.62		
HYDROGRAPH AT	SECT25	222.	13.25	77.	24.	8.	1.00		
ROUTED TO	RT1	222.	13.50	77.	24.	8.	1.00		
HYDROGRAPH AT	SECT36	92.	13.33	34.	11.	4.	.51		
3 COMBINED AT	SECT36	1315.	13.58	704.	498.	225.	13.13		
HYDROGRAPH AT	mcclin	200.	12.08	29.	8.	3.	.11		
2 COMBINED AT	cmcln	1332.	13.50	711.	504.	228.	13.24		
ROUTED TO	RT2536	1319.	13.58	711.	504.	228.	13.24		
HYDROGRAPH AT	RUSWL1	5.	14.75	4.	1.	0.	.21		
ROUTED TO	RT1	5.	14.83	4.	1.	0.	.21		
HYDROGRAPH AT	RUSWL2	2.	14.33	1.	0.	0.	.09		
ROUTED TO	RT2	2.	14.58	1.	0.	0.	.09		
HYDROGRAPH AT	RUSWL3	42.	12.83	10.	3.	1.	.10		
4 COMBINED AT	COMB1	1338.	13.58	722.	509.	229.	13.64		
ROUTED TO	RT3	1334.	13.58	722.	509.	229.	13.64		
HYDROGRAPH AT	RUSWL4	3.	14.33	2.	1.	0.	.16		

HYDROGRAPH AT	RUSWL5	74.	12.50	12.	4.	1.	.09
ROUTED TO	RT4	73.	12.58	12.	4.	1.	.09
HYDROGRAPH AT	RUSWL6	3.	14.00	2.	1.	0.	.15
3 COMBINED AT	COMB2	73.	12.58	16.	5.	2.	.40
ROUTED TO	RT5	72.	12.67	16.	5.	2.	.40
HYDROGRAPH AT	RUSWL7	2.	14.00	2.	1.	0.	.13
HYDROGRAPH AT	RUSWL8	32.	12.33	4.	1.	0.	.06
HYDROGRAPH AT	RUSWL9	64.	12.42	10.	3.	1.	.10
5 COMBINED AT	SW34	1365.	13.58	748.	519.	233.	14.33
ROUTED TO	RT35	1345.	13.67	748.	519.	233.	14.33
HYDROGRAPH AT	SECT9	94.	12.75	22.	7.	2.	.33
HYDROGRAPH AT	SECT10	9.	13.17	3.	1.	0.	.03
HYDROGRAPH AT	SECT10	37.	12.92	11.	4.	1.	.19
ROUTED TO	RT1	37.	13.08	11.	4.	1.	.19
3 COMBINED AT	COMB1	122.	12.83	35.	11.	4.	.55
ROUTED TO	RT2	121.	13.42	35.	11.	4.	.55
HYDROGRAPH AT	SECT16	69.	12.67	13.	4.	1.	.14
HYDROGRAPH AT	SECT15	94.	13.25	31.	9.	3.	.31
3 COMBINED AT	COMB2	231.	13.42	78.	24.	8.	1.00
ROUTED TO	RT3	229.	13.67	77.	24.	8.	1.00
HYDROGRAPH AT	SECT21	186.	12.83	44.	13.	4.	.42
HYDROGRAPH AT	SECT22	143.	12.75	37.	12.	4.	.82
3 COMBINED AT	COMB3	421.	12.92	157.	49.	16.	2.24
ROUTED TO	RT4	417.	13.08	156.	49.	16.	2.24
HYDROGRAPH AT	SECT12	6.	15.08	5.	2.	1.	.50
ROUTED TO	RT5	6.	15.58	4.	2.	1.	.50
HYDROGRAPH AT	SECT11	51.	13.25	21.	7.	2.	.51
2 COMBINED AT	COMB4	51.	13.25	24.	9.	3.	1.01
ROUTED TO	RT6	51.	13.50	24.	9.	3.	1.01
HYDROGRAPH AT	SECT10	65.	12.75	19.	6.	2.	.50
2 COMBINED AT	COMB5	84.	13.33	42.	15.	5.	1.51
ROUTED TO	RT7	84.	13.92	41.	15.	5.	1.51
HYDROGRAPH AT	SECT13	54.	12.92	26.	10.	3.	1.00

ROUTED TO	RT8	54.	13.42	26.	10.	3.	1.00
HYDROGRAPH AT	SECT14	15.	14.50	10.	4.	1.	1.00
HYDROGRAPH AT	SECT15	81.	13.25	31.	10.	3.	.69
4 COMBINED AT	COMB6	207.	13.67	104.	39.	13.	4.20
ROUTED TO	RT9	207.	14.08	104.	39.	13.	4.20
HYDROGRAPH AT	SECT24	27.	13.75	17.	7.	2.	1.00
ROUTED TO	RT10	27.	14.33	17.	7.	2.	1.00
HYDROGRAPH AT	SECT23	14.	15.17	10.	4.	1.	1.00
HYDROGRAPH AT	SECT22	79.	12.50	13.	4.	1.	.13
4 COMBINED AT	COMB7	251.	14.17	134.	54.	18.	6.33
ROUTED TO	RT11	251.	14.42	134.	54.	18.	6.33
HYDROGRAPH AT	SECT26	221.	13.33	79.	24.	8.	1.00
2 COMBINED AT	COMB8	365.	14.25	207.	79.	26.	7.33
ROUTED TO	RT12	364.	14.50	206.	79.	26.	7.33
HYDROGRAPH AT	SECT28	71.	12.83	23.	8.	3.	.69
HYDROGRAPH AT	SECT27	119.	13.92	60.	20.	7.	1.00
4 COMBINED AT	COMB9	761.	13.33	439.	156.	52.	11.26
ROUTED TO	RT13	758.	13.50	437.	155.	52.	11.26
HYDROGRAPH AT	SECT34	93.	13.50	39.	12.	4.	.67
3 COMBINED AT	COMBB	2179.	13.58	1217.	687.	289.	26.26
HYDROGRAPH AT	SECT33	126.	12.75	28.	8.	3.	.26
2 COMBINED AT	COMBB	2221.	13.58	1240.	695.	291.	26.52
HYDROGRAPH AT	SECT16	4.	14.83	3.	1.	0.	.23
ROUTED TO	RT1	4.	15.83	3.	1.	0.	.23
HYDROGRAPH AT	SECT20	267.	12.42	38.	11.	4.	.29
2 COMBINED AT	COMB1	267.	12.42	40.	12.	4.	.52
ROUTED TO	RT2	264.	12.75	39.	12.	4.	.52
HYDROGRAPH AT	SECT29	95.	13.00	29.	9.	3.	.50
2 COMBINED AT	COMB2	342.	12.75	68.	21.	7.	1.02
ROUTED TO	RT3	332.	13.00	68.	21.	7.	1.02
HYDROGRAPH AT	SECT16	215.	12.75	49.	14.	5.	.50
ROUTED TO	RT4	212.	13.08	48.	14.	5.	.50
HYDROGRAPH AT	SECT21	217.	12.83	53.	16.	5.	.59

2 COMBINED AT	COMB3	405.	13.00	101.	30.	10.	1.09
ROUTED TO	RT5	397.	13.33	100.	30.	10.	1.09
HYDROGRAPH AT	SECT28	76.	12.92	21.	6.	2.	.30
2 COMBINED AT	COMB4	452.	13.25	120.	37.	12.	1.39
ROUTED TO	RT6	443.	13.42	119.	37.	12.	1.39
HYDROGRAPH AT	SECT32	135.	12.83	32.	10.	3.	.33
3 COMBINED AT	OUTLTC	719.	13.42	217.	68.	23.	2.74
HYDROGRAPH AT	SECT33	126.	12.50	24.	8.	3.	.53
2 COMBINED AT	WCHAN	749.	13.42	241.	75.	25.	3.27
2 COMBINED AT	INBB	2886.	13.58	1478.	770.	316.	29.79

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
rtbasg	MANE	3.00	189.98	1016.00	.93	5.00	189.97	1015.00	.93
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2162E+03 EXCESS= .0000E+00 OUTFLOW= .2162E+03 BASIN STORAGE= .4429E-02 PERCENT ERROR= .0									
RT1	MANE	1.45	969.64	815.29	2.07	5.00	969.02	815.00	2.07
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1262E+04 EXCESS= .0000E+00 OUTFLOW= .1262E+04 BASIN STORAGE= .4085E+00 PERCENT ERROR= -.1									
RT1	MANE	4.87	222.35	809.68	.88	5.00	222.20	810.00	.88
CONTINUITY SUMMARY (AC-FT) - INFLOW= .4703E+02 EXCESS= .0000E+00 OUTFLOW= .4699E+02 BASIN STORAGE= .1506E-05 PERCENT ERROR= .1									
RT2536	MANE	.67	1331.28	811.42	1.92	5.00	1319.15	815.00	1.92
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1355E+04 EXCESS= .0000E+00 OUTFLOW= .1355E+04 BASIN STORAGE= .2990E+00 PERCENT ERROR= .0									
RT1	MANE	3.06	5.36	890.68	.26	5.00	5.36	890.00	.26
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2950E+01 EXCESS= .0000E+00 OUTFLOW= .2951E+01 BASIN STORAGE= .1935E-08 PERCENT ERROR= .0									
RT2	MANE	4.50	1.78	874.14	.20	5.00	1.78	875.00	.20
CONTINUITY SUMMARY (AC-FT) - INFLOW= .9822E+00 EXCESS= .0000E+00 OUTFLOW= .9823E+00 BASIN STORAGE= .6775E-08 PERCENT ERROR= .0									
RT3	MANE	.99	1334.70	815.50	1.88	5.00	1333.57	815.00	1.88
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1365E+04 EXCESS= .0000E+00 OUTFLOW= .1365E+04 BASIN STORAGE= .4185E+00 PERCENT ERROR= .0									
RT4	MANE	1.37	73.73	753.45	1.47	5.00	73.39	755.00	1.47
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6979E+01 EXCESS= .0000E+00 OUTFLOW= .6982E+01 BASIN STORAGE= .9618E-09 PERCENT ERROR= .0									
RT5	MANE	1.83	73.08	759.13	.48	5.00	72.50	760.00	.48
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1024E+02 EXCESS= .0000E+00 OUTFLOW= .1024E+02 BASIN STORAGE= .9098E-08 PERCENT ERROR= .0									
RT35	MANE	1.93	1360.69	818.86	1.81	5.00	1345.27	820.00	1.81

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1384E+04 EXCESS= .0000E+00 OUTFLOW= .1384E+04 BASIN STORAGE= .8813E+00 PERCENT ERROR= -.1

RT1	MANE	5.00	36.77	786.27	.69	5.00	36.62	785.00	.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6956E+01 EXCESS= .0000E+00 OUTFLOW= .6954E+01 BASIN STORAGE= .1052E-06 PERCENT ERROR= .0

RT2	MANE	4.93	121.84	808.21	.75	5.00	121.13	805.00	.75

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2200E+02 EXCESS= .0000E+00 OUTFLOW= .2200E+02 BASIN STORAGE= .1486E-04 PERCENT ERROR= .0

RT3	MANE	4.63	230.25	818.71	.91	5.00	228.81	820.00	.91

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4828E+02 EXCESS= .0000E+00 OUTFLOW= .4830E+02 BASIN STORAGE= .2292E-04 PERCENT ERROR= -.1

RT4	MANE	5.00	419.26	783.77	.82	5.00	417.10	785.00	.82

CONTINUITY SUMMARY (AC-FT) - INFLOW= .9772E+02 EXCESS= .0000E+00 OUTFLOW= .9760E+02 BASIN STORAGE= .4090E-04 PERCENT ERROR= .1

RT5	MANE	5.00	6.32	934.56	.14	5.00	6.32	935.00	.14

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3839E+01 EXCESS= .0000E+00 OUTFLOW= .3840E+01 BASIN STORAGE= .3322E-06 PERCENT ERROR= .0

RT6	MANE	5.00	51.30	809.64	.33	5.00	51.26	810.00	.33

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1787E+02 EXCESS= .0000E+00 OUTFLOW= .1786E+02 BASIN STORAGE= .1710E-05 PERCENT ERROR= .1

RT7	MANE	5.00	84.04	834.55	.38	5.00	83.94	835.00	.38

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3039E+02 EXCESS= .0000E+00 OUTFLOW= .3038E+02 BASIN STORAGE= .2638E-04 PERCENT ERROR= .0

RT8	MANE	5.00	53.94	805.24	.36	5.00	53.82	805.00	.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1908E+02 EXCESS= .0000E+00 OUTFLOW= .1919E+02 BASIN STORAGE= .2429E-05 PERCENT ERROR= -.6

RT9	MANE	4.97	206.80	843.86	.35	5.00	206.75	845.00	.35

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7804E+02 EXCESS= .0000E+00 OUTFLOW= .7802E+02 BASIN STORAGE= .8735E-04 PERCENT ERROR= .0

RT10	MANE	4.91	27.28	863.89	.25	5.00	27.28	860.00	.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1329E+02 EXCESS= .0000E+00 OUTFLOW= .1329E+02 BASIN STORAGE= .1912E-05 PERCENT ERROR= .0

RT11	MANE	4.92	250.88	868.68	.32	5.00	250.68	865.00	.32

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1074E+03 EXCESS= .0000E+00 OUTFLOW= .1076E+03 BASIN STORAGE= .1700E-03 PERCENT ERROR= -.2

RT12	MANE	5.00	363.79	866.99	.40	5.00	363.70	870.00	.40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1561E+03 EXCESS= .0000E+00 OUTFLOW= .1560E+03 BASIN STORAGE= .2962E-03 PERCENT ERROR= .0

RT13	MANE	5.00	757.89	809.76	.51	5.00	757.59	810.00	.51

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3087E+03 EXCESS= .0000E+00 OUTFLOW= .3085E+03 BASIN STORAGE= .3493E-03 PERCENT ERROR= .1

RT1	MANE	5.00	4.13	948.98	.19	5.00	4.13	950.00	.19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2376E+01 EXCESS= .0000E+00 OUTFLOW= .2376E+01 BASIN STORAGE= .1754E-05 PERCENT ERROR= .0

RT2	MANE	3.85	263.74	765.08	.86	5.00	263.68	765.00	.86

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2387E+02 EXCESS= .0000E+00 OUTFLOW= .2393E+02 BASIN STORAGE= .1525E-04 PERCENT ERROR= -.2

RT3	MANE	3.80	336.66	775.86	.78	5.00	332.07	780.00	.78

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4230E+02 EXCESS= .0000E+00 OUTFLOW= .4258E+02 BASIN STORAGE= .2116E-04 PERCENT ERROR= -.7

RT4	MANE	5.00	213.46	786.95	1.07	5.00	211.74	785.00	1.06

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2834E+02 EXCESS= .0000E+00 OUTFLOW= .2840E+02 BASIN STORAGE= .3142E-05 PERCENT ERROR= -.2

RT5	MANE	5.00	403.35	797.39	1.03	5.00	397.35	800.00	1.03

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5995E+02 EXCESS= .0000E+00 OUTFLOW= .5991E+02 BASIN STORAGE= .1825E-04 PERCENT ERROR= .1

RT6	MANE	4.75	450.11	806.98	.98	5.00	443.39	805.00	.98

CONTINUITY SUMMARY (AC-FT) - INFLOW= .7263E+02 EXCESS= .0000E+00 OUTFLOW= .7253E+02 BASIN STORAGE= .2258E-04 PERCENT ERROR= .1

*** NORMAL END OF HEC-1 ***

BASIN B COMPLEX HYDROLOGIC/HYDRAULIC ROUTING

Time (hrs)	Inflow (cfs)	Inflow Σ Vol. ac-ft	Q (cfs) into Eq. Basin	Controlling WSE (ft)	Eq. Bsn & Forebay Tot. Vol.	Outlet Siphon Q (cfs)	Weir Q (cfs)	Weir Coeff. C_{RATIO}	Weir Coeff. C_{sub}	Weir Vol. Into Basin B (ac-ft)	Continuity Check Inflow= Outflow	Basin B WSE (ft)	Avg. Volume (ac-ft)	Total Storage (ac-ft)	Comments
10.50	0	0.00													
10.58	0	0.00													
10.67	0	0.00													
10.75	0	0.00	0												
10.83	1	0.01	1	1138.5	0.0									0.01	
10.92	8	0.06	8	1138.6	0.1									0.06	
11.00	15	0.17	15	1138.7	0.2									0.17	
11.08	10	0.23	10	1138.7	0.2									0.23	
11.17	7	0.28	7	1138.8	0.3									0.28	
11.25	5	0.32	5	1138.8	0.3									0.32	
11.33	4	0.34	4	1138.8	0.3									0.34	
11.42	4	0.37	4	1138.9	0.4									0.37	
11.50	5	0.41	5	1138.9	0.4									0.41	
11.58	10	0.48	10	1139.0	0.5									0.48	
11.67	14	0.57	14	1139.1	0.6									0.57	
11.75	27	0.76	27	1139.3	0.8									0.76	
11.83	42	1.05	42	1139.6	1.0									1.05	
11.92	48	1.38	48	1139.8	1.4									1.38	
12.00	49	1.71	49	1140.0	1.7									1.71	
12.08	48	2.05	48	1140.2	2.0									2.05	
12.17	112	2.82	112	1140.6	2.8									2.82	
12.25	338	5.14	338	1141.9	5.1									5.14	
12.33	624	9.44	624	1143.9	9.4									9.44	
12.42	806	14.99	806	1145.8	15.0									14.99	
12.50	941	21.47	941	1147.8	21.5	0					0			21.47	
12.58	1044	28.66	0	1153.0	42.5	729	315	0.00	1.00	2.17	0	1129.6		44.62	
12.67	1115	36.34	0	1153.0	42.6	736	379	0.00	1.00	4.78	0	1130.1		47.38	
12.75	1146	44.24	0	1153.0	42.7	739	407	0.00	1.00	7.58	0	1130.5		50.24	
12.83	1350	53.53		1153.1	43.0	757	593	0.00	1.00	11.66	0	1131.1		54.69	
12.92	1713	65.33		1153.2	43.6	785	928	0.00	1.00	18.05	0	1131.6		61.66	
13.00	1991	79.04		1153.3	44.0	805	1186	0.00	1.00	26.21	0	1132.3		70.22	
13.08	2196	94.17		1153.4	44.3	819	1377	0.00	1.00	35.70	0	1133.1		79.97	
13.17	2359	110.41		1153.4	44.5	830	1529	0.00	1.00	46.23	0	1134.0		90.71	
13.25	2523	127.79		1153.5	44.7	841	1682	0.00	1.00	57.81	0	1134.9		102.49	
13.33	2683	146.27		1153.5	44.9	851	1832	0.00	1.00	70.43	0	1135.9		115.30	
13.42	2800	165.55		1153.5	45.0	858	1942	0.00	1.00	83.81	0	1136.7		128.81	
13.50	2870	185.32		1153.5	45.1	862	2008	0.00	1.00	97.63	0	1137.5		142.72	
13.58	**2890**	**205.22**		**1153.5**	**45.1**	**863**	**2027**	**0.00**	**1.00**	**111.59**	**0**	**1138.3**		**156.70**	Peak discharge from the Basin B Complex
13.67	2826	224.68		1153.5	45.0	859	1967	0.00	1.00	125.14	0	1139.0		170.17	
13.75	2656	242.98		1153.5	44.8	849	1807	0.00	1.00	137.58	0	1139.8		182.42	
13.83	2382	259.38		1153.4	44.5	832	1550	0.00	1.00	148.26	0	1140.4		192.77	
13.92	2107	273.89		1153.3	44.2	813	1294	0.00	1.00	157.17	0	1140.9		201.33	
14.00	1958	287.38		1153.3	44.0	803	1155	0.00	1.00	165.13	0	1141.3		209.09	
14.08	2015	301.25		1153.3	44.0	807	1208	0.00	1.00	173.45	0	1141.8		217.49	
14.17	2139	315.98		1153.3	44.2	815	1324	0.00	1.00	182.57	0	1142.2		226.77	
14.25	2138	330.71		1153.3	44.2	815	1323	0.00	1.00	191.68	0	1142.7		235.88	

BASIN B COMPLEX HYDROLOGIC/HYDRAULIC ROUTING

Time (hrs)	Inflow (cfs)	Inflow Σ Vol. ac-ft	Q (cfs) into Eq. Basin	Controlling WSE (ft)	Eq. Bsn & Forebay Tot. Vol.	Outlet Siphon Q (cfs)	Weir Q (cfs)	Weir Coeff. C_{RATIO}	Weir Coeff. C_{sub}	Weir Vol. Into Basin B (ac-ft)	Continuity Check Inflow= Outflow	Basin B WSE (ft)	Avg. Volume (ac-ft)	Total Storage (ac-ft)	Comments
14.33	2071	344.97		1153.3	44.1	811	1260	0.00	1.00	200.36	0	1143.2		244.47	
14.42	2020	358.88		1153.3	44.0	807	1213	0.00	1.00	208.71	0	1143.6		252.76	
14.50	1982	372.53		1153.3	44.0	804	1178	0.00	1.00	216.82	0	1144.1		260.82	
14.58	1968	386.09		1153.3	44.0	803	1165	0.00	1.00	224.84	0	1144.5		268.82	
14.67	1953	399.54		1153.3	44.0	802	1151	0.00	1.00	232.77	0	1144.9		276.72	
14.75	1912	412.71		1153.3	43.9	799	1113	0.00	1.00	240.43	0	1145.3		284.33	
14.83	1849	425.44		1153.3	43.8	795	1054	0.00	1.00	247.69	0	1145.7		291.50	
14.92	1783	437.72		1153.2	43.7	790	993	0.00	1.00	254.53	0	1146.0		298.24	
15.00	1737	449.68		1153.2	43.6	787	950	0.00	1.00	261.07	0	1146.4		304.72	
15.08	1685	461.29		1153.2	43.6	783	902	0.00	1.00	267.28	0	1146.7		310.85	
15.17	1625	472.48		1153.2	43.5	779	846	0.00	1.00	273.11	0	1147.0		316.58	
15.25	1576	483.33		1153.2	43.4	775	801	0.00	1.00	278.62	0	1147.2		322.02	
15.33	1531	493.88		1153.1	43.3	772	759	0.00	1.00	283.85	0	1147.5		327.18	
15.42	1492	504.15		1153.1	43.3	769	723	0.00	1.00	288.83	0	1147.7		332.10	
15.50	1465	514.24		1153.1	43.2	767	698	0.00	1.00	293.64	0	1148.0		336.87	
15.58	1424	524.05		1153.1	43.2	763	661	0.00	1.00	298.19	0	1148.2		341.35	
15.67	1373	533.51		1153.1	43.1	759	614	0.00	1.00	302.42	0	1148.4		345.49	
15.75	1304	542.49		1153.1	42.9	753	551	0.00	1.00	306.21	0	1148.6		349.16	
15.83	1196	550.72		1153.0	42.8	744	452	0.00	1.00	309.32	0	1148.7		352.08	
15.92	1075	558.13		1153.0	42.5	732	343	0.00	1.00	311.68	0	1148.9		354.20	
16.00	1001	565.02		1152.9	42.4	725	276	0.00	1.00	313.59	0	1149.0		355.95	
16.08	1033	572.13		1152.9	42.4	728	305	0.00	1.00	315.69	0	1149.1		358.12	
16.17	1131	579.92		1153.0	42.6	738	393	0.00	1.00	318.39	0	1149.2		361.03	
16.25	1155	587.88		1153.0	42.7	740	415	0.00	1.00	321.25	0	1149.3		363.93	
16.33	1128	595.65		1153.0	42.6	738	390	0.00	1.00	323.94	0	1149.5		366.57	
16.42	1098	603.21		1153.0	42.6	735	363	0.00	1.00	326.44	0	1149.6		369.01	
16.50	1074	610.61		1153.0	42.5	732	342	0.00	1.00	328.80	0	1149.7		371.31	
16.58	1052	617.85		1153.0	42.5	730	322	0.00	1.00	331.01	0	1149.8		373.48	
16.67	1031	624.95		1152.9	42.4	728	303	0.00	1.00	333.10	0	1149.9		375.53	
16.75	1010	631.91		1152.9	42.4	726	284	0.00	1.00	335.06	0	1150.0		377.44	
16.83	993	638.75		1152.9	42.3	724	269	0.00	1.00	336.91	0	1150.1		379.26	
16.92	988	645.55		1152.9	42.3	723	265	0.00	1.00	338.73	0	1150.2		381.07	
17.00	973	652.25		1152.9	42.3	722	251	0.00	1.00	340.46	0	1150.3		382.77	
17.08	943	658.75		1152.9	42.2	719	224	0.00	1.00	342.01	0	1150.4		384.25	
17.17	919	665.08		1152.9	42.2	716	203	0.00	1.00	343.40	0	1150.4		385.60	
17.25	902	671.29		1152.9	42.2	714	188	0.00	1.00	344.69	0	1150.5		386.85	
17.33	886	677.39		1152.9	42.1	713	173	0.00	1.00	345.89	0	1150.5		388.01	
17.42	871	683.39		1152.9	42.1	711	160	0.00	1.00	346.99	0	1150.6		389.07	
17.50	855	689.28		1152.9	42.0	709	146	0.00	1.00	347.99	0	1150.7		390.04	
17.58	842	695.08		1152.9	42.0	708	134	0.00	1.00	348.92	0	1150.7		390.94	
17.67	835	700.83		1152.9	42.0	707	128	0.00	1.00	349.80	0	1150.7		391.80	
17.75	834	706.57		1152.9	42.0	707	127	0.00	1.00	350.68	0	1150.8		392.68	
17.83	783	711.96		1152.8	41.9	701	82	0.00	1.00	351.25	0	1150.8		393.12	
17.92	691	716.72		1152.7	41.4	680	11	0.00	1.00	351.32	0	1150.8		392.76	
18.00	628	721.05		1152.5	40.3	628	0	0.00	1.00	351.32	0	1150.8		391.64	
18.08	663	725.61		1152.6	41.1	663	0	0.00	1.00	351.32	0	1150.8		392.39	

BASIN B COMPLEX HYDROLOGIC/HYDRAULIC ROUTING

Time (hrs)	Inflow (cfs)	Inflow Σ Vol. ac-ft	Q (cfs) into Eq. Basin	Controlling WSE (ft)	Eq. Bsn & Forebay Tot. Vol.	Outlet Siphon Q (cfs)	Weir Q (cfs)	Weir Coeff. C_{RATIO}	Weir Coeff. C_{sub}	Weir Vol. Into Basin B (ac-ft)	Continuity Check Inflow= Outflow	Basin B WSE (ft)	Avg. Volume (ac-ft)	Total Storage (ac-ft)	Comments
18.17	775	730.95		1152.8	41.9	700	75	0.00	1.00	351.83	0	1150.8		393.69	
18.25	839	736.73		1152.9	42.0	707	132	0.00	1.00	352.74	0	1150.9		394.75	
18.33	851	742.59		1152.9	42.0	709	142	0.00	1.00	353.72	0	1150.9		395.76	
18.42	848	748.43		1152.9	42.0	708	140	0.00	1.00	354.69	0	1151.0		396.71	
18.50	845	754.25		1152.9	42.0	708	137	0.00	1.00	355.63	0	1151.0		397.65	
18.58	841	760.04		1152.9	42.0	707	134	0.00	1.00	356.55	0	1151.1		398.56	
18.67	840	765.83		1152.9	42.0	707	133	0.00	1.00	357.46	0	1151.1		399.47	
18.75	840	771.61		1152.9	42.0	707	133	0.00	1.00	358.38	0	1151.2		400.39	
18.83	841	777.40		1152.9	42.0	707	134	0.00	1.00	359.29	0	1151.2		401.31	
18.92	842	783.20		1152.9	42.0	708	134	0.00	1.00	360.22	0	1151.2		402.24	
19.00	844	789.02		1152.9	42.0	708	136	0.00	1.00	361.16	0	1151.3		403.18	
19.08	846	794.84		1152.9	42.0	708	138	0.00	1.00	362.11	0	1151.3		404.13	
19.17	850	800.70		1152.9	42.0	709	141	0.00	1.00	363.08	0	1151.4		405.12	
19.25	863	806.64		1152.9	42.1	710	153	0.00	1.00	364.14	0	1151.4		406.20	
19.33	865	812.60		1152.9	42.1	710	155	0.00	1.00	365.20	0	1151.5		407.27	
19.42	853	818.47		1152.9	42.0	709	144	0.00	1.00	366.20	0	1151.5		408.24	
19.50	848	824.31		1152.9	42.0	708	140	0.00	1.00	367.16	0	1151.6		409.19	
19.58	849	830.16		1152.9	42.0	708	141	0.00	1.00	368.13	0	1151.6		410.16	
19.67	845	835.98		1152.9	42.0	708	137	0.00	1.00	369.07	0	1151.7		411.09	
19.75	819	841.62		1152.8	42.0	705	114	0.00	1.00	369.86	0	1151.7		411.82	
19.83	747	846.76		1152.8	41.8	697	50	0.00	1.00	370.20	0	1151.7		412.00	
19.92	646	851.21		1152.6	40.7	646	0	0.00	1.00	370.20	0	1151.7		410.90	
20.00	579	855.20		1152.2	39.3	579	0	0.00	1.00	370.20	0	1151.7		409.51	
20.08	622	859.48		1152.4	40.2	622	0	0.00	1.00	370.20	0	1151.7		410.40	
20.17	756	864.69		1152.8	41.8	698	58	0.00	1.00	370.60	0	1151.7		412.42	
20.25	828	870.39		1152.8	42.0	706	122	0.00	1.00	371.44	0	1151.8		413.43	
20.33	845	876.21		1152.9	42.0	708	137	0.00	1.00	372.39	0	1151.8		414.41	
20.42	846	882.04		1152.9	42.0	708	138	0.00	1.00	373.34	0	1151.8		415.36	
20.50	847	887.87		1152.9	42.0	708	139	0.00	1.00	374.29	0	1151.9		416.32	
20.58	848	893.71		1152.9	42.0	708	140	0.00	1.00	375.25	0	1151.9		417.28	
20.67	849	899.56		1152.9	42.0	708	141	0.00	1.00	376.22	0	1152.0		418.26	
20.75	850	905.41		1152.9	42.0	709	141	0.00	1.00	377.20	0	1152.0		419.23	
20.83	852	911.28		1152.9	42.0	709	143	0.00	1.00	378.18	0	1152.1		420.22	
20.92	853	917.16		1152.9	42.0	709	144	0.00	1.00	379.18	0	1152.1		421.22	
21.00	855	923.04		1152.9	42.0	709	146	0.00	1.00	380.18	0	1152.2		422.23	
21.08	855	928.93		1152.9	42.0	709	146	0.00	1.00	381.19	0	1152.2		423.23	
21.17	855	934.82		1152.9	42.0	709	146	0.00	1.00	382.19	0	1152.3		424.24	
21.25	856	940.72		1152.9	42.0	709	147	0.00	1.00	383.20	0	1152.3		425.25	
21.33	855	946.60		1152.9	42.0	709	146	0.00	1.00	384.21	0	1152.4		426.25	
21.42	856	952.50		1152.9	42.0	709	147	0.00	1.00	385.22	0	1152.4		427.27	
21.50	855	958.39		1152.9	42.0	709	146	0.00	1.00	386.22	0	1152.4		428.27	
21.58	856	964.28		1152.9	42.0	709	147	0.00	1.00	387.24	0	1152.5		429.28	
21.67	854	970.17		1152.9	42.0	709	145	0.00	1.00	388.23	0	1152.5		430.28	
21.75	824	975.84		1152.8	42.0	706	118	0.00	1.00	389.05	0	1152.6		431.02	
21.83	741	980.94		1152.8	41.8	696	45	0.00	1.00	389.36	0	1152.6		431.14	
21.92	634	985.31		1152.7	41.4	678					-44		433.32	433.00	Begin weir submergence

BASIN B COMPLEX HYDROLOGIC/HYDRAULIC ROUTING

Time (hrs)	Inflow (cfs)	Inflow Σ Vol. ac-ft	Q (cfs) into Eq. Basin	Controlling WSE (ft)	Eq. Bsn & Forebay Tot. Vol.	Outlet Siphon Q (cfs)	Weir Q (cfs)	Weir Coeff. C_{RATIO}	Weir Coeff. C_{sub}	Weir Vol. Into Basin B (ac-ft)	Continuity Check Inflow= Outflow	Basin B WSE (ft)	Avg. Volume (ac-ft)	Total Storage (ac-ft)	Comments
22.00	565	989.20		1152.8	41.7	691					-126		434.95	433.00	
22.08	609	993.40		1152.8	41.7	692					-83		435.10	433.00	
22.17	752	998.57		1152.8	41.8	696					56		435.59	433.39	
22.25	836	1004.33		1152.8	41.9	701					135		436.27	434.32	
22.33	856	1010.23		1152.9	42.1	710					146		437.26	435.32	
22.42	870	1016.22		1152.9	42.2	718					152		438.32	436.37	
22.50	869	1022.20		1152.9	42.4	727					142		439.36	437.35	
22.58	857	1028.11		1153.0	42.6	735					122		440.30	438.19	
22.67	851	1033.97		1153.0	42.7	742					109		441.12	438.94	
22.75	849	1039.81		1153.0	42.8	748					101		441.86	439.64	
22.83	848	1045.65		1153.1	43.0	754					94		442.56	440.29	
22.92	847	1051.49		1153.1	43.1	759					88		443.20	440.89	
23.00	845	1057.31		1153.1	43.2	764					81		443.80	441.45	
23.08	844	1063.12		1153.1	43.3	769					75		444.36	441.97	
23.17	843	1068.93		1153.2	43.4	773					70		444.87	442.45	
23.25	841	1074.72		1153.2	43.4	777					64		445.35	442.89	
23.33	839	1080.50		1153.2	43.5	781					58		445.78	443.29	
23.42	838	1086.27		1153.2	43.6	784					54		446.18	443.66	
23.50	836	1092.02		1153.2	43.6	787					49		446.54	444.00	
23.58	835	1097.78		1153.2	43.7	790					45		446.88	444.31	
23.67	838	1103.55		1153.2	43.8	793					45		447.20	444.62	
23.75	817	1109.17		1153.3	43.8	795					22		447.44	444.78	
23.83	731	1114.21		1153.2	43.8	793					-62		447.30	444.35	
23.92	610	1118.41		1153.2	43.6	786					-176		446.45	443.13	
24.00	523	1122.01		1153.2	43.4	774					-251		444.93	441.41	
24.08	560	1125.87		1153.1	43.1	760					-200		443.34	440.03	
24.17	711	1130.76		1153.1	42.9	753					-42		442.48	439.74	
24.25	799	1136.27		1153.1	42.9	753					46		442.49	440.06	
24.33	810	1141.85		1153.1	43.0	756					54		442.84	440.43	
24.42	806	1147.40		1153.1	43.1	759					47		443.20	440.75	
24.50	801	1152.91		1153.1	43.1	762					39		443.51	441.02	
24.58	794	1158.38		1153.1	43.2	764					30		443.75	441.23	
24.67	787	1163.80		1153.1	43.2	765					22		443.94	441.38	
24.75	780	1169.17		1153.1	43.2	766					14		444.06	441.47	
24.83	772	1174.49		1153.1	43.2	767					5		444.13	441.51	
24.92	763	1179.75		1153.1	43.2	767					-4		444.14	441.48	
25.00	754	1184.94		1153.1	43.2	766					-12		444.08	441.40	
25.08	746	1190.08		1153.1	43.2	765					-19		443.97	441.26	
25.17	736	1195.14		1153.1	43.2	764					-28		443.80	441.07	
25.25	727	1200.15		1153.1	43.1	762					-35		443.57	440.83	
25.33	717	1205.09		1153.1	43.1	760					-43		443.30	440.53	
25.42	708	1209.97		1153.1	43.0	757					-49		442.97	440.19	
25.50	699	1214.78		1153.1	43.0	754					-55		442.60	439.81	
25.58	689	1219.52		1152.8	41.6	689					0				Inflow equals outflow for the system
25.67	678	1224.19		1152.7	41.4	678					0				
25.75	643	1228.62		1152.5	40.6	643					0				

BASIN B COMPLEX HYDROLOGIC/HYDRAULIC ROUTING

Time (hrs)	Inflow (cfs)	Inflow Σ Vol. ac-ft	Q (cfs) into Eq. Basin	Controlling WSE (ft)	Eq. Bsn & Forebay Tot. Vol.	Outlet Siphon Q (cfs)	Weir Q (cfs)	Weir Coeff. C_{RATIO}	Weir Coeff. C_{sub}	Weir Vol. Into Basin B (ac-ft)	Continuity Check Inflow= Outflow	Basin B WSE (ft)	Avg. Volume (ac-ft)	Total Storage (ac-ft)	Comments
25.83	560	1232.48		1152.1	38.9	560					0				
25.92	455	1235.61		1151.6	36.7	455					0				
26.00	373	1238.18		1151.2	34.9	373					0				
26.08	381	1240.81		1151.3	35.1	381					0				
26.17	519	1244.38		1152.0	38.1	519					0				
26.25	602	1248.53		1152.3	39.8	602					0				
26.33	617	1252.78		1152.4	40.1	617					0				
26.42	611	1256.98		1152.4	40.0	611					0				
26.50	604	1261.14		1152.4	39.8	604					0				
26.58	597	1265.25		1152.3	39.7	597					0				
26.67	590	1269.32		1152.3	39.5	590					0				
26.75	584	1273.34		1152.3	39.4	584					0				
26.83	578	1277.32		1152.2	39.3	578					0				
26.92	571	1281.25		1152.2	39.1	571					0				
27.00	565	1285.14		1152.2	39.0	565					0				
27.08	558	1288.99		1152.1	38.9	558					0				
27.17	552	1292.79		1152.1	38.8	552					0				
27.25	546	1296.55		1152.1	38.6	546					0				
27.33	539	1300.26		1152.1	38.5	539					0				
27.42	533	1303.93		1152.0	38.4	533					0				
27.50	527	1307.56		1152.0	38.2	527					0				
27.58	522	1311.16		1152.0	38.1	522					0				
27.67	514	1314.70		1151.9	38.0	514					0				
27.75	492	1318.09		1151.8	37.5	492					0				
27.83	428	1321.03		1151.5	36.2	428					0				
27.92	337	1323.35		1151.0	34.1	337					0				
28.00	264	1325.17		1150.6	32.4	264					0				

Combined Volumes Prior to Weir Submergence

Volumes (ac-ft)				
Combined	**Elevation**	**EQ Basin**	**Forebay**	**Combined**
0.0	1138.5	0.0	0.0	0.0
0.5	1139.0	0.5	0.0	0.5
0.9	1139.5	0.9	0.0	0.9
1.7	1140.0	1.7	0.0	1.7
2.5	1140.5	2.5	0.0	2.5
3.6	1141.0	3.4	0.2	3.6
5.4	1142.0	5.0	0.4	5.4
7.5	1143.0	6.7	0.8	7.5
9.6	1144.0	8.3	1.3	9.6
12.6	1145.0	10.8	1.8	12.6
15.7	1146.0	13.3	2.4	15.7
19.0	1147.0	15.8	3.2	19.0
22.3	1148.0	18.3	4.0	22.3
23.3	**1148.3**	**19.0**	**4.3**	**23.3**
25.7	1149.0	20.8	4.9	25.7
29.8	1150.0	23.9	5.9	29.8
34.0	1151.0	27.0	7.0	34.0
38.3	1152.0	30.1	8.2	38.3
41.3	**1152.7**	**32.2**	**9.1**	**41.3**
42.7	1153.0	33.2	9.5	42.7
47.2	1154.0	36.3	10.9	47.2
52.2	1155.0	39.8	12.4	52.2
57.2	1156.0	43.3	13.9	57.2
62.8	1157.0	47.2	15.6	62.8

Combined Volumes After Weir Submergence

Volumes (ac-ft)					
Combined	**Elevation**	**EQ Basin**	**Forebay**	**Basin B**	**Combined**
433.0	**1152.7**	**32.2**	**9.1**	**391.7**	**433.0**
440.8	1153.0	33.2	9.5	398.2	440.8
466.9	1154.0	36.3	10.9	419.7	466.9
493.9	1155.0	39.8	12.4	441.7	493.9
521.3	1156.0	43.3	13.9	464.1	521.3
549.8	1157.0	47.2	15.6	487.0	549.8

Basin B Vol.		
Elev (ft)	Vol. (ac-ft)	Elev (ft)
1129.3	0.0	1129.3
1130.0	4.4	1130.0
1131.0	10.8	1131.0
1132.0	22.1	1132.0
1133.0	34.1	1133.0
1134.0	46.8	1134.0
1135.0	59.6	1135.0
1136.0	72.3	1136.0
1137.0	89.7	1137.0
1138.0	107.1	1138.0
1139.0	124.5	1139.0
1140.0	141.9	1140.0
1141.0	159.3	1141.0
1142.0	178.2	1142.0
1143.0	197.0	1143.0
1144.0	215.9	1144.0
1145.0	234.7	1145.0
1146.0	253.6	1146.0
1147.0	273.9	1147.0
1148.0	294.2	1148.0
1149.0	314.5	1149.0
1150.0	334.8	1150.0
1151.0	355.1	1151.0
1152.0	376.6	1152.0
1152.7	**391.7**	**1152.7**
1153.0	398.2	1153.0
1154.0	419.7	1154.0
1156.0	464.1	1156.0
1157.0	487.0	1157.0

TOPO MEASUREMENTS									
Equalization Basin					Basin B				
AREA (ac)	ELEV. (ft)	DEPTH (ft)	Vol. ac-ft	ΔV (Vol. ac-ft) HEC-1 Conic Method	AREA (ac)	ELEV. (ft)	DEPTH (ft)	Vol. ac-ft	ΔV (Vol. ac-ft) HEC-1 Conic Method
0.3	1138.5	0	0	***0***	4.81	1129.3	0.0	**0.0**	0.0
1.0	1139.0	0.5	0.5	***0.5***	7.9	1131.0	1.7	**10.8**	10.8
1.5	1139.5	1.0	0.9	***0.9***	14.6	1132.5	3.2	**27.7**	27.7
2.2	1144.0	5.5	8.5	**8.3**	16.7	1136.0	6.7	**72.3**	82.4
2.8	1149.0	10.5	21.0	**20.8**	18.1	1141.0	11.7	**159.3**	169.4
3.4	1154.0	15.5	36.5	**36.3**	19.6	1146.0	16.7	**253.6**	263.6
3.5	1154.4	15.9	37.9	**37.6**	21.0	1151.0	21.7	**355.1**	365.1
3.7	1156.0	17.5	43.6	**43.3**	22.1	1154.4	25.1	**428.3**	438.4
3.9	1157.0	18.5	47.5	**47.2**	22.6	1156.0	26.7	**464.1**	474.1
					23.0	1157.0	27.7	**487.0**	497.0

Forebay Channel Volume			
Forebay Length (ft) = **1000**			
Bottom Width BW (ft) = 8			
Channel Depth (ft) = 14			
Side Slope H:V = 2			
Elev (ft)	**Avg. D (ft)**	**Vol. (ft^3)**	**Vol. (ac-ft)**
1140.5	0	0	0.0
1141.0	0.5	4500	0.2
1142.0	1.5	16500	0.4
1143.0	2.5	32500	0.8
1144.0	3.5	52500	1.3
1145.0	4.5	76500	1.8
1146.0	5.5	104500	2.4
1147.0	6.5	136500	3.2
1148.0	7.5	172500	4.0
1149.0	8.5	212500	4.9
1150.0	9.5	256500	5.9
1151.0	10.5	304500	7.0
1152.0	11.5	356500	8.2
1153.0	12.5	412500	9.5
1154.0	13.5	472500	10.9
1155.0	14.5	536500	12.4
1156.0	15.5	604500	13.9
1157.0	16.5	676500	15.6

COMBINED FLOWS					
Weir Length (ft) = 1000 ft					
$Q_{Combined}$ (cfs)	Elevation (ft)	Q_{Siphon} (cfs)	Q_{weir} (cfs)	$Q_{Combined}$ (cfs)	Elevation (ft)
0	1148.3	0	0	0	1148.3
16	1148.5	16	0	16	1148.5
57	1149.0	57	0	57	1149.0
98	1149.5	98	0	98	1149.5
167	1150.0	167	0	167	1150.0
243	1150.5	243	0	243	1150.5
330	1151.0	330	0	330	1151.0
424	1151.5	424	0	424	1151.5
528	1152.0	528	0	528	1152.0
635	1152.5	635	0	635	1152.5
676	1152.7	676	0	676	1152.7
740	1152.8	696	44	740	1152.8
928	1152.9	717	211	928	1152.9
1142	1153.0	739	403	1142	1153.0
1390	1153.1	761	629	1390	1153.1
1673	1153.2	783	891	1673	1153.2
1988	1153.3	805	1183	1988	1153.3
2332	1153.4	829	1504	2332	1153.4
2708	1153.5	852	1855	2708	1153.5
3110	1153.6	876	2234	3110	1153.6
3538	1153.7	900	2638	3538	1153.7
3989	1153.8	924	3064	3989	1153.8
4460	1153.9	949	3511	4460	1153.9

BASIN B WEIR FLOWS						
Weir Length = 1000 (ft)						
Elevation (ft)	Energy Elev. (ft)	$Q = CLH^{3/2}$ (cfs)	H (ft)	C	Velocity H (ft)	Specific Energy (ft)
1152.7	1152.7	0	0.0	0.00	0.000	0.000
1152.8	1152.8	45	0.1	1.41	0.003	0.103
1152.9	1152.9	253	0.2	2.82	0.025	0.225
1153.0	1153.0	484	0.3	2.94	0.040	0.340
1153.1	1153.2	770	0.4	3.04	0.058	0.458
1153.2	1153.3	1107	0.5	3.13	0.076	0.576
1153.3	1153.4	1488	0.6	3.20	0.096	0.696
1153.4	1153.5	1910	0.7	3.26	0.116	0.816
1153.5	1153.6	2376	0.8	3.32	0.137	0.937
1153.6	1153.8	2886	0.9	3.38	0.160	1.060
1153.7	1153.9	3430	1.0	3.43	0.183	1.183
1153.8	1154.0	4004	1.1	3.47	0.206	1.306
1153.9	1154.1	4615	1.2	3.51	0.230	1.430
1154.0	1154.3	5253	1.3	3.54	0.254	1.554
1154.1	1154.4	5925	1.4	3.58	0.278	1.678
1154.2	1154.5	6632	1.5	3.61	0.304	1.804
1154.3	1154.6	7226	1.6	3.57	0.317	1.917
1154.4	1154.7	7902	1.7	3.57	0.335	2.035
1154.5	1154.9	8598	1.8	3.56	0.354	2.154
1154.6	1155.0	9324	1.9	3.56	0.374	2.274

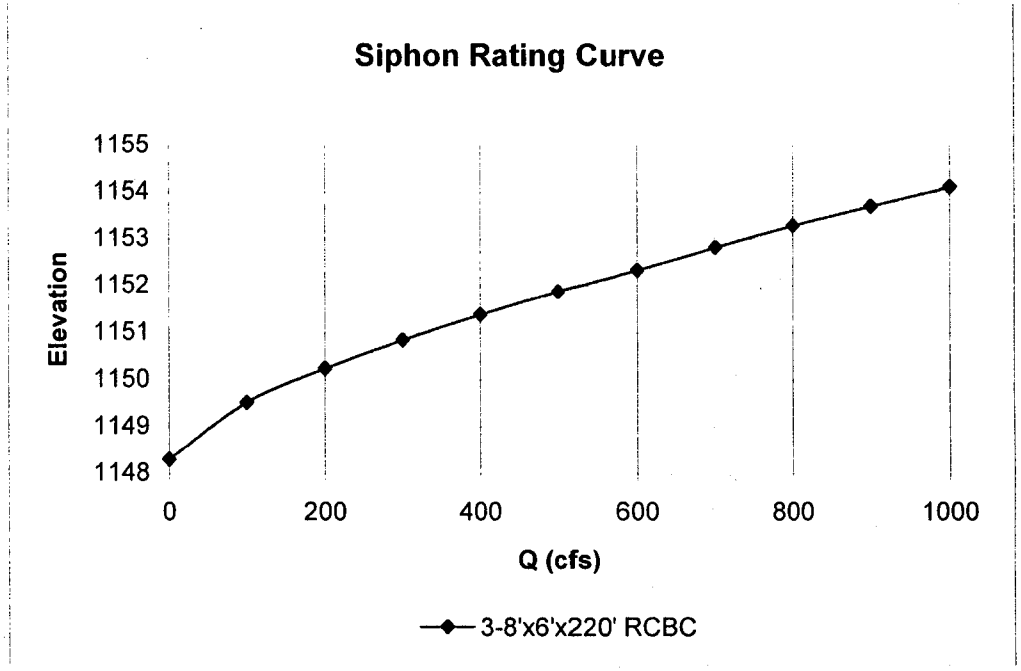
Weir Coefficient
Trapezoidal Cross Section w/ Both Inclined Faces (2:1)

H	C
0.00	0.00
0.20	2.82
0.30	2.94
0.40	3.04
0.50	3.13
0.60	3.20
0.70	3.26
0.80	3.32
0.90	3.38
1.00	3.43
1.20	3.51
1.50	3.61
1.60	3.57
1.80	3.56
2.00	3.56
2.50	3.57
3.00	3.58
3.50	3.60
4.00	3.62
4.50	3.65
5.00	3.68
5.50	3.70

Weir Submergence Ratio

C_{RATIO}	C_{SUB}
0.00	1.00
0.10	0.99
0.20	0.98
0.30	0.97
0.40	0.96
0.50	0.95
0.60	0.94
0.70	0.91
0.80	0.85
0.85	0.80
0.90	0.68
0.95	0.40
1.00	0.00

Siphon		
Energy Elev. (ft)	Q (cfs)	Energy Elev. (ft)
1148.30	0	1148.30
1149.52	100	1149.52
1150.24	200	1150.24
1150.84	300	1150.84
1151.38	400	1151.38
1151.87	500	1151.87
1152.33	600	1152.33
1152.82	700	1152.82
1153.28	800	1153.28
1153.70	900	1153.70
1154.11	1000	1154.11



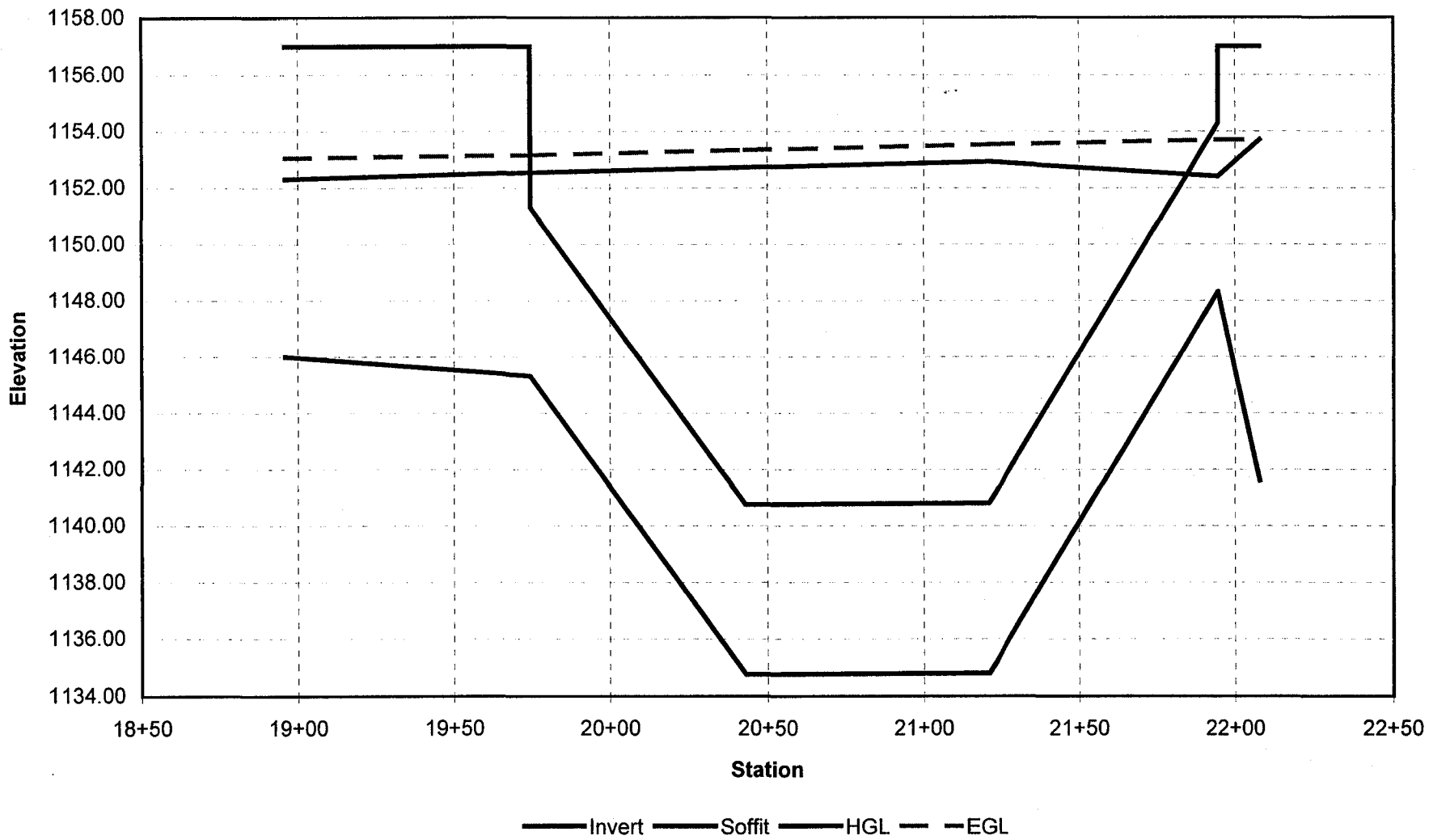
Hydraulic Grade Line Rating Table

	Siphon Discharge (cfs)										
Station	100	200	300	400	500	600	700	800	900	1000	Location
18+95.91	1148.13	1149.05	1149.74	1150.31	1150.80	1151.23	1151.63	1151.99	1152.32	1152.64	HGL_g
19+74.40	1148.49	1149.53	1150.31	1150.93	1151.43	1151.81	1152.13	1152.37	1152.55	1152.69	HGL_f
20+42.90	1148.51	1149.57	1150.36	1150.98	1151.49	1151.89	1152.24	1152.51	1152.73	1152.91	HGL_e
21+20.90	1148.51	1149.58	1150.38	1151.02	1151.55	1151.98	1152.36	1152.67	1152.93	1153.16	HGL_d
21+94.40	1149.11	1149.59	1149.99	1150.35	1150.68	1150.99	1151.63	1152.06	1152.41	1152.75	HGL_c
22+07.80	1149.52	1150.24	1150.84	1151.38	1151.87	1152.33	1152.82	1153.28	1153.70	1154.11	HGL_b

Energy Grade Line Rating Table

	Siphon Discharge (cfs)										
Station	100	200	300	400	500	600	700	800	900	1000	Location
18+95.91	1148.36	1149.38	1150.16	1150.80	1151.34	1151.83	1152.28	1152.68	1153.06	1153.42	EGL_g
19+74.40	1148.51	1149.60	1150.40	1151.06	1151.62	1152.08	1152.49	1152.85	1153.16	1153.44	EGL_f
20+42.90	1148.51	1149.60	1150.42	1151.10	1151.67	1152.16	1152.60	1152.99	1153.34	1153.66	EGL_e
21+20.90	1148.52	1149.61	1150.44	1151.14	1151.74	1152.25	1152.72	1153.15	1153.54	1153.91	EGL_d
21+94.40	1149.52	1150.24	1150.84	1151.38	1151.87	1152.33	1152.82	1153.28	1153.70	1154.11	EGL_c
22+07.80	1149.52	1150.24	1150.84	1151.38	1151.87	1152.33	1152.82	1153.28	1153.70	1154.11	EGL_b

Basin B Outfall Siphon Profiles
(900 cfs)



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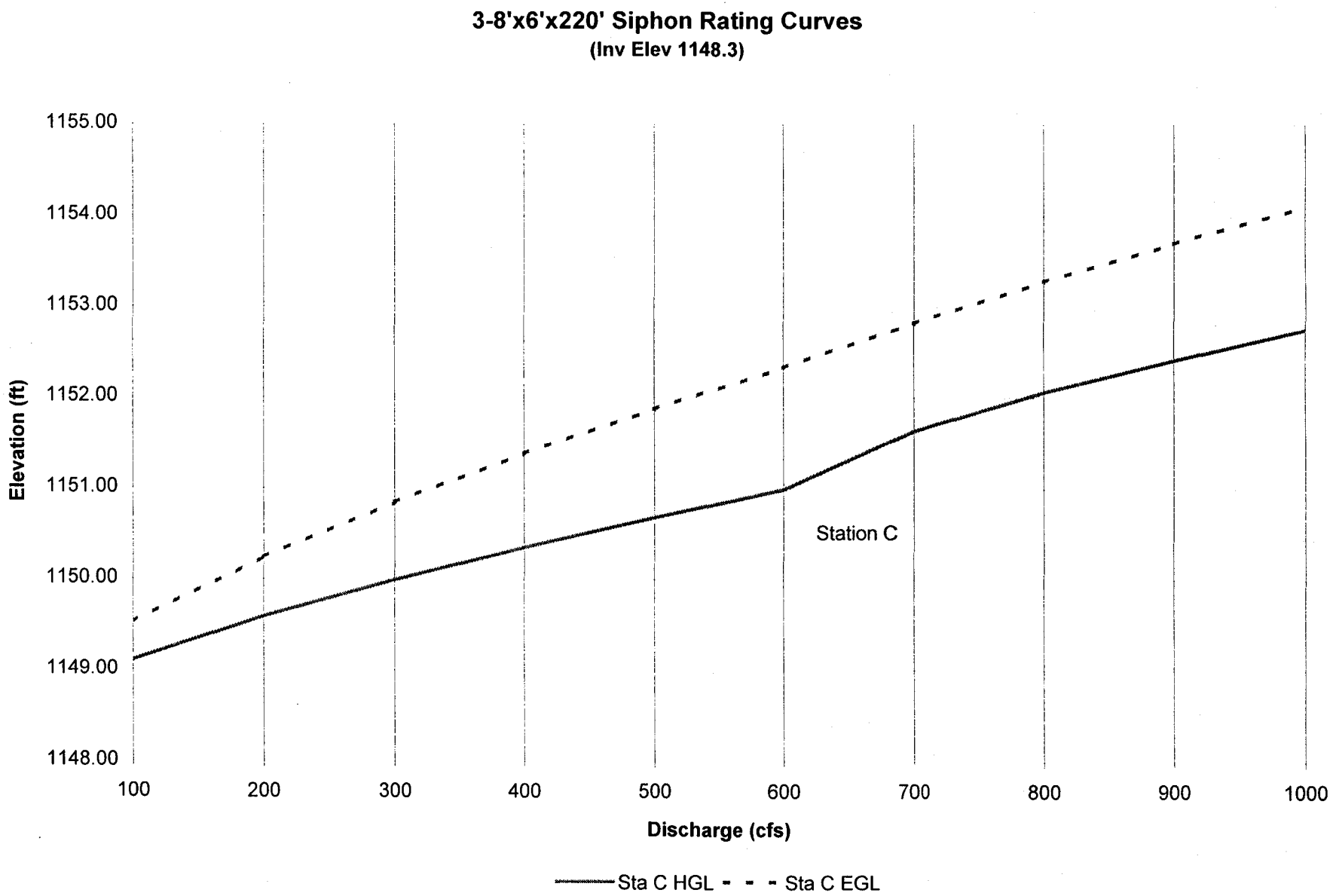

siphonrating7.xls

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Table
Rating Table for Trapezoidal Channel

Project Description	
Project File	j:\sanc\design\drn\hydraulics\siphon.fm2
Worksheet	Outfall Channel Downstream of Siphon
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Constant Data	
Mannings Coefficient	0.016
Channel Slope	0.001000 ft/ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	8.00 ft

Input Data	Minimum	Maximum	Increment
Discharge	100.00	1,000.00	100.00 cfs

Rating Table

Discharge (cfs)	Depth (ft)	Velocity (ft/s)
100.00	2.13	3.83
200.00	3.05	4.64
300.00	3.74	5.18
400.00	4.31	5.59
500.00	4.80	5.92
600.00	5.23	6.21
700.00	5.63	6.46
800.00	5.99	6.69
900.00	6.32	6.90
1,000.00	6.64	7.08

Siphon Geometry: Cell := 3 Span := 8 Rise := 6

$Sta_g := 1895.91$ $Inv_g := 1146.00$ $Box\_area := Cell \cdot Span \cdot Rise$ $Box\_area = 144.00$

$Sta_f := 1974.4$ $Inv_f := 1145.31$ Constants: $g := 32.2$ $n := 0.016$ (USACOE)

$Sta_e := 2042.9$ $Inv_e := 1134.75$

Tailwater Conditions:

$Q := 100$ $d_g := 2.13$ $v_g := 3.83$

$Sta_d := 2120.9$ $Inv_d := 1134.79$

Full flow hydraulic parameters:

$Sta_c := 2194.4$ $Inv_c := 1148.3$

$v_p := \frac{Q}{Box\_area}$ $hv_p := \frac{v_p^2}{2 \cdot g}$ $hv_p = 0.0075$

$Sta_b := 2207.8$ $Inv_b := 1141.6$

Siphon slope lengths (geometry):

$L_1 := \left[(Inv_f - Inv_e)^2 + (Sta_e - Sta_f)^2 \right]^{\frac{1}{2}}$ $L_1 = 69.31$

$L_2 := \left[(Inv_e - Inv_d)^2 + (Sta_d - Sta_e)^2 \right]^{\frac{1}{2}}$ $L_2 = 78.00$

$L_3 := \left[(Inv_c - Inv_d)^2 + (Sta_c - Sta_d)^2 \right]^{\frac{1}{2}}$ $L_3 = 74.73$

$L_t := L_1 + L_2 + L_3$ $L_t = 222.04$ Total siphon length

Siphon Geometry Graphing Definitions:

$$Station := \begin{bmatrix} Sta_g \\ Sta_f \\ Sta_e \\ Sta_d \\ Sta_c \\ Sta_b \end{bmatrix} \quad Inv := \begin{bmatrix} Inv_g \\ Inv_f \\ Inv_e \\ Inv_d \\ Inv_c \\ Inv_b \end{bmatrix} \quad Soffit := \begin{bmatrix} 1154.5 \\ 1154.81 \\ 1140.75 \\ 1140.79 \\ 1157 \\ 1157 \end{bmatrix}$$

Box Culvert Wetted Perimeter:

$W_p := Cell \cdot ((2 \cdot Span) + (2 \cdot Rise))$ $W_p = 84.00$

Box Culvert Hydraulic Radius:

$r := \frac{Box\_area}{W_p}$ $r = 1.71$

Energy Equation Calculations:

End of Outlet Transition (Sta_g):

$hv_g := \frac{v_g^2}{2g}$ $\quad hv_g = 0.23$ Outfall channel velocity head

$HGL_g := Inv_g + d_g$ $\quad HGL_g = 1148.13$

$EGL_g := HGL_g + hv_g$ $\quad EGL_g = 1148.36$

Initial Guess $\quad d_1 := 5$

Given

$$Inv_g + d_g + \frac{v_g^2}{2\cdot g} + 1.1\cdot\left[0.7\cdot\left[\frac{v_g^2}{2\cdot g} - \frac{\left(\frac{Q}{24\cdot d_1}\right)^2}{2\cdot g}\right]\right] = Inv_f + \frac{\left(\frac{Q}{24\cdot d_1}\right)^2}{2\cdot g} + d_1$$

$dsolve1 := find(d_1)$ $\quad dsolve1 = 3.18$ $\quad Rise = 6.00$ $\quad vsolve1 := \frac{Q}{24\cdot dsolve1}$

Maximum velocity switch: $\quad v_f := if(vsolve1 < v_p, v_p, vsolve1)$

$vsolve1 = 1.31$ $\quad v_p = 0.69$ $\quad v_f = 1.31$

$hv_f := \frac{v_f^2}{2\cdot g}$ $\quad d_f := \frac{Q}{24\cdot v_f}$ $\quad d_f = 3.18$

$hv_f = 0.03$ $\quad hv_p = 0.0075$ $\quad hv_g = 0.23$

Outlet Transition Losses:

$h_o := 1.1\cdot(0.7\cdot hv_g - hv_f)$

$h_o = 0.15$

$EGL_f := EGL_g + h_o$ $\quad EGL_f = 1148.51$

$HGL_f := EGL_f - hv_f$ $\quad HGL_f = 1148.49$

Siphon Friction Slope Losses: (HDS No. 5, pg 35)

$S_f := \frac{(29.1\cdot n^2\cdot v_p^2)}{r^{\frac{4}{3}}\cdot 2g}$ $\quad S_f = 0.000027$

Siphon Losses (Sta_f to Sta_e):

$h_{fl} := L_1 \cdot S_f \qquad h_{fl} = 0.0019$

Bend Losses:

$h_b := 1.1 \cdot (0.04 \cdot hv_p) \qquad h_b = 3.295 \cdot 10^{-4}$

$h_{l\_e} := h_{fl} + h_b \qquad h_{l\_e} = 0.0022$

$EGL_e := EGL_f - h_{l\_e} \qquad EGL_e = 1148.51$

$HGL_e := EGL_e - hv_p \qquad HGL_e = 1148.51$

Siphon Losses (Sta_e to Sta_d):

$h_{f2} := L_2 \cdot S_f \qquad h_{f2} = 0.0021$

$h_{l\_d} := h_{f2} + h_b \qquad h_{l\_d} = 0.0025$

$EGL_d := EGL_e - h_{l\_d} \qquad EGL_d = 1148.52$

$HGL_d := EGL_d - hv_p \qquad HGL_d = 1148.51$

Siphon Losses (Sta_d to Sta_c):

$h_{f3} := L_3 \cdot S_f \qquad h_{f3} = 0.0020$

$EGL_{c1} := EGL_d + h_{f3} \qquad EGL_{c1} = 1148.52$

Calculate critical depth at the inlet to the siphon:

$$d_{crit} := \sqrt[3]{\frac{\left(\frac{Q}{Cell \cdot Span}\right)^2}{g}} \qquad d_{crit} = 0.81$$

Check friction loss solution for inlet control and backwater effects:

$\Delta EGL_c := EGL_{c1} - Inv_c \qquad \Delta EGL_c = 0.22$

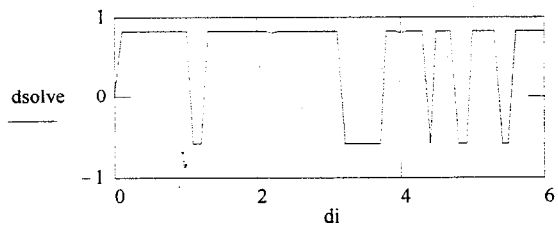
Initial Guess $dvar := 5$ $Qvar := Q$ $\Delta EGLvar := \Delta EGL_c$

Given

$$\Delta EGLvar = dvar + \frac{\left(\frac{Qvar}{24 \cdot dvar}\right)^2}{2 \cdot g} \qquad df(\Delta EGLvar, Qvar, dvar) := minerr(dvar)$$

$id := 1..60$ $di_{id} := \frac{id}{10}$ $dsolve_{id} := df(\Delta EGLvar, Qvar, di_{id})$ $d_i := max(dsolve)$ $d_i = 0.819$

Check numerical solution:



$$d_i + \frac{\left(\frac{Qvar}{24 \cdot d_i}\right)^2}{2 \cdot g} = 1.22 \qquad \Delta EGLvar = 0.22$$

Real solution switch: $d_i := if\left(\Delta EGLvar \neq d_i + \frac{\left(\frac{Qvar}{24 \cdot d_i}\right)^2}{2 \cdot g}, 0, d_i\right)$ $d_i = 0.00$

Subcritical/supercritical flow condition switch: $d_c := if(d_i > d_{crit}, d_i, d_{crit})$ $d_c = 0.81$

$v_c := \frac{Q}{Cell \cdot Span \cdot d_c}$ $v_c = 5.12$ $hv_c := \frac{v_c^2}{2 \cdot g}$

$HGL_c := Inv_c + d_c$ $HGL_c = 1149.11$

$EGL_c := Inv_c + d_c + hv_c$ $EGL_c = 1149.52$

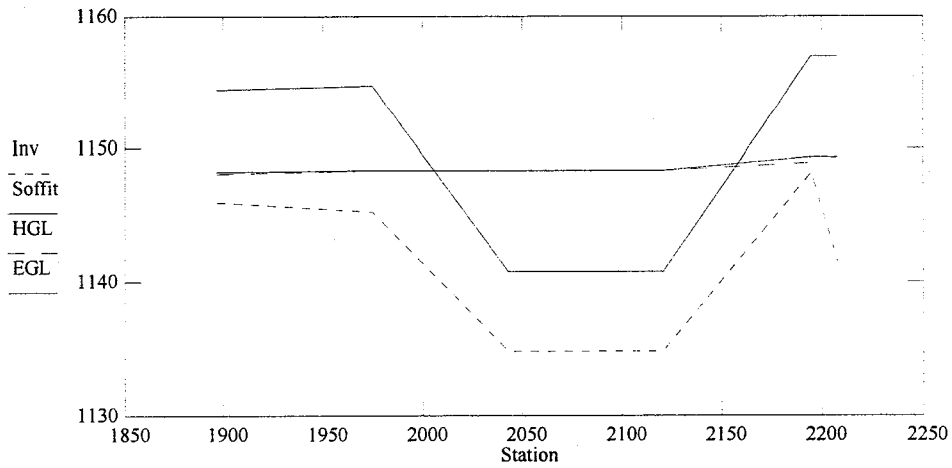
Inlet is controlled by critical depth if there is no solution for d_i

Assume level pool routing for basin complex:

Therefore, v_b=0 at inlet to Siphon

$EGL_b := EGL_c$ $HGL_b := EGL_c$

$$\text{Station} = \begin{bmatrix} 1895.91 \\ 1974.40 \\ 2042.90 \\ 2120.90 \\ 2194.40 \\ 2207.80 \end{bmatrix} \quad \text{HGL} = \begin{bmatrix} 1148.13 \\ 1148.49 \\ 1148.51 \\ 1148.51 \\ 1149.11 \\ 1149.52 \end{bmatrix} \quad \text{EGL} = \begin{bmatrix} 1148.36 \\ 1148.51 \\ 1148.51 \\ 1148.52 \\ 1149.52 \\ 1149.52 \end{bmatrix}$$



Siphon Geometry: Cell = 3 Span = 8 Rise = 6

$Sta_g = 1895.91$ $Inv_g = 1146.00$ Box_area = Cell·Span·Rise Box_area = 144.00

$Sta_f = 1974.4$ $Inv_f = 1145.31$ Constants: $g = 32.2$ $n = 0.016$ (USACOE)

$Sta_e = 2042.9$ $Inv_e = 1134.75$

Tailwater Conditions:

$Q = 500$ $d_g = 4.8$ $v_g = 5.92$

$Sta_d = 2120.9$ $Inv_d = 1134.79$

Full flow hydraulic parameters:

$Sta_c = 2194.4$ $Inv_c = 1148.3$

$Sta_b = 2207.8$ $Inv_b = 1141.6$

$v_p = \frac{Q}{Box\_area}$ $hv_p = \frac{v_p^2}{2 \cdot g}$ $hv_p = 0.19$

Siphon slope lengths (geometry):

$L_1 = \left(Inv_f - Inv_e\right)^2 - \left(Sta_e - Sta_f\right)^2\right)^{\frac{1}{2}}$ $L_1 = 69.31$

$L_2 = \left(Inv_e - Inv_d\right)^2 - \left(Sta_d - Sta_e\right)^2\right)^{\frac{1}{2}}$ $L_2 = 78.00$

$L_3 = \left(Inv_c - Inv_d\right)^2 - \left(Sta_c - Sta_d\right)^2\right)^{\frac{1}{2}}$ $L_3 = 74.73$

$L_t = L_1 + L_2 + L_3$ $L_t = 222.04$ Total siphon length

Siphon Geometry Graphing Definitions:

Station =	Inv =	Soffit =
Sta_g	Inv_g	1154.5
Sta_f	Inv_f	1154.81
Sta_e	Inv_e	1140.75
Sta_d	Inv_d	1140.79
Sta_c	Inv_c	1157
Sta_b	Inv_b	1157

Box Culvert Wetted Perimeter:

$W_p = Cell \cdot ((2 \cdot Span) + (2 \cdot Rise))$ $W_p = 84.00$

Box Culvert Hydraulic Radius:

$r = \frac{Box\_area}{W_p}$ $r = 1.71$

Energy Equation Calculations:

End of Outlet Transition (Sta_g):

$hv_g := \frac{v_g^2}{2 \cdot g}$ $\quad hv_g = 0.54$ Outfall channel velocity head

$HGL_g := Inv_g - d_g$ $\quad HGL_g = 1150.8$

$EGL_g := HGL_g + hv_g$ $\quad EGL_g = 1151.34$

Initial Guess $\quad d_1 := 5$

Given

$$Inv_g - d_g - \frac{v_g^2}{2 \cdot g} - 1.1 \cdot 0.7 \cdot \frac{v_g^2}{2 \cdot g} - \frac{\left(\frac{Q}{24 \cdot d_1}\right)^2}{2 \cdot g} = Inv_f - \frac{\left(\frac{Q}{24 \cdot d_1}\right)^2}{2 \cdot g} - d_1$$

$dsolve1 := find(d_1)$ $\quad dsolve1 = 6.14$ $\quad Rise = 6.00$ $\quad vsolve1 := \frac{Q}{24 \cdot dsolve1}$

Maximum velocity switch: $\quad v_f := if(vsolve1 < v_p, v_p, vsolve1)$

$vsolve1 = 3.40$ $\quad v_p = 3.47$ $\quad v_f = 3.47$

$hv_f := \frac{v_f^2}{2 \cdot g}$ $\quad d_f := \frac{Q}{24 \cdot v_f}$ $\quad d_f = 6.00$

$hv_f = 0.19$ $\quad hv_p = 0.19$ $\quad hv_g = 0.54$

Outlet Transition Losses:

$h_o := 1.1 \cdot 0.7 \cdot hv_g - hv_f$

$h_o = 0.27$

$EGL_f := EGL_g - h_o$ $\quad EGL_f = 1151.62$

$HGL_f := EGL_f - hv_f$ $\quad HGL_f = 1151.43$

Siphon Friction Slope Losses: (HDS No. 5, pg 35)

$S_f := \frac{29.1 \cdot n^2 \cdot v_p^2}{r^{\frac{4}{3}} \cdot 2 \cdot g}$ $\quad S_f = 0.00068$

Siphon Losses (Sta_f to Sta_e):

$h_{fl} := L_1 \cdot S_f \qquad h_{fl} = 0.05$

Bend Losses:

$h_b := 1.1 \cdot 0.04 \cdot hv_p \qquad h_b = 0.008$

$h_{l\_e} := h_{fl} - h_b \qquad h_{l\_e} = 0.06$

$EGL_e := EGL_f - h_{l\_e} \qquad EGL_e = 1151.67$

$HGL_e := EGL_e - hv_p \qquad HGL_e = 1151.49$

Siphon Losses (Sta_e to Sta_d):

$h_{f2} := L_2 \cdot S_f \qquad h_{f2} = 0.05$

$h_{l\_d} := h_{f2} - h_b \qquad h_{l\_d} = 0.06$

$EGL_d := EGL_e - h_{l\_d} \qquad EGL_d = 1151.74$

$HGL_d := EGL_d - hv_p \qquad HGL_d = 1151.55$

Siphon Losses (Sta_d to Sta_c):

$h_{f3} := L_3 \cdot S_f \qquad h_{f3} = 0.05$

$EGL_{c1} := EGL_d - h_{f3} \qquad EGL_{c1} = 1151.79$

Calculate critical depth at the inlet to the siphon:

$$d_{crit} := \sqrt[3]{\frac{\left(\frac{Q}{Cell \cdot Span}\right)^2}{g}} \qquad d_{crit} = 2.38$$

Check friction loss solution for inlet control and backwater effects:

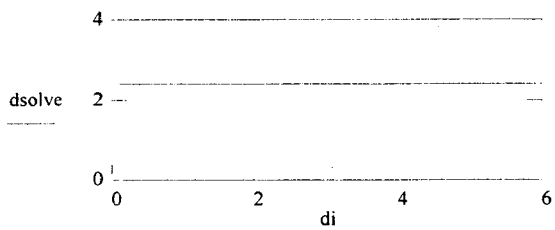
$\Delta EGL_c := EGL_{c1} - Inv_c \qquad \Delta EGL_c = 3.49$

Initial Guess $dvar := 5$ $Qvar := Q$ $\Delta EGLvar := \Delta EGL_c$

Given

$$\Delta EGLvar = dvar - \frac{\left(\frac{Qvar}{24 \cdot dvar}\right)^2}{2 \cdot g} \qquad df(\Delta EGLvar, Qvar, dvar) := minerr(dvar)$$

$id := 1..60$ $di_{id} := \frac{id}{10}$ $dsolve_{id} := df(\Delta EGLvar, Qvar, di_{id})$ $d_i := max(dsolve)$ $d_i = 2.382$



Check numerical solution:

$$d_i - \frac{\left(\frac{Qvar}{24 \cdot d_i}\right)^2}{2 \cdot g} = 3.57 \qquad \Delta EGLvar = 3.49$$

Real solution switch: $d_i := if\left(\Delta EGLvar = d_i - \frac{\left(\frac{Qvar}{24 \cdot d_i}\right)^2}{2 \cdot g}, 0, d_i\right)$ $d_i = 0.00$

Subcritical/supercritical flow condition switch: $d_c := if(d_i > d_{crit}, d_i, d_{crit})$ $d_c = 2.38$

$v_c := \frac{Q}{Cell \cdot Span \cdot d_c}$ $v_c = 8.75$ $hv_c := \frac{v_c^2}{2 \cdot g}$

$HGL_c := Inv_c - d_c$ $HGL_c = 1150.68$

$EGL_c := Inv_c - d_c - hv_c$ $EGL_c = 1151.87$

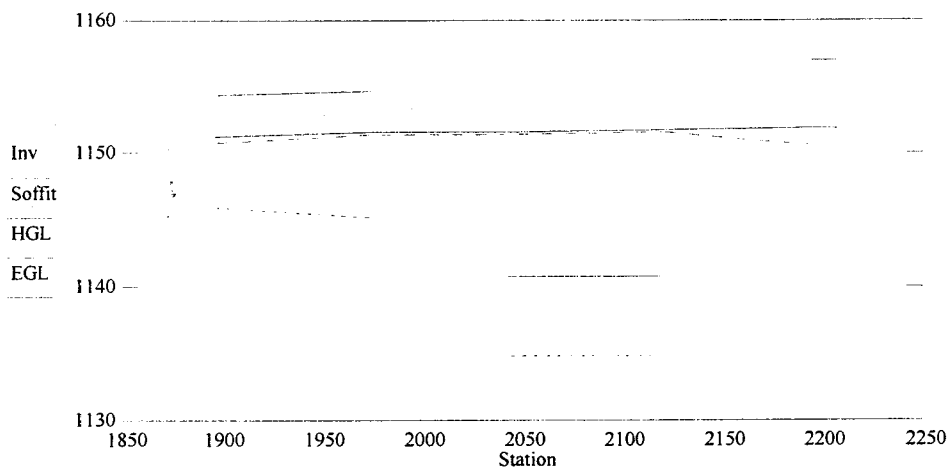
Inlet is controlled by critical depth if there is no solution for d_i

Assume level pool routing for basin complex:

Therefore, v_b=0 at inlet to Siphon

$EGL_b := EGL_c$ $HGL_b := EGL_c$

Station =	HGL =	EGL =
1895.91	1150.80	1151.34
1974.40	1151.43	1151.62
2042.90	1151.49	1151.67
2120.90	1151.55	1151.74
2194.40	1150.68	1151.87
2207.80	1151.87	1151.87



Siphon Geometry: Cell = 3 Span = 8 Rise = 6

$Sta_g = 1895.91$ $Inv_g = 1146.00$ $Box\_area = Cell \cdot Span \cdot Rise$ $Box\_area = 144.00$

$Sta_f = 1974.4$ $Inv_f = 1145.31$ Constants: $g = 32.2$ $n = 0.016$ (USACOE)

$Sta_e = 2042.9$ $Inv_e = 1134.75$

Tailwater Conditions:

$Q = 900$ $d_g = 6.32$ $v_g = 6.90$

$Sta_d = 2120.9$ $Inv_d = 1134.79$

Full flow hydraulic parameters:

$Sta_c = 2194.4$ $Inv_c = 1148.3$

$Sta_b = 2207.8$ $Inv_b = 1141.6$

$$v_p = \frac{Q}{Box\_area} \quad hv_p = \frac{v_p^2}{2 \cdot g} \quad hv_p = 0.61$$

Siphon slope lengths (geometry):

$$L_1 = \left(Inv_f - Inv_e\right)^2 + \left(Sta_e - Sta_f\right)^2\right)^{\frac{1}{2}} \quad L_1 = 69.31$$

$$L_2 = \left(Inv_e - Inv_d\right)^2 + \left(Sta_d - Sta_e\right)^2\right)^{\frac{1}{2}} \quad L_2 = 78.00$$

$$L_3 = \left(Inv_c - Inv_d\right)^2 + \left(Sta_c - Sta_d\right)^2\right)^{\frac{1}{2}} \quad L_3 = 74.73$$

$L_t = L_1 + L_2 + L_3$ $L_t = 222.04$ Total siphon length

Siphon Geometry Graphing Definitions:

Station	Inv	Soffit
Sta_g	Inv_g	1154.5
Sta_f	Inv_f	1154.81
Sta_e	Inv_e	1140.75
Sta_d	Inv_d	1140.79
Sta_c	Inv_c	1157
Sta_b	Inv_b	1157

Box Culvert Wetted Perimeter:

$W_p = Cell \cdot ((2 \cdot Span) + (2 \cdot Rise))$ $W_p = 84.00$

Box Culvert Hydraulic Radius:

$$r = \frac{Box\_area}{W_p} \quad r = 1.71$$

Energy Equation Calculations:

End of Outlet Transition (Sta_g):

$hv_g = \frac{v_g^2}{2g}$ $\quad hv_g = 0.74$ Outfall channel velocity head

$HGL_g = Inv_g - d_g$ $\quad HGL_g = 1152.32$

$EGL_g = HGL_g - hv_g$ $\quad EGL_g = 1153.06$

Initial Guess $\quad d_1 = 5$

Given

$$Inv_g - d_g - \frac{v_g^2}{2 \cdot g} - 1.1 \cdot 0.7 \cdot \frac{v_g^2}{2 \cdot g} - \frac{\left(\frac{Q}{24 \cdot d_1}\right)^2}{2 \cdot g} = Inv_f - \frac{\left(\frac{Q}{24 \cdot d_1}\right)^2}{2 \cdot g} - d_1$$

$dsolve1 = \text{find}\ d_1$ $\quad dsolve1 = 7.66$ $\quad Rise = 6.00$ $\quad vsolve1 = \frac{Q}{24 \cdot dsolve1}$

Maximum velocity switch: $\quad v_f = \text{if}\ vsolve1 < v_p, v_p, vsolve1$

$vsolve1 = 4.90$ $\quad v_p = 6.25$ $\quad v_f = 6.25$

$hv_f = \frac{v_f^2}{2 \cdot g}$ $\quad d_f = \frac{Q}{24 \cdot v_f}$ $\quad d_f = 6.00$

$hv_f = 0.61$ $\quad hv_p = 0.61$ $\quad hv_g = 0.74$

Outlet Transition Losses:

$h_o = 1.1 \cdot 0.7 \cdot hv_g - hv_f$

$h_o = 0.10$

$EGL_f = EGL_g - h_o$ $\quad EGL_f = 1153.16$

$HGL_f = EGL_f - hv_f$ $\quad HGL_f = 1152.55$

Siphon Friction Slope Losses: (HDS No. 5, pg 35)

$S_f = \frac{29.1 \cdot n^2 \cdot v_p^2}{r^{\frac{4}{3}} \cdot 2g}$ $\quad S_f = 0.002202$

Siphon Losses (Sta_f to Sta_e):

$h_{fl} := L_1 \cdot S_f \qquad h_{fl} = 0.15$

Bend Losses:

$h_b := 1.1 \cdot 0.04 \cdot hv_p \qquad h_b = 0.027$

$h_{l\_e} := h_{fl} - h_b \qquad h_{l\_e} = 0.18$

$EGL_e := EGL_f - h_{l\_e} \qquad EGL_e = 1153.34$

$HGL_e := EGL_e - hv_p \qquad HGL_e = 1152.73$

Siphon Losses (Sta_e to Sta_d):

$h_{f2} := L_2 \cdot S_f \qquad h_{f2} = 0.17$

$h_{l\_d} := h_{f2} - h_b \qquad h_{l\_d} = 0.20$

$EGL_d := EGL_e - h_{l\_d} \qquad EGL_d = 1153.54$

$HGL_d := EGL_d - hv_p \qquad HGL_d = 1152.93$

Siphon Losses (Sta_d to Sta_c):

$h_{f3} := L_3 \cdot S_f \qquad h_{f3} = 0.16$

$EGL_{c1} := EGL_d - h_{f3} \qquad EGL_{c1} = 1153.70$

Calculate critical depth at the inlet to the siphon:

$$d_{crit} := \left(\frac{\frac{Q}{Cell \cdot Span}}{g}\right)^{\frac{2}{3}} \qquad d_{crit} = 3.52$$

Check friction loss solution for inlet control and backwater effects:

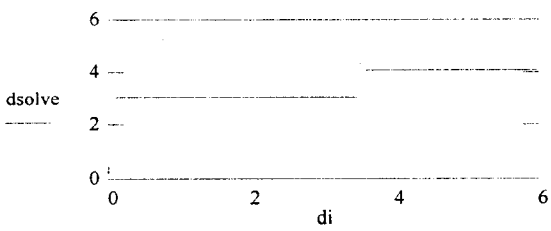
$\Delta EGL_c := EGL_{c1} - Inv_c \qquad \Delta EGL_c = 5.40$

Initial Guess $dvar := 5$ $Qvar := Q$ $\Delta EGLvar := \Delta EGL_c$

Given

$$\Delta EGLvar = dvar - \frac{\left(\frac{Qvar}{24 \cdot dvar}\right)^2}{2 \cdot g} \qquad df(\Delta EGLvar, Qvar, dvar) := minerr(dvar)$$

$id := 1..60$ $di_{id} := \frac{id}{10}$ $dsolve_{id} := df(\Delta EGLvar, Qvar, di_{id})$ $d_i := max(dsolve)$ $d_i = 4.113$



Check numerical solution:

$$d_i - \frac{\left(\frac{Qvar}{24 \cdot d_i}\right)^2}{2 \cdot g} = 5.40 \qquad \Delta EGLvar = 5.40$$

Real solution switch: $d_i := if\left(\Delta EGLvar = d_i - \frac{\left(\frac{Qvar}{24 \cdot d_i}\right)^2}{2 \cdot g}, 0, d_i\right)$ $d_i = 4.11$

Subcritical/supercritical flow condition switch: $d_c := if(d_i > d_{crit}, d_i, d_{crit})$ $d_c = 4.11$

$v_c := \frac{Q}{Cell \cdot Span \cdot d_c}$ $v_c = 9.12$ $hv_c := \frac{v_c^2}{2 \cdot g}$

$HGL_c := Inv_c - d_c$ $HGL_c = 1152.41$

$EGL_c := Inv_c - d_c - hv_c$ $EGL_c = 1153.70$

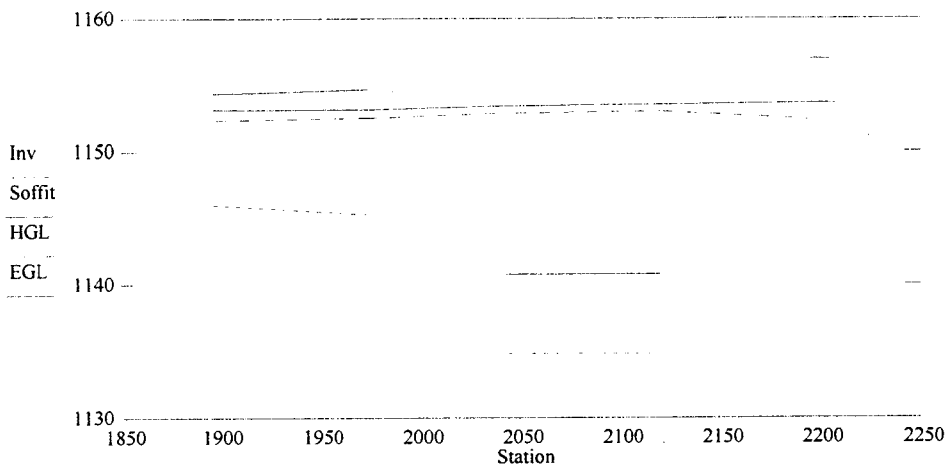
Inlet is controlled by critical depth if there is no solution for d_i

Assume level pool routing for basin complex:

Therefore, v_b=0 at inlet to Siphon

$EGL_b := EGL_c$ $HGL_b := EGL_c$

Station =	HGL =	EGL =
1895.91	1152.32	1153.06
1974.40	1152.55	1153.16
2042.90	1152.73	1153.34
2120.90	1152.93	1153.54
2194.40	1152.41	1153.70
2207.80	1153.70	1153.70



GILA DRAIN FLOODWAY
SUBAREA BOUNDARY MAP

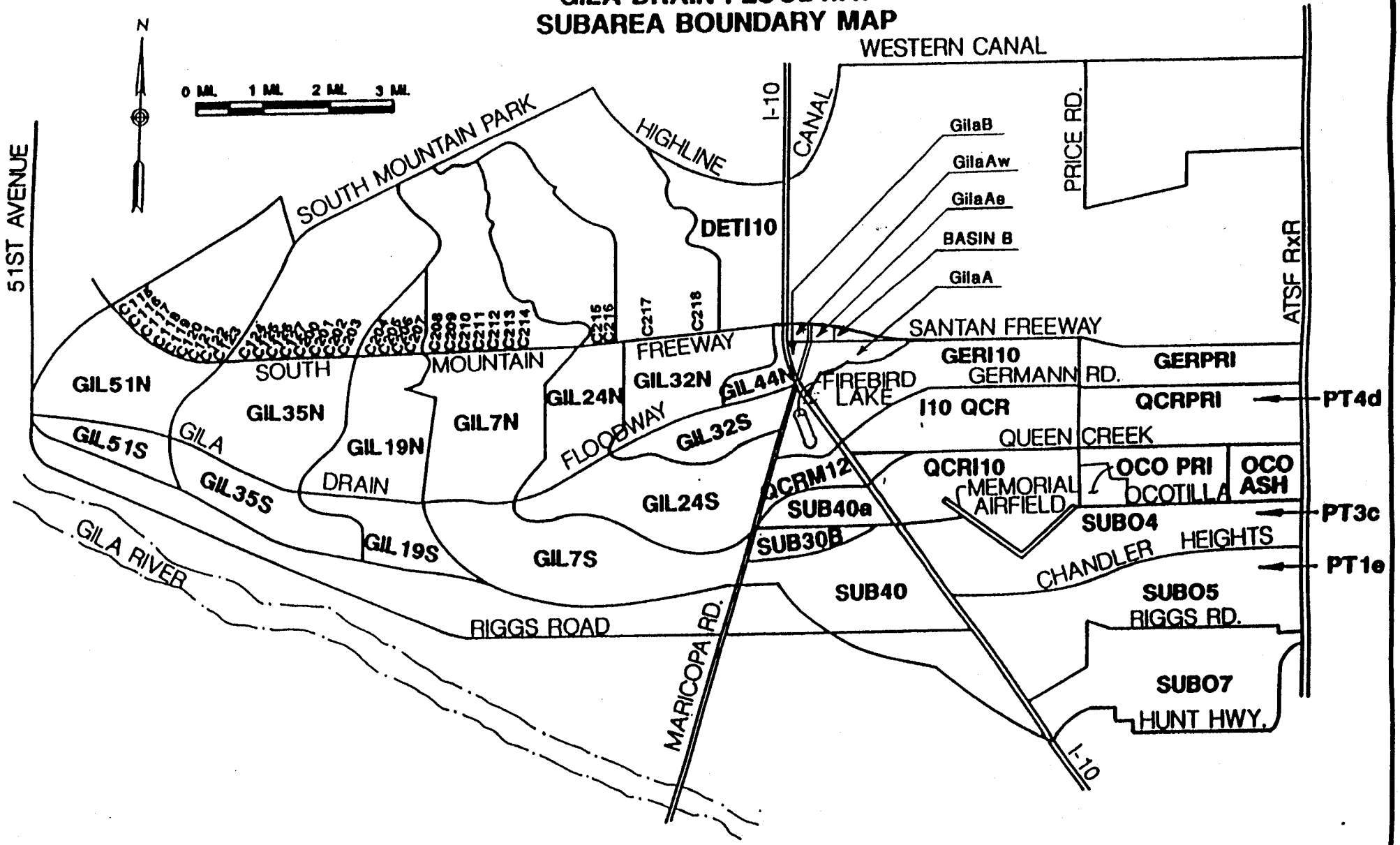


FIGURE 1

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   11AUG99  TIME  11:05:34  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X       XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        FN: SEVRDS3B.DAT  May 1998       ADAPTED FROM: HDR48.DAT (HDR 4/98)
  2           ID        This model has two revisions from the previous model.
  3           ID        1. The 48th Street Basin was removed from the model.
  4           ID        2. The HDR model indicates that flow will not be discharged to the
  5           ID           SEVRDS Channel during the flood event.  Therefore, the 48th Street
  6           ID           detention basin was removed from the HEC-1 model.
  7           ID        3. Model incorporates DMJM Basin B Outfall Siphon rating per spreadsheet
  8           ID           5/8/99.  Outfall is routed thru the Gila Floodway.
  9           ID        4. This model incorporates additional drainage areas defined by HDR
 10           ID           between the Gila Drain and I-10.
 11           ID        ****************************************************************************
 12           ID
 13           ID        INITIAL ABSTRACTION USED TO REPRESENT DEVELOPMENT RETENTION PROVIDED
 14           ID        100 YEAR - 24 HOUR STORM
 15           ID        DMJM - PHOENIX
 16           ID        FILENAME: SEVRDS3B.DAT
 17           IT       5                    1000
 18           IO       5
              *DIAGRAM

 19           KK    BASB
 20           KM        BASIN B OUTFALL SIPHON TO SANTAN CHANNEL PER SPREADSHEET 5/11/99
 21           BA   29.79
 22           IN       5
 23           QI       0       0       0       0       0       0       0       0       0       0
 24           QI       0       0       0       0       0       0       0       0       0       0
 25           QI       0       0       0       0       0       0       0       0       0       0
 26           QI       0       0       0       0       0       0       0       0       0       0
 27           QI       0       0       0       0       0       0       0       0       0       0
 28           QI       0       0       0       0       0       0       0       0       0       0
 29           QI       0       0       0       0       0       0       0       0       0       0
 30           QI       0       0       0       0       0       0       0       0       0       0
 31           QI       0       0       0       0       0       0       0       0       0       0
 32           QI       0       0       0       0       0       0       0       0       0       0
 33           QI       0       0       0       0       0       0       0       0       0       0
 34           QI       0       0       0       0       0       0       0       0       0       0
 35           QI       0       0       0       0       0       0       0       0       0       0
 36           QI       0       0       0       0       0       0       0       0       0       0
 37           QI       0     729     736     739     757     785     805     819     830     841
 38           QI     851     858     862     863     859     849     832     813     803     807
 39           QI     815     815     811     807     804     803     802     799     795     790
 40           QI     787     783     779     775     772     769     767     763     759     753
 41           QI     744     732     725     728     738     740     738     735     732     730
 42           QI     728     726     724     723     722     719     716     714     713     711
 43           QI     709     708     707     707     701     680     628     663     700     707
 44           QI     709     708     708     707     707     707     707     707     708     708
 45           QI     709     710     710     709     708     708     708     705     697     646
 46           QI     579     622     698     706     708     708     708     708     708     709
 47           QI     709     709     709     709     709     709     709     709     709     709
 48           QI     709     706     696     678     691     692     696     701     710     718
 49           QI     727     735     742     748     754     759     764     769     773     777
 50           QI     781     784     787     790     793     795     793     786     774     760
 51           QI     753     753     756     759     762     764     765     766     767     767
 52           QI     766     765     764     762     760     757     754     689     678     643
 53           QI     560     455     373     381     519     602     617     611     604     597
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  54          QI     590     584     578     571     565     558     552     546     539     533
  55          QI     527     522     514     492     428     337     264     258     361     453
  56          QI     472     469     464     459     454     448     443     439     434     430
  57          QI     426     422     417     413     409     405     400     384     339     270
              *
              *

  58          KK  Rtgila
  59          KM       Route thru SANTAN OUTFALL CHANNEL TO 56th Street
  60          RD    2500   .0008    .015            TRAP      8     2.0
              *
              * NEW BASIN GILAAE ADDED BY HDR
              *

  61          KK  GilaAe
  62          KM   BASIN EAST OF 56th STR. AND WEST OF GILA DRAIN
  63          KM   CURVE NUMBER ASSUMED.  AREA ASSUMED DEVELOPED AS
  64          KM   COMMERCIAL/INDUSTRIAL
  65          PH             4.5    0.77    1.50    2.64    2.89    3.06    3.37    3.68    4.00
  66          BA   0.097
  67          LS              80
  68          UD    0.25
              *

  69          KK  CGilaE
  70          KM       Add hydrograph to Santan discharge - above I-10 structures
  71          HC       2
              *

  72          KK   RBI10
  73          KM       Route 2-10x8 box culvert to West of I-10 at Conf w/ 48th St. Outlet
  74          RD    3100   .0765   0.013            DEEP      20       0
              *
              * NEW BASIN GILAAW ADDED BY HDR
              *

  75          KK  GilaAw
  76          KM   BASIN WEST OF 56th STR. AND EAST OF I-10
  77          KM   CURVE NUMBER ASSUMED.  AREA ASSUMED DEVELOPED AS
  78          KM   COMMERCIAL/INDUSTRIAL
  79          BA   0.111
  80          LS              80
  81          UD     .23
              *

  82          KK  CGILAW
  83          KM   ADD HYDROGRAPHS FROM RBI10 AND GILAAW
  84          HC       2
              *
              * ************************************************************************
              * 48TH STREET DETENTION BASIN MODEL REMOVED
              * ************************************************************************
              * SEE ASSUMPTIONS ABOVE.
              * ************************************************************************
              *
              * KK I10W
              * KM       Combine SMF/I10/S.48th flow from Basin 15 with Santan Channel Flow
              * HC     3
              *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 85           KK   RI10W
 86           KM       Route from SMF/I10/Santan TI to Gila Drain Floodway
 87           RS       1    FLOW      -1
 88           RC    .035   0.018   0.035    4000    .002
 89           RX       0       2      14      26      36      49      61      63
 90           RY    1153    1154    1153    1147  1146.5    1153    1154    1153
              *
              * ID      Gila Floodway offsite Hydrology                          <GILA1b>
              * ID      Proposed Floodway using detention basins
              * ID      HYDROLOGY FOR SEGMENT 1 of GILA FLOODWAY
              * ID      I-10 TO 44th STREET
              * ID      Inflow hydrographs from other analyses
              * ID      Cells for detention - I10 to the Treatment Plant
              * ID      100 year 24-Hour Storm - Aug 18, 1992   HDR - PHX
              * IT    10                    2000
              * IO     4       0       0
              * DIAGRAM
              *
              * KKCGilaB
              * KM      Outflow hydrograph from Santan Freeway drainage system
              * KM      Outflow Hydrograph at Maricopa Road and I-10
              * BA30.859
              * IN     5
              *
              *  ***************QI LINES DELETED***********************
              *  ****************************************************
              * KKDETI10
              * KM      Outflow hydrograph from South Mountain Freeway
              * KM      Detention Basin @ interchange
              * BA 4.083
              * IN     5
              * *****************QI LINES DELETED********************
              * ****************************************************
              *
              * KK CGila
              * KM      Combine Santan & east So. Mt. Frwy Q's @ U/S end of Gila Floodway
              * HC     2
              *

 91           KK  R1Gila
 92           KM       Route inflow through first cell of Gila Floodway
 93           KM        Revised embankment of cell 1
 94           RS       1    STOR       0
 95           SV     0.0     1.8    9.25    14.8    29.8    37.5    45.2    61.0
 96           SE    34.5    35.5    36.5    37.0    38.0    38.5    39.0    40.0
 97           SQ     0.0     7.4    23.0    30.0    40.0   281.6   720.0  1954.7
              *

 98           KK  R2Gila
 99           KM       Route inflow through second cell of Gila Floodway
100           KM        Revised embankment of cell 2
101           RS       1    STOR       0
102           SV     0.0     4.2    15.6    24.9    49.5    62.4    75.2   101.4
103           SE    30.5    31.5    32.5    33.0    34.0    34.5    35.0    36.0
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 104          SQ     0.0     7.4    23.0    30.0    40.0   281.6   720.0  1954.7
              *

 105          KK  R3Gila
 106          KM       Route inflow through third cell of Gila Floodway
 107          KM        Revised grading of cell 3
 108          RS       1    STOR       0
 109          SV     0.0     0.2    10.9    43.5    55.0    67.3    94.9
 110          SE    21.9    22.0    24.0    26.0    26.5    27.0    28.0
 111          SQ     0.0     1.0    23.2    44.2   376.7   981.6  2687.3
              *
              * ******************************************************************************
              *       NOTE: THIS MODEL DOES NOT INCLUDE INFLOW FROM THE 48TH STREET
              *       DETENTION BASIN.
              * ******************************************************************************
              *
 112          ZZ
```

```
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   19        BASB
                V
                V
   58      Rtgila
                .
                .
   61           .      GilaAe
                .           .
                .           .
   69      CGilaE............
                V
                V
   72       RBI10
                .
                .
   75           .      GilaAw
                .           .
                .           .
   82      CGILAW............
                V
                V
   85       RI10W
                V
                V
   91      R1Gila
                V
                V
   98      R2Gila
                V
                V
  105      R3Gila

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   11AUG99  TIME  11:05:34   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
FN: SEVRDS3B.DAT  May 1998        ADAPTED FROM: HDR48.DAT (HDR 4/98)
This model has two revisions from the previous model.
1. The 48th Street Basin was removed from the model.
2. The HDR model indicates that flow will not be discharged to the
   SEVRDS Channel during the flood event.  Therefore, the 48th Street
   detention basin was removed from the HEC-1 model.
3. Model incorporates DMJM Basin B Outfall Siphon rating per spreadsheet
   5/8/99.  Outfall is routed thru the Gila Floodway.
4. This model incorporates additional drainage areas defined by HDR
   between the Gila Drain and I-10.
*************************************************************************

INITIAL ABSTRACTION USED TO REPRESENT DEVELOPMENT RETENTION PROVIDED
100 YEAR - 24 HOUR STORM
DMJM - PHOENIX
FILENAME: SEVRDS3B.DAT

18 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT          HYDROGRAPH TIME DATA
                      NMIN          5  MINUTES IN COMPUTATION INTERVAL
                     IDATE      1   0  STARTING DATE
                     ITIME       0000  STARTING TIME
                        NQ       1000  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      4   0  ENDING DATE
                    NDTIME       1115  ENDING TIME
                     ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   83.25 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
```

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	BASB	863.	12.75	760.	565.	367.	29.79		
ROUTED TO	Rtgila	861.	12.83	759.	564.	366.	29.79		
HYDROGRAPH AT	GilaAe	155.	12.33	19.	5.	2.	.10		
2 COMBINED AT	CGilaE	969.	12.33	778.	569.	368.	29.89		
ROUTED TO	RBI10	968.	12.42	778.	569.	368.	29.89		
HYDROGRAPH AT	GilaAw	182.	12.33	22.	6.	2.	.11		
2 COMBINED AT	CGILAW	1146.	12.33	799.	575.	370.	30.00		
ROUTED TO	RI10W	1105.	12.42	796.	574.	369.	30.00	1152.64	12.42
ROUTED TO	R1Gila	937.	13.00	769.	561.	363.	30.00	39.18	13.00
ROUTED TO	R2Gila	797.	14.58	733.	539.	352.	30.00	35.06	14.58
ROUTED TO	R3Gila	781.	23.58	732.	525.	344.	30.00	26.83	23.58

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
Rtgila	MANE	3.25	860.79	770.25	1.37	5.00	860.79	770.00	1.37

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2182E+04 EXCESS= .0000E+00 OUTFLOW= .2177E+04 BASIN STORAGE= .5341E+01 PERCENT ERROR= .0

RBI10	MANE	1.07	969.60	742.34	1.37	5.00	968.47	745.00	1.37

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2188E+04 EXCESS= .0000E+00 OUTFLOW= .2188E+04 BASIN STORAGE= .6122E+00 PERCENT ERROR= .0

*** NORMAL END OF HEC-1 ***

PREMIER
ENGINEERING CORPORATION

Technical Memorandum

To: Jeff Minch, P.E. (DMJM)

From: Anthony J. Regis, P.E.

Date: 7/26/99

Re: Santan Channel – Hearthstone Hydrology

Registered Professional Engineer (Civil)
CERTIFICATE NO
28178
ANTHONY J.
REGIS
Date Signed 7/26/99
ARIZONA

We have completed our hydrologic analysis of the Hearthstone subdivision. The results of the analysis and our assumptions are documented below.

The drainage areas were delineated using a combination of aerial photographs, as-built plans for a portion of the Hearthstone subdivision, the USGS 7.5-minute *Guadalupe* quadrangle, and field reconnaissance. See the attached drainage area map.

As the drainage area map shows, offsite flow from the adjacent agricultural fields in the northeast quarter of the section will impact Hearthstone during the 100-year 24-hour storm event. Some flow will be diverted to the south along the eastern boundary of the subdivision by a tailwater ditch as well as residential block walls.

In analyzing the 100-year 24-hour runoff from the Hearthstone residential area, Premier utilized the same hydrologic methodology as in the overall Santan Channel hydrologic analysis in order to maintain consistency with that model.

The rainfall distribution from the file WPSANTAN.DAT was utilized, along with SCS curve numbers for drainage subareas MCSWL2, MCSWL3, and SECT36. The kinematic wave flood routing method was used for routing flows through subdivision streets. As in the original Santan Channel hydrology model, the SCS dimensionless unit hydrograph was used, except that times of concentration were computed from Equation 4-1 from the Arizona Department of Transportation *Highway Drainage Design Manual, Hydrology (HDDM)*, March 1993. It was assumed that the SCS lag time equals 0.6 times the time of concentration.

As stated above, the SCS curve number method was used for modeling soil losses; within residential drainage subbasins, a percent impervious value of 30 percent was used to model the effective impervious area. This figure is based on Table 3-3 in the ADOT *HDDM*.

Residential drainage areas 10, 20, 25, and 30 were reduced on the HEC-1 BA record to account for backyard on-site retention. Nearly all back yards are surrounded by block walls and are also isolated from the front yards by block walls. For this reason, it was assumed that all of the 100-year rainfall draining to the back yard would be retained on site. For simplicity, it was assumed that one half of every lot would drain to the back yard. Taking into account the half-street frontage and the residential collector streets such as Country Club Way, the on-site percent area retained equals approximately 45 percent of the gross drainage area. Therefore the gross drainage areas were multiplied by (1-0.45), or 0.55, to model the on-site retention.

There are two retention basins within the Hearthstone subdivision. The part of the subdivision north of Frye Road (subbasin 10) drains into the largest basin, located along Frye Road and extending from McClintock Drive east approximately 1/3 mile. This basin has a storage volume equal to the 100-year 2-hour storm runoff, and was modeled by level-pool storage routing methods in HEC-1, with the only outfall modeled being an emergency overflow along McClintock Drive. Based on visual inspection during field visits, McClintock Drive will serve as the only emergency overflow and no flow will break out to the south within the subdivision.

The other retention basin lies within drainage subbasin 20, as can be seen on the drainage area map. Since only a part of subbasin 20 drains to this retention basin, it was modeled using an initial abstraction value on the LS card in HEC-1 corresponding to the 100-year 2-hour rainfall depth. This rainfall depth was multiplied by a reducing factor of 0.66, corresponding to the percent of subbasin 20 draining into the retention basin. Note that this is also the methodology used in the original Santan Channel hydrologic analysis.

Flow splits occur at several locations within the hydrology model. One, mentioned above, is at the eastern boundary of the Hearthstone subdivision; another is at the intersection of Country Club Way and Kenwood Drive; another is located at the intersection of Kenwood Drive and Morelos Street; and another occurs within subbasin 20 at the intersection of Morelos Street and Los Feliz Drive.

These flow splits were modeled using HEC-1 divert operations. The percent of flow in each direction was estimated using the percent of total street width available for flow in each direction. For example, at divert operation 16DIV (Country Club and Kenwood), there are three streets at 25 feet width, totaling 75 feet, available for flow towards the west through subbasin 20. Country Club Way has a width of approximately 40 feet, so it was estimated that 40/ 75 = 0.35 or 35 percent of the flow would follow Country Club Way. In the absence of as-built information for this part of the subdivision, it was assumed that all four streets have similar longitudinal slopes. Furthermore, it was assumed that only the southern half of Country Club Way would split to the south onto Kenwood Drive, making the

diverted percentage of flow onto Kenwood 35/2 or 17 percent. A similar approach was used on the other divert operations within Hearthstone.

Below is a summary of our results:

Location	**100-yr 24-hr Peak Flow**
McClintock Dr. at Santan Channel	60 cfs (channel E of McClintock)
	10 cfs (McClintock roadway)
Los Feliz Dr. south of Geronimo St.	40 cfs
Geronimo St. south of Kesler Ln.	10 cfs
Pecos Rd. west of Kenwood Ln.	10 cfs
Country Club Way alignment at Santan Channel	30 cfs

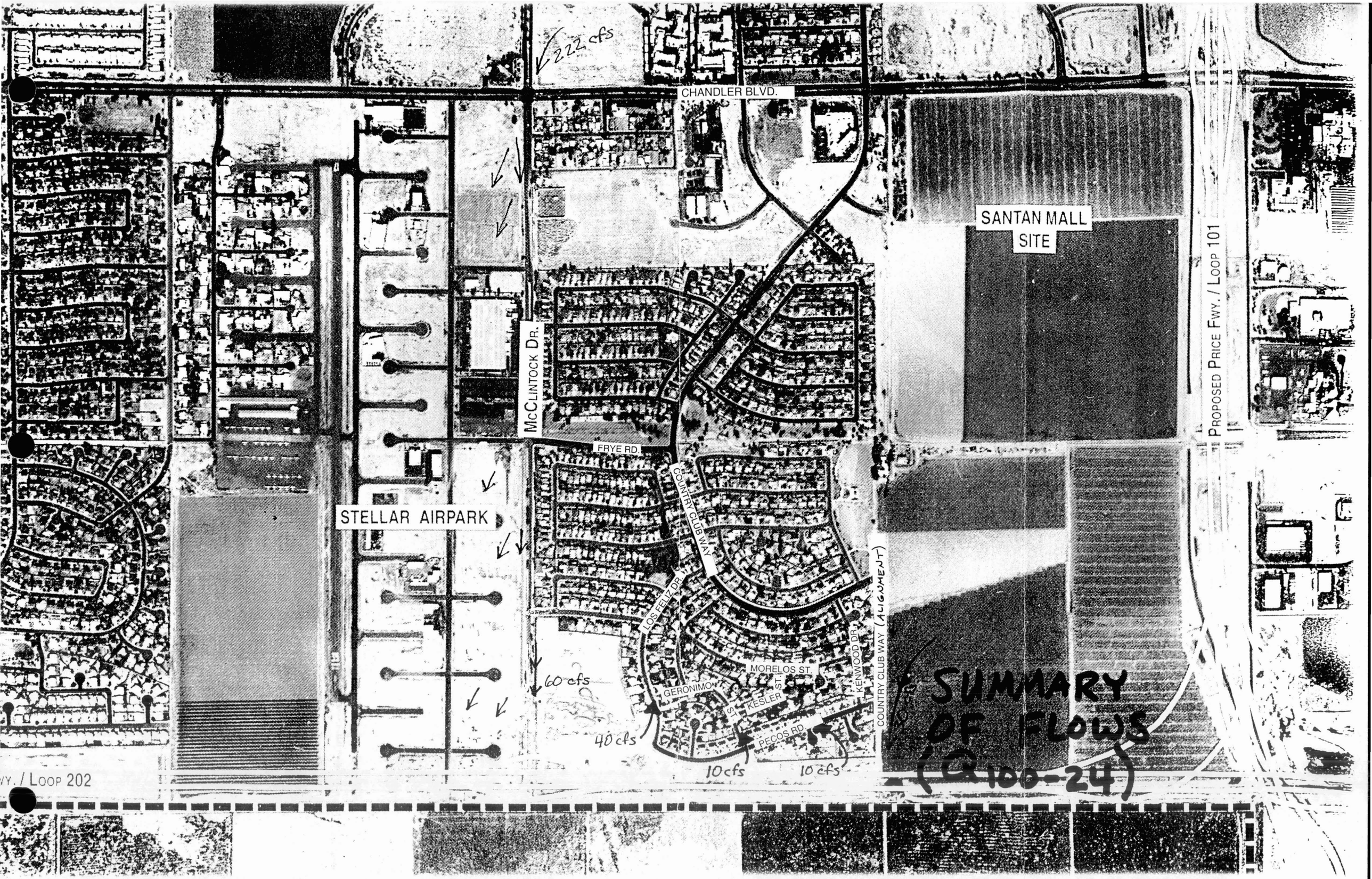
Refer to the attached HEC-1 schematic diagram, HEC-1 output printout, the annotated drainage area map from the DMJM/Wood/Patel Santan Freeway Drainage Report (1996), and the annotated aerial photo showing the above computed flows.

Referring to the 1996 DMJM/Wood/Patel Santan Freeway Drainage Report, we see that roughly 92 plus 52 plus 42 cfs, or roughly 190 cfs, was estimated to run off from approximately the same watershed. The current analysis shows approximately 160 cfs of total runoff. (Peak flows are added since the times to peak are all very similar.) The result is expected due to the effect of retention basins and the back yard on-site retention.

Note that the original Santan Channel HEC-1 model WPSANTAN.DAT shows a flow of 222 cfs on McClintock Drive south of Chandler Boulevard. This flow originates north of Chandler Boulevard and is modeled as a channel route operation with a bottom width of 25 feet. Given the flat slopes along McClintock Drive, and the open land and steeper slopes towards the west from McClintock Drive, it does not appear that this quantity of flow will be contained entirely within the McClintock Drive roadway as far south as the Santan Freeway. Flow will break out starting just south of Chandler Boulevard and will proceed southwestward through the Stellar Airpark.

For this reason, the 100-year 24-hour flow reaching the Santan Freeway alignment along McClintock Drive will be limited to the capacity of the McClintock Drive roadway section. The ultimate quantity of this flow may increase with the possible future construction of block walls along the west side of McClintock Drive or with the future widening of McClintock Drive. For the existing condition, however, the

capacity of 10 cfs was estimated based on an assumed slope of 0.2 percent, a total roadway width of 25 feet, and a flow depth of 6 inches.


222 cfs
CHANDLER BLVD.
SANTAN MALL SITE
PROPOSED PRICE FWY. / LOOP 101
McCLINTOCK DR.
FRYE RD.
STELLAR AIRPARK
COUNTRY CLUB WAY
LOS FELIZ DR.
MORELOS ST.
GERONIMO
KESLER
PECOS RD
KENWOOD DR.
COUNTRY CLUB WAY (ALIGNMENT)
60 cfs
40 cfs
10 cfs
10 cfs
SUMMARY OF FLOWS (Q100-24)
WY. / LOOP 202

```
1*************************************
*                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)*
*          SEPTEMBER 1990           *
*            VERSION 4.0            *
*                                   *
* RUN DATE  07/26/1999  TIME  14:18:05 *
*                                   *
*************************************
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```
*************************************
*                                   *
*   U.S. ARMY CORPS OF ENGINEERS    *
*   HYDROLOGIC ENGINEERING CENTER   *
*         609 SECOND STREET         *
*      DAVIS, CALIFORNIA 95616      *
*          (916) 756-1104           *
*                                   *
*************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                          HEC-1 INPUT                                                    PAGE  1

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        SANTAN CHANNEL PROJECT
  2           ID        COMPUTATION OF RUNOFF FROM HEARTHSTONE SUBDIVISION AND
  3           ID        UPSTREAM OFFSITE AREAS
  4           ID        ***********************************************************************
  5           ID        THIS MODEL PREPARED BY ANTHONY J. REGIS, P.E.
  6           ID        PREMIER ENGINEERING CORPORATION, INC.
  7           ID        7/26/99
  8           ID        ***********************************************************************
  9           ID        HYDROLOGIC METHODOLOGY MATCHES MODEL DEVELOPED FOR SANTAN FREEWAY
 10           ID        BY HDR (1987) AND WOOD/PATEL (1996)
 11           ID        FILENAME: HRTHSTN.TXT
 12           IT       5                  1000
 13           IO       5       0       0
              *DIAGRAM

 14           KK      5S
 15           KM   RUNOFF FROM SUBBASIN 5
 16           KM   DESERT
 17           PH       1    .608    0.71    1.39    2.44    2.66    2.81    3.11    3.33    3.70
 18           BA     .03
 19           LS              83
 20           UD    0.27

 21           KK      5R
 22           KM   ROUTE 5S THROUGH 10S TO RETENTION BASIN AT FRYE
 23           RK    1980   .0014    .020            TRAP      50     .01

 24           KK     10S
 25           KM   RUNOFF FROM SUBBASIN 10
 26           KM   RESIDENTIAL
 27           KM   SUBBASIN AREA OF .141 REDUCED TO ACCOUNT FOR ON-LOT BACKYARD RETENTION
 28           KM   ASSUMPTION: 1/2 OF RESIDENTIAL LOT RUNOFF RETAINED ONSITE
 29           BA   .0776
 30           LS     1.5      83      30
 31           UD     .22

 32           KK     10C
 33           KM   COMBINE 5R AND 10S AT FRYE RETENTION BASIN
 34           HC       2

 35           KK   10DET
 36           KM   ROUTE 10C THROUGH FRYE RETENTION BASIN
 37           KM   EMERGENCY OVERFLOW ONTO MCCLINTOCK DR
 38           RS       1    FLOW      -1
 39           SA     5.4     5.6     5.9     5.9
 40           SE       0       2       3       5
 41           SQ       0       0       0    1320

 42           KK     15S
 43           KM   RUNOFF FROM SUBBASIN 15
 44           KM   AGRICULTURAL
 45           BA    .283
 46           LS     1.5      83
 47           UD    2.26
1                                          HEC-1 INPUT                                                    PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 48           KK   15RET
 49           KM   RUNOFF RETAINED IN TAILWATER DITCH AT MIDSECTION LINE:  1.2 AC-FT
 50           KM   MODELED AS DIVERT OPERATION WITH MAX VOLUME OF 1.2 AC-FT
 51           DT    15D1     1.2
 52           DI       0    1000
 53           DQ       0    1000

 54           KK   15DIV
 55           KM   DIVERT FLOW TO SOUTH ALONG HEARTHSTONE EASTERN BOUNDARY
 56           DT    15D2
 57           DI       0     155     490     957
 58           DQ       0      33     104     203
```

```
 59          KK   16DIV
 60          KM   DIVERT 17 PERCENT OF REMAINING FLOW TO SOUTH ALONG KENWOOD DRIVE
 61          DT     16D
 62          DI       0    1000
 63          DQ       0     170

 64          KK     16R
 65          KM   ROUTE 16DIV THROUGH SUBBASIN 20
 66          RK    2760   .0019     .02            TRAP      70     .01

 67          KK     20S
 68          KM   RUNOFF FROM SUBBASIN 20
 69          KM   RESIDENTIAL
 70          KM   IA OF 1.76 INCHES CORRESPONDS TO 100-YR 2-HR RETENTION FOR 66 PERCENT OF
 71          KM   SUBBASIN AREA
 72          KM   SUBBASIN AREA OF .129 REDUCED TO ACCOUNT FOR ON-LOT BACKYARD RETENTION
 73          KM   ASSUMPTION: 1/2 OF RESIDENTIAL LOT RUNOFF RETAINED ONSITE
 74          BA   .0710
 75          LS    1.76      83      30
 76          UD     .21

 77          KK   20DIV
 78          KM   DIVERT 50 PERCENT OF RUNOFF TO MCCLINTOCK DRIVE
 79          DT     20D
 80          DI       0    1000
 81          DQ       0     500

 82          KK     20C
 83          KM   COMBINE 16R AND 20DIV AT LOS FELIZ DRIVE OUTLET
 84          HC       2

 85          KK    21DR
 86          KM   RETRIEVE DIVERTED FLOW 16D
 87          DR     16D

 88          KK   21DIV
 89          KM   DIVERT 25 PERCENT OF FLOW TO WEST ALONG MORELOS STREET
 90          DT     21D
 91          DI       0    1000
 92          DQ       0     250
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 93          KK     21R
 94          KM   ROUTE REMAINING FLOW TO PECOS DRIVE OUTLET
 95          RK    1600   .0014    .020            TRAP      35     .01

 96          KK     25S
 97          KM   RUNOFF FROM SUBBASIN 25
 98          KM   RESIDENTIAL
 99          KM   SUBBASIN AREA OF .015 REDUCED TO ACCOUNT FOR ON-LOT BACKYARD RETENTION
100          KM   ASSUMPTION:  1/2 OF RESIDENTIAL LOT RUNOFF RETAINED ONSITE
101          BA   .0083
102          LS     1.5      83      30
103          UD     .12

104          KK     25C
105          KM   COMBINE 21R AND 25S AT PECOS DRIVE OUTLET
106          HC       2

107          KK    26DR
108          KM   RETRIEVE DIVERTED FLOW 21D
109          DR     21D

110          KK     26R
111          KM   ROUTE REMAINING FLOW TO GERONIMO STREET OUTLET
112          RK    1140   .0023    .020            TRAP      35     .01

113          KK     30S
114          KM   RUNOFF FROM SUBBASIN 30
115          KM   RESIDENTIAL
116          KM   SUBBASIN AREA OF .011 REDUCED TO ACCOUNT FOR ON-LOT BACKYARD RETENTION
117          KM   ASSUMPTION:  1/2 OF RESIDENTIAL LOT RUNOFF RETAINED ONSITE
118          BA   .0061
119          LS     1.5      83      30
120          UD     .10

121          KK     30C
122          KM   COMBINE 26R AND 30S AT GERONIMO STREET OUTLET
123          HC       2

124          KK    31DR
125          KM   RETREIVE DIVERTED FLOW 15D2
126          DR    15D2

127          KK     31R
128          KM   ROUTE 15D2 TO OUTLET OF SUBBASIN 35
129          RK    1440   .0015    .025            TRAP      50     .01

130          KK     35S
131          KM   RUNOFF FROM SUBBASIN 35
132          KM   AGRICULTURAL
133          BA    .123
134          LS     1.5      83
135          UD    1.65
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

136          KK     35C
137          KM   COMBINE 31R AND 35S
138          HC       2

139          KK    36DR
140          KM   RETRIEVE DIVERTED FLOW 20D
141          DR     20D
```

```
142          KK     36R
143          KM   ROUTE TO OUTLET OF SUBBASIN 40
144          RK     600    .008    .040            TRAP       1       5

145          KK     40S
146          KM   RUNOFF FROM SUBBASIN 40
147          KM   DESERT
148          BA    .013
149          LS              83
150          UD     .15

151          KK     40C
152          KM   COMBINE 36R AND 40S
153          HC       2
154          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    14          5S
                 V
                 V
    21          5R
                 .
                 .
    24           .         10S
                 .           .
                 .           .
    32         10C...........
                 V
                 V
    35       10DET
                 .
                 .
    42           .         15S
                 .           .
                 .           .
    51           .           .------->    15D1
    48           .       15RET
                 .           .
                 .           .
    56           .           .------->    15D2
    54           .       15DIV
                 .           .
                 .           .
    61           .           .------->     16D
    59           .       16DIV
                 .           V
                 .           V
    64           .         16R
                 .           .
                 .           .
    67           .           .         20S
                 .           .           .
                 .           .           .
    79           .           .           .------->     20D
    77           .           .       20DIV
                 .           .           .
                 .           .           .
    82           .         20C...........
                 .           .
                 .           .
    87           .           .           .<-------     16D
    85           .           .        21DR
                 .           .           .
                 .           .           .
    90           .           .           .------->     21D
    88           .           .       21DIV
                 .           .           V
                 .           .           V
    93           .           .         21R
                 .           .           .
                 .           .           .
    96           .           .           .         25S
                 .           .           .           .
                 .           .           .           .
   104           .           .         25C...........
                 .           .           .
                 .           .           .
   109           .           .           .           .<-------     21D
   107           .           .           .        26DR
                 .           .           .           V
                 .           .           .           V
   110           .           .           .         26R
                 .           .           .           .
                 .           .           .           .
   113           .           .           .           .         30S
                 .           .           .           .           .
                 .           .           .           .           .
   121           .           .           .         30C...........
                 .           .           .           .
                 .           .           .           .
   126           .           .           .           .           .<-------    15D2
   124           .           .           .           .        31DR
                 .           .           .           .           V
                 .           .           .           .           V
   127           .           .           .           .         31R
                 .           .           .           .           .
                 .           .           .           .           .
   130           .           .           .           .           .         35S
                 .           .           .           .           .           .
                 .           .           .           .           .           .
   136           .           .           .           .         35C...........
                 .           .           .           .           .
                 .           .           .           .           .
   141           .           .           .           .           .           .<-------     20D
   139           .           .           .           .           .        36DR
```

```
                .         .         .         .         .         V
                .         .         .         .         .         V
  142           .         .         .         .         .        36R
                .         .         .         .         .         .
                .         .         .         .         .         .
  145           .         .         .         .         .         .         40S
                .         .         .         .         .         .          .
                .         .         .         .         .         .          .
  151           .         .         .         .         .        40C...........
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*************************************                                    *************************************
*                                   *                                    *                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)*                                   *   U.S. ARMY CORPS OF ENGINEERS    *
*          SEPTEMBER 1990           *                                    *   HYDROLOGIC ENGINEERING CENTER   *
*           VERSION 4.0             *                                    *         609 SECOND STREET         *
*                                   *                                    *      DAVIS, CALIFORNIA 95616      *
*  RUN DATE  07/26/1999  TIME  14:18:05 *                                *         (916) 756-1104            *
*                                   *                                    *                                   *
*************************************                                    *************************************
```

```
                    SANTAN CHANNEL PROJECT
                    COMPUTATION OF RUNOFF FROM HEARTHSTONE SUBDIVISION AND
                    UPSTREAM OFFSITE AREAS
                    ********************************************************************
                    THIS MODEL PREPARED BY ANTHONY J. REGIS, P.E.
                    PREMIER ENGINEERING CORPORATION, INC.
                    7/26/99
                    ********************************************************************
                    HYDROLOGIC METHODOLOGY MATCHES MODEL DEVELOPED FOR SANTAN FREEWAY
                    BY HDR (1987) AND WOOD/PATEL (1996)
                    FILENAME: HRTHSTN.TXT

*** ERROR *** SPECIFIED START AND END DATES RESULT IN TOO MANY TIME PERIODS

  13 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME       0055  ENDING TIME
                      ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA          SQUARE MILES
               PRECIPITATION DEPTH    INCHES
               LENGTH, ELEVATION      FEET
               FLOW                   CUBIC FEET PER SECOND
               STORAGE VOLUME         ACRE-FEET
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT
1
                                                RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                       TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
          OPERATION        STATION   FLOW    PEAK                                          AREA      STAGE     MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR
          HYDROGRAPH AT
+                            5S       47.   12.33          6.          2.          2.       .03
          ROUTED TO
+                            5R       46.   12.50          6.          2.          2.       .03
          HYDROGRAPH AT
+                           10S      104.   12.33         13.          4.          4.       .08
          2 COMBINED AT
+                           10C      136.   12.42         19.          6.          5.       .11
          ROUTED TO
+                          10DET     124.   12.50         19.          6.          5.       .11
+                                                                                                   3.19       12.50
          HYDROGRAPH AT
+                           15S       47.   14.67         27.          8.          8.       .28
          DIVERSION TO
+                          15D1       25.   14.67          2.          1.          1.       .28
          HYDROGRAPH AT
+                          15RET      47.   14.67         26.          8.          7.       .28
          DIVERSION TO
+                          15D2       10.   14.67          6.          2.          2.       .28
          HYDROGRAPH AT
+                          15DIV      37.   14.67         21.          6.          6.       .28
          DIVERSION TO
+                           16D        6.   14.67          4.          1.          1.       .28
          HYDROGRAPH AT
+                          16DIV      31.   14.67         17.          5.          5.       .28
```

+	ROUTED TO	16R	31.	14.92	17.	5.	5.	.28
+	HYDROGRAPH AT	20S	84.	12.33	11.	3.	3.	.07
+	DIVERSION TO	20D	42.	12.33	6.	2.	2.	.07
+	HYDROGRAPH AT	20DIV	42.	12.33	6.	2.	2.	.07
+	2 COMBINED AT	20C	42.	12.33	20.	7.	6.	.35
+	HYDROGRAPH AT	21DR	6.	14.67	4.	1.	1.	.00
+	DIVERSION TO	21D	2.	14.67	1.	0.	0.	.00
+	HYDROGRAPH AT	21DIV	5.	14.67	3.	1.	1.	.00
+	ROUTED TO	21R	5.	14.92	3.	1.	1.	.00
+	HYDROGRAPH AT	25S	14.	12.17	1.	0.	0.	.01
+	2 COMBINED AT	25C	14.	12.17	4.	1.	1.	.01
+	HYDROGRAPH AT	26DR	2.	14.58	1.	0.	0.	.00
+	ROUTED TO	26R	2.	14.83	1.	0.	0.	.00
+	HYDROGRAPH AT	30S	11.	12.17	1.	0.	0.	.01
+	2 COMBINED AT	30C	11.	12.17	2.	1.	1.	.01
+	HYDROGRAPH AT	31DR	10.	14.67	6.	2.	2.	.00
+	ROUTED TO	31R	10.	14.83	5.	2.	2.	.00
+	HYDROGRAPH AT	35S	26.	13.92	12.	4.	4.	.12
+	2 COMBINED AT	35C	34.	14.17	18.	5.	5.	.12
+	HYDROGRAPH AT	36DR	42.	12.33	6.	2.	2.	.00
+	ROUTED TO	36R	42.	12.33	6.	2.	2.	.00
+	HYDROGRAPH AT	40S	26.	12.17	3.	1.	1.	.01
+	2 COMBINED AT	40C	64.	12.25	8.	2.	2.	.01

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
5R	MANE	3.92	46.71	747.24	2.02	5.00	45.83	750.00	2.02

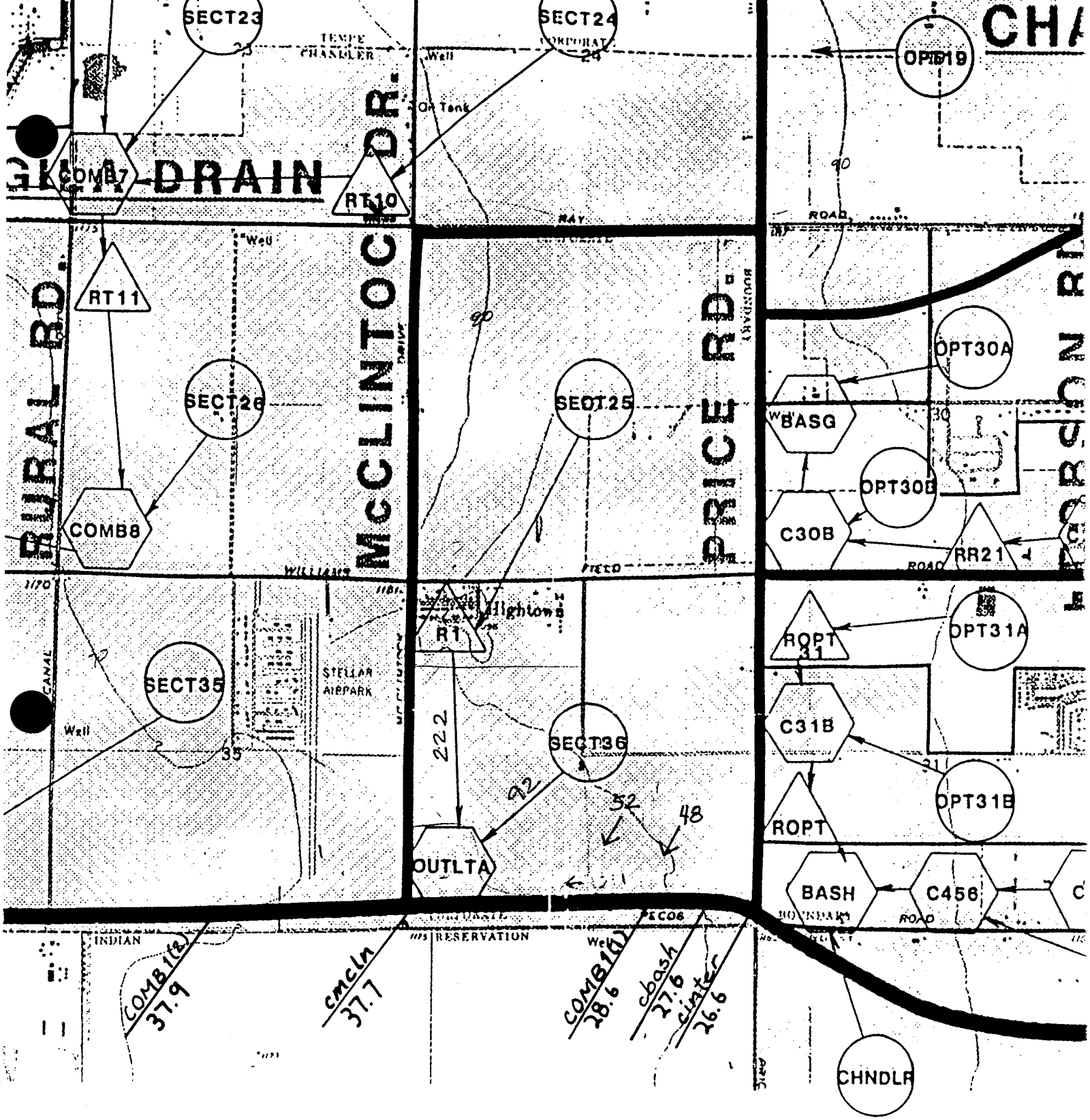
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3241E+01 EXCESS= .0000E+00 OUTFLOW= .3236E+01 BASIN STORAGE= .2628E-01 PERCENT ERROR= -.7

16R	MANE	4.83	30.66	893.30	.65	5.00	30.63	895.00	.65

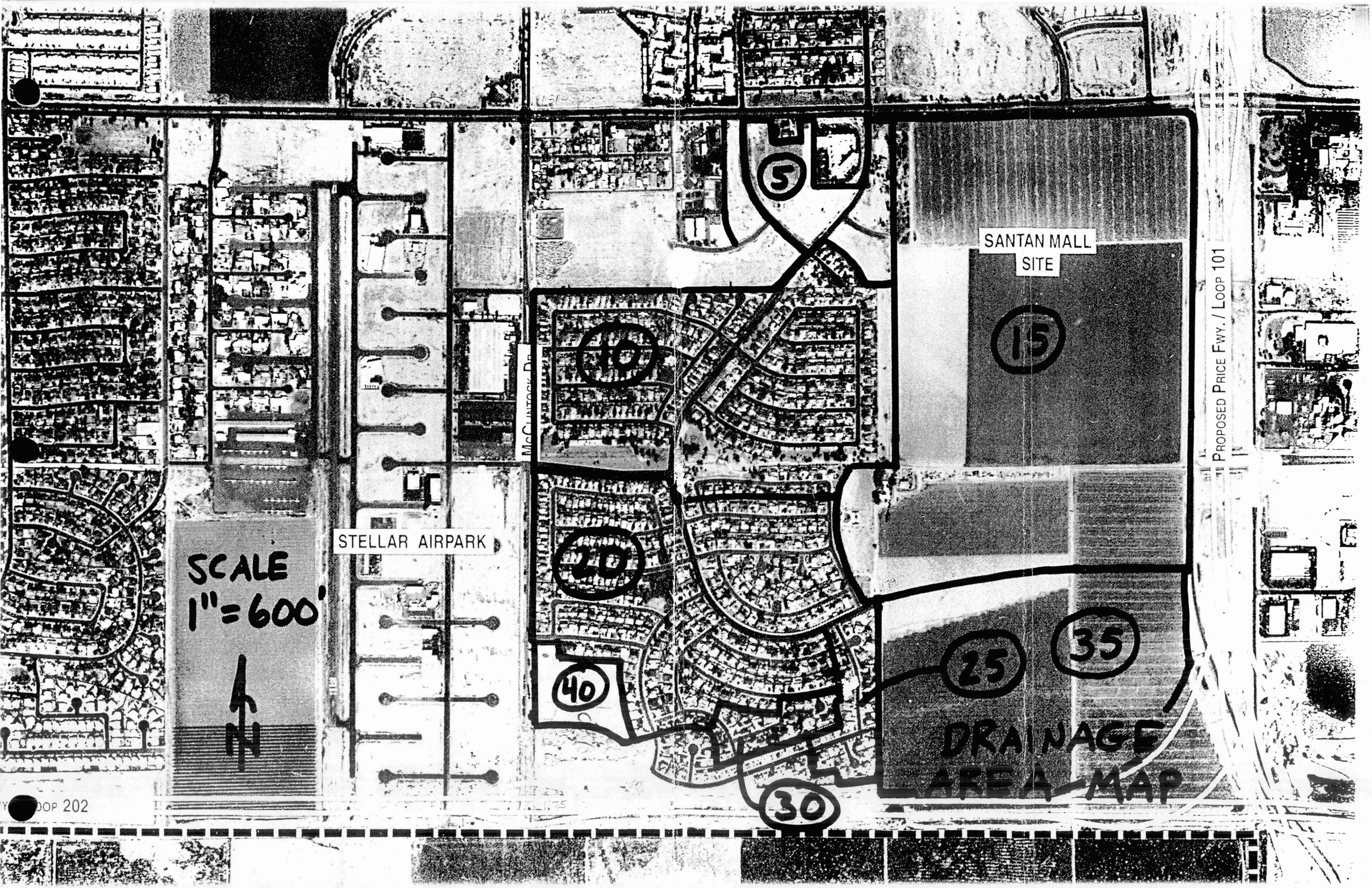
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1002E+02 EXCESS= .0000E+00 OUTFLOW= .9833E+01 BASIN STORAGE= .2086E+00 PERCENT ERROR= -.2

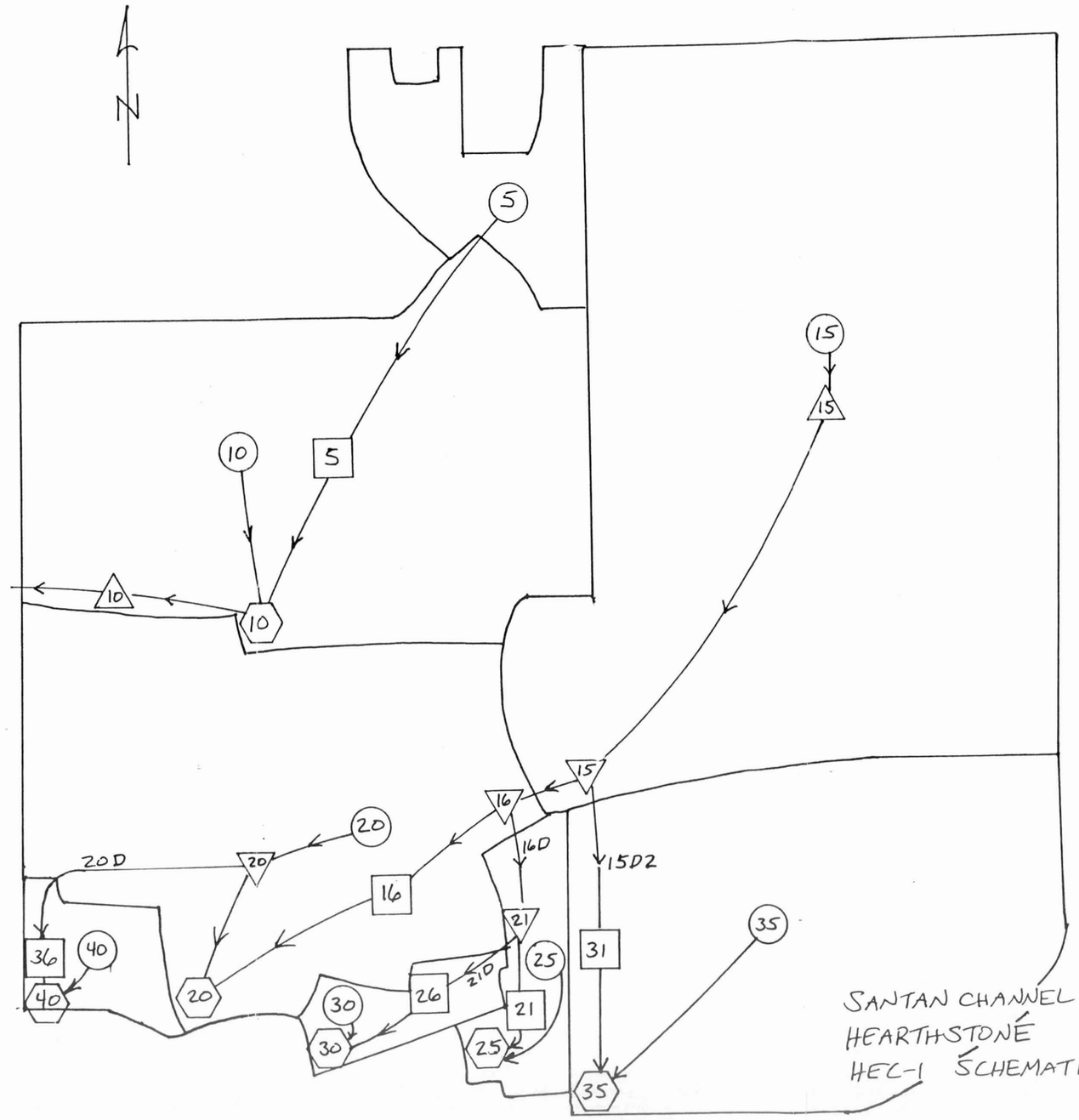
21R	MANE	4.99	4.71	894.52	-1.00	5.00	4.71	895.00	-1.00
26R	MANE	4.62	1.57	893.01	-1.00	5.00	1.57	890.00	-1.00
31R	MANE	5.00	9.99	889.79	-1.00	5.00	9.99	890.00	-1.00
36R	MANE	.88	42.02	741.67	-1.00	5.00	41.88	740.00	-1.00

*** NORMAL END OF HEC-1 ***



DRAINAGE MAP FROM
"DRAINAGE REPORT
SANTAN FREEWAY, 56TH ST. TO PRICE RD.
AND GILA DRAIN FLOODWAY TO BASIN B"
1996


SANTAN MALL
SITE
STELLAR AIRPARK
McCUNTOCK RD
PROPOSED PRICE FWY. / LOOP 101
LOOP 202
SCALE
1" = 600'
N
5
10
15
20
25
30
35
40
DRAINAGE
AREA MAP



SANTAN CHANNEL PROJECT
HEARTHSTONE
HEC-1 SCHEMATIC DIAGRAM

SCALE 1" = 600'

7/23/99

APPENDIX D

ON-SITE HYDRAULIC MODELING

SR202L - SANTAN FREEWAY

DRAINAGE AREA CALCULATIONS

Revised : 6/24/99

System #3 - Drain to Sump at KYRENE RD,

DA No.	LOC.	BEGIN STA.	ENDING STA.	WIDTH PAV.	WIDTH UNPAV.	AREA, sf PAV.	AREA, sf UNPAV	TOT. AREA Ac.	C	CA
107	EB	2065+50	2069+50	*	*	9200	45141	1.247	0.742	0.926
108	WB	2065+50	2069+50	*	*	8000	35140	0.990	0.746	0.739
109	EB	2069+50	2072+00	81	*	20250	8750	0.666	0.875	0.582
109A	Ramp B			*	*	39172	33075	1.659	0.836	1.386
110	WB	2069+50	2072+00	*	*	29337.5	8475	0.868	0.894	0.776
110A	Ramp A			*	*	30912	24840	1.280	0.839	1.073
111	EB	2072+00	2074+84	81	*	23004	15478	0.883	0.849	0.750
112	WB	2072+00	2074+84	69	*	19596	8662	0.649	0.873	0.567
113	EB	2074+84	2078+14	*	*	26515.5	28545	1.264	0.820	1.037
114	WB	2074+84	2078+14	69	*	22770	22110	1.030	0.827	0.852
115	EB	2078+14	2081+44	*	*	25459.5	32835	1.338	0.809	1.083
116	WB	2078+14	2081+44	69	*	22770	30525	1.223	0.807	0.987
117	EB	2081+44	2084+74	*	*	23793	35805	1.368	0.800	1.094
118	WB	2081+44	2084+74	69	*	22770	35970	1.348	0.797	1.075
119	EB	2084+74	2085+94	69	*	8280	12060	0.467	0.802	0.374
120	WB	2084+74	2085+94	69	*	8280	12120	0.468	0.801	0.375
121	EB	2085+94	2089+24	69	*	22770	27720	1.159	0.813	0.942
122	WB	2085+94	2089+24	69	*	22770	29040	1.189	0.810	0.963
123	EB	2089+24	2092+54	69	*	22770	18150	0.939	0.839	0.788
124	WB	2089+24	2092+54	69	*	22770	21615	1.019	0.828	0.844
125	EB	2092+54	2095+84	69	*	22770	10230	0.758	0.873	0.661
126	WB	2092+54	2095+84	69	*	22770	14190	0.848	0.854	0.725
127	EB	2095+84	2099+14	*	*	14145	3178	0.398	0.904	0.360
127A	Ramp D			*	*	50714	66794	2.698	0.808	2.179
128	WB	2095+84	2099+14	*	*	12696	4784	0.401	0.882	0.354
128A	Ramp C			*	*	52281	61265	2.607	0.815	2.125
129	EB	2099+14	2102+44	*	*	32059.5	24585	1.300	0.841	1.094
130	WB	2099+14	2102+44	*	*	31927.5	24585	1.297	0.841	1.091
131	EB	2102+44	2105+74	*	*	29221.5	22605	1.190	0.841	1.001
132	WB	2102+44	2105+74	69	*	22770	22605	1.042	0.825	0.860
133	EB	2105+74	2109+04	*	*	27439.5	23100	1.160	0.836	0.970
134	WB	2105+74	2109+04	69	68	22770	23100	1.053	0.824	0.868
135	EB	2109+04	2112+34	81	*	26730	20625	1.087	0.841	0.914
136	WB	2109+04	2112+34	69	57	22770	20625	0.996	0.831	0.828
137	EB	2112+34	2115+64	81	*	26730	17490	1.015	0.851	0.864
138	WB	2112+34	2115+64	69	49	22770	17490	0.924	0.841	0.778

SR202L - SANTAN FREEWAY

DRAINAGE AREA CALCULATIONS

Revised : 6/24/99

System #3 - Drain to Sump at KYRENE RD,

DA No.	LOC.	BEGIN STA.	ENDING STA.	WIDTH PAV.	WIDTH UNPAV.	AREA, sf PAV.	AREA, sf UNPAV	TOT. AREA Ac.	C	CA
139	EB	2115+64	2118+94	81	*	26730	16005	0.981	0.856	0.840
140	WB	2115+64	2118+94	69	48	22770	16005	0.890	0.847	0.754
141	EB	2118+94	2122+24	81	*	26730	15675	0.973	0.858	0.835
142	WB	2118+94	2122+24	69	47	22770	15675	0.883	0.848	0.748
143	EB	2122+24	2125+54	81	*	26730	15015	0.958	0.860	0.824
144	WB	2122+24	2125+54	69	44	22770	15015	0.867	0.851	0.738
145	EB	2125+54	2128+84	69	*	22770	14190	0.848	0.854	0.725
146	WB	2125+54	2128+84	69	42	22770	14190	0.848	0.854	0.725
147	EB	2128+84	2132+14	69	*	22770	13200	0.826	0.858	0.709
148	WB	2128+84	2132+14	69	38	22770	13200	0.826	0.858	0.709
149	EB	2132+14	2135+44	69	*	22770	12540	0.811	0.861	0.698
150	WB	2132+14	2135+44	69	38	22770	12540	0.811	0.861	0.698
151	EB	2135+44	2138+74	69	*	22770	12375	0.807	0.862	0.695
152	WB	2135+44	2138+74	69	37	22770	12375	0.807	0.862	0.695
153	EB	2138+74	2142+04	69	*	22770	10230	0.758	0.873	0.661
154	WB	2138+74	2142+04	69	25	22770	10230	0.758	0.873	0.661
155	EB	2142+04	2145+34	69	*	22770	7095	0.686	0.891	0.611
156	WB	2142+04	2145+34	69	18	22770	7095	0.686	0.891	0.611
157	EB	2145+34	2148+64	69	*	22770	5940	0.659	0.898	0.592
158	WB	2145+34	2148+64	69	18	22770	5940	0.659	0.898	0.592
159	EB	2148+64	2153+21	69	*	31533	8208	0.912	0.898	0.820
160	WB	2148+64	2153+21	69	18	31533	8208	0.912	0.898	0.820
							TOTAL	57.997		48.64

NOTES: SEE ATTTACHED TABLE OF PAVEMENT WIDTHS

* DA 107 Unpaved: (14+32) x 400/2 = 9200 sf
Paved: 400x81+ (21.5+47) x 372/2= 45141 sf

DA 108 Unpaved:(12+28)x400/2 = 8000 sf
Paved: (81+94.7)x400/2= 35140 sf

DA 109 Unpaved (20+50) x 250/2 = 8750 sf

SR202L - SANTAN FREEWAY

DRAINAGE AREA CALCULATIONS

Revised : 6/24/99

System #3 - Drain to Sump at KYRENE RD,

DA No.	LOC.	BEGIN STA.	ENDING STA.	WIDTH PAV.	WIDTH UNPAV.	AREA, sf PAV.	AREA, sf UNPAV	TOT. AREA Ac.	C	CA
		DA 109A	Unpaved: (32+18)x1323/2				33075 sf			
			Paved: 581 x 24 +(28+40)x742/2=				39172 sf			
		DA 110	Unpaved : (10+15)x48/2 + (28+35) x 25				8475 sf			
			Paved: 250 x 81 +(47+25.7)x250/2				29337.5 sf			
		DA 110A	Unpaved: (35+10)x1104/2 =				24840 sf			
			Paved: 1104 x 28 =				30912 sf			
		DA 111	Unpaved: (40+69)x284/2=			15478 sf				
		DA 112	Unpaved: (15+46)*284/2=			8662 sf				
		DA 113	Unpaved: (69+104)x330/2=			28545 sf				
			Paved: (81+79.7) x 330/2			26515.5 sf				
		DA 114	Unpaved: (46+80)x330/2=			22110 sf				
		DA 115	Unpaved: (94+105)x330/2 =				32835 sf			
			Paved: (79.7+74.6) x 330/2 =				25459.5 sf			
		DA 116	Unpaved: (80+115)x330/2 =			30525 sf				
		DA 117	Unpaved: (105+112)x330/2			35805 sf				
			Paved: (74.6+69.6) x 330/2 =				23793 sf			
		DA 118	Unpaved: (115+103)x330/2			35970 sf				
		DA 119	Unpaved: (112+99)x120/2 =			12060 sf				
		DA 120	Unpaved: (103+99)x120/2 =			12120 sf				
		DA 121	Unpaved: (99+69)x330/2 =			27720 sf				
		DA 122	Unpaved: (99+77)x330/2 =			29040 sf				
		DA 123	Unpaved: (69+41)x330/2			18150 sf				

SR202L - SANTAN FREEWAY

DRAINAGE AREA CALCULATIONS

Revised : 6/24/99

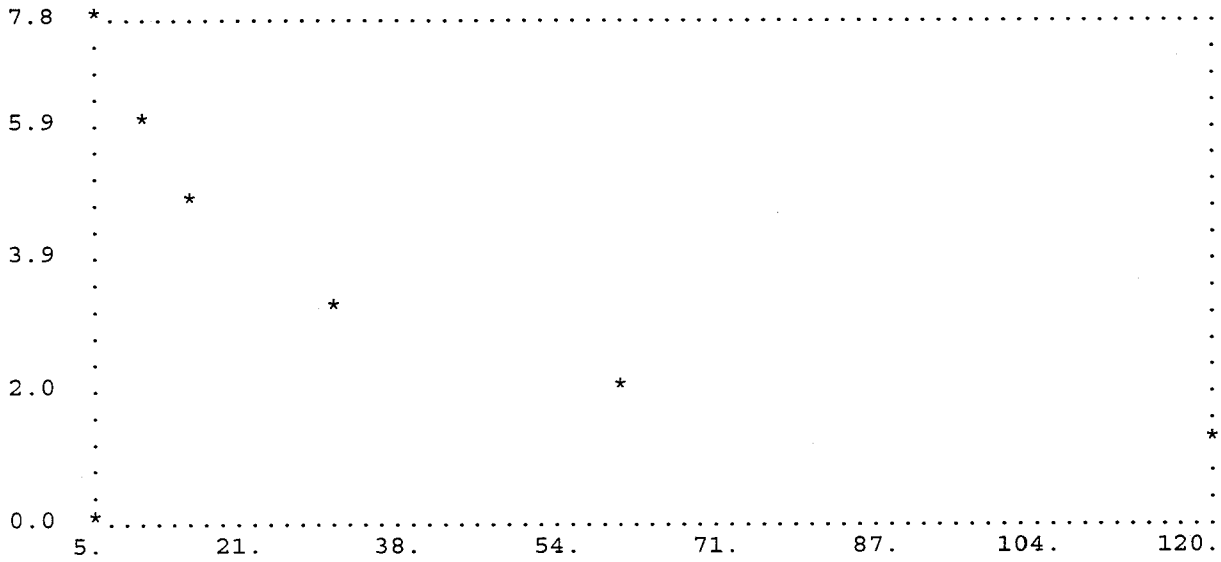
System #3 - Drain to Sump at KYRENE RD,

DA No.	LOC.	BEGIN STA.	ENDING STA.	WIDTH PAV.	WIDTH UNPAV.	AREA, sf PAV.	AREA, sf UNPAV	TOT. AREA Ac.	C	CA
		DA 124	Unpaved: (77+54)x330/2 =			21615 sf				
		DA 125	Unpaved: (41+21)*330/2 =			10230 sf				
		DA 126	Unpaved: (54+32)x330/2 =			14190 sf				
		DA 127	Unpaved: (21+10)*205/2			3177.5 sf				
			Paved: 69x205 =			14145 sf				
		DA 127A	Unpaved: (15+76)x1468/2 =				66794			
			Paved: 1343x28 +(116+102)x125/2=				50714 sf			
		DA 128	Unpaved: (32+20)x184/2 =			4784 sf				
			Paved: 69 x 184 =			12696 sf				
		DA 128A	Unpaved: (12+67)x 1551/2 =					61265 sf		
			Paved: (40+22) x 655/2 + 22x750 + (110+102)x14					52281 sf		
		DA 129	Unpaved: (84+65) x 330/2 =				24585 sf			
			Paved: (102.5 + 91.8) x 330/2 =				32059.5 sf			
		DA 130	Unpaved (84+65) x 330/2 =				24585 sf			
			Paved: (102 +91.5) x 330/2 =				31927.5 sf			
		DA 131	Unpaved (65+72) x 330/2 =				22605 sf			
			Paved (91.8+85.3) x 330/2 =				29221.5 sf			
		DA 132	Unpaved (65+72) x 330/2 =				22605			
		DA 133	Unpaved (72+68) x 330/2 =				23100			
			Paved (85.3+81) x 330/2 =				27439.5 sf			

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
+++ Commands Read From File C:\HYDRA\WKYRENE.HDA
  JOB
  SWI2
  REM SITE SPECIFIC RDDF FOR 50 YEAR
  RAI5 7.8 10 6.0 15 5.1 30 3.4 60 2.2 120 1.2
```

IDF CURVE



PLOT-DATA (TIME Vs.VALUE)

5.	7.80	60.	2.20	0.	.00	0.	.00	0.	.00
10.	6.00	120.	1.20	0.	.00	0.	.00	0.	.00
15.	5.10	0.	.00	0.	.00	0.	.00	0.	.00
30.	3.40	0.	.00	0.	.00	0.	.00	0.	.00

```
  REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
  PDA.012 24 3.75 1.5 3 .0001
  HGL1
  REM CREST AT 2065+50
  NEWDA 108
  STO.990 .746 32
  PIP176 1152.06 1152.24
+++ Tc =  32.0 min
+++ CA =    .7
+++ Link #  1,  Flow depth =    .68 ft
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
  PNC71 72 3 180 0
  PIP8 1152.24 1152.49
+++ Tc =  33.1 min
+++ CA =    .7
+++ Link #  2,  Flow depth =    .40 ft
  PNC72 73 3 90 0
  HOL30
  NEWDA 107
  STO1.247 .742 32
  PIP39 1151.30 1152.49
+++ Tc =  32.0 min
+++ CA =    .9
+++ Link #  3,  Flow depth =    .68 ft
  PNC70 73 3 110 0
  REC30
  PIP250 1152.49 1150.09 1147.45 1146.34 -24
+++ Tc =  33.1 min
+++ CA =   1.7
+++ Link #  4,  Flow depth =    .80 ft
  PNC73 78 3 180 0
  HOL31
  NEW RAMP B
  STO1.659 .836 10
  PIP62 1150.40 1150.09
+++ Tc =  10.0 min
+++ CA =   1.4
+++ Link #  5,  Flow depth =    .98 ft
  PNC74 78 3 90 0
  HOL32
  NEWDAs 110 & 109
  STO0.868 .894 10
  PIP52 1149.98 1149.96
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link #  6,  Flow depth =    .88 ft
  PNC75 76 3 180 0
  PIP150 1149.96 1149.84
+++ Tc =  10.2 min
+++ CA =    .8
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
+++ Link #  7,  Flow depth =    .90 ft
  PNC76 77 3 180 0
  STO0.666 .875 10
  PIP8 1149.84 1150.09
+++ Tc =  11.0 min
+++ CA =   1.4
+++ Link #  8,  Flow depth =    .74 ft
  PNC77 78 3 90 0
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
  REC31
  REC32
  PIP285 1150.09 1148.65 1145.43 1144.42 -30
+++ Tc =  34.0 min
+++ CA =   4.4
+++ Link #  9,  Flow depth =   1.33 ft
  PNC78 81 3 180 0
  HOL33
  NEWDAs RAMP A, 112, 111
  REM RAMP A
  STO1.280 .839 10
  PIP163 1148.85 1148.40
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 10,  Flow depth =   1.00 ft
  PNC100 79 3 120 0
  STO0.649 .873 10
  PIP150 1148.40 1148.40 1144.19 1144.09 -30
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 11,  Flow depth =   1.77 ft
  PNC79 80 3 180 0
  STO0.883 .849 10
  PIP8 1148.40 1148.65 1144.09 1143.99 -30
+++ Tc =  11.6 min
+++ CA =   2.4
+++ Link # 12,  Flow depth =    .90 ft
  PNC80 81 3 90 0
  REC33
  PIP332 1148.65 1145.32 1143.99 1141.11 -30
+++ Tc =  34.9 min
+++ CA =   6.8
+++ Link # 13,  Flow depth =   1.30 ft
  PNC81 84 3 180 0
  HOL34
  NEWDAs 114, 113
  STO1.030 .827 10
  PIP149 1145.07 1145.07
+++ Tc =  10.0 min
+++ CA =    .9
+++ Link # 14,  Flow depth =    .96 ft
  PNC82 83 3 180 0
  STO1.264 .820 10
  PIP8 1145.07 1145.32
+++ Tc =  10.7 min
+++ CA =   1.9
+++ Link # 15,  Flow depth =    .90 ft
  PNC83 84 3 90 0
  REC34
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
  PIP332 1145.32 1141.42  1140.55 1137.21 -30
+++ Tc =  35.5 min
+++ CA =   8.7
+++ Link # 16,  Flow depth =   1.43 ft
  PNC84 87 3 180 0
  HOL35
  NEWDAs 116, 115
  STO1.223 .807 10
  PIP144 1141.17 1141.17
+++ Tc =  10.0 min
+++ CA =   1.0
+++ Link # 17,  Flow depth =   1.16 ft
  PNC85 86 3 180 0
  STO1.338 .809 10
  PIP8 1141.17 1141.42
+++ Tc =  10.8 min
+++ CA =   2.1
+++ Link # 18,  Flow depth =    .94 ft
  PNC86 87 3 90 0
  REC35
  PIP332 1141.42 1140.37 1135.02 1134.54 -48
+++ Tc =  36.1 min
+++ CA =  10.8
+++ Link # 19,  Flow depth =   2.20 ft
  PNC87 91 3 90 0
  HOL36
  NEWDAs 118, 117
  STO1.348 .797 10
  PIP69 1140.12 1139.71
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 20,  Flow depth =    .82 ft
  PNC88 89 3 180 0
  PIP69 1139.71 1140.12
+++ Tc =  10.2 min
+++ CA =   1.1
+++ Link # 21,  Flow depth =   1.20 ft
  PNC89 90 3 180 0
  STO1.368 .797 10
  PIP8 1140.12 1140.37
+++ Tc =  10.6 min
+++ CA =   2.2
+++ Link # 22,  Flow depth =    .96 ft
  PNC90 91 3 90 0
  REC36
  PIP60 1140.37 1140.34 1134.54 1134.43 -48
+++ Tc =  37.2 min
+++ CA =  12.9
+++ Link # 23,  Flow depth =   2.24 ft
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

```
  PNC91 95 3 90 0
  HOL37
  NEWDAs 120, 119
  STO0.468 .801 10
  PIP69 1140.09 1139.68
+++ Tc =  10.0 min
+++ CA =    .4
+++ Link # 24,  Flow depth =    .48 ft
  PNC92 93 3 180 0
  PIP69 1139.68 1140.09
+++ Tc =  10.3 min
+++ CA =    .4
+++ Link # 25,  Flow depth =    .66 ft
  PNC93 94 3 180 0
  STO0.467 .801 10
  PIP8 1140.09 1140.34
+++ Tc =  10.7 min
+++ CA =    .7
+++ Link # 26,  Flow depth =    .56 ft
  PNC94 95 3 180 0
  REC37
  REMFLOWS FROM EAST
  FLO107.6
  PIP594 1140.34 1142.36 1119.64 1119.10 -66
+++ Tc =  37.4 min
+++ CA =  13.7
+++ Link # 27,  Flow depth =   5.50 ft
  PNC95 96 3 180 2
  END
 END OF INPUT DATA.
```

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DA 108 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
1	176	24	1148.31	.00180	3.8	1.6	2.7	2.45	0.
			1147.99		4.2		3.3	10.44	
2	8	24	1147.99	.01260	4.2	2.1	5.4	2.42	0.
			1147.89		4.6		8.8	27.59	

Length = 184. ft Total length = 184. ft
Cost = 0. Total Cost = 0.

*** DA 107 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
3	39	24	1147.55	.00266	3.8	1.6	3.3	3.07	0.
			1147.45		5.0		4.0	12.68	

Length = 39. ft Total length = 39. ft
Cost = 0. Total Cost = 0.

*** DA 107 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
4	250	24	1147.45	.00444	5.0	2.9	4.7	5.45	33		
			1146.34		3.7	1.6	5.2	16.37			

Length = 289. ft Total length = 473. ft

Length = 289. ft Total length = 473. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** RAMP B DA 109A

Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
5	62	24	1146.65	.00500	3.8	1.6	5.5	8.32	0.
			1146.34		3.8		5.5	17.38	

Length = 62. ft Total length = 62. ft
Cost = 0. Total Cost = 0.

*** DAs 110 & 109

Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
6	52	24	1146.23	.00231	3.8	1.6	3.5	4.66	0.
			1146.11		3.8		3.8	11.80	
7	150	24	1146.11	.00213	3.8	1.7	3.4	4.62	0.
			1145.79		4.0		3.6	11.35	
8	8	24	1145.79	.01260	4.0	1.9	7.6	7.91	0.
			1145.69		4.4		8.8	27.59	

Length = 210. ft Total length = 210. ft
Cost = 0. Total Cost = 0.

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DAs 110 & 109 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
9	285	30	1145.43	.00354	4.7	2.0	5.5	14.29	54		
			1144.42		4.2	1.5	5.4	26.52			

Length = 495. ft Total length = 1030. ft

*** DAs RAMP A (110A) Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
10	163	24	1145.10	.00276	3.8	1.6	4.1	6.44	0.
			1144.65		3.8		4.1	12.91	

Length = 163. ft Total length = 163. ft
Cost = 0. Total Cost = 0.

*** DAs 112, 111 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
11	150	30	1144.19	.00067	4.2	1.5	2.6	9.65	84		
			1144.09		4.3	1.6	2.3	11.50			
12	8	30	1144.09	.01250	4.3	1.6	8.6	13.65	27		
			1143.99		4.7	2.0	10.1	49.81			

Length = 321. ft Total length = 321. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DAs RAMP A (110A), 112, 111 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
13	332	30	1143.99	.00867	4.7	2.0	8.5	21.80	53		
			1141.11		4.2	1.5	8.5	41.50			

Length = 653. ft Total length = 1683. ft

*** DAs 114, 113 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
14	149	24	1141.32	.00211	3.8	1.6	3.5	5.11	0.
			1141.01		4.1		3.6	11.30	
15	8	24	1141.01	.01260	4.1	1.9	8.3	11.09	0.
			1140.90		4.4		8.8	27.59	

Length = 157. ft Total length = 157. ft
Cost = 0. Total Cost = 0.

*** DAs 114, 113 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
16	332	30	1140.55	.01006	4.8	2.1	9.6	27.62	62		
			1137.21		4.2	1.5	9.1	44.69			

Length = 489. ft Total length = 2172. ft

Length = 489. ft Total length = 2172. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DAs 116, 115 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
17	144	24	1137.42	.00149	3.8	1.6	3.2	5.92	0.
			1137.21		4.0		3.0	9.48	
18	8	24	1137.21	.01260	4.0	1.8	8.5	12.14	0.
			1137.10		4.3		8.8	27.59	

Length = 152. ft Total length = 152. ft
Cost = 0. Total Cost = 0.

*** DAs 116, 115 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
19	332	48	1135.02	.00145	6.4	2.1	4.9	33.96	57		
			1134.54		5.8	1.5	4.7	59.33			

Length = 484. ft Total length = 2656. ft

*** DAs 118, 117 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
20	69	24	1136.37	.00594	3.8	1.6	5.4	6.45	0.
			1135.96		3.8		6.0	18.94	
21	69	24	1135.96	.00155	3.8	1.6	3.3	6.41	0.
			1135.85		4.3		3.1	9.67	

Length = 138. ft Total length = 138. ft
Cost = 0. Total Cost = 0.

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DAs 118, 117 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
22	8	24	1135.85	.01260	4.3	2.1	8.6	12.77	0.
			1135.75		4.6		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 118, 117 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
23	60	48	1134.54	.00183	5.8	1.5	5.6	40.20	60		
			1134.43		5.9	1.6	5.3	66.80			

Length = 206. ft Total length = 2862. ft

*** DAs 120, 119 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
24	69	24	1136.34	.00594	3.8	1.6	4.1	2.25	0.
			1135.93		3.8		6.0	18.94	
25	69	24	1135.93	.00155	3.8	1.6	2.5	2.23	0.
			1135.82		4.3		3.1	9.67	
26	8	24	1135.82	.01260	4.3	2.1	6.4	4.39	0.
			1135.72		4.6		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

SR202L - PUMPSTA @ KYRENE, WEST SIDE

*** DAs 120, 119 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
27	594	66	1119.64	.00091	20.7	14.7	6.3	150.03	136	40.05	48
			1119.10		23.3	17.3	4.6	109.99			

Length = 740. ft Total length = 3602. ft

SR202L - PUMPSTA @ KYRENE, WEST SIDE

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
1	72	1150.00	1149.99	Y	1152.24	N	1.76	1.09
2	73	1149.50	1149.89	N	1152.49	Y	.97	1.01
3	73	1148.59	1149.45	N	1152.49	N	.97	1.01
4	78	1147.95	1148.34	N	1150.09	Y	1.38	.31
5	78	1147.32	1148.34	N	1150.09	Y	1.38	.31
6	76	1146.98	1148.11	N	1149.96	N	.00	.00
7	77	1147.75	1147.79	N	1149.84	N	1.50	1.04
8	78	1146.81	1147.69	N	1150.09	Y	1.38	.31
9	81	1146.43	1146.92	N	1148.65	Y	1.86	1.01
10	79	1145.65	1146.65	N	1148.40	N	.00	.00
11	80	1147.69	1146.59	Y	1148.40	N	2.98	1.09
12	81	1146.43	1146.49	N	1148.65	Y	1.86	1.01
13	84	1143.42	1143.61	N	1145.32	Y	2.14	1.01
14	83	1144.65	1143.01	Y	1145.07	N	3.03	1.14
15	84	1143.42	1142.90	Y	1145.32	Y	2.14	1.01
16	87	1138.63	1139.71	N	1141.42	Y	2.77	2.44
17	86	1139.30	1139.21	Y	1141.17	N	1.51	1.04
18	87	1138.03	1139.10	N	1141.42	Y	2.77	2.44
19	91	1137.26	1138.54	N	1140.37	N	2.48	1.00
20	89	1136.77	1137.96	N	1139.71	Y	.00	.00
21	90	1138.27	1137.85	Y	1140.12	N	1.80	1.08
22	91	1137.02	1137.75	N	1140.37	Y	2.48	1.00
23	95	1136.67	1138.43	N	1140.34	N	5.76	.83
24	93	1136.39	1137.93	N	1139.68	Y	.00	.00
25	94	1137.02	1137.82	N	1140.09	N	.87	1.03
26	95	1136.26	1137.72	N	1140.34	Y	5.76	.83
27	96	1124.60	1124.60	N	1142.36	N/A	.00	.00

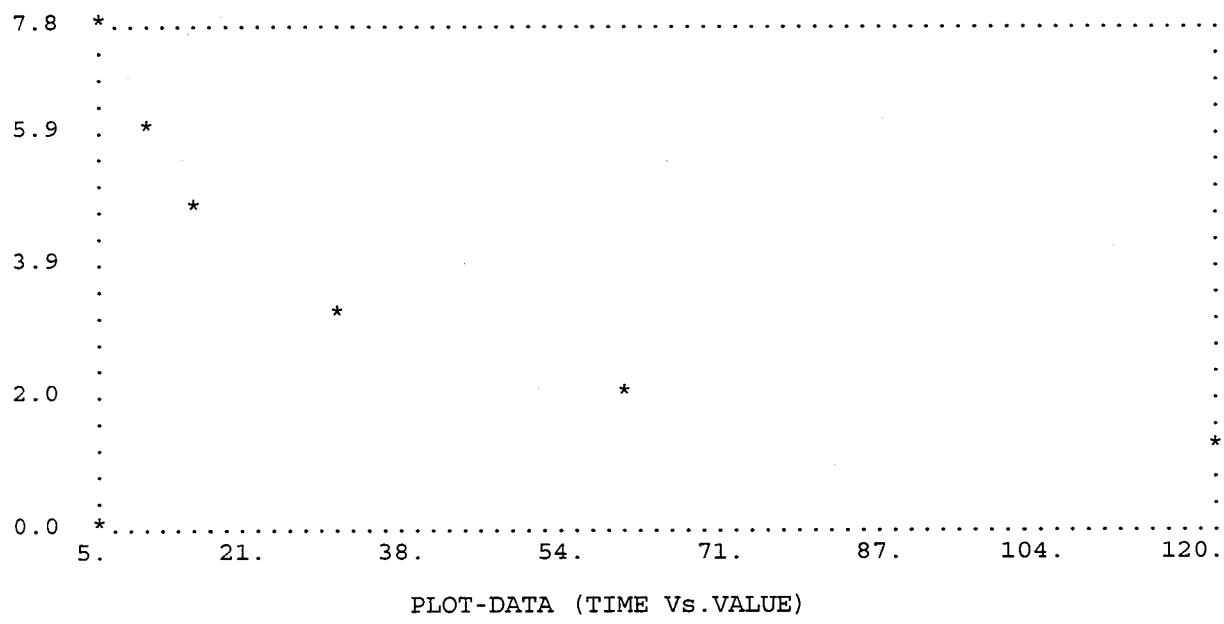
Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
1	71	1150.21	1152.06	1.50
3	70	1148.85	1151.30	1.50
5	74	1148.32	1150.40	1.50

NORMAL END OF HYDRA

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Commands Read From File C:\HYDRA\EKYRENE.HDA
  JOB
  SWI2
  REM SITE SPECIFIC RDDF FOR 50 YEAR
  RAI5 7.8 10 6.0 15 5.1 30 3.4 60 2.2 120 1.2
```

IDF CURVE



PLOT-DATA (TIME Vs.VALUE)

5.	7.80	60.	2.20	0.	.00	0.	.00	0.	.00
10.	6.00	120.	1.20	0.	.00	0.	.00	0.	.00
15.	5.10	0.	.00	0.	.00	0.	.00	0.	.00
30.	3.40	0.	.00	0.	.00	0.	.00	0.	.00

```
  REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
  PDA.012 24 3.75 1.5 3 .0001
  HGL1
  REM CREST AT 2153+21
  NEWDAs 160, 159
  STO0.912 .898 10
  PIP138 1164.69 1164.69
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link #  1,  Flow depth =   1.02 ft
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
  PNC1 2 3 180 0
  STO0.912 .898 10
  PIP8 1164.69 1164.94
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link #  2,  Flow depth =    .82 ft
  PNC2 3 3 90 0
  PIP330 1165.20 1163.87 1159.99 1159.33 -24
+++ Tc =  10.8 min
+++ CA =   1.6
+++ Link #  3,  Flow depth =   1.46 ft
  PNC3 6 3 180 0
  HOL1
  NEWDAs 158, 157
  STO0.659 .898 10
  PIP138 1163.36 1163.36
+++ Tc =  10.0 min
+++ CA =    .6
+++ Link #  4,  Flow depth =    .84 ft
  PNC4 5 3 180 0
  STO0.659 .898 10
  PIP8 1163.36 1163.61
+++ Tc =  10.8 min
+++ CA =   1.2
+++ Link #  5,  Flow depth =    .70 ft
  PNC5 6 3 90 0
  REC1
  PIP330 1163.61 1162.29 1158.84 1158.08 -30
+++ Tc =  12.2 min
+++ CA =   2.8
+++ Link #  6,  Flow depth =   1.62 ft
  PNC6 9 3 180 0
  HOL2
  NEWDAs 156, 155
  STO0.686 .891 10
  PIP138 1162.04 1162.04
+++ Tc =  10.0 min
+++ CA =    .6
+++ Link #  7,  Flow depth =    .86 ft
  PNC7 8 3 180 0
  STO0.686 .891 10
  PIP8 1162.24 1162.29
+++ Tc =  10.8 min
+++ CA =   1.2
+++ Link #  8,  Flow depth =    .70 ft
  PNC8 9 3 90 0
  REC2
  PIP330 1162.29 1160.96 1156.56 1156.00 -36
+++ Tc =  13.3 min
+++ CA =   4.0
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Link #  9,  Flow depth =   1.92 ft
  PNC9 12 3 180 0
  HOL3
  NEWDAs 154, 153
  STO0.758 .873 10
  PIP138 1160.71 1160.71
+++ Tc =  10.0 min
+++ CA =     .7
+++ Link # 10,  Flow depth =    .90 ft
  PNC10 11 3 180 0
  STO0.758 .873 10
  PIP8 1160.71 1160.96
+++ Tc =  10.8 min
+++ CA =   1.3
+++ Link # 11,  Flow depth =    .74 ft
  PNC11 12 3 90 0
  REC3
  PIP330 1160.96 1159.64 1155.48 1154.89 -36
+++ Tc =  14.5 min
+++ CA =   5.4
+++ Link # 12,  Flow depth =   2.25 ft
  PNC12 15 3 180 0
  HOL4
  NEWDAs 152, 151
  STO0.807 .862 10
  PIP138 1159.39 1159.39
+++ Tc =  10.0 min
+++ CA =     .7
+++ Link # 13,  Flow depth =    .92 ft
  PNC13 14 3 180 0
  STO0.807 .862 10
  PIP8 1159.39 1159.64
+++ Tc =  10.8 min
+++ CA =   1.4
+++ Link # 14,  Flow depth =    .76 ft
  PNC14 15 3 90 0
  REC4
  PIP330 1159.64 1158.31 1153.35 1153.02 -42
+++ Tc =  15.6 min
+++ CA =   6.8
+++ Link # 15,  Flow depth =   2.83 ft
  PNC15 18 3 180 0
  HOL5
  NEWDAs 150, 149
  STO0.811 .861 10
  PIP138 1158.06 1158.06
+++ Tc =  10.0 min
+++ CA =     .7
+++ Link # 16,  Flow depth =    .92 ft
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
  PNC16 17 3 180 0
  STO0.811 .861 10
  PIP8 1158.06 1158.31
+++ Tc =  10.8 min
+++ CA =   1.4
+++ Link # 17,  Flow depth =    .76 ft
  PNC17 18 3 90 0
  REC5
  PIP330 1158.31 1156.98 1151.38 1151.15 -48
+++ Tc =  17.0 min
+++ CA =   8.2
+++ Link # 18,  Flow depth =   3.20 ft
  PNC18 21 3 180 0
  HOL6
  NEWDAs 148, 147
  STO0.826 .858 10
  PIP138 1156.73 1156.73
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 19,  Flow depth =    .94 ft
  PNC19 20 3 180 0
  STO0.826 .858 10
  PIP8 1156.73 1156.98
+++ Tc =  10.8 min
+++ CA =   1.4
+++ Link # 20,  Flow depth =    .76 ft
  PNC20 21 3 90 0
  REC6
  PIP330 1156.98 1155.66 1149.52 1149.29 -54
+++ Tc =  18.4 min
+++ CA =   9.6
+++ Link # 21,  Flow depth =   3.06 ft
  PNC21 24 3 180 0
  HOL7
  NEWDAs 146, 145
  STO0.848 .854 10
  PIP138 1155.41 1155.21
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 22,  Flow depth =    .86 ft
  PNC22 23 3 180 0
  STO0.848 .854 10
  PIP8 1155.41 1155.66
+++ Tc =  10.7 min
+++ CA =   1.4
+++ Link # 23,  Flow depth =    .78 ft
  PNC23 24 3 90 0
  REC7
  PIP330 1155.66 1154.33 1148.19 1147.96 -54
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Tc =  19.8 min
+++ CA =  11.0
+++ Link # 24,  Flow depth =   3.33 ft
  PNC24 27 3 180 0
  HOL8
  NEWDAs 144, 143
  STO0.867 .851 10
  PIP150 1154.08 1154.08
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 25,  Flow depth =    .88 ft
  PNC25 26 3 180 0
  STO0.958 .824 10
  PIP8 1154.08 1154.33
+++ Tc =  10.7 min
+++ CA =   1.5
+++ Link # 26,  Flow depth =    .80 ft
  PNC26 27 3 90 0
  REC8
  PIP330 1154.33 1153.01 1146.87 1146.64 -54
+++ Tc =  21.2 min
+++ CA =  12.5
+++ Link # 27,  Flow depth =   3.65 ft
  PNC27 30 3 180 0
  HOL9
  NEWDAs 142, 141
  STO0.883 .848 10
  PIP150 1152.76 1152.76
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 28,  Flow depth =    .88 ft
  PNC28 29 3 180 0
  STO0.973 .858 10
  PIP8 1152.76 1153.01
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 29,  Flow depth =    .80 ft
  PNC29 30 3 90 0
  REC9
  PIP330 1153.01 1151.68 1144.35 1144.22 -66
+++ Tc =  22.6 min
+++ CA =  14.1
+++ Link # 30,  Flow depth =   3.85 ft
  PNC30 33 3 180 0
  HOL10
  NEWDAs 140, 139
  STO0.890 .847 10
  PIP150 1151.43 1151.43
+++ Tc =  10.0 min
+++ CA =    .8
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Link # 31,  Flow depth =    .90 ft
  PNC31 32 3 180 0
  STO0.981 .856 10
  PIP8 1151.43 1151.68
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 32,  Flow depth =    .82 ft
  PNC32 33 3 90 0
  REC10
  PIP330 1151.68 1150.35 1143.02 1142.89 -66
+++ Tc =  24.2 min
+++ CA =  15.7
+++ Link # 33,  Flow depth =   4.01 ft
  PNC33 36 3 180 0
  HOL11
  NEWDAs 138, 137
  STO0.924 .841 10
  PIP150 1150.10 1150.10
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 34,  Flow depth =    .90 ft
  PNC34 35 3 180 0
  STO1.015 .841 10
  PIP8 1150.10 1150.35
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 35,  Flow depth =    .82 ft
  PNC35 36 3 90 0
  REC11
  PIP330 1150.35 1149.03 1141.70 1141.57 -66
+++ Tc =  25.8 min
+++ CA =  17.4
+++ Link # 36,  Flow depth =   4.23 ft
  PNC36 39 3 180 0
  HOL12
  NEWDAs 136, 135
  STO0.996 .831 10
  PIP150 1148.78 1148.78
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 37,  Flow depth =    .94 ft
  PNC37 38 3 180 0
  STO1.087 .831 10
  PIP8 1148.78 1149.03
+++ Tc =  10.7 min
+++ CA =   1.7
+++ Link # 38,  Flow depth =    .84 ft
  PNC38 39 3 90 0
  REC12
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
  PIP330 1149.03 1147.46 1140.13 1140.00 -66
+++ Tc =  27.4 min
+++ CA =  19.1
+++ Link # 39,  Flow depth =   4.40 ft
  PNC39 42 3 180 0
  HOL13
  NEWDAs 134, 133
  STO1.053 .824 10
  PIP154 1147.45 1147.21
+++ Tc =  10.0 min
+++ CA =    .9
+++ Link # 40,  Flow depth =   1.06 ft
  PNC40 41 3 180 0
  STO1.160 .830 10
  PIP8 1147.21 1147.46
+++ Tc =  10.8 min
+++ CA =   1.8
+++ Link # 41,  Flow depth =    .88 ft
  PNC41 42 3 90 0
  REC13
  PIP330 1147.46 1145.98 1138.65 1138.52 -66
+++ Tc =  29.0 min
+++ CA =  20.9
+++ Link # 42,  Flow depth =   5.50 ft
  PNC42 45 3 180 0
  HOL14
  NEWDAs 132, 131
  STO1.042 .825 10
  PIP177 1145.93 1145.73
+++ Tc =  10.0 min
+++ CA =    .9
+++ Link # 43,  Flow depth =   1.02 ft
  PNC43 44 3 180 0
  STO1.190 .841 10
  PIP8 1145.73 1145.98
+++ Tc =  10.9 min
+++ CA =   1.9
+++ Link # 44,  Flow depth =    .88 ft
  PNC44 45 3 90 0
  REC14
  PIP330 1145.98 1144.43 1136.56 1136.43 -72
+++ Tc =  30.7 min
+++ CA =  22.8
+++ Link # 45,  Flow depth =   4.26 ft
  PNC45 48 3 180 0
  HOL15
  NEWDAs 130, 129
  STO1.297 .841 10
  PIP182 1144.18 1144.18
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 46,  Flow depth =   1.18 ft
  PNC46 47 3 180 0
  STO1.300 .841 10
  PIP8 1144.18 1144.43
+++ Tc =  10.9 min
+++ CA =   2.2
+++ Link # 47,  Flow depth =    .96 ft
  PNC47 48 3 90 0
  REC15
  PIP206 1144.43 1144.18 1136.03 1135.95 -72
+++ Tc =  32.3 min
+++ CA =  25.0
+++ Link # 48,  Flow depth =   4.50 ft
  PNC48 50 3 180 0
  HOL16
  NEWDA 127A - RAMP D
  STO2.698 .808 10
  PIP20 1143.66 1144.18 1139.91 1137.95 -24
+++ Tc =  10.0 min
+++ CA =   2.2
+++ Link # 49,  Flow depth =    .56 ft
  PNC49 50 3 90 1
  REC16
  PIP97 1144.18 1143.99  1135.95 1135.90 -72
+++ Tc =  33.2 min
+++ CA =  27.1
+++ Link # 50,  Flow depth =   4.26 ft
  PNC50 54 3 180 0
  HOL17
  NEWDAs 128A - RAMP C, 128
  REM RAMP C
  STO2.607 .815 10
  PIP84 1143.55 1143.74
+++ Tc =  10.0 min
+++ CA =   2.1
+++ Link # 51,  Flow depth =   1.70 ft
  PNC51 52 3 120 0
  STO0.401 .882 10
  PIP138 1143.74 1143.74
+++ Tc =  10.4 min
+++ CA =   2.5
+++ Link # 52,  Flow depth =   1.77 ft
  PNC52 53 3 180 0
  STO0.398 .904 10
  PIP8 1143.74 1143.99 1139.02 1138.42 -30
+++ Tc =  11.0 min
+++ CA =   2.8
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
+++ Link # 53,  Flow depth =    .63 ft
  PNC53 54 3 90 0
  REC17
  PIP330 1143.99 1142.66 1134.25 1134.12 -78
+++ Tc =  33.6 min
+++ CA =  30.0
+++ Link # 54,  Flow depth =   4.68 ft
  PNC54 57 3 180 0
  HOL18
  NEWDAs 126, 125
  STO0.848 .854 10
  PIP138 1142.41 1142.41
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 55,  Flow depth =    .94 ft
  PNC55 56 3 180 0
  STO0.758 .873 10
  PIP8 1142.41 1142.66
+++ Tc =  10.8 min
+++ CA =   1.4
+++ Link # 56,  Flow depth =    .76 ft
  PNC56 57 3 90 0
  REC18
  PIP332 1142.66 1141.33 1132.92 1132.79 -78
+++ Tc =  35.0 min
+++ CA =  31.4
+++ Link # 57,  Flow depth =   4.81 ft
  PNC57 60 3 180 0
  HOL19
  NEWDAs 124, 123
  STO1.019 .828 10
  PIP138 1141.08 1141.08
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 58,  Flow depth =   1.04 ft
  PNC58 59 3 180 0
  STO0.939 .839 10
  PIP8 1141.08 1141.33
+++ Tc =  10.7 min
+++ CA =   1.6
+++ Link # 59,  Flow depth =    .82 ft
  PNC59 60 3 90 0
  REC19
  PIP332 1141.33 1140.37 1131.96 1131.83 -78
+++ Tc =  36.5 min
+++ CA =  33.0
+++ Link # 60,  Flow depth =   4.94 ft
  PNC60 64 3 90 2
  HOL20
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

```
  NEWDAs 122, 121
  STO1.189 .810 10
  PIP69 1140.12 1139.70
+++ Tc =  10.0 min
+++ CA =   1.0
+++ Link # 61,  Flow depth =    .76 ft
  PNC61 62 3 180 0
  PIP69 1139.70 1140.12
+++ Tc =  10.2 min
+++ CA =   1.0
+++ Link # 62,  Flow depth =   1.12 ft
  PNC62 63 3 180 0
  STO1.159 .813 10
  PIP8 1140.12 1140.37
+++ Tc =  10.6 min
+++ CA =   1.9
+++ Link # 63,  Flow depth =    .90 ft
  PNC63 64 3 90 0
  REC20
  PIP60 1140.37 1140.34 1131.83 1131.72 -78
+++ Tc =  37.9 min
+++ CA =  34.9
+++ Link # 64,  Flow depth =   3.06 ft
  PNC64 95 3 90 2
  END
 END OF INPUT DATA.
```

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 160, 159 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
1	138	24	1160.94	.00155	3.8	1.6	3.1	4.91	0.
			1160.73		4.0		3.1	9.67	
2	8	24	1160.73	.01260	4.0	1.8	8.0	9.61	0.
			1160.63		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 160, 159 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
3	330	24	1159.99	.00200	5.2	3.0	3.9	9.60	87		
			1159.33		4.5	2.4	3.5	10.99			

Length = 476. ft Total length = 476. ft

*** DAs 158, 157 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
4	138	24	1159.61	.00155	3.8	1.6	2.8	3.55	0.
			1159.40		4.0		3.1	9.67	
5	8	24	1159.40	.01260	4.0	1.8	7.3	6.93	0.
			1159.30		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 158, 157 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
6	330	30	1158.84	.00230	4.8	2.1	4.8	15.83	74		
			1158.08		4.2	1.5	4.4	21.38			

Length = 476. ft Total length = 952. ft

*** DAs 156, 155 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
7	138	24	1158.29	.00155	3.8	1.6	2.9	3.67	0.
			1158.08		4.0		3.1	9.67	
8	8	24	1158.08	.01260	4.2	2.0	7.4	7.16	0.
			1157.98		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 156, 155 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
9	330	36	1156.56	.00170	5.7	2.5	4.6	21.85	73		
			1156.00		5.0	1.7	4.2	29.85			

Length = 476. ft Total length = 1428. ft

Length = 476. ft Total length = 1428. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 154, 153 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
10	138	24	1156.96	.00155	3.8	1.6	2.9	3.97	0.
			1156.75		4.0		3.1	9.67	
11	8	24	1156.75	.01260	4.0	1.8	7.5	7.75	0.
			1156.65		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 154, 153 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
12	330	36	1155.48	.00179	5.5	2.2	4.9	27.85	91		
			1154.89		4.8	1.5	4.3	30.63			

Length = 476. ft Total length = 1904. ft

*** DAs 152, 151 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
13	138	24	1155.64	.00155	3.8	1.6	3.0	4.17	0.
			1155.43		4.0		3.1	9.67	
14	8	24	1155.43	.01260	4.0	1.8	7.6	8.15	0.
			1155.33		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 152, 151 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
15	330	42	1153.35	.00100	6.3	2.5	4.1	33.99	98		
			1153.02		5.3	1.5	3.6	34.56			

Length = 476. ft Total length = 2380. ft

*** DAs 150, 149 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
16	138	24	1154.31	.00155	3.8	1.6	3.0	4.19	0.
			1154.10		4.0		3.1	9.67	
17	8	24	1154.10	.01260	4.0	1.8	7.6	8.18	0.
			1154.00		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 150, 149 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
18	330	48	1151.38	.00070	6.9	2.6	3.7	39.77	97		
			1151.15		5.8	1.5	3.3	41.19			

Length = 476. ft Total length = 2856. ft

Length = 476. ft Total length = 2856. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 148, 147 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
19	138	24	1152.98	.00155	3.8	1.6	3.0	4.25	0.
			1152.77		4.0		3.1	9.67	
20	8	24	1152.77	.01260	4.0	1.8	7.7	8.31	0.
			1152.67		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 148, 147 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
21	330	54	1149.52	.00070	7.5	2.6	3.9	45.09	80		
			1149.29		6.4	1.5	3.5	56.41			

Length = 476. ft Total length = 3332. ft

*** DAs 146, 145 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
22	138	24	1151.66	.00217	3.8	1.6	3.4	4.35	0.
			1151.36		3.8		3.6	11.46	
23	8	24	1151.36	.01260	4.1	1.9	7.8	8.51	0.
			1151.26		4.4		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 146, 145 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
24	330	54	1148.19	.00070	7.5	2.6	4.0	50.17	89		
			1147.96		6.4	1.5	3.5	56.38			

Length = 476. ft Total length = 3808. ft

*** DAs 144, 143 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
25	150	24	1150.33	.00210	3.8	1.6	3.4	4.43	0.
			1150.02		4.1		3.6	11.26	
26	8	24	1150.02	.01260	4.1	1.9	7.8	8.96	0.
			1149.91		4.4		8.8	27.59	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

*** DAs 144, 143 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
27	330	54	1146.87	.00070	7.5	2.6	4.0	55.17	98		
			1146.64		6.4	1.5	3.5	56.39			

Length = 488. ft Total length = 4296. ft

Length = 488. ft Total length = 4296. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 142, 141 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
28	150	24	1149.01	.00210	3.8	1.6	3.4	4.49	0.
			1148.70		4.1		3.6	11.26	
29	8	24	1148.70	.01260	4.1	1.9	7.9	9.29	0.
			1148.59		4.4		8.8	27.59	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

*** DAs 142, 141 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
30	330	66	1144.35	.00039	8.7	2.7	3.4	59.95	83		
			1144.22		7.5	1.5	3.0	72.44			

Length = 488. ft Total length = 4784. ft

*** DAs 140, 139 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
31	150	24	1147.68	.00210	3.8	1.6	3.4	4.52	0.
			1147.37		4.1		3.6	11.26	
32	8	24	1147.37	.01260	4.1	1.9	7.9	9.35	0.
			1147.26		4.4		8.8	27.59	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

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*** DAs 140, 139 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
33	330	66	1143.02	.00039	8.7	2.7	3.4	63.83	88		
			1142.89		7.5	1.5	3.0	72.40			

Length = 488. ft Total length = 5272. ft

*** DAs 138, 137 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
34	150	24	1146.35	.00210	3.8	1.6	3.4	4.66	0.
			1146.04		4.1		3.6	11.26	
35	8	24	1146.04	.01260	4.1	1.9	8.0	9.57	0.
			1145.93		4.4		8.8	27.59	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

*** DAs 138, 137 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
36	330	66	1141.70	.00039	8.7	2.7	3.5	67.30	93		
			1141.57		7.5	1.5	3.0	72.40			

Length = 488. ft Total length = 5760. ft

Length = 488. ft Total length = 5760. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 136, 135 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
37	150	24	1145.03	.00210	3.8	1.6	3.5	4.97	0.
			1144.71		4.1		3.6	11.26	
38	8	24	1144.71	.01260	4.1	1.9	8.1	10.16	0.
			1144.61		4.4		8.8	27.59	

Length = 158. ft Total length = 158. ft
Cost = 0. Total Cost = 0.

*** DAs 136, 135 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
39	330	66	1140.13	.00039	8.9	2.9	3.5	70.58	97		
			1140.00		7.5	1.5	3.0	72.40			

Length = 488. ft Total length = 6248. ft

*** DAs 134, 133 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
40	154	24	1143.70	.00156	3.8	1.6	3.1	5.21	0.
			1143.46		3.8		3.1	9.70	
41	8	24	1143.46	.01260	3.8	1.6	8.2	10.71	0.
			1143.36		4.1		8.8	27.59	

Length = 162. ft Total length = 162. ft
Cost = 0. Total Cost = 0.

Length = 162. ft Total length = 162. ft
Cost = 0. Total Cost = 0.

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 134, 133 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
42	330	66	1138.65	.00039	8.8	2.9	3.1	73.59	102	1.19	24
			1138.52		7.5	1.5	3.0	72.40			

Length = 492. ft Total length = 6740. ft

*** DAs 132, 131 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
43	177	24	1142.18	.00170	3.8	1.6	3.2	5.16	0.
			1141.88		3.8		3.2	10.12	
44	8	24	1141.88	.01260	3.8	1.7	8.2	10.86	0.
			1141.78		4.2		8.8	27.59	

Length = 185. ft Total length = 185. ft
Cost = 0. Total Cost = 0.

*** DAs 132, 131 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
45	330	72	1136.56	.00039	9.4	2.9	3.6	76.78	84		
			1136.43		8.0	1.5	3.2	91.31			

Length = 515. ft Total length = 7255. ft

Length = 515. ft Total length = 7255. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 130, 129 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
46	182	24	1140.43	.00175	3.8	1.6	3.5	6.54	0.
			1140.11		4.1		3.3	10.27	
47	8	24	1140.11	.01260	4.1	1.9	8.6	12.76	0.
			1140.01		4.4		8.8	27.59	

Length = 190. ft Total length = 190. ft
Cost = 0. Total Cost = 0.

*** DAs 130, 129 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
48	206	72	1136.03	.00039	8.4	1.9	3.6	82.62	91		
			1135.95		8.2	1.7	3.2	90.63			

Length = 396. ft Total length = 7651. ft

*** DA 127A - RAMP D Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
49	20	24	1139.91	.09800	3.8	1.6	18.3	13.08	17		
			1137.95		6.2	4.1	24.5	76.93			

Length = 20. ft Total length = 20. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DA 127A - RAMP D — Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
50	97	72	1135.95	.00052	8.2	1.7	4.1	88.81	85		
			1135.90		8.1	1.6	3.7	104.50			

Length = 117. ft Total length = 7768. ft

*** DAs 128A - RAMP C, 1 — Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
51	84	30	1139.34	.00129	4.2	1.5	3.6	12.75	0.
			1139.23		4.5		3.3	16.01	
52	138	30	1139.23	.00155	4.5	1.8	4.0	14.70	0.
			1139.02		4.7		3.6	17.53	

Length = 222. ft Total length = 222. ft
Cost = 0. Total Cost = 0.

*** DAs 128A - RAMP C, 1 — Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
53	8	30	1139.02	.07500	4.7	2.0	17.3	16.54	14		
			1138.42		5.6	2.9	24.9	122.02			

Length = 230. ft Total length = 230. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

*** DAs 128A - RAMP C, 1 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
54	330	78	1134.25	.00039	9.7	2.7	3.8	97.63	86		
			1134.12		8.5	1.5	3.4	113.04			

Length = 560. ft Total length = 8328. ft

*** DAs 126, 125 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
55	138	24	1138.66	.00155	3.8	1.6	3.0	4.35	0.
			1138.45		4.0		3.1	9.67	
56	8	24	1138.45	.01260	4.0	1.8	7.6	8.12	0.
			1138.35		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 126, 125 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
57	332	78	1132.92	.00039	9.7	2.7	3.8	100.34	89		
			1132.79		8.5	1.5	3.4	112.75			

Length = 478. ft Total length = 8806. ft

Length = 478. ft Total length = 8806. ft

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*** DAs 124, 123 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
58	138	24	1137.33	.00155	3.8	1.6	3.1	5.06	0.
			1137.12		4.0		3.1	9.67	
59	8	24	1137.12	.01260	4.0	1.8	8.0	9.57	0.
			1137.02		4.3		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 124, 123 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
60	332	78	1131.96	.00039	9.4	2.3	3.8	103.66	92		
			1131.83		8.5	1.5	3.4	112.69			

Length = 478. ft Total length = 9284. ft

*** DAs 122, 121 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
61	69	24	1136.37	.00609	3.8	1.6	5.3	5.78	0.
			1135.95		3.8		6.1	19.17	
62	69	24	1135.95	.00155	3.8	1.6	3.2	5.74	0.
			1135.84		4.3		3.1	9.67	

Length = 138. ft Total length = 138. ft
Cost = 0. Total Cost = 0.

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*** DAs 122, 121 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
63	8	24	1135.84	.01260	4.3	2.1	8.3	11.24	0.
			1135.74		4.6		8.8	27.59	

Length = 146. ft Total length = 146. ft
Cost = 0. Total Cost = 0.

*** DAs 122, 121 Analysis of Existing Pipes

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Cover Up/Dn (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Load (%)	-Solutions- Remove (cfs)	Diam (in)
64	60	78	1131.83	.00184	8.5	1.5	7.1	107.64	44		
			1131.72		8.6	1.6	7.4	243.96			

Length = 206. ft Total length = 9490. ft

SR202L - PUMPSTA @ KYRENE, EAST SIDE

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
1	2	1162.61	1162.73	N	1164.69	N	1.37	1.03
2	3	1161.56	1162.63	N	1165.20	Y	1.57	1.04
3	6	1160.78	1161.33	N	1163.61	N	1.66	.33
4	5	1161.38	1161.40	N	1163.36	N	1.55	1.05
5	6	1160.50	1161.30	N	1163.61	Y	1.66	.33
6	9	1159.68	1160.58	N	1162.29	N	1.94	.20
7	8	1159.64	1160.08	N	1162.24	N	1.13	1.02
8	9	1158.67	1159.98	N	1162.29	Y	1.94	.20
9	12	1157.92	1159.00	N	1160.96	N	2.44	1.01
10	11	1158.86	1158.75	Y	1160.71	N	1.65	1.06
11	12	1157.92	1158.65	N	1160.96	Y	2.44	1.01
12	15	1157.14	1157.89	N	1159.64	N	2.84	.14
13	14	1157.13	1157.43	N	1159.39	N	1.24	1.03
14	15	1156.19	1157.33	N	1159.64	Y	2.84	.14
15	18	1155.84	1156.52	N	1158.31	N	3.17	.10
16	17	1155.79	1156.10	N	1158.06	N	1.22	1.04
17	18	1154.74	1156.00	N	1158.31	Y	3.17	.10
18	21	1154.31	1155.15	N	1156.98	N	3.05	.08
19	20	1154.47	1154.77	N	1156.73	N	1.23	1.04
20	21	1153.42	1154.67	N	1156.98	Y	3.05	.08
21	24	1152.33	1153.79	N	1155.66	N	3.43	1.01
22	23	1153.10	1153.36	N	1155.41	N	1.25	1.05
23	24	1152.02	1153.26	N	1155.66	Y	3.43	1.01
24	27	1151.27	1152.46	N	1154.33	N	3.73	1.01
25	26	1151.80	1152.02	N	1154.08	N	1.28	1.05
26	27	1150.70	1151.91	N	1154.33	Y	3.73	1.01
27	30	1150.24	1151.14	N	1153.01	N	3.84	.25
28	29	1150.52	1150.70	N	1152.76	N	1.31	1.05
29	30	1149.39	1150.59	N	1153.01	Y	3.84	.25
30	33	1148.03	1149.72	N	1151.68	N	4.10	1.01
31	32	1149.20	1149.37	N	1151.43	N	1.32	1.06
32	33	1148.07	1149.26	N	1151.68	Y	4.10	1.01
33	36	1146.90	1148.39	N	1150.35	N	4.29	1.01
34	35	1147.89	1148.04	N	1150.10	N	1.34	1.06
35	36	1146.75	1147.93	N	1150.35	Y	4.29	1.01
36	39	1145.77	1147.07	N	1149.03	N	4.48	1.01
37	38	1146.64	1146.71	N	1148.78	N	1.38	1.06
38	39	1145.45	1146.61	N	1149.03	Y	4.48	1.01
39	42	1144.39	1145.50	N	1147.46	N	5.58	1.01
40	41	1145.44	1145.46	N	1147.21	N	1.43	1.07
41	42	1144.23	1145.36	N	1147.46	Y	5.58	1.01

SR202L - PUMPSTA @ KYRENE, EAST SIDE

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
42	45	1144.02	1144.02	N	1145.98	N/A	4.22	.04
43	44	1143.88	1143.88	Y	1145.73	N	1.44	1.07
44	45	1142.65	1143.78	N	1145.98	Y	4.22	.04
45	48	1140.64	1142.43	N	1144.43	N	4.60	1.01
46	47	1142.32	1142.11	Y	1144.18	N	1.58	1.09
47	48	1140.97	1142.01	N	1144.43	Y	4.60	1.01
48	50	1140.45	1141.95	N	1144.18	N	4.25	.00
49	50	1140.20	1139.95	Y	1144.18	Y	4.25	.00
50	54	1140.15	1141.90	N	1143.99	N	4.66	.03
51	52	1140.92	1141.73	N	1143.74	N	.00	.00
52	53	1145.00	1141.52	Y	1143.74	N	3.30	1.15
53	54	1139.04	1140.92	N	1143.99	Y	4.66	.03
54	57	1138.78	1140.62	N	1142.66	N	4.89	1.01
55	56	1140.15	1140.45	N	1142.41	N	1.22	1.06
56	57	1139.09	1140.35	N	1142.66	Y	4.89	1.01
57	60	1137.57	1139.29	N	1141.33	N	5.03	1.00
58	59	1138.98	1139.12	N	1141.08	N	1.34	1.07
59	60	1137.83	1139.02	N	1141.33	Y	5.03	1.00
60	64	1136.75	1138.33	N	1140.37	N	3.42	1.00
61	62	1136.70	1137.95	N	1139.70	Y	.00	.00
62	63	1137.89	1137.84	Y	1140.12	N	1.47	1.08
63	64	1136.63	1137.74	N	1140.37	Y	3.42	1.00
64	95	1134.74	1138.22	N	1140.34	N	.00	.00

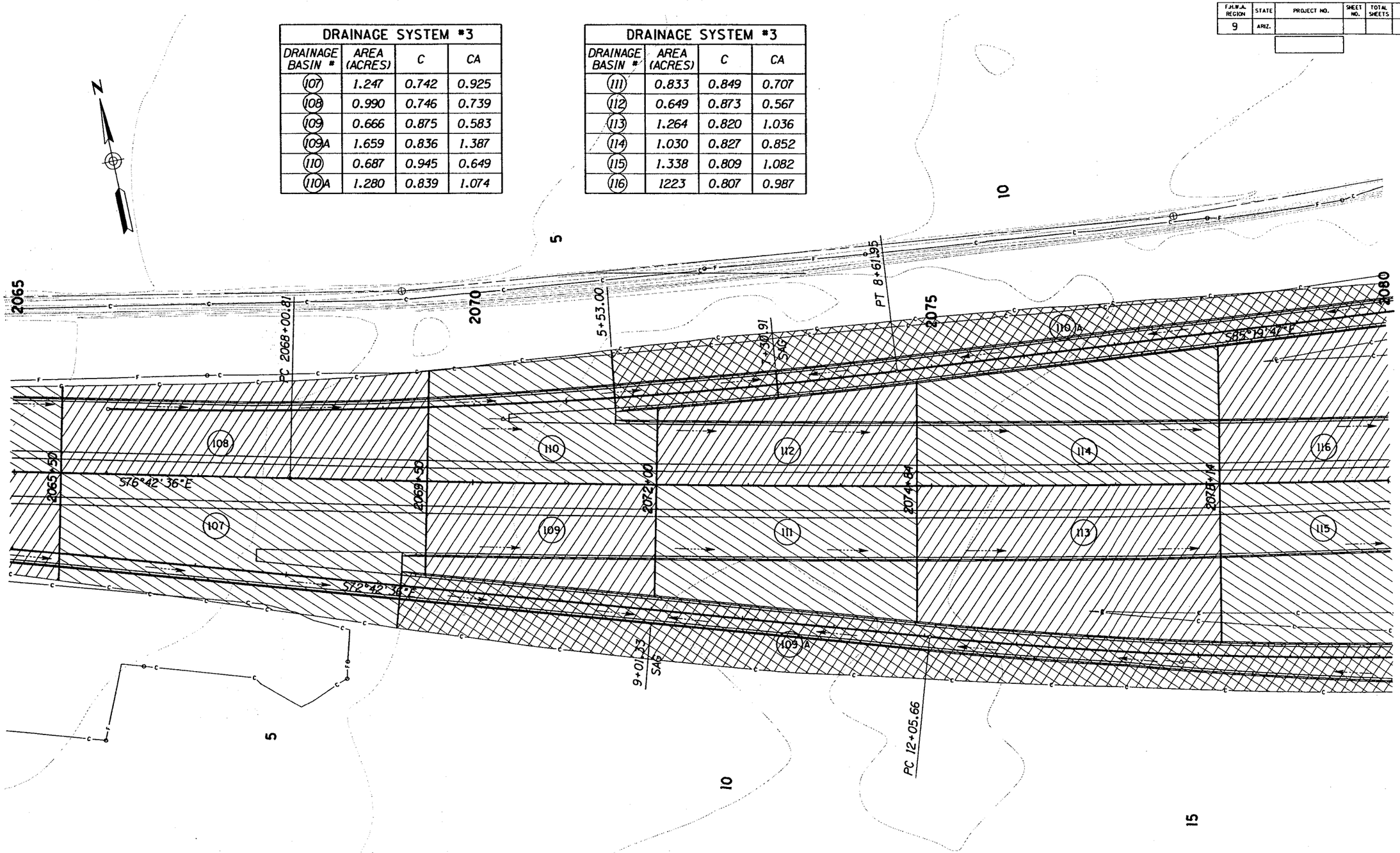
Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
1	1	1162.84	1164.69	1.50
49	49	1148.23	1143.66	1.50

NORMAL END OF HYDRA

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

DRAINAGE SYSTEM #3			
DRAINAGE BASIN #	AREA (ACRES)	C	CA
107	1.247	0.742	0.925
108	0.990	0.746	0.739
109	0.666	0.875	0.583
109A	1.659	0.836	1.387
110	0.687	0.945	0.649
110A	1.280	0.839	1.074

DRAINAGE SYSTEM #3			
DRAINAGE BASIN #	AREA (ACRES)	C	CA
111	0.833	0.849	0.707
112	0.649	0.873	0.567
113	1.264	0.820	1.036
114	1.030	0.827	0.852
115	1.338	0.809	1.082
116	1223	0.807	0.987



	NAME	DATE
DESIGN		6/99
DRAWN	CPG	6/99
CHECKED		6/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4320 (602) 331-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

56TH STREET - KYRENE ROAD
DRAINAGE AREA PLAN SHEET
Sta 2065+00 to Sta 2080+00

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

PRELIMINARY
30%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. - .

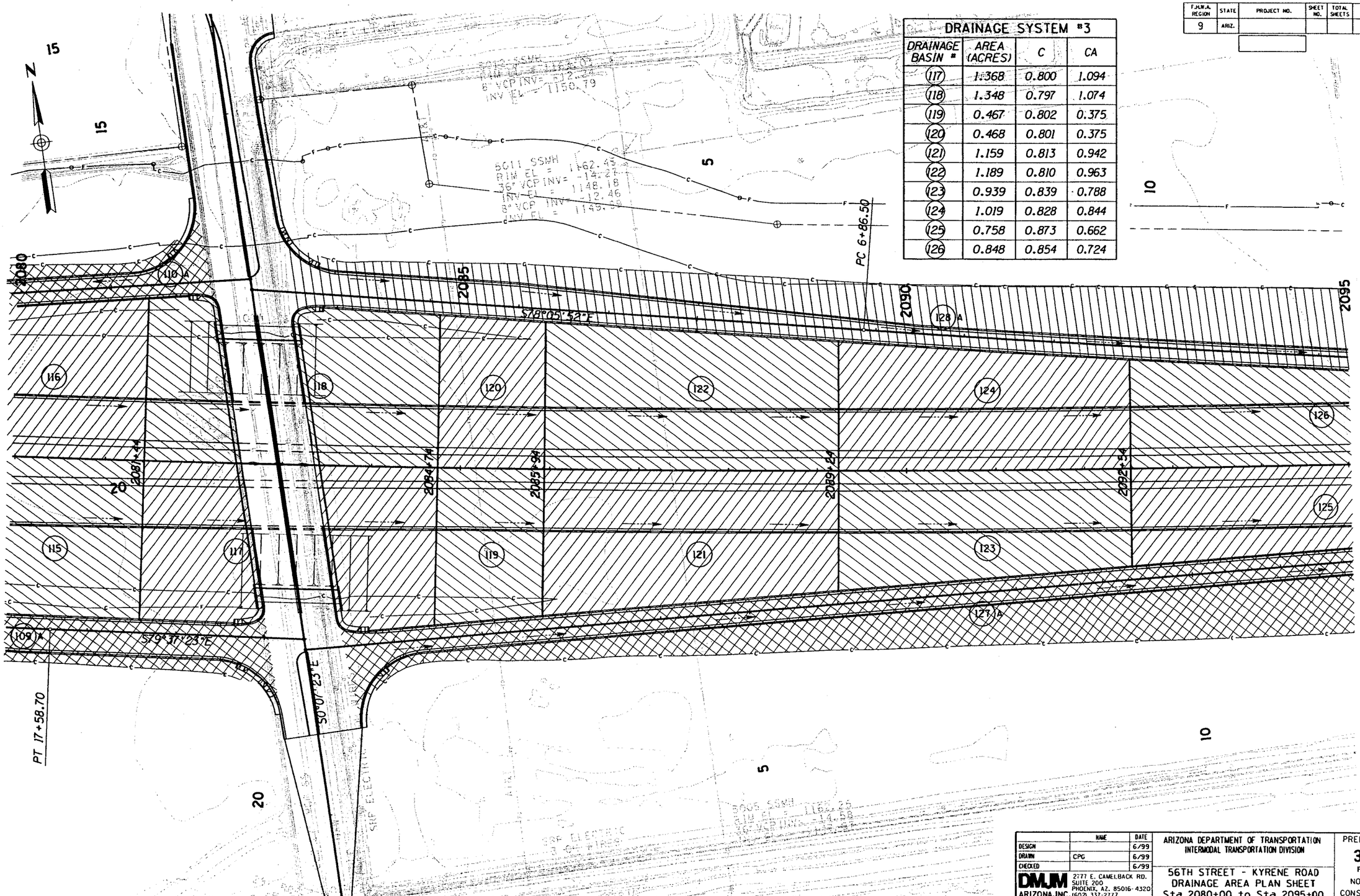
TRACS NO.

8 OF 18

SURVEY	FINISHED PLANS	REVISIONS	LOCATION	DATE

j:\56-kyrene\prod\drn\56drp3.dgn VIEW NAME:
25 JUN 1999

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				



DRAINAGE SYSTEM #3

DRAINAGE BASIN #	AREA (ACRES)	C	CA
117	1.368	0.800	1.094
118	1.348	0.797	1.074
119	0.467	0.802	0.375
120	0.468	0.801	0.375
121	1.159	0.813	0.942
122	1.189	0.810	0.963
123	0.939	0.839	0.788
124	1.019	0.828	0.844
125	0.758	0.873	0.662
126	0.848	0.854	0.724

	NAME	DATE
DESIGN		6/99
DRAWN	CPG	6/99
CHECKED		6/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4320 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

56TH STREET - KYRENE ROAD
DRAINAGE AREA PLAN SHEET
Sta 2080+00 to Sta 2095+00

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

PRELIMINARY
30%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. - -

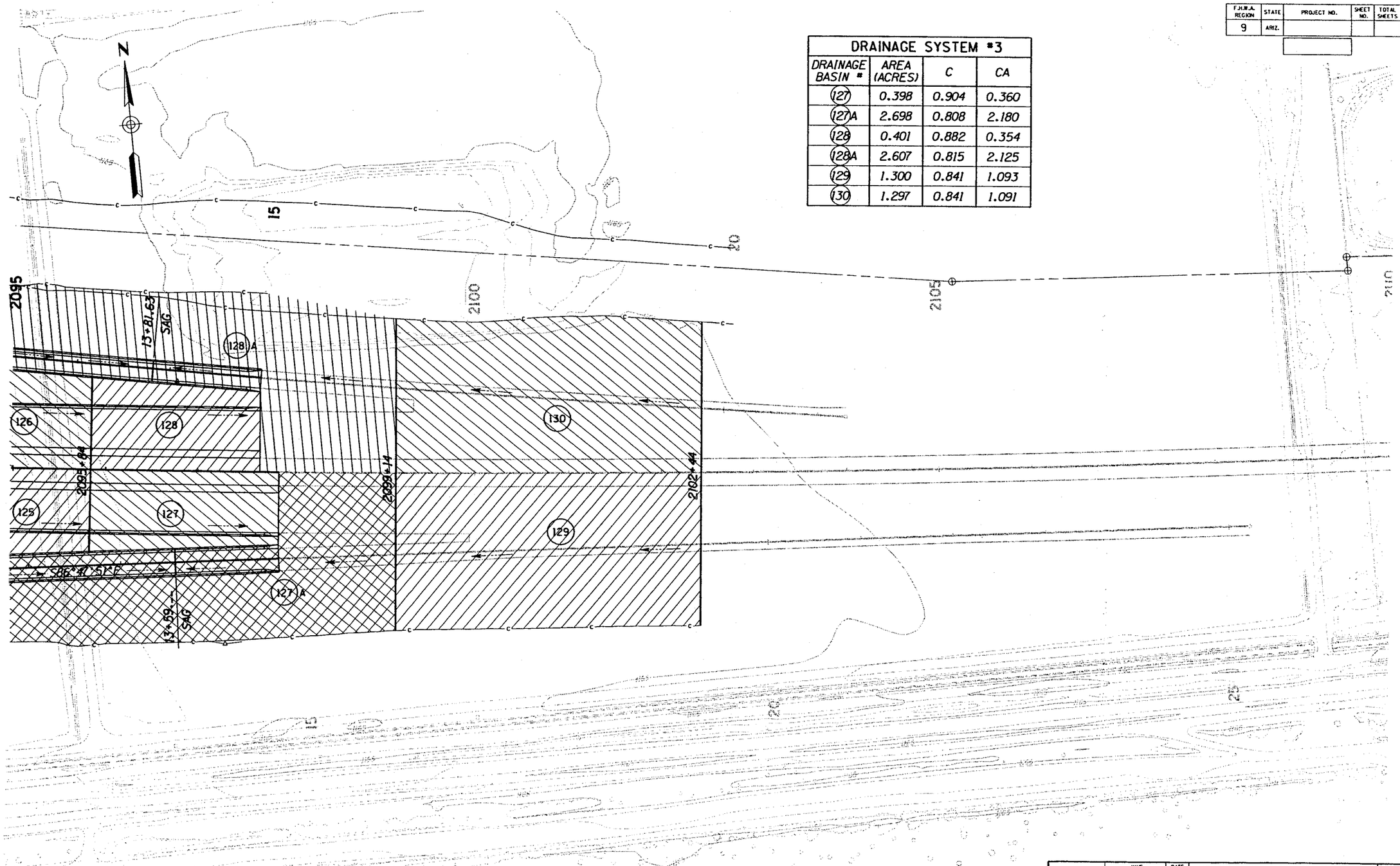
SURVEY | FINISHED PLANS | REVISIONS | LOCATION | DATE

j:\56-kyrene\prod\drn\56drp4.dgn VIEW NAME:
25 JUN 1999

TRACS NO.

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

DRAINAGE SYSTEM #3			
DRAINAGE BASIN #	AREA (ACRES)	C	CA
127	0.398	0.904	0.360
127A	2.698	0.808	2.180
128	0.401	0.882	0.354
128A	2.607	0.815	2.125
129	1.300	0.841	1.093
130	1.297	0.841	1.091



	NAME	DATE
DESIGN		6/99
DRAWN	CPG	6/99
CHECKED		6/99

DMJM ARIZONA, INC. 2777 E. CAMELBACK RD. SUITE 200 PHOENIX, AZ. 85016-4320 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

56TH STREET - KYRENE ROAD
DRAINAGE AREA PLAN SHEET
Sta 2095+00 to Sta 2102+44

ROUTE: 202L
LOCATION: 56TH STREET - KYRENE ROAD

PRELIMINARY
30%
Review
NOT FOR CONSTRUCTION OR RECORDING

DWG. NO. - -

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

j:\56-kyrene\prod\drn\56drp5.dgn VIEW NAME:
25 JUN 1999

TRACS NO.

SR202L - SANTAN FREEWAY

DRAINAGE AREA CALCULATIONS

Revised : 8/4/99

System # - DRAIN TO McClintock Drive

DA No.	LOC.	BEGIN STA.	ENDING STA.	WIDTH PAV.	WIDTH UNPAV.	AREA, sf PAV.	AREA, sf UNPAV	TOTAL Ac.	C	CA	SUM CA
161	EB	2153+21	2157+61	69	*	30360	2640	0.758	0.930	0.705	1.4
162	WB	2153+21	2157+61	69	*	30360	2640	0.758	0.930	0.705	
163	EB	2157+61	2160+91	69	*	22770	4703	0.631	0.907	0.572	2.6
164	WB	2157+61	2160+91	73	*	24090	4703	0.661	0.909	0.601	
165	EB	2160+91	2164+21	69	*	22770	6683	0.676	0.893	0.604	3.9
166	WB	2160+91	2164+21	78	*	25740	6683	0.744	0.898	0.669	
167	EB	2164+21	2167+51	69	*	22770	8910	0.727	0.880	0.640	5.2
168	WB	2164+21	2167+51	79	*	26070	8910	0.803	0.886	0.712	
169	EB	2167+51	2170+81	80	*	26400	12210	0.886	0.871	0.772	6.7
170	WB	2167+51	2170+81	*	*	26235	12210	0.883	0.871	0.768	
171	EB	2170+81	2174+11	*	*	61930	43615	2.423	0.847	2.052	11.0
172	WB	2170+81	2174+11	*	*	64185	47618	2.567	0.844	2.165	
173	EB	2174+11	2177+41	69	*	22770	13200	0.826	0.858	0.709	12.4
174	WB	2174+11	2177+41	69	*	22770	15675	0.883	0.848	0.748	
175	EB	2177+41	2180+71	71	*	23430	19305	0.981	0.837	0.821	14.2
176	WB	2177+41	2180+71	72	*	23760	29370	1.220	0.812	0.990	
177	EB	2180+71	2184+01	76	*	25080	24750	1.144	0.826	0.945	16.4
178	WB	2180+71	2184+01	77	*	25410	39435	1.489	0.798	1.188	
179	EB	2184+01	2187+31	81	*	26730	27390	1.242	0.823	1.023	18.7
180	WB	2184+01	2187+31	81	*	26730	44055	1.625	0.794	1.291	
181	EB	2187+31	2190+61	81	*	26730	29370	1.288	0.819	1.055	26.2
182	WB	2187+31	2190+61	81	*	26730	43065	1.602	0.796	1.275	
183	EB	2190+61	2193+05	81	*	19764	23180	0.986	0.815	0.804	23.9
184	WB	2190+61	2193+05	82	*	20008	29768	1.143	0.800	0.915	
185	EB	2193+05	2195+49	81	*	19764	23180	0.986	0.815	0.804	22.2
186	WB	2193+05	2195+49	84	*	20496	28426	1.123	0.805	0.904	
187	EB	2195+49	2196+81	81	*	10692	12540	0.533	0.815	0.435	20.5
188	WB	2195+49	2196+81	89	*	11748	13926	0.589	0.814	0.480	
189	EB	2196+81	2200+11	81	*	26730	31350	1.333	0.815	1.087	19.6
190	WB	2196+81	2200+11	93	*	30690	32010	1.439	0.822	1.184	
191	EB	2200+11	2203+41	81	*	26730	31350	1.333	0.815	1.087	17.3
192	WB	2200+11	2203+41	93	*	30690	31020	1.417	0.824	1.168	
193	EB	2203+41	2206+71	81	*	26730	31350	1.333	0.815	1.087	15.0
194	WB	2203+41	2206+71	93	*	30690	31020	1.417	0.824	1.168	
195	EB	2206+71	2210+01	81	*	26730	31020	1.326	0.816	1.081	12.8
196	WB	2206+71	2210+01	93	*	30690	31020	1.417	0.824	1.168	
197	EB	2210+01	2213+31	*	*	28050	27390	1.273	0.872	1.110	10.5

SR202L - SANTAN FREEWAY

DRAINAGE AREA CALCULATIONS

Revised : 8/4/99

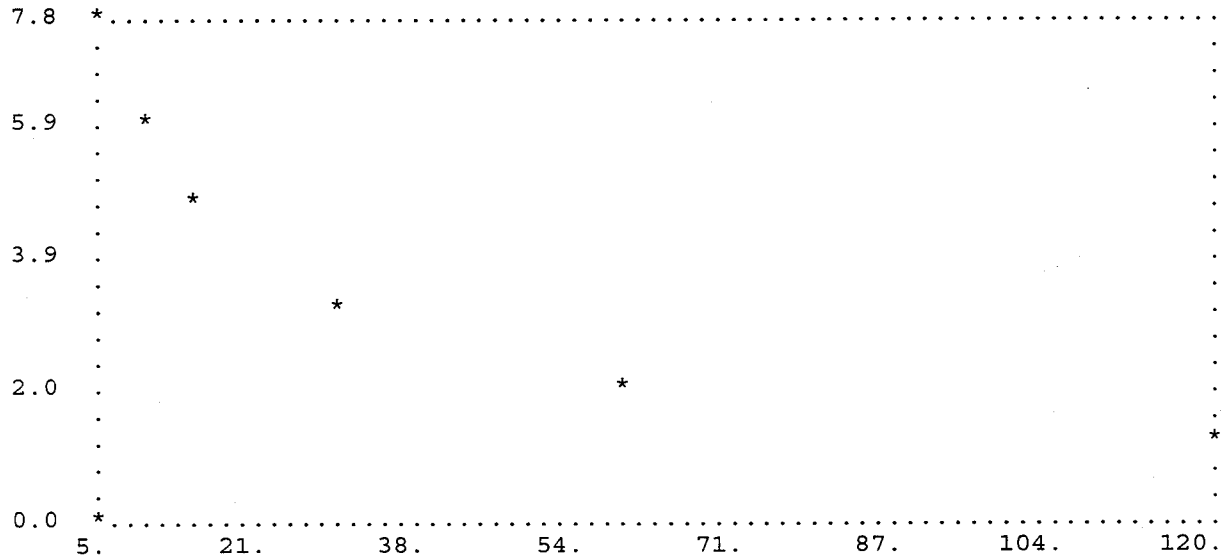
System # - DRAIN TO McClintock Drive

DA No.	LOC.	BEGIN STA.	ENDING STA.	WIDTH PAV.	WIDTH UNPAV.	AREA, sf PAV.	AREA, sf UNPAV	TOTAL Ac.	C	CA	SUM CA
198	WB	2210+01	2213+31	*	*	79890	97900	4.081	0.812	3.316	
199	EB	2213+31	2216+61	*	*	83810	87505	3.933	0.822	3.234	6.1
200	WB	2213+31	2216+61	69	*	22770	7425	0.693	0.889	0.616	
201	EB	2216+61	2222+26	69	*	38985	12675	1.186	0.889	1.054	2.3
202	WB	2216+61	2222+26	69	*	38985	22600	1.414	0.858	1.213	
							TOTAL	53.771		44.92	

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

```
+++ Commands Read From File C:\HYDRA\WMCLINT.HDA
  JOB
  SWI2
  REM SITE SPECIFIC RDDF FOR 50 YEAR
  RAI5 7.8 10 6.0 15 5.1 30 3.4 60 2.2 120 1.2
```

IDF CURVE



PLOT-DATA (TIME Vs.VALUE)

5.	7.80	60.	2.20	0.	.00	0.	.00	0.	.00
10.	6.00	120.	1.20	0.	.00	0.	.00	0.	.00
15.	5.10	0.	.00	0.	.00	0.	.00	0.	.00
30.	3.40	0.	.00	0.	.00	0.	.00	0.	.00

```
  REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
  PDA.012 24 3.75 1.5 3 .0001
  HGL1
  REM CREST AT 2153+21
  NEWDAs 162, 161
  STO0.758 .930 10
  PIP69 1165.02 1164.61
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link #  1,  Flow depth =    .66 ft
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

```
  PNC1 2 3 180 0
  PIP69 1164.61 1165.02
+++ Tc =  10.2 min
+++ CA =    .7
+++ Link #  2,  Flow depth =    .94 ft
  PNC2 3 3 180 0
  STO0.758 .930 10
  PIP8 1165.02 1165.27
+++ Tc =  10.6 min
+++ CA =   1.4
+++ Link #  3,  Flow depth =    .76 ft
  PNC3 4 3 90 0
  PIP330 1165.27 1163.79
+++ Tc =  10.6 min
+++ CA =   1.4
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
+++ Link #  4,  Flow depth =   1.34 ft
  PNC4 7 3 180 0
  HOL1
  NEWDAs 164, 163
  STO0.631 .907 10
  PIP146 1163.70 1163.54
+++ Tc =  10.0 min
+++ CA =    .6
+++ Link #  5,  Flow depth =    .80 ft
  PNC5 6 3 180 0
  STO0.661 .909 10
  PIP8 1163.54 1163.79
+++ Tc =  10.8 min
+++ CA =   1.2
+++ Link #  6,  Flow depth =    .70 ft
  PNC6 7 3 90 0
  REC1
  PIP330 1163.79 1162.43
+++ Tc =  12.1 min
+++ CA =   2.6
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link #  7,  Flow depth =   1.58 ft
  PNC7 11 3 180 0
  HOL2
  NEWDAs 166, 165
  STO0.676 .893 10
  PIP69 1162.38 1161.97
+++ Tc =  10.0 min
+++ CA =    .6
+++ Link #  8,  Flow depth =    .60 ft
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

```
  PNC8 9 3 180 0
  PIP79 1161.97 1162.18
+++ Tc =  10.2 min
+++ CA =    .6
+++ Link #  9,  Flow depth =    .74 ft
  PNC9 10 3 180 0
  STO0.744 .898 10
  PIP8 1162.18 1162.43
+++ Tc =  10.6 min
+++ CA =   1.3
+++ Link # 10,  Flow depth =    .72 ft
  PNC10 11 3 90 0
  REC2
  PIP330 1162.43 1161.07
+++ Tc =  13.2 min
+++ CA =   3.9
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 11,  Flow depth =   1.98 ft
  PNC11 14 3 180 0
  HOL3
  NEWDAs 168, 167
  STO0.727 .880 10
  PIP150 1161.06 1160.82
+++ Tc =  10.0 min
+++ CA =    .6
+++ Link # 12,  Flow depth =    .88 ft
  PNC12 13 3 180 0
  STO0.803 .886 10
  PIP8 1160.82 1161.07
+++ Tc =  10.9 min
+++ CA =   1.4
+++ Link # 13,  Flow depth =    .74 ft
  PNC13 14 3 90 0
  REC3
  PIP330 1161.07 1159.59
+++ Tc =  14.4 min
+++ CA =   5.2
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
*** WARNING: Pipe invert at U/S dropped to meet cover criterion at U/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 14,  Flow depth =   2.23 ft
  PNC14 18 3 180 0
  HOL4
  NEWDAs 170, 169
  STO0.886 .871 10
  PIP91 1159.30 1159.17
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

```
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 15,  Flow depth =    .86 ft
  PNC15 16 3 180 0
  PIP89 1159.17 1159.34
+++ Tc =  10.4 min
+++ CA =    .8
+++ Link # 16,  Flow depth =    .86 ft
  PNC16 17 3 180 0
  STO0.883 .871 10
  PIP8 1159.34 1159.59
+++ Tc =  10.8 min
+++ CA =   1.5
+++ Link # 17,  Flow depth =    .80 ft
  PNC17 18 3 90 0
  REC4
  PIP330 1159.59 1158.67
+++ Tc =  15.5 min
+++ CA =   6.7
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
*** WARNING: Pipe invert at U/S dropped to meet cover criterion at U/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 18,  Flow depth =   2.74 ft
  PNC18 21 3 180 0
  HOL5
  NEWDAs 172 (RAMP A), 171 (RAMP B)
  STO2.423 .847 10
  PIP138 1158.42 1158.42
+++ Tc =  10.0 min
+++ CA =   2.1
+++ Link # 19,  Flow depth =   1.73 ft
  PNC19 20 3 180 0
  STO2.567 .844 10
  PIP8 1158.42 1158.67
+++ Tc =  10.6 min
+++ CA =   4.2
+++ Link # 20,  Flow depth =   1.50 ft
  PNC20 21 3 90 0
  REC5
  PIP330 1158.67 1157.35
+++ Tc =  16.9 min
+++ CA =  11.0
*** WARNING: Pipe invert at U/S dropped to meet cover criterion at U/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 21,  Flow depth =   3.51 ft
  PNC21 25 3 180 0
  HOL6
  NEWDAs 174, 173
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

```
  STO0.826 .858 10
  PIP69 1157.10 1156.69
+++ Tc =  10.0 min
+++ CA =    .7
+++ Link # 22,  Flow depth =    .66 ft
  PNC22 23 3 180 0
  PIP69 1156.69 1157.10
+++ Tc =  10.2 min
+++ CA =    .7
+++ Link # 23,  Flow depth =    .94 ft
  PNC23 24 3 180 0
  STO0.883 .848 10
  PIP8 1157.10 1157.35
+++ Tc =  10.6 min
+++ CA =   1.5
+++ Link # 24,  Flow depth =    .78 ft
  PNC24 25 3 90 0
  REC6
  PIP330 1157.35 1155.90
+++ Tc =  18.2 min
+++ CA =  12.4
*** WARNING: Pipe invert at U/S dropped to meet cover criterion at U/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 25,  Flow depth =   3.74 ft
  PNC25 28 3 180 0
  HOL7
  NEWDAs 176, 175
  STO0.984 .837 10
  PIP149 1155.69 1155.65
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 26,  Flow depth =   1.02 ft
  PNC26 27 3 180 0
  STO1.220 .812 10
  PIP8 1155.65 1155.90
+++ Tc =  10.8 min
+++ CA =   1.8
+++ Link # 27,  Flow depth =    .88 ft
  PNC27 28 3 90 0
  REC7
  PIP330 1155.90 1154.47
+++ Tc =  19.8 min
+++ CA =  14.2
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 28,  Flow depth =   4.07 ft
  PNC28 32 3 180 0
  HOL8
  NEWDAs 178, 177
  STO1.144 .826 10
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

```
  PIP80 1154.24 1154.05
+++ Tc =  10.0 min
+++ CA =    .9
+++ Link # 29,  Flow depth =    .98 ft
  PNC29 30 3 180 0
  PIP81 1154.05 1154.22
+++ Tc =  10.4 min
+++ CA =    .9
+++ Link # 30,  Flow depth =    .96 ft
  PNC30 31 3 180 0
  STO1.489 .798 10
  PIP8 1154.22 1154.47
+++ Tc =  10.7 min
+++ CA =   2.1
+++ Link # 31,  Flow depth =    .96 ft
  PNC31 32 3 90 0
  REC8
  PIP330 1154.47 1153.15
+++ Tc =  21.4 min
+++ CA =  16.4
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 32,  Flow depth =   4.45 ft
  PNC32 35 3 180 0
  HOL9
  NEWDAs 180, 179
  STO1.242 .823 10
  PIP162 1152.90 1152.90
+++ Tc =  10.0 min
+++ CA =   1.0
+++ Link # 33,  Flow depth =   1.08 ft
  PNC33 34 3 180 0
  STO1.625 .794 10
  PIP8 1152.90 1153.15
+++ Tc =  10.8 min
+++ CA =   2.3
+++ Link # 34,  Flow depth =   1.00 ft
  PNC34 35 3 90 0
  REC9
  PIP330 1153.15 1151.83
+++ Tc =  23.0 min
+++ CA =  18.7
*** WARNING: Pipe invert at U/S dropped to meet cover criterion at U/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 35,  Flow depth =   4.26 ft
  PNC35 39 3 90 2
  END
 END OF INPUT DATA.
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

*** DAs 162, 161 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
1	69	24	1161.27	.00594	3.8	1.6	4.9	4.23	0.
			1160.86		3.8		6.0	18.94	
2	69	24	1160.86	.00155	3.8	1.6	3.0	4.20	0.
			1160.75		4.3		3.1	9.67	
3	8	24	1160.75	.01260	4.3	2.1	7.7	8.30	0.
			1160.65		4.6		8.8	27.59	
4	330	24	1160.65	.00186	4.6	1.6	3.7	8.30	0.
			1160.04		3.8		3.4	10.59	

Length = 476. ft Total length = 476. ft
Cost = 0. Total Cost = 0.

*** DAs 164, 163 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
5	146	24	1159.95	.00178	3.8	1.6	3.0	3.43	0.
			1159.69		3.8		3.3	10.37	
6	8	24	1159.69	.01260	3.8	1.7	7.3	6.87	0.
			1159.59		4.2		8.8	27.59	
7	330	27	1159.40	.00276	4.4	1.5	5.0	14.51	0.
			1158.49		3.9		4.4	17.66	

Length = 484. ft Total length = 960. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

*** DAs 166, 165 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
8	69	24	1158.63	.00594	3.8	1.6	4.7	3.62	0.
			1158.22		3.8		6.0	18.94	
9	79	24	1158.22	.00263	3.8	1.6	3.5	3.60	0.
			1158.01		4.2		4.0	12.61	
10	8	24	1158.01	.01260	4.2	2.0	7.5	7.49	0.
			1157.91		4.5		8.8	27.59	
11	330	33	1157.18	.00179	5.2	1.5	4.6	20.89	0.
			1156.59		4.5		4.1	24.32	

Length = 486. ft Total length = 1446. ft
Cost = 0. Total Cost = 0.

*** DAs 168, 167 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
12	150	24	1157.31	.00160	3.8	1.6	2.9	3.84	0.
			1157.07		3.8		3.1	9.83	
13	8	24	1157.07	.01260	3.8	1.6	7.6	7.90	0.
			1156.97		4.1		8.8	27.59	
14	330	33	1155.86	.00228	5.2	1.5	5.3	27.09	0.
			1155.11		4.5		4.6	27.40	

Length = 488. ft Total length = 1934. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

*** DAs 170, 169 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
15	91	24	1155.55	.00253	3.8	1.6	3.6	4.63	0.
			1155.32		3.8		3.9	12.36	
16	89	24	1155.32	.00235	3.8	1.7	3.5	4.57	0.
			1155.11		4.2		3.8	11.90	
17	8	24	1155.11	.01260	4.2	2.1	7.8	9.01	0.
			1155.01		4.6		8.8	27.59	
18	330	45	1153.40	.00088	6.2	1.5	4.0	34.05	0.
			1153.11		5.6		3.5	38.96	

Length = 518. ft Total length = 2452. ft
Cost = 0. Total Cost = 0.

*** DAs 172 (RAMP A), 171 (RAMP B) Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
19	138	27	1154.48	.00155	3.9	1.5	3.8	12.31	0.
			1154.27		4.2		3.3	13.24	
20	8	24	1154.27	.01260	4.2	2.0	9.9	24.85	0.
			1154.17		4.5		8.8	27.59	
21	330	54	1151.21	.00071	7.5	1.5	4.1	53.62	0.
			1150.98		6.4		3.6	56.75	

Length = 476. ft Total length = 2928. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

*** DAs 174, 173 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
22	69	24	1153.35	.00594	3.8	1.6	4.9	4.25	0.
			1152.94		3.8		6.0	18.94	
23	69	24	1152.94	.00155	3.8	1.6	3.0	4.22	0.
			1152.83		4.3		3.1	9.67	
24	8	24	1152.83	.01260	4.3	2.1	7.8	8.58	0.
			1152.73		4.6		8.8	27.59	
25	330	66	1148.57	.00040	8.8	1.5	3.4	58.84	0.
			1148.44		7.5		3.1	73.21	

Length = 476. ft Total length = 3404. ft
Cost = 0. Total Cost = 0.

*** DAs 176, 175 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
26	149	24	1151.94	.00161	3.8	1.6	3.1	4.94	0.
			1151.70		3.9		3.1	9.86	
27	8	24	1151.70	.01260	3.9	1.8	8.2	10.63	0.
			1151.60		4.3		8.8	27.59	
28	330	66	1147.14	.00040	8.8	1.5	3.5	64.84	0.
			1147.01		7.5		3.1	73.21	

Length = 487. ft Total length = 3891. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

*** DAs 178, 177 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
29	80	24	1150.49	.00237	3.8	1.6	3.8	5.67	0.
			1150.30		3.8		3.8	11.97	
30	81	24	1150.30	.00257	3.8	1.6	3.9	5.61	0.
			1150.09		4.1		4.0	12.45	
31	8	24	1150.09	.01260	4.1	2.0	8.6	12.53	0.
			1149.99		4.5		8.8	27.59	
32	330	66	1145.82	.00040	8.6	1.5	3.5	71.62	0.
			1145.69		7.5		3.1	73.21	

Length = 499. ft Total length = 4390. ft
Cost = 0. Total Cost = 0.

*** DAs 180, 179 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
33	162	24	1149.15	.00195	3.8	1.6	3.6	6.13	0.
			1148.83		4.1		3.5	10.86	
34	8	24	1148.83	.01260	4.1	1.9	8.7	13.56	0.
			1148.73		4.4		8.8	27.59	
35	330	72	1143.96	.00040	9.2	1.5	3.7	78.42	0.
			1143.83		8.0		3.3	92.33	

Length = 500. ft Total length = 4890. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
1	2	1163.36	1162.86	Y	1164.61	Y	2.42	1.11
2	3	1163.19	1162.75	Y	1165.02	N	1.95	1.06
3	4	1162.21	1162.65	N	1165.27	Y	1.45	1.04
4	7	1161.37	1162.04	N	1163.79	N	1.57	.08
5	6	1161.85	1161.69	Y	1163.54	N	1.72	1.05
6	7	1160.97	1161.59	N	1163.79	Y	1.57	.08
7	11	1160.05	1160.74	N	1162.43	N	2.01	.25
8	9	1158.81	1160.22	N	1161.97	Y	.00	.00
9	10	1160.11	1160.01	Y	1162.18	N	1.64	1.05
10	11	1159.19	1159.91	N	1162.43	Y	2.01	.25
11	14	1158.56	1159.34	N	1161.07	N	2.44	1.02
12	13	1159.26	1159.07	Y	1160.82	N	1.72	1.06
13	14	1158.31	1158.97	N	1161.07	Y	2.44	1.02
14	18	1157.34	1157.86	N	1159.59	N	2.81	.75
15	16	1156.17	1157.32	N	1159.17	N	.00	.00
16	17	1157.22	1157.11	Y	1159.34	N	1.61	1.05
17	18	1156.21	1157.01	N	1159.59	Y	2.81	.75
18	21	1155.82	1156.86	N	1158.67	N	3.51	.21
19	20	1157.43	1156.52	Y	1158.42	N	2.32	1.09
20	21	1155.65	1156.17	N	1158.67	Y	3.51	.21
21	25	1154.46	1155.48	N	1157.35	N	3.76	.25
22	23	1153.58	1154.94	N	1156.69	Y	.00	.00
23	24	1154.59	1154.83	N	1157.10	N	1.26	1.06
24	25	1153.50	1154.73	N	1157.35	Y	3.76	.25
25	28	1152.17	1153.94	N	1155.90	N	4.12	1.01
26	27	1153.67	1153.70	N	1155.65	N	1.42	1.06
27	28	1152.46	1153.60	N	1155.90	Y	4.12	1.01
28	32	1151.04	1152.51	N	1154.47	N	4.50	1.01
29	30	1151.27	1152.30	N	1154.05	N	.00	.00
30	31	1152.27	1152.09	Y	1154.22	N	1.56	1.08
31	32	1150.94	1151.99	N	1154.47	Y	4.50	1.01
32	35	1150.10	1151.19	N	1153.15	N	4.26	.04
33	34	1151.11	1150.83	Y	1152.90	N	1.63	1.08
34	35	1149.72	1150.73	N	1153.15	Y	4.26	.04
35	39	1148.08	1149.83	N	1151.83	N	.00	.00

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
1	1	1163.95	1165.02	1.50

SANTAN FWAY - PUMPSTA @ McCLINTOCK WEST HALF

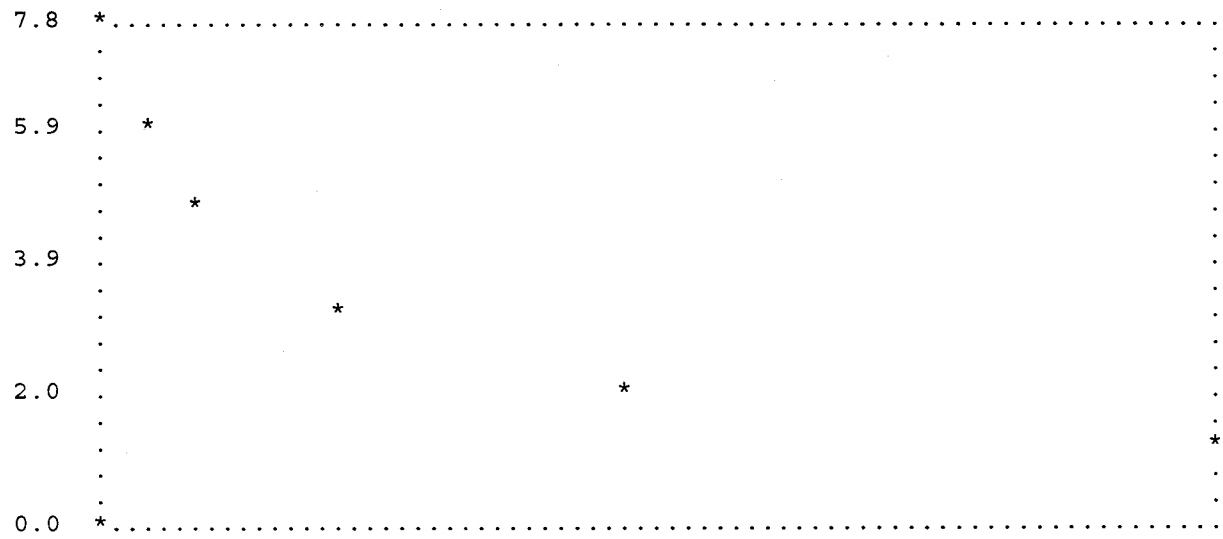
Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.

NORMAL END OF HYDRA

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

```
+++ Commands Read From File C:\HYDRA\EMCCLINT.HDA
  JOB
  SWI2
  REM SITE SPECIFIC RDDF FOR 50 YEAR
  RAI5 7.8 10 6.0 15 5.1 30 3.4 60 2.2 120 1.2
```

IDF CURVE



PLOT-DATA (TIME Vs.VALUE)

5.	7.80	60.	2.20	0.	.00	0.	.00	0.	.00
10.	6.00	120.	1.20	0.	.00	0.	.00	0.	.00
15.	5.10	0.	.00	0.	.00	0.	.00	0.	.00
30.	3.40	0.	.00	0.	.00	0.	.00	0.	.00

```
  REM ASSUMES A PAVEMENT SECTION OF 18 INCHES
  PDA.012 24 3.75 1.5 3 .0001
  HGL1
  REM DRAINAGE AREA BEGINS 2222+22
  NEWDAs 202, 201
  STO1.186 .889 10
  PIP97 1157.39 1157.40
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link #  1,  Flow depth =   1.08 ft
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

```
  PNC41 42 3 180 0
  PIP69 1157.40 1157.95
+++ Tc =  10.4 min
+++ CA =   1.1
+++ Link #  2,  Flow depth =   1.18 ft
  PNC42 43 3 180 0
  STO1.414 .858 10
  PIP8 1157.95 1158.20
+++ Tc =  10.8 min
+++ CA =   2.3
+++ Link #  3,  Flow depth =    .98 ft
  PNC43 44 3 90 0
  PIP330 1158.20 1156.84
+++ Tc =  10.8 min
+++ CA =   2.3
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link #  4,  Flow depth =   1.75 ft
  PNC44 47 3 180 0
  HOL11
  NEWDAs 200, 199
  STO3.933 .822 10
  PIP152 1153.31 1156.59
+++ Tc =  10.0 min
+++ CA =   3.2
+++ Link #  5,  Flow depth =   2.06 ft
  PNC45 46 3 180 0
  STO0.693 .889 10
  PIP8 1156.59 1156.84
+++ Tc =  10.6 min
+++ CA =   3.8
+++ Link #  6,  Flow depth =   1.40 ft
  PNC46 47 3 90 0
  REC11
  PIP330 1156.84 1155.01
+++ Tc =  12.3 min
+++ CA =   6.1
+++ Link #  7,  Flow depth =   3.04 ft
  PNC47 51 3 180 0
  HOL12
  NEWDAs 198, 197
  STO1.273 .872 10
  PIP81 1155.00 1154.83
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link #  8,  Flow depth =   1.12 ft
  PNC48 49 3 180 0
  PIP93 1154.83 1154.76
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

```
+++ Tc =  10.4 min
+++ CA =   1.1
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
+++ Link #  9,  Flow depth =   1.16 ft
  PNC49 50 3 180 0
  STO4.081 .821 10
  PIP8 1154.76 1155.01
+++ Tc =  10.8 min
+++ CA =   4.5
+++ Link # 10,  Flow depth =   1.56 ft
  PNC50 51 3 90 0
  REC12
  PIP330 1155.01 1153.66
+++ Tc =  13.8 min
+++ CA =  10.6
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 11,  Flow depth =   3.69 ft
  PNC51 54 3 180 0
  HOL13
  NEWDAs 196, 195
  STO1.326 .816 10
  PIP174 1153.65 1153.41
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 12,  Flow depth =   1.12 ft
  PNC52 53 3 180 0
  STO1.417 .824 10
  PIP8 1153.41 1153.66
+++ Tc =  10.8 min
+++ CA =   2.2
+++ Link # 13,  Flow depth =    .98 ft
  PNC53 54 3 90 0
  REC13
  PIP330 1153.66 1152.31
+++ Tc =  15.2 min
+++ CA =  12.8
*** WARNING: Pipe invert at U/S dropped to meet cover criterion at U/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 14,  Flow depth =   4.07 ft
  PNC54 58 3 180 0
  HOL14
  NEWDAs 194, 193
  STO1.333 .815 10
  PIP81 1152.30 1152.12
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 15,  Flow depth =   1.08 ft
  PNC55 56 3 180 0
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

```
  PIP93 1152.12 1152.06
+++ Tc =  10.4 min
+++ CA =   1.1
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
+++ Link # 16,  Flow depth =   1.16 ft
  PNC56 57 3 180 0
  STO1.417 .824 10
  PIP8 1152.06 1152.31
+++ Tc =  10.8 min
+++ CA =   2.3
+++ Link # 17,  Flow depth =    .98 ft
  PNC57 58 3 90 0
  REC14
  PIP330 1152.31 1151.00
+++ Tc =  16.8 min
+++ CA =  15.1
*** WARNING: Pipe invert at U/S dropped to meet cover criterion at U/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 18,  Flow depth =   4.08 ft
  PNC58 61 3 180 0
  HOL15
  NEWDAs 192, 191
  STO1.333 .815 10
  PIP174 1150.99 1150.75
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 19,  Flow depth =   1.12 ft
  PNC59 60 3 180 0
  STO1.417 .824 10
  PIP8 1150.75 1151.00
+++ Tc =  10.8 min
+++ CA =   2.3
+++ Link # 20,  Flow depth =    .98 ft
  PNC60 61 3 90 0
  REC15
  PIP330 1151.00 1150.43
+++ Tc =  18.3 min
+++ CA =  17.3
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 21,  Flow depth =   4.44 ft
  PNC61 65 3 180 0
  HOL16
  NEWDAs 190, 189
  STO1.333 .815 10
  PIP174 1150.37 1150.18
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 22,  Flow depth =   1.18 ft
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

```
  PNC62 64 3 180 0
  STO1.439 .822 10
  PIP8 1150.18 1150.43
+++ Tc =  10.9 min
+++ CA =   2.3
+++ Link # 23,  Flow depth =    .98 ft
  PNC64 65 3 90 0
  REC16
  PIP66 1150.43 1150.38
+++ Tc =  19.8 min
+++ CA =  19.6
+++ Link # 24,  Flow depth =   3.35 ft
  PNC65 69 3 180 0
  HOL17
  NEWDAs 188, 187 -SAG
  STO0.533 .815 10
  PIP81 1150.35 1150.18
+++ Tc =  10.0 min
+++ CA =    .4
+++ Link # 25,  Flow depth =    .66 ft
  PNC66 67 3 180 0
  PIP92 1150.18 1150.13
+++ Tc =  10.5 min
+++ CA =    .4
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
+++ Link # 26,  Flow depth =    .70 ft
  PNC67 68 3 180 0
  STO0.589 .814 10
  PIP8 1150.13 1150.38
+++ Tc =  11.0 min
+++ CA =    .9
+++ Link # 27,  Flow depth =    .60 ft
  PNC68 69 3 90 0
  REC17
  PIP66 1150.38 1150.43
+++ Tc =  19.9 min
+++ CA =  20.5
+++ Link # 28,  Flow depth =   3.45 ft
  PNC69 73 3 180 0
  HOL18
  NEWDAs 186, 185
  STO0.986 0.815 10
  PIP81 1150.37 1150.20
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 29,  Flow depth =    .92 ft
  PNC70 71 3 180 0
  PIP91 1150.20 1150.18
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

```
+++ Tc =  10.4 min
+++ CA =    .8
*** WARNING:  Pipe invert at D/S end dropped to meet minimum depth
    to invert criterion at D/S end
+++ Link # 30,  Flow depth =    .88 ft
  PNC71 72 3 180 0
  STO1.123 .805 10
  PIP8 1150.18 1150.43
+++ Tc =  10.8 min
+++ CA =   1.7
+++ Link # 31,  Flow depth =    .84 ft
  PNC72 73 3 90 0
  REC18
  PIP244 1150.43 1150.90
+++ Tc =  20.1 min
+++ CA =  22.2
+++ Link # 32,  Flow depth =   4.80 ft
  PNC73 76 3 180 0
  HOL19
  NEWDAs 184, 183
  STO0.986 .815 10
  PIP167 1150.74 1150.65
+++ Tc =  10.0 min
+++ CA =    .8
+++ Link # 33,  Flow depth =    .98 ft
  PNC74 75 3 180 0
  STO1.143 .800 10
  PIP8 1150.65 1150.90
+++ Tc =  10.9 min
+++ CA =   1.7
+++ Link # 34,  Flow depth =    .84 ft
  PNC75 76 3 90 0
  REC19
  PIP244 1150.90 1151.83
+++ Tc =  21.1 min
+++ CA =  23.9
+++ Link # 35,  Flow depth =   4.55 ft
  PNC76 39 3 90 0
  HOL20
  NEWDAs 182, 181 to PUMP HSE
  STO1.288 .819 10
  PIP81 1151.58 1151.41
+++ Tc =  10.0 min
+++ CA =   1.1
+++ Link # 36,  Flow depth =   1.08 ft
  PNC36 37 3 180 0
  PIP81 1151.41 1151.58
+++ Tc =  10.4 min
+++ CA =   1.1
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

```
+++ Link # 37,  Flow depth =   1.02 ft
  PNC37 38 3 180 0
  STO1.602 .796 10
  PIP8 1151.58 1151.83
+++ Tc =  10.7 min
+++ CA =   2.3
+++ Link # 38,  Flow depth =   1.00 ft
  PNC38 39 3 180 0
  REC20
  REMFLOWS FROM WEST
  FLO78.4
  PIP360 1151.83 1150.41
+++ Tc =  22.0 min
+++ CA =  26.3
*** WARNING: Pipe invert at U/S dropped to meet cover criterion at U/S end
*** WARNING: Inverts at D/S & U/S dropped to meet cover criterion at D/S end
+++ Link # 39,  Flow depth =   6.56 ft
  PNC39 40 3 180 2
  END
 END OF INPUT DATA.
```

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

*** DAs 202, 201 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
1	97	24	1153.64	.00216	3.8	1.6	3.7	6.33	0.
			1153.43		4.0		3.6	11.42	
2	69	24	1153.43	.00155	4.0	1.8	3.3	6.24	0.
			1153.32		4.6		3.1	9.67	
3	8	24	1153.32	.01260	4.6	2.5	8.7	13.29	0.
			1153.22		5.0		8.8	27.59	
4	330	30	1153.06	.00131	5.1	1.5	3.7	13.28	0.
			1152.63		4.2		3.3	16.13	

Length = 504. ft Total length = 504. ft
Cost = 0. Total Cost = 0.

*** DAs 200, 199 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
5	152	33	1148.83	.00142	4.5	1.5	4.1	19.40	0.
			1148.62		8.0		3.6	21.62	
6	8	24	1148.62	.01260	8.0	5.8	9.8	22.67	0.
			1148.51		8.3		8.8	27.59	
7	330	45	1148.51	.00071	8.3	2.7	3.6	34.17	0.
			1148.28		6.7		3.2	34.90	

Length = 490. ft Total length = 994. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

*** DAs 198, 197 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
8	81	24	1151.25	.00210	3.8	1.6	3.7	6.66	0.
			1151.08		3.8		3.6	11.26	
9	93	24	1151.08	.00183	3.8	1.6	3.5	6.59	0.
			1150.91		3.8		3.3	10.51	
10	8	24	1150.91	.01260	3.8	1.7	10.0	26.12	0.
			1150.81		4.2		8.8	27.59	
11	330	54	1147.52	.00071	7.5	1.5	4.1	56.17	0.
			1147.29		6.4		3.6	56.75	

Length = 512. ft Total length = 1506. ft
Cost = 0. Total Cost = 0.

*** DAs 196, 195 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
12	174	24	1149.90	.00195	3.8	1.6	3.6	6.49	0.
			1149.56		3.8		3.5	10.86	
13	8	24	1149.56	.01260	3.8	1.7	8.7	13.17	0.
			1149.46		4.2		8.8	27.59	
14	330	66	1144.98	.00040	8.7	1.5	3.5	65.15	0.
			1144.85		7.5		3.1	73.21	

Length = 512. ft Total length = 2018. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

*** DAs 194, 193 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
15	81	24	1148.55	.00222	3.8	1.6	3.8	6.52	0.
			1148.37		3.8		3.7	11.59	
16	93	24	1148.37	.00172	3.8	1.6	3.4	6.45	0.
			1148.21		3.8		3.2	10.19	
17	8	24	1148.21	.01260	3.8	1.7	8.7	13.20	0.
			1148.11		4.2		8.8	27.59	
18	330	72	1143.13	.00040	9.2	1.5	3.6	73.90	0.
			1143.00		8.0		3.3	92.33	

Length = 512. ft Total length = 2530. ft
Cost = 0. Total Cost = 0.

*** DAs 192, 191 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
19	174	24	1147.24	.00195	3.8	1.6	3.6	6.52	0.
			1146.90		3.8		3.5	10.86	
20	8	24	1146.90	.01260	3.8	1.7	8.7	13.20	0.
			1146.80		4.2		8.8	27.59	
21	330	72	1142.56	.00040	8.4	1.5	3.7	81.97	0.
			1142.43		8.0		3.3	92.33	

Length = 512. ft Total length = 3042. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

*** DAs 190, 189 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
22	174	24	1146.62	.00167	3.8	1.6	3.4	6.52	0.
			1146.33		3.8		3.2	10.03	
23	8	24	1146.33	.01260	3.8	1.7	8.7	13.27	0.
			1146.23		4.2		8.8	27.59	
24	66	60	1142.43	.00161	8.0	2.6	6.4	89.39	0.
			1142.32		8.1		5.8	113.68	

Length = 248. ft Total length = 3290. ft
Cost = 0. Total Cost = 0.

*** DAs 188, 187 -SAG Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
25	81	24	1146.60	.00210	3.8	1.6	2.9	2.61	0.
			1146.43		3.8		3.6	11.26	
26	92	24	1146.43	.00163	3.8	1.6	2.6	2.57	0.
			1146.28		3.8		3.2	9.92	
27	8	24	1146.28	.01260	3.8	1.7	6.8	5.31	0.
			1146.18		4.2		8.8	27.59	
28	66	60	1142.32	.00161	8.1	2.6	6.5	93.16	0.
			1142.22		8.2		5.8	113.68	

Length = 247. ft Total length = 3537. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

*** DAs 186, 185 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
29	81	24	1146.62	.00210	3.8	1.6	3.4	4.82	0.
			1146.45		3.8		3.6	11.26	
30	91	24	1146.45	.00242	3.8	1.6	3.6	4.76	0.
			1146.23		3.9		3.8	12.08	
31	8	24	1146.23	.01260	3.9	1.8	8.1	10.00	0.
			1146.13		4.3		8.8	27.59	
32	244	72	1142.22	.00051	8.2	1.7	4.2	100.49	0.
			1142.09		8.8		3.7	103.87	

Length = 424. ft Total length = 3961. ft
Cost = 0. Total Cost = 0.

*** DAs 184, 183 Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
33	167	24	1146.99	.00174	3.8	1.6	3.2	4.82	0.
			1146.70		3.9		3.3	10.24	
34	8	24	1146.70	.01260	3.9	1.8	8.1	10.04	0.
			1146.60		4.3		8.8	27.59	
35	244	78	1142.09	.00051	8.8	1.8	4.3	105.62	0.
			1141.97		9.9		3.9	128.58	

Length = 419. ft Total length = 4380. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

*** DAs 182, 181 to PUMP HOUSE

Pipe Design

Link	Length (ft)	Diam (in)	Invert Up/Dn (ft)	Slope (ft/ft)	Depth Up/Dn (ft)	Min. Cover (ft)	Velocity Act/Full (ft/s)	--Flow-- Act/Full (cfs)	Estimated Cost ($)
36	81	24	1147.83	.00210	3.8	1.6	3.7	6.33	0.
			1147.66		3.8		3.6	11.26	
37	81	24	1147.66	.00257	3.8	1.6	4.0	6.26	0.
			1147.45		4.1		4.0	12.45	
38	8	24	1147.45	.01260	4.1	2.0	8.7	13.68	0.
			1147.35		4.5		8.8	27.59	
39	360	96	1140.38	.00038	11.5	1.5	4.4	191.49	0.
			1140.24		10.2		3.8	192.56	

Length = 530. ft Total length = 4910. ft
Cost = 0. Total Cost = 0.

SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

Hydraulic Gradeline Computations

Link #	Down-stream Node #	Hydraulic Gradeline Elevation	Crown Elev.	Possible Surcharge	Ground Elev.	Super-crit.?	Manhole Depth	Loss Coef
1	42	1156.42	1155.43	Y	1157.40	N	2.89	1.29
2	43	1156.19	1155.32	Y	1157.95	N	2.20	1.15
3	44	1154.83	1155.22	N	1158.20	Y	1.77	.37
4	47	1154.36	1155.13	N	1156.84	N	3.65	6.38
5	46	1154.96	1151.37	Y	1156.59	N	5.28	1.43
6	47	1152.80	1150.51	Y	1156.84	Y	3.65	6.38
7	51	1151.29	1152.03	N	1155.01	N	3.67	.22
8	49	1152.19	1153.08	N	1154.83	N	.00	.00
9	50	1154.24	1152.91	Y	1154.76	N	2.44	1.15
10	51	1152.36	1152.81	N	1155.01	Y	3.67	.22
11	54	1150.93	1151.79	N	1153.66	N	4.07	.25
12	53	1151.81	1151.56	Y	1153.41	N	1.61	1.09
13	54	1150.43	1151.46	N	1153.66	Y	4.07	.25
14	58	1148.89	1150.35	N	1152.31	N	5.43	.05
15	56	1149.44	1150.37	N	1152.12	N	.00	.00
16	57	1150.46	1150.21	Y	1152.06	N	1.61	1.09
17	58	1149.08	1150.11	N	1152.31	Y	5.43	.05
18	61	1148.53	1149.00	N	1151.00	N	5.97	1.01
19	60	1149.92	1148.90	Y	1150.75	N	2.33	1.17
20	61	1148.53	1148.80	N	1151.00	Y	5.97	1.01
21	65	1148.39	1148.43	N	1150.43	N	5.64	1.02
22	64	1149.46	1148.33	Y	1150.18	N	2.44	1.17
23	65	1148.07	1148.23	N	1150.43	Y	5.64	1.02
24	69	1147.72	1147.32	Y	1150.38	N	5.07	1.01
25	67	1147.08	1148.43	N	1150.18	N	.00	.00
26	68	1148.18	1148.28	N	1150.13	N	1.51	1.09
27	69	1147.40	1148.18	N	1150.38	Y	5.07	1.01
28	73	1147.05	1147.22	N	1150.43	N	4.81	.20
29	71	1147.36	1148.45	N	1150.20	N	.00	.00
30	72	1148.13	1148.23	N	1150.18	N	1.37	1.05
31	73	1147.02	1148.13	N	1150.43	Y	4.81	.20
32	76	1146.97	1148.09	N	1150.90	N	4.87	.03
33	75	1148.61	1148.70	N	1150.65	N	1.37	1.06
34	76	1147.43	1148.60	N	1150.90	Y	4.87	.03
35	39	1146.94	1148.47	N	1151.83	N	6.56	.27
36	37	1148.73	1149.66	N	1151.41	N	.00	.00
37	38	1149.74	1149.45	Y	1151.58	N	1.64	1.08
38	39	1148.35	1149.35	N	1151.83	Y	6.56	.27
39	40	1146.76	1148.24	N	1150.41	N	.00	.00

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.
1	41	1156.78	1157.39	1.50

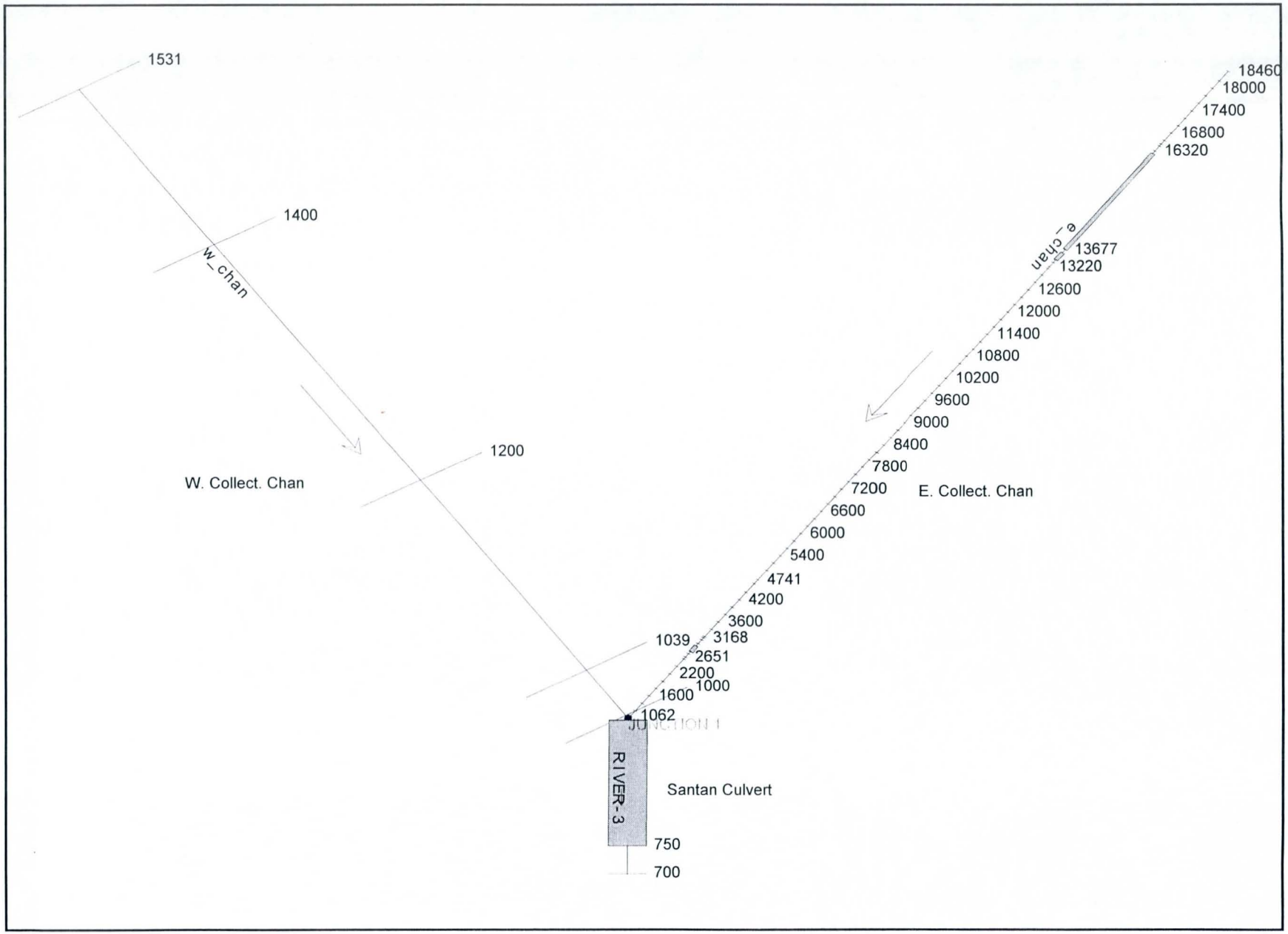
SANTAN FWAY - PUMPSTA @ McCLINTOCK EAST HALF

Link #	Terminal Node #	Hydraulic Gradeline Elevation	Ground Elevation	Loss Coef.

NORMAL END OF HYDRA

APPENDIX E

CHANNEL HYDRAULIC ANALYSES


1531
1400
w_chan
1200
W. Collect. Chan
18460
18000
17400
16800
16320
e_chan
13677
13220
12600
12000
11400
10800
10200
9600
9000
8400
7800
7200
E. Collect. Chan
6600
6000
5400
4741
4200
3600
3168
1039
2651
2200
1000
1600
1062
JUNCTION 1
RIVER-3
Santan Culvert
750
700

West Channel	
HEC-RAS River Sta	Construcion C_L & PGL
59+93.00	12+40.82
58+96.50	13+37.32
58+00.00	14+33.82
57+29.33	15+04.49
56+58.66	15+75.16
55+88.00	16+45.82
54+74.00	17+59.82
54+14.00	18+19.82
52+99.00	19+34.82
52+81.00	19+52.82
45+07.00	27+26.82
44+89.00	27+44.82
43+64.00	28+69.82
43+04.00	29+29.82
41+79.00	30+54.82
40+89.50	31+44.32
40+00.00	32+33.82
39+00.00	33+33.82
38+00.00	34+33.82
37+00.00	35+33.82
36+00.00	36+33.82
35+00.00	37+33.82
34+00.00	38+33.82
33+00.00	39+33.82
32+00.00	40+33.82
30+00.00	42+33.82
28+00.00	44+33.81
27+52.95	44+80.86
27+38.81	44+95.00
26+00.00	46+33.81
24+00.00	48+33.81
22+00.00	50+33.81
20+00.00	52+33.81
18+35.33	53+98.48
17+72.05	54+61.77
17+16.05	55+17.77
16+50.05	55+83.77
15+94.05	56+39.77
15+31.00	57+02.82
14+00.00	58+33.82
12+40.00	59+93.82
12+00.00	60+33.82
10+39.00	61+94.82
10+00.00	62+33.82

HEC-RAS Plan: santan River: e_chan Reach: E. Collect. Chan

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	L. Freeboard	R. Freeboard	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
E. Collect. Chan	18460	938.00	1166.44	1173.49	1.45	7.19		1173.91	0.000476	5.24	178.86	39.70	0.44
E. Collect. Chan	18200	938.00	1166.18	1173.39	1.29	7.03		1173.79	0.000427	5.04	186.15	40.40	0.41
E. Collect. Chan	18000	938.00	1165.98	1173.32	1.16	6.90		1173.70	0.000395	4.90	191.58	40.94	0.40
E. Collect. Chan	17800	938.00	1165.80	1173.26	1.98	6.76		1173.61	0.000369	4.77	196.57	41.46	0.39
E. Collect. Chan	17600	975.00	1165.58	1173.18	1.90	6.64		1173.54	0.000369	4.82	202.12	41.95	0.39
E. Collect. Chan	17400	975.00	1165.38	1173.12	1.76	6.50		1173.46	0.000341	4.68	208.18	42.53	0.37
E. Collect. Chan	17200	975.00	1165.18	1173.07	1.61	6.35		1173.39	0.000314	4.54	214.54	43.12	0.36
E. Collect. Chan	17000	975.00	1164.98	1173.02	1.46	6.20		1173.33	0.000290	4.41	221.18	43.73	0.35
E. Collect. Chan	16800	975.00	1164.80	1172.98	1.80	6.04		1173.26	0.000269	4.29	227.36	44.33	0.33
E. Collect. Chan	16600	1011.00	1164.58	1172.92	1.66	4.90		1173.21	0.000266	4.31	234.39	44.92	0.33
E. Collect. Chan	16500	1011.00	1164.48	1172.90	1.58	4.82		1173.18	0.000256	4.25	238.00	45.24	0.33
E. Collect. Chan	16450	1011.00	1164.43	1172.99	1.44	4.68		1173.13	0.000115	3.10	326.49	55.76	0.23
E. Collect. Chan	16320	1011.00	1164.30	1172.83	1.25	2.70		1173.10	0.000241	4.16	243.15	45.66	0.32
E. Collect. Chan	16252	1332.00	1164.23	1172.36	1.22	3.59	1168.61	1173.00	0.000565	6.42	207.33	25.50	0.40
E. Collect. Chan	16251	Culvert											
E. Collect. Chan	13677	1332.00	1161.66	1169.20	0.46	1.25		1169.96	0.000711	6.97	191.09	25.40	0.45
E. Collect. Chan	13601	1332.00	1161.58	1169.16	0.44	1.21	1165.96	1169.90	0.000689	6.89	193.30	25.50	0.44
E. Collect. Chan	13600	Culvert											
E. Collect. Chan	13402	1332.00	1161.38	1168.52	1.86	1.66		1169.34	0.000811	7.29	182.66	25.64	0.48
E. Collect. Chan	13335	1332.00	1161.32	1168.45	1.86	4.61		1169.28	0.000920	7.33	181.68	39.98	0.61
E. Collect. Chan	13220	1332.00	1161.20	1168.71	1.49	4.23		1169.08	0.000334	4.91	271.13	51.57	0.38
E. Collect. Chan	13170	1332.00	1161.15	1168.11	2.04	4.78		1169.01	0.001006	7.58	175.80	39.39	0.63
E. Collect. Chan	13000	1332.00	1160.98	1167.94	2.06	4.78		1168.83	0.001005	7.57	175.84	39.36	0.63
E. Collect. Chan	12800	1332.00	1160.80	1167.77	1.04	6.25		1168.63	0.000962	7.42	179.61	40.32	0.62
E. Collect. Chan	12600	1332.00	1160.60	1167.58	1.03	6.24		1168.43	0.000957	7.40	179.96	40.35	0.62
E. Collect. Chan	12400	1332.00	1160.38	1167.40	1.01	6.20		1168.24	0.000941	7.36	181.02	40.45	0.61
E. Collect. Chan	12200	1332.00	1160.18	1167.15	1.55	4.27		1168.04	0.001000	7.56	176.13	39.39	0.63
E. Collect. Chan	12000	1332.00	1159.98	1166.95	1.53	4.27		1167.84	0.000991	7.54	176.71	39.46	0.63
E. Collect. Chan	11800	1332.00	1159.78	1166.76	1.52	4.26		1167.64	0.000990	7.53	176.79	39.46	0.63
E. Collect. Chan	11600	1332.00	1159.58	1166.56	1.52	4.26		1167.44	0.000989	7.53	176.88	39.47	0.63
E. Collect. Chan	11400	1332.00	1159.38	1166.36	1.52	4.26		1167.24	0.000988	7.53	176.97	39.48	0.63
E. Collect. Chan	11200	1332.00	1159.18	1166.16	1.52	4.26		1167.04	0.000986	7.52	177.09	39.49	0.63
E. Collect. Chan	11000	1332.00	1158.98	1165.97	1.51	4.25		1166.84	0.000984	7.52	177.22	39.51	0.63
E. Collect. Chan	10800	1332.00	1158.78	1165.77	1.51	4.25		1166.65	0.000982	7.51	177.36	39.52	0.62
E. Collect. Chan	10600	1332.00	1158.60	1165.57	1.51	4.25		1166.45	0.000992	7.54	176.73	39.49	0.63
E. Collect. Chan	10400	1332.00	1158.38	1165.38	1.50	4.24		1166.25	0.000976	7.49	177.72	39.56	0.62
E. Collect. Chan	10200	1332.00	1158.18	1165.19	1.49	4.23		1166.06	0.000973	7.49	177.94	39.58	0.62
E. Collect. Chan	10000	1332.00	1157.98	1164.99	1.49	4.23		1165.86	0.000970	7.48	178.18	39.60	0.62
E. Collect. Chan	9800	1332.00	1157.78	1164.80	1.48	4.22		1165.66	0.000966	7.46	178.45	39.63	0.62
E. Collect. Chan	9600	1332.00	1157.58	1164.61	1.47	4.21		1165.47	0.000961	7.45	178.76	39.66	0.62
E. Collect. Chan	9400	1332.00	1157.38	1164.42	1.46	4.20		1165.27	0.000956	7.44	179.10	39.70	0.62
E. Collect. Chan	9200	1332.00	1157.18	1164.23	1.45	4.19		1165.08	0.000949	7.42	179.56	39.74	0.62
E. Collect. Chan	9000	1332.00	1156.98	1164.04	1.44	4.18		1164.89	0.000942	7.40	180.10	39.80	0.61
E. Collect. Chan	8800	1332.00	1156.80	1163.85	1.43	4.17		1164.70	0.000944	7.40	179.99	39.82	0.61
E. Collect. Chan	8600	1332.00	1156.58	1163.67	1.41	4.15		1164.51	0.000928	7.36	181.09	39.91	0.61

HEC-RAS Plan: santan River: e_chan Reach: E. Collect. Chan (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	L. Freeboard	R. Freeboard	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
E. Collect. Chan	8400	1332.00	1156.38	1163.49	1.39	4.13		1164.32	0.000912	7.31	182.27	40.01	0.60
E. Collect. Chan	8200	1332.00	1156.18	1163.31	1.39	4.11		1164.14	0.000907	7.30	182.58	40.04	0.60
E. Collect. Chan	8000	1332.00	1155.98	1163.14	1.34	5.58		1163.96	0.000885	7.23	184.28	40.22	0.60
E. Collect. Chan	7800	1332.00	1155.78	1162.98	1.30	5.54		1163.78	0.000868	7.18	185.59	40.35	0.59
E. Collect. Chan	7600	1332.00	1155.58	1162.81	1.27	5.51		1163.60	0.000849	7.12	187.10	40.50	0.58
E. Collect. Chan	7400	1332.00	1155.38	1162.66	1.22	5.46		1163.43	0.000829	7.05	188.81	40.66	0.58
E. Collect. Chan	7200	1332.00	1155.18	1162.49	1.37	5.93		1163.26	0.000820	7.04	189.24	40.51	0.57
E. Collect. Chan	7000	1332.00	1154.98	1162.34	1.48	5.88		1163.10	0.000808	7.01	189.99	40.42	0.57
E. Collect. Chan	6800	1332.00	1154.78	1162.20	1.60	5.32		1162.93	0.000766	6.85	194.34	41.20	0.56
E. Collect. Chan	6600	1332.00	1154.58	1162.07	1.53	5.25		1162.78	0.000739	6.76	196.94	41.45	0.55
E. Collect. Chan	6400	1332.00	1154.38	1161.93	1.47	5.19		1162.62	0.000711	6.67	199.82	41.73	0.54
E. Collect. Chan	6200	1332.00	1154.20	1161.81	1.37	5.11		1162.48	0.000684	6.57	202.77	42.05	0.53
E. Collect. Chan	6000	1332.00	1154.00	1161.69	1.29	4.03	1159.47	1162.34	0.000653	6.46	206.23	42.38	0.52
E. Collect. Chan	5800	1400.00	1153.78	1161.48	1.30	4.04	1159.40	1162.19	0.000721	6.79	206.29	42.35	0.54
E. Collect. Chan	5600	1470.00	1153.58	1161.22	1.38	4.10	1159.37	1162.03	0.000827	7.23	203.25	42.05	0.58
E. Collect. Chan	5400	1470.00	1153.38	1161.07	1.31	4.05		1161.86	0.000799	7.14	205.89	42.31	0.57
E. Collect. Chan	5200	1542.00	1153.18	1160.77	1.41	4.15		1161.68	0.000929	7.65	201.70	41.91	0.61
E. Collect. Chan	5000	1613.00	1152.98	1160.38	1.60	4.34		1161.45	0.001134	8.33	193.68	41.14	0.68
E. Collect. Chan	4741	1684.00	1152.72	1159.50	2.10	4.96		1161.04	0.001790	9.96	169.03	38.72	0.84
E. Collect. Chan	4640	1825.00	1152.62	1160.06	1.56	4.57		1160.67	0.000536	6.28	290.66	54.83	0.48
E. Collect. Chan	4400	1825.00	1152.40	1159.96	1.42	4.44		1160.54	0.000504	6.14	297.09	55.28	0.47
E. Collect. Chan	4200	1968.00	1152.20	1159.74	1.44	4.46		1160.42	0.000591	6.65	296.11	55.21	0.51
E. Collect. Chan	4000	1968.00	1151.98	1159.64	1.34	3.36		1160.30	0.000558	6.51	302.36	55.63	0.49
E. Collect. Chan	3800	2039.00	1151.78	1159.49	1.29	3.31		1160.18	0.000585	6.69	304.89	55.81	0.50
E. Collect. Chan	3600	2180.00	1151.58	1159.23	1.35	3.37		1160.04	0.000687	7.22	301.91	55.60	0.55
E. Collect. Chan	3400	2180.00	1151.38	1159.12	1.26	3.28		1159.90	0.000659	7.11	306.49	55.93	0.54
E. Collect. Chan	3200	2180.00	1151.18	1159.01	1.17	3.19		1159.77	0.000630	7.00	311.46	56.28	0.52
E. Collect. Chan	3168	2231.00	1151.15	1158.93	1.22	3.24		1159.74	0.000681	7.24	307.96	56.06	0.54
E. Collect. Chan	3118	2231.00	1151.10	1159.13	0.97	2.99		1159.62	0.000364	5.60	398.06	67.09	0.41
E. Collect. Chan	3013	2231.00	1150.99	1158.69	1.31	3.32		1159.53	0.000705	7.34	304.13	55.76	0.55
E. Collect. Chan	2960	2231.00	1150.90	1158.92	1.02	0.87	1154.68	1159.34	0.000276	5.19	429.61	53.67	0.32
E. Collect. Chan	2959	Culvert											
E. Collect. Chan	2792	2231.00	1150.77	1158.65	0.75	1.64		1159.08	0.000290	5.28	422.80	53.67	0.33
E. Collect. Chan	2741	2250.00	1150.72	1157.92	1.80	2.32		1158.94	0.000924	8.10	277.64	53.77	0.63
E. Collect. Chan	2651	2250.00	1150.63	1158.16	1.47	1.99		1158.75	0.000469	6.15	366.10	65.10	0.46
E. Collect. Chan	2601	2250.00	1150.58	1157.53	2.04	2.57		1158.66	0.001066	8.53	263.92	52.80	0.67
E. Collect. Chan	2400	2250.00	1150.38	1157.31	2.07	2.59		1158.45	0.001083	8.57	262.42	52.68	0.68
E. Collect. Chan	2200	2250.00	1150.18	1157.07	1.11	2.13		1158.23	0.001101	8.63	260.81	52.56	0.68
E. Collect. Chan	2000	2250.00	1149.98	1156.84	1.14	2.16		1158.01	0.001125	8.69	258.81	52.41	0.69
E. Collect. Chan	1800	2250.00	1149.78	1156.57	1.21	1.73		1157.78	0.001166	8.80	255.54	52.16	0.70
E. Collect. Chan	1600	2250.00	1149.58	1156.29	1.29	1.31		1157.53	0.001227	8.97	250.95	51.80	0.72
E. Collect. Chan	1400	2250.00	1149.38	1155.95	1.43	1.45		1157.27	0.001329	9.23	243.90	51.26	0.75
E. Collect. Chan	1200	2250.00	1149.18	1155.47	1.71	1.73		1156.96	0.001570	9.79	229.92	50.15	0.81
E. Collect. Chan	1062	2250.00	1149.00	1154.58	2.42	2.44	1154.58	1156.63	0.002473	11.49	195.75	47.33	1.00
E. Collect. Chan	1039	2250.00	1142.00	1153.96	2.04	2.11		1154.17	0.000103	3.68	611.77	64.74	0.21

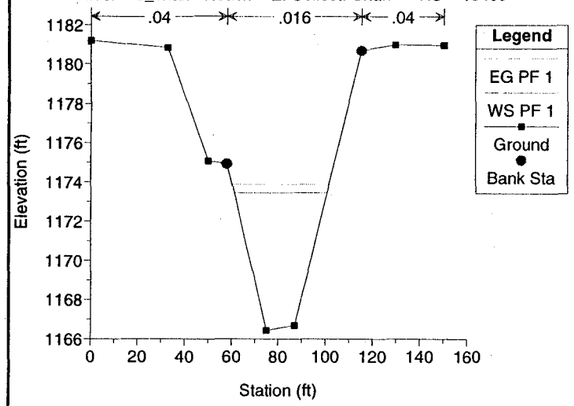
HEC-RAS Plan: santan River: e_chan Reach: E. Collect. Chan (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	L. Freeboard	R. Freeboard	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
E. Collect. Chan	1000	2250.00	1142.00	1153.96	2.54	2.04		1154.17	0.000102	3.66	614.20	64.77	0.21

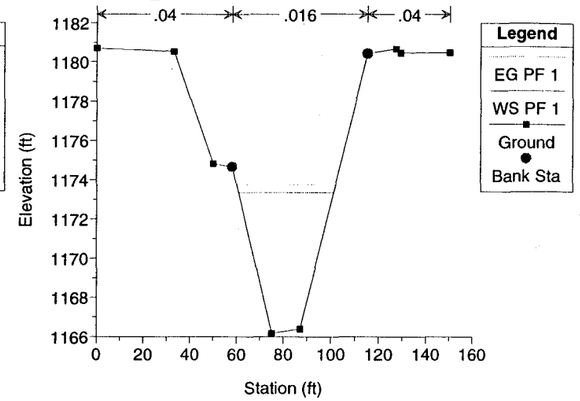
HEC-RAS Plan: santan River: w_chan Reach: W. Collect. Chan

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	L. Freeboard	R. Freeboard	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
W. Collect. Chan	1531	750.00	1146.11	1154.12	1.51	1.46		1154.21	0.000068	2.33	321.42	56.88	0.17
W. Collect. Chan	1400	750.00	1145.98	1154.12	1.38	1.36		1154.20	0.000064	2.28	329.02	57.52	0.17
W. Collect. Chan	1200	750.00	1145.77	1154.11	1.19	1.16		1154.18	0.000058	2.20	340.63	58.31	0.16
W. Collect. Chan	1039	750.00	1142.00	1154.14	1.86	0.86		1154.16	0.000011	1.22	616.56	64.32	0.07
W. Collect. Chan	1000	750.00	1142.00	1154.14	1.86	1.86		1154.16	0.000011	1.20	625.83	65.14	0.07

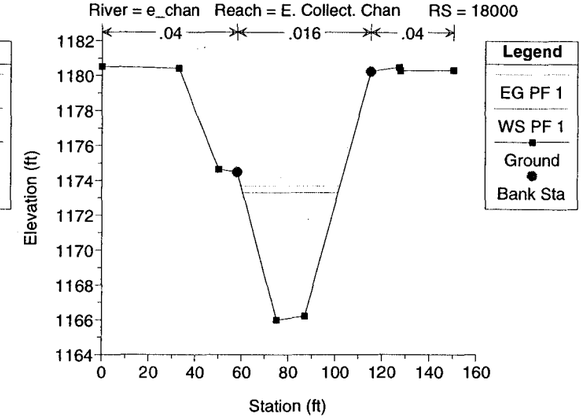
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 18460



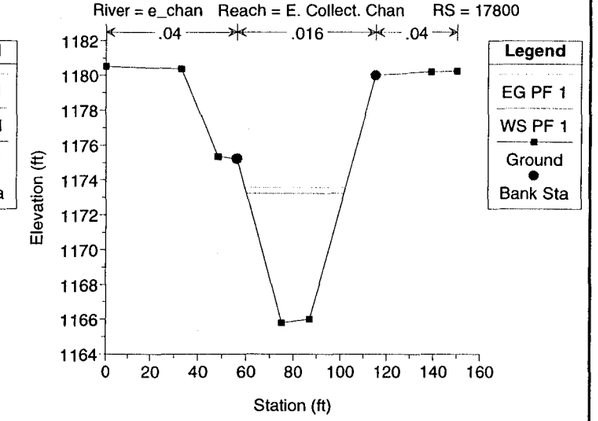
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 18200



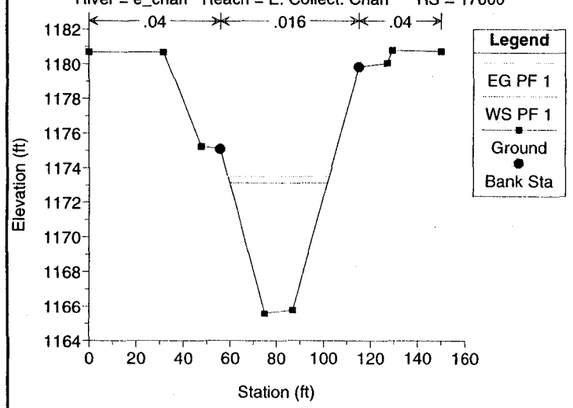
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 18000



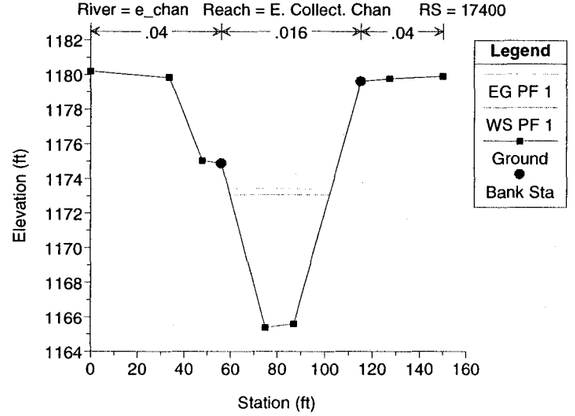
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 17800



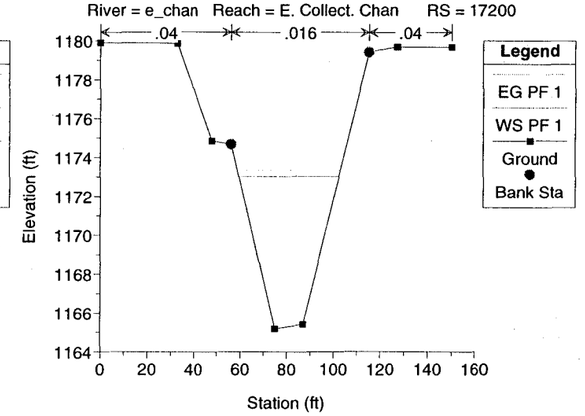
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 17600



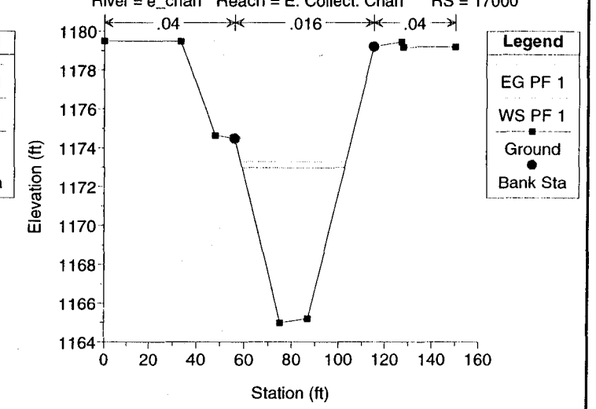
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 17400



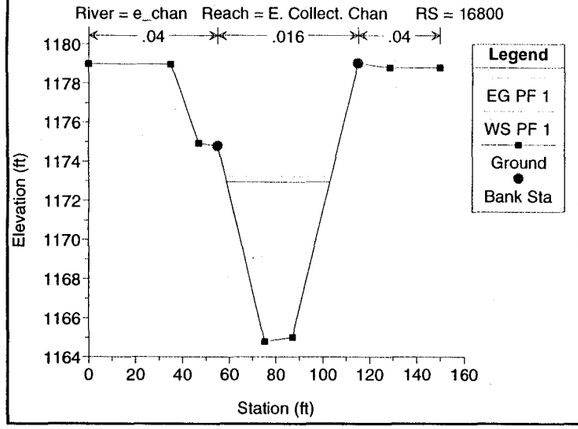
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 17200



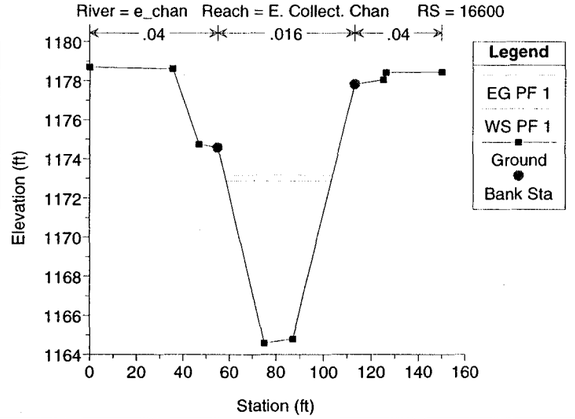
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 17000



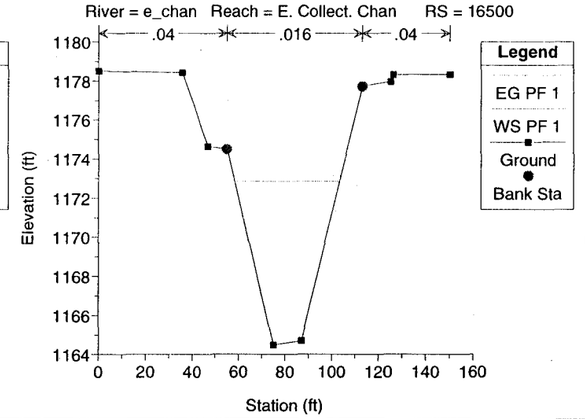
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 16800



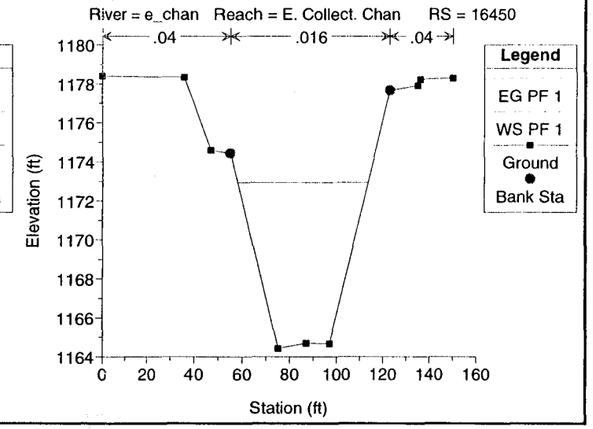
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 16600



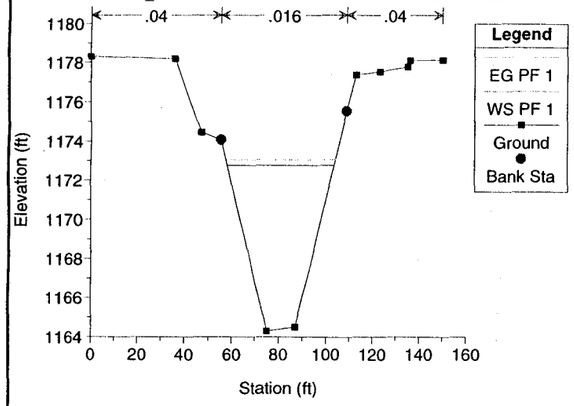
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 16500



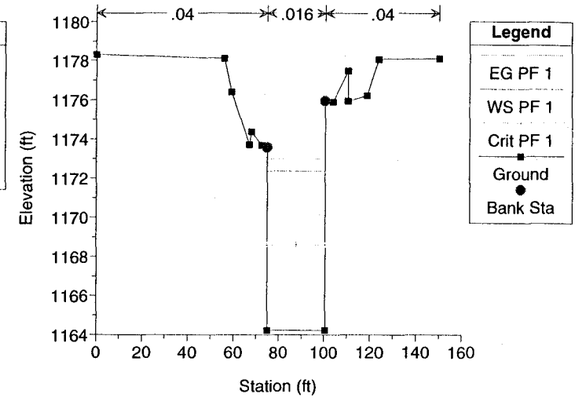
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 16450



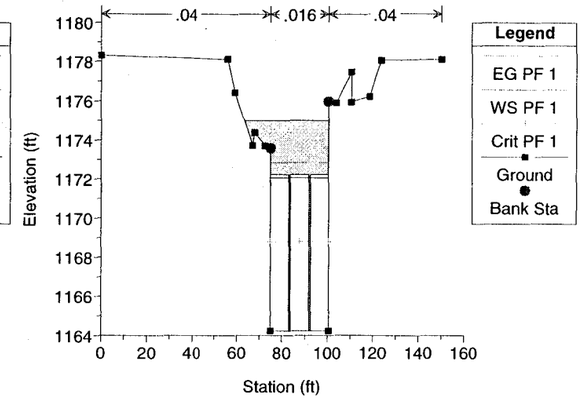
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 16320



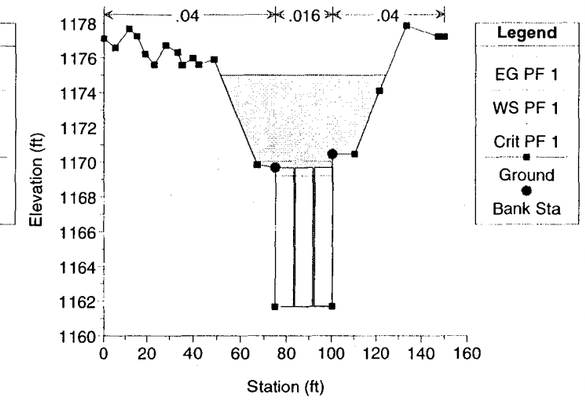
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 16252



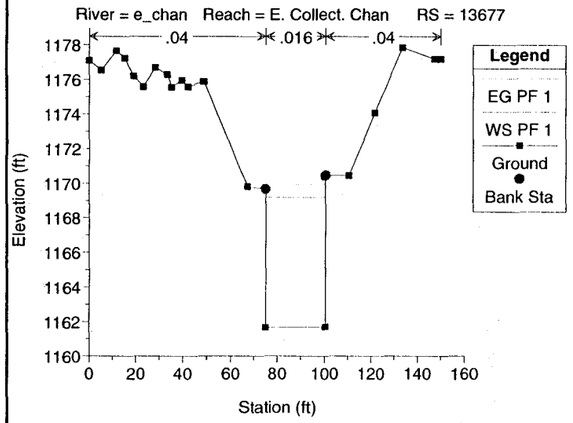
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan 3-8' x 8' x 2575' CBC - McClintock to Co RS = 16251



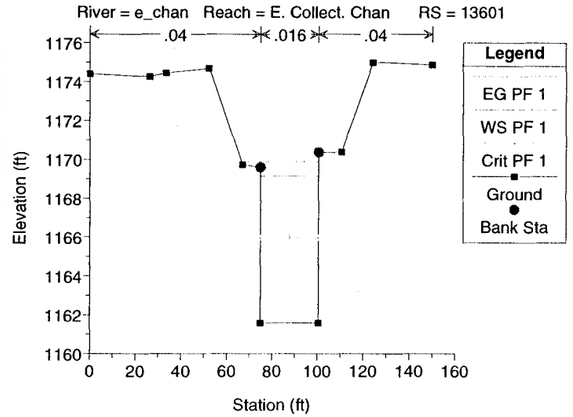
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan 3-8' x 8' x 2575' CBC - McClintock to Co RS = 16251



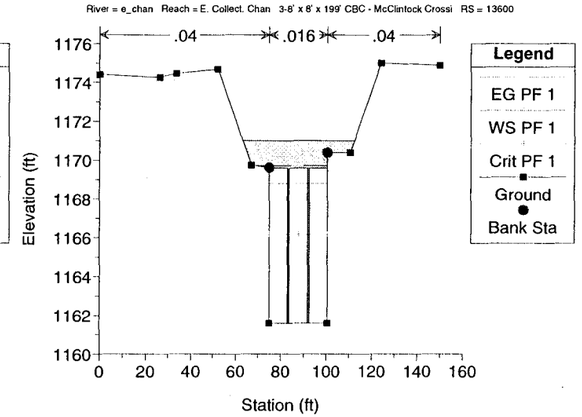
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 13677



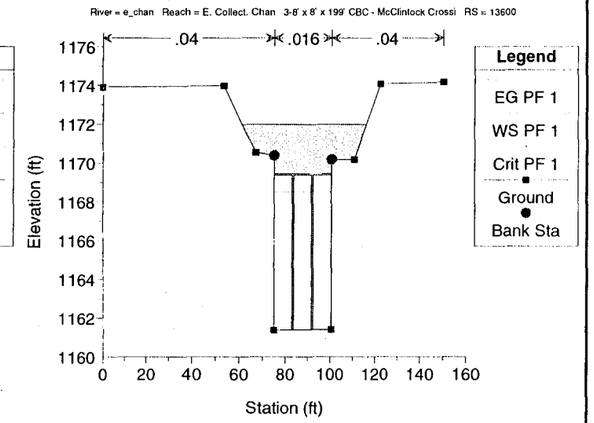
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 13601



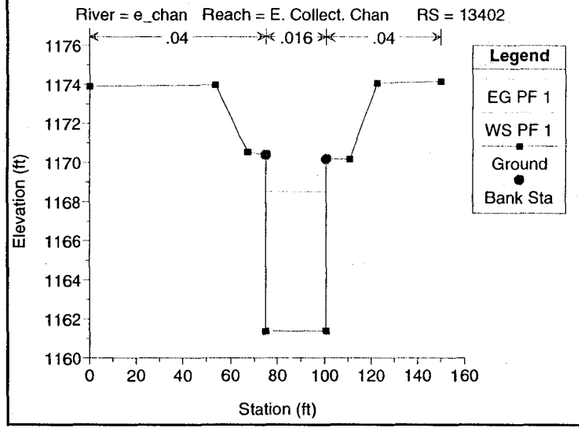
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan 3-8' x 8' x 199' CBC - McClintock Crossi RS = 13600



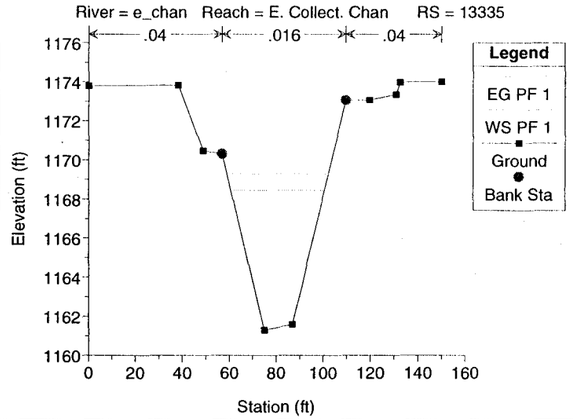
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan 3-8' x 8' x 199' CBC - McClintock Crossi RS = 13600



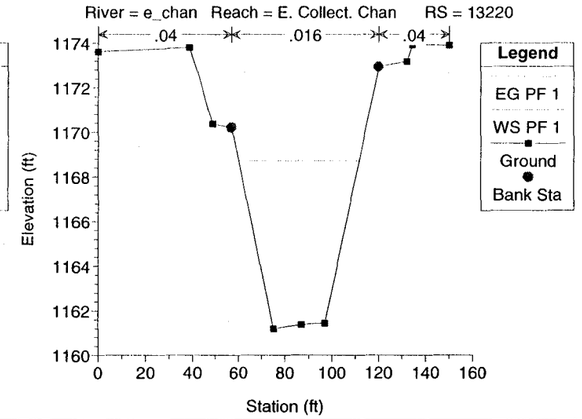
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 13402



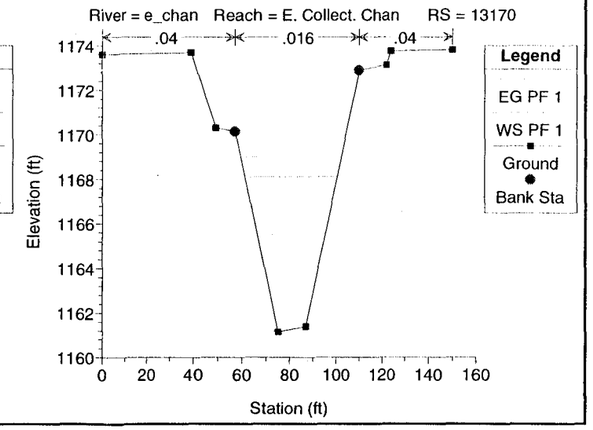
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 13335



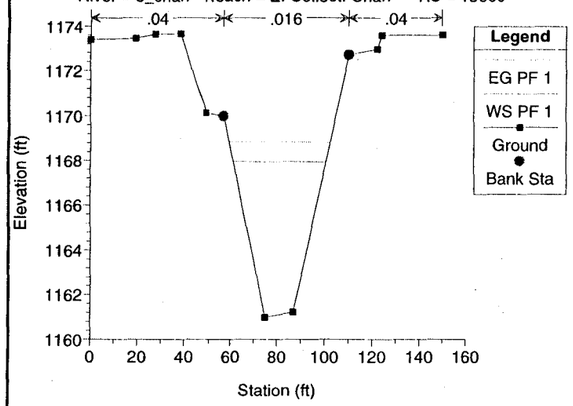
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 13220



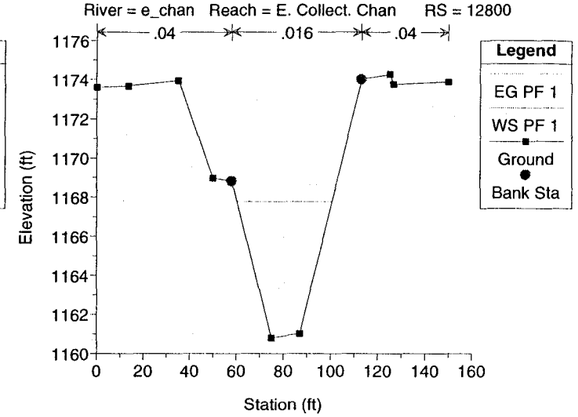
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 13170



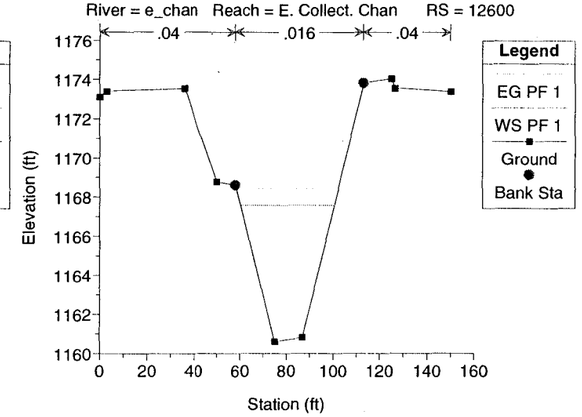
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 13000



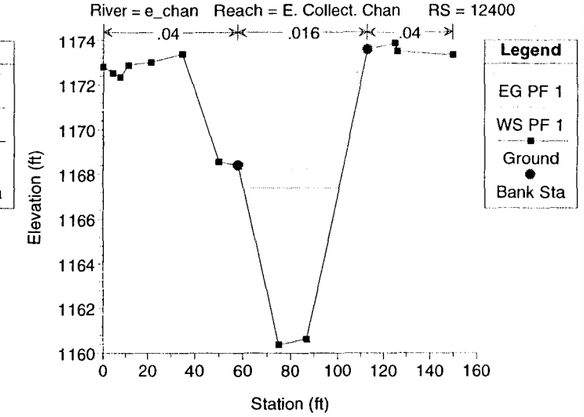
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 12800



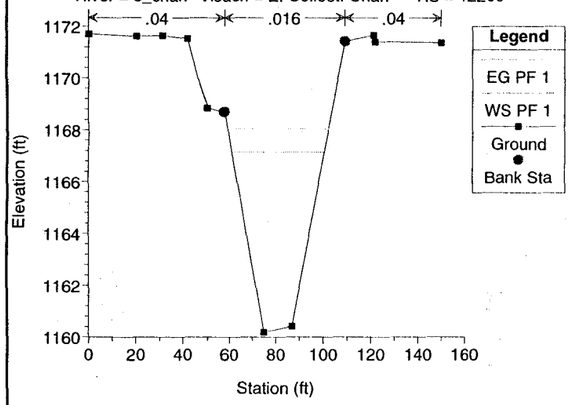
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 12600



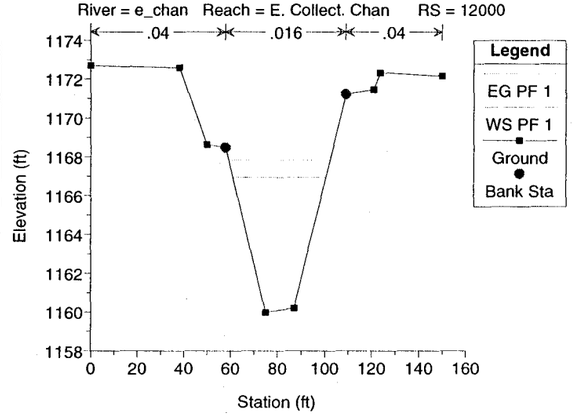
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 12400



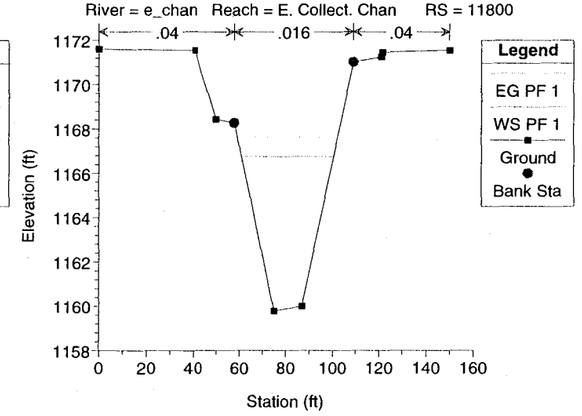
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 12200



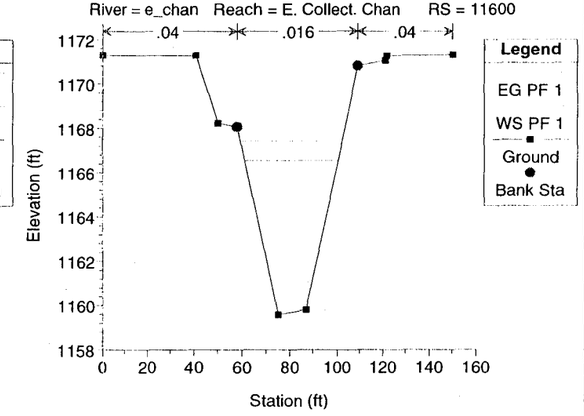
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 12000



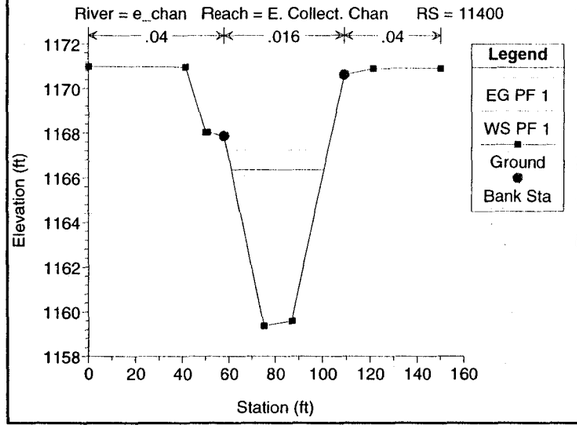
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 11800



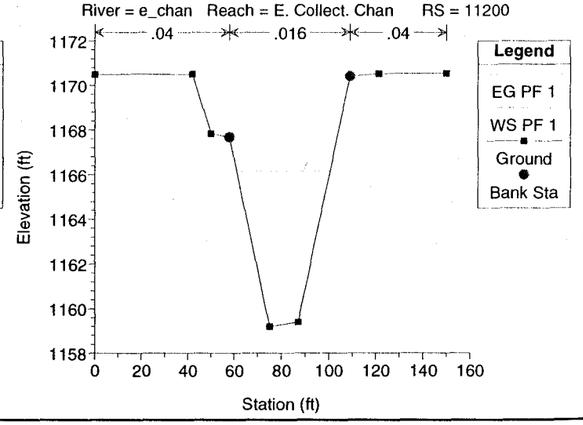
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 11600



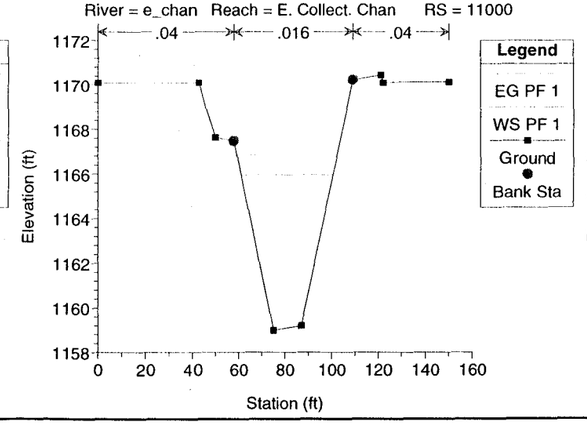
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 11400



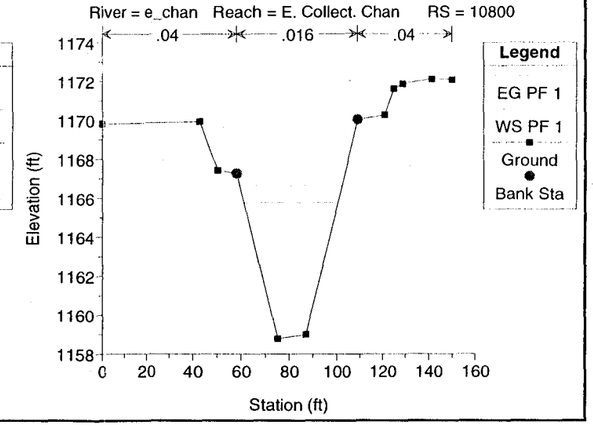
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 11200



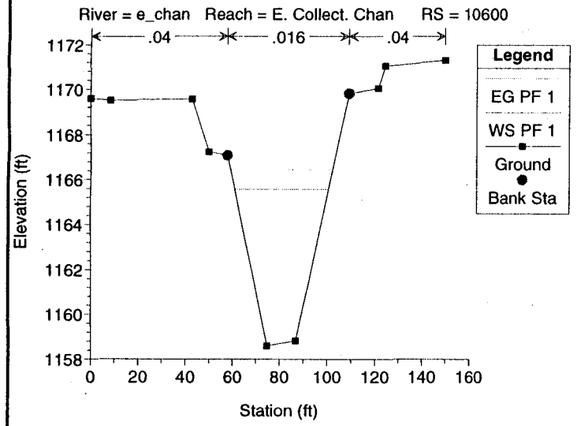
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 11000



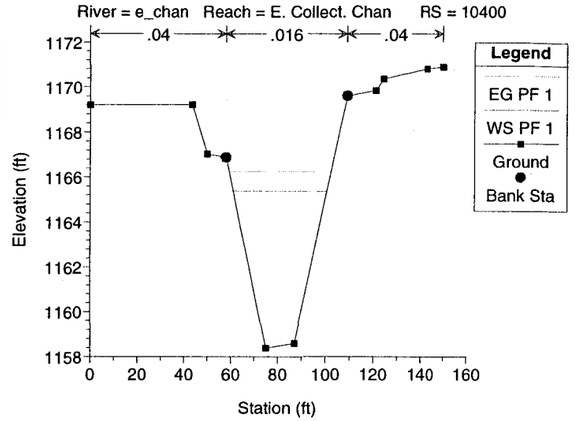
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 10800



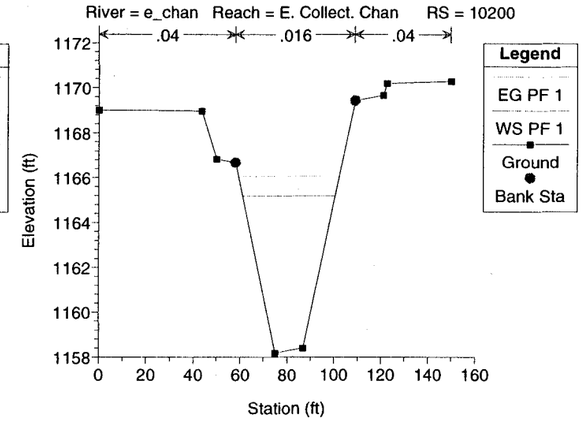
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 10600



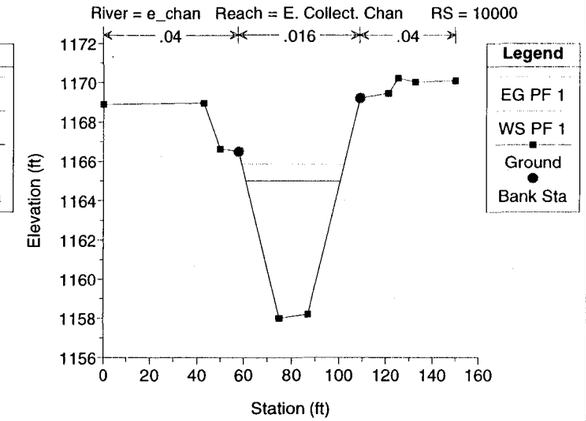
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 10400



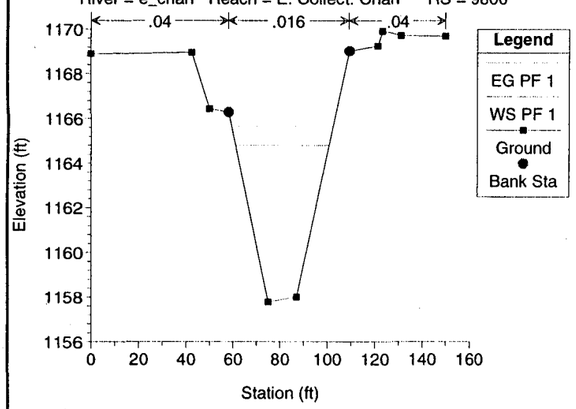
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 10200



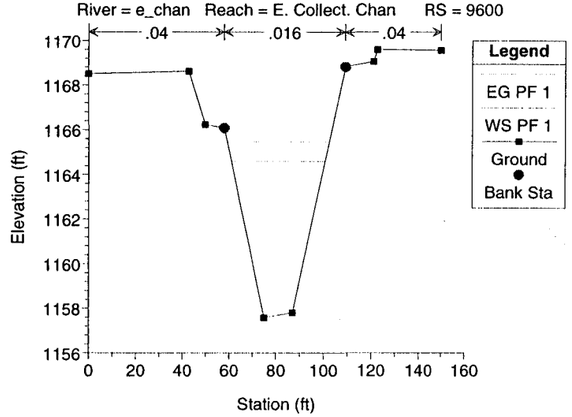
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 10000



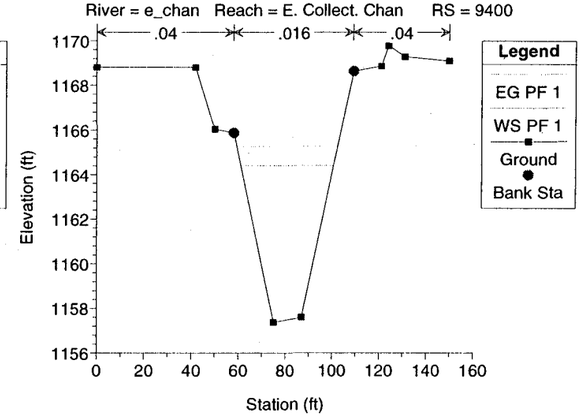
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 9800



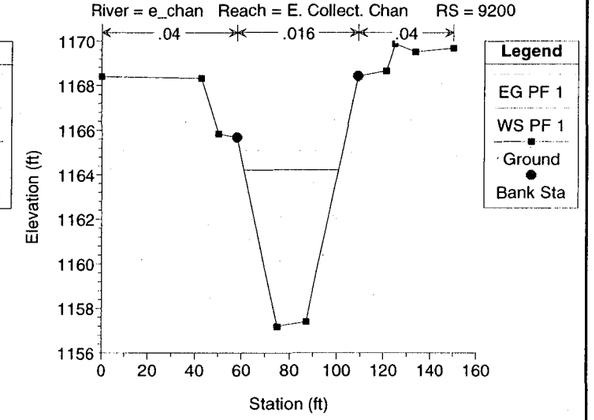
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 9600



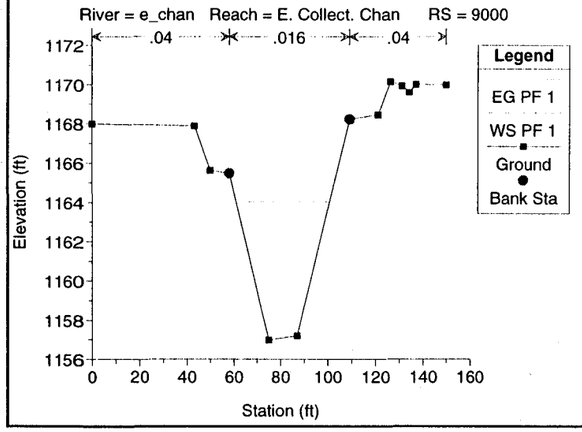
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 9400



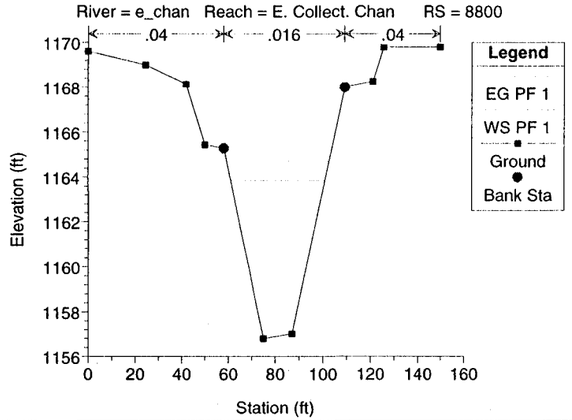
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 9200



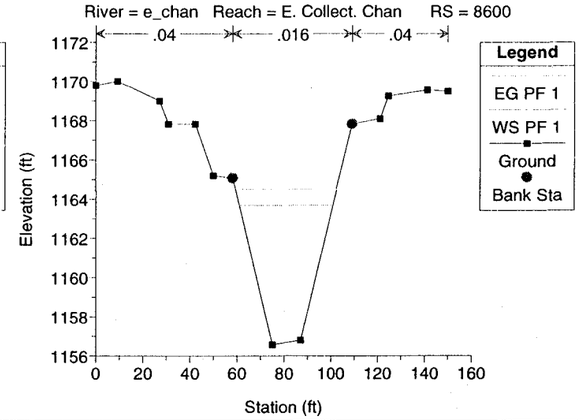
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 9000



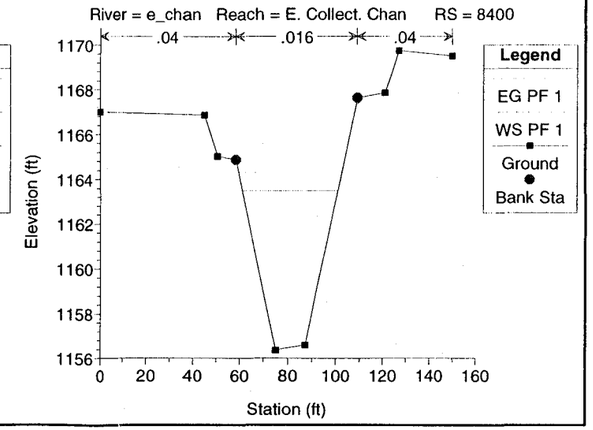
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 8800

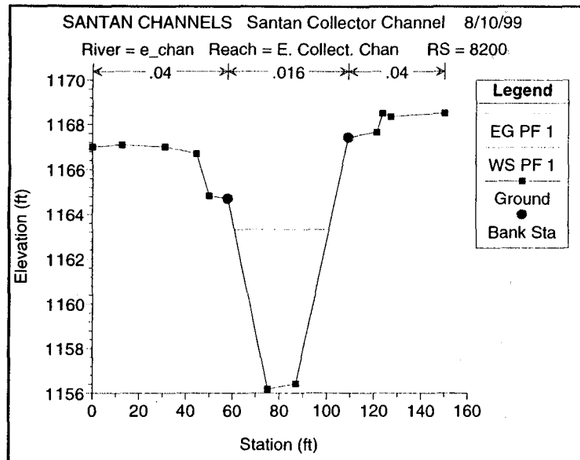


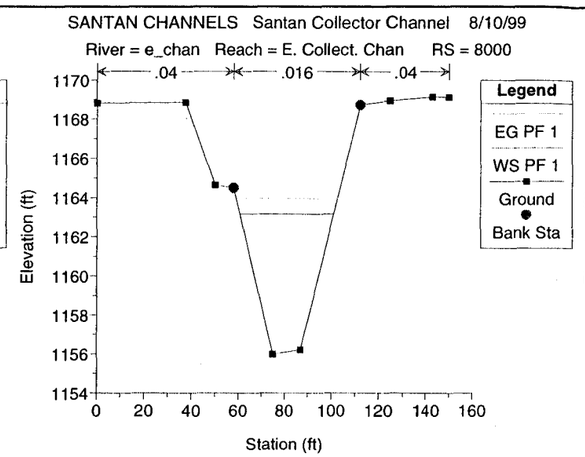
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 8600

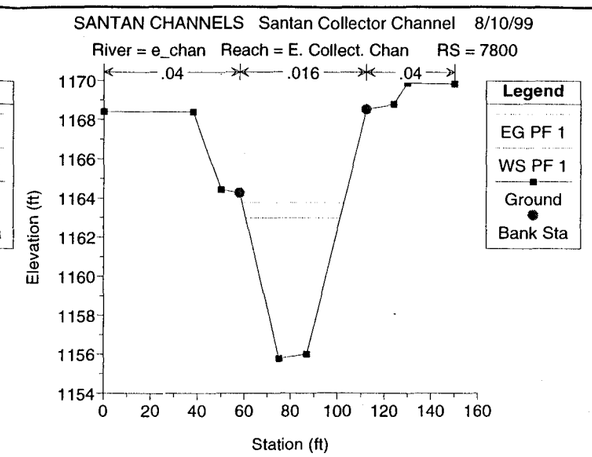


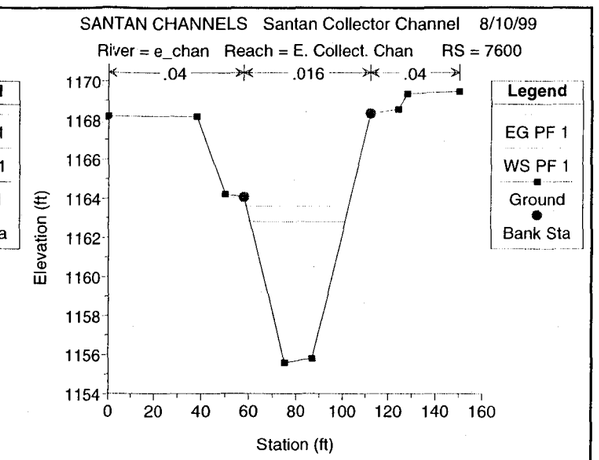
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 8400

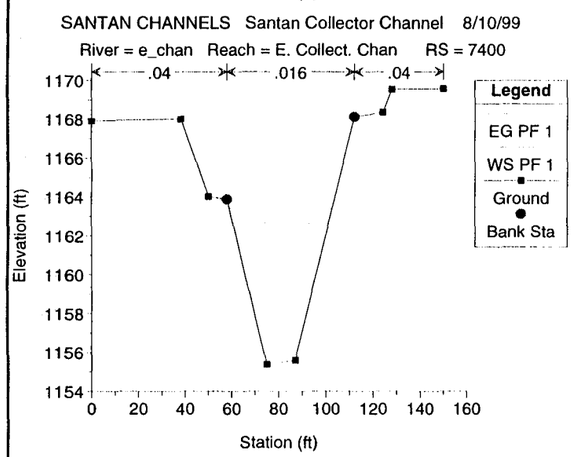


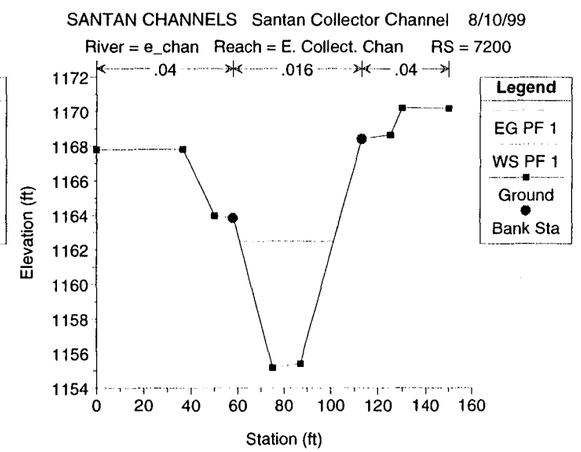

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 8200
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

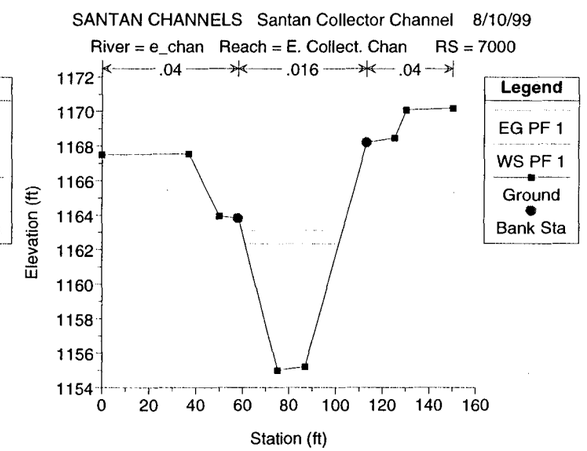

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 8000
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

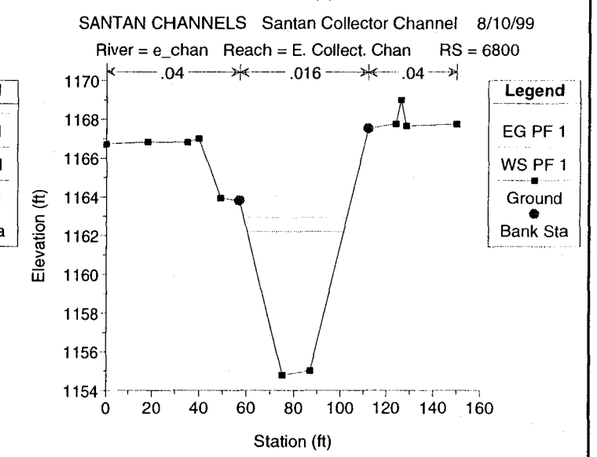

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 7800
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

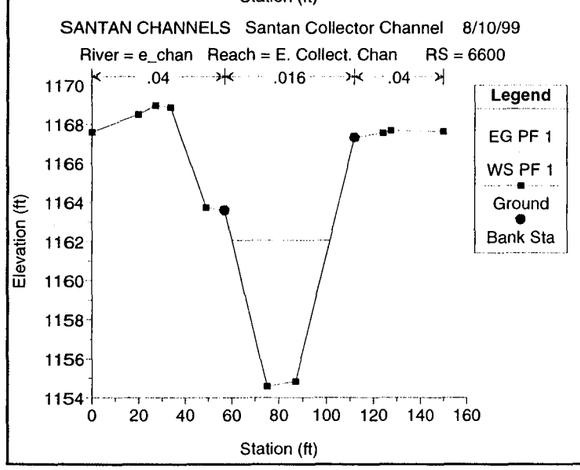

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 7600
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

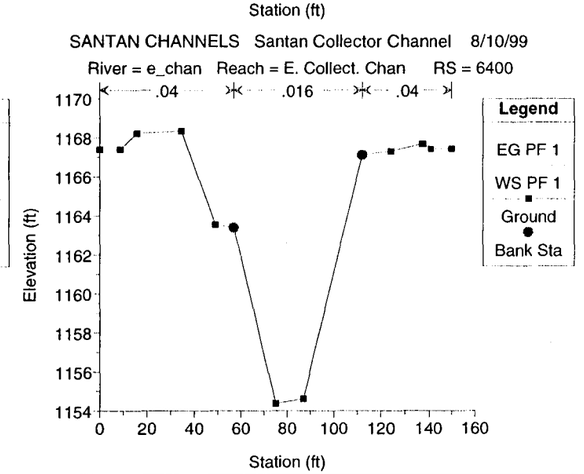

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 7400
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

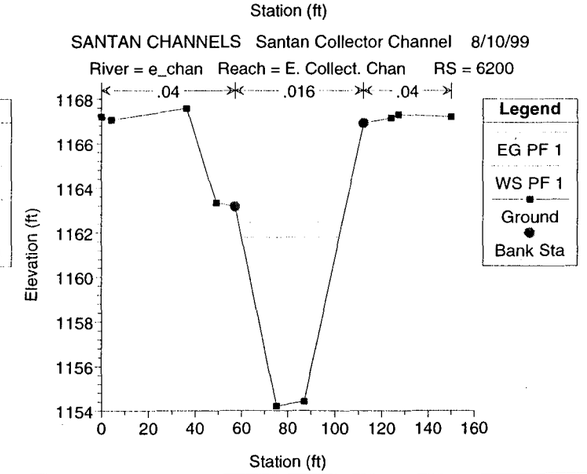

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 7200
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

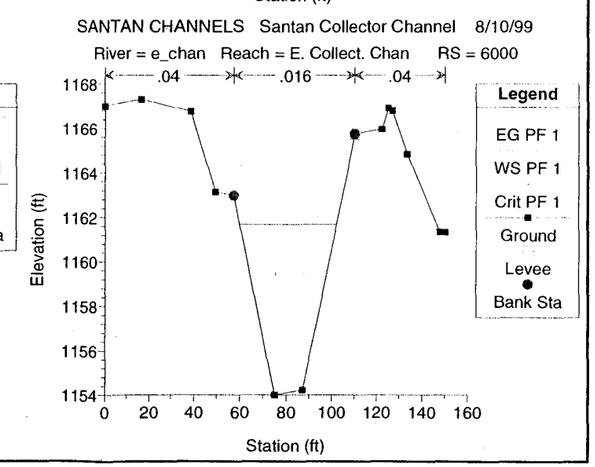

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 7000
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 6800
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

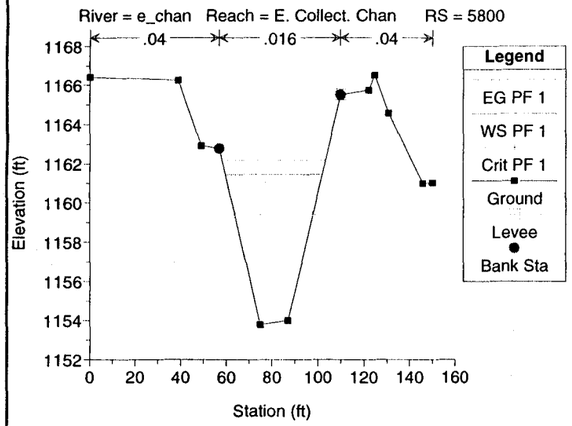

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 6600
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 6400
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

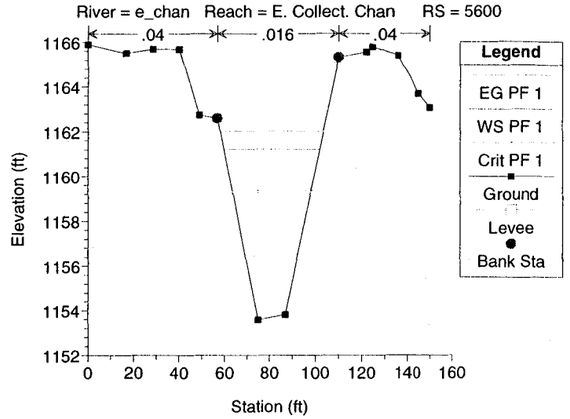

SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 6200
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 6000
.04 .016 .04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

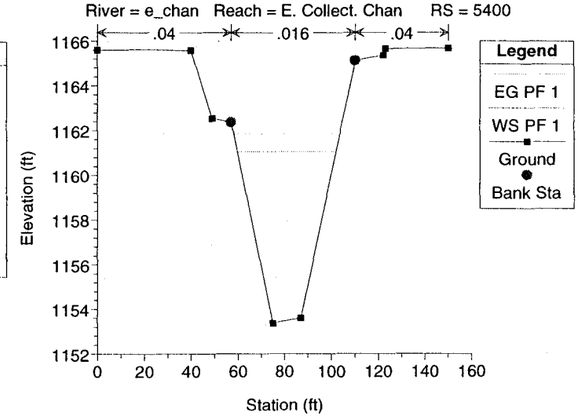
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 5800



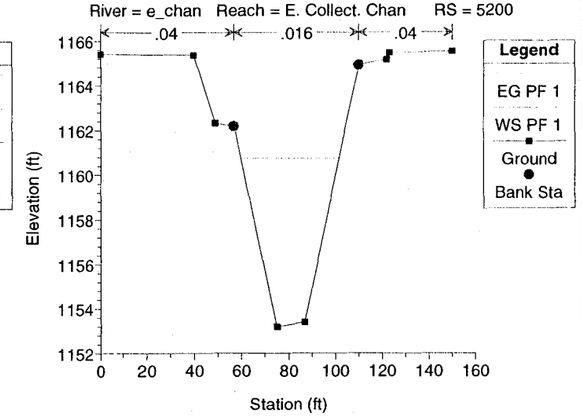
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 5600



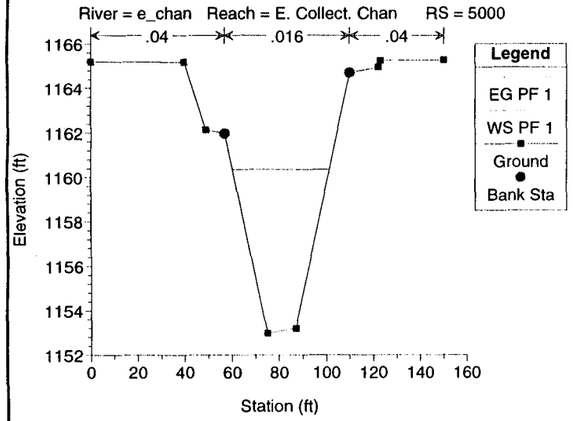
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 5400



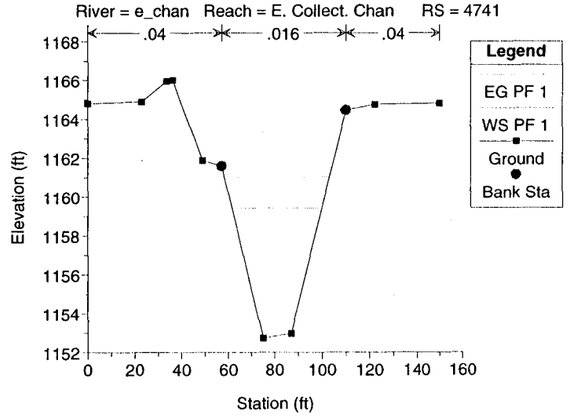
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 5200



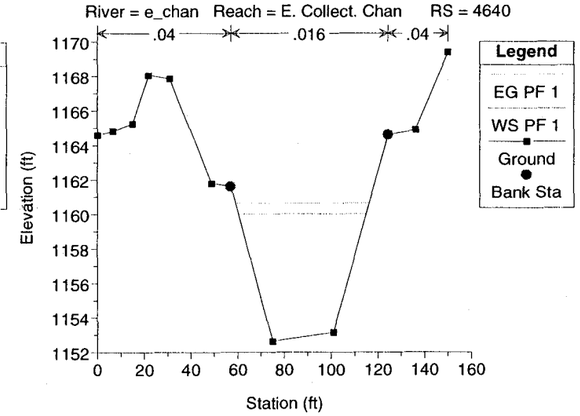
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 5000



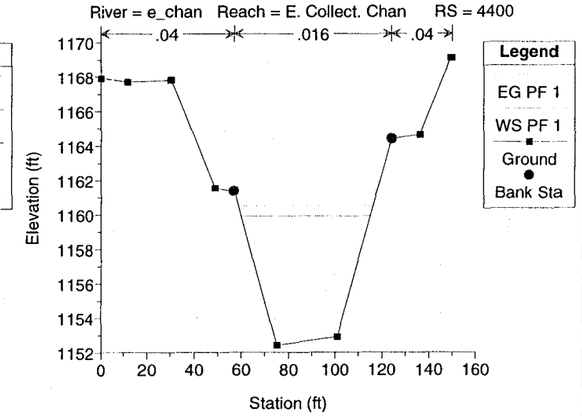
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 4741



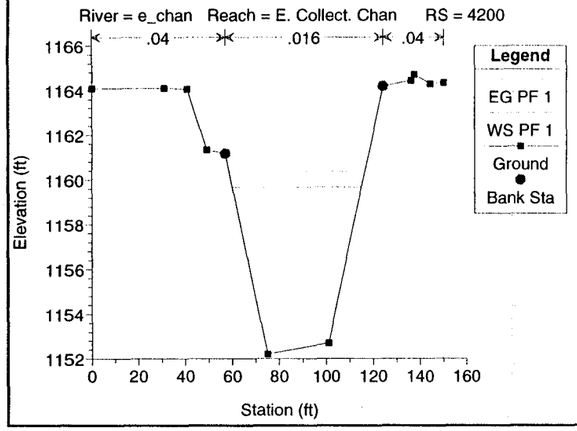
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 4640



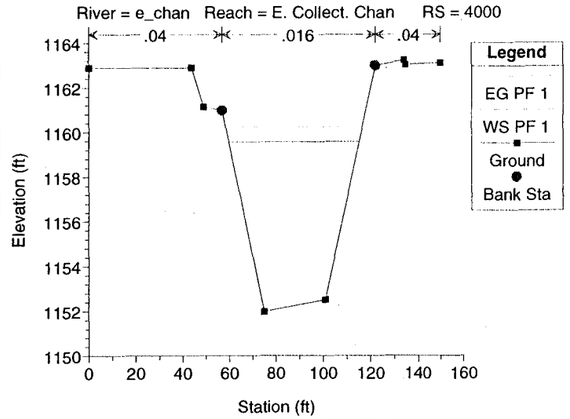
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 4400



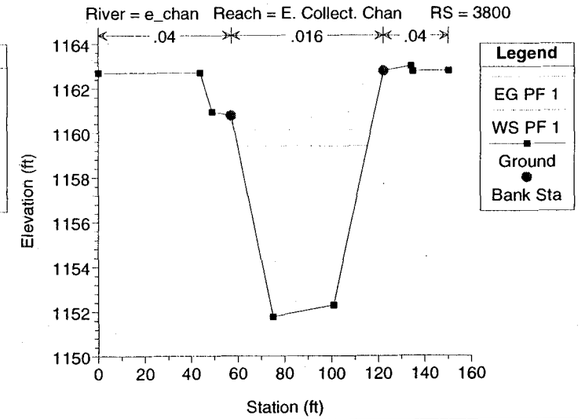
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 4200



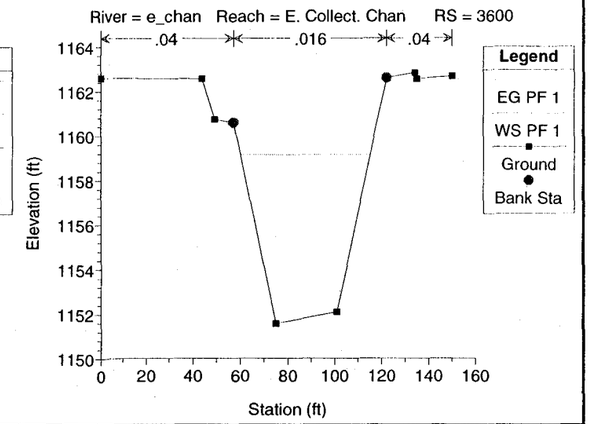
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 4000



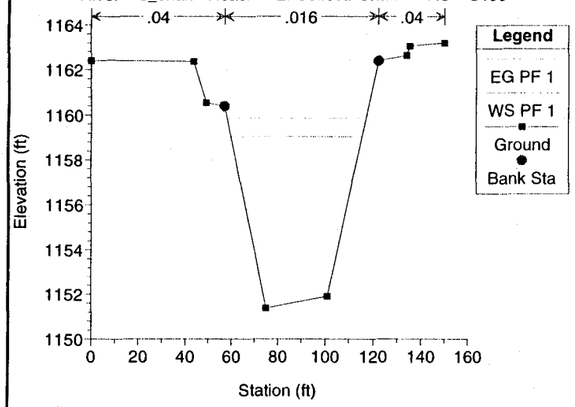
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 3800



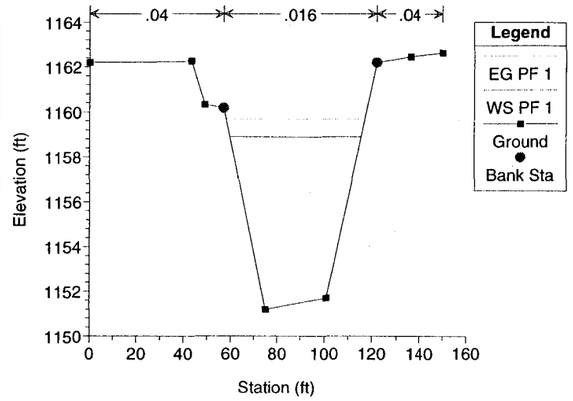
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 3600



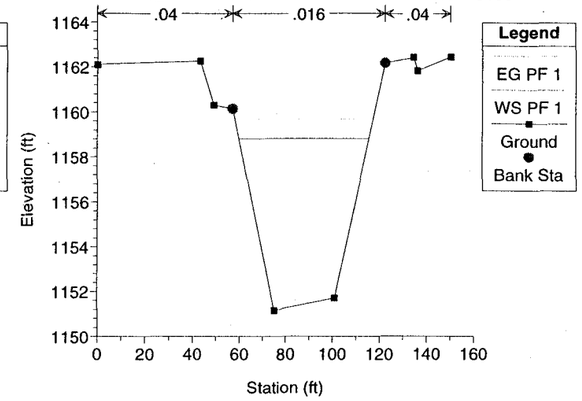
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 3400



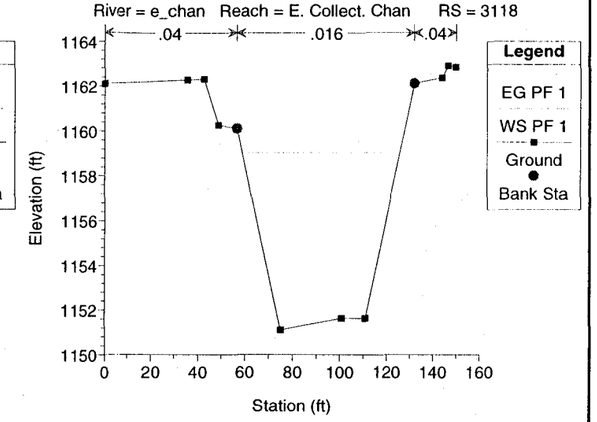
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 3200



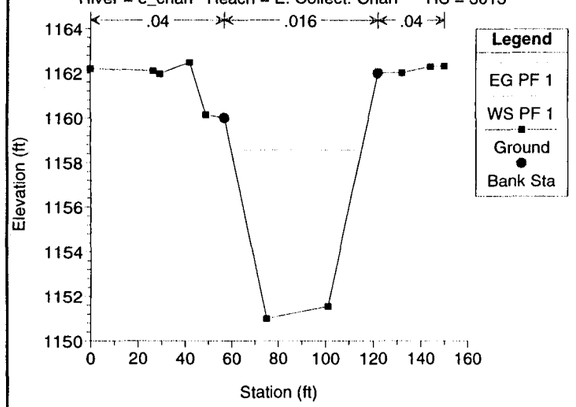
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 3168



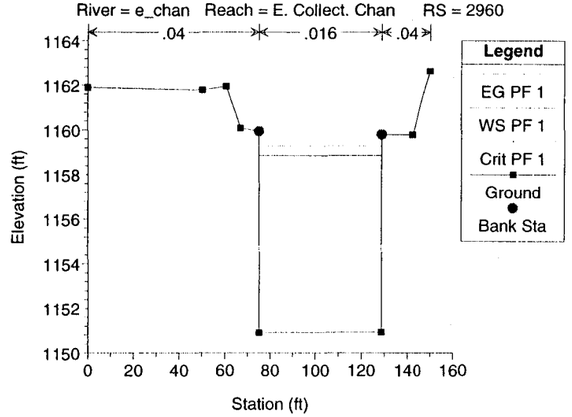
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 3118



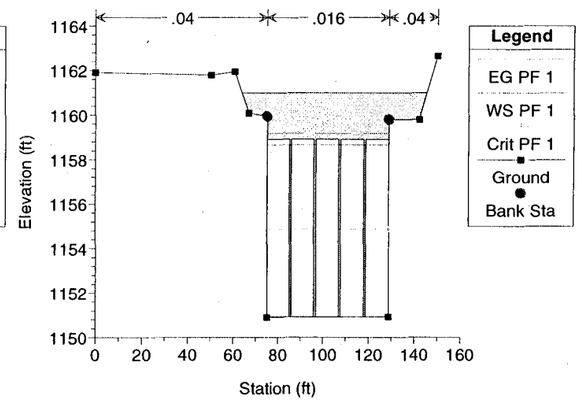
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 3013



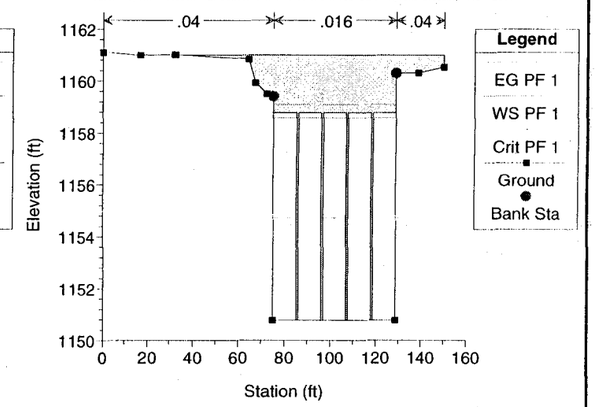
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 2960



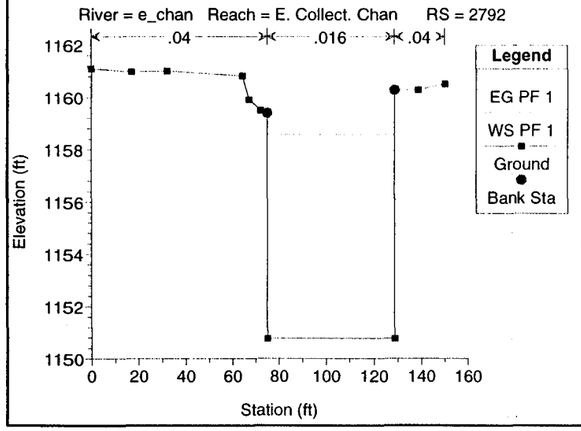
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan 5-10' x 8' x 168' CBC - Kyrene Crossing RS = 2959



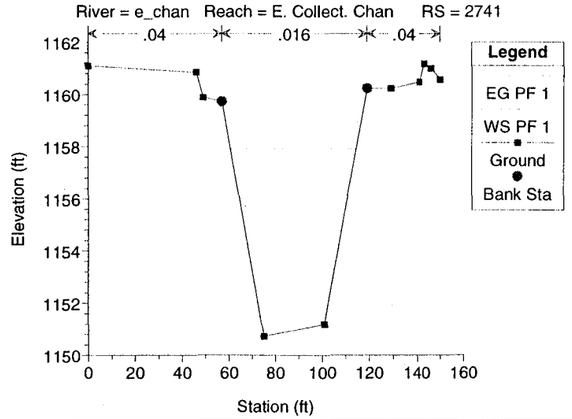
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan 5-10' x 8' x 168' CBC - Kyrene Crossing RS = 2959



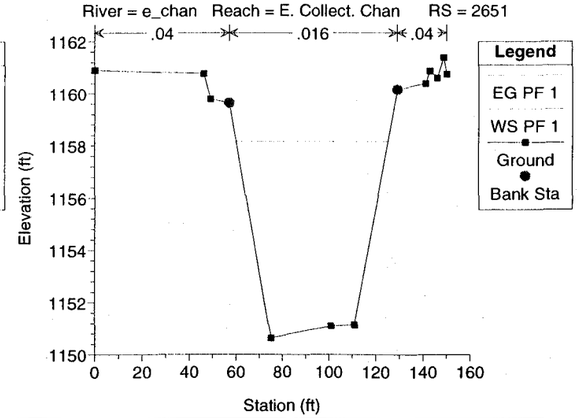
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 2792



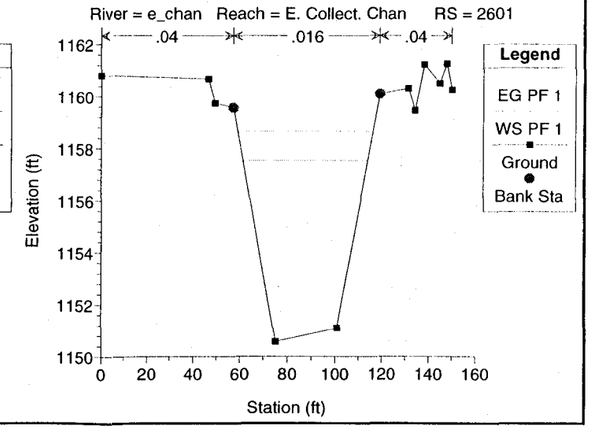
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 2741



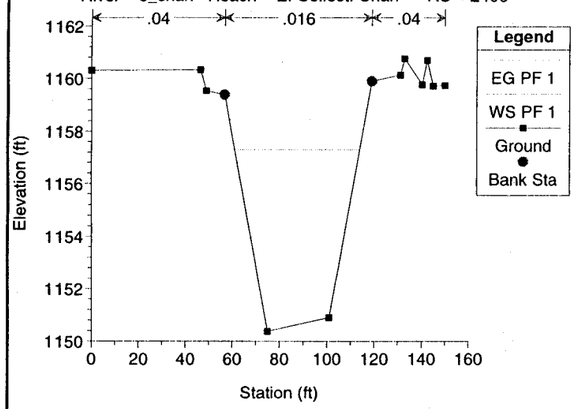
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 2651



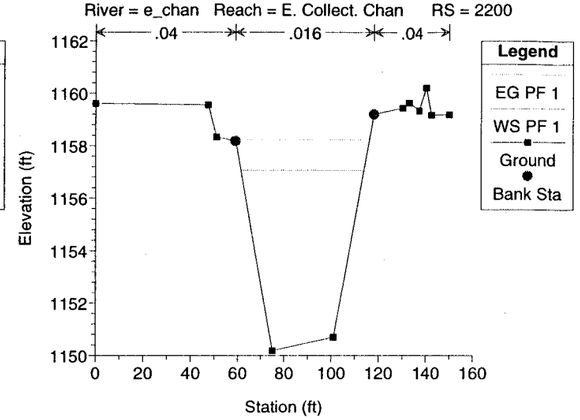
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 2601



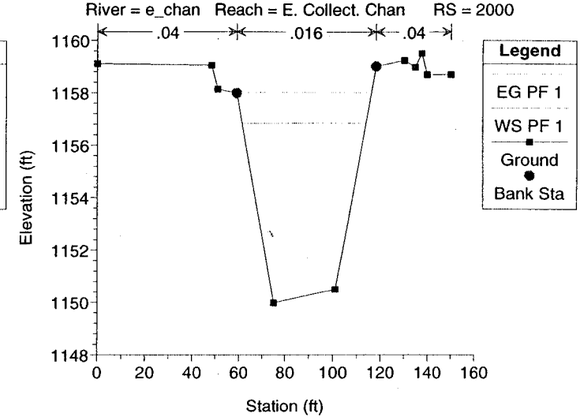
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 2400



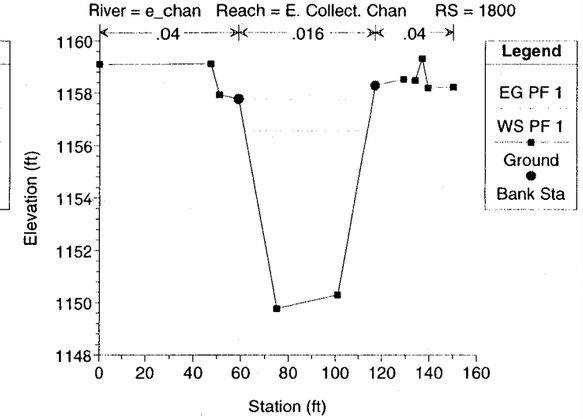
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 2200



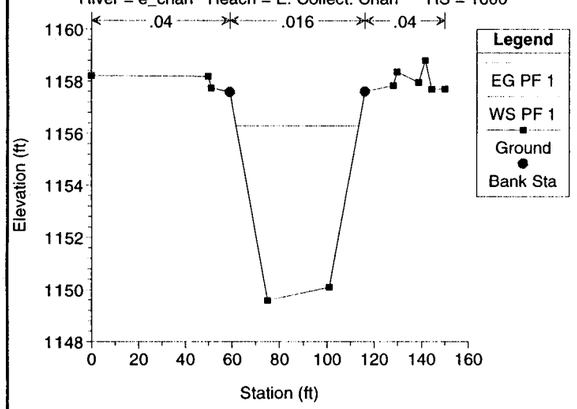
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 2000



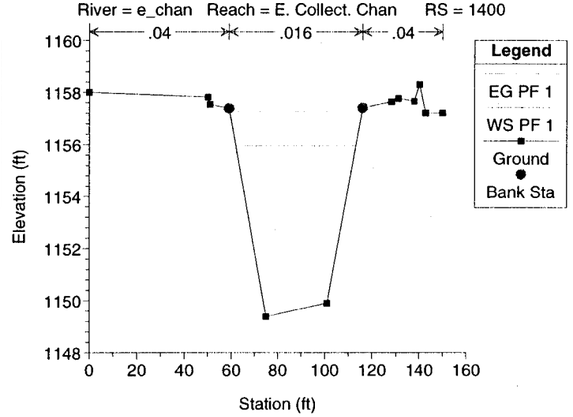
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 1800



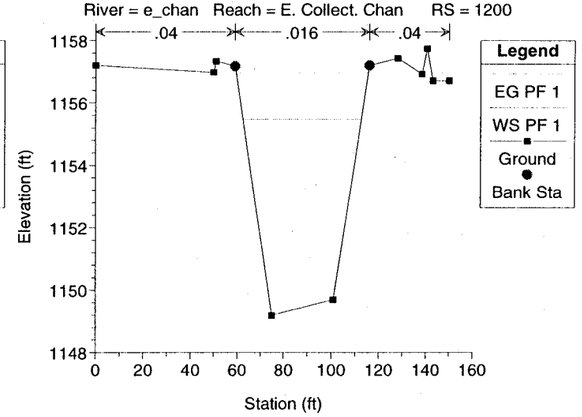
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 1600



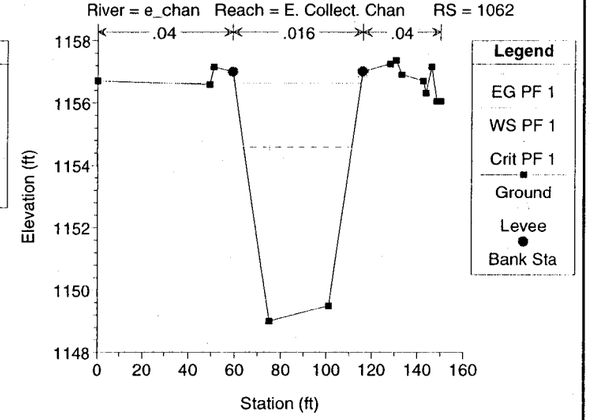
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 1400



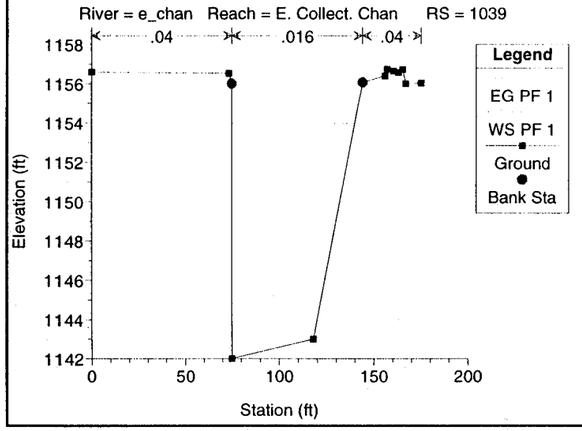
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 1200



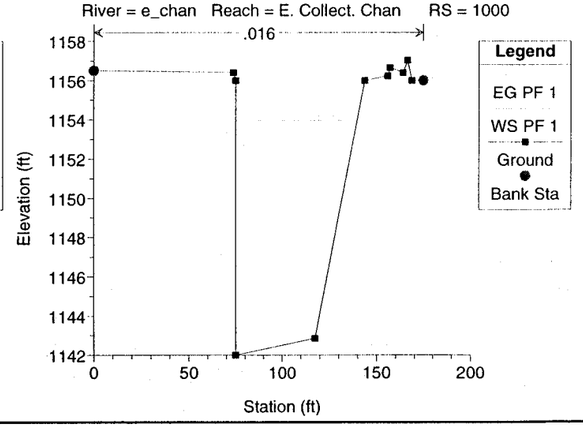
SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 1062



SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 1039



SANTAN CHANNELS Santan Collector Channel 8/10/99
River = e_chan Reach = E. Collect. Chan RS = 1000



Siphon Geometry: $Cell = 2$ $Span = 10$ $Rise = 8$

$Sta_g = 1531$ $Inv_g = 1146.11$ $Box\_area = Cell \cdot Span \cdot Rise$ $Box\_area = 160$

$Sta_f = 1594$ $Inv_f = 1144.94$ Constants: $g = 32.2$ $n = 0.013$

$Sta_e = 1650$ $Inv_e = 1132.11$

Tailwater Conditions:

$Q = 750$ $d_g = 8.03$ $v_g = 2.58$

$Sta_d = 1716$ $Inv_d = 1132.13$

Full flow hydraulic parameters:

$Sta_c = 1772$ $Inv_c = 1145.8$

$Sta_b = 1835$ $Inv_b = 1146.97$

$$v_p = \frac{Q}{Box\_area} \qquad hv_p = \frac{v_p^2}{2 \cdot g} \qquad hv_p = 0.34$$

Siphon slope lengths (geometry):

$$L_1 = \left[(Inv_f - Inv_e)^2 + (Sta_e - Sta_f)^2\right]^{\frac{1}{2}} \qquad L_1 = 57.45$$

$$L_2 = \left[(Inv_e - Inv_d)^2 + (Sta_d - Sta_e)^2\right]^{\frac{1}{2}} \qquad L_2 = 66$$

$$L_3 = \left[(Inv_c - Inv_d)^2 + (Sta_c - Sta_d)^2\right]^{\frac{1}{2}} \qquad L_3 = 57.64$$

$L_t = L_1 + L_2 + L_3$ $L_t = 181.1$ Total siphon length

Siphon Geometry Graphing Definitions:

$$Station = \begin{bmatrix} Sta_g \\ Sta_f \\ Sta_e \\ Sta_d \\ Sta_c \\ Sta_b \end{bmatrix} \qquad Inv = \begin{bmatrix} Inv_g \\ Inv_f \\ Inv_e \\ Inv_d \\ Inv_c \\ Inv_b \end{bmatrix} \qquad Soffit = Inv - Rise$$

Box Culvert Wetted Perimeter:

$W_p = Cell \cdot ((2 \cdot Span) + (2 \cdot Rise))$ $W_p = 72$

Box Culvert Hydraulic Radius:

$$r = \frac{Box\_area}{W_p} \qquad r = 2.22$$

Energy Equation Calculations:

End of Outlet Transition (Sta_g):

$hv_g = \frac{v_g^2}{2g}$ $\quad hv_g = 0.1$ $\quad$ Outfall channel velocity head

$HGL_g = Inv_g + d_g$ $\quad HGL_g = 1154.14$

$EGL_g = HGL_g + hv_g$ $\quad EGL_g = 1154.24$

Initial Guess $\quad d_1 = 5$

Given

$$Inv_g + d_g + \frac{v_g^2}{2 \cdot g} + 1.1 \cdot \left[0.7 \cdot \left[\frac{v_g^2}{2 \cdot g} - \frac{\left(\frac{Q}{24 \cdot d_1}\right)^2}{2 \cdot g}\right]\right] = Inv_f + \frac{\left(\frac{Q}{24 \cdot d_1}\right)^2}{2 \cdot g} + d_1$$

$dsolve1 = find(d_1)$ $\quad dsolve1 = 9.06$ $\quad Rise = 8$ $\quad vsolve1 = \frac{Q}{24 \cdot dsolve1}$

Maximum velocity switch: $\quad v_f = if(vsolve1 < v_p, v_p, vsolve1)$

$vsolve1 = 3.45$ $\quad v_p = 4.69$ $\quad v_f = 4.69$

$hv_f = \frac{v_f^2}{2 \cdot g}$ $\quad d_f = \frac{Q}{24 \cdot v_f}$ $\quad d_f = 6.67$

$hv_f = 0.34$ $\quad hv_p = 0.34$ $\quad hv_g = 0.1$

Outlet Transition Losses:

$h_o = 1.1 \cdot (0.7 \cdot hv_g - hv_f)$

$h_o = 0.18$

$EGL_f = EGL_g + h_o$ $\quad EGL_f = 1154.43$

$HGL_f = EGL_f - hv_f$ $\quad HGL_f = 1154.09$

Siphon Friction Slope Losses:

$S_f = \frac{(29.1 \cdot n^2 \cdot v_p^2)}{r^{\frac{4}{3}} \cdot 2g}$ $\quad S_f = 0.000579$

Siphon Losses (Sta_f to Sta_e):

$h_{fl} := L_1 \cdot S_f \qquad h_{fl} = 0.03$

Bend Losses:

$h_b := 1.1 \cdot (0.04 \cdot hv_p) \qquad h_b = 0.015$

$h_{l\_e} := h_{fl} - h_b \qquad h_{l\_e} = 0.05$

$EGL_e := EGL_f - h_{l\_e} \qquad EGL_e = 1154.47$

$HGL_e := EGL_e - hv_p \qquad HGL_e = 1154.13$

Siphon Losses (Sta_e to Sta_d):

$h_{f2} := L_2 \cdot S_f \qquad h_{f2} = 0.04$

$h_{l\_d} := h_{f2} - h_b \qquad h_{l\_d} = 0.05$

$EGL_d := EGL_e - h_{l\_d} \qquad EGL_d = 1154.53$

$HGL_d := EGL_d - hv_p \qquad HGL_d = 1154.19$

Siphon Losses (Sta_d to Sta_c):

$h_{f3} := L_3 \cdot S_f \qquad h_{f3} = 0.03$

$EGL_{c1} := EGL_d - h_{f3} \qquad EGL_{c1} = 1154.56$

Calculate critical depth at the inlet to the siphon:

$$d_{crit} := \sqrt[3]{\frac{\left(\frac{Q}{Cell \cdot Span}\right)^2}{g}} \qquad d_{crit} = 3.52$$

Check friction loss solution for inlet control and backwater effects:

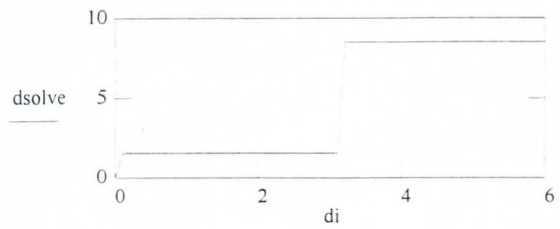
$\Delta EGL_c := EGL_{c1} - Inv_c \qquad \Delta EGL_c = 8.76$

Initial Guess $dvar := 6$ $Qvar := Q$ $\Delta EGLvar := \Delta EGL_c$

Given

$$\Delta EGLvar = dvar - \frac{\left(\frac{Qvar}{24 \cdot dvar}\right)^2}{2 \cdot g} \qquad df(\Delta EGLvar, Qvar, dvar) := minerr(dvar)$$

$id := 1..60$ $di_{id} := \frac{id}{10}$ $dsolve_{id} := df(\Delta EGLvar, Qvar, di_{id})$ $d_i := max(dsolve)$ $d_i = 8.554$



Check numerical solution:

$$d_i - \frac{\left(\frac{Qvar}{24 \cdot d_i}\right)^2}{2 \cdot g} = 8.76 \qquad \Delta EGLvar = 8.76$$

Real solution switch: $d_i := if\left(\Delta EGLvar = d_i - \frac{\left(\frac{Qvar}{24 \cdot d_i}\right)^2}{2 \cdot g}, 0, d_i\right)$ $d_i = 8.55$

Subcritical/supercritical flow condition switch: $d_c := if(d_i > d_{crit}, d_i, d_{crit})$ $d_c = 8.55$

$v_c := \frac{Q}{Cell \cdot Span \cdot d_c}$ $v_c = 4.38$ $hv_c := \frac{v_c^2}{2 \cdot g}$

$HGL_c := Inv_c + d_c$ $HGL_c = 1154.35$

$EGL_c := Inv_c + d_c + hv_c$ $EGL_c = 1154.65$

Inlet is controlled by critical depth if there is no solution for d_i

Assume HEC-RAS approach velocity head at the transition inlet:

Therefore, v_b=4.36 ft/sec at inlet transition

$v_b := 4.36$ $hv_b := \frac{v_b^2}{2 \cdot g}$ $hv_b = 0.3$ $h_i := 1.1 \cdot (0.4 \cdot hv_c - hv_b)$ $h_i = 1.43 \cdot 10^{-3}$

$EGL_{b1} := EGL_c - h_i$ $EGL_{b1} = 1154.65$ $EGL_{b1} - Inv_b = 7.68$

$d_{b1} := EGL_{b1} - hv_b - Inv_b$ $d_{b1} = 7.39$

Assumed Channel bottom width $B = 9$

$$dchan_{crit} = \sqrt[3]{\frac{\left(\frac{Q}{B}\right)^2}{g}} \qquad dchan_{crit} = 6 \qquad vchan_{crit} = \frac{Q}{B \cdot dchan_{crit}} \qquad vchan_{crit} = 13.9$$

$$hv_{chan\_crit} = \frac{vchan_{crit}^2}{2 \cdot g} \qquad hv_{chan\_crit} = 3 \qquad d_{b2} = dchan_{crit}$$

$$EGL_{b2} = Inv_b - dchan_{crit} - \frac{vchan_{crit}^2}{2 \cdot g} \qquad EGL_{b2} = 1155.97$$

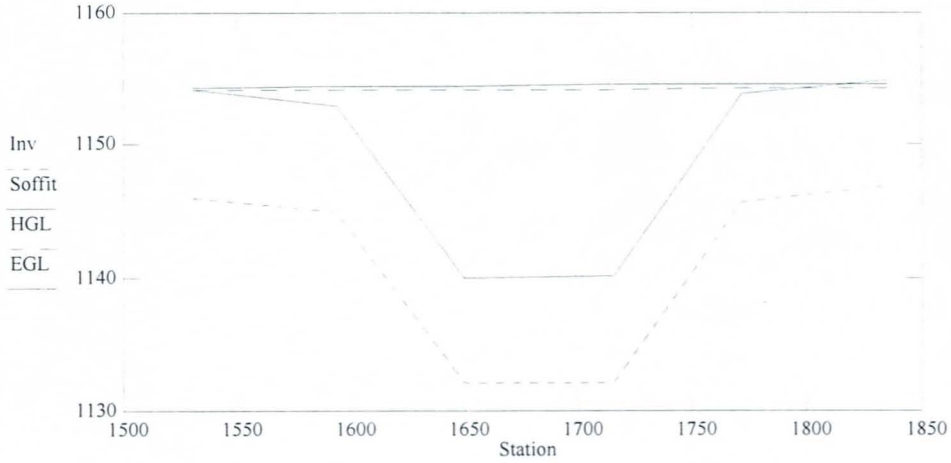
Subcritical/supercritical flow condition switch:

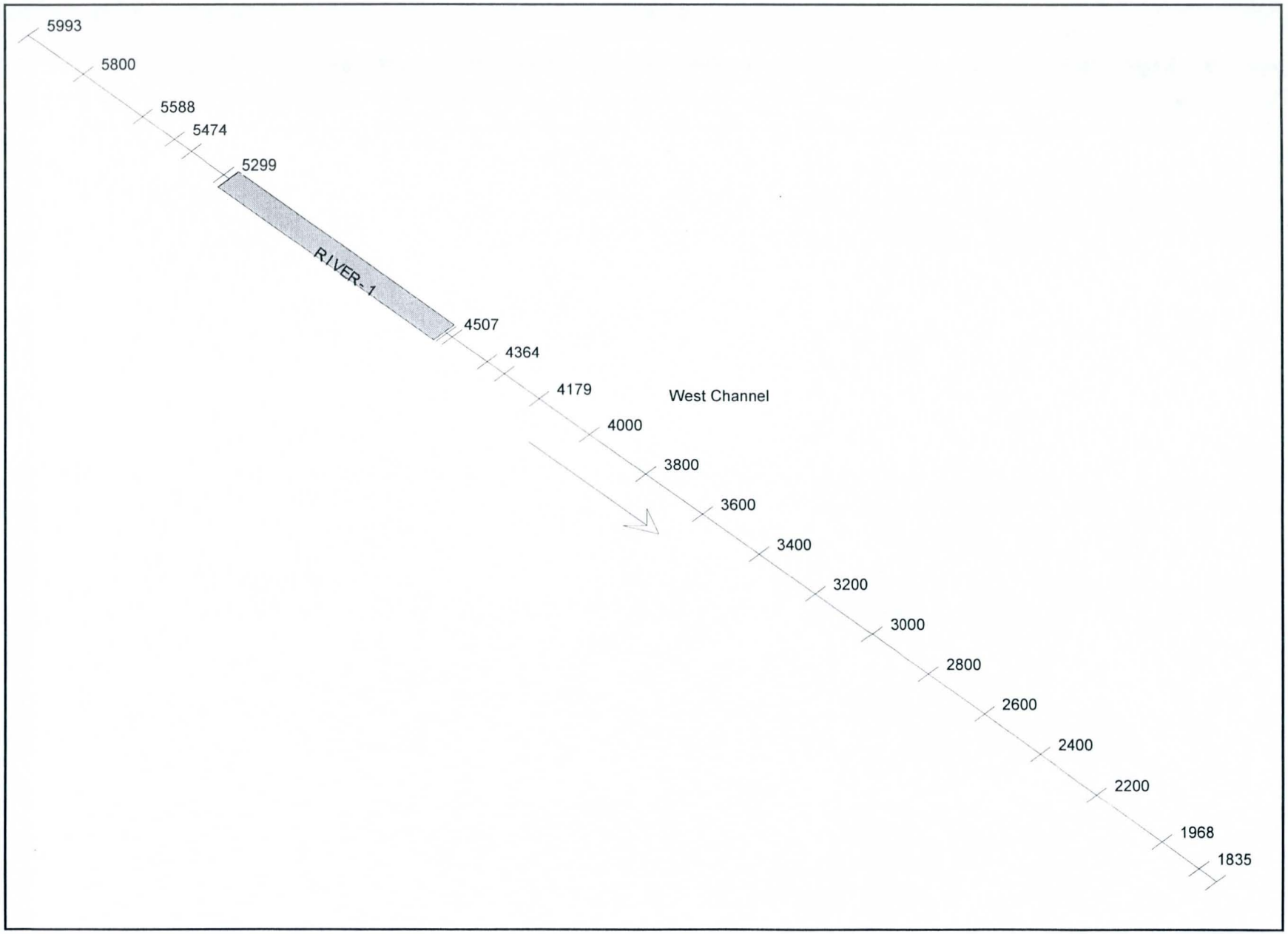
$$d_b = if(d_{b1} > d_{b2}, d_{b1}, d_{b2}) \qquad d_b = 7.39$$

$$EGL_b = if(d_b = d_{b1}, EGL_{b1}, EGL_{b2}) \qquad EGL_b = 1154.65$$ **Inlet water-surface elevation**

$$HGL_b = Inv_b - d_b \qquad HGL_b = 1154.36$$

$$Station = \begin{bmatrix} 1531.0 \\ 1594.0 \\ 1650.0 \\ 1716.0 \\ 1772.0 \\ 1835.0 \end{bmatrix} \qquad HGL = \begin{bmatrix} 1154.14 \\ 1154.09 \\ 1154.13 \\ 1154.19 \\ 1154.35 \\ 1154.36 \end{bmatrix} \qquad EGL = \begin{bmatrix} 1154.24 \\ 1154.43 \\ 1154.47 \\ 1154.53 \\ 1154.65 \\ 1154.65 \end{bmatrix}$$

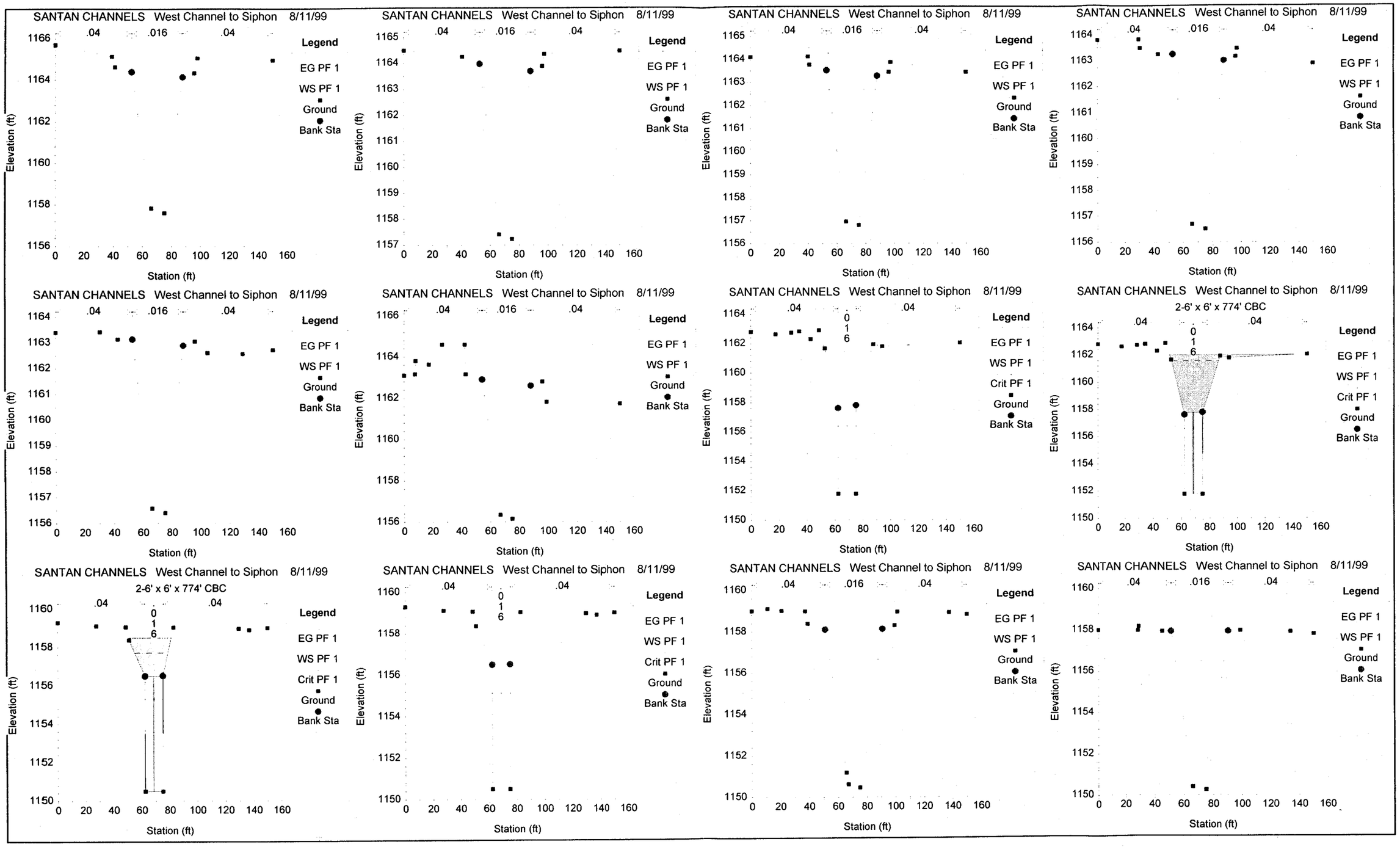


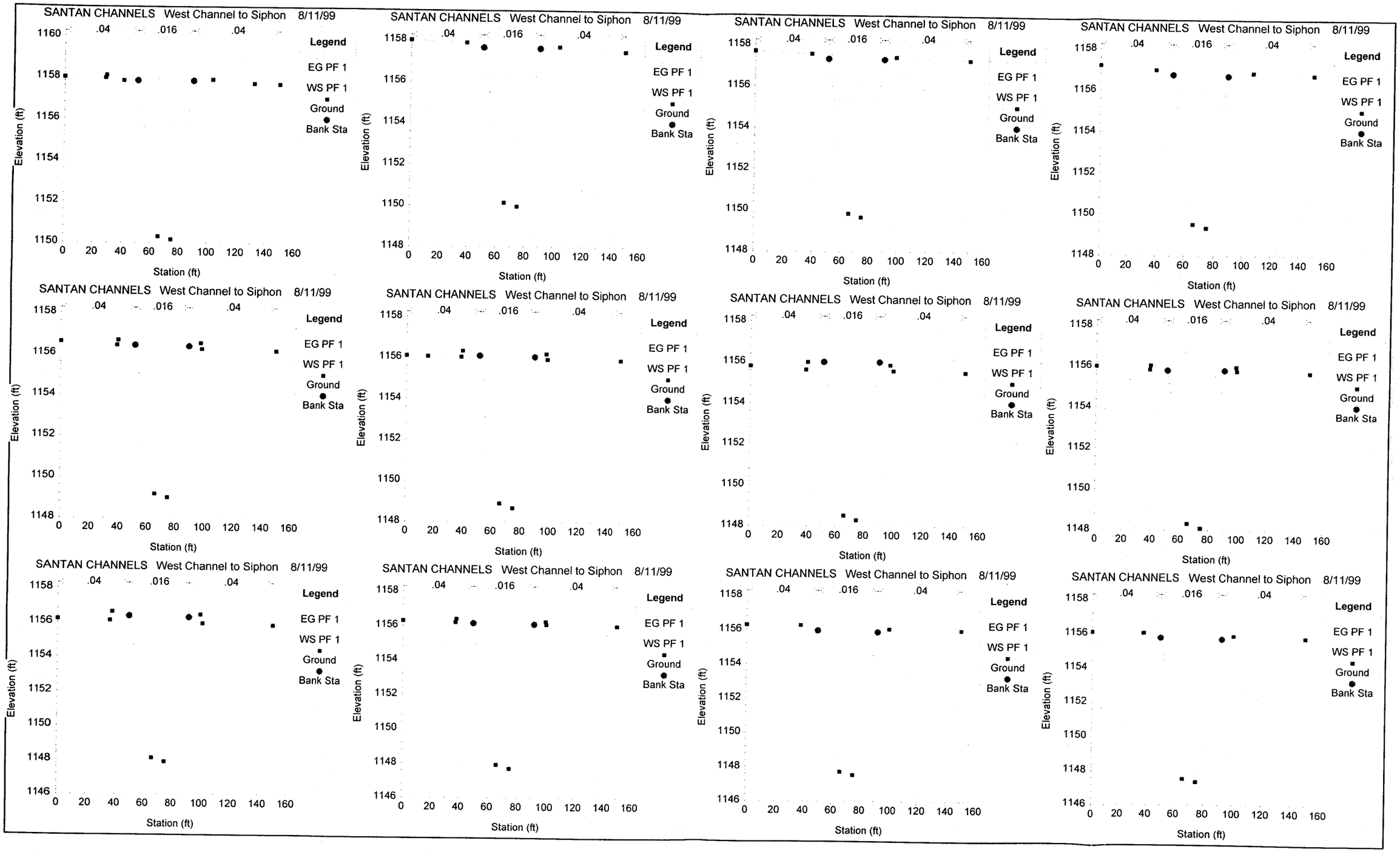

5993
5800
5588
5474
5299
RIVER-1
4507
4364
4179
West Channel
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
1968
1835

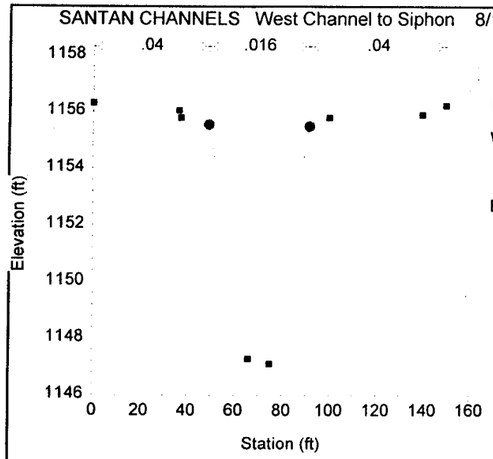
West Channel	
HEC-RAS River Sta	Construcion C_L & PGL
59+93.00	12+40.82
58+96.50	13+37.32
58+00.00	14+33.82
57+29.33	15+04.49
56+58.66	15+75.16
55+88.00	16+45.82
54+74.00	17+59.82
54+14.00	18+19.82
52+99.00	19+34.82
52+81.00	19+52.82
45+07.00	27+26.82
44+89.00	27+44.82
43+64.00	28+69.82
43+04.00	29+29.82
41+79.00	30+54.82
40+89.50	31+44.32
40+00.00	32+33.82
39+00.00	33+33.82
38+00.00	34+33.82
37+00.00	35+33.82
36+00.00	36+33.82
35+00.00	37+33.82
34+00.00	38+33.82
33+00.00	39+33.82
32+00.00	40+33.82
30+00.00	42+33.82
28+00.00	44+33.81
27+52.95	44+80.86
27+38.81	44+95.00
26+00.00	46+33.81
24+00.00	48+33.81
22+00.00	50+33.81
20+00.00	52+33.81
18+35.33	53+98.48
17+72.05	54+61.77
17+16.05	55+17.77
16+50.05	55+83.77
15+94.05	56+39.77
15+31.00	57+02.82
14+00.00	58+33.82
12+40.00	59+93.82
12+00.00	60+33.82
10+39.00	61+94.82
10+00.00	62+33.82

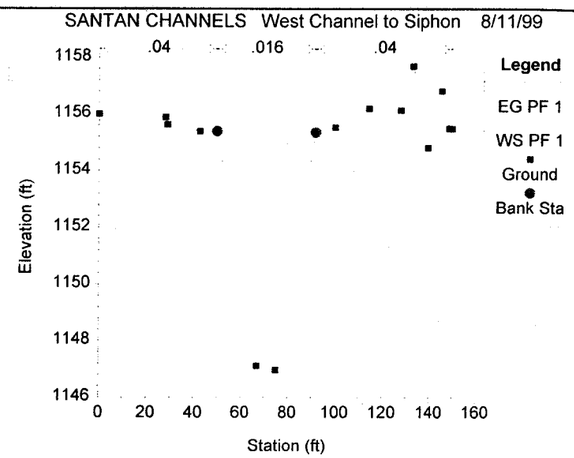
HEC-RAS Plan: w_chan River: RIVER-1 Reach: West Channel

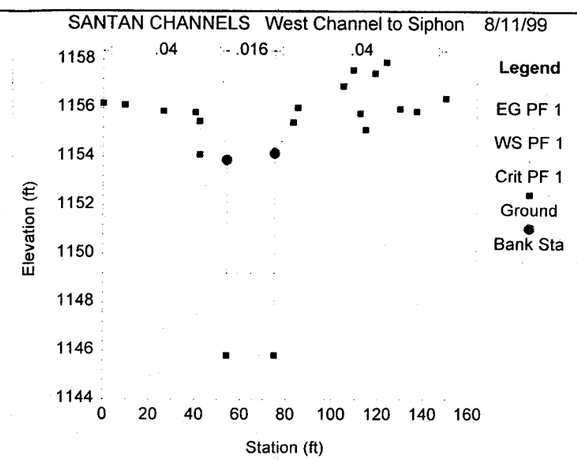
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	L. Freeboard	R. Freeboard	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
West Channel	5993	719.00	1157.60	1162.39	2.01	1.76		1163.48	0.002007	8.40	85.61	27.63	0.84
West Channel	5800	719.00	1157.23	1162.03	1.95	1.67		1163.09	0.001939	8.29	86.78	27.88	0.83
West Channel	5588	719.00	1156.80	1161.67	1.85	1.60		1162.68	0.001790	8.04	89.39	28.25	0.80
West Channel	5474	719.00	1156.52	1161.53	1.74	1.49		1162.46	0.001617	7.75	92.74	28.68	0.76
West Channel	5414	719.00	1156.40	1161.46	1.68	1.43		1162.36	0.001550	7.63	94.23	28.90	0.74
West Channel	5299	719.00	1156.14	1160.94	1.97	1.66		1162.12	0.002185	8.72	82.43	26.66	0.87
West Channel	5281	719.00	1151.77	1161.44	-3.82	-3.64	1156.38	1161.88	0.000406	5.49	160.97	32.88	0.31
West Channel	5280	Culvert											
West Channel	4507	719.00	1150.50	1155.13	1.37	1.39	1155.13	1157.44	0.004636	12.22	58.84	12.79	1.00
West Channel	4489	750.00	1150.47	1155.80	2.30	2.32		1156.65	0.001405	7.40	101.35	30.35	0.71
West Channel	4364	750.00	1150.26	1155.67	2.27	2.27		1156.46	0.001255	7.14	105.04	30.32	0.68
West Channel	4304	750.00	1150.16	1155.61	2.23	2.23		1156.39	0.001218	7.06	106.19	30.47	0.67
West Channel	4179	750.00	1149.95	1155.48	2.16	2.12		1156.23	0.001158	6.93	108.27	30.81	0.65
West Channel	4000	750.00	1149.66	1155.33	2.01	1.97		1156.02	0.001042	6.66	112.60	31.38	0.62
West Channel	3800	750.00	1149.33	1155.18	1.58	1.52		1155.80	0.000915	6.35	118.13	32.04	0.58
West Channel	3600	750.00	1149.00	1155.05	1.38	1.33		1155.61	0.000790	6.01	124.74	32.85	0.54
West Channel	3400	750.00	1148.67	1154.94	1.16	1.11		1155.45	0.000685	5.70	131.58	33.73	0.51
West Channel	3200	750.00	1148.30	1154.87	1.15	1.15		1155.30	0.000563	5.31	141.30	34.77	0.46
West Channel	3000	750.00	1148.10	1154.77	1.05	1.05		1155.19	0.000525	5.17	145.07	35.20	0.45
West Channel	2800	750.00	1147.90	1154.69	1.68	1.62		1155.08	0.000487	5.03	149.18	35.67	0.43
West Channel	2600	750.00	1147.70	1154.61	1.56	1.50		1154.98	0.000451	4.88	153.55	36.16	0.42
West Channel	2400	750.00	1147.54	1154.54	1.43	1.36		1154.89	0.000420	4.76	157.71	36.67	0.40
West Channel	2200	750.00	1147.34	1154.47	1.30	1.23		1154.80	0.000386	4.61	162.67	37.20	0.39
West Channel	1968	750.00	1147.10	1154.40	1.13	1.08		1154.71	0.000349	4.44	168.99	37.86	0.37
West Channel	1835	750.00	1146.96	1154.35	1.05	1.00		1154.66	0.000357	4.47	167.76	37.86	0.37
West Channel	1772	750.00	1145.80	1154.36	-0.49	-0.23	1149.21	1154.63	0.000249	4.18	183.92	34.31	0.25

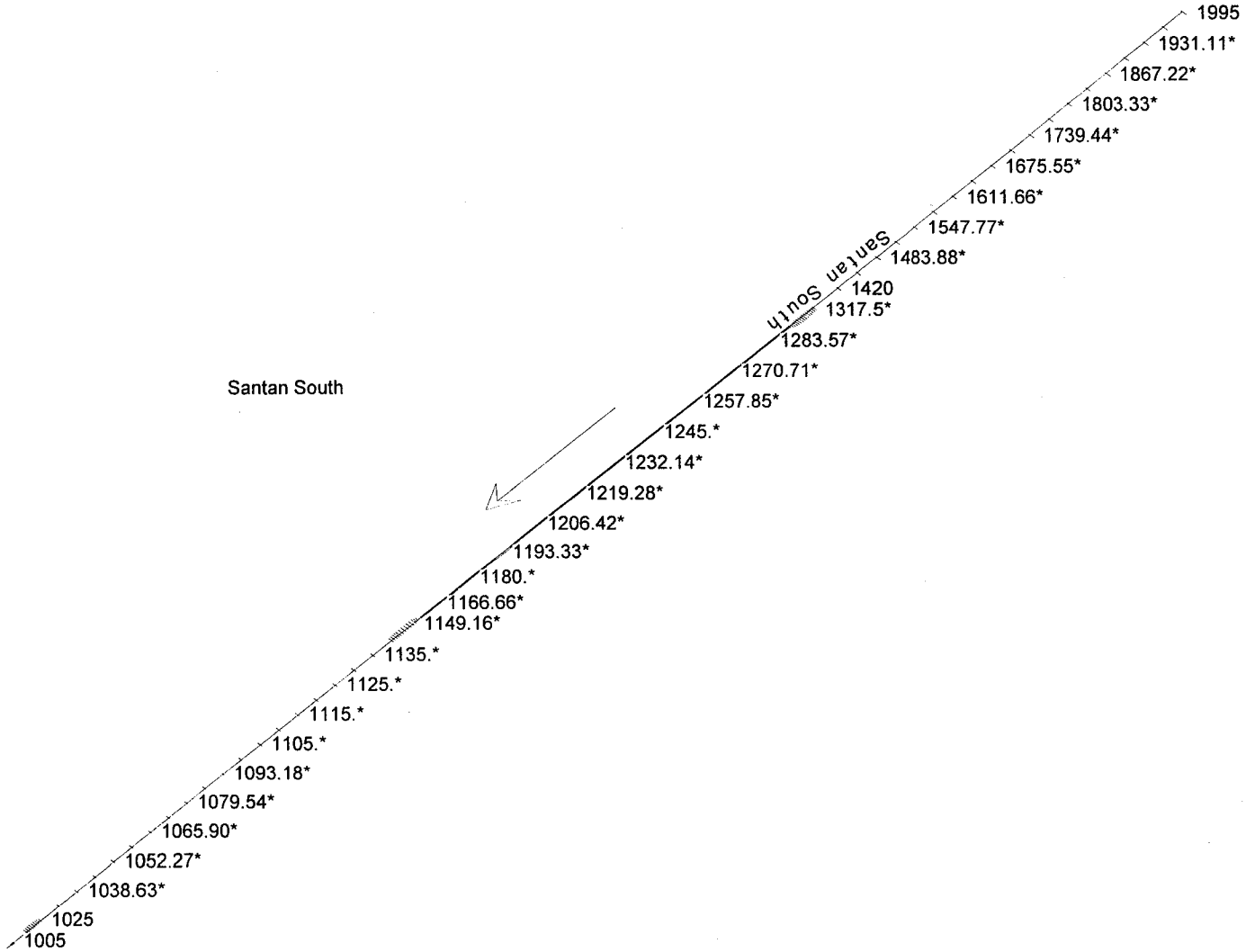

SANTAN CHANNELS West Channel to Siphon 8/11/99
2-6' x 6' x 774' CBC
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
.04
.016
0
1
6


SANTAN CHANNELS West Channel to Siphon 8/11/99
.04 .016 .04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


SANTAN CHANNELS West Channel to Siphon 8/11/99
.04
.016
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


SANTAN CHANNELS West Channel to Siphon 8/11/99
.04
.016
.04
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


SANTAN CHANNELS West Channel to Siphon 8/11/99
.04
.016
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


1995
1931.11*
1867.22*
1803.33*
1739.44*
1675.55*
1611.66*
1547.77*
1483.88*
1420
1317.5*
1283.57*
1270.71*
1257.85*
1245.*
1232.14*
1219.28*
1206.42*
1193.33*
1180.*
1166.66*
1149.16*
1135.*
1125.*
1115.*
1105.*
1093.18*
1079.54*
1065.90*
1052.27*
1038.63*
1025
1005
Santan South
Santan South

HEC-RAS Plan: SOC River: Santan South Reach: Santan South

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	L. Freeboard	R. Freeboard	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Santan South	1995	24.49	349.14	351.14	1.46	1.46		351.23	0.000289	1.27	19.26	13.78	0.34
Santan South	1963.05*	24.49	349.10	351.13	1.38	1.38		351.21	0.000276	1.25	19.56	13.84	0.34
Santan South	1931.11*	24.49	349.06	351.12	1.31	1.29		351.19	0.000260	1.22	20.00	14.01	0.33
Santan South	1899.16*	24.49	349.02	351.11	1.23	1.21		351.18	0.000247	1.20	20.37	14.09	0.32
Santan South	1867.22*	24.49	348.98	351.10	1.16	1.13		351.17	0.000233	1.18	20.82	14.24	0.31
Santan South	1835.27*	24.49	348.94	351.09	1.08	1.04		351.15	0.000221	1.15	21.23	14.35	0.30
Santan South	1803.33*	24.49	348.90	351.08	1.00	0.96		351.14	0.000209	1.13	21.63	14.44	0.30
Santan South	1771.38*	24.49	348.86	351.07	0.92	0.88		351.13	0.000197	1.11	22.15	14.61	0.29
Santan South	1739.44*	24.49	348.82	351.06	0.85	0.79		351.12	0.000186	1.09	22.57	14.70	0.28
Santan South	1707.5*	24.49	348.78	351.05	0.77	0.71		351.11	0.000180	1.07	22.87	14.78	0.27
Santan South	1675.55*	24.49	348.74	351.04	0.69	0.62		351.10	0.000166	1.04	23.56	14.98	0.26
Santan South	1643.61*	24.49	348.70	351.04	0.61	0.53		351.09	0.000156	1.01	24.14	15.18	0.26
Santan South	1611.66*	24.49	348.66	351.03	0.53	0.45		351.08	0.000148	1.00	24.58	15.26	0.25
Santan South	1579.72*	24.49	348.62	351.03	0.45	0.36		351.07	0.000140	0.98	25.06	15.37	0.24
Santan South	1547.77*	24.49	348.58	351.02	0.37	0.27		351.07	0.000132	0.96	25.55	15.48	0.24
Santan South	1515.83*	24.49	348.54	351.01	0.29	0.19		351.06	0.000124	0.94	26.18	15.68	0.23
Santan South	1483.88*	24.49	348.50	351.01	0.20	0.10		351.05	0.000117	0.91	26.79	15.87	0.22
Santan South	1451.94*	24.49	348.46	351.00	0.13	0.01		351.05	0.000111	0.90	27.30	15.97	0.22
Santan South	1420	24.49	348.42	351.00	0.04	-0.08		351.04	0.000103	0.88	28.01	18.32	0.21
Santan South	1320	24.49	348.37	351.00	0.24	-0.13		351.03	0.000095	0.86	28.87	18.41	0.20
Santan South	1317.5*	24.49	348.36	351.00	0.23	-0.14		351.03	0.000076	0.78	31.58	19.44	0.18
Santan South	1315.*	24.49	348.36	351.00	0.23	-0.14		351.03	0.000063	0.72	34.18	20.44	0.17
Santan South	1312.5*	24.49	348.36	351.00	0.23	-0.14		351.03	0.000052	0.67	36.80	21.45	0.15
Santan South	1310	24.49	348.35	351.01	0.22	-0.15		351.03	0.000044	0.62	39.48	22.46	0.14
Santan South	1308.33*	24.49	348.35	351.00	0.22	-0.15		351.03	0.000051	0.65	37.77	22.47	0.15
Santan South	1306.66*	24.49	348.35	351.00	0.22	-0.15		351.02	0.000061	0.69	35.90	22.47	0.16
Santan South	1305.*	24.49	348.34	351.00	0.21	-0.16		351.02	0.000074	0.73	33.96	22.47	0.18
Santan South	1303.33*	24.49	348.34	350.99	0.22	-0.15		351.02	0.000089	0.77	32.07	22.45	0.20
Santan South	1301.66*	24.49	348.33	350.99	0.21	-0.16		351.02	0.000107	0.81	30.40	22.48	0.21
Santan South	1300	24.49	348.33	350.99	0.21	-0.15		351.02	0.000091	0.84	29.38	18.47	0.20
Santan South	1297.75*	24.49	348.33	350.97	0.23	-0.14		351.02	0.000097	0.94	26.31	16.07	0.22
Santan South	1295.5*	24.49	348.32	350.95	0.24	-0.14		351.01	0.000130	1.08	22.83	13.47	0.24
Santan South	1293.25*	24.49	348.32	350.92	0.27	-0.11		351.01	0.000166	1.27	19.44	11.07	0.27
Santan South	1291	24.49	348.32	350.87	0.32	-0.06		351.00	0.000252	1.54	16.04	8.63	0.31
Santan South	1290	24.49	348.32	350.84	-0.12	-0.12	349.51	350.99	0.000864	1.70	14.39		0.34
Santan South	1283.57*	24.49	348.28	350.80	-0.12	-0.12	349.47	350.94	0.000862	1.70	14.39		0.34
Santan South	1277.14*	24.49	348.24	350.75	-0.11	-0.11	349.43	350.90	0.000862	1.70	14.39		0.34
Santan South	1270.71*	24.49	348.20	350.71	-0.11	-0.11	349.39	350.86	0.000862	1.70	14.39		0.34
Santan South	1264.28*	24.49	348.16	350.67	-0.11	-0.11	349.35	350.81	0.000862	1.70	14.39		0.34
Santan South	1257.85*	24.49	348.12	350.62	-0.10	-0.10	349.31	350.77	0.000862	1.70	14.39		0.34
Santan South	1251.42*	24.49	348.08	350.58	-0.10	-0.10	349.27	350.73	0.000859	1.70	14.41		0.34
Santan South	1245.*	24.49	348.04	350.54	-0.10	-0.10	349.23	350.69	0.000859	1.70	14.41		0.34
Santan South	1238.57*	24.49	348.00	350.50	-0.09	-0.09	349.19	350.64	0.000859	1.70	14.41		0.34
Santan South	1232.14*	24.49	347.96	350.45	-0.09	-0.09	349.15	350.60	0.000862	1.70	14.39		0.34
Santan South	1225.71*	24.49	347.92	350.41	-0.09	-0.09	349.11	350.56	0.000862	1.70	14.39		0.34

HEC-RAS Plan: SOC River: Santan South Reach: Santan South (Continued)

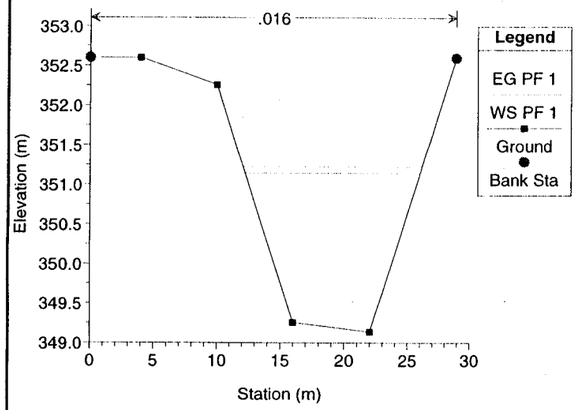
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	L. Freeboard	R. Freeboard	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Santan South	1219.28*	24.49	347.88	350.37	-0.09	-0.09	349.07	350.51	0.000862	1.70	14.39		0.34
Santan South	1212.85*	24.49	347.84	350.32	-0.08	-0.08	349.03	350.47	0.000862	1.70	14.39		0.34
Santan South	1206.42*	24.49	347.80	350.28	-0.08	-0.08	348.99	350.43	0.000862	1.70	14.39		0.35
Santan South	1200	24.49	347.76	350.24	-0.08	-0.08	348.95	350.38	0.000861	1.70	14.41		0.34
Santan South	1193.33*	24.49	347.72	350.20	-0.07	-0.07	348.92	350.35	0.000859	1.70	14.41		0.35
Santan South	1186.66*	24.49	347.69	350.16	-0.07	-0.07	348.88	350.31	0.000862	1.70	14.39		0.35
Santan South	1180.*	24.49	347.66	350.13	-0.07	-0.07	348.85	350.28	0.000862	1.70	14.39		0.35
Santan South	1173.33*	24.49	347.62	350.09	-0.07	-0.07	348.82	350.24	0.000867	1.71	14.36		0.35
Santan South	1166.66*	24.49	347.59	350.06	-0.07	-0.07	348.78	350.20	0.000862	1.70	14.39		0.35
Santan South	1160	24.49	347.56	350.02	-0.06	-0.06	348.75	350.17	0.000861	1.70	14.41		0.35
Santan South	1159	24.49	347.56	350.03	1.43	1.43		350.16	0.000423	1.59	15.39	6.23	0.32
Santan South	1156.75*	24.49	347.55	350.03	1.34	1.34		350.15	0.000371	1.56	15.71	7.53	0.34
Santan South	1154.5*	24.49	347.55	350.03	1.25	1.25		350.15	0.000336	1.49	16.47	9.02	0.35
Santan South	1152.25*	24.49	347.55	350.04	1.15	1.15		350.14	0.000321	1.42	17.27	10.58	0.35
Santan South	1150	32.56	347.55	349.91	1.18	1.18		350.11	0.000698	1.96	16.64	11.78	0.53
Santan South	1149.16*	32.56	347.54	349.91	1.18	1.18		350.10	0.000703	1.96	16.59	11.76	0.53
Santan South	1148.33*	32.56	347.53	349.90	1.18	1.18		350.10	0.000689	1.95	16.73	11.84	0.52
Santan South	1147.5*	32.56	347.53	349.94	1.15	1.15		350.08	0.000600	1.67	19.46	15.92	0.48
Santan South	1146.66*	32.56	347.52	349.96	1.11	1.11		350.06	0.000390	1.47	22.21	16.03	0.40
Santan South	1145.83*	32.56	347.52	349.97	1.10	1.10		350.06	0.000268	1.31	24.91	16.11	0.34
Santan South	1145	32.56	347.51	349.98	1.09	1.08		350.05	0.000195	1.19	27.45	16.17	0.29
Santan South	1143.75*	32.56	347.51	349.96	1.10	1.10		350.05	0.000252	1.31	24.77	15.10	0.33
Santan South	1142.5*	32.56	347.50	349.93	1.12	1.12		350.04	0.000334	1.47	22.14	14.03	0.37
Santan South	1141.25*	32.56	347.50	349.89	1.16	1.16		350.04	0.000480	1.69	19.22	12.87	0.44
Santan South	1140	32.56	347.50	349.82	1.23	1.22		350.03	0.000762	2.02	16.10	11.60	0.55
Santan South	1135.*	32.56	347.46	349.78	1.07	1.07		349.99	0.000759	2.02	16.13	11.63	0.55
Santan South	1130.*	32.56	347.42	349.74	0.92	0.91		349.95	0.000765	2.03	16.07	11.57	0.55
Santan South	1125.*	32.56	347.38	349.71	0.75	0.75		349.92	0.000758	2.02	16.12	11.60	0.55
Santan South	1120.*	32.56	347.34	349.67	0.59	0.59		349.88	0.000776	2.03	16.01	11.61	0.55
Santan South	1115.*	32.56	347.30	349.63	0.44	0.44		349.84	0.000748	2.01	16.22	11.66	0.54
Santan South	1110.*	32.56	347.26	349.59	0.28	0.28		349.80	0.000751	2.01	16.17	11.60	0.54
Santan South	1105.*	32.56	347.22	349.56	0.12	0.12		349.76	0.000746	2.01	16.22	11.62	0.54
Santan South	1100	32.56	347.19	349.52	-0.04	-0.04		349.73	0.000723	2.00	16.47	18.66	0.54
Santan South	1093.18*	32.56	347.15	349.49	-0.04	-0.05		349.69	0.000715	1.99	16.56	19.05	0.53
Santan South	1086.36*	32.56	347.11	349.46	-0.04	-0.04		349.66	0.000717	1.99	16.55	19.41	0.53
Santan South	1079.54*	32.56	347.07	349.42	-0.05	-0.05		349.62	0.000706	1.98	16.67	19.90	0.53
Santan South	1072.72*	32.56	347.03	349.39	-0.06	-0.06		349.59	0.000692	1.97	16.82	19.90	0.53
Santan South	1065.90*	32.56	347.00	349.36	-0.06	-0.07		349.55	0.000685	1.96	16.91	19.90	0.52
Santan South	1059.09*	32.56	346.96	349.32	-0.06	-0.06		349.52	0.000683	1.96	16.93	19.90	0.52
Santan South	1052.27*	32.56	346.92	349.29	-0.07	-0.07		349.49	0.000667	1.95	17.12	19.90	0.52
Santan South	1045.45*	32.56	346.88	349.26	-0.08	-0.08		349.45	0.000653	1.93	17.30	19.90	0.51
Santan South	1038.63*	32.56	346.85	349.23	-0.08	-0.09		349.42	0.000645	1.93	17.38	19.90	0.51
Santan South	1031.81*	32.56	346.81	349.20	-0.09	-0.09		349.39	0.000638	1.92	17.48	19.90	0.51
Santan South	1025	32.56	346.77	349.17	-0.10	-0.10		349.36	0.000618	1.90	17.73	19.90	0.50
Santan South	1023.33*	32.56	346.77	349.21	-0.14	-0.14		349.34	0.000372	1.57	21.61	21.20	0.39

HEC-RAS Plan: SOC River: Santan South Reach: Santan South (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	L. Freeboard	R. Freeboard	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(m3/s)	(m)	(m)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Santan South	1021.66*	32.56	346.76	349.24	-0.18	-0.18		349.33	0.000238	1.32	25.73	22.60	0.32
Santan South	1020	32.56	346.76	349.25	-0.19	-0.19		349.32	0.000173	1.16	29.21	23.90	0.28
Santan South	1019.*	32.56	346.76	349.24	-0.18	-0.19		349.32	0.000220	1.25	27.23	23.90	0.31
Santan South	1018.*	32.56	346.75	349.22	-0.17	-0.17		349.32	0.000284	1.35	25.24	23.90	0.35
Santan South	1017.*	32.56	346.75	349.20	-0.15	-0.15		349.31	0.000387	1.48	23.01	23.90	0.40
Santan South	1016.*	32.56	346.74	349.18	-0.14	-0.14		349.31	0.000540	1.63	20.81	23.90	0.46
Santan South	1015	32.56	346.74	349.12	-0.08	-0.08		349.30	0.000889	1.90	17.68	23.90	0.58
Santan South	1010	32.56	346.73	349.00	0.76	0.76	348.12	349.27	0.000608	2.28	14.28	6.28	0.48
Santan South	1005	Culvert											
Santan South	1000	32.56	346.70	348.78	1.21	1.21	348.10	349.10	0.000780	2.49	13.05	6.28	0.55

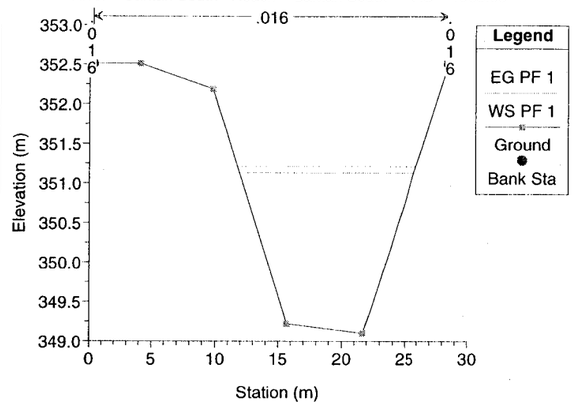
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South End Side Slope Transition - "A-2" Alignm RS = 1995



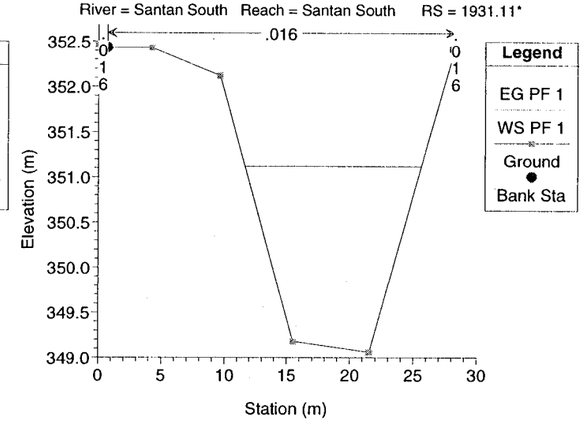
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1963.05*



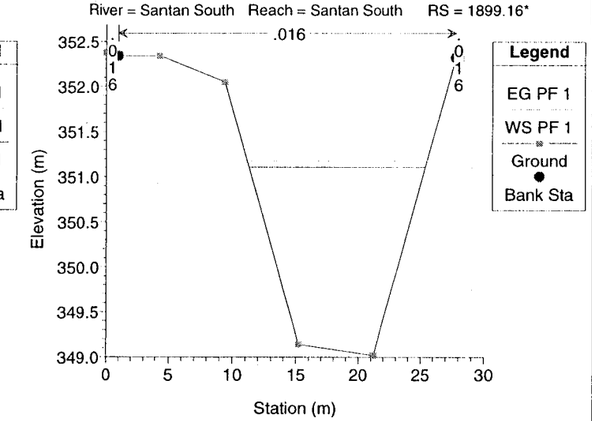
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1931.11*



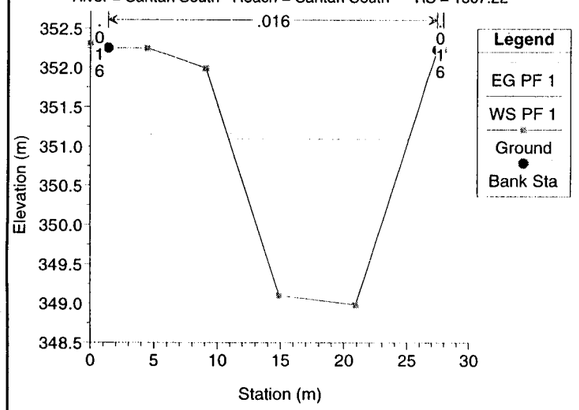
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1899.16*



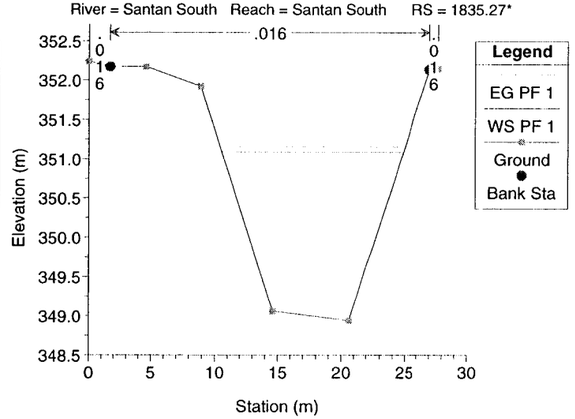
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1867.22*



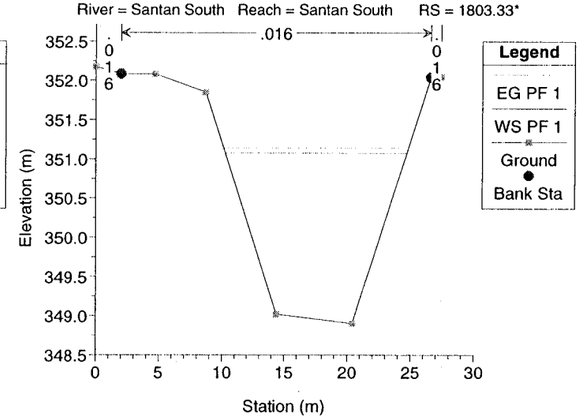
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1835.27*



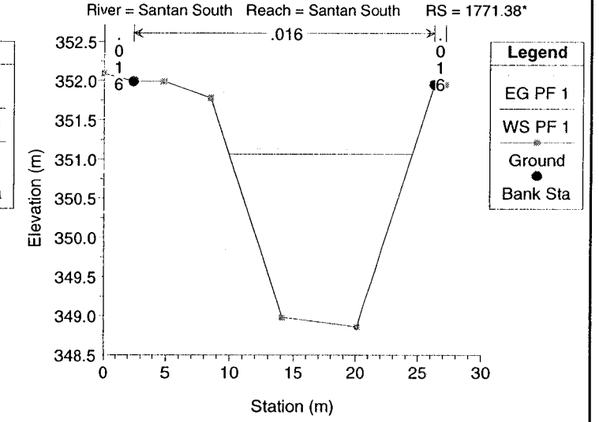
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1803.33*



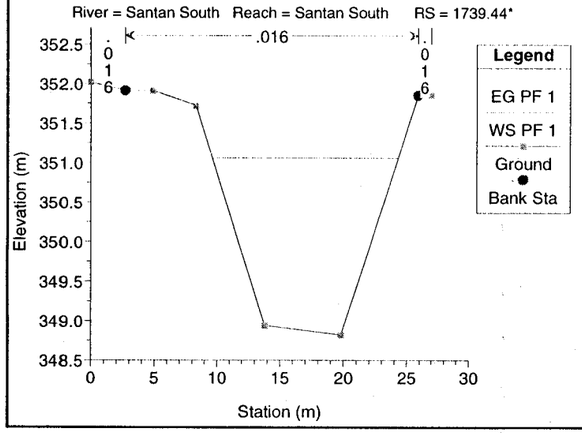
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1771.38*



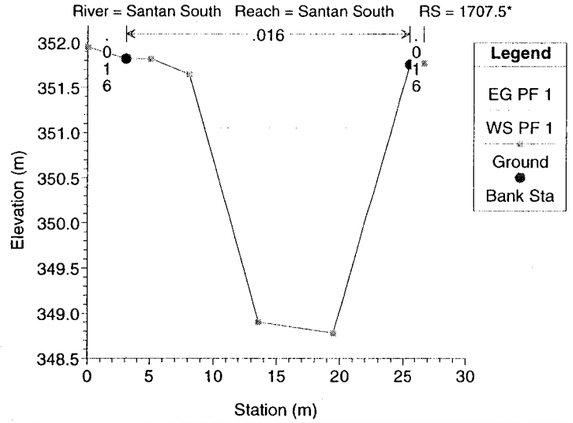
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1739.44*



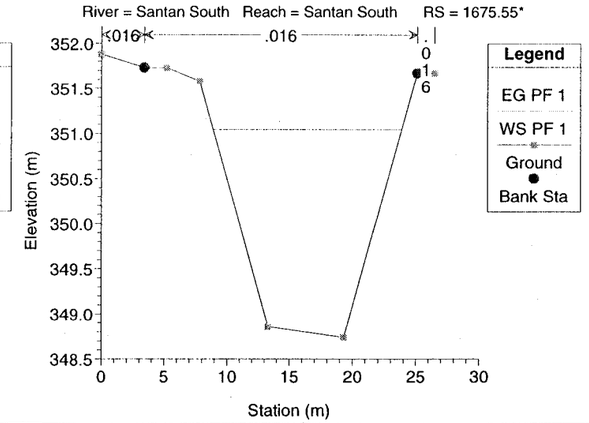
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1707.5*



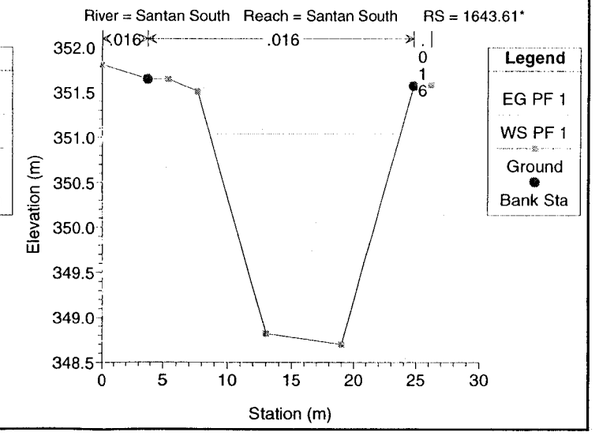
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1675.55*



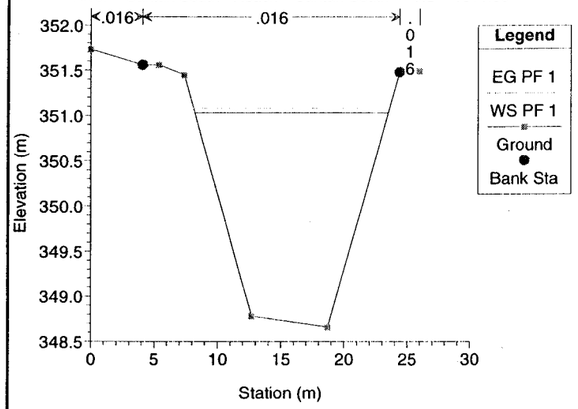
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1643.61*



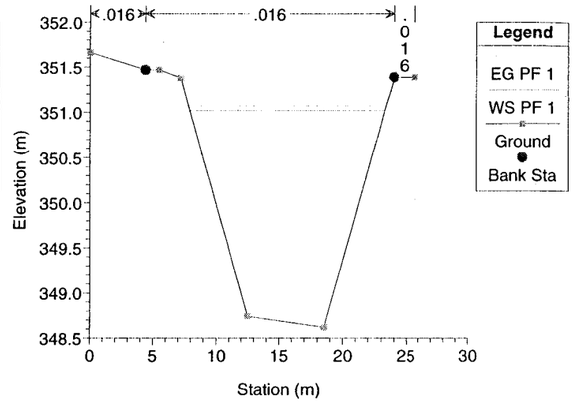
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1611.66*



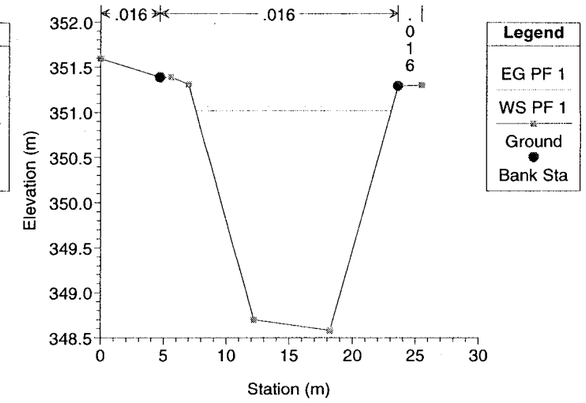
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1579.72*



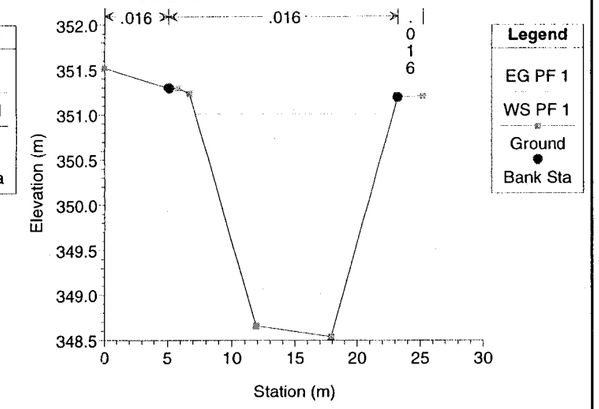
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1547.77*



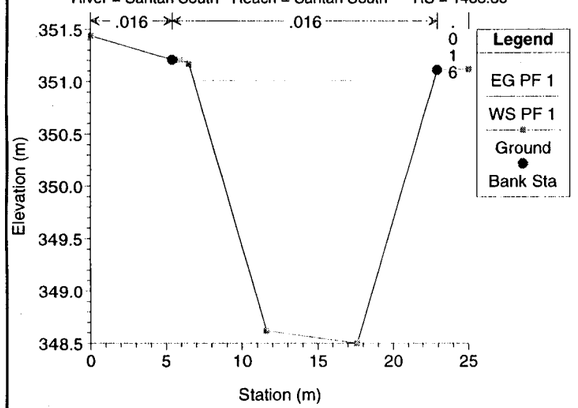
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1515.83*



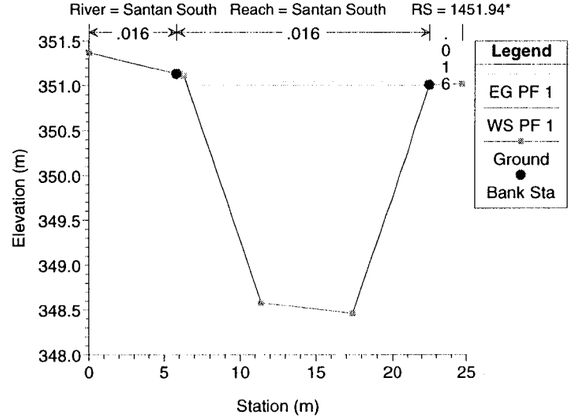
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1483.88*



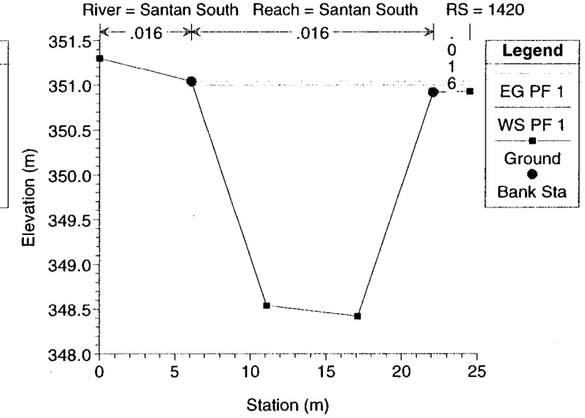
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1451.94*



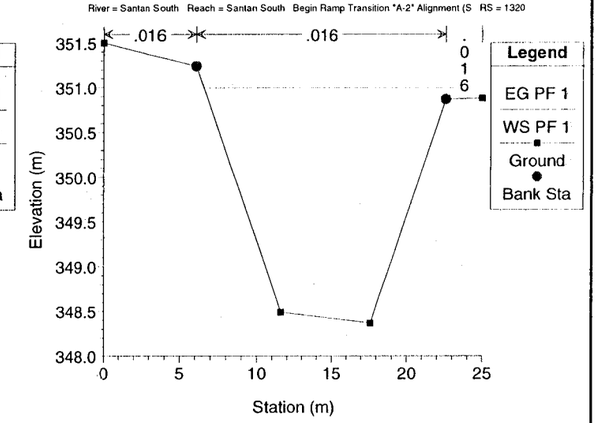
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1420



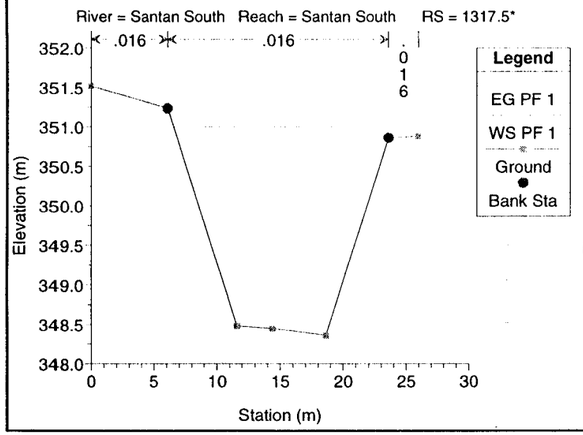
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South Begin Ramp Transition "A-2" Alignment (S RS = 1320



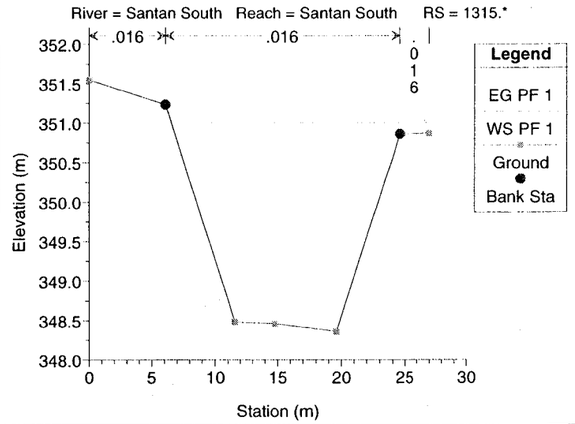
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1317.5*



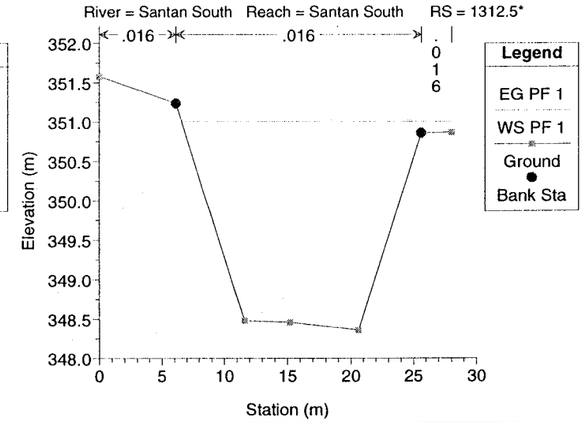
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1315.*



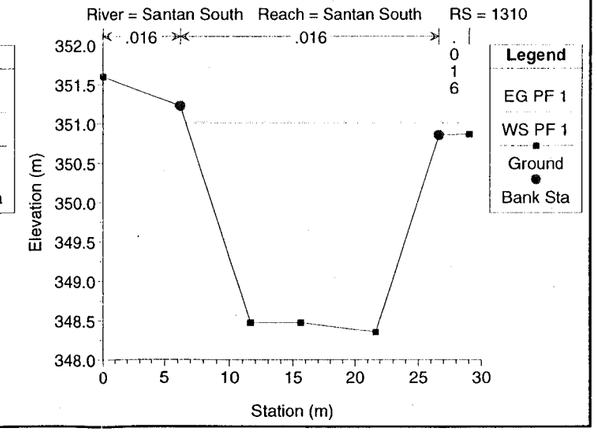
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1312.5*



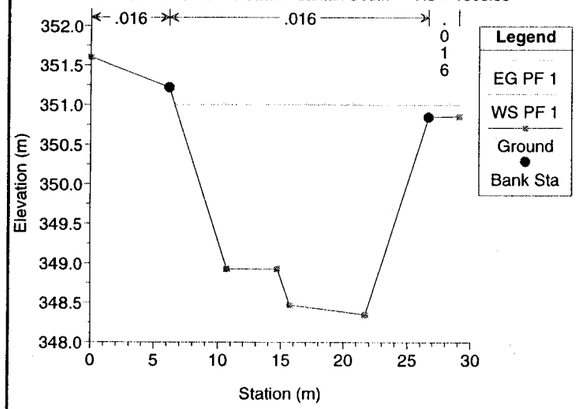
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1310



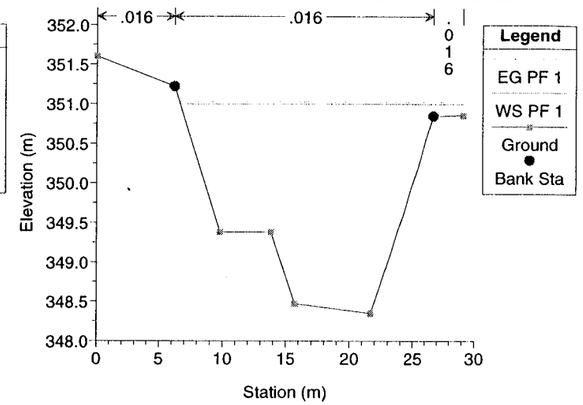
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1308.33*



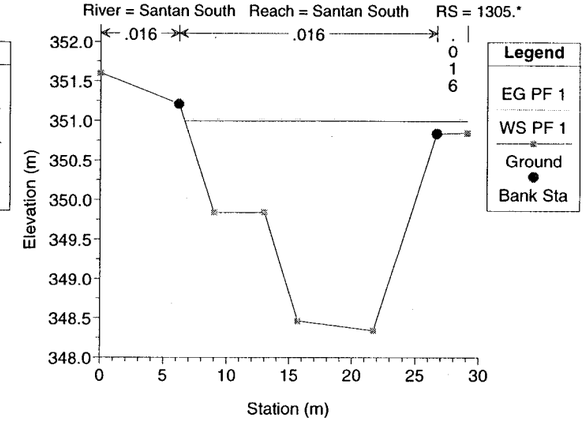
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1306.66*



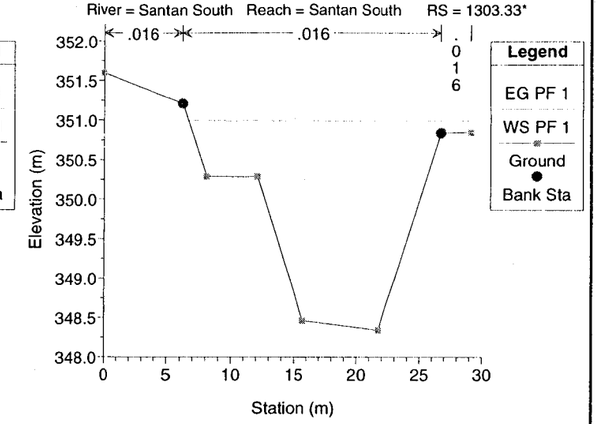
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1305.*



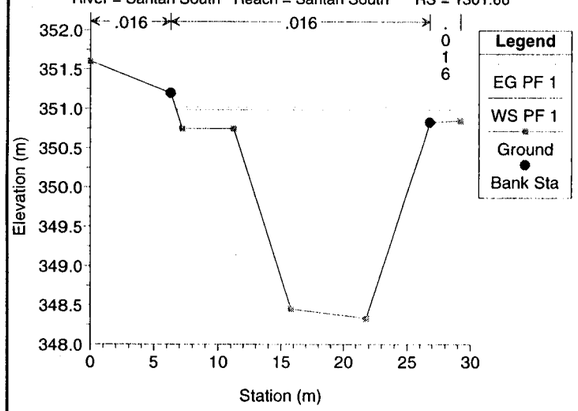
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1303.33*



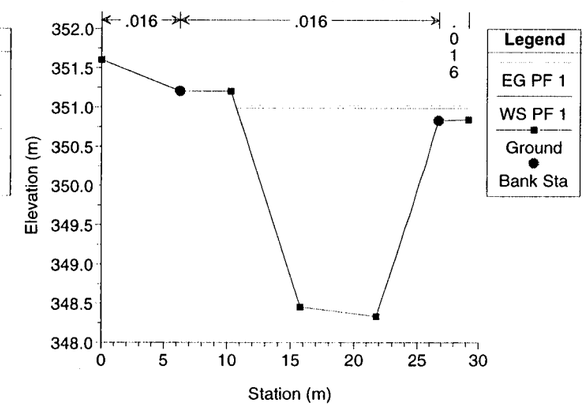
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1301.66*



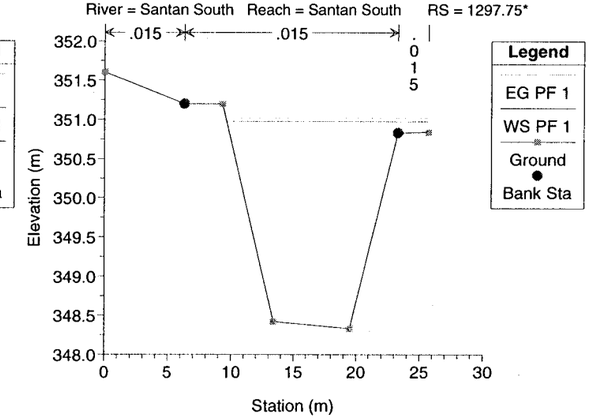
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South End Ramp Transition, Begin Vertical Tran RS = 1300



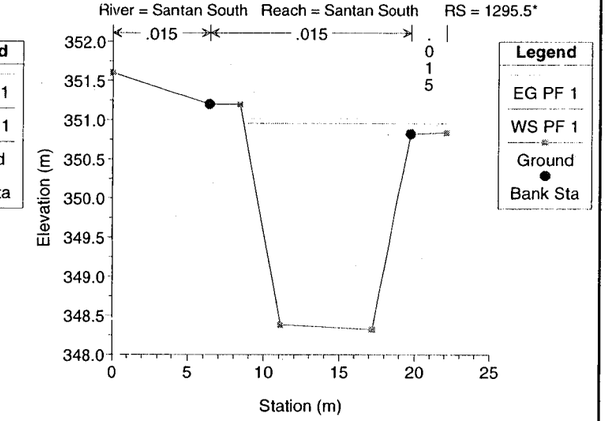
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1297.75*



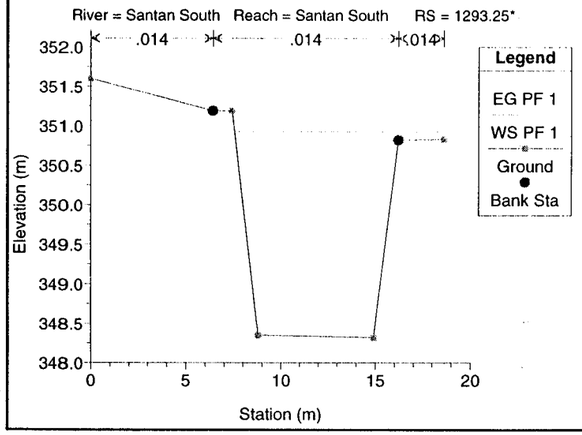
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1295.5*



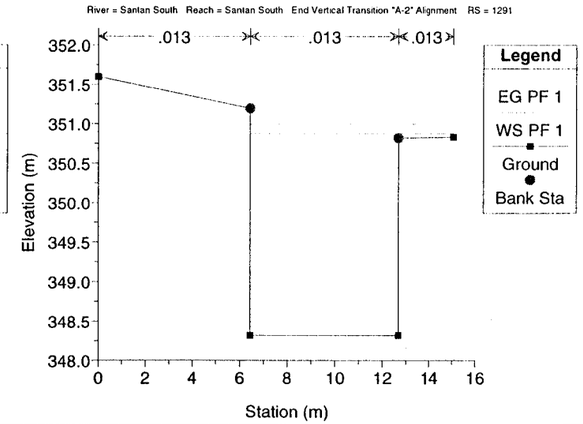
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1293.25*



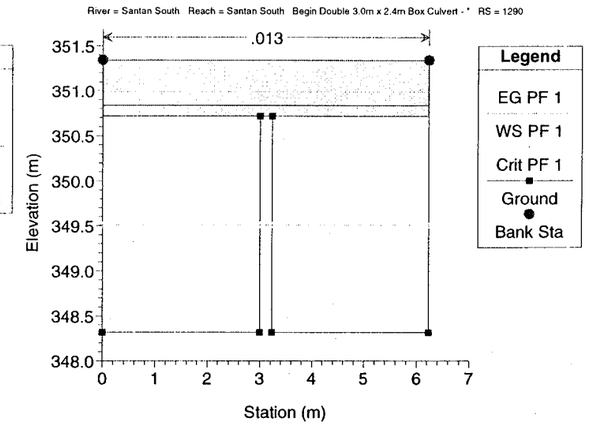
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South End Vertical Transition "A-2" Alignment RS = 1291



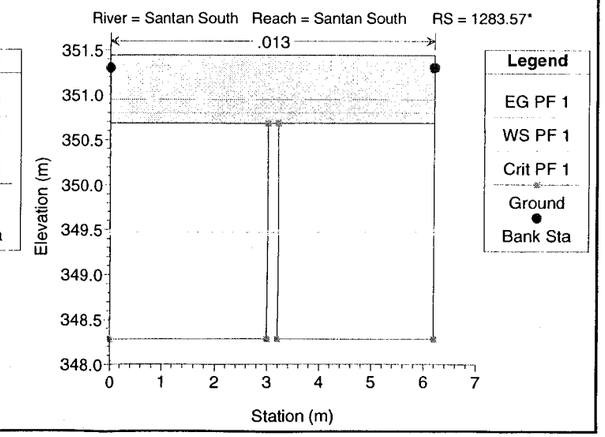
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South Begin Double 3.0m x 2.4m Box Culvert - * RS = 1290



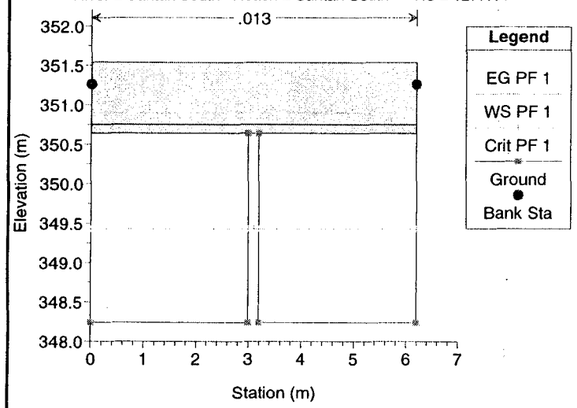
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1283.57*



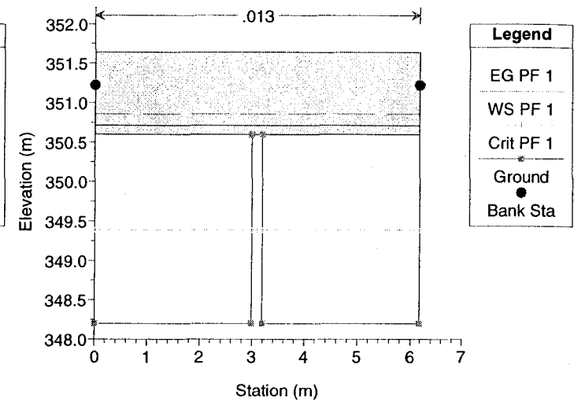
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1277.14*



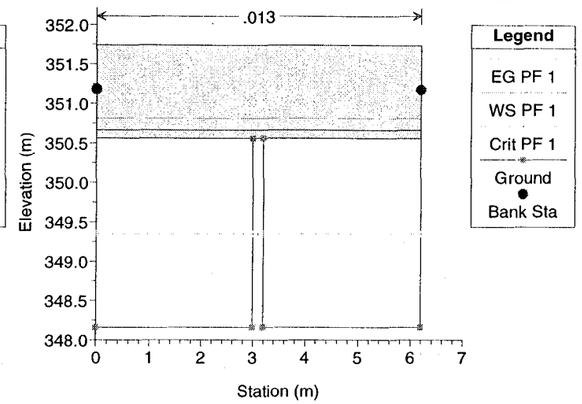
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1270.71*



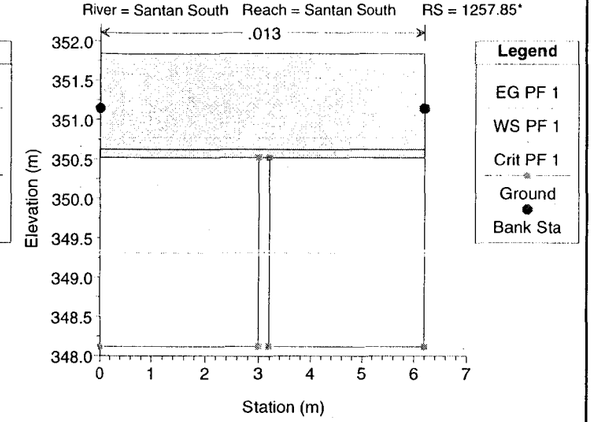
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1264.28*



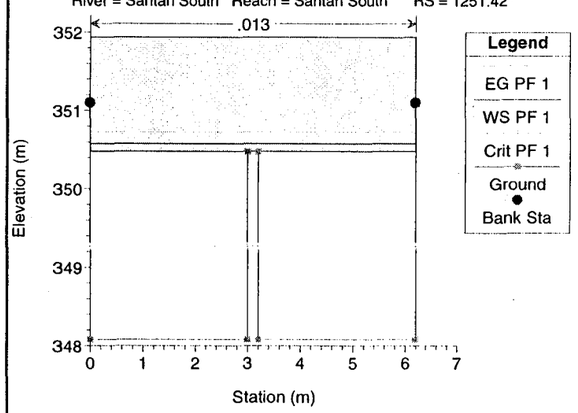
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1257.85*



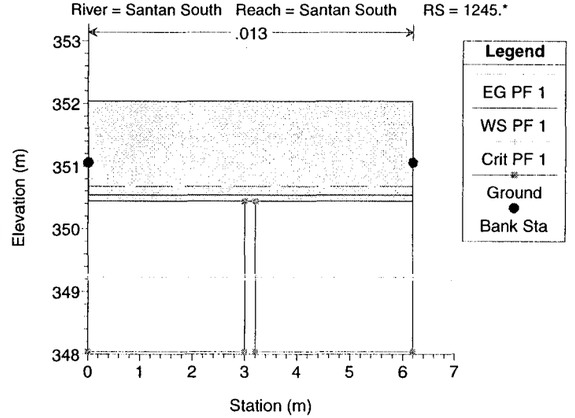
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1251.42*



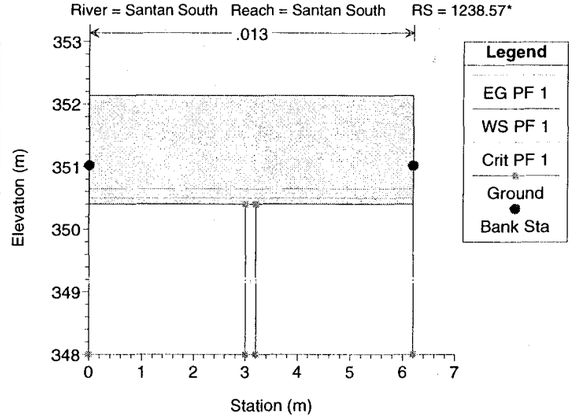
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1245.*



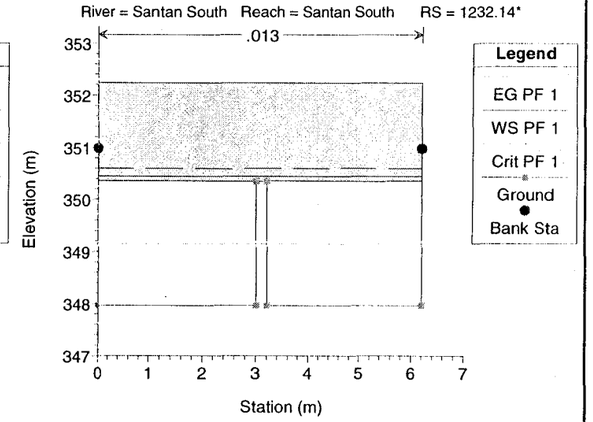
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1238.57*



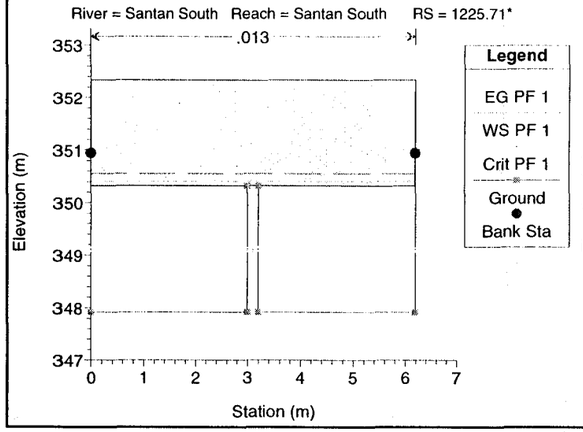
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1232.14*



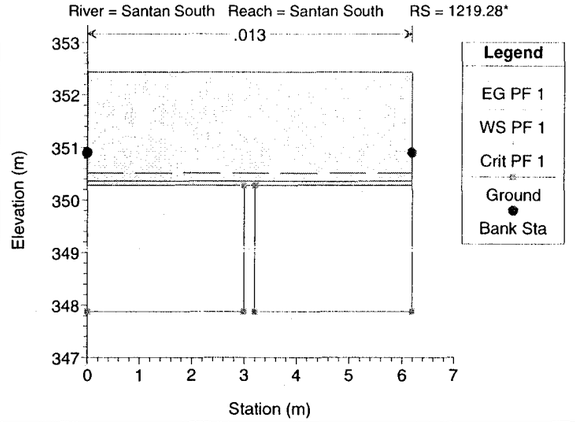
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1225.71*



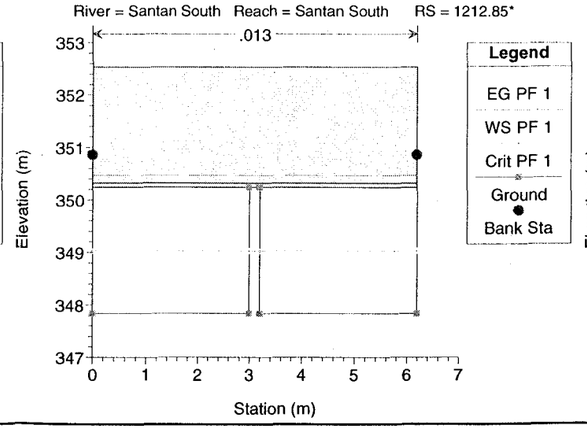
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1219.28*



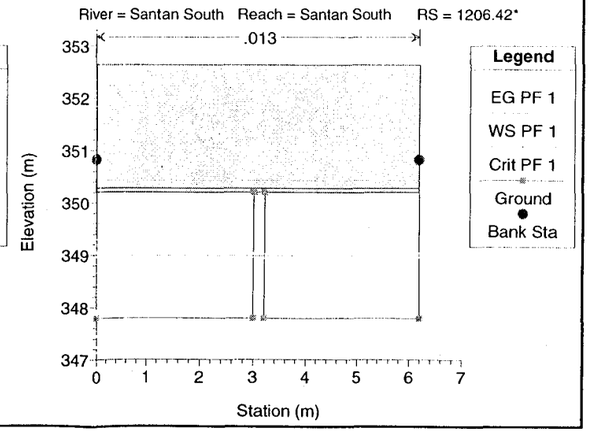
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1212.85*



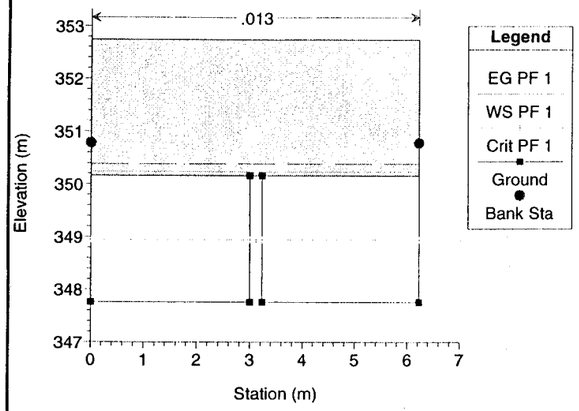
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1206.42*



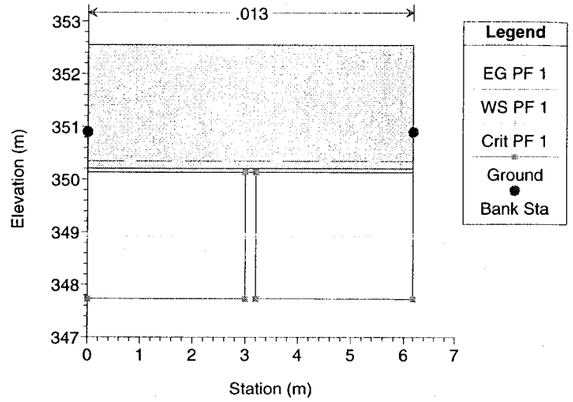
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South Box Culvert Approx East Side of I-10 "A- RS = 1200



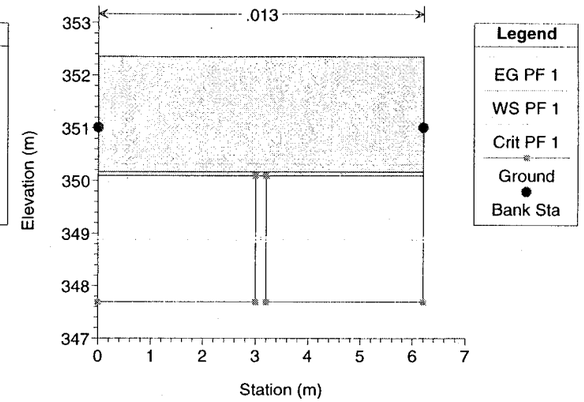
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1193.33*



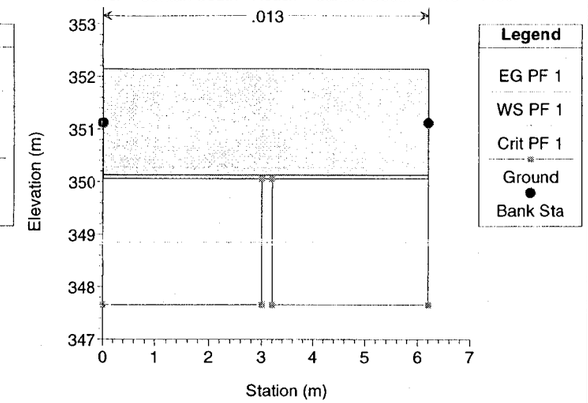
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1186.66*



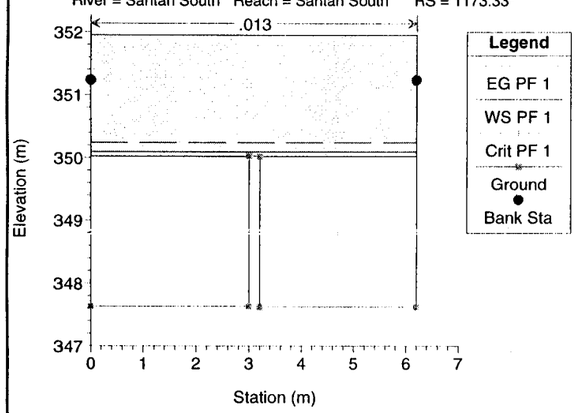
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1180.*



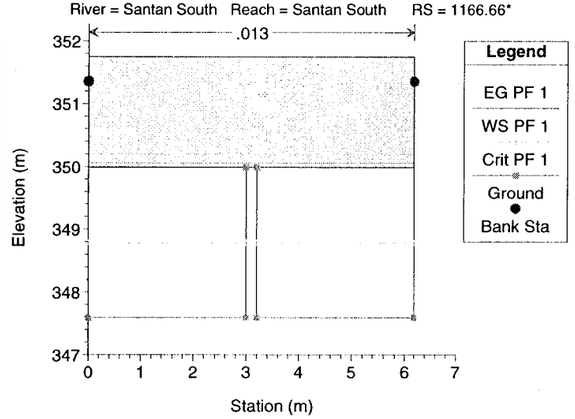
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1173.33*



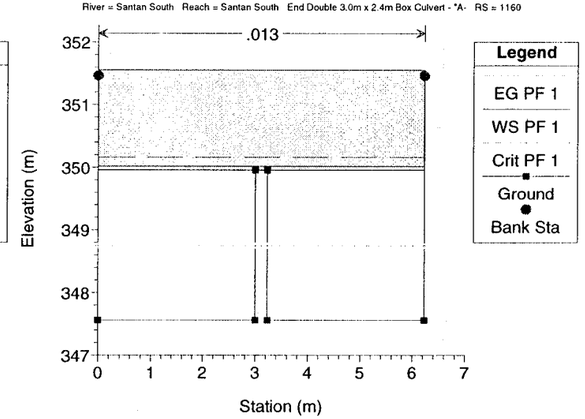
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1166.66*



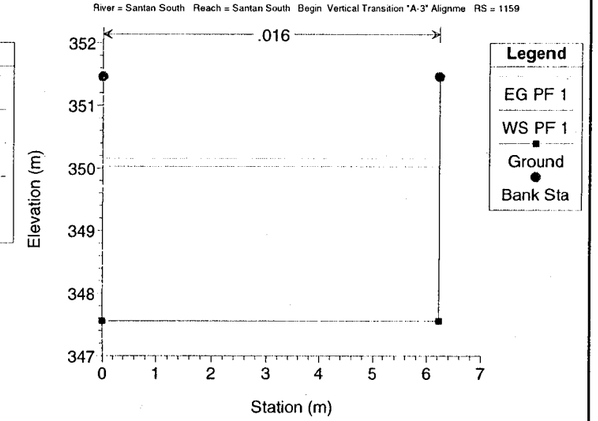
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South End Double 3.0m x 2.4m Box Culvert - "A- RS = 1160



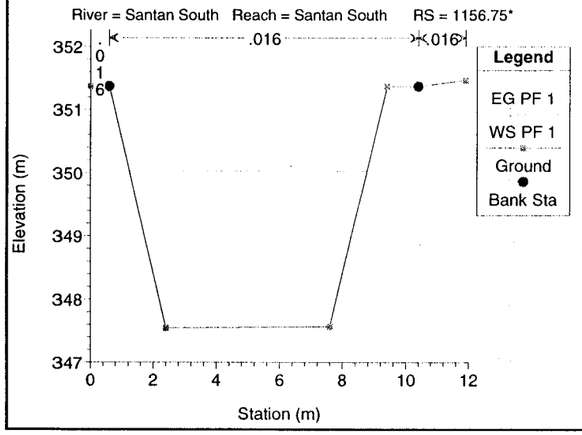
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South Begin Vertical Transition "A-3" Alignme RS = 1159



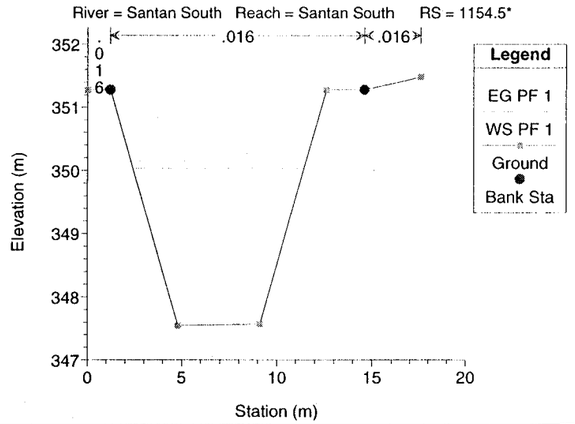
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1156.75*



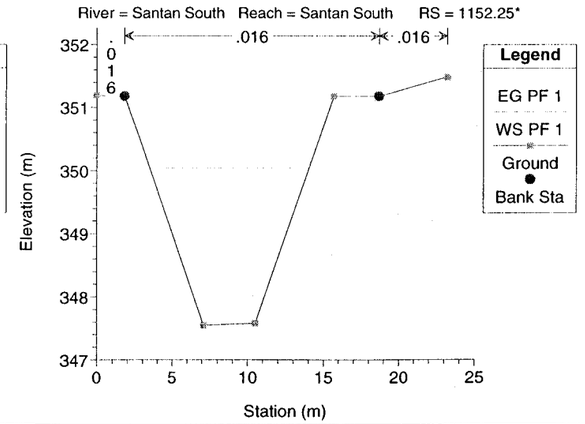
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1154.5*



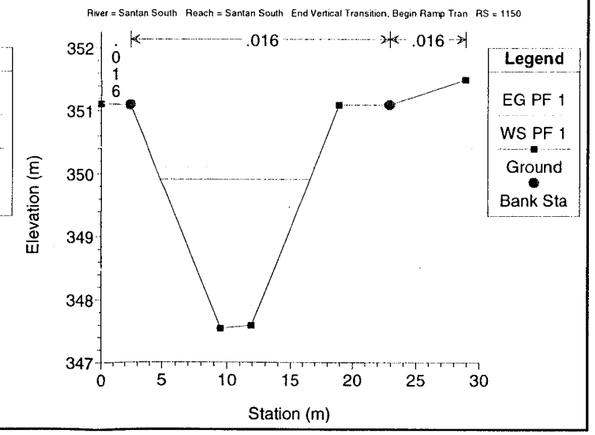
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1152.25*



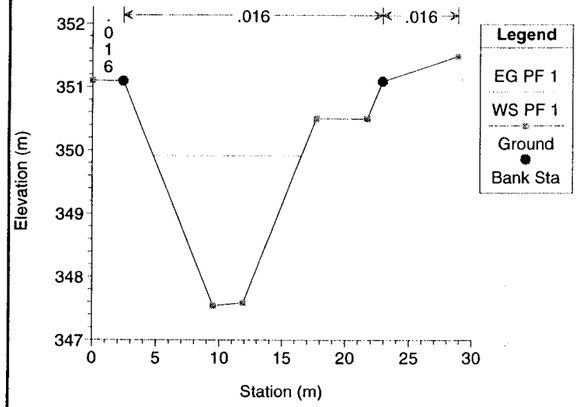
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South End Vertical Transition, Begin Ramp Tran RS = 1150



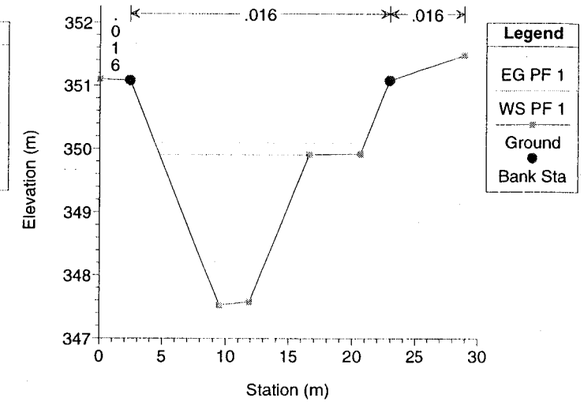
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1149.16*



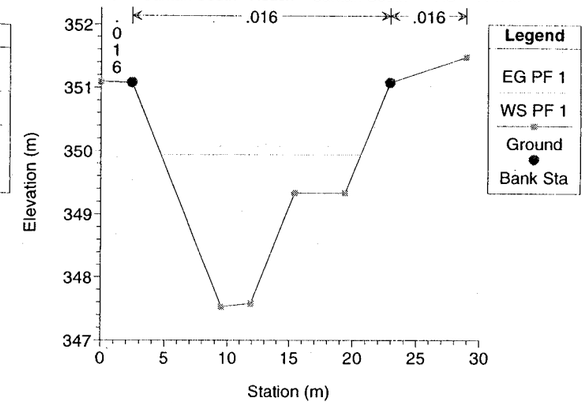
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1148.33*



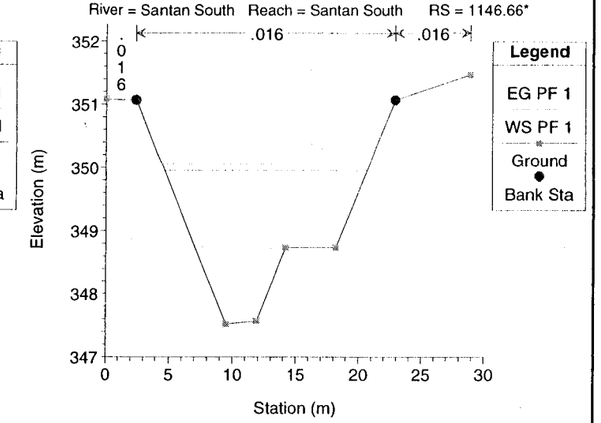
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1147.5*



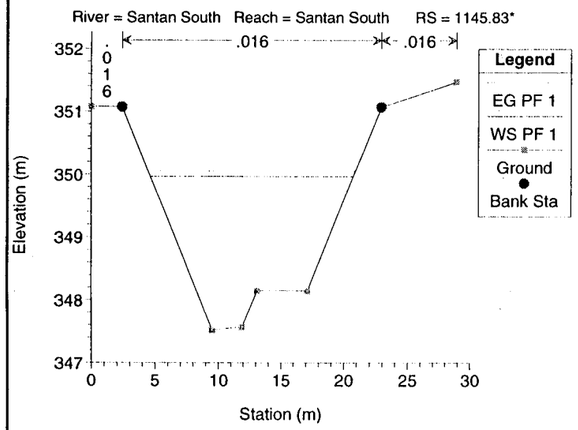
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1146.66*



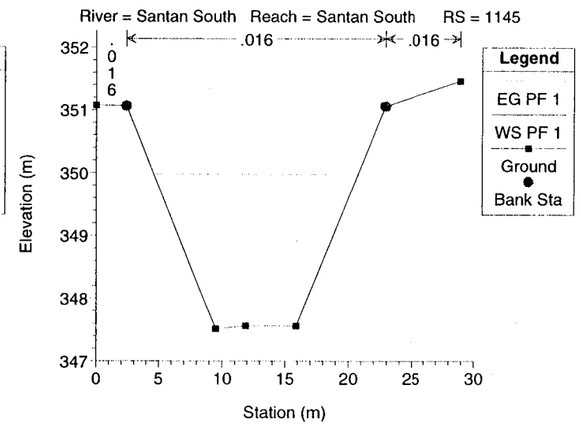
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1145.83*



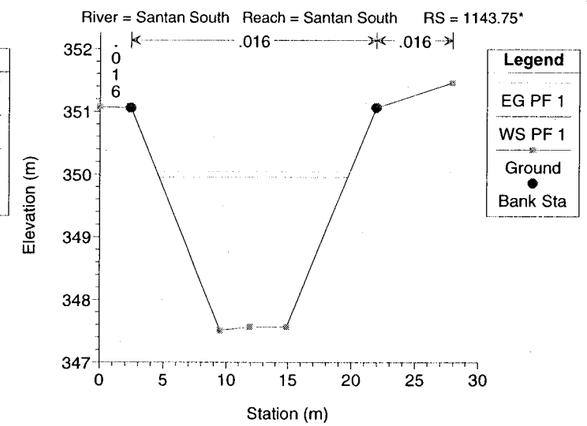
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1145



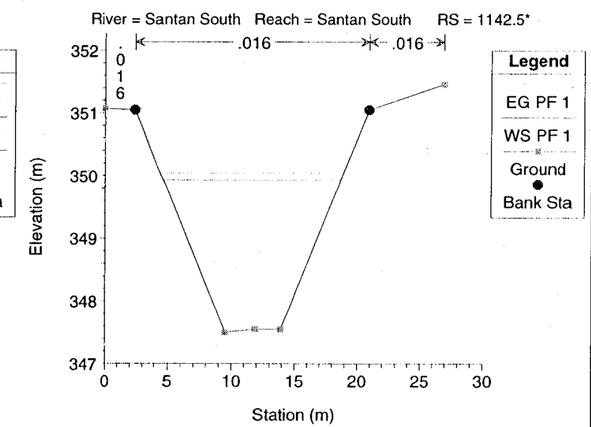
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1143.75*



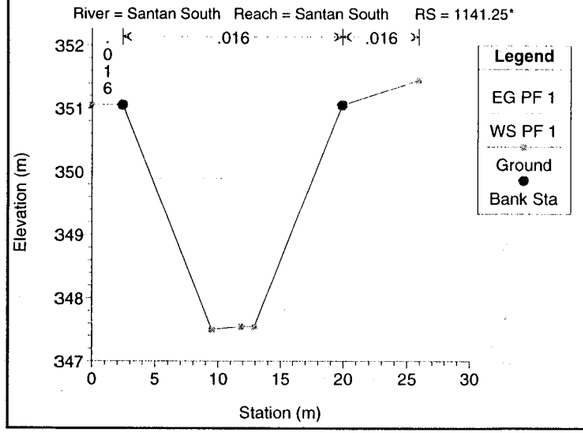
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1142.5*



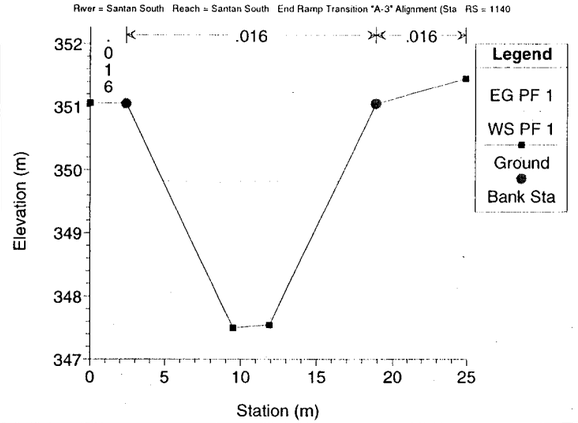
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1141.25*



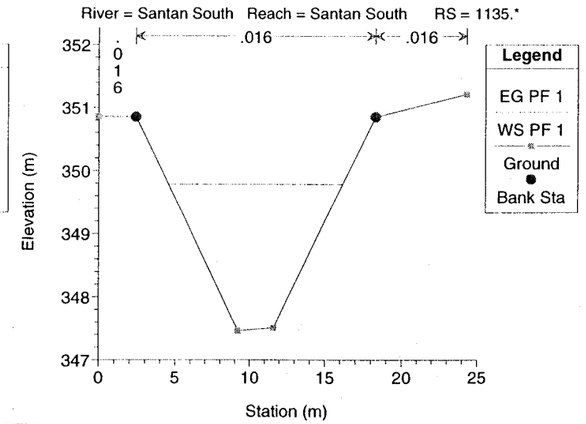
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South End Ramp Transition "A-3" Alignment (Sta RS = 1140



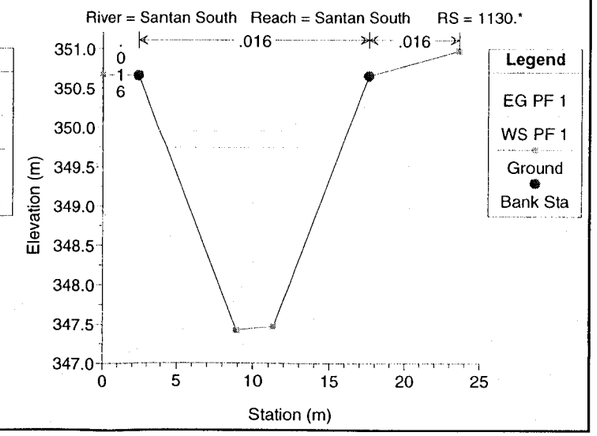
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1135.*



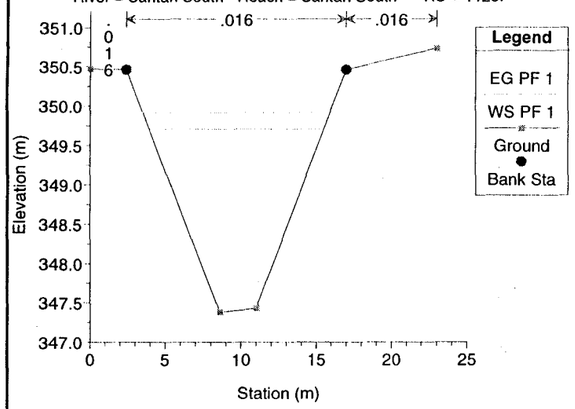
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1130.*



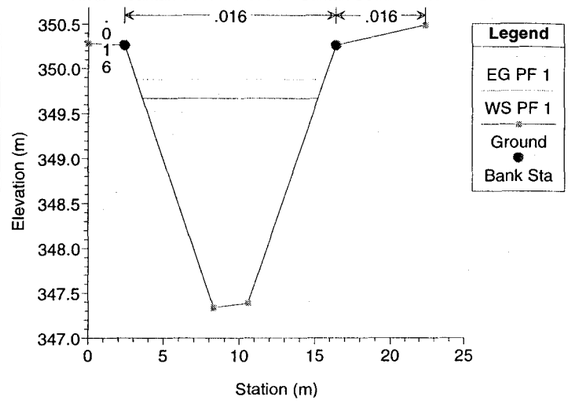
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1125.*



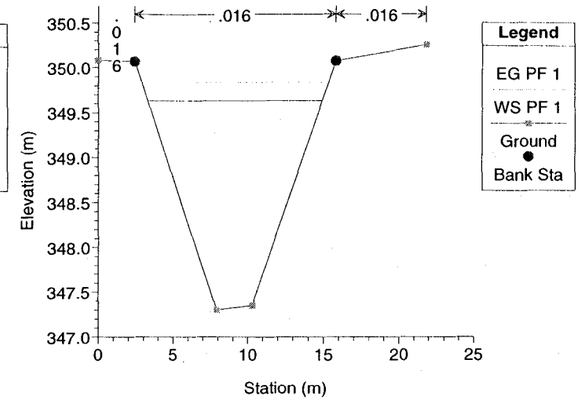
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1120.*



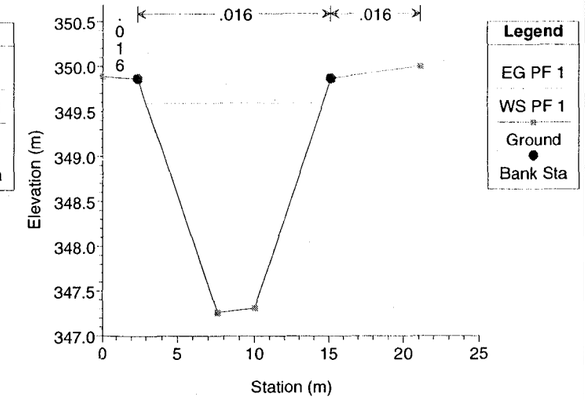
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1115.*



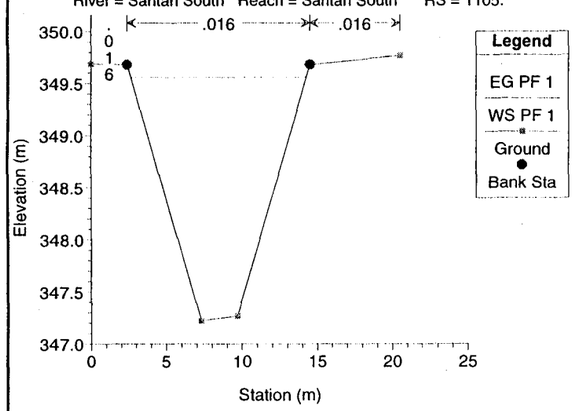
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1110.*



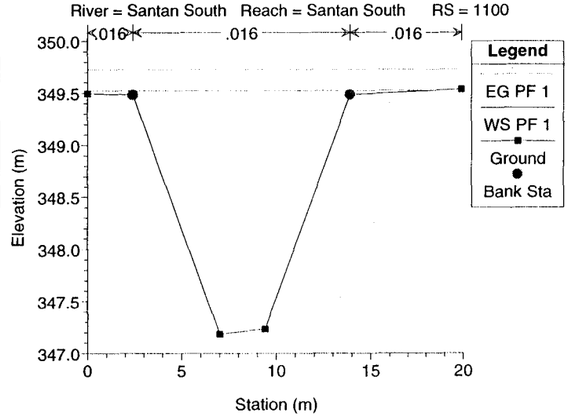
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1105.*



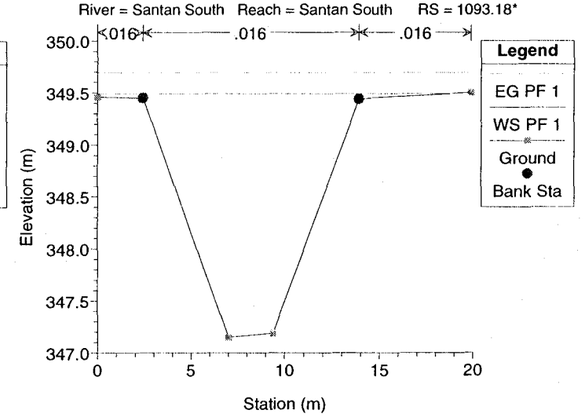
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1100



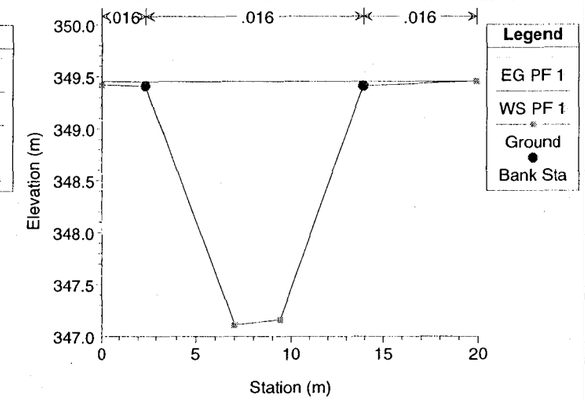
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1093.18*



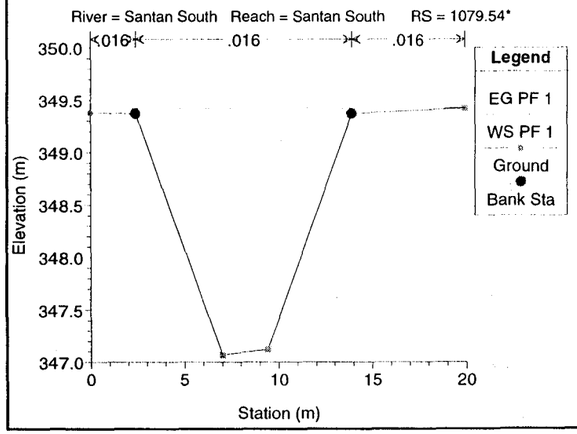
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1086.36*



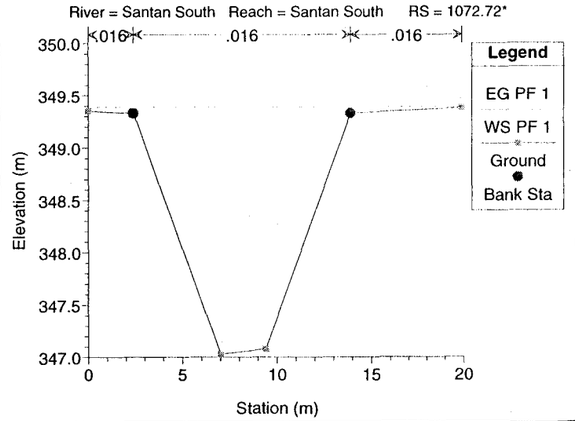
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1079.54*



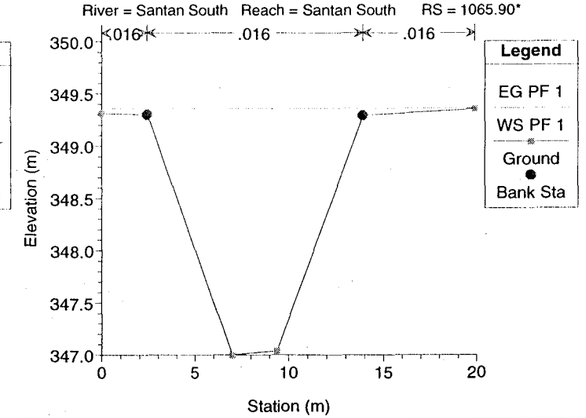
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1072.72*



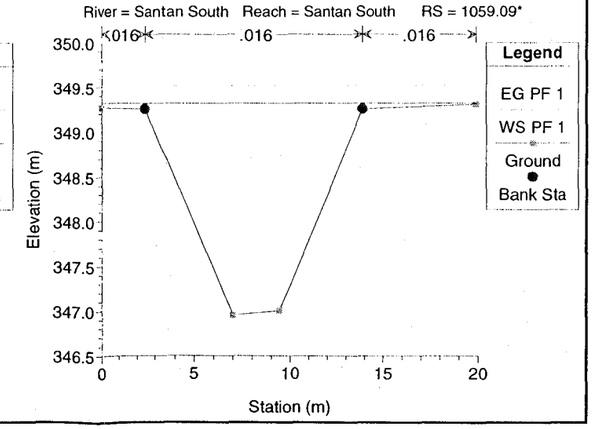
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

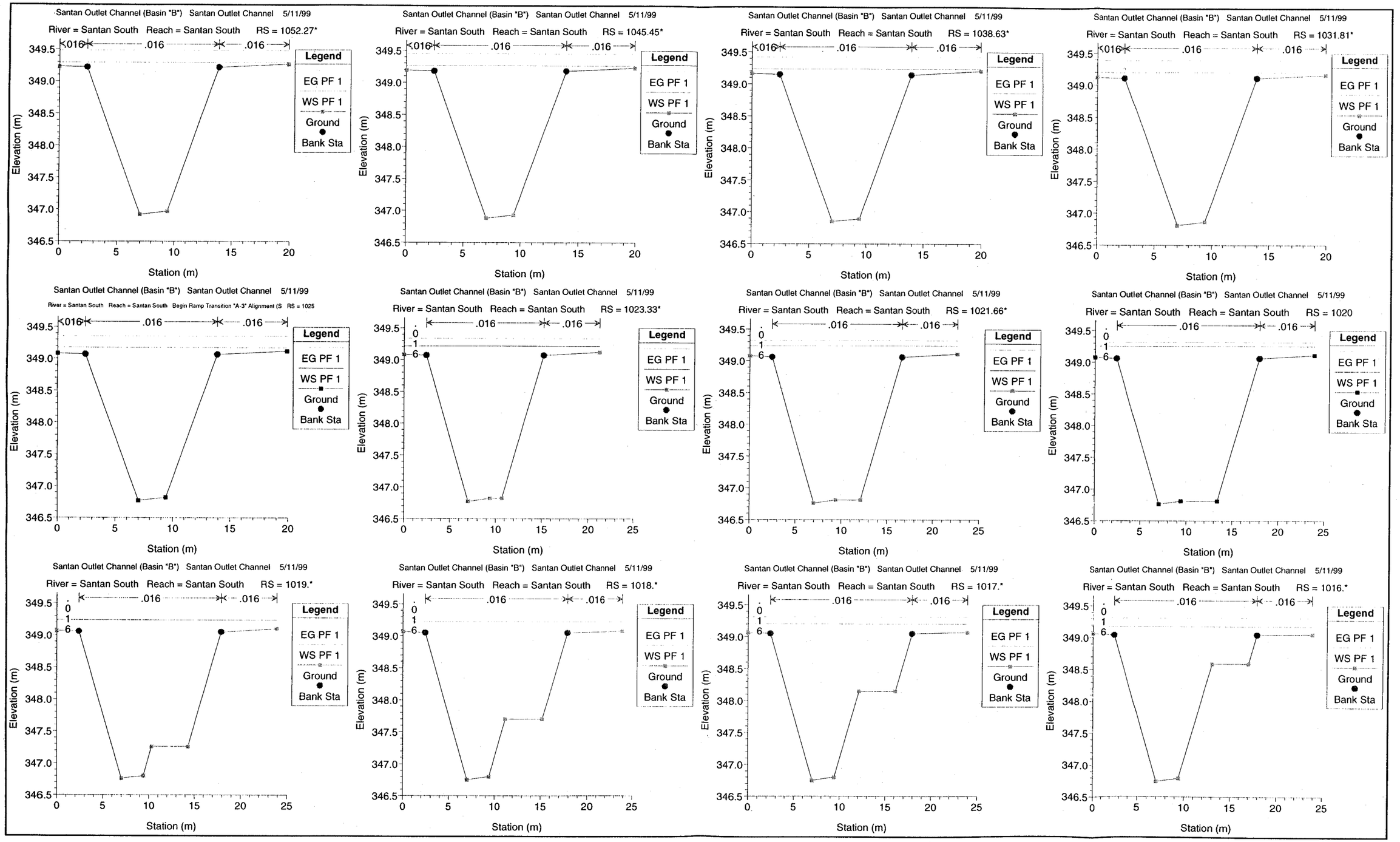
River = Santan South Reach = Santan South RS = 1065.90*



Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

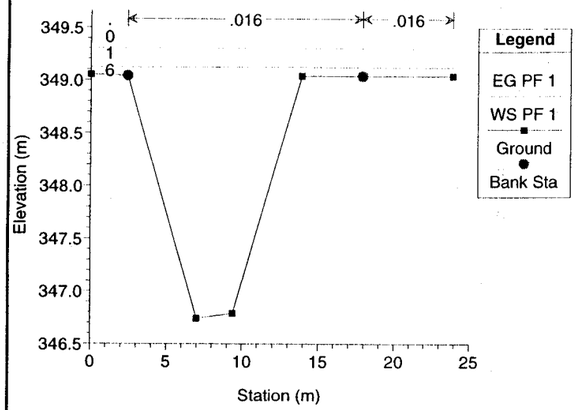
River = Santan South Reach = Santan South RS = 1059.09*




Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99
River = Santan South Reach = Santan South RS = 1052.27*
River = Santan South Reach = Santan South RS = 1045.45*
River = Santan South Reach = Santan South RS = 1038.63*
River = Santan South Reach = Santan South RS = 1031.81*
River = Santan South Reach = Santan South Begin Ramp Transition "A-3" Alignment (S RS = 1025
River = Santan South Reach = Santan South RS = 1023.33*
River = Santan South Reach = Santan South RS = 1021.66*
River = Santan South Reach = Santan South RS = 1020
River = Santan South Reach = Santan South RS = 1019.*
River = Santan South Reach = Santan South RS = 1018.*
River = Santan South Reach = Santan South RS = 1017.*
River = Santan South Reach = Santan South RS = 1016.*
.016
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (m)
Station (m)

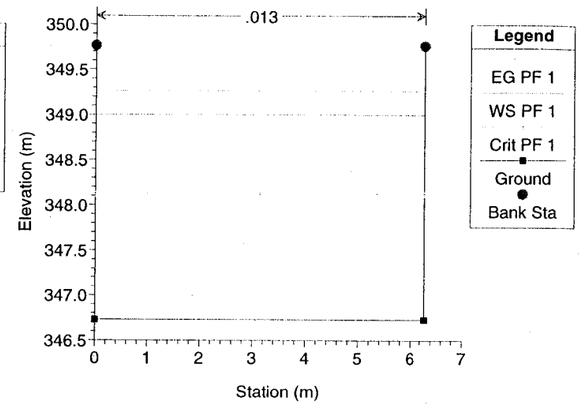
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South End Ramp Transition and Begin Vertical T RS = 1015



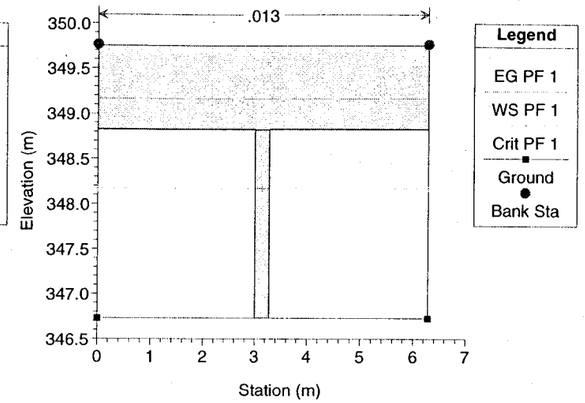
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South Begin Double 3.0m x 2.1m Box Culvert and RS = 1010



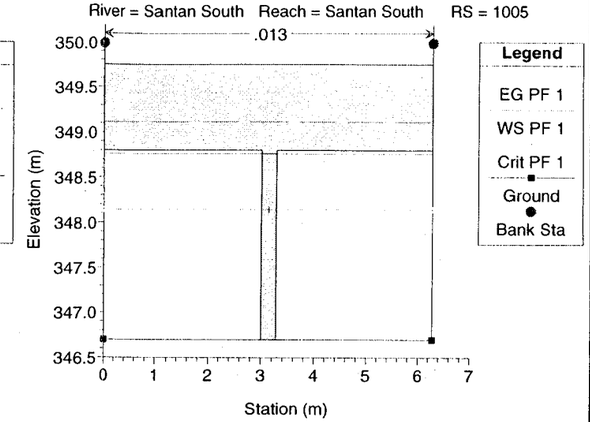
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1005



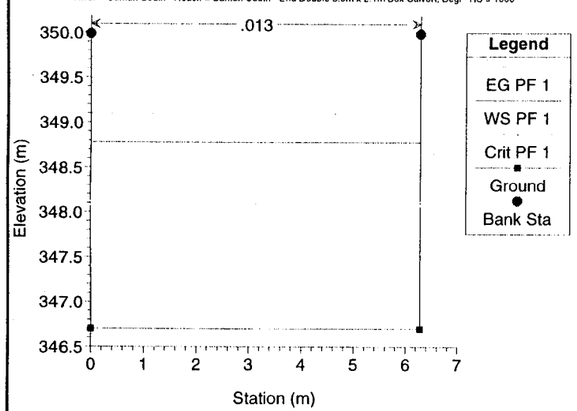
Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South RS = 1005



Santan Outlet Channel (Basin "B") Santan Outlet Channel 5/11/99

River = Santan South Reach = Santan South End Double 3.0m x 2.1m Box Culvert, Begi RS = 1000



05/29/86

W C P M

8.03 BY-PASS FACILITIES

EXHIBIT 1

DESIGN AND CONSTRUCTION REQUIREMENTS

1. Requests for by-pass facilities shall be submitted to the SRP Project Leader for processing and must include: (1) a sketch showing the location, cross-section and profile of the proposed facility, and (2) all hydraulic calculations conforming to the following criteria. All documents must be stamped by an Arizona Registered Civil Engineer.

   a. Mannings "n" for graded dirt by-pass ditches shall be 0.030 and 0.022 for corrugated metal pipe.

   b. Maximum velocity shall be 3.0 FPS for open ditches.

   c. Side slopes shall be no steeper than 0.75:1 or flatter than 1.5:1.

   d. Minimum bottom width shall be 2.0 feet.

   e. Minimum berm height shall be 1.0 foot above calculated water surface. Top width of berm shall be 1.0 foot minimum with minimum slope of 1.25:1.

   f. Where the bypass ditch may be subjected to vehicular traffic, the minimum berm height on the traffic side shall be 1.0 foot above the adjacent ground or as specified in "e", whichever is higher.

   g. The capacity shall be as shown of SRP plans unless the customer obtains authorization from the Area Watermaster for an alternate design capacity (Exhibit 2).

2. Acquisition of all right-of-way required is the responsibility of the customer.

3. The following construction specifications are to be made part of the construction plans

   a. Construct ditch to the cross-section and grade or corrugated metal pipe to alignment and grade established and staked by the licensee's engineer.

Prepared By:

Reviewed By:

Approved By:

8.03 BY-PASS FACILITIES

b. Ditch sides and bottom shall be smoothly cut and all loose material cleaned out.

c. Dirt berms shall be built as necessary to provide a minimum freeboard of one foot above the designed water surface elevation.

d. If the designed water surface elevations for a by-pass ditch are above the existing ground elevations along the proposed ditch alignment, then the existing surface must be cleaned of all vegetation and foreign matter, and scarified a minimum of six inches deep prior to the installation of the dirt berms (c).

e. Safety berms, a minimum 1.0 foot above adjacent ground shall be constructed where bypass ditch may be subjected to vehicular traffic.

f. Soil for berms shall be sufficiently wetted to bring it to within 2% of optimum moisture content.

g. All fill material, except that placed for constructing safety berms <u>only</u> shall be placed at plus or minus 2% of optimum moisture content in maximum 8 inch lifts and compacted to a minimum of 95% of maximum Proctor density in accordance with ASTM D698.

Prepared By: Andy Owenby

Reviewed By:

Approved By:

4. Additional Requirements

a. The Licensee agrees to maintain the by-pass ditch in a safe and operable condition as determined by SRP. SRP reserves the right to perform any emergency maintenance needed at full cost to the Licensee.

b. Any cuts in existing permanent open ditch banks will be filled, compacted and concrete lined to SRP specifications at the conclusion of the by-pass ditch use, unless otherwise approved by SRP.

Prepared By: Andy Overby

Reviewed By:

Approved By:

05/29/86

W C P M

8.03 BY-PASS FACILITIES

EXHIBIT 2

ALTERNATE CAPACITY AUTHORIZATION FILE NO: _____

Project Name _____

Coordinate Location _____

The alternate capacity of _____ is approved for the by-pass facility located from _____ to _____ for the period from _____ to _____.

_____ _____
Approved by SRP Area Watermaster (date)

Prepared By: Andy Overby

Reviewed By: _____

Approved By: _____

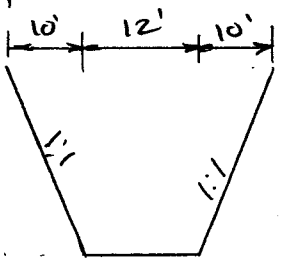
DMJM	PROJECT: SANTAN DRAINAGE	JOB NO. 6508	SHEET 1 of 1
		DESIGNED BY JRC	DATE 4/20/99
SUBJECT: SRP DRAIN / LATERAL REALIGNMENTS		CHECKED BY	DATE

GILA DRAIN

EXISTING INVERT ELEV UPSTREAM = 1148.9

EXISTING INVERT ELEV DOWNSTREAM = 1148.4

LENGTH OF REALIGNMENT = 986.8 ft



SLOPE $\frac{48.9 - 48.4}{986.8} = .0005$

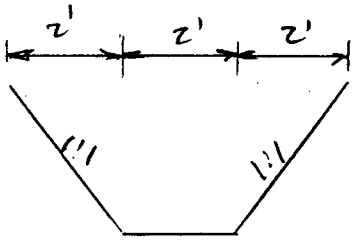
$= \underline{0.0517\%}$

LATERAL @ KYRENE ROAD

EXIST. INVERT ELEV UPSTREAM = 1159.9

EXIST. INVERT ELEV DOWNSTREAM = 1159.0

LENGTH OF REALIGNMENT = 291.4



SLOPE $\frac{59.9 - 59.0}{291.4} = .0030$

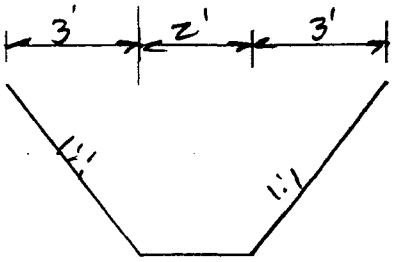
$= \underline{0.3089\%}$

LATERAL @ McCLINTOCK DRIVE

EXIST. INVERT ELEV UPSTREAM = 1171.9

EXIST INVERT ELEV DOWNSTREAM = 1171.6

LENGTH OF REALIGNMENT = 326.8'



SLOPE $\frac{71.9 - 71.6}{326.8} = 0.0009$

$= \underline{0.0918\%}$

Temporary SRP Drain Realignment
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\santan.fm2
Worksheet	Gila Drain
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

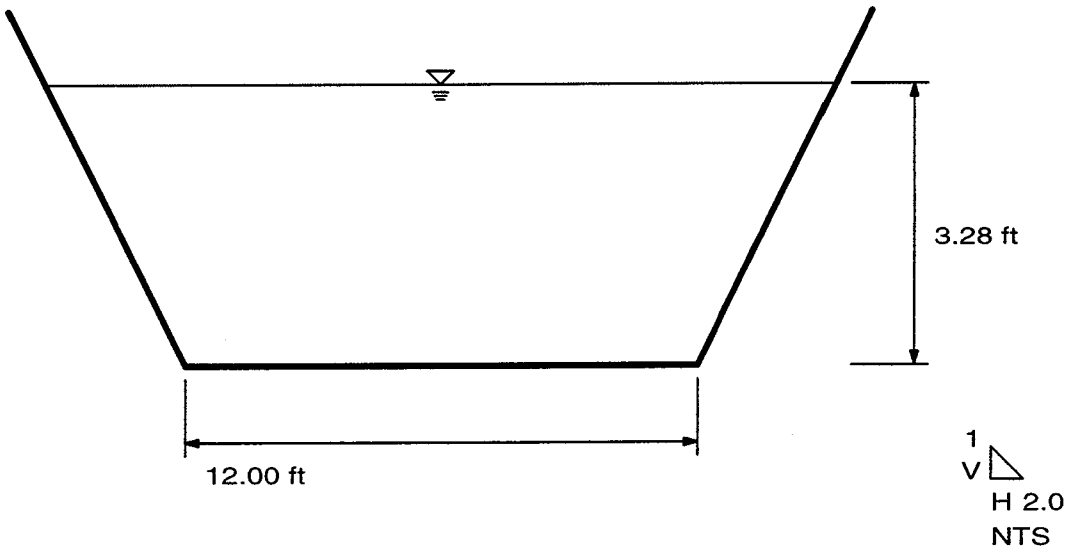
Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.000517	ft/ft
Left Side Slope	1.000000	H : V
Right Side Slope	1.000000	H : V
Bottom Width	12.00	ft
Discharge	100.00	cfs

Results		
Depth	3.28	ft
Flow Area	50.15	ft^2
Wetted Perimeter	21.28	ft
Top Width	18.56	ft
Critical Depth	1.25	ft
Critical Slope	0.013763	ft/ft
Velocity	1.99	ft/s
Velocity Head	0.06	ft
Specific Energy	3.34	ft
Froude Number	0.21	
Flow is subcritical.		

Temporary SRP Drain Realignment
Cross Section for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\santan.fm2
Worksheet	Gila Drain
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.030	
Channel Slope	0.000517	ft/ft
Depth	3.28	ft
Left Side Slope	1.000000	H : V
Right Side Slope	1.000000	H : V
Bottom Width	12.00	ft
Discharge	100.00	cfs



Temporary SRP Lateral Realignment
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\santan.fm2
Worksheet	SRP Lateral @ Kyrene
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

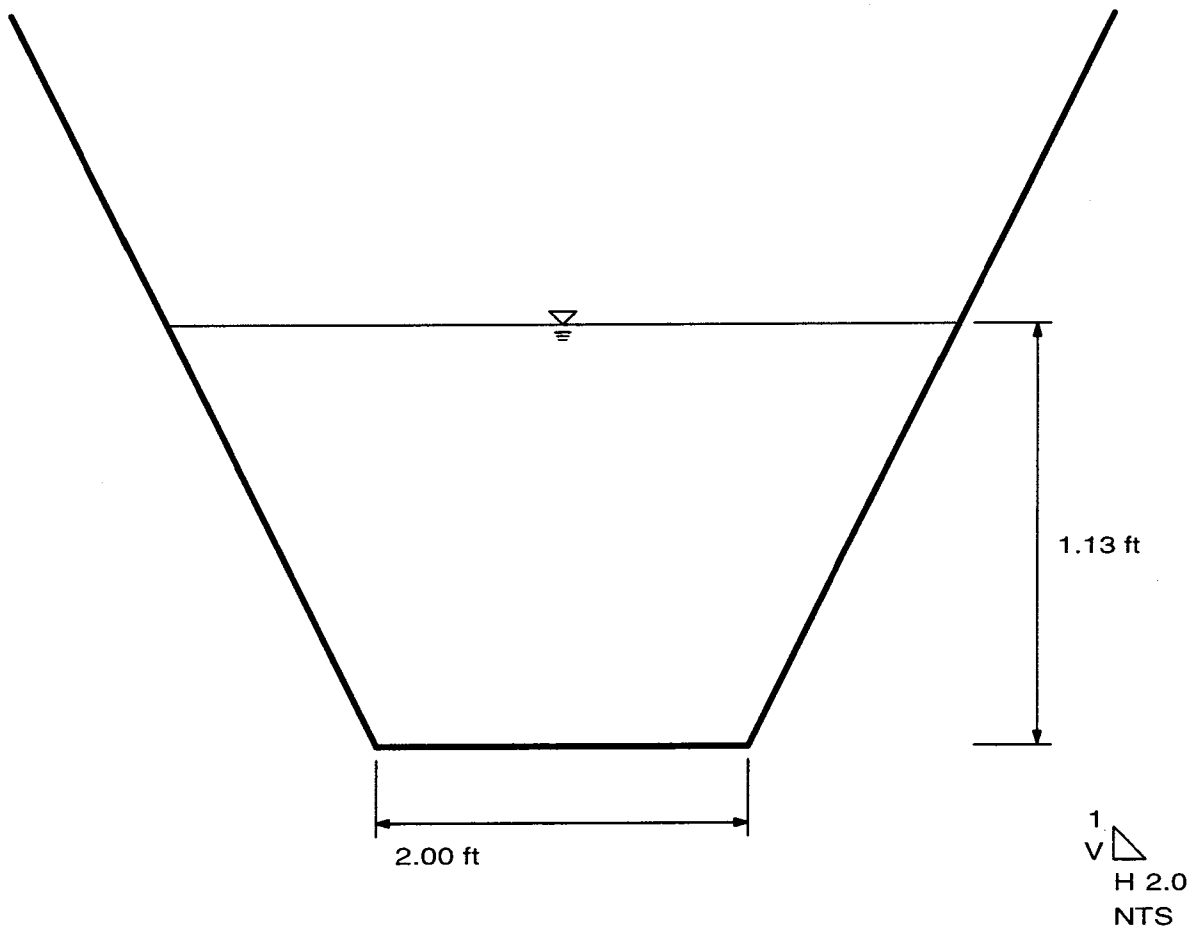
Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.003089	ft/ft
Left Side Slope	1.000000	H : V
Right Side Slope	1.000000	H : V
Bottom Width	2.00	ft
Discharge	7.50	cfs

Results		
Depth	1.13	ft
Flow Area	3.53	ft^2
Wetted Perimeter	5.19	ft
Top Width	4.25	ft
Critical Depth	0.67	ft
Critical Slope	0.019803	ft/ft
Velocity	2.13	ft/s
Velocity Head	0.07	ft
Specific Energy	1.20	ft
Froude Number	0.41	
Flow is subcritical.		

Temporary SRP Lateral Realignment
Cross Section for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\santan.fm2
Worksheet	SRP Lateral @ Kyrene
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.030	
Channel Slope	0.003089	ft/ft
Depth	1.13	ft
Left Side Slope	1.000000	H : V
Right Side Slope	1.000000	H : V
Bottom Width	2.00	ft
Discharge	7.50	cfs



Temporary SRP Lateral Realignment
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\santan.fm2
Worksheet	SRP Lateral @ McClintock
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

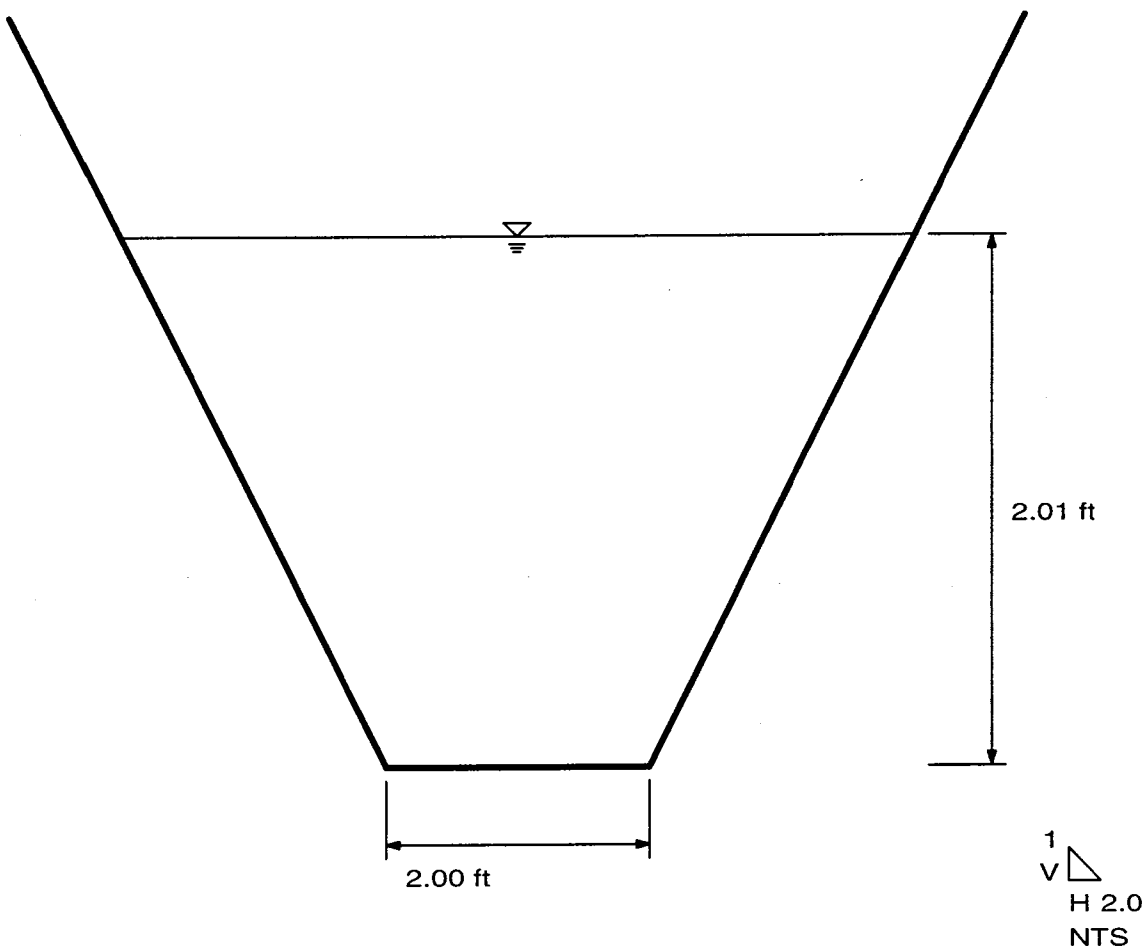
Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.000918	ft/ft
Left Side Slope	1.000000	H : V
Right Side Slope	1.000000	H : V
Bottom Width	2.00	ft
Discharge	12.50	cfs

Results		
Depth	2.01	ft
Flow Area	8.07	ft^2
Wetted Perimeter	7.69	ft
Top Width	6.02	ft
Critical Depth	0.91	ft
Critical Slope	0.018841	ft/ft
Velocity	1.55	ft/s
Velocity Head	0.04	ft
Specific Energy	2.05	ft
Froude Number	0.24	
Flow is subcritical.		

Temporary SRP Lateral Realignment
Cross Section for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\santan.fm2
Worksheet	SRP Lateral @ McClintock
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.030	
Channel Slope	0.000918	ft/ft
Depth	2.01	ft
Left Side Slope	1.000000	H : V
Right Side Slope	1.000000	H : V
Bottom Width	2.00	ft
Discharge	12.50	cfs



DMJM	PROJECT: SANTAN CHANNEL - 3	JOB NO.	SHEET 1 of
		DESIGNED BY ABM	DATE
SUBJECT: WEIR SPILLWAY		CHECKED BY DBL	DATE 8/10/99

CHANNEL FREEBOARD

- UTILIZE VELOCITY FOR SPILLWAY CHUTE SINCE CONSERVATIVE

$Y = 0.12' = 0.0358\,m \qquad V = 16.98\,fps = 5.18\,m/s$

$\therefore F_b = 0.20(y + V^2/2g) = .2\left(.036 + \frac{5.18^2}{2(9.81)}\right)$

$= 0.281\,m$

USE 0.3m OR 1.0 FT.

DEPTH OF FLOW @ CREST = 0.8 FT

$\therefore$ USE $D_{MIN} = 1.8 - 2.0$ FT.

OUTLET EROSION PROTECTION

USING: STEEPEST PORTION OF ROCK (CONSERVATIVE)

$Q = 1377$ cfs (Q_{MAX} PRIOR TO TW_{DESIGN})

$V = 4.55$ fps, $S = 7.44\%$ $n = .04$

$$D_{50} = 10\,\frac{[CD(SN)]^{1.5}\,V^3}{[K(G_s - 1)]^{1.5}\,R^{0.5}}$$

FOR: $C = 1$, $D = 1$, $K = 0.87$, $G_s = 2.4$, $V = 1.39\,m^3/s$, $SN = 1.4$, $R = 0.300$

$\therefore D_{50} = 56.4\,mm = .18'$

FOR SAME W/ AVERAGE VELOCITY

$(14.55 + 1.74)/2 = 8.15$ fps (2.48 m/s) $\quad y \approx .17$, $R = .17$

$\therefore D_{50} = 425\,mm = 1.39'$

DMJM	PROJECT: SANTAN CHANNEL 3	JOB NO.	SHEET 2 of
		DESIGNED BY	DATE
SUBJECT: WEIR SPILLWAY		CHECKED BY DBL	DATE 8/10/99

OUTLET EROSION PROTECTION (CONTINUED)

CHECK ROCK THROUGH SILL (USING $b = 500'$)

$V = 5.93$ fps $= 1.81$ m/s

$R = 0.46$

$\therefore D_{50} = 100$ mm $= 0.33'$

USE $D_{50} = 18''$ OR 450 mm (DEPTH = 4.5')

→ FOR FIRST 15' BEYOND SILL, THEN USE 12" d_{50} FOR REMAINDER. (DEPTH = 3')

Spillway Channel Outlet
Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\santanc3.fm2
Worksheet	Santan Phase 3 - Basin Flow at Sill
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.015	
Channel Slope	0.010000	ft/ft
Bottom Width	500.00	ft
Discharge	1,377.00	cfs

Results		
Depth	0.46	ft
Flow Area	232.13	ft^2
Wetted Perimeter	500.93	ft
Top Width	500.00	ft
Critical Depth	0.62	ft
Critical Slope	0.003862	ft/ft
Velocity	5.93	ft/s
Velocity Head	0.55	ft
Specific Energy	1.01	ft
Froude Number	1.53	
Flow is supercritical.		

Spillway Channel Outlet
Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\santanc3.fm2
Worksheet	Santan Phase 3 - Rock Flow prior to TW
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.015	
Channel Slope	0.074000	ft/ft
Bottom Width	1,000.00	ft
Discharge	1,377.00	cfs

Results		
Depth	0.17	ft
Flow Area	167.92	ft^2
Wetted Perimeter	1,000.34	ft
Top Width	1,000.00	ft
Critical Depth	0.39	ft
Critical Slope	0.004495	ft/ft
Velocity	8.20	ft/s
Velocity Head	1.05	ft
Specific Energy	1.21	ft
Froude Number	3.53	
Flow is supercritical.		

Spillway Channel Outlet
Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\santanc3.fm2
Worksheet	Santan Phase 3 - Steep Rock prior to TW
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	0.074000	ft/ft
Bottom Width	1,000.00	ft
Discharge	1,377.00	cfs

Results		
Depth	0.30	ft
Flow Area	302.51	ft^2
Wetted Perimeter	1,000.61	ft
Top Width	1,000.00	ft
Critical Depth	0.39	ft
Critical Slope	0.031968	ft/ft
Velocity	4.55	ft/s
Velocity Head	0.32	ft
Specific Energy	0.62	ft
Froude Number	1.46	
Flow is supercritical.		

Spillway Channel Outlet
Worksheet for Rectangular Channel

Project Description	
Project File	c:\haestad\fmw\santanc3.fm2
Worksheet	Santan Phase 3 - Flat Rock prior to TW
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Channel Slope	0.003000	ft/ft
Bottom Width	1,000.00	ft
Discharge	1,377.00	cfs

Results		
Depth	0.79	ft
Flow Area	791.66	ft²
Wetted Perimeter	1,001.58	ft
Top Width	1,000.00	ft
Critical Depth	0.39	ft
Critical Slope	0.031968	ft/ft
Velocity	1.74	ft/s
Velocity Head	0.05	ft
Specific Energy	0.84	ft
Froude Number	0.34	
Flow is subcritical.		

DMJM	PROJECT: SANTAN CHANNEL PHASE 3	JOB NO. 6J0P	SHEET 1 of 2
		DESIGNED BY ABM	DATE 6/25/99
SUBJECT: SPILLWAY ENERGY DISSIPATER		CHECKED BY DBL	DATE 8/10/99

RETENTION BASIN SPILLWAY DESIGN

FROM 60% PLANS WEIR LENGTH:

TOP, L = ~~1017.2'~~ (1000')

BOTTOM, L = 1000' ∴ USE 1000' (CONSERVATIVE)

① TYPE II BASIN:

FROM FLOW MASTER W/ RECTANGULAR CHANNEL,

Q = 2027 cfs $Y_1 = 0.12' = 1.44''$ ✓

$\mathbb{F} = 8.66$

TW = 1138.3 − 1130.5 = 7.8' ✓

CHUTE BLOCKS

∴ IMPRACTICAL TO USE 1½" BLOCKS

∴ USE 8" BLOCKS $h_B = W_b = 8''$ ✓

$N_c = W / 2W_b = 1000' / (2)(.667) = 750$ BLOCKS

FOR $y_1 = 0.12'$ & $\mathbb{F} = 8.66$,

$Y_2/.12' = \frac{1}{2}(\sqrt{1+8(8.66)^2} - 1)(1.1)' = 1.55'$

FIG VII-D-2, $TW_{min.} = 11.7(.12) = 1.40'$

LENGTH OF JUMP FLOOR (L_B)

FROM FIG. VII-D-3, $L_B / Y_2 = 4.25$

∴ $L_B = 4.25(1.55) = 6.58'$

USE 7'0" ✓

DMJM	PROJECT:	JOB NO. 6508	SHEET 2 of
		DESIGNED BY	DATE
SUBJECT:		CHECKED BY DBL	DATE 8/10/99

NOTE, FOR INITIAL PORTION OF SPILLWAY USE, THE DESIGN TAILWATER WILL NOT BE ACHIEVED. IT IMPOSES COST AND MAINTENANCE PROBLEMS TO DEPRESS THE BASIN POOL FOR THIS HALF HOUR PERIOD OF FUNCTION. THEREFORE PROVIDE SILL TOEWALL AND ROCK RIPRAP EROSION PROTECTION.

DENTATED SILL

$W_3 = W_4 = 0.15 y_2 \quad h_2 = 0.2 y_2$

$\therefore W_3 \cong .15(1.55) = 0.23'$ USE ~~6"~~ 9"

$h_2 = .2(1.55) = 0.31'$ USE ~~8"~~ 12"

$N_s = 1000/.23 = 4348$ ... IMPRACTICAL

IF $W_3 = W_4 = 6" \rightarrow$ ~~2000~~ ... ~~1000~~ 667 BLOCKS

~~1000~~ 666 SPACES (~~1/2 ON~~ EACH END)

TYPE III STILLING BASINS WOULD WORK FOR THE FROUDE NUMBER HOWEVER IT WOULD INVOLVE BAFFLE BLOCKS (ADDITIONAL COSTS). A TYPE IV STILLING BASIN IS RECOMMENDED FOR USE WITH FROUDE NUMBERS < 4.5.

Spillway Channel
Worksheet for Rectangular Channel

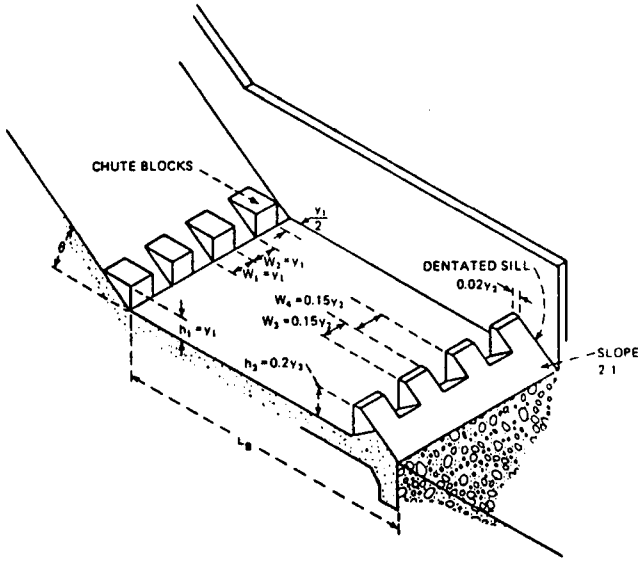
Project Description	
Project File	c:\haestad\fmw\santanc3.fm2
Worksheet	Santan Phase 3 - Pond Spillway
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

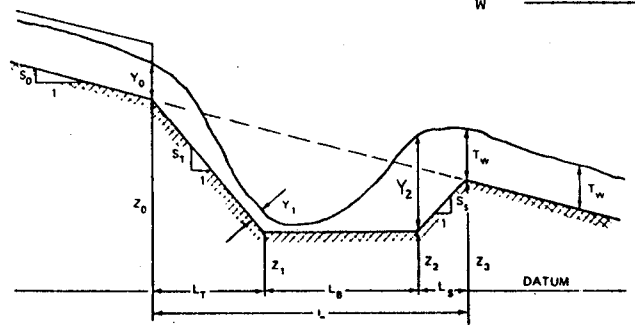
Input Data		
Mannings Coefficient	0.015	
Channel Slope	0.500000	ft/ft
Bottom Width	1,000.00	ft
Discharge	2,027.00	cfs

Results		
Depth	0.12	ft
Flow Area	119.38	ft^2
Wetted Perimeter	1,000.24	ft
Top Width	1,000.00	ft
Critical Depth	0.50	ft
Critical Slope	0.004127	ft/ft
Velocity	16.98	ft/s
Velocity Head	4.48	ft
Specific Energy	4.60	ft
Froude Number	8.66	
Flow is supercritical.		

USBR TYPE II

7-D





C_1 = _____

S_s = _____

S_T = _____

W_B = _____

y_2 = _____

T_W = _____

If $y_2 > T_W$, Depress Basin

$Z_1 = Z_2$	y_1	V_1	Fr_1	y_2	L_B	L_T	Z_3	$y_2 + Z_2$ (1)	$Z_3 + T_W$ (1)
L_S	L	W_1	h_1	N_c	h_2	W_3	W_4	N_s	

(1) $Z_3 + T_W \geq y_2 + Z_2$

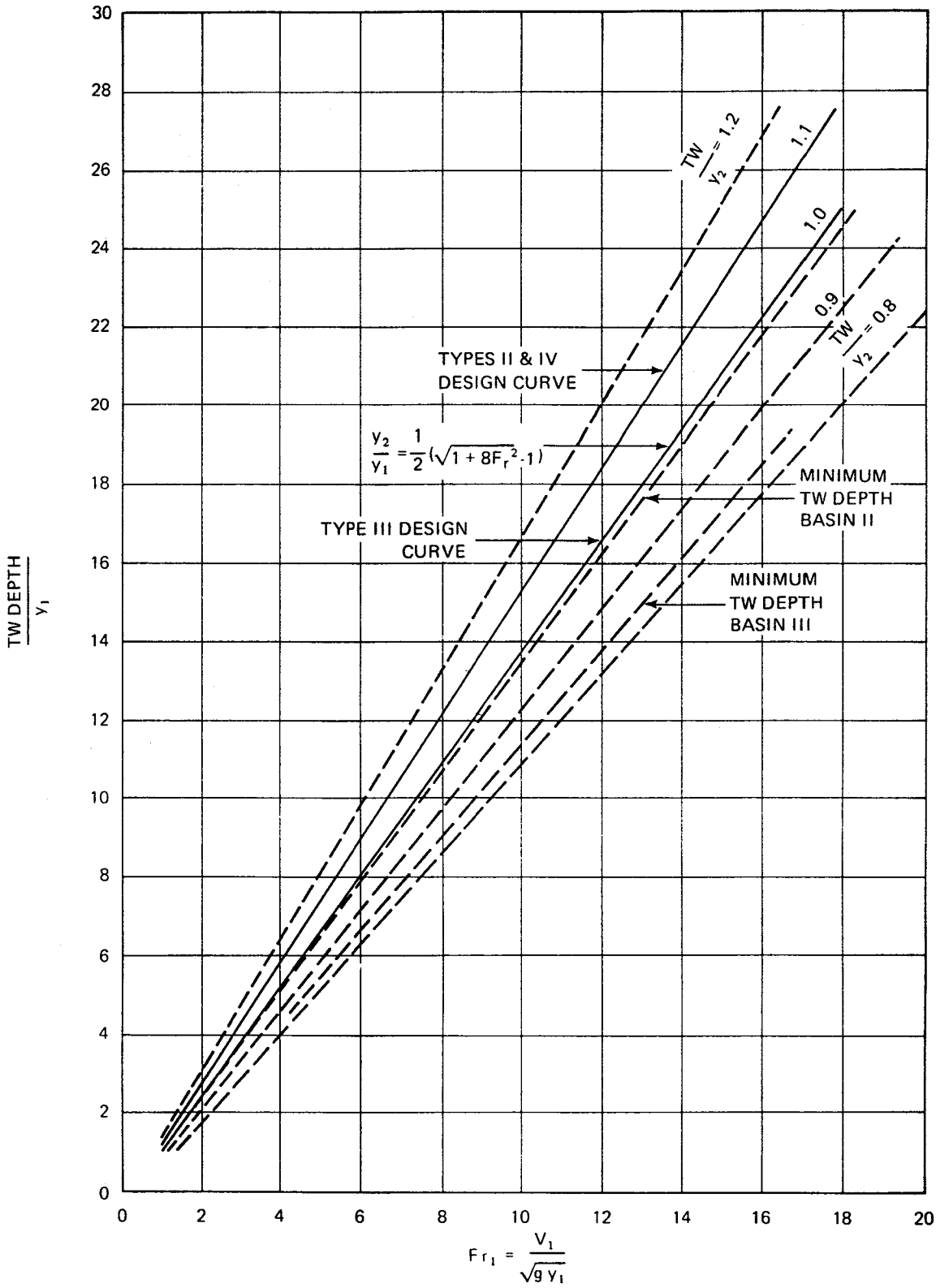


FIGURE VII - D - 2 TAIL WATER DEPTH (BASIN II, III & IV)

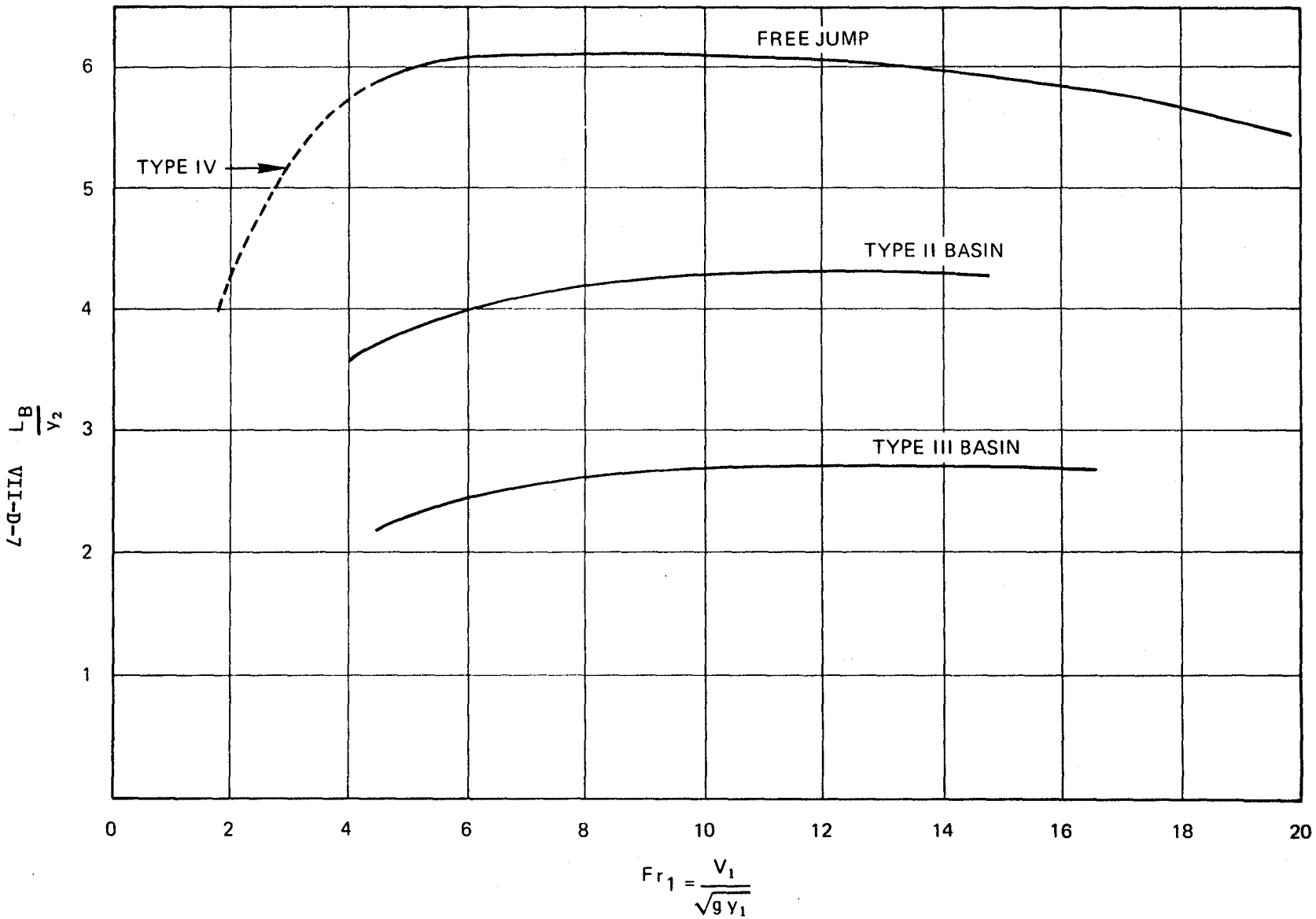


FIGURE VII - D - 3. LENGTH OF JUMP ON HORIZONTAL FLOOR

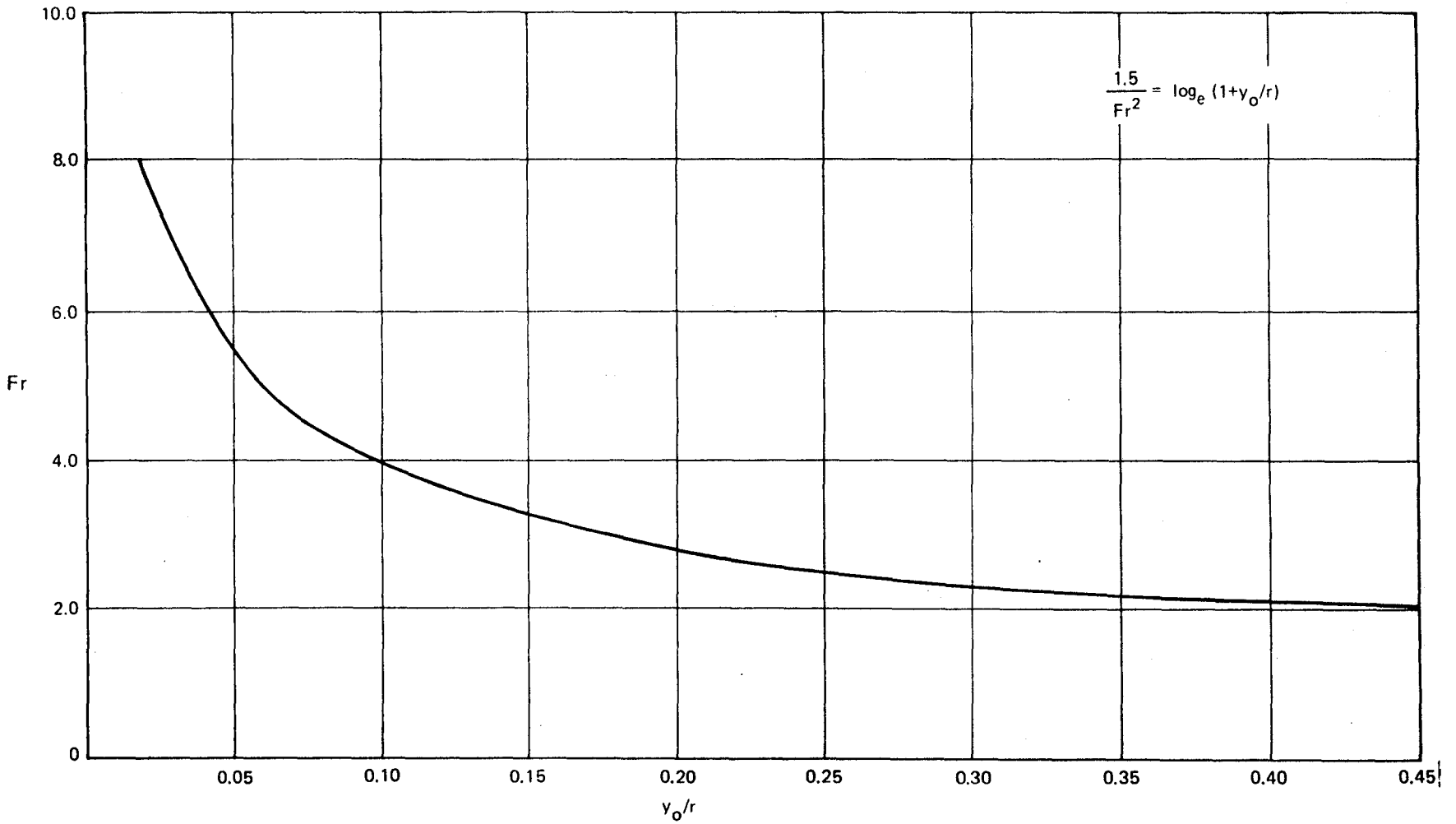


FIGURE IV-B-5 Fr Vs. y_o/r FOR TRANSITION FROM REFERENCE IV-B-1

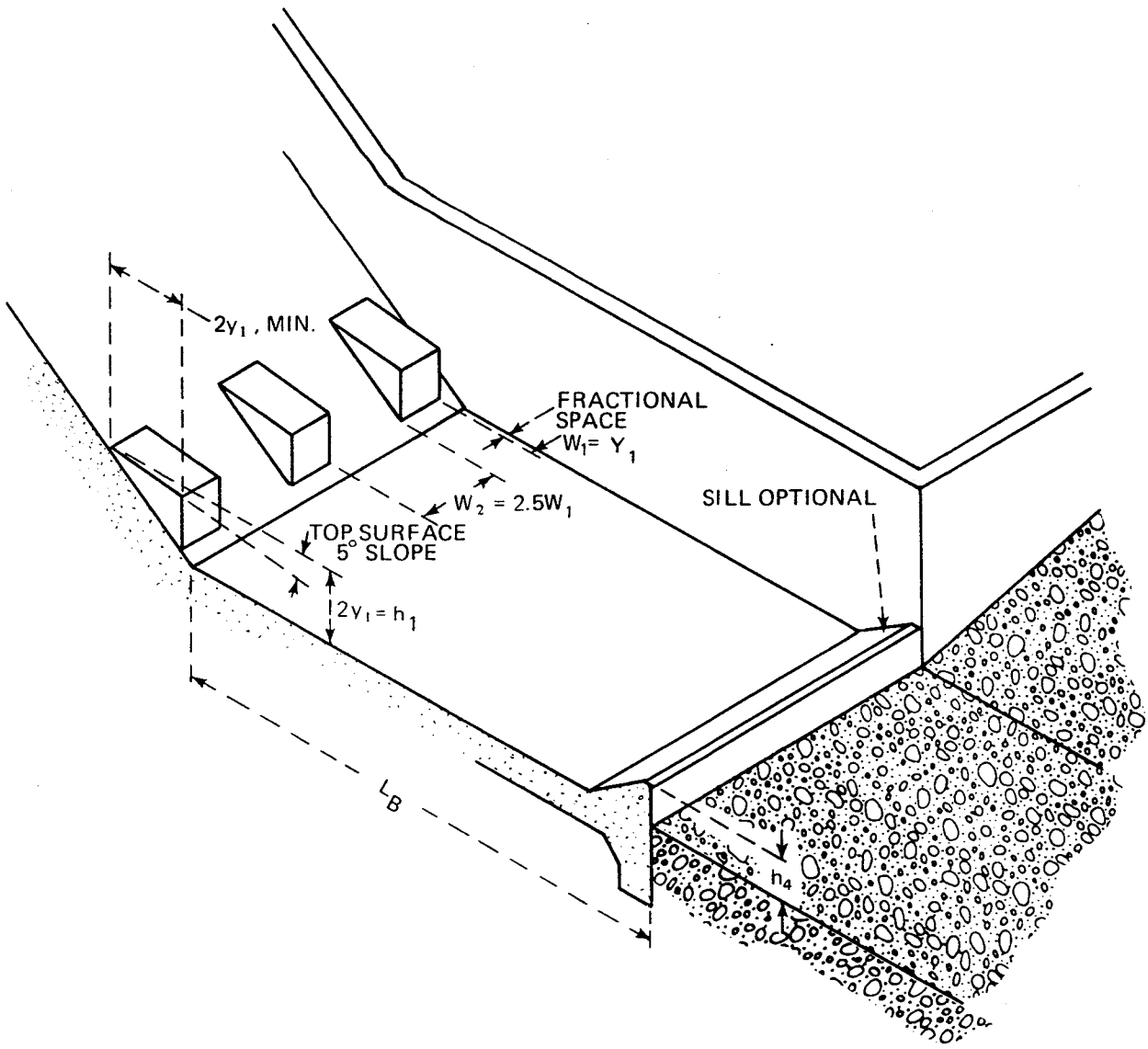
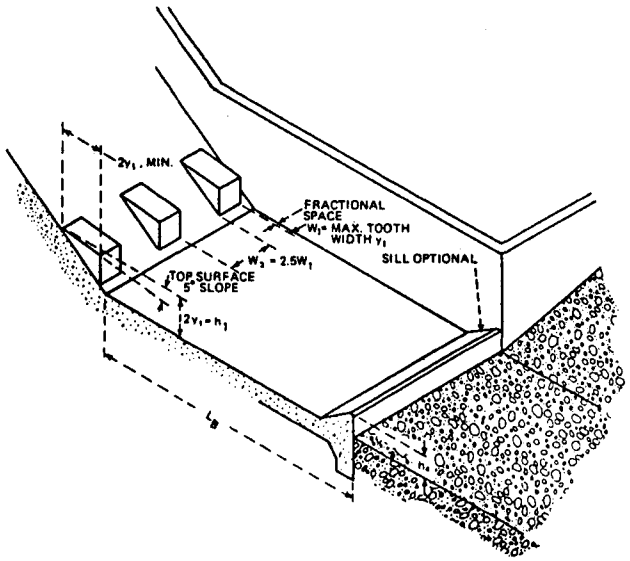
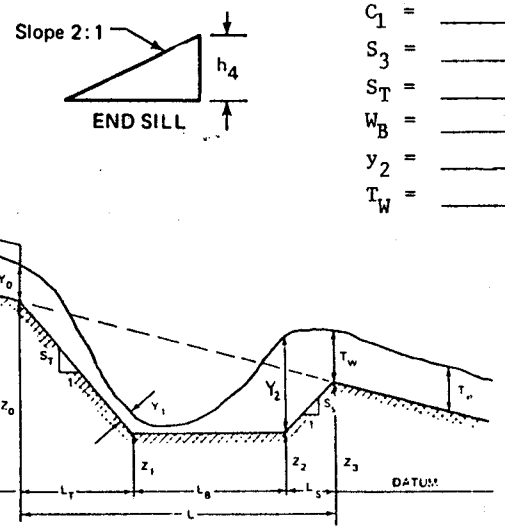


FIGURE VII - F - 1 USBR TYPE IV BASIN

USBR TYPE IV

7-F





C_1 = _____

S_3 = _____

S_T = _____

W_B = _____

y_2 = _____

T_W = _____

If $y_2 > T_W$, Depress Basin

$Z_1 = Z_2$	y_1	V_1	Fr_1	y_2	L_B	L_T	Z_3	$y_2 + Z_2$ (1)	$Z_3 + T_W$ (1)
L_s	L	h_1	W_1	W_2	N_c	Wall Spaces	h_4		

(1) $Z_3 + T_W \geq y_2 + Z_2$

Forebay Outlet to Equilibrium Basin
Worksheet for Trapezoidal Channel

Project Description	
Project File	c:\haestad\fmw\santanc3.fm2
Worksheet	Santan 3 - Channel Dive prior to TW
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.016	
Channel Slope	0.006670	ft/ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	8.00	ft
Discharge	296.30	cfs

Results		
Depth	2.14	ft
Flow Area	30.77	ft^2
Wetted Perimeter	21.51	ft
Top Width	20.81	ft
Critical Depth	2.55	ft
Critical Slope	0.003266	ft/ft
Velocity	9.63	ft/s
Velocity Head	1.44	ft
Specific Energy	3.58	ft
Froude Number	1.40	
Flow is supercritical.		

DMJM	PROJECT: SANTAN CHANNEL - 3	JOB NO.	SHEET 1 of
		DESIGNED BY ABM	DATE 7/8/99
SUBJECT: EROSION PROTECTION		CHECKED BY DDL	DATE 8/10/99

ROCK RIPRAP SIZING @ FOREBAY DISCHARGE INTO EQUILIBRIUM BASIN

- FIND OPTIMUM (WORST CASE) SITUATION OF CHANNEL FLOW PRIOR TO BASIN TAILWATER EFFECTS.

TRIAL & ERROR:

FOR WSE = 1139.52 + 2.50' = 1142.02

FOREBAY Q (VIA INTERPOLATION) $Q_F = 355.2$ cfs

FROM FLOWMASTER (MANNINGS) w/ b = 8', z = 3, S = .61

Y = 2.34'

TRY Y = 2.4', WSE = 1141.92, $Q_F = 340.9$ cfs

Y = 2.29'

TRY Y = 2.3', WSE = 1141.82, $Q_F = 324.1$ cfs

Y = 2.23'

FOR Y = 2.2' WSE = 1141.72, $Q_F = 306.7$ cfs

Y = 2.17'

→ FOR Y = 2.14' WSE = 1141.66, $Q_F = 296.3$ cfs

Y = 2.14'

∴ SIZE ROCK BASED UPON Q ≈ 300 cfs

DMJM	PROJECT: SANTAN CHANNEL-3	JOB NO.	SHEET 2 of
		DESIGNED BY ABM	DATE 7/8/99
SUBJECT: EROSION PROTECTION		CHECKED BY DRL	DATE 8/10/99

ROCK SIZING (CONTINUED):

① USING ADOT EQ.:

$$D_{50} = \frac{10[CD(SN)]^{1.5} V^3}{[K(G_s - 1)]^{1.5} R^{0.5}}$$

FOR: $C = 1.29$, $D = 1$, $K = 0.87$, $SN = 1.40$, $G_s = 2.4$

$V = 9.63$ fps $= 2.94$ m/s, $R = 1.43$

$$D_{50} = \frac{10[(1.29)(1.40)]^{1.5}(2.94)^3}{[(0.87)(1.40)]^{1.5}(1.43)^{0.5}} = \frac{616.76}{1.607}$$

$D_{50} = 383.7$ mm $= 1.275'$

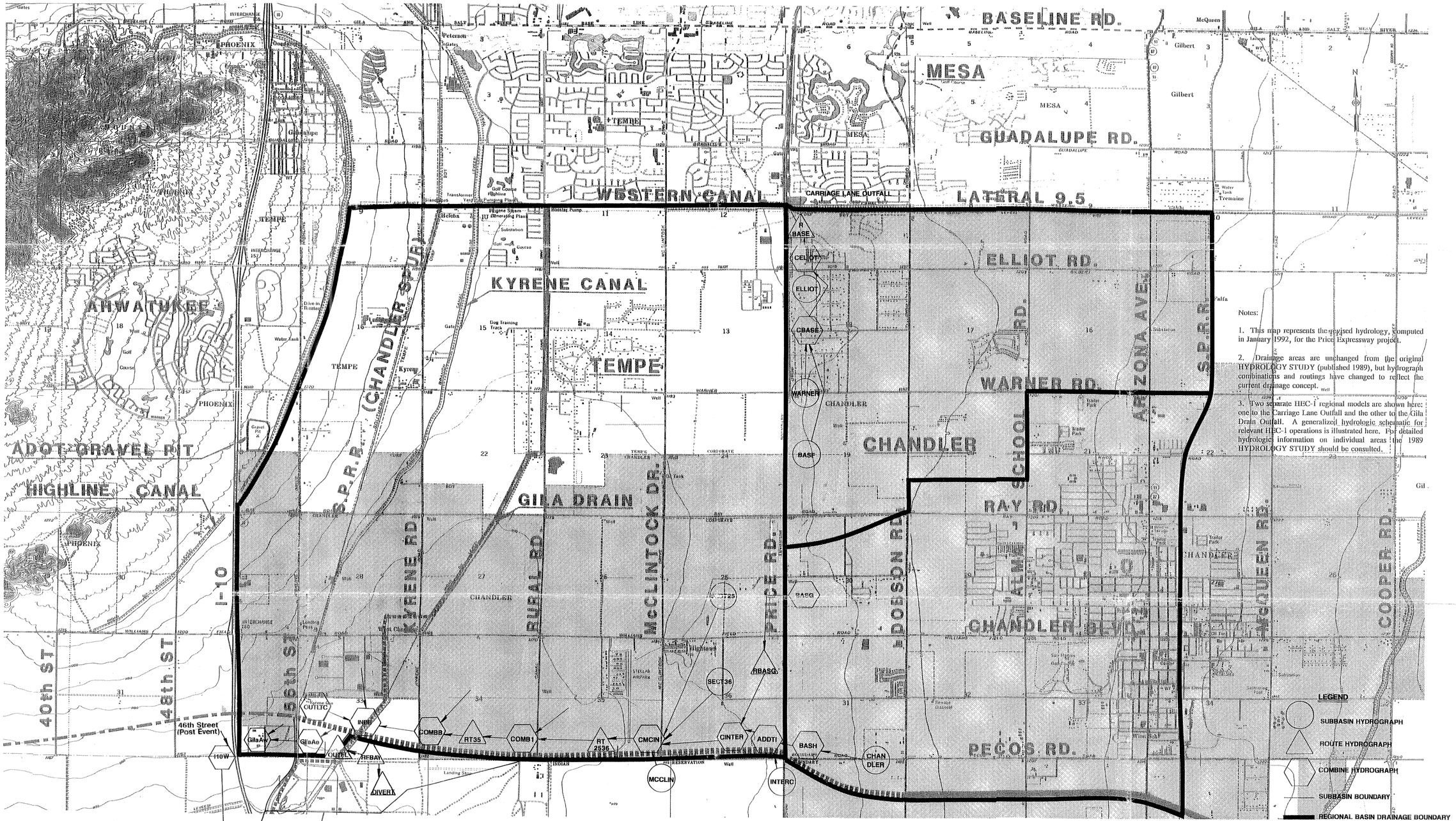
② USING UD & FCD:

$$d_{50} = \frac{VS^{.17}}{(S_s - 1)^{.66}(4.5)} = \frac{9.63(.0067)^{.17}}{(1.4)^{.66}(4.5)}$$

$\therefore d_{50} = 0.73'$

$\therefore$ USE $d_{50} = 18''$ 4.5' THICK

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
	ARIZ.				



Notes:

1. This map represents the revised hydrology, computed in January 1992, for the Price Expressway project.

2. Drainage areas are unchanged from the original HYDROLOGY STUDY (published 1989), but hydrograph combinations and routings have changed to reflect the current drainage concept.

3. Two separate HEC-1 regional models are shown here: one to the Carriage Lane Outfall and the other to the Gila Drain Outfall. A generalized hydrologic schematic for relevant HEC-1 operations is illustrated here. For detailed hydrologic information on individual areas the 1989 HYDROLOGY STUDY should be consulted.

Schematic was revised in May 1998 to reflect changes to the Basin B and Outfall Channel routings for Phases 1 and 2 of the Santan Channel Project. Changes are for the HEC-1 Model File No. SVRD05-2.OUT included in the *Final Drainage Report, Phase 1 and Phase 2, Santan Channel Project*, ADOT Contract No. 97-16, May 1998.

	NAME	DATE
DESIGN	EL	1-92
DRAWN	JOM	1-92
CHECKED		

HDR Engineering, Inc.

ROUTE | MILEPOST

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
HIGHWAY PLANS

CONCEPT DRAINAGE PLAN
HYDROLOGY SCHEMATIC

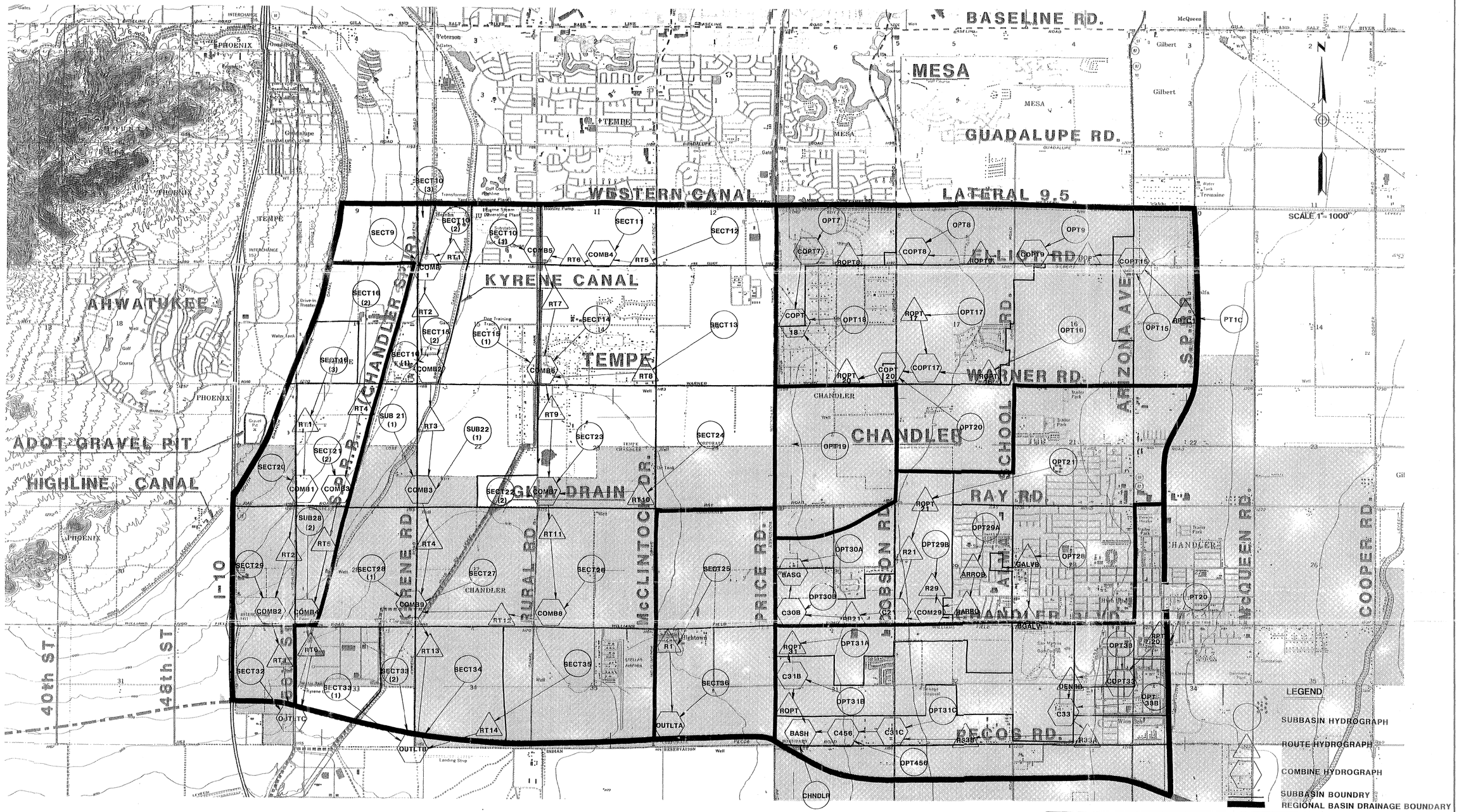
LOCATION
PRICE EXPRESSWAY/SANTAN FREEWAY

SHEET OF

H-2222-01 D

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
	ARIZ.				



This Schematic is included in the *Final Drainage Report, Phase 1 and Phase 2, Santan Channel Project*, ADOT Contract No. 97-16, May 1998 for reference only. The routings east of Price Road changed as a result of the Gila Drain Alternative study that directed flows from Basin G south to the Gila Drain as shown in the Concept Drainage Plan dated January 1992. The HEC-1 model structure west of Price Road remains the same except for the Santan Channel routings along Pecos Road to Basin B.

	NAME	DATE
DESIGN		12-87
DRAWN		
CHECKED		

HDR Engineering, Inc.

ROUTE | MILEPOST | LOCATION

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
HIGHWAY PLANS

HYDROLOGY STUDY
DRAINAGE AREA MAP
AND HEC-1 MODEL SCHEMATIC

SHEET 2 OF 5

H-2222-01D

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE