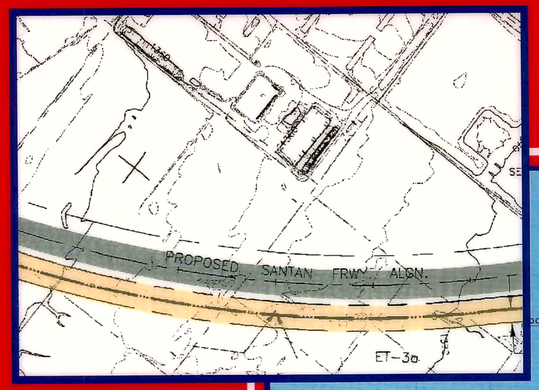
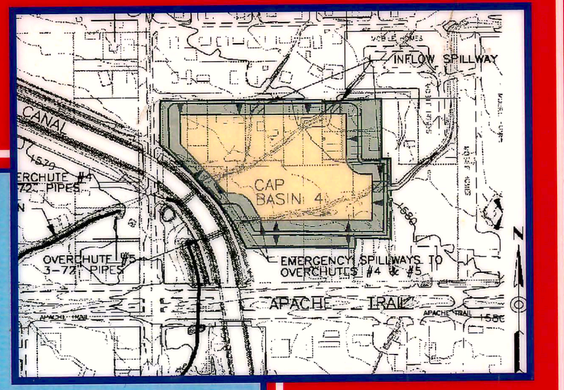
East Mesa Area Drainage Master Plan
FCD #95-32

July, 1998

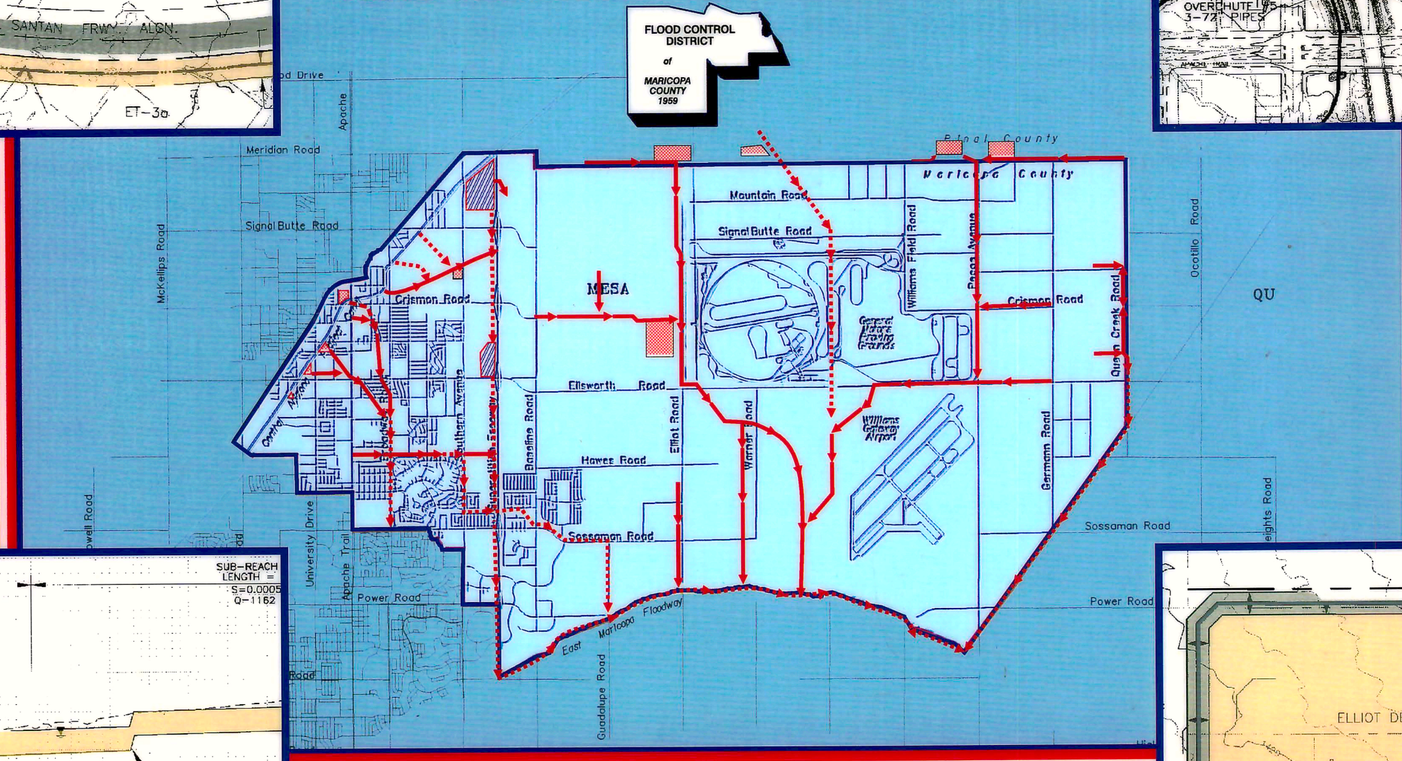
Recommended Design Report

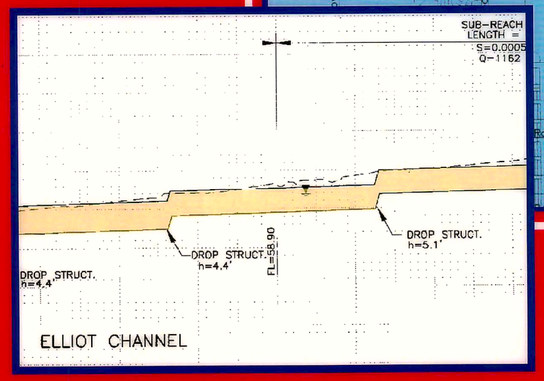


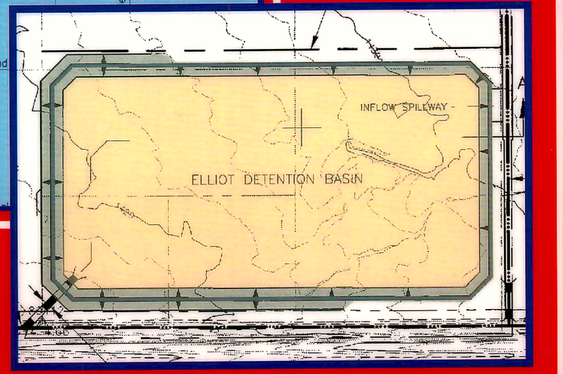


Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY







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EAST MESA AREA DRAINAGE MASTER PLAN
FCD #95-32

RECOMMENDED DESIGN REPORT

Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Prepared by:

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EAST MESA AREA DRAINAGE MASTER PLAN
RECOMMENDED DESIGN REPORT

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EAST MESA AREA DRAINAGE MASTER PLAN
RECOMMENDED DESIGN REPORT

I. INTRODUCTION

A. Objective

This Recommended Design Report has been prepared for the Flood Control District of Maricopa County (FCDMC) as part of the East Mesa Area Drainage Master Plan (ADMP). The purpose of the project is to identify drainage problems and develop cost-effective solutions for a storm water collection and disposal system for the east Mesa area. The study recommends necessary drainage facilities and the level of flood protection these facilities will provide. The project location is shown on **Figure 1**. The study area covers eastern Maricopa County including portions of the City of Mesa, the Town of Gilbert, the Town of Queen Creek, and unincorporated Maricopa County. The jurisdictional boundaries are depicted on **Figure 2**.

The project is developed in two phases. Phase I includes analysis of existing conditions and identification of existing problem areas, followed by development and analysis of various alternative drainage solutions. Phase II includes mapping and preliminary design of the selected drainage solution. This *Recommended Design Report* is the final Phase II product documenting the preliminary design and costs of the recommended alternative resulting from Phase I. *Preliminary Design Plans* are included showing project plan elements in plan and profile at a scale of 1 inch = 400 feet.

B. Study Area

The study area is approximately bounded by the Maricopa County/Pinal County line (Meridian Road) to the east, the East Maricopa Floodway (EMF) to the west, the Rittenhouse channel and Queen Creek Road to the south, the Central Arizona Project Salt-Gila Aqueduct (CAP) to the northeast, extending north to Brown Road near Hawes Road, and an approximate diagonal line from Hawes Road and the CAP south to Power Road and the Superstition Freeway. The limits of the study are shown on **Figure 2**.

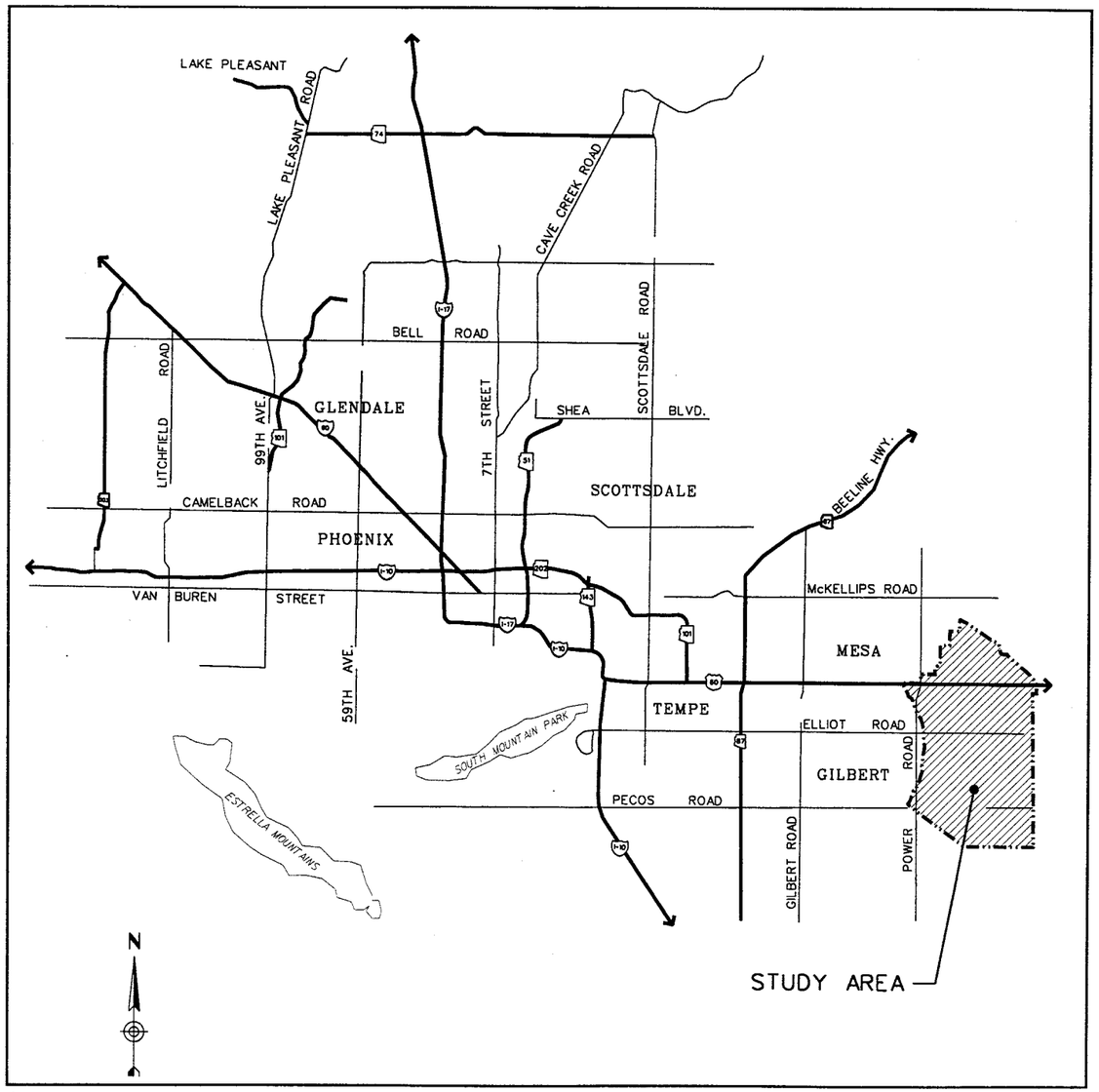
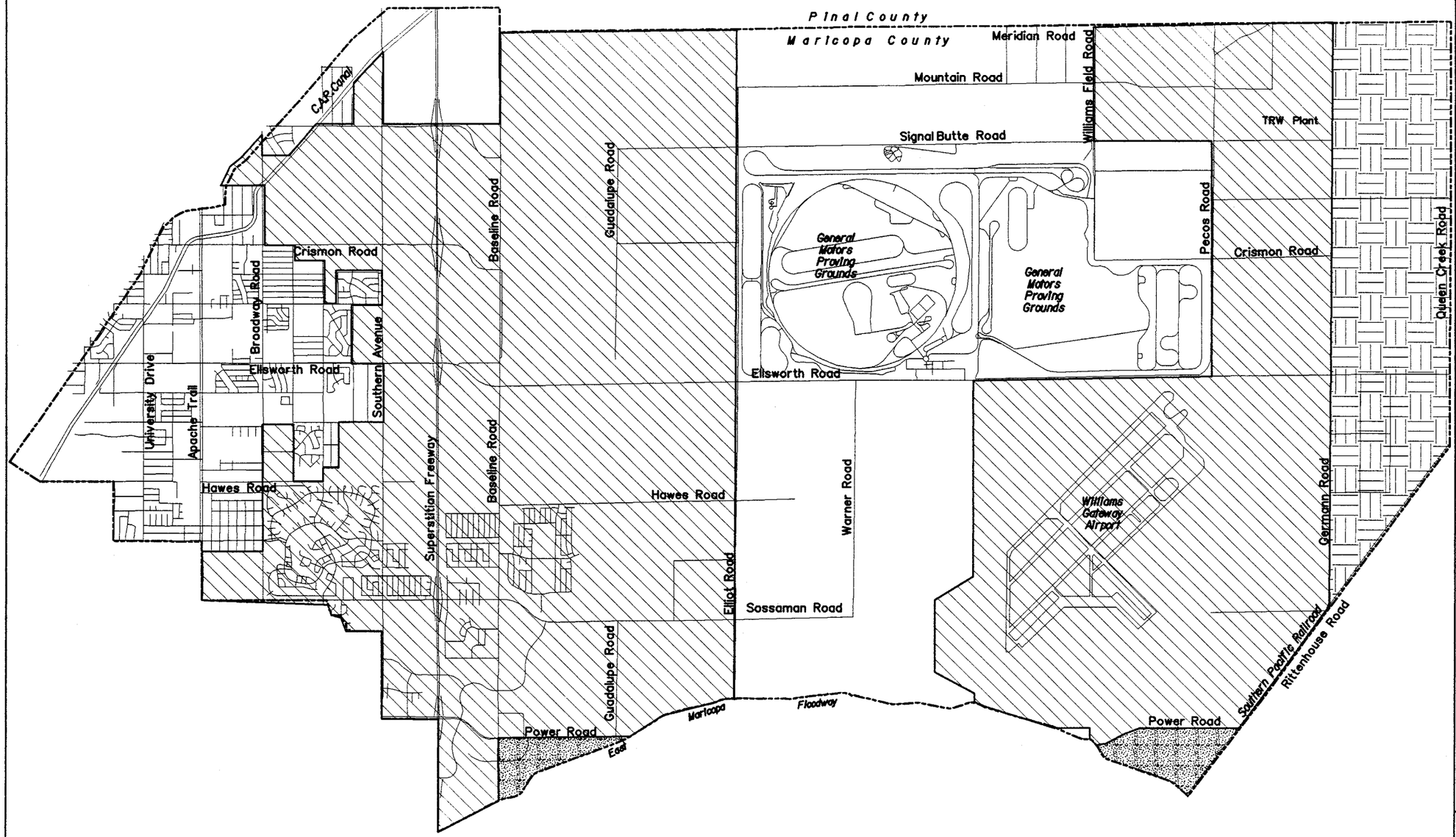


Figure 1 - Project Location

The Superstition Freeway (State Route 60) bisects the study area from east to west and forms a physical barrier to the natural drainage patterns, except for locations where structures have been designed to convey drainage from the north side to the south side of the freeway. The freeway has also formed a demarcation line for the current and future development patterns in the area. A majority of the existing and older developments lie on the north side of the freeway. A great deal of the current development is occurring at a rapid pace within large tracts of land on the south side of the freeway.



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

- MESA
- MARICOPA UNINCORPORATED
- GILBERT
- QUEEN CREEK

N

2500 0' 2500 5000
SCALE: 1" = 5000'

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
SINCE 1982

Hoskin Engineering Consultants

JURISDICTIONAL BOUNDARIES

FIGURE 2

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C. Existing Reports

The east Mesa area has been previously studied in other master plans and studies. These plans and studies are discussed in the Phase I *Alternatives Analysis Report*, October 1997. Improvements identified in this report are based on preliminary information contained in the *Alternatives Analysis Report*. The reader is referred to the *Alternatives Analysis Report* for additional background information on the alternatives considered and the selection process.

D. Project Coordination

A Review Committee was established by the FCDMC to provide coordination throughout the project. The Review Committee includes representatives from local government agencies and primary landholders with an interest in the project. The Review Committee met several times during Phase I of the project to provide direction and feedback during development and selection of the Recommended Alternative Plan. The Review Committee is made up of the following members:

GM Proving Grounds	Mr. Stacey Christensen
Town of Gilbert	Mr. Lonnie Frost
Pinal County	Mr. Bill Clemans
City of Mesa	Mr. Peter Knudson
Williams Gateway Airport	Mr. Art Allen
TRW	Mr. Walter Vail
Town of Queen Creek	Mr. Dick Schaner
ADOT	Mr. Joseph Spadafino
MCDOT	Mr. Tom Phalen
FCDMC	Mr. Raju Shah
Dibble & Associates	Mr. Brian Fry
Hoskin Engineering	Mr. Paul Hoskin

Following completion of the *Alternatives Analysis Report*, as part of the design development, further input was solicited from project stakeholders. Meetings were held at City of Mesa, FCDMC, Williams Gateway Airport, and at GM Proving Grounds. Based on input received in those meetings, modifications were made to the plan to help meet the needs and objectives of the stakeholders.

A final neighborhood meeting was held June 16, 1998 to present the plan to residents of the study area.

E. Deliverables

Deliverables for Phase I of the project include the *Data Collection Report*, *Preliminary Alternatives Report*, and the *Alternatives Analysis Report*. Phase II deliverables consist of this *Recommended Design Report* which includes descriptions and cost estimates of all recommended improvements and preliminary plan and profile drawings for the recommended alternative.

F. Acknowledgments

The completion of this report was made possible by many individuals whose assistance and cooperation are gratefully acknowledged. We especially wish to thank Mr. Raju Shah, Mr. Don Rerick, Mr. Dave Degerness, and Ms. Valerie Swick of the Flood Control District of Maricopa County, Mr. Peter Knudson of the City of Mesa Engineering Department, Mr. Frank Mizner of the City of Mesa Planning and Zoning Department, and all members of the Review Committee.

G. Consultant Project Team

Dibble and Associates was the prime consultant on the project. The following individuals from Dibble and Associates were responsible for completion of this project: Mr. Richard Perry, P.E., Principal in Charge, Mr. Brian Fry, P.E., Project Manager, Mr. Frank Brown, P.E., and Mr. Dan Frank, EIT, Project Engineers, Mr. Jack Vandersee, CADD technician, and Mr. Myron Jasmann, RLS, field survey manager.

Dibble and Associates was assisted by Hoskin Engineering Consultants (HEC). Individuals from HEC who contributed to the completion of the project include: Mr. Paul Hoskin, P.E., Project Engineer and Ms. Paula Ethridge, CADD technician.

Additional sub-consultant firms and their representatives who also contributed to the completion of this project include: Mr. Larry Maldonado, P.E., Project Engineering Consultants, for the aerial mapping control, Mr. Robert Parks, Aerial Mapping Company, for the aerial mapping, and Ms. Diane McCloskey, McCloskey Peltz, Landscape Architects for landscape mitigation planning.

II. HYDROLOGY

A. Introduction

The hydrology for this study has been prepared by the FCDMC. The FCDMC modified the existing conditions hydrology from Phase I to incorporate the selected design hydrologic criteria and the future condition land use from the new MAG 1997 land use maps. Dibble and Associates then modified the FCDMC supplied hydrology to reflect changes in flow routing from the planned channels, storm drains, and detention basins.

B. Methodology

Hydrology for the east Mesa area is developed using the U.S. Army Corps of Engineers, *HEC-1 Flood Hydrograph Package* (HEC-1) computer program. Guidance is given in the *Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology* (Hydrology Manual) for application of the HEC-1 program within Maricopa County. Additionally, the computer program *Drainage Design Menu System* (DDMS), developed by the Flood Control District of Maricopa County, was used to aid in the application of the methods described in DDM1. Features within the DDMS used for this study include *Computation of Precipitation Frequency-Duration Values in the Western United States* (PREFRE) and *Maricopa County Unit Hydrograph Procedure 2* (MCUHP2). The application of these tools is more specifically described in the Flood Control District Hydrology Report.

Runoff is evaluated under developed conditions for the 100-year, 24-hour storm using the SCS Type II rainfall distribution. Aerial reduction factors are used from the NWS HYDRO-40. Rainfall losses are estimated using the Green-Ampt method. The S-graph method with the Phoenix Valley S-graph is used to represent runoff characteristics for the watershed and to convert them to a Unit graph for input into the HEC-1 model. The drainage subarea boundaries are shown on **Figure 3**. The drainage subarea boundaries with the schematic routing diagram are contained in the **Appendix**.

C. Hydrologic Criteria

The preliminary design hydrology is based on providing 100-year flood protection under fully developed watershed conditions. Due to the County's retention requirement, the developed conditions runoff will be less than under existing conditions. As a result, project elements constructed prior to full build-out conditions may have less than 100-year capacity until the full development is achieved. The following assumptions are incorporated into the hydrology:

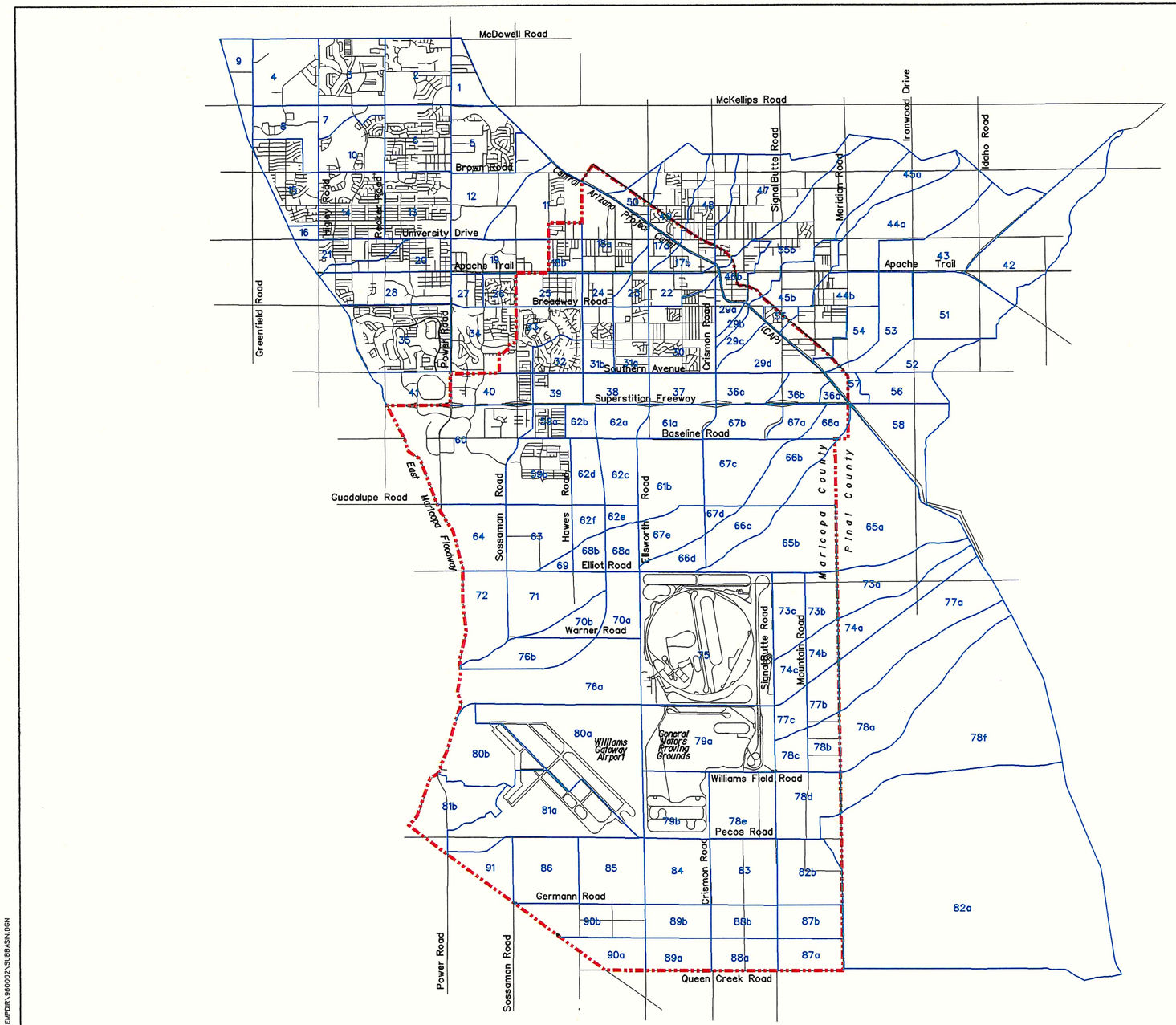
- Future development within the study area will occur according to the MAG 1997 land use projections.
- Retention will be provided with new development in Maricopa County to retain the entire 100-year, 2-hour runoff from the development. However, 20 percent of the developed area is assumed to not be retained due to public roadways that do not provide retention and due to inefficiencies in on-site retention that may result in un-attenuated runoff exiting the site in either a planned or unplanned manner.
- Retention will be provided with development occurring within watersheds in Pinal County that drain into Maricopa County along Meridian Road. The retention will limit runoff to not exceed existing conditions. Therefore, existing conditions runoff is used for watershed areas within Pinal County.

D. Drainage Area Characteristics

The drainage area contributing runoff to the study area encompasses 90 square miles, extending east into Pinal County. The Superstition Freeway and the CAP canal form major drainage boundaries. Runoff is concentrated upstream of the CAP canal and discharged over the canal in overchutes. The Superstition Freeway has a system of collector channels and detention basins that collects runoff and discharges the detained flows under the freeway.

The area south of the Superstition Freeway is characterized by agricultural and industrial land uses with large portions of undeveloped desert. The GM Proving Grounds and Williams Gateway Airport (WGA) occupy approximately 25 percent of the study area south of the freeway, and have a major impact on the hydrology. Almost all of the runoff entering the study area from Pinal County encounters the GM Proving Grounds at some point along its boundary. The Proving Grounds presents a four mile long barrier to runoff. GM has made substantial changes to the natural drainage patterns as part of construction of their test track facilities. Runoff reaching the GM Proving Grounds is diverted around the north and south property boundaries and through the site in the Powerline Floodway. Williams Gateway Airport has taken a similar approach to handling off-site flows. Perimeter channels divert flows around the north and south boundaries to the East Maricopa Floodway.

The area north of the Superstition Freeway is characterized by longtime existing development with a complex drainage network that has evolved over time with development. Typically, the drainage network has a low capacity which can be exceeded during large storm events. Runoff enters the study area through several CAP overchutes and is conveyed by the local drainage network, by streets and overland flow to the Superstition Freeway.



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

East Mesa Area
Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

STUDY BOUNDARY

SUB-BASIN BOUNDARY

SUB-BASIN IDENTIFICATION 42

N

1 0 1 2
SCALE IN MILES

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

Hoskin Engineering Consultants

DRAINAGE SUB-AREA
BOUNDARIES

FIGURE 3

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III. DESIGN CRITERIA & OBJECTIVES

A. Introduction

This section describes the criteria for open channel, box culvert, and detention basin design and the computational procedures used for preliminary design.

B. Design Criteria

Drainage design for hydraulic structures in Maricopa County is governed by criteria presented in *Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics*, January 28, 1996 (Hydraulics Manual.) In addition to the criteria from the Hydraulics Manual, additional criteria are adopted for preliminary design. The criteria listed below are used as a guideline during design development and are intended to be followed during final design development.

1. Open Channels

Channel Section - The maximum side slope is 2:1 for concrete channels and 4:1 for earth channels. The design side slope for earth channels is 6:1 where sufficient right of way is available. A minimum bottom width of 4 feet is required, however, an eight foot bottom width is provided where feasible. The design channel lining depth is the normal flow depth plus freeboard. Required freeboard is 0.25 times the sum of depth plus velocity head with a minimum of 1 foot for sub-critical flow and 2 feet for super-critical flow conditions.

Manning's n - The following Manning's n values are used in development of the channel design: n=0.015 for concrete, n=0.025 for earth, and n=0.040 for riprap.

Froude Number - Froude numbers for channel design are to be less than or equal to 0.86 for sub-critical flow. In most cases channels are designed for sub-critical flow. Drop structures are provided, if necessary, to flatten the grade to achieve sub-critical flow conditions. Super-critical flow is allowed in special circumstances, such as where right-of-way is limited. Super-critical flow channels, when used, are to have Froude numbers greater than 1.13 and less than 2.0.

Longitudinal Slope - Extremely flat slopes are avoided for constructibility reasons. Specific slope criteria are not provided because slopes will generally be dictated by the Froude number criteria. Slopes are set as steeply as possible within the limitations of the channel material maximum allowable velocity and the limitation on Froude number.

Drop Structures and Channel Profile - When the natural ground slope is steeper than the maximum allowable longitudinal channel slope, drop structures are provided. The size and spacing of drops are established based on a minimum drop height of 3 feet, and a maximum drop height of 6 feet. Additionally, the top of channels should project no more than 2 feet above adjacent existing ground (fill situations) and the top of channels should be incised no more than 3 feet below adjacent existing ground (cut situations).

Side Drainage - Surface runoff entering the channel from the side should be directed to enter the channel at planned locations with side spillways. This will prevent rill erosion for earth channels and undermining at the concrete-soil interface for concrete channels.

Auxiliary Drainage Facilities - Where the top of channel projects above the adjacent existing ground (fill situations), a parallel channel or swale should be used to convey runoff to a planned channel inflow point. Additional right of way may be required in these areas. The parallel auxiliary drainage channel should generally be a vee-shaped swale.

Maintenance Access Road - The channel cross-section allows for a 16-foot wide maintenance road on each side of the channel. Where the channel is adjacent to a public street, the street serves as one of the maintenance roads. New maintenance roads should have a 2% cross slope, away from the main channel. At specified locations, the maintenance road should be dipped to allow side drainage to enter the main channel. A 4-inch thick gravel surface is required on the maintenance road.

Some areas with existing development adjacent to an unimproved channel don't have adequate right of way to allow maintenance roads. The District should be involved in decisions to provide either dry weather access only, along the channel bottom, or to obtain additional right of way for all weather access roads.

Fence - A 6 foot high chain link fence should be provided on both sides of the channel. In some areas with existing block walls, no new fence is needed. Equestrian and pedestrian gates can be provided for access to multipurpose channels.

Concrete Lining - For planning purposes, concrete channel lining includes 6-inch thick concrete lining with reinforcing steel using #4 bars at 12 inch center spacing each way. The final concrete channel section

design should include recommendations from a geotechnical investigation.

2. Box Culverts

Height & Cover Requirements - A minimum height of 4 feet shall be provided for maintenance purposes. A minimum of 1 foot of cover is planned for a full roadway structural section. If one foot of cover cannot be provided, traffic should drive directly on the box culvert top slab. Approach slabs shall be included for box culverts with no cover.

Design Flow - Culverts constructed with channels shall be designed to the same 100-year design discharge as used for the channel. The 50-year design flow criteria from the Hydraulics Manual will apply only to crossroad culverts with natural channels.

3. Detention Basins

Side Slopes - Side slopes of 6:1 are normally used for the inside basin side slopes. Maximum inside side slopes of 4:1 are used when required to achieve the required volume within the available site. Side slopes on fill embankments outside the basin are limited to a maximum of 3:1, with 4:1 desired when site constraints permit.

Basin Longitudinal Slope - Minimum slopes of 0.5% are used for grass or earth low-flow channels or swales. A minimum slope of 0.2% and a maximum slope of 0.5% is used for concrete low-flow channels. Concrete low-flow channels are designed according to the rectangular concrete channel section found in Figure 8.3 of the Hydraulics Manual.

Basin Cross Slope - A 1% minimum cross slope is used for sheet flow runoff surfaces. Surfaces are graded to drain toward the low-flow channel or outlet pipe.

Embankment Width and Maintenance Road - A 16-foot wide top-width is provided at the top of basin embankment fills to accommodate a maintenance access road around the basin. The maintenance road will include a 4-inch thick gravel surface. Provision should be made in final design for maintenance access to the basin floor by providing one or more access ramps.

Principal Outlet Pipe - Principal outlet pipes consist of a concrete pipe or box culvert, designed to operate under inlet or pipe control. The minimum allowable outlet pipe size is 24-inches. The outlet pipe invert is typically set 12 inches below the basin floor to facilitate complete draining of the basin and to prevent soggy areas near the outlet. For planning purposes, the outlet pipes are modeled in HEC-1 as orifices with an orifice coefficient of 0.62. A more detailed analysis of the outlet should be made during final design.

Emergency Spillway - All detention basins will be provided with emergency spillways. The spillway should be located to direct overtopping flows along the historic flow path. The spillway crest elevation is set at the 100-year design water surface. Spillways are designed as broad-crested weirs, according to the formula $Q= CLH^{1.5}$ using 2.5 for the coefficient C, and assuming vertical side slopes for computation purposes only. The spillway is designed to pass the un-attenuated 100-year inflow. The spillway length is set for a design overflow depth of 2 feet with an additional 1 foot of residual freeboard for a weir height of 3 feet. The weir cross-section will be a trapezoid with 6:1 side slopes to allow maintenance vehicular passage.

Total Freeboard - Total freeboard of 3 feet is provided between the emergency spillway crest and the top of the embankment. At some locations, with basins of relatively shallow depths, 2 feet of freeboard is acceptable, which reduces the residual freeboard to 0.0 feet.

Safety Features - A 6-foot high chain link fence is required around the entire basin perimeter. Gates will be provided for maintenance access. All inflow and outflow pipes will be equipped with access barrier grates. The grates shall have adequate open area to limit design flow velocities through the grate to 3 feet per second (ft/s) or less with a plugging factor of 50% applied to the clear opening area. A maximum clear opening of 4 inches is allowed between grate bars.

ADWR Jurisdictional Dams - Detention basins are designed for this master plan to limit embankment fills to ensure that basins are classified as "non-jurisdictional dams." Embankment fills of six feet or less are classified as non-jurisdictional dams, regardless of storage capacity. Embankment fills of less than twenty-five feet are classified as non-jurisdictional if the storage capacity is less than fifty acre-feet. If the storage volume is less than 15 acre-feet, regardless of embankment height, the basin is classified as non-jurisdictional. The dam height for purposes of ADWR classification is the vertical distance between the lowest point on the downstream toe (at natural ground) to the spillway crest.

Off Line Storage basins - Off line detention basin concepts are utilized in this master plan. Planning level estimates are provided for the inflow weir length based on an average depth of flow of 1 ft over the weir. More detailed analysis will be required during final design to ensure proper functioning of side weirs.

C. Design Calculations

New open channels, box culverts, and detention basins are sized based on projected peak runoff rates under fully developed conditions. The developed condition's hydrology model is updated to reflect the design channel cross sections and slopes and the detention basin stage-storage-discharge relationships and then rerun. The resulting updated flows are used to update the design calculations. Through this process the hydrologic routing effects of the proposed improvements are included in the design discharges. The design calculations for each project element are presented on the facing page of each preliminary plan sheet in the back of this report.

1. Open Channels

Open channels are sized using Manning's equation. The maximum allowable slope is determined based on the Froude number criteria and the maximum allowable velocity for the channel material. If the maximum allowable slope is flatter than the existing ground slope, the number and size of drop structures are determined to match the existing ground slope. The design slope and drop structures are then fit into the profile using the preliminary plan and profile sheets. The freeboard requirement is computed from the hydraulic parameters and added to the normal flow depth to determine the channel lining depth and top width. The right of way requirement for the channel, maintenance access road(s), and cut or fill slopes are added to determine the total right of way requirement for the reach. The channel cross-section and profile are then input into surface modeling computer software to compute the cut and fill quantities for the earthwork estimates. The surface modeling software is used to compute the difference in earthwork volume between existing washes and the planned channels.

The channel design calculations are tabulated on the facing page of each channel plan and profile sheet in the *Preliminary Design Plans* section of this report. The headings in the "Channel Properties" portion of the facing page calculations are defined as follows:

Col No.	Heading	Description
1	I.D.	Reach identifier from plans.
2	HEC-1 I.D.	Identifier from HEC-1 output.
3	Design Q100	Design discharge from HEC-1 output corresponding to HEC-1 I.D.
4	Comp. Capacity	Computed channel capacity from parameters in table (should match Design Q100)
5	DS Invert El.	Invert El. at downstream end of reach.
6	US Invert El.	Invert El. at upstream end of reach.
7	Length	Length of channel reach.
8	Comp. Invert Slope	Natural ground slope.
9	Design Invert Slope	Design channel invert slope.
10	Total Vert. Drop	Vertical drop from difference in natural and design invert slopes.
11	No. Of Drops	Number of drop structures in reach
12	Vertical Drop	height of each drop structure
13	Material Type	Channel lining material code
14	Manning's n	N-value for lining material
15	Bottom Width	channel design bottom width
16	Depth of Flow	design normal depth of flow
17	SS Left	channel side-slope left
18	SS Right	channel side-slope right
19	Area	Flow cross-sectional area
20	Perimeter	wetted perimeter of flow
21	Froude No.	Froude no based on hydraulic depth
22	Type of Flow	Flow regime; sub-critical, transition, or super-critical.
23	Velocity	Average channel flow velocity
24	Freeboard	Required freeboard
25	Design Depth	channel flow depth plus freeboard.
26	Channel Topwidth	Topwidth at design depth.

2. Box Culverts

New culverts are sized using standard culvert design methodology considering inlet or outlet control as presented in Federal Highway Administration, Hydraulic Design Series No. 5, *Hydraulic Design of Highway Culverts*, September 1985. The calculations check for inlet control, pipe barrel (friction), or tail water control. The condition resulting in the highest computed headwater elevation controls.

The culvert design calculations are also tabulated on the facing page of each channel plan and profile sheet in the *Preliminary Design Plans* section of this report. The headings in the "Culvert Properties" portion of the facing page calculations are defined as follows:

Col No.	Heading	Description
1	I.D.	Reach identifier from plans.
2	HEC-1 I.D.	Identifier from HEC-1 output.
3	Design Q100	Design discharge from HEC-1 output corresponding to HEC-1 I.D.
4	Comp. Capacity	Computed culvert capacity from parameters in table (should match Design Q100)
5	Length	Length of culvert
6	Inlet Invert	Invert El. at culvert inlet.
7	outlet Invert	Invert El. at culvert outlet.
8	Slope	Culvert barrel slope.
9	Mat/Barrel type	Culvert material code (C=concrete).
10	Manning's n	N-value for culvert material.
11	No. of barrels	Number of culvert barrels.
12	Culv. Dia./Height	Diameter of pipes or height of boxes.
13	Unit	Units for "12"; in. for pipes, ft. for boxes.
14	Width	Width for box culvert barrels.
15	Barrel Material	RCBC for box, RCP for pipes
16	Entrance	Wingwall, Headwall, or Project.
17	Tailwater depth	Tailwater depth of downstream channel.
18	Comp. headwater	U.S. ponding depth at culvert inlet.
19	Comp. HW/D	Ratio of headwater depth to culvert height.
20	Control	Flow control condition; IC, Pipe, OC

3. Detention Basins

Detention basins are sized by developing a preliminary grading plan that optimizes the volume available at each site based on the design constraints presented in Section B. "Design Criteria" and the physical constraints presented at each site. The site constraints include existing topography and land slope, existing development, outfall pipe elevation

limits to "daylight," and inflow capture requirements.

Opportunities for an off-line basin concept are first explored. Off-line basins allow for a more effective use of the available basin volume by passing low flows by the basin without occupying any storage volume. This preserves more available storage volume for attenuating the flow peaks when they arrive at the basin. Opportunities for off-line basin concept development exist when the inflow can be channelized. When runoff to be captured in the basin presents itself in an overland flow condition or in many small channels, an off-line concept may not be feasible. In these cases a flow-through basin concept is utilized. Storage volume can be preserved for peak flows in flow-through basins by providing a low flow channel and by depressing the outlet. A depressed outlet allows a hydraulic head to build up on the outlet before a significant area within the basin is ponded. The low flow channel conveys low flows to the depressed outlet also without ponding.

Following development of the optimum grading plan for the site and determination of flow-by or flow-through concept, the basin inlet and outlet structures are sized to accommodate the design inflow hydrograph. In an off-line basin, a trial flow-by discharge is selected and coded into the hydrology model with the basin stage-storage relationship from the grading plan. The model is run to determine the resulting peak flow attenuation. The flow-by discharge and the basin outlet pipe size are adjusted until the available basin volume is used and a favorable peak flow attenuation is achieved. In a flow-through basin, the outlet pipe size is adjusted until the available basin volume is used.

The side spillway for the off-line basins is then sized for the flow in excess of the flow-by discharge. Side spillways are sized using the broad crested weir equation with a C coefficient of 2.5, using the average flow depth over the side spillway. The grading plan is input into the surface modeling software to determine the stage-storage relationship. The stage-discharge relationship is determined by inputting the outlet pipe size and invert elevation. The HEC-1 model develops the stage-discharge relationship using the orifice equation. Finally, the emergency spillway is sized based on the un-attenuated 100-year peak inflow discharge. In addition to the stage-storage relationship, the surface modeling software is used to compute the cut and fill quantities for the earthwork estimate.

IV. EXISTING UTILITIES & PLANNING CONSTRAINTS

A. Introduction

This section describes the existing utilities within the project limits and constraints that impacted the preliminary design.

B. Existing Utilities

Major existing and planned utilities within the study area are shown on **Figure 4**. Utility conflicts affecting each planned project are identified on the *Preliminary Design Plans*. Utility providers with facilities within the study area are listed in **Table 1** with the name and phone number of the local representative contacted during the study.

1. Water and Sanitary Sewer

The **City of Mesa** provides water and sewer service to the study area. The water distribution system consists of water-mains constructed on section line roads where section line roads exist. The distribution system is planned to be expanded to include new section line roads as they are constructed. Existing primary water distribution corridors include Ellsworth Road, Elliott Road, Mountain Road, and Pecos Road which contain 16 inch waterlines.

A large diameter gravity sanitary sewer main extends from Mountain Road to Ellsworth Road within Pecos Road, a 10 inch force main then extends north along Ellsworth Road to Elliott Road, continuing west along Elliott Road to Sossaman Road, then north to the vicinity of Baseline Road and Power Road where it leaves the study area. An 18 inch sanitary sewer is planned along the Salt River Project (SRP) easement aligned with the east-west mid section line between Elliot and Guadalupe Roads.

2. Natural Gas

The majority of the study area, north of the Superstition Freeway, has natural gas service provided by **Southwest Gas Corporation**. However, some areas are supplied by the **City of Mesa**. The area south of the Freeway is primarily supplied by Southwest Gas and includes a gas plant located on Mountain Road, north of Pecos Avenue.

3. Electric Power

The study area is within the **Salt River Project** electric power service area. SRP has an east-west oriented 230 KV overhead transmission corridor along the mid section line between Elliot and Guadalupe Roads.

The U.S. Department of Energy, **Western Area Power Administration** (WAPA) also has a 230 KV overhead transmission corridor crossing the study area extending from approximately Crismon Road and Apache Trail to the Ray Road alignment at the Maricopa - Pinal County line.

4. Cable TV

Cable TV service is provided by **Cox Communications**. Cable TV lines are shown on the *Preliminary Design Plans*. Cable TV is not considered a critical utility conflict, but is shown for reference.

5. Telephone

Telephone lines owned by **U.S. West** are found within the study area. Major duct banks and fiber optic lines are considered critical utility conflicts and are shown on the *Preliminary Design Plans*.

6. Irrigation

Irrigation water delivery is provided by the **Roosevelt Water Conservation District** (RWCD) and the **Queen Creek Irrigation District** (QCID). The RWCD has a major delivery canal aligned parallel to the EMF which forms the western study boundary. The RWCD canal is downstream from the EMF and is therefore not in conflict with any of the proposed improvements. QCID facilities are found in the vicinity of Queen Creek Road and the Queen Creek Channel project.

7. Petroleum

There is a **Kinder/Morgan** (formally known as Southern Pacific Pipeline) petroleum line that provides jet fuel to Williams Gateway Airport and continues on to Davis-Monthan Air Force Base in Tucson. The petroleum line follows the Rittenhouse Road alignment and is outside the study area except for the lateral deliverly line that enters Williams Gateway Airport. There are no conflicts with planned drainage improvements.

C. Planning Constraints

In addition to the existing utilities constraints there are other physical constraints that impact the design development.

1. Planned Development

The study area, particularly the area south of the Superstition Freeway extending to the Powerline Floodway, is developing at a rapid pace. Although development was scarce in this area at the beginning of the study, several developments have broken ground during the course of the study and others are about to begin construction as of this writing.

Table 1 - Utility Company Contacts

Utility	Representative	Telephone No.
City of Mesa - Water	Peter Knudson	644-2514
City of Mesa - Sanitary Sewer	Peter Knudson	644-2514
City of Mesa - Natural Gas	Peter Knudson	644-2514
Southwest Gas Corporation	Bob Sprague	484-5343
Salt River Project - Power	Cheryl Olmstead	236-6179
Western Area Power Admin.		
Cox Communications	Carl McKay	352-5860 x 155
U.S. West - Telephone	Bill Crouch	831-4702
Roosevelt Water Cons. Dist.	Joe Nyikes	988-9586
Queen Creek Irrigation District	Dean Griffith	987-3002
Kinder / Morgan	Med Ruzario	(714)506-4932

Planned developments are identified on **Figure 5**. The planned developments shown were identified by the Planning and Zoning Department of the City of Mesa. The plan development and timing of implementation is constrained by the developments shown on **Figure 5**.

2. GM Proving Grounds & Williams Gateway Airport

There is an existing dike along the east side of the TRW plant that was constructed by farmers to protect their fields from flooding. The dike is along the County line and directs runoff north to the Pecos Road alignment where runoff proceeds westerly toward the GM Proving Grounds. The GM Proving Grounds has constructed channels around the entire perimeter to protect the site from flooding. The perimeter channels direct runoff to Ellsworth Road, north of Pecos Road. Runoff crosses Ellsworth Road westerly in a sheet flow fashion and flows directly into the North Perimeter Channel of the Williams Gateway Airport. The North Perimeter Channel conveys the runoff to the Powerline Floodway. There is little slope in this area resulting in ponding during most storm events.

3. Existing Drainage Features

Existing major regional drainage features within the master plan area include the overchutes of the CAP, the ADOT collection channels and retention basins along the north side of the Superstition Freeway, the Sossaman Channel, the Guadalupe Channel, the Powerline Floodway, Phase 1 of the Rittenhouse Channel, and the EMF. Many other local drainage structures are also located within the study boundary. The following major existing regional drainage facilities constrain the plan development by acting as barriers to runoff, storm drainage outfalls, or elements to be incorporated into the plan:

The Central Arizona Project Canal - The CAP Canal forms the northeastern boundary for the study and acts as a barrier to upstream storm runoff. Its design includes overchutes to convey storm water across the canal to the downstream side. The City of Mesa has identified the overchutes as an important drainage concern to be addressed by this plan. There are 14 CAP overchutes within the project limits. The overchute sizes and design discharges are summarized in **Table 2**. The overchutes are numbered consecutively from the northwest end with overchute number one west of Ellsworth Road, to overchute number 14 at the southeast end near the Superstition Freeway. **Table 2** shows the design discharge from the USBR design plans and the 100 year peak discharge from the hydrology developed for this plan.

ADOT Collection Channels and Retention Basins - ADOT has constructed a series of collection channels and detention basins along the north side of the Superstition Freeway which serve as regional drainage facilities for storm runoff from north of the freeway. All master plan improvements north of the freeway eventually drain to the ADOT channels or under the freeway through an ADOT system.

Table 2 - CAP Overchutes

No	Size	Design Capacity (cfs)	Q100 (cfs)
1	3 x 54-inch Steel	460	262
2	4 flumes 9' w x 4.7' ea.	800	530
3	4 flumes 9' w x 4.7' ea.	800	476
4	3 x 72-inch Steel	565	54 \ combined
5	3 x 72-inch Steel	565	54 /
6	2 x 60-inch Steel	NR	231
7	3 x 72-inch Steel	NR	504
8	5 x 72-inch Steel	NR	454
9	5 x 72-inch Steel	NR	35
10	5 x 72-inch Steel	NR	1263
11	5 x 72-inch Steel	NR	1250 \ comb.
12	5 x 72-inch Steel	NR	1034 /
13	5 x 72-inch Steel	NR	754 \combined
14	5 x 54-inch Steel	400	754 /

NR - Not Reported

The Sossaman Channel & Basin and Guadalupe Channel - The Sossaman Channel is a north-south collection channel and basin that intercepts storm runoff at the Sossaman Road alignment and conveys it southerly to the Guadalupe Channel at Guadalupe Road. The Guadalupe Channel then conveys the runoff westerly to the EMF.

The Powerline Floodway - The Powerline Floodway conveys attenuated discharges from a series of Soil Conservation Service (SCS) flood retarding structures located east of the study area, within Pinal County. The Powerline Floodway bisects the GM Proving Grounds and follows a course along the Ray Road alignment to its outfall at the EMF.

Phase 1 of the Rittenhouse Channel - The Rittenhouse Channel lies along the upstream side of the Southern Pacific Railroad, parallel to Rittenhouse Road. Phase 1 is constructed between The EMF and Sossaman Road. Phase II is soon to be constructed from Sossaman Road to Ellsworth Road at Queen Creek Road. The channel serves as an outfall for drainage from the Williams Gateway Airport and, when completed, for runoff from areas north of Queen Creek Road.

The East Maricopa Floodway - The East Maricopa Floodway forms the western study area boundary south of the Superstition Freeway. The EMF lies on the east side of the Roosevelt Water Conservation District (RWCD) Canal and serves as a regional outfall for eastern Maricopa County. The EMF intercepts storm runoff from east of the RWCD canal south of the Southern Canal near Thomas Road and Val Vista Drive. The EMF starts at Brown and Greenfield Roads, parallels the RWCD canal, and crosses the Maricopa County southern boundary into Pinal County to its outfall at the Gila River.

All runoff from the study area eventually drains into the EMF. The FCDMC is currently undertaking a study to determine the capacity of the EMF. It is currently believed that the floodway is undersized for the 100-year peak discharge. Although this study does not include consideration of the EMF capacity, it has been recognized throughout the plan development that reductions in peak discharge entering the EMF are beneficial to regional flood control plans. 100-year peak discharges entering the EMF from the study area are tabulated in **Table 3** for existing runoff conditions and at build-out of the area with the master plan improvements in place.

Table 3 - Summary of Flows Entering the EMF

Location	100-year Peak Discharge (cfs)		
	Existing Conditions	Developed Conditions	Change
Guadalupe Road	2435	1687	-748
Elliot Road	435	330	-105
Warner Road	1760	919	-841
Knox Road	1731	457	-1274
Ray Road	1629	0	-1629
Powerline Floodway	5347	4119	-1228
Williams Field Rd	1139	1150	+11
Rittenhouse Road	2339	1978	-361

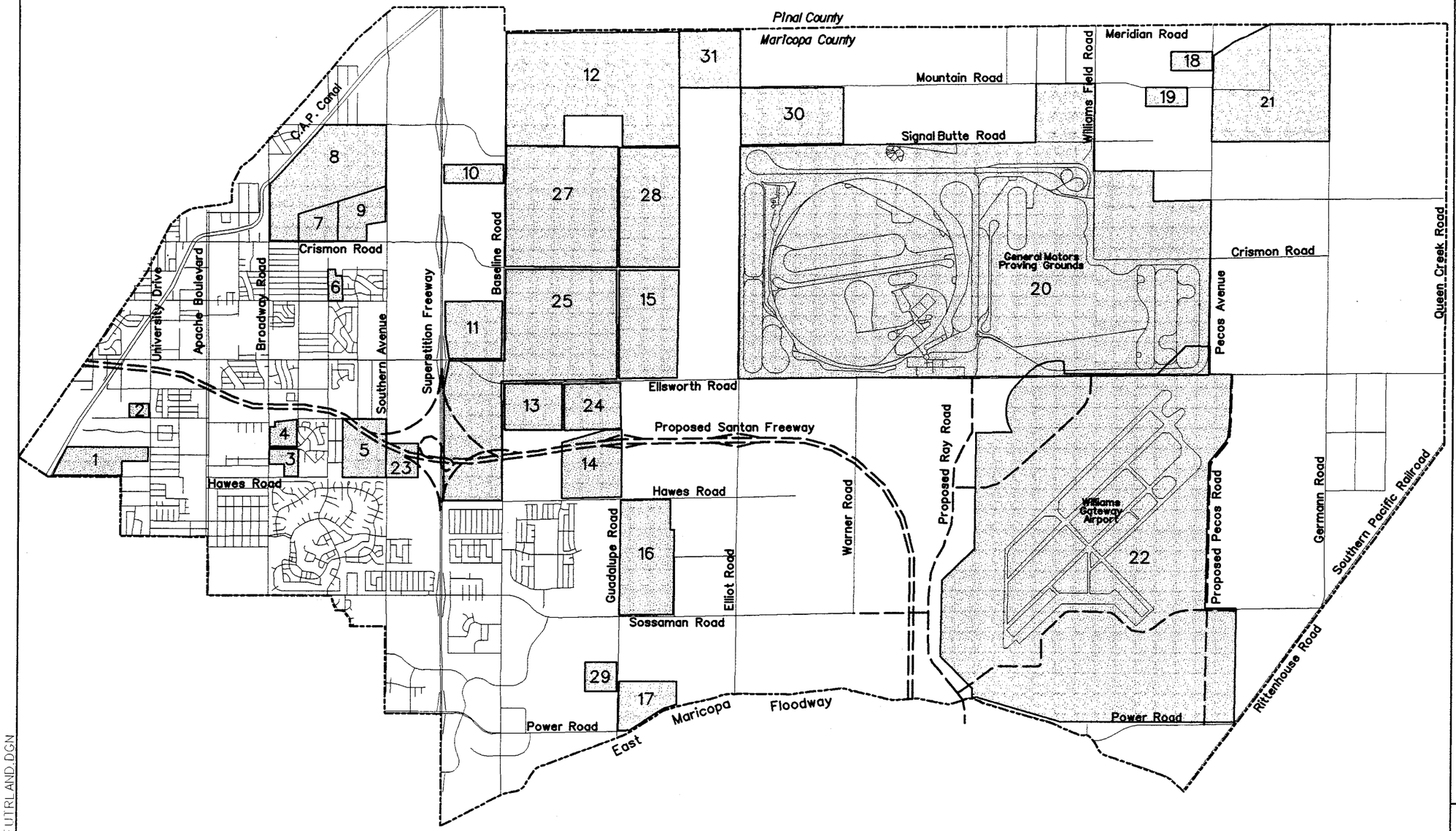
4. Planned Public Improvements

Other projects are planned within the study area by the City of Mesa, FCDMC, MCDOT, and ADOT that impact the implementation of this plan. The City of Mesa has plans to improve the existing channel along Southern Avenue from Hawes Road to the Sossaman Channel. Mesa will also improve the channel along the west side of Hawes Road from Southern Avenue to the Superstition Freeway channel. These planned improvements have been included in this preliminary plan.

The FCDMC has recently bid the construction of the Rittenhouse Channel Phase II from Germann Road to east of Ellsworth Road. The Rittenhouse Channel extension recommended in this plan is based on the completion of the Rittenhouse Channel Phase II.

The ADOT planned Santan Freeway passes through the study area. The alignment is shown on Figure 5. Improvements south of the Superstition Freeway have been coordinated with the ADOT plans for implementation of the Santan Freeway.

MCDOT is planning improvements to Ellsworth Road from Germann Road to Baseline Road. A Design Concept Report (DCR) study is underway to develop the design concept. Implementation of this ADMP will be coordinated with development of the MCDOT DCR.



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

VIEWPOINT R.V. RESORT	1
UNIVERSITY PLACE	2
SUPERSTITION POINT-MESA	3
WYNSTONE	4
CRESCENT RUN	5
GRIFFITH ESTATES	6
CITY PARK (FUTURE)	7
SIGNAL BUTTE RANCH (SOUTH)	8
MESA HIGH SCHOOL & JUNIOR HIGH SCHOOL	9
MESA MARKETPLACE	10
SIERRA RANCH I	11
SUNLAND SPRINGS VILLAGE	12
MONTE VISTA TRAVEL TRAILER RESORT EXPANSION	13
SUNLAND SPRINGS VILLAGE	14
MESQUITE CANYON	15
BOULDER CREEK	16
GILBERT JUNIOR HIGH SCHOOL	17
BAKER RECYCLING	18
OLIN MITSUBISHI	19
GENERAL MOTORS PROVING GROUNDS	20
TRW PLANT	21
WILLIAMS GATEWAY AIRPORT	22
RV PARK	23
RYLAND HOMES DEVLOPMENT*	24
AUGUSTA RANCH	25
SIERRA RANCH II*	26
STATE LAND TRUST	27
SANTA RITA RANCH*	28
MONTEREY ELEMENTARY SCHOOL	29
UNKNOWN	30
LKY PROPERTIES	31

*Zoning Pending

N

2500 0' 2500 5000

SCALE: 1" = 5000'

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

Hoskin Engineering Consultants

PLANNED MAJOR DEVELOPMENTS

FIGURE 5

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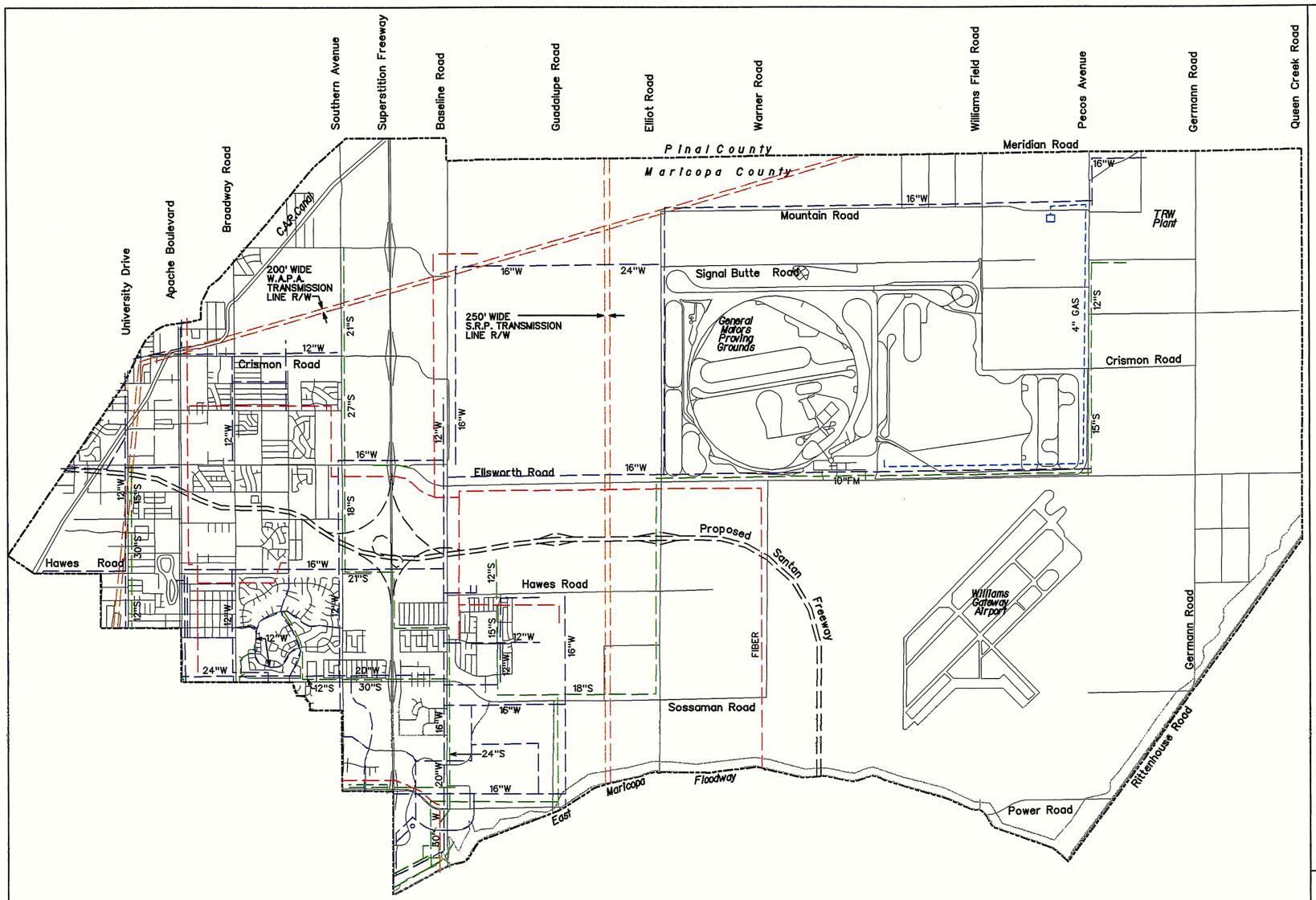

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

- STUDY BOUNDARY
- EXISTING SEWER LINE
- EXISTING WATER LINE
- EXISTING TELEPHONE CONDUIT/CABLE
- EXISTING TELEPHONE FIBER OPTIC CABLE
- EXISTING GAS LINE
- EXISTING TRANSMISSION LINE R/W
- PROPOSED SANTAN FREEWAY

ONLY TRANSMISSION LINE CORRIDORS & PIPES OF 12 INCH IN DIAMETER OR LARGER ARE SHOWN (EXCEPT GAS)

N

2500 0' 2500 5000

SCALE: 1" = 5000'

DIBBLE & ASSOCIATES CONSULTING ENGINEERS

Since 1962

Hoskin Engineering Consultants

EXISTING MAJOR UTILITIES

FIGURE 4

960002\UTILITY

V. PRELIMINARY PLAN

A. Introduction

The Preliminary Plan is shown on **Figure 6**. The plan elements are shown in plan and profile on the *Preliminary Design Plans* at the end of this report. This section is intended to be used with the *Preliminary Design Plans* to further describe the planned improvements, project costs, and special issues to be considered during final planning and design. The project elements are described as well as 404 permit impacts, right-of-way requirements, and utility conflicts. In addition, agencies with an interest in the project are identified as possible participants in project implementation.

B. CAP Detention Basin 1 (Sheet 10 of 43) $1.32M

1. Location: Immediately downstream of the CAP canal overchute No. 1 north of Decatur Road and west of 90th Street, in Mesa.

2. Purpose: Intercept flow from the CAP overchutes before they discharge to a natural wash and cause downstream flooding along 88th Street. The basin will attenuate flow as it passes through the basin, allowing its safe discharge to the existing natural wash.

3. Project elements: The proposed basin site covers an area of approximately 10 acres and will impound approximately 10 acre-feet of storm water. The outlet from the basin is a 24-inch diameter pipe which will discharge into an existing natural wash. The basin will reduce the flow exiting the site from approximately 262 cfs to 30 cfs during a 100-year storm event.

4. Special Considerations: The basin site has been configured to be incorporated into a planned development site plan referred to as Ashley Heights. Access to the basin will be provided along 90th Street.

5. 404 Permit: Construction of the basin will obliterate approximately 500 lineal feet of a jurisdictional wash. The impacted jurisdictional area is approximately 0.1 acres. A 404 permit will be required.

6. Right-of-Way: Right-of-way will need to be obtained from the developer of Ashley Heights. Final configuration of the basin will need to be established through coordination with the developer's site plan layout.

7. Utility Conflicts: No utility conflicts.

8. Project Participants: The City of Mesa and the developer of Ashley Heights, MCDOT, and ADOT.

C. CAP Detention Basin 2 & Outlet (Sheet 7 of 43) . $2.20M

1. Location: A triangular parcel of land south of the CAP canal overchute No. 2, north of University Drive and approximately 250 feet east of Ellsworth Road. The outlet channel/pipe extends south and drains into the Apache Channel south of its intersection with the CAP Basin 3 Outlet Channel.

2. Purpose: Intercept flow from the CAP overchutes before they discharge across University Drive, east of Ellsworth Road, and then across Ellsworth Road. The basin will attenuate flow and convey it south to a new channel system north of Apache Trail. The basin will attenuate flows reaching the planned Santan Freeway.

3. Project elements: The proposed basin covers an area of approximately 14 acres and will impound 19 acre-feet of storm water. The basin will reduce the peak discharge leaving the site from approximately 530 cfs to 38 cfs during a 100-year storm event. The outlet from the basin will be a 24-inch diameter pipe which will discharge to a 36-inch storm drain across University Drive. The 36-inch diameter pipe will follow the 93rd Street alignment to Sleepy Hollow (Boise) Street. At Sleepy Hollow Street the pipe will discharge into a lined channel within an existing drainage easement. Due to existing right-of-way limitations, the channel will have sideslopes of 1.5 horizontal to 1 vertical and will flow in the supercritical flow regime.

4. Special Considerations: An approximately 250 foot strip of land is available for commercial frontage along Ellsworth Road.

5. 404 Permit: The basin and its outlet will obliterate the upstream end of a jurisdictional wash. The impacted jurisdictional area is approximately 0.2 acres, for which a 404 permit will be necessary.

6. Right-of-Way: There is some flexibility in the final basin configuration which could allow for some commercial frontage or a parking area on University Drive at the east end of the site. This area does not provide very efficient use due its triangular configuration and the grades which are at the high end of the basin. The 36-inch drain pipe will lie within the street right-of-way for 93rd Street. 93rd Street ends at Sleepy Hollow Street, and the new channel will be constructed within an existing drainage easement along the east boundary of an existing mini-storage facility. A new 20 foot right-of-way will need to be acquired within the existing easement. Due to right-of-way limitations, no maintenance road will be built.

7. Utility Conflicts: An 8 inch water line is in conflict with the 24 inch Basin 2 outlet pipe. A 6 inch water line and a 2 inch gas line are in conflict with the 36 inch storm drain pipe in 93rd Street. All three utilities will be relocated.

8. Project Participants: The City of Mesa, MCDOT, and ADOT.

D. CAP Detention Basin 3 & Outlet (Sheet 8 of 43) . $2.22M

1. Location: An irregular shaped parcel of land south of the CAP canal, west of 96th Street, and north of Boise Street. Boise Street is located a quarter mile north of Apache Trail. The outlet channel/pipe continues in a southwesterly direction to its outlet at the Apache Channel at 93rd Street.

2. Purpose: Intercept flow from the CAP overchutes before they discharge into an existing improved channel at 95th Street. The existing channel system downstream is through a mobile home park and has insufficient capacity for the estimated 100-year peak discharge of 476 cfs. The basin will reduce the peak discharge leaving the site to approximately 57 cfs. The basin will attenuate flows reaching the planned Santan Freeway.

3. Project elements: The basin has been configured to fit within existing parcel boundaries and covers an area of approximately

8 acres. The basin will impound approximately 18 acre-feet of storm water. The outlet from the basin will be a 30-inch diameter pipe which will discharge to an existing lined channel within the existing subdivision to the west. Due to right-of-way constraints, a 48-inch diameter pipe will convey flow within the mobile homes downstream of the basin.

4. Special Considerations: Due to the location of the existing overchutes, a portion of the 96th Street right-of-way, and a parcel east of 96th Street, will need to be acquired. The basin boundary does not need to extend south to Boise Street, thus allowing for the use of this land for future development or a parking lot.

5. 404 Permit: The outlet of this basin will be constructed along the alignment of an existing jurisdictional wash. The total impacted jurisdictional area is approximately 0.8 acres. A 404 permit will be required.

6. Right-of-Way: 8.2 acres of new right-of-way will be required for the detention basin. A new 20 foot right-of-way will be required within the existing downstream mobile home park. Access easements may need to be acquired from the mobile home park for maintenance of the pipe system.

7. Utility Conflicts: A 6 inch waterline and 3-36 inch CMP's are in conflict with the 48 inch outlet pipe. The 6 inch water line will be relocated and the 3-36 inch CMP's will be removed.

8. Project Participants: City of Mesa, MCDOT, and ADOT.

E. Apache Channel (Sheets 6 and 7 of 43) **$3.88M**

1. Location: The Apache Channel extends from its confluence with the CAP Basin 2 and 3 outlet channels at 93rd Street, downstream to its confluence with the Broadway Channel near 88th Street.

2. Purpose: The Apache Channel will provide an outlet for CAP Basins 2 and 3 and for downstream runoff generated from south of the CAP canal and east of Ellsworth Road. The channel will also provide concentrated drainage under the planned Santan Freeway.

3. Project elements: The channel will be concrete lined upstream of Apache Trail. Channel flow will be underneath Apache Trail, near its intersection with Ellsworth Road through a single 10' x 4' concrete box culvert. An existing 10' x 3' concrete box culvert under Ellsworth Road will remain. Downstream from this point, the existing earthen channel will be improved by excavation and the addition of grade control structures to control flow velocities.

4. Special Considerations: A channel exists along part of the alignment, as it passes through an existing subdivision. Care will need to be taken to ensure that disturbance of the neighborhoods is minimized.

5. 404 Permit: This channel will be constructed along the same alignment as an existing 30' wide jurisdictional channel. The total impacted jurisdictional area is approximately 1.2 acres. A 404 permit will be necessary.

6. Right-of-Way: There is an existing 60 foot right-of-way through the subdivision west of Ellsworth Road. Due to existing right-of-way limitations, it will not be possible to construct a maintenance road on the bank of the channel. Drop structures should be designed to allow vehicular access. Downstream of 90th Street, a subdivision is under construction, and has provided right-of-way and grading for the channel. New right-of-way is proposed adjacent to the new San Tan Freeway.

7. Utility Conflicts: A 6 inch water line and a telephone line will be relocated at Apache Trail. There is a 6 inch high pressure gas line west of Ellsworth Road which should be avoided.

8. Project Participants: City of Mesa, MCDOT, and ADOT.

F. CAP Detention Basin 4 & Outlet (Sheets 9 and 10 of 43) **$4.62M**

1. Location: Immediately upstream of the CAP canal overchute Nos. 4 and 5, north of Apache Trail and east of Crismon Road. The outlet channel extends in a southwesterly direction to the confluence with the Broadway Channel near 98th Street.

2. Purpose: To reduce the flow which crosses the CAP canal through a series of six 72-inch diameter steel pipes. Currently these overchutes outlet to two downstream channels which have had minor improvements in some locations. Downstream flooding of existing residences is likely in a 100-year storm event.

3. Project elements: The basin will accommodate approximately 26 acre-feet of storm water storage on an 11 acre site. The basin will reduce the peak discharge from 546 cfs to 54 cfs during a 100-year event. The northern overchute (No. 4) will be used for the release of detained flows. Two spillways will be constructed to direct the emergency overflow toward both existing downstream drainageways. In this way, it can be assured that there will be no negative impact from the basin construction during interim development phases.

4. Special Considerations: The existing southern drainageway must remain in place for emergency overflows and to handle local drainage from downstream of the CAP canal.

5. 404 Permit: The proposed location of this basin has been moved since the time that the delineation study was conducted. Therefore, the location of this basin was not delineated for 404 permit jurisdiction. However, mapping indicates that this basin will obliterate portions of 3 washes which equate to approximately 1 acre of jurisdictional area. A 404 permit will be necessary.

6. Right-of-Way: Approximately 11.0 acres of right-of-way will be acquired for the detention basin. Parcel acquisition will include several existing residential structures. Downstream from the CAP overchute structures, existing culverts cross Crismon Road and discharge to an existing wash. A new 60 foot right-of-way will need to be acquired for the channel and a 16 foot maintenance road on one side. The channel is sized to handle half of the emergency spillway flow. The other half of the emergency spillway flow will be directed toward overchute #5 which will discharge to an existing channel to the south. No right-of-way acquisition is proposed for this existing channel system.

7. Utility Conflicts: No utility conflicts.

8. Project Participants: City of Mesa, MCDOT, and ADOT.

G. Broadway Channel (Sheets 5 and 9 of 43) **$6.13M**

1. Location: Extends downstream from the CAP Basin 4 Outlet Channel at 98th Street to Broadway Road at Ellsworth Road, and from there along Broadway Road to Hawes Road.

2. Purpose: Provide an outfall for the CAP Basin 4 and to convey runoff from an area downstream of the CAP canal.

3. Project elements: The upper reaches of the channel will be earth with grade control structures to help reduce the flow velocities. In the lower reaches, adjacent to Broadway Road, there is an existing concrete lined channel which is inadequate for the estimated 100-year peak discharge. This channel will be removed and replaced with a new concrete lined channel with grade control structures.

4. Special Considerations: Right-of-way and planning constraints may limit the maximum width of this channel thus requiring the removal of all existing structures and lowering the existing channel invert.

5. 404 Permit: The entire reach of this channel is along the same alignment as an existing jurisdictional wash. The total impacted jurisdictional area is approximately 4.1 acres. A 404 permit will be required.

6. Right-of-Way: The area is already heavily developed. The proposed channel follows existing drainage corridors. The need for new right-of-way varies along the length of the channel. The existing channel will be removed in the lower reaches and replaced with a deeper channel cross-section. Exact right-of-way needs are unknown at this level of detail. The need for right-of-way which would entail structure removal should be avoided with structural modifications and possibly steeper channel sideslopes. A new concrete box culvert for reach BY-4 will enable the channel to be contained within existing street rights-of-way

7. Utility Conflicts: Eight 6 inch water lines will be relocated. Three of the 6 inch water lines are in conflict with proposed box culvert crossings. Five of the 6 inch water lines are in conflict with the proposed channel. In addition, one 12 inch water line in conflict with a box culvert crossing will be relocated.

8. Project Participants: City of Mesa, MCDOT, and ADOT.

H. Hawes Channel (Sheets 3 and 4 of 43) **$5.78M**

1. Location: Along the Hawes Road alignment from Apache Trail to the Superstition Freeway interceptor channel.

2. Purpose: To replace an existing unlined channel in this location.

3. Project elements: The channel will be concrete lined for its entire length with drop structures to maintain a subcritical flow regime. Box culvert crossings are provided at Coral Bell Avenue and Broadway Road.

4. Special Considerations: At Southern Avenue the channel splits and approximately 1,100 cfs is diverted west within new concrete box culverts which will be constructed as part of a City of Mesa improvement project. The City of Mesa plans also show a channel to be re-constructed south of Southern Avenue. This channel was designed for a flow rate less than the design flow rate for this ADMP study. The excess flow therefore does not meet the freeboard design criteria.

5. 404 Permit: Construction of the channel will impact approximately 3.8 acres of jurisdictional area. A 404 permit will be required.

6. Right-of-Way: The portion of Hawes Channel from the Superstition Freeway outfall channel to Coral Bell Avenue will be contained within the existing street right-of-way. North of Coral Bell Avenue, a new 90 foot and 60 foot right-of-way will be required. The exact amount of right-of-way required will need to be determined when widening improvements are proposed for Hawes Road. Sufficient right-of-way is shown to enable the entire channel cross-section to fit plus a single 16 foot maintenance road.

7. Utility Conflicts: A 2 inch gas line and telephone lines will be relocated at Pueblo Avenue and a 16-inch water line will be relocated at Coral Bell Avenue.

8. Project Participants: City of Mesa.

I. Parkwood Ranch Detention Basin & Outlet Channel (Sheet 11 and 12 of 43) **$3.54M**

1. Location: The channel is located within a transmission line corridor extending from Broadway Road, east of Crismon Road, to the Superstition Freeway interceptor channel. Between Broadway Road and Southern Avenue the channel is located within the master planned development of Parkwood Ranch. The detention basin will be located immediately north of Southern Avenue and approximately 1,400 feet east of Crismon Road.

2. Purpose: Channel will re-direct flows which currently reach and overtax the existing Crismon Road channel. The basin will reduce the 100-year peak discharge so that it may be accommodated within the existing ADOT Superstition Freeway channel east of Crismon Road.

3. Project elements: Channel will be unlined both entering and exiting the basin. The basin will have a capacity of 87 acre-feet and will reduce the inflow of 742 cfs to 265 cfs.

4. Special Considerations: An existing 2 barrel 8' x 2' box culvert crossing Southern Avenue will be abandoned.

5. 404 Permit: At the time that the delineation study was being conducted, the land which the basin and its outlet are proposed to occupy was being developed. Some houses had already been constructed and others were being built. Consequently, no jurisdictional washes were found. A 404 permit will not be required.

6. Right-of-Way: Channel to be within the existing 130' transmission line corridor easement. Additional right-of-way may be required around the towers. Basin right-of-way is currently owned by the Mesa School District and Communities Southwest. South of Southern Avenue, a new 65 foot right-of-way will be required. This right-of-way will be within the existing transmission line corridor, although a change in alignment near the Superstition Freeway outlet channel, and additional right-of-way for a channel transition to the existing channel will be necessary

7. Utility Conflicts: No Utility Conflicts.

8. Project Participants: City of Mesa, Mesa School District, ADOT, Communities Southwest (developer of Parkwood Ranch).

J. Sunland Springs Channel & Siphon Draw Detention Basin (Sheets 22,23 of 43) **$12.12M**

1. Location: The Siphon Draw Detention Basin is east of Meridian Road in Pinal County, and north of the Elliot Road alignment. The Sunland Springs Channel follows the Meridian Road alignment north of the Siphon Draw Basin, adjacent to the 890 acre Sunland Springs Village development.

2. Purpose: To convey runoff reaching the site from two CAP overchutes and to intercept runoff at the Pinal County line. The Siphon Draw Detention Basin collects channelized runoff and runoff from Siphon Draw and attenuates flows to allow a reduction in size of downstream improvements.

3. Project elements: The Sunland Springs Channel is a concrete channel with 8 drop structures extending 6800 feet north of the Siphon Draw Detention Basin. The channel acts as a flow-by channel that conveys discharges up to 434 cfs past the basin. Discharges in excess of 434 cfs spill into the basin through a side channel spillway. The Siphon Draw Detention Basin collects the overflow from the Sunland Springs Channel and surface runoff from Siphon Draw at two additional locations that will require inflow spillways. This basin uses 95 acre feet of storage volume.

4. Special Considerations: The Sunland Springs Village Master Drainage Plan shows a grass lined channel along the east side of the Meridian Road alignment to intercept runoff on the upstream side of the future road.

5. 404 Permit: No jurisdictional waters are identified along the Sunland Springs Channel alignment. The Siphon Draw Detention Basin was not delineated for jurisdiction because it is beyond the limits of the aerial photographs used for the delineations. Siphon Draw is jurisdictional downstream from the basin and is impacted by the project due to runoff being intercepted and diverted away from the natural wash. A 404 permit will be required for this project.

6. Right-of-Way: Ninety feet of new ROW is required for the Sunland Springs Channel and 66 acres of new ROW for the Siphon Draw Detention Basin.

7. Utility Conflicts: No utility conflicts.

8. Project Participants: Farnsworth Development Company, the Sunland Springs Village developer, should participate in the channel construction project. City of Mesa.

K. Elliot Channel (Phase 2) (Sheets 20,21 of 43) **$4.78M**

1. Location: Adjacent to Elliot Road from the Siphon Draw Detention Basin at Meridian Road to Crismon Road.

2. Purpose: To convey discharge from the Sunland Springs Channel and Siphon Draw Detention Basin to the Elliot Channel Phase 1.

3. Project elements: A trapezoidal channel with 13 drop structures. The channel is concrete adjacent to the GM Proving Grounds south of Elliot Road and earth where it is north of Elliot Road. Box culvert crossings are at Meridian Road, Mountain Road, and at Elliot Road where the channel crosses from the north to the south side of Elliot Road.

4. Special Considerations: The channel crosses to the south side of Elliot Road to utilize the existing channel alignment along the north side of the GM Proving Grounds. The channel is aligned adjacent to Elliot Road instead of along the existing Siphon Draw alignment to facilitate future development of the area.

   The GM Proving Grounds has security concerns about public access near the Proving Grounds. These concerns will need to be addressed before GM will allow use of their ROW for a channel. The channel is designed to fit between the existing GM berm and Elliot Road. The south side maintenance road would then be on top of the GM berm, and Elliot Road would be used as the north side maintenance road.

5. 404 Permit: The existing channel along the GM Proving Grounds north boundary is jurisdictional and will require a 404 permit to replace. The impacted jurisdictional area is approximately 1.0 acres.

6. Right-of-Way: 60 to 80 feet of ROW is required for the channel reach north of Elliot Road. Sixty feet of new ROW is required from GM.

7. Utility Conflicts: A 16 inch waterline is in conflict with the proposed Elliot Road box culvert crossing. The waterline will be lowered.

8. Project Participants: The GM Proving Ground has an interest in relieving the flooding along Elliot and Ellsworth Roads and could participate by providing right-of-way for a portion of the channel. City of Mesa and MCDOT.

L. Crismon Channel & Lateral (Sheets 17-19 of 43) . **$6.30M**

1. Location: The Crismon Road alignment from Elliot Road to Baseline Road.

2. Purpose: To replace an existing dirt channel and convey runoff to the Elliot Detention Basin. Runoff from the east is intercepted by the channel.

3. Project elements: A trapezoidal concrete channel with 9 drop structures. Box culvert crossings are at the mid-section road south of Baseline Road, Guadalupe Road alignment, Elliot Road, and where the channel crosses from the east to the west side of the Crismon Road alignment. The southerly portion of the channel acts as a flow by channel for the Elliot Detention Basin, discharging up to 207 cfs flow by the basin. Discharges in excess of 207 cfs spill into the detention basin.

   The Crismon Lateral extends 2130 feet east of the Crismon Road alignment along the Guadalupe Road alignment.

4. Special Considerations: It is anticipated that Crismon Road will be constructed in the future. The channel is aligned along the east side of the Crismon Road alignment to intercept surface runoff before reaching the roadway. The channel crosses to the west side of the Crismon alignment to accommodate the side channel spillway into the detention basin.

5. 404 Permit: At the time that the delineation study was conducted, the existing Crismon Channel was found to be jurisdictional. Since that time, however, most of the channel has been obliterated by present residential development. If the developer creates a new channel which is compatible with the Crismon Channel and Lateral project, no 404 permit will be required. However, if the present developer constructs a channel which is incompatible with the Crismon Channel and Lateral project, a 404 permit may be required since the new channel will most likely be jurisdictional. A new delineation study for this area will have to be conducted after development is completed.

6. Right-of-Way: Between 50 and 70 feet of new right-of-way is required, depending upon location along Crismon Road.

7. Utility Conflicts: No utility conflicts.

8. Project Participants: The Crismon Channel from ½ mile north of Elliot Road is being constructed by Continental Homes as part of the Mesquite Canyon Development. City of Mesa may also participate.

M. Elliot Detention Basin (Sheet 25 of 43) **$6.17M**

1. Location: immediately north of Elliot Road extending from the 96th Street alignment to the Crismon Road alignment.

2. Purpose: Collect runoff from the Crismon Channel and Lateral and

attenuate peak flows to reduce the cost of downstream improvements. The basin will also act as a City of Mesa park.

3. Project elements: The basin is an off line basin and has a side channel inlet spillway along Crismon Road. The outlet is at the southwest corner of the basin and drains to the Elliot Channel at Elliot Road. The basin uses 313 acre feet of storage volume.

4. Special Considerations: The basin is sited immediately north of Elliot Road to provide a buffer between the residential development to the north and the GM Proving Grounds. Access will need to be provided for pedestrians entering the park from the Elliot Channel.

5. 404 Permit: Construction of the basin will remove portions of 2 jurisdictional washes, as well as a man-made detention pond intended to catch and store runoff for sheep and cattle. The total impacted jurisdictional area is approximately 1.2 acres. A 404 permit will be required.

6. Right-of-Way: 73 acres will be required for the basin.

7. Utility Conflicts: No utility conflicts.

8. Project Participants: The City of Mesa has an interest in developing the basin as a park. LKY Development Company owns the land and may need fill material or a temporary detention area for the Mesquite Canyon or Santa Rita Ranch developments located upstream from the basin.

N. Elliot Channel (Phase 1) (Sheets 13-16 of 43) . . . **$14.27M**

1. Location: The outfall for the Elliot Channel is the EMF. The channel follows the proposed Santan Freeway alignment to near Elliot Road, then follows Elliot Road to the Crismon Channel near the GM Proving Grounds property.

2. Purpose: Conveys discharge from the Crismon and Elliot Phase 2 Channels to the EMF. Pavement runoff from the planned Santan Freeway will also be accommodated.

3. Project elements: A landscaped earth channel with 19 drop structures. A concrete box culvert is required at Ellsworth Road.

4. Special Considerations: The channel is a landscaped earth channel that is planned to have a pedestrian/equestrian trail along the access road. The City of Mesa intends for the channel to be a link from the EMF to the Elliot Detention Basin park. The channel will also accommodate freeway runoff from the Santan Freeway. The "clean" watershed runoff could be conveyed in a low flow channel along the toe of slope away from the freeway to support native plant vegetation. A concrete low flow channel could be used along the toe of slope near the freeway for the freeway runoff. During larger storm events, when the low flow channel capacity is exceeded, the runoff would co-mingle in the full channel cross-section.

The GM Proving Grounds has security concerns about public access near the Proving Grounds. These concerns will need to be addressed before GM will allow use of their ROW for a channel. Because space is limited, a concrete channel is used along Elliot Road. Adjacent to Elliot Road, the channel is designed to fit between the existing GM berm and Elliot Road. One maintenance road would be on top of the GM berm, and Elliot Road would be used as the other maintenance road. The recreational path could be placed along the north side of Elliot Road. Alternatively, Elliot Road could be shifted north to allow room for a wider earth channel between GM Proving Grounds and Elliot Road.

5. 404 Permit: A portion of the channel impacts jurisdictional washes, as well as a low sump area which is jurisdictional. The total impacted jurisdictional area is approximately 7 acres. A 404 permit will be necessary for this project.

6. Right-of-Way: The ROW requirements shown on the *Preliminary Design Plans* are the total ROW requirement for the full channel section assuming the channel ROW will be acquired by the FCDMC before the ADOT ROW is acquired. It is anticipated that a portion of the planned ADOT ROW will be credited to the channel.

7. Utility Conflicts: An 8 inch waterline is in conflict at the Ellsworth Road crossing. The waterline will be lowered.

8. Project Participants: The City of Mesa, GM Proving Grounds, Maricopa County Department of Transportation (MCDOT), and ADOT are all expected to be participants in this project. The City of Mesa is interested in the linear park concept and access to the Elliot Detention Basin park. MCDOT is planning improvements to Ellsworth Road which would benefit from the project. The GM Proving Grounds is interested in relieving the flooding along Elliot and Ellsworth Roads and could assist with ROW along their north and west property boundaries. ADOT is interested in developing the Santan Freeway drainage concept and would benefit from participation in the channel improvements.

If ADOT does not participate in the channel project, the alignment may be shifted back to the original alignment identified in the *Alternatives Analysis Report.* The original alignment is 1/4 mile north of Warner Road as shown on **Figure 6.**

O. Powerline Detention Basin (Sheet 24 of 43) **$1.37M**

1. Location: In Pinal County along the north side of the Powerline Floodway.

2. Purpose: To capture surface runoff from Pinal County and attenuate the peak discharges before entering the Powerline Floodway. This may help compensate for inadequate capacity in the EMF.

3. Project elements: A 26 acre-foot detention basin with surface inflow from the east. The basin reduces the 100 year peak flow from 289 cfs to 36 cfs.

4. Special Considerations: The basin is set back 500 feet from the Meridian Road alignment to allow for future frontage development along the section line street.

5. 404 Permit: The Powerline Detention Basin was not delineated because it is beyond the limits of the photography used for jurisdictional delineations. Mapping indicates washes within the limits of the basin which are possibly jurisdictional. A field investigation must be performed before it can be determined if a 404 permit is necessary for this project.

6. Right-of-Way: 35 acres of ROW is required for the basin.

7. Utility Conflicts: No utility conflicts.

8. Project Participants: The Flood Control District is the primary beneficiary of the basin and operates the Powerline Floodway and EMF. No other project participants are identified.

P. Pecos North & South Detention Basins (Sheets 34,36 of 43) **$15.49M**

1. Location: In Pinal County, east of Meridian Road, north and south of the Pecos Road alignment.

2. Purpose: To collect runoff from Pinal County and attenuate flows to reduce the size and cost of downstream drainage improvements.

3. Project elements: Flow through detention basins that collect sheet runoff from the east, within Pinal County. The basins are situated at the flow line of two natural washes 2200 feet apart. The outlet flows from the two basins are combined at Pecos Avenue.

4. Special Considerations: A low lying area south of the Pecos South Basin needs to be filled with excavated material to raise the natural ground to the basin embankment elevation to prevent inundation from ponding within the basin. The basins are each set back 660 feet from the Pecos Road alignment to allow room for future frontage development.

5. 404 Permit: The Pecos North and South Detention Basins are not delineated because they are beyond the limit of the photography used for jurisdictional delineations. However, they are almost certainly jurisdictional and will likely require a 404 permit. A field investigation of the area must be performed before a determination can be made.

6. Right-of-Way: 64 acres of new ROW is required for the Pecos North Detention basin and 68 acres is required for the Pecos South Detention Basin.

7. Utility Conflicts: No utility conflicts.

8. Project Participants: Baker Recycling, Olin Mitsubishi, and TRW are local industrial landholders that experience access problems when flooding occurs along Pecos Road. The detention basin construction will directly benefit their operations. The City of Mesa is also a project participant.

Q. Meridian North & South Channels (Shts 34-37 of 43) **$2.39**

1. Location: Extending from Queen Creek Road on the south to ½ mile north of the Williams Field Road alignment on the north, adjacent to the Meridian Road alignment in Pinal County.

2. Purpose: To intercept surface runoff from Pinal County and direct it into the Pecos North and South Detention basins which attenuate flows to allow a reduction in size of downstream improvements.

3. Project elements: The Meridian North channel has a trapezoidal section and drains south into the Pecos North Detention Basin. The Meridian South channel has a trapezoidal section and drains north into the Pecos South Detention Basin. Culvert crossings are provided for the future extensions of Williams Field and Germann Roads. The Pecos North and South basin discharges converge at Meridian Road and Pecos Road and drain to the west in the Pecos Channel.

4. Special Considerations: The Meridian South channel will replace an existing training dike constructed by the Soil Conservation Service (SCS). The dike can be abandoned or removed following construction of the channels and basins.

5. 404 Permit: No jurisdictional waters, no 404 permit required.

6. Right-of-Way: 170 feet of new ROW is required for the Meridian North Channel and 125 feet is required for the Meridian South Channel. The ROW should share, and extend beyond, the ultimate east ROW line for Meridian Road.

7. Utility Conflicts: No Utility Conflicts.

8. Project Participants: As with the Pecos North and South Detention basins, Baker Recycling, Olin Mitsubishi, and TRW will directly benefit from the drainage improvements. The City of Mesa will also participate.

R. Pecos Channel & Lateral (Sheets 31-33,39 of 43) **$14.74M**

1. Location: Extends from Ellsworth Road to Meridian Road along the north side of Pecos Road. The Pecos Lateral extends 1 mile south along the Crismon Road alignment to Germann Road.

2. Purpose: To convey the Pecos North and South Detention basin outlet discharge to the Ellsworth Channel and to collect local runoff generated south of Pecos Road in the Pecos Lateral.

3. Project elements: The Pecos Channel consists of 3 miles of trapezoidal earth channel with 9 drop structures and 5 culvert crossings. The drop structures are incorporated into the culvert crossings when possible. A 1000 foot section of box culvert is planned along the frontage of Baker Recycling under their front parking lot. The Pecos Lateral is 1 mile of trapezoidal earth channel with 1 drop structure.

4. Special Considerations: A 1000 foot section of box culvert is required due to a conflict with the parking lot at Baker Recycling.

5. 404 Permit: The channel will destroy a detention pond on the GM Proving Ground property. Construction of the channel will possibly impact the existing channel along the south side of the GM property. If this is the case, the total impacted jurisdictional area is approximately 4.9 acres and a 404 permit will be required.

6. Right-of-Way: Channel ROW requirements vary from 115 to 130 feet along the channel alignment.

7. Utility Conflicts: A 16 inch waterline will be lowered at up to 2 locations.

8. Project Participants: As with the Pecos North and South Detention basins, Baker Recycling, Olin Mitsubishi, and TRW will directly benefit from the drainage improvements. Additionally, GM Proving Grounds could participate with 1.5 miles of channel improvements that are within their ROW. MCDOT would have a project interest as part of any planned improvements to Pecos Road.

S. Ellsworth Channel (Sheets 28-30,38 of 43) **$15.24M**

1. Location: Along the east side of Ellsworth Road from Germann Road north to a point 2200 feet south of the Powerline Floodway where it crosses Ellsworth Road and continues westerly adjacent to a planned internal roadway within WGA to the Powerline Floodway.

2. Purpose: To alleviate significant flooding problems within Ellsworth Road north of Pecos Road where water currently flows over the top of the road and ponds. The Ellsworth Channel also conveys the Pecos Channel flows to the Powerline Floodway.

3. Project elements: A trapezoidal channel with 4 box culverts and 2 drop structures. The Pecos Channel combines with the Ellsworth

Channel at Pecos Road.

4. Special Considerations: The channel will replace the existing north perimeter channel through WGA which will allow WGA to reclaim the land for development. The WGA "Runway Approach Surface" (RAS) limits the height of objects beneath the approach flight path which passes over Ellsworth Road at Pecos Road. Ellsworth Road already encroaches on the RAS by nearly 3 feet. It is therefore critical that Ellsworth Road not be raised above the existing profile grades. The Ellsworth channel will need to stay low enough at this point to accommodate the Ellsworth Road profile restriction.

5. 404 Permit: The construction of the channel along the east side of Ellsworth road will impact the existing channel along the same alignment on the west side of the GM Proving Ground property. The total impacted jurisdictional area is approximately 4.8 acres. A 404 permit will be required.

6. Right-of-Way: ROW requirements vary from 50 feet to 110 feet.

7. Utility Conflicts: There is a sanitary sewer force main and a gas line along Ellsworth Road that are in conflict with the Pecos Road and Ellsworth Road box culvert crossings. Both utilities will be lowered.

8. Project Participants: WGA, GM Proving Grounds, and MCDOT have an interest in the project. MCDOT is planning major roadway improvements to Ellsworth Road that will need to be coordinated with the channel and box culvert improvements. GM Proving Ground could participate with ROW for the portions of the channel within their property. WGA could participate with ROW and construction costs within their property due to the development benefit from realigning the channel.

T. Powerline Floodway (Sheets 26,27 of 43) **$9.43M**

1. Location: The existing Powerline Floodway will be reconstructed for 3800 feet along the north perimeter of WGA and will be relocated around the north side of the new runway extension. The realigned Powerline Floodway will extend to the Elliot Channel adjacent to the Santan Freeway.

2. Purpose: To combine flows from the existing north perimeter channel with the existing Powerline Floodway flows and combine with the proposed Elliot Channel to provide one large outfall channel to the EMF. The realigned Powerline Floodway will also facilitate the planned WGA runway extension.

3. Project elements: Trapezoidal concrete channel with 3 drop structures and 2 box culvert crossings.

4. Special Considerations: The channel confluence with the Elliot Channel will need to be given consideration during design to ensure good hydraulic characteristics that avoid adverse backwater or scour effects.

5. 404 Permit: The alignment of the proposed channel coincides with the alignment of the existing north perimeter channel for approximately 2400' before the proposed channel turns to the north. Constructing this portion of the channel will impact approximately 3.2 acres of jurisdictional waters. A 404 permit will be required for this project.

6. Right-of-Way: Twenty feet of new ROW is required along the existing Powerline Floodway, 110 feet of new ROW is required along the new alignment.

7. Utility Conflicts: No Utility Conflicts.

8. Project Participants: WGA is a logical participant. WGA will eventually modify the Powerline Floodway with FAA funding to accommodate the runway extension. Perhaps FAA funds could be used to assist with the project.

U. Rittenhouse Channel Extension & Laterals (Sheets 40-43 of 43) **$2.77M**

1. Location: An extension of the Rittenhouse Channel along Queen Creek Road from ½ mile east of Ellsworth Road 1 mile to ½ mile east of Crismon. Laterals will extend north ½ mile along the mid-section lines east and west of Crismon Road.

2. Purpose: To collect sheet flow draining westerly in the area north of Queen Creek Road and convey it to the Rittenhouse Channel.

3. Project elements: Trapezoidal earth channel with 3 drop structures and 3 culvert crossings.

4. Special Considerations: The new channel will tie into the Rittenhouse Channel south of Queen Creek Road. The channel will cross to the north side of Queen Creek Road and continue to the east.

5. 404 Permit: No Jurisdictional waters were found within the project limits. No 404 permit is required.

6. Right-of-Way: Eighty-six feet of new ROW is required for the channels.

7. Utility Conflicts: Existing water, gas, telephone, and irrigation utilities will be relocated for the Queen Creek Road box culvert crossing.

8. Project Participants: The Town of Queen Creek may be a project participant.

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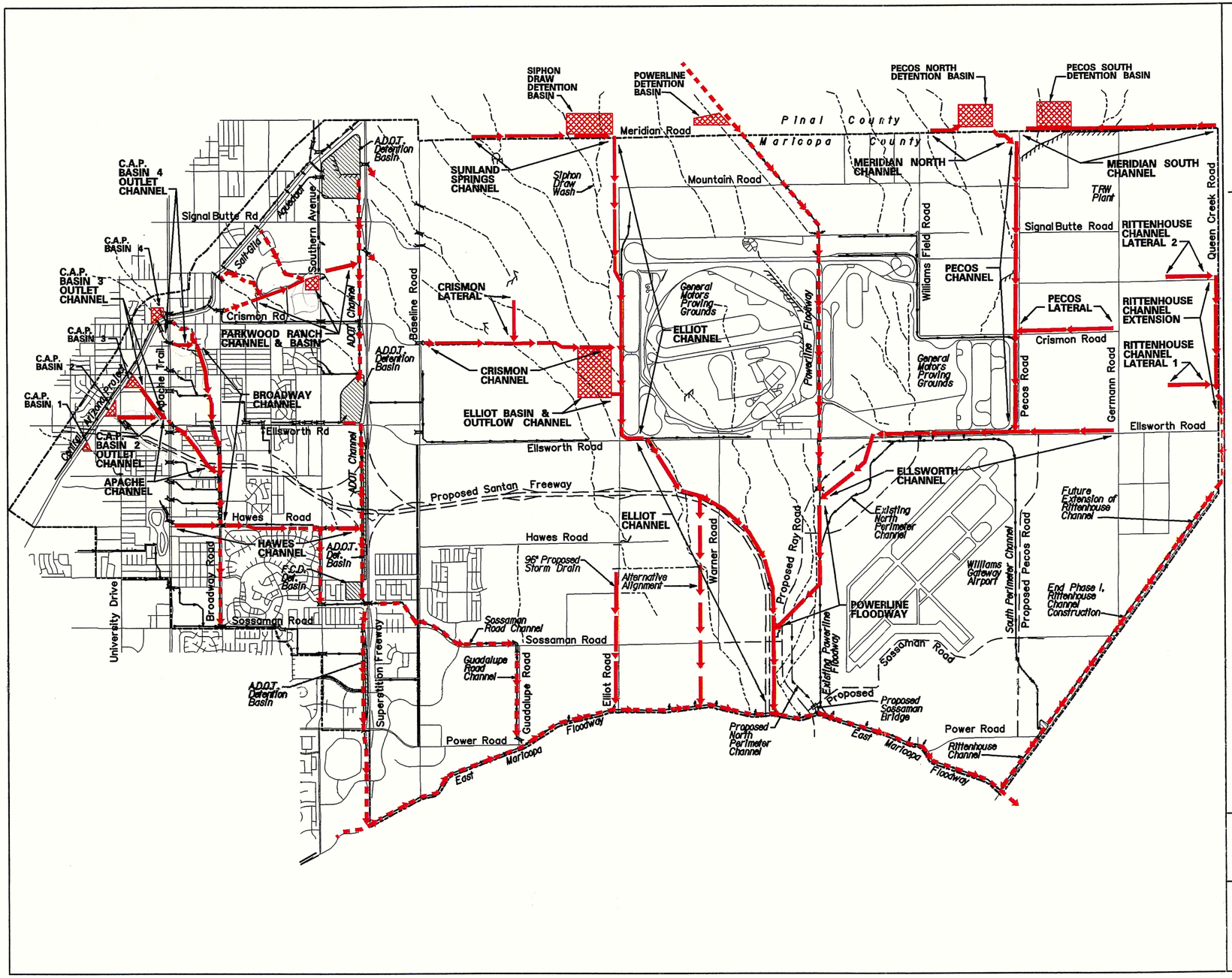

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

- STUDY BOUNDARY
- EXISTING CHANNEL/DITCH
- EXISTING BRIDGE/CULVERT
- EXISTING STORM DRAIN
- EXISTING ROADWAY DIP SECTION/ WEIR/OVER-CHUTE
- EXISTING DIVERSION DIKE
- EXISTING WASH
- PROPOSED ROAD ALIGNMENT
- PROPOSED CHANNEL/STORM DRAIN
- EXISTING/PLANNED MAJOR CHANNEL
- PROPOSED DETENTION BASIN

N

2500 0' 2500 5000
SCALE IN FEET

DIBBLE & ASSOCIATES
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Since 1962
Hoskin Engineering Consultants

PRELIMINARY PLAN

FIGURE 6

VI. ENVIRONMENTAL AND PERMIT ISSUES

A. Introduction

Section 404 of the Clean Water Act regulates construction activities within "Waters of the U.S." The U.S. Army Corps of Engineers enforces the Section 404 requirements through the 404 permit program. Prior to undertaking construction activities within waters of the U.S., a 404 permit must be obtained. The purpose of the 404 permit program is to avoid adverse impacts or to offset unavoidable adverse impacts to existing aquatic resources.

The Environmental Protection Agency prepared guidelines to be followed in evaluating 404 permit applications. The guidelines, referred to as 404(b)(1) guidelines, require the evaluation of practicable alternatives to the project that would eliminate the need for a 404 permit. If, through an alternatives analysis, it is determined that no practicable alternatives exist, steps must be taken to minimize the potential adverse impacts on the aquatic ecosystem. These steps typically include mitigation measures such as replacement of lost "functions and values" of the ecosystem through re-establishing lost habitat within the project or nearby in proportion to the habitat lost due to the project. In cases where mitigation cannot be accomplished at the project site or would not be as environmentally beneficial, compensation for adverse impacts to aquatic ecosystems can be made through mitigation banking. Mitigation banking consists of restoration, creation, or enhancement of aquatic resources expressly for the purpose of compensating for unavoidable impacts in advance of development actions. Mitigation banking may be an acceptable form of compensatory mitigation in the southeast Mesa area.

Alternative measures were evaluated during Phase I of the project, which considered various alternative alignments and approaches to flood control within the study area. Environmental impacts of each alternative were included in the evaluation through consideration of impacts to native vegetation, wildlife habitat, and water quality. The drainage system alternative that emerged from the evaluation process as the most favorable includes primarily concrete channels with detention basins strategically located throughout the study area. The detention basins provide an opportunity to mitigate adverse impacts through establishment of native vegetation and habitat within the basins. This section describes additional environmental considerations to be carried forward in the final project design and project specific 404 permit issues and requirements including a delineation of waters of the U.S. that may be impacted by the Preliminary Plan.

B. Environmental Design Considerations

Most of the channels presented in the *Preliminary Design Plans* are concrete lined. In keeping with the intent of the Clean Water Act and the 404(b)(1) guidelines to avoid or minimize adverse impacts to aquatic resources, the following discussion is offered as an alternative to concrete lined channels. Alternative channel lining schemes are presented to provide the Flood Control District of Maricopa County and the future project designer with alternatives that may serve to minimize the adverse impacts of the project. The EPA requires consideration of avoidance and minimization before considering mitigation. Alternative "kinder and gentler" channel materials may be considered as methods of minimization which may reduce or eliminate the need for any compensatory mitigation.

1. Unlined Earth

Earth channels are the most natural of the alternative channel linings, however, the erosive nature of native soils require very flat slopes and frequent drop structures. Native grasses can be established in the channel bed and larger trees and shrubs can be placed along the bank and over-bank areas above the design water surface creating a good habitat area. The natural appearance of the channel is pleasing for recreational users and wildlife habitat is enhanced. Long-term maintenance costs are high due to the ongoing weed control and repair of nuisance erosion. Earth channels should be carefully excavated to finished grades. Over-excavation should be avoided except where necessary to replace objectionable material.

2. Plain Rip-Rap Lining

Plain loose rip-rap is commonly considered as an alternative to concrete channel linings however, there are problems with weed control and accumulation of garbage and debris between the stones. FCDMC maintenance personnel have indicated that maintenance of loose rip-rap is very difficult. Re-vegetation cannot be accomplished within the channel and good quality stone of sufficient size is often scarce at nearby locations. One advantage of rip-rap is that due to the high roughness, channels can be constructed at steeper slopes which may eliminate the need for costly drop structures.

3. Grouted Rock Lining

Grouted rock is an evolution of rip-rap that eliminates the small size material that fills the void spaces in loose rip-rap and fills the voids with grout which binds the system together into a rigid channel lining scheme. Whereas loose rip-rap is well graded, the rock for grouted rock

is a uniform size. The rock is placed in a single layer and grouted from the sub-base level up to near the surface. The face of the rock is left protruding above the grout and kept clean to produce a pleasing appearance. The grouted rock reduces the weed and garbage problem of loose rip-rap while maintaining the roughness characteristics that allow a steeper channel slope. Grouted rock requires relatively large rocks which may be scarce and requires strict quality control during construction to ensure good rock selection and placement and full grout penetration.

4. Reno Mattress (Gabion) Lining

Reno Mattresses are stone filled wire baskets laid on a prepared sub-base. Reno mattresses come in six and nine inch thicknesses. Reno mattresses can withstand fairly high velocities and require smaller size stones than loose rip-rap or grouted rock. Gabions are not very attractive and are dependent on the wire mesh baskets for their integrity. Corrosion or abrasion from transported sediments can deteriorate the wires. Additionally, wires are occasionally cut by over-zealous landscapers in their pursuit of river rock. The baskets can be covered with earth to hide them and grasses can be established within the structure.

5. Soil Cement Plating

Soil Cement Plating consists of mixing cement with local, native earth and placing in four to six inch lifts along the channel perimeter. The finished thickness should be a minimum of 12 inches. By using native earth material in the mixture, the local color is preserved and the lining looks relatively natural while withstanding much higher velocities than earth only channels. Shrinkage cracks often develop in soil cement plating linings; however, field studies have indicated that the vast majority of the crack openings are no larger than hairline width and are usually filled by stream sediments. Methods have been identified to control shrinkage cracking where it is a concern.

6. Articulating Concrete Block (ACB) Lining

Articulating Concrete Block liners consist of pre-formed sections which interlock with each other to form a continuous blanket or mat. Some ACB's are connected with cables and placed as sheets. ACB's are available with openings within or between each block to allow growth of native grasses. Blocks can be left out to allow planting of trees and shrubs. The completed surface can be covered with earth to create a natural looking appearance, however, soil will likely be washed away during stream flow events. The ACB's can withstand high velocities and due to their high roughness factor can be constructed at steeper channel slopes which will reduce or eliminate the need for drop structures.

7. Alternative Channel Lining Design

This section is intended to allow modification of the Preliminary Plan to incorporate "kinder and gentler" channel lining materials, where appropriate. The foregoing discussion presents alternative lining materials that have a history of use and have been tested and proven for certain applications. Additionally, adequate design guidance is available in the literature to allow a prudent design.

Table 4 provides channel design parameters that can be used to develop alternative designs for the Preliminary Plan. Manning's equation can be used to develop a channel cross-section and design slope that meets the hydraulic criteria from Section III. The design slope can then be fit into the existing ground profile from the *Preliminary Design Plans* and the location and size of drop structures established. Allowing for cut and fill slopes and maintenance access roads, a new right of way requirement can be determined.

Table 4 - Channel Design Parameters

Lining Type	Max. Side Slope (H:V)	Manning's n	Max. Velocity (Ft/s)
1. Earth	4:1	0.025	2.5 - 5
2. Rip-Rap	3:1	0.040	per stability analysis
3. Grouted Rock	3:1	0.040	per stability analysis
4. Reno Mattress	2:1	0.025	15 - 20
5. Soil Cement	3:1	0.020	10 - 15
6. AC Blocks	2:1	0.032	15

C. 404 Permit

A meeting was held with the U.S. Army Corps of Engineers, Regulatory Branch (COE) early in the project, (during Phase I) where the COE was invited to provide input on the three alternatives being evaluated. The COE response letter, dated March 19, 1997 is contained in the Appendix of the Phase I report. In that letter, the COE indicated that the "Detention" alternative has many aspects that are environmentally sensitive and that a Section 404 permit will be required for any of the alternatives. The letter further stated that "The Clean Water Act requires us to permit the least environmentally damaging, most practicable alternative."

1. Pre-Application Consultation

The first step in the 404 permit process was to have a Pre-Application

Consultation with the COE to discuss 404 permit requirements and strategies for the project. During this meeting, the COE recommended that a single, individual 404 permit be acquired for the entire plan. Advantages of this approach are a single application rather than numerous applications for each project and the resulting savings in processing costs for the COE and the FCDMC/City of Mesa. Additionally, environmental impacts and resulting mitigation can be evaluated on an area wide basis allowing more flexibility in meeting the 404 permit requirements.

The difficulty with this approach is that the COE issues a 404 permit to a single "permittee" who is responsible for implementation of the plan according to the permit requirements. As this is a *master plan*, the FCDMC has not acquired right of way or gained control of the property identified for improvements. As such, the FCDMC has no authority to enforce the requirements of the plan until they acquire the right of way. As a result, the COE recommended approach may have to be abandoned and individual 404 permits acquired for each individual construction project.

2. Delineation of Jurisdiction

The next step in the 404 permit process is to delineate the limits of waters of the U.S. within the project limits that will be claimed for jurisdiction by the COE. Waters claimed by the COE as waters of the U.S. are referred to as "jurisdictional waters." The 404 permit requirements and limitations apply only to jurisdictional waters that are impacted by the project.

The limits to be surveyed in the field for jurisdiction were first identified by superimposing the Preliminary Plan over aerial photos of the area. Drainage-ways were identified that may be impacted by the project and a boundary established for the field work. No attempt was made to delineate every wash in the study area, only those washes along the corridors of the planned improvements and those washes downstream from the improvements that may be impacted by the improvements. The survey area was then reviewed in the field. Photographs were taken throughout the study area and measurements taken of the bank full width of jurisdictional washes. The limits of jurisdictional waters were then plotted on the aerial photos and submitted to the COE along with the photographs. Impacts to waters of the U.S. for each project are discussed in Section V.

3. Mitigation Planning

This section provides guidance for mitigation planning to be used in the implementation of this plan to meet the COE mitigation requirements. Planning level unit cost estimates are included for budget projections. Generally, mitigation will be in conformance with the *Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects* dated December 16, 1992 published by the Flood Control District of Maricopa County. The following detention basins and unlined earth channels are planned for landscape mitigation:

<u>Detention Basins</u>

- CAP Basins 1-4
- Elliot Basin
- Siphon Draw Detention Basin
- Pecos North and South Detention Basins

<u>Unlined Earth Channels</u>

- Elliot Channel from Meridian Road west to the Elliot Road crossing at the north end of the GM Proving Grounds
- Elliot Channel from Ellsworth Road west to the East Maricopa Floodway
- Pecos Channel from Meridian Road west to Ellsworth Road
- Pecos Lateral along Crismon Road
- Meridian North Channel
- Meridian South Channel
- Rittenhouse Channel Extension & Laterals

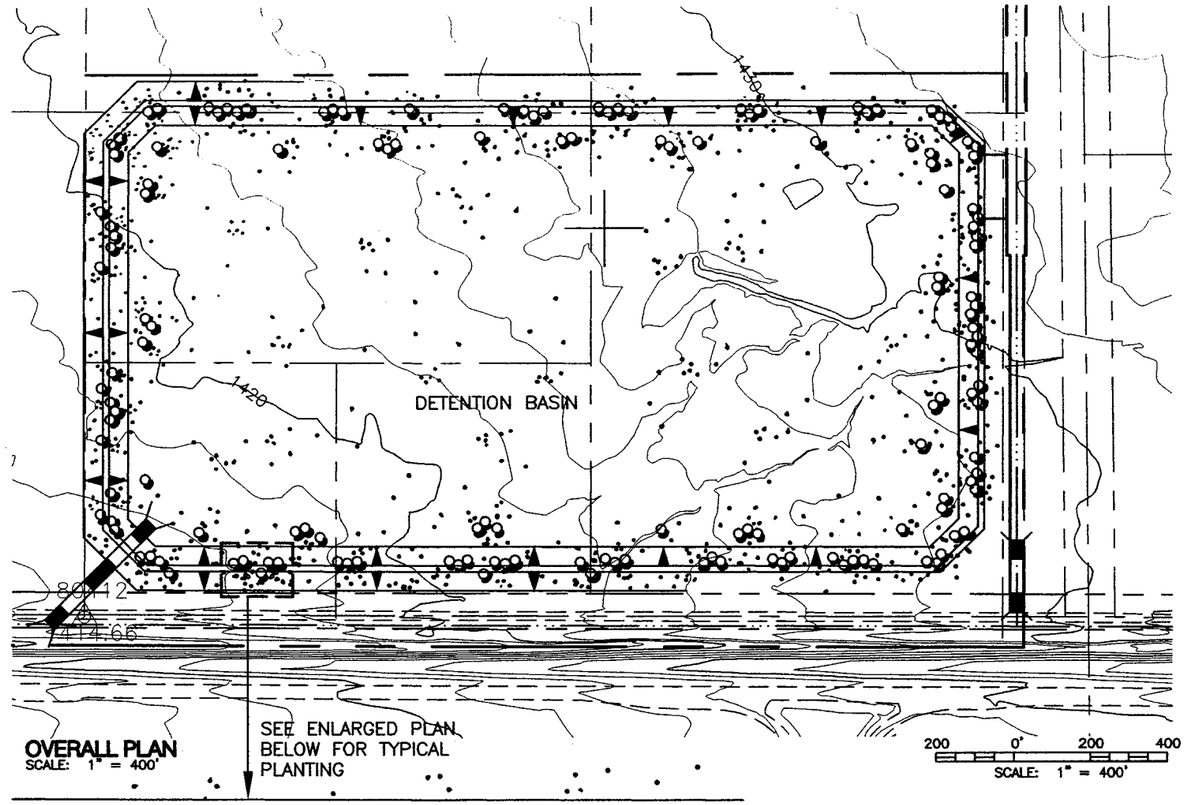
CAP Basins 1-4 - In addition to their function as flood control facilities, the CAP Basins 1-4 will also accommodate future neighborhood and community park amenities to be provided by the City of Mesa. The initial installation will include tree and shrub plantings with a completely automated drip irrigation system and a decomposed granite rock ground cover over the entire basin. Basin sideslopes may include both tree and shrub plantings while the basin bottom will include tree plantings only. The landscape treatment will provide aesthetic appeal, slope erosion protection, and climate mitigation potential for the future park users. Planting layouts will be designed so that plantings will not conflict with the future park amenities or planned turf areas. Plant palettes will be selected from the current Arizona Department of Water Resources Low Water Use Plant List, will be compatible and consistent with the adjacent areas and in conformance with the current City of Mesa's standards. Landscape design and planned future park amenities will be in conformance with Mesa's guidelines for retention basin recreational facilities. The estimated landscape cost for CAP basins 1-4 is $.40 - $.50 per square foot. This is based on 10 trees per acre (50% of total trees to be 15 gallon, 50% to be 24" box), 3 - 5 gallon shrubs per tree, 1 gallon shrubs, ground covers, and accents (60% of total shrubs to be 5 gallon, 40% to be 1 gallon), fully automated drip irrigation with emitters to each plant, and decomposed granite rock ground cover. Note: costs do not include any native plant salvage or relocation. There are some existing saguaros within CAP basins 1-4 which may require relocation.

In contrast to the CAP Basins 1-4, the Elliot Basin, Siphon Draw Detention Basin, and Pecos North and South Detention Basins as well

as the unlined earth channels are located in areas which currently are much less densely populated. These basins and channels will be re-vegetated in a more natural manner using a palette consisting of a combination of native indigenous trees and shrubs along with native seed mix. Density of plantings will be similar to that along existing natural washes and drainage areas in this vicinity. See **Figures 7 and 8** for typical landscapes. The plantings will require an irrigation system until they become established then the supplemental water may be tapered off until the entire landscape can manage on natural rainfall. Seed mix areas may be established relying only on natural rainfall however without supplemental water, depending on the time of year and amount of rainfall, seed germination may be unreliable and seeding establishment slow. The seeds will germinate when conditions are favorable. It is best to sow seed in the Fall just prior to the rainy season.

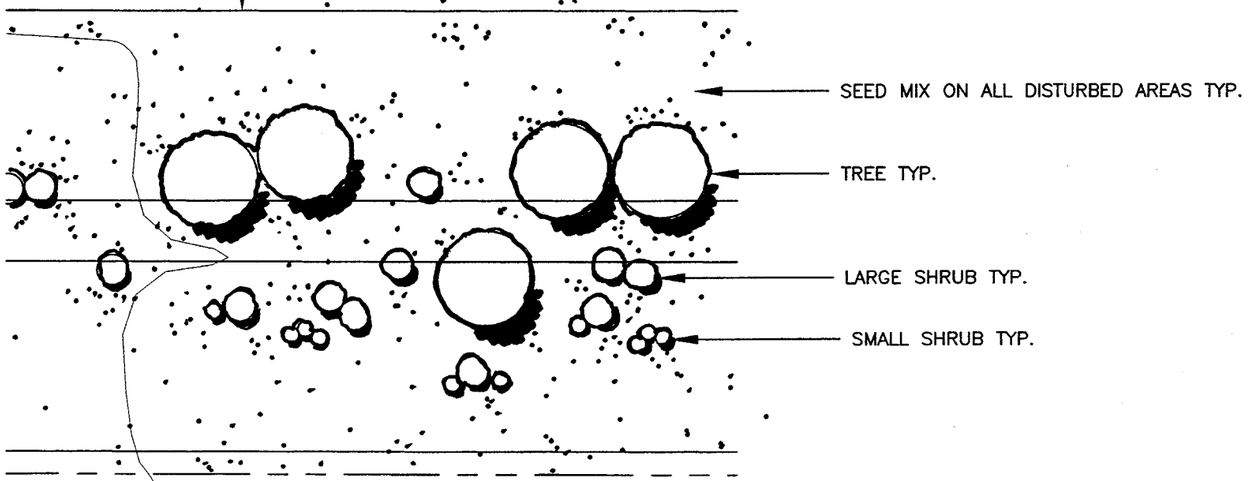
Other Detention Basins - The detention basins are designed with 6:1 slopes on the inside of the basin and 4:1 slopes on the outside. Depths vary from 6' to 15'. The basin re-vegetation will consist of tree and shrub plantings on the basin side slopes. Some trees will also be planted in the basin bottom to take advantage of water harvesting. All areas disturbed by grading will be hydroseeded with native seed mix consisting of native grasses and shrubs. See **Figure 7** for a typical basin landscape. The estimated landscape cost for the detention basins is $.20 - $.25 per square foot. This is based on approximately 20 trees per acre (50% of total trees to be 15 gallon, 50% to be 24" box), 3 - 5 gallon shrubs per tree, 1 gallon shrubs and ground covers (60% of total shrubs to be 5 gallon, 40% to be 1 gallon), fully automated drip irrigation with emitters to each plant, and native seed mix over all disturbed areas. Native seed mix areas will not be irrigated.

Earth Channels - The earth lined channels will be designed in a similar manner to the natural washes in this area which are characterized by vegetated sideslopes and sandy bottoms. The earth lined channels are designed with 6:1 sideslopes with depths varying between 4' and 10' and the channel bottoms varying in width from 6' to 80'. There is typically a 16' wide road adjacent to each side of the channel at the top of the sideslopes and a slope graded at 4:1 from the edge of the road to meet existing grade. The channel re-vegetation will consist of tree and shrub plantings in combination with native seed mix on the channel sideslopes. See **Figure 8** for typical earth lined channel landscape. Trees will be set back from the adjacent 16' road a minimum of 15' to maintain required clearances. Any seed mix applied to the channel bottom will likely be washed away therefore the channel bottom will remain earth lined. Some loose rock material may also be used in the channel for erosion protection at drop structures or along the outside of curves or turns where the channel changes direction. The estimated landscape cost for the earth lined channels is $.23 - $.28 per square foot of channel right of way. This is based on approximately 15-20 trees per acre (50% of total trees to be 15 gallon, 50% to be 24" box), minimum 3 - 5 gallon shrubs per tree, 1 gallon shrubs and ground covers (40% of total shrubs to be 5 gallon, 60% to be 1 gallon), fully automated drip irrigation with emitters to each plant, and native seed mix over channel sideslopes. Native seed mix areas will not be irrigated. In addition, costs include loose rock material installed within the channel at drop structures and at channel changes of direction.

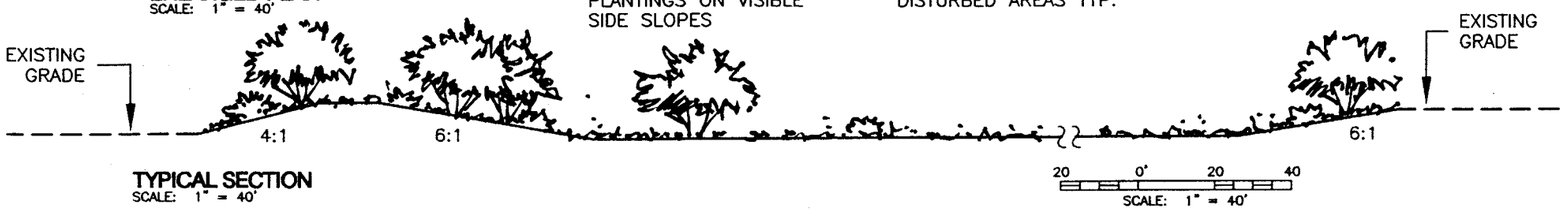


OVERALL PLAN
SCALE: 1" = 400'

200 0' 200 400
SCALE: 1" = 400'



ENLARGED PLAN
SCALE: 1" = 40'



TYPICAL SECTION
SCALE: 1" = 40'

20 0' 20 40
SCALE: 1" = 40'

PROPOSED PLANT LIST

TREES
CERCIDIUM FLORIDUM
BLUE PALO VERDE

OLNEYA TESOTA
IRONWOOD

PROSOPIS SPP.
MESQUITE

SHRUBS
ACACIA GREGGII
CATCLAW ACACIA

AMBROSIA AMBROSIODES
GIANT BURSAGE

AMBROSIA DELTOIDEA
BURSAGE

ENCELIA FARINOSA
BRITTLEBUSH

HYPTIS EMORYI
DESERT LAVENDER

JUSTICIA CALIFORNICA
CHUPAROSA

LARREA TRIDENTATA
CREOSOTE

SEED MIX
AMBROSIA DELTOIDEA
BURSAGE

ARISTIDA PURPUREA
PURPLE THREE AWN

ENCELIA FARINOSA
BRITTLEBUSH

ERIOGONUM FASCICULATUM VAR.
POLIOFOLIUM
FLATTOP BUCKWHEAT

LARREA TRIDENTATA
CREOSOTE

LUPINUS SPARSIFLORUS
LUPINE

SENNA COVESII
COVE'S CASSIA

SPHAERALCEA AMBIGUA
GLOBE MALLOW

SPOROBOLIS CRYPTANDRUS
SAND DROPSEED

NOTE: THIS CONCEPT APPLIES TO THE ELLIOT BASIN, THE SIPHON DRAW DETENTION BASIN, AND THE PECOS NORTH AND SOUTH DETENTION BASINS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

East Mesa Area
Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

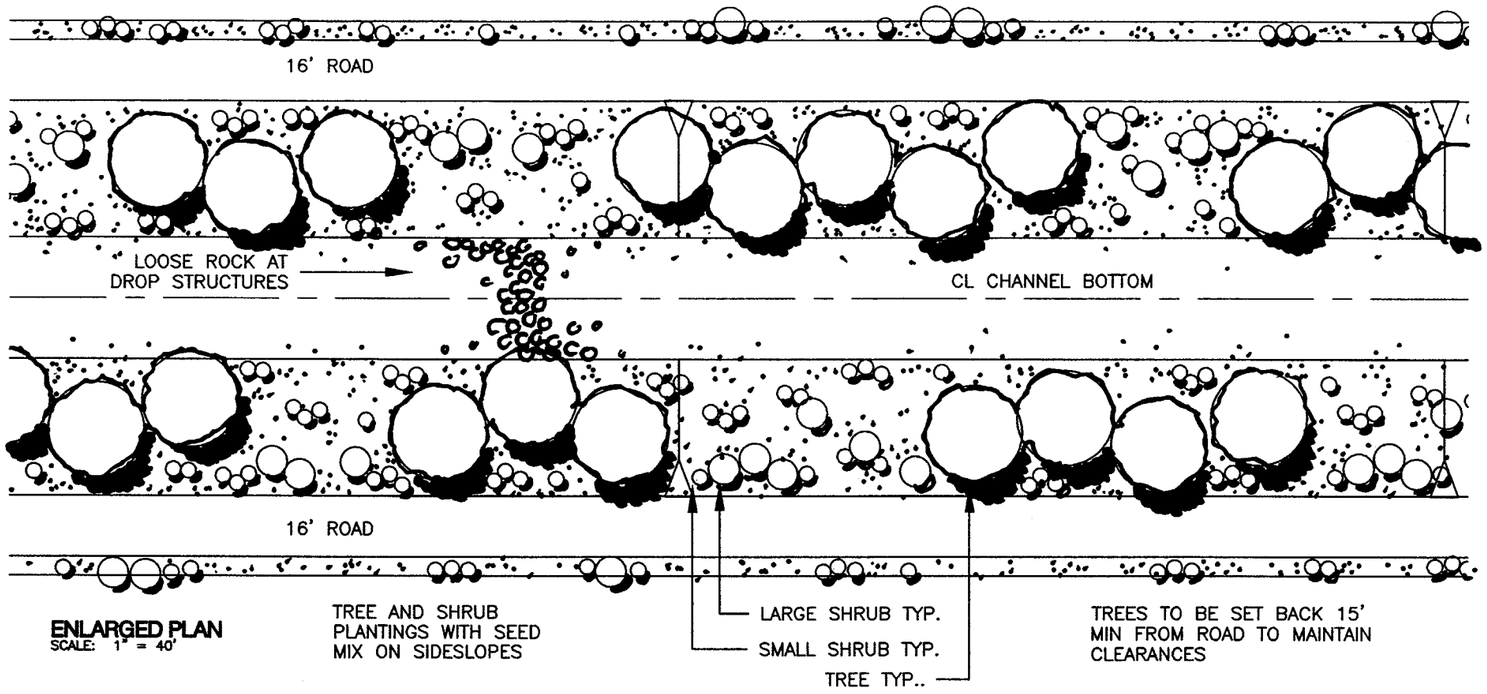
LEGEND

TREE
SHRUB
SEED MIX

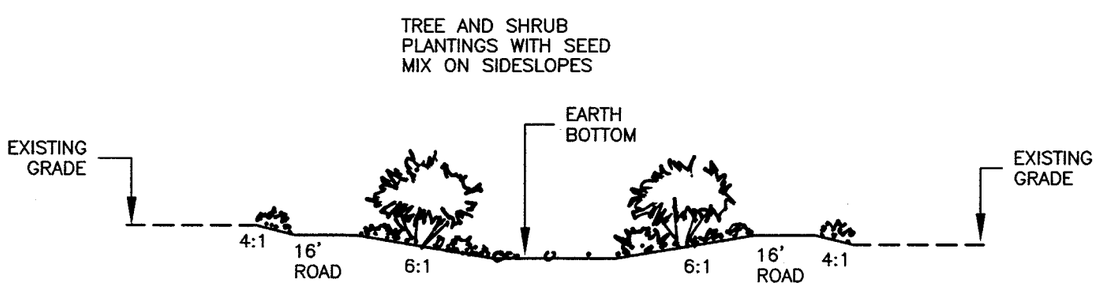
McCloskey • Peltz, Inc.
LANDSCAPE ARCHITECTS
P.O. Box 24294
Tempe, Arizona 85285-4294
(602)838-4777 or 838-7774

BASIN LANDSCAPE CONCEPT

FIGURE 7



ENLARGED PLAN
SCALE: 1" = 40'



TYPICAL SECTION
SCALE: 1" = 40'

NOTE: CHANNEL DEPTHS VARY CHANNEL BOTTOMS VARY SEE PLANS

NOTE: PROVIDE LOOSE ROCK IN CHANNEL BOTTOM AT DROP STRUCTURES AND AT CHANNEL CHANGES OF DIRECTION FOR EROSION CONTROL

SEED MIX ON ALL DISTURBED AREAS EXCEPT CHANNEL BOTTOM TYP.

20 0' 20 40
SCALE: 1" = 40'

PROPOSED PLANT LIST

TREES
CERCIDIUM FLORIDUM
BLUE PALO VERDE

OLNEYA TESOTA
IRONWOOD

PROSOPIS SPP.
MESQUITE

SHRUBS
ACACIA GREGGII
CATCLAW ACACIA

AMBROSIA AMBROSIODES
GIANT BURSAGE

AMBROSIA DELTOIDEA
BURSAGE

ENCELIA FARINOSA
BRITTLEBUSH

HYPTIS EMORYI
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SENNA COVESII
COVE'S CASSIA

SPHAERALCEA AMBIGUA
GLOBE MALLOW

SPOROBOLIS CRYPTANDRUS
SAND DROPSEED

NOTE: THIS CONCEPT APPLIES TO ALL EARTH LINED CHANNELS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

East Mesa Area
Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

TREE
SHRUB
SEED MIX

McCloskey • Peltz, Inc.
LANDSCAPE ARCHITECTS
P.O. Box 24294
Tempe, Arizona 85285-4294
(602)838-4777 or 838-7774

EARTH LINED CHANNEL LANDSCAPE CONCEPT

FIGURE 8

VII. PHASING AND IMPLEMENTATION

A. Introduction

This Section contains recommendations for cost sharing, budgetary and construction phasing for the recommended projects identified in Section V.

For budgeting purposes, capital improvements must be prioritized and constructed in phases as funding permits. To identify phasing of capital improvements, three priority categories are used. Priority 1 projects are current needs that should be constructed as soon as possible to correct existing system deficiencies. Priority 2 projects are projects that should be budgeted now for construction over the next five years and are needed to accommodate the anticipated development over the next five years. Priority 3 projects are improvements that are not needed within the next five years but will be needed as development occurs. Construction scheduling of priority 3 projects will be dictated by development timing and patterns.

Figure 7 illustrates Priority No. 1, 2, and 3 projects. **Table 5** summarizes each of the master plan projects and their construction cost listed by priority.

Priorities have been assigned only as a guide to the relative urgency of the storm drainage improvements. They are subject to revision for various reasons. For instance, in the next few years changes in development patterns may occur within the study area. The current financial obligations of government agencies or that of land developers may also vary. Further, as scheduling of roadway construction in the area becomes clearer, significant savings may be achieved by coordinating box culvert and channel construction with that of the roads or highways.

B. Cost Estimates

The construction costs for drainage improvements were computed using bidding information from seven recent FCDMC projects and from the ADOT *Construction Costs 1995* publication.

General estimates of land acquisition costs were developed by the FCDMC's Lands department utilizing data from COMPS of Arizona. For the study, the eleven land use categories shown on the *East Mesa ADMS* Current Land Use Map were combined into three general uses: Vacant Commercial, Vacant Industrial, and Vacant Residential (including all residential, agriculture, desert, lake, and park). Land costs were found to be different for property located north of Guadalupe Road compared to south of Guadalupe Road. The land acquisition costs used for the cost estimates were provided by the District.

Costs are grouped first by area (Area 1, Area 2, and Area 3), then by type of construction (i.e. channels, culverts, and basins), and finally by facility name. Major cost items included in the cost estimate are excavation, concrete, fencing, drop structures, utilities, and land acquisition. Excavation costs are based on the required volume of excavation, concrete costs are based on the required volume of concrete, and fence costs are based on the required fence lengths. The drop structure costs are based on the drop structure size, the number of drop structures, and a unit cost. Drop structure size, in square feet, is calculated as the drop structure height multiplied by the channel top width. The unit cost for drop structures, in dollars per square foot, is based on the materials cost for a typical drop structure. Utilities costs are included as a lump sum, as a dollar amount per utility crossing. The land acquisition costs are included only for new facilities and are based on required right-of-way widths.

The Grand Total for Land Acquisition, Total Construction, and Total Construction and Land Costs include three additional percentages. There is a construction contingency of 15%, a design and field engineering cost of 15%, and a 5% change orders cost. These percentages are applied to only the construction costs and not to the land costs.

C. Priority No. 1

The total estimated cost of Priority 1 projects is **50.82 million** dollars. **Table 5** shows the breakdown of priority 1 costs by project and cost type.

D. Priority No. 2

The total estimated cost of Priority 2 projects is **73.88 million** dollars. **Table 5** shows the breakdown of priority 2 costs by project and cost type.

E. Priority No. 3

The total estimated cost of Priority 3 projects is **10.06 million** dollars. **Table 5** shows the breakdown of priority 3 costs by project and cost type.

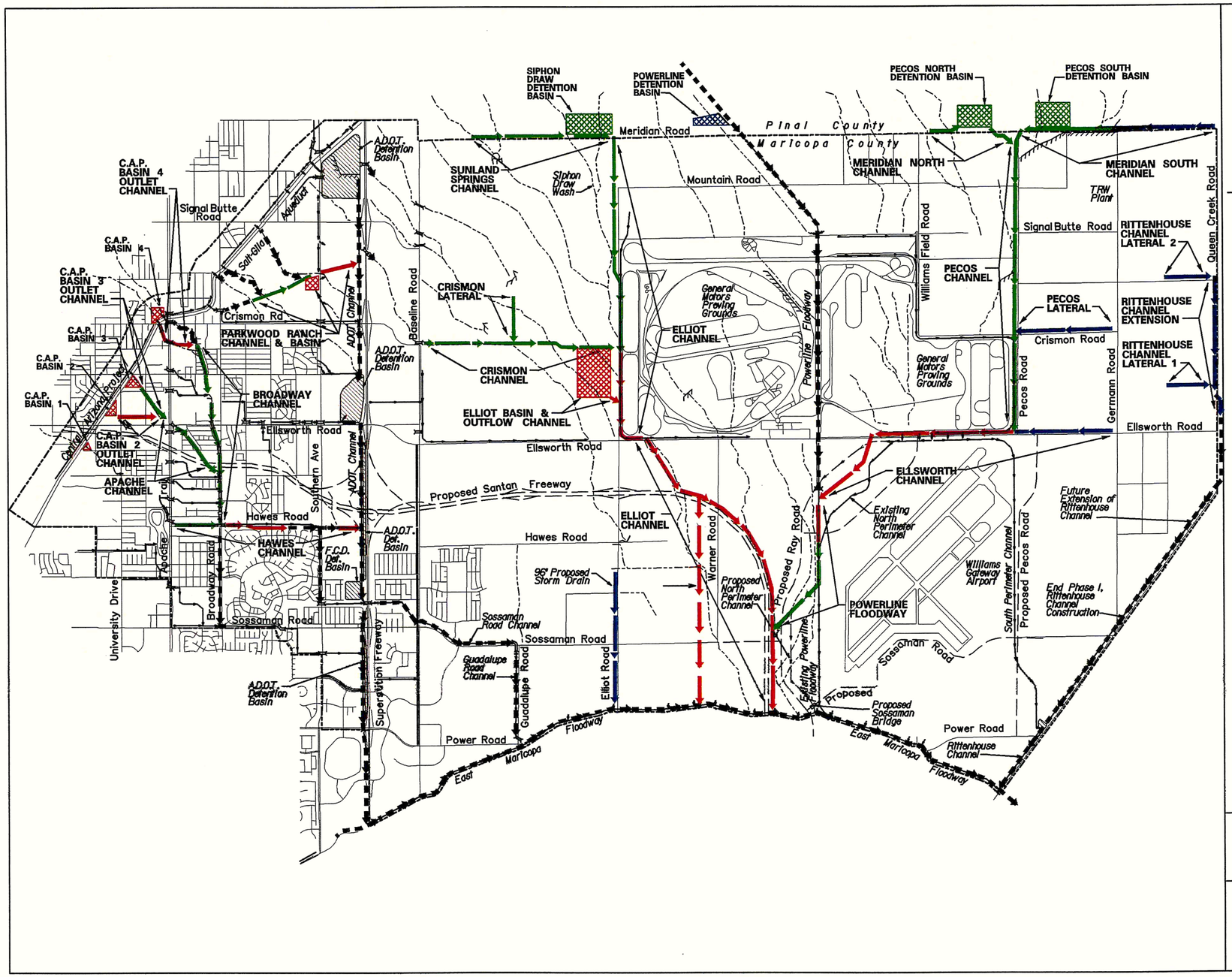
F. Project Funding

The development of this master plan has been a cooperative effort between many agencies and local interests within the study area. The

agencies have been involved throughout the project with an eye towards developing a plan that will be consistent with the ongoing development plans within the area and will be accepted by the local interests. The FCDMC participates in implementation of regional flood control projects based on an internal prioritization process. Cost sharing is one of the criteria included in the prioritization. If a local agency is willing to cost share the project, typically at a level of 50 percent, the project is scored more highly than projects with no cost sharing. The following agencies have an interest in the area and will benefit from implementation of the plan:

- City of Mesa
- Arizona Department of Transportation (ADOT)
- Maricopa County Department of Transportation (MCDOT)
- Williams Gateway Airport Authority (WGAA)
- General Motors Desert Proving Ground
- Flood Control District of Maricopa County (FCDMC)

Projects where shared benefits may accrue to the above agencies are identified in Section V. "Preliminary Plan." It is anticipated that as a result of the information contained in this *Recommended Design Report*, a concept for shared project participation can be agreed upon between the agencies. Based on the cost sharing arrangement and the phased implementation costs, the participating agencies can incorporate project costs into their capital improvement programs.



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

- STUDY BOUNDARY
- EXISTING CHANNEL/DITCH
- EXISTING BRIDGE/CULVERT
- EXISTING STORM DRAIN
- EXISTING ROADWAY DIP SECTION/ WEIR/OVER-CHUTE
- EXISTING DIVERSION DIKE
- EXISTING WASH
- PROPOSED ROAD ALIGNMENT
- PROPOSED CHANNEL/STORM DRAIN
  - PRIORITY 1
  - PRIORITY 2
  - PRIORITY 3
- EXISTING/PLANNED MAJOR CHANNEL
- PROPOSED DETENTION BASIN
  - PRIORITY 1
  - PRIORITY 2
  - PRIORITY 3

N

2500 0' 2500 5000

SCALE: 1" = 5000'

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962

Hoskin Engineering Consultants

PROJECT PHASING

FIGURE 9

Table 5 - Prioritized Project Costs

East Mesa Area Drainage Master Plan
COST ESTIMATE BY PRIORITY

Priority	Preliminary Plan Section	Channel Construction Cost	Landscape Cost	Channel Land Acquisition Cost	Culvert Cost	Detention Basin Construction Cost	Detention Basin Land Acquisition Cost	Total Cost
Priority 1	B. CAP Detention Basin 1		$130,680			$928,995	$258,746	$1,318,422
	C. CAP Detention Basin 2 & Outlet	$241,872	$267,714	$29,453	$210,036	$972,224	$474,368	$2,195,666
	D. CAP Detention Basin 3		$265,046			$962,536	$388,120	$1,615,702
	F. CAP Detention Basin 4	$372,912	$276,477	$145,233	$89,148	$1,004,047	$2,731,212	$4,619,029
	H. Hawes Channel -- South of Broadway Road	$3,032,085	$0	$105,138	$840,696			$3,977,919
	I. Parkwood Ranch Detention Basin & Outlet Channel	$252,470	$281,208	$159,638		$1,021,228	$862,488	$2,577,031
	M. Elliot Detention Basin		$805,860			$3,426,685	$1,934,064	$6,166,609
	N. Elliot Channel (Phase 1)	$10,693,747	$863,030	$2,359,665	$353,004			$14,269,446
	S. Ellsworth Channel -- North of Pecos Road	$9,849,915	$0	$1,286,888	$986,424			$12,123,226
	T. Powerline Floodway -- East of Existing North Perimeter Channel	$1,110,896	$0	$129,281	$714,564			$1,954,741
	Total Priority 1 Costs	$25,553,896	$2,890,015	$4,215,295	$3,193,872	$8,315,714	$6,648,998	**$50,817,791**
Priority 2	D. CAP Detention Basin 3 Outlet & Channel		$265,046		$343,236			$608,282
	E. Apache Channel	$3,192,338	$33,600	$141,372	$513,636			$3,880,946
	G. Broadway Channel	$3,964,383	$32,256	$400,554	$1,736,040			$6,133,233
	H. Hawes Channel -- North of Broadway Road	$1,644,620	$0	$162,162				$1,806,782
	I. Parkwood Ranch Channel North of Parkwood Ranch Detention Basin	$626,578	$45,150	$290,565				$962,293
	J. Sunland Springs Channel & Siphon Draw Detention Basin	$5,906,600	$598,950	$543,578	$171,534	$3,457,431	$1,437,480	$12,115,573
	K. Elliot Channel (Phase 2)	$3,023,498	$213,208	$1,006,683	$534,888			$4,778,276
	L. Crismon Channel & Lateral	$5,349,360	$0	$606,338	$347,622			$6,303,319
	P. Pecos North & South Detention Basins		$1,873,080			$9,124,539	$4,495,392	$15,493,011
	Q. Meridian North Channel	$347,369	$0	$354,375				$701,744
	R. Pecos Channel	$8,365,403	$0	$3,468,750	$1,788,066			$13,622,219
	T. Powerline Floodway -- West of Existing North Perimeter Channel	$5,549,321	$0	$760,594	$1,167,204			$7,477,119
	Total Priority 2 Costs	$37,969,470	$3,061,290	$7,734,969	$6,602,226	$12,581,971	$5,932,872	**$73,882,798**
Priority 3	O. Powerline Detention Basin		$283,140			$411,971	$679,536	$1,374,647
	Q. Meridian South Channel	$760,449	$0	$804,688	$119,370			$1,684,506
	R. Pecos Channel Laterals	$750,705	$0	$264,000	$101,430			$1,116,135
	S. Ellsworth Channel -- South of Pecos Road	$2,824,219	$0	$148,500	$139,794			$3,112,513
	U. Rittenhouse Channel & Laterals	$1,688,960	$263,011	$563,595	$255,438			$2,771,004
	Total Priority 3 Costs	$6,024,333	$546,151	$1,780,783	$616,032	$411,971	$679,536	**$10,058,806**
	Total Cost (Priorities 1, 2, and 3)	**$69,547,699**	**$6,497,456**	**$13,731,047**	**$10,412,130**	**$21,309,656**	**$13,261,406**	**$134,759,395**

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East Mesa Area Drainage Master Plan
AREA 1

Channel Costs

I.D.	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Drop Structures (No.)	Drop Structure Size * (ft^2)	Unit Cost ($/sf)	Drop Structures Cost	Utilities Cost	Channel Length (ft)	Existing Right-of-Way Width (ft.)	Right-of-Way Width Required (ft.)	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Contingencies Cost**	Total Land, Construction, Landscape, and Contingencies
CN-1	33243	$11	$365,673	0	$310	$0	11000	$12	$132,000	1	247	$163	$40,316	$6,000	5500	0	80	10.1	Res. S.	$0.60	$264,000	$543,989	$123,200	$206,716	$1,137,905
Sub-Total CN	**33243**	**$11**	**$365,673**	**0**	**$310**	**$0**	**11000**	**$12**	**$132,000**	**1**			**$40,316**	**$6,000**	**5500**			**10.1**			**$264,000**	**$543,989**	**$123,200**	**$206,716**	**$1,137,905**
EH-1	32991	$11	$362,901	4067	$310	$1,260,812	6080	$12	$72,960	2	263	$163	$85,621	$0	3040	0	95	6.6	Ind. S.	$1.25	$361,000	$1,782,294	$0	$677,272	$2,820,565
EH-2	32,991	$11	$362,901	2,167	$310	$671,880	3240	$12	$38,880	0	0	$163	$0	$6,000	1620	0	95	3.5	Ind. S.	$1.25	$192,375	$1,079,661	$0	$410,271	$1,682,307
EH-3a	61104	$11	$672,149	5672	$310	$1,758,179	10000	$12	$120,000	0	0	$163	$0	$0	5000	0	70	8.0	Ind. S.	$1.25	$437,500	$2,550,328	$0	$969,125	$3,956,952
EH-3b	41334	$11	$454,674	3837	$310	$1,189,471	6766	$12	$81,192	0	0	$163	$0	$0	3383	0	70	5.4	Ind. S.	$1.25	$296,013	$1,725,337	$0	$655,628	$2,676,978
EH-4	24539	$11	$269,929	232	$310	$71,918	720	$12	$8,640	0	0	$163	$0	$3,000	360	0	45	0.4	Res. S.	$0.60	$9,720	$353,487	$0	$134,325	$497,532
EH-5	24539	$11	$269,929	380	$310	$117,866	1180	$12	$14,160	0	0	$163	$0	$3,000	590	0	45	0.6	Res. S.	$0.60	$15,930	$404,955	$0	$153,883	$574,768
EH-6	24539	$11	$269,929	2932	$310	$908,965	9100	$12	$109,200	0	0	$163	$0	$0	4550	0	45	4.7	Res. S.	$0.60	$122,850	$1,288,094	$0	$489,476	$1,900,419
Sub-Total EH	**242037**	**$11**	**$2,662,411**	**19287**	**$310**	**$5,979,091**	**37086**	**$12**	**$445,032**	**2**		**$163**	**$85,621**	**$12,000**	**18543**			**29.3**			**$1,435,388**	**$9,184,155**	**$0**	**$3,489,979**	**$14,109,522**
MN-1	5830	$11	$64,130	0	$310	$0	1900	$12	$22,800	0	0	$163	$0	$3,000	950	0	105	2.3	Ind. S.	$1.25	$124,688	$89,930	$27,930	$34,173	$276,721
MN-2	12417	$11	$136,587	0	$310	$0	2100	$12	$25,200	0	0	$163	$0	$0	1050	0	175	4.2	Ind. S.	$1.25	$229,688	$161,787	$51,450	$61,479	$504,404
MN-3	32044	$11	$352,484	0	$310	$0	10300	$12	$123,600	1	460	$163	$74,966	$0	5150	0	125	14.8	Ind. S.	$1.25	$804,688	$551,050	$180,250	$209,399	$1,745,386
Sub-Total MN	**50291**	**$11**	**$553,201**	**0**	**$310**	**$0**	**14300**	**$12**	**$171,600**	**1**			**$74,966**	**$3,000**	**7150**			**21.3**			**$1,159,063**	**$802,767**	**$259,630**	**$305,051**	**$2,526,510**
PS-1	75802	$11	$833,822	0	$310	$0	9680	$12	$116,160	2	637	$163	$207,756	$0	4840	0	135	15.0	Ind. S.	$1.25	$816,750	$1,157,738	$182,952	$439,940	$2,597,380
PS-2	62541	$11	$687,951	0	$310	$0	4540	$12	$54,480	2	422	$163	$137,463	$0	2270	0	135	7.0	Ind. S.	$1.25	$383,063	$879,894	$85,806	$334,360	$1,683,123
PS-3	62541	$11	$687,951	0	$310	$0	2640	$12	$31,680	1	399	$163	$65,098	$0	1320	0	135	4.1	Ind. S.	$1.25	$222,750	$784,729	$49,896	$298,197	$1,355,572
PS-4	62541	$11	$687,951	0	$310	$0	3940	$12	$47,280	2	372	$163	$121,396	$0	1970	0	135	6.1	Ind. S.	$1.25	$332,438	$856,627	$74,466	$325,518	$1,589,049
PS-5	35358	$11	$388,938	0	$310	$0	1440	$12	$17,280	0	0	$163	$0	$0	720	0	80	1.3	Ind. S.	$1.25	$72,000	$406,218	$16,128	$154,363	$648,709
PS-6	15688	$11	$172,568	0	$310	$0	1960	$12	$23,520	1	404	$163	$65,826	$3,000	980	0	80	1.8	Ind. S.	$1.25	$98,000	$264,914	$21,952	$100,668	$485,534
PS-7	35358	$11	$388,938	0	$310	$0	3120	$12	$37,440	1	411	$163	$67,033	$3,000	1560	0	100	3.6	Ind. S.	$1.25	$195,000	$496,411	$43,680	$188,636	$923,727
PS-8	15688	$11	$172,568	0	$310	$0	1500	$12	$18,000	0	0	$163	$0	$3,000	750	0	100	1.7	Ind. S.	$1.25	$93,750	$193,568	$21,000	$73,556	$381,874
PS-9	5776	$11	$63,536	0	$310	$0	1000	$12	$12,000	0	0	$163	$0	$0	500	0	90	1.0	Ind. S.	$1.25	$56,250	$75,536	$12,600	$28,704	$173,090
PS-10	54113	$11	$595,243	0	$310	$0	10960	$12	$131,520	2	673	$163	$219,488	$0	5480	0	175	22.0	Ind. S.	$1.25	$1,198,750	$946,251	$268,520	$359,575	$2,773,096
Sub-Total PS	**425406**	**$11**	**$4,679,466**	**0**	**$310**	**$0**	**40780**	**$12**	**$489,360**	**11**		**$163**	**$884,060**	**$9,000**	**20390**			**63.7**			**$3,468,750**	**$6,061,886**	**$777,000**	**$2,303,517**	**$12,611,153**
PR-1	41035	$11	$451,385	472	$310	$146,325	640	$12	$7,680	0	0	$163	$0	$0	320	0	105	0.8	Ind. S.	$1.25	$42,000	$605,390	$0	$230,048	$877,438
PR-2	41035	$11	$451,385	4278	$310	$1,326,067	5800	$12	$69,600	1	352	$163	$57,396	$0	2900	0	105	7.0	Ind. S.	$1.25	$380,625	$1,904,449	$0	$723,690	$3,008,764
PR-3	29026	$11	$319,286	3503	$310	$1,086,008	5150	$12	$61,800	1	272	$163	$44,315	$0	2575	0	105	6.2	Ind. S.	$1.25	$337,969	$1,511,409	$0	$574,335	$2,423,713
PR-4	29026	$11	$319,286	1340	$310	$415,424	1970	$12	$23,640	1	286	$163	$46,647	$0	985	0	105	2.4	Ind. S.	$1.25	$129,281	$804,997	$0	$305,899	$1,240,177
Sub-Total PR	**140122**	**$11**	**$1,541,342**	**9593**	**$310**	**$2,973,824**	**13560**	**$12**	**$162,720**	**3**			**$148,358**	**$0**	**6780**			**16.3**			**$889,875**	**$4,826,244**	**$0**	**$1,833,973**	**$7,550,092**
RH-1	4868	$11	$53,548	0	$310	$0	1420	$12	$17,040	0	0	$163	$0	$9,000	710	0	85	1.4	Res. S.	$0.60	$36,210	$79,588	$16,898	$30,243	$162,939
RH-2a	19993	$11	$219,925	0	$310	$0	3800	$12	$45,600	1	249	$163	$40,617	$6,000	1900	0	85	3.7	Res. S.	$0.60	$96,900	$312,142	$45,220	$118,614	$572,875
RH-2b	5630	$11	$61,926	0	$310	$0	1070	$12	$12,840	0	0	$163	$0	$0	535	0	85	1.0	Res. S.	$0.60	$27,285	$74,766	$12,733	$28,411	$143,195
RH-3	27622	$11	$303,843	0	$310	$0	5250	$12	$63,000	2	297	$163	$96,747	$3,000	2625	0	60	3.6	Res. S.	$0.60	$94,500	$463,590	$44,100	$176,164	$778,355
RH-4	7277	$11	$80,047	0	$310	$0	4900	$12	$58,800	0	0	$163	$0	$0	2450	0	105	5.9	Res. S.	$0.60	$154,350	$138,847	$72,030	$52,762	$417,989
RH-5	8741	$11	$96,151	0	$310	$0	4900	$12	$58,800	0	0	$163	$0	$0	2450	0	105	5.9	Res. S.	$0.60	$154,350	$154,951	$72,030	$58,881	$440,212
Sub-Total QC	**74131**	**$11**	**$815,440**	**0**	**$310**	**$0**	**21340**	**$12**	**$256,080**	**3**			**$137,364**	**$18,000**	**10670**			**21.6**			**$563,595**	**$1,223,884**	**$263,011**	**$465,076**	**$2,515,566**

** Drop Structure Size = Drop Structure Height x Channel Topwidth*
Size is per Drop Structure.

Culvert Costs

I.D.	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Contingencies Costs**	Total Land, Construction, and Contingencies Costs
EHC-1	100	$2,200	$220,000	1	$10,800	$10,800	1	$16,600	$16,600	0.0	N/A	$0	$0	$247,400	$94,012	$341,412
EHC-2	200	$2,200	$440,000	1	$10,800	$10,800	1	$16,600	$16,600	0.0	N/A	$0	$0	$467,400	$177,612	$645,012
EHC-3	80	$700	$56,000	1	$9,100	$9,100	1	$13,600	$13,600	0.0	N/A	$0	$0	$78,700	$29,906	$108,606
EHC-4	20	$700	$14,000	1	$3,100	$3,100	1	$5,500	$5,500	0.0	N/A	$0	$0	$22,600	$8,588	$31,188
MNC-2	60	$1,300	$78,000	1	$2,300	$2,300	1	$6,200	$6,200	0.0	N/A	$0	$0	$86,500	$32,870	$119,370
PRC-1	280	$2,900	$812,000	1	$13,500	$13,500	1	$20,300	$20,300	0.0	N/A	$0	$0	$845,800	$321,404	$1,167,204
PRC-2	120	$2,000	$240,000	1	$6,900	$6,900	1	$12,000	$12,000	0.0	N/A	$0	$0	$258,900	$98,382	$357,282
PRC-3	120	$2,000	$240,000	1	$6,900	$6,900	1	$12,000	$12,000	0.0	N/A	$0	$0	$258,900	$98,382	$357,282
PSC-1	60	$1,100	$66,000	1	$4,200	$4,200	1	$8,400	$8,400	0.0	N/A	$0	$0	$78,600	$29,868	$108,468
PSC-2	60	$1,400	$84,000	1	$4,200	$4,200	1	$8,400	$8,400	0.0	N/A	$0	$0	$96,600	$36,708	$133,308
PSC-3	60	$1,400	$84,000	1	$6,100	$6,100	1	$12,000	$12,000	0.0	N/A	$0	$0	$102,100	$38,798	$140,898
PSC-4	60	$800	$48,000	1	$3,500	$3,500	1	$7,100	$7,100	0.0	N/A	$0	$0	$58,600	$22,268	$80,868
PSC-5	80	$800	$64,000	1	$3,500	$3,500	1	$7,100	$7,100	0.0	N/A	$0	$0	$74,600	$28,348	$102,948
PSC-6	1000	$800	$800,000	1	$3,500	$3,500	1	$7,100	$7,100	0.0	N/A	$0	$0	$810,600	$308,028	$1,118,628
PSC-7	80	$800	$64,000	1	$3,500	$3,500	1	$7,100	$7,100	0.0	N/A	$0	$0	$74,600	$28,348	$102,948
PSC-8	80	$800	$64,000	1	$3,400	$3,400	1	$6,100	$6,100	0.0	N/A	$0	$0	$73,500	$27,930	$101,430
RHC-1	90	$600	$54,000	1	$4,000	$4,000	1	$6,800	$6,800	0.0	N/A	$0	$0	$64,800	$24,624	$89,424
RHC-2	60	$600	$36,000	1	$4,000	$4,000	1	$6,800	$6,800	0.0	N/A	$0	$0	$46,800	$17,784	$64,584
RHC-3	80	$800	$64,000	1	$3,400	$3,400	1	$6,100	$6,100	0.0	N/A	$0	$0	$73,500	$27,930	$101,430

Detention Basin Costs

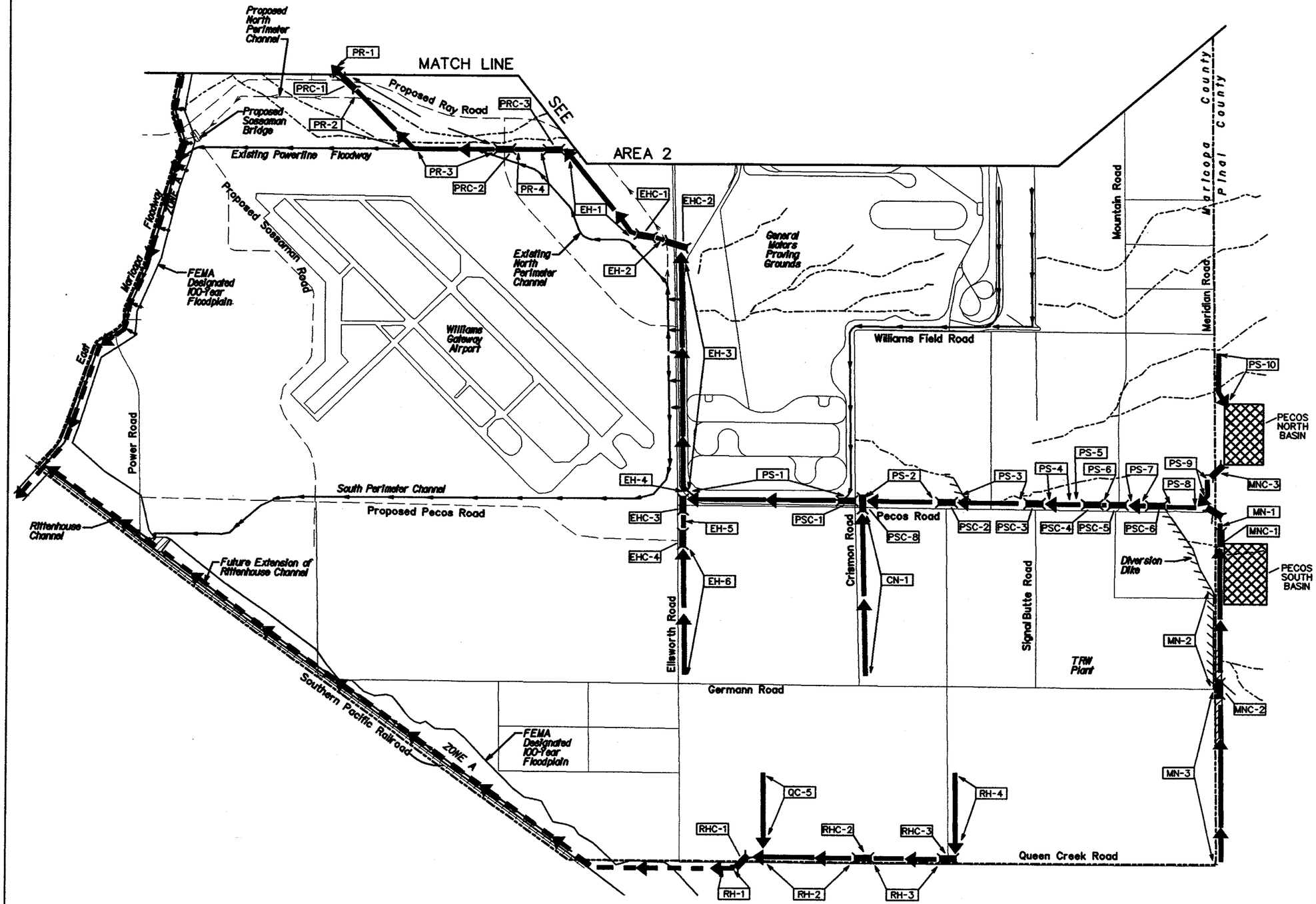
I.D.	Basin Excavation Volume (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Area (ft^2)	Unit Cost ($/ft^2)	Emergency Spillway Cost	Inflow Spillway Area (ft^2)	Inflow Spillway Cost	Length of Fencing (ft)	Unit Cost ($/lf)	Fence Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Contingencies Cost**	Total Construction, Land, Landscape, and Contingencies
Pecos North Basin	398,200	$6	$2,389,200	200	$190	$38,000	2	$2,200	$4,400	11058	$5	$55,290	N/A	N/A	6,000	$12	$72,000.00	97.0	Res. S.	$0.60	$2,535,192	$2,558,890	$1,056,330	$972,378	$7,122,790
Pecos South Basin	643,300	$6	$3,859,800	150	$230	$34,500	2	$3,025	$6,050	11349	$5	$56,745	N/A	N/A	8,000	$12	$96,000.00	75.0	Res. S.	$0.60	$1,960,200	$4,053,095	$816,750	$1,540,176	$8,370,221

*** Total Contingencies Cost is the sum of: 1. Construction Contingencies @ 15% of the Total Construction Cost*
2. Design and Field Engineering Costs @ 15% of the sum of Total Construction Cost and Construction Contingencies.
3. Change Orders @ 5% of the sum of Total Construction Cost and Construction Contingencies.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

East Mesa Area Drainage Master Plan

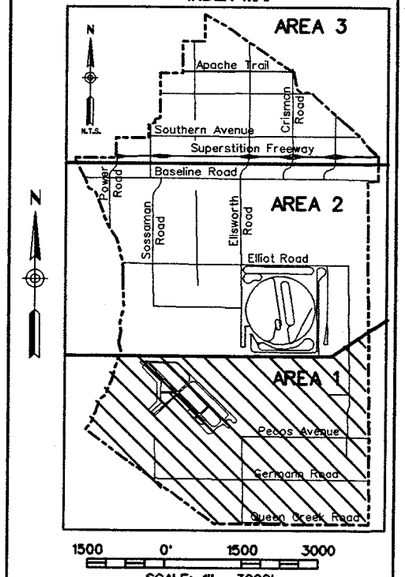
F.C.D. CONTRACT NO. 95-32



LEGEND

- STUDY BOUNDARY
- EXISTING CHANNEL/DITCH
- EXISTING BRIDGE/CULVERT
- EXISTING STORM DRAIN
- EXISTING ROADWAY DIP SECTION/ WEIR/OVER-CHUTE
- EXISTING DIVERSION DIKE
- EXISTING WASH
- EXISTING DETENTION BASIN
- EXISTING/PLANNED MAJOR CHANNEL
- PROPOSED MAJOR CHANNEL
- PROPOSED ROAD ALIGNMENT
- PROPOSED DETENTION BASIN
- PROPOSED CULVERT

INDEX MAP



1500 0' 1500 3000

SCALE: 1" = 3000'

DIBBLE & ASSOCIATES CONSULTING ENGINEERS

Hoskin Engineering Consultants

AREA 1 PRELIMINARY PLAN

960002\REC1A

East Mesa Area Drainage Master Plan
AREA 2

Channel Costs

I.D.	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Drop Structures (No.)	Drop Structure Size* (ft^2)	Unit Cost ($/sf)	Drop Structures Cost	Utilities Cost	Channel Length (ft)	Existing Right-of-Way Width (ft.)	Right-of-Way Width Required (ft.)	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Contingencies Cost**	Total Land, Construction, Landscape, and Contingencies
CN-1	5280	$11	$58,080	460	$310	$142,696	1760	$12	$21,120	0	0	$163	$0	$3,000	880	0	95	1.9	Res. S.	$0.60	$50,160	$224,896	$0	$85,461	$360,517
CN-2	6945	$11	$76,395	1480	$310	$458,671	3720	$12	$44,640	1	105	$163	$17,126	$0	1860	0	65	2.8	Res. S.	$0.60	$72,540	$596,832	$0	$226,796	$896,168
CN-3	17245	$11	$189,695	1830	$310	$567,286	4680	$12	$56,160	2	120	$163	$39,024	$0	2340	0	70	3.8	Res. S.	$0.60	$98,280	$852,166	$0	$323,823	$1,274,269
CN-4	13717	$11	$150,887	1748	$310	$541,816	5160	$12	$61,920	4	86	$163	$55,971	$0	2580	0	45	2.7	Res. N.	$0.99	$114,939	$810,594	$0	$308,026	$1,233,559
CN-5	13720	$11	$150,920	1707	$310	$529,216	5040	$12	$60,480	2	116	$163	$37,843	$0	2520	0	45	2.6	Res. N.	$0.99	$112,266	$778,459	$0	$295,814	$1,186,539
Sub-Total CN	**56907**	**$11**	**$625,977**	**7225**	**$310**	**$2,239,685**	**20360**	**$12**	**$244,320**	**9**			**$149,965**	**$3,000**	**10180**			**13.7**			**$448,185**	**$3,262,947**	**$0**	**$1,239,920**	**$4,951,052**
ET-1	128989	$11	$1,418,879	0	$310	$0	7700	$12	$92,400	2	896	$163	$292,097	$0	3850	0	230	20.3	Res. S.	$0.60	$531,300	$1,803,376	$247,940	$685,283	$3,267,899
ET-2a	36498	$11	$401,478	0	$310	$0	4300	$12	$51,600	3	479	$163	$234,470	$0	2150	0	160	7.9	Res. S.	$0.60	$206,400	$687,548	$96,320	$261,268	$1,251,537
ET-2b	64886	$11	$713,746	0	$310	$0	7200	$12	$86,400	3	544	$163	$265,966	$0	3600	0	160	13.2	Res. S.	$0.60	$345,600	$1,066,112	$161,280	$405,123	$1,978,115
ET-3a	34412	$11	$378,532	0	$310	$0	4800	$12	$57,600	2	594	$163	$193,686	$0	2400	0	150	8.3	Res. S.	$0.60	$216,000	$629,818	$100,800	$239,331	$1,185,949
ET-3b	31545	$11	$346,995	0	$310	$0	4200	$12	$50,400	2	370	$163	$120,579	$3,000	2100	0	150	7.2	Res. S.	$0.60	$189,000	$520,974	$88,200	$197,970	$996,144
ET-4	27129	$11	$298,419	0	$310	$0	5540	$12	$66,480	3	545	$163	$266,277	$9,000	2770	0	145	9.2	Res. S.	$0.60	$240,990	$640,176	$112,462	$243,267	$1,236,895
ET-5a	10047	$11	$110,517	0	$310	$0	1860	$12	$22,320	0	0	$163	$0	$3,000	930	0	145	3.1	Ind. S.	$1.25	$168,563	$135,837	$37,758	$51,618	$393,776
ET-5b	4862	$11	$53,482	0	$310	$0	900	$12	$10,800	0	0	$163	$0	$0	450	0	145	1.5	Ind. S.	$1.25	$81,563	$64,282	$18,270	$24,427	$188,542
ET-6	22302	$11	$245,322	2198	$310	$681,314	4700	$12	$56,400	1	209	$163	$34,023	$0	2350	0	60	3.2	Ind. S.	$1.25	$176,250	$1,017,059	$0	$386,483	$1,579,792
ET-7	27017	$11	$297,187	2449	$310	$759,294	5440	$12	$65,280	3	127	$163	$62,148	$0	2720	0	60	3.7	Ind. S.	$1.25	$204,000	$1,183,909	$0	$449,885	$1,837,794
ET-8	7524	$11	$82,764	787	$310	$243,826	1880	$12	$22,560	1	111	$163	$18,083	$0	940	0	55	1.2	Ind. S.	$1.25	$64,625	$367,234	$0	$139,549	$571,407
ET-9	9802	$11	$107,822	1547	$310	$479,611	4400	$12	$52,800	3	90	$163	$43,920	$3,000	2200	0	55	2.8	Ind. S.	$1.25	$151,250	$687,152	$0	$261,118	$1,099,520
ET-10	10365	$11	$114,015	0	$310	$0	5440	$12	$65,280	5	321	$163	$261,289	$0	2720	0	105	6.6	Ind. S.	$1.25	$357,000	$440,584	$79,968	$167,422	$1,044,974
ET-11	8378	$11	$92,158	0	$310	$0	4220	$12	$50,640	1	506	$163	$82,450	$0	2110	0	105	5.1	Ind. S.	$1.25	$276,938	$225,248	$62,034	$85,594	$649,814
ET-12	18757	$11	$206,327	0	$310	$0	4980	$12	$59,760	3	418	$163	$204,635	$0	2490	0	105	6.0	Res. S.	$0.60	$156,870	$470,722	$73,206	$178,874	$879,672
Sub-Total ET	**442513**	**$11**	**$4,867,643**	**6981**	**$310**	**$2,164,045**	**67560**	**$12**	**$810,720**	**32**			**$2,079,624**	**$18,000**	**33780**			**99.4**			**$3,366,348**	**$9,940,032**	**$1,078,238**	**$3,777,212**	**$18,161,830**
GE-1	13161	$11	$144,771	1183	$310	$366,722	4260	$12	$51,120	3	104	$163	$50,787	$0	2130	0	75	3.7	Res. N.	$0.99	$158,153	$613,400	$0	$233,092	$1,004,645
Sub-Total GE	**13161**	**$11**	**$144,771**	**1183**	**$310**	**$366,722**	**4260**	**$12**	**$51,120**	**3**			**$50,787**	**$0**	**2130**			**3.7**			**$158,153**	**$613,400**	**$0**	**$233,092**	**$1,004,645**
MN-1	5678	$11	$62,458	465	$310	$144,225	1260	$12	$15,120	0	0	$163	$0	$0	630	0	60	0.9	Res. S.	$0.60	$22,680	$221,803	$0	$84,285	$328,768
MN-2	9319	$11	$102,509	603	$310	$186,912	1800	$12	$21,600	1	90	$163	$14,629	$0	900	0	60	1.2	Res. S.	$0.60	$32,400	$325,650	$0	$123,747	$481,797
MN-3a	10910	$11	$120,010	1518	$310	$470,617	2400	$12	$28,800	0	0	$163	$0	$0	1200	0	90	2.5	Res. S.	$0.60	$64,800	$619,427	$0	$235,382	$919,609
MN-3b	8232	$11	$90,552	759	$310	$235,308	1200	$12	$14,400	0	0	$163	$0	$0	600	0	90	1.2	Res. S.	$0.60	$32,400	$340,260	$0	$129,299	$501,959
MN-4	18037	$11	$198,407	2031	$310	$629,536	3520	$12	$42,240	2	156	$163	$50,978	$0	1760	0	90	3.6	Res. S.	$0.60	$95,040	$921,161	$0	$350,041	$1,366,242
MN-5	42202	$11	$464,222	2186	$310	$677,800	4300	$12	$51,600	3	117	$163	$57,297	$0	2150	0	90	4.4	Res. N.	$0.99	$191,565	$1,250,920	$0	$475,349	$1,917,834
MN-6	11479	$11	$126,269	1195	$310	$370,384	2820	$12	$33,840	3	144	$163	$70,432	$0	1410	0	75	2.4	Res. N.	$0.99	$104,693	$600,924	$0	$228,351	$933,968
Sub-Total MN	**105857**	**$11**	**$1,164,427**	**8757**	**$310**	**$2,714,782**	**17300**	**$12**	**$207,600**	**9**			**$193,336**	**$0**	**8650**			**16.3**			**$543,578**	**$4,280,145**	**$0**	**$1,626,455**	**$6,450,177**

** Drop Structure Size = Drop Structure Height x Channel Topwidth*
Size is per Drop Structure.

Culvert Costs

I.D.	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Contingencies Cost**	Total Land, Construction, and Contingencies Costs
CNC-1	100	$300	$30,000	1	$2,800	$2,800	1	$5,000	$5,000	0.0	N/A	$0	$0	$37,800	$14,364	$52,164
CNC-2	140	$800	$112,000	1	$3,400	$3,400	1	$6,100	$6,100	0.0	N/A	$0	$0	$121,500	$46,170	$167,670
CNC-3	80	$800	$64,000	1	$3,400	$3,400	1	$6,100	$6,100	0.0	N/A	$0	$0	$73,500	$27,930	$101,430
CNC-4	80	$600	$48,000	1	$3,200	$3,200	1	$5,700	$5,700	0.0	N/A	$0	$0	$56,900	$21,622	$78,522
ETC-1	200	$1,200	$240,000	1	$5,900	$5,900	1	$9,900	$9,900	0.0	N/A	$0	$0	$255,800	$97,204	$353,004
ETC-2	140	$700	$98,000	1	$5,100	$5,100	1	$8,500	$8,500	0.0	N/A	$0	$0	$111,600	$42,408	$154,008
ETC-3	80	$600	$48,000	1	$4,100	$4,100	1	$7,000	$7,000	0.0	N/A	$0	$0	$59,100	$22,458	$81,558
ETC-4	280	$600	$168,000	1	$4,100	$4,100	1	$7,000	$7,000	0.0	N/A	$0	$0	$179,100	$68,058	$247,158
MNC-1	80	$1,400	$112,000	1	$4,400	$4,400	1	$7,900	$7,900	0.0	N/A	$0	$0	$124,300	$47,234	$171,534

Detention Basin Costs

I.D.	Basin Excavation Volume (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Area (ft^2)	Unit Cost ($/ft^2)	Emergency Spillway Cost	Inflow Spillway Area (ft^2)	Inflow Spillway Cost	Length of Fencing (ft)	Unit Cost ($/lf)	Fence Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Contingencies Cost**	Total Land, Construction, Landscape, and Contingencies
Siphon Draw Basin	378,700	$6	$2,272,200	200	$110	$22,000	2	$1,500	$3,000	13677	$5	$68,385	15960	$79,800	5,000	$12	$60,000.00	55.0	Res. S.	$0.60	$1,437,480	$2,505,385	$598,950	$952,046	$5,493,861
Powerline Detention Basin	20,580	$6	$123,480	200	$55	$11,000	2	$1,100	$2,200	20370	$5	$101,850	N/A	N/A	5,000	$12	$60,000.00	26.0	Res. S.	$0.60	$679,536	$298,530	$283,140	$113,441	$1,374,647
Elliot Detention Basin	382,580	$6	$2,295,480	380	$70	$26,600	2	$1,300	$2,600	4365	$5	$21,825	11000	$55,000	6,800	$12	$81,600.00	74.0	Res. S.	$0.60	$1,934,064	$2,483,105	$805,860	$943,580	$6,166,609

*** Total Contingencies Cost is the sum of: 1. Construction Contingencies @ 15% of the Total Construction Cost*
2. Design and Field Engineering Costs @ 15% of the sum of Total Construction Cost and Construction Contingencies.
3. Change Orders @ 5% of the sum of Total Construction Cost and Construction Contingencies.

MATCH LINE SEE AREA 3

FEMA Designated 100-Year Floodplain

ZONE A

East Maricopa Floodway

Power Road

Baseline Road

Guadalupe Road Channel

Sossaman Road Channel

Guadalupe Road

96" Proposed Storm Drain

Elliot Road

Hawes Road

Sossaman Road

Alternative Alignment

Warner Road

ET-1

ET-2

ET-3

ET-4

ET-5

ET-6

ET-7

ET-8

ET-9

ETC-1

ETC-2

ETC-3

ETC-4

Proposed Santan Freeway

Ellsworth Road

CNC-4

CN-5

CN-4

GE-1

CNC-3

CN-3

CNC-2

CN-2

CN-1

CNC-1

ELLIOT BASIN

Siphon Draw Wash

MN-1 TO MN-3

SIPHON DRAW BASIN

ET-10

ET-11

ET-12

Meridian Road

MN-6

MN-5

MNC-1

MN-4

Mountain Road

Maricopa County

Pinal County

General Motors Proving Grounds

POWERLINE BASIN

Powerline Floodway

MATCH LINE SEE AREA 1

AREA 1

960002\rectb

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

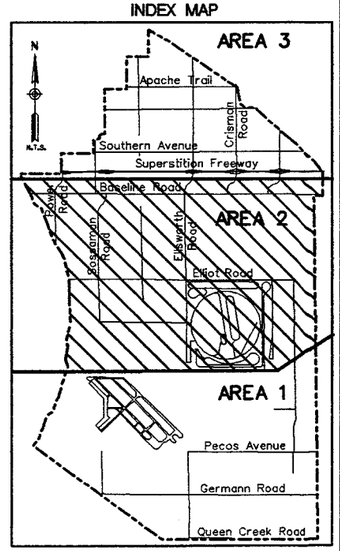
East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

- STUDY BOUNDARY
- EXISTING CHANNEL/DITCH
- EXISTING BRIDGE/CULVERT
- EXISTING STORM DRAIN
- EXISTING ROADWAY DIP SECTION/ WEIR/OVER-CHUTE
- EXISTING DIVERSION DIKE
- EXISTING WASH
- EXISTING DETENTION BASIN
- EXISTING/PLANNED MAJOR CHANNEL
- PROPOSED MAJOR CHANNEL
- PROPOSED ROAD ALIGNMENT
- PROPOSED DETENTION BASIN
- PROPOSED CULVERT

INDEX MAP



1500 0' 1500 3000

SCALE: 1" = 3000'

DIBBLE & ASSOCIATES CONSULTING ENGINEERS

Since 1962

Hoskin Engineering Consultants

AREA 2 PRELIMINARY PLAN

East Mesa Area Drainage Master Plan
AREA 3

Channel Costs

I.D.	Excavated Volume (cy)	Unit Cost ($/cy)	Excavation Cost	Concrete Volume (cy)	Unit Cost ($/cy)	Concrete Cost	Fence Length (ft.)	Unit Cost ($/lf)	Fence Cost	Drop Structures (No.)	Drop Structure Size* (ft^2)	Unit Cost ($/sf)	Drop Structures Cost	Utilities Cost	Channel Length (ft)	Existing Right-of-Way Width (ft.)	Right-of-Way Width Required (ft.)	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Contingencies Cost**	Total Land, Construction, Landscape, and Contingencies Costs
AE-1	9852	$11	$108,369	0	$310	$0	3000	$12	$36,000	3	154.0	$163	$75,324	$3,000	1500	0	80	2.8	Res. N.	$0.99	$118,800	$222,693	$33,600	$84,623	$459,716
AE-2	7225	$11	$79,471	0	$310	$0	2200	$12	$26,400	3	156.5	$163	$76,511	$0	1100	0	0	0.0	Res. N.	$0.99	$0	$182,382	$0	$69,305	$251,687
AE-3	4072	$11	$44,793	0	$310	$0	1240	$12	$14,880	2	129.8	$163	$42,315	$21,000	620	0	0	0.0	Res. N.	$0.99	$0	$122,988	$0	$46,735	$169,723
AE-4	23004	$11	$253,044	2013	$310	$624,089	520	$12	$6,240	1	46.6	$163	$7,597	$0	260	0	40	0.2	Res. N.	$0.99	$10,296	$890,969	$0	$338,568	$1,239,834
AE-5	23051	$11	$253,557	2017	$310	$625,356	620	$12	$7,440	1	48.5	$163	$7,904	$0	310	0	40	0.3	Res. N.	$0.99	$12,276	$894,257	$0	$339,818	$1,246,350
Sub-Total AE	**67203**	**$11**	**$739,233**	**4030**	**$310**	**$1,249,444**	**7580**	**$12**	**$90,960**	**10**			**$209,651**	**$24,000**	**3790**			**3.3**			**$141,372**	**$2,313,289**	**$33,600**	**$879,050**	**$3,367,310**
BY-1	3408	$11	$37,488	373	$310	$115,718	840	$12	$10,080	1	89.5	$163	$14,586	$3,000	420	0	40	0.4	Res. N.	$0.99	$16,632	$180,871	$0	$68,731	$266,234
BY-2	2029	$11	$22,314	222	$310	$68,879	500	$12	$6,000	1	69.5	$163	$11,325	$3,000	250	0	40	0.2	Res. N.	$0.99	$9,900	$111,519	$0	$42,377	$163,796
BY-3	6004	$11	$66,049	658	$310	$203,883	1480	$12	$17,760	2	86.9	$163	$28,342	$3,000	740	0	40	0.7	Res. N.	$0.99	$29,304	$319,035	$0	$121,233	$469,572
BY-4	5355	$11	$58,909	587	$310	$181,842	1320	$12	$15,840	1	22.6	$163	$3,688	$9,000	660	0	40	0.6	Res. N.	$0.99	$26,136	$269,279	$0	$102,326	$397,741
BY-5	5355	$11	$58,909	587	$310	$181,842	1320	$12	$15,840	3	102.8	$163	$50,265	$0	660	0	40	0.6	Res. N.	$0.99	$26,136	$306,856	$0	$116,605	$449,597
BY-6	3822	$11	$42,046	470	$310	$145,761	1240	$12	$14,880	3	74.8	$163	$36,591	$3,000	620	0	60	0.9	Res. N.	$0.99	$36,828	$242,278	$0	$92,066	$371,171
BY-7	8100	$11	$89,096	1041	$310	$322,818	2640	$12	$31,680	2	127.8	$163	$41,659	$3,000	1320	0	60	1.8	Res. N.	$0.99	$78,408	$488,253	$0	$185,536	$752,198
BY-8	2021	$11	$22,234	259	$310	$80,302	660	$12	$7,920	1	99.3	$163	$16,192	$0	330	0	55	0.4	Res. N.	$0.99	$17,969	$126,647	$0	$48,126	$192,742
BY-9	919	$11	$10,107	118	$310	$36,501	300	$12	$3,600	0	0.0	$163	$0	$3,000	150	0	55	0.2	Res. N.	$0.99	$8,168	$53,207	$0	$20,219	$81,593
BY-10	2695	$11	$29,646	345	$310	$107,069	880	$12	$10,560	1	92.6	$163	$15,088	$0	440	0	55	0.6	Res. N.	$0.99	$23,958	$162,363	$0	$61,698	$248,019
BY-11	1470	$11	$16,170	188	$310	$58,401	480	$12	$5,760	1	91.2	$163	$14,866	$0	240	0	55	0.3	Res. N.	$0.99	$13,068	$95,197	$0	$36,175	$144,440
BY-12	11977	$11	$131,748	0	$310	$0	2560	$12	$30,720	2	279.9	$163	$91,251	$3,000	1280	0	90	2.6	Res. N.	$0.99	$114,048	$256,719	$32,256	$97,553	$500,577
BY-13	12164	$11	$133,807	0	$310	$0	2600	$12	$31,200	3	195.3	$163	$95,511	$0	1300	0	0	0.0	Res. N.	$0.99	$0	$260,517	$0	$98,997	$359,514
Sub-Total BY	**65320**	**$11**	**$718,523**	**4848**	**$310**	**$1,503,016**	**16820**	**$12**	**$201,840**	**21**			**$419,363**	**$30,000**	**8410**			**9.3**			**$400,554**	**$2,872,741**	**$32,256**	**$1,091,642**	**$4,397,193**
C2-1	2267	$11	$24,939	390	$310	$120,931	1700	$12	$20,400	0	0.0	$163	$0	$9,000	850	0	35	0.7	Res. N.	$0.99	$29,453	$175,269	$0	$66,602	$271,324
Sub-Total C2	**2267**	**$11**	**$24,939**	**390**	**$310**	**$120,931**	**1700**	**$12**	**$20,400**	**0**			**$0**	**$9,000**	**850**			**0.7**			**$29,453**	**$175,269**	**$0**	**$66,602**	**$271,324**
C3-1	Existing	$0	$0	0	$0	$0	0	$0	$0	0	0.0	$0	$0	$0	0	0	0	0.0	N/A	$0.00	$0	$0	$0	$0	$0
Sub-Total C3	**Existing**	**$0**	**$0**	**0**	**$0**	**$0**	**0**	**$0**	**$0**	**0**			**$0**	**$0**	**0**			**0.0**			**$0**	**$0**	**$0**	**$0**	**$0**
C4-1	1320	$11	$14,516	0	$310	$0	440	$12	$5,280	0	0.0	$163	$0	$0	220	0	60	0.3	Res. N.	$0.99	$13,068	$19,796	$3,696	$7,522	$44,082
C4-2	7238	$11	$79,619	0	$310	$0	2700	$12	$32,400	2	165.4	$163	$53,931	$0	1350	0	60	1.9	Res. N.	$0.99	$80,190	$165,950	$22,680	$63,061	$331,881
C4-3	429	$11	$4,718	0	$310	$0	160	$12	$1,920	0	0.0	$163	$0	$0	80	0	0	0.0	Res. N.	$0.99	$0	$0	$0	$0	$0
C4-4	4021	$11	$44,233	0	$310	$0	1500	$12	$18,000	1	136.5	$163	$22,248	$0	750	0	70	1.2	Res. N.	$0.99	$51,975	$84,480	$14,700	$32,103	$183,258
Sub-Total C4	**13008**	**$11**	**$143,086**	**0**	**$310**	**$0**	**4800**	**$12**	**$57,600**	**3**			**$76,178**	**$0**	**2400**			**3.4**			**$145,233**	**$270,226**	**$41,076**	**$102,686**	**$559,221**
HS-1	6607	$11	$72,672	750	$310	$232,501	1520	$12	$18,240	0	0.0	$163	$0	$0	760	0	0	0.0	Res. N.	$0.99	$0	$323,413	$0	$122,897	$446,310
HS-2	Existing	$0	$0	0	$0	$0	0	$0	$0	0	0.0	$0	$0	$0	0	0	0	0.0	N/A	$0.00	$0	$0	$0	$0	$0
HS-3	Existing	$0	$0	0	$0	$0	0	$0	$0	0	0.0	$0	$0	$0	0	0	0	0.0	N/A	$0.00	$0	$0	$0	$0	$0
HS-4a	9229	$11	$101,517	857	$310	$265,749	1360	$12	$16,320	0	0.0	$163	$0	$12,000	680	0	0	0.0	Res. N.	$0.99	$0	$395,586	$0	$150,323	$545,908
HS-4b	16558	$11	$182,134	1,538	$310	$476,784	2,440	$12	$29,280	0	0	$163	$0	$3,000	1,220	0	0	0.0	Res. N.	$0.99	$0	$691,198	$0	$262,655	$953,853
HS-5	18395	$11	$202,347	1631	$310	$505,701	2360	$12	$28,320	2	155.2	$163	$50,598	$0	1180	0	90	2.4	Res. N.	$0.99	$105,138	$786,966	$0	$299,047	$1,191,151
HS-6	8683	$11	$95,517	995	$310	$308,523	2180	$12	$26,160	2	141.9	$163	$46,251	$0	1090	0	60	1.5	Res. N.	$0.99	$64,746	$476,451	$0	$181,051	$722,248
HS-7	10758	$11	$118,335	1233	$310	$382,161	2700	$12	$32,400	3	139.0	$163	$67,951	$0	1350	0	60	1.9	Res. N.	$0.99	$80,190	$600,846	$0	$228,322	$909,358
HS-8	2310	$11	$25,413	265	$310	$82,084	580	$12	$6,960	0	0.0	$163	$0	$0	290	0	60	0.4	Res. N.	$0.99	$17,226	$114,457	$0	$43,494	$175,176
Sub-Total HS	**72539**	**$11**	**$797,934**	**7269**	**$310**	**$2,253,503**	**13140**	**$12**	**$157,680**	**7**			**$164,800**	**$15,000**	**6570**			**6.2**			**$267,300**	**$3,388,917**	**$0**	**$1,287,788**	**$4,944,005**
PR-1	11941	$11	$131,349	0	$310	$0	4300	$12	$51,600	0	0.0	$163	$0	$0	2150	0	75	3.7	Res. N.	$0.99	$159,638	$182,949	$45,150	$69,521	$457,257
PR-2	25792	$11	$283,710	0	$310	$0	3600	$12	$43,200	0	0.0	$163	$0	$0	1800	0	130	5.4	Res. N.	$0.99	$231,660	$326,910	$0	$124,226	$682,796
PR-3	10030	$11	$110,332	0	$310	$0	1400	$12	$16,800	0	0.0	$163	$0	$0	700	0	85	1.4	Res. N.	$0.99	$58,905	$127,132	$0	$48,310	$234,347
Sub-Total PR	**47763**	**$11**	**$525,391**	**0**	**$310**	**$0**	**9300**	**$12**	**$111,600**	**0**			**$0**	**$0**	**4650**			**10.4**			**$450,203**	**$636,991**	**$45,150**	**$242,057**	**$1,374,400**

** Drop Structure Size = Drop Structure Height x Channel Topwidth*
Size is per Drop Structure.

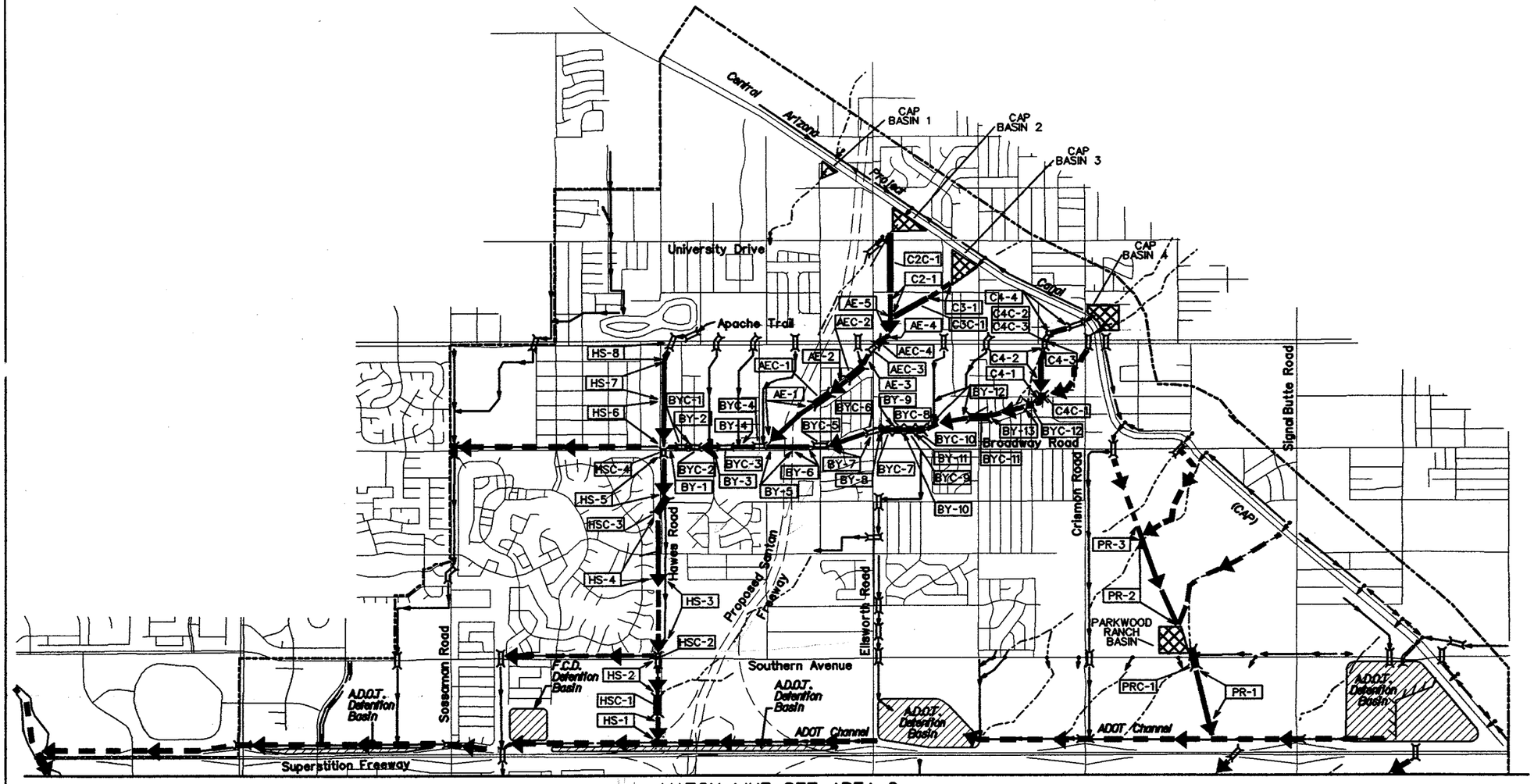
Culvert Costs

I.D.	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Inlet Headwall	Unit Cost (Ea.)	Inlet Headwall Cost	Outlet Headwall	Unit Cost (Ea.)	Outlet Headwall Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Contingencies Cost**	Total Land, Construction, and Contingencies Costs
AEC-1	70	$1,000	$70,000	1	$3,700	$3,700	1	$6,600	$6,600	0.0	N/A	$0	$0	$80,300	$30,514	$110,814
AEC-2	70	$1,000	$70,000	1	$3,700	$3,700	1	$6,600	$6,600	0.0	N/A	$0	$0	$80,300	$30,514	$110,814
AEC-3	Existing	$0	$0	0	$0	$0	0	$0	$0	0.0	N/A	$0	$0	$0	$0	$0
AEC-4	290	$700	$203,000	1	$3,100	$3,100	1	$5,500	$5,500	0.0	N/A	$0	$0	$211,600	$80,408	$292,008
BYC-1	50	$1,200	$60,000	1	$5,900	$5,900	1	$9,900	$9,900	0.0	N/A	$0	$0	$75,800	$28,804	$104,604
BYC-2	50	$1,200	$60,000	1	$5,900	$5,900	1	$9,900	$9,900	0.0	N/A	$0	$0	$75,800	$28,804	$104,604
BYC-3	62	$1,200	$74,400	1	$5,900	$5,900	1	$9,900	$9,900	0.0	N/A	$0	$0	$90,200	$34,276	$124,476
BYC-4	330	$1,200	$396,000	1	$5,900	$5,900	1	$9,900	$9,900	0.0	N/A	$0	$0	$411,800	$156,484	$568,284
BYC-5	99	$800	$79,200	1	$5,400	$5,400	1	$9,000	$9,000	0.0	N/A	$0	$0	$93,600	$35,568	$129,168
BYC-6	108	$400	$43,200	1	$2,200	$2,200	1	$4,000	$4,000	0.0	N/A	$0	$0	$49,400	$18,772	$68,172
BYC-7	50	$1,100	$55,000	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0	$0	$65,900	$25,042	$90,942
BYC-8	50	$1,100	$55,000	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0	$0	$65,900	$25,042	$90,942
BYC-9	50	$1,100	$55,000	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0	$0	$65,900	$25,042	$90,942
BYC-10	50	$1,100	$55,000	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0	$0	$65,900	$25,042	$90,942
BYC-11	80	$1,100	$88,000	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0	$0	$98,900	$37,582	$136,482
BYC-12	80	$1,100	$88,000	1	$3,900	$3,900	1	$7,000	$7,000	0.0	N/A	$0	$0	$98,900	$37,582	$136,482
C2C-1	1370	$110	$150,700	0	$1,500	$0	1	$1,500	$1,500	0.0	N/A	$0	$0	$152,200	$57,836	$210,036
C3C-1	1500	$150	$225,000	0	$2,200	$0	1	$2,200	$2,200	0.7	Res. N.	$0.99	$29,700	$227,200	$86,336	$343,236
C4C-1	80	$700	$56,000	1	$3,100	$3,100	1	$5,500	$5,500	0.0	N/A	$0	$0	$64,600	$24,548	$89,148
C4C-2	Existing	$0	$0	0	$0	$0	0	$0	$0	0.0	N/A	$0	$0	$0	$0	$0
C4C-3	Existing	$0	$0	0	$0	$0	0	$0	$0	0.0	N/A	$0	$0	$0	$0	$0
HSC-1	50	$1,100	$55,000	1	$5,700	$5,700	1	$9,500	$9,500	0.0	N/A	$0	$0	$70,200	$26,676	$96,876
HSC-2	Existing	$0	$0	0	$0	$0	0	$0	$0	0.0	N/A	$0	$0	$0	$0	$0
HSC-3	180	$2,000	$360,000	1	$6,900	$6,900	1	$11,700	$11,700	0.0	N/A	$0	$0	$378,600	$143,868	$522,468
HSC-4	132	$1,100	$145,200	1	$5,700	$5,700	1	$9,500	$9,500	0.0	N/A	$0	$0	$160,400	$60,952	$221,352

Detention Basin Costs

I.D.	Basin Excavation Volume (cy)	Unit Cost ($/cy)	Detention Basin Excavation Cost	Length of Pipe/ Box Culvert (ft.)	Unit Cost ($/ft.)	Pipe/Box Culvert Cost	Headwall	Unit Cost (Ea.)	Headwall Cost	Emergency Spillway Area (ft^2)	Unit Cost ($/ft^2)	Emergency Spillway Cost	Inflow Spillway Area (ft^2)	Inflow Spillway Cost	Length of Fencing (ft)	Unit Cost ($/lf)	Fence Cost	Required Land Acquisition (Ac.)	Zoning	Unit Cost ($/sf)	Land Acquisition Cost	Total Construction Cost	Total Landscape Cost	Total Contingencies Cost**	Total Land, Construction, Landscape, and Contingencies Costs
CAP Basin 1	14,555	$6	$600,000	175	$55	$9,625	2	$1,100	$2,200	2910	$5	$14,550	4130	$20,650	2,180	$12	$26,160	6.0	Res. N.	$0.99	$258,746	$673,185	$130,680	$255,810	$1,318,422
CAP Basin 2	175,315	$6	$600,000	140	$55	$7,700	2	$1,100	$2,200	5820	$5	$29,100	7750	$38,750	2,230	$12	$26,760	11.0	Res. N.	$0.99	$474,368	$704,510	$239,580	$267,714	$1,686,172
CAP Basin 3	49,219	$6	$600,000	150	$70	$10,500	2	$1,300	$2,600	5820	$5	$29,100	4194	$20,970	2,960	$12	$34,320	9.0	Res. N.	$0.99	$388,120	$697,490	$196,020	$265,046	$1,546,676
CAP Basin 4	93,259	$6	$600,000	80	$110	$8,800	2	$1,500	$3,000	6984	$5	$34,920	8850	$44,250	3,050	$12	$36,600	11.0	Com. N.	$5.70	$2,731,212	$727,570	$239,580	$276,477	$3,974,839
Parkwood Ranch Basin	160,000	$6	$600,000	130	$300	$39,000	1 inlet, 1 outlet		$5,900	6984	$5	$34,920	1600	$8,000	4,350	$12	$52,200	20.0	Res. N.	$0.99	$862,488	$740,020	$435,600	$281,208	$2,319,316

*** Total Contingencies Cost is the sum of: 1. Construction Contingencies @ 15% of the Total Construction Cost*
2. Design and Field Engineering Costs @ 15% of the sum of Total Construction Cost and Construction Contingencies.
3. Change Orders @ 5% of the sum of Total Construction Cost and Construction Contingencies.



MATCH LINE SEE AREA 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

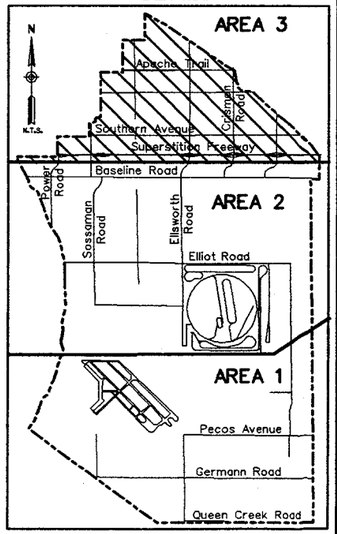
East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

- STUDY BOUNDARY
- EXISTING CHANNEL/DITCH
- EXISTING BRIDGE/CULVERT
- EXISTING STORM DRAIN
- EXISTING ROADWAY DIP SECTION/ WEIR/OVER-CHUTE
- EXISTING DIVERSION DIKE
- EXISTING WASH
- EXISTING DETENTION BASIN
- EXISTING/PLANNED MAJOR CHANNEL
- PROPOSED MAJOR CHANNEL
- PROPOSED ROAD ALIGNMENT
- PROPOSED DETENTION BASIN
- PROPOSED CULVERT

INDEX MAP



DIBBLE & ASSOCIATES CONSULTING ENGINEERS

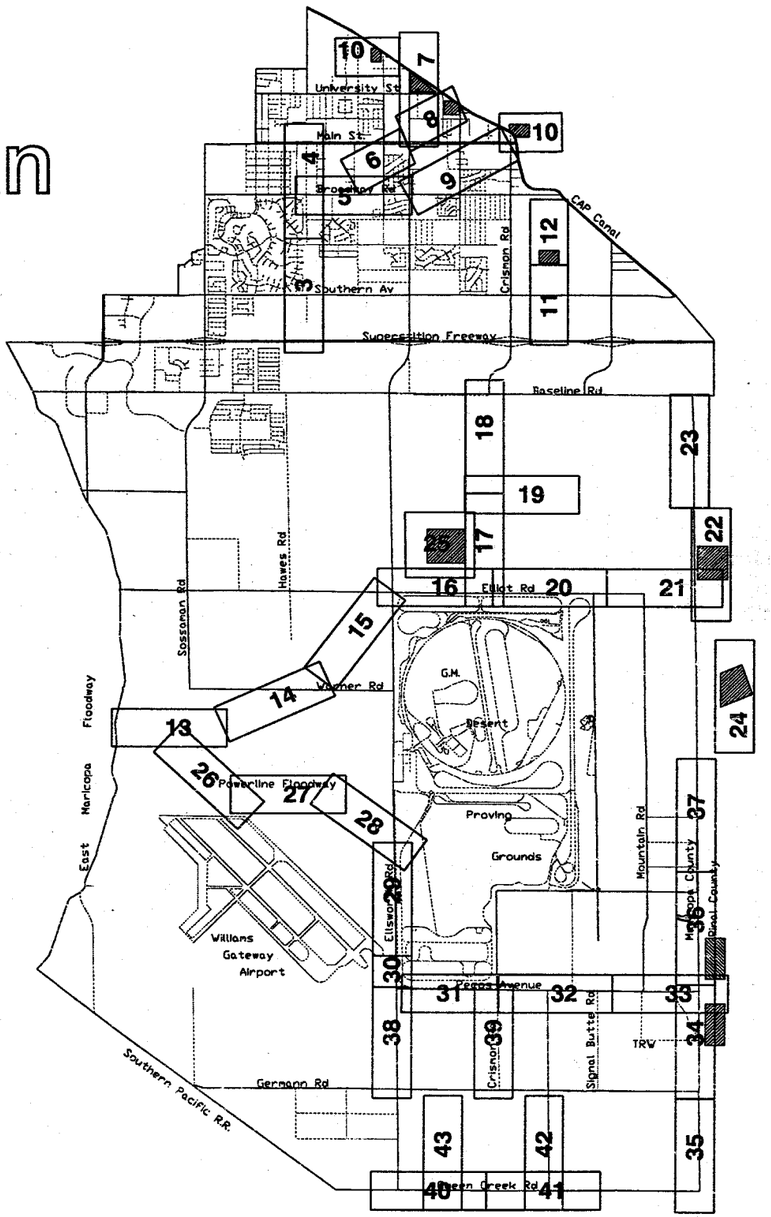
Hoskin Engineering Consultants

AREA 3 PRELIMINARY PLAN

960002\A11C

East Mesa
Area Drainage Master Plan
FCD #95-32

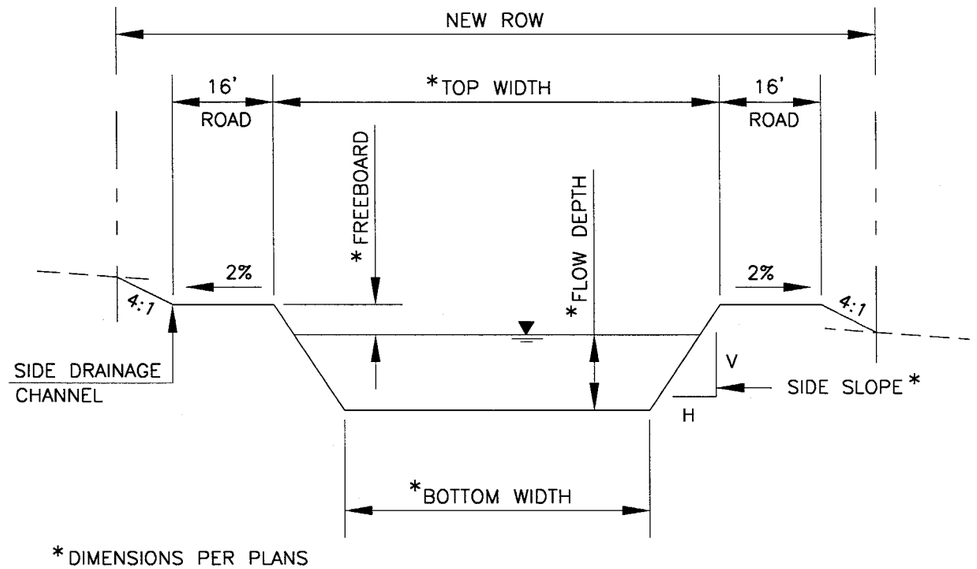
Preliminary Design Plans



FLOOD CONTROL DISTRICT of MARICOPA COUNTY 1959

NOTE: CONTROL DATUMS ARE BASED ON THE FOLLOWING:
HORIZONTAL – STATE PLANE COORDINATE SYSTEM 1927
VERTICAL – NATIONAL GEODETIC VERTICAL DATUM 1929.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: COVER SHEET
	SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 3-2-98 / DES. DCF DATE: 3-2-98 / CKD. BJF DATE: 6-18-98
		SCALE: HORIZONTAL / VERTICAL
		SHEETS: NO. 1 OF 43



*DIMENSIONS PER PLANS

TYPICAL CHANNEL SECTION

LEGEND

- XX–1 — CHANNEL REACH
- CHANNEL FLOWLINE
- NEW CHANNEL ROW
- DETENTION BASIN SLOPE
- NEW CULVERT
- PARCEL LINE
- SECTION LINE
- EXISTING ROAD
- 15"S — EXISTING UTILITY
- 1410 — INDEX CONTOUR
- INTERMEDIATE CONTOUR

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: TYPICAL SECTION/LEGEND

DRN. JEV DATE: 3-26-98
DES. DCF DATE: 3-26-98
CKD. FEB DATE: 6-18-98

SCALE: HORIZONTAL / VERTICAL

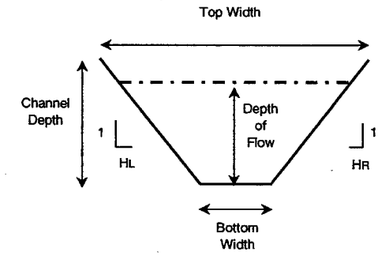
SHEETS NO. 2 OF 43

East Mesa Area Drainage Master Plan
AREA 3 - HAWES CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)	
HS-1	31T38	1026	1026	1431.1	1432.4	760	0.0017	0.0017	0.0	0	0.0	C	0.0150	25.0	3.8	2	2	122.7	41.9	0.84	Sub	8.4	1.2	5.0	44.9	
HS-2	31T38	1026	1026	1435.0	1437.5	1134	0.0022	0.0022	0.0	0	0.0	C	0.0150	10.0	5.1	2	2	103.0	32.8	0.95	Trans	10.0	1.7	6.8	37.0	Existing channel to remain
HS-3	C31	2290	2290	1438.3	1444.7	1935	0.0033	0.0033	0.0	0	0.0	C	0.0150	16.7	6.1	1.5	1.5	157.7	38.7	1.21	Trans	14.5	2.3	8.4	42.0	Existing channel to remain
HS-4a	C31	2290	2290	1444.7	1445.9	680	0.0018	0.0018	0.0	0	0.0	C	0.0150	50.0	4.5	0	0	225.5	59.02	0.84	Sub	10.2	1.5	6.0	50.0	A portion of the channel to be placed underground

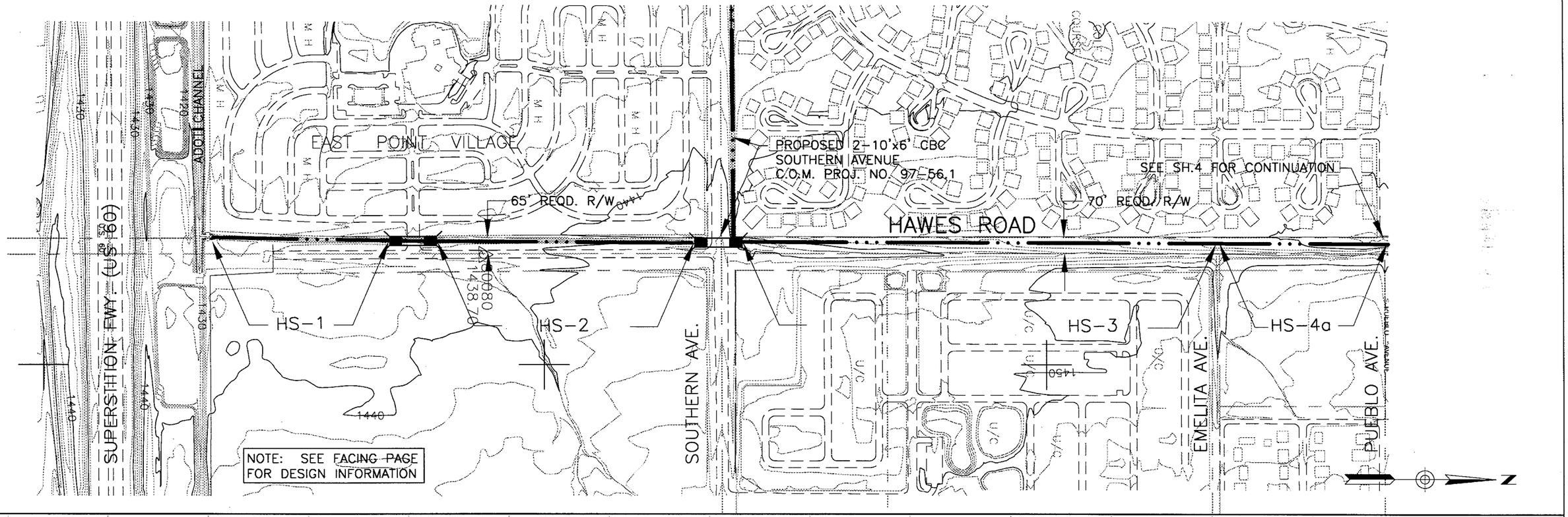
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

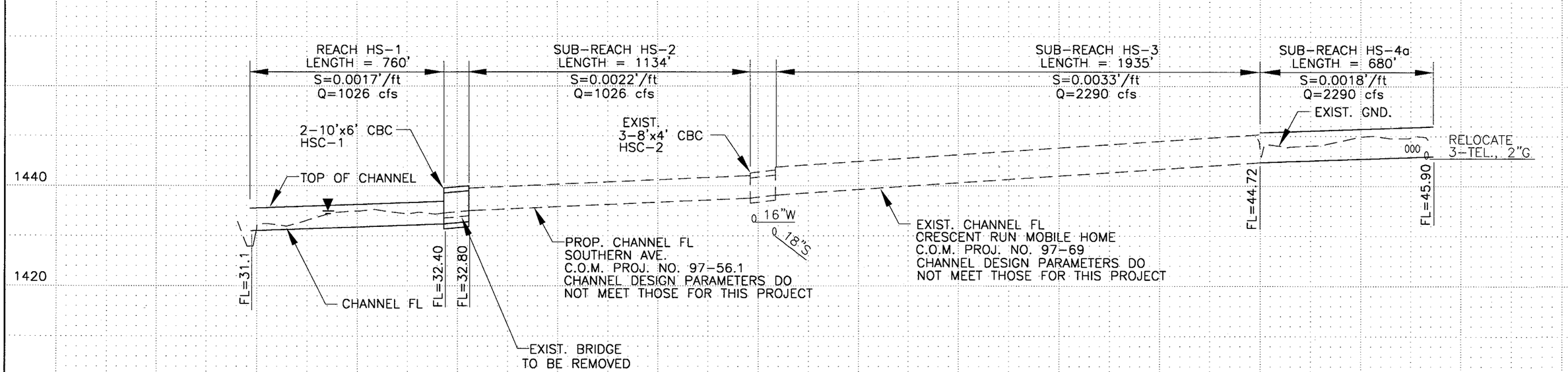


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	
HSC-1	31T38	1026	1026	50	1432.8	1432.4	0.0080	C	0.0120	2	6	ft.	10	RCBC	Wingwall	3.77	7.03	1.17	IC	
HSC-2	31T38	1026	1026	114	1438.1	1437.5	0.0053	C	0.0120	3	4	ft.	8	RCBC	Wingwall	5.1	7.62	1.90	IC	Existing to remain





HAWES CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS (Since 1962)	PROJECT DESCRIPTION: AREA 3 HAWES CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-16-98 / SCALE / SHEETS
		DES. PWH DATE: 6-11-98 / 1" = 400' HORIZONTAL
		CKD. FEB DATE: 6-17-98 / 1" = 20' VERTICAL / NO. 3 OF 43

East Mesa Area Drainage Master Plan
AREA 3 - HAWES CHANNEL

Channel Properties

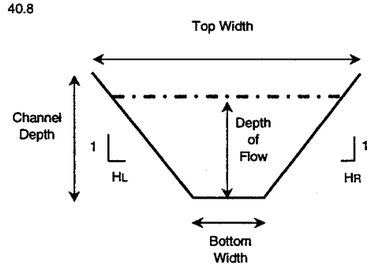
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
HS-4b	C31	2290	2290	1445.9	1448.0	1220	0.0018	0.0018	0.0	0	0.0	C	0.0150	50.0	4.5	0	0	225.5	59	0.84	Sub	10.2	1.5	6.0	50.0
HS-5	C31	2290	2290	1449.0	1455.5	1180	0.0055	0.0015	4.7	2	2.4	C	0.0150	40.0	4.8	2	2	240.7	61.7	0.83	Sub	9.5	1.6	6.4	65.6
HS-6	C18A	922	922	1456.2	1465.0	1090	0.0081	0.0017	6.9	2	3.5	C	0.0150	20.0	4.0	2	2	110.3	37.7	0.84	Sub	8.4	1.3	5.2	40.8
HS-7	C18A	922	922	1465.0	1477.5	1350	0.0093	0.0017	10.2	3	3.4	C	0.0150	20.0	4.0	2	2	110.3	37.7	0.84	Sub	8.4	1.3	5.2	40.9
HS-8	C18A	922	922	1477.5	1478.0	290	0.0017	0.0017	0.0	0	0.0	C	0.0150	20.0	4.0	2	2	110.3	37.7	0.84	Sub	8.4	1.3	5.2	40.8

Max. topwidth = 30 feet

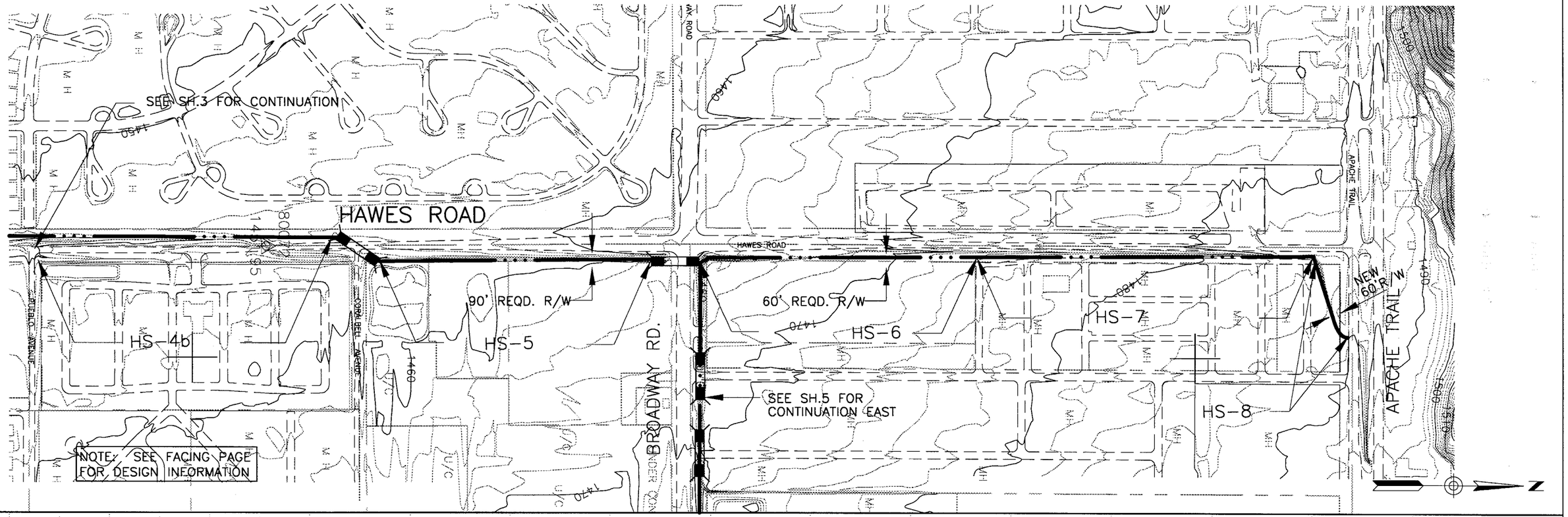
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

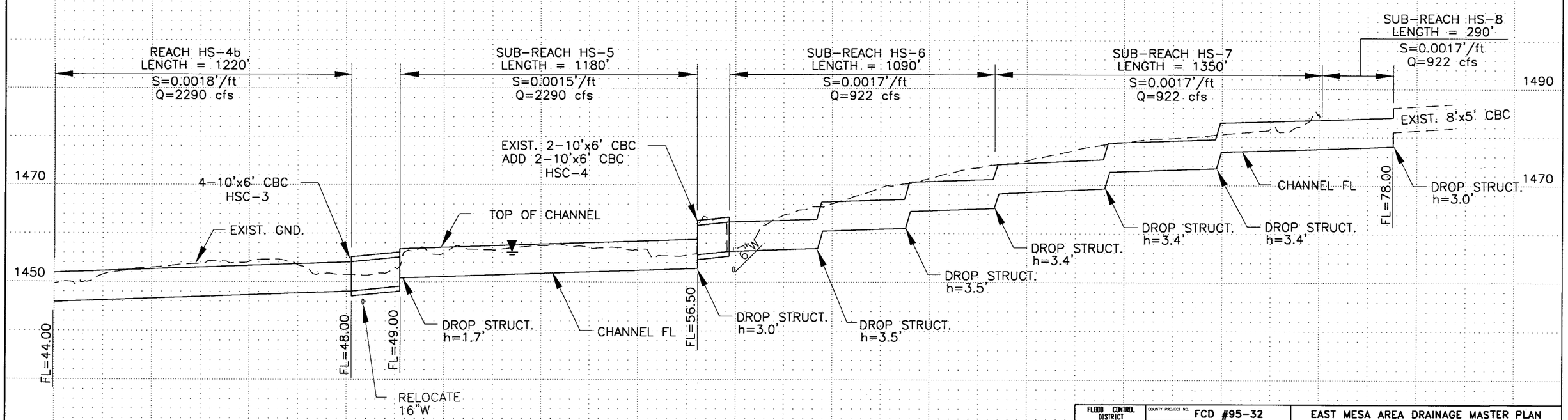
Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	
HSC-3	C31	2290	2290	180	1449.0	1448.0	0.0056	C	0.0120	4	6	ft.	10	RCBC	Wingwall	4.5	8.33	1.39	IC	
HSC-4	C31	2290	2290	132	1456.2	1455.8	0.0030	C	0.0120	4	6	ft.	10	RCBC	Wingwall	4.8	8.35	1.39	IC	Existing to remain, add 2-10'x6' CBC



Typical Channel Section





HAWES CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN	
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 3 HAWES CHANNEL	
	SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 6-16-98	SCALE
		DES. PWH DATE: 6-11-98	1"=400' HORIZONTAL
		CKD. FEB DATE: 6-17-98	1"=20' VERTICAL
			SHEETS NO. 4 OF 43

East Mesa Area Drainage Master Plan
AREA 3 - BROADWAY CHANNEL

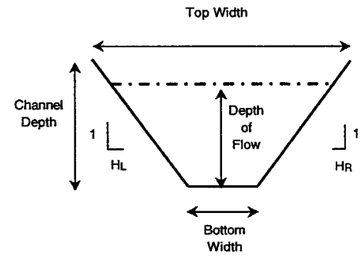
Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
BY-1	C23B	970	970	1456.2	1459.2	420	0.0071	0.0017	2.3	1	2.3	C	0.0150	15.0	4.6	2	2	111.1	35.5	0.84	Sub	8.7	1.4	6.0	39.1
BY-2	C23B	970	970	1459.8	1462.0	250	0.0088	0.0017	1.8	1	1.8	C	0.0150	15.0	4.6	2	2	111.1	35.5	0.84	Sub	8.7	1.4	6.0	39.1
BY-3	C23B	970	970	1462.8	1468.5	740	0.0077	0.0017	4.4	2	2.2	C	0.0150	15.0	4.6	2	2	111.1	35.5	0.84	Sub	8.7	1.4	6.0	39.1
BY-4	C23B	970	970	1469.3	1471.0	660	0.0026	0.0017	0.6	1	0.6	C	0.0150	15.0	4.6	2	2	111.1	35.5	0.84	Sub	8.7	1.4	6.0	39.1
BY-5	C23B	970	970	1473.0	1482.0	660	0.0136	0.0017	7.9	3	2.6	C	0.0150	15.0	4.6	2	2	111.1	35.5	0.84	Sub	8.7	1.4	6.0	39.1
BY-6	C22A	629	629	1482.0	1490.0	620	0.0129	0.0017	6.9	3	2.3	C	0.0150	10.0	4.3	2	2	79.1	29.1	0.82	Sub	8.0	1.3	5.6	32.3
BY-7	C22A	629	629	1492.2	1502.0	1320	0.0074	0.0018	7.4	2	3.7	C	0.0150	16.0	3.5	2	2	80.4	31.6	0.84	Sub	7.8	1.1	4.6	34.4

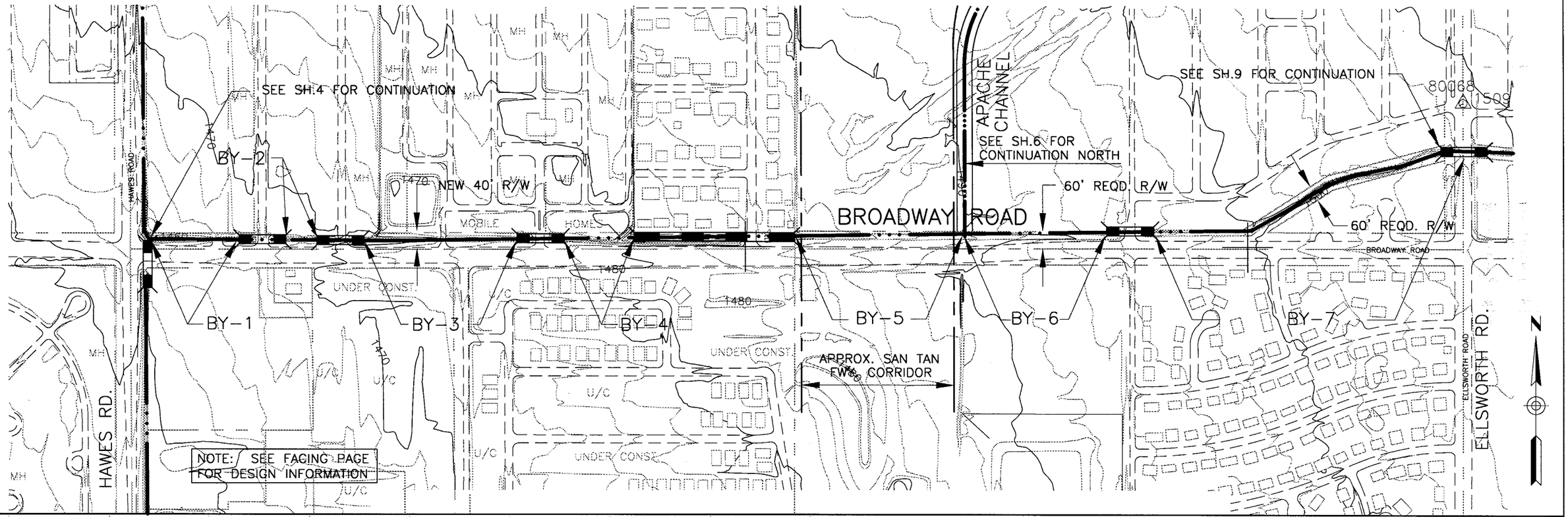
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

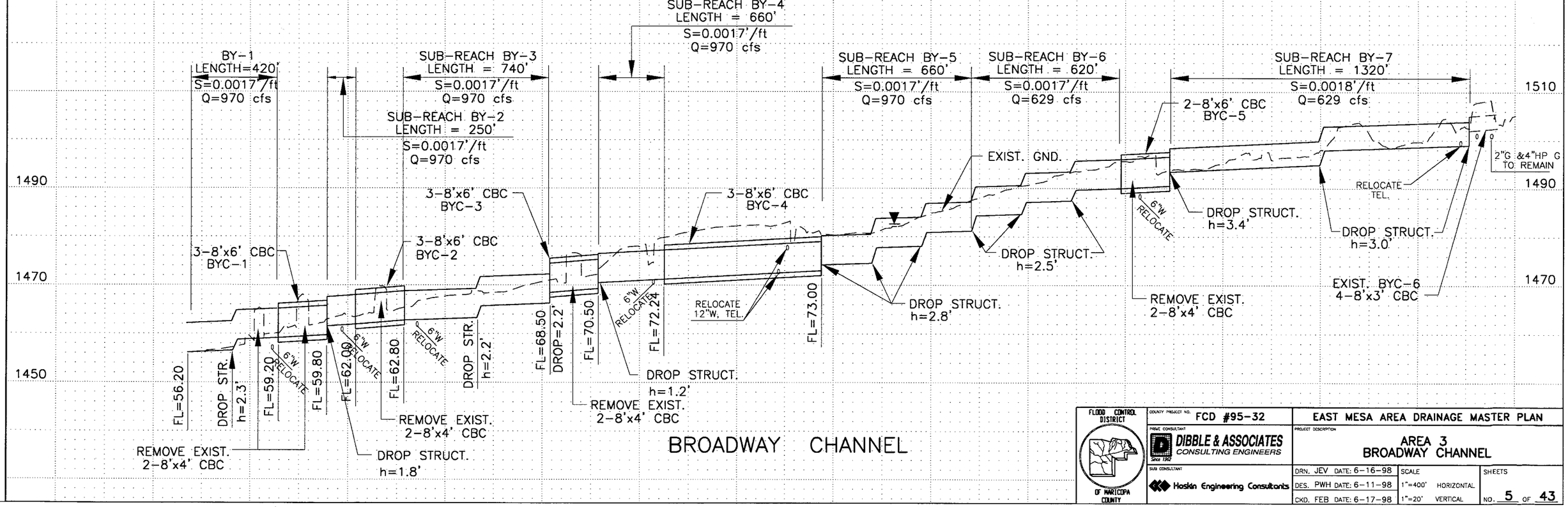
Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	
BYC-1	C23B	970	970	50	1459.8	1459.2	0.0120	C	0.0120	3	6	ft.	8	RCBC	Wingwall	4.592	5.95	0.99	IC	
BYC-2	C23B	970	970	50	1462.8	1462.0	0.0160	C	0.0120	3	6	ft.	8	RCBC	Wingwall	4.592	5.93	0.99	IC	
BYC-3	C23B	970	970	62	1469.3	1468.5	0.0129	C	0.0120	3	6	ft.	8	RCBC	Wingwall	4.592	5.94	0.99	IC	
BYC-4	C23B	970	970	330	1473.0	1471.0	0.0061	C	0.0120	3	6	ft.	8	RCBC	Wingwall	4.592	5.96	0.99	IC	
BYC-5	C22A	629	629	99	1490.5	1490.0	0.0051	C	0.0120	2	6	ft.	8	RCBC	Wingwall	4.267	5.85	0.98	IC	
BYC-6	C22A	629	629	108	1500.5	1490.0	0.0972	C	1.0120	4	3	ft.	8	RCBC	Wingwall	3.495	3.79	1.26	IC	Existing to remain, add 1-8'x3' CBC



Typical Channel Section





BROADWAY CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1960

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 3 BROADWAY CHANNEL

DRN. JEV DATE: 6-16-98
DES. PWH DATE: 6-11-98
CKD. FEB DATE: 6-17-98

SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL

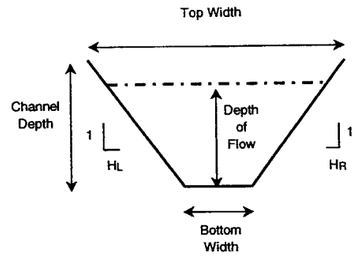
SHEETS NO. 5 OF 43

East Mesa Area Drainage Master Plan
AREA 3 - APACHE CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
AE-1	C23A	368	368	1482.0	1496.5	1500	0.0097	0.0029	10.2	3	3.4	E	0.0250	15.0	2.8	4	4	74.0	38.2	0.62	Sub	5.0	1.0	3.8	45.5
AE-2	C23A	368	368	1497.0	1510.5	1100	0.0123	0.0029	10.3	3	3.4	E	0.0250	15.0	2.8	4	4	74.0	38.2	0.62	Sub	5.0	1.0	3.8	45.5
AE-3	C23A	368	368	1510.5	1518.0	620	0.0121	0.0029	5.7	2	2.9	E	0.0250	15.0	2.8	4	4	74.0	38.2	0.62	Sub	5.0	1.0	3.8	45.5

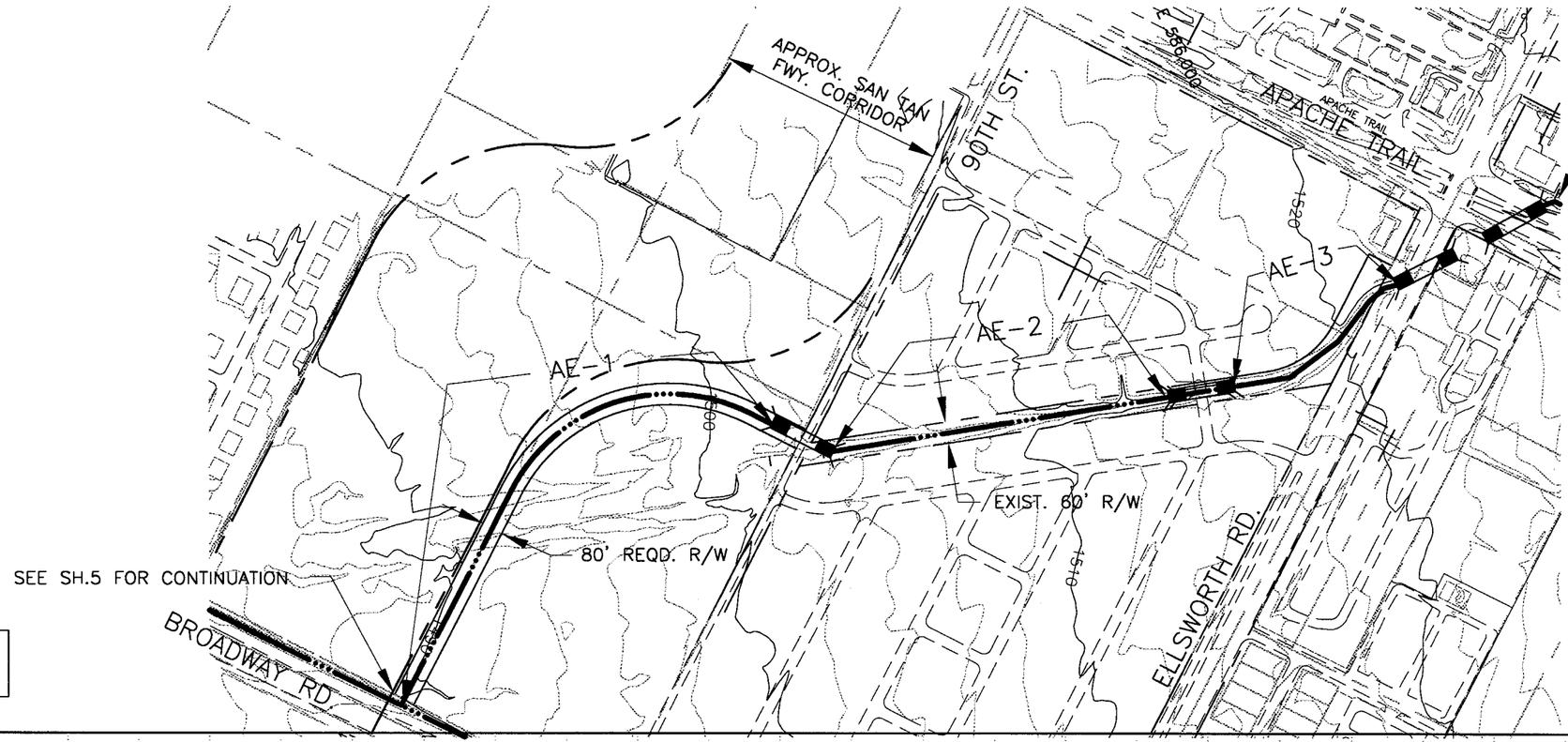
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



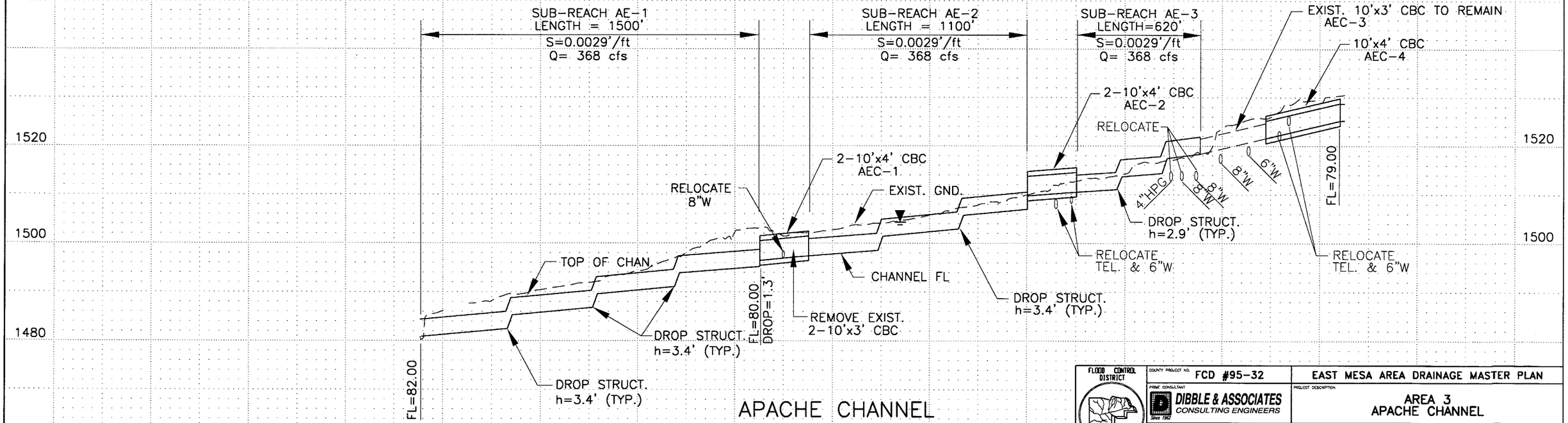
Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	
AEC-1	C23A	368	368	70	1497.0	1496.5	0.0071	C	0.0120	2	4	ft.	10	RCBC	Wingwall	2.8	3.51	0.88	IC	
AEC-2	C23A	368	368	70	1510.5	1510.1	0.0057	C	0.0120	2	4	ft.	10	RCBC	Wingwall	2.8	3.51	0.88	IC	
AEC-3	C17A2	189	189	170	1521.5	1518.0	0.0206	C	0.0120	1	3	ft.	10	RCBC	Wingwall	2.8	3.60	1.20	IC	Existing to remain
AEC-4	C17A2	189	189	290	1524.0	1521.5	0.0086	C	0.0120	1	4	ft.	10	RCBC	Wingwall	2.8	3.57	0.89	IC	



NOTE: SEE FACING PAGE FOR DESIGN INFORMATION



APACHE CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962	PROJECT DESCRIPTION: AREA 3 APACHE CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-16-98 / DES. PWH DATE: 6-11-98 / CKD. FEB DATE: 6-17-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS: NO. 6 OF 43

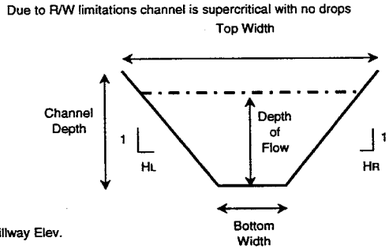
East Mesa Area Drainage Master Plan
AREA 3 - CAP BASIN 2 OUTLET CHANNEL & APACHE CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
AE-4	C17A2	189	189	1524.0	1526.9	260	0.0112	0.0021	2.4	1	2.4	C	0.0150	4.0	3.0	2	2	29.2	17.2	0.84	Sub	6.5	1.0	4.0	19.8
AE-5	C17A2	189	189	1526.9	1530.0	310	0.0100	0.0021	2.4	1	2.4	C	0.0150	4.0	3.0	2	2	29.2	17.2	0.84	Sub	6.5	1.0	4.0	19.8
C2-1	INTERP	149	149	1530.0	1536.0	850	0.0071	0.0071	0.0	0	0.0	C	0.0150	4.0	2.1	1.5	1.5	15.0	11.6	1.45	Sup	9.9	2.0	4.1	16.3

Due to R/W limitations channel is supercritical with no drops

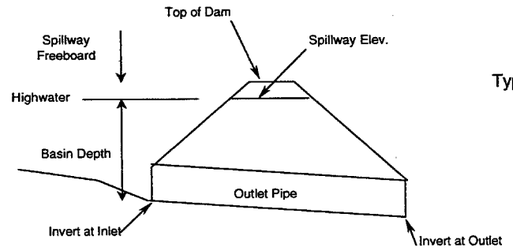
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)
C2C-1	RCAP2A	53	53	1370	1548.1	1536.0	0.0088	C	0.0120	1	36	in.	N/A	RCP	N/A



Typical Detention Basin Outlet

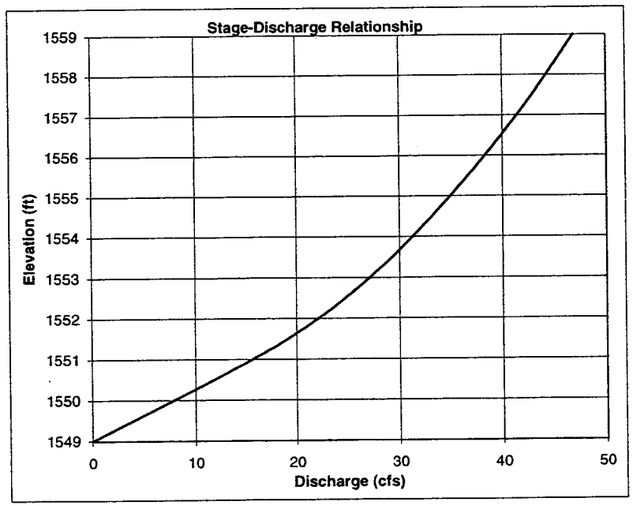
Detention Basin Properties

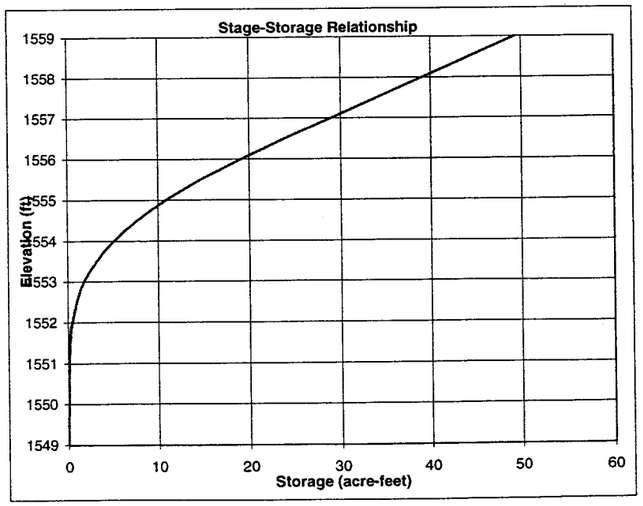
CAP Basin No. 2

Basin Land Area	11.0 Acres	Length of Fencing =	2,230 ft
Basin Excavation Volume	175,315 C.Y.		
Q100 Inflow (HEC-1 I.D. CAP2) =	530 cfs	Outflow Pipe (no. & Dia.) =	1 24 in.
Q100 Outflow (HEC-1 I.D. BASIN2) =	38 cfs	Pipe Invert at Inlet=	1549.00 ft
Emergency Spillway Flow =	530 cfs	Pipe Invert at Outlet=	1548.12 ft
Emergency Spillway Width (3) =	100 ft	Pipe Length =	140 ft
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =	0.0063 ft/ft
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =	1550.0 ft
Spillway Flow Depth =	1.7 ft	Orifice Coeff., C =	0.62
Highwater Elev. (Q100) =	1556 ft	Inflow Spillway Width (3) =	100 ft
Maximum Ponding Depth =	7.0 ft	Inflow Spillway Length (3) =	77.5 ft
		Spillway Elevation =	1556 ft

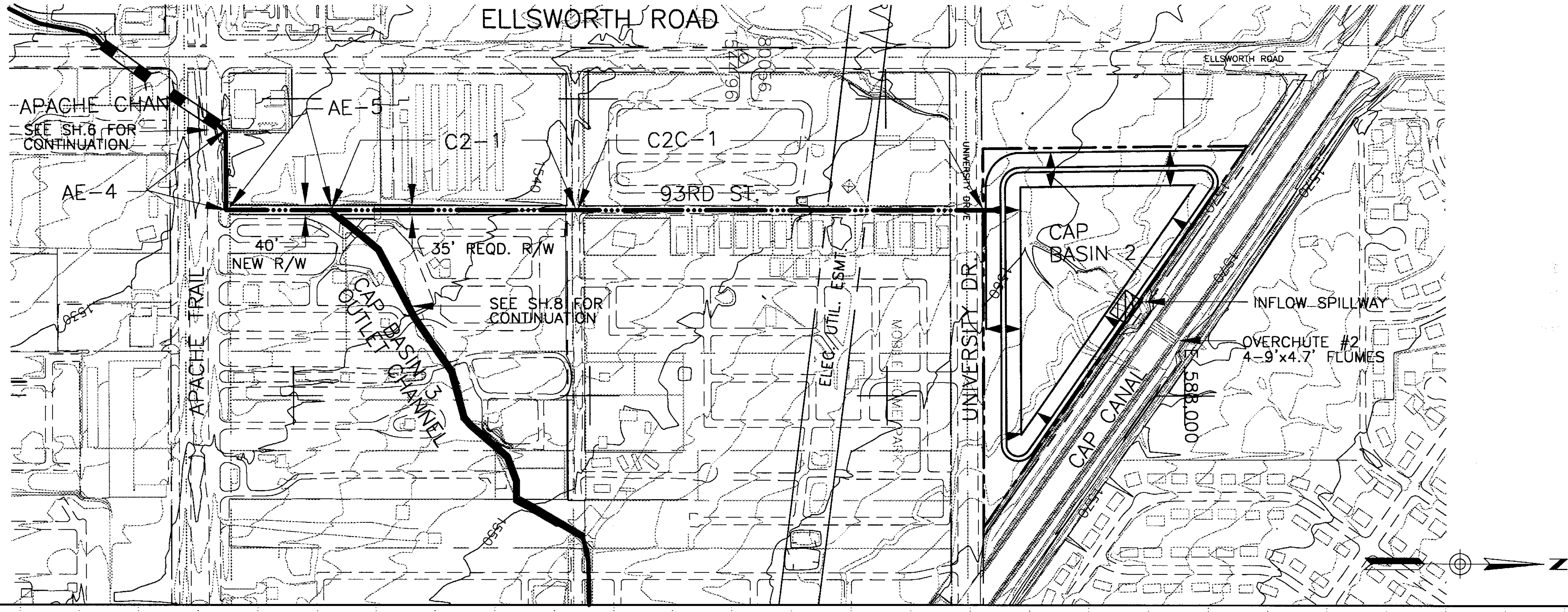
Elev.	Area (ac.)	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe Flow (cfs)
1549	0.00	0.00	0.00	0	0	0
1551	0.15	0.10	0.10	16	0	16
1552	0.60	0.35	0.45	22	0	22
1553	2.20	1.32	1.77	27	0	27
1554	4.60	3.33	5.09	31	0	31
1555	7.10	5.80	10.90	35	0	35
1556	9.40	8.22	19.12	38	0	38
1557	10.20	9.80	28.92	41	250	291
1558	10.20	10.20	39.12	44	707	751
1559	10.20	10.20	49.32	47	1299	1346

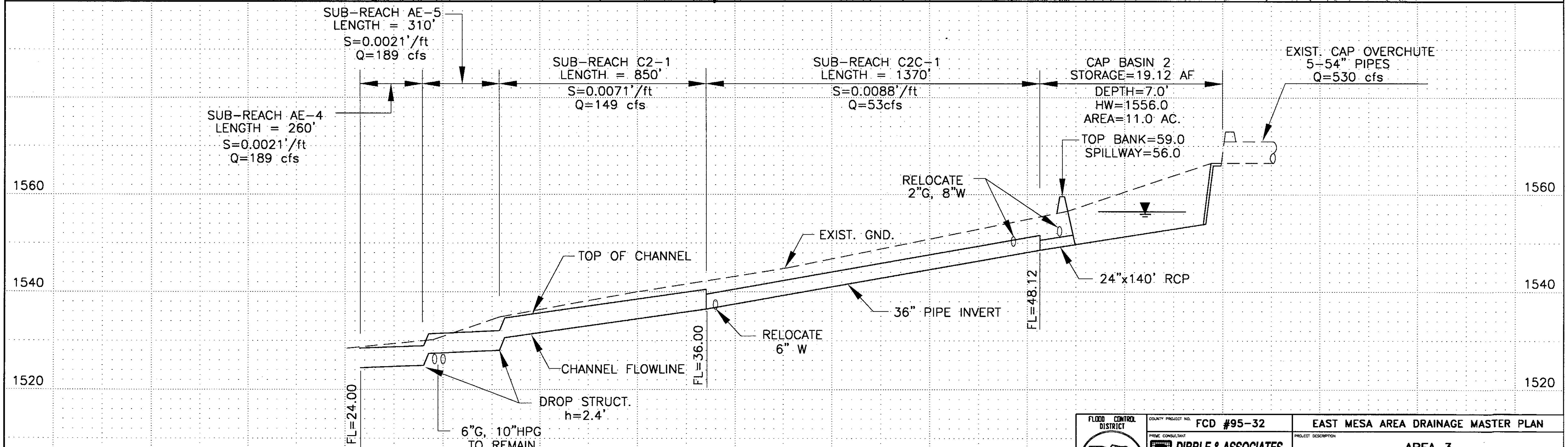
*Note: (1) Volume computations based upon Conic Method where Vol.(inc.) = h/3(A1+A2+(A1*A2)^0.5)*
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.





NOTE: SEE FACING PAGE FOR DESIGN INFORMATION





CAP BASIN 2 OUTLET CHANNEL & APACHE CHANNEL

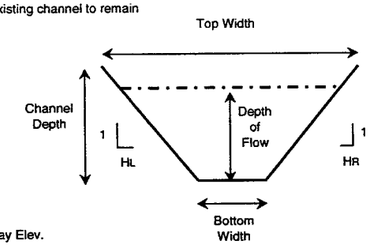
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962	PROJECT DESCRIPTION: AREA 3 CAP BASIN 2 OUTLET & APACHE CHAN.
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-16-98 / DES. PWH DATE: 6-11-98 / CKD. FEB DATE: 6-17-98 — SCALE 1"=400' HORIZONTAL, 1"=20' VERTICAL — SHEETS NO. 7 OF 43

East Mesa Area Drainage Master Plan
AREA 3 - CAP BASIN 3 OUTLET CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)	
C3-1	RCAP3	57	57	1549.0	1554.0	520	0.0096	0.0096	0.0	0	0.0	C	0.0150	6.0	1.1	0	0	6.7	8.2	1.41	Sup	8.5	2.0	3.1	6.0	Existing channel to remain

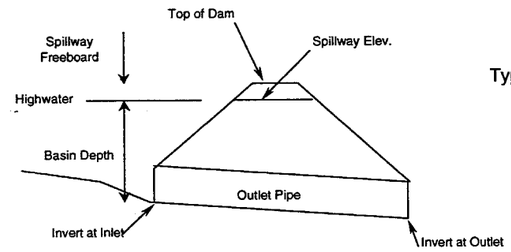
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
C3C-1	INTERP	110	110	1500	1549.0	1530.0	0.0127	C	0.0120	1	48	in.	0	RCP	Headwall	3.0	5.15	1.29	IC



Typical Detention Basin Outlet

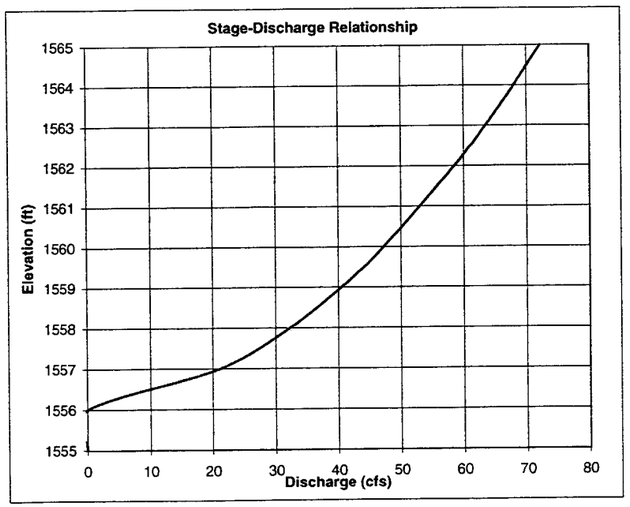
Detention Basin Properties

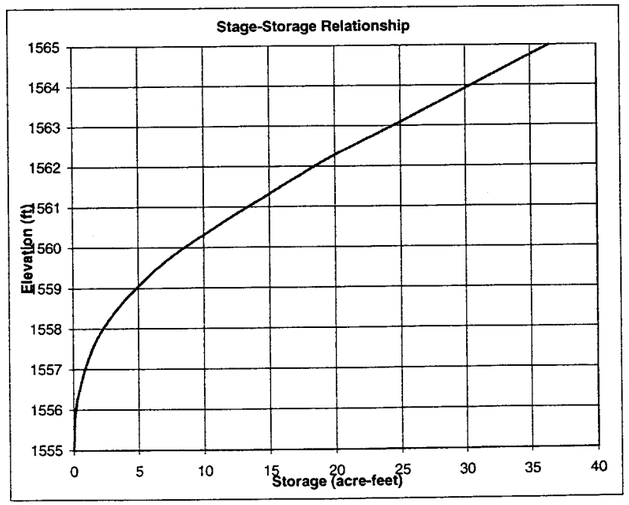
CAP Basin No. 3

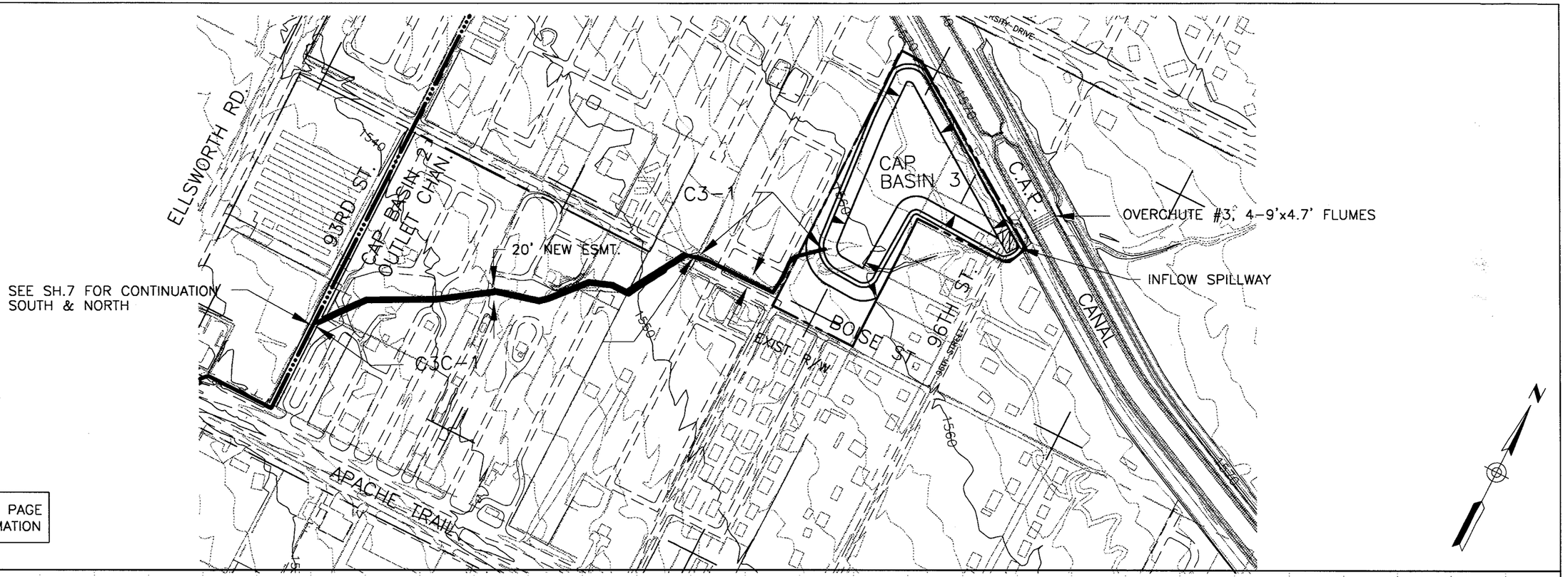
Basin Land Area	9.0 Acres	Length of Fencing =		2,860 ft	
Basin Excavation Volume	49,219 C.Y.				
Q100 Inflow (HEC-1 I.D. CAP3) =	476 cfs	Outflow Pipe (no. & Dia.) =	1	30 in.	
Q100 Outflow (HEC-1 I.D. BASIN3) =	57 cfs	Pipe Invert at Inlet=		1555.0 ft	
Emergency Spillway Flow =	476 cfs	Pipe Invert at Outlet=		1554.0 ft	
Emergency Spillway Width (3) =	100 ft	Pipe Length =		150 ft	
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =		0.0067 ft/ft	
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =		1556.25 ft	
Spillway Flow Depth =	1.5 ft	Orifice Coeff., C =		0.62	
Highwater Elev. (Q100) =	1562 ft	Inflow Spillway Width (3) =		90 ft	
Maximum Ponding Depth	7.0 ft	Inflow Spillway Length (3) =		46.6 ft	
		Spillway Elevation =		1562 ft	

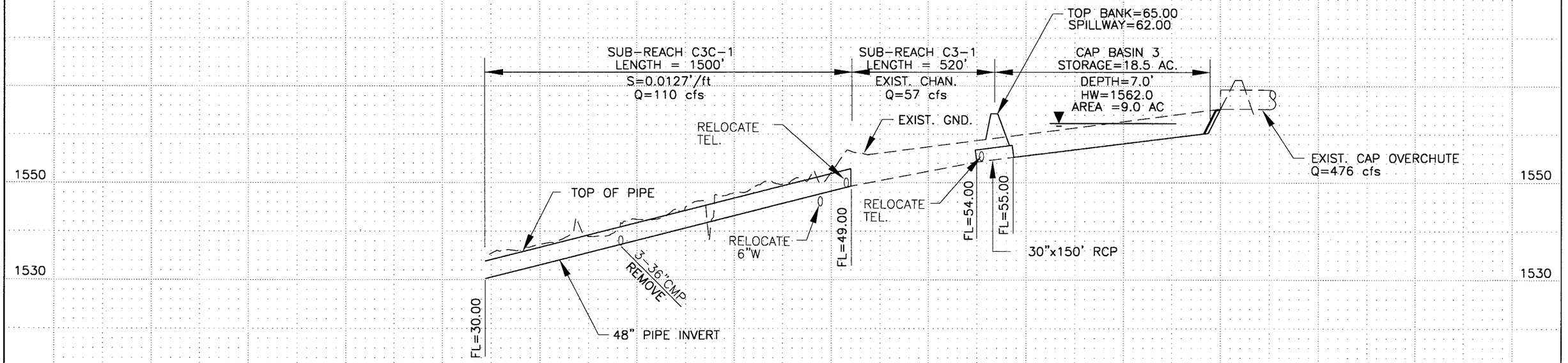
Elev.	Area (ac.)	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe (cfs)
1555	0.00	0.00	0.00	0	0	0
1556	0.50	0.17	0.17	0	0	0
1557	1.00	0.74	0.90	21	0	21
1558	1.80	1.38	2.28	32	0	32
1559	3.40	2.56	4.84	41	0	41
1560	4.00	3.70	8.54	47	0	47
1562	6.00	9.93	18.47	59	0	59
1563	6.00	6.00	24.47	63	250	313
1564	6.00	6.00	30.47	68	707	775
1565	6.00	6.00	36.47	72	1299	1371

*Note: (1) Volume computations based upon Conic Method where Vol.(inc.) = h/3(A1+A2+(A1*A2)^0.5)*
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.









CAP BASIN 3 OUTLET CHANNEL

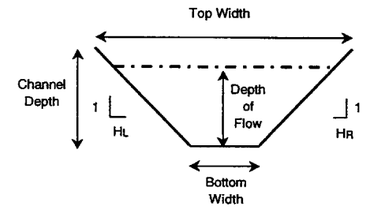
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1960	PROJECT DESCRIPTION: AREA 3 CAP BASIN 3 OUTLET CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-16-98 / SCALE
		DES. PWH DATE: 6-11-98 / 1"=400' HORIZONTAL
		CKD. FEB DATE: 6-17-98 / 1"=20' VERTICAL
		SHEETS NO. 8 OF 43

East Mesa Area Drainage Master Plan
AREA 3 - BROADWAY CHANNEL & CAP BASIN 4 OUTLET CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)	
BY-8	C22A	629	629	1502.5	1506.0	330	0.0106	0.0018	2.9	1	2.9	C	0.0150	15.5	3.5	2	2	80.1	31.4	0.84	Sub	7.9	1.1	4.7	34.2	
BY-9	C22A	629	629	1506.5	1508.0	150	0.0100	0.0018	1.2	0	0.0	C	0.0150	15.5	3.5	2	2	80.1	31.4	0.84	Sub	7.9	1.1	4.7	34.2	
BY-10	C22A	629	629	1508.5	1512.0	440	0.0080	0.0018	2.7	1	2.7	C	0.0150	15.5	3.5	2	2	80.1	31.4	0.84	Sub	7.9	1.1	4.7	34.2	
BY-11	C22A	629	629	1512.5	1515.6	240	0.0129	0.0018	2.7	1	2.7	C	0.0150	15.5	3.5	2	2	80.1	31.4	0.84	Sub	7.9	1.1	4.7	34.2	
BY-12	C22A	629	629	1516.0	1528.5	1280	0.0098	0.0021	9.8	2	4.9	E	0.0250	20.0	3.6	4	4	125.2	49.9	0.55	Sub	5.0	1.0	4.6	57.1	
BY-13	C22A	629	629	1529.0	1542.0	1300	0.0100	0.0021	10.3	3	3.4	E	0.0250	20.0	3.6	4	4	125.2	49.9	0.55	Sub	5.0	1.0	4.6	57.1	
C4-1	RCAP4B	273	273	1542.5	1543.0	220	0.0023	0.0020	0.1	0	0.0	E	0.0250	8.0	3.2	4	4	66.2	34.3	0.52	Sub	4.1	1.0	4.2	41.5	Designed for half of Basin 4 Emergency Spillway Flow
C4-2	RCAP4B	273	273	1544.0	1557.0	1350	0.0096	0.0033	8.5	2	4.3	E	0.0250	8.0	2.8	4	4	55.0	31.4	0.65	Sub	5.0	1.0	3.8	38.7	Designed for half of Basin 4 Emergency Spillway Flow
C4-3	RCAP4A	273	273	1557.5	1557.8	80	0.0037	0.0033	0.0	0	0.0	E	0.0250	8.0	2.8	4	4	55.0	31.4	0.65	Sub	5.0	1.0	3.8	38.7	Designed for half of Basin 4 Emergency Spillway Flow
C4-4	RCAP4A	273	273	1558.0	1564.0	750	0.0080	0.0033	3.5	1	3.5	E	0.0250	8.0	2.8	4	4	55.0	31.4	0.65	Sub	5.0	1.0	3.8	38.7	Designed for half of Basin 4 Emergency Spillway Flow

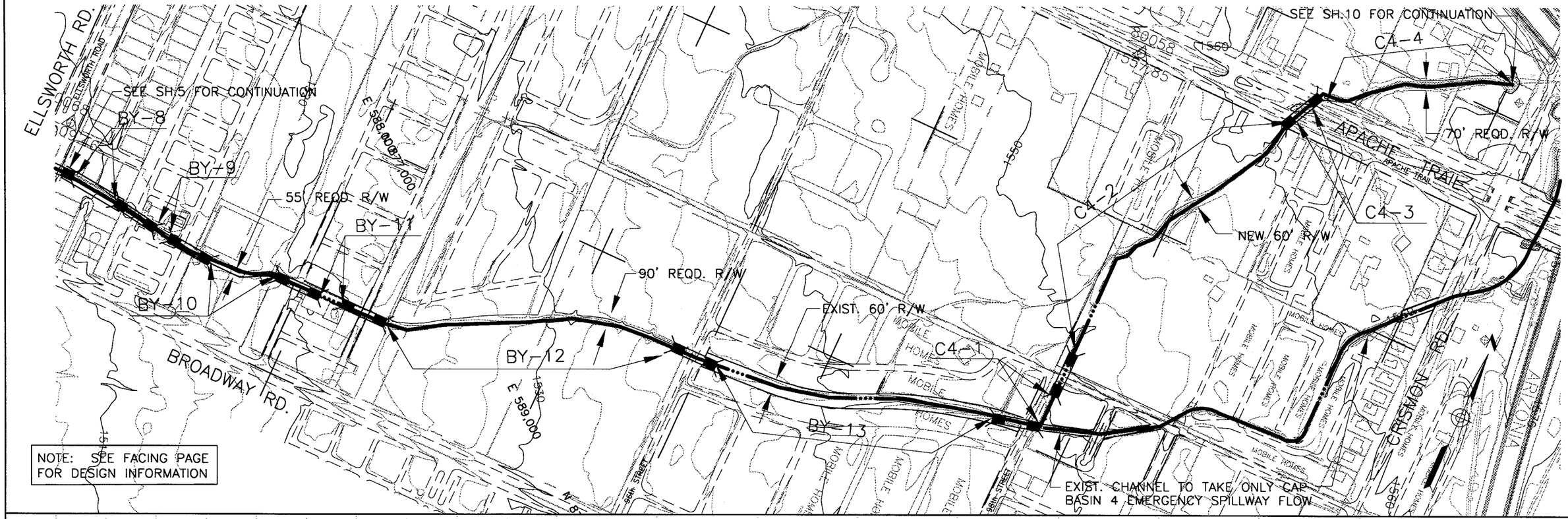
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

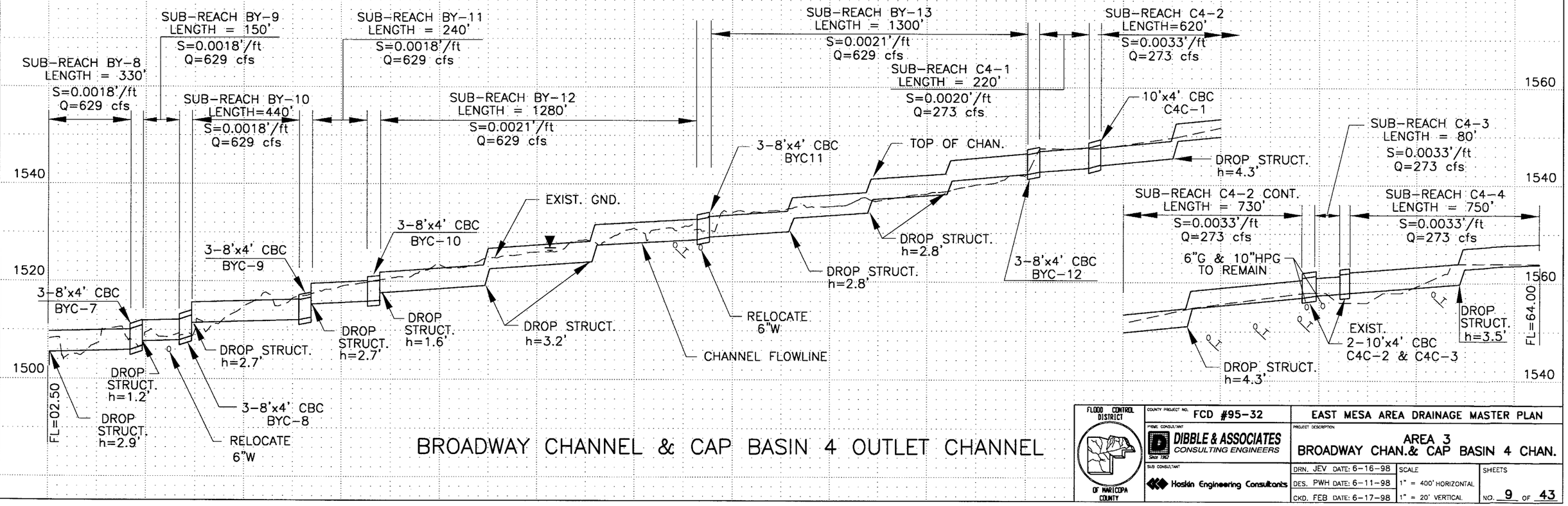


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control	
BYC-7	C22A	629	629	50	1506.5	1506.0	0.0100	C	0.0120	3	4	ft.	8	RCBC	Wingwall	3.545	4.48	1.12	IC	
BYC-8	C22A	629	629	50	1508.5	1508.0	0.0100	C	0.0120	3	4	ft.	8	RCBC	Wingwall	3.545	4.48	1.12	IC	
BYC-9	C22A	629	629	50	1512.5	1512.0	0.0100	C	0.0120	3	4	ft.	8	RCBC	Wingwall	3.545	4.48	1.12	IC	
BYC-10	C22A	629	629	50	1516.0	1515.6	0.0080	C	0.0120	3	4	ft.	8	RCBC	Wingwall	3.545	4.48	1.12	IC	
BYC-11	C22A	629	629	80	1529.0	1528.5	0.0063	C	0.0120	3	4	ft.	8	RCBC	Wingwall	3.627	4.49	1.12	IC	
BYC-12	C22A	629	629	80	1542.5	1542.0	0.0063	C	0.0120	3	4	ft.	8	RCBC	Wingwall	3.627	4.49	1.12	IC	
C4C-1	RCAP4A	273	273	80	1544.0	1543.3	0.0088	C	0.0120	1	4	ft.	10	RCBC	Wingwall	3.19	4.61	1.15	IC	
C4C-2	RCAP4A	273	273	70	1557.5	1557.0	0.0071	C	0.0120	2	4	ft.	10	RCBC	Wingwall	2.84	2.86	0.71	IC	Existing to remain
C4C-3	RCAP4A	273	273	40	1558.0	1557.8	0.0050	C	0.0120	2	4	ft.	10	RCBC	Wingwall	2.84	2.97	0.74	OC	Existing to remain





BROADWAY CHANNEL & CAP BASIN 4 OUTLET CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS (Since 1962)	PROJECT DESCRIPTION: AREA 3 BROADWAY CHAN.& CAP BASIN 4 CHAN.
	SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 6-16-98 / SCALE / SHEETS
		DES. PWH DATE: 6-11-98 / 1" = 400' HORIZONTAL
		CKD. FEB DATE: 6-17-98 / 1" = 20' VERTICAL / NO. 9 OF 43

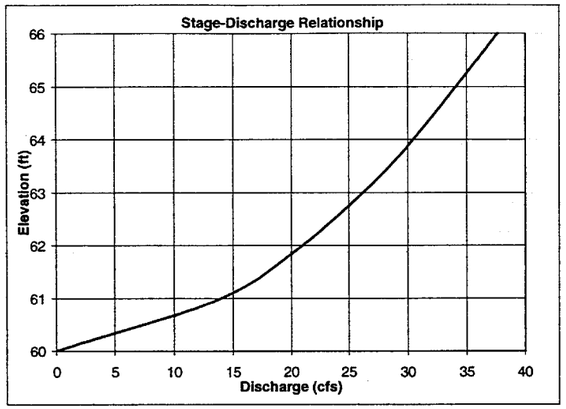
East Mesa Area Drainage Master Plan
AREA 3 - CAP BASINS 1 & 4

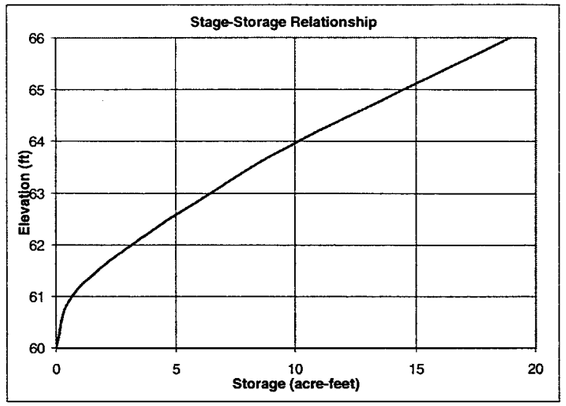
Detention Basin Properties

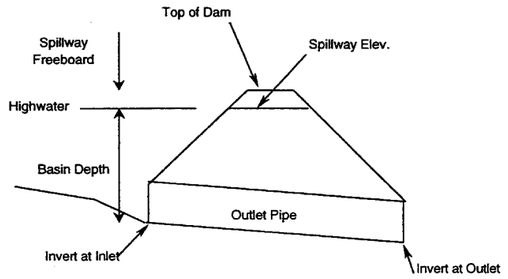
Basin No. 1

Basin Land Area	6.00 Acres	Length of Fencing =		2,180 ft
Basin Excavation Volume	14,555 C.Y.			
Q100 Inflow (HEC-1 I.D. CAP1) =	262 cfs	Outflow Pipe (no. & Dia.) =	1	24 in.
Q100 Outflow(HEC-1 I.D. BASIN1) =	29 cfs	Pipe Invert at Inlet=		59.2 ft
Emergency Spillway Flow =	262 cfs	Pipe Invert at Outlet=		58.4 ft
Emergency Spillway Width (3) =	50 ft	Pipe Length =		175 ft
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =		0.0046 ft/ft
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =		60.2 ft
Spillway Flow Depth =	1.6 ft	Orifice Coeff., C =		0.62
Highwater Elev. (Q100) =	64 ft	Inflow Spillway Width (3) =		70 ft
Maximum Ponding Depth	4.8 ft	Inflow Spillway Length (3) =		59 ft
		Spillway Elevation =		64 ft

Elev.	Area (ac.)	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe Flow (cfs)
60	0.00	0.00	0.00	0	0	0
61	1.94	0.65	0.65	14	0	14
62	3.10	2.50	3.14	21	0	21
63	3.49	3.29	6.44	26	0	26
64	3.94	3.71	10.15	30	0	30
66	4.85	8.77	18.92	38	354	391







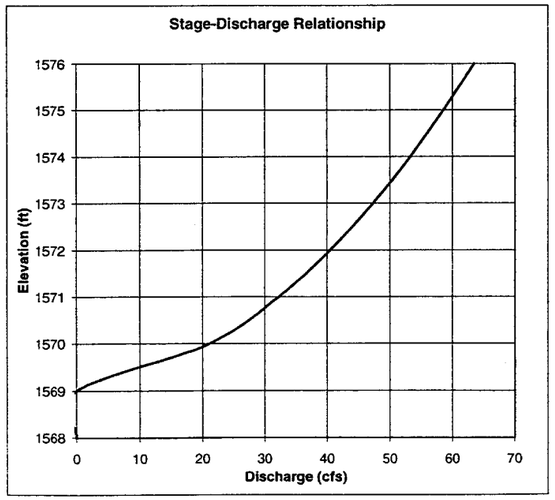
Typical Detention Basin Outlet

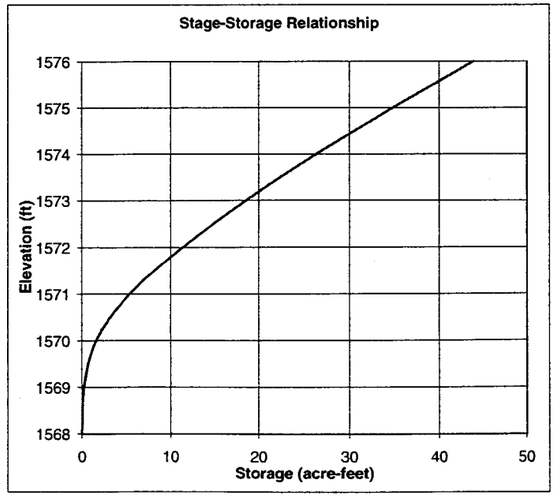
Basin No. 4

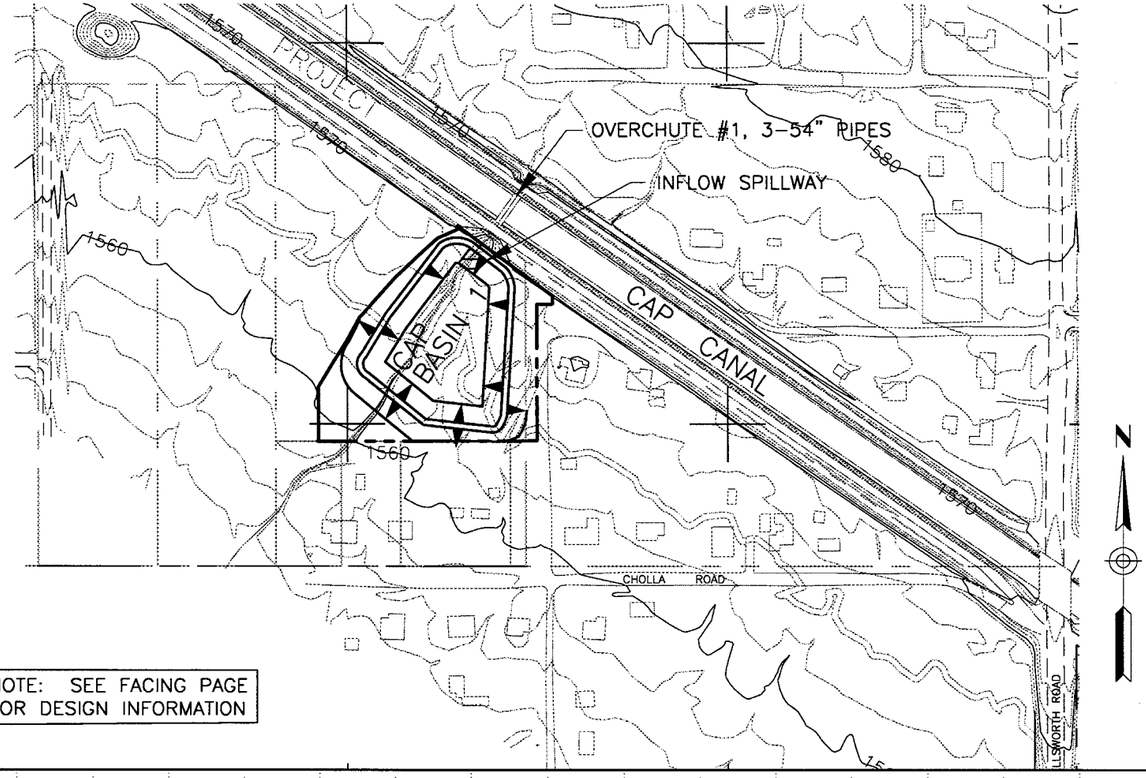
Basin Land Area	11.00 Acres	Length of Fencing =		3,050 ft
Basin Excavation Volume	93,259 C.Y.			
Q100 Inflow (HEC-1 I.D. D47) =	546 cfs	Outflow Pipe (no. & Dia.) =	1	30 in.
Q100 Outflow (HEC-1 I.D. BASIN4) =	54 cfs	Pipe Invert at Inlet=		1568.0 ft
Emergency Spillway Flow =	546 cfs	Pipe Invert at Outlet=		1567.5 ft
Emergency Spillway Width (3) =	120 ft	Pipe Length =		80 ft
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =		0.0063 ft/ft
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =		1569.25 ft
Spillway Flow Depth =	1.5 ft	Orifice Coeff., C =		0.62
Highwater Elev. (Q100) =	1574 ft	Inflow Spillway Width (3) =		150 ft
Maximum Ponding Depth	6.0 ft	Inflow Spillway Length (3) =		59 ft
		Spillway Elevation =		1574 ft

Elev.	Area (ac.)	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe Flow (cfs)
1568	0.00	0.00	0.00	0	0	0
1569	0.64	0.21	0.21	0	0	0
1570	2.30	1.38	1.60	21	0	21
1571	5.28	3.69	5.29	32	0	32
1572	6.88	6.06	11.35	41	0	41
1573	7.51	7.19	18.54	47	0	47
1574	8.14	7.82	26.36	53	0	53
1575	8.77	8.45	34.82	59	300	359
1576	9.41	9.09	43.91	63	849	912

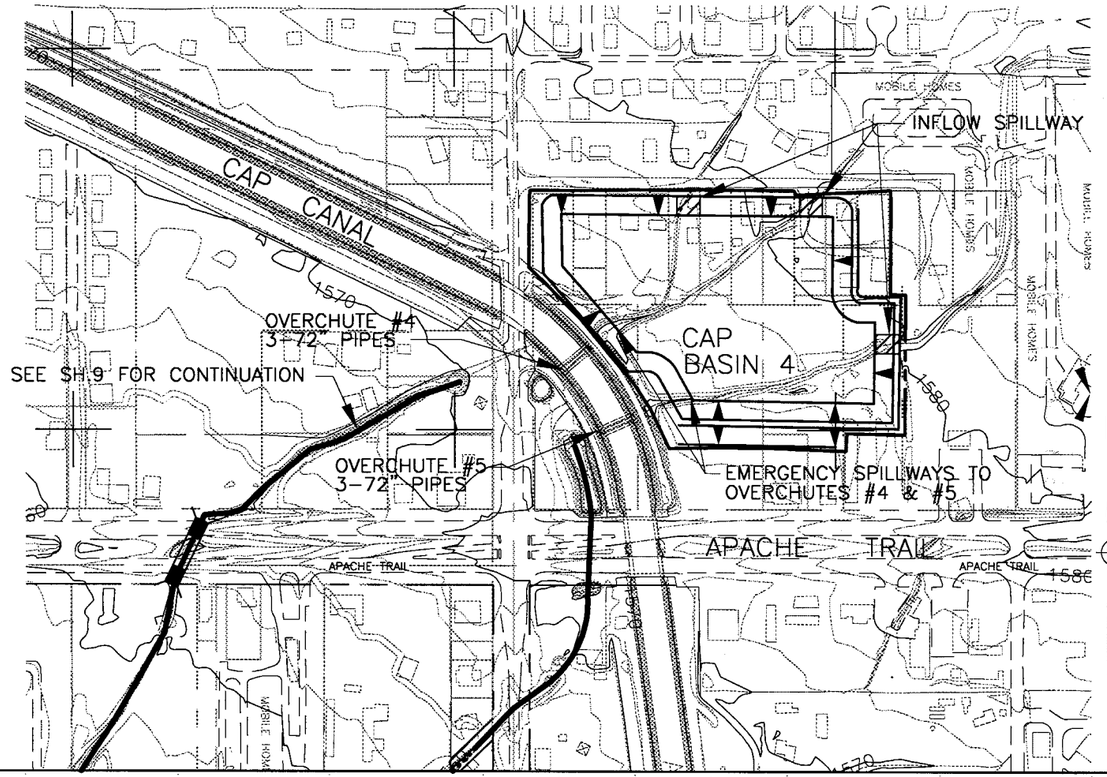
*Note: (1) Volume computations based upon Conic Method where Vol.(inc.) = h/3(A1+A2+(A1*A2)^0.5)*
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.

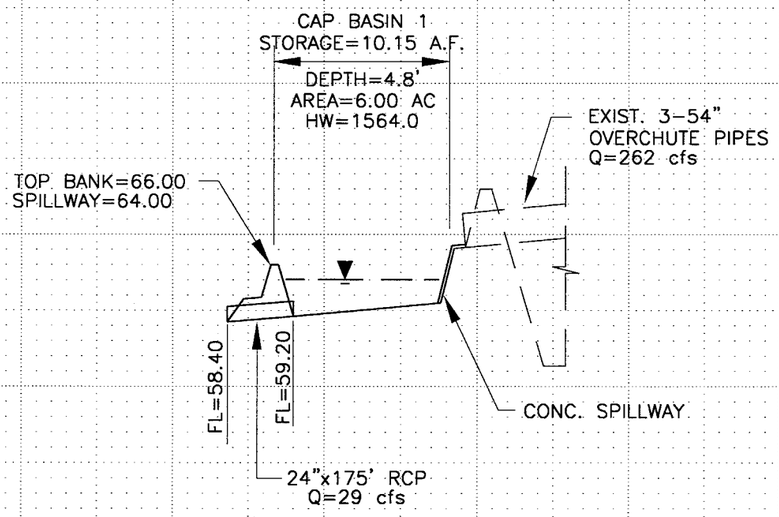




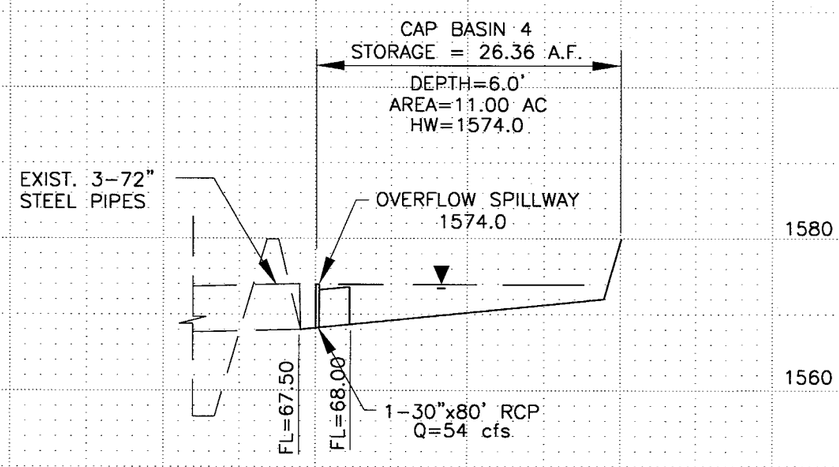


NOTE: SEE FACING PAGE FOR DESIGN INFORMATION





CAP BASIN 1



CAP BASIN 4

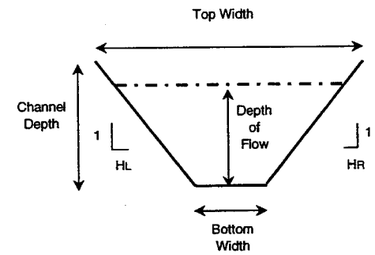
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN	
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962	PROJECT DESCRIPTION: CAP BASINS 1 & 4	
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-16-98	SCALE: 1" = 400' HORIZONTAL
		DES. PWH DATE: 6-11-98	1" = 20' VERTICAL
		CKD. FEB DATE: 6-17-98	SHEETS NO. 10 OF 43

East Mesa Area Drainage Master Plan
AREA 3 - PARKWOOD RANCH CHANNEL & BASIN

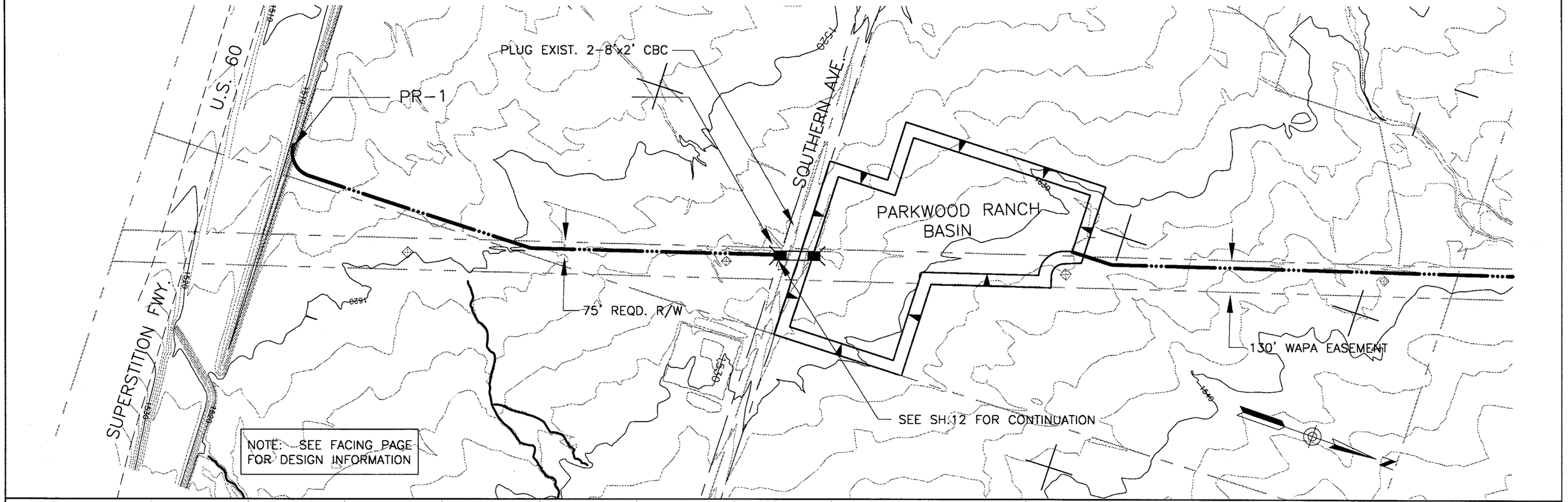
Channel Properties

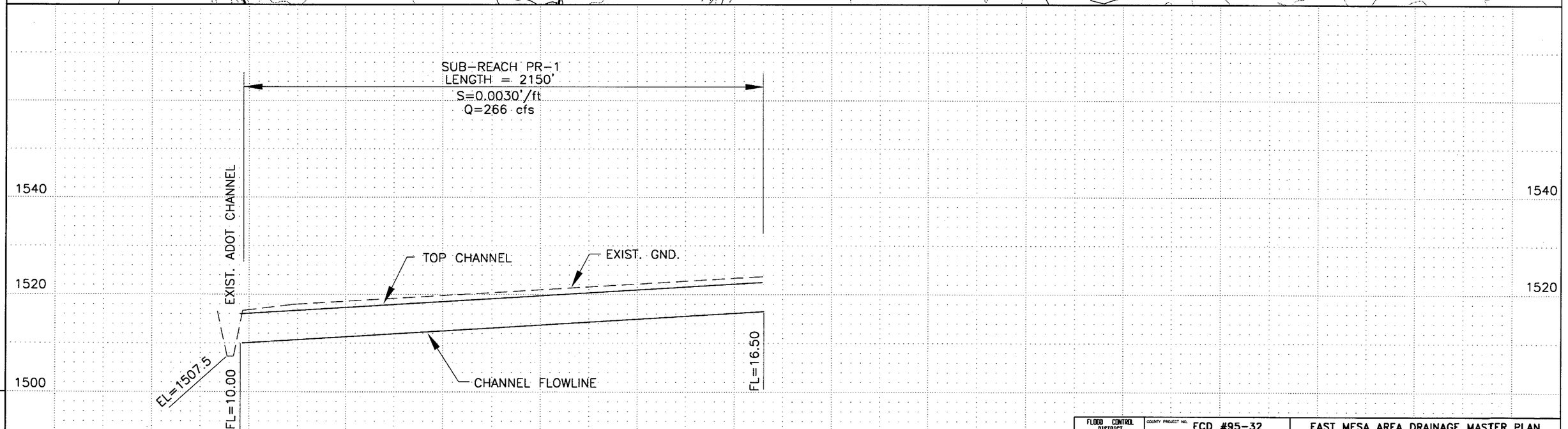
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PR-1	BASIN5	266	266	1510.0	1516.5	2150	0.0030	0.0030	0.0	0	0.0	E	0.0250	12.0	2.6	4	4	56.9	33.1	0.62	Sub	4.7	1.0	3.6	40.48

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





PARKWOOD RANCH CHANNEL & BASIN

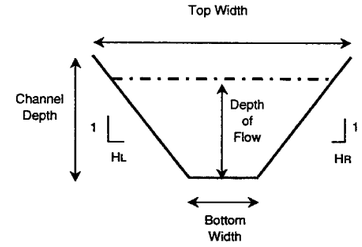
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962	PROJECT DESCRIPTION: AREA 3 PARKWOOD RANCH CHANNEL & BASIN
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-16-98 / DES. PWH DATE: 6-11-98 / CKD. FEB DATE: 6-17-98
		SCALE: 1" = 400' HORIZONTAL, 1" = 20' VERTICAL
		SHEETS: NO. 11 OF 43

East Mesa Area Drainage Master Plan
AREA 3 - PARKWOOD RANCH CHANNEL & BASIN

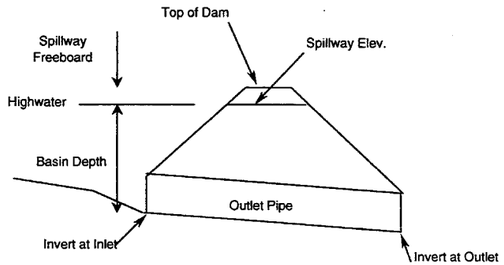
Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PR-2	C29C3	849	849	1526.0	1535.0	1800	0.0050	0.0050	0.0	0	0.0	G	0.0430	40.0	3.2	6	6	192.4	79.4	0.50	Sub	4.4	1.0	4.2	90.9
PR-3	C29C3	849	849	1535.0	1539.7	700	0.0067	0.0050	1.2	0	0.0	G	0.0430	40.0	3.2	6	6	192.4	79.4	0.50	Sub	4.4	1.0	4.2	90.9

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section



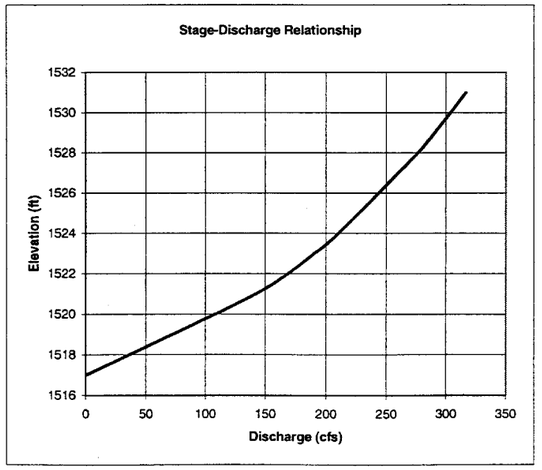
Typical Detention Basin Outlet

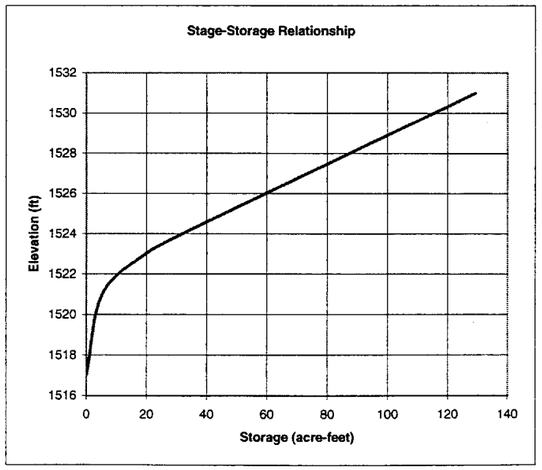
Detention Basin Properties

Parkwood Ranch Basin

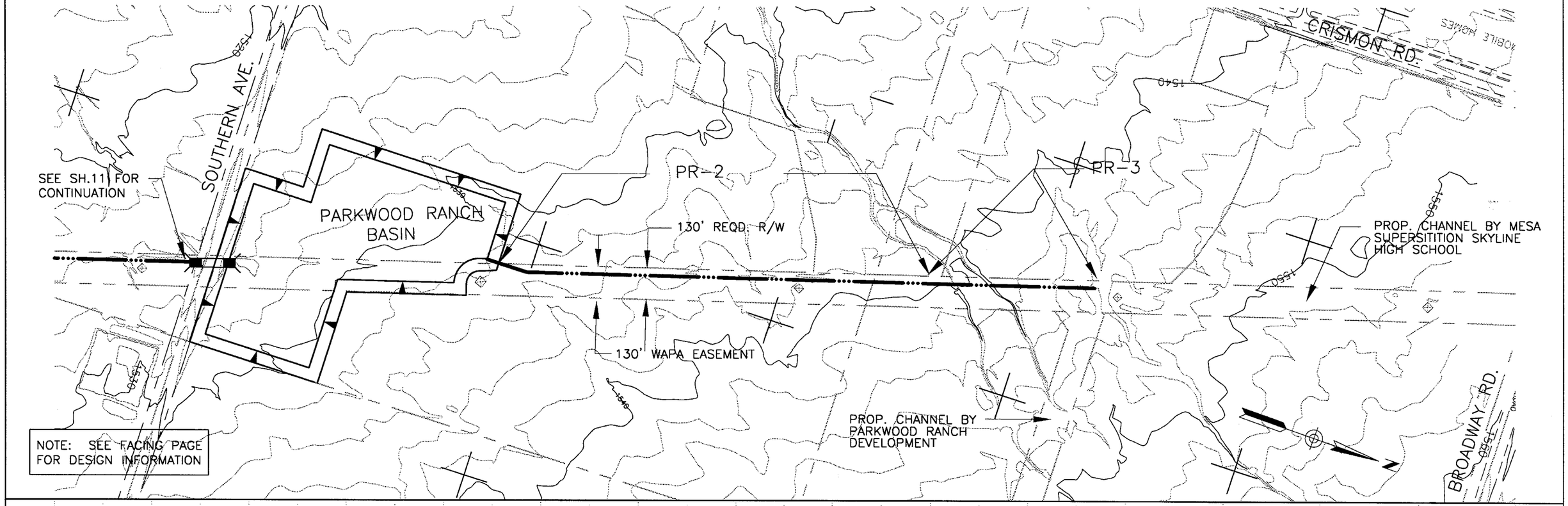
Basin Land Area	20 Acres	Length of Fencing =	4,350 ft
Basin Excavation Volume	160,000 C.Y.		
Q100 Inflow (HEC-1 I.D. C29C3) =	819 cfs	Outflow Pipe (1 - 6' x 3' CBC)	
Q100 Outflow (HEC-1 I.D. BASIN5) =	267 cfs	CBC Invert at Inlet=	1517.0 ft
Emergency Spillway Flow =	819 cfs	CBC Invert at Outlet=	1516.5 ft
Emergency Spillway Width (3) =	120 ft	CBC Length =	130 ft
Emergency Spillway Length (3) =	58.2 ft	CBC Slope =	0.0038 ft/ft
Spillway Coeff. =	2.5	CBC Centerline at Inlet =	1518.5 ft
Spillway Flow Depth =	2.0 ft	Orifice Coeff., C =	0.62
Highwater Elev. (Q100) =	1528 ft	Inflow Spillway Width (3) =	80 ft
Maximum Ponding Depth	11.0 ft	Inflow Spillway Length (3) =	20 ft
		Spillway Elevation =	1528 ft

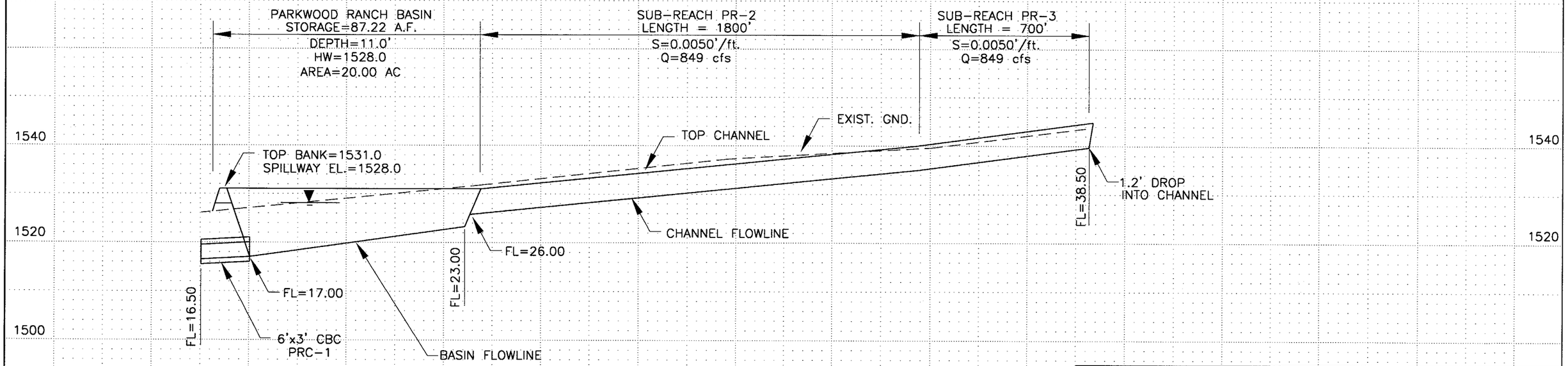
Elev.	Area (ac.)	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	CBC Outflow (cfs)	Spillway Flow (cfs)	Spillway & CBC (cfs)
1517	0.00	0.00	0.00	0	0	0
1521	3.90	5.20	5.20	142	0	142
1523	11.00	14.30	19.50	190	0	190
1524	13.70	12.33	31.83	210	0	210
1528	14.00	55.40	87.22	276	0	276
1529	14.00	14.00	101.22	290	300	590
1530	14.00	14.00	115.22	304	849	1152
1531	14.00	14.00	129.22	317	1559	1875





*Note: (1) Volume computations based upon Conic Method where Vol.(inc.) = h/3(A1+A2+(A1*A2)^0.5)*
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.





PARKWOOD RANCH CHANNEL & BASIN

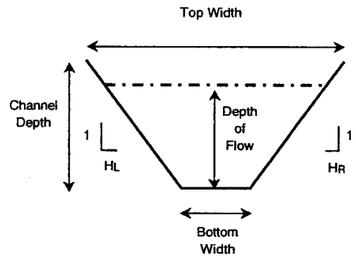
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1960	PROJECT DESCRIPTION: AREA 3 PARKWOOD RANCH CHANNEL & BASIN
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-16-98 / DES. PWH DATE: 6-11-98 / CKD. FEB DATE: 6-17-98
		SCALE: 1" = 400' HORIZONTAL, 1" = 20' VERTICAL
		SHEETS NO. 12 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - ELLIOT CHANNEL

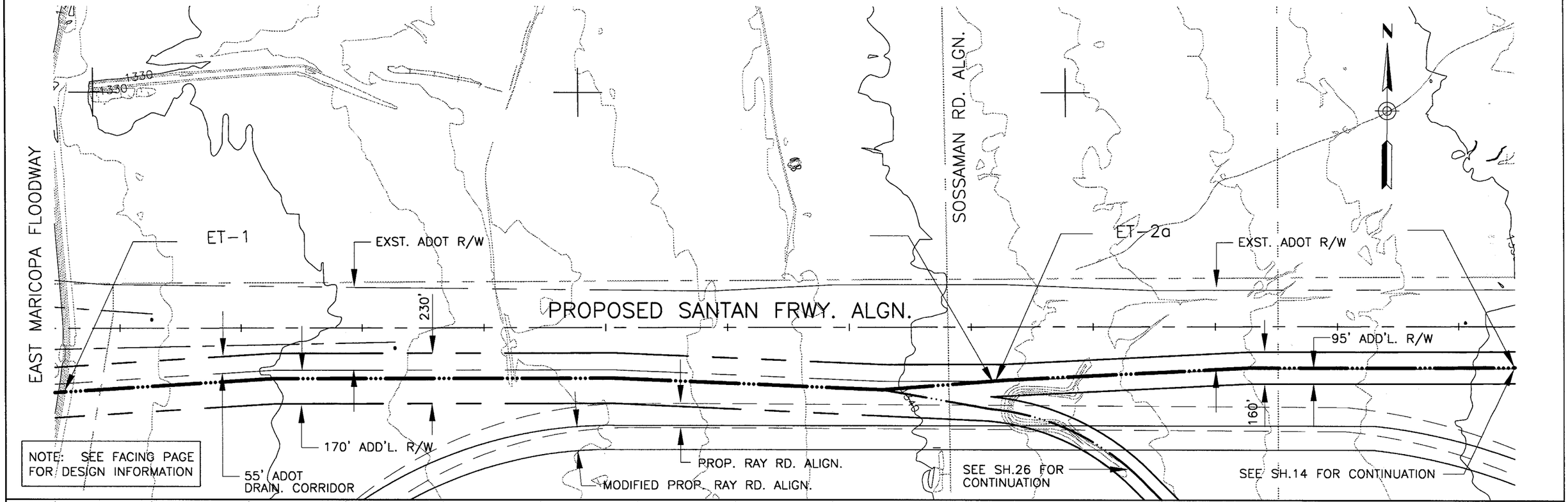
Channel Properties

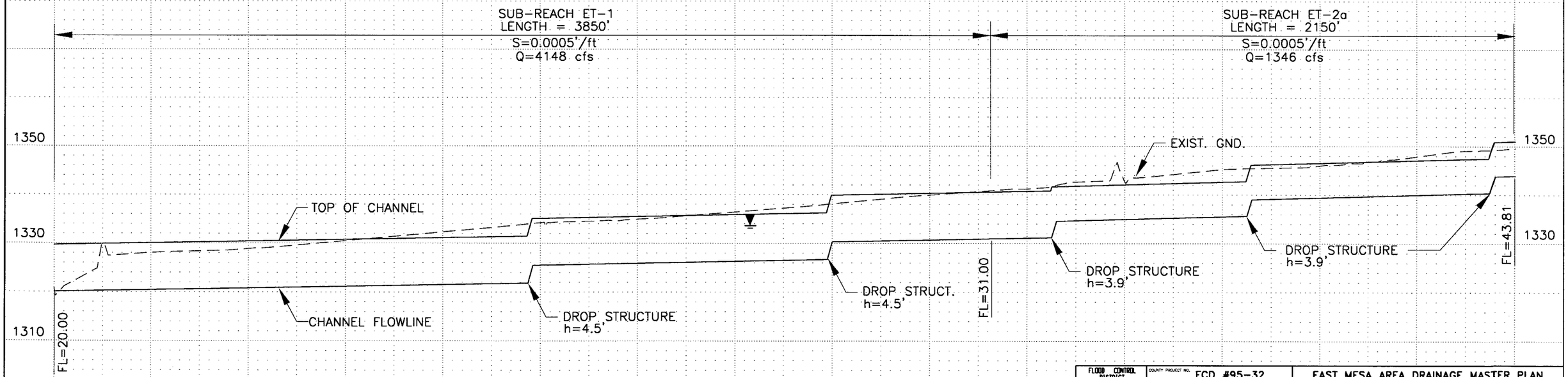
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
ET-1	CPSAN	4148	4148	1320.0	1331.0	3850	0.0029	0.0005	9.1	2	5	m	0.0250	80.0	7.8	6	6	984.9	174.6	0.31	Sub	4.2	2.0	9.8	197.5
ET-2a	C76A	1346	1346	1331.0	1343.8	2150	0.0060	0.0005	11.7	3	4	E	0.0250	32.0	6.0	6	6	409.2	105.1	0.29	Sub	3.3	1.5	7.6	122.7

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





ELLIOT CHANNEL

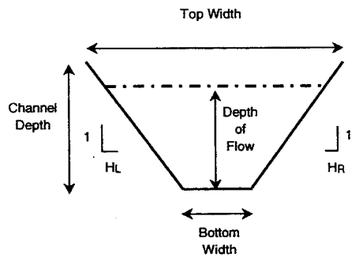
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 2 ELLIOT CHANNEL
	SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 6-13-98 / DES. FEB DATE: 6-10-98 / CKD. DCF DATE: 6-11-98
		SCALE: 1" = 400' HORIZONTAL, 1" = 20' VERTICAL
		SHEETS: NO. 13 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - ELLIOT CHANNEL

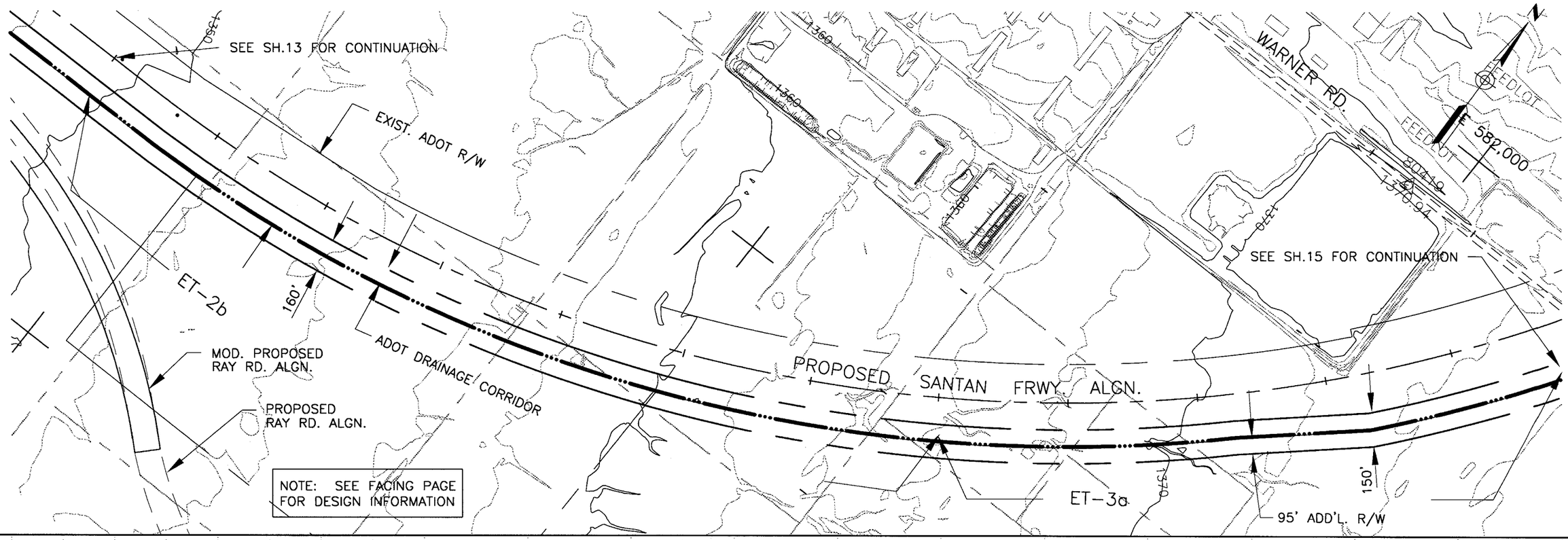
Channel Properties

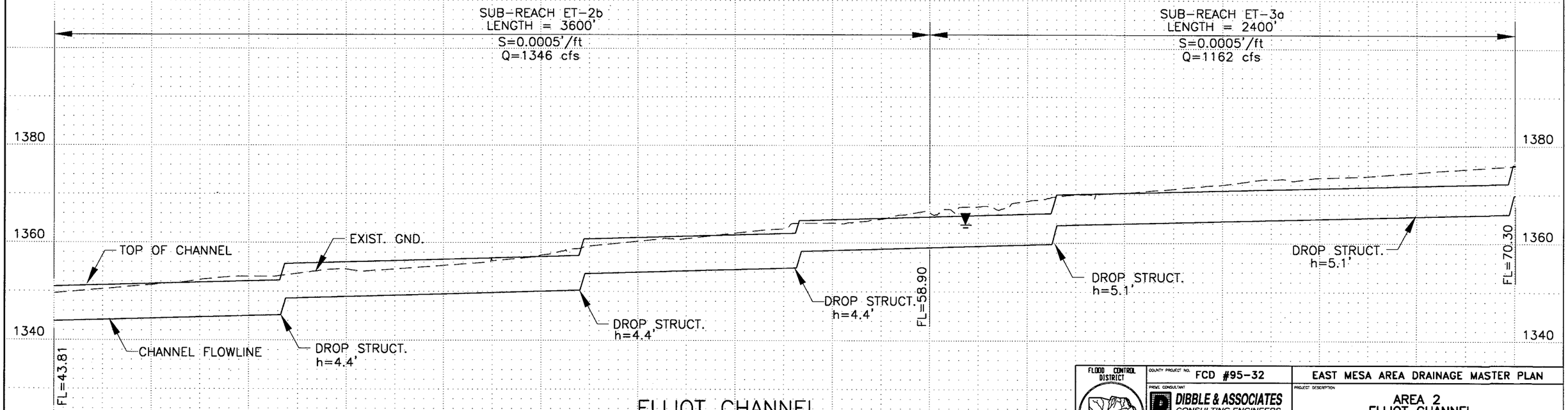
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
ET-2b	C76A	1346	1346	1343.8	1358.9	3600	0.0042	0.0005	13.3	3	4.4	E	0.0250	32.0	6.0	6	6	409.2	105.1	0.29	Sub	3.3	1.5	7.6	122.7
ET-3a	C70A2	1162	1162	1358.9	1370.3	2400	0.0047	0.0005	10.2	2	5.1	E	0.0250	32.0	5.6	6	6	367.6	100.2	0.29	Sub	3.2	1.4	7.0	116.5

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





ELLIOT CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

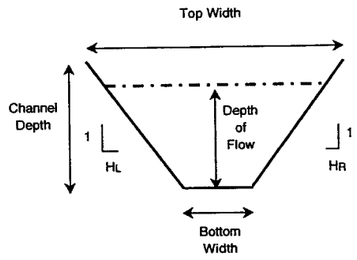
COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN	
PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 2 ELLIOT CHANNEL	
SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-13-98	SCALE
	DES. FEB DATE: 6-10-98	1"=400' HORIZONTAL
	CKD. DCF DATE: 6-11-98	1"=20' VERTICAL
		SHEETS NO. 14 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - ELLIOT CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
ET-3b	C70A2	1162	1162	1370.3	1377.7	2100	0.0035	0.0005	6.4	2	3.2	E	0.0250	32.0	5.6	6	6	367.6	100.2	0.29	Sub	3.2	1.4	7.0	116.5
ET-4	C66D	1074	1074	1377.7	1393.5	2770	0.0057	0.0005	14.4	3	4.8	E	0.0250	32.0	5.4	6	6	347.0	97.6	0.29	Sub	3.1	1.4	6.8	113.3
ET-5a	C66D	1074	1074	1395.8	1397.5	930	0.0018	0.0005	1.2	0	0.0	E	0.0250	32.0	5.4	6	6	347.0	97.6	0.29	Sub	3.1	1.4	6.8	113.3

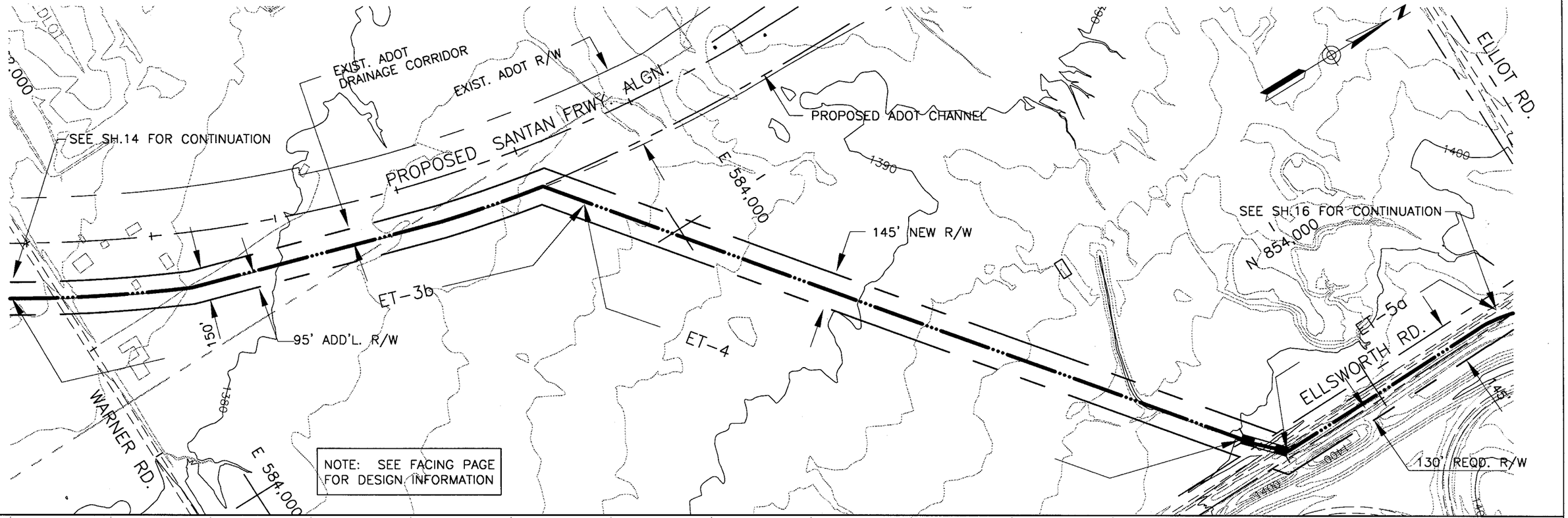
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

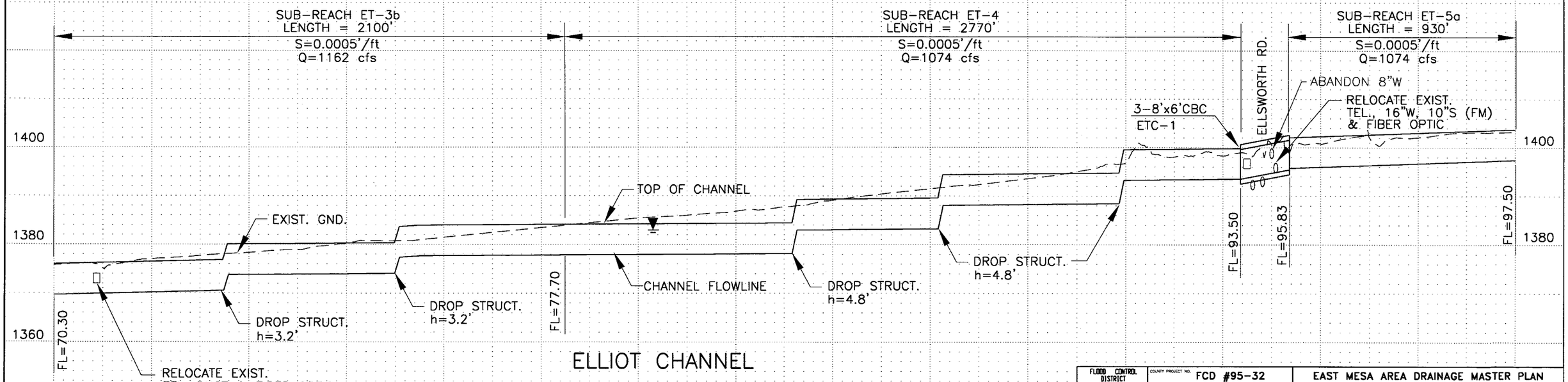


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
ETC-1	C66D	1074	1074	200	1395.8	1393.5	0.0116	C	0.0120	3	6	ft.	8	RCBC	Wingwall	5.392	6.38	1.06	IC





ELLIOT CHANNEL

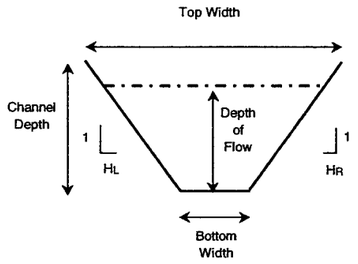
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN	
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS SINCE 1962	PROJECT DESCRIPTION: AREA 2 ELLIOT CHANNEL	
	SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 6-13-98	SCALE: 1" = 400' HORIZONTAL; 1" = 20' VERTICAL
		DES. FEB DATE: 6-10-98	
		CKD. DCF DATE: 6-11-98	SHEETS NO. 15 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - ELLIOT CHANNEL

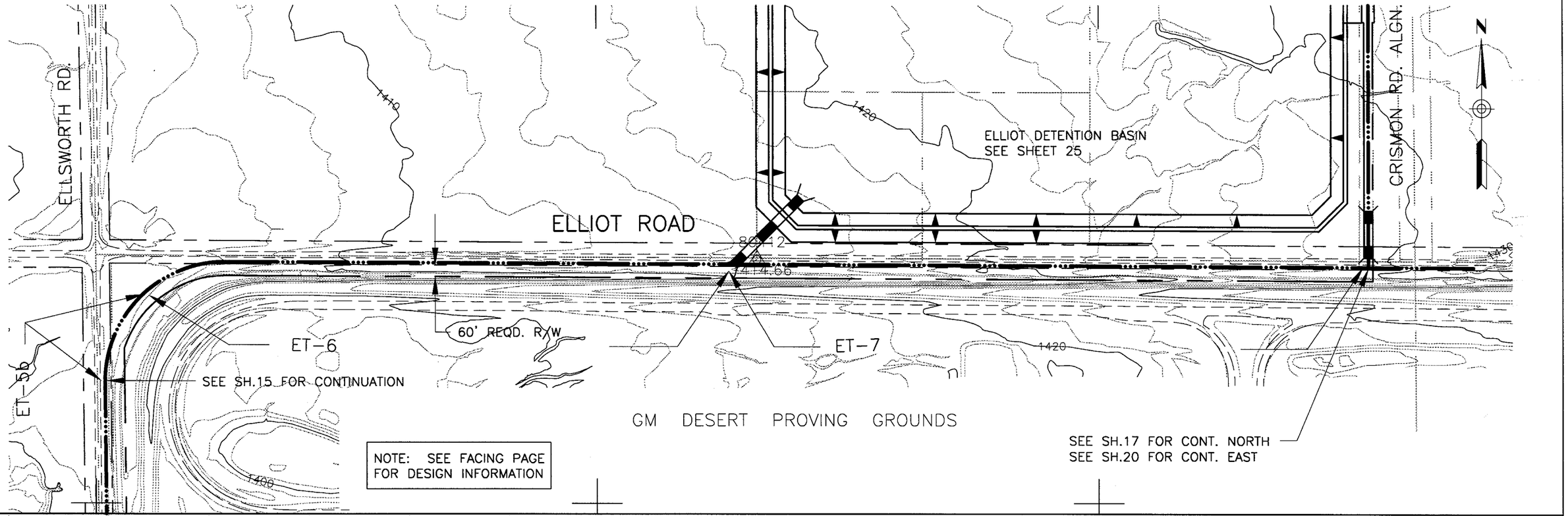
Channel Properties

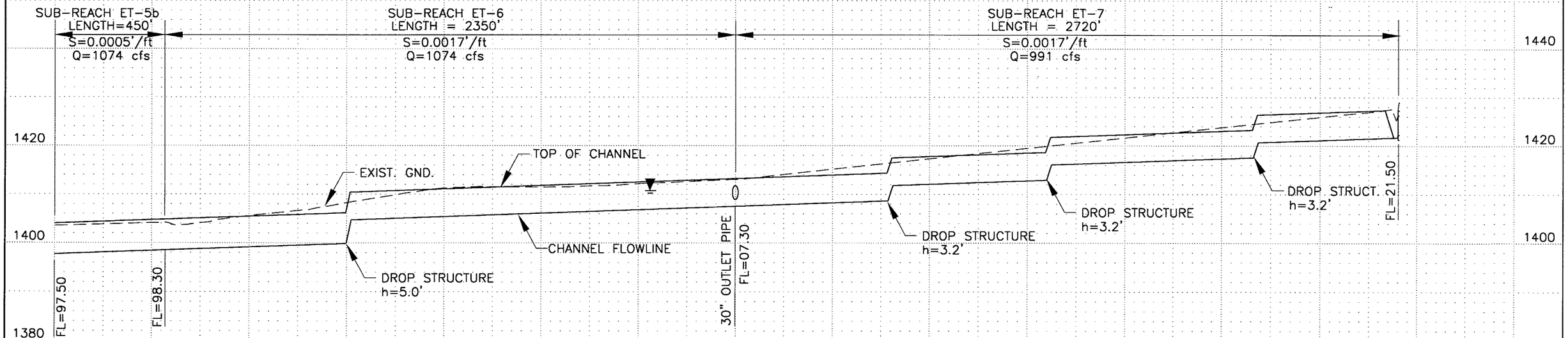
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
ET-5b	C66D	1074	1074	1397.5	1398.3	450	0.0018	0.0005	0.6	0	0.0	m	0.0250	32.0	5.4	6	6	347.0	97.6	0.29	Sub	3.1	1.4	6.8	113.3
ET-6	C66D	1074	1074	1398.3	1407.3	2350	0.0038	0.0017	5.0	1	5.0	C	0.0150	18.0	4.5	2	2	121.4	38.1	0.85	Sub	8.8	1.4	5.9	41.7
ET-7	CP66	991	991	1407.3	1421.5	2720	0.0052	0.0017	9.6	3	3.2	C	0.0150	16.0	4.5	2	2	113.4	36.2	0.84	Sub	8.7	1.4	6.0	39.8

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





ELLIOT CHANNEL

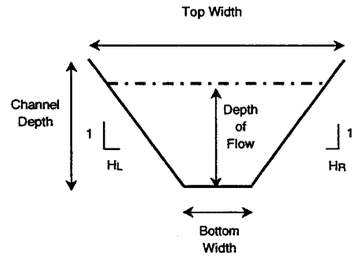
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 2 ELLIOT CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-13-98 / DES. FEB DATE: 6-10-98 / CKD. DCF DATE: 6-11-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS: NO. 16 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - CRISMON CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
CN-1	DI66	207	207	1422.5	1425.3	880	0.0032	0.0021	1.0	0	0.0	C	0.0150	4.0	3.1	2	2	31.3	17.8	0.84	Sub	6.6	1.0	4.1	20.3
CN-2	CP66C2	712	712	1425.3	1431.7	1860	0.0034	0.0018	3.1	1	3.1	C	0.0150	13.0	4.1	2	2	86.1	31.2	0.85	Sub	8.3	1.3	5.4	34.4
CN-3	C67D	671	671	1432.7	1444.0	2340	0.0048	0.0018	7.1	2	3.5	C	0.0150	13.0	4.0	2	2	82.6	30.7	0.85	Sub	8.1	1.2	5.2	33.8

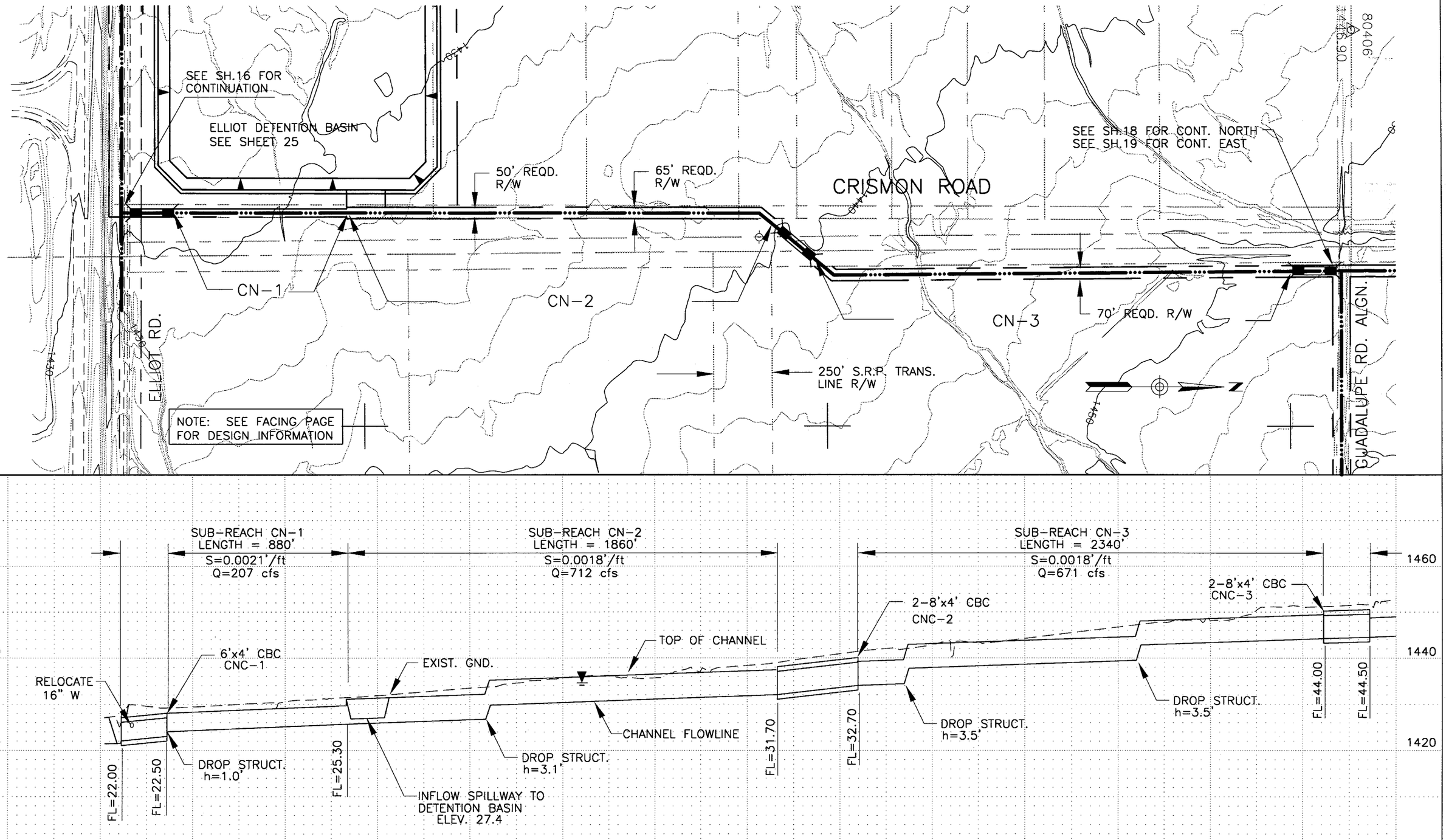
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
CNC-1	DI66	207	207	100	1422.5	1422.0	0.0050	C	0.0120	1	4	ft.	6	RCBC	Wingwall	4.5	6.08	1.52	IC
CNC-2	C67D	671	671	140	1432.7	1431.7	0.0071	C	0.0120	2	4	ft.	8	RCBC	Wingwall	4.1	7.44	1.86	IC
CNC-3	C67D	671	671	80	1444.5	1444.0	0.0063	C	0.0120	2	4	ft.	8	RCBC	Wingwall	4.0	7.45	1.86	IC



CRISMON CHANNEL

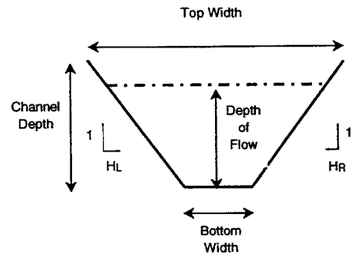
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 1 CRISMON CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-13-98 · SCALE · SHEETS
		DES. FEB DATE: 6-10-98 · 1"=400' HORIZONTAL
		CKD. DCF DATE: 6-11-98 · 1"=20' VERTICAL · NO. 17 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - CRISMON CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
CN-4	C67B	424	424	1444.5	1461.4	2580	0.0066	0.0019	12.0	4	3.0	C	0.0150	12.0	3.2	2	2	57.8	26.1	0.84	Sub	7.3	1.0	4.2	28.6
CN-5	C67B	424	424	1461.9	1474.8	2520	0.0051	0.0019	8.1	2	4.1	C	0.0150	12.0	3.2	2	2	57.8	26.1	0.84	Sub	7.3	1.0	4.2	28.6

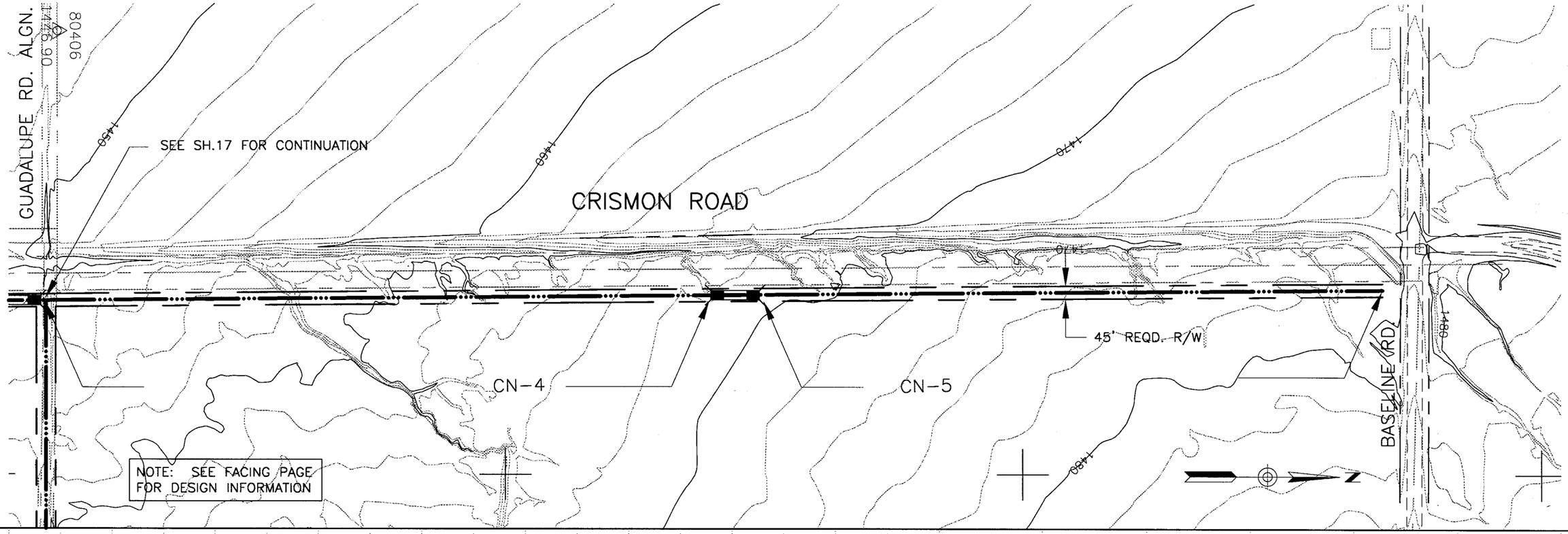
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
CNC-4	C67B	424	424	80	1461.9	1461.4	0.0063	C	0.0120	2	4	ft.	6	RCBC	Wingwall	3.155	6.22	1.55	IC



CRISMON CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

EAST MESA AREA DRAINAGE MASTER PLAN

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS (Since 1960)

PROJECT DESCRIPTION: AREA 2 CRISMON CHANNEL

SUB CONSULTANT: Hoskin Engineering Consultants

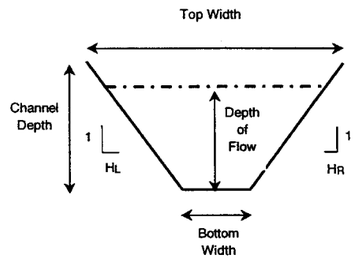
DRN. JEV DATE: 6-13-98	SCALE		SHEETS
DES. FEB DATE: 6-10-98	1"=400'	HORIZONTAL	
CKD. DCF DATE: 6-11-98	1"=20'	VERTICAL	NO. 18 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - CRISMON LATERAL

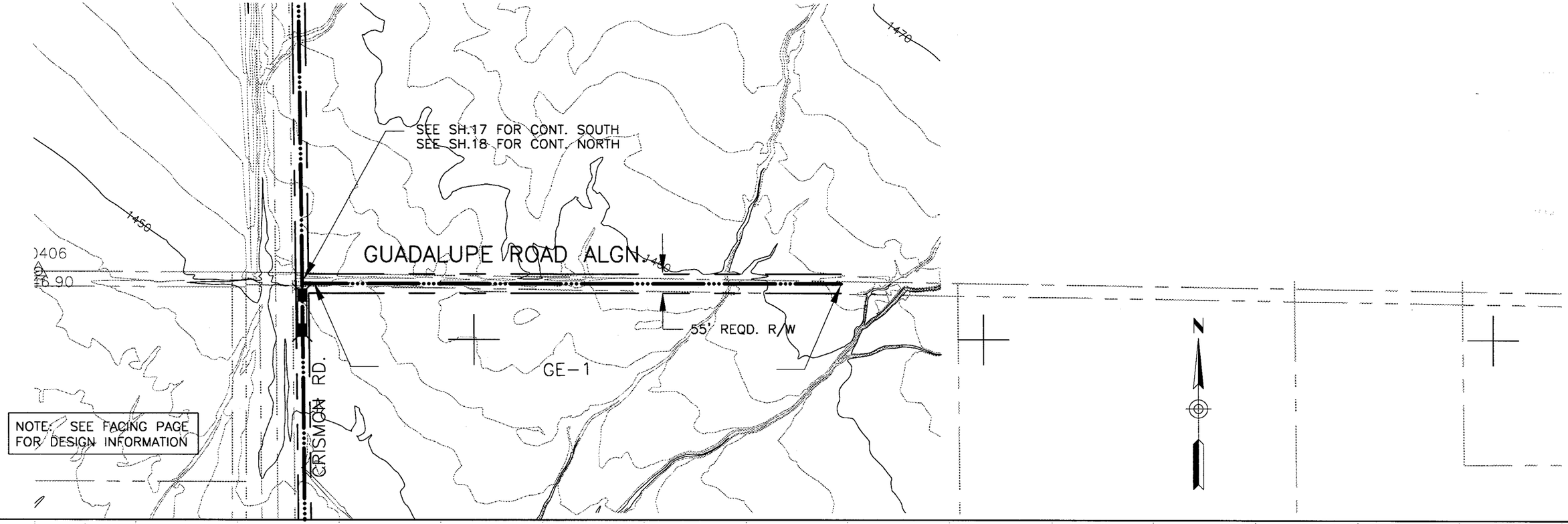
Channel Properties

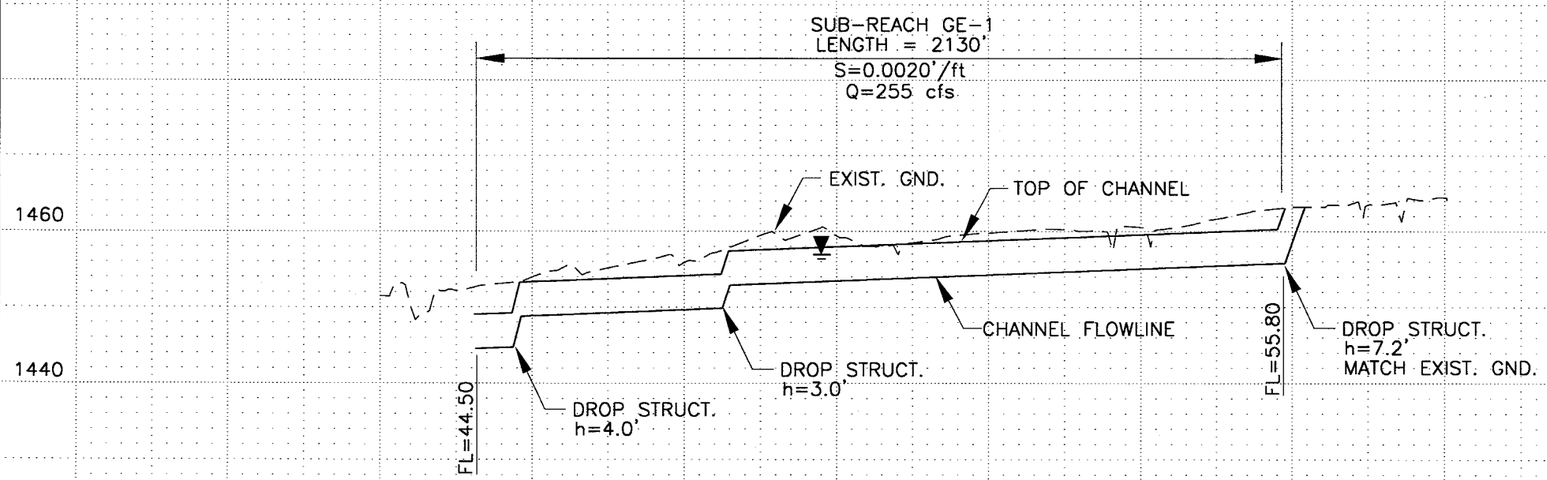
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
GE-1	C67A	255	255	1444.5	1463.0	2130	0.0087	0.0020	14.2	3	4.7	C	0.0150	4.0	3.4	2	2	37.2	19.3	0.83	Sub	6.9	1.0	4.5	21.9

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





CRISMON LATERAL

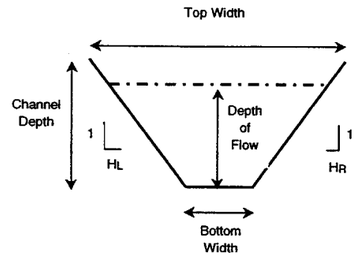
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962	PROJECT DESCRIPTION: AREA 2 CRISMON LATERAL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-13-98 / DES. FEB DATE: 6-10-98 / CKD. DCF DATE: 6-11-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS NO. 19 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - ELLIOT CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
ET-8	CP65	851	851	1421.5	1426.2	940	0.0050	0.0018	3.1	1	3.1	C	0.0150	12.0	4.6	2	2	98.5	32.7	0.85	Sub	8.6	1.4	6.1	36.3
ET-9	C65A2	509	509	1426.2	1439.4	2200	0.0060	0.0019	9.1	3	3.0	C	0.0150	10.0	3.7	2	2	65.5	26.7	0.85	Sub	7.8	1.2	4.9	29.7
ET-10	C65A2	509	509	1440.8	1461.0	2720	0.0074	0.0005	18.8	5	3.8	E	0.0250	22.0	4.2	6	6	197.2	72.9	0.28	Sub	2.6	1.1	5.3	85.1

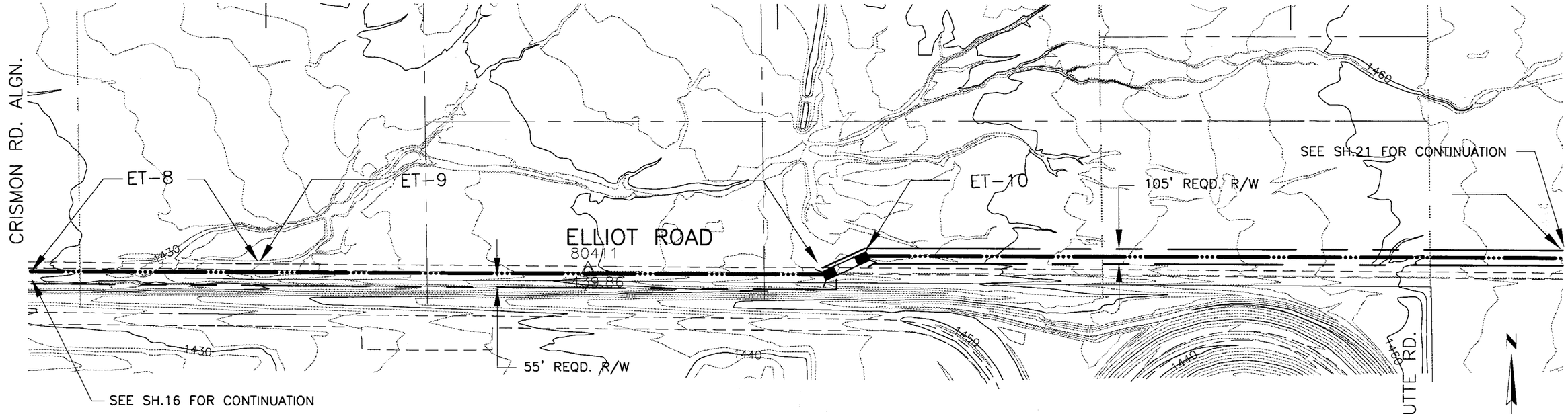
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



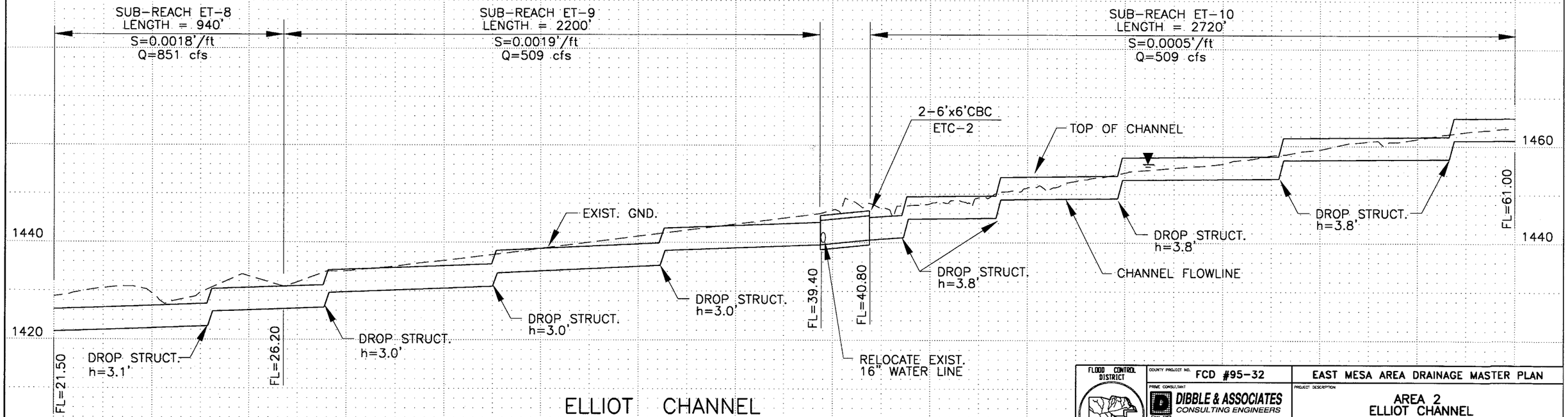
Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
ETC-2	C65A2	509	509	140	1440.8	1439.4	0.0100	C	0.0120	2	6	ft.	6	RCBC	Wingwall	3.743	6.15	1.03	IC



NOTE: SEE FACING PAGE FOR DESIGN INFORMATION



ELLIOT CHANNEL

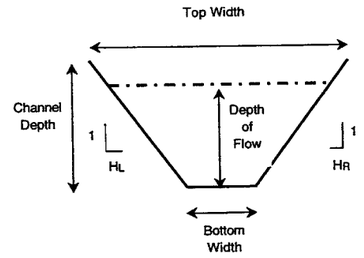
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION AREA 2 ELLIOT CHANNEL
	SUB CONSULTANT Hoskin Engineering Consultants	DRN. JEV DATE: 6-13-98 / SCALE / SHEETS
		DES. FEB DATE: 6-10-98 / 1"=400' HORIZONTAL
		CKD. DCF DATE: 6-11-98 / 1"=20' VERTICAL / NO. 20 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - ELLIOT CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
ET-11	C65A2	509	509	1461.0	1468.0	2110	0.0033	0.0005	5.9	1	5.9	E	0.0250	22.0	4.2	6	6	197.2	72.9	0.28	Sub	2.6	1.1	5.3	85.1
ET-12	C65A2	509	509	1469.8	1485.8	2490	0.0064	0.0005	14.8	3	4.9	E	0.0250	22.0	4.2	6	6	197.2	72.9	0.28	Sub	2.6	1.1	5.3	85.1

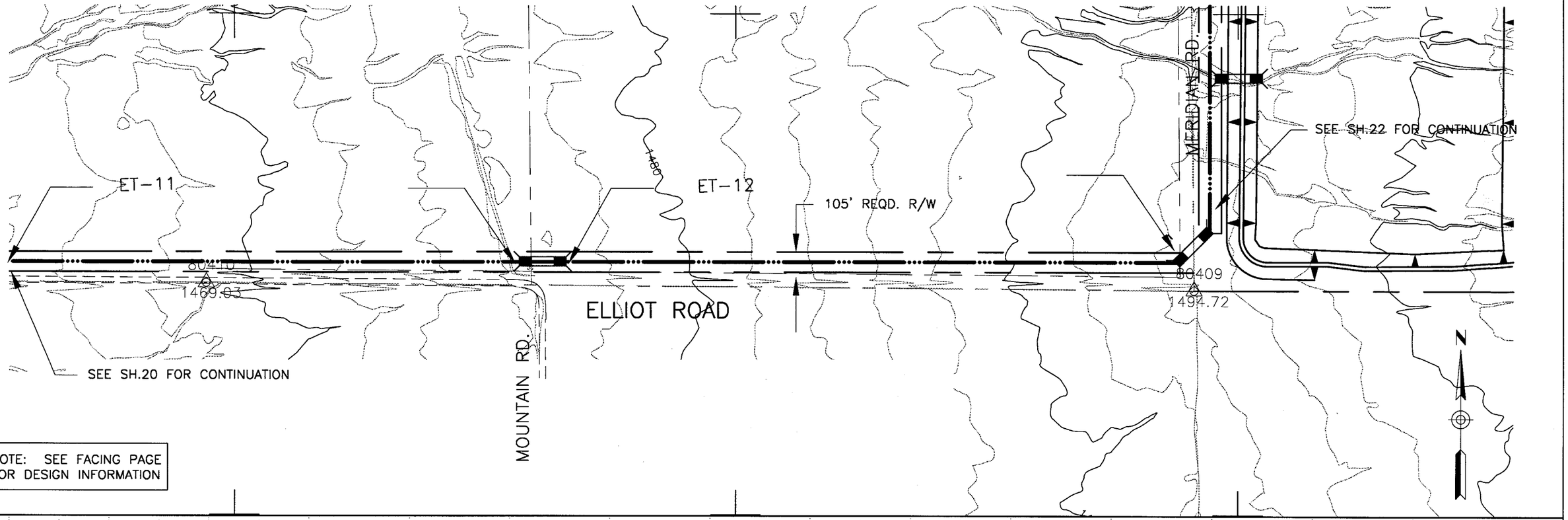
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



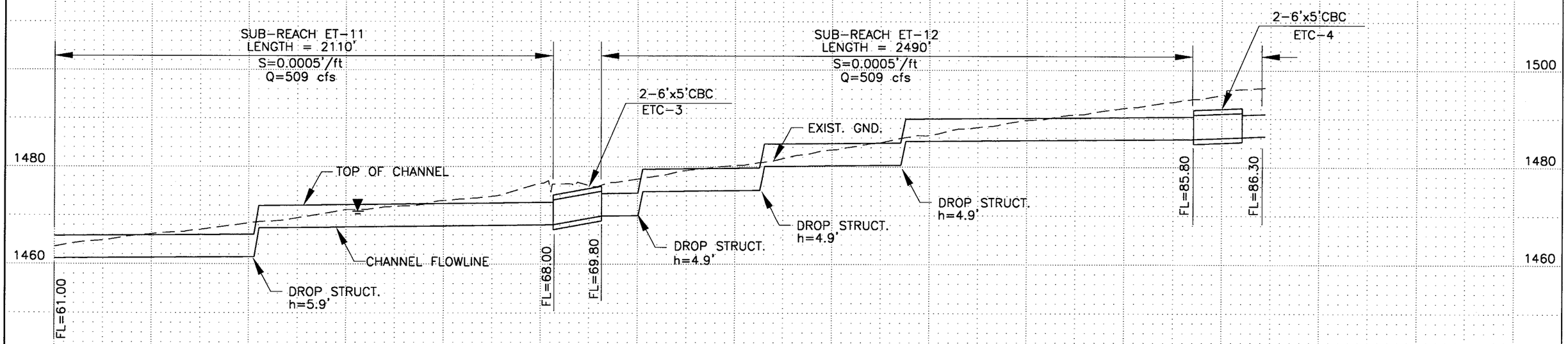
Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
ETC-3	C65A2	509	509	80	1469.8	1468.0	0.0225	C	0.0120	2	5	ft.	6	RCBC	Wingwall	4.185	6.71	1.34	IC
ETC-4	C65A2	509	509	280	1486.3	1485.8	0.0020	C	0.0120	2	5	ft.	6	RCBC	Wingwall	4.185	6.81	1.36	IC



NOTE: SEE FACING PAGE FOR DESIGN INFORMATION



ELLIOT CHANNEL

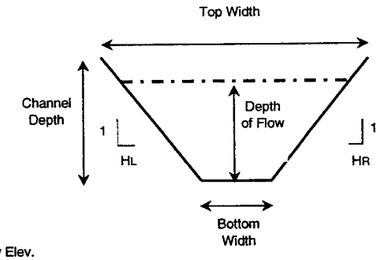
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 2 ELLIOT CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-13-98 / DES. FEB DATE: 6-10-98 / CKD. DCF DATE: 6-11-98
		SCALE: 1"=400' HORIZONTAL / 1"=20' VERTICAL
		SHEETS NO. 21 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - SUNLAND SPRINGS CHANNEL & SIPHON DRAW DETENTION BASIN

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
MN-1	C65A2	509	509	1486.3	1487.2	630	0.0014	0.0014	0.0	0	0.0	C	0.0150	12.0	3.8	2	2	73.5	28.8	0.74	Sub	6.9	1.1	4.9	31.6
MN-2	DIDB65	434	434	1487.2	1491.7	900	0.0050	0.0019	3.2	1	3.2	C	0.0150	10.0	3.4	2	2	57.9	25.4	0.84	Sub	7.5	1.1	4.5	28.0
MN-3a	C65A1	2618	2618	1491.7	1493.9	1200	0.0015	0.0015	0.0	0	0.0	C	0.0150	22.0	6.9	2	2	244.9	52.7	0.85	Sub	10.7	2.2	9.0	58.1

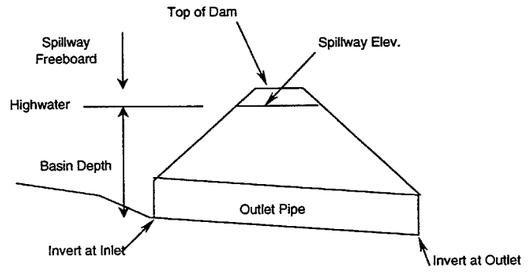
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Proiect)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
SDC-1		85	85	200	1490.0	1489.0	0.0050	C	0.01200	1	36	in.		RCP	Headwall	1.0	6.43	2.14	IC



Typical Detention Basin Outlet

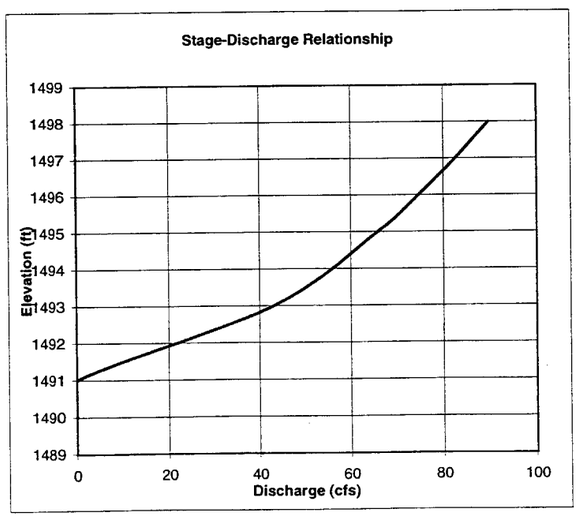
Detention Basin Properties

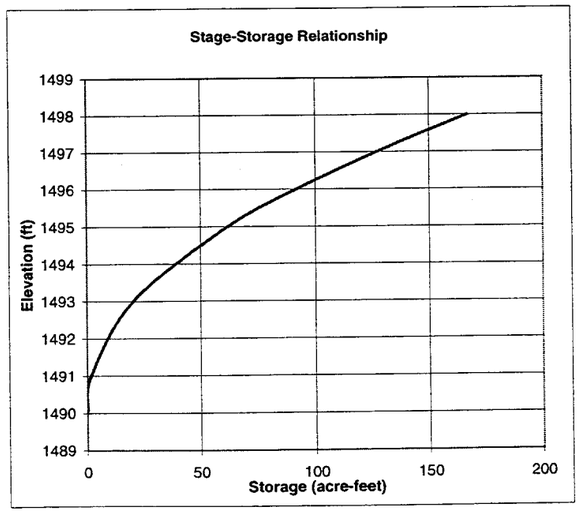
Siphon Draw Basin

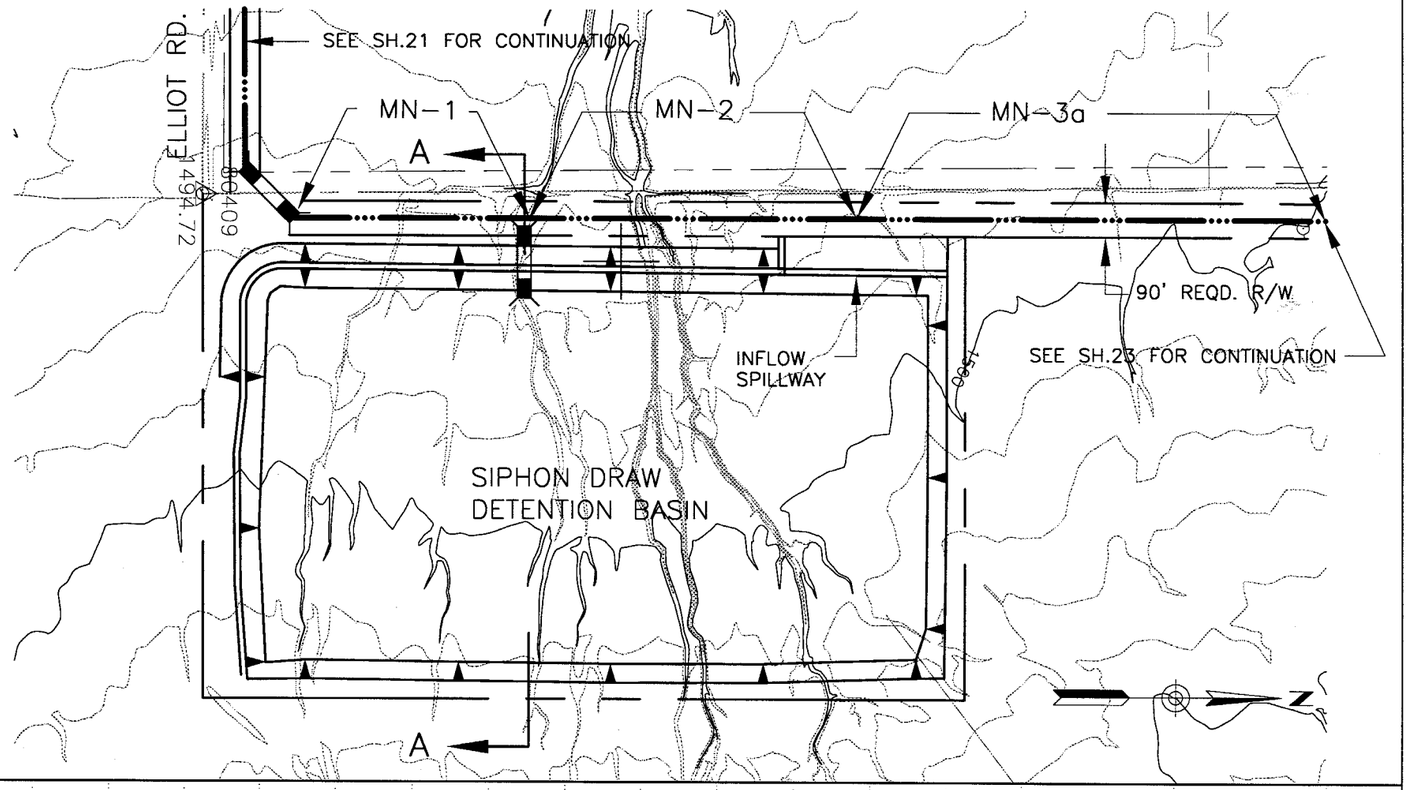
Basin Land Area	55.0 Acres	Length of Fencing =	5,000 ft
Basin Excavation Volume	378,700 C.Y.		
Q100 Inflow (HEC-1 I.D. DIB65P) =	1,665 cfs	Outflow Pipe (no. & Dia.) =	1 36 in.
Q100 Outflow(HEC-1 I.D. DB65A) =	77 cfs	Pipe Invert at Inlet=	1490.0 ft
Emergency Spillway Flow =	1,665 cfs	Pipe Invert at Outlet=	1489.0 ft
Emergency Spillway Width (3) =	235 ft	Pipe Length =	200 ft
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =	0.0050 ft/ft
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =	1491.5 ft
Spillway Flow Depth =	2.0 ft	Orifice Coeff., C =	0.62
Highwater Elev. (Q100) =	1496 ft	Inflow Spillway Width (3) =	665 ft
Maximum Ponding Depth	6.0 ft	Inflow Spillway Length (3) =	24 ft
		Spillway Elevation =	1496 ft

Elev.	Area (ac.)	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe Flow (cfs)
1490		0.00	0.00	0	0	0
1491		1.56	1.56	0	0	0
1493		18.74	20.29	43	0	43
1495		41.58	61.87	66	0	66
1496		29.77	91.64	75	0	75
1497		35.16	126.80	82	587.5	670
1498		39.98	166.78	90	1661.7	1751

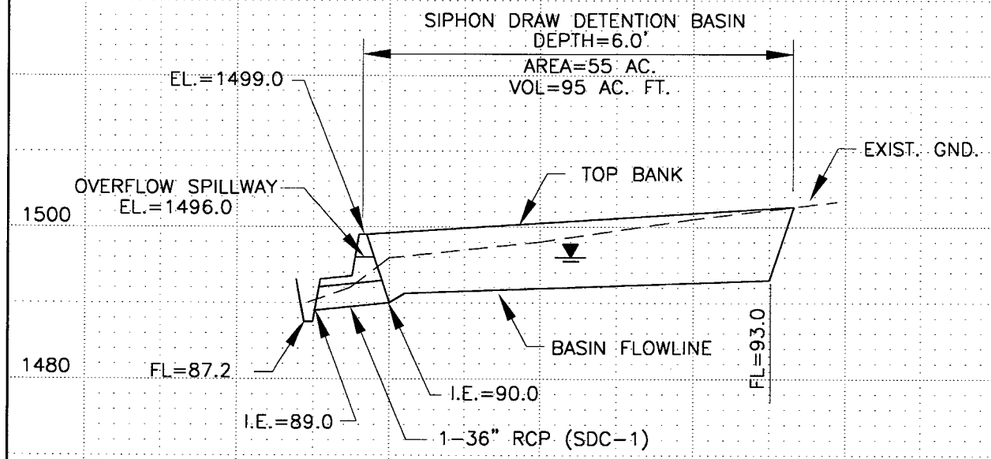
Note: (1) Volume computations based upon results obtained from surface modeling software.
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.



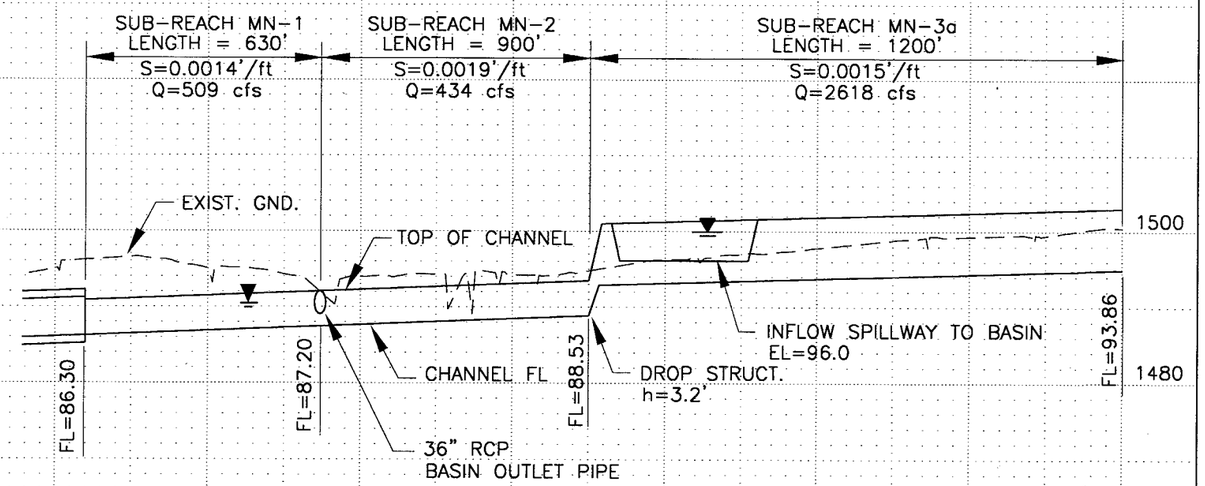




NOTE: SEE FACING PAGE FOR DESIGN INFORMATION



SIPHON DRAW DETENTION BASIN
SECTION A-A



SUNLAND SPRINGS CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 2 SUNLAND SPRINGS CHANNEL

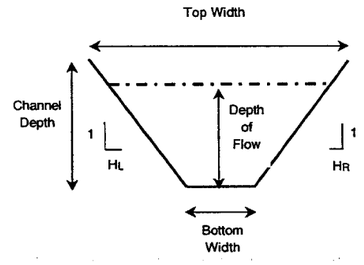
DRN. JEV DATE: 6-13-98	SCALE	SHEETS
DES. FEB DATE: 6-10-98	1"=400' HORIZONTAL	
CKD. DCF DATE: 6-11-98	1"=20' VERTICAL	NO. 22 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - SUNLAND SPRINGS CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
MN-3b	C65A1	2618	2618	1493.9	1494.8	600	0.0015	0.0015	0.0	0	0.0	C	0.0150	22.0	6.9	2	2	244.9	52.7	0.85	Sub	10.7	2.2	9.0	58.1
MN-4	INTERP	2000	2000	1494.8	1503.4	1760	0.0049	0.0015	6.0	2	3.0	C	0.0150	20.0	6.2	2	2	200.2	47.7	0.83	Sub	10.0	1.9	8.1	52.5
MN-5	INTERP	1400	1400	1505.0	1516.2	2150	0.0052	0.0016	7.7	3	2.6	C	0.0150	18.0	5.3	2	2	150.0	41.5	0.84	Sub	9.3	1.7	6.9	45.7
MN-6	INTERP	800	800	1516.2	1530.1	1410	0.0099	0.0017	11.6	3	3.9	C	0.0150	16.0	4.0	2	2	97.3	34.1	0.83	Sub	8.2	1.3	5.3	37.2

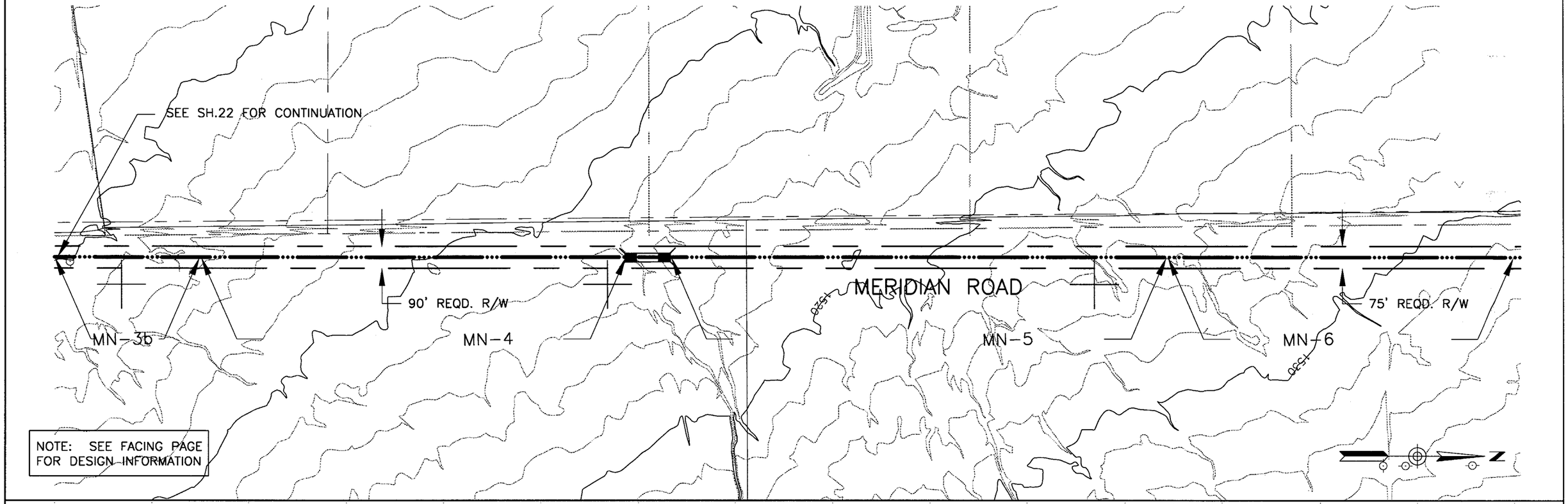
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

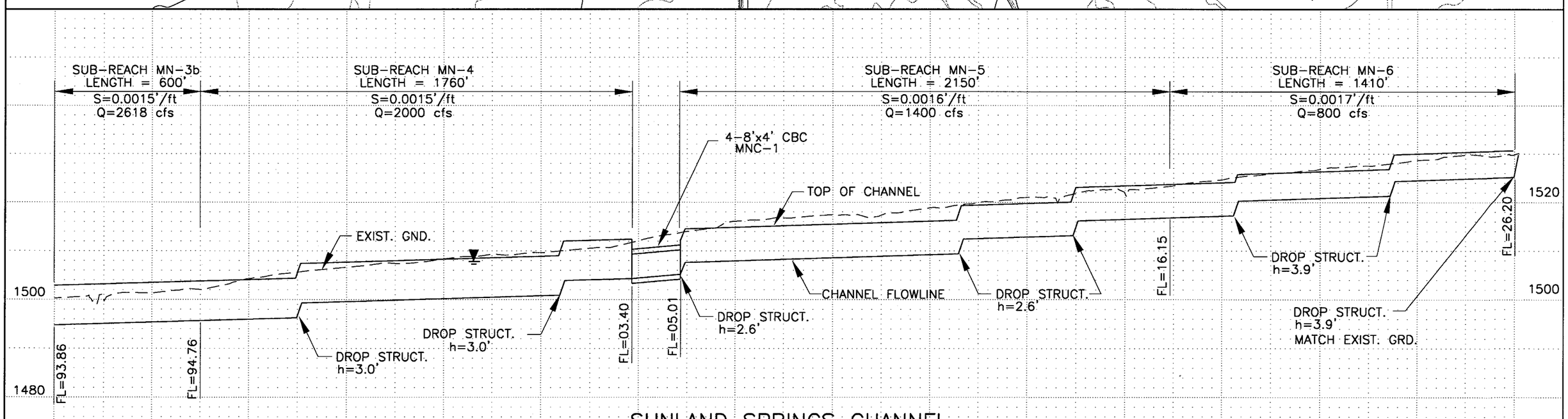


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
MNC-1	INTERP	1400	1400	80	1505.0	1503.4	0.0201	C	0.0120	4	4	ft.	8	RCBC	Wingwall	6.185	7.77	1.94	IC





SUNLAND SPRINGS CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32		EAST MESA AREA DRAINAGE MASTER PLAN
PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION	AREA 2 SUNLAND SPRINGS CHANNEL
SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-13-98	SCALE
	DES. FEB DATE: 6-10-98	1"=400' HORIZONTAL
	CKD. DCF DATE: 6-11-98	1"=20' VERTICAL
		SHEETS NO. 23 OF 43

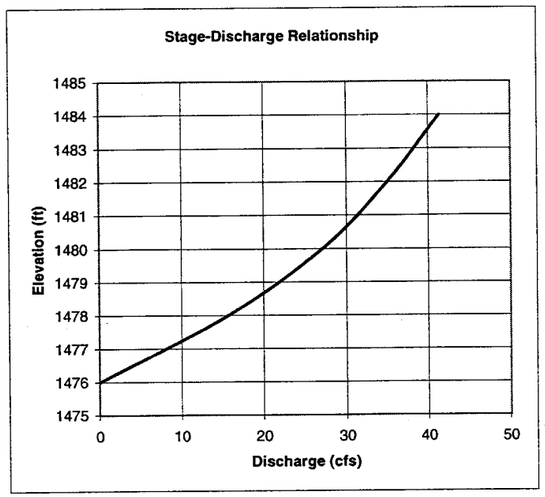
Detention Basin Properties

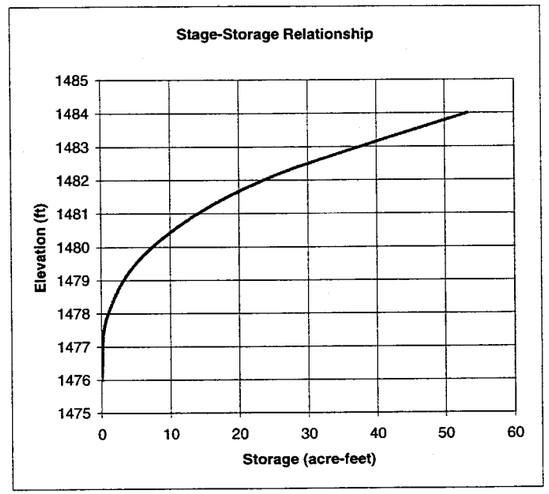
Powerline Detention Basin

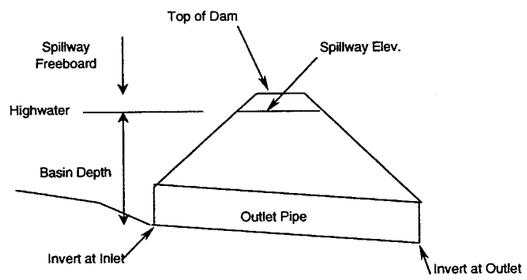
Basin Land Area	26.0 Acres	Length of Fencing =	5,000 ft		
Basin Excavation Volume	20,580 C.Y.				
Q100 Inflow (HEC-1 I.D. 74A) =	289 cfs	Outflow Pipe (no. & Dia.) =	1	24	in.
Q100 Outflow(HEC-1 I.D. DB74A) =	36 cfs	Pipe Invert at Inlet=		1476.0	ft
Emergency Spillway Flow =	289 cfs	Pipe Invert at Outlet=		1475.0	ft
Emergency Spillway Width (3) =	350 ft	Pipe Length =		200	ft
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =		0.0050	ft/ft
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =		1477	ft
Spillway Flow Depth =	0.5 ft	Orifice Coeff., C =		0.62	
Highwater Elev. (Q100) =	1482.2 ft	Inflow Spillway Width (3) =		N/A	ft
Maximum Ponding Depth	6.2 ft	Inflow Spillway Length (3) =		N/A	ft
		Spillway Elevation =		1482.2	ft

Elev.	Area (ac.)	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe Flow (cfs)
1476	0.00	0.00	0.00	0	0	0
1478	1.43	0.95	0.95	16	0	16
1480	5.38	6.39	7.34	27	0	27
1482	11.14	16.17	23.52	35	0	35
1484	18.97	29.76	53.28	41	2113	2154

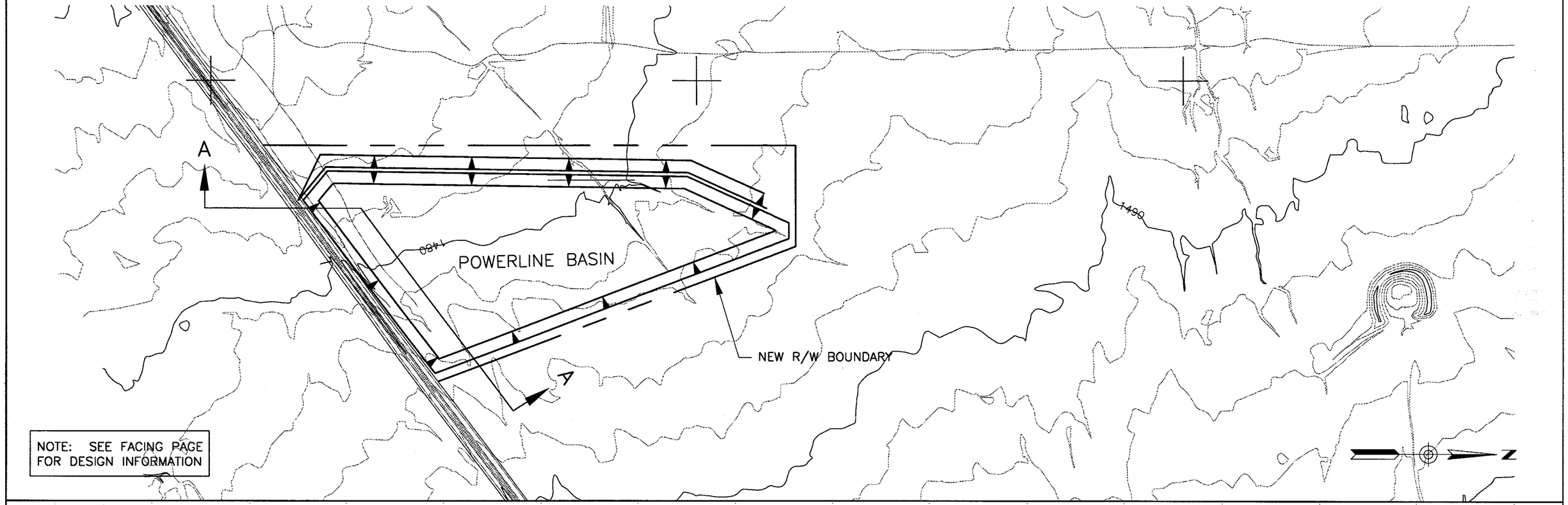
Note: (1) Volume computations based upon results obtained from surface modeling software.
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.

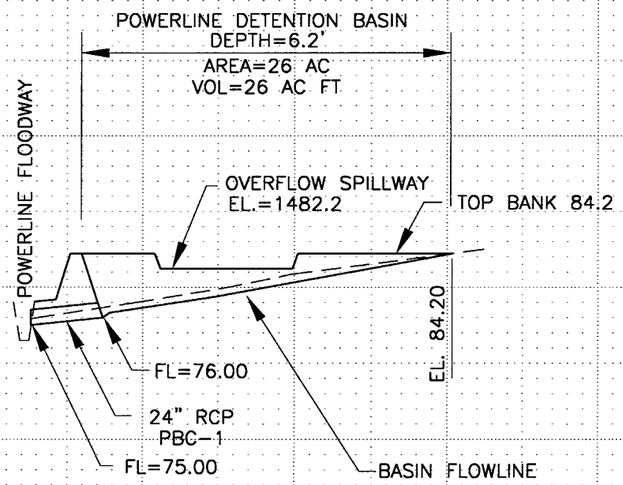






Typical Detention Basin Outlet





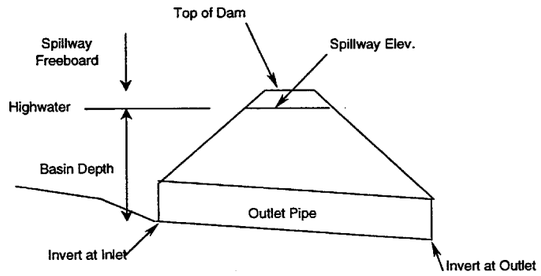
POWERLINE DETENTION BASIN
SECTION A-A

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962	PROJECT DESCRIPTION: AREA 2 POWERLINE DETENTION BASIN
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-13-98 / DES. FEB DATE: 6-10-98 / CKD. DCF DATE: 6-11-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS: NO. 24 OF 43

East Mesa Area Drainage Master Plan
AREA 2 - ELLIOT DETENTION BASIN

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
EBC-1	DB74A	45	45	180	1411.0	1409.5	0.0039	C	0.0120	1	30	in.	0	RCP	Headwall	4.498	8.44	3.38	TW



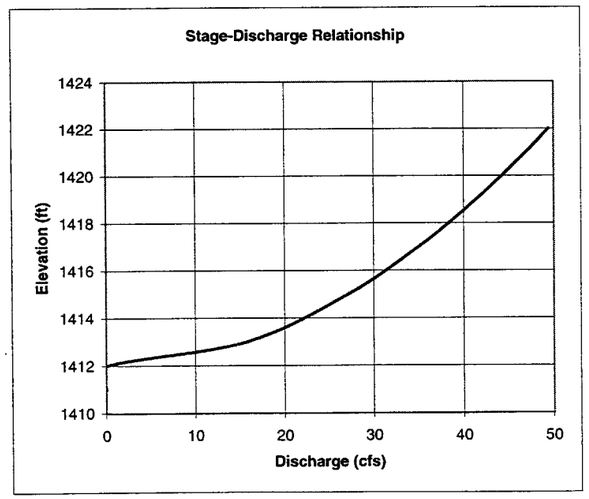
Typical Detention Basin Outlet

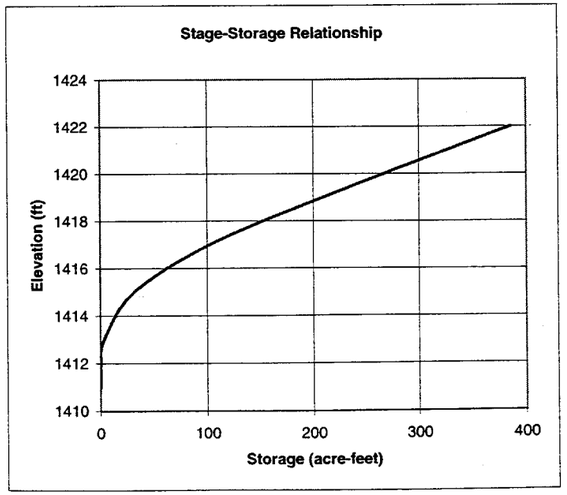
Detention Basin Properties

Elliot Detention Basin

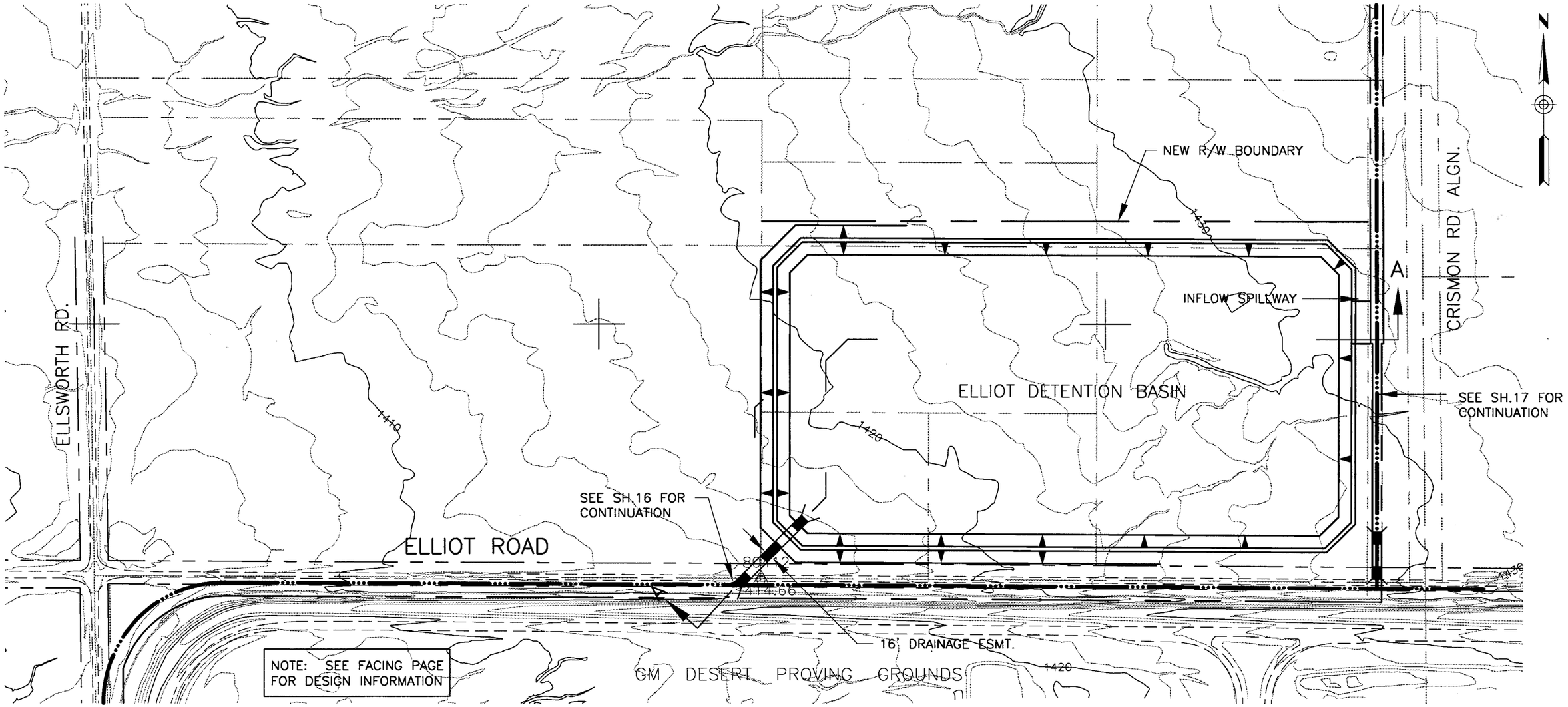
Basin Land Area	74.0 Acres	Length of Fencing =	6,800 ft
Basin Excavation Volume	382,580 C.Y.		
Q100 Inflow (HEC-1 I.D. DR66) =	509 cfs	Outflow Pipe (no. & Dia.) =	1 24 in.
Q100 Outflow(HEC-1 I.D. DB74A) =	45 cfs	Pipe Invert at Inlet=	1411.0 ft
Emergency Spillway Flow =	509 cfs	Pipe Invert at Outlet=	1409.5 ft
Emergency Spillway Width (3) =	75 ft	Pipe Length =	380 ft
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =	0.0039 ft/ft
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =	1412 ft
Spillway Flow Depth =	2.0 ft	Orifice Coeff., C =	0.62
Highwater Elev. (Q100) =	1420.5 ft	Inflow Spillway Width (3) =	200 ft
Maximum Ponding Depth	9.5 ft	Inflow Spillway Length (3) =	55 ft
		Spillway Elevation =	1421 ft

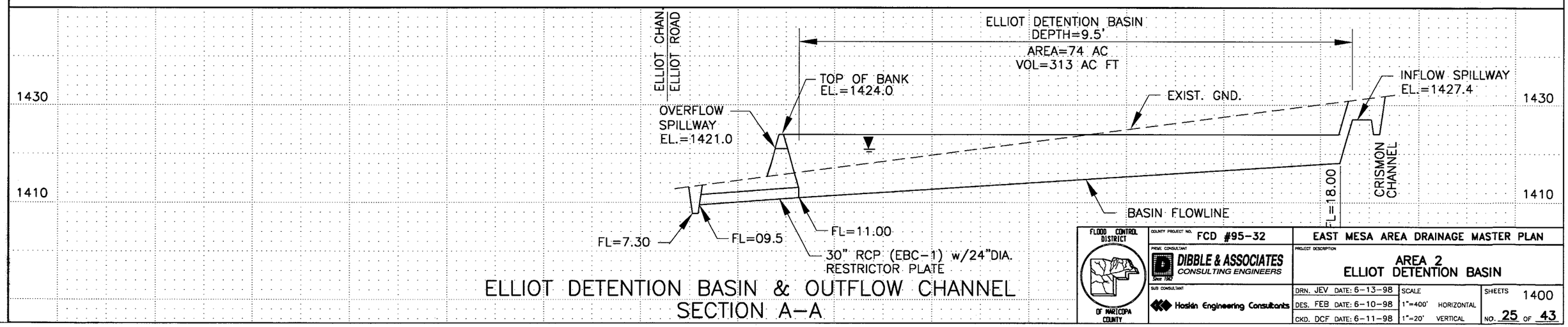
Elev.	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe Flow (cfs)
1411	0.00	0.00	0	0	0
1412	0.17	0.17	0	0	0
1413	2.89	3.06	16	0	16
1415	18.87	31.17	27	0	27
1417	40.69	101.65	35	0	35
1419	56.33	208.17	41	0	41
1421	59.25	325.76	47	66	113
1422	60.15	385.91	49	344	394





Note: (1) Volume computations based upon results obtained from surface modeling software.
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.





ELLIOT DETENTION BASIN & OUTFLOW CHANNEL SECTION A-A

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 2 ELLIOT DETENTION BASIN

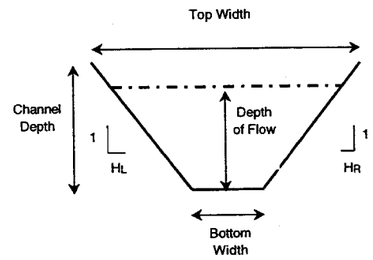
DRN. JEV DATE: 6-13-98	SCALE		SHEETS 1400
DES. FEB DATE: 6-10-98	1"=400'	HORIZONTAL	NO. 25 OF 43
CKD. DCF DATE: 6-11-98	1"=20'	VERTICAL	

East Mesa Area Drainage Master Plan
AREA 1 - POWERLINE FLOODWAY

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PR-1	CP80A	3731	3731	1331.0	1331.5	320	0.0016	0.0014	0.0	0	0.0	C	0.0150	30.0	7.4	2	2	332.6	63.2	0.84	Sub	11.2	2.3	9.8	69.0
PR-2	CP80A	3731	3731	1331.8	1341.0	2900	0.0032	0.0014	5.1	1	5.1	C	0.0150	30.0	7.4	2	2	332.6	63.2	0.84	Sub	11.2	2.3	9.8	69.0

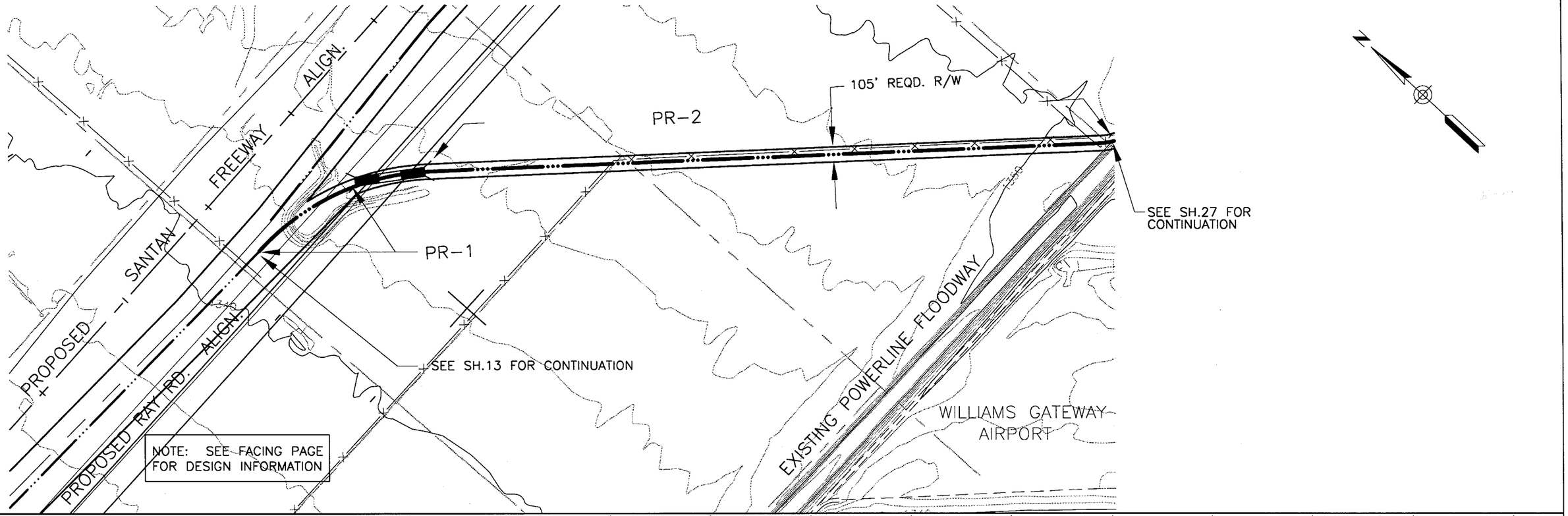
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Intel Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
PRC-1	CP80A	3731	3731	280	1331.8	1331.5	0.0014	C	0.0120	4	9	ft	12	RCBC	Wingwall	7.418	9.25	1.03	IC



POWERLINE FLOODWAY

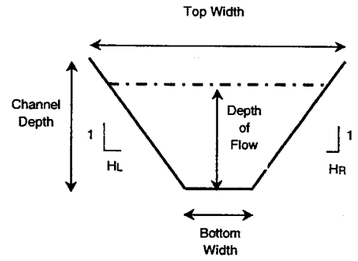
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1960	PROJECT DESCRIPTION: AREA 1 POWERLINE FLOODWAY
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / DES. DCF DATE: 6-3-98 / CKD. BJF DATE: 6-8-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS: NO. 26 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - POWERLINE FLOODWAY

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PR-3	CPPWR	2932	2932	1341.0	1348.9	2575	0.0031	0.0014	4.3	1	4.3	C	0.0150	28.0	6.7	2	2	278.2	58.0	0.82	Sub	10.5	2.1	8.8	63.3
PR-4	CPPWR	2932	2932	1349.0	1354.9	985	0.0060	0.0014	4.5	1	4.5	C	0.0150	28.0	6.7	2	2	278.2	58.0	0.82	Sub	10.5	2.1	8.8	63.3

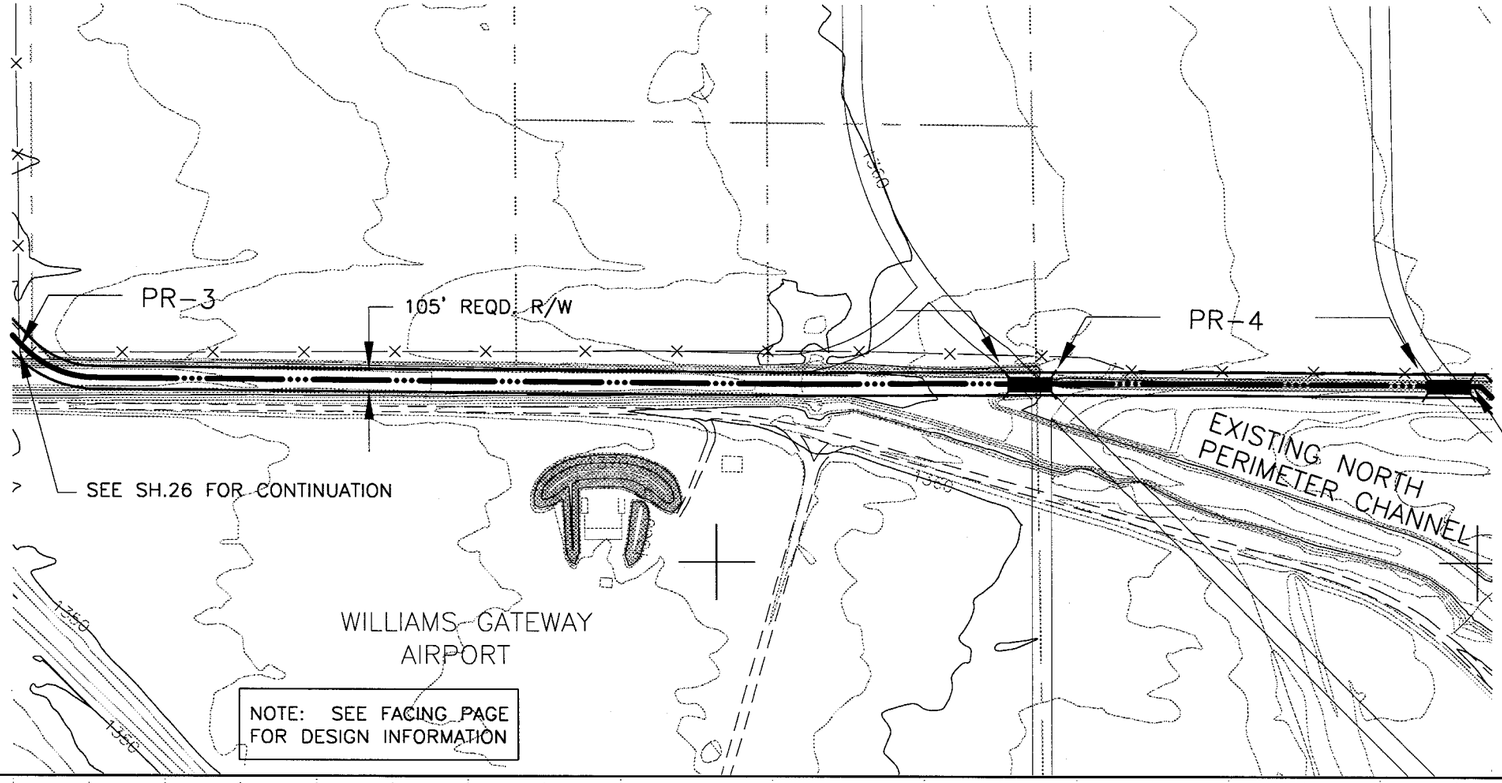
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

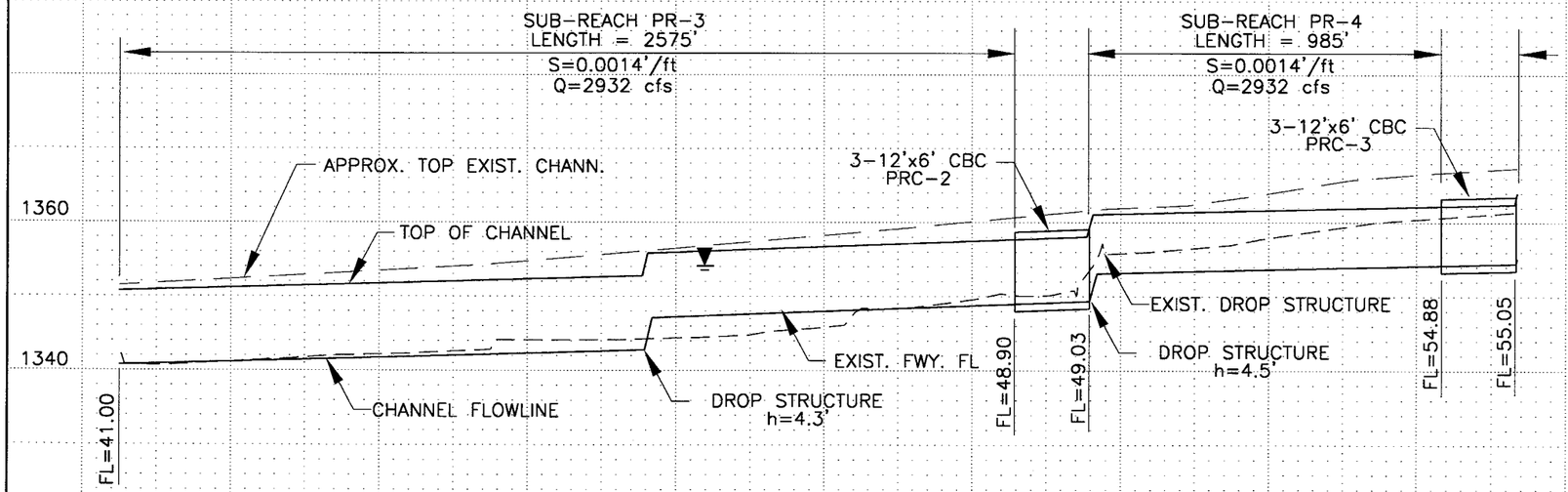


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
PRC-2	CPPWR	2932	2932	120	1349	1348.9	0.0011	C	0.0120	3	6	ft.	12	RCBC	Wingwall	6.715	11.95	1.99	IC
PRC-3	CPPWR	2932	2932	120	1355	1354.9	0.0010	C	0.0120	3	6	ft.	12	RCBC	Wingwall	6.715	11.95	1.99	IC





POWERLINE FLOODWAY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962

SUB CONSULTANT: Haskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 1 POWERLINE FLOODWAY

DRN. JEV DATE: 6-10-98

DES. DCF DATE: 6-3-98

CKD. BJF DATE: 6-8-98

SCALE: 1"=400' HORIZONTAL; 1"=20' VERTICAL

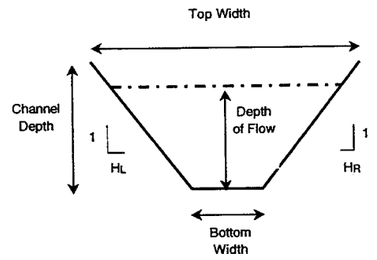
SHEETS NO. 27 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - ELLSWORTH CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
EH-1	C79B	2766	2766	1355.0	1367.7	3040	0.0042	0.0014	8.4	2	4.2	C	0.0150	28.0	6.5	2	2	266.9	57.1	0.82	Sub	10.4	2.0	8.6	62.2
EH-2	C79B	2766	2766	1367.8	1370.0	1620	0.0014	0.0014	0.0	0	0.0	C	0.0150	28.0	6.5	2	2	266.9	57.1	0.82	Sub	10.4	2.0	8.6	62.2

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
EHC-1	C79B	2766	2766	100	1367.8	1367.7	0.0010	C	0.0120	3	8	ft.	12	RCBC	Wingwall	6.508	9.22	1.15	IC
EHC-2	C79B	2766	2766	200	1370.2	1370.0	0.0010	C	0.0120	3	8	ft.	12	RCBC	Wingwall	6.508	9.22	1.15	IC

NOTE: SEE FACING PAGE FOR DESIGN INFORMATION

EXISTING POWERLINE FLOODWAY

EH-2

EH-1

GM DESERT PROVING GROUNDS

ELLSWORTH RD.

SEE SH.29 FOR CONTINUATION

95' REQD. R/W

EXISTING NORTH PERIMETER CHANNEL

WILLIAMS GATEWAY AIRPORT

SEE SH.27 FOR CONTINUATION

SUB-REACH EH-1
LENGTH = 3040'
S=0.0014'/ft
Q=2766 cfs

SUB-REACH EH-2
LENGTH = 1620'
S=0.0014'/ft
Q=2766 cfs

3-12'x8' CBC
EHC-1

3-12'x8' CBC
EHC-2

ELLSWORTH ROAD

1380

1360

TOP OF CHANNEL

EXIST. GND.

CHANNEL FLOWLINE

DROP STRUCTURE
h=4.2'

DROP STRUCTURE
h=4.2'

FL=55.05

FL=67.68

FL=67.78

FL=70.00

FL=70.20

10'S

FM

RELOCATE EXIST. SEWER & GAS LINE

ELLSWORTH CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS

SUB CONSULTANT: Haskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 1 ELLSWORTH CHANNEL

DRN. JEV DATE: 6-10-98

DES. DCF DATE: 6-3-98

CKD. BJF DATE: 6-8-98

SCALE 1"=400' HORIZONTAL 1"=20' VERTICAL

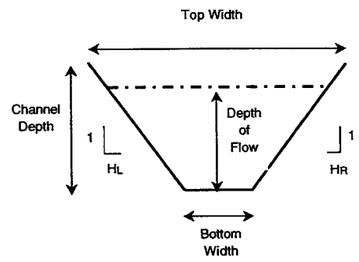
SHEETS NO. 28 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - ELLSWORTH CHANNEL

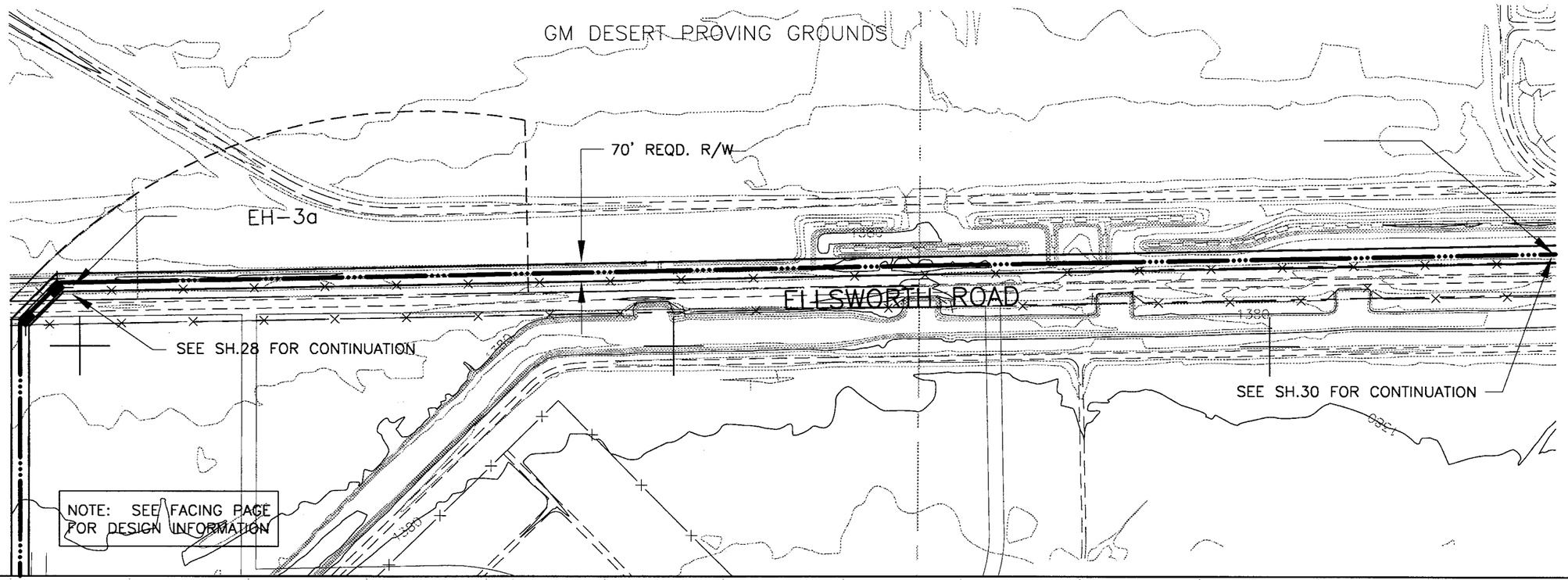
Channel Properties

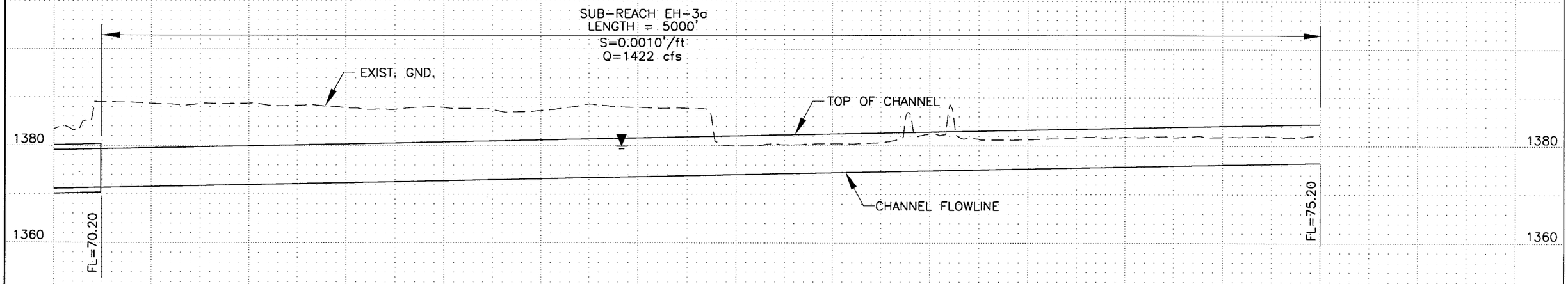
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
EH-3a	C79A	1422	1422	1370.2	1375.2	5000	0.0010	0.0010	0.0	0	0.0	C	0.0150	25.0	5.2	2	2	185.4	48.4	0.67	Sub	7.7	1.5	6.8	52.1

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





ELLSWORTH CHANNEL

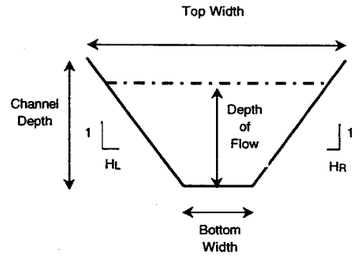
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 1 ELLSWORTH CHANNEL
	SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / DES. DCF DATE: 6-3-98 / CKD. BJF DATE: 6-8-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS NO. 29 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - ELLSWORTH CHANNEL

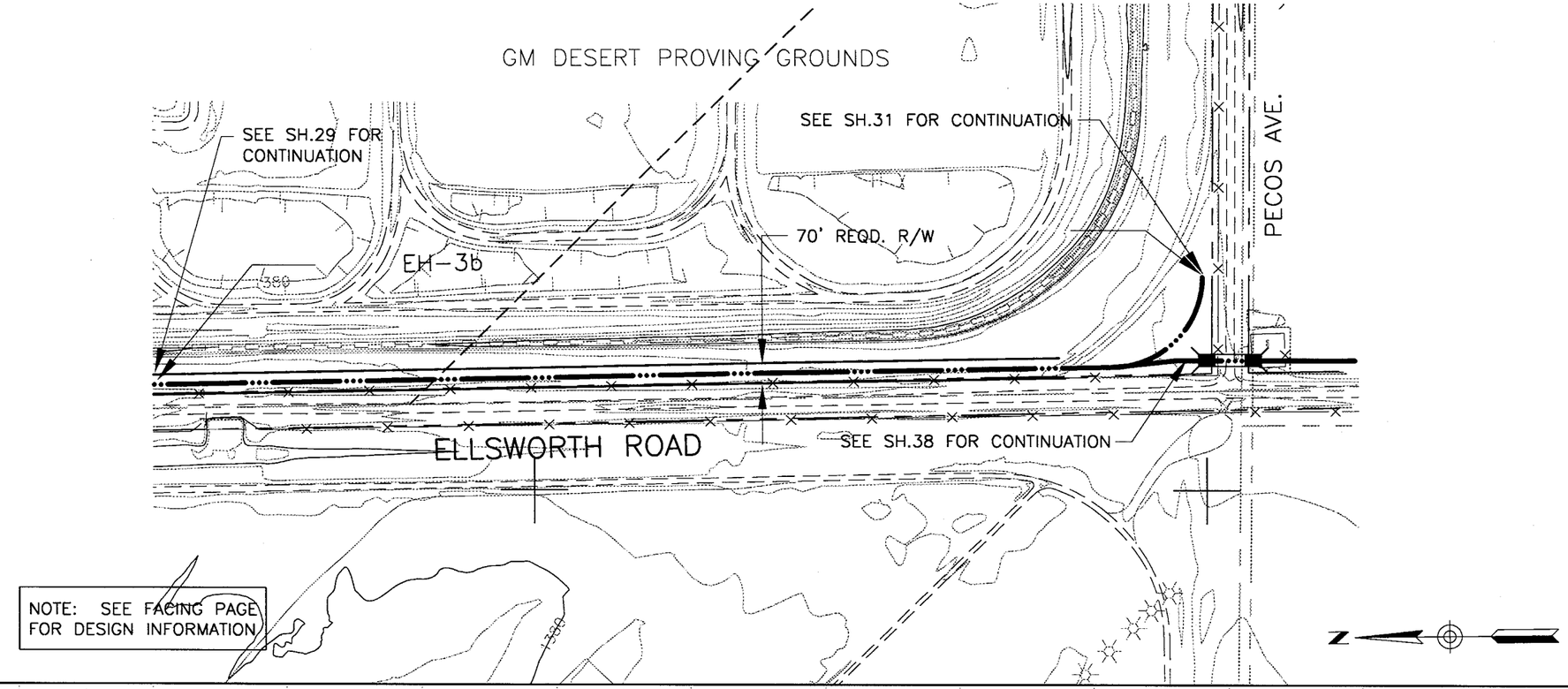
Channel Properties

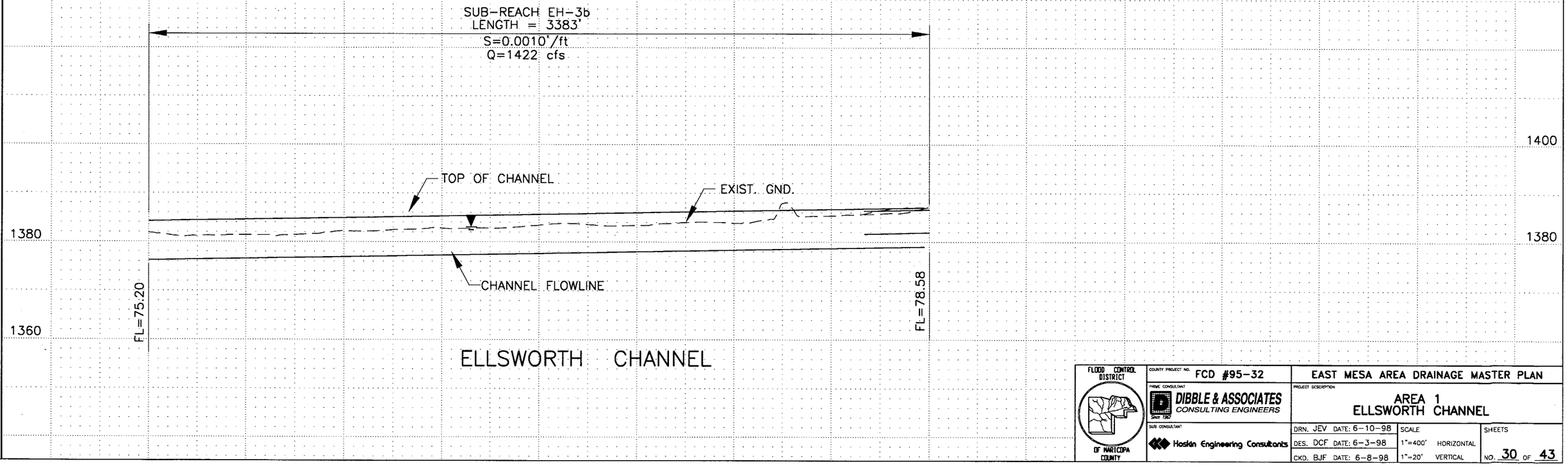
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
EH-3b	C79A	1422	1422	1375.2	1378.6	3383	0.0010	0.0010	0.0	0	0.0	C	0.0150	25.0	5.2	2	2	185.4	48.4	0.67	Sub	7.7	1.5	6.8	52.1

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





ELLSWORTH CHANNEL

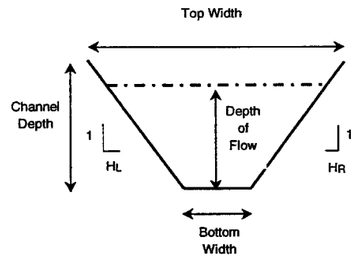
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 1 ELLSWORTH CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / DES. DCF DATE: 6-3-98 / CKD. BJF DATE: 6-8-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS NO. 30 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - PECOS CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PS-1	C84	1085	1085	1378.6	1392.0	4840	0.0028	0.0005	11.0	2	5.5	E	0.0250	40.0	5.0	6	6	354.3	101.4	0.29	Sub	3.1	1.3	6.3	116.1

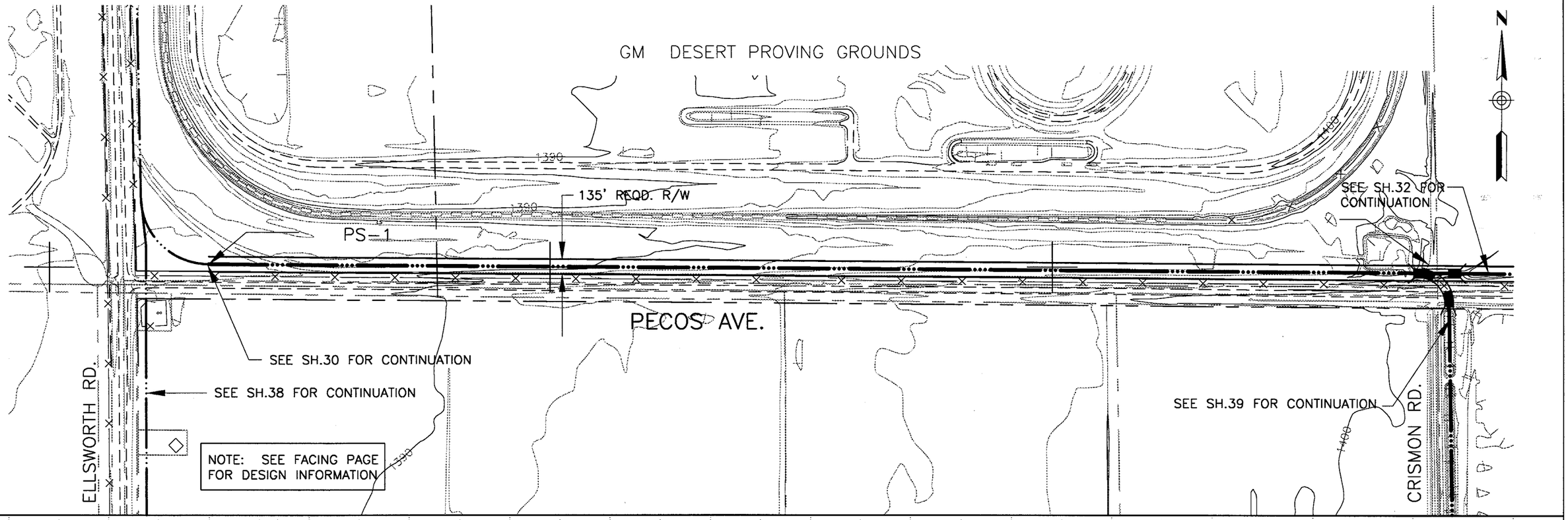
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

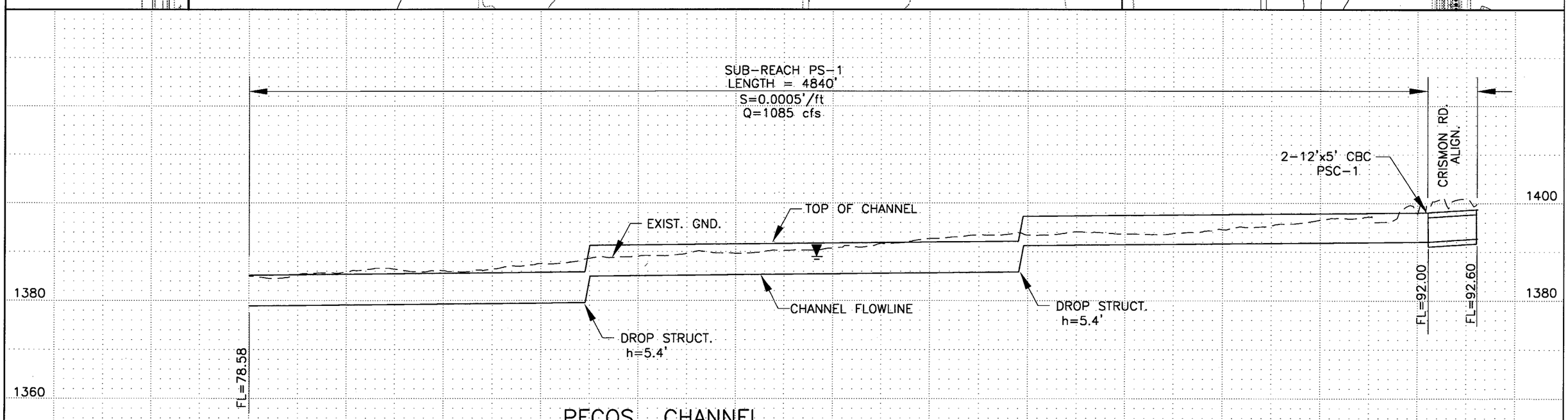


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
PSC-1	C84	1085	1085	60	1392.6	1392	0.0100	C	0.0120	2	5	ft.	12	RCBC	Wingwall	5.043	7.15	1.43	IC





PECOS CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

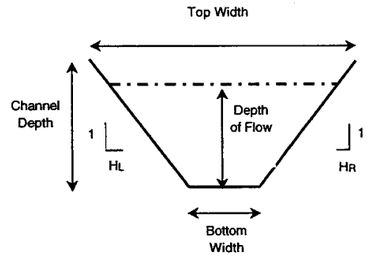
COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN	
PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 1 PECOS CHANNEL	
SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 6-10-98	SCALE
	DES. DCF DATE: 6-3-98	1"=400' HORIZONTAL
	CKD. BJF DATE: 6-8-98	1"=20' VERTICAL
		SHEETS NO. 31 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - PECOS CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PS-2	C84	1085	1085	1392.6	1401.0	2270	0.0037	0.0005	7.3	2	3.6	E	0.0250	40.0	5.0	6	6	354.3	101.4	0.29	Sub	3.1	1.3	6.3	116.1
PS-3	C84	1085	1085	1402.0	1406.1	1320	0.0031	0.0005	3.4	1	3.4	E	0.0250	40.0	5.0	6	6	354.4	101.4	0.29	Sub	3.1	1.3	6.3	116.1
PS-4	C84	1085	1085	1407.0	1414.4	1970	0.0038	0.0005	6.4	2	3.2	E	0.0250	40.0	5.0	6	6	354.4	101.4	0.29	Sub	3.1	1.3	6.3	116.1

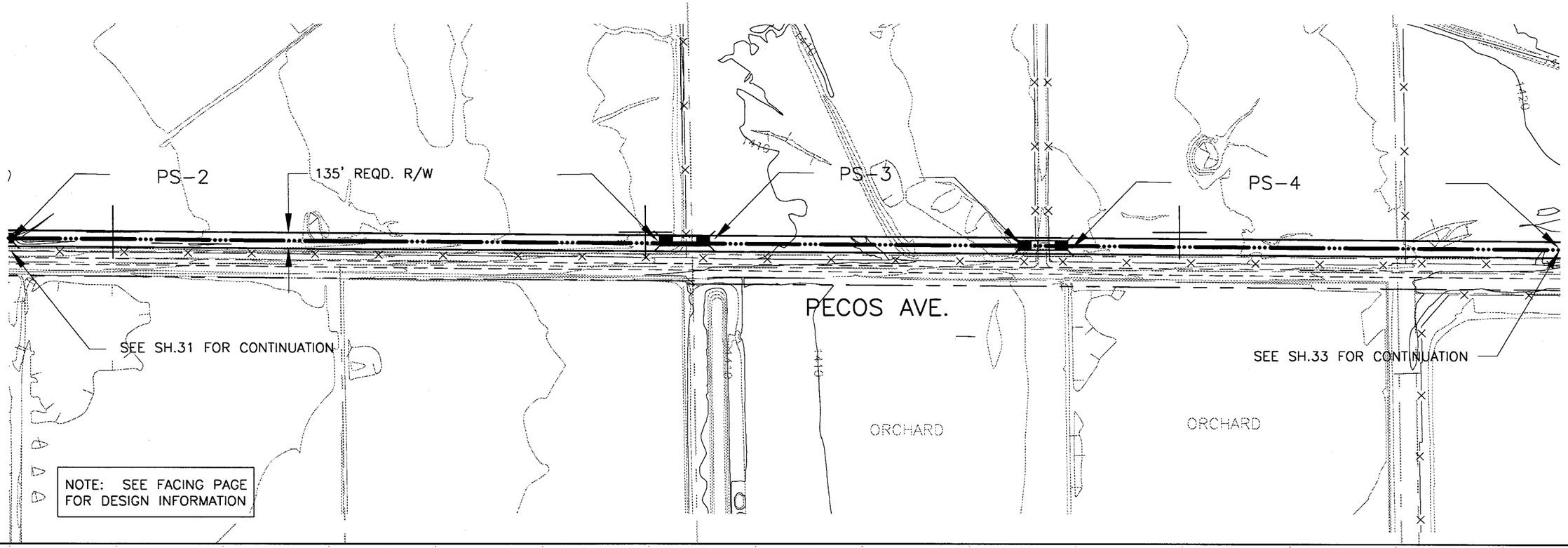
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

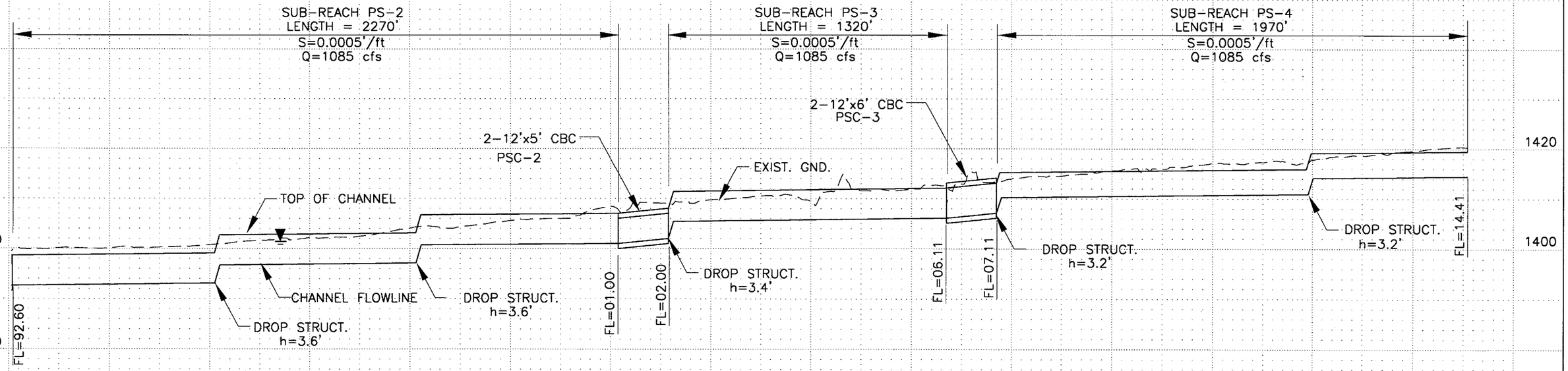


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
PSC-2	C84	1085	1085	60	1402.0	1401.0	0.0167	C	0.0120	2	5	ft.	12	RCBC	Wingwall	3.238	7.11	1.42	IC
PSC-3	C84	1085	1085	60	1407.1	1406.1	0.0167	C	0.0120	2	6	ft.	12	RCBC	Wingwall	5.044	6.41	1.07	IC





PECOS CHANNEL

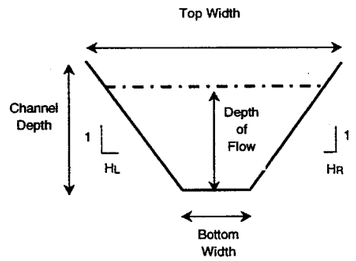
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 1 PECOS CHANNEL
	SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / DES. DCF DATE: 6-3-98 / CKD. BJF DATE: 6-8-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS: NO. 32 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - PECOS CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PS-5	BOXT78	469	469	1414.5	1414.8	720	0.0004	0.0005	0.0	0	0.0	E	0.0250	20.0	4.1	6	6	184.9	70.2	0.27	Sub	2.5	1.1	5.2	82.2
PS-6	BOXT78	469	469	1415.1	1420.5	980	0.0055	0.0005	4.9	1	4.9	E	0.0250	20.0	4.1	6	6	184.9	70.2	0.27	Sub	2.5	1.1	5.2	82.2
PS-7	BOXT78	469	469	1420.9	1426.6	1560	0.0037	0.0005	5.0	1	5.0	E	0.0250	20.0	4.1	6	6	184.9	70.2	0.27	Sub	2.5	1.1	5.2	82.2
PS-8	82TBOX	469	469	1428.6	1429.0	750	0.0005	0.0005	0.0	0	0.0	E	0.0250	20.0	4.1	6	6	184.9	70.2	0.27	Sub	2.5	1.1	5.2	82.2

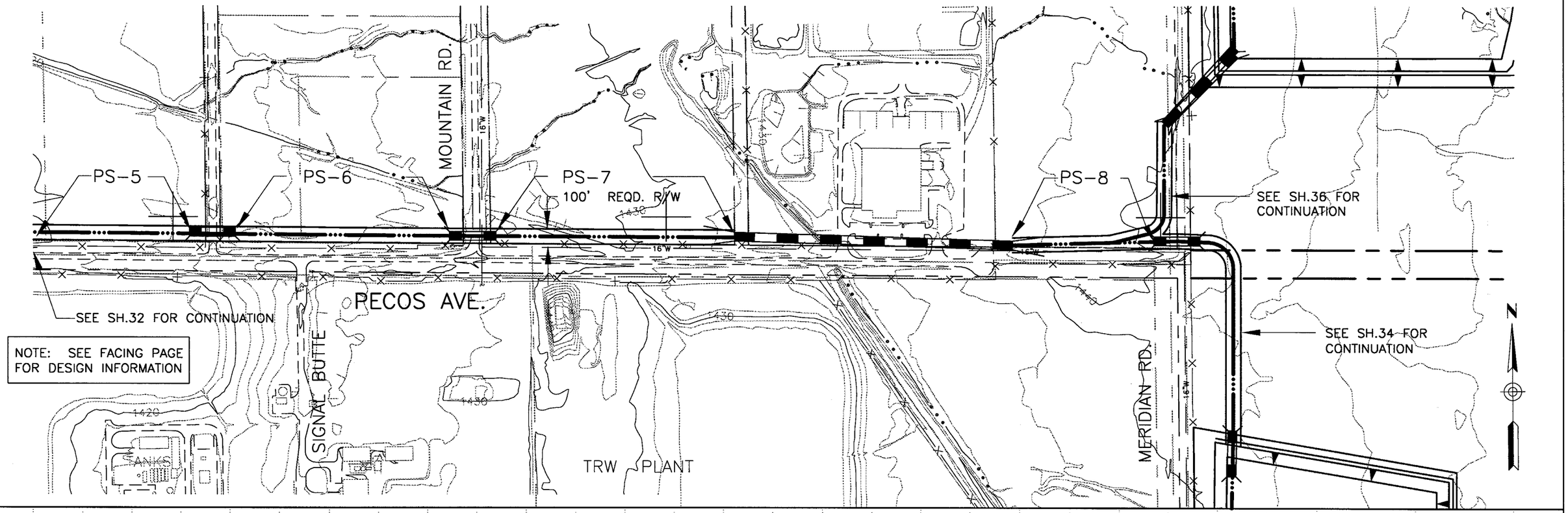
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

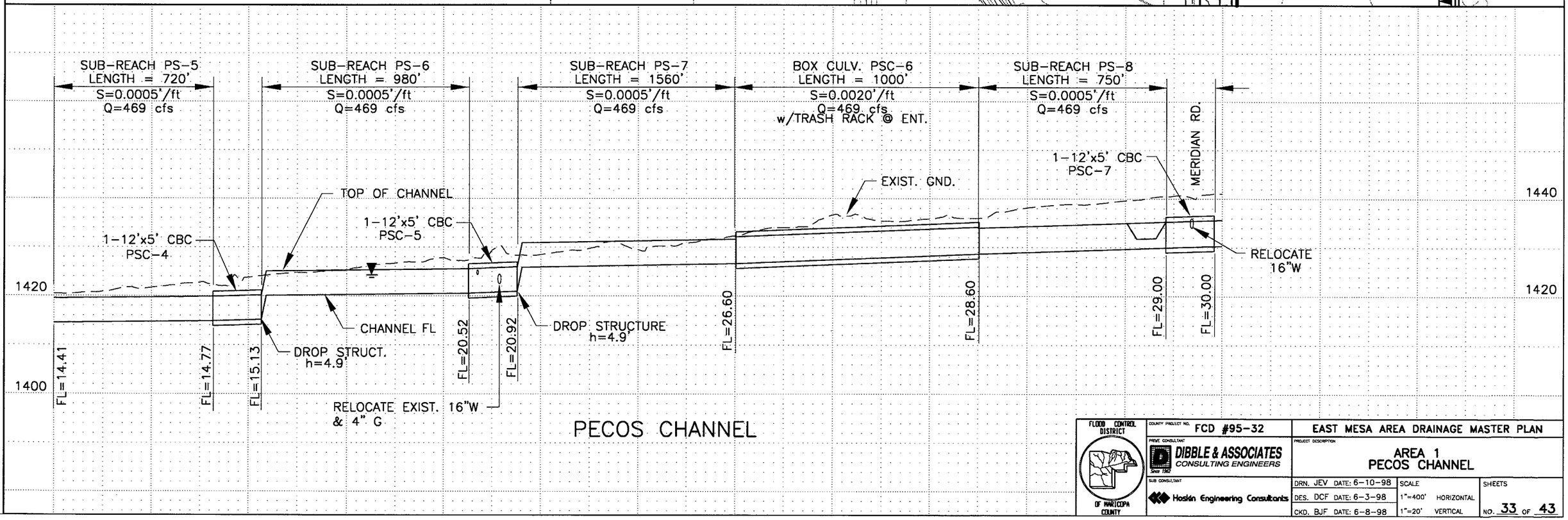


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
PSC-4	0	469	469	60	1415.1	1414.8	0.0050	C	0.0120	1	5	ft.	12	RCBC	Wingwall	4.13	5.87	1.17	IC
PSC-5	0	469	469	80	1420.9	1420.5	0.0050	C	0.0120	1	5	ft.	12	RCBC	Wingwall	4.13	5.87	1.17	IC
PSC-6	0	469	469	1000	1428.6	1426.6	0.0020	C	0.0120	1	5	ft.	12	RCBC	Wingwall	4.13	5.88	1.18	IC
PSC-7	0	469	469	80	1430.0	1429.0	0.0125	C	0.0120	1	5	ft.	12	RCBC	Wingwall	4.13	5.85	1.17	IC





PECOS CHANNEL

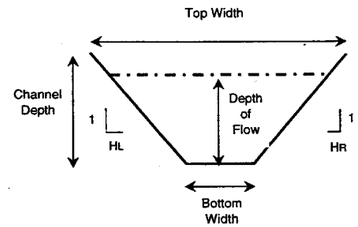
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 1 PECOS CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / SCALE / SHEETS
		DES. DCF DATE: 6-3-98 / 1"=400' HORIZONTAL
		CKD. BJF DATE: 6-8-98 / 1"=20' VERTICAL / NO. 33 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - MERIDIAN SOUTH CHANNEL & PECOS SOUTH BASIN

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
MN-1	DB82B	329	329	1430.0	1430.5	950	0.0005	0.0005	0.0	0	0.0	m	0.0250	8.0	4.2	6	6	139.5	59.1	0.27	Sub	2.4	1.1	5.3	71.3
MN-2	CP82A5	1588	1588	1435.0	1435.6	1050	0.0006	0.0005	0.1	0	0.0	m	0.0250	60.0	5.3	6	6	483.0	124.1	0.29	Sub	3.3	1.4	6.6	139.6

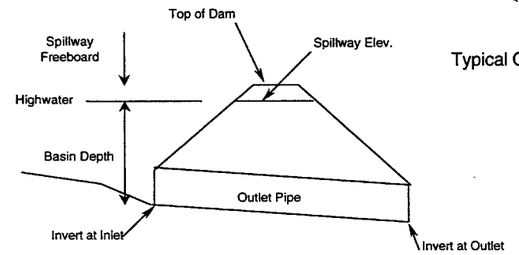
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
MNC-1	DB82B	329	329	150	1431.5	1430.5	0.0067	C	0.0120	1	66	in.		RCP	Headwall	4.205	9.63	1.75	IC



Typical Detention Basin Outlet

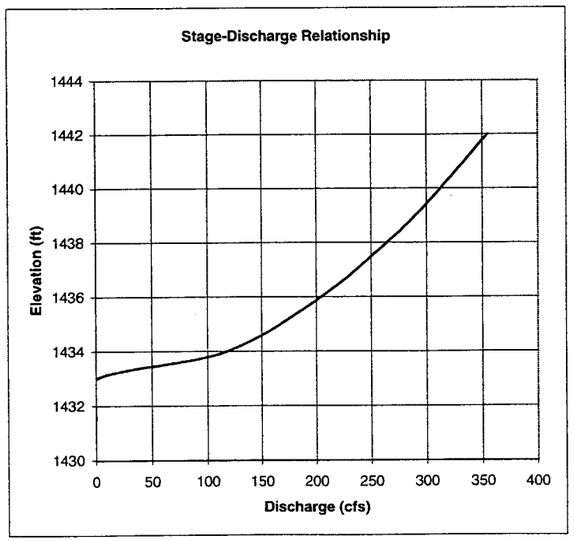
Detention Basin Properties

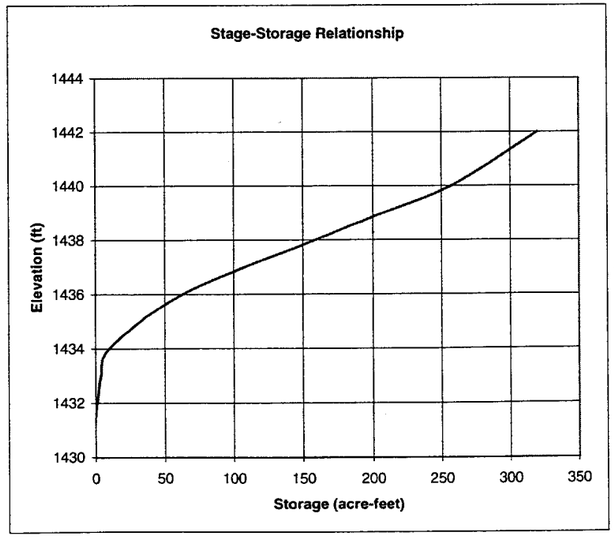
Pecos South Basin

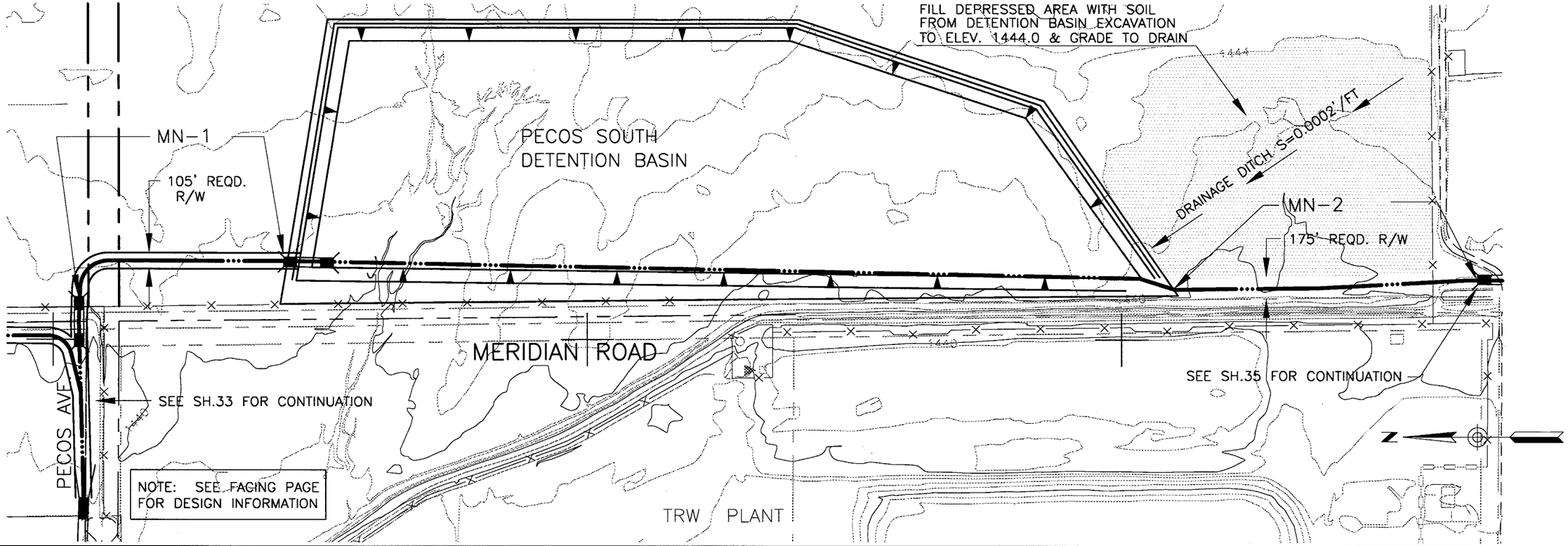
Basin Land Area	75.0 Acres	Length of Fencing =	8,000 ft
Basin Excavation Volume	643,300 C.Y.		
Q100 Inflow (HEC-1 I.D. C82A5) =	1,588 cfs	Outflow Pipe (no. & Dia.) =	1 66 in.
Q100 Outflow (HEC-1 I.D. DB82B) =	329 cfs	Pipe Invert at Inlet=	1431.5 ft
Emergency Spillway Flow =	1,588 cfs	Pipe Invert at Outlet=	1431.0 ft
Emergency Spillway Width (3) =	195 ft	Pipe Length =	100 ft
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =	0.0050 ft/ft
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =	1433 ft
Spillway Flow Depth =	2.0 ft	Orifice Coeff., C =	0.62
Highwater Elev. (Q100) =	1441 ft	Inflow Spillway Width (3) =	N/A ft
Maximum Ponding Depth	9.5 ft	Inflow Spillway Length (3) =	N/A ft
		Spillway Elevation =	1441 ft

Elev.	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe Flow (cfs)
1431.5	0.00	0.00	0	0	0
1433	0.00	3.50	0	0	0
1434	0.00	9.60	118	0	118
1436	0.00	62.70	205	0	205
1438	0.00	158.70	264	0	264
1439	0.00	207.50	290	0	290
1440	0.00	257.30	313	0	313
1442	0.00	320.00	355	488	842

Note: (1) Volume computations based upon results obtained from surface modeling software.
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.







MERIDIAN SOUTH CHANNEL & PECOS SOUTH BASIN

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 1 MERIDIAN SOUTH CHANNEL

DRN. JEV DATE: 6-10-98
DES. DCF DATE: 6-3-98
CKD. BJF DATE: 6-8-98

SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL

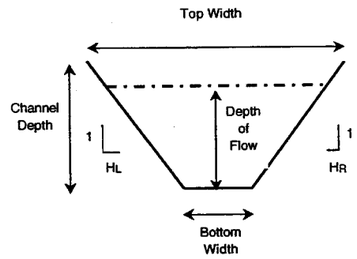
SHEETS NO. 34 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - MERIDIAN SOUTH CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
MN-3	82A4	597	597	1436.6	1444.2	5150	0.0015	0.0005	5.0	1	5.0	m	0.0250	28.0	4.2	6	6	224.5	79.3	0.28	Sub	2.7	1.1	5.3	91.5

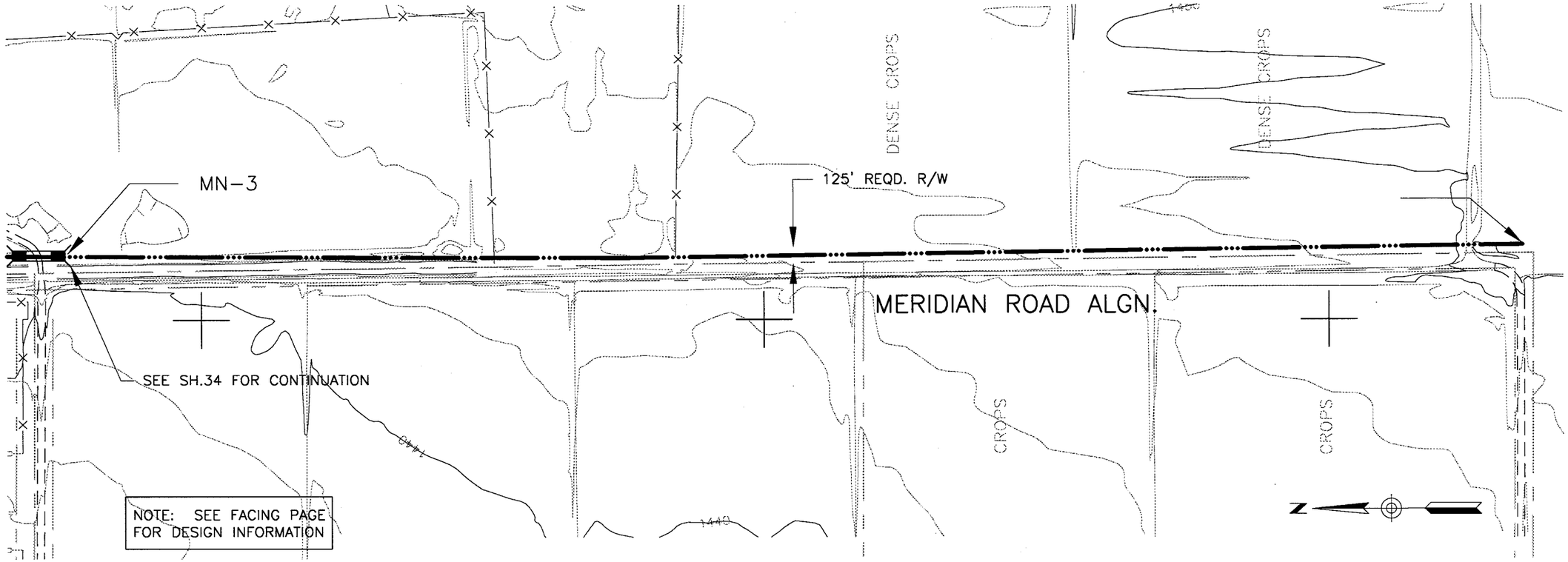
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

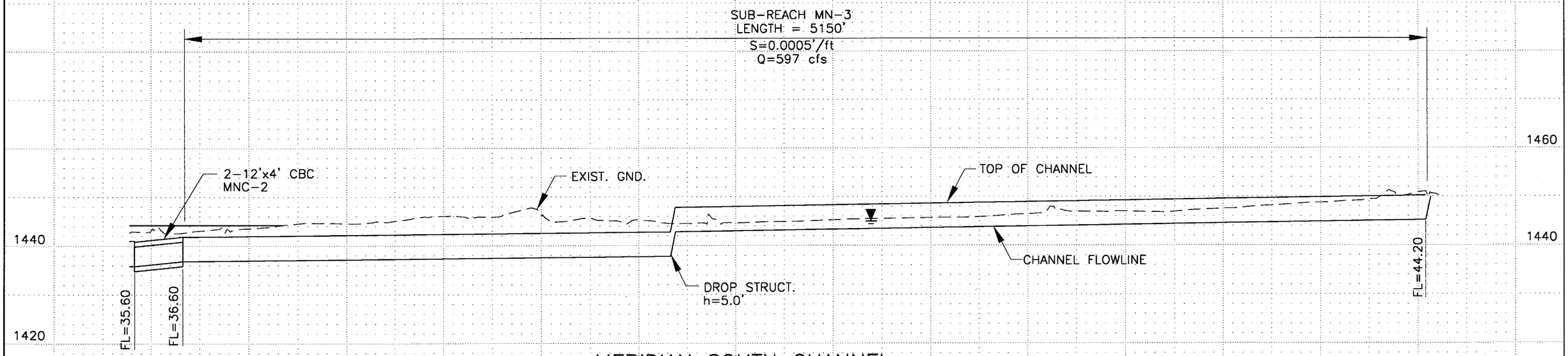


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
MNC-2	82A4	597	597	60	1436.6	1435.6	0.0167	C	0.0120	2	4	ft.	12	RCBC	Wingwall	5.271	5.20	1.30	TW





MERIDIAN SOUTH CHANNEL

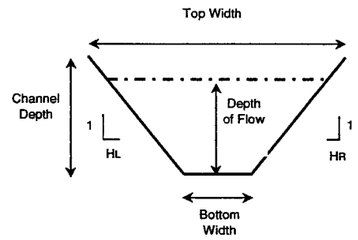
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962	PROJECT DESCRIPTION AREA 1 MERIDIAN SOUTH CHANNEL
	SUB CONSULTANT Haskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / DES. DCF DATE: 6-3-98 / CKD. BJF DATE: 6-8-98
		SCALE 1"=400' HORIZONTAL / 1"=20' VERTICAL
		SHEETS NO. 35 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - MERIDIAN NORTH CHANNEL & PECOS NORTH BASIN

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PS-9	DB82A1	162	162	1430.0	1430.3	500	0.0006	0.0005	0.0	0	0.0	E	0.0250	4.0	3.4	6	6	81.8	45.1	0.26	Sub	2.0	1.0	4.4	56.5

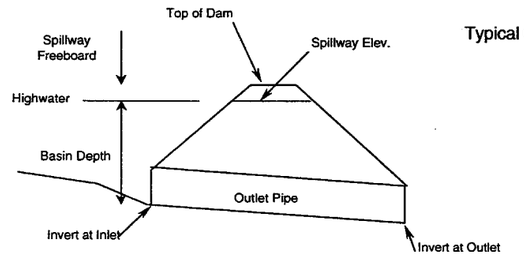
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
MNC-3	DB82A1	162	162	200	1432.0	1431.3	0.0035	C	0.0120	1	48	in.		RCP	Headwall	3.375	7.93	1.98	TW



Typical Detention Basin Outlet

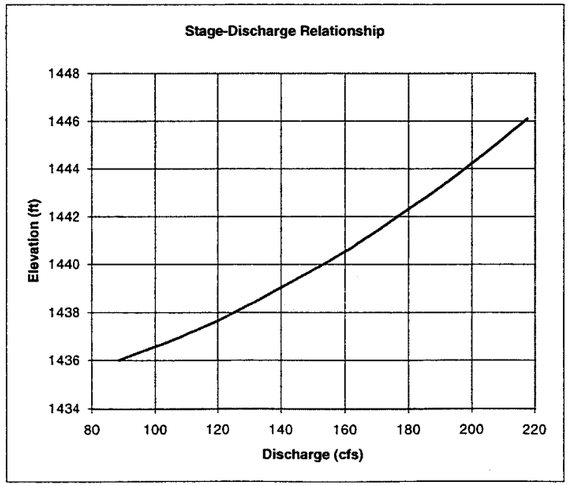
Detention Basin Properties

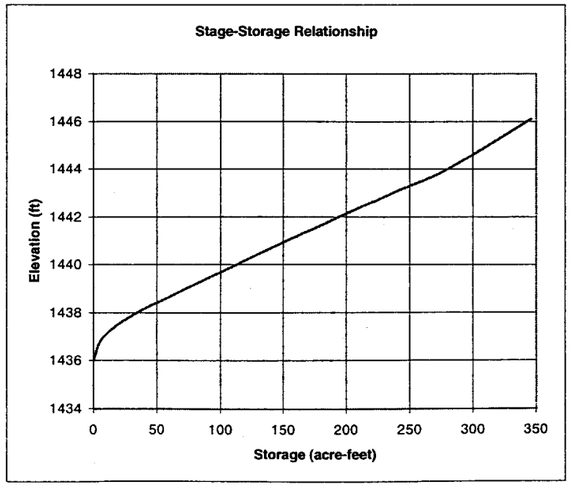
Pecos North Basin

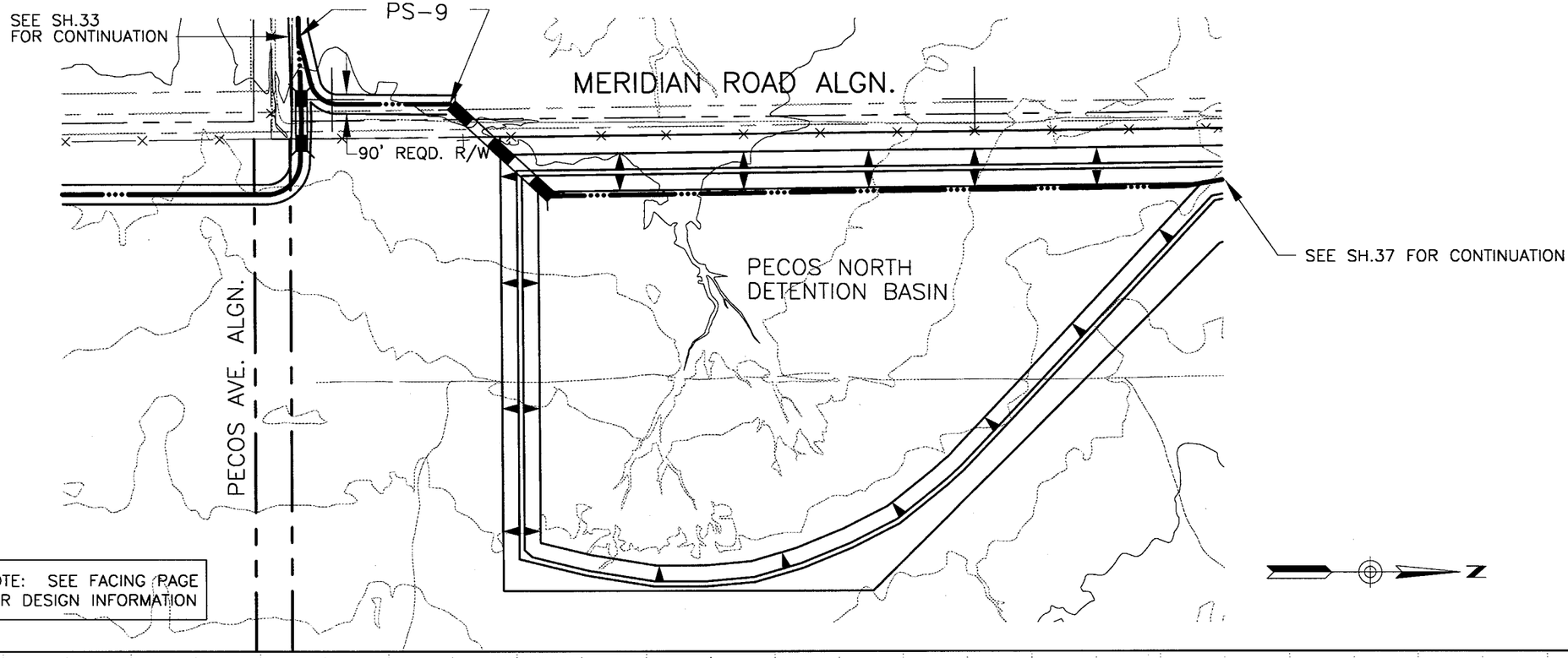
Basin Land Area	97.0 Acres	Length of Fencing =	6,000 ft
Basin Excavation Volume	398,200 C.Y.		
Q100 Inflow (HEC-1 I.D. C82A5) =	1,637 cfs	Outflow Pipe (no. & Dia.) =	1 48 in.
Q100 Outflow (HEC-1 I.D. DB82B) =	162 cfs	Pipe Invert at Inlet=	1432.0 ft
Emergency Spillway Flow =	1,637 cfs	Pipe Invert at Outlet=	1431.3 ft
Emergency Spillway Width (3) =	190 ft	Pipe Length =	200 ft
Emergency Spillway Length (3) =	58.2 ft	Pipe Slope =	0.0035 ft/ft
Spillway Coeff. =	2.5	Pipe Centerline at Inlet =	1434 ft
Spillway Flow Depth =	2.0 ft	Orifice Coeff., C =	0.62
Highwater Elev. (Q100) =	1444 ft	Inflow Spillway Width (3) =	N/A ft
Maximum Ponding Depth	12.0 ft	Inflow Spillway Length (3) =	N/A ft
		Spillway elevation =	1444 ft

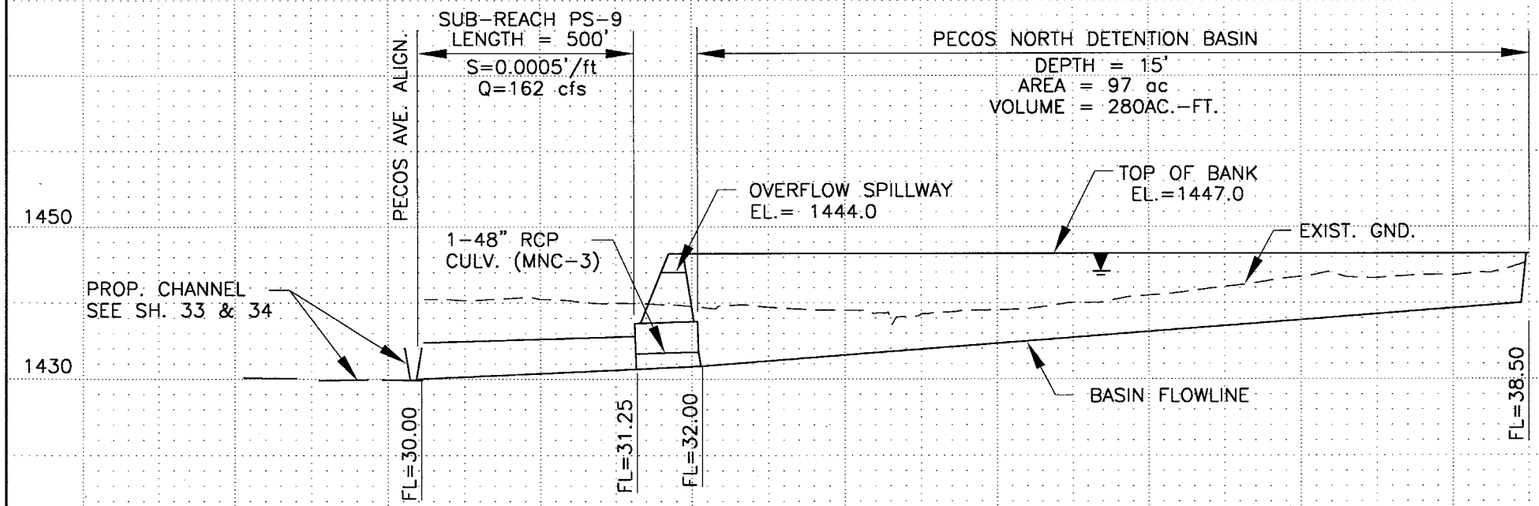
Elev.	Inc. Volume (acre-ft.)	Cum. Volume (acre-ft.)	Pipe Outflow (cfs)	Spillway Flow (cfs)	Spillway & Pipe Flow (cfs)
1436	0.00	0.00	88	0	88
1437	0.00	8.00	108	0	108
1438	0.00	34.00	125	0	125
1440	0.00	113.00	153	0	153
1441	0.00	153.00	165	0	165
1443	0.00	237.00	188	0	188
1444	0.00	280.00	198	0	198
1446.1	0.00	346.00	218	1446	1663

Note: (1) Volume computations based upon results obtained from surface modeling software.
(2) Outflow rate = CA(2gh)^0.5
(3) Width is perpendicular to flow. Length is measured down the slope.









MERIDIAN NORTH CHANNEL & PECOS NORTH BASIN

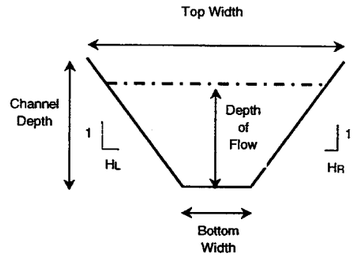
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS (Since 1962)	PROJECT DESCRIPTION: AREA 1 MERIDIAN NORTH CHANNEL
	SUB CONSULTANT: Haskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / DES. DCF DATE: 6-3-98 / CKD. BJF DATE: 6-8-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS NO. 36 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - MERIDIAN NORTH CHANNEL

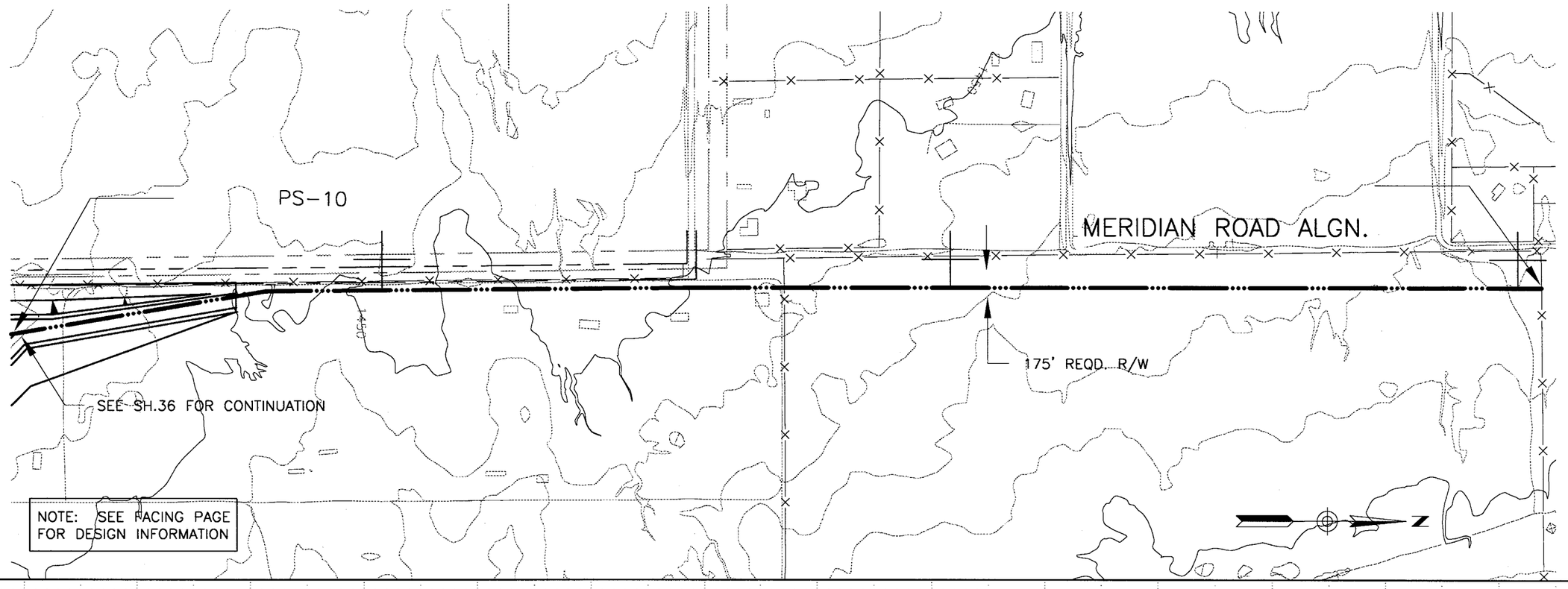
Channel Properties

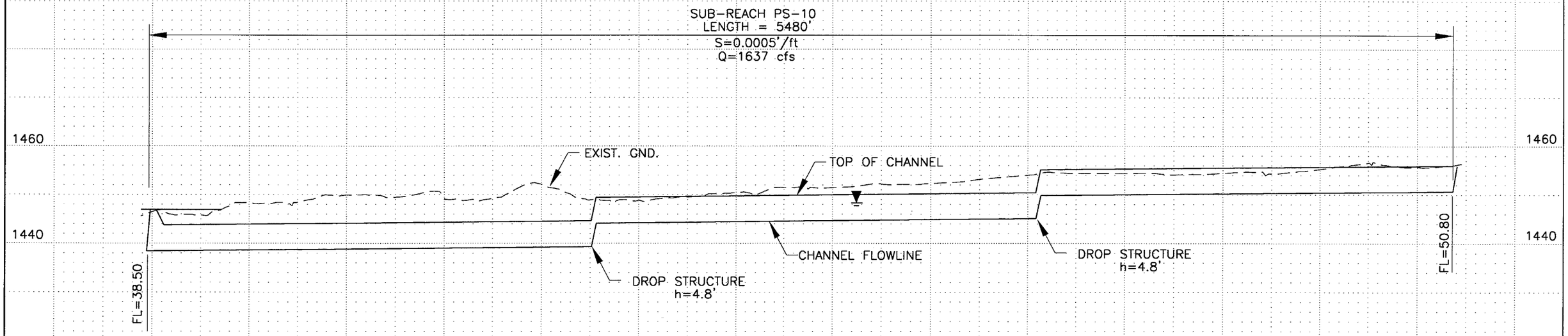
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
PS-10	C82A1	1637	1637	1438.5	1450.8	5480	0.0022	0.0005	9.6	2	4.8	E	0.0250	60.0	5.4	6	6	493.5	125.2	0.29	Sub	3.3	1.4	6.7	140.9

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





MERIDIAN NORTH CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 1 MERIDIAN NORTH CHANNEL

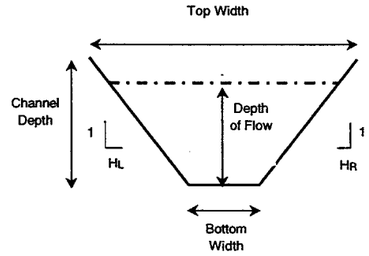
DRN. JEV DATE: 6-10-98	SCALE		SHEETS
DES. DCF DATE: 6-3-98	1"=400'	HORIZONTAL	NO. 37 OF 43
CKD. BJF DATE: 6-8-98	1"=20'	VERTICAL	

East Mesa Area Drainage Master Plan
AREA 1 - ELLSWORTH CHANNEL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
EH-4	R84	314	314	1381.6	1382.0	360	0.0011	0.0011	0.0	0	0.0	C	0.0150	8.0	3.6	2	2	55.2	24.2	0.64	Sub	5.7	1.0	4.7	26.6
EH-5	R84	314	314	1382.1	1382.7	590	0.0010	0.0011	0.0	0	0.0	C	0.0150	8.0	3.6	2	2	55.2	24.2	0.64	Sub	5.7	1.0	4.7	26.6
EH-6	R84	314	314	1382.7	1387.8	4550	0.0011	0.0011	0.1	0	0.0	C	0.0150	8.0	3.6	2	2	55.2	24.2	0.64	Sub	5.7	1.0	4.7	26.6

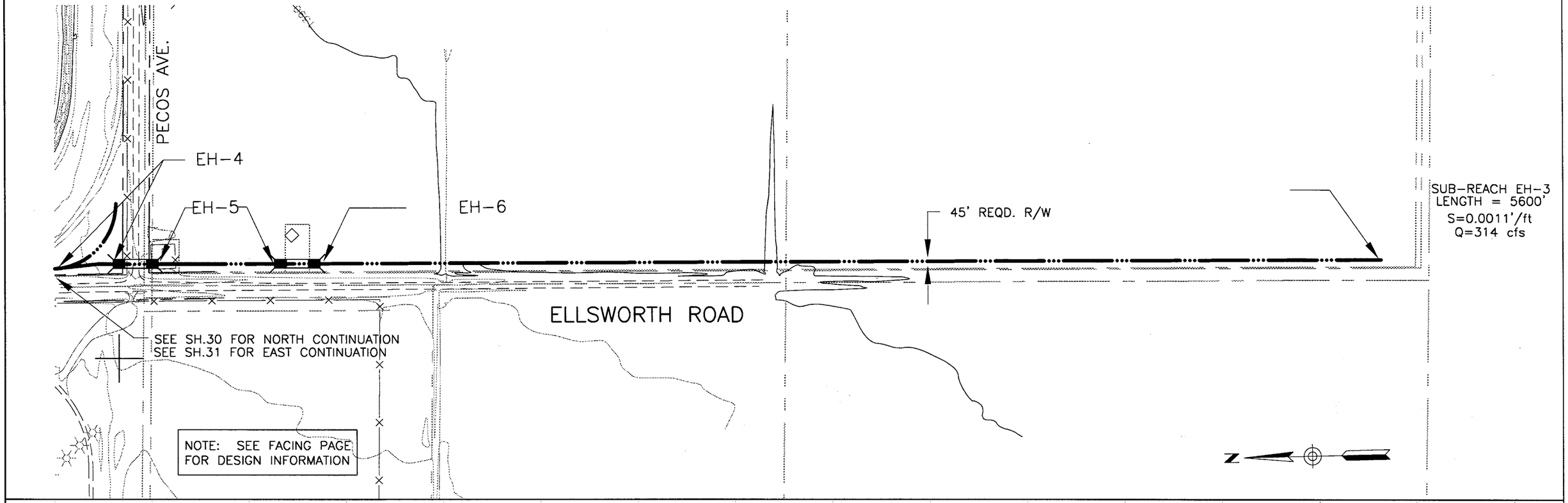
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

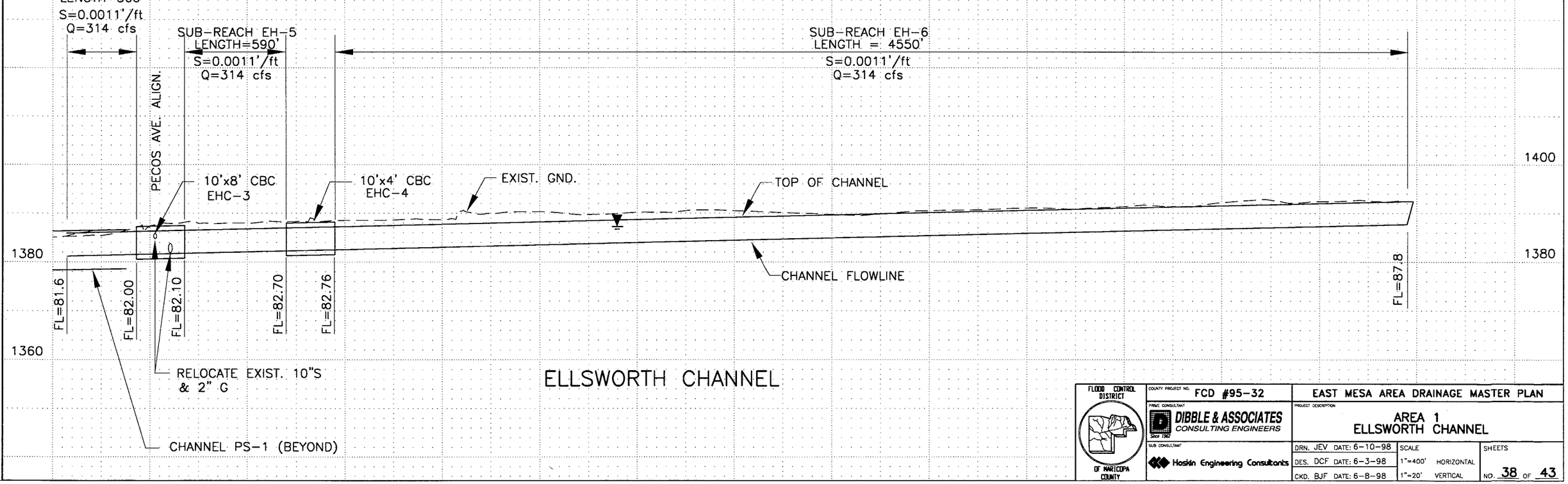


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
EHC-3	R84	314	314	80	1382.1	1380.0	0.0262	C	0.0120	1	8	ft.	10	RCBC	Wingwall	3.62	4.88	0.61	IC
EHC-4	R84	314	314	20	1382.8	1382.7	0.0050	C	0.0120	1	4	ft.	10	RCBC	Wingwall	3.62	5.59	1.40	IC





ELLSWORTH CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962

SUB CONSULTANT: Haskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 1 ELLSWORTH CHANNEL

DRN. JEV DATE: 6-10-98

DES. DCF DATE: 6-3-98

CKD. BJF DATE: 6-8-98

SCALE: 1"=400' HORIZONTAL; 1"=20' VERTICAL

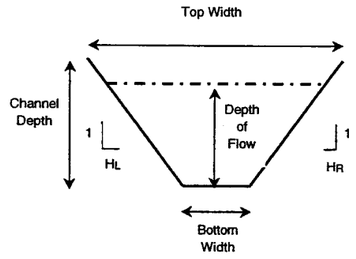
SHEETS NO. 38 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - PECOS LATERAL

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
CN-1	R83	523	523	1394.9	1403.7	5500	0.0016	0.0010	3.3	1	3.3	E	0.0250	6.0	4.6	6	6	152.1	61.5	0.38	Sub	3.4	1.2	5.7	75.0

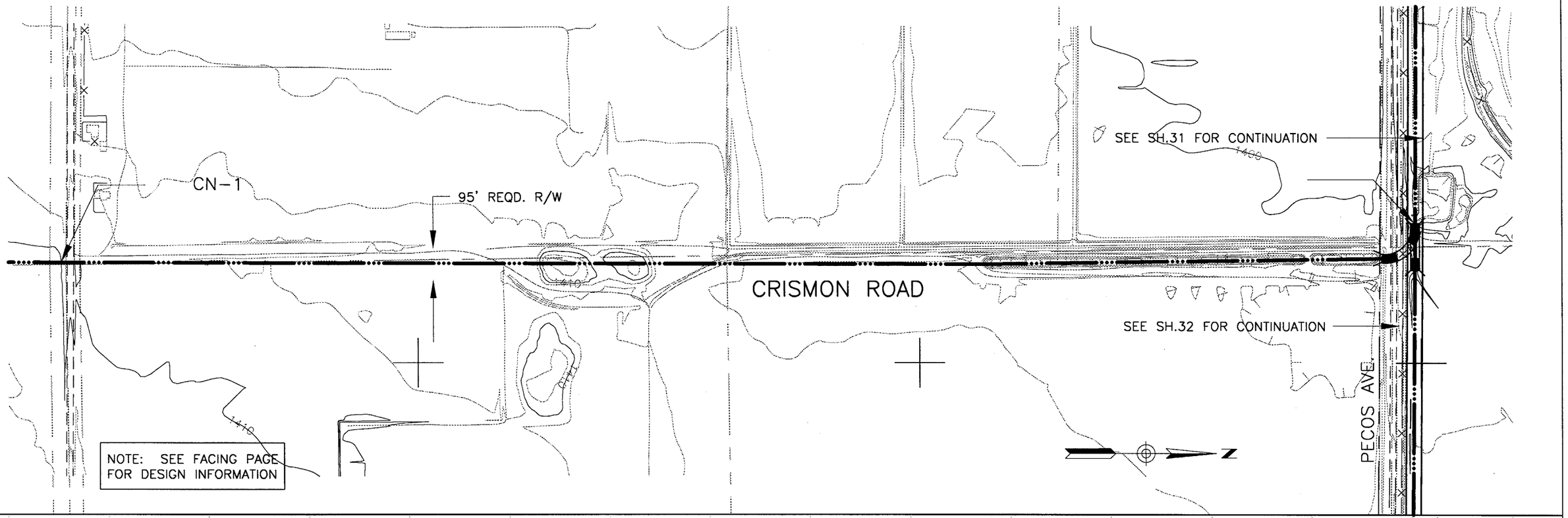
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

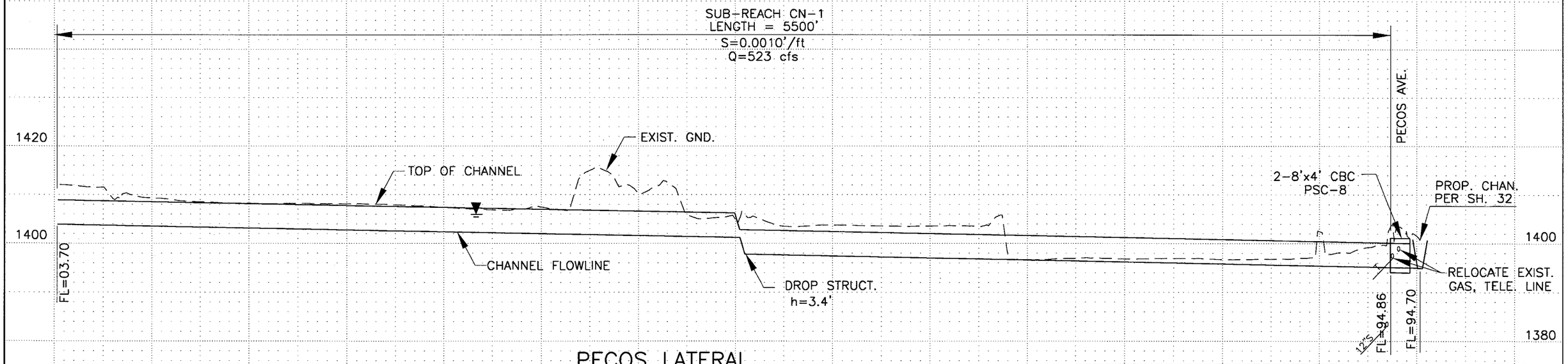


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
PSC-8	82TBOX	523	523	80	1394.9	1394.7	0.0020	C	0.0120	2	4	ft.	8	RCBC	Wingwall	5.043	6.57	1.64	TW





PECOS LATERAL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 1 PECOS LATERAL

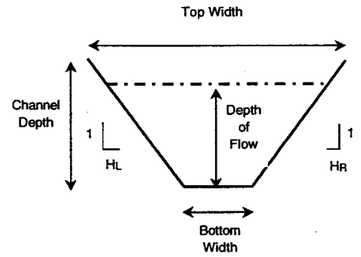
DRN. JEV	DATE: 6-10-98	SCALE	SHEETS
DES. DCF	DATE: 6-3-98	1"=400' HORIZONTAL	NO. 39 OF 43
CKD. BJF	DATE: 6-8-98	1"=20' VERTICAL	

East Mesa Area Drainage Master Plan
AREA 1 - RITTENHOUSE CHANNEL EXTENSION

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (H_L)	Sideslope (H:1) Right (H_R)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
RH-1	R88A	426	426	1394.9	1395.9	710	0.0014	0.0010	0.3	0	0.0	E	0.0250	10.0	3.9	6	6	131.1	57.6	0.38	Sub	3.3	1.0	4.9	69.2
RH-2a	R88A	426	426	1396.9	1402.4	1900	0.0029	0.0010	3.6	1	3.6	E	0.0250	10.0	3.9	6	6	131.1	57.6	0.38	Sub	3.3	1.0	4.9	69.2

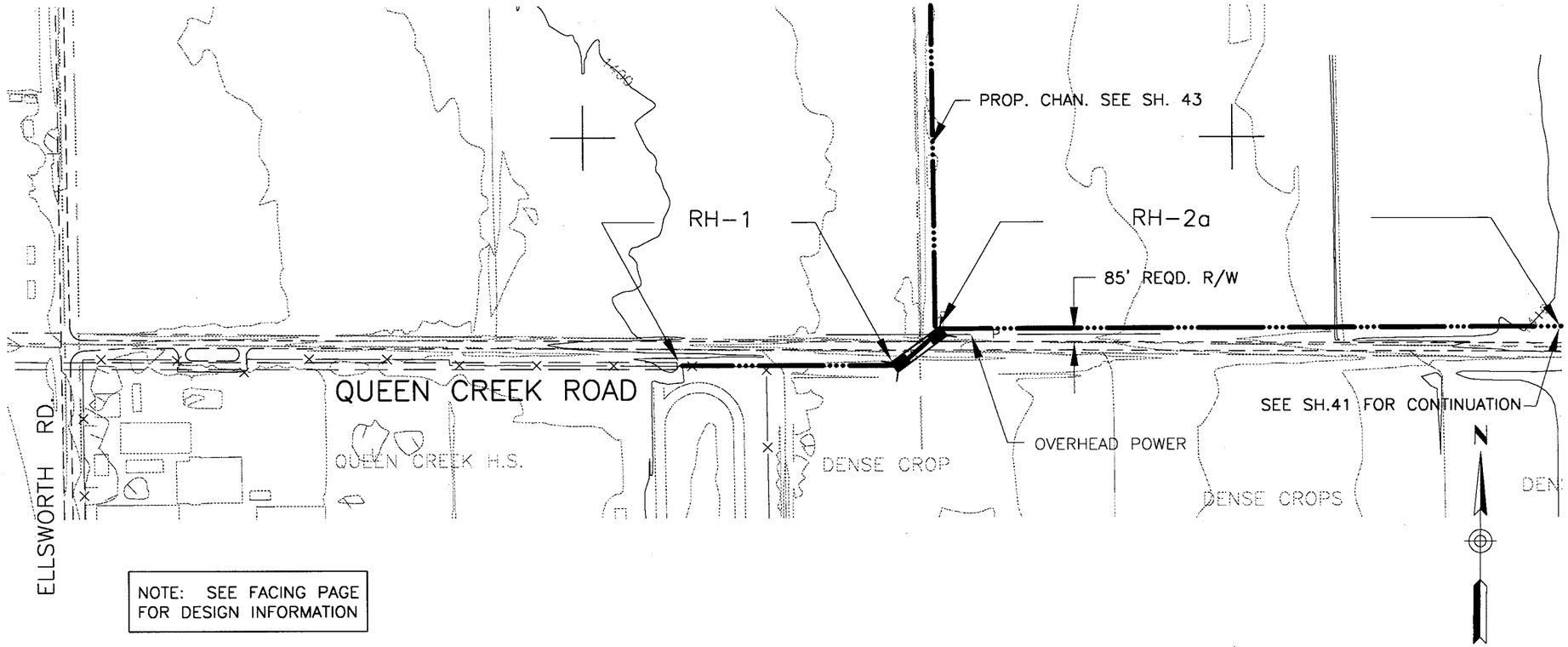
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

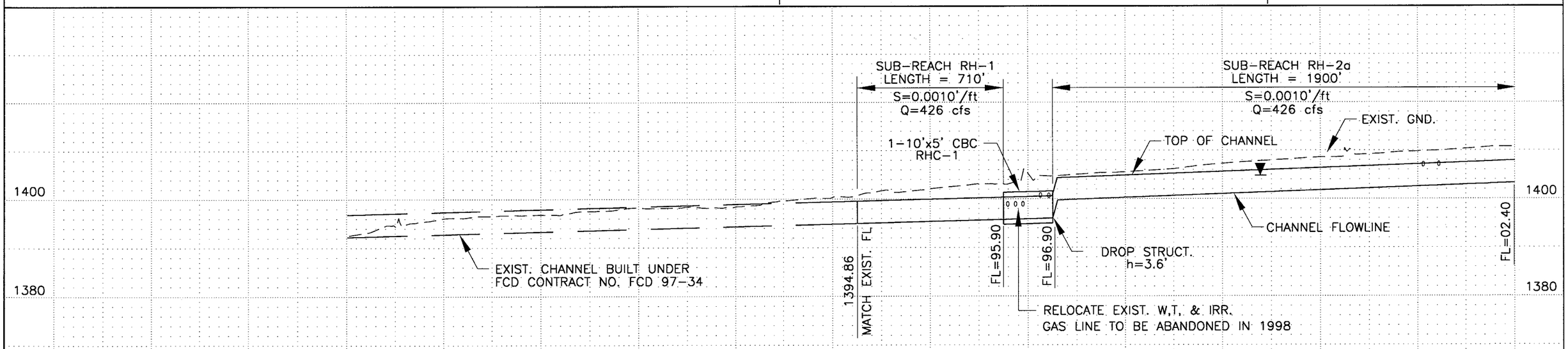


Typical Channel Section

Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
RHC-1	R88A	426	426	90	1396.9	1395.9	0.0111	C	0.0120	1	5	ft.	10	RCBC	Wingwall	3.915	6.79	1.36	IC





RITTENHOUSE CHANNEL EXTENSION

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

PROJECT DESCRIPTION: AREA 1 RITTENHOUSE CHANNEL EXTENSION

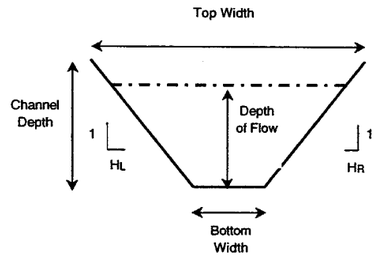
DRN. JEV DATE: 6-10-98	SCALE	SHEETS
DES. DCF DATE: 6-3-98	1"=400' HORIZONTAL	NO. 40 OF 43
CKD. BJF DATE: 6-8-98	1"=20' VERTICAL	

East Mesa Area Drainage Master Plan
AREA 1- RITTENHOUSE CHANNEL EXTENSION

Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
RH-2b	R88A	426	426	1402.4	1402.9	535	0.0009	0.0010	0.0	0	0.0	E	0.0250	10.0	3.9	6	6	131.1	57.6	0.38	Sub	3.3	1.0	4.9	69.2
RH-3	R88A	426	426	1403.9	1415.1	2625	0.0043	0.0010	8.6	2	4.3	E	0.0250	10.0	3.9	6	6	131.1	57.6	0.38	Sub	3.3	1.0	4.9	69.2

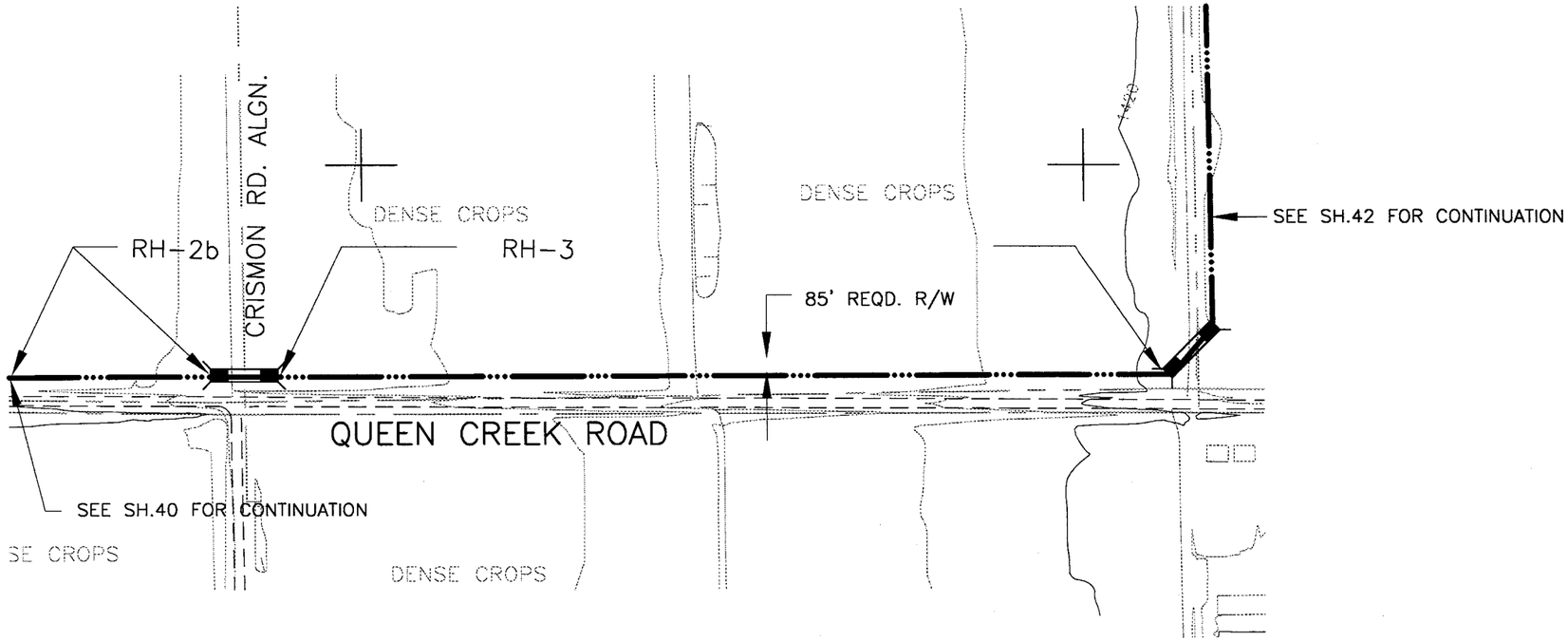
Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth

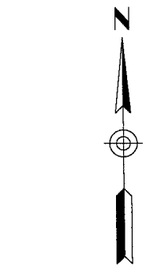


Typical Channel Section

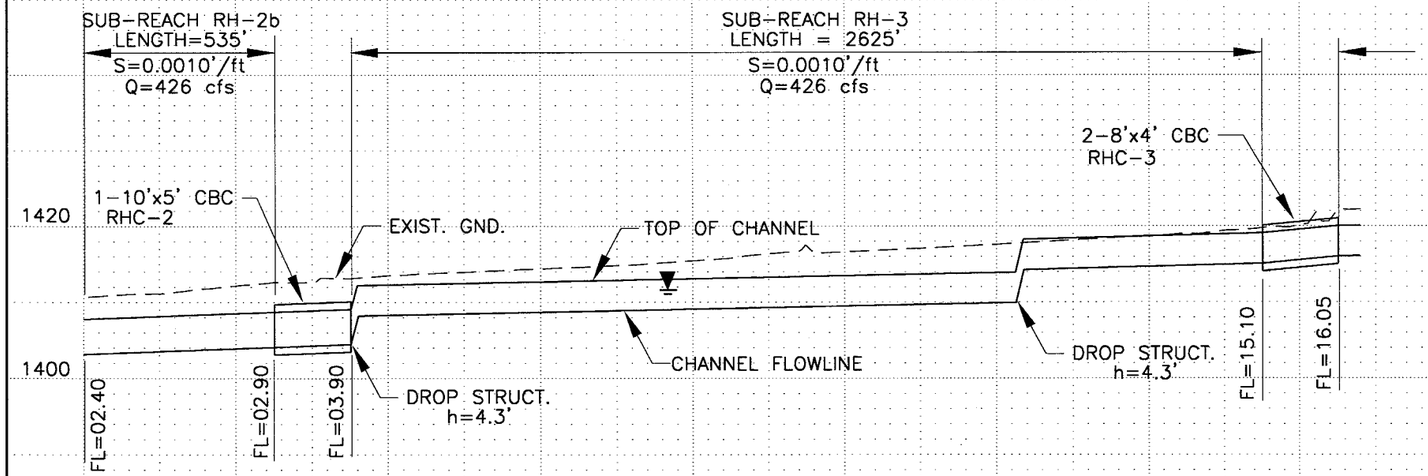
Culvert Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Length (ft.)	Inlet Inv. (ft.)	Outlet Inv. (ft.)	Slope (ft./ft.)	Material/ Barrel Type	Manning's "n" Value	Number of Barrels	Culvert Dia./ Height	Unit	Width (ft)	Barrel/ Material	Entrance (Wingwall, Headwall or Project)	Tailwater Depth (ft.)	Computed Headwater	Computed HW/D	Control
RHC-2	R88A	426	426	60	1403.9	1402.9	0.0167	C	0.0120	1	5	ft.	10	RCBC	Wingwall	3.915	6.76	1.35	IC
RHC-3	R88A	426	426	80	1416.1	1415.1	0.0125	C	0.0120	2	4	ft.	8	RCBC	Wingwall	3.915	4.53	1.13	IC





NOTE: SEE FACING PAGE FOR DESIGN INFORMATION



RITTENHOUSE CHANNEL EXTENSION

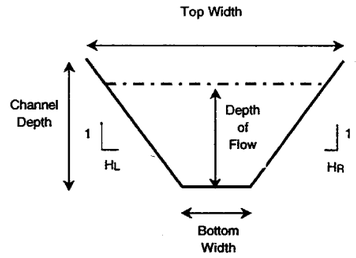
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS	PROJECT DESCRIPTION: AREA 1 RITTENHOUSE CHANNEL EXTENSION
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / SCALE / SHEETS
		DES. DCF DATE: 6-3-98 / 1"=400' HORIZONTAL
		CKD. BJF DATE: 6-8-98 / 1"=20' VERTICAL / NO. 41 OF 43

East Mesa Area Drainage Master Plan
AREA 1 - RITTENHOUSE CHANNEL LATERAL 2

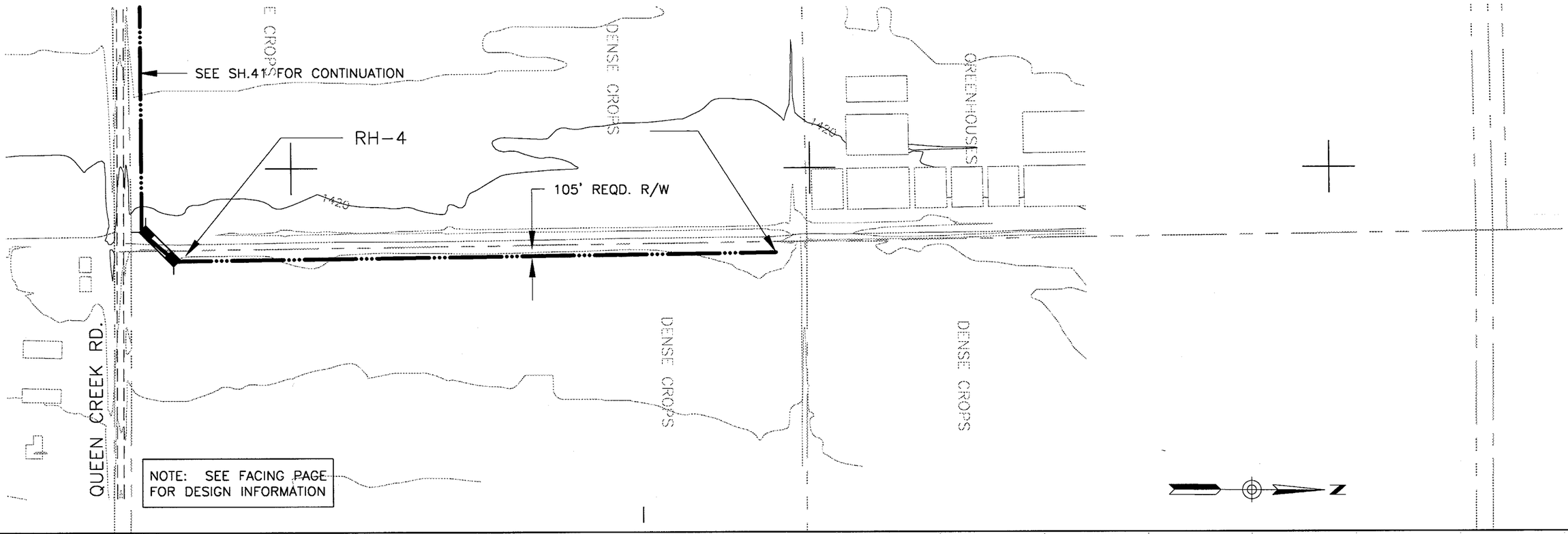
Channel Properties

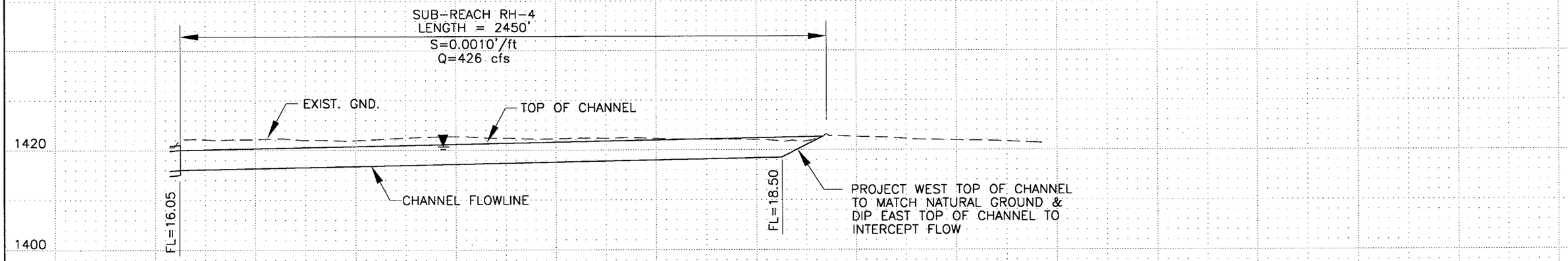
I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
RH-4	R88A	426	426	1416.1	1418.5	2450	0.0010	0.0010	0.0	0	0.0	R	0.0250	10.0	3.9	6	6	131.1	57.6	0.38	Sub	3.3	1.0	4.9	69.2

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section





RITTENHOUSE CHANNEL LATERAL 2

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

COUNTY PROJECT NO. FCD #95-32

PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962

SUB CONSULTANT: Hoskin Engineering Consultants

EAST MESA AREA DRAINAGE MASTER PLAN

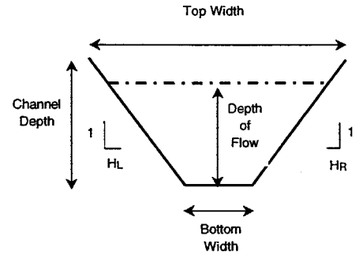
PROJECT DESCRIPTION: AREA 1 RITTENHOUSE CHANNEL LATERAL 2

DRN. JEV DATE: 6-10-98	SCALE		SHEETS
DES. DCF DATE: 6-3-98	1"=400'	HORIZONTAL	NO. 42 OF 43
CKD. BJF DATE: 6-8-98	1"=20'	VERTICAL	

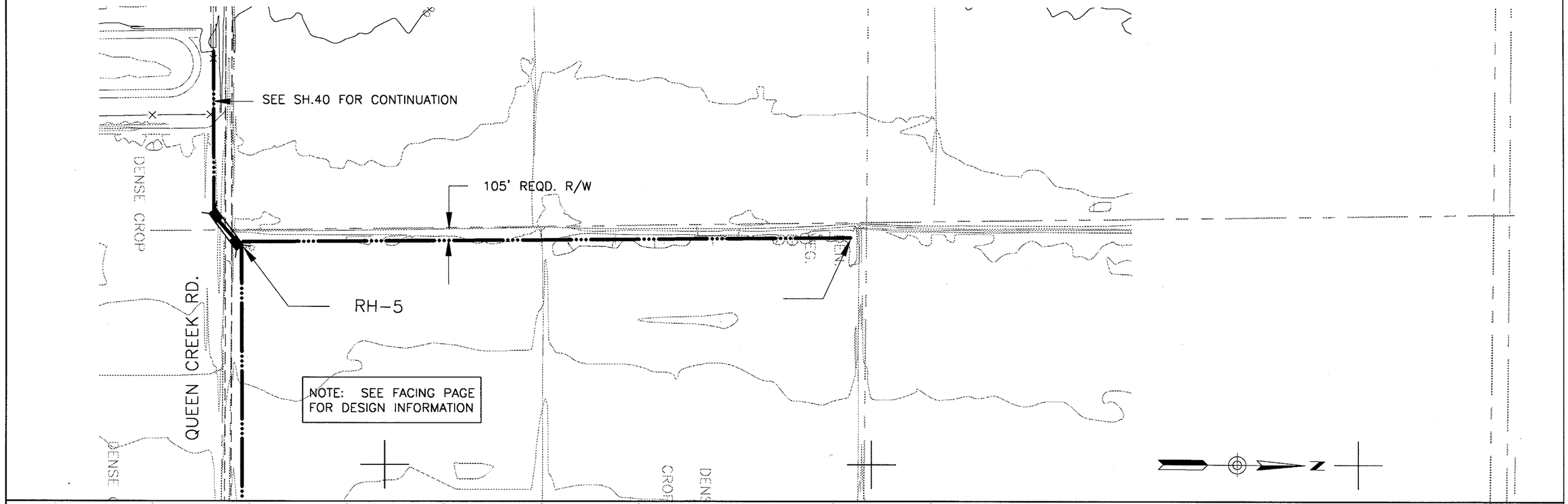
Channel Properties

I.D.	HEC-1 I.D.	Design Q100 (cfs)	Comp. Capacity (cfs)	Downstream Invert Elevation (ft)	Upstream Invert Elevation (ft)	Length (ft.)	Computed Invert. Slope (ft./ft.)	Design Invert Slope (ft./ft.)	Total Vertical Drop (ft.)	No. of Drops	Vertical Drop (ft.)	Material Type	Manning's "n" Value	Bottom Width, W (ft.)	Depth of Flow(ft.)	Sideslope (H:1) Left (HL)	Sideslope (H:1) Right (HR)	Area (sf.)	Perimeter (ft.)	Froude Number	Type of Flow	Velocity (fps)	Freeboard (ft.)	Design Depth (ft)	Channel Topwidth (ft)
RH-5	R88A	426	426	1398.2	1400.7	2450	0.0010	0.0010	0.1	0	0.0	m	0.0250	12.0	3.8	6	6	131.4	58.0	0.38	Sub	3.2	1.0	4.8	69.4

Channel Material Type: C = Concrete, R = Riprap, G = Grass, E = Natural or Earth



Typical Channel Section



RITTENHOUSE CHANNEL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY	COUNTY PROJECT NO. FCD #95-32	EAST MESA AREA DRAINAGE MASTER PLAN
	PRIME CONSULTANT: DIBBLE & ASSOCIATES CONSULTING ENGINEERS Since 1962	PROJECT DESCRIPTION: AREA 1 RITTENHOUSE CHANNEL
	SUB CONSULTANT: Hoskin Engineering Consultants	DRN. JEV DATE: 6-10-98 / DES. DCF DATE: 6-3-98 / CKD. BJF DATE: 6-8-98
		SCALE: 1"=400' HORIZONTAL, 1"=20' VERTICAL
		SHEETS NO. 43 OF 43

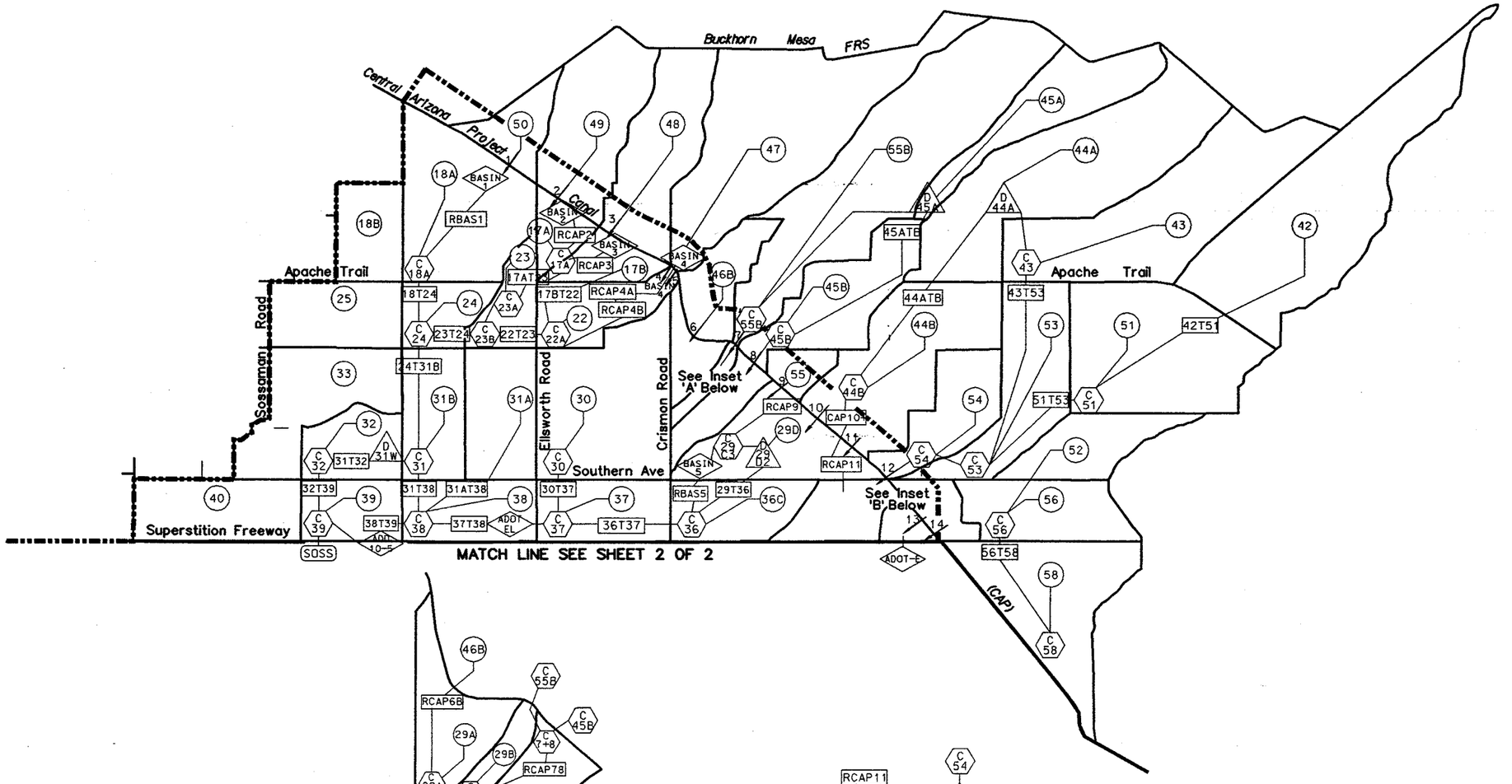
APPENDIX

HEC-1 Schematic - North of Superstition Freeway
HEC-1 Schematic - South of Superstition Freeway

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32



2500 0' 2500 5000

SCALE: 1" = 5000'

LEGEND

STUDY BOUNDARY	
SUB-BASIN BOUNDARY	
DIVERT HYDROGRAPH	DT TRW
SUB-BASIN RUNOFF	90A
ROUTE HYDROGRAPH	6AT7B
COMBINE HYDROGRAPH	CP 90A
OUTFLOW FROM STUDY AREA	CAP5
DETENTION BASIN	ADOT W
CAP OVERCHUTE	5

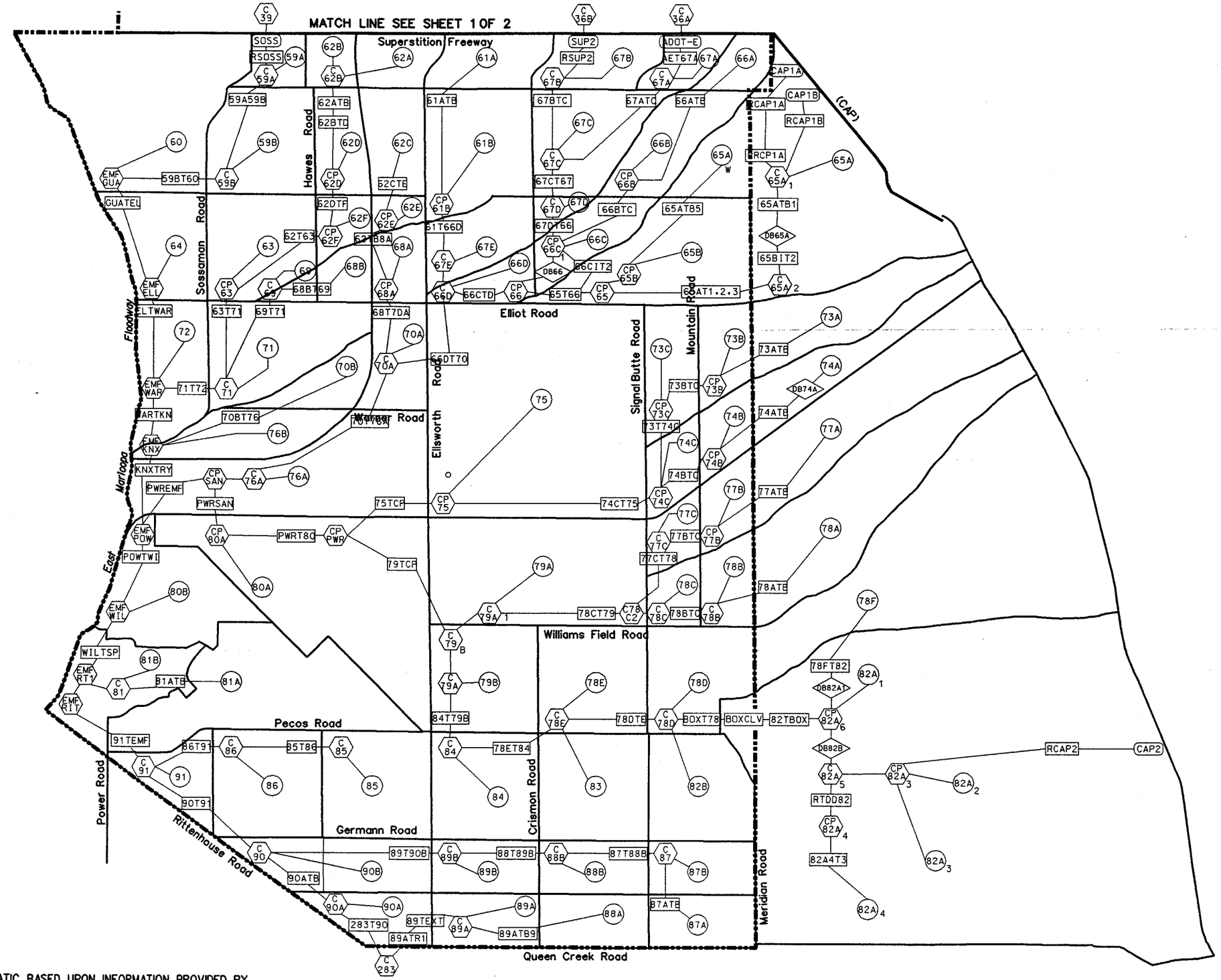
NOTE:
SCHEMATIC BASED UPON INFORMATION PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DIBBLE & ASSOCIATES CONSULTING ENGINEERS

Hoskin Engineering Consultants

HEC-1 SCHEMATIC NORTH OF SUPERSTITION FREEWAY

SHEET 1 OF 2



NOTE:
SCHEMATIC BASED UPON INFORMATION PROVIDED BY
THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

East Mesa Area Drainage Master Plan

F.C.D. CONTRACT NO. 95-32

LEGEND

- STUDY BOUNDARY
- SUB-BASIN BOUNDARY
- DIVERT HYDROGRAPH (DT TRW)
- SUB-BASIN RUNOFF (90A)
- ROUTE HYDROGRAPH (6AT7E)
- COMBINE HYDROGRAPH (CP 90A)
- OUTFLOW FROM STUDY AREA (CAP5)
- DETENTION BASIN (ADOT -W)
- CAP OVERCHUTE (5)

DIBBLE & ASSOCIATES
CONSULTING ENGINEERS
Since 1962
Hoskin Engineering Consultants

HEC-1 SCHEMATIC SOUTH OF SUPERSTITION FREEWAY

SHEET 2 OF 2

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									
+		42	1207.	12.67	267.	82.	27.	1.75		
	DIVERSION TO									
+		D42	872.	12.33	94.	27.	9.	1.75		
	HYDROGRAPH AT									
+		D42	1207.	12.67	201.	55.	18.	1.75		
	ROUTED TO									
+		42T51	1057.	13.25	198.	55.	18.	1.75		
	HYDROGRAPH AT									
+		51	1321.	12.25	220.	71.	24.	1.24		
	DIVERSION TO									
+		D51	935.	12.00	84.	25.	8.	1.24		
	HYDROGRAPH AT									
+		D51	1321.	12.25	165.	46.	15.	1.24		
	2 COMBINED AT									
+		C51	1297.	12.25	354.	99.	33.	2.99		
	ROUTED TO									
+		51T53	1011.	14.00	349.	99.	33.	2.99		
	HYDROGRAPH AT									
+		44A	1006.	12.75	231.	71.	24.	1.59		
	DIVERSION TO									
+		D44A	776.	12.42	83.	24.	8.	1.59		
	HYDROGRAPH AT									
+		D44A	1006.	12.75	172.	47.	16.	1.59		
	DIVERSION TO									
+		D44A	754.	12.75	133.	36.	12.	1.59		
	HYDROGRAPH AT									
+		DIV44A	252.	12.75	39.	10.	3.	1.59		
	HYDROGRAPH AT									
+		43	1416.	12.33	258.	84.	28.	1.42		
	DIVERSION TO									
+		D43	1093.	12.08	105.	31.	10.	1.42		
	HYDROGRAPH AT									
+		D43	1416.	12.33	188.	53.	18.	1.42		
	2 COMBINED AT									
+		C43	1395.	12.33	221.	62.	21.	3.01		
	ROUTED TO									
+		43T53	918.	13.58	216.	62.	21.	3.01		
	HYDROGRAPH AT									
+		53	721.	12.42	128.	40.	13.	.78		
	DIVERSION TO									
+		D53	485.	12.08	46.	14.	5.	.78		
	HYDROGRAPH AT									
+		D53	721.	12.42	96.	26.	9.	.78		
	3 COMBINED AT									
+		C53	1755.	13.67	626.	179.	60.	6.78		
	HYDROGRAPH AT									
+		54	405.	12.50	77.	23.	8.	.49		
	DIVERSION TO									
+		D54	174.	12.00	18.	6.	2.	.49		
	HYDROGRAPH AT									
+		D54	405.	12.50	66.	18.	6.	.49		
	2 COMBINED AT									
+		C54	1779.	13.67	682.	194.	65.	7.27		
	DIVERSION TO									
+		SOUTH	665.	13.67	196.	49.	16.	7.27		
	HYDROGRAPH AT									
+		DCAP12	1115.	13.67	486.	145.	48.	7.27		
	ROUTED TO									
+		CAP12	1034.	14.08	485.	145.	48.	7.27		
	HYDROGRAPH AT									
+		DR44A	776.	12.42	83.	24.	8.	1.59		
	ROUTED TO									
+		44ATB	350.	13.25	84.	24.	8.	1.59		
	HYDROGRAPH AT									
+		44B	1104.	12.33	196.	60.	20.	1.06		
	DIVERSION TO									
+		D44B	249.	11.75	38.	12.	4.	1.06		
	HYDROGRAPH AT									
+		D44B	1104.	12.33	179.	48.	16.	1.06		

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
+	2 COMBINED AT	C44B	1303.	12.42	248.	73.	24.	1.06		
+	ROUTED TO	CAP10+	1263.	12.50	248.	73.	24.	1.06		
+	ROUTED TO	RCAP11	1250.	12.50	248.	73.	24.	1.06		
+	2 COMBINED AT	C12	1807.	12.58	707.	213.	71.	8.33		
+	ROUTED TO	ADOT-W	392.	15.33	372.	212.	71.	8.33		
+	ROUTED TO	RADOTW	392.	15.42	372.	212.	71.	8.33		
+	HYDROGRAPH AT	36B	276.	12.58	53.	15.	5.	.32		
+	DIVERSION TO	D36B	276.	12.58	38.	10.	3.	.32		
+	HYDROGRAPH AT	D36B	190.	12.83	18.	5.	2.	.32		
+	2 COMBINED AT	C36B	422.	13.00	381.	215.	72.	8.65		
+	HYDROGRAPH AT	RSOUTH	665.	13.67	196.	49.	16.	7.27		
+	HYDROGRAPH AT	57	252.	12.08	37.	12.	4.	.18		
+	DIVERSION TO	D42	252.	12.08	27.	8.	3.	.18		
+	HYDROGRAPH AT	D57	152.	12.33	15.	4.	1.	.18		
+	2 COMBINED AT	C57	756.	13.58	237.	60.	20.	.18		
+	ROUTED TO	CAP13+	754.	13.67	237.	60.	20.	.18		
+	HYDROGRAPH AT	36A	114.	12.17	15.	4.	1.	.10		
+	2 COMBINED AT	C36A	756.	13.67	251.	65.	22.	.28		
+	ROUTED TO	ADOT-E	246.	14.42	175.	64.	22.	.28		
+	HYDROGRAPH AT	52	509.	12.25	84.	26.	9.	.43		
+	DIVERSION TO	D52	487.	12.17	47.	13.	4.	.43		
+	HYDROGRAPH AT	D52	500.	12.33	47.	13.	4.	.43		
+	HYDROGRAPH AT	56	822.	12.08	116.	37.	12.	.55		
+	DIVERSION TO	D56	536.	11.83	42.	13.	4.	.55		
+	HYDROGRAPH AT	D56	822.	12.08	89.	25.	8.	.55		
+	2 COMBINED AT	C56	961.	12.33	135.	38.	13.	.98		
+	ROUTED TO	56T58	744.	12.67	134.	38.	13.	.98		
+	HYDROGRAPH AT	58	849.	12.50	189.	62.	21.	.95		
+	DIVERSION TO	D58	849.	12.50	131.	37.	12.	.95		
+	HYDROGRAPH AT	D58	613.	12.75	85.	25.	8.	.95		
+	2 COMBINED AT	C58	1257.	12.83	211.	62.	21.	1.93		
+	3 COMBINED AT	CLEAR	1491.	12.92	686.	320.	108.	10.86		
+	HYDROGRAPH AT	46B	272.	12.67	64.	21.	7.	.36		
+	DIVERSION TO	D46	13.	9.58	8.	3.	1.	.36		
+	HYDROGRAPH AT	D46B	272.	12.67	64.	19.	6.	.36		

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
+	ROUTED TO	CAP6	231.	12.83	64.	19.	6.	.36		
+	ROUTED TO	RCAP6B	230.	12.92	64.	19.	6.	.36		
+	HYDROGRAPH AT	29A	119.	12.58	25.	8.	3.	.18		
+	DIVERSION TO	D29A	119.	12.58	17.	5.	2.	.18		
+	HYDROGRAPH AT	D29A	94.	12.83	11.	3.	1.	.18		
+	2 COMBINED AT	C29A	323.	12.83	74.	22.	7.	.54		
+	HYDROGRAPH AT	45A	299.	12.92	72.	21.	7.	.62		
+	DIVERSION TO	D29A	299.	12.92	45.	12.	4.	.62		
+	HYDROGRAPH AT	D45A	251.	13.08	33.	9.	3.	.62		
+	DIVERSION TO	45ATB	239.	13.08	31.	9.	3.	.62		
+	HYDROGRAPH AT	D45A	13.	13.08	2.	0.	0.	.62		
+	HYDROGRAPH AT	55B	881.	13.08	257.	80.	27.	1.86		
+	DIVERSION TO	D55B	881.	13.08	168.	46.	15.	1.86		
+	HYDROGRAPH AT	D55B	671.	13.42	118.	34.	11.	1.86		
+	2 COMBINED AT	C55B	674.	13.42	118.	34.	11.	2.48		
+	ROUTED TO	CAP7	504.	13.67	118.	34.	11.	2.48		
+	HYDROGRAPH AT	RD45A	239.	13.08	31.	9.	3.	.62		
+	ROUTED TO	45ATB	149.	14.17	29.	9.	3.	.62		
+	HYDROGRAPH AT	45B	593.	12.50	127.	41.	14.	.66		
+	DIVERSION TO	D45B	335.	12.08	39.	12.	4.	.66		
+	HYDROGRAPH AT	D45B	593.	12.50	104.	29.	10.	.66		
+	2 COMBINED AT	C45B	593.	12.50	131.	37.	12.	.66		
+	ROUTED TO	CAP8	454.	12.75	130.	37.	12.	.66		
+	2 COMBINED AT	C7+8	699.	13.42	237.	70.	23.	3.14		
+	ROUTED TO	RCAP78	687.	13.58	235.	70.	23.	3.14		
+	HYDROGRAPH AT	29B	50.	12.50	9.	3.	1.	.08		
+	DIVERSION TO	D29B	50.	12.50	9.	3.	1.	.08		
+	HYDROGRAPH AT	D29B	0.	22.83	0.	0.	0.	.08		
+	2 COMBINED AT	C29B1	687.	13.58	235.	70.	23.	3.22		
+	2 COMBINED AT	C29B2	788.	13.58	299.	90.	30.	3.76		
+	ROUTED TO	TRANS	743.	13.67	298.	90.	30.	3.76		
+	HYDROGRAPH AT	29C	223.	12.33	37.	11.	4.	.23		
+	DIVERSION TO	D29	223.	12.33	32.	9.	3.	.23		
+	HYDROGRAPH AT	D29C	76.	12.83	9.	3.	1.	.23		
+	2 COMBINED AT	C29C2	752.	13.67	305.	92.	31.	3.99		

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	55	161.	12.17	21.	6.	2.	.14		
+	DIVERSION TO	D55	161.	12.17	17.	5.	2.	.14		
+	HYDROGRAPH AT	D55	70.	12.42	6.	2.	1.	.14		
+	ROUTED TO	CAP9	35.	12.58	6.	2.	1.	.14		
+	ROUTED TO	RCAP9	20.	13.17	6.	2.	1.	.14		
+	HYDROGRAPH AT	29D	522.	12.58	113.	36.	12.	.65		
+	DIVERSION TO	D29D	449.	12.33	47.	14.	5.	.65		
+	HYDROGRAPH AT	D29D	522.	12.58	80.	22.	7.	.65		
+	DIVERSION TO	D29DE	345.	12.58	53.	15.	5.	.65		
+	HYDROGRAPH AT	D29D2	178.	12.58	27.	8.	3.	.65		
+	3 COMBINED AT	C29C3	849.	13.00	333.	100.	33.	4.78		
+	ROUTED TO	BASIN5	266.	15.00	244.	100.	33.	4.78		
+	ROUTED TO	RBAS5	266.	15.08	244.	100.	33.	4.78		
+	HYDROGRAPH AT	G29DE	345.	12.58	53.	15.	5.	.65		
+	ROUTED TO	29T36	345.	12.67	52.	15.	5.	.65		
+	HYDROGRAPH AT	36C	710.	12.00	105.	36.	12.	.44		
+	DIVERSION TO	D36C	640.	11.92	66.	19.	6.	.44		
+	HYDROGRAPH AT	D36C	699.	12.08	57.	17.	6.	.44		
+	3 COMBINED AT	C36	680.	12.08	321.	130.	43.	5.22		
+	ROUTED TO	36T37	514.	12.83	318.	130.	43.	5.22		
+	HYDROGRAPH AT	30	857.	12.58	187.	61.	20.	1.12		
+	DIVERSION TO	D30	72.	11.33	31.	11.	4.	1.12		
+	HYDROGRAPH AT	D30	857.	12.58	181.	50.	17.	1.12		
+	ROUTED TO	30T37	829.	12.75	181.	50.	17.	1.12		
+	HYDROGRAPH AT	37	752.	12.00	109.	37.	12.	.47		
+	DIVERSION TO	D37	684.	11.92	65.	19.	6.	.47		
+	HYDROGRAPH AT	D37	709.	12.08	62.	18.	6.	.47		
+	3 COMBINED AT	C37	1340.	12.83	531.	190.	63.	6.81		
+	ROUTED TO	ADOTEL	17.	26.17	17.	17.	17.	6.81		
+	ROUTED TO	37T38	17.	26.67	17.	17.	17.	6.81		
+	HYDROGRAPH AT	48	543.	12.50	96.	29.	10.	.77		
+	DIVERSION TO	D48	535.	12.42	51.	14.	5.	.77		
+	HYDROGRAPH AT	D48	520.	12.58	53.	15.	5.	.77		
+	ROUTED TO	CAP3	476.	12.67	53.	15.	5.	.77		
+	ROUTED TO	BASIN3	57.	13.50	48.	15.	5.	.77		

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
+	ROUTED TO	RCAP3	57.	13.50	48.	15.	5.	.77		
+	HYDROGRAPH AT	49	555.	12.50	100.	30.	10.	.79		
+	DIVERSION TO	D49	505.	12.33	49.	14.	5.	.79		
+	HYDROGRAPH AT	D49	555.	12.50	60.	17.	6.	.79		
+	ROUTED TO	CAP2	530.	12.58	60.	17.	6.	.79		
+	ROUTED TO	BASIN2	53.	13.58	39.	17.	6.	.79		
+	ROUTED TO	RCAP2A	53.	13.58	39.	17.	6.	.79		
+	ROUTED TO	RCAP2B	53.	13.58	39.	17.	6.	.79		
+	HYDROGRAPH AT	17A	158.	12.42	30.	10.	3.	.18		
+	DIVERSION TO	D17A	26.	11.75	6.	2.	1.	.18		
+	HYDROGRAPH AT	D17A	158.	12.42	28.	8.	3.	.18		
+	2 COMBINED AT	C17A1	173.	12.50	62.	24.	8.	.97		
+	2 COMBINED AT	C17A2	189.	12.58	105.	38.	13.	1.74		
+	ROUTED TO	AT23B	190.	12.58	105.	38.	13.	1.74		
+	ROUTED TO	AT23A	167.	12.75	103.	38.	13.	1.74		
+	HYDROGRAPH AT	23	322.	12.08	45.	15.	5.	.28		
+	DIVERSION TO	D23	187.	11.92	17.	5.	2.	.28		
+	HYDROGRAPH AT	D23	322.	12.08	34.	9.	3.	.28		
+	2 COMBINED AT	C23A	368.	12.17	134.	47.	16.	2.02		
+	HYDROGRAPH AT	17B	211.	12.42	42.	14.	5.	.22		
+	DIVERSION TO	D17B	17.	11.17	7.	3.	1.	.22		
+	HYDROGRAPH AT	D17B	211.	12.42	40.	11.	4.	.22		
+	ROUTED TO	17BT22	210.	12.42	40.	11.	4.	.22		
+	HYDROGRAPH AT	47	802.	12.92	189.	55.	18.	1.67		
+	DIVERSION TO	D47	802.	12.92	128.	34.	11.	1.67		
+	HYDROGRAPH AT	D47	546.	13.25	75.	21.	7.	1.67		
+	ROUTED TO	BASIN4	52.	14.75	48.	21.	7.	1.67		
+	ROUTED TO	RCAP4A	52.	14.92	48.	21.	7.	1.67		
+	ROUTED TO	RCAP4B	52.	14.92	48.	21.	7.	1.67		
+	ROUTED TO	RCAP4C	52.	15.25	48.	21.	7.	1.67		
+	ROUTED TO	RCAP4D	52.	15.33	48.	21.	7.	1.67		
+	HYDROGRAPH AT	22	477.	12.17	73.	24.	8.	.41		
+	DIVERSION TO	D22	71.	11.58	17.	6.	2.	.41		
+	HYDROGRAPH AT	D22	477.	12.17	67.	19.	6.	.41		
+	3 COMBINED AT	C22A	629.	12.25	135.	50.	17.	2.30		

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
	ROUTED TO									
+		22T23	624.	12.25	135.	50.	17.	2.30		
	2 COMBINED AT									
+		C23B	970.	12.25	261.	94.	31.	4.32		
	ROUTED TO									
+		23T24	930.	12.33	260.	94.	31.	4.32		
	HYDROGRAPH AT									
+		50	255.	12.33	45.	15.	5.	.28		
	DIVERSION TO									
+		D50	227.	12.17	23.	7.	2.	.28		
	HYDROGRAPH AT									
+		D50	255.	12.33	29.	8.	3.	.28		
	ROUTED TO									
+		CAP1	262.	12.42	29.	11.	7.	.28		
	ROUTED TO									
+		BASIN1	29.	13.33	25.	11.	7.	.28		
	ROUTED TO									
+		RBAS1	29.	13.83	25.	11.	7.	.28		
	HYDROGRAPH AT									
+		18A	922.	12.33	162.	52.	17.	1.01		
	DIVERSION TO									
+		D18A	553.	12.00	55.	17.	6.	1.01		
	HYDROGRAPH AT									
+		D18A	922.	12.33	129.	36.	12.	1.01		
	2 COMBINED AT									
+		C18A	922.	12.33	151.	46.	19.	1.29		
	ROUTED TO									
+		18T24	901.	12.42	150.	46.	19.	1.29		
	HYDROGRAPH AT									
+		24	299.	12.25	48.	15.	5.	.29		
	DIVERSION TO									
+		D24	5.	6.58	4.	1.	0.	.29		
	HYDROGRAPH AT									
+		D24	299.	12.25	48.	14.	5.	.29		
	3 COMBINED AT									
+		C24	2010.	12.33	436.	150.	53.	5.90		
	DIVERSION TO									
+		DWC24	0.	.00	0.	0.	0.	5.90		
	HYDROGRAPH AT									
+		DC24	2010.	12.33	436.	150.	53.	5.90		
	ROUTED TO									
+		RT31B1	1983.	12.33	435.	150.	53.	5.90		
	ROUTED TO									
+		RT31B2	1987.	12.42	434.	150.	53.	5.90		
	ROUTED TO									
+		RT31B3	1939.	12.50	434.	150.	53.	5.90		
	HYDROGRAPH AT									
+		31B	455.	12.33	74.	23.	8.	.47		
	DIVERSION TO									
+		D31B	449.	12.25	41.	12.	4.	.47		
	HYDROGRAPH AT									
+		D31B	453.	12.33	42.	12.	4.	.47		
	2 COMBINED AT									
+		C31	2290.	12.42	469.	159.	56.	6.37		
	DIVERSION TO									
+		D31W	1261.	12.42	258.	88.	31.	6.37		
	HYDROGRAPH AT									
+		D31	1029.	12.42	211.	72.	25.	6.37		
	ROUTED TO									
+		31T381	1026.	12.50	210.	72.	25.	6.37		
	ROUTED TO									
+		31T382	1026.	12.50	210.	72.	25.	6.37		
	HYDROGRAPH AT									
+		31A	585.	12.17	92.	30.	10.	.53		
	DIVERSION TO									
+		D31A	177.	11.75	25.	8.	3.	.53		
	HYDROGRAPH AT									
+		D31A	585.	12.17	79.	22.	7.	.53		
	ROUTED TO									
+		31AT38	539.	12.50	79.	22.	7.	.53		

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	38	512.	12.25	89.	30.	10.	.47		
+	DIVERSION TO	D38	150.	11.75	23.	8.	3.	.47		
+	HYDROGRAPH AT	D38	512.	12.25	79.	22.	7.	.47		
+	4 COMBINED AT	C38	1785.	12.50	350.	121.	53.	14.18		
+	ROUTED TO	38T39	1777.	12.50	349.	121.	53.	14.18		
+	DIVERSION TO	DB10	551.	12.50	36.	9.	3.	14.18		
+	HYDROGRAPH AT	ADD10	1226.	12.50	314.	112.	50.	14.18		
+	DIVERSION TO	DB9	340.	12.50	30.	7.	2.	14.18		
+	HYDROGRAPH AT	ADD9	886.	12.50	284.	105.	48.	14.18		
+	DIVERSION TO	DB8	240.	12.50	29.	7.	2.	14.18		
+	HYDROGRAPH AT	ADD8	646.	12.50	255.	97.	45.	14.18		
+	DIVERSION TO	DB7	0.	.00	0.	0.	0.	14.18		
+	HYDROGRAPH AT	ADD7	646.	12.50	255.	97.	45.	14.18		
+	DIVERSION TO	DB6	0.	.00	0.	0.	0.	14.18		
+	HYDROGRAPH AT	ADD6	646.	12.50	255.	97.	45.	14.18		
+	DIVERSION TO	DB5	0.	.00	0.	0.	0.	14.18		
+	HYDROGRAPH AT	ADD5	646.	12.50	255.	97.	45.	14.18		
+	HYDROGRAPH AT	D31W	1261.	12.42	258.	88.	31.	6.37		
+	ROUTED TO	31WT32	1083.	12.58	254.	88.	31.	6.37		
+	HYDROGRAPH AT	32	359.	12.25	53.	16.	5.	.38		
+	2 COMBINED AT	C32	1360.	12.58	315.	110.	39.	.38		
+	ROUTED TO	32T39	1329.	12.58	315.	110.	39.	.38		
+	HYDROGRAPH AT	39	356.	12.33	61.	20.	7.	.36		
+	DIVERSION TO	D39	11.	8.92	6.	2.	1.	.36		
+	HYDROGRAPH AT	D39	356.	12.33	61.	18.	6.	.36		
+	3 COMBINED AT	C39	1933.	12.58	579.	206.	83.	14.92		
+	DIVERSION TO	BASIN	133.	12.58	5.	1.	0.	14.92		
+	HYDROGRAPH AT	SOSS	1800.	12.58	574.	205.	83.	14.92		

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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	SOSS	1800.	12.58	574.	205.	86.	12.50		
+	ROUTED TO	RSOSS	1787.	12.75	572.	204.	85.	12.50		
+	HYDROGRAPH AT	59A	292.	12.33	40.	12.	4.	.26		
+	DIVERSION TO	D59A	4.	8.42	3.	1.	0.	.26		
+	HYDROGRAPH AT	R59A	292.	12.33	40.	11.	4.	.26		
+	2 COMBINED AT	C59A	1898.	12.67	606.	215.	89.	12.76		
+	ROUTED TO	59A59B	1882.	12.83	603.	215.	89.	12.76		
+	HYDROGRAPH AT	59B	606.	12.83	126.	37.	14.	.94		
+	DIVERSION TO	D59B	606.	12.83	118.	32.	11.	.94		
+	HYDROGRAPH AT	R59B	57.	13.58	17.	6.	2.	.94		
+	2 COMBINED AT	C59B	1882.	12.83	612.	219.	91.	13.70		
+	ROUTED TO	59BT60	1710.	13.33	608.	219.	90.	13.70		
+	HYDROGRAPH AT	60	1026.	13.50	345.	108.	39.	2.30		
+	DIVERSION TO	D60	1026.	13.50	312.	86.	31.	2.30		
+	HYDROGRAPH AT	R60	234.	15.00	70.	23.	8.	2.30		
+	2 COMBINED AT	EMFGUA	1710.	13.33	654.	238.	97.	16.00		
+	ROUTED TO	GUATEL	1618.	13.67	623.	237.	96.	16.00		
+	HYDROGRAPH AT	64	887.	12.42	150.	49.	18.	.81		
+	DIVERSION TO	D64	887.	12.42	121.	34.	12.	.81		
+	HYDROGRAPH AT	R64	330.	12.83	50.	16.	6.	.81		
+	2 COMBINED AT	EMFELL	1687.	13.58	661.	250.	101.	16.81		
+	ROUTED TO	ELTWAR	1463.	14.00	633.	249.	100.	16.81		
+	HYDROGRAPH AT	62A	782.	12.00	86.	30.	11.	.38		
+	DIVERSION TO	D62A	782.	12.00	58.	17.	6.	.38		
+	HYDROGRAPH AT	R62A	509.	12.17	43.	13.	5.	.38		
+	ROUTED TO	62ATB	372.	12.25	43.	13.	5.	.38		
+	HYDROGRAPH AT	62B	530.	12.00	53.	18.	7.	.23		
+	DIVERSION TO	D62B	442.	11.92	33.	10.	3.	.23		
+	HYDROGRAPH AT	R62B	458.	12.08	29.	9.	3.	.23		
+	2 COMBINED AT	C62B	547.	12.17	70.	21.	8.	.61		
+	ROUTED TO	62BTD	364.	12.58	67.	21.	8.	.61		
+	HYDROGRAPH AT	62D	587.	12.17	83.	27.	10.	.46		
+	DIVERSION TO	D62D	587.	12.17	63.	18.	6.	.46		
+	HYDROGRAPH AT	R62D	209.	12.58	31.	9.	3.	.46		
+	2 COMBINED AT	CP62D	564.	12.58	95.	30.	11.	1.07		

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
+	ROUTED TO	62DTF	339.	13.17	94.	30.	11.	1.07		
+	HYDROGRAPH AT	62F	409.	12.17	48.	16.	6.	.26		
+	DIVERSION TO	D62F	409.	12.17	32.	9.	3.	.26		
+	HYDROGRAPH AT	R62F	277.	12.25	23.	7.	2.	.26		
+	2 COMBINED AT	CP62F	359.	13.17	113.	36.	13.	1.33		
+	ROUTED TO	62T63	349.	13.50	111.	36.	13.	1.33		
+	HYDROGRAPH AT	63	1141.	12.33	170.	56.	20.	.91		
+	DIVERSION TO	D63	1141.	12.33	128.	36.	13.	.91		
+	HYDROGRAPH AT	R63	559.	12.58	66.	20.	7.	.91		
+	2 COMBINED AT	CP63	589.	12.58	172.	56.	20.	2.24		
+	ROUTED TO	63T71	256.	15.42	151.	56.	20.	2.24		
+	HYDROGRAPH AT	68B	567.	12.00	57.	19.	7.	.25		
+	DIVERSION TO	D68B	567.	12.00	43.	12.	4.	.25		
+	HYDROGRAPH AT	R68	207.	12.17	24.	7.	3.	.25		
+	ROUTED TO	68BT69	90.	12.50	23.	7.	3.	.25		
+	HYDROGRAPH AT	69	204.	12.00	21.	7.	3.	.09		
+	DIVERSION TO	D69	204.	12.00	16.	5.	2.	.09		
+	HYDROGRAPH AT	R69	93.	12.17	9.	3.	1.	.09		
+	2 COMBINED AT	C69	108.	12.42	31.	10.	4.	.34		
+	ROUTED TO	69T71	58.	14.08	28.	10.	4.	.34		
+	HYDROGRAPH AT	71	1887.	12.17	248.	85.	31.	1.09		
+	DIVERSION TO	D71	1887.	12.17	187.	53.	19.	1.09		
+	HYDROGRAPH AT	R71	862.	12.33	102.	32.	12.	1.09		
+	3 COMBINED AT	C71	807.	12.33	246.	95.	34.	3.67		
+	ROUTED TO	71T72	576.	12.58	243.	95.	34.	3.67		
+	HYDROGRAPH AT	72	1370.	12.17	195.	67.	24.	.84		
+	DIVERSION TO	D72	1370.	12.17	147.	42.	15.	.84		
+	HYDROGRAPH AT	R72	667.	12.42	80.	25.	9.	.84		
+	2 COMBINED AT	CP72	919.	12.50	316.	119.	43.	4.51		
+	2 COMBINED AT	EMFWAR	1653.	14.00	857.	353.	138.	21.32		
+	ROUTED TO	WARTKN	1579.	14.25	854.	353.	138.	21.32		
+	HYDROGRAPH AT	70B	628.	12.17	89.	30.	11.	.38		
+	DIVERSION TO	D70B	628.	12.17	68.	19.	7.	.38		
+	HYDROGRAPH AT	R70B	249.	12.50	35.	11.	4.	.38		
+	ROUTED TO	70BT76	79.	14.00	34.	11.	4.	.38		

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	76B	1119.	12.17	153.	52.	19.	.64		
+	DIVERSION TO	D76B	1119.	12.17	118.	33.	12.	.64		
+	HYDROGRAPH AT	R76B	457.	12.42	59.	18.	7.	.64		
+	2 COMBINED AT	KNOX	447.	12.42	91.	29.	10.	1.02		
+	2 COMBINED AT	EMFKNX	1680.	14.17	905.	376.	146.	22.34		
+	ROUTED TO	KNXTRY	1597.	14.42	902.	375.	146.	22.34		
+	HYDROGRAPH AT	65AW	535.	12.25	67.	21.	7.	.43		
+	DIVERSION TO	D65AW	535.	12.25	58.	16.	6.	.43		
+	HYDROGRAPH AT	R65AW	99.	12.75	16.	5.	2.	.43		
+	ROUTED TO	65AT65	30.	14.17	14.	5.	2.	.43		
+	HYDROGRAPH AT	65B	1490.	12.42	261.	85.	31.	1.37		
+	DIVERSION TO	D65B	1490.	12.42	219.	60.	22.	1.37		
+	HYDROGRAPH AT	R65B	416.	13.00	76.	24.	9.	1.37		
+	2 COMBINED AT	CP65B	415.	13.00	87.	29.	10.	1.80		
+	HYDROGRAPH AT	65A	2503.	12.50	490.	162.	59.	2.54		
+	DIVERSION TO	D65A	2503.	12.50	307.	88.	32.	2.54		
+	HYDROGRAPH AT	R65A	2184.	12.67	254.	75.	27.	2.54		
+	HYDROGRAPH AT	CAP1A	217.	2.00	217.	217.	213.	.01		
+	ROUTED TO	RCAP1A	218.	2.33	217.	217.	212.	.01		
+	ROUTED TO	RRCP1A	218.	2.33	217.	217.	212.	.01		
+	HYDROGRAPH AT	CAP1B	217.	2.00	217.	217.	213.	.01		
+	ROUTED TO	RCAP1B	218.	2.33	217.	217.	212.	.01		
+	3 COMBINED AT	C65A1	2618.	12.67	688.	509.	451.	2.56		
+	ROUTED TO	65ATB1	2574.	12.75	688.	509.	451.	2.56		
+	DIVERSION TO	DB65A	2140.	12.75	254.	75.	27.	2.56		
+	HYDROGRAPH AT	DIDB65	434.	2.42	434.	434.	424.	2.56		
+	ROUTED TO	65B1T2	434.	2.42	434.	434.	423.	2.56		
+	HYDROGRAPH AT	DIB65P	2140.	12.75	254.	75.	27.	2.56		
+	ROUTED TO	DB65A	75.	17.00	75.	66.	27.	2.56		
+	2 COMBINED AT	C65A2	509.	17.00	509.	500.	450.	2.56		
+	ROUTED TO	65AT-1	509.	17.08	509.	500.	450.	2.56		
+	ROUTED TO	65AT-2	509.	17.58	509.	500.	445.	2.56		
+	ROUTED TO	65AT-3	509.	17.58	509.	500.	444.	2.56		
+	2 COMBINED AT	CP65	851.	13.00	584.	526.	454.	4.36		
+	ROUTED TO	65T66	829.	13.00	583.	526.	454.	4.36		

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	ADOT-E	246.	14.42	175.	64.	23.	.01		
+	ROUTED TO	AET67A	245.	14.67	175.	64.	23.	.01		
+	HYDROGRAPH AT	67A	375.	12.25	50.	16.	6.	.30		
+	DIVERSION TO	D67A	375.	12.25	38.	11.	4.	.30		
+	HYDROGRAPH AT	R67A	158.	12.58	18.	5.	2.	.30		
+	2 COMBINED AT	C67A	255.	14.67	183.	69.	25.	.31		
+	ROUTED TO	67ATC	254.	15.00	183.	69.	25.	.31		
+	HYDROGRAPH AT	SUP2	422.	13.00	381.	215.	78.	.01		
+	ROUTED TO	RSUP2	395.	16.25	378.	215.	78.	.01		
+	HYDROGRAPH AT	67B	688.	12.25	101.	33.	12.	.53		
+	DIVERSION TO	D67B	688.	12.25	74.	21.	7.	.53		
+	HYDROGRAPH AT	R67B	385.	12.50	42.	13.	5.	.53		
+	2 COMBINED AT	C67B	424.	12.50	394.	228.	83.	.54		
+	ROUTED TO	67BTC	411.	16.42	394.	228.	83.	.54		
+	HYDROGRAPH AT	67C	973.	12.42	139.	43.	15.	.93		
+	DIVERSION TO	D67C	973.	12.42	125.	34.	12.	.93		
+	HYDROGRAPH AT	R67C	121.	13.08	27.	9.	3.	.93		
+	3 COMBINED AT	C67C	669.	15.08	591.	304.	111.	1.78		
+	ROUTED TO	67CT67	669.	15.17	591.	304.	111.	1.78		
+	HYDROGRAPH AT	67D	179.	12.17	19.	6.	2.	.13		
+	DIVERSION TO	D67D	179.	12.17	17.	5.	2.	.13		
+	HYDROGRAPH AT	R67D	35.	12.50	4.	1.	0.	.13		
+	2 COMBINED AT	C67D	671.	15.17	593.	305.	111.	1.91		
+	ROUTED TO	67DT66	671.	15.25	593.	305.	111.	1.91		
+	HYDROGRAPH AT	66A	432.	12.17	44.	14.	5.	.26		
+	DIVERSION TO	D66A	432.	12.17	39.	11.	4.	.26		
+	HYDROGRAPH AT	R66A	64.	12.42	9.	3.	1.	.26		
+	ROUTED TO	66ATB	20.	13.25	9.	3.	1.	.26		
+	HYDROGRAPH AT	66B	580.	12.58	99.	30.	11.	.67		
+	DIVERSION TO	D66B	580.	12.58	90.	24.	9.	.67		
+	HYDROGRAPH AT	R66B	79.	13.42	19.	6.	2.	.67		
+	2 COMBINED AT	CP66B	94.	13.42	26.	9.	3.	.93		
+	ROUTED TO	66BTC	71.	13.83	26.	9.	3.	.93		
+	HYDROGRAPH AT	66C	681.	12.25	90.	29.	10.	.50		
+	DIVERSION TO	D66C	681.	12.25	77.	21.	8.	.50		

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	R66C	122.	12.75	25.	8.	3.	.50		
+	2 COMBINED AT	CP66C1	120.	12.75	47.	16.	6.	1.43		
+	2 COMBINED AT	CP66C2	712.	15.00	628.	320.	116.	3.34		
+	ROUTED TO	66TDI	712.	15.08	628.	320.	116.	3.34		
+	DIVERSION TO	DB66	505.	15.08	429.	185.	67.	3.34		
+	HYDROGRAPH AT	DI66	207.	15.08	199.	135.	50.	3.34		
+	ROUTED TO	66C1T2	207.	15.08	199.	135.	50.	3.34		
+	2 COMBINED AT	CP66	991.	13.00	778.	657.	503.	7.70		
+	ROUTED TO	66CTD	952.	13.08	777.	657.	502.	7.70		
+	HYDROGRAPH AT	DR66	505.	15.08	429.	185.	67.	3.34		
+	ROUTED TO	DB66D	47.	28.58	46.	45.	34.	3.34		
+	2 COMBINED AT	CP66D	968.	13.08	809.	698.	536.	7.70		
+	HYDROGRAPH AT	66D	633.	12.08	73.	25.	9.	.31		
+	DIVERSION TO	D66D	633.	12.08	55.	16.	6.	.31		
+	HYDROGRAPH AT	R66D	283.	12.25	30.	9.	3.	.31		
+	HYDROGRAPH AT	61A	764.	12.17	92.	30.	11.	.52		
+	DIVERSION TO	D61A	764.	12.17	76.	21.	8.	.52		
+	HYDROGRAPH AT	R61A	150.	12.42	28.	9.	3.	.52		
+	ROUTED TO	61ATB	80.	13.33	27.	9.	3.	.52		
+	HYDROGRAPH AT	61B	1122.	12.42	168.	52.	19.	1.09		
+	DIVERSION TO	D61B	1122.	12.42	150.	41.	15.	1.09		
+	HYDROGRAPH AT	R61B	156.	13.08	36.	12.	4.	1.09		
+	2 COMBINED AT	CP61B	204.	13.08	60.	20.	7.	1.61		
+	ROUTED TO	61T66D	155.	13.83	58.	20.	7.	1.61		
+	HYDROGRAPH AT	67E	743.	12.33	107.	35.	13.	.58		
+	DIVERSION TO	D67E	743.	12.33	91.	25.	9.	.58		
+	HYDROGRAPH AT	R67E	140.	12.83	30.	10.	3.	.58		
+	2 COMBINED AT	C67E	185.	13.83	82.	29.	10.	2.19		
+	3 COMBINED AT	C66D	1074.	13.08	897.	731.	548.	10.20		
+	ROUTED TO	66T70A	1056.	13.17	896.	731.	548.	10.20		
+	ROUTED TO	66T70B	994.	14.33	893.	730.	544.	10.20		
+	HYDROGRAPH AT	62C	803.	12.17	95.	31.	11.	.55		
+	DIVERSION TO	D62C	724.	12.08	55.	16.	6.	.55		
+	HYDROGRAPH AT	R62C	763.	12.25	52.	15.	5.	.55		
+	ROUTED TO	62CTE	400.	12.50	51.	15.	5.	.55		

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	62E	223.	12.17	27.	9.	3.	.15		
+	DIVERSION TO	D62E	223.	12.17	22.	6.	2.	.15		
+	HYDROGRAPH AT	R62E	50.	12.50	8.	2.	1.	.15		
+	2 COMBINED AT	CP62E	432.	12.50	58.	17.	6.	.70		
+	ROUTED TO	62T68A	220.	12.92	55.	17.	6.	.70		
+	HYDROGRAPH AT	68A	675.	12.08	74.	25.	9.	.35		
+	DIVERSION TO	D68A	675.	12.08	55.	16.	6.	.35		
+	HYDROGRAPH AT	R68A	309.	12.25	30.	9.	3.	.35		
+	2 COMBINED AT	CP68A	283.	12.25	82.	26.	9.	1.05		
+	ROUTED TO	68T70A	226.	13.25	80.	26.	9.	1.05		
+	HYDROGRAPH AT	70A	1107.	12.08	120.	40.	14.	.54		
+	DIVERSION TO	D70A	1107.	12.08	94.	26.	9.	.54		
+	HYDROGRAPH AT	R70A	353.	12.25	43.	13.	5.	.54		
+	2 COMBINED AT	C70A	322.	12.33	120.	39.	14.	1.59		
+	2 COMBINED AT	C70A2	1162.	13.50	971.	764.	556.	11.79		
+	ROUTED TO	70T76A	1134.	14.00	969.	763.	553.	11.79		
+	HYDROGRAPH AT	76A	2065.	12.58	411.	131.	47.	1.91		
+	DIVERSION TO	D76A	2065.	12.58	338.	93.	34.	1.91		
+	HYDROGRAPH AT	R76A	751.	13.08	123.	38.	14.	1.91		
+	2 COMBINED AT	C76A	1346.	13.25	1065.	794.	564.	13.70		
+	ROUTED TO	76ATPR	1285.	14.08	1056.	794.	559.	13.70		
+	HYDROGRAPH AT	73A	355.	13.33	90.	23.	8.	.95		
+	ROUTED TO	73ATB	286.	13.83	90.	23.	8.	.95		
+	HYDROGRAPH AT	73B	562.	12.17	59.	17.	6.	.42		
+	DIVERSION TO	D73B	562.	12.17	55.	15.	5.	.42		
+	HYDROGRAPH AT	R73B	47.	12.58	7.	2.	1.	.42		
+	2 COMBINED AT	CP73B	294.	13.83	96.	25.	9.	1.37		
+	ROUTED TO	73BTC	293.	14.00	95.	25.	9.	1.37		
+	HYDROGRAPH AT	73C	1353.	12.00	134.	46.	17.	.58		
+	DIVERSION TO	D73C	1353.	12.00	103.	29.	11.	.58		
+	HYDROGRAPH AT	R73C	410.	12.17	54.	17.	6.	.58		
+	2 COMBINED AT	CP73C	405.	12.17	146.	41.	15.	1.95		
+	ROUTED TO	73T74C	322.	14.33	144.	41.	15.	1.95		
+	HYDROGRAPH AT	74A	289.	13.33	72.	18.	6.	.75		
+	ROUTED TO	DB74A	36.	14.92	34.	18.	6.	.75		

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
+	ROUTED TO	74ATB	36.	15.08	34.	18.	6.	.75		
+	HYDROGRAPH AT	74B	435.	12.25	41.	11.	4.	.33		
+	DIVERSION TO	D74B	435.	12.25	41.	11.	4.	.33		
+	HYDROGRAPH AT	R74B	1.	15.33	0.	0.	0.	.33		
+	2 COMBINED AT	CP74B	36.	15.33	35.	18.	6.	1.08		
+	ROUTED TO	74BTC	36.	15.67	35.	18.	6.	1.08		
+	HYDROGRAPH AT	74C	746.	12.00	82.	28.	10.	.34		
+	DIVERSION TO	D74C	746.	12.00	62.	18.	6.	.34		
+	HYDROGRAPH AT	R74C	335.	12.17	34.	10.	4.	.34		
+	3 COMBINED AT	CP74C	374.	14.33	200.	68.	24.	3.37		
+	ROUTED TO	74CT75	369.	14.50	198.	68.	24.	3.37		
+	HYDROGRAPH AT	75	251.	14.75	114.	30.	11.	4.01		
+	2 COMBINED AT	C75	604.	14.67	307.	96.	35.	7.38		
+	ROUTED TO	75TPC	602.	14.75	306.	96.	35.	7.38		
+	HYDROGRAPH AT	77A	526.	13.75	164.	41.	15.	1.74		
+	ROUTED TO	77ATB	451.	14.17	163.	41.	15.	1.74		
+	HYDROGRAPH AT	77B	504.	12.17	42.	11.	4.	.36		
+	DIVERSION TO	D77B	504.	12.17	32.	8.	3.	.36		
+	HYDROGRAPH AT	R77B	257.	12.33	11.	3.	1.	.36		
+	2 COMBINED AT	CP77B	452.	14.17	173.	44.	16.	2.10		
+	ROUTED TO	77BTC	443.	14.50	172.	44.	16.	2.10		
+	HYDROGRAPH AT	77C	660.	12.00	65.	22.	8.	.28		
+	DIVERSION TO	D77C	660.	12.00	50.	14.	5.	.28		
+	HYDROGRAPH AT	R77C	212.	12.08	26.	8.	3.	.28		
+	2 COMBINED AT	C77C	458.	14.50	195.	51.	18.	2.38		
+	ROUTED TO	77CT78	452.	14.67	194.	51.	18.	2.38		
+	HYDROGRAPH AT	78A	568.	13.75	177.	44.	16.	1.88		
+	ROUTED TO	78ATB	466.	14.42	177.	44.	16.	1.88		
+	HYDROGRAPH AT	78B	610.	12.17	65.	17.	6.	.39		
+	2 COMBINED AT	C78B	610.	12.25	237.	60.	22.	2.27		
+	ROUTED TO	78BTC	503.	12.50	237.	60.	22.	2.27		
+	HYDROGRAPH AT	78C	646.	12.00	69.	22.	8.	.28		
+	DIVERSION TO	D78C	610.	12.00	43.	12.	4.	.28		
+	HYDROGRAPH AT	R78C	512.	12.08	35.	10.	4.	.28		
+	3 COMBINED AT	C78C	907.	14.67	456.	120.	43.	4.93		

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
+	ROUTED TO	78CT79	899.	14.92	453.	119.	43.	4.93		
+	HYDROGRAPH AT	79A	902.	13.50	266.	67.	24.	2.01		
+	2 COMBINED AT	C79A1	1422.	13.58	708.	184.	66.	6.94		
+	HYDROGRAPH AT	78F	1028.	14.17	384.	97.	35.	4.19		
+	HYDROGRAPH AT	82A1	1069.	13.50	291.	73.	26.	3.12		
+	2 COMBINED AT	C82A1	1637.	13.50	667.	168.	61.	7.31		
+	ROUTED TO	DB82A1	162.	15.92	152.	134.	99.	7.31		
+	ROUTED TO	PS-9	162.	16.00	152.	134.	99.	7.31		
+	HYDROGRAPH AT	CAP2	64.	20.00	64.	64.	53.	.01		
+	ROUTED TO	RCAP2	64.	21.17	64.	64.	52.	.01		
+	HYDROGRAPH AT	82A2	839.	14.75	374.	99.	36.	4.13		
+	2 COMBINED AT	CP82A3	876.	14.75	414.	155.	87.	4.14		
+	HYDROGRAPH AT	82A4	597.	13.83	199.	50.	18.	2.13		
+	ROUTED TO	82A4T3	583.	14.00	198.	50.	18.	2.13		
+	HYDROGRAPH AT	82A3	508.	14.17	188.	48.	17.	2.02		
+	2 COMBINED AT	CP82A3	1051.	14.08	381.	96.	35.	4.15		
+	2 COMBINED AT	CP82A5	1588.	14.08	784.	249.	121.	8.29		
+	ROUTED TO	DB82B	329.	16.83	312.	244.	120.	8.29		
+	ROUTED TO	MN-1	329.	16.92	312.	244.	120.	8.29		
+	2 COMBINED AT	CP82A6	470.	17.00	454.	369.	216.	15.60		
+	ROUTED TO	82TBOX	470.	17.00	454.	369.	215.	15.60		
+	ROUTED TO	BOXCLV	470.	17.08	454.	369.	215.	15.60		
+	ROUTED TO	BOXT78	469.	17.33	454.	369.	214.	15.60		
+	HYDROGRAPH AT	78D	1488.	12.17	186.	60.	22.	.89		
+	DIVERSION TO	D78D	1488.	12.17	154.	42.	15.	.89		
+	HYDROGRAPH AT	R78D	334.	12.50	55.	17.	6.	.89		
+	HYDROGRAPH AT	82B	1496.	12.17	174.	57.	21.	.92		
+	DIVERSION TO	D82	14.	1.08	2.	1.	0.	.92		
+	HYDROGRAPH AT	R82	1496.	12.17	174.	57.	20.	.92		
+	DIVERSION TO	TRW	1496.	12.17	174.	55.	20.	.92		
+	HYDROGRAPH AT	DTTRW	6.	18.92	5.	1.	0.	.92		
+	3 COMBINED AT	C78D	488.	17.33	471.	380.	219.	17.41		
+	ROUTED TO	78DTE	488.	17.67	471.	379.	217.	17.41		
+	HYDROGRAPH AT	78E	799.	12.75	149.	38.	14.	1.01		
+	HYDROGRAPH AT	83	1321.	12.25	190.	62.	22.	1.01		

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
+	DIVERSION TO	D83	1321.	12.25	150.	42.	15.	1.01		
+	HYDROGRAPH AT	R83	523.	12.58	66.	21.	7.	1.01		
+	3 COMBINED AT	C78E	1178.	12.75	556.	423.	235.	19.43		
+	ROUTED TO	78ET84	966.	13.17	550.	422.	233.	19.43		
+	HYDROGRAPH AT	84	1254.	12.25	185.	61.	22.	.99		
+	DIVERSION TO	D84	1254.	12.25	154.	43.	15.	.99		
+	HYDROGRAPH AT	R84	314.	12.75	57.	18.	7.	.99		
+	2 COMBINED AT	C84	1085.	13.08	593.	436.	238.	20.42		
+	ROUTED TO	84T79B	1079.	13.17	592.	436.	237.	20.42		
+	HYDROGRAPH AT	79B	643.	13.08	152.	38.	14.	1.00		
+	2 COMBINED AT	C79B1	1658.	13.17	705.	467.	249.	21.42		
+	ROUTED TO	84T79B	1635.	13.25	704.	467.	249.	21.42		
+	2 COMBINED AT	C79B2	2766.	13.42	1322.	627.	307.	28.36		
+	ROUTED TO	79TPC2	2738.	13.50	1318.	627.	306.	28.36		
+	2 COMBINED AT	CPPWR	2932.	13.58	1552.	698.	331.	35.74		
+	ROUTED TO	PWRT80	2913.	13.67	1550.	698.	330.	35.74		
+	HYDROGRAPH AT	80A	2344.	12.83	575.	182.	66.	2.64		
+	DIVERSION TO	D80A	71.	8.83	53.	17.	6.	2.64		
+	HYDROGRAPH AT	R80A	2344.	12.83	575.	166.	60.	2.64		
+	2 COMBINED AT	CP80A	3731.	13.33	1997.	831.	383.	38.38		
+	ROUTED TO	PWRSAN	3725.	13.42	1995.	831.	383.	38.38		
+	2 COMBINED AT	CPSAN	4148.	13.58	2773.	1554.	913.	52.08		
+	ROUTED TO	PWREMF	4119.	13.75	2762.	1553.	909.	52.08		
+	2 COMBINED AT	EMFPOW	4985.	14.25	3396.	1853.	1026.	74.42		
+	ROUTED TO	POWTWI	4965.	14.42	3391.	1853.	1022.	74.42		
+	HYDROGRAPH AT	80B	1150.	12.50	214.	68.	25.	1.12		
+	DIVERSION TO	D80B	15.	4.00	8.	2.	1.	1.12		
+	HYDROGRAPH AT	R80B	1150.	12.50	214.	66.	24.	1.12		
+	2 COMBINED AT	MFWILL	5005.	14.42	3469.	1899.	1042.	75.54		
+	ROUTED TO	WILTSP	4972.	14.67	3463.	1898.	1035.	75.54		
+	HYDROGRAPH AT	81A	1594.	12.67	346.	115.	41.	1.81		
+	DIVERSION TO	D81A	28.	2.67	10.	3.	1.	1.81		
+	HYDROGRAPH AT	R81A	1594.	12.67	346.	112.	40.	1.81		
+	ROUTED TO	81ATB	1470.	13.00	346.	112.	40.	1.81		
+	HYDROGRAPH AT	81B	1168.	12.25	173.	59.	21.	.84		

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
+	DIVERSION TO	D81B	444.	11.92	55.	18.	6.	.84		
+	HYDROGRAPH AT	R81B	1168.	12.25	145.	41.	15.	.84		
+	2 COMBINED AT	C81	1604.	13.00	483.	152.	55.	2.65		
+	2 COMBINED AT	EMFRT1	5149.	14.58	3767.	2014.	1082.	78.19		
+	HYDROGRAPH AT	SUB258	449.	16.17	355.	141.	51.	3.68		
+	DIVERSION TO	D258	449.	16.17	244.	61.	22.	3.68		
+	HYDROGRAPH AT	R258	405.	17.42	229.	81.	29.	3.68		
+	ROUTED TO	RO259	327.	19.67	222.	81.	29.	3.68		
+	HYDROGRAPH AT	SUB260	250.	13.25	106.	33.	12.	.98		
+	DIVERSION TO	D260	250.	13.25	54.	14.	5.	.98		
+	HYDROGRAPH AT	R260	172.	14.00	60.	20.	7.	.98		
+	2 COMBINED AT	CO262	350.	19.67	242.	99.	36.	4.66		
+	ROUTED TO	RO263	329.	21.42	238.	99.	36.	4.66		
+	HYDROGRAPH AT	SUB264	232.	13.50	111.	35.	13.	.99		
+	DIVERSION TO	D264	232.	13.50	58.	15.	5.	.99		
+	HYDROGRAPH AT	R264	170.	14.33	63.	21.	8.	.99		
+	2 COMBINED AT	CO266	349.	21.33	255.	118.	43.	5.65		
+	ROUTED TO	RO267	321.	24.92	249.	118.	43.	5.65		
+	HYDROGRAPH AT	SUB268	163.	14.42	101.	34.	12.	.96		
+	DIVERSION TO	D268	163.	14.42	56.	14.	5.	.96		
+	HYDROGRAPH AT	R268	133.	15.42	60.	20.	7.	.96		
+	2 COMBINED AT	CO270	338.	24.92	259.	136.	49.	6.61		
+	ROUTED TO	RO283	322.	27.83	255.	136.	49.	6.61		
+	HYDROGRAPH AT	88A	1103.	12.00	115.	40.	14.	.50		
+	DIVERSION TO	D88A	1103.	12.00	89.	25.	9.	.50		
+	HYDROGRAPH AT	R88A	426.	12.17	46.	14.	5.	.50		
+	ROUTED TO	88AT89	163.	12.33	44.	14.	5.	.50		
+	HYDROGRAPH AT	89A	976.	12.08	114.	39.	14.	.50		
+	DIVERSION TO	D89A	976.	12.08	89.	25.	9.	.50		
+	HYDROGRAPH AT	R89A	316.	12.33	45.	14.	5.	.50		
+	2 COMBINED AT	C89A	467.	12.33	87.	28.	10.	1.00		
+	ROUTED TO	89ATRI	258.	12.58	85.	28.	10.	1.00		
+	2 COMBINED AT	C283	322.	27.83	255.	155.	59.	7.61		
+	ROUTED TO	283T90	316.	28.25	254.	154.	59.	7.61		
+	HYDROGRAPH AT	90A	907.	12.08	94.	32.	11.	.48		

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
+	DIVERSION TO	D90A	907.	12.08	76.	21.	8.	.48		
+	HYDROGRAPH AT	R90A	236.	12.33	33.	10.	4.	.48		
+	2 COMBINED AT	C90A	316.	28.25	253.	162.	62.	8.09		
+	ROUTED TO	90ATB	311.	28.58	252.	161.	62.	8.09		
+	HYDROGRAPH AT	87A	1008.	12.08	112.	39.	14.	.49		
+	DIVERSION TO	D87A	1008.	12.08	87.	25.	9.	.49		
+	HYDROGRAPH AT	R87A	387.	12.25	44.	14.	5.	.49		
+	ROUTED TO	87ATB	117.	12.83	42.	14.	5.	.49		
+	HYDROGRAPH AT	87B	989.	12.08	113.	39.	14.	.49		
+	DIVERSION TO	D87B	989.	12.08	87.	25.	9.	.49		
+	HYDROGRAPH AT	R87B	373.	12.25	45.	14.	5.	.49		
+	2 COMBINED AT	C87	350.	12.25	84.	28.	10.	.98		
+	ROUTED TO	87T88B	200.	12.83	82.	28.	10.	.98		
+	HYDROGRAPH AT	88B	1001.	12.08	114.	39.	14.	.50		
+	DIVERSION TO	D88B	1001.	12.08	89.	25.	9.	.50		
+	HYDROGRAPH AT	R88B	344.	12.25	45.	14.	5.	.50		
+	2 COMBINED AT	C88B	295.	12.25	122.	41.	15.	1.48		
+	ROUTED TO	88T89B	264.	13.08	119.	41.	15.	1.48		
+	HYDROGRAPH AT	89B	1014.	12.08	113.	39.	14.	.50		
+	DIVERSION TO	D89B	1014.	12.08	87.	25.	9.	.50		
+	HYDROGRAPH AT	R89B	415.	12.25	45.	14.	5.	.50		
+	2 COMBINED AT	C89B	407.	12.25	159.	55.	20.	1.98		
+	ROUTED TO	89TB90	311.	13.75	154.	55.	20.	1.98		
+	HYDROGRAPH AT	90B	637.	12.67	122.	37.	13.	.82		
+	DIVERSION TO	D90B	377.	12.33	39.	12.	4.	.82		
+	HYDROGRAPH AT	R90B	637.	12.67	95.	26.	9.	.82		
+	3 COMBINED AT	C90	771.	12.83	328.	233.	88.	10.89		
+	ROUTED TO	90T91	562.	13.50	311.	230.	88.	10.89		
+	HYDROGRAPH AT	85	1270.	12.25	184.	61.	22.	1.00		
+	DIVERSION TO	D85	1270.	12.25	152.	42.	15.	1.00		
+	HYDROGRAPH AT	R85	358.	12.67	58.	19.	7.	1.00		
+	ROUTED TO	85T86	213.	13.00	56.	19.	7.	1.00		
+	HYDROGRAPH AT	86	1284.	12.25	185.	61.	22.	1.00		
+	DIVERSION TO	D86	1284.	12.25	154.	43.	15.	1.00		
+	HYDROGRAPH AT	R86	331.	12.67	57.	18.	7.	1.00		

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
+	2 COMBINED AT	C86	353.	13.00	110.	36.	13.	2.00		
+	ROUTED TO	86T91	329.	13.25	106.	36.	13.	2.00		
+	HYDROGRAPH AT	91	644.	12.25	86.	28.	10.	.46		
+	DIVERSION TO	D91	644.	12.25	69.	19.	7.	.46		
+	HYDROGRAPH AT	RET91	200.	12.58	30.	9.	3.	.46		
+	3 COMBINED AT	CP91	822.	13.42	416.	265.	101.	13.35		
+	ROUTED TO	91TEMF	817.	13.50	415.	264.	101.	13.35		
+	2 COMBINED AT	EMFRIT	5432.	14.67	3967.	2180.	1147.	91.54		

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